1.0 INTRODUCTION AND STUDY OBJECTIVES

1.1 Project Overview

Treasury Metals is proposing to develop the Goliath Gold Project and associated infrastructure near Dryden, Ontario. The Project is located within with the Kenora Mining Division in northwestern Ontario. The Project site is approximately 4 kilometres (km) northwest of the village of Wabigoon, 20 km east of Dryden and 2 km north of the Trans-Canada Highway 17. The Project is located within the Hartman and Zealand townships. Treasury Metals has been exploring the Project site since 2008 and has commenced extensive environmental, geotechnical, metallurgical, engineering, socio-economic, and logistical studies in order to advance the Project towards commissioning and operation. The purpose of the Project is to extract gold for sale on the open market by mining gold-bearing ore and producing doré product at an onsite gold processing facility. The overall Project footprint is relatively small compared to other mining projects in northern Ontario and will cover approximately 188 ha during the maximum of extent of operations. The entire footprint of the Project is situated on lands that are either patented or leased (mining rights and surface rights) to Treasury Metals.

The Project can be defined using the following four phases and associated temporal boundaries: site preparation and construction (2 years), operations (11-12 years), closure (3 years), and post-closure (17 years). The site preparation and construction phase of the Project will consist of the construction of infrastructure and water management systems to ensure the environmental safety of areas surrounding the Project. The construction of the perimeter runoff and seepage collection ditch will be staged to enclose the areas with active earthworks, and will collect and hold the runoff water from those areas under initial phases of construction. Surface water runoff will be prevented from entering the open pit during normal operations by means of a field-fit berm and/or ditch. This water will be collected and will then form part of the recycled water used for processing in the plant facility. The operations phase of the Project will consist of open pit mining, underground development, ore processing, and storage of waste rock, tailings, and low-grade ore. The process plant will operate at approximately 2,700 tonnes per day to process a total of approximately 5.5 million tonnes of open pit ore and 3.5 million tonnes of underground ore over the 12-year operational phase of the mine. During operations, excess water not required in the process will be treated and discharged as effluent to Blackwater Creek. However, effluent from the Project during operations will meet the Provincial Water Quality Objectives (PWQO) or background concentrations, if background levels are above the PWQO. Where there is no PWQO for a parameter, the commitment will be to meet the Canadian Water Quality Guidelines (CWQG). For total mercury, the commitment will be that effluent discharged to Blackwater Creek will meet background concentrations for that watercourse. Background concentrations for Blackwater Creek are defined as the 75th percentile of the available monitoring data, in accordance MOECC receiving water assessment policy.

Closure of the Project will be governed by the Ontario Mining Act (the Act) and its associated regulations and codes. The objective is to reclaim the Project site area to a naturalized and productive biological state when mining ceases. The Act requires that a detailed closure plan be filed for any mining project before the project is initiated. Financial assurance is required before any substantive development takes place to ensure that funds are in place to carry out the closure plan. During the closure phase, Treasury Metals has committed to reclaiming the site and restoring the land to a naturalized state per the mine closure plan approved by the Ministry of Northern Development and Mines. At closure, dewatering activities will cease and the open pit will be allowed to flood. Modelling has indicated that it should take between 6 and 8 years for the open pit to fully fill. Until such time that the final pit is fully flooded and the Agency or other responsible authorities deem appropriate to ensure closure of the mine is performing as predicted, Treasury Metals will hold the site in care and maintenance. Environmental monitoring and potential effluent quality management will occur during this passive period of reclamation, which is anticipated to take approximately 17 years. The pit lake will be monitored as it is filling to determine whether batch treatment will be required to ensure the water meets PWQO, or background if background levels exceed the PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek. Treasury Metals also expect that monitoring of the pit lake will continue for a period of time after flooding to determine whether additional batch treatments will be required to ensure the water released from the open will meet effluent limits.

The Project is located within the area covered by Treaty No. 3. Treaty No. 3 includes 28 First Nation communities and a number of villages and towns including Wabigoon, Dryden, Eagle River, Vermillion Bay, Sioux Lookout, Atikokan, Fort Frances, and Kenora. The Project is also located within an area identified by the Métis Nation of Ontario as the Treaty No. 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake traditional harvesting territories, also named Region 1. Treasury Metals has been participating in meaningful engagement activities with key Indigenous stakeholder groups since 2008 and has obtained valuable information regarding traditional knowledge and information about the current use of land and resources for traditional purposes. Treasury Metals recognizes that Indigenous people live, work, hunt, fish, trap, drink water, and gather/harvest throughout their lands and rely on them for their individual as well as their community's overall cultural, social, spiritual, physical, and economic well-being. Further to this, Treasury Metals recognizes that these traditional lands are inextricably connected to an Indigenous community's identity and culture, inclusive of ceremonial and spiritual recognition. Treasury Metals, in respect to this, understands the importance of assessing any potential effects of the Project. Treasury Metals is aware that many the Indigenous communities are particularly concerned with the potential effects of the Project on their health including how the Project may affect their drinking water, country foods (fish, berries, wild game), and air quality.

Treasury Metals submitted a Project Description to the Canadian Environmental Assessment Agency (the Agency) on November 26, 2012 and on January 18, 2013 received draft guidelines for the preparation of an Environmental Impact Statement (EIS) for an environmental assessment conducted pursuant to the Canadian Environmental Assessment Act, 2012 (CEAA 2012). Treasury Metals submitted an original EIS report assessment the potential effects of the Project on the environment. The Agency raised 859 questions as part of the Round #1 Information Request process including 49 that were specific to the HHERA prepared by Tetratech in 2014 and submitted as part of the original EIS submission (Appendix W). Treasury Metals submitted a revised EIS to the Agency on September 5, 2017, and the Agency identified a need to see further revision to the revised EIS, as well as expanded responses to 287 of the 859 information request responses. Of the 287 questions raised by the Agency, 29 were related to the HHERA. With the assistance of Wood (formally Amec Foster Wheeler), Treasury Metals provided expanded responses to all 287 questions flagged by the Agency. This included a limited amount of supplemental information with respect to the original HHERA to support the latest re-submission of the EIS (dated April 20, 2018) in an effort to move the Project forward into technical review. This supplemental information regarding the human health risk assessment was presented in the revised responses, and in Section 6.19 of the revised EIS. However, the April 20, 2018 submission to the Agency did not include a comprehensive standalone HHERA document completed in accordance with current Agency, Health Canada, Environment Canada and Climate Change, Department of Oceans and Fisheries, and/or Parks Canada Agency regulatory requirements.

It is Wood's understanding that a new stand-alone HHERA document completed in accordance with current regulatory guidance and risk assessment practices will be required for the Project to achieve final approval under CEAA, 2012.

1.2 Study Objectives

The objective of the HHERA is to assess the potential health risks associated with the Project in accordance with the current regulatory guidance on environmental assessments (EAs) and risk assessment to support Treasury Metals Inc. in achieving final Project approval under *CEAA, 2012.*

The HHERA will be conducted to evaluate potential health risks to humans (workers, residents, visitors) and ecological receptors (terrestrial and aquatic wildlife, invertebrate, and vegetation communities) associated with the baseline conditions in the Project area, the Project alone, and the combination of baseline and Project, as per Agency EA guidance. Potential risks associated with the combined effects of the baseline conditions, the Project, as well as reasonable foreseeable projects and future activities in the region will be discussed qualitatively only.

1.3 Regulatory Context

The HHERA will be conducted according to industry accepted risk assessment practices and methodologies and will follow guidance published and endorsed by government agencies. This approach is consistent with previous projects in Ontario that have been reviewed by the Agency. The following guidance documents will be relied upon in the HHERA:

- Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 2.0 (Health Canada 2012a);
- Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors Version 2.0 (Health Canada 2010a);

- Part V: Guidance on Human Health Detailed Quantitative Risk Assessment For Chemicals ($DQRA_{CHEM}$) (Health Canada 2010b);
- Supplemental Guidance on Human Health Risk Assessment for Country Foods ($HHRA_{Foods}$) (Health Canada, 2010c);
- Supplemental Guidance on Human Health Risk Assessment of Indoor Settled Dust ($HHRA_{DUST}$) (Health Canada 2018);
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality (Health Canada 2016);
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality (Health Canada 2016);
- A Framework for Ecological Risk Assessment- Canadian Council of Ministers of the Environment (CCME 1996);
- Federal Contaminated Sites Action Plan (FCSAP) Ecological Risk Assessment Guidance (Environment Canada 2012);
- Procedures for the Use of Risk Assessment under Part XV.1 of the Environmental Protection Act (MOECC 2005);
- Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario (MOECC 2011a); and
- Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta (Alberta Health and Wellness 2011).

2.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FRAMEWORK

2.1 Overview of the Risk Assessment Process

A human health risk assessment (HHRA) is the process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future. An ecological risk assessment (ERA) assesses potential risk to ecological health who may be exposed to chemicals in environmental media.

Where a chemical, route of exposure, and a receptor are all present in an environmental scenario, the potential for health risks also exists (as shown in Figure 2-1).

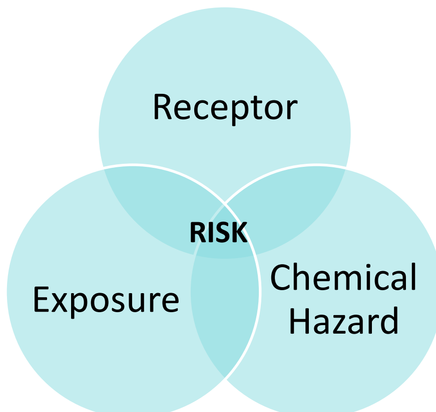


Figure 2-1: Risk Assessment Components

The risk assessment process involves the following four (4) fundamental steps:

- Problem Formulation;
- Exposure Assessment;
- Toxicity Assessment; and
- Risk Characterization.

2.2 Problem Formulation

The problem formulation is the first step of an RA and involves the identification and screening of the three main components of a risk assessment: chemicals of concern (COCs), exposure pathways, and receptors. Problem formulation provides the framework and methodology for the risk assessment, and allows the definition of boundaries for the risk assessment based on scientific rationale.

2.3 Exposure Assessment

The exposure assessment is conducted for all chemicals, exposure pathways, and receptors identified in the problem formulation. The exposure assessment involves the estimation of the intake of chemicals of concern by human and ecological receptors. The total estimated intake is calculated via the sum of intakes from each operable pathway identified in the problem formulation. This step involves the determination of exposure point concentrations of each chemical in the various environmental media either by direct measurement or predictive modelling. The exposure assessment also includes the intake rate of each environmental media by the relevant receptors.

2.4 Toxicity Assessment

The toxicity assessment is completed for all COCs identified in the problem formulation, and involves the identification of the toxic endpoints for each. It involves the determination of either a) a maximum dose or concentration each chemical to which a receptor can be exposed without an appreciable amount of adverse health effect occurring (threshold dose or concentration), or b) the relationship between dose and incidence or severity of adverse effect (dose-response identification). In most causes the toxicity assessment involves the selection of a toxicity reference value (TRV) recommended by an appropriate regulatory agency (such as Health Canada, MOECC, or CCME), or in cases where a regulatory published TRV is not available, evaluation of the most current state of science based on a review of peer-reviewed manuscripts presenting scientific data.

2.5 Risk Characterization

The risk characterization step involves qualitatively and quantitatively evaluating the potential risks to receptors resulting from exposure to each chemical. The risk characterization step is done for all chemicals and exposure pathway/receptor combinations identified in the problem formulation step. The risk characterization involves the following:

- Integration of exposure and toxicity assessments to calculate a risk value;
- Describing the potential risk in terms of magnitude, type and uncertainty; and
- Comparison of the risk value to a regulatory benchmark of risk to determine the level of "acceptability"

Uncertainty was an inherent aspect of the risk assessment process due to assumptions regarding the Goliath Gold Project site, human receptors and mathematical modelling. Uncertainties may arise from a number of areas due to some inherent lack of precision about the true value of a parameter (e.g., body weight, inhalation rate, ingestion rate). In most instances, uncertainties may be accounted for by assuming 100% efficiency during operations and the most conservative receptor to exaggerate exposures in order to ensure that risks were overestimated as opposed to underestimated.

In the framework for HHERA's specific to the Environmental Assessment process, potential risks should be discussed in the context of assessment scenario. That is, the potential risks identified for the combination of baseline and Project (i.e. Project), should be discussed relative to risks associated with the baseline conditions in the Project area that would occur in the absence of the Project, as well as the risks associate the Project alone, wherever appropriate. A more detailed description of the assessment scenarios is provided below in Section 3.2.

3.0 STUDY AREAS AND ASSESSMENT SCENARIOS FOR THE HHERA

3.1 Spatial Boundaries and Temporal Boundaries

3.1.1 Spatial Boundaries

Spatial extents for assessing potential human and ecological health risks were selected to chosen to represent the areas where human and ecological receptors would experience the highest magnitude, frequency, and duration of chemical exposure representative of the various phases of the Project. Human receptors who experience chemical exposure may be those who work within the operations area of the Project, live in the vicinity of the Project, or who visit the area surrounding the Project to practice traditional land and resources uses including fishing, hunting and harvesting. Ecological receptors may include plants and invertebrates, mammals and birds, and aquatic biota that may reside or pass through the Project operations area and areas in close vicinity of the Project. Specific factors considered in the receptor location selection processes included the activities that may occur throughout all Project phases within the Project footprint including mining related activities and guided access to site visitors, other land uses within the LSA, and the nearest populated area with critical subgroups of the population.

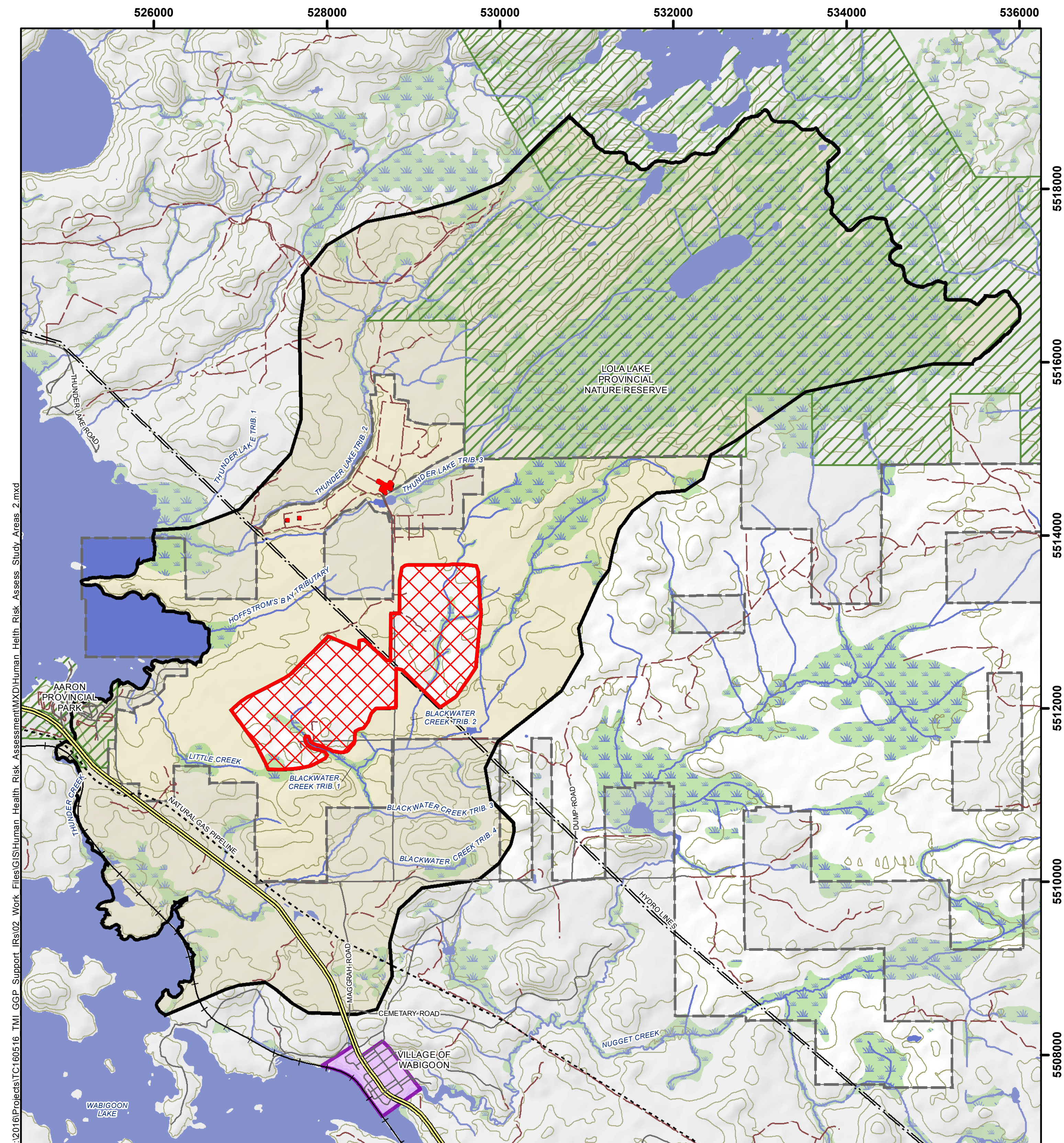
Based on the current and future uses of the Project operations area, land use within the LSA, and the location of sensitive receptors, for the purposes of the HHERA, the three study areas shown in Table 3.1.1-1 were chosen for assessment of potential health risks:

Table 3.1.1-1: Study Areas Used in the Risk Assessment

HHERA Study Area Number	Study Area Name	Description	Size (ha)
No.1	Operations Area	Area within the operational footprint of the Project, referred to as the operations area.	309.6
No.2	HHERA Local Study Area	Area outside the operations area but within the HHERA LSA.	4,694
No. 3	Village of Wabigoon	Located approximately 4 kilometers (km) southeast of the Project	44.3

The selected study areas of the HHERA are shown on Figure 3.1.1-1, and are described below:

- **Operations area**: The operations area (see Figure 3.1.1-1) includes all of the active mining areas associated with the Project. During the active life of the Project, access to the operations area will be restricted for safety and security reasons. Only employees of Treasury Metals, or visitors to the site for project related business will be allowed within the operations area.



LEGEND

- Railway
- Hydro Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Provinical Park
- Wetland
- Watercourse
- Waterbody
- Contours (10 m interval)
- Property Boundary of Claims and Dispositions
- Area Beyond Property Boundary

Human Health and Ecological Risk Assessment Study Areas

1. Operations Area
2. Terrestrial Local Study Area
3. Village of Wabigoon

0 0.5 1 2 3 4 5 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

N E S W

TREASURY METALS Inc. wood.

GOLIATH GOLD PROJECT

Human Health and Ecological Risk Assessment Study Areas

PROJECT N°: TC160516	FIGURE: 3.1.1-1
SCALE: 1:60,000	DATE: June 2018

- **HHERA Local Study Area**: The HHERA LSA corresponds with the LSA used in the revised EIS for evaluating the effects of the Project on wildlife and wildlife habitat, as well as evaluating the effects of the Project on terrestrial vegetation. The HHERA LSA excludes the operations area. The HHERA LSA includes areas those areas within the property boundary (i.e., the lands leased by Treasury Metals, or for which Treasury Metals holds surface and mineral rights), which would continue to be available for traditional uses by members of Indigenous communities.

- **Village of Wabigoon**: The Village of Wabigoon is located approximately 4 km to the southeast of the Project and represents the closest populated community to the Project.

In addition to the assessment of potential health risks to members of the general population or common species at the study areas presented in the above table, consideration is also given to receptors of the population who may experience a greater risk given their lifestyle and/or behavior characteristics. Critical subgroup may include the following:

- **Toddlers** — Toddlers are considered to be the more highly exposed human receptors because they eat, drink, and breathe more in proportion to body size, and exhibit behaviors (e.g., hand-to-mouth activity) that increased exposure to media such as soil.

- **Pregnant female** — Assessment of a pregnant female human receptor would be protective of the developmental effect elicited during gestation, but might not be protective of any secondary effects of the chemical which could be elicited during exposure as a child.

- **Indigenous community members** — Treasury Metals recognizes that Indigenous people live, work, hunt, fish, trap, drink water, and gather/harvest throughout their lands and rely on them for their individual as well as their community's overall cultural, social, spiritual, physical, and economic well-being. Further to this, Treasury Metals recognizes that these traditional lands are inextricably connected to an Indigenous community's identity and culture, inclusive of ceremonial and spiritual recognition. Members of Indigenous communities use land and resources for traditional purposes differently than members of the general population including a higher rate of country foods ingestion, or more time spent outdoors. An Indigenous community member may also include the other critical subgroups noted (i.e. a toddler and/or pregnant female).

- **Species at Risk** — federally protected species at risk require different levels of protection relative to common species.

3.1.2 Temporal Boundaries

The temporal boundaries used in the HHERA were selected to be consistent with those used in evaluating the effects of the Project, namely:

- Site preparation and construction phase (2 years);
- Operations (11 to 12 years);
- Closure (3 years); and
- Post-closure (beyond year 17).

The above phases are deemed suitable to capture all of the environmental effects associated with the Project. Although the majority of activities associated with the Project will occur during the first three phases, some effects will occur during the post-closure phase.

Temporal consideration in the HHERA also includes the nature of exposure (acute versus chronic) as well as site-specific and receptor-specific durations over which the chronic exposures will occur.

3.2 Assessment Scenarios

3.2.1 Base Scenario

The Base Scenario considers potential risk to human and ecological health associated with present, pre-Project conditions, including ambient environmental conditions and existing sources of potential risk (including chemical concentrations in soil, water, air, and country foods). The Base Scenario represe3nts the level of risk that would be experienced in the vicinity of the Project should the Project not proceed.

The Base Scenario is assessed by evaluating the potential risk associated with existing concentrations in chemical media, obtained from the results of monitoring completed in support of the EIS. The use of existing measured data is supplemented by modelled predictions where data gaps have been identified (e.g., baseline chemical concentrations in country foods and ecological receptors).

3.2.2 Project Alone Scenario

The Project Alone Scenario evaluates potential human and ecological health risks from exposure to predicted chemical concentrations in environmental media as a result of the Project alone. Chemical concentrations in environmental media are obtained using air, soil, and water data modelled from measured data. Chemical concentrations in Project-specific media such as waste rock, ore (representative of the tailings composition), and tailings storage facility (TSF) supernatant water were measured. Predicted chemical concentrations in country foods and ecological are modelled as part of the HHERA. The Project Alone Scenario does not consider existing chemical concentrations associated with the Base Scenario.

3.2.3 Project Scenario

The Project Scenario includes the consideration of the anticipated Project Alone Scenario conditions in combination with the Baseline Scenario. This assessment scenario evaluates the contributions of the Project in addition to baseline conditions for all life stages of the Project defined above namely: Site Preparation and Construction, Operations, Closure, and Post-Closure. The Project Scenario represents the levels of exposure that would be experienced in the vicinity of the Project should the Project proceed.

3.2.4 Cumulative Effects Scenario

The Cumulative Effects Scenario will be assessed qualitatively only, where feasible. The Cumulative Effects Scenario will consider the potential risks associated with the combined effects of the baseline conditions, the Project, as well as reasonable foreseeable projects and future activities in the region. The objective of this scenario is to ensure that the combined exposures and potential risk associated with all anticipated sources of chemicals to the regional environment are not underestimated.

The approach used for assessing the potential cumulative effects of the Project with respect to human and ecological health is generally consistent with the requirements of CEAA 2012, and follow the procedures set out by the Agency in the document entitled "Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012" (CEAA, 2014). Additional information is set out in the operational policy statement entitled "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012" (CEAA, 2015). The Cumulative Effects Scenario is consistent with the cumulative effects assessment presented in Section 7 of the revised EIS (April 2018).

3.2.4.1 Present and Future Activities Considered

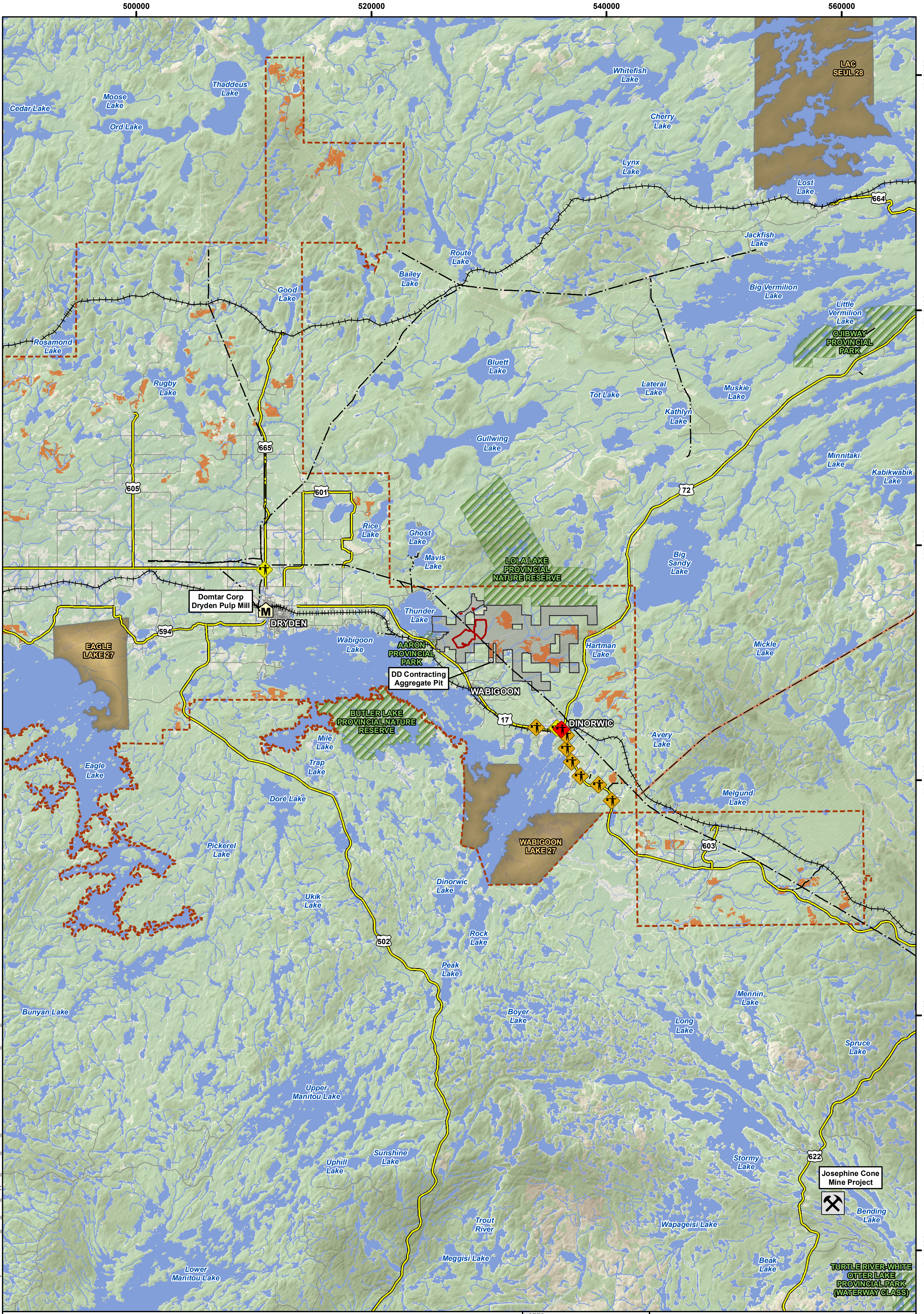
The following present and future activities were explicitly considered as part of the cumulative effects assessment for the Project. These project were identified by the Agency as part of the Round 1 information requests (TMI_252-CE(1)-02) as having to be explicitly considered as part of the cumulative effects assessment:

- Treasury Metals Inc. exploration program;
- Highway 17;
- Canadian Pacific rail line;
- Forestry operations by Dryden Forest Management Company;
- Domtar Corp.'s Dryden Pulp Mill;
- Josephine Cone Mine Project;
- Aggregate pits or quarries;

- The 230kV transmission line proposed by Wataynikaneyap Power; and
- The development of local infrastructure and minor road upgrades in Dryden and Wabigoon.

These projects are discussed briefly below and are show in Figure 3.2.4-1:

- **Treasury Metals Exploration Program**: During all phases associated with the Project, Treasury Metals may conduct mineral exploration within its property boundary to further delineate its deposit or to identify new deposits. Mineral exploration activities could include, but are not limited to; prospecting, surveys and exploration drilling. To the extent possible, these activities would not require the removal of forest cover. Nor would the exploratory drilling work be conducted within wetland areas. Mineral exploration programs could result in effects to the environment which are cumulative with effects from the Project. Accordingly, mineral exploration activities within the Project property boundary have been included through this cumulative effects assessment.
- **Highway 17**: King's Highway 17 is part of the Trans-Canada Highway system and is the main Trans-Canada highway through the province of Ontario. It begins at the Ontario/Manitoba boarder approximately 50 km west of Kenora, Ontario, and traverses west until it becomes Highway 417 west of Arnprior, Ontario. Highway 17 passes through the town of Dryden, Ontario and is a major transportation route between Dryden and the proposed Goliath Gold Project. The MNDM publishes a list of northern highway projects, including projects along Highway 17 (MNDM, 2016), Upcoming work being done to Highway 17 near the Project includes: resurfacing, culvert replacements at McKenzie Creek and Moose Creek near Dryden, and replacement of a Canadian Pacific Railways overpass near Dinorwic. These projects have been included in the cumulative effects assessment.
- **Canadian Pacific Railway**: The Canadian Pacific Railway is a publicly traded company on the Toronto and New York stock exchanges. It has over 14,000 miles of rail network from Vancouver to Montreal along with rail to a few major industrial centers in the US (Canadian Pacific, 2017). Canadian Pacific Railway has tracks that run proximal to the Project, and generally parallel to Highway 17. An annual vegetation control program is implemented along the tracks to decrease vegetation growth adjacent to the rails.
- **Dryden Forest Management Company Limited**: The Dryden Forest Management Company Limited (DFMC) has managed the Dryden Forest area since it was issued a Sustainable Forest License from the Ontario Minister of Natural Resources and Forestry in 1998. The DFMC has identified through its Ten-year Forest Management Plan, that it plans on logging in areas located between Thunder Lake and Hartman Lake located within the Treasury Metals' property boundary between 2016 and 2021 (Dryden Forest Management Company, 2016). The current 10-year Forest Management Plans 2011 to 2021 (FMP) show a planned harvest of approximately 11,952 ha. The forest management plans are not yet available for the period after 2021.



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LEGEND

- Operations Area
- Treasury Metals Exploration Program
- Josephine Cone Mine Project
- Domtar Corp Dryden Pulp Mill
- Proposed Wataynikaneyap Power
- Transmission Line
- DD Contracting Aggregate Pit
- Canadian Pacific Railway
- First Nation Reserves
- Provinical Parks
- Dryden Forest Management Unit
- Planned Harvest Areas (2016 - 2021)
- Highway
- Local Road

MNDM Proposed Road Works (2017-2021)

- Bridge Rehabilitation
- Culvert Replacement
- Resurfacing

0 2.5 5 10 15 20 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.
- MNDM proposed road works extracted from Northern Highways Program 2017-2021.
- Planned harvest areas were digized from Dryden Forest Management Units Operational Planning Maps.
- Wataynikaneyap Power routes extracted from 'Phase 1 Draft ES', Golder Associates, 2016.

Datum: NAD83
Projection: UTM Zone 15N

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GOLIATH GOLD PROJECT

Projects Considered in Cumulative Effects Assessment

PROJECT N°: TC160516	FIGURE: 3.2.4-1
SCALE: 1:300,000	DATE: April 2018

- **Domtar Corporations Dryden Pulp Mill**: Domtar Corporation's Dryden Pulp Mill is located along the Wabigoon Chain of Lakes within Dryden, Ontario and produces cellulose fibers including paper grade and bleached softwood kraft market pulp. It has an annual pulp production capacity of 327,000 tonnes and is the largest employer in Dryden supporting over 350 employees with a regional economic impact of $603.4 million (Domtar, 2017). The pulp mill has been in operation in Dryden since 1913, and was acquired by Domtar in 2007. The pulp mill is located on the west side of Dryden, approximately 15 km from the Project, adjacent to the Wabigoon River.
- **Josephine Cone Mine Project:** The Josephine Cone Mine Project is a proposed iron ore mine owned by Bending Lake Iron Group Limited. The proposed mine would be located 49 km southwest of Ignace, Ontario, 80 km north of Atikokan, Ontario and approximately 50 km southwest of the Project property boundary. This project would be an open pit mine with an ore throughput of approximately 56,000 tonnes per day. This project is currently undergoing a Federal Environmental Assessment, which commenced in mid-2012. The EIS Guidelines were issued in June of 2012, and have since been extended to June of 2018, although no EIS had been filed at the time of Treasury Metals revised EIS preparation. This project, if constructed, has an anticipated life span greater than 25 years.
- **Aggregate Pits and Quarries**: D&D Contracting holds an aggregate permit (Permit 46764) for an aggregate pit within the property boundary of Treasury Metals (MNRF, 2017). This aggregate pit has been included in the cumulative effects assessment.
- **Wataynikaneyap Power**: Wataynikaneyap Power is a transmission company owned by 22 First Nations communities and provides power to remote First Nations communities in Northwestern Ontario by means of diesel generation. The Wataynikaneyap Transmission Project plans to bring reliable power to 16 of these remote communities with 1,800 km of new transmission lines with a potential construction start date in December of 2018 (Wataynikaneyap Power, 2012). A segment of the transmission line will run from the Hydro One 230 kV line southeast of Dinorwic to Pickle Lake. The segment of this project within the cumulative effects study area is expected to be completed in 2020.
- **Local infrastructure:** The development of local infrastructure and minor road upgrades are expected in communities within the cumulative effects study area (i.e., Dryden and Wabigoon). No largescale projects (>$500,000) are anticipated (Meridian Planning Consultants, 2007).

3.2.4.2 Summary of Section 7 of the Revised EIS (April 2018)

As set out in Table 7.6-1 of the revised EIS (April 2018), the only quantifiable cumulative effects are related to loss of habitat. As such, those cumulative effects would not alter the chemical composition of environmental media or country foods, and would therefore not alter or modify the findings of the HHERA presented herein. That is to say, the cumulative effects scenario results would be numerically the same as the Project scenario.

3.3 Project Setting

This section provides an overview of the proposed Goliath Gold Project phases, components, and undertakings. Full Project details are provided in Section 3 “Project Description” of the revised EIS (April 2018).

The objective of this section is to provide a platform for describing chemical emissions and releases (i.e., exposure pathways), receptors, and risk management measures incorporated into the design of the Project for each of the temporal boundaries of the HHERA. A more detailed description of operable exposure pathways and receptors relevant to the HHRA and ERA are discussed within those respective subsections.

3.3.1 Property Information

The Project is located within with the Kenora Mining Division in northwestern Ontario (Figure 3.3.1-1). The Project site is approximately 4 kilometres (km) northwest of the village of Wabigoon, 20 km east of Dryden and 2 km north of the Trans-Canada Highway 17 and within the Hartman and Zealand townships (Figure 3.3.1-2). Access to the Project property is via existing gravel roads managed through the Local Services Board: Tree Nursery Road and Anderson Road which originates at Highway 17, west of the village of Wabigoon.

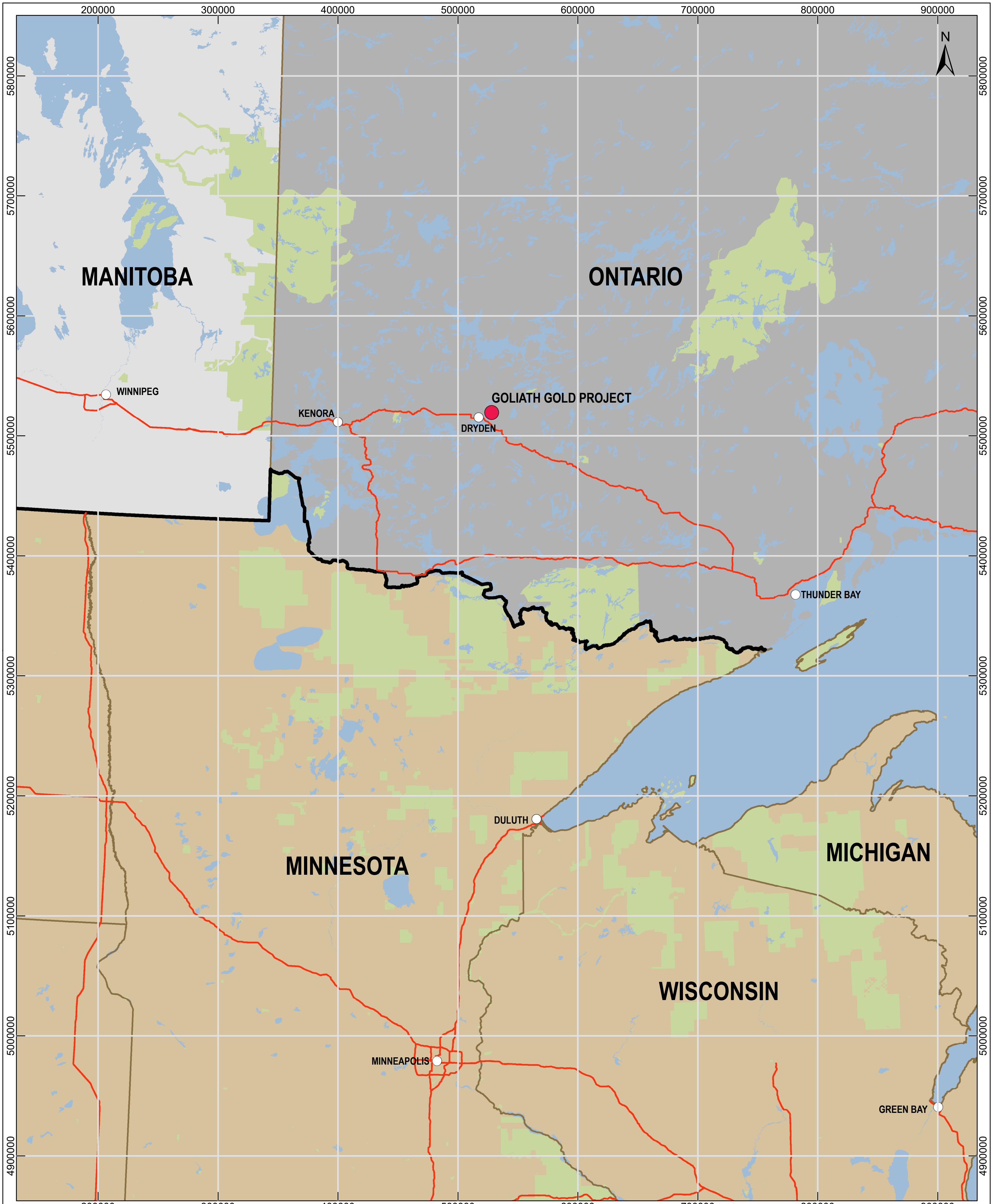
The Project is located within the area covered by Treaty 3. Treaty 3 area includes approximately 14,245,000 hectares (ha) in Ontario ranging from the vicinity of Upsala in the east, following the Canada-United States border in the south, and extending past the Ontario-Manitoba border in the west (Figure 3.3.1-3). Treaty 3 includes 28 First Nation communities and a number of villages and towns including Wabigoon, Dryden, Eagle River, Vermillion Bay, Sioux Lookout, Atikokan, Fort Frances, and Kenora. The relative locations of the closest First Nations communities are shown on Figure 3.3.1-4. The Project is also located within an area identified by the Métis Nation of Ontario as the Treaty 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake traditional harvesting territories, also named Region 1.

The physical address of the Project Office is:

Treasury Metals Incorporated – Goliath Gold Project
899 Tree Nursery Road
Wabigoon, Ontario, P0V 2W0, Canada

The location of the Project Site (centered on the open pits) is:

- UTM Coordinates (NAD 83 15N):
  - Easting – 528210.0
  - Northing – 5511680.0
- Latitude and Longitude:
  - Latitude: 49° 46’ 25” North
  - Longitude: 92° 36’ 30” West



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.		
Location of the Goliath Gold Project (Regional Scale)	DESIGN: MP 31/07/2017 GIS: MP 31/07/2017 CHECK: MW 31/07/2017 REVIEW: DB 31/07/2017		
Figure 3.3.1-1	REV.01		

Legend: Canada; United States; Ontario; Population Center; Highway/Interstate; Provincial/State Line; International Boundary

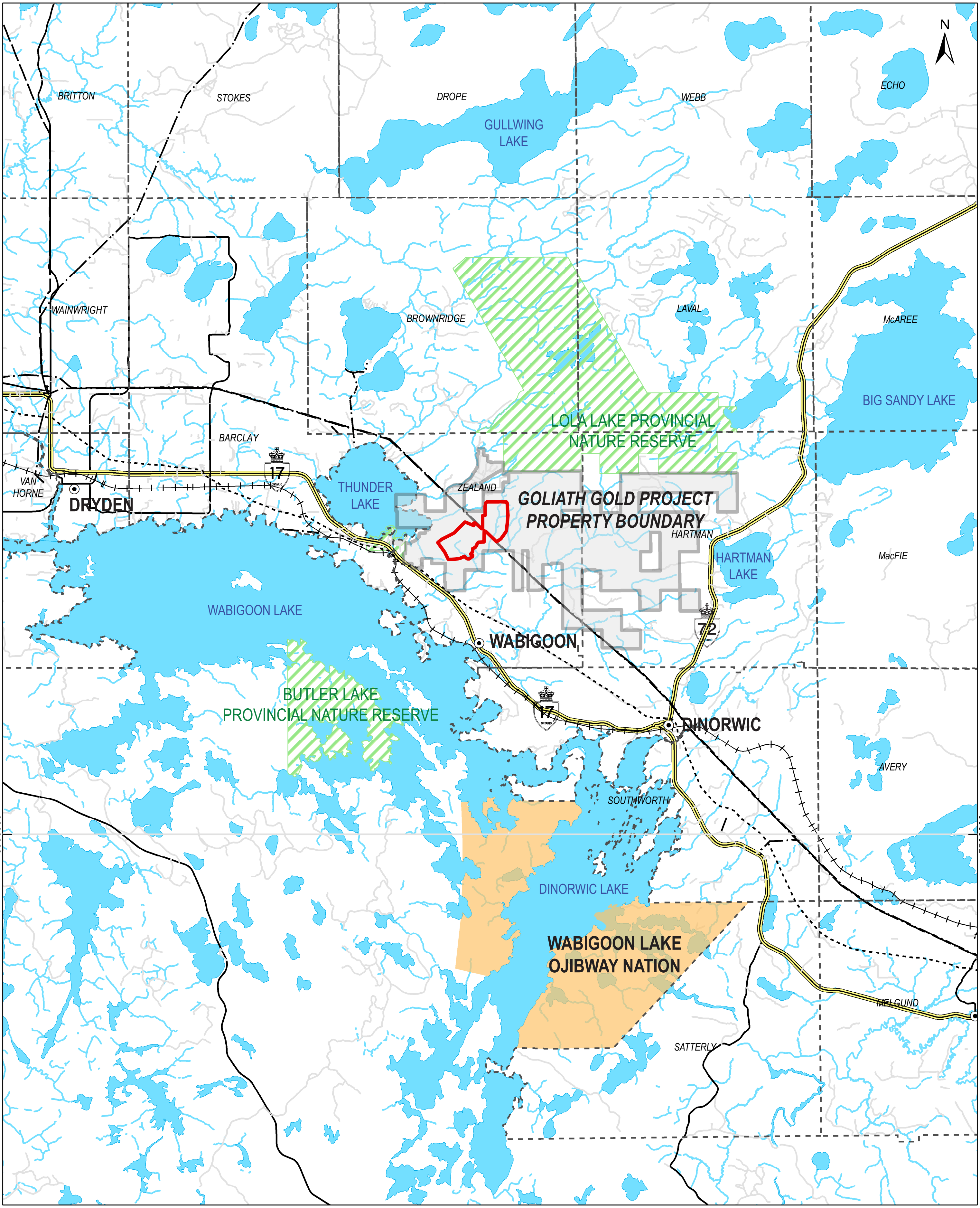
SCALE 1:4,000,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 100 200 Kilometers

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Location of the Goliath Gold Project (Local Scale)

DESIGN:	MP	17/08/2017
GIS:	MP	17/08/2017
CHECK:	MW	17/08/2017
REVIEW:	MW	17/08/2017

Figure 3.3.1-2 REV.02

Operations Area
Property Boundary
Townships
Indigenous Communities
Provincial Parks
Populated Area
Waterbody
Watercourse
Railway
Arterial Roadway
Expressway / Highway
Resource / Recreation

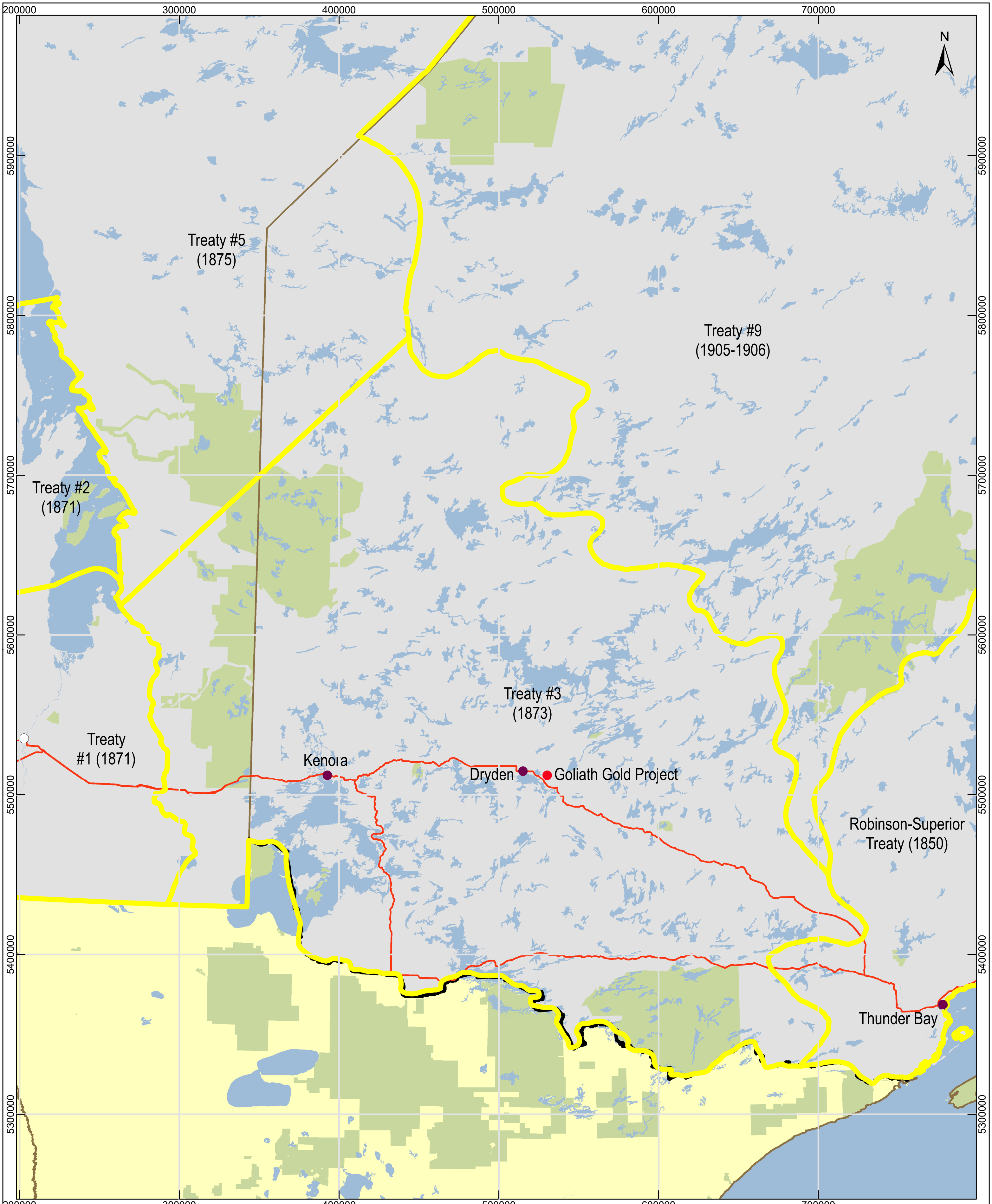
SCALE 1:200,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 1 2 3 4 5 6 7 8 9 10
Kilometers

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Treaty Areas - Regional Scale

Figure 3.3.1-3 REV.01

TREASURY METALS Inc.

DESIGN: MP 18/08/2017
GIS: MP 18/08/2017
CHECK: MW 18/08/2017
REVIEW: MW 18/08/2017

Treaty Areas
Population Center
Canada
Highways
United States

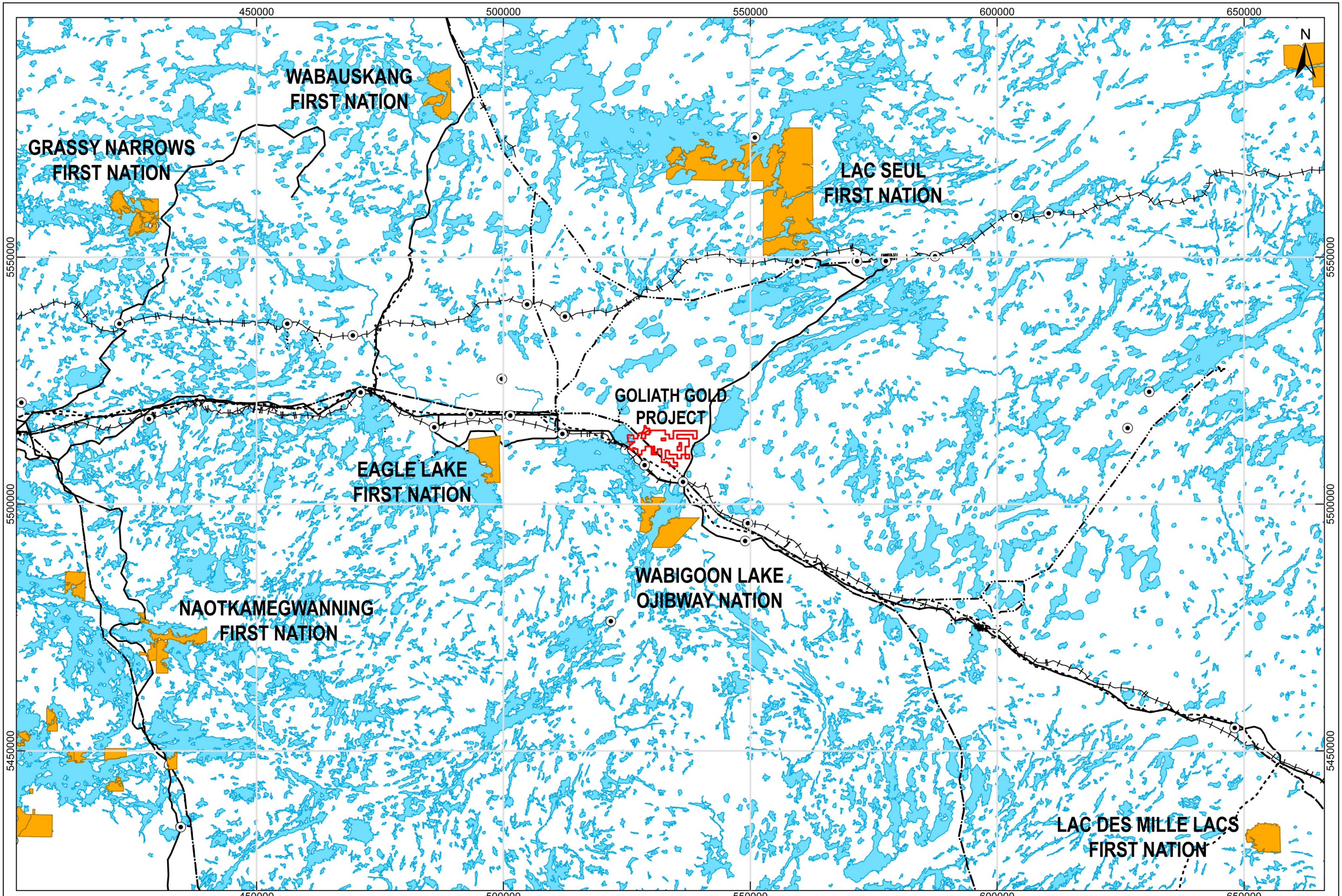
SCALE 1:3,000,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 100
Kilometers

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Indigenous Communities

DESIGN: MP 18/08/2017
GIS: MP 18/08/2017
CHECK: MW 18/08/2017
REVIEW: MW 18/08/2017

Figure 3.3.1-4 REV.02

Indigenous Communities
Goliath Property Boundary
Populated Area
Hydro Line
Natural Gas Pipeline
Railway
Highway
Waterbody

SCALE 1:1,000,000

Coordinate System: NAD 1983 UTM Zone 15N
Projection: Transverse Mercator
Datum: North American 1983

0 20 40 60
Kilometers

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
All details preliminary and subject to change as engineering designs are updated.

3.3.2 Project Description

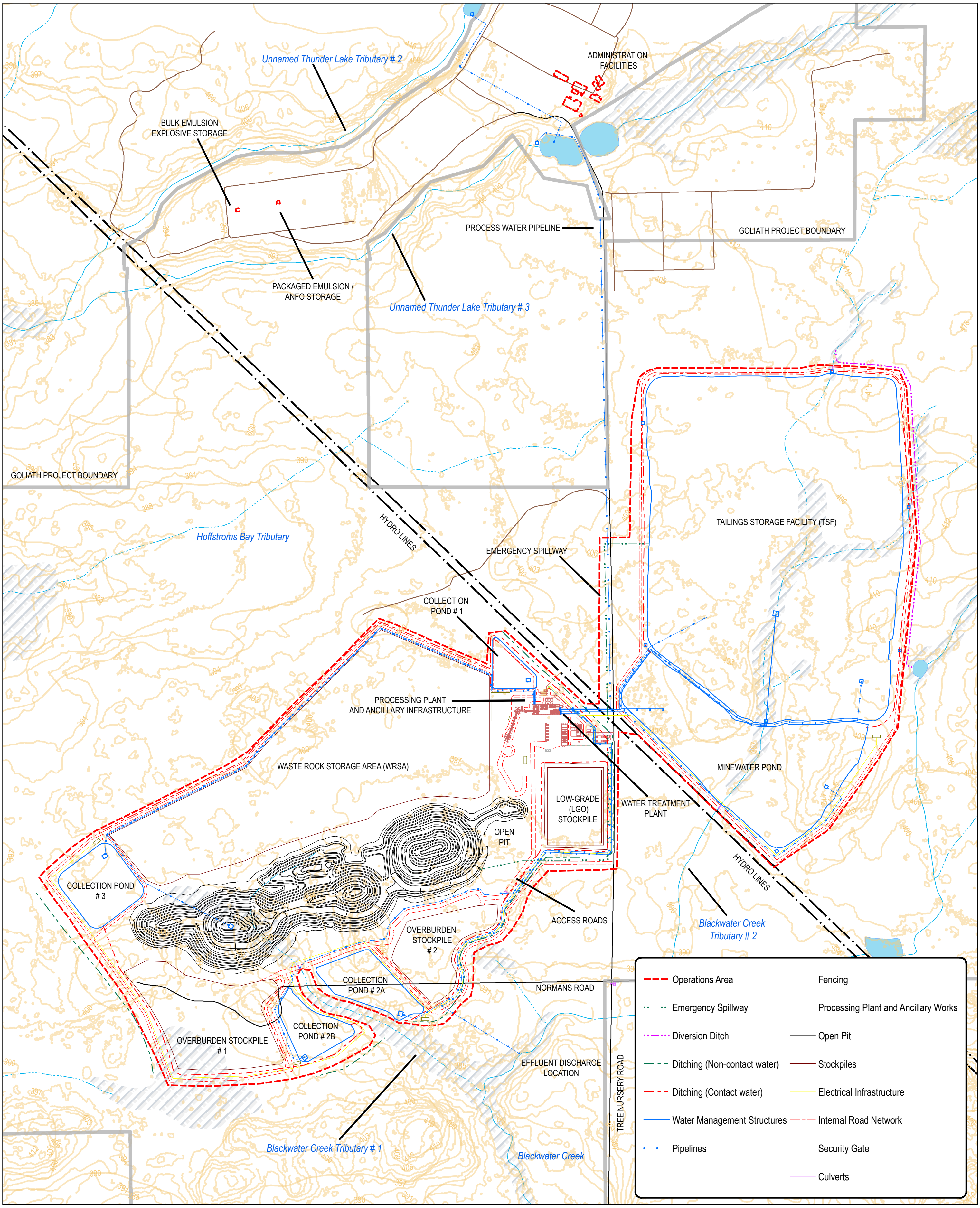
The mine layout places most mine-related facilities in close proximity to the proposed open pit, and to the extent possible, on private lands owned by Treasury Metals. Figure 3.3.2-1 shows the Operations Area (Study Area No. 1) that will be surrounded by a perimeter ditch, which will prevent direct discharges to the environment. The overall Project footprint will cover approximately 188 ha during the maximum of extent of operations with the entire footprint on Treasury Metals lands that are either patented or leased (mining rights and surface rights). The site plan shown in Figure 3.3.2-1 shows the preferred alternatives for Project components, as described in Section 2 of the revised EIS (April 2018). Figure 3.3.2-2 provides an illustration of the Plant site details, while the layout of the Administration Area is provided in Figure 3.3.2-3. At closure, Treasury Metals will reclaim the site as described in Section 3.14 of the revised EIS (April 2018). Two options are discussed in the EIS for closure, one using a dry cover for the closure of the tailings storage facility (TSF) (see Figure 3.3.2-4), and one using a wet cover for the closure of the TSF (see Figure 3.3.2-5).

The Project is designed to:

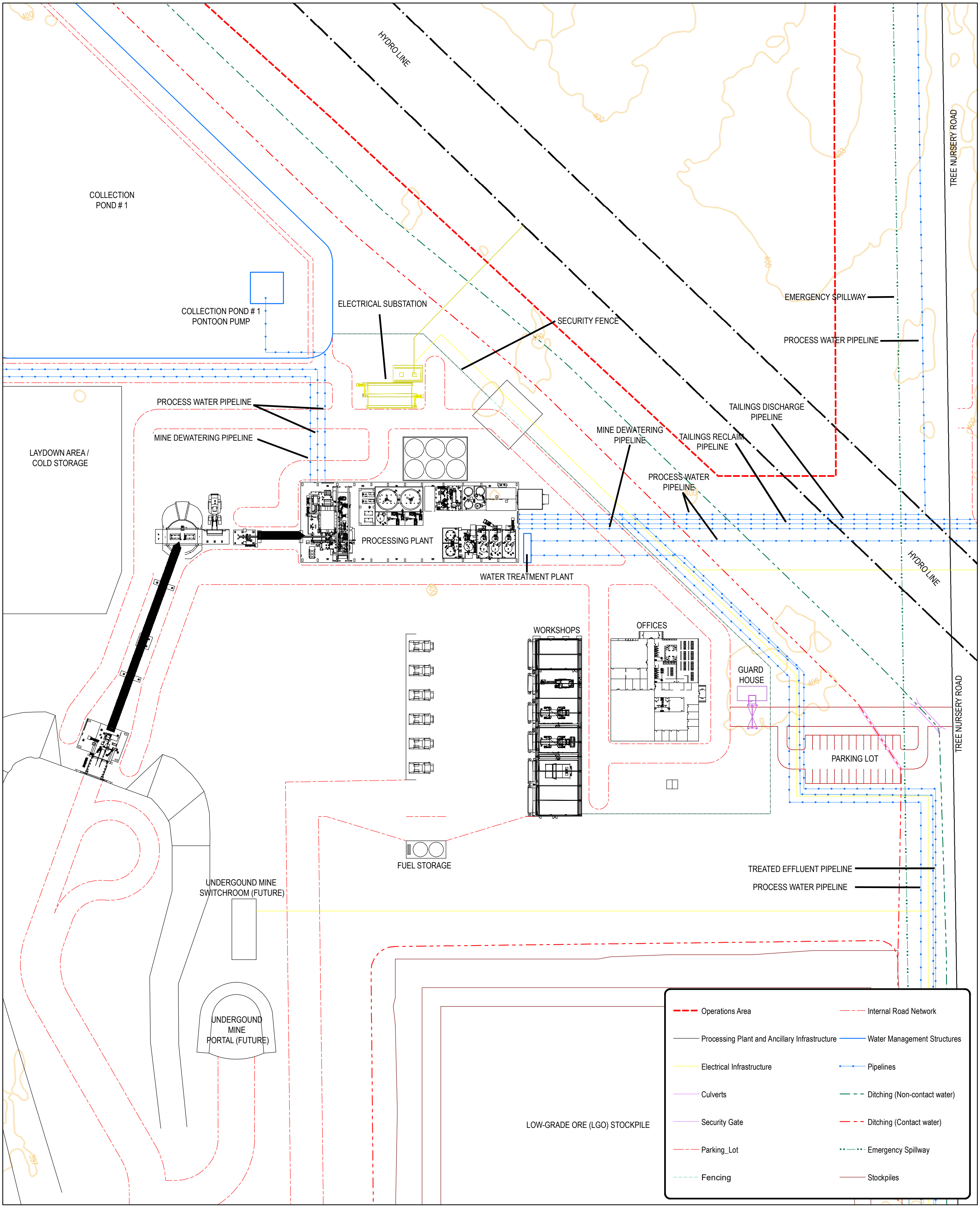
- Use well known, conventional and environmentally sound mining techniques and technologies used commonly in northern environments;
- Minimize overall footprint;
- Minimize associated potential effects;
- Manage water effectively and efficiently;
- Mitigate or compensate for effects on biological habitat; and
- Accommodate effective planning for final closure and site abandonment, rendering the site suitable for other compatible land uses and functions.

The area surrounding the Project is a mixture of abandoned homesteads, small hobby farms and residential dwellings. Most of the properties associated with the Project have been privately owned since around 1900 and have been acquired by Treasury Metals by means of private purchase agreements. Mineral exploration of the Project site has been carried out since 1990 by various companies and is ongoing. The Ontario Ministry of Natural Resources and Forestry (MNRF) established a tree nursery facility, located north of the mineral deposit, which was sold to Treasury Metals in 2011 and houses the Project office (Figure 3.3.2-1).

The Project site is accessed from Highway 17 via Anderson Road and Tree Nursery Road (Figure 3.3.2-1). Highway 17 is part of the Trans-Canada Highway network and is operated by the MTO. Anderson Road and Tree Nursery Road are unpaved and maintained by the municipality.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	Hydro Line	Expressway / Highway	Waterbody	SCALE 1:16,000	NAD 83, UTM Zone 15	Base Data: Treasury Metals Inc., LIO Database, KBM Resources Group
General Arrangement Operations Phase	DESIGN: MP 03/27/2017 GIS: MP 03/27/2017 CHECK: MW 03/27/2017 REVIEW: DB 03/27/2017	Natural Gas Pipeline Railway Provincial Parks	Local Road Resource / Recreation Road Contours (3 meters)	Intermittent Streams Permanent Streams Wetland	0 – 750 Meters	N	Notes: Harvest will be contained within operations area.
Figure 3.3.2-1	REV.01						



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

General Arrangement
Operations Phase (Plant Site Details)

Figure 3..3.2-2 REV.01

DESIGN: MP 03/27/2017
GIS: MP 03/27/2017
CHECK: MW 03/27/2017
REVIEW: MW 03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Provincial Parks
Expressway / Highway
Local Road
Resource / Recreation Road
Contours (3 meters)
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:2,000

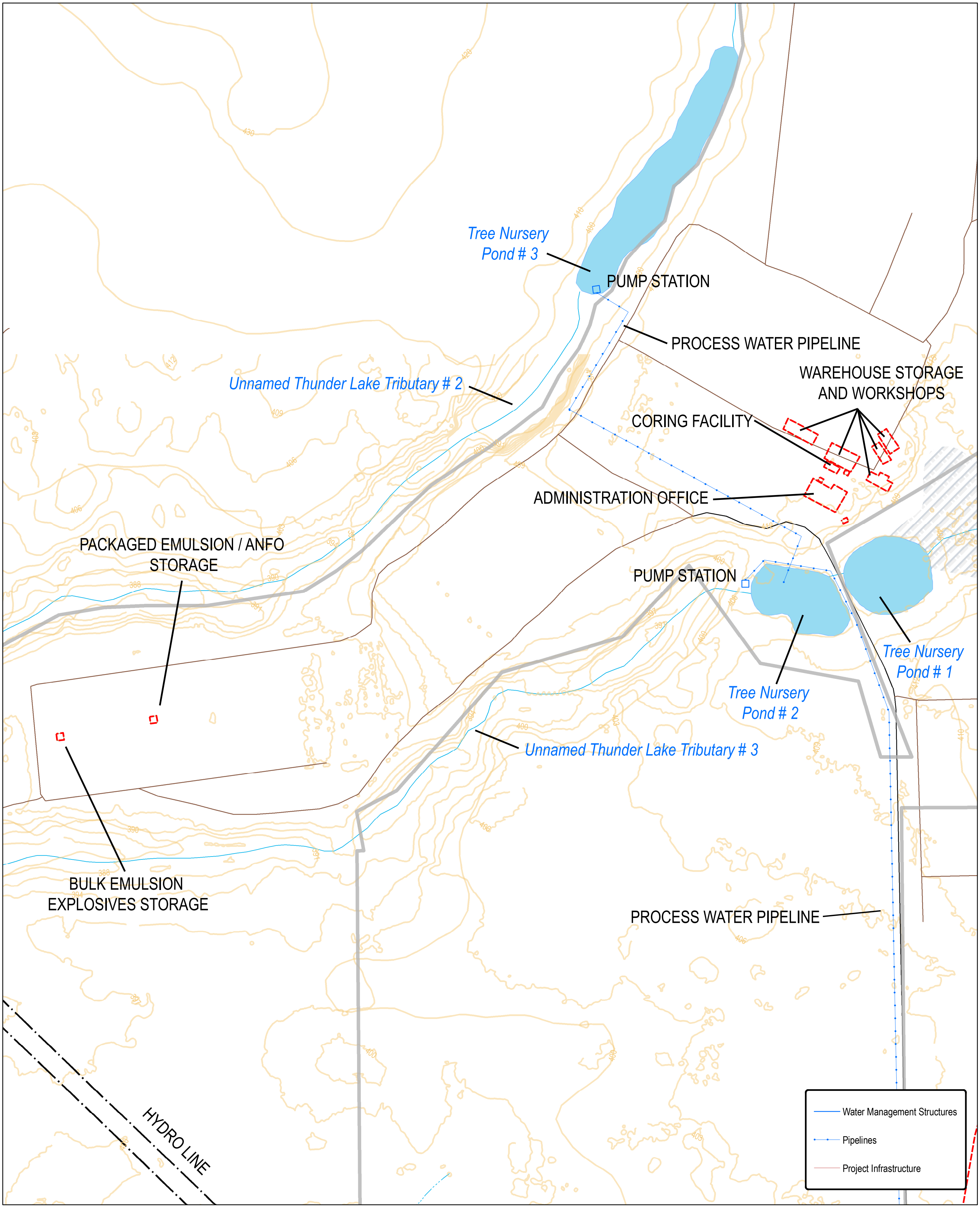
NAD 83, UTM Zone 15

N

0 100
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
Harvest will be contained within operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

General Arrangement
Operations Phase (Administration Area)

DESIGN: MP 03/27/2017
GIS: MP 03/27/2017
CHECK: MW 03/27/2017
REVIEW: MW 03/27/2017

Figure 3.3.2-3 REV.01

Hydro Line
Natural Gas Pipeline
Railway
Provincial Parks
Expressway / Highway
Local Road
Resource / Recreation Road
Contours (3 meters)
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:7,000

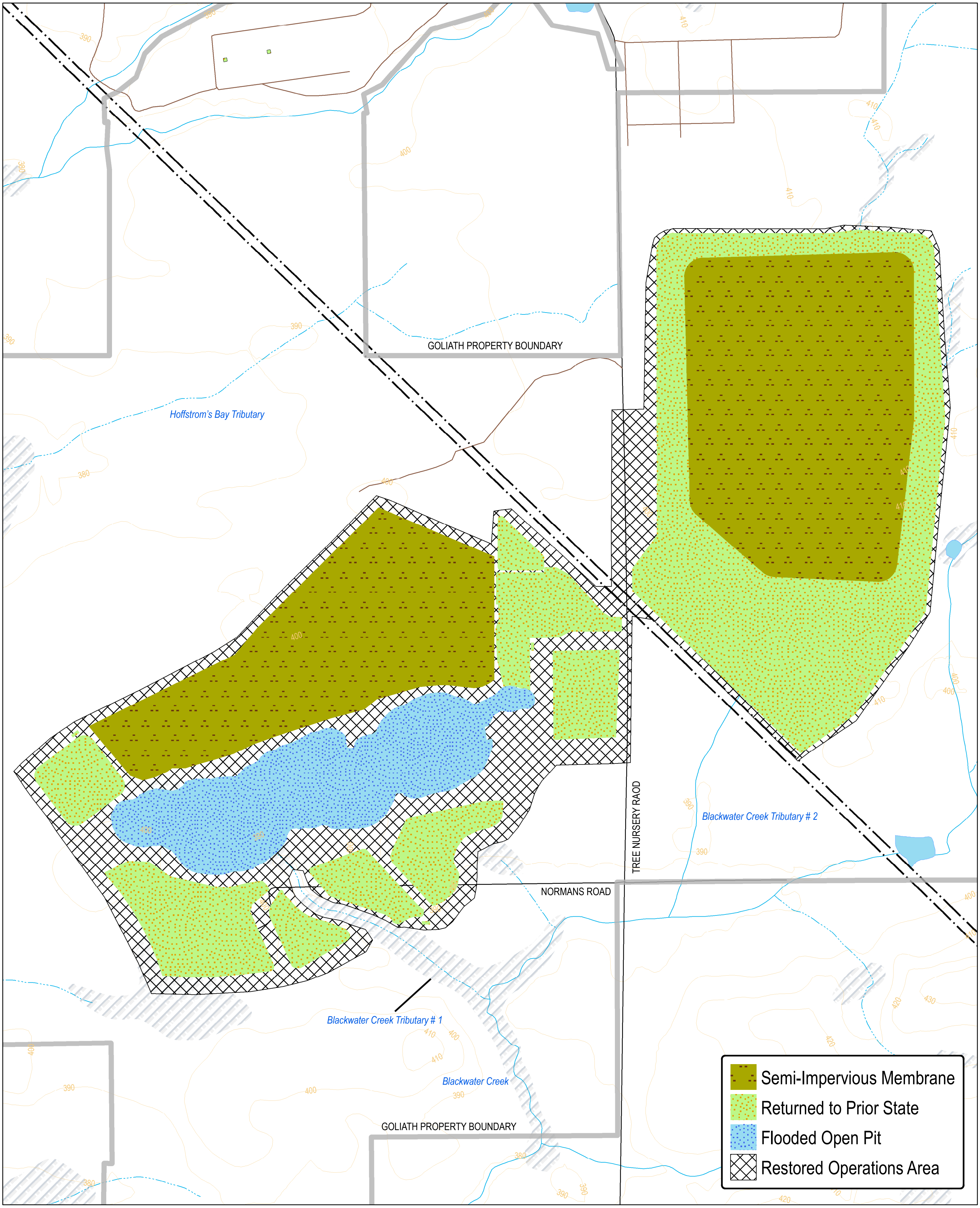
NAD 83, UTM Zone 15

N

0 300
Meters

Base Data:
Treasury Metals Inc., LIO Database, KBM Resources Group

Notes:
Harvest will be contained within operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Project Configuration
Post-Closure (Dry TSF Cover)

Figure 3.3.2-4 REV.01

DESIGN:	MP	03/27/2017
GIS:	MP	03/27/2017
CHECK:	MW	03/27/2017
REVIEW:	MW	03/27/2017

Hydro Line
Natural Gas Pipeline
Railway
Expressway / Highway
Local Road
Resource / Recreation Road
Provincial Parks
Waterbody
Intermittent Streams
Permanent Streams
Wetland

SCALE 1:15,000

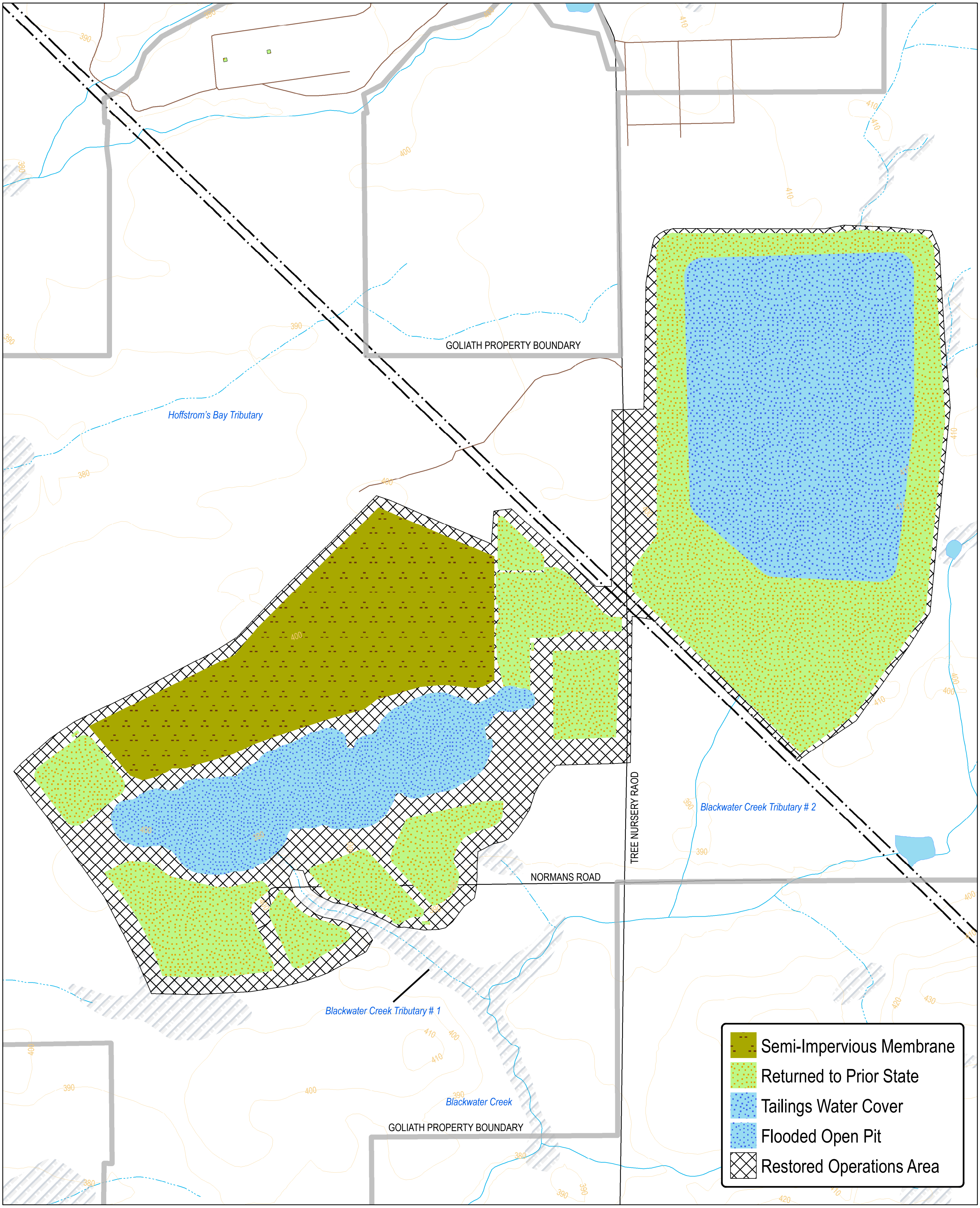
NAD 83, UTM Zone 15

N

0 750
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
Harvest will be contained within operations area.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Project Configuration
Post-Closure (Wet TSF Cover)

Figure 3.3.2-5 REV.01

DESIGN: MP 03/27/2017
GIS: MP 03/27/2017
CHECK: MW 03/27/2017
REVIEW: MW 03/27/2017

Hydro Line	Expressway / Highway	Waterbody
Natural Gas Pipeline	Local Road	Intermittent Streams
Railway	Resource / Recreation Road	Permanent Streams
	Provincial Parks	Wetland

SCALE 1:15,000

NAD 83, UTM Zone 15

N

0 750
Meters

Base Data:
Treasury Metals Inc., LIO Database,
KBM Resources Group

Notes:
Harvest will be contained within
operations area.

3.3.3 Description of Project Phases

3.3.3.1 Site Preparation and Construction Phase

Before mining operations can commence, Treasury will need to prepare the site and construct key elements of the Project infrastructure. The first activities to occur will be associated with the preparation of the site. These activities will include:

- Establish and implement environmental protection and monitoring plans;
- Initiate overburden stripping;
- Establish water management and flood protection infrastructure;
- Construction of dams and water realignment channels/ditches; and
- Construction of support buildings and infrastructure.
- Dewater ponds and wetlands within footprint of proposed infrastructure;
- Establish water management and flood protection infrastructure for mine components;
- Construct surface drainage diversion structures and water realignment channels/ditches;
- Construction of any access roads for planned infrastructure;
- Initiate overburden stripping over the ore body, the TSF location, and mill site; and
- Construction of support buildings and infrastructure required for construction.

Treasury will initiate construction once site preparation activities are completed, with some activities overlapping in time (e.g., construction in one area of the site while site preparation in another area continues). Construction activities will be coordinated according to manpower and equipment availability, scheduling constraints and site conditions. Some activities, particularly those involving work in wet or poorly developed accessible terrains are best carried out under frozen ground conditions. Some of the key construction activities include:

- Procurement of materials and equipment;
- Movement of construction materials to identified laydown areas and site;
- Construction of additional site access roads and any possible required realignment of existing roads;
- Development of aggregate source(s) anticipated to be principally for possible concrete manufacturing, foundation work and TSF dam filter zones;
- Construction of the TSF;
- Establishment of site drainage works, including pipelines from freshwater/recycled water sources;

- Development and installation of construction facilities;
- Construction of associated building and facilities;
- Preparation of on-site mineral waste handling facilities; and
- Construction and energizing of a 115 kV transmission line including on-site electrical substation.

Overall, this phase of the project could last up to two years in length.

During Site Preparation and Construction workers may be exposed to higher concentrations of fugitive dust emissions from overburden (i.e. baseline soils). There will be no emissions from waste rock, tailings, or the ore bodies during Site Preparation and Construction. A fence will be constructed around the perimeter of the Project footprint during this Project phase, thereby minimizing access to large mammals and human receptors other than site workers. Under good occupational health and safety practices, a Health and Safety Plan including additional personal protective equipment such as a respirator and dust mask will be implemented to minimize inhalation of total suspended particulate matter and particulate matter in the air during this project phase.

3.3.3.2 Operations Phase

Ore will begin to be produced immediately by processing incoming material from the open pit. The process plant will operate at approximately 2,700 tonnes per day (tpd) to process a total of approximately 5,500,000 tonnes of open pit ore and 3,500,000 tonnes of underground ore over the 10 to 12 year operational phase of the mine.

As the operations phase continues, the open pit will become progressively deeper. Approximately 40% of the waste rock will be used to backfill the mined-out areas of the pit. The TSF capacity will be increased as required through dam raises.

Solid and liquid wastes/effluent will be managed to ensure regulatory compliance. Environment related activities that will be carried out during the operations phase are anticipated to include:

- Ongoing management of chemicals and wastes;
- Water management/treatment;
- Air quality and noise management;
- Biological monitoring;
- Environmental monitoring and reporting;
- Follow up environmental studies; and
- Progressive site reclamation, where practical.

During Operations human receptors may be exposed to fugitive dust emissions from the Project. Human receptors may be exposed via direct dermal contact to baseline soils and waste rock, however not tailings, as tailings will be maintained under contestant water cover in the TSF during the operations phase of the Project. Fugitive dust from the tailings beach has been considered as part of the air quality modelling in addition to emissions from the waste rock. Under good occupational health and safety practices, a Health and Safety Plan including additional personal protective equipment such as a respirator/ dust mask, work gloves, and long sleeves and pants will be implemented to minimize human exposure during the operations phase of the Project. Access to the operations area to ecological receptors will be limited with the implementation of the fence around the Project footprint. The TSF will also be fenced thereby restricting the ability of mammals to use the TSF as a source of drinking water, and reducing this pathway of exposure to birds alone. The TSF is being designed with a cyanide management system to ensure that wildlife, including waterfowl and aquatic life, are protected. Treasury Metals will employ a two part strategy for managing cyanide at Project, namely: reduce and re-use; and treatment or destruction. The TSF will be lined to prevent chemical seepage to the groundwater system and subsequently downgradient surface water bodies. Treasury Metals has committed (Cmt_034) that during operations, effluent discharged from the Project to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) or background concentrations if background levels are above the PWQO. Where there is no PWQO for a parameter, the commitment will be to meet the Canadian Water Quality Guidelines (CWQG). For total mercury, the commitment will be that effluent discharged to Blackwater Creek will meet background concentrations for that watercourse. Background concentrations for Blackwater Creek are defined as the 75th percentile in accordance MOECC receiving water assessment policy. Detailed parameters will be determined through engagement with appropriate Provincial and Federal regulatory bodies.

3.3.3.3 Closure Phase

Closure of the Project will be governed by the *Ontario Mining Act* (the Act) and its associated regulations and codes. The Act requires that a detailed closure plan be filed for any mining project before the project is initiated. Financial assurance is required before any substantive development takes place to ensure that funds are in place to carry out the closure plan. The objective of this is to reclaim the Project site area to a naturalized and productive biological state when mining ceases. The terms naturalized and productive are interpreted to mean a reclaimed site without infrastructure, which, although different from the existing environment, is capable of supporting plant, wildlife and fish communities, and other land uses. A conceptual closure plan is described in Section 3.14 and in Appendix KK of the revised EIS (April 2018).

Treasury Metals expects the active closure period of the Project will take approximately three years after operations cease.

During closure, Treasury Metals will optimize, design and install an engineered cover (either a dry or wet cover) to mitigate chemical stability issues in accordance with Section 59 of Schedule 2 of O. Regulation 240/00. In both cover scenarios the TSF supernatant and treatment to meet the appropriate regulatory standards prior to any release into the environment. The TSF will be graded and the tailings encapsulated under a gravel layer and liner. In the wet cover scenario the former TSF facility will be flooded with non-process water, and in the dry cover option graded with clean fill (non-acid generating) and revegetated with the use of non-edible plants with shallow root systems to discourage foot consumption by human receptors, and damage to the liner system over time, respectively. The waste rock storage area (WRSA) has been modified to locate it primarily in the Blackwater Creek watershed and minimize the portion that extends into the Thunder Lake watershed. The WRSA will be constructed with an embankment slope that is adequate for long-term physical stability to avoid the need to re-contour the WRSA at closure. As embankments are removed from active fill placement, they will be covered with overburden and vegetated with ground cover species as well as tree species that are consistent with planting prescriptions in the Dryden Forest Management Plan (FMP).

During the closure the fencing will remain around the project footprint thereby limiting access to human and ecological receptors. Human receptors may be exposed to waste rock and tailings for a short period of time via direct dermal contact during the construction of their final closure encapsulation. Inhalation of fugitive dust from these sources and baseline soils is also an operable pathway. At closure the pit lake will be allowed to flood. The pit lake will be monitored as it is filling to determine whether batch treatment will be required to ensure the water meets PWQO, or background if background levels exceed the PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek.

3.3.3.4 Post-Closure Phase

Following the Closure Phase there will be a period of time (i.e., the Post-Closure Phase) required until the final pit is fully flooded. Modelling has indicated that should take between 6 and 8 years. Until such time that the final pit is fully flooded and the Agency or other responsible authorities deem appropriate to ensure closure of the mine is performing as predicted, Treasury Metals will hold the site in care and maintenance. Environmental monitoring and potential effluent quality management will occur during this passive period of reclamation which is anticipated to take approximately 17 years. The pit lake will be monitored as it is filling to determine whether batch treatment will be required to ensure the water meets PWQO, or background if background levels exceed the PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek. Treasury Metals also expect that monitoring of the pit lake will continue for a period of time after flooding to determine whether additional batch treatments will be required to ensure the water released from the open will meet effluent limits.

During the Post-Closure Phase, there will be no fugitive dust emissions except those from baseline soils. However, the baseline soils in the Post-Closure phase will consider be the change in baseline soil chemistry from dust deposition during all previous Project phases. The change in baseline sol chemistry will be considered for surface soils (i.e. < 1.5 meters below ground surface (MOECC, 2011)). Changes in baseline soil chemistry may result in chemical update into plants and soil organisms and subsequently bioaccumulate within the food chain. An evaluation of ingestion of country foods (plants, wild game, fish) will be evaluated for the Post-Closure Phase of the Project as this is when human and ecological receptors may also once again have full access to the Project site (i.e. it will no longer be fenced). There will be no exposure to waste rock or tailings during post-closure as these wastes will be completely encapsulated.

3.4 Hydrogeological Setting

The proposed mine site is located in the west-central portion of a hydrological basin containing low to moderate relief topographic features, including low lying marsh type lands and exposed bedrock ridges. This basin has been defined by inferred groundwater divides associated with topographic watersheds, and is bordered by upland areas to the east, in the vicinity of Hartman Lake, and to the north, part of which is occupied by a significant wetland area; the Thunder Lake Tributary drainage basin to the west; and Wabigoon Lake to the south. This basin contains the Thunder Lake drainage area to the west, Blackwater Creek drainage area through the central region, and the Hughes and Nugget Creek drainage areas in the east. Blackwater Creek and Hughes Creek both drain southerly into Wabigoon Lake. The extent of this area is shown in Figure 5.6.1-1 of the revised EIS (April 2018).

The regional hydrogeology of this study area reportedly consists of relatively shallow (less than 10 m), localized overburden aquifers, as well as fractured metamorphic bedrock aquifer conditions.

3.4.1 Overburden Aquifer Conditions

As described in Section 5.6 of the revised EIS (April 2018), the hydrogeological investigations conducted to date for this area were based on the following infrastructure:

- Nine monitoring wells/groundwater quality wells were constructed in the overburden and bedrock contact in May 2013.
- 20 geotechnical boreholes were drilled in March/April 2014 with four of these completed with shallow stand pipes for groundwater monitoring.
- Groundwater elevations were manually recorded in the water quality wells on near monthly intervals between June 2013 and January 2014, and in the standpipes on one occasion in May 2014.
- Hydraulic conductivity testing of the overburden soils was performed on six of the water quality wells in February 2014.

Borehole logs and well construction details for these monitoring wells are provided in Appendix M to the revised EIS (April 2018).

3.4.1.1 Overburden Geology

Overburden throughout the area consists of fine grained lacustrine deposits and coarser grained glaciofluvial outwash deposits, distributed over shallow, irregular bedrock. This overburden has an average thickness of around 7.5 m, but does vary from non-existent where bedrock outcrops at surface in various locations in the vicinity of the project site, as well as to the north and south, to depths of around 15 m in limited areas, with a maximum depth of 40 m below grade. The distribution of this surficial geology is shown in Figure 5.6.2.1-1 of the revised EIS (April 2018). For additional details relating to the surficial geology, including cross section through the study area, please refer to Section 5.5 of the revised EIS (April 2018).

For the most part, the lacustrine deposits of clay, silt and sand-clay or silt-sand, have a low hydraulic conductivity (10^{-8} m/s), and are expected to act as an aquitard. These deposits are generally not expected to provide any significant base flow to the local creeks or streams, or to be suitable for development as a groundwater resource through use of private wells.

Through portions of this area (exploratory drilling suggest 40% of borehole locations), there is a basal sand of variable but generally limited thickness (3 to 4 m maximum), underlying the lacustrine clay-rich unit. Hydraulic conductivities of the basal sand unit are in the order of 10^{-6} m/s, so there is the potential for development of this water bearing zone as a localized groundwater resource. These deposits generally infill the low areas of the variable bedrock surface.

Across the northeastern portion of the study area, the overburden geology is dominated by sand and sand and gravel glacial deposits, associated with the Hartman Moraine, a northwest to southeast trending feature running parallel to the shoreline of Thunder Lake. These outwash deposits are expected to provide base flow to various tributaries draining into Thunder Lake, and are suitable for development as a groundwater resource. A second area of deeper sand and gravel deposits is present in the southeast portion of the study area in the form of a Kame deposit.

3.4.1.2 Aquifer Characteristics

In February 2014, rising head slug tests were conducted by Treasury on six of the groundwater quality wells installed in the overburden and overburden/ bedrock interface. Hydraulic conductivities ranged from 4.6×10^{-7} m/s to 1.3×10^{-6} m/s with a geometric mean of 9.2×10^{-7} m/s and arithmetic mean of 9.8×10^{-7} m/s. In most of the wells in which rising head slug tests were conducted, the screened portion of the well extended through a mixture of clay and sand immediately above the contact with the bedrock surface (location of auger refusal) or the screen straddled the basal sand and bedrock contact surface. Details relating to the well construction, stratigraphy and conductivity values are summarized in Table 5.6.2.2-13.4.2.2-1.

Table 3.4.2.2-1: Overburden Hydraulic Conductivity Testing Summary

Well ID	Screened Depth (m below grade)	Screened Stratigraphy	Depth to Water (m below grade)	Hydraulic Conductivity (m/s)
1A	3.1 – 4.6	Basal sand and bedrock	1.06	1.3×10^{-6}
3AS	3.1 – 6.1	Sand	1.66	7.1×10^{-7}
3AD	10.9 – 12.9	Clay and basal sand	1.20	4.6×10^{-7}
5A	6.6 – 9.6	Clay	2.0	1.0×10^{-6}
6D	3.0 – 6.0	Clay and basal sand	1.91	1.1×10^{-6}
7A	4.0 – 7.0	Clay and silt and sand	1.43	1.2×10^{-6}

3.4.1.3 Groundwater Flow

During the limited period of groundwater elevation monitoring (June 2013 to January 2014), the depth to groundwater ranged from 0.14 m to 1.9 m below grade. Seasonal fluctuations of the water table were noted as a slight rise in the fall and then a decrease in the winter, with the range of fluctuation in the individual wells being 0.5 m to 1.7 m. The groundwater elevations recorded are summarized in Table 5.6.2.3-1 of the revised EIS (April 2018).

Based on limited monitoring of various wells (water quality monitoring and geotechnical boreholes) installed throughout the area, groundwater flow in the basal sand feature appears to be southwesterly, from the elevated wetland to the north, then splitting off in the general vicinity of the project site to the south towards Wabigoon Lake and to the west towards Thunder Lake, suggesting that this flow is largely controlled by local topography. The groundwater contours and apparent flow direction is shown in Figure 5.6.3 of Appendix M to the revised EIS (April 2018).

Based on this flow system, the recharge area for the basal sand aquifer is expected to be in higher elevation, outwash areas to the north, and the Kame deposit to the southeast, or along the edges of the localized bedrock outcrops.

Monitoring of stream flows in Blackwater and Little Creek during the regional dry/low precipitation year of 2011 found that these creeks had no flow or not enough flow for accurate measurement beyond the spring freshet. This was considered to be an indication that there was no significant groundwater discharge to these creeks, as otherwise some baseflow could be expected during very dry conditions. In 2012 and 2013, precipitation was again below the 30 year average, but near continuous flow was noted in both of these creeks, which was then assumed to account for part of the recharge to the overburden aquifer system.

3.4.2 Bedrock Aquifer Conditions

As described in Appendix M to the revised EIS (April 2018), the hydrogeological investigations conducted to date for the bedrock system were based on the following infrastructure:

- Records for available geological exploration boreholes were initially reviewed and six of these were incorporated in to the hydrogeological assessment program.
- Three additional boreholes were drilled into the bedrock in February 2013 to assess hydrogeological conditions.
- All nine of these hydrogeological purposes bedrock boreholes are located in the immediate vicinity of the proposed mine development site.
- In February 2014, multi-level hydraulic conductivity testing was conducted on three existing geological exploration boreholes and in the three bedrock boreholes drilled for hydrogeological assessment.

The three drilled boreholes were equipped with vibrating wire piezometers to allow for continuous water level fluctuation monitoring through 2013.

3.4.2.1 Bedrock Geology

Bedrock throughout the area consists of metasedimentary rock, with mafic to intermediate metavolcanic rock to the north and south. Groundwater availability and flow through these units is dependent on fracture frequency and fracture interconnectivity which allows for groundwater storage movement from the recharge areas. The areas of higher conductivity in the metasedimentary unit are most commonly in the upper portion, which has been subjected to historical weathering, and in a central unit of more highly altered rock (e.g., schists), which shows an east–west structural trend. Please refer to Section 5.4 of the revised EIS (April 2018) for additional details relating to the bedrock geology.

For the most part, the rocks outside of the surficial portion and the central unit are fairly competent with fracture frequency decreasing with depth, as indicated by Rock Quality Designation (RQD) recovery values of around 90%, and therefore are unlikely to produce any significant amount of groundwater. The central unit, although more conductive as a result of the higher fracturing rate, still shows a limited potential for groundwater flow (RQD value of 83%), typical of Canadian Shield bedrock environments.

3.4.2.2 Aquifer Characteristics

Hydraulic conductivity testing was conducted in three existing exploration boreholes and in three boreholes drilled in part for hydrogeological purposes, to estimate the hydraulic conductivity in the bedrock along the east-west structural trend. This conductivity testing involved the use of packers to isolate a limited portion of the borehole, either starting at the base of existing exploration boreholes and moving upward to increase the length of exposed fractured zone, or moving downward as drilling progressed in new boreholes. The groundwater within the isolated zone was pumped out and a rising head slug test performed.

A total of six boreholes were tested in this way, with each borehole being tested over between five to nine intervals. The estimated bedrock hydraulic conductivities that resulted from the packer testing in the existing exploration boreholes ranged from 2×10^{-6} m/s near the surface due to weathering and fracturing of the bedrock, down to 1×10^{-8} m/s, decreasing with depth. The exception was within the central mineralized zone where hydraulic conductivity values were in the order of 1×10^{-7} m/s. This coincided with anecdotal information from the construction of the portal which indicated that groundwater flow was associated with the mineralized zones.

A summary of the packer test results averaged over the length of the individual boreholes is provided in Table 3.4.3-1.

Table 3.4.3-1: Hydraulic Conductivity Summary of Bedrock Units

Well ID	Tested Zone (m below grade)	Geological Unit Penetration Sequence	Average Depth to Water (m below grade)	Average Hydraulic Conductivity (m/s)
TL13321	18 – 254	Hanging-wall – Central – Foot-wall	5.0	1.3×10^{-7}
TL13317	17 – 210	Hanging-wall – Central	3.4	6.5×10^{-7}
TL13315	15 – 225	Foot-wall – Central	1.7	3.9×10^{-7}
TL0855	27 – 237	Hanging-wall – Central	3.0	2.2×10^{-8}
TL10111	27 – 168	Hanging-wall – Central	3.2	4.8×10^{-7}
TL11195	45 – 224	Hanging-wall – Central (intercepts NW Fault at 130 m downhole)	0.6	1.8×10^{-8}

The locations of the boreholes in which packer testing was conducted is shown in Figure 5.6.2.1-1 of the revised EIS (April 2018). Additional details relating to the individual rising head tests performed are provided in Appendix D to Appendix M of the revised EIS (April 2018).

3.4.2.3 Groundwater Flow

Between March and July 2013, groundwater levels were measured on seven occasions in the nine bedrock boreholes identified for hydrogeological purposes. During this period, groundwater was found to show flowing well conditions in two boreholes, with water heights of 0.8 m to over 1.4 m above grade (the height of the casing). Groundwater levels in the remaining seven wells ranged from 0.3 to 4.0 m below grade, and generally showed an increase in the spring (April to June) and then either stabilized or decreased, with a total range of fluctuation of 0.4 to 2.9 m. A summary of groundwater monitoring results is provided in Table 5.6.2.3-1 of the revised EIS (April 2018). Review of the vibrating wire piezometer levels reportedly indicated a groundwater elevation rise following the spring freshet, followed by a gradual decline through to the winter of 2013/2014. Total water level fluctuations in these wells was reported to be between 1.0 and 1.5 m.

Based on limited monitoring of these bedrock boreholes situated in the immediate vicinity of the proposed mine site, the groundwater flow appears to be suggest an outward radial flow to the east and southwest. These elevations also suggest an upward vertical flow gradient within the bedrock, and from the bedrock into the overburden units, which may then result in some groundwater discharge to the adjacent Blackwater Creek.

3.5 Chemical Concentrations in Environmental and Project Specific Media

3.5.1 Selection of COCs

Chemical concentrations in environmental media including air, soil, and water were measured and/or modelled for use in the HHERA. Chemical concentrations in Project-specific media including waste rock, ore/future tailings, and TSF supernatant water were also considered for the HHERA for the operations and closure phases of the Project for Study Area No. 1. The relatively large number of data points (provided in Appendix A) allowed for the use of the 95% upper confidence limit of the mean (UCLM) as the exposure point concentration (EPC) for all assessment scenarios and receptor locations for all media types except for the TSF supernatant water. Metal concentrations in particulate matter (PM), total suspended particulates (TSP) and dust fall were predicted using the UCLM of the waste rock assay and tailings/ore assay results. Chemical analysis of waste rock and ore/tailings includes many chemical parameters for which there is insufficient toxicity data to support derivation of a risk-based soil, air, or water guideline or standard or the chemical is considered a micro or macro nutrient, essential to the health of an organism or ecosystem. Data from baseline measurements, chemical assays, or predictive modelling are provided in Appendix A, however, for the sake of the HHERA, only those chemicals which are currently known or suspected to have potential toxicity to humans or ecological receptors are presented herein and considered for a quantitative and qualitative assessment of potential risk. The data provided in Appendix A may be used as part of follow-up programs for the HHERA (as described in Section 13 of the revised EIS [April 2018]) in the event new toxicity data emerges for those parameters.

Chemicals of concern (COCs) were selected based on an EPC exceeding an applicable environmental quality standard or guideline. Special consideration was given to chemicals that have the ability to transform or bioaccumulate within organisms, or where the guidelines or standards are currently under scientific review. Examples of these include mercury, methyl-mercury, and lead.

Chemical concentrations of selected COCs in air, soil, water or Project-specific media were then modelled into plants and soil organisms, mammals and birds, and aquatic receptors including fish for use in the country foods component of the human health risk assessment, and for use in the ecological risk assessment.

3.5.2 Chemical of Concern Screening

3.5.2.1 Air

Section 6.6 of the revised EIS (April 2018) provided an evaluation of the effects of the Project on air quality, and considered the potential effects of the Project on air quality during the Site Preparation and Construction, Operations, and Closure phases of the Project. There are no air emission sources during the Post-Closure phase of the Project. The air quality assessment presented in Section 6.6 of the revised EIS (April 2018) focussed, appropriately on the maximum predicted concentrations at the property line, as well as at 43 identified sensitive receptors. The property line predictions would represent the appropriate values for determining compliance with Ontario Regulation 419/05, while the CCME (2006) identifies that the sensitive receptor locations would be most appropriate for determining compliance with ambient air quality objectives.

As described in Section 3.1.1, all of Study Are No. 1 (the operations area), and parts of Study Area No. 2 (the HHERA LSA) are located within the property line for the Project (i.e., areas owned or leased by Treasury Metals, or areas where Treasury Metals has surface and mineral rights).

However, there are areas that fall within the property line where access will be available to members of Indigenous communities to practice traditional uses of the lands and resources in the area. To capture the possible risk to peoples using these areas, the air modelling was redone using the same emissions and methods as presented in Section 6.6 of the revised EIS (April 2018), but focussing on possible modelling receptors covering the study areas described in Section 3.1.1. The refined modelling includes 308 modelling receptor located within the operations area (Study Area No. 1), 3,774 modelling receptor locations within the HHERA LSA (Study Area No. 2), and at 46 modelling receptor locations within the Village of Wabigoon (Study Area No. 3).

The maximum concentrations for each of the modelling receptors, and averaging periods evaluated were determined for the Site Preparation and Construction, Operations, and Closure phases of the Project. The highest UCLM over the five-year period modelled was selected as the EPC for each parameter within each study area. There are no air emission sources during the Post-Closure phase of the Project, thus no air quality modelling results are calculated for the post-closure phase.

Activities associated with each Project phase are expected to emit Criteria Air Contaminants (CACs) including CO, NO_x, SO_2, TSP, PM_{10}, and $PM_{2.5}$, as well as a series of other COCs including metals. The effects of the Project on air quality with respect to CACs are discussed in Section 6.6 of the EIS and has not been replicated as part of the HHERA.

The potential effects of the Project on human health, specifically via the inhalation of COCs (specifically metals) associated with the inhalation of suspended particular matter (PM_{10}, $PM_{2.5}$ and TSP) are assessed herein. Total suspended particulate (TSP) was selected as the most conservative particulate matter group to be used in determining possible chemical exposures to airborne COCs. As illustrated in Figure 3.5.2-1, TSP will include both the PM_{10} and $PM_{2.5}$ fractions of the airborne particulate matter associated with the Project. Although Health Canada recommends the use of PM_{10} in their DQRA guidance document, the PM_{10} emissions from the Project represent 29% of the TSP emissions (averaged over the site preparations and construction, operations and closure phases). The $PM_{2.5}$ fraction of the airborne particulate matter could represent the finer airborne particles known to pose a greater risk to human health, as they can be inhaled deeply into the lungs, are chemically reactive, and have complex characteristics. However, the use of $PM_{2.5}$ emissions from the Project represent 6% of the TSP emissions (averaged over the site preparations and construction, operations and closure phases). Therefore, while scientific logic may be used in support of the use of either PM_{10} or $PM_{2.5}$, for determining exposures for use in the HHERA, the choice to use TSP for calculating exposures for the HHERA represents the conservative approach that captures 100% of the airborne particulate emissions and thus 100% of the possible exposure to airborne metals.

Exposure point concentrations of metals sorbed to TSP in air were modelled based on multiple emission sources specific to each Project phase and UCLM concentrations of metals in baseline soils, waste rock or ore/tailings assay results as described in Appendix A. The EPC for each chemical parameter was compared to its respective health-based MOECC Ambient Air Quality

Criteria and exceedances were considered as air COC's requiring further assessment as part of the HHERA.

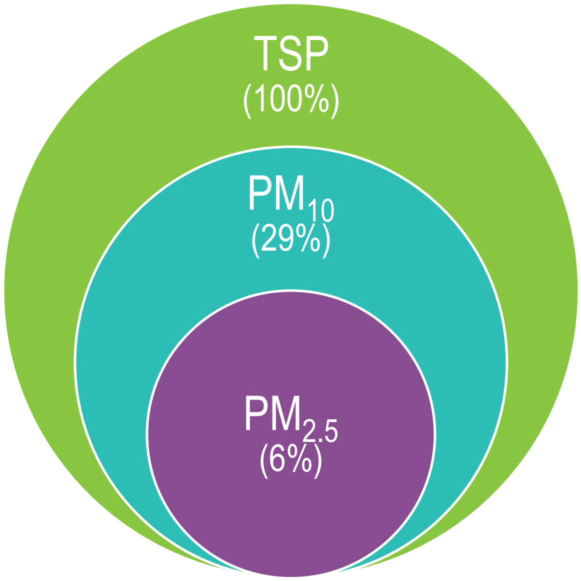


Figure 3.5.2-1: Distribution of Airborne particle Sizes

The EPCs screening for each of the three study areas (see Section 3.1.1) are provided for each of the following quantified assessment scenarios:

- Base Scenario (Table 3.5.2.1-1);
- Project Alone Scenario (Table 3.5.2.1-2); and
- Project Scenario (Table 3.5.2.1-3).

Table 3.5.2.1-1: Exposure Point Concentration of Metals in Air (Base Assessment Scenario)

Compound	Screening Criteria (µg/m³)	Operations Area	Local Study Area	Village of Wabigoon
Antimony (Sb)	25	0.00002	0.00002	0.00002
Arsenic (As)	0.3	0.00011	0.00011	0.00011
Barium (Ba)	10	0.00367	0.00367	0.00367
Beryllium (Be)	0.01	0.00002	0.00002	0.00002
Bismuth (Bi)	—	0.00002	0.00002	0.00002
Boron (B)	120	0.00014	0.00014	0.00014
Cadmium (Cd)	0.025	0.00001	0.00001	0.00001
Chromium (Cr)	1	0.00180	0.00180	0.00180
Cobalt (Co)	0.1	0.00037	0.00037	0.00037
Copper (Cu)	50	0.00081	0.00081	0.00081

Table 3.5.2-1: Exposure Point Concentration of Metals in Air (Base Assessment Scenario) (continued)

Compound	Screening Criteria (µg/m³)	Operations Area	Local Study Area	Village of Wabigoon
Iron (Fe)	4	0.88612	0.88612	0.88612
Lead (Pb)	0.5	0.00031	0.00031	0.00031
Lithium (Li)	20	0.00075	0.00075	0.00075
Manganese (Mn)	0.4	0.01813	0.01813	0.01813
Mercury (Hg)	2	0.000001	0.000001	0.000001
Molybdenum (Mo)	120	0.00002	0.00002	0.00002
Nickel (Ni)	0.04	0.00102	0.00102	0.00102
Phosphorus (P)	—	0.01823	0.01823	0.01823
Selenium (Se)	10	0.00002	0.00002	0.00002
Silver (Ag)	1	0.000004	0.000004	0.000004
Strontium (Sr)	120	0.00136	0.00136	0.00136
Thallium (Tl)	—	0.00001	0.00001	0.00001
Tin (Sn)	10	0.00008	0.00008	0.00008
Titanium (Ti)	120	0.05151	0.05151	0.05151
Uranium (U)	0.06	0.00002	0.00002	0.00002
Vanadium (V)	2	0.00184	0.00184	0.00184
Zinc (Zn)	120	0.00222	0.00222	0.00222

NOTES:

Units	All units in µg/m³
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.1-2: Exposure Point Concentration of Metals in Air (Project Alone Assessment Scenario)

Compound	Screening Criteria (µg/m³)	Site Preparation and Construction Predictions			Operations Predictions			Closure Predictions		
		Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon
Antimony (Sb)	25	0.000632	0.000046	0.000011	0.001359	0.000087	0.000017	0.000618	0.000046	0.000010
Arsenic (As)	0.3	0.002642	0.000193	0.000045	0.004538	0.000291	0.000056	0.002585	0.000192	0.000044
Barium (Ba)	10	0.012632	0.000922	0.000215	0.020859	0.001339	0.000257	0.012372	0.000917	0.000210
Beryllium (Be)	0.01	0.000044	0.000003	0.000001	0.000067	0.000004	0.000001	0.000043	0.000003	0.000001
Bismuth (Bi)	—	0.000029	0.000002	0.000000	0.000219	0.000014	0.000003	0.000029	0.000002	0.000000
Boron (B)	120	0.004753	0.000347	0.000081	0.005506	0.000353	0.000068	0.004649	0.000344	0.000079
Cadmium (Cd)	0.025	0.000153	0.000011	0.000003	0.000345	0.000022	0.000004	0.000150	0.000011	0.000003
Chromium (Cr)	1	0.006770	0.000494	0.000115	0.009629	0.000618	0.000118	0.006630	0.000491	0.000113
Cobalt (Co)	0.1	0.016099	0.001175	0.000274	0.018882	0.001212	0.000232	0.015748	0.001167	0.000267
Copper (Cu)	50	0.005649	0.000412	0.000096	0.009654	0.000620	0.000119	0.005529	0.000410	0.000094
Iron (Fe)	4	3.120731	0.227684	0.053034	3.117949	0.200121	0.038351	3.056477	0.226428	0.051889
Lead (Pb)	0.5	0.019372	0.001413	0.000329	0.046584	0.002990	0.000573	0.018949	0.001404	0.000322
Lithium (Li)	20	0.001939	0.000141	0.000033	0.002136	0.000137	0.000026	0.001900	0.000141	0.000032
Manganese (Mn)	0.4	0.063974	0.004667	0.001087	0.072306	0.004641	0.000889	0.062657	0.004642	0.001064
Mercury (Hg)	2	0.000037	0.000003	0.000001	0.000043	0.000003	0.000001	0.000036	0.000003	0.000001
Molybdenum (Mo)	120	0.000135	0.000010	0.000002	0.000314	0.000020	0.000004	0.000132	0.000010	0.000002
Nickel (Ni)	0.04	0.003329	0.000243	0.000057	0.003960	0.000254	0.000049	0.003261	0.000242	0.000055
Phosphorus (P)	—	0.077790	0.005675	0.001322	0.088495	0.005680	0.001088	0.076171	0.005643	0.001293
Selenium (Se)	10	0.000009	0.000001	0.000000	0.000210	0.000014	0.000003	0.000009	0.000001	0.000000
Silver (Ag)	1	0.000171	0.000012	0.000003	0.000599	0.000038	0.000007	0.000167	0.000012	0.000003
Strontium (Sr)	120	0.003127	0.000228	0.000053	0.004672	0.000300	0.000057	0.003065	0.000227	0.000052
Thallium (Tl)	—	0.000044	0.000003	0.000001	0.000272	0.000017	0.000003	0.000043	0.000003	0.000001
Tin (Sn)	10	0.000159	0.000012	0.000003	0.001887	0.000121	0.000023	0.000156	0.000012	0.000003
Titanium (Ti)	120	0.126959	0.009263	0.002158	0.143668	0.009221	0.001767	0.124417	0.009217	0.002112

Table 3.5.2-2: Exposure Point Concentration of Metals in Air (Project Alone Assessment Scenario) (continued)

Compound	Screening Criteria (µg/m³)	Site Preparation and Construction Predictions			Operations Predictions			Closure Predictions		
		Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon
Uranium (U)	0.06	0.000133	0.000010	0.000002	0.000328	0.000021	0.000004	0.000130	0.000010	0.000002
Vanadium (V)	2	0.003709	0.000271	0.000063	0.003893	0.000250	0.000048	0.003636	0.000269	0.000062
Zinc (Zn)	120	0.060092	0.004384	0.001021	0.119230	0.007653	0.001467	0.058786	0.004355	0.000998

NOTES:

Units	All units in µg/m³
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.1-3: Exposure Point Concentration of Metals in Air (Project Assessment Scenario)

Compound	Screening Criteria (µg/m³)	Site Preparation and Construction Predictions			Operations Predictions			Closure Predictions		
		Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon
Antimony (Sb)	25	0.000771	0.000185	0.000150	0.001616	0.000345	0.000274	0.000757	0.000184	0.000149
Arsenic (As)	0.3	0.003223	0.000773	0.000625	0.005398	0.001151	0.000915	0.003165	0.000771	0.000624
Barium (Ba)	10	0.015407	0.003697	0.002990	0.024809	0.005289	0.004207	0.015148	0.003692	0.002986
Beryllium (Be)	0.01	0.000053	0.000013	0.000010	0.000080	0.000017	0.000014	0.000052	0.000013	0.000010
Bismuth (Bi)	—	0.000035	0.000009	0.000007	0.000260	0.000056	0.000044	0.000035	0.000009	0.000007
Boron (B)	120	0.005797	0.001391	0.001125	0.006549	0.001396	0.001110	0.005692	0.001387	0.001122
Cadmium (Cd)	0.025	0.000187	0.000045	0.000036	0.000411	0.000088	0.000070	0.000184	0.000045	0.000036
Chromium (Cr)	1	0.008258	0.001981	0.001602	0.011453	0.002442	0.001942	0.008118	0.001979	0.001600
Cobalt (Co)	0.1	0.019636	0.004711	0.003810	0.022458	0.004788	0.003808	0.019281	0.004700	0.003801
Copper (Cu)	50	0.006890	0.001653	0.001337	0.011482	0.002448	0.001947	0.006770	0.001650	0.001334
Iron (Fe)	4	3.806269	0.913221	0.738571	3.708404	0.790577	0.628806	3.742225	0.912176	0.737637

Table 3.5.2.1-3: Exposure Point Concentration of Metals in Air (Project Assessment Scenario) (continued)

Compound	Screening Criteria (µg/m³)	Site Preparation and Construction Predictions			Operations Predictions			Closure Predictions		
		Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon	Operations Area	Local Study Area	Village of Wabigoon
Lead (Pb)	0.5	0.023628	0.005669	0.004585	0.055406	0.011812	0.009395	0.023200	0.005655	0.004573
Lithium (Li)	20	0.002365	0.000567	0.000459	0.002541	0.000542	0.000431	0.002326	0.000567	0.000459
Manganese (Mn)	0.4	0.078027	0.018721	0.015140	0.085998	0.018334	0.014582	0.076714	0.018699	0.015121
Mercury (Hg)	2	0.000045	0.000011	0.000009	0.000051	0.000011	0.000009	0.000044	0.000011	0.000009
Molybdenum (Mo)	120	0.000165	0.000039	0.000032	0.000373	0.000080	0.000063	0.000162	0.000039	0.000032
Nickel (Ni)	0.04	0.004061	0.000974	0.000788	0.004710	0.001004	0.000799	0.003993	0.000973	0.000787
Phosphorus (P)	—	0.094879	0.022764	0.018410	0.105253	0.022438	0.017847	0.093260	0.022732	0.018383
Selenium (Se)	10	0.000011	0.000003	0.000002	0.000250	0.000053	0.000042	0.000011	0.000003	0.000002
Silver (Ag)	1	0.000209	0.000050	0.000041	0.000712	0.000152	0.000121	0.000205	0.000050	0.000040
Strontium (Sr)	120	0.003814	0.000915	0.000740	0.005556	0.001185	0.000942	0.003753	0.000915	0.000740
Thallium (Tl)	—	0.000054	0.000013	0.000010	0.000323	0.000069	0.000055	0.000053	0.000013	0.000010
Tin (Sn)	10	0.000193	0.000046	0.000038	0.002244	0.000478	0.000380	0.000190	0.000046	0.000038
Titanium (Ti)	120	0.154848	0.037152	0.030047	0.170875	0.036428	0.028974	0.152331	0.037131	0.030026
Uranium (U)	0.06	0.000162	0.000039	0.000032	0.000390	0.000083	0.000066	0.000160	0.000039	0.000031
Vanadium (V)	2	0.004523	0.001085	0.000878	0.004631	0.000987	0.000785	0.004452	0.001085	0.000877
Zinc (Zn)	120	0.073293	0.017585	0.014222	0.141809	0.030232	0.024046	0.071975	0.017544	0.014187

NOTES:

Units	All units in µg/m³
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

As shown in Tables 3.5.2.1-1, 3.5.2.1-1, and 3.5.2.1-3, none of the modelled concentrations of metals in air exceeded their respective health-based screening criteria. However, the following chemicals did not have a MOECC air screening criteria available:

- Bismuth,
- Phosphorus, and
- Thallium

Bismuth is considered to be minimally toxic to human and ecological receptors and pose a negligible amount of potential risk in the environment. As such, no toxicity reference values are available for use in a human or ecological risk assessment of this chemical, and subsequently no risk-based screening criteria have been derived. Based on the current state of science, bismuth is not carried forward as a COC in the HHERA. Should new toxicity information emerge for bismuth to allow for its quantitative assessment of potential risk, a follow-up HHERA should be conducted as per Section 13 of the revised EIS (April 2018).

A risk-based air guideline or standard is not currently available from any regulatory body for thallium. There are however, soil quality guidelines available (Section 3.6.2.2). Health Canada states in their PQRA guidance that often, intake due to the inhalation of fugitive dust will be insignificant relative to the direct ingestion of soil and water, and to dermal contact. Given that the maximum predicted concentration thallium concentration in air is low (0.000054 µg/m^3), this chemical will be assessed via the direct dermal contact and incidental ingestion pathways only (if required) for the HHERA.

Phosphorus is an essential macronutrient for plant growth and is ubiquitous in the environment. However, at elevated levels phosphorus can lead to the proliferation of algae blooms and the eutrophication of waterways. The primary concern of phosphorus is eutrophication rather than chemical specific toxicity and as such no risk-based soil standards or guidelines are available. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

Based on the screening process, no soil COCs are identified for any of the assessment scenarios, or Project phases at any of the three study areas.

The concentrations of metals in dust deposited as a result of the Project are considered as part of the soil COC selection described below.

3.5.2.2 Soil

Overburden soil was sampled at 25 shallow sampling (<1.7 mbgs) locations and analysed for the chemical concentrations of select metals. The UCLM concentration was calculated and used as the EPC for the Base Scenario as shown in Table 3.5.2.2-1.

The air modelling completed to support the health assessment (see Section 3.5.2.1) included modelling of dustfall (airborne particles that are deposited on the surrounding landscape) for each of the Site Preparation and Construction, Operations, and Closure. There are no emissions associated with the Post-Closure phase of the Project. The maximum annual UCLM dustfall rate of the five- year period was selected for each of the three study areas and three Project phases for which there are air emissions. Changes in soil metal concentrations as a result of metals deposited in dustfall are dependent on the concentration calculated in the soils at the end of the phase before.

The measured soil EPCs and modelled soil EPCs were compared to the CCME soil quality guidelines for agricultural land use, or the MOECC Table 1 Full-Depth Background Site Condition Standards for Agricultural land use. In the absence of a risk-based screening criteria the Ontario Typical Range (OTR_{98}) values were employed for screening purposes. The OTR values were published by the Ontario Ministry of Environment and Energy in 1993. The OTR_{98}, which is the 97.5^{th} percentile of the distribution of a database of surface soils in Ontario that are not contaminated by point sources is used as the basis of the background soil standards. In the absence of Canadian or Ontario specific criteria, the US EPA Risk-Based Regional Screening Levels were selected (toddler, hazard quotient =0.2, target risk= 10^{-6})

The soil screening results for the three study areas (i.e., Operations Area, HHERA LSA, and the Village of Wabigoon) are provide in the following tables:

- Base Scenario (Table 3.5.2.2-1);
- Project Alone Scenario (Table 3.5.2.2-2); and
- Project Scenario (Table 3.5.2.2-3).

Table 3.5.2.2-1: Exposure Point Concentration of Metals in Soil (Operations Area, Study Area No. 1)

Parameter and Symbol	CCME Soil Guidelines	MOECC Table 1 Site Condition Standards	Base Scenario	Project Alone Scenario				Project Scenario			
			Baseline Soil Concentration	Site Preparation and Construction	Operations	Closure	Post-closure	Site Preparation and Construction	Operations	Closure	Post-closure
Antimony (Sb)	20	1	0.500	0.005	0.056	0.062	0.062	0.505	0.556	0.562	0.562
Arsenic (As)	12	11	3.364	0.022	0.193	0.215	0.215	3.386	3.557	3.578	3.578
Barium (Ba)	750	210	111.186	0.106	0.892	0.996	0.996	111.292	112.078	112.182	112.182
Beryllium (Be)	4	2.5	0.526	0.000	0.003	0.003	0.003	0.526	0.529	0.529	0.529
Bismuth (Bi)	—	—	0.500	0.000	0.008	0.009	0.009	0.500	0.508	0.509	0.509
Boron (B) total	—	36	4.093	0.040	0.247	0.286	0.286	4.133	4.340	4.379	4.379
Cadmium (Cd)	1.4	1	0.374	0.001	0.014	0.016	0.016	0.375	0.388	0.389	0.389
Chromium (Cr)	64	67	54.502	0.057	0.420	0.475	0.475	54.559	54.921	54.977	54.977
Cobalt (Co)	40	19	11.353	0.135	0.846	0.979	0.979	11.489	12.200	12.332	12.332
Copper (Cu)	63	62	24.630	0.047	0.411	0.457	0.457	24.677	25.041	25.087	25.087
Iron (Fe)	—	34,000[a]	26852.014	26.212	143.647	169.292	169.292	26878.225	26995.661	27021.306	27021.306
Lead (Pb)	70	45	9.325	0.163	1.917	2.076	2.076	9.488	11.243	11.402	11.402
Lithium (Li)	—	31.3[b]	22.737	0.016	0.097	0.113	0.113	22.753	22.833	22.849	22.849
Manganese (Mn)	—	1,400[a]	549.400	0.537	3.261	3.786	3.786	549.938	552.661	553.187	553.187
Mercury (Hg)	6.6	0.16	0.039	0.000	0.002	0.002	0.002	0.040	0.041	0.041	0.041
Molybdenum (Mo)	5	2	0.576	0.001	0.013	0.014	0.014	0.577	0.589	0.590	0.590
Nickel (Ni)	45	37	30.915	0.028	0.177	0.204	0.204	30.943	31.092	31.119	31.119
Phosphorus (P)	—	—	552.340	0.653	3.986	4.626	4.626	552.994	556.327	556.966	556.966
Selenium (Se)	1	1.2	0.500	0.000	0.008	0.008	0.008	0.500	0.508	0.508	0.508
Silver (Ag)	20	0.5	0.117	0.001	0.024	0.025	0.025	0.119	0.141	0.143	0.143
Strontium (Sr)	—	77[a]	41.332	0.026	0.202	0.228	0.228	41.358	41.534	41.560	41.560
Thallium (Tl)	1	1	0.250	0.000	0.011	0.011	0.011	0.250	0.261	0.261	0.261
Tin (Sn)	5	—	2.500	0.001	0.072	0.074	0.074	2.501	2.572	2.574	2.574
Titanium (Ti)	—	4,700[a]	1560.904	1.066	6.478	7.521	7.521	1561.971	1567.382	1568.426	1568.426
Uranium (U)	23	1.9	0.500	0.001	0.013	0.015	0.015	0.501	0.513	0.515	0.515
Vanadium (V)	130	86	55.635	0.031	0.178	0.208	0.208	55.666	55.812	55.843	55.843
Zinc (Zn)	200	290	67.305	0.505	4.995	5.489	5.489	67.810	72.301	72.794	72.794

NOTES:

Units	All units in µg/g
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.2-2: Exposure Point Concentration of Metals in Soil (HHERA LSA, Study Area No. 2)

Parameter and Symbol	CCME Soil Guidelines	MOECC Table 1 Site Condition Standards	Base Scenario	Project Alone Scenario				Project Scenario			
			Baseline Soil Concentration	Site Preparation and Construction	Operations	Closure	Post-closure	Site Preparation and Construction	Operations	Closure	Post-closure
Antimony (Sb)	20	1	0.5000	0.0002	0.0030	0.0032	0.0032	0.5002	0.5030	0.5032	0.5032
Arsenic (As)	12	11	3.3636	0.0009	0.0102	0.0111	0.0111	3.3645	3.3737	3.3746	3.3746
Barium (Ba)	750	210	111.1861	0.0043	0.0470	0.0513	0.0513	111.1904	111.2331	111.2374	111.2374
Beryllium (Be)	4	2.5	0.5260	0.0000	0.0002	0.0002	0.0002	0.5260	0.5261	0.5261	0.5261
Bismuth (Bi)	—	—	0.5000	0.0000	0.0005	0.0005	0.0005	0.5000	0.5005	0.5005	0.5005
Boron (B) (total)	—	36	4.0929	0.0016	0.0129	0.0145	0.0145	4.0945	4.1058	4.1074	4.1074
Cadmium (Cd)	1.4	1	0.3736	0.0001	0.0008	0.0008	0.0008	0.3737	0.3744	0.3744	0.3744
Chromium (Cr)	64	67	54.5019	0.0023	0.0220	0.0243	0.0243	54.5042	54.5238	54.5262	54.5262
Cobalt (Co)	40	19	11.3535	0.0055	0.0441	0.0496	0.0496	11.3590	11.3976	11.4031	11.4031
Copper (Cu)	63	62	24.6297	0.0019	0.0217	0.0236	0.0236	24.6316	24.6513	24.6533	24.6533
Iron (Fe)	—	34,000[a]	26852.0135	1.0655	7.4405	8.5098	8.5098	26853.0790	26859.4540	26860.5233	26860.5233
Lead (Pb)	70	45	9.3255	0.0066	0.1019	0.1085	0.1085	9.3321	9.4273	9.4340	9.4340
Lithium (Li)	—	31.3[b]	22.7366	0.0007	0.0050	0.0057	0.0057	22.7373	22.7416	22.7423	22.7423
Manganese (Mn)	—	1,400[a]	549.4003	0.0218	0.1697	0.1916	0.1916	549.4222	549.5700	549.5919	549.5919
Mercury (Hg)	6.6	0.16	0.0392	0.0000	0.0001	0.0001	0.0001	0.0392	0.0393	0.0393	0.0393
Molybdenum (Mo)	5	2	0.5759	0.0000	0.0007	0.0007	0.0007	0.5760	0.5766	0.5766	0.5766
Nickel (Ni)	45	37	30.9147	0.0011	0.0092	0.0104	0.0104	30.9159	30.9239	30.9251	30.9251
Phosphorus (P)	—	—	552.3403	0.0266	0.2075	0.2341	0.2341	552.3669	552.5478	552.5745	552.5745
Selenium (Se)	1	1.2	0.5000	0.0000	0.0004	0.0004	0.0004	0.5000	0.5004	0.5004	0.5004
Silver (Ag)	20	0.5	0.1173	0.0001	0.0013	0.0013	0.0013	0.1174	0.1186	0.1187	0.1187
Strontium (Sr)	—	77[a]	41.3320	0.0011	0.0106	0.0117	0.0117	41.3330	41.3426	41.3437	41.3437
Thallium (Tl)	1	1	0.2500	0.0000	0.0006	0.0006	0.0006	0.2500	0.2506	0.2506	0.2506
Tin (Sn)	5	—	2.5000	0.0001	0.0039	0.0040	0.0040	2.5001	2.5039	2.5040	2.5040
Titanium (Ti)	—	4,700[a]	1560.9044	0.0433	0.3371	0.3806	0.3806	1560.9477	1561.2415	1561.2850	1561.2850
Uranium (U)	23	1.9	0.5000	0.0000	0.0007	0.0008	0.0008	0.5000	0.5007	0.5008	0.5008
Vanadium (V)	130	86	55.6347	0.0013	0.0092	0.0105	0.0105	55.6359	55.6439	55.6452	55.6452
Zinc (Zn)	200	290	67.3054	0.0205	0.2643	0.2849	0.2849	67.3259	67.5697	67.5902	67.5902

NOTES:

Units	All units in µg/g
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.2-3: Exposure Point Concentration of Metals in Soil (Village of Wabigoon, Study Area No. 3)

Parameter and Symbol	CCME Soil Guidelines	MOECC Table 1 Site Condition Standards	Base Scenario	Project Alone Scenario				Project Scenario			
			Baseline Soil Concentration	Site Preparation and Construction	Operations	Closure	Post-closure	Site Preparation and Construction	Operations	Closure	Post-closure
Antimony (Sb)	20	1	0.50000	0.00004	0.00038	0.00042	0.00042	0.50004	0.50038	0.50042	0.50042
Arsenic (As)	12	11	3.36355	0.00017	0.00131	0.00147	0.00147	3.36372	3.36486	3.36502	3.36502
Barium (Ba)	750	210	111.18612	0.00080	0.00605	0.00682	0.00682	111.18692	111.19217	111.19294	111.19294
Beryllium (Be)	4	2.5	0.52597	0.00000	0.00002	0.00002	0.00002	0.52597	0.52598	0.52599	0.52599
Bismuth (Bi)	—	—	0.50000	0.00000	0.00006	0.00006	0.00006	0.50000	0.50006	0.50006	0.50006
Boron (B) total	—	36	4.09290	0.00030	0.00169	0.00198	0.00198	4.09320	4.09459	4.09488	4.09488
Cadmium (Cd)	1.4	1	0.37362	0.00001	0.00010	0.00011	0.00011	0.37363	0.37371	0.37372	0.37372
Chromium (Cr)	64	67	54.50185	0.00043	0.00285	0.00327	0.00327	54.50228	54.50470	54.50512	54.50512
Cobalt (Co)	40	19	11.35347	0.00102	0.00577	0.00676	0.00676	11.35449	11.35924	11.36023	11.36023
Copper (Cu)	63	62	24.62967	0.00036	0.00279	0.00313	0.00313	24.63002	24.63245	24.63280	24.63280
Iron (Fe)	—	34,000[a]	26852.01355	0.19739	0.98213	1.17388	1.17388	26852.21094	26852.99568	26853.18742	26853.18742
Lead (Pb)	70	45	9.32548	0.00123	0.01295	0.01414	0.01414	9.32671	9.33843	9.33962	9.33962
Lithium (Li)	—	31.3[b]	22.73662	0.00012	0.00066	0.00078	0.00078	22.73674	22.73728	22.73740	22.73740
Manganese (Mn)	—	1,400[a]	549.40033	0.00405	0.02224	0.02618	0.02618	549.40438	549.42258	549.42651	549.42651
Mercury (Hg)	6.6	0.16	0.03923	0.00000	0.00001	0.00002	0.00002	0.03923	0.03924	0.03925	0.03925
Molybdenum (Mo)	5	2	0.57590	0.00001	0.00009	0.00010	0.00010	0.57591	0.57599	0.57600	0.57600
Nickel (Ni)	45	37	30.91472	0.00021	0.00121	0.00141	0.00141	30.91493	30.91592	30.91613	30.91613
Phosphorus (P)	—	—	552.34031	0.00492	0.02719	0.03197	0.03197	552.34523	552.36750	552.37228	552.37228
Selenium (Se)	1	1.2	0.50000	0.00000	0.00005	0.00005	0.00005	0.50000	0.50005	0.50005	0.50005
Silver (Ag)	20	0.5	0.11735	0.00001	0.00016	0.00017	0.00017	0.11736	0.11751	0.11752	0.11752
Strontium (Sr)	—	77[a]	41.33198	0.00020	0.00137	0.00157	0.00157	41.33218	41.33335	41.33354	41.33354
Thallium (Tl)	1	1	0.25000	0.00000	0.00007	0.00007	0.00007	0.25000	0.25007	0.25007	0.25007
Tin (Sn)	5	—	2.50000	0.00001	0.00048	0.00049	0.00049	2.50001	2.50048	2.50049	2.50049
Titanium (Ti)	—	4,700[a]	1560.90440	0.00803	0.04419	0.05199	0.05199	1560.91243	1560.94859	1560.95640	1560.95640
Uranium (U)	23	1.9	0.50000	0.00001	0.00009	0.00010	0.00010	0.50001	0.50009	0.50010	0.50010
Vanadium (V)	130	86	55.63467	0.00023	0.00121	0.00144	0.00144	55.63490	55.63588	55.63611	55.63611
Zinc (Zn)	200	290	67.30535	0.00380	0.03381	0.03750	0.03750	67.30915	67.33916	67.34285	67.34285

NOTES:

Units	All units in µg/g
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

As demonstrated in Tables 3.5.2.2-1, 3.5.2.2-2, and 3.5.2.2-3, none of the metal parameters for which criteria were available exceeded the respective CCME or MOECC Guidelines or Standards for any of the assessment scenarios, within any of the study areas. As such, no soil COCs are identified requiring qualitative or quantitative assessment as part of the HHERA.

The following chemicals do not have a screening criterion available:

- Bismuth (Bi);
- Phosphorus (P)

Bismuth is considered to be minimally toxic to human and ecological receptors and pose a negligible amount of potential risk in the environment. As such, no toxicity reference values are available for use in a human or ecological risk assessment of this chemical, and subsequently no risk-based screening criteria have been derived. Based on the current state of science, bismuth is not carried forward as a COC in the HHERA. Should new toxicity information emerge for bismuth to allow for its quantitative assessment of potential risk, a follow-up HHERA should be conducted as per Section 13 of the revised EIS (April 2018).

Phosphorus is an essential macronutrient for plant growth and is ubiquitous in the environment. However, at elevated levels phosphorus can lead to the proliferation of algae blooms and the eutrophication of waterways. The primary concern of phosphorus is eutrophication rather than chemical specific toxicity and as such no risk-based soil standards or guidelines are available. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

Based on the screening process, no soil COCs are identified for any of the assessment scenarios, or Project phases at any of the three study areas.

3.5.2.3 Surface Water

Baseline water quality was measured from 15 locations within the HHERA LSA and used to model existing water quality and predicted water quality as a result of the Project at nine (9) nodes, as described in Section 6.8 of the revised EIS. For the purposes of assessing the potential effects of the Project, the revised EIS (April 2018) relied on the 50^{th} percentile of the monitored data for describing baseline water conditions. However, the UCLM of the available baseline data has been selected as the EPS for water quality for the purposes of the HHERA. Water quality was modelled at the nine nodes considering three flow scenarios: wet year, dry year, and average year. Water quality data were modelled for existing conditions (i.e., Base Scenario), and for the effects of the Project (i.e., Project Scenario) during Operations and Post-Closure phases of the Project. There are no discharges during Site Preparation and Closure and as such these Project phases did not require surface water quality modelling. For Post-Closure there are two cover options being considered for the TSF: a dry cover (see Figure 3.3.1-4) and a wet cover (Figure 3.3.1-5), with the dry cover option providing slightly more conservative predictions and the wet cover options considered the preferred approach would have slightly greatly mitigation. The water quality modelling for the EIS did not consider the Project Alone scenario. Thus, for the purposes of the HHERA, the Project Alone Scenario is described as any instance where the effect of the Project results in a meaningful change, specifically increase, in concentration relative to the existing modelled concentrations.

The modelled surface water UCLMs and overall EPCs were compared to the Ontario Provincial Water Quality Objectives (PWQO) or when a PWQO was not available, the CCME water quality guidelines (CWQG). The Health Canada health based maximum acceptable concentrations (MAC) served a drinking water quality guideline was also considered for all chemicals. Chemicals were thus considered COCs if they exceeded the lowest of either the PWQO (or CCME). Or Health Canada criteria.

The UCLM of surface water quality modelling are described in the following seven (7) tables provided in Appendix A.

- Base Assessment Scenario
- Project Alone Assessment Scenario, Operations
- Project Assessment Scenario, Operations
- Project Alone Assessment Scenario, Post-Closure (TSF WET COVER OPTION)
- Project Assessment Scenario, Post-Closure (TSF WET COVER OPTION)
- Project Alone Assessment Scenario, Post-Closure (TSF DRY COVER OPTION)
- Project Assessment Scenario, Post-Closure (TSF DRY COVER OPTION)

The EPC for use in the HHERA was selected as the maximum concentration at any of the surface water quality nodes, for all flow scenarios (i.e. average, wet, or dry), for each assessment scenario, Project Phase, and TSF cover option. The maximum surface water concentration from any watercourse is conservatively being used for the assessment in Study Areas No. 1, 2 and 3 for each assessment scenario and Project phase given that humans and wildlife may have access to all watercourses. The EPC of metals in surface water for all assessment scenarios, Project phases, study areas, and TSF cover options are summarized in Table 3.5.2.3-1.

The results demonstrate that seven (7) parameters including; aluminum, cobalt, iron, phosphorus, silver, thallium, and uranium, exceed their respective PWQO/CCME guideline for the protection of freshwater aquatic life in the Base Assessment Scenario and subsequently the Project Scenario.

Arsenic and antimony exceeded Health Canada's drinking water quality guideline during operations from the Project alone and Project assessment scenarios. The only exceedances of health based drinking water criteria were in Blackwater Creek. Appendix A provides the details with respect to the exceedance locations.

Zinc was the only parameter released from the Project that resulted in an additional PQWO exceedance for the Post-Closure Project phase, however only for the dry TSF cover option. The wet TSF cover option effectively mitigates the zinc exceedance.

Two parameters, iron and phosphorus, exceeded their respective surface water quality standard however are not being carried forward as COCs in the HHERA based on the following rationale:

- **Phosphorus**: Phosphorus is an essential macronutrient for plant growth and is ubiquitous in the environment. However, at elevated levels phosphorus can lead to the proliferation of algae blooms and the eutrophication of waterways. The primary concern of phosphorus is eutrophication rather than chemical specific toxicity and as such no risk-based soil standards or guidelines are available. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

- **Iron**: Iron is naturally occurring via erosion and weathering of rocks and minerals. The surface water quality guidelines for iron are set based on aesthetic criteria (i.e. taste and staining of drinking water) rather than protection of human or ecological receptors. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

Concentrations of lead and mercury were below their respective surface water criteria for all assessment scenarios and all project phases. Therefore, no further human or ecological assessment is required. Given that during engagement activities with local Indigenous communities and other stakeholder groups, concern was specifically expressed regarding the concentration of these parameters in surface water, they will conservatively be assessed in both the HHRA and ERA at their maximum EPC. In aquatic systems inorganic mercury may be transformed via abiotic respiration to organic methyl-mercury which can bioaccumulate within organisms and pose risk to human health. Methyl-mercury was not measured as part of the baseline sampling efforts. For all assessment scenarios and project phases, methyl-mercury in water is conservatively assumed to be 100% of the mercury concentration. This approach is conservative as it is unlikely that 100% of the mercury in surface water will be methylated. Furthermore, 100% of the mercury cannot exist as both 100% inorganic mercury and 100% methyl-mercury, thereby representing an additional level of conservatism.

The assumed concentration of methyl-mercury in surface water exceeded the CCME reported water quality guideline for the protection of freshwater aquatic life for the base assessment scenario and thus subsequently exceeded as a result of the Project alone and Project assessment scenarios.

Table 3.5.2.3-1: Exposure Point Concentration of Metals in Surface Water (All Study Areas, No.1, 2, and 3)

Parameter	Criteria (PWQO/CWQG, or MAC*)	Base	Project Alone (Operations)	Project (Operations)	Project Alone (Post-Closure) WET COVER	Project (Post-Closure) WET COVER	Project Alone (Post-Closure) DRY COVER	Project (Post-Closure) DRY COVER
Aluminum	0.075	**0.6928**	—	**0.6929**	—	**0.6927**	**0.6926**	**0.6926**
Antimony	0.006*	0.0024	0.0061	**0.0061**	—	0.0024	0.0024	0.0024
Arsenic	0.01*	0.0031	0.0249	**0.02**	—	0.0031	0.0031	0.0031
Beryllium	0.011	0.0029	0.0044	0.0044	—	0.0029	0.0029	0.0029
Boron	0.2	0.1390	0.1345	0.1390	—	0.1390	0.1390	0.1390
Cadmium	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chloride(a)	120	3.8589	28.8548	28.8548	43.1325	43.1325	2.5057	2.5057
Chromium	0.0089	0.0033	0.0042	0.0042	—	0.0033	0.0033	0.0033
Cobalt	0.0009	**0.0019**	—	**0.0018**	—	**0.0018**	**0.0017**	**0.0017**
Copper	0.005	0.0038	0.0034	0.0038	0.0033	0.0038	0.0040	0.0040
Cyanide	0.005	0.0036	0.0032	0.0036	0.0035	0.0036	0.0036	0.0036
Iron	0.3	**2.4120**	—	**2.1714**	—	**2.0643**	**1.8808**	**2.0161**
Lead	0.010*	0.0028	0.0030	0.0030	0.0026	0.0028	0.0036	0.0036
Mercury	0.0002	0.00005	—	0.00005	—	0.00005	0.00004	0.00004
Methyl-Mercury	0.000004	**0.00005**	—	**0.00005**	—	**0.00005**	**0.00004**	**0.00004**
Molybdenum	0.04	0.0029	0.0110	0.0110	—	0.0029	0.0029	0.0029
Nickel	0.025	0.0059	0.0095	0.0095	0.0119	0.0119	0.0124	0.0124
Nitrate(a)	13	0.1624	3.0505	3.0505	4.6086	4.6086	4.8736	4.8736
Phosphorus	0.03	**0.0770**	—	**0.0770**	—	**0.0770**	**0.0770**	**0.0770**
Selenium	0.1	0.0492	0.0609	0.0609	—	0.0413	0.0371	0.0402
Silver	0.0001	**0.0003**	—	**0.0003**	—	**0.0003**	**0.0003**	**0.0003**
Thallium	0.0003	**0.0009**	—	**0.0009**	—	**0.0009**	**0.0009**	**0.0009**
Uranium	0.005	**0.0139**	—	**0.0139**	—	**0.0139**	**0.0139**	**0.0139**
Vanadium	0.006	0.0035	0.0036	0.0036	—	0.0035	0.0035	0.0035
Zinc	0.03	0.0147	0.0149	0.0149	0.0173	0.0173	**0.0315**	**0.0315**

NOTES:

Units	All units in mg/L
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

3.5.2.4 Project-Specific Media

The nature of the mining Project dictates that during operations, within the operations area (i.e., Study Area No.1), additional Project-specific media should be considered when assessing potential human and ecological health risk. Human receptors, specifically workers, may be exposed via direct dermal contact and incidental ingestion to waste rock used in the construction of roads, or tailings during TSF maintenance. Human receptors will also have access to the pit-lake during the Post-Closure phase of the Project. Ecological receptors including plants, mammals and birds may be exposed to COCs in the pit lake, waste rock or tailing supernatant water. Tailings will be maintained under water cover during the operations phase of the Project and then encapsulated at closure through post-closure using a wet or dry cover option. As such there will be very minimal human or ecological exposure to tailings.

A full data set is provided in Appendix A. Briefly, waste rock data EPCs were selected as the UCLM of 161 waste rock samples submitted for laboratory analysis of select metals. Ore assay results are representative of the future tailings composition, and EPCs were selected as the UCLM of parameters analysed in 10 to 2,111 ore samples submitted for laboratory analysis. Process water will be treated in the cyanide destruction circuit prior to discharge to the TSF. As noted in Section 3 of the EIS, the SO_2-air destruction process has been chosen as the preferred method for cyanide destruction. The tailings solution chemistry coming from the detoxification circuit was modelled using the PHREEQCI model, using results presented in literature (Devuyst et al., 1988; Devuyst et al., 1989) for comparable free milling gold circuits. In the modelling, typical SO_2-air removal factors were assumed. Ammonia has been assumed at a value of 6 mg/L which is a common target when using the SO_2-air cyanide destruction process. The TSF supernatant water is the only media type for which the EPC concentrations represent the maximum predicted as only one prediction was made (N=1), and therefore the 95% UCLM could not be calculated.

The water quality of the pit lake was modelled in the same way as the surface water described in 3.5.2.3 and was modelled for both cover options for the TSF (i.e. wet cover and dry cover). Pit lake water was screened using the same criteria as TSF supernatant water and surface water. No pit lake water COCs were identified.

The EPC of chemicals Project-specific media including waste rock and ore/tailings, TSF supernatant water, and the pit lake, are described in Table 3.5.2.4-1, Table 3.5.2.4-2, and Table 3.5.2.4-3, respectively.

Table 3.5.2.4-1: Exposure Point Concentration of Metals in Ore/Tailings and Waste Rock

Parameter	CCME Soil Guidelines	MOECC Table 1 Site Condition Standards	Ore/Tailings UCLM	Waste Rock UCLM
Antimony	20	1	**34.504**	**4.695**
Arsenic	12	11	**82.631**	**19.466**
Barium	750	210	**456.835**	80.515
Beryllium	4	2.5	1.472	0.260

Table 3.5.2.4-1: Exposure Point Concentration of Metals in Ore/Tailings and Waste Rock (continued)

Parameter	CCME Soil Guidelines	MOECC Table 1 Site Condition Standards	Ore/Tailings UCLM	Waste Rock UCLM
Bismuth	—	—	10.752	0.153
Boron	—	36	—	35.270
Cadmium	1.4	1	**9.523**	**1.106**
Chromium	64	67	**153.627**	43.825
Cobalt	40	19	9.836	**119.807**
Copper	63	62	**193.780**	39.316
Iron	—	34,000[a]	2.291	19972.159
Lead	70	45	**1322.100**	**144.735**
Manganese	—	—	461.135	409.562
Mercury	6.6	0.16	—	**0.275**
Molybdenum	5	2	**9.198**	0.940
Nickel	45	37	**37.491**	21.009
Selenium	1	1.2	**11.593**	0.854
Silver	20	0.5	**22.042**	**1.275**
Strontium	—	—	101.652	18.110
Thallium	1	1	**1458.870**	0.299
Tin	5	—	**96.534**	0.865
Uranium	23	1.9	**10.000**	0.937
Vanadium	130	86	37.301	20.605
Zinc	200	290	**2751.831**	**443.903**

NOTES:

Units	All units in µg/m³
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.4-2: Exposure Point Concentration of Metals in TSF Supernatant Water

Parameter	Criteria (PWQO/ CWQG or MAC)	Predicted Tailings Supernatant
Aluminum	0.075	**0.199**
Antimony	0.006	**0.002**
Arsenic	0.01	**0.018**

Table 3.5.2.4-2: Exposure Point Concentration of Metals in TSF Supernatant Water (continued)

Parameter	Criteria (PWQO/ CWQG or MAC)	Predicted Tailings Supernatant
Barium	—	0.012
Beryllium	0.011	0.0005
Bismuth	—	0.0005
Boron	0.2	0.02
Cadmium	0.002	0.002
Calcium	—	7.15
Carbonate	—	15.88
Chromium	0.0089	0.0001
Chloride	120	0.78
Cobalt	0.0009	**0.004**
Copper	0.005	**0.018**
Cyanide	0.005	**<1****
Iron	0.3	**0.358**
Lead	0.005	**0.082**
Lithium	—	0.024
Magnesium	—	1.44
Manganese	—	0.063
Mercury	0.0002	**0.0018**
Methyl Mercury	0.00004	**0.0018**
Molybdenum	0.04	0.001
Nickel	0.025	0.021
Nitrate (as N)	13	7.07
Phosphorus	0.03	**0.06**
Potassium	—	1.78
Selenium	0.1	0.0005
Silicon	—	0.099
Silver	0.0001	0.00005
Sodium	—	1.16
Strontium	—	0.032
Sulphates	—	68.67
Sulphur	—	22.94
Thallium	0.0003	**0.642**
Tin	—	0.0005
Titanium	—	0.003
Uranium	0.005	0.005
Vanadium	0.006	0.004

Table 3.5.2.4-2: Exposure Point Concentration of Metals in TSF Supernatant Water (continued)

Parameter	Criteria (PWQO/ CWQG or MAC)	Predicted Tailings Supernatant
Zinc	0.03	**0.04**

NOTES:

Units	All units in mg/L
BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Table 3.5.2.4-3: Exposure Point Concentration of Metals in Pit Lake Water

Parameter	Criteria (PWQO/ CWQG, or MAC)	Base Case	Project Only				Project			
			Site Preparation and Construction	Operations	Closure	Post-closure	Site Preparation and Construction	Operations	Closure	Post-closure
Aluminum	0.075	—	—	—	—	0.075	—	—	—	0.075
Antimony	0.006	—	—	—	—	0.0011339	—	—	—	0.0011339
Arsenic	0.01	—	—	—	—	0.0014358	—	—	—	0.0014358
Beryllium	0.011	—	—	—	—	0.0010333	—	—	—	0.0010333
Boron	0.2	—	—	—	—	0.0514054	—	—	—	0.0514054
Cadmium	0.0002	—	—	—	—	9.535E-05	—	—	—	9.535E-05
Chloride	120	—	—	—	—	120	—	—	—	120
Chromium	0.0089	—	—	—	—	0.0009669	—	—	—	0.0009669
Cobalt	0.0009	—	—	—	—	0.0009	—	—	—	0.0009
Copper	0.005	—	—	—	—	0.003896	—	—	—	0.003896
Cyanide	0.005	—	—	—	—	0.005	—	—	—	0.005
Iron	0.3	—	—	—	—	0.3	—	—	—	0.3
Lead	0.005	—	—	—	—	0.0029783	—	—	—	0.0029783
Mercury	0.0002	—	—	—	—	2.42E-05	—	—	—	2.42E-05
Methyl-Mercury	0.000004	—	—	—	—	2.42E-05	—	—	—	2.42E-05
Molybdenum	0.04	—	—	—	—	0.0010082	—	—	—	0.0010082
Nickel	0.025	—	—	—	—	0.025	—	—	—	0.025
Nitrate	13	—	—	—	—	13	—	—	—	13
Phosphorus	0.03	—	—	—	—	0.03	—	—	—	0.03
Selenium	0.1	—	—	—	—	0.0009536	—	—	—	0.0009536

Parameter	Criteria (PWQO/ CWQG, or MAC)	Base Case	Project Only				Project			
			Site Preparation and Construction	Operations	Closure	Post-closure	Site Preparation and Construction	Operations	Closure	Post-closure
Silver	0.0001	—	—	—	—	9.944E-05	—	—	—	9.944E-05
Thallium	0.0003	—	—	—	—	0.0003	—	—	—	0.0003
Uranium	0.005	—	—	—	—	0.005	—	—	—	0.005
Vanadium	0.006	—	—	—	—	0.0010417	—	—	—	0.0010417
Zinc	0.03	—	—	—	—	0.03	—	—	—	0.03

Units All units in mg/L

BOLD & SHADED	Concentration exceeds criteria, parameter carried forward as COC in HHERA
BOLD & SHADED	Concentration exceeds criteria, however criteria set based on criteria other than human or ecological health. Parameter is not carried forward as COC in HHERA.

Two parameters, iron and phosphorus, exceeded their respective surface water quality standard in TSF supernatant water, however, are not being carried forward as COCs in the HHERA based on the following rationale:

- **Phosphorus:** Phosphorus is an essential macronutrient for plant growth and is ubiquitous in the environment. However, at elevated levels phosphorus can lead to the proliferation of algae blooms and the eutrophication of waterways. The primary concern of phosphorus is eutrophication rather than chemical specific toxicity and as such no risk-based soil standards or guidelines are available. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

- **Iron:** Iron is naturally occurring via erosion and weathering of rocks and minerals. The surface water quality guidelines for iron are set based on aesthetic criteria (i.e. taste and staining of drinking water) rather than protection of human or ecological receptors. It is not considered a COC to human or ecological receptors, and is subsequently not carried forward for further assessment.

3.5.3 Country Foods Assessment

Exposure point concentrations of COCs in environmental media and Project-specific media were modelled into country foods for all three study areas and all assessment scenarios for all chemicals that were identified as a COC in any of the media described above. The country foods assessment modeling inputs including bioaccumulation factors, transfer factors, wet/dry weight conversion factors, and receptor-specific characteristics are provided in Appendix B: County Foods Assessment.

The following of country foods were selected based on the current use of the land and resources for traditional purposes:

Plants:

- Forage (considered as a pathway within country foods rather than a food).
- Root Vegetables;
- Berries;
- Macrophytes; and
- Labrador Tea.

Meat (Wild Game)

- Moose;
- Ruffled Grouse;
- Canada Goose; and
- Invertebrate (considered as a pathway within country foods rather than a food).

Fish

- Consumed fish (e.g., Pickerel, Lake Trout, Perch)

The following list describes the COCs identified in any of the media requiring modelling into country foods:

- Aluminum
- Antimony
- Arsenic
- Cadmium
- Cobalt
- Copper
- Cyanide
- Lead
- Mercury
- Methyl-Mercury
- Silver
- Thallium
- Uranium
- Zinc.

Exposure to tailings in the TSF is considered an inoperable pathway given that the tailings will be submerged or encapsulated as per the engineering design of the Project. Therefore, uptake of COCs into country foods from waste rock was considered the dominate exposure pathway for COC uptake into country foods, and COC concentrations from ore/tailings were not used in the country foods assessment. Aquatic plants, birds, and mammals may ingest supernatant water from the TSF during the operations phase of the Project and pit lake water during post-closure. Therefore, for these receptors it was conservatively assumed that 100% of COC exposure from the water pathways during operations was from the supernatant water and 100% from pit lake at post-closure.

The following series of tables provides the EPCs of COCs identified in air, soil, water, or Project-specific media modelled into country foods at the three Study Areas for the Base Assessment Scenario, Project Alone Assessment Scenario, and Project Assessment Scenario.

Table 3.5.3-1: Exposure Point Concentrations of COCs in Country Foods (Base Assessment Scenario, All Study Areas)

Contaminant of Concern	Country Food Concentration (mg/kg)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Aluminum	—	—	1.6E+03	—	—	1.4E+01	5.3E+01	1.2E-02	—	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.2E+01	4.1E-03	1.3E-03	3.4E-03	9.0E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.1E-03	1.6E-02	6.0E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.5E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.1E-02	7.5E-03	6.8E+00	1.4E+05	2.1E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.8E-03	1.2E-02	3.3E-03	3.1E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.7E-06	2.1E-03	6.4E-01	9.0E+02	1.9E-03	1.2E-02	2.2E-02	2.5E-04	3.9E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00

Table 3.5.3-2: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 1, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTION										
Aluminum	5.0E+00	3.3E-01	—	1.4E+05	3.2E-03	1.8E-01	3.8E-01	9.4E-02	9.7E-02	—
Antimony	2.9E-04	1.6E-05	—	4.5E-01	4.3E-05	7.7E-06	2.0E-05	9.3E-06	1.8E-03	—
Arsenic	2.2E-04	4.0E-05	—	4.0E-01	4.8E-05	1.7E-05	1.1E-04	2.8E-05	5.7E-04	—
Cadmium	4.4E-05	8.5E-06	—	1.2E+01	2.2E-05	1.5E-07	1.5E-06	2.6E-06	2.2E-03	—
Cobalt	7.3E-04	9.0E-05	—	1.6E+03	2.6E-04	7.8E-04	3.6E-05	2.6E-05	4.5E-02	—
Copper	5.1E-03	1.1E-03	—	9.5E+01	3.2E-03	1.3E-03	1.5E-03	4.2E-04	3.6E-03	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	2.0E-03	3.0E-05	—	2.8E+02	4.0E-04	2.2E-05	8.6E-05	5.7E-05	5.4E-02	—
Mercury	8.4E-05	5.7E-06	—	2.4E+00	8.4E-06	2.1E-05	6.5E-06	2.3E-06	1.6E-04	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	7.0E-08	2.6E-05	—	1.1E+01	2.3E-05	7.0E-07	3.9E-06	3.0E-06	4.8E-04	—
Thallium	4.0E-07	8.0E-07	—	1.1E+01	4.0E-08	2.7E-06	5.9E-07	4.6E-07	1.2E-04	—
Uranium	6.1E-06	2.4E-07	—	8.9E-01	1.8E-05	2.9E-08	1.5E-07	1.1E-07	3.7E-04	—
Zinc	3.4E-02	9.2E-03	—	2.0E+02	1.2E-01	8.0E-05	2.5E-01	1.5E-01	2.9E-01	—

Table 3.5.3-2: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 1, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	4.5E+03	3.0E+02	4.5E+02	1.3E+08	2.9E+00	1.7E+02	3.6E+02	8.4E+01	8.7E+01	—
Antimony	2.5E-01	1.4E-02	5.0E-02	4.0E+02	3.8E-02	7.2E-03	1.9E-02	8.2E-03	1.6E+00	5.6E-02
Arsenic	1.9E-01	3.6E-02	9.5E-02	3.5E+02	4.2E-02	1.9E-02	1.0E-01	2.5E-02	5.0E-01	3.5E-01
Cadmium	3.7E-02	7.3E-03	5.6E+00	1.0E+04	1.9E-02	4.1E-03	4.4E-02	2.3E-03	1.9E+00	1.3E-02
Cobalt	6.5E-01	7.9E-02	1.4E+01	1.4E+06	2.3E-01	2.4E+00	7.2E-02	2.3E-02	4.0E+01	—
Copper	4.3E+00	9.1E-01	1.1E+01	7.9E+04	2.7E+00	1.7E+00	2.4E+00	3.5E-01	3.0E+00	4.3E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.8E+00	2.6E-02	4.1E+01	2.5E+05	3.5E-01	9.4E-02	2.9E-01	5.1E-02	4.8E+01	5.4E-02
Mercury	7.4E-02	5.0E-03	4.0E+00	2.1E+03	7.4E-03	2.6E-01	1.4E-01	2.1E-03	1.4E-01	—
Methyl-Mercury	—	—	4.0E+00	—	—	1.9E-02	1.1E-03	2.4E-07	—	—
Silver	6.2E-05	2.3E-02	1.1E-01	9.8E+03	2.1E-02	2.6E-03	7.2E-03	2.7E-03	4.3E-01	—
Thallium	3.2E-04	6.4E-04	5.6E+03	8.9E+03	3.2E-05	1.3E+03	1.1E+02	6.8E-03	1.0E-01	—
Uranium	5.1E-03	2.0E-04	1.2E+00	7.5E+02	1.5E-02	6.9E-04	1.9E-03	9.3E-05	3.1E-01	—
Zinc	3.0E+01	8.1E+00	4.7E+00	1.8E+05	1.1E+02	7.3E-02	2.3E+02	1.3E+02	2.6E+02	3.7E+00
CLOSURE										
Aluminum	3.6E+01	2.4E+00	—	1.0E+06	2.3E-02	1.3E+00	2.8E+00	6.8E-01	7.1E-01	—
Antimony	3.3E-03	1.8E-04	—	5.2E+00	5.0E-04	8.9E-05	2.3E-04	1.1E-04	2.1E-02	—
Arsenic	2.1E-03	3.9E-04	—	3.9E+00	4.6E-04	1.7E-04	1.0E-03	2.7E-04	5.5E-03	—
Cadmium	5.3E-04	1.0E-04	—	1.5E+02	2.7E-04	1.8E-06	1.8E-05	3.2E-05	2.7E-02	—
Cobalt	5.3E-03	6.5E-04	—	1.2E+04	1.8E-03	5.6E-03	2.6E-04	1.9E-04	3.3E-01	—
Copper	4.9E-02	1.1E-02	—	9.1E+02	3.1E-02	1.2E-02	1.5E-02	4.0E-03	3.4E-02	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	2.5E-02	3.8E-04	—	3.5E+03	5.0E-03	2.8E-04	1.1E-03	7.3E-04	6.9E-01	—
Mercury	6.0E-04	4.1E-05	—	1.7E+01	6.0E-05	1.5E-04	4.7E-05	1.7E-05	1.2E-03	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	1.2E-06	4.6E-04	—	1.9E+02	4.1E-04	1.2E-05	6.9E-05	5.4E-05	8.5E-03	—
Thallium	1.2E-05	2.4E-05	—	3.3E+02	1.2E-06	8.1E-05	1.8E-05	1.4E-05	3.7E-03	—
Uranium	7.9E-05	3.1E-06	—	1.2E+01	2.4E-04	3.8E-07	1.9E-06	1.4E-06	4.9E-03	—
Zinc	3.7E-01	1.0E-01	—	2.2E+03	1.3E+00	8.7E-04	2.7E+00	1.6E+00	3.2E+00	—
POST-CLOSURE										
Aluminum	3.6E+01	2.4E+00	1.6E+03	1.0E+06	2.3E-02	1.5E+01	5.5E+01	6.9E-01	7.1E-01	4.6E+01
Antimony	3.3E-03	1.8E-04	6.1E-02	5.2E+00	5.0E-04	6.4E-04	1.8E-03	1.3E-04	2.1E-02	2.2E-02

Table 3.5.3-2: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 1, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	2.1E-03	3.9E-04	1.6E-02	3.9E+00	4.6E-04	8.5E-04	3.0E-03	3.4E-04	5.5E-03	4.3E-02
Cadmium	5.3E-04	1.0E-04	3.9E-01	1.5E+02	2.7E-04	2.8E-04	3.0E-03	3.2E-05	2.7E-02	2.0E-02
Cobalt	5.3E-03	6.5E-04	5.9E+00	1.2E+04	1.8E-03	7.1E-01	1.7E-02	1.9E-04	3.3E-01	1.6E-01
Copper	4.9E-02	1.1E-02	2.4E+00	9.1E+02	3.1E-02	1.5E-01	2.7E-01	4.2E-03	3.4E-02	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	2.5E-02	3.8E-04	1.8E+00	3.5E+03	5.0E-03	3.6E-03	1.0E-02	7.4E-04	6.9E-01	6.5E-02
Mercury	6.0E-04	4.1E-05	9.7E-02	1.7E+01	6.0E-05	5.9E-03	3.3E-03	1.7E-05	1.2E-03	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	1.2E-06	4.6E-04	6.4E-01	1.9E+02	4.1E-04	1.2E-02	2.2E-02	5.9E-05	8.5E-03	4.3E-02
Thallium	1.2E-05	2.4E-05	7.6E+00	3.3E+02	1.2E-06	1.8E+00	1.5E-01	2.2E-05	3.7E-03	2.5E+00
Uranium	7.9E-05	3.1E-06	3.2E+00	1.2E+01	2.4E-04	1.9E-03	4.9E-03	1.2E-05	4.9E-03	3.2E-01
Zinc	3.7E-01	1.0E-01	3.7E+00	2.2E+03	1.3E+00	3.1E-03	1.2E+01	1.6E+00	3.2E+00	7.9E+00

Table 3.5.3-3: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 1, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTIO										
Aluminum	5.0E+00	3.3E-01	1.6E+03	1.4E+05	3.2E-03	1.4E+01	5.3E+01	1.1E-01	9.7E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.3E+01	4.1E-03	1.3E-03	3.5E-03	9.1E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.2E-03	1.6E-02	6.1E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.6E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.2E-02	7.6E-03	6.8E+00	1.4E+05	2.2E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.2E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.9E-03	1.2E-02	3.3E-03	3.2E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	3.0E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00

Table 3.5.3-3: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 1, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	4.5E+03	3.0E+02	4.5E+02	1.3E+08	2.9E+00	1.7E+02	3.6E+02	8.4E+01	8.7E+01	4.6E+01
Antimony	2.5E-01	1.4E-02	5.0E-02	4.0E+02	3.8E-02	7.2E-03	1.9E-02	8.2E-03	1.6E+00	5.6E-02
Arsenic	1.9E-01	3.6E-02	9.5E-02	3.5E+02	4.2E-02	1.9E-02	1.0E-01	2.5E-02	5.0E-01	3.5E-01
Cadmium	3.7E-02	7.3E-03	5.6E+00	1.0E+04	1.9E-02	4.1E-03	4.4E-02	2.3E-03	1.9E+00	1.3E-02
Cobalt	6.5E-01	7.9E-02	1.4E+01	1.4E+06	2.3E-01	2.4E+00	7.2E-02	2.3E-02	4.0E+01	1.7E-01
Copper	4.3E+00	9.1E-01	1.1E+01	7.9E+04	2.7E+00	1.7E+00	2.4E+00	3.5E-01	3.0E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.8E+00	2.6E-02	4.1E+01	2.5E+05	3.5E-01	9.4E-02	2.9E-01	5.1E-02	4.8E+01	5.4E-02
Mercury	7.4E-02	5.0E-03	4.0E+00	2.1E+03	7.4E-03	2.6E-01	1.4E-01	2.1E-03	1.4E-01	2.2E-01
Methyl-Mercury	—	—	4.0E+00	—	—	1.9E-02	1.1E-03	2.4E-07	—	7.4E-03
Silver	6.2E-05	2.3E-02	1.1E-01	9.8E+03	2.1E-02	2.6E-03	7.2E-03	2.7E-03	4.3E-01	4.3E-02
Thallium	3.2E-04	6.4E-04	5.6E+03	8.9E+03	3.2E-05	1.3E+03	1.1E+02	6.8E-03	1.0E-01	2.5E+00
Uranium	5.1E-03	2.0E-04	1.2E+00	7.5E+02	1.5E-02	6.9E-04	1.9E-03	9.3E-05	3.1E-01	3.2E-01
Zinc	3.0E+01	8.1E+00	4.7E+00	1.8E+05	1.1E+02	7.3E-02	2.3E+02	1.3E+02	2.6E+02	3.7E+00
CLOSURE										
Aluminum	3.6E+01	2.4E+00	1.6E+03	1.0E+06	2.3E-02	1.5E+01	5.5E+01	6.9E-01	7.1E-01	4.6E+01
Antimony	3.0E-02	1.7E-03	6.1E-02	4.8E+01	4.5E-03	1.4E-03	3.7E-03	1.0E-03	1.9E-01	2.2E-02
Arsenic	3.5E-02	6.5E-03	1.6E-02	6.4E+01	7.7E-03	3.5E-03	1.9E-02	4.6E-03	9.2E-02	4.3E-02
Cadmium	1.3E-02	2.6E-03	2.0E-01	3.7E+03	6.7E-03	1.9E-04	2.0E-03	7.9E-04	6.7E-01	9.9E-03
Cobalt	6.7E-02	8.2E-03	6.8E+00	1.5E+05	2.3E-02	8.8E-01	2.3E-02	2.3E-03	4.1E+00	1.9E-01
Copper	2.7E+00	5.8E-01	2.3E+00	5.0E+04	1.7E+00	8.2E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.4E-01	2.1E-03	1.4E+00	1.9E+04	2.8E-02	4.1E-03	1.3E-02	4.0E-03	3.8E+00	5.1E-02
Mercury	1.1E-02	7.6E-04	1.1E-01	3.2E+02	1.1E-03	9.3E-03	4.6E-03	3.1E-04	2.2E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	7.0E-06	2.6E-03	6.4E-01	1.1E+03	2.3E-03	1.2E-02	2.2E-02	3.1E-04	4.8E-02	4.3E-02
Thallium	2.8E-04	5.6E-04	7.6E+00	7.8E+03	2.8E-05	1.8E+00	1.5E-01	3.3E-04	8.7E-02	2.5E+00
Uranium	2.8E-03	1.1E-04	3.2E+00	4.1E+02	8.4E-03	1.9E-03	4.9E-03	5.9E-05	1.7E-01	3.2E-01
Zinc	4.9E+00	1.3E+00	1.7E+00	2.9E+04	1.8E+01	1.3E-02	4.0E+01	2.1E+01	4.2E+01	3.7E+00
POST-CLOSURE										
Aluminum	3.6E+01	2.4E+00	1.6E+03	1.0E+06	2.3E-02	1.5E+01	5.5E+01	6.9E-01	7.1E-01	4.6E+01
Antimony	3.0E-02	1.7E-03	6.1E-02	4.8E+01	4.5E-03	1.4E-03	3.7E-03	1.0E-03	1.9E-01	2.2E-02

Table 3.5.3-3: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 1, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	3.5E-02	6.5E-03	1.6E-02	6.4E+01	7.7E-03	3.5E-03	1.9E-02	4.6E-03	9.2E-02	4.3E-02
Cadmium	1.3E-02	2.6E-03	3.9E-01	3.7E+03	6.7E-03	3.2E-04	3.5E-03	7.9E-04	6.7E-01	2.0E-02
Cobalt	6.7E-02	8.2E-03	6.1E+00	1.5E+05	2.3E-02	8.0E-01	2.1E-02	2.3E-03	4.1E+00	1.7E-01
Copper	2.7E+00	5.8E-01	2.4E+00	5.0E+04	1.7E+00	8.3E-01	1.1E+00	2.2E-01	1.9E+00	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.4E-01	2.1E-03	1.8E+00	1.9E+04	2.8E-02	4.8E-03	1.5E-02	4.0E-03	3.8E+00	6.5E-02
Mercury	1.1E-02	7.6E-04	9.7E-02	3.2E+02	1.1E-03	8.5E-03	4.1E-03	3.1E-04	2.2E-02	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	7.0E-06	2.6E-03	6.4E-01	1.1E+03	2.3E-03	1.2E-02	2.2E-02	3.1E-04	4.8E-02	4.3E-02
Thallium	2.8E-04	5.6E-04	7.6E+00	7.8E+03	2.8E-05	1.8E+00	1.5E-01	3.3E-04	8.7E-02	2.5E+00
Uranium	2.8E-03	1.1E-04	3.2E+00	4.1E+02	8.4E-03	1.9E-03	4.9E-03	5.9E-05	1.7E-01	3.2E-01
Zinc	4.9E+00	1.3E+00	3.7E+00	2.9E+04	1.8E+01	1.4E-02	4.5E+01	2.1E+01	4.2E+01	7.9E+00

Table 3.5.3-4: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 2, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTION										
Aluminum	2.0E-01	1.4E-02	—	5.7E+03	1.3E-04	7.4E-03	1.6E-02	3.8E-03	4.0E-03	—
Antimony	1.2E-05	6.4E-07	—	1.8E-02	1.7E-06	3.1E-07	7.9E-07	3.8E-07	7.2E-05	—
Arsenic	8.8E-06	1.6E-06	—	1.6E-02	1.9E-06	7.1E-07	4.3E-06	1.1E-06	2.3E-05	—
Cadmium	1.8E-06	3.5E-07	—	5.0E-01	9.0E-07	6.0E-09	6.0E-08	1.1E-07	9.0E-05	—
Cobalt	3.0E-05	3.6E-06	—	6.6E+01	1.0E-05	3.2E-05	1.4E-06	1.0E-06	1.8E-03	—
Copper	2.1E-04	4.5E-05	—	3.9E+00	1.3E-04	5.3E-05	6.2E-05	1.7E-05	1.5E-04	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	8.1E-05	1.2E-06	—	1.1E+01	1.6E-05	8.9E-07	3.5E-06	2.3E-06	2.2E-03	—
Mercury	3.4E-06	2.3E-07	—	9.7E-02	3.4E-07	8.3E-07	2.7E-07	9.5E-08	6.6E-06	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	2.8E-09	1.1E-06	—	4.5E-01	9.5E-07	2.8E-08	1.6E-07	1.2E-07	2.0E-05	—
Thallium	1.6E-08	3.2E-08	—	4.5E-01	1.6E-09	1.1E-07	2.4E-08	1.9E-08	5.0E-06	—
Uranium	2.5E-07	9.8E-09	—	3.6E-02	7.4E-07	1.2E-09	6.0E-09	4.3E-09	1.5E-05	—
Zinc	1.4E-03	3.7E-04	—	8.2E+00	5.0E-03	3.3E-06	1.0E-02	6.0E-03	1.2E-02	—

Table 3.5.3-4: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 2, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	1.6E+00	1.1E-01	—	4.6E+04	1.1E-03	5.9E-02	1.3E-01	3.1E-02	3.2E-02	—
Antimony	1.6E-04	8.9E-06	1.5E-01	2.5E-01	2.4E-05	1.4E-03	4.0E-03	6.7E-05	1.0E-03	5.6E-02
Arsenic	9.9E-05	1.9E-05	1.3E-01	1.8E-01	2.2E-05	5.6E-03	1.7E-02	6.2E-04	2.6E-04	3.5E-01
Cadmium	2.6E-05	5.0E-06	2.6E-01	7.2E+00	1.3E-05	1.8E-04	2.0E-03	1.9E-06	1.3E-03	1.3E-02
Cobalt	2.4E-04	2.9E-05	—	5.3E+02	8.3E-05	2.5E-04	1.2E-05	8.4E-06	1.5E-02	—
Copper	2.3E-03	5.0E-04	2.0E+00	4.3E+01	1.5E-03	1.2E-01	2.2E-01	3.8E-04	1.6E-03	4.3E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.2E-03	1.9E-05	1.5E+00	1.7E+02	2.5E-04	2.8E-03	7.8E-03	4.3E-05	3.4E-02	5.4E-02
Mercury	2.7E-05	1.8E-06	—	7.7E-01	2.7E-06	6.6E-06	2.1E-06	7.5E-07	5.3E-05	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	6.2E-08	2.3E-05	—	9.8E+00	2.1E-05	6.2E-07	3.5E-06	2.7E-06	4.3E-04	—
Thallium	6.2E-07	1.2E-06	—	1.7E+01	6.2E-08	4.2E-06	9.2E-07	7.1E-07	1.9E-04	—
Uranium	3.9E-06	1.5E-07	—	5.7E-01	1.2E-05	1.9E-08	9.4E-08	6.8E-08	2.4E-04	—
Zinc	1.8E-02	4.8E-03	1.7E+00	1.1E+02	6.4E-02	1.1E-03	4.4E+00	9.5E-02	1.5E-01	3.7E+00
CLOSURE										
Aluminum	1.8E+00	1.2E-01	—	5.2E+04	1.2E-03	6.6E-02	1.4E-01	3.5E-02	3.6E-02	—
Antimony	1.7E-04	9.6E-06	—	2.7E-01	2.6E-05	4.6E-06	1.2E-05	5.6E-06	1.1E-03	—
Arsenic	1.1E-04	2.0E-05	—	2.0E-01	2.4E-05	8.7E-06	5.3E-05	1.4E-05	2.9E-04	—
Cadmium	2.7E-05	5.4E-06	—	7.7E+00	1.4E-05	9.4E-08	9.2E-07	1.7E-06	1.4E-03	—
Cobalt	2.7E-04	3.3E-05	—	5.9E+02	9.4E-05	2.9E-04	1.3E-05	9.4E-06	1.7E-02	—
Copper	2.6E-03	5.5E-04	—	4.7E+01	1.6E-03	6.4E-04	7.6E-04	2.1E-04	1.8E-03	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.3E-03	2.0E-05	—	1.8E+02	2.6E-04	1.5E-05	5.7E-05	3.8E-05	3.6E-02	—
Mercury	3.1E-05	2.1E-06	—	8.7E-01	3.1E-06	7.4E-06	2.4E-06	8.5E-07	5.9E-05	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	6.5E-08	2.4E-05	—	1.0E+01	2.2E-05	6.5E-07	3.6E-06	2.8E-06	4.5E-04	—
Thallium	6.3E-07	1.3E-06	—	1.8E+01	6.3E-08	4.3E-06	9.4E-07	7.3E-07	2.0E-04	—
Uranium	4.1E-06	1.6E-07	—	6.1E-01	1.2E-05	2.0E-08	1.0E-07	7.2E-08	2.5E-04	—
Zinc	1.9E-02	5.2E-03	—	1.1E+02	6.9E-02	4.5E-05	1.4E-01	8.3E-02	1.6E-01	—
POST-CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	1.7E-04	9.6E-06	6.1E-02	2.7E-01	2.6E-05	5.6E-04	1.6E-03	3.0E-05	1.1E-03	2.2E-02

Table 3.5.3-4: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 2, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	1.1E-04	2.0E-05	1.6E-02	2.0E-01	2.4E-05	6.9E-04	2.1E-03	8.9E-05	2.9E-04	4.3E-02
Cadmium	2.7E-05	5.4E-06	3.9E-01	7.7E+00	1.4E-05	2.8E-04	3.0E-03	2.2E-06	1.4E-03	2.0E-02
Cobalt	2.7E-04	3.3E-05	5.9E+00	5.9E+02	9.4E-05	7.0E-01	1.7E-02	1.2E-05	1.7E-02	1.6E-01
Copper	2.6E-03	5.5E-04	2.4E+00	4.7E+01	1.6E-03	1.4E-01	2.6E-01	4.3E-04	1.8E-03	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.3E-03	2.0E-05	1.8E+00	1.8E+02	2.6E-04	3.3E-03	9.4E-03	4.7E-05	3.6E-02	6.5E-02
Mercury	3.1E-05	2.1E-06	9.7E-02	8.7E-01	3.1E-06	5.8E-03	3.3E-03	1.6E-06	5.9E-05	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	6.5E-08	2.4E-05	6.4E-01	1.0E+01	2.2E-05	1.2E-02	2.2E-02	7.8E-06	4.5E-04	4.3E-02
Thallium	6.3E-07	1.3E-06	7.6E+00	1.8E+01	6.3E-08	1.8E+00	1.5E-01	9.3E-06	2.0E-04	2.5E+00
Uranium	4.1E-06	1.6E-07	3.2E+00	6.1E-01	1.2E-05	1.9E-03	4.9E-03	1.0E-05	2.5E-04	3.2E-01
Zinc	1.9E-02	5.2E-03	3.7E+00	1.1E+02	6.9E-02	2.2E-03	9.1E+00	1.2E-01	1.6E-01	7.9E+00

Table 3.5.3-5: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 2, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTION										
Aluminum	2.0E-01	1.4E-02	1.6E+03	5.7E+03	1.3E-04	1.4E+01	5.3E+01	1.6E-02	4.0E-03	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.2E+01	4.1E-03	1.3E-03	3.4E-03	9.0E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.1E-03	1.6E-02	6.0E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.5E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.1E-02	7.5E-03	6.8E+00	1.4E+05	2.1E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.8E-03	1.2E-02	3.3E-03	3.1E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.7E-06	2.1E-03	6.4E-01	9.0E+02	1.9E-03	1.2E-02	2.2E-02	2.5E-04	3.9E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00

Table 3.5.3-5: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 2, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	1.6E+00	1.1E-01	1.6E+03	4.6E+04	1.1E-03	1.4E+01	5.3E+01	4.3E-02	3.2E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	1.5E-01	4.3E+01	4.1E-03	2.1E-03	5.9E-03	9.4E-04	1.7E-01	5.6E-02
Arsenic	3.3E-02	6.2E-03	1.3E-01	6.1E+01	7.3E-03	8.2E-03	3.3E-02	4.8E-03	8.7E-02	3.5E-01
Cadmium	1.3E-02	2.5E-03	2.6E-01	3.6E+03	6.5E-03	2.3E-04	2.4E-03	7.6E-04	6.4E-01	1.3E-02
Cobalt	6.2E-02	7.6E-03	6.4E+00	1.4E+05	2.2E-02	8.2E-01	2.1E-02	2.2E-03	3.8E+00	1.7E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.5E+00	1.6E+04	2.3E-02	4.0E-03	1.3E-02	3.3E-03	3.2E+00	5.4E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00
CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.3E+01	4.1E-03	1.3E-03	3.5E-03	9.1E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.2E-03	1.6E-02	6.1E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.6E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.2E-02	7.6E-03	6.8E+00	1.4E+05	2.2E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.9E-03	1.2E-02	3.3E-03	3.2E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00
POST-CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.3E+01	4.1E-03	1.3E-03	3.5E-03	9.1E-04	1.7E-01	2.2E-02

Table 3.5.3-5: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 2, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	3.3E-02	6.2E-03	1.6E-02	6.1E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	3.9E-01	3.6E+03	6.5E-03	3.2E-04	3.4E-03	7.6E-04	6.4E-01	2.0E-02
Cobalt	6.2E-02	7.6E-03	6.1E+00	1.4E+05	2.2E-02	7.9E-01	2.1E-02	2.2E-03	3.8E+00	1.7E-01
Copper	2.7E+00	5.7E-01	2.4E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.8E+00	1.6E+04	2.3E-02	4.6E-03	1.4E-02	3.3E-03	3.2E+00	6.5E-02
Mercury	1.1E-02	7.2E-04	9.7E-02	3.0E+02	1.1E-03	8.4E-03	4.1E-03	2.9E-04	2.1E-02	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	3.7E+00	2.7E+04	1.6E+01	1.3E-02	4.2E+01	2.0E+01	3.9E+01	7.9E+00

Table 3.5.3-6: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 3, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTION										
Aluminum	2.0E-01	1.4E-02	—	5.7E+03	1.3E-04	7.4E-03	1.6E-02	3.8E-03	4.0E-03	—
Antimony	1.2E-05	6.4E-07	—	1.8E-02	1.7E-06	3.1E-07	7.9E-07	3.8E-07	7.2E-05	—
Arsenic	8.8E-06	1.6E-06	—	1.6E-02	1.9E-06	7.1E-07	4.3E-06	1.1E-06	2.3E-05	—
Cadmium	1.8E-06	3.5E-07	—	5.0E-01	9.0E-07	6.0E-09	6.0E-08	1.1E-07	9.0E-05	—
Cobalt	3.0E-05	3.6E-06	—	6.6E+01	1.0E-05	3.2E-05	1.4E-06	1.0E-06	1.8E-03	—
Copper	2.1E-04	4.5E-05	—	3.9E+00	1.3E-04	5.3E-05	6.2E-05	1.7E-05	1.5E-04	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	8.1E-05	1.2E-06	—	1.1E+01	1.6E-05	8.9E-07	3.5E-06	2.3E-06	2.2E-03	—
Mercury	3.4E-06	2.3E-07	—	9.7E-02	3.4E-07	8.3E-07	2.7E-07	9.5E-08	6.6E-06	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	2.8E-09	1.1E-06	—	4.5E-01	9.5E-07	2.8E-08	1.6E-07	1.2E-07	2.0E-05	—
Thallium	1.6E-08	3.2E-08	—	4.5E-01	1.6E-09	1.1E-07	2.4E-08	1.9E-08	5.0E-06	—
Uranium	2.5E-07	9.8E-09	—	3.6E-02	7.4E-07	1.2E-09	6.0E-09	4.3E-09	1.5E-05	—
Zinc	1.4E-03	3.7E-04	—	8.2E+00	5.0E-03	3.3E-06	1.0E-02	6.0E-03	1.2E-02	—

Table 3.5.3-6: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 3, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	1.6E+00	1.1E-01	—	4.6E+04	1.1E-03	5.9E-02	1.3E-01	3.1E-02	3.2E-02	—
Antimony	1.6E-04	8.9E-06	1.5E-01	2.5E-01	2.4E-05	1.4E-03	4.0E-03	6.7E-05	1.0E-03	5.6E-02
Arsenic	9.9E-05	1.9E-05	1.3E-01	1.8E-01	2.2E-05	5.6E-03	1.7E-02	6.2E-04	2.6E-04	3.5E-01
Cadmium	2.6E-05	5.0E-06	2.6E-01	7.2E+00	1.3E-05	1.8E-04	2.0E-03	1.9E-06	1.3E-03	1.3E-02
Cobalt	2.4E-04	2.9E-05	—	5.3E+02	8.3E-05	2.5E-04	1.2E-05	8.4E-06	1.5E-02	—
Copper	2.3E-03	5.0E-04	2.0E+00	4.3E+01	1.5E-03	1.2E-01	2.2E-01	3.8E-04	1.6E-03	4.3E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.2E-03	1.9E-05	1.5E+00	1.7E+02	2.5E-04	2.8E-03	7.8E-03	4.3E-05	3.4E-02	5.4E-02
Mercury	2.7E-05	1.8E-06	—	7.7E-01	2.7E-06	6.6E-06	2.1E-06	7.5E-07	5.3E-05	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	6.2E-08	2.3E-05	—	9.8E+00	2.1E-05	6.2E-07	3.5E-06	2.7E-06	4.3E-04	—
Thallium	6.2E-07	1.2E-06	—	1.7E+01	6.2E-08	4.2E-06	9.2E-07	7.1E-07	1.9E-04	—
Uranium	3.9E-06	1.5E-07	—	5.7E-01	1.2E-05	1.9E-08	9.4E-08	6.8E-08	2.4E-04	—
Zinc	1.8E-02	4.8E-03	1.7E+00	1.1E+02	6.4E-02	1.1E-03	4.4E+00	9.5E-02	1.5E-01	3.7E+00
CLOSURE										
Aluminum	1.8E+00	1.2E-01	—	5.2E+04	1.2E-03	6.6E-02	1.4E-01	3.5E-02	3.6E-02	—
Antimony	1.7E-04	9.6E-06	—	2.7E-01	2.6E-05	4.6E-06	1.2E-05	5.6E-06	1.1E-03	—
Arsenic	1.1E-04	2.0E-05	—	2.0E-01	2.4E-05	8.7E-06	5.3E-05	1.4E-05	2.9E-04	—
Cadmium	2.7E-05	5.4E-06	—	7.7E+00	1.4E-05	9.4E-08	9.2E-07	1.7E-06	1.4E-03	—
Cobalt	2.7E-04	3.3E-05	—	5.9E+02	9.4E-05	2.9E-04	1.3E-05	9.4E-06	1.7E-02	—
Copper	2.6E-03	5.5E-04	—	4.7E+01	1.6E-03	6.4E-04	7.6E-04	2.1E-04	1.8E-03	—
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.3E-03	2.0E-05	—	1.8E+02	2.6E-04	1.5E-05	5.7E-05	3.8E-05	3.6E-02	—
Mercury	3.1E-05	2.1E-06	—	8.7E-01	3.1E-06	7.4E-06	2.4E-06	8.5E-07	5.9E-05	—
Methyl-Mercury	—	—	—	—	—	—	—	—	—	—
Silver	6.5E-08	2.4E-05	—	1.0E+01	2.2E-05	6.5E-07	3.6E-06	2.8E-06	4.5E-04	—
Thallium	6.3E-07	1.3E-06	—	1.8E+01	6.3E-08	4.3E-06	9.4E-07	7.3E-07	2.0E-04	—
Uranium	4.1E-06	1.6E-07	—	6.1E-01	1.2E-05	2.0E-08	1.0E-07	7.2E-08	2.5E-04	—
Zinc	1.9E-02	5.2E-03	—	1.1E+02	6.9E-02	4.5E-05	1.4E-01	8.3E-02	1.6E-01	—
POST-CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	1.7E-04	9.6E-06	6.1E-02	2.7E-01	2.6E-05	5.6E-04	1.6E-03	3.0E-05	1.1E-03	2.2E-02

Table 3.5.3-6: Exposure Point Concentrations of COCs in Country Foods (Project Alone Assessment Scenario, Study Area No. 3, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project Alone									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	1.1E-04	2.0E-05	1.6E-02	2.0E-01	2.4E-05	6.9E-04	2.1E-03	8.9E-05	2.9E-04	4.3E-02
Cadmium	2.7E-05	5.4E-06	3.9E-01	7.7E+00	1.4E-05	2.8E-04	3.0E-03	2.2E-06	1.4E-03	2.0E-02
Cobalt	2.7E-04	3.3E-05	5.9E+00	5.9E+02	9.4E-05	7.0E-01	1.7E-02	1.2E-05	1.7E-02	1.6E-01
Copper	2.6E-03	5.5E-04	2.4E+00	4.7E+01	1.6E-03	1.4E-01	2.6E-01	4.3E-04	1.8E-03	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.3E-03	2.0E-05	1.8E+00	1.8E+02	2.6E-04	3.3E-03	9.4E-03	4.7E-05	3.6E-02	6.5E-02
Mercury	3.1E-05	2.1E-06	9.7E-02	8.7E-01	3.1E-06	5.8E-03	3.3E-03	1.6E-06	5.9E-05	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	6.5E-08	2.4E-05	6.4E-01	1.0E+01	2.2E-05	1.2E-02	2.2E-02	7.8E-06	4.5E-04	4.3E-02
Thallium	6.3E-07	1.3E-06	7.6E+00	1.8E+01	6.3E-08	1.8E+00	1.5E-01	9.3E-06	2.0E-04	2.5E+00
Uranium	4.1E-06	1.6E-07	3.2E+00	6.1E-01	1.2E-05	1.9E-03	4.9E-03	1.0E-05	2.5E-04	3.2E-01
Zinc	1.9E-02	5.2E-03	3.7E+00	1.1E+02	6.9E-02	2.2E-03	9.1E+00	1.2E-01	1.6E-01	7.9E+00

Table 3.5.3-7: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 3, All Project Phases)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
SITE PREPARATION AND CONSTRUCTION										
Aluminum	2.0E-01	1.4E-02	1.6E+03	5.7E+03	1.3E-04	1.4E+01	5.3E+01	1.6E-02	4.0E-03	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.2E+01	4.1E-03	1.3E-03	3.4E-03	9.0E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.1E-03	1.6E-02	6.0E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.5E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.1E-02	7.5E-03	6.8E+00	1.4E+05	2.1E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.8E-03	1.2E-02	3.3E-03	3.1E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.7E-06	2.1E-03	6.4E-01	9.0E+02	1.9E-03	1.2E-02	2.2E-02	2.5E-04	3.9E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00

Table 3.5.3-7: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 3, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
OPERATIONS										
Aluminum	1.6E+00	1.1E-01	1.6E+03	4.6E+04	1.1E-03	1.4E+01	5.3E+01	4.3E-02	3.2E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	1.5E-01	4.3E+01	4.1E-03	2.1E-03	5.9E-03	9.4E-04	1.7E-01	5.6E-02
Arsenic	3.3E-02	6.2E-03	1.3E-01	6.1E+01	7.3E-03	8.2E-03	3.3E-02	4.8E-03	8.7E-02	3.5E-01
Cadmium	1.3E-02	2.5E-03	2.6E-01	3.6E+03	6.5E-03	2.3E-04	2.4E-03	7.6E-04	6.4E-01	1.3E-02
Cobalt	6.2E-02	7.6E-03	6.4E+00	1.4E+05	2.2E-02	8.2E-01	2.1E-02	2.2E-03	3.8E+00	1.7E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.5E+00	1.6E+04	2.3E-02	4.0E-03	1.3E-02	3.3E-03	3.2E+00	5.4E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00
CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.3E+01	4.1E-03	1.3E-03	3.5E-03	9.1E-04	1.7E-01	2.2E-02
Arsenic	3.3E-02	6.2E-03	1.6E-02	6.1E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	2.0E-01	3.6E+03	6.5E-03	1.8E-04	1.9E-03	7.6E-04	6.4E-01	9.9E-03
Cobalt	6.2E-02	7.6E-03	6.8E+00	1.4E+05	2.2E-02	8.7E-01	2.3E-02	2.2E-03	3.8E+00	1.9E-01
Copper	2.7E+00	5.7E-01	2.3E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	4.8E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.4E+00	1.6E+04	2.3E-02	3.9E-03	1.2E-02	3.3E-03	3.2E+00	5.1E-02
Mercury	1.1E-02	7.2E-04	1.1E-01	3.0E+02	1.1E-03	9.2E-03	4.6E-03	2.9E-04	2.1E-02	2.2E-01
Methyl-Mercury	—	—	1.1E-01	—	—	5.2E-04	2.9E-05	6.5E-09	—	7.4E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	1.7E+00	2.7E+04	1.6E+01	1.2E-02	3.7E+01	2.0E+01	3.9E+01	3.7E+00
POST-CLOSURE										
Aluminum	1.8E+00	1.2E-01	1.6E+03	5.2E+04	1.2E-03	1.4E+01	5.3E+01	4.6E-02	3.6E-02	4.6E+01
Antimony	2.7E-02	1.5E-03	6.1E-02	4.3E+01	4.1E-03	1.3E-03	3.5E-03	9.1E-04	1.7E-01	2.2E-02

Table 3.5.3-7: Exposure Point Concentrations of COCs in Country Foods (Project Assessment Scenario, Study Area No. 3, All Project Phases) (continued)

Contaminant of Concern	Assessment Scenario: Project									
	Country Food Concentration (mg/kg wet weight)									
	Forage	Berries	Macrophytes	Labrador Tea	Root Vegetable	Moose	Goose	Grouse	Invertebrate	Fish
Arsenic	3.3E-02	6.2E-03	1.6E-02	6.1E+01	7.3E-03	3.3E-03	1.8E-02	4.3E-03	8.7E-02	4.3E-02
Cadmium	1.3E-02	2.5E-03	3.9E-01	3.6E+03	6.5E-03	3.2E-04	3.4E-03	7.6E-04	6.4E-01	2.0E-02
Cobalt	6.2E-02	7.6E-03	6.1E+00	1.4E+05	2.2E-02	7.9E-01	2.1E-02	2.2E-03	3.8E+00	1.7E-01
Copper	2.7E+00	5.7E-01	2.4E+00	4.9E+04	1.7E+00	8.1E-01	1.0E+00	2.2E-01	1.9E+00	5.0E-01
Cyanide	—	—	—	—	—	—	—	—	—	—
Lead	1.1E-01	1.7E-03	1.8E+00	1.6E+04	2.3E-02	4.6E-03	1.4E-02	3.3E-03	3.2E+00	6.5E-02
Mercury	1.1E-02	7.2E-04	9.7E-02	3.0E+02	1.1E-03	8.4E-03	4.1E-03	2.9E-04	2.1E-02	1.9E-01
Methyl-Mercury	—	—	9.7E-02	—	—	4.5E-04	2.5E-05	5.7E-09	—	6.5E-03
Silver	5.8E-06	2.2E-03	6.4E-01	9.1E+02	1.9E-03	1.2E-02	2.2E-02	2.6E-04	4.0E-02	4.3E-02
Thallium	2.7E-04	5.4E-04	7.6E+00	7.5E+03	2.7E-05	1.8E+00	1.5E-01	3.2E-04	8.4E-02	2.5E+00
Uranium	2.7E-03	1.1E-04	3.2E+00	4.0E+02	8.2E-03	1.9E-03	4.9E-03	5.8E-05	1.7E-01	3.2E-01
Zinc	4.6E+00	1.2E+00	3.7E+00	2.7E+04	1.6E+01	1.3E-02	4.2E+01	2.0E+01	3.9E+01	7.9E+00

4.0 HUMAN HEALTH RISK ASSESSMENT

A risk assessment is a process used to assess the potential risk to human receptors resulting from one or more environmental stressors. In so doing, the risk assessment takes into account the concentrations of the chemicals to be evaluated, their toxicity and the manner in which receptors may be exposed.

The objective of the human health risk assessment is to assess potential human health risks associated with the identified COCs all three study areas, all assessment scenarios, and associated with each Project phase. Potential health risks to human receptors will be determined by completing a qualitative and quantitative assessment using site-specific conditions, where available, and generic assumptions provided by Health Canada or MOECC.

The HHRA will be conducted according to industry accepted risk assessment practices and methodologies and will follow guidance published and endorsed by government agencies. This approach is consistent with previous projects in Ontario that have been reviewed by the Agency. The following guidance documents will be relied upon in the HHRA:

- Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 2.0 (Health Canada 2012a);
- Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors Version 2.0 (Health Canada 2010a);
- Part V: Guidance on Human Health Detailed Quantitative Risk Assessment For Chemicals ($DQRA_{CHEM}$) (Health Canada 2010b);
- Supplemental Guidance on Human Health Risk Assessment for Country Foods ($HHRA_{Foods}$) (Health Canada, 2010c);
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality (Health Canada 2016);
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality (Health Canada 2016);
- Procedures for the Use of Risk Assessment under Part XV.1 of the Environmental Protection Act (MOECC 2005);
- Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario (MOECC 2011a); and
- Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta (Alberta Health and Wellness 2011).

4.1 Problem Formulation

The problem formulation step is used to identify how COCs might adversely impact human health. It allows the definition of boundaries for the HHRA based on scientific rationale. Problem formulation provides the framework and methodology for the risk assessment, and consists of identifying the relevant components of the risk assessment. These components include identifying and characterizing relevant human receptor groups; and, identifying all operable exposure pathways based on the COCs and environmental transport mechanisms, and supplemental screening of the COCs that are relevant specifically to human health via the operable pathways.

Where exposure pathways can be reasonably assumed to be complete, a more detailed examination of potential risks is conducted via qualitative and quantitative approaches. A qualitative supplemental screening of all COCs is completed where chemical concentrations are compared to component criteria specific to human health. Chemical concentrations that do not exceed their respective human health component value are qualitatively considered to present a negligible amount of potential risk. For concentrations that exceed their respective human health component value, they are carried forward for a quantitative assessment of potential risk. The detailed quantitative assessment involves the remaining steps of the HHRA framework including the exposure assessment, toxicity assessment, and risk characterization.

Receptors included the assessment are conservatively considered to include all human rectors defined by Health Canada (i.e. infant, toddler, child, teen, and adults) adults who may be Workers, Residents, or Visitors/Harvesters. All receptors are assumed to be both members of Indigenous communities and members of the general public as per the valued components used in the assessment of Project effects as described in the EIS (April 2018).

Table 4.1-1: Human Health Problem Formulation

EIS Valued Component	Receptor Group	Receptor	Pathway
Non-Indigenous Human Health	Subsurface/Construction Worker	Adult, short term exposure	• Inhalation of air impacted by subsurface vapour intrusion, • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Direct contact with water
	Outdoor Worker	Adult	• Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of **soil (overburden soils, tailings/ore, and/or waste rock);** • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.
	Indoor Worker	Adult	• Inhalation of indoor air impacted by subsurface vapour intrusion; and/or • Ingestion of water as drinking water.
	Visitor, or Harvester	All Ages	• Ingestion of country foods (plants, fish, wild game); • Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.

EIS Valued Component	Receptor Group	Receptor	Pathway
	Resident	All Ages	• Inhalation of indoor air impacted by subsurface vapour intrusion • Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.
Indigenous Human Health	Resident	All Ages	• Ingestion of country foods (plants, fish, wild game); • Inhalation of indoor air impacted by subsurface vapour intrusion • Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.
	Visitor, or Harvester	All Ages	• Ingestion of country foods (plants, fish, wild game); • Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.
	Subsurface/Construction Worker	Adult, short term exposure	• Inhalation of air impacted by subsurface vapour intrusion, • Direct contact (dermal contact and incidental ingestion) of **soil (overburden soils, tailings/ore, and/or waste rock**); • Inhalation of soil particulates (fugitive dust); and/or • Direct contact with water.
	Outdoor Worker	Adult	• Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil; • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of water as drinking water.
	Indoor Worker	Adult	• Inhalation of indoor air impacted by subsurface vapour intrusion; and/or • Ingestion of water as drinking water.

4.1.1 Identification and Characterization of Potential Human Receptors

Based on the proposed Project, and current use of the lands and resources, receptors for each Study Area include:

Study Area No. 1: Operations Area

- **Project Workers** — A Project Worker is assumed to be an adult who may be an Indoor Worker, Outdoor Worker, or Construction/Subsurface Worker, hereafter collectively referred to as a Worker. Workers are considered to be members of the general public as well as members of Indigenous communities. Workers in Study Area No. 1 may be exposed to COCs via the inhalation of fugitive dust, inhalation of volatiles in indoor and outdoor air, direct contact (dermal contact and ingestion) with soil and surface water. Exposure to Project-specific media is assessed for a Worker. Workers in Study Area No. 1 are assessed for Site Preparations and Construction through Post-Closure phases of the Project Alone and Project Assessment Scenarios.

- **Residents —** Post-Closure and following the expiration of institutional controls, Study Area No.1 may potentially be used for residential purposes. Residents include members of the public and members of Indigenous communities who are considered to inhabit areas within the Operations Area on a permanent basis and use the lands and resources within this study area for traditional purposes. Indigenous community members have higher rates of country foods ingestion than the general public, therefore all Residents are conservatively assumed to be Indigenous community members. These receptors may also access the pit lake during post-closure. Resident receptors are considered all age groups, i.e., infants, toddlers, children, teenagers, and adults. Residents in the Village of Wabigoon may be exposed to COCs via the inhalation of fugitive dust, direct contact (dermal contact and ingestion) with soil and surface water, and ingestion of country foods harvested within all three Study Areas. Residents in Study Area No. 1 are assessed for Project Alone, and Project Assessment Scenarios for Post-Closure only.

Study Area No. 2: HHERA Local Study Area

- **Residents —** Residents include members of the public and members of Indigenous communities who are considered to inhabit areas within the Study Area No. 2 on a permanent basis and use the lands and resources within this study area for traditional purposes. Indigenous community members have higher rates of country foods ingestion than the general public, therefore all Residents are conservatively assumed to be Indigenous community members. Resident receptors are considered all age groups, (i.e., infants, toddlers, children, teenagers, and adults. Residents in Study Area No. 2 may be exposed to COCs via the inhalation of fugitive dust, direct contact (dermal contact and ingestion) with soil and surface water, and ingestion of country foods harvested within all three Study Areas. Residents in Study Area No. 2 are assessed for Base, Project Alone, and Project Assessment Scenarios. In reality, residents will not have uncontrolled access to all of Study Area No. 2 during the operating life of the Project. For security and public safety reasons, access to the portions of Study Area No. 2 occupied by the former MNRF tree nursery will be restricted during the Site Preparation and Construction, Operations, Closure, and portions of the Post-closure phases of the Project will be restricted.

- **Visitors/Harvesters —** Visitors/ harvesters include members of the public and members of Indigenous communities who practice the use of lands and resources for traditional purposes on areas outside of the Operations Area but on lands in the vicinity of the Project, including lands considered as part of the Treasury Metals Goliath Gold Project Property. Indigenous community members have higher rates of country foods ingestion than the general public, therefore all Visitors/Harvesters are conservatively assumed to be Indigenous community members. It is Treasury Metals' understanding that Aboriginal peoples are entitled to access to their lands according to their Aboriginal and Treaty #3 (1873) Rights, and Treasury Metals is committed to working with the Indigenous communities to ensure that the effects of the Project on their traditional land and resource use, or alternatively referred to as Aboriginal and Treaty Rights, are appropriately considered and protected. For security and public safety reasons, access to portions of

Study Area No. 2 will be restricted during the Site Preparation and Construction, Operations, Closure, and portions of the Post-closure phases of the Project will be restricted. However, Treasury Metals have committed to provide accompanied access for Visitors/Harvesters from Indigenous communities that wish to practice traditional uses on the grounds of the former MNRF tree nursery. Although Visitors/Harvesters are most likely to be adults, all receptor age groups will be conservatively considered. Visitors/Harvesters in Study Area No. 2 are assessed for Base, Project Alone, and Project Assessment Scenarios.

Study Area No. 3: The Village of Wabigoon

- **Residents —** Residents include members of the public and members of Indigenous communities who are considered to inhabit areas within the Village of Wabigoon on a permanent basis and use the lands and resources within this study area for traditional purposes. Indigenous community members have higher rates of country foods ingestion than the general public, therefore all Residents are conservatively assumed to be Indigenous community members. Resident receptors are considered all age groups, i.e. infants, toddlers, children, teenagers, and adults. Residents in the Village of Wabigoon may be exposed to COCs via the inhalation of fugitive dust, direct contact (dermal contact and ingestion) with soil and surface water, and ingestion of country foods harvested within all three Study Areas. The assessment of permanent residents in Study Area No. 3 is also protective of Visitors/Harvesters of this study area. Residents in Study Area No. 3 are assessed for Base, Project Alone, and Project Assessment Scenarios.

4.1.2 Identification of Exposure Scenarios and Operable Pathways

The exposure assessment evaluates the likelihood that human receptors may come into contact with the COCs in environmental and Project-specific media. The likelihood of exposure is determined through consideration of the properties that control chemical mobility, and the various pathways through which the COC could be transported to contact the receptor, or through which the receptor could move to contact the COC. The exposure analysis also considers the possible mechanisms through which a COC can be introduced to a human receptor (i.e., ingestion, dermal contact, and inhalation).

Exposure pathways are used to describe how a substance could move from the impacted environmental; media (air, soil, and water) and Project-specific media (waste rock, ore/tailings, TSF supernatant water, and pit lake water) to a point where it can come in contact with a human receptor.

The potential exposure pathways for soil contaminants and their relevance at the Site are summarized in Table 4.1.2-1. Those complete hazard-exposure-receptor combinations considered to have the highest likelihood to contribute to human health risk are carried forward for further quantitative analysis.

Table 4.1.2-1 Potential Exposure Scenarios - Human Receptors

Source Media	Exposure Pathway Description	Pathway Complete?	Quantitative Assessment Required	Justification
Air	Inhalation of fugitive dust	Yes	No	No air COCs were identified
Soil	Ingestion	Yes	No	No soil COCs were identified
	Dermal Contact			
	Ingestion of County Foods			
	Vapour Intrusion			
Water	Dermal Contact (Recreational Use)	Yes	Yes	Assessed for Residents and Visitors/Harvesters at all Study Areas.
	Ingestion of Drinking Water	Yes	Yes	Assessed for Workers, Residents and Visitors/Harvesters at all Study Areas.
	Ingestion of Country Foods	Yes	Yes	Assessed for Residents and Visitors/Harvesters at all Study Areas.
Waste Rock	Ingestion	Yes	Yes	Assessed for Workers at Study Area No. 1 only
	Dermal Contact	Yes	Yes	Assessed for Workers at Study Area No. 1 only
	Ingestion of County Foods	Yes	Yes	Assessed for Residents and Visitors/Harvesters at Study Areas No. 1, 2 and 3.
	Vapour Intrusion	Yes	No	No volatile compounds were identified in waste rock
Ore/Tailings	Ingestion	No	No	Tailings will be submerged or encapsulated during all Project Phases.
	Dermal Contact	No	No	Tailings will be submerged or encapsulated during all Project Phases.
	Ingestion of County Foods	No	No	Tailings will be submerged or encapsulated during all Project Phases.
	Vapour Intrusion	Yes	No	No volatile compounds were identified in tailings

Table 4.1.2-1 Potential Exposure Scenarios - Human Receptors (continued)

Source Media	Exposure Pathway Description	Pathway Complete?	Quantitative Assessment Required	Justification
TSF Supernatant Water	Dermal Contact (Recreational Use)	No	No	There will be no recreational use of the TSF
	Ingestion of Drinking Water	No	No	The supernatant water is not considered potable, it will not be used as a drinking water source.
	Ingestion of Country Foods	Yes	Yes	TSF supernatant water will be available for ingestion by birds and mammals which may ingested as country foods.
Pit Lake Water	Dermal Contact (Recreational Use)	Yes	No	No Pit Lake Water COCs identified.
	Ingestion of Drinking Water	Yes	No	
	Ingestion of Country Foods	Yes	No	

4.1.3 Supplemental COC Screening for Human Health

4.1.3.1 Air

Human receptors may be exposed to COCs via the inhalation of fugitive dust. None of the chemical parameters predicted in air (as fugitive dust) exceeded their respective screening criteria for any of the assessment scenarios or study areas. As such, no potential human health risks are anticipated via the inhalation of fugitive dust pathway. No further assessment of the inhalation of fugitive dust pathway is required as part of the HHRA.

Dust deposition to overburden soil was modelled and assessed as part of the soil exposure pathways.

4.1.3.2 Soil

Human receptors may be exposed to soil COCs via the following pathways:

- Direct dermal contact and incidental ingestion;
- Ingestion of drinking water impacted with chemicals that have leached from soil;
- Inhalation of air impacted with volatile soil COCs (soil vapour); and
- Ingestion of country foods impacted by soil COCs.

None of the chemical parameters measured or predicted in soil exceeded their respective screening criteria for any of the assessment scenarios or study areas. As such, no potential human health risks are identified via the qualitative assessment of risk. A quantitative assessment of these pathways is required as part of the HHRA.

4.1.3.3 Water

Human receptors may be exposed to water COCs via the following pathways:

- Ingestion of drinking water;
- Recreational uses; and
- Ingestion of country foods impacted by surface water COCs.

Several water COCs were identified as part of the COC selection process including:

- Aluminum
- Antimony
- Arsenic
- Cobalt
- Methyl-mercury
- Silver

- Thallium
- Uranium
- Zinc

The EPC for each of the identified COCs was supplemental screening against:

- Health Canada (2012)- *"Guidelines for Canadian Recreational Water Quality – Third Edition*";
- Health Canada (2017)- *"Guidelines for Canadian Drinking Water Quality";* and
- MOECC (2011)- *"Groundwater Components for Potable Water, Coarse Textured Soil (GW1- drinking water pathway)".*

Health Canada states that there is insufficient information to support the establishment of guideline values for specific chemical parameters in recreational waters. In general, potential risks from exposure to chemical parameters will be much smaller than the risks from the microbiological hazards potentially present in recreational waters (WHO, 2003a). With chemical concentrations typically found in water, most recreational water users will not be exposed to sufficient concentrations necessary to elicit either an acute or chronic illness response. For inorganic parameters, ingestion as drinking water is considered the primary pathway of exposure for inorganic chemical contaminants. Therefore, the supplemental screening for the water ingestion pathway is considered to provide sufficient protection via the recreational use direct pathway also.

The qualitative supplemental screening process for the protection of human receptors via the water pathways of exposure indicates that no potential risks are anticipated for any of the assessment scenarios or study areas. The chemical concentrations of all metals are below levels that would pose risk to human receptors via the ingestion of water as drinking water, and consequently via recreational use. Furthermore, the concentration of mercury in water for all assessment scenarios is at a minimum, one order of magnitude below the concentrations that would pose risk to human health. As such, no potential human health risks are identified.

The EPCs of arsenic and antimony in surface water exceeded Health Canada's MAC drinking water quality guideline during operations for the Project Alone and Project assessment scenarios. The only exceedances of health based drinking water criteria were in Blackwater Creek. Appendix A provides the details with respect to the exceedance locations. Blackwater Creek is a low gradient stream, punctuated by active and inactive beaver dams and ponds. Surface water from Blackwater Creek is not suitable or used as drinking water due to microbiological contaminants, such as bacteria, protozoa and viruses. As such, arsenic and antimony are not carried forward as drinking water COCs in the HHRA as the use of surface water as drinking water from Blackwater Creek is not considered a reasonably operable pathway of exposure. No potential human health risks are identified.

The results of the supplemental screening for the protection of human health via the surface water exposure pathways is provided in Table 4.1.3-1 below.

Table 4.1.3-1: Human Health COC Supplemental Screening: Surface Water

Contaminant of Concern (COC)	Exposure Point Concentration (mg/L)							Supplemental Screening Criteria (mg/L)			
	Base Scenario	Project Alone (Operations)	Project (Operations)	Project Alone (Post-Closure) WET COVER	Project (Post-Closure) WET COVER	Project Alone (Post-Closure) DRY COVER	Project (Post-Closure) DRY COVER	Recreational Water Quality[1]	Aesthetic Water Quality [2]	Human Health Water Quality [2]	MOECC GW 1 Component[3]
Aluminum	0.6928	—	0.6929	—	0.6927	0.6926	0.6926	Insufficient Data to Derive	0.1	No Value	No Value
Antimony	—	—	**0.0061**	—	—	—	—	Insufficient Data to Derive	No Value	**0.006**	**0.006**
Arsenic	—	—	**0.02**	—	—	—	—	Insufficient Data to Derive	No Value	**0.01**	**0.00001**
Cobalt	0.0019	—	0.0018	—	0.0018	0.0017	0.0017	Insufficient Data to Derive	No Value	No Value	0.003
Mercury	0.00005	—	0.00005	—	0.00005	0.00004	0.00004	Insufficient Data to Derive	No Value	0.001	0.001
Methyl-Mercury*	0.00005	—	0.00005	—	0.00005	0.00004	0.00004	Insufficient Data to Derive	No Value	0.001	0.0003
Silver	0.0003	—	0.0003	—	0.0003	0.0003	0.0003	Insufficient Data to Derive	No Value	No Value	0.1
Thallium	0.0009	—	0.0009	—	0.0009	0.0009	0.0009	Insufficient Data to Derive	No Value	No Value	0.024
Uranium	0.0139	—	0.0139	—	0.0139	0.0139	0.0139	Insufficient Data to Derive	No Value	0.02	0.02
Zinc	0.0147	0.0149	0.0149	0.0173	0.0173	0.0315	0.0315	Insufficient Data to Derive	5	No Value	5

NOTES:

Units	All units in mg/L
*	The EPC for methyl-mercury was assumed to be 100% of the mercury EPC
1	Health Canada 2012. Guidelines for Canadian Recreational Water Quality Third Edition
2	Health Canada 2017. Guidelines for Canadian Drinking Water Quality Summary Table (Maximum Acceptable Concentration (MAC))
3	MOECC 2011. Rationale for the development of soil and ground water standards. GW1- Drinking Water
BOLD & SHADED	Exceeds Human Health Supplemental Screening Criteria, Quantitative Assessment or Risk Management Measures are Required.
BOLD & SHADED	Exceeds Drinking Water quality guideline, however pathway is considered inoperable due to microbiological contaminants, such as bacteria, protozoa and viruses.

4.1.3.4 Project-Specific Media

As discussed in Section 3.6.2.4, Project-Specific Media, human receptors within the operations area (Study Area No. 1) may be exposed via direct dermal contact and incidental ingestion, and inhalation of fugitive dust of metals in waste rock during the operations phase of the Project. As defined in the exposure assessment, the tailings will be under water cover or encapsulated and therefore will not present an operable pathway of exposure. Supplemental screening is therefore limited to the COCs that exceeded their respective criteria in Waste Rock.

The MOECC Soil Components for Table 2- Potable Water Scenario (MOCC Table 2 component criteria) for coarse textured soils were selected for COC screening and selection as part of the HHRA. An MOECC component value is derived to provide a receptor or group of receptors protection from a contaminant via a specific pathway and were generally derived following CCME, US EPA, and or Health Canada risk assessment guidance. In the MOECC "*Rational for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario*" (MOECC 2011), it is explained that the components are derived based on a default source allocation factor of 0.2 for non-cancer. This means that $1/5^{th}$ of the tolerable daily intake was allocated for the component values which is consistent with the most recent Health Canada DQRA approach. For chemicals considered to be carcinogenic (e.g., arsenic), a target cancer level of 1×10^{-6} was allocated to each component value, which is more conservative than Health Canada requires. The MOCC Table 2 Component criteria represent the current state of risk assessment science in Ontario, and are therefore appropriate for use as part of a qualitative assessment of risk with respect to the Project.

The maximum concentrations of COCs in soils that exceeded their CCME SQG or MOECC Site Condition Standard were further assessed herein against the most conservative MOCC Table 2 Soil Components- Potable Water Scenario (Coarse -Textured Soil) for the following:

- S2-Direct soil contact- dermal contact and incidental ingestion- Long Term Worker (Indigenous and Non-Indigenous)
- S3-Direct soil contact- dermal contact, incidental ingestion, and inhalation of soil particulates- Short Term Construction/ Subsurface (Indigenous and Non-Indigenous)
- S-GW1- Soil leaching to groundwater and migrating to a drinking water system- Toddler Resident. The derivation of the S1 component criteria assumes a residential exposure scenario (i.e. 24 hours a day/7 days a week exposure scenario) so also conservatively protects Site Workers and Site Visitors and Harvesters (Indigenous and Non-Indigenous).
- S-OA- Soil migrating to Outdoor Air via Soil Vapour Pathway. The S-OA value was selected from the residential land use scenario in addition to the commercial/ industrial land use scenario therefore providing protection to Workers, Residents, and Site Visitor/ Harvesters (Indigenous and Non-Indigenous).
- S-IA- Soil migrating to Indoor Air via Soil Vapour Pathway. The S-IA value was selected from the residential land use scenario in addition to the commercial/ industrial land use

scenario therefore providing protection to Workers, Residents, and Site Visitor/ Harvesters (Indigenous and Non-Indigenous).

The EPCs of arsenic and lead in waste rock exceeded their respective MOECC component criteria protective of a Visitor/Harvester (toddler), Outdoor Worker and Subsurface Worker, quantitative assessment of these parameters is required as part of the HHRA. The results of the supplemental screening for human health COCs in Project-specific media are provided in Table 4.1.3-2.

Several chemicals were identified as COCs in the supernatant water of the TSF (Section 3.6.2.4) and require supplemental screening for the pathways specific to human health. Supernatant water will be screening for chemicals specific to human health using the same rationale as for the surface water screening. This represents an overly conservative approach as the TSF will not be used for recreational or drinking water purposes. The assessment of this pathway is specific to incidental dermal contact and ingestion for a Project Worker. Workers will be the only human receptors exposed to the supernatant water and only during the operations phase of the Project. This exposure scenario is specific to Study Area No. 1 only.

The results of the human health supplemental screening of the TSF supernatant water (Table 4.1.3-3) indicate that potential risk to workers via direct dermal contact and incidental ingestion of supernatant water cannot be ruled out for cyanide, lead, mercury, methyl-mercury and thallium. A quantitative assessment is required for these parameters.

No COCs were identified in the pit lake water, as such no supplemental screening is required. No potential human health risks are identified via human exposure to the pit lake post-closure.

Table 4.1.3-2: Human Health COC Supplemental Screening: Waste Rock

Contaminant of Concern (COC)	Exposure Point Concentration (µg/g)	Supplemental Screening Criteria				
		MOECC Table 2 Component Criteria[1] (µg/g)				
	Waste Rock	S2	S3	S-GW1	S-OA	S/IA
Aluminum	No data					
Antimony	4.695	63	63	NV	NV	NV
Arsenic	**19.466**	**1.3**	**47**	NV	NV	NV
Chromium (total)	—	240,000	240,000	NV	NV	NV
Cobalt	119.807	250	2,500	NV	NV	NV
Copper	—	5,600	5,600	NV	NV	NV
Lead*	**144.735**	**120***	**120***	NV	NV	NV
Mercury	0.275	67	670	550	35	3.9
Silver	1.275	490	490	NV	NV	NV
Thallium	—	3.3	33	NV	NV	NV
Uranium	—	300	300	NV	NV	NV
Zinc	443.903	47000	47000	NV	NV	NV

NOTES:

Units	All units in µg/g
1	MOECC 2011. Rationale for the development of soil and ground water standards, Table 2 Component Values for Full Depth, Potable Water Scenario, coarse textured soil and commercial land use.
S2	Direct soil contact- dermal contact and incidental ingestion- Outdoor Worker
S3	Direct soil contact- dermal contact and incidental ingestion- Subsurface Worker
S-GW-1	Soil migrating to groundwater used for drinking water (Resident)
S-OA	Soil to Outdoor Air via Soil Vapour Pathway (Worker)
—	EPC concentration did not exceed guideline or standard in Section 3.5.2. Not considered a COC. No supplemental screening required
NV	No Value- insufficient toxicity and/or contaminant transport data to support pathway evaluation. Qualitative assessment only
BOLD & SHADED	Exceeds Human Health Supplemental Screening Criteria, Quantitative Assessment or Risk Management Measures are Required.

Table 4.1.3-3: Human Health COC Supplemental Screening: TSF Supernatant Water

Contaminant of Concern (COC)	Exposure Point Concentration	Supplemental Screening Criteria			
	(mg/L)	(mg/L)			
	Predicted Tailings Supernatant	Recreational Water Quality[1]	Aesthetic Water Quality [2]	Human Health Water Quality [2]	MOECC GW 1 Component[3]
Aluminum	0.199	Insufficient Data to Derive	0.1	No Value	No Value
Cobalt	0.004	Insufficient Data to Derive	No Value	No Value	0.003
Copper	0.018	Insufficient Data to Derive	1	No Value	1
Cyanide	**<1**	Insufficient Data to Derive	No Value	**0.2**	**0.2**
Lead	**0.082**	Insufficient Data to Derive	No Value	**0.01**	**0.01**
Mercury	**0.0018**	Insufficient Data to Derive	No Value	**0.001**	**0.001**
Methyl-Mercury[1]	**0.0018**	Insufficient Data to Derive	No Value	**0.001**	**0.0003**
Thallium	**0.642**	Insufficient Data to Derive	No Value	No Value	**0.024**
Zinc	0.04	Insufficient Data to Derive	5	No Value	5

NOTES:

Units	All units in mg/L
*	The EPC for methyl-mercury was assumed to be 100% of the mercury EPC
1	Health Canada 2012. Guidelines for Canadian Recreational Water Quality Third Edition
2	Health Canada 2017. Guidelines for Canadian Drinking Water Quality Summary Table
3	MOECC 2011. Rationale for the development of soil and ground water standards. GW1- Drinking Water
BOLD & SHADED	Exceeds Human Health Supplemental Screening Criteria, Quantitative Assessment or Risk Management Measures are Required.

4.1.4 Conceptual Site Model

The information collected in the problem formulation is depicted on the human health conceptual site model (Figure 4-1), which illustrates the source media for COCs, identifies the receptors at each of the Study Areas, and operable exposure pathways by which receptors may be exposed to the COCs.

The CSM for human receptors is provided in Figure 4.1.4-1.