6.0 DESCRIPTION OF PROJECT EFFECTS

6.1 Methods Used in the Assessment of Project Effects

6.1.1 Integration of Public and Aboriginal Feedback

Throughout the process of preparing the EIS for the Project, Treasury Metals undertook to engage potentially affected parties and individuals. The engagement with members of Indigenous communities is detailed in an updated Aboriginal Engagement Report, included as Appendix DD to this revised EIS. The Aboriginal Engagement Report has been prepared as part of the process for responding to the Round 1 information requests, and sets out how Treasury Metals has tried to addressed issues raised by members of Indigenous communities during the EIS process. This information is also summarized in Section 9 of this revised EIS.

Through the engagement process and the EIS review, members of Indigenous communities have shared their traditional knowledge regarding the existing conditions for the Project and surrounding area. This traditional knowledge has been incorporated into the description of the existing conditions presented in Section 5 of this revised EIS. Where available, information regarding the current and historic use of the lands and resources by Indigenous communities has been compiled (Section 5.13) to help in understanding the potential impact of the Project on the rights of members of Indigenous communities to continue to practice their traditional uses of the lands, and the resources therein.

6.1.2 Integration of Responses to Round 1 Information Requests

As part of the Round 1 information request process, there were some 859 individual information requests, to which Treasury Metals has provided individual, specific responses. Of those requests, 440 questions were identified by the Agency as coming from Aboriginal peoples, while 90 were identified as coming from other interested stakeholders. In total, there were 329 questions from the Agency and other regulators.

All of these questions have been responded to individually. In several cases, the responses to the information requests have been used as guides for re-organizing how information has been presented in this revised EIS. In revising the EIS, efforts were made to incorporate the information from all of the responses provided to questions from members of Indigenous communities, stakeholders, and regulators. Where there are specific questions that influenced sections of this report, those questions have been listed to provide a concordance back to the individual responses themselves.

6.1.3 Selection of Valued Components (VCs) and Indicators

The use of valued components (VCs) in the environmental assessment process is important as they provide structure and focus for the assessment, as well as ensuring that the likely effects of a Project are considered. Since VCs are used as assessment endpoints, it is important that the selected VCs can be used to meaningfully describe the effects of the Project. The concept of VCs has become integral to the environmental assessment process in Canada since it was first introduced by Beanlands and Duinker (1983).

The Canadian Environmental Assessment Agency (the Agency) describes VCs as an "…environmental features that may be affected by a project and that have been identified to be of concern by the proponent, government agencies, Aboriginal peoples or the public." (CEAA 2015b). The EIS Guidelines for the Project (CEAA 2013) go on to indicate that the "…proponent will identify the VCs deemed appropriate to ensure the full consideration of the factors listed in subsection 19(1) of CEAA, 2012 as well as the 2012 amendment to section 79 of the Species at Risk Act." Although not explicitly identified in the EIS Guidelines (CEAA 2013), Section 9.1 the guidelines do list the areas that should be addressed in the EIS.

From an ecological perspective, a VCs can be any of the following:

- An aspect of the physical environment (e.g., air quality or surface water quality);
- An individual plant or animal species (e.g., walleye or northern pike);
- A range of species that serve as a surrogate for species that interact similarly with the environment (e.g., upland birds); or
- A complex feature or element of the natural environment (e.g., a local wetland or stream) considered to be culturally or scientifically important.

From a socio-economic perspective, VCs could represent an aspect of community well-being, such as housing or employment.

In selecting the VCs used to assess the effects of the Project were selected with consideration for the above, but also with consideration those VCs, processes, and interactions that "…were identified to be of concern during any workshops or meetings held by the proponent or that the proponent considers likely to be affected by the project." However, the Round 1 information requests also include questions related to the VCs selected, or justification for elements of the environment not selected for use as VCs in the EIS. The following sections describe the VCs used in the EIS, organized by component of the environment. Where specific concerns or issues were raised that help identify the VCs used, this has been identified in each section. Additionally, the individual component sections include information to reflect the responses to the Round 1 information requests.

6.1.3.1 Terrain and Soils

The following three VCs have been selected for evaluating the potential effects of the Project on terrain and soils:

- Natural landscape;

- Overburden; and
- Soil chemistry.

The natural landscape was selected as a VC to capture concerns raised regarding whether the Project would materially alter the topography, landscape, and ultimately the viewscape of the surrounding area. The Project area is relatively flat, with only 140 m vertical variability within 20 km of the site. Elevated surface features within the Project, such as the waste rock storage area (WRSA), the overburden stockpiles, and the low-grade ore (LGO) stockpile could be visible, and present a contrast with the natural terrain. The changes in topography associated with Project could be visible to nearby residents (e.g., residents and cottagers on Thunder Lake) and other individuals in the area.

The overburden was selected as a VC because the overburden acts as a medium to sustain plant growth, it helps to filter and retain precipitation, and is part of the wildlife habitat. In order to access the resource, Treasury Metals will need to strip the overburden from the open pit area. This overburden will also need to be preserved to support the reclamation and closure activities at the end of the Project life. Overburden stripping will occur during the site preparation and construction phase, as will cut-and-fill of overburden in the vicinity of Project facilities requiring a leveled surface. As a result, the overburden could be susceptible to wind and water erosion due to the disruption of the stable state of the soils (removal of vegetation and alteration of consolidated materials).

Soil chemistry was also selected as a VC in the EIS. The existing chemistry of the soils in the area define their function within the environment, and is critical for the maintaining the current ecosystem. Once disturbed, soils can undergo weathering or be chemically altered. Additionally, mining activities and equipment can result in spills and leaks that, if not contained and remediated, can alter the chemistry of the soils at the site. Finally, the mine waste rock stored in the WRSA could undergo geochemical transformation if exposed to oxygen and moisture, potentially resulting in acid rock drainage and metal leaching (ARD/ML) that could, in turn, affect the chemistry of disturbed and undisturbed soils.

The bedrock in the area was not selected as a VC because it is mostly covered by overburden or relatively flat where exposed. Due to its inconspicuous or buried state, the bedrock in the Project area is not expected to provide a significant habitat opportunities, or has not been identified as a component of the environment valued by stakeholders.

The following questions related to terrain and soils were raised as part of the Round 1 information request process:

- TMI_228-AC(1)-240: landscape views of cultural importance and views of Thunder Lake;
- TMI_619-AC(1)-292: potential impacts on overall landscape, as well effects to sacred site at Mavis and Ghost Lake;

- TMI_711-PC(1)-26: visual impacts of mine; and
- TMI_828-AC(1)-409: change in landscape.

The listing of the VCs used in evaluating the potential effects of the Project on terrain and soils provided in Table 6.1.3.1-1, uses the same VCs as used in the original EIS, but the indicators and measures have been adjusted to reflect feedback provided.

Table 6.1.3.1-1: Terrain and Soil VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Natural Landscapes	Viewscapes	How visible Project features are to offsite observers
		How Project features change the characteristics of viewscapes
Overburden	Erosion of disturbed overburden	Amount of stockpiled overburden material lost to erosion
Soil chemistry	Changes in soil chemistry	Extent of permanent changes tot eh onsite soil chemistry

6.1.3.2 Geology and Geochemistry

Although geology and geochemistry would not normally be considered assessment endpoints, they are important for understanding how the Project could affect the environment. For example, geology and geochemistry describe the potential for acid rock drainage (ARD) and the associated metals leaching (ML). Both ARD and ML are important parameters of geology and geochemistry that could influence other components (e.g., surface water quality). Specifically, geology and geochemistry will influence the quality of seepage from the tailings storage facility (TSF) and the waste rock storage area (WRSA), as well as dictating the quality of the water in the pit lake that is allowed to form following closure.

Although there were no questions as part of the Round 1 information requests specifically directed at the choice to not identify any VCs for geology and geochemistry, one VC has been added for geology and geochemistry in order to capture the effects of ARD and ML on the quality of water in the pit lake following closure. This VC addresses the request in TMI_134-FH(1)-13 to assess the quality of the water within the pit lake. Geology and geochemistry are also important for determining the quality of seepage from the TSF and WRSA. These were not selected as a VC because the effects of this seepage on the receiving environment has been explicitly addressed as part of the surface water quality and groundwater quality VCs discussed in Sections 6.1.3.7 and 6.1.3.9, respectively.

Table 6.1.3.2-1 summarizes the VC, indicators and measures used for evaluating the potential effects of the Project on geology and geochemistry. The indicators and measures are consistent with those defined for surface water quality (Section 6.1.3.7).

Table 6.1.3.2-1: Geology and Geochemistry VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Pit Lake Water Quality	Aluminum (Al)	Concentrations (mg/L)
	Antimony (Sb)	Concentrations (mg/L)
	Arsenic (As)	Concentrations (mg/L)
	Beryllium (Be)	Concentrations (mg/L)
	Boron (B)	Concentrations (mg/L)
	Cadmium (Cd)	Concentrations (mg/L)
	Chromium (Cr)	Concentrations (mg/L)
	Cobalt (Co)	Concentrations (mg/L)
	Copper (Cu)	Concentrations (mg/L)
	Iron (Fe)	Concentrations (mg/L)
	Lead (Pb)	Concentrations (mg/L)
	Mercury (Hg)	Concentrations (mg/L)
	Molybdenum (Mo)	Concentrations (mg/L)
	Nickel (Ni)	Concentrations (mg/L)
	Selenium (Se)	Concentrations (mg/L)
	Silver (Ag)	Concentrations (mg/L)
	Thallium (Tl)	Concentrations (mg/L)
	Uranium (U)	Concentrations (mg/L)
	Vanadium (V)	Concentrations (mg/L)
	Zinc (Zn)	Concentrations (mg/L)

6.1.3.3 Noise

The following VCs have been identified for evaluating the effects of the Project on noise:

- Environmental noise levels;
- Noise disturbance to wildlife (including SAR);
- Blasting noise and vibration; and
- Noise related health effects.

In Ontario, ambient noise levels are regulated by the Ministry of Environment and Climate Change. The Ministry of Environment and Climate Change has established “Stationary Source” guidelines set out in MOE Publication NPC-300 (MOECC 2013). These guidelines state that one-hour sound exposures (A-weighted hourly LEQ values) from stationary noise source shall not exceed that the established limits or background levels. Under the guidelines, background is defined as the sound level present in the environment produced by noise sources other than those associated with the Project. The MOE Publication NPC-300 establishes sound level limits at the façade (or plane of window) for the following three different times of the day, which were used as indicators for the ambient noise level VC:

- Daytime hours (0700 to 1900h);
- Evening hours (1900 to 2300h); and
- Night-time hours (2300 to 0700h).

High levels of environmental noise can also affect wildlife, including species at risk (SAR), causing changes in behaviour or avoidance of affected areas, for at least temporary periods of time. For the "noise effects to wildlife" VC, it was necessary to turn to literature to identify suitable criteria for use in the noise assessment. The assessment of effects of the Project on the "noise effects to wildlife" VC focused on determining whether the predicted noise levels were above the identified criteria or not. An evaluation of how the predicted noise levels could affect wildlife is provided in in the wildlife and wildlife habitat assessment provided in Section 6.12 of the revised EIS.

One criteria that was considered for evaluating the effects of noise on wildlife was the criteria suggested in the Round 1 information requests, specifically TMI_192-AE-(1)-30. The information request indicates that Environment Canada's 'Incidental Take of Migratory Birds in Canada' website (EC 2016: website) identifies that migratory birds are typically disturbed by sound levels exceeding 50 dBA. Such disturbance could contribute to adverse effects on migratory birds and SAR. However, this is not the only literature relevant to the subject, with recent projects evaluated by the Agency having also considered the subject.

The recent Rainy River Project EIS (New Gold 2013) described the types of effects noise could have on wildlife particularly birds. The most common effect they identified was masking of important communication signals. The EIS went on to indicate that "…sound masking has been shown to occur at sound emissions levels of 50 to 60 dBA (Dooling and Popper 2007)". A threshold of 50 dBA was used to determining areas that could potentially represent reductions in habitat suitability.

An extensive literature search was also made as part of the recent regulatory process for the Deep Geologic Repository (DGR) project. The findings (OPG 2013) identified 27 separate publicly available studies and reports dealing with issues related to noise effects on livestock and wildlife, but found that "…species-specific information on the response to increases in background noise for SAR in Ontario was not readily available." The findings (OPG 2013) went on to indicate that "the literature review relied on information regarding species that can be considered comparable to the SAR of interest". Some other findings include the following:

- Exposure to constant noise has been documented to lead to habituation even if the levels are high (54 dB);
- Birds adapt to relatively noisy environments by changing their vocalization (Brumm 2004);

- Birds can acclimatize to relatively high background noise (54 dB) (Golder 2012);
- Birds are often more disturbed by sporadic activities than continuous noise (Golder 2012);
- American bullfrog have been documented to modify their call structure by altering the call frequency level and increasing call bandwidth (Wilson 2012); and
- Literature suggests that species respond to increased noise either through avoidance and/or habituation.

Based on the above, the 50 dBA value represents a threshold for evaluating the “noise effects on wildlife” VC, which was also recommended in TMI_192-AE-(1)-30. The potential effects of noise on wildlife are described as displacement. To describe the potential displacement of wildlife, the predicted effects of the Project to the noise effects on wildlife VC, are described using the areal extent with predicted noise levels in excess of the 50 dBA threshold. However, while it is possible to predict, and describe the areas where noise levels as a result of the Project are expected to exceed 50 dBA, what this means to individual wildlife VCs or species requires consideration with other factors and effects of the Project. Therefore, the consideration of the potential effects of noise from the Project on wildlife will be considered as a component of the wildlife and wildlife habitat assessment described in Section 6.12 of the revised EIS.

The following questions, raised as part of the Round 1 IRs, specifically asked about the selection of the noise VCs used in the EIS:

- TMI_184-AE(1)-16: Blasting vibration;
- TMI_194-HE(1)-01: Linkages between noise and Aboriginal health;
- TMI_515- AC(1)-189: Noise associated with blasting; and
- TMI_526-AC(1)-200: Noise associated with blasting.

To address specific noise questions in the Round 1 IRs, two additional noise VCs (blasting noise and vibration, and noise related health effects) have been added. All of the technical work necessary to address these two additional VCs was already presented in Appendix H of the original EIS, and has been re-issued as Appendix H to the revised EIS. Table 6.1.3.3-1 lists the noise VCs, along with the corresponding indicators and measures.

Table 6.1.3.3-1: Noise VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Environmental noise levels	Equivalent noise levels, L_{EQ}	A-weighted decibels (dBA)
Noise disturbance to wildlife (including SAR)	Area predicted L_{EQ} above 50 dBA	Area (ha)
Blasting noise and vibration	Peak sound pressure level	Decibels (dB)
	Peak particle velocity	Centimetres per second (cm/s)
Noise related health effects	Absolute sound pressure, L_{DN}	A-weighted decibels (dBA)
	Percent highly annoyed,%HA	Change in%HA

6.1.3.4 Light

The development of the Project will require the use of artificial, exterior lighting in order for activities at the Project to proceed safely, and to ensure security. However, artificial lighting can also represent an effect on the environment. The following single VCs is used for evaluating the effects of the Project on light:

- Light trespass.

The development of the Project will require the use of exterior lighting for operations, safety and security. Treasury Metals also ensured that the nuisance factor of potential light trespass from the Project to neighboring residences was evaluated by identifying light trespass as a VC.

In addition, night-time lighting of structures (e.g., work lights) has been shown to act as an attractant to wildlife, thereby increasing the probability of Project-wildlife interactions. Although wildlife attraction to novel light sources was selected as a VC in the original EIS, there are no specific criteria or thresholds or criteria that can be used from the perspective of light to evaluate these effects. Therefore, the assessment of the effects of light on wildlife has been addressed in this revised EIS as a part of the description of effects on wildlife and wildlife habitat described in Section 6.12. Therefore, the “wildlife attraction” VC from the original EIS is no longer used, and the effects of light on wildlife incorporated when evaluating the effects of the Project on the wildlife VCs, described in Section 6.12.

There were no questions in the Round 1 IRs that specifically asked about the selection of the light VCs used in the EIS.

Table 6.1.3.4-1 lists the light VC, along with the corresponding indicators and measures.

Table 6.1.3.4-1: Light VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Light trespass	Ambient light levels	Lux

6.1.3.5 Air Quality

Project activities during the site preparation and construction phase, operations phase, and decommissioning and abandonment phase are expected to result in air emissions that can affect air quality. These air emissions can be broadly grouped as either gaseous or particulate emissions. However, both categories of emissions can be effectively with a single Valued Component (VC), namely air quality.

Both gaseous and particulate emissions are comprised of a number of compounds, often referred to as air contaminants. Those air contaminants expected to be released in amounts to result in measurable air concentrations beyond the Project were selected as indicators for air quality.

The following gaseous compounds were used as air quality indicators for assessing the effects of the Project on the air quality VC (RWDI 2014e: Section 2.1.1, included as Appendix J-1):

- Sulphur Dioxide (SO_2);
- Nitrogen Dioxide (NO_2); and
- Carbon Monoxide (CO).

The following particulate compounds are used as air quality indicators for assessing the effects of the Project on the air quality VC (RWDI 2014e: Section 2.1.2 and 2.1.3, included as part of Appendix J):

- Total Suspended Particulate (TSP), or dust, which includes nearly all of the airborne particles likely to be emitted by the Project.
- Inhalable particulate matter (PM_{10}), which, includes airborne particles with an aerodynamic diameters less than 10 microns.
- Respirable particulate matter ($PM_{2.5}$), which includes airborne particles aerodynamic diameters less than 2.5 microns.
- Metals present in the airborne particulate matter. The specific compounds selected are those for which relevant ambient air criteria were available (i.e., silver, copper, iron, lead, zinc aluminium, arsenic, barium, calcium, cadmium, cobalt, chromium, potassium, lithium, magnesium, manganese, molybdenum, nickel, phosphorous, antimony, selenium, tin, strontium, titanium, thallium, vanadium, tungsten, yttrium, sulphur, uranium, platinum, palladium, rhodium, sodium).
- Deposition of airborne particles as a result of gravitational settling and other influences. The deposited particulates are often referred to as dustfall, and are measured as deposition on a mass per area per time basis ($g/m^2/30$ days).

Gaseous compounds potentially associated with projects of this nature, but not chosen as air quality indicators for this assessment are ammonia (NH_3), Volatile Organic Compounds (VOC) and ozone (O_3). Ammonia emissions were excluded as air quality indicators because the emissions of ammonia to air are minimal from the Project (Appendix J-2: Section 2.1.1). The heavy equipment at the mine will be diesel-fired, which will minimize the emissions of VOC to the point where the Project will result in no measurable change in the VOC concentrations. Although O_3 can form in the atmosphere through photochemical reactions with oxides of nitrogen (NO_X) and VOC emissions, the magnitude of these emissions from the Project is viewed as negligible from the perspective of O_3 formation (Appendix J-2). In fact, the NO_X emissions from the Project are likely to result in a local decrease in O_3 due to scavenging (as detailed in the response to

TMI_165-AE(1)-03). Finally, the climate in the area is not conducive to ozone formation. Overall, the Project is expected to have little or no lasting effect on ground-level ozone concentrations in the region.

There are other metals likely to be present in the dust emitted from the Project, including beryllium, bismuth, gallium, gold, lanthanum, scandium, and thorium. Air quality criteria are not available for these compounds, so they will not be used in evaluating the effects of the Project on the air quality VC. Predictions of these compounds will be used provided as inputs to the human health risk assessment.

The following questions, raised as part of the Round 1 IRs, specifically asked about the selection of the air quality VCs used in the EIS:

- TMI_165-AE(1)-03: expected direction of ozone (O_3) formation;
- TMI_465-AC(1)-139: VOC and O_3 as indicators; and
- TMI_529-AC(1)-203: air quality as the VC, and O_3 as an indicator.

Table 6.1.3.5-1 summarizes the VCs, indicators and measures used for evaluating the potential effects of the Project on air quality, which considers the response to the Round 1 IR listed above.

Table 6.1.3.5-1: Air Quality VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Air Quality	Sulphur Dioxide (SO_2)	Concentrations (µg/m³)
	Nitrogen Dioxide (NO_2)	Concentrations (µg/m³)
	Carbon Monoxide (CO)	Concentrations (µg/m³)
	Total Suspended particulate (TSP)	Concentrations (µg/m³)
	Inhalable particulate (PM_{10})	Concentrations (µg/m³)
	Respirable particulate ($PM_{2.5}$)	Concentrations (µg/m³)
	Airborne metals	Concentrations (µg/m³)
	Particulate deposition (dustfall)	Deposition (g/m²/30 days)

6.1.3.6 Climate

Throughout the operating life of the Project, there will be equipment operating on the site that will be equipped with internal combustion engines, and will thus result in greenhouse gas (GHG) emissions. One aspect of the Project that will not materially contribute to the direct GHG emissions from the Project is the power supply. Treasury Metals intends on relying on the HydroOne 115 kV transmission line that runs through the Project, in the vicinity of the proposed plant site [Mit_047]. The Project GHG emissions are a potential concern as they could contribute to climate change. Additionally, both the federal and provincial governments have implemented initiatives to manage and mitigate the GHG emissions.

The following questions, raised as part of the Round 1 IRs, specifically asked about the selection of the climate VCs used in the EIS:

- TMI_263-EE(1)-06: climate projections for the region;
- TMI_439-AC(1)-114: consideration of changing climate;
- TMI_530-AC(1)-204: typo in VC section;
- TMI_586-AC(1)-260: consideration of changing climate; and
- TMI_738-PC(1)-71: GHG emissions comparison

In order to capture the potential effects of the Project on climate, the following to VCs will be used:

- Project GHG emissions, and
- Changes in climate due to the Project.

While these VC are slightly different from the single VC identified in the original EIS (i.e., GHG emission compliance with CEAA and MOECC climate change guidelines), it is felt they more fully describe the potential effects of the Project, and address issues raised in the Round 1 information requests. They are also consistent with the current federal guidance document (FPTCCCEA 2003) for addressing climate change considerations in environmental assessments. This guidance document talks about the need to address both the potential effects of the Project, as well as potential effects on the Project. Both of the VCs identified are used for assessing the effects of the Project on the environment related to climate.

Table 6.1.3.6-1 summarizes the VCs, indicators and measures used for evaluating the potential effects of the Project on climate.

Table 6.1.3.6-1: Climate VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Project GHG emissions	Annual equivalent carbon dioxide emissions (eCO_2)	Mt/year
Changes in climate due to the Project	Changes in annual temperature	°C
	Changes in annual precipitation	Percent change from current precipitation levels

The evaluation of the potential effects of the environment on the Project, specifically the effects of changing climate on the Project are set out in the federal guidance (FPTCCCEA 2003), as well as described in Section 7.1.3 of the EIS Guidelines. Since the operating life of the Project will be relatively short, lasting approximately 15 years from site preparation and construction phase through the active closure phase, climate conditions during the operating life of the Project were expected to be comparable to the current levels. Therefore, the effects of climate change on the Project are expected to be relatively minimal during the operating life.

Although climate change is not expected to have a noticeable effect on the Project over its operating life, longer-term conditions extending into post-closure are projected to be different from those experienced today. The implications of these changes to the Project were specifically addressed in Section 4.4.5, as well as the response to TMI_263-EE(1)-06.

6.1.3.7 Surface Water Quality

During the engagement process for the Project, regulators, Aboriginal peoples and stakeholders all stressed the importance of protecting surface water quality from potential adverse effects related to the Project. Activities during the various phases of the Project life are expected to result in releases to receiving waters that have the potential to affect surface water quality. These effects can be effectively evaluated using a single Valued Component (VC), namely surface water quality.

Based on the EIS and understanding of the Project design, the compounds likely to be released by the Project will be used as indicators. The following parameters were used as indicators for the surface water quality VC:

- Aluminum (Al);
- Antimony (Sb);
- Arsenic (As);
- Beryllium (Be);
- Boron (B);
- Cadmium (Cd);
- Chloride (Cl);
- Chromium (Cr);
- Cobalt (Co);
- Copper (Cu);
- Cyanide (CN);
- Iron (Fe);
- Lead (Pb);
- Mercury (Hg);
- Molybdenum (Mo);
- Nickel (Ni);
- Nitrate (NO_3);
- Phosphorus (P);
- Selenium (Se);
- Silver (Ag);
- Thallium (Tl);
- Uranium (U);
- Vanadium (V); and
- Zinc (Zn).

The above indicators are described using concentrations in units of milligrams per litre (mg/L), which will be used as the “measures” in the assessment.

Table 6.1.3.7-1 summarizes the VCs, indicators and measures used for evaluating the potential effects of the Project on surface water quality.

Table 6.1.3.7-1: Surface Water Quality VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Surface water quality	Aluminum (Al)	Concentrations (mg/L)
	Antimony (Sb)	Concentrations (mg/L)
	Arsenic (As)	Concentrations (mg/L)
	Beryllium (Be)	Concentrations (mg/L)
	Boron (B)	Concentrations (mg/L)
	Cadmium (Cd)	Concentrations (mg/L)
	Chloride (Cl)	Concentrations (mg/L)
	Chromium (Cr)	Concentrations (mg/L)
Surface water quality	Cobalt (Co)	Concentrations (mg/L)
	Copper (Cu)	Concentrations (mg/L)
	Cyanide (CN)	Concentrations (mg/L)
	Iron (Fe)	Concentrations (mg/L)
	Lead (Pb)	Concentrations (mg/L)
	Mercury (Hg)	Concentrations (mg/L)
	Molybdenum (Mo)	Concentrations (mg/L)
	Nickel (Ni)	Concentrations (mg/L)
	Nitrate (NO_3)	Concentrations (mg/L)
	Phosphorus (P)	Concentrations (mg/L)
	Selenium (Se)	Concentrations (mg/L)
	Silver (Ag)	Concentrations (mg/L)
	Thallium (Tl)	Concentrations (mg/L)
	Uranium (U)	Concentrations (mg/L)
	Vanadium (V)	Concentrations (mg/L)
	Zinc (Zn)	Concentrations (mg/L)

The following question, raised as part of the Round 1 information requests, specifically asked about the selection of the water quality VC used in the EIS. The response to this question was considered in identifying the VCs, indicators and measures presented in the table above.

- TMI_531-AC(1)-205: water quality as the VC;

6.1.3.8 Surface Water Quantity

During the engagement process for the Project, regulators, members of Indigenous communities and stakeholders stressed the importance of protecting surface water from potential adverse effects related to the Project. Activities during the various phases of the Project life will have the potential to affect the quantity of water in the receiving environment. To address these effects, a single Valued Component (VC), surface water quantity has been selected. This single VC is considered to be more inclusive than the pair of VCs identified in the original EIS (i.e., alteration of flow rates in Blackwater Creek throughout Project operations and closure; and, alteration of flow rates in the Hoffstrom's Bay Tributary during operations) as it does not limit the assessment to a specific watercourse, or a specific period during the Project life. The watercourses and waterbodies evaluated in the assessments are described in Section 6.3.9.

Table 6.1.3.8-1 summarizes the VCs, indicators and measures used for evaluating the potential effects of the Project on surface water quantity.

Table 6.1.3.8-1: Surface Water Quantity VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Surface water quantity	Increase in surface water flows	Change in annual flow (%)
	Decrease in surface water flows	Change in monthly flow (%)
	Change in lake levels	Change in annual inflow (%)

Although there were no specific questions raised as part of the Round 1 information requests regarding the VC used in the EIS for evaluating surface water quantities, the following questions support the decision to select more inclusive VCs that consider potential effects beyond just Blackwater Creek and Hoffstrom's Bay Tributary:

- TMI_700-PC(1)-15: water levels of Thunder Lake and Wabigoon Lake; and
- TMI_719-PC(1)-34: water quality and water quantity in Thunder Lake.

6.1.3.9 Groundwater Quality

There are records for about 140 private water wells in the general area, mostly to the south and west, the majority of which are assumed to be providing private sources of drinking water for residents. Existing water quality in those areas is also expected to be generally compliant with Ontario Drinking Water Quality Standards, although some private in home water treatment equipment (e.g., filters, softeners, chlorinators) may be necessary (and may currently be in use), based on the assumption that the closest wells in the area, which are located to the south and west of the Project, access the groundwater from both the overburden and bedrock aquifers for domestic use. This is supported by measurements of existing groundwater quality information that shows that groundwater in the basal sand and silt water bearing units are generally in compliance with the Provincial Water Quality Objectives (PWQO), which are more stringent than drinking water criteria and are established to protect sensitive aquatic receptors. Some compounds, however, have naturally occurring elevated metals (i.e., aluminum, arsenic, chromium, cobalt, copper, iron, tungsten, vanadium and zinc).

A single Valued Component (VC), groundwater quality was identified in the EIS for evaluating the effects of the Project. There were no specific questions related to the choice of this VC in the Round 1 information requests, therefore, this VC has been retained for evaluating the effects of the Project on groundwater quality. Table 6.1.3.9-1 summarizes the VC, indicators and measures used for evaluating the potential effects of the Project on groundwater quality. The indicators and measures are consistent with those defined for geology and geochemistry (Section 6.1.3.2).

Table 6.1.3.9-1: Groundwater Quality VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Groundwater Quality	Aluminum (Al)	Concentrations (mg/L)
	Antimony (Sb)	Concentrations (mg/L)
Groundwater Quality	Arsenic (As)	Concentrations (mg/L)
	Beryllium (Be)	Concentrations (mg/L)
	Boron (B)	Concentrations (mg/L)
	Cadmium (Cd)	Concentrations (mg/L)
	Chromium (Cr)	Concentrations (mg/L)
	Cobalt (Co)	Concentrations (mg/L)
	Copper (Cu)	Concentrations (mg/L)
	Cyanide (CN)	Concentrations (mg/L)
	Iron (Fe)	Concentrations (mg/L)
	Lead (Pb)	Concentrations (mg/L)
	Mercury (Hg)	Concentrations (mg/L)
	Molybdenum (Mo)	Concentrations (mg/L)
	Nickel (Ni)	Concentrations (mg/L)
	Selenium (Se)	Concentrations (mg/L)
	Silver (Ag)	Concentrations (mg/L)
	Thallium (Tl)	Concentrations (mg/L)
	Uranium (U)	Concentrations (mg/L)
	Vanadium (V)	Concentrations (mg/L)
	Zinc (Zn)	Concentrations (mg/L)

6.1.3.10 Groundwater Quantity

There are records for about 140 private water wells in the general area of the Project, mostly to the south and west, the majority of which are assumed to be providing private sources of drinking water for residents. Stakeholders and residents living in the vicinity of the Project have identified concerns related to the effects of the dewatering associated with the Project will have on the availability of water from existing water wells. Additionally, regulators, members of Indigenous communities and stakeholders have identified potential concerns that the dewatering of the open pit and underground mine could also have an effect on the water in nearby watercourses and waterbodies. To evaluate the effects of the Project on groundwater quantities, the single VC of groundwater quantity will be used.

Understanding changes in groundwater quantities is important as it could have an effect on the viability and use of domestic water wells in the area, which is why "decreasing groundwater elevations in private wells" has been identified as an indicator, as shown in Table 6.1.3.10-1.

Table 6.1.3.10-1: Groundwater Quantity VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Groundwater quantity	Decrease groundwater elevations in private wells	Decrease in groundwater elevations at private water wells (m)

Changes in groundwater quantity could have an effect on surrounding waterbodies, although the existing groundwater conditions described in Section 5.6.2.3 suggest that the majority of the watercourse in the area are runoff dominated, and underlain with a combination of silts and clays making them less susceptible to changes in groundwater levels. For this reason, the effects of the Project on the amount of groundwater discharge to surface watercourses near the Project has been predicted as part of the description of the effects of the Project on surface water quantities. However, “decreasing contribution to surface flow patterns” is not identified as an indicator for groundwater quantity. Instead, the predicted changes in groundwater discharge are used as inputs when describing the effects of the Project on surface water quantities (Section 6.9).

The same models used for describing changes in groundwater quantities have also been used for describing the groundwater discharge to the open pit and the quantity and fate of seepage from the onsite facilities (i.e., waste rock storage area [WRSA] and the tailings storage facility [TSF]). The predicted “groundwater discharge to open pit and seepage” is not identified as indicators for groundwater quantity. The predicted values are presented as part of describing the effects of the Project on groundwater quantities, and the results incorporated into the description of effects to geochemistry and surface water quality presented in Section 6.3 and 6.8, respectively. The predicted discharge to the open pit are also incorporated in the Project water balance described in Section 3.8.6, and Appendix F.

Although there were no specific questions in the Round 1 information requests regarding groundwater quantity VC, the following IRs were identified as supporting both of the indicators selected for the groundwater quantity VC:

- TMI_126-FH(1)-05: groundwater drawdown effects on surface water;
- TMI_341-AC(1)-15: water levels in local wells;
- TMI_632.3-AC(1)-305: contribution of groundwater to surface water flows;
- TMI_634-AC(1)-307: contribution of groundwater to surface water flows; and
- TMI_767-PC(1)-82: effects on water wells.

6.1.3.11 Wildlife and Wildlife Habitat

The importance of wildlife to Aboriginal peoples and other stakeholders was highlighted through the engagement process undertaken by Treasury Metals in support of the Project. To address these concerns, the following VCs have been used for assessment of the effects of the Project on wildlife and wildlife habitat:

- Wildlife Species at Risk;
- Ungulates;
- Furbearers;
- Upland birds;

- Wetland birds;
- Small mammals;
- Reptiles and amphibians; and
- Invertebrates.

As part of the Round 1 information request process, there were a number of questions asking for clarification or justification for the VCs selected or discarded with respect to wildlife. In response to this feedback, the list of VCs, indicators and measures used for assessing the effects on wildlife and wildlife habitat has been modified. Table 6.1.3.11-1 lists the indicators and measures that have been used for assessing the effects of the Project on wildlife and wildlife habitat in this report.

Table 6.1.3.11-1: Wildlife and Wildlife Habitat VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Wildlife Species at Risk	Common Nighthawk	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
	Northern Myotis/Little Brown Myotis	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
	Barn Swallow	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Ungulates	Moose	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Furbearers	American Marten	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
	American Beaver	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Upland birds	Upland birds	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Wetland birds	Marsh birds	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Small mammals	Small mammals	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Reptiles and amphibians	Reptiles and amphibians	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Invertebrates	Terrestrial invertebrates	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality

In choosing the VCs, indicators and measures to be used for evaluating the potential effects of the Project on wildlife and wildlife health, consideration was given to the purpose, concept and intent of VCs, described in Section 6.3.1. From an ecological perspective, VCs can be a range of species that serve as a surrogate for individual species that interact similarly with the environment (e.g., upland birds). It is not necessary to assess every individual species within the group when the effects are can be described effectively for a surrogate. Table 6.1.3.11-2 provides the justification for the VCs used in the Revised EIS for evaluating the effects of the Project on wildlife and wildlife habitat. A decision was made by Treasury Metals to select VCs from a holistic perspective of assessing some broad ecosystem components and species groups rather than focusing on more specific ecosystem components and species (with the exception of SAR and economically and culturally important species – where individual species were assessed).

Table 6.1.3.11-2: Justification for the Selection of Wildlife and Wildlife Habitat VCs, Indicators and Measures

Valued Components (VCs)	Justification
Wildlife Species at Risk	• Species at risk must be afforded special consideration given their status and vulnerability • Important component to the function of the ecosystem • Educational, scientific, or aesthetic interest • Provincial, national or international significance.
Ungulates	• Significant habitat for locally important species • Component is of economic or cultural significance
Furbearers	• Significant habitat for locally important species • Component is of economic or cultural significance • Input from members of Indigenous communities
Upland birds	• Significant habitat for locally important species • Significant habitat for uncommon, rare or unusual species • Notable species or species groups • Component is of provincial, national or international significance
Wetland birds	• Significant habitat for locally important species • Significant habitat for uncommon, rare or unusual species • Notable species or species groups • Indicator of environmental health • Component is of economic or cultural significance • Component is of provincial, national or international significance
Small mammals	• Significant habitat for locally important species • Indicators of general ecosystem biodiversity and health • Important component of food webs for higher level predators
Reptiles and amphibians	• Indicators of general ecosystem biodiversity and health (particularly wetlands and aquatic habitats) • Important component of food webs
Invertebrates	• Important components of food webs • Important component to the function of healthy ecosystems

For the wildlife species at risk VCs, the following indicators have been selected:

- Common Nighthawk;
- Northern Myotis and Little Brown Myotis (considered collectively); and
- Barn Swallow.

These have been selected due to their occurrence with in the LSA and as a result of the legislative requirements surrounding any potential effects to the species or their habitats.

Furbearers, such as American Martin and American Beaver, are not only important for their relevance to ecosystem biodiversity, but also because of their economic and cultural significance.

Ungulates present in the LSA and the RSA include White-tailed deer and Moose. Both are relatively common throughout the LSA, however, Moose were chosen as a VC based on the fact that the Project lies within MNRFs Cervid Ecological Zone C1, which emphasis management for higher moose populations and lower White-tailed deer populations.

The remaining VCs (upland birds, wetland birds, small mammals, reptiles and amphibians and invertebrates) were chosen based on the fact that each group of species has individual members with a variety of disturbance tolerances and habitat requirements. As such, an effects assessment on these groups will provide insights into the effects of the ecosystem as a whole as opposed to the effects on a single species.

The importance of wildlife and wildlife habitat in the region was reflected in the number of Round 1 information requests from regulators, Aboriginal peoples and stakeholders on the subject. The following information requests relate specifically to the selection of valued components, indicators and measures for wildlife and wildlife habitat:

- TMI_153-WL(1)-10: include VCs for reptiles and amphibians, terrestrial invertebrates, and small mammals;
- TMI_153-WL(1)-10 (revised): additional SAR species;
- TMI_156-WL(1)-13: bird SAR as a separate VC;
- TMI_336-AC(1)-10: presence of owls, wild turkeys and robins near Project site;
- TMI_358-AC(1)-32: presence of fox and bear near Project site;
- TMI_359-AC(1)-33: potential effects on moose, furbearers (e.g., beaver and muskrat), aquatic animals and small terrestrial mammals ;
- TMI_532-AC(1)-206: need to provide indicators and measures;
- TMI_542-AC(1)-216: need to identify specific SAR for assessment of effects; and
- TMI_748-PC(1)-63: presence of wolves near the Project site.

In the Round 1 information requests, specifically TMI_153-WL(1)-10 (revised), the Agency asked for specific justification for not explicitly evaluating the potential effects of the Project on the following VCs, which were discussed in Appendix G to the original EIS:

- Mammals: American Badger (Taxidea taxus), Grey Fox (Urocyon cinereoargenteus), Eastern Timber Wolf (Canis lupus lycaon);
- Reptiles: Snapping Turtle (Chelydra serpentina); and
- Arthropods: Monarch (Danaus plexippus).

While these species were discussed original EIS baseline work, and were included in the baseline surveys, the results of the baseline work confirmed that they were not present in the areas likely to be affected by the Project and thus would not be suitable for identification as VCs for evaluating the effects of the Project on the environment. Each of these species is discussed more fully below.

Gray Fox

Gray Fox distribution is closely associated with the presence of deciduous forest, with denning usually occurring in shrublands close to water. Recent (i.e., within the last 20 years) observations in the Wabigoon Ecoregion were located near the US and Manitoba borders, roughly 150 to 170 km from Dryden. This represents the northern extent of this species' global range. The primary threats to Gray Fox in northern Ontario are trapping and road mortality. Although this species was captured in the RSA and habitat capable of supporting Gray Foxes exists within the LSA, the Project footprint does not include sufficient shrubland to support a denning family unit. The Project effects will not impact existing populations. Therefore there would be no potential effects on this species and the exclusion from the list of VCs and associated indicators is justified.

Eastern Wolf

The Eastern Wolf (Canis lycaon; listed as Threatened federally)—formerly assessed as Eastern Timber Wolf (C. lupus lycaon), recently listed as provincially Threatened by COSSARO under Algonquin Wolf (Canis sp.).

Eastern wolves exploit a relatively narrow ecological niche, inhabiting mixedwood forests with low levels of human disturbance, and requiring larger prey (e.g., White-tailed Deer [Odocoileus virginianus] and American Beaver [Castor canadensis]) to meet their energy requirements. Eastern Wolf distribution is limited to southeastern Ontario, the nearest record occurring in Killarney Provincial Park, over 900 km from Dryden. Although Eastern Wolf-Grey Wolf hybrids - the Great Lakes-Boreal Wolf (C. lupus x C. sp. cf. lycaon) - may extend further into central and northern Ontario, the hybrids are ecological analogues of Grey Wolves (Canis Lupus). Although the Great Lakes-Boreal Wolf range extends over the Project area, they are not afforded the same protection as the Eastern Wolf proper.

Eastern Wolves do not occur within the local or regional study areas. Therefore, there would be no potential effects on this species and the exclusion from the list of VCs and associated indicators is justified.

American Badger

There has only been one documented American Badger sighting in the Kenora and Dryden areas since 1979, roughly 40 km west of Dryden. The estimated mature population in northwestern Ontario may be as few as 5 individuals. Though they are not expected to occur within the Project area, American Badgers are considered below because of the scarcity of the species in northern Ontario and the relative proximity of the Project to a reported sighting.

The northwestern population of American Badger is small but supported by consistent sightings in the province, primarily in a 3000 km2 area of agricultural land between Rainy River and Fort Francis. Further north in Kenora/Dryden areas, they are seldom observed, with only one record since 1979. These observations represent the northern extent of this species' global range.

Primary American Badger habitat consists of grasslands, open forest, hedgerows and agricultural field edges, but recent work suggests they may also use areas within forested environments opened by disturbance (e.g., road right-of-way). Their primary habitat requirements appear to be soil conditions suitable for digging and the availability of prey. This species does not appear to use defined movement corridors and does not exhibit seasonal migrations. The major threats to American Badger are habitat loss and road mortality, although they are also susceptible to hunting pressure, disease, loss of prey and secondary poisoning.

Mammal encounter surveys were conducted in 2011. Transects were established in habitats specifically targeting American Badgers (i.e., grasslands and open areas) throughout the LSA. There were no sightings or signs of American Badger activity from these surveys.

Project activities that compact soil (e.g., drilling) may disturb suitable American Badger habitat, but other activities like line clearing or road construction in forested areas may open new habitat as a secondary effect. The operations area of the Project covers roughly 310 ha characterized by a mixture of coniferous, deciduous and successional forests, wetlands, and developed area. Although there are undoubtedly some open areas, the Project area does not constitute high quality American Badger habitat. Combined with the historical records in northwestern Ontario, Project activity is unlikely to impact American Badgers. As a result, it was concluded that the exclusion from the list of VCs and associated indicators is justified.

It should be noted that the Wildlife Management Plan (section 12.9 of the revised EIS) will incorporate procedures to be followed, including the implementation of mitigation measures, in the event American Badger are identified in the Project area.

Snapping Turtle

Extensive aquatic, wetland and terrestrial surveys were conducted in the LSA, all of which failed to detect Snapping Turtles (Chelydra serpentine; listed as Special Concern in Ontario). The nearest reported occurrences roughly 40 km west of Dryden, representing the northern-most extent of this species' global range. As a result it was concluded that the exclusion from the list of VCs and associated indicators is justified.

Although Snapping Turtles are not expected to occur in the Project area and species of "Special Concern" are not afforded additional protection in Ontario, Snapping Turtles have been identified in the Wildlife Management Plan (Section 12.9 of the revised EIS) because of the presence of potential nesting habitat and the relative proximity of historical sightings.

Monarch

The range of Monarch butterflies (Danaus plexippus; listed as Special Concern in Ontario) extends across the Project area. Monarchs require four distinct habitats for different parts of their life history, including overwintering, breeding, staging and nectar (feeding) habitats. Monarchs overwinter in Mexico, and the Project area does not appear to be an important migratory staging area or exist within a high volume migratory corridor. The Project area could potentially be used for breeding and nectar habitats.

Breeding habitat is confined to where milkweed (Asclepias sp.) grows, since this serves as the sole food for their caterpillars. Although Swamp Milkweed (Asclepias incarnata) was identified in the LSA, it was not abundant enough to provide high quality Monarch breeding habitat. Monarchs breeding activity within the Project area is expected to be negligible.

Several flowering plants occur within the LSA, so adults may feed throughout Project area. However, adult Monarch abundance is considered very low because there were no observations during three years of fieldwork and the lack of abundant breeding habitat.

Generally, species listed as "Special Concern" in Ontario are not afforded any additional protection. Nevertheless, Project effects are not expected to impact Monarchs. As a result it was concluded that the exclusion from the list of VCs and associated indicators is justified.

6.1.3.12 Migratory Birds

Migratory birds were not identified as a separate discipline in the original EIS, but have been added in the revised EIS at the request of the Agency to facilitate their review process. The information regarding the on migratory birds uses the following VCs:

- Upland birds; and
- Wetland birds.

Table 6.1.3.12-1 lists the valued components, indicators and measures used for describing the effects of the Project on migratory wildlife and wildlife habitat in this report.

Table 6.1.3.12-1: Migratory Birds VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Upland birds	Upland birds	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality
Wetland birds	Marsh birds	Habitat loss (ha)
		Habitat alteration or displacement (ha)
		Potential for mortality

6.1.3.13 Fish and Fish Habitat

Project activities during the site preparation and construction phase, operations phase, closure phase and post-closure phase will all have the potential to effect fish and fish habitat. The importance of these potential effects to Aboriginal peoples and other stakeholders was highlighted through the engagement process undertaken by Treasury Metals in support of the Project. The following VCs have been used for describing the effects of the Project on fish and fish habitat:

- Stream-resident fish population;
- Migratory fish populations;
- Lake-resident fish populations; and
- Fish species-at-risk.

Based on a review of the questions raised as part of the Round 1 information request, the list of valued components has been changed to include stream-resident fish populations, migratory fish populations, lake-resident fish populations, and fish species at risk. Stream-resident fish populations are species that complete their entire life cycle (spawning, nursery, foraging, overwintering) in the habitats that are present within the local watercourses. In streams such as those affected by the project these are typically small-bodied fishes. Migratory fish populations are populations that migrate into streams to complete a portion of their life cycle, usually spawning. In some cases the streams also provide nursery habitat. Lake-resident populations are populations that complete their entire life cycle in lakes. Fish species-at-risk are species that have status under the federal *Species at Risk Act* or the *Ontario Endangered Species Act*.

The indicators selected to help describe the effects for each of the VCs, include the following:

- Direct loss or alteration of habitat;
- Changes to flows or water levels;

- Changes to water quality; and
- Blasting.

The direct loss or alteration of habitat occurs when watercourses or waterbodies are overprinted by the construction of Project elements (e.g., the tailings storage facility, or TSF, will overprint portions of Blackwater Creek Tributary 2), or Project components are constructed within waterbodies (e.g., construction of the discharge structure in Blackwater Creek). Changes in flows, either lower or higher, can alter the suitability of a waterbody for use by fish. In the case of increases in flows, these could make it more difficult for migratory fish to access spawning areas. Changes in surface water quality could diminish the suitability of a waterbody to support fish species, and could result in fish mortality if quality is degraded to a point where fish can no longer survive. Finally, the Project will employ blasting as part of the mining process that could result in fish mortality if fish are subjected to lethal pressure changes. Table 6.1.3.13-1 lists the VCs, indicators and measures to be used in evaluating the effects of the Project on fish and fish habitat.

Table 6.1.3.13-1: Fish and Fish Habitat VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)
		Pond area (ha)
		Fish mortality proportion (%)
	Changes in flows or water levels	Stream length (km)
		Pond area (ha)
	Changes in water quality	Stream length (km)
		Pond area (ha)
		Fish mortality proportion (%)
	Blasting	Fish mortality proportion (%)
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)
		Pond area (ha)
		Fish mortality proportion (%)
	Changes in flows or water levels	Stream length (km)
		Pond area (ha)
	Changes in water quality	Stream length (km)
		Pond area (ha)
		Fish mortality proportion (%)
	Blasting	Fish mortality proportion (%)
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)
		Fish mortality proportion (%)
	Changes water levels	Lake area (ha)
	Changes in water quality	Lake area (ha)
		Fish mortality proportion (%)
	Blasting	Fish mortality proportion (%)

Table 6.1.3.13-1: Fish and Fish Habitat VCs, Indicators and Measures (continued)

Valued Components (VCs)	Indicators	Measures
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)
		Pond or lake area (ha)
		Fish mortality proportion (%)
	Changes in flows or water levels	Stream length (km)
		Pond or lake area (ha)
	Changes in water quality	Stream length (km)
		Pond or lake area (ha)
		Fish mortality proportion (%)
	Blasting	Fish mortality proportion (%)

The following Round 1 information requests commented on the VCs for fish and fish habitat, specifically the selection of Fish Species of Management Concern:

- TMI_142-FH(1)-21: selection of valued components, indicators and measures;
- TMI_143-FH(1)-22: identification of Fish Species of Management Concern; and
- TMI_475-AC(1)-149: identification of Fish Species of Management Concern.

6.1.3.14 Wetlands and Vegetation

Wetlands are important habitat for many wildlife species including moose, birds, amphibians, and fish. They may also provide key hydrological functions such as groundwater recharge and water quality improvement. Wetlands may also serve a cultural and social function—for example, as sites where wild rice may grow, or where recreational fisheries may occur. The following VCs are used for describing the effects of the Project on wetlands and vegetation:

- Wetlands; and
- Vegetation communities.

Although additional VCs that may be associated with wetlands were identified, they were more directly related to other resource topics such as water quality, fish and fish habitat, and wildlife and wildlife habitat, and are discussed in those sections. Based on a review of the questions raised as part of the Round 1 information request, the list of valued components for wetlands and vegetation has been retained for consideration (Table 6.1.3.14-1)

Table 6.1.3.14-1: Wetlands and Vegetation VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Wetlands	Wetland extent	Change in area (ha)
	Wild rice	Loss of identified habitat (ha)
		Changes in water level (m)
		Changes in water quality
	Floating Marsh Marigold (*Caltha natans*)	Change in potential habitat (ha)
Vegetation communities	Predominantly coniferous forest	Change in area (ha)
	Predominantly deciduous forest	Change in area (ha)
	Successional areas	Change in area (ha)
	Potential berry harvesting areas	Change in area (ha)

Wetland extent was chosen as an indicator for wetlands to capture the importance of wetlands as integral components of the watersheds. Wetland functions including water storage and delay, contribute to year-round flows of streams that are connected by surface or sub-surface flow. These flows in turn support year-round habitat for aquatic species. Intact, functional wetlands help to ensure that downstream flow rates are moderated.

Northwestern Ontario is one of the highest concentrations of naturally remaining wild rice (manomin) growing areas, and several locations of wild rice are documented in the region. Wild rice reseeds itself naturally in areas of circulating mineral-rich water, in depths from one to twelve feet. However, wild rice is known to be sensitive to changes in water level or water quality during its growth cycle between germination in mid-April and its full ripe stage in late August or early September. As identified during the engagement process, wild rice represents an important resource to Indigenous communities. Of particular note is a wild rice harvesting and processing business known as Kawiosa Manomin that was established by Wabigoon Lake Ojibway Nation in 1987. This processing plant ships product to markets world-wide.

The only provincially listed plant species detected within the LSA is the floating marsh marigold (provincially rare). This species is considered an indicator for wetlands as it is found only in wetlands, and its presence serves as an indicator of wetland health. Also, it is considered a rare species, both regionally and in the ecosystem type in which it is found.

Wetlands are abundant in the region. Baseline studies found swamps dominated by tall shrubs, to be the most dominant type of wetland in the LSA. Small areas of fens and marshes dominated by emergent vegetation and shrubs are also common. The Lola Lake wetland is a very large (1,487 ha) wetland complex adjacent to the LSA. It is within a provincial nature reserve designed to protect the unique geology of the area. Baseline studies did not identify any other wetland within the LSA as being provincially significant according to the Ontario Wetland Evaluation System (OWES). The Lola Lake wetland has not been evaluated.

In addition to potential effects on wetlands, the Project will result of the potential loss of vegetation communities, primarily due to the land clearing required in order to construct the Project elements necessary for operations. Vegetation communities are important in their own right, but are also important for the role they play in providing wildlife habitat, habitat for migratory birds, and a location for the gathering of plant materials for consumption, medicinal or spiritual use by members of Indigenous communities.

The following information requests relate specifically to the selection of valued components, indicators and measures for wetlands and vegetation:

- TMI_153-WL(1)-10 (revised): additional SAR species;
- TMI_282-RG(1)-17: hydrology of Lola Lake;
- TMI_283-RG(1)-18: fen inventories, vegetation, and SAR surveys;
- TMI_333-AC(1)-07: water quality impacts to Lola Lake;
- TMI_478-AC(1)-152: define spatial boundary for wetlands; and
- TMI_534-AC(1)-208: better identification of wetland and vegetation VCs.

The following Round 1 information requests specifically mention wild rice, its importance and the requirement for it to be evaluated as part of the EIS:

- TMI_228-HE(1)-35
- TMI_231-HE(1)-38
- TMI_238-HE(1)-45
- TMI_238-HE(1)-45
- TMI_240-HE(1)-47
- TMI_240-HE(1)-47
- TMI_307-SD(1)-02
- TMI_307-SD(1)-02
- TMI_347-AC(1)-21
- TMI_348-AC(1)-22
- TMI_354-AC(1)-28
- TMI_361-AC(1)-35
- TMI_362-AC(1)-36
- TMI_485-AC(1)-159
- TMI_500-AC(1)-174
- TMI_618-AC(1)-291
- TMI_619-AC(1)-292
- TMI_651-AC(1)-324
- TMI_654-AC(1)-327
- TMI_664-AC(1)-337
- TMI_732-PC(1)-47
- TMI_733-PC(1)-48
- TMI_742-PC(1)-57
- TMI_747-PC(1)-62
- TMI_787-AC(1)-368
- TMI_797-AC(1)-378
- TMI_822-AC(1)-403
- TMI_850-AC(1)-431
- TMI_851-AC(1)-432

In the Round 1 information requests, specifically TMI_153-WL(1)-10 (revised), the Agency asked for specific justification for not explicitely evaluating the potential effects of the Project on Western Silvery Aster (Symphyotrichum sericeum), which were discussed in Appendix G to the original EIS. Western Silvery Aster (Symphyotrichum sericeum; listed as Endangered in Ontario) occurs in only two areas in Ontario, roughly 130–150 km from Dryden. In the northern Ontario portion of its range, this species is only found in Bur Oak (Quercus macrocarpa) savannah on shallow soil over mafic (i.e., basic) bedrock. This habitat is very uncommon, with most bedrock across the Boreal Shield composed of acidic (usually granite) rock. These observations represent the north-eastern extent of the species' global range. Although Western Silvery Aster was identified within the RSA, suitable habitat does not occur within the LSA. Project effects will not impact the existing populations. Therefore there would be no potential effects on this species and the exclusion from the list of VCs and associated indicators is justified.

6.1.3.15 Land and Resource Use

The evaluation of Project effects on land and resource use has been expanded as part of the revised EIS to consider the resource uses. Considering the review of the existing information related to land and resource use, review of the Round 1 information requests, and knowledge of similar land and resource assessments, the following VCs were identified for use in evaluating the effects of the Project on land use, including resource use:

- Land Use Planning and Policies;
- Aggregate Operations;
- Forestry;
- Mineral Exploration;
- Fishing - Recreational and Commercial;
- Hunting;
- Trapping;
- Cottagers and Outfitters; and
- Other Recreational Uses.

Following a review of the Round 1 information requests, the transportation VC used in the original EIS has been incorporated as part of a new social VC entitled Transportation and Traffic, as described in Section 6.1.3.16.

The land and resource use VCs, indicators and measures are listed in Table 6.1.3.15-1.

Table 6.1.3.15-1: Land and Resource Use VCs, Indicators, and Measures

Valued Components (VCs)	Indicators	Measures
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	• Conflict with policies
	Overlap with protected areas.	• Overlap of Project with protected areas
Aggregate Operations	Change in access to aggregate resources.	• Change in access
	Change in demand of aggregate resources extraction.	• Change in aggregate demand
Forestry	Change in access to forestry resources for management.	• Change in access
	Loss of forestry resources.	• Forest areas cleared
Mineral Exploration	Change in access to mineral claims for exploration and production.	• Change in access
Fishing - Recreational and Commercial	Change in access to fisheries resources, affecting the ability to fish.	• Change in access
	Change in the abundance of fisheries resources, affecting the ability to fish.	• Change in fish habitat • Changes in fish populations
	Change in contaminant levels in fish, affecting the suitability for harvesting.	• Change in fish consumption restrictions
	Diminished experience of being on the land and conducting fishing activities.	• Changes in noise • Changes in light trespass • Changes in air quality (dust) • Changes in viewscapes
Hunting	Change in access to wildlife resources, affecting the ability to hunt.	• Change in access
	Change in abundance of wildlife resources, affecting the ability to hunt.	• Change in available wildlife habitat • Change in wildlife populations
	Diminished experience of being on the land and conducting hunting activities.	• Changes in noise • Changes in light trespass • Changes in air quality (dust) • Changes in viewscapes
Trapping	Change in access to wildlife resources, affecting the ability to trap.	• Change in access
	Change in abundance of wildlife resources, affecting the ability to trap.	• Change in available wildlife habitat • Change in wildlife populations
	Diminished experience of being on the land and conducting trapping activities.	• Changes in noise • Changes in light trespass • Changes in air quality (dust) • Changes in viewscapes
Cottagers and Outfitters	Diminished experience of being on the land.	• Change in traffic volumes • Changes in noise and vibration • Changes in light trespass • Changes in air quality (dust) • Changes in viewscapes

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Components (VCs)	Indicators	Measures
	Change in access to cottage and/or outfitter areas.	• Change in access
	Changes in clientele for outfitters with lodges located near the Project.	• Change in clientele
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes (e.g., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).	• Change in access
	Change in access for residents and visitors to public lands to pick berries and/or mushrooms and/or other vegetation for consumptive purposes.	• Change in access
	Change in abundance of berries and/or mushrooms and/or other vegetation used for consumptive purposes.	• Change in the abundance of berries, mushrooms and other vegetation used for consumptive purposes
	Diminished experience of being on the land.	• Change in traffic volumes • Changes in noise and vibration • Changes in light trespass • Changes in air quality (dust) • Changes in viewscapes

The rationale for selection of land and resource use valued components is presented in Table 6.1.3.15-2.

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
Land use planning and policies	**NA**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** • Project could overlap with conservation areas where the Project conflicts with the use of the land. **Aboriginal:**	• This VC is recommended due to the potential Project effects associated with Ontario's Living Legacy Land Use Strategy (1999), Dryden District Land Use Guidelines (1983) and potential policies from the local services board (designated place – Wabigoon). • The Project may overlap with planning or policies that have not been detailed in the EIS. Potential effects on land use plans and policies may include overlapping of land use policy area where the use would not be allowed and creating land use conflicts. • The Project site footprint overlaps the Crown Land Use area G2531, Dryden,

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		• Project could overlap land use planning and policies where the Project conflicts with the intended use of the land or associated policies. **Other Stakeholder:** • Project could overlap land use planning and policies where the Project conflicts with the intended use of the land or associated policies.	Vermilion Bay and Area, General Use Area by less than 1% (414.25 ha). The Project is consistent with the intent of this land use policy area. • The LSA overlaps portions of P2552, Aaron Provincial Park and P2591, Lola Lake Provincial Park by 29.5% (34.48 ha) and 27.4% (1,682.96 ha), respectively. • Project may conflict with Dryden District Land Use Guidelines (1983) or if the local services board has guidelines or policies with which the Project may conflict.
Aggregate operations	**NA**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** • Not applicable **Aboriginal:** NA **Other Stakeholder:** • The Project may overlap and/or change access to existing aggregate operations. The Project may increase the demand on aggregate resources in the LSA.	• This VC is recommended due to the potential Project effects on aggregates that may include the overlapping aggregate areas; the long-term removal of aggregate (at the Project site footprint); and changes to access at the Project site. The Project may also increase the demand for aggregates in LSA. • There are three aggregate operations in close proximity to the LSA but not within it. There are two active and one MTO aggregate pit within the LSA. The two aggregate pits are located on Maggrah and Johnsons roads south of Anderson Road. The MTO pit is located on the north side of Anderson Road, east of Johnsons Road. • There is the potential for increased demand of aggregate resources during to the construction of the Project, which are generally addressed in the socio-economic component.
Forestry	**NA**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:** NA **Other Stakeholder:**	• This VC is recommended due to the potential Project effects on forestry that may include the overlapping, and therefore, loss of Forest Management Units (FMUs) area; the long-term removal of forest resources (at the Project site footprint); and changes to access at the Project site. • The Project Site Footprint overlaps FMU 535, Dryden Forest by less than 1% (415.34 ha). The LSA overlaps FMU 535, Dryden Forest and FMU 130,

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		• The Project may overlap and/or change access to FMUs.	Wabigoon Forest by 1.23% (3,832.51 ha) and less than 1% (1,171.01 ha), respectively. • Treasury Metals may be required to obtain a forestry license from the MNRF to clear forest resources for Project construction, the applicable Sustainable Forest License Holder will be given first right of refusal to harvest.
Mineral exploration	**1.2.3 Land Ownership**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:** NA **Other Stakeholder:** • Project could overlap and/or change access to land that is associated with ownership and/or mineral claims to parties other than Treasury. Project could overlap or change access to Crown land.	• This VC is recommended due to the potential Project effects that may either create improved access to mineral claims through the development of new access roads or limit access by removing previously used access roads.
Fishing - recreational and commercial	**5.11.5.3 Fishing** **6.2.1.12 Fish and Fish Habitat** **6.4.1.12 Fish and Fish Habitat** **Appendix EE: Country Foods Assessment**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific**: NA **Aboriginal**: • Potential Project effects on fishing include loss of recreational or commercial fishing areas, changes to access to these areas, and changes to abundance and distribution of fish. **Other Stakeholder**: • Potential Project effects on fishing include loss of	• This VC is recommended due to the potential Project effects on Fisheries Management Zones (FMZs), bait harvest areas or other important management areas from the Project that may include the loss of bait harvest areas, commercial fishing areas, or recreational fishing areas; changes to access to fishing areas; and changes to the abundance and distribution of fish that could affect fishing success rates, and therefore, any commercial fishing income (such as for bait fish harvesters) due to changes in biophysical or anthropogenic conditions. • The EIS identifies fish and fish habitat effects from the Project, including alteration of existing watercourses that will result in the loss of 6 ha of fish habitat. Potential impacts to fish also include direct mortality due to physical

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		recreational or commercial fishing areas, changes to access to these areas, and changes to abundance and distribution of fish.	disturbances and/or release of a deleterious substance. • The Project overlaps FMZ 5 by less than 1% (415.34 ha) and bait harvest areas DR0031 by 1.66% (415.34 ha). The LSA overlaps these areas and bait harvest area DR0030. • From Crown Use designations (Ontario's Living Legacy Land Use Strategy (1999)): Thunder Lake is a designated the lake for natural trout management. See Inland Ontario Lakes Designated for Lake Trout Management (2015). • There is a designated provincial fish sanctuary at the mouth of Nugget Creek at Wabigoon Lake. • Commercial fishing licences are held for Thunder and Wabigoon lakes.
Hunting	**5.11.5.2 Hunting and Trapping** **6.2.1.11; 6.4.1.11 Wildlife and Wildlife Habitat** **Appendix EE: Country Foods Assessment**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:** • Potential Project effects on hunting include changes to access. Potential Project effects on hunting include changes to abundance and distribution of wildlife that could affect hunting success rates. **Other Stakeholder:** • Potential Project effects on hunting include changes to access WMUs or BMAs. Potential Project effects on hunting include changes to abundance and distribution of wildlife that could affect hunting success rates.	• This VC is recommended due to the potential Project effects on hunting that relate to Wildlife Management Units (WMUs) and Bear Management Areas (BMAs), where the Project may overlap, and therefore, limit use and access to WMUs and BMAs, increase access along corridors, and change the abundance and distribution of wildlife that could affect hunting success rates. • These effects can be experienced by the residential or non-residential (tourist) hunter as well as tourism outfitters. • The EIS identifies that habitat will be lost as a result of the Project, as well as there being the potential of direct mortality from interactions with Project vehicles • The Project Site Footprint overlaps WMU 8, BMAs DR-08-050 and DR-05-067. The Project Site Footprint also overlaps the Cervid Ecological Zone C1. The LSA also overlaps with WMU 5.
Trapping	**5.11.5.2 Hunting and Trapping**	**Regulator:**	• This VC is recommended due to the potential Project effects on trapping that

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
	6.2.1.11; 6.4.1.11 Wildlife and Wildlife Habitat **6.2.1.12;6.4.1.12 Fish and Fish Habitat** **Appendix EE: Country Foods Assessment**	• EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:** • Potential Project effects on trapping include loss of trapline areas or trapping cabins and access to trapline areas or cabins. • Potential Project effects on trapping include changes to abundance and distribution of furbearers that could affect trapping success rates, and therefore, trapping income due to changes in biophysical or anthropogenic conditions. **Other Stakeholder**: • Potential Project effects on trapping include loss of trapline areas or trapping cabins and access to trapline areas or cabins. • Potential Project effects on trapping include changes to abundance and distribution of furbearers that could affect trapping success rates, and therefore, trapping income due to changes in biophysical or anthropogenic conditions.	may include the loss of trapline areas or trap cabins; changes to access to trapline areas or trapping cabins; and changes to the abundance and distribution of furbearers that could affect trapping success rates, and therefore, trapping income due to changes in biophysical or anthropogenic conditions. • These potential effects could be experienced by licenced trappers. • The EIS identifies that habitat will be lost as a result of the Project, as well as there being the potential of direct mortality from interactions with Project vehicles • The Project site footprint overlaps trapline area DR026, and D027 by. Trapline areas.
Cottagers and outfitters	**5.2 Air Quality; 5.3 Acoustic and Light Environment** **6.2.1.1; 6.3.1.1; 6.4.1.1 Terrain and Soils** **6.2.1.3; 6.3.1.3; 6.4.1.3 Noise**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:**	• This VC is recommended due to the potential Project effects for residential cottage areas located near the Project site. Potential effects on the cottagers may include decreased enjoyment and leisure lifestyle associated with cottaging due to noise and dust; perceived effects to water quality, quantity and area aesthetics); and increased vehicle traffic. • Tourist outfitters are likely to be situated in the area and/or use the area for their

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
	6.2.1.4; 6.3.1.4; 6.4.1.4 Light **6.2.1.5; 6.3.1.5; 6.4.1.5 Air Quality**	• Potential Project effects to the cottagers and rural residential properties include decreased enjoyment and leisure lifestyle associated due to noise and dust, perceived effect to water quality and quantity, and area aesthetics. • Potential Project effects to the outfitters may include decreased areas recommended by outfitters to clientele, perception of the area is not pristine or natural which could deter clientele, and increase local clientele due to increased workforce in the area. **Other Stakeholder:** • Potential Project effects to the cottagers and rural residential properties include decreased enjoyment and leisure lifestyle associated due to noise and dust, perceived effect to water quality and quantity, and area aesthetics. • Potential Project effects to the outfitters may include decreased areas recommended by outfitters to clientele, perception of the area is no pristine or natural which could detract clientele, and increase local clientele due to increased workforce in the area.	clientele. The potential effects of the Project on the outfitters may include decrease in areas recommended by outfitters to clientele (related to effects on BMAs); perception that the area is not pristine or natural which could detract clientele; and increased local clientele due to increased workforce in area (staying or hunting, etc). • The LSA overlaps the Thunder Lake Lodge.
Other recreational uses	**5.11.5.1 Vegetation** **Appendix EE: Country Foods Assessment** **Appendix W: Screening Level Risk Assessment**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. Land use context (e.g., hunting, fishing, outdoor recreation, use of seasonal cabins, existing land development). • EIS Guideline 10.3 – Public concerns **Conservation / Scientific:** NA **Aboriginal:** • Potential Project effects on other recreational uses include changes to access, changes to abundance and distribution of	• This VC is recommended due to the potential Project effects on other recreational uses (including the use of motorized and non-motorized recreational vehicles, canoeing, hiking, mushroom and berry picking, wild rice harvesting and wood gathering). The potential effects on other recreational uses may include the temporary disruption of the snowmobile trails; changes to access to the Project area that may have previously been used for other recreation uses; and changes in the natural aesthetic of the area which may detract some recreational users from using the Project area.

Table 6.1.3.15-2: Rationale for Land and Resource Use VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		harvested foods, and changes to the natural aesthetic. **Other Stakeholder:** • Potential Project effects on other recreational uses include changes to access, changes to abundance and distribution of harvested foods, and changes to the natural aesthetic.	

There were a range of questions asked as part of the Round 1 information request process related to land and resource use. The following lists those specific questions that relate to the selection of VCs, indicators and measures for the land and resource use component:

Land Use Planning and Policies

- Government Agency - CEA Agency:
  - TMI_194-HE(1)-01 – Land use
- Métis Nation of Ontario:
  - TMI_535-AC(1)-209 – Land use
  - TMI_536-AC(1)-210 – Land use
  - TMI_582-AC(1)-256 – Crown land
  - TMI_583-AC(1)-257 – Crown land, trapping
  - TMI_584-AC(1)-258 – Crown land, hunting, trapping
- Wabigoon Lake Ojibway Nation:
  - TMI_360-AC(1)-34 – Land use

Forestry

- Government Agency - CEA Agency:
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping
- Wabigoon Lake Ojibway Nation:
  - TMI_360-AC(1)-34 – Land use, fishing, hunting, trapping, other recreational uses

Mineral Exploration

- Thunder Lake residents:

  - TMI_715-PC(1)-30 – Surface mining rights

Fishing - Recreational and Commercial

- Government Agency - CEA Agency:
  - TMI_194-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping
- Métis Nation of Ontario:
  - TMI_505-AC(1)-179 – Fishing, fish sanctuary
- Eagle Lake First Nation:
  - TMI_349-AC(1)-23 – Fish
  - TMI_362-AC(1)-36 – Fishing, other recreational uses
- Naotkamegwanning First Nation:
  - TMI_349-AC(1)-23 – Commercial fishing
- Wabigoon Lake Ojibway Nation:
  - TMI_360-AC(1)-34 – Baitfishing
  - TMI_348-AC(1)-22 – Fishing, hunting, trapping, other recreational uses, and outfitters

Hunting

- Government Agency - CEA Agency:
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping , Bear Management Area
  - TMI_194-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
- Métis Nation of Ontario
  - TMI_584-AC(1)-258 – Crown land, hunting, trapping

Trapping

- Government Agency - CEA Agency:
  - TMI_194-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
- Métis Nation of Ontario
  - TMI_581-AC(1)-255 – Hunting, trapping

- TMI_583-AC(1)-257 - Crown land, trapping
- TMI_584-AC(1)-258 – Crown land, hunting, trapping

Cottagers and Outfitters

- Government Agency - CEA Agency:
  - TMI_194-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping , Bear Management Area
- Thunder Lake residents:
  - TMI_715-PC(1)-30 – Cottage

Other Recreational Uses

- Government Agency - CEA Agency:
  - TMI_194-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
- City of Dryden residents:
  - TMI_731-PC(1)-46 – Mushroom
  - TMI_732-PC(1)-47 – Wild rice
- Member of the public:
  - TMI_745-PC(1)-60 – Berry
- Eagle Lake First Nation:
  - TMI_362-AC(1)-36 – Fishing, other recreational uses
- Wabigoon Lake Ojibway Nation:
  - TMI_360-AC(1)-34 – Harvest

6.1.3.16 Social

The following VCs have been used for describing the potential social effect of the Project:

- Population demographics;
- Education;
- Infrastructure and services;
- Housing and property values;

- Public safety; and
- Transportation and traffic.

Table 6.1.3.16-1 contains a listing of the social factor VCs, their indicators and measures.

Table 6.1.3.16-1: Social VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Population demographics	Population change	Population size
		Age and gender of population
		In- and out-migration
Education	Capacity of education services	Enrollment
	Education attainment	Highest level of education achieved
	Project-specific Training	Training type and number of trainees
Infrastructure and services	Municipal Services	Landfill availability and capacity
	Community services such as recreation, health and social services	To be determined in conjunction with affected communities
Housing and property values	Housing availability	Quantity of available accommodations, including temporary accommodations
		Number of building lots available in Dryden and Village of Wabigoon
	Property values	Real estate prices
		Property conditions
Public safety	Crime rate	Types / categories of crime
	Capacity of emergency services	Traffic accident rate
	Requests for emergency services initiated by the Project	Number and type of requests
Transportation and traffic	Road network capacity and conditions	Traffic volumes
		Traffic accident rate

The rationale for selection of social valued components is presented in Table 6.1.3.16-2.

Table 6.1.3.16-2: Rationale for Social VC Selection

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
Population demographics	**6.3.2.2; 6.4.2.2 Social Factors**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation / Scientific**: NA **Aboriginal:** • Changes in population demographics as a result of Project economic activities could place strain on existing social conditions and community infrastructure, affect housing	• Unlike remote mining projects, the Project is in an area surrounded by several communities which are within reasonable commuting distance (100 km or less). Consequently, the Project design does not include a camp and it is anticipated that potential changes to population demographics could occur because of economic opportunities (direct and indirect employment, supply of goods and services) associated with the Project.

Table 6.1.3.16-2 Rationale for Social VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		availability and affordability and influence other social value components. **Other Stakeholders:** • Changes in population demographics as a result of Project economic activities could place strain on existing social conditions and community infrastructure, affect housing availability and affordability and influence other social value components.	• Speculative in-migration could occur as people look for work with the Project, which could be both positive and negative. Employment opportunities associated with the Project may also positively support retention of existing population and stem the current outmigration trend of young adults within the socio-economic study area. • Project-related changes to the regional demographics may affect other social VCs.
Education	**6.3.2.2; 6.4.2.2 Social Factors**	**Regulator:** NA **Conservation / Scientific**: NA **Aboriginal:** • Changes in population demographics as a result of Project economic activities could affect existing education services. Opportunities for employment could affect education levels. **Other Stakeholders:** • Changes in population demographics as a result of Project economic activities could affect existing education services. Opportunities for employment could affect education levels.	• In-migration of workers to the area with their families may have a potential effect on education enrollments. • The Project's commitment to provide industry training for workers may result in an increased demand for post-secondary education and training. • The prospect of Project-related employment could have a positive effect, acting as motivation to stay in school or have a negative effect, acting as a motivation to discontinue education and pursue employment.
Infrastructure and services	**6.3.2.2; 6.4.2.2 Social Factors**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation / Scientific**: NA **Aboriginal:** • Changes in population demographics could place strain on existing community infrastructure and services. **Other Stakeholders:** • Changes in population demographics could place strain on existing community infrastructure and services.	• Potential changes within the population may affect the demand on existing infrastructure and services such as utilities, municipal infrastructure, communication services and recreation facilities.

Table 6.1.3.16-2 Rationale for Social VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
Housing	**6.2.2.2; 6.3.2.2; 6.4.2.2 Social Factors**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation / Scientific**: NA **Aboriginal:** • Changes in population demographics could affect housing availability and affordability. **Other Stakeholders:** • Changes in population demographics could affect housing availability and affordability. Project-related activities (e.g., blasting) could affect property values and cause damage to housing.	• Short-term demand for housing during site preparation and construction may strain availability of permanent and temporary accommodations. • Potential for increased demands for accommodation because of in-migration during site preparation and construction and operations may affect local real estate values. • No on-site camp is proposed for housing workers during site preparation and construction and operations. Non-resident workers are expected to stay in rental houses and temporary accommodation within the local area during site preparation and construction and may choose to move permanently during mine operations. This has the potential to affect community services and infrastructure, cost of living and real estate. It is anticipated that sufficient housing capacity exists within the socio-economic study area to house in-migrants who choose to live in the area to participate in Project-related employment and business opportunities. • The proximity of the Project may affect property values of some housing.
Public safety	**New – previously captured within Crime VC; 6.2.2.2; 6.3.2.2; 6.4.2.2 Social Factors**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation / Scientific**: NA **Aboriginal:** • Changes in population demographics could increase demand for emergency services. Individual lifestyle choices may be positively or negatively affected by income from Project-related employment. **Other Stakeholders:** • Changes in population demographics could increase demand for emergency services. Individual lifestyle choices may be positively or negatively	• There is a potential for increased demand for public safety services due to increased traffic volumes as a result of the Project. • Potential changes within the population may increase pressure and demand on fire protection services, emergency services and police services. • There are potential effects on crime rate related to the behavior of a non-local labour force and increased income / spending levels as a result of Project-related employment.

Table 6.1.3.16-2 Rationale for Social VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		affected by income from Project-related employment.	
Transportation and traffic	**6.2.2.1; 6.3.2.1; 6.4.2.1 Land Use**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation / Scientific**: NA **Aboriginal:** • Project-related traffic and changes in population demographics could increase current traffic volumes. **Other Stakeholders:** • Project-related traffic and changes in population demographics could increase current traffic volumes.	• Potential impact on transportation infrastructure due to potential population changes and transportation of goods and services throughout the life of the Project. • Potential increase of traffic on roads in the vicinity of the Project site. • Potential impact on traffic safety and accidents / road collision particularly during the site preparation and construction phase.

There were a range of questions asked as part of the Round 1 information request process related to the social factors component. The following lists those specific questions that relate to the selection of VCs, indicators and measures for social factors:

Population Demographics

- Government Agencies:
  - TMI_227-HE(1)-34: Potential for population increases.

Housing

- Métis Nation of Ontario:
  - TMI_590- AC(1)-264: Property values.
- Eagle Lake First Nation:
  - TMI_611-AC(1)-284: Property damage.
- Other Stakeholders:
  - TMI_708-PC(1)-23: Property values.
  - TMI_715-PC(1)-30: Noise.
  - TMI_716-PC(1)-31: Noise and vibration.
  - TMI_716-PC(1)-31: Noise and vibration / property damage.

- TMI_722-PC(1)-37: Property values.
- TMI_724-PC(1)-39: Property values.

Public Safety

- Métis Nation of Ontario:
  - TMI_492-AC(1)-166: Inadequate baseline to determine crime effects.
- Other Stakeholders:
  - TMI_735-PC(1)-50: Fire services.

Transportation and Traffic

- Government Agencies:
  - TMI_227-HE(1)-34: Potential for increased traffic.
  - TMI_17-PD(1)-04: Redirection of Tree Nursery Road.
  - TMI_186-AE(1)-24: Noise from vehicle traffic.

6.1.3.17 Economic

The following VCs are used for evaluating the effects of the Project on economic factors:

- Labour Force, Labour Participation and Employment;
- Income Levels;
- Cost of Living;
- Real Estate;
- Economic Development;
- Existing Businesses; and
- Government Revenues.

Public comments and input regarding the Project have been received though engagement and consultation activities such as public and special interest group meetings. Comments include those reflecting employment, business and training. The region has experienced significant local regional declines in employment and population. Employment has largely decreased due to downsizing and permanent closure of paper machines and sawmilling capacity in the forestry industry. Appendix CC of the EIS provides further details on regional declines of employment and localized employment shifts.

The construction and operations of the Project will have a positive effect on the local economy. Employment opportunities arising from the Project may also allow skilled trade workers who left the City of Dryden after downsizing of the Weyerhaeuser/Domtar pulp and paper facilities to find employment at the Project. Job opportunities created at the Project will provide an opportunity for youth to stay in the region, and attract new working age migrants. The overall economic effects of the Project will be felt most within commuting distance from the site (estimated 100 km).

The economic valued components, indicators, and measures are presented in Table 6.1.3.17-1.

Table 6.1.3.17-1: Economic VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Labour force, labour participation and employment	Labour income employment	• Direct impacts on employment, labour compensation and Gross Domestic Product (GDP). • Indirect impacts on employment, labour compensation and GDP. • Induced impacts on employment, labour compensation and GDP • Employment by skill category.
Income levels	Income levels and categories	• Project contribution to additional labour income through employment creation.
Cost of living	Current prevailing cost of living	• Changes in cost of living and inflation.
Real estate	Housing prices and affordability	• Changes in housing prices and affordability.
Economic development	Municipal taxes and contribution to economic development projects	• Changes in municipal taxes and contribution to economic development projects.
Existing businesses	Local business availability	• Local economic effects. • Potential for growth.
Government revenues	Taxes and revenues	• Changes in government revenues.

The rationale for selection of economic valued components is presented in Table 6.1.3.17-2.

Table 6.1.3.17-2: Rationale for Economic VC Selection

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
Labour force, labour participation and employment	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation/Scientific:** • Assessment of economic conditions provides useful information to government decision makers on the size of the proposed Project's economic contribution to the provincial economy, and the proposed	• The Project will provide short term and long term demand for local staff providing employment opportunity for local residents. It could also encourage people to migrate to the area for employment. In-migration of workers could have positive or negative effects on the population of the region. Positive if it is within the design capacity of community services and infrastructure and negative if it is not since it could create competition and raises inflation.

Table 6.1.3.17-2: Rationale for Economic VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		Project's potential economic benefits and costs. It also increase government revenues and thus contribute to economic development in the region. **Aboriginal:** • For Aboriginal people and businesses, participation by Aboriginal people in the Project will improve their participation in wage economy and improve their labour income. **Other Stakeholders:** • The Project could provide employment and business opportunities for local and regional residents/businesses.	• Project employment will affect the population of the socio-economic study area either temporarily during the construction phase or permanently during operations. • Closure and Post Closure of the Project will create short term employment but will reduce the local Project-related employment, the demand for local goods and services, and government tax revenues. This could slow the economic development in the region. • Economic effects of major projects are of interest to all levels of government, Aboriginal peoples and the general public. • The construction and operations expenditures of the Project will create direct, indirect and induced economic effects on GDP, labour income and employment. The economic effects could bring economic benefits to the region.
Income levels	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation/Scientific:** • The Project demand for labour, goods and services could lead to competition with other industries in the area and increase wage rates and cost of living. **Aboriginal:** • The Project will improve labour income in the region through employment and contacting opportunities. **Other Stakeholders:** **N**The Project will improve labour income in the region through employment and contacting opportunities.	• The Project will provide employment and business opportunities for local and regional residents/businesses and improve labour income. • Additional labour income could have positive or negative effects. Positive if used to improve style of living and overall investment in local economy and negative if it is used as a disposable income and increases substance abuse.
Cost of living	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Conservation/Scientific:**	• Economic effects will be experienced through increased employment, income, and the associated demand for local goods and services. Additional demands for local goods and services

Table 6.1.3.17-2: Rationale for Economic VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		• The Project demand for labour, goods and services could lead to competition with other industries in the area and increase wage rates and cost of living. **Aboriginal:** • Demand for labour could encourage in-migration of new residents. Arrival of new residents could create higher demand for housing which in turn, could create inflation and affect cost of living in local communities. **Other Stakeholders:** • Demand for labour could encourage influx of new residents. Arrival of new residents could create higher demand for housing which in turn, could create inflation and affect cost of living in local communities.	could have positive and negative effects on local businesses. Positive effects when additional demand creates additional supply and contribute to the growth of local businesses and negative effects when local businesses are unable to increase supply which results in higher cost of goods and services.
Real estate	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Aboriginal** • In-migration of workers from outside the region could affect the real estate market within the socio-economic study area. **Other Stakeholders:** • In-migration of workers from outside the region could affect the real estate market within the socio-economic study area.	• Temporary or permanent demand for housing, created by the arrival of workers from outside the region, could affect the real estate market either positively or negatively. • Positively, when the market is able to expand and cover the additional demand and negatively if the market is unable to increase the supply which would result in competition for housing and higher inflation rate.
Economic development	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Aboriginal:** • Assessment of economic conditions provides useful information to government decision makers on the size of the proposed Project's economic contribution to the provincial	• The Project will generate government revenues at three levels, Federal, Provincial and local government, through both income and corporate tax generated during the construction and operations phases of the Project. • Government revenues could be used to develop community infrastructure in the socio-economic study area and contribute to the economic development of the region.

Table 6.1.3.17-2: Rationale for Economic VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		economy, and the proposed Project's potential economic benefits and costs. It also increases government revenues and thus contributes to economic development in the region. **Other Stakeholders:** • Assessment of economic conditions provides useful information to government decision makers on the size of the proposed Project's economic contribution to the provincial economy, and the proposed Project's potential economic benefits and costs. It also increases government revenues and thus contributes to economic development in the region.	
Existing businesses	**5.11.3; 6.4.2**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Aboriginal:** • The Project will create additional demands for local goods and services during the construction and operations phase. This has the potential to improve existing local businesses and contribute to their growth. **Other Stakeholders:** • The Project will create additional demands for local goods and services during the construction and operations phase. This has the potential to improve existing local businesses and contribute to their growth.	• Economic effects will be experienced through increased employment, income, and associated demand for local goods and services. Additional demands for local goods and services could have positive and negative effects on local businesses. • Positive effects when local business are able to expand and improve to meet the new and additional demands and negative if local businesses are unable to compete in the new market.
Government revenues	**5.11.3**	**Regulator:** • NEIS Guideline 9.1.3 – Human Environment – socio-economic conditions. **Aboriginal:** • Assessment of economic conditions provides useful information to government decision makers on the size of	• Economic effects of major projects are of interest to all levels of government, Aboriginal peoples and the general public. • The Project will generate government revenues at three levels Federal, Provincial and local government through both income and corporate tax

Table 6.1.3.17-2: Rationale for Economic VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		the proposed Project's economic contribution to the provincial economy, and the proposed Project's potential economic benefits and costs. It also increases government revenues and thus contributes to economic development in the region. **Other Stakeholders:** • Assessment of economic conditions provides useful information to government decision makers on the size of the proposed Project's economic contribution to the provincial economy, and the proposed Project's potential economic benefits and costs. It also increases government revenues and thus contributes to economic development in the region.	generated during the construction and operations phases of the Project. • Generated revenues could be used to develop community infrastructure in the socio-economic study area and contribute to the economic development of the region.

The Round 1 information requests related to **economic effects** are:

- CEA Agency
  - TMI_3-EA(1)-03: General VC and Assessment Criteria
  - TMI_227-PC(1) 42: Socio-economic Effects
  - TMI_230-HE(1)-37: General TML
- Métis Nation of Ontario
  - TMI_507-AC(1)-181: Socio-economic VC
- City of Dryden, Thunder Lake, and Village of Wabigoon residents
  - TMI_228-PC(1)-43: Socio-economic Effects
- Wabigoon Lake Ojibway Nation
  - TMI_348-AC(1)-22: Socio-economic Effects
  - TMI_728-PC(1)-43: Socio-economic Effects

6.1.3.18 Human Health

As part of the process to respond to the Round 1 information requests, Treasury Metals have included an evaluation of the potential effects of the Project in the body of the EIS. This assessment, which builds on the health risk assessment presented in Appendix W, uses the following VCs for describing the effects on the Project on human health:

- Non-Indigenous Human Health; and
- Indigenous Human Health.

As part of the Round 1 information requests, a need was identified to distinguish between the potential health effects for Aboriginal peoples (Indigenous peoples) and non-Aboriginals (non-Indigenous peoples). This was addressed by organizing the human health indicators by receptors (workers, residents, and site visitors) and assessing the Project using the results of the risk assessment via the exposure pathways to those receptors. In many cases there will be an overlap between non-Indigenous human health and Indigenous-human health; however, it is crucial to differentiate the two groups as consideration of traditional land and resource use will define the site-specific input parameters for the exposure scenarios for Indigenous peoples. Table 6.1.3.18-1 lists the VCs, indicators, and measures to be used in evaluating the effects of the Project on human health.

Table 6.1.3.18-1: Human Health VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Non-Indigenous Human Health	Subsurface/Construction Worker	Potential risks relative to Health Canada risk benchmarks
	Outdoor Worker	Potential risks relative to Health Canada risk benchmarks
	Indoor Worker	Potential risks relative to Health Canada risk benchmarks
	Site Visitor, or Harvester	Potential risks relative to Health Canada risk benchmarks
	Resident	Potential risks relative to Health Canada risk benchmarks
Indigenous Human Health	Resident	Potential risks relative to Health Canada risk benchmarks
	Site Visitor, or Harvester	Potential risks relative to Health Canada risk benchmarks
	Subsurface/Construction Worker	Potential risks relative to Health Canada risk benchmarks
	Outdoor Worker	Potential risks relative to Health Canada risk benchmarks
	Indoor Worker	Potential risks relative to Health Canada risk benchmarks

The following questions, raised as part of the Round 1 information requests, specifically asked about the need to describe the potential effects of the Project on human health:

- TMI_194-HE(1)-01: Aboriginal human health;
- TMI_257-CE(1)-07: cumulative human health;
- TMI_338-AC(1)-12: human health effects of air quality;
- TMI_373-AC(1)-47: impacts to human health;
- TMI_611-AC(1)-284: human health concerns;
- TMI_617-AC(1)-290: risk of health issues;
- TMI_620-AC(1)-293: human health and dissolved mercury;
- TMI_643-AC(1)-316: impact on health;
- TMI_709-PC(1)-24: potential health effects;
- TMI_710-PC(1)-25: health and air quality; and
- TMI_719-PC(1)-34: health and water quality health.

6.1.3.19 Heritage Resources

The heritage resources component of the assessment refers specifically to those components of the environment regulated under the *Ontario Heritage Act*. The following two VCs were used for describing the potential effects of the Project on heritage resources:

- Archaeological sites; and
- Historic heritage sites.

As part of the Round 1 information requests, there were several questions raised regarding cultural activities by Aboriginal peoples and the absence of this as part of the heritage resources component. In preparing this revised EIS, consideration was given to addressing these questions, which has been done as part of the Aboriginal peoples component and VCs discussed in Section 6.1.3.20. For addressing the heritage resource components relevant to the *Ontario heritage Act*, the valued Components, indicators and measures identified in Table 6.1.3.19-1 are used.

Table 6.1.3.19-1: Heritage Resources VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Archaeological sites	Presence of a site	Distance from the Project
	Disturbance of a site	Level of disturbance
Historic heritage sites	Presence of a site	Distance from the Project
	Disturbance of a site	Level of disturbance

Table 6.1.3.20-1: Aboriginal People VCs, Indicators, and Measures (continued)

6.1.3.20 Aboriginal Peoples

In evaluating the potential effects of the Project to Aboriginal peoples, an emphasis has been placed on describing how to how changes in the environment as a result of the Project could affect the resources traditionally relied on by members of Indigenous communities, or how the Project could affect the ability to practice their current or historic use of lands and resources for traditional purposes. In addition, this revised EIS looks at how the Project might affect the health or social wellbeing of members of Indigenous communities. It is important to note that the terms “Aboriginal peoples” and “Indigenous peoples” are used to capture recent changes in the official language accepted by the Government of Canada. Aboriginal and Indigenous may be used interchangeably and both refer to those peoples who identify themselves as First Nations, Métis, or Inuit. This scope of assessment was consistent with the Round 1 information requests that included questions regarding the potential impact of the Project on Aboriginal and treaty rights, as defined by the right for a continued ability to the use of lands and resources for traditional purposes, including gathering, harvesting and cultural activities. The Round 1 information requests also indicated interests in the socio-economic and health effects on Aboriginal people. The following VCs have been used for evaluating the effects of the Project on Aboriginal peoples:

- Human Health;
- Harvesting and Gathering of Plant Materials;
- Hunting;
- Trapping;
- Fishing;
- Cultural and spiritual; and
- Socio-economic Factors.

Table 6.1.3.20-1 provides a listing of the valued components, indicators and measures used for the assessment of the effects of the Project on Aboriginal peoples.

Table 6.1.3.20-1: Aboriginal People VCs, Indicators, and Measures

Valued Components (VCs)	Indicators	Measures
Human Health	Risk Assessment for Indigenous Human Health	Potential risks relative to Health Canada risk benchmarks
	Surface Water Quality	Changes in concentrations
	Groundwater Quality	Changes in concentrations
	Soil Quality	Changes in concentrations
	Ambient Air Quality	Changes in concentrations
Harvesting and gathering of plant material	Wild rice	Loss of wild rice areas
		Changes in water quality

Table 6.1.3.20-1: Aboriginal People VCs, Indicators, and Measures (continued)

Valued Components (VCs)	Indicators	Measures
		Changes in water levels
		Quality for consumption
	Berry Harvesting	Loss of potential harvest areas
		Quality for consumption
	Medicinal plant harvesting	Loss of forest
		Loss of wetland
		Quality for consumption
	Changes in access	Land where access is controlled
		Lands removed from access
	Diminished on-the-land experience	Changed views
		Noticeable changes in noise
Hunting	Ungulates	Habitat loss
		Quality for consumption
	Furbearers	Habitat loss
	Waterfowl	Habitat loss
		Quality for consumption
	Changes in access	Land where access is controlled
		Lands removed from access
	Diminished on-the-land experience	Changed views
		Noticeable changes in noise
Trapping	Furbearers	Habitat loss
	Changes in access	Land where access is controlled
		Lands removed from access
	Diminished on-the-land experience	Changed views
		Noticeable changes in noise
Fishing	Sport fish	Change in abundance
		Quality for consumption
	Baitfish	Change in abundance
	Commercial fishing	Fish for consumption (sport fish)
		Baitfish collection
	Changes in access	Land where access is controlled
		Lands removed from access
	Diminished on-the-land experience	Changed views
		Noticeable changes in noise
Cultural and spiritual	Cultural or spiritual sites	Loss or disturbance to known sites
		Restriction of access
	Traditional Travel routes	Interruption - discontinued
		Interference – close to project and
	Diminished on-the-land experience	Changed views
		Noticeable changes in noise
Socio-economic factors	Economic effects	Aboriginal employment opportunities
		Cost of living

Table 6.1.3.20-1: Aboriginal People VCs, Indicators, and Measures (continued)

Valued Components (VCs)	Indicators	Measures
		Project purchases from Aboriginal businesses
	Social effects	In- and out-migration
		Capacity of education services
		Education attainment
		Project-specific Training
		Housing availability
		Property values (off reserve)
		Capacity of emergency services
		Road network capacity and conditions

The rationale for selection of Aboriginal people valued components is presented in Table 6.1.3.20-2. The process considered the results of the engagement process conducted with Aboriginal peoples (as detailed in the Aboriginal Engagement Report, Appendix DD to the revised EIS), as well as the responses to the various questions raised as part of the Round 1 information request process.

Table 6.1.3.20-2: Rationale for Aboriginal People VC Selection

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
Human health	**6.3.2.5; 6.4.2.5 Aboriginal People**	**Regulator:** • EIS Guideline 10.1.3 – Effects of changes to the environment on Aboriginal peoples **Conservation / Scientific**: NA **Aboriginal:** • Aboriginal communities have expressed concerns about impacts on water quality that could impact drinking water quality and fish and fish habitat. Aboriginal people also expressed concern regarding air quality and exposure by people, wildlife, and birds to tailings. **Other Stakeholder:** NA	• The traditional land uses of Aboriginal people in the study area includes harvesting of fish, wildlife, birds, and plants. If any of those traditional resources are contaminated, there could be adverse impacts on Aboriginal health.
Harvesting and gathering of plant materials	**6.32.5; 6.4.2.5 Aboriginal People**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. The current use of land and resources for traditional purposes by Aboriginal persons is to be considered. • EIS Guideline 10.2 – Adverse Impacts on Aboriginal and Treaty Rights and Related Interests	• Removal of traditionally used plant resources or restricting access to existing resources would reduce the areas available to Aboriginal people to exercise their traditional gathering activities, including the gathering of plant materials for food, medicinal, spiritual, and other uses.

Table 6.1.3.20-2: Rationale for Aboriginal People VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		• EIS Guideline 11.2 – Measures to address impacts on Aboriginal rights **Conservation / Scientific**: NA **Aboriginal:** • Aboriginal traditional land use includes the gathering of plants and berries, including blueberries, chanterelles, and wild rice. **Other Stakeholder:** NA	• Real or perceived contamination of plant materials may reduce gathering activities.
Hunting, trapping, fishing	**6.32.5; 6.4.2.5 Aboriginal People**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. The current use of land and resources for traditional purposes by aboriginal persons is to be considered. • EIS Guideline 10.2 – Adverse Impacts on Aboriginal and Treaty Rights and Related Interests • EIS Guideline 11.2 – Measures to address impacts on Aboriginal rights **Conservation / Scientific**: NA **Aboriginal:** • Aboriginal traditional land use activities include hunting, trapping, and fishing. **Other Stakeholder:** NA	• Impacts on resources that are hunted, trapped or fished or reduced access to areas of previous hunting, trapping, or fishing could adversely the ability of Aboriginal people to participate in traditional activities. • Real or perceived contamination of animals, birds or fish may reduce harvesting activities.
Cultural and spiritual	**New valued component**	**Regulator:** • EIS Guideline 9.1.3 – Human Environment. The current use of land and resources for traditional purposes by Aboriginal persons is to be considered. • EIS Guideline 10.2 – Adverse Impacts on Aboriginal and Treaty Rights and Related Interests • EIS Guideline 11.2 – Measures to address impacts on Aboriginal rights **Conservation / Scientific**: NA **Aboriginal:** • Aboriginal cultural activities and cultural teachings can occur in specific locations or while practicing traditional activities. Changes to the ability to practice traditional activities to access to culturally important sights could adversely impact the ability to participate in cultural activities.	• A restriction in the ability to access culturally important sites would reduce the ability to practice traditional cultural, spiritual or ceremonial activities. • A reduction in the ability to conduct traditional practices could reduce the ability to share cultural practices within an Indigenous community which could adversely affect the culture.

Table 6.1.3.20-2: Rationale for Aboriginal People VC Selection (continued)

Valued Component	EIS Section	Conservation / Scientific Importance	Rationale for Inclusion
		Other Stakeholder: NA	
Socio-economic effects	**New valued component**	**Regulator:** • EIS Guideline 10.1.3 – Effects of changes to the environment on Aboriginal peoples **Conservation / Scientific**: NA **Aboriginal:** • Aboriginal communities have expressed concerns that there may be Project-related social and economic effects. **Other Stakeholder:** NA	• The Project spending on labour and goods and services could have positive economic effects on Aboriginal people and businesses. • Impacts on social valued components could be experienced by Aboriginal people.

There were a range of questions asked as part of the Round 1 information request process related to the potential effects on Aboriginal peoples. The following lists those specific questions that relate to the selection of VCs, indicators and measures for Aboriginal peoples:

Health Effects

- Government Agencies
  - TMI_194-HE(1)-01 Aboriginal health

Gathering Plant Materials, and Hunting, Trapping and Fishing

- Métis Nation of Ontario
  - TMI_426-AC(1)-101 Traditional land use study
  - TMI_500-AC(1)-174 Traditional harvesting

Cultural Activities

- Government agencies
  - TMI_240-HE(1)-47 Cultural resources
- Wabigoon Lake Ojibway Nation
  - TMI_354-AC(1)-28 Cultural resources

Socio-economic Effects

- Government Agencies
  - TMI_226-HE(1)-33 Aboriginal socio-economic study area

- TMI_228-HE(1)-35 Aboriginal socio-economic effects
- Métis Nation of Ontario
    - TMI_446-AC(1)-120 Aboriginal socio-economic effects

6.1.3.21 Summary of Valued Components (VCs)

As detailed in the preceding sections, the VCs used for assessing the effects of the Project on the environment have been refined to reflect the feedback received as part of the Round 1 information request process. Table 6.1.3.21-1 provides a summary of the VCs and indicators for evaluating the potential effects of the Project.

Table 6.1.3.21-1: Summary of Valued Components and Indicators

Discipline	Valued Components (VCs)	Indicators
Terrain and soils	Natural landscapes	Viewscapes
	Overburden	Erosion of disturbed overburden
	Soil chemistry	Changes in soil chemistry
Geology and Geochemistry	Pit lake water quality	Concentrations of indicator compounds
Noise	Environmental noise levels	Equivalent noise levels, L_{EQ}
	Noise disturbance to wildlife (including SAR)	Area predicted L_{EQ} above 50 dBA
	Blasting noise and vibration	Peak sound pressure level
		Peak particle velocity
	Noise related health effects	Absolute sound pressure, L_{DN}
		Percent highly annoyed, %HA
Light	Light trespass	Ambient light levels
Air quality	Air quality	Concentrations of indicator compounds
Climate	Project GHG emissions	Annual equivalent carbon dioxide emissions (eCO_2)
	Changes in climate due to the Project	Changes in annual temperature
		Changes in annual precipitation
Surface water quality	Surface water quality	Concentrations of indicator compounds
Surface water quantity	Surface water quantity	Increase in surface water flows
		Decrease in surface water flows
		Change in lake levels
Groundwater quality	Groundwater quality	Concentrations of indicator compounds
Groundwater quantity	Groundwater quantity	Decrease in groundwater elevations in private water wells
Wildlife and wildlife habitat	Wildlife Species at Risk	Common Nighthawk
		Northern Myotis/Little Brown Myotis
		Barn Swallow
	Ungulates	Moose
	Furbearers	American Marten
		American Beaver
	Upland birds	Upland birds
	Wetland birds	Marsh birds
	Small mammals	Small mammals
	Reptiles and amphibians	Reptiles and amphibians

Table 6.1.3.21-1: Summary of Valued Components and Indicators (continued)

Discipline	Valued Components (VCs)	Indicators
	Invertebrates	Terrestrial invertebrates
Migratory Birds	Upland birds	Upland birds
	Wetland birds	Marsh birds
Fish and fish habitat	Stream-resident fish population	Direct loss or alteration of habitat
		Changes in flows or water levels
		Changes in water quality
		Blasting
	Migratory fish populations	Direct loss or alteration of habitat
		Changes in flows or water levels
		Changes in water quality
		Blasting
	Lake-resident fish populations	Direct loss or alteration of habitat
		Changes in flows or water levels
		Changes in water quality
		Blasting
	Fish species-at-risk	Direct loss or alteration of habitat
		Changes in flows or water levels
		Changes in water quality
		Blasting
Wetlands and vegetation	Wetlands	Wetland extent
		Wild rice
		Floating Marsh Marigold (*Caltha natans*)
	Vegetation communities	Predominantly coniferous forest
		Predominantly deciduous forest
		Successional areas
		Potential berry harvesting areas
Land and resource use	Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.
		Overlap with protected areas.
	Aggregate Operations	Change in access to aggregate resources.
		Change in demand of aggregate resources extraction.
	Forestry	Change in access to forestry resources.
		Loss of forestry resources.
	Mineral Exploration	Change in access to mineral claims for exploration and production.
	Fishing - Recreational and Commercial	Change in access to fisheries resources.
		Change in the abundance of fisheries resources.
		Change in contaminant levels in fish
		Diminished experience of being on the land.
	Hunting	Change in access to wildlife resources.
		Change in abundance of wildlife resources.
		Diminished experience of being on the land
	Trapping	Change in access to wildlife resources.
		Change in abundance of wildlife resources.
		Diminished experience of being on the land
	Cottagers and Outfitters	Diminished experience of being on the land.

Table 6.1.3.21-1: Summary of Valued Components and Indicators (continued)

Discipline	Valued Components (VCs)	Indicators
		Change in access to cottage and/or outfitter areas.
		Changes in clientele for outfitters with lodges located near the Project.
	Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes
		Change in access for residents and visitors to public lands for consumptive purposes.
		Change in abundance of berries, mushrooms and/or other vegetation used for consumption
		Diminished experience of being on the land.
Social	Population demographics	Population change
	Education	Capacity of education services
		Education attainment
		Project-specific Training
	Infrastructure and services	Municipal Services
		Community services (e.g., health, social services)
	Housing and property values	Housing availability
		Property values
	Public safety	Crime rate
		Capacity of emergency services
		Requests for emergency services by Project
	Transportation and traffic	Road network capacity and conditions
Economic	Labour force, labour participation and employment	Labour income employment
	Income levels	Income levels and categories
	Cost of living	Current prevailing cost of living
	Real estate	Housing prices and affordability
	Economic development	Municipal taxes and contribution to economic development projects
	Existing businesses	Local business availability
	Government revenues	Taxes and revenues
Human health	Non-Indigenous Human Health	Subsurface/Construction Worker
		Outdoor Worker
		Indoor Worker
		Site Visitor, or Harvester
		Resident
	Indigenous Human Health	Resident
		Site Visitor, or Harvester
		Subsurface/Construction Worker
		Outdoor Worker
		Indoor Worker
Heritage resources	Archaeological sites	Archaeological sites
	Historic heritage sites	Historic heritage sites
Aboriginal Peoples	Human Health	Risk Assessment for Indigenous Human Health
	Harvesting and gathering of plant material	Wild rice
		Berry Harvesting
		Medicinal plant harvesting

Table 6.1.3.21-1: Summary of Valued Components and Indicators (continued)

Discipline	Valued Components (VCs)	Indicators
		Changes in access
		Diminished on-the-land experience
	Hunting	Ungulates
		Furbearers
		Waterfowl
		Changes in access
		Diminished on-the-land experience
	Trapping	Furbearers
		Changes in access
		Diminished on-the-land experience
	Fishing	Sport fish
		Baitfish
		Commercial fishing
		Changes in access
		Diminished on-the-land experience
	Cultural and spiritual	Cultural or spiritual sites
		Traditional Travel routes
		Diminished on-the-land experience
	Socio-economic factors	Economic effects
		Social effects

6.1.4 Selection of Study Areas

6.1.4.1 Terrain and Soils

As described in Section 6.1.3.1, the following three VCs are used when describing the effects of the Project on terrain and soils:

- Natural landscape;
- Overburden; and
- Soil chemistry.

For the overburden and soils chemistry VCs, the effects are expected to be restricted to the area physically disturbed by the Project, also referred to as the operations area (see Figure 3.0-1A). In the case of terrain, the effects can extend beyond the Project footprint, as far as the features associated with the Project would be visible. To ensure these effects are captures, a local study area (LSA) 7.5 km in radius was selected. This LSA, shown in Figure 6.1.4.1-1, is large enough to enclose all of Thunder Lake and the associated cottages that surround the lake. The terrain and soils LSA is also large enough to extend up to Mavis Lake, identified by Eagle Lake First Nation (TMI_609-AC(1)-292) an area where a sacred feature called the Serpent is located. The

LSA is also large enough to enclose a large portion of Wabigoon Lake. No regional study area (RSA) is defined for terrain and soils.

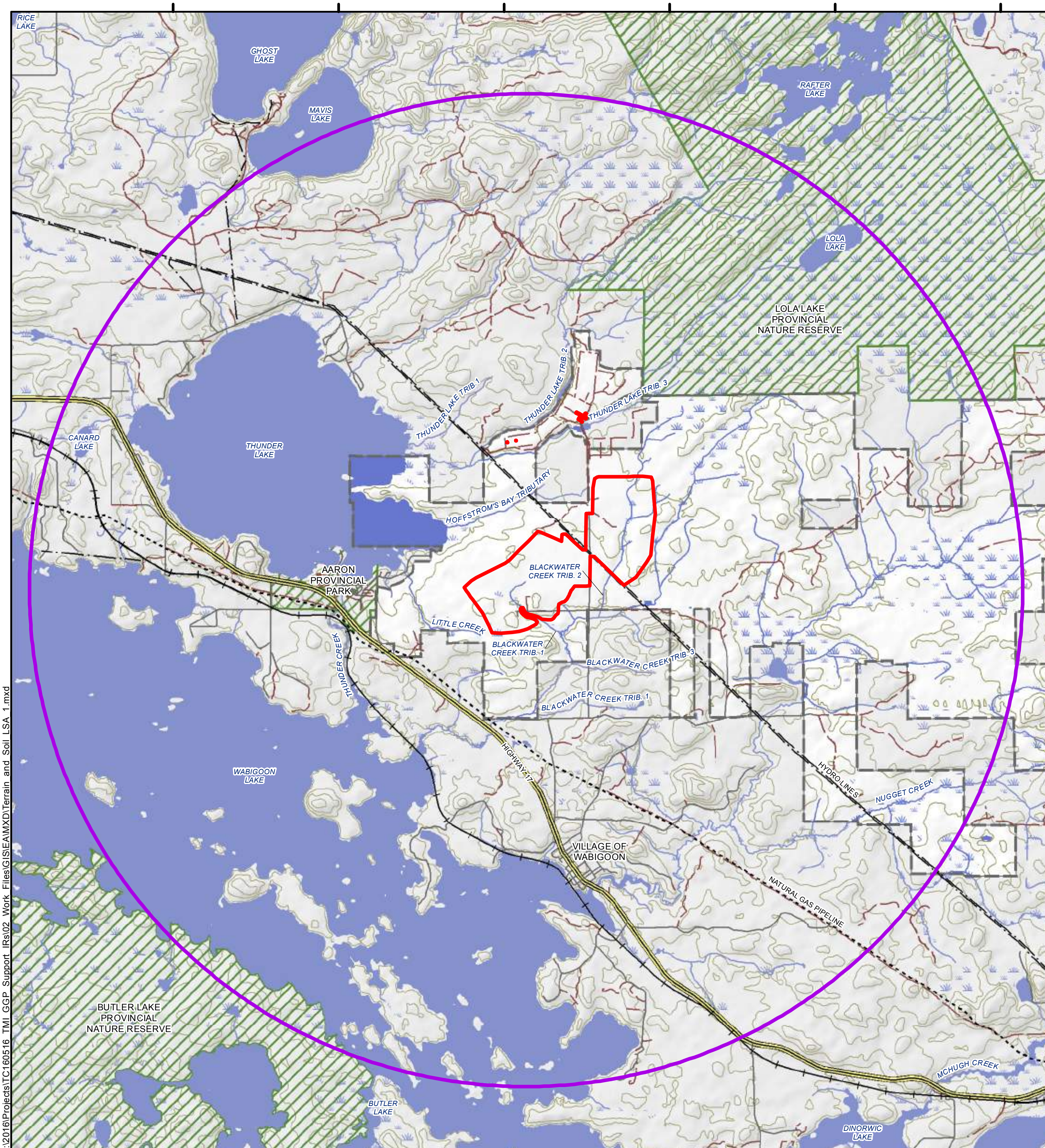
6.1.4.2 Geology and Geochemistry

As described in Section 6.1.3.2, a single VC (pit lake water quality) was defined for evaluating the effects of the Project on geochemistry. Secondary effects of geochemistry, such as the effects of seepage from on-site facilities on surface water quality and groundwater quality, are addresses as a component of those disciplines. There were no assessment endpoints identified for geology.

The existing regional geologic setting was described over an area spanning from Thunder Bay in the east, to Kenora in the west, and from the US-Canadian border in the south to Lac Seul in the north (Figure 5.4.2-1 of the revised EIS). The local bedrock geology was described over a smaller area, enclosing the entire property line for the Project, and extending from the west end of Thunder Lake in the West, to the east of Wee Sandy Lake in the East (Figure 5.4.2.3-1 of the revised EIS). Geology was also described in the vertical extent, spanning from the surface to approximately 450 metres below the Project site (Figure 5.4.2.3-2 of the revised EIS). The RSA and LSA used for geology is shown on Figure 6.4.2.2-1 (regional geology), and 6.4.2.2-2 (bedrock geology).

The geochemistry of the rocks associated with the Project was not described on any spatial scale, rather it was described using the specific materials to be mined as part of the Project. The understanding of how these rocks will undergo chemical changes once exposed to the elements is important for understanding the effects of the Project on components of the receiving environment (such as surface water quality). The spatial extent of the assessment of the effects of the Project on geochemistry are limited to the physical footprint of the Project. While the effects of geochemical reactions on the receiving environment over time may extend beyond the Project site, these effects will be captured as part of other components (e.g., surface water quality).

There was a single question related to the geochemical study areas (TMI_44-MW(1)-06), which was looking for specific information regarding justification for the geochemical study areas based on the surface water bodies potentially affected by long-term seepage from the Project. As noted in discussion on geology and geochemistry VCs (Section 6.1.3.2), seepage from the on-site features (e.g., TSF and WRSA) were not identified as VCs, in themselves. However, the potential effects of seepage from these on-site features were incorporated into the considerations for the study areas for surface water quality (Section 6.1.4.8) and groundwater quality (6.1.4.10).



LEGEND

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

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

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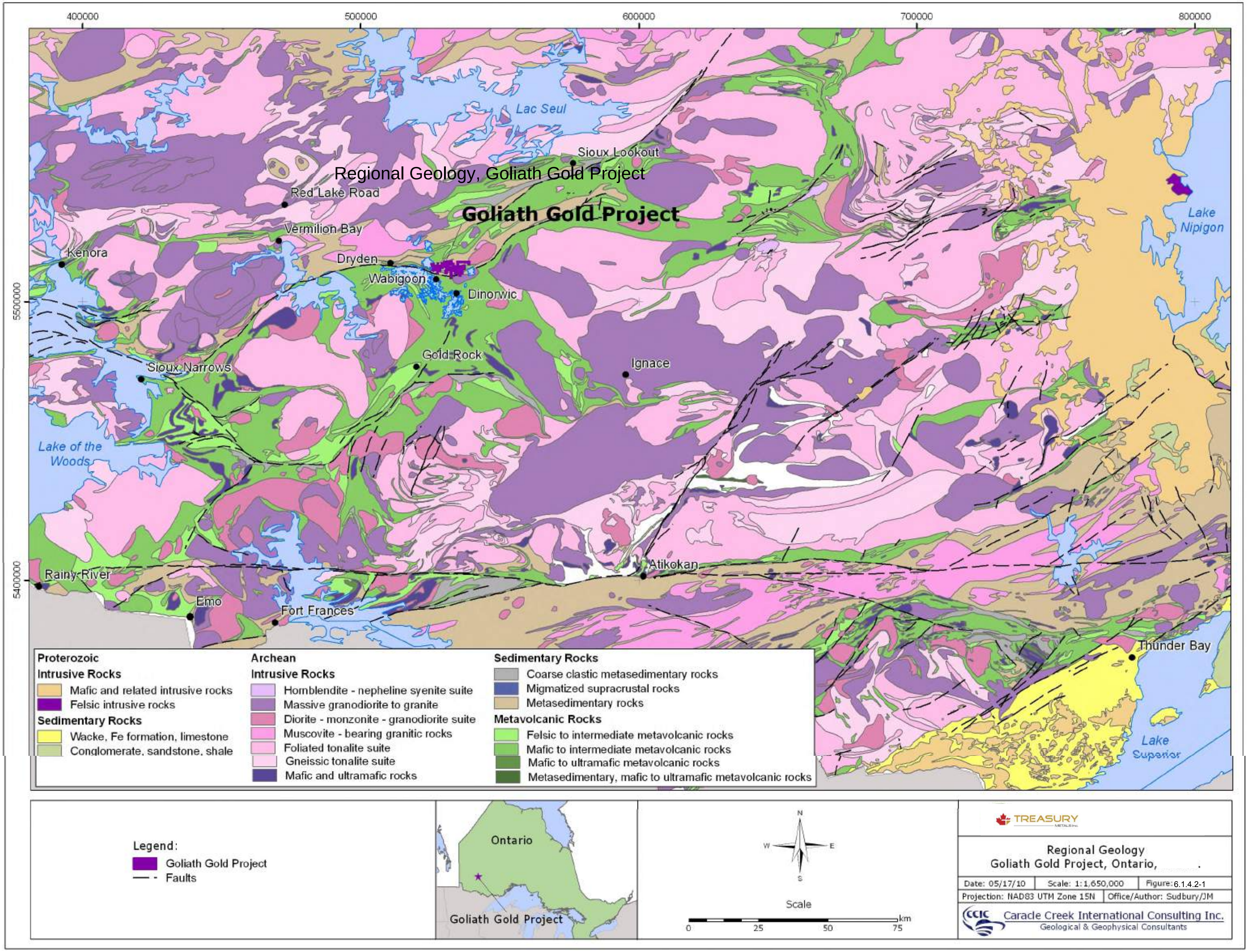
amec foster wheeler

GOLIATH GOLD PROJECT

Terrain and Soil Local Study Area (LSA)

PROJECT N^{o}: TC160516	FIGURE: 6.1.4.1-1
SCALE: 1:80,000	DATE: April 2018



400000
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Regional Geology, Goliath Gold Project
Goliath Gold Project
Lac Seul
Sioux Lookout
Red Lake Road
Vermilion Bay
Kenora
Dryden
Wabigoon
Dinorwic
Gold Rock
Sioux Narrows
Ignace
Lake of the Woods
Lake Nipigon
Rainy River
Emo
Fort Frances
Atikokan
Thunder Bay
Lake Superior
Proterozoic
Intrusive Rocks
Mafic and related intrusive rocks
Felsic intrusive rocks
Sedimentary Rocks
Wacke, Fe formation, limestone
Conglomerate, sandstone, shale
Archean
Intrusive Rocks
Hornblendite - nepheline syenite suite
Massive granodiorite to granite
Diorite - monzonite - granodiorite suite
Muscovite - bearing granitic rocks
Foliated tonalite suite
Gneissic tonalite suite
Mafic and ultramafic rocks
Sedimentary Rocks
Coarse clastic metasedimentary rocks
Migmatized supracrustal rocks
Metasedimentary rocks
Metavolcanic Rocks
Felsic to intermediate metavolcanic rocks
Mafic to intermediate metavolcanic rocks
Mafic to ultramafic metavolcanic rocks
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Goliath Gold Project
Faults
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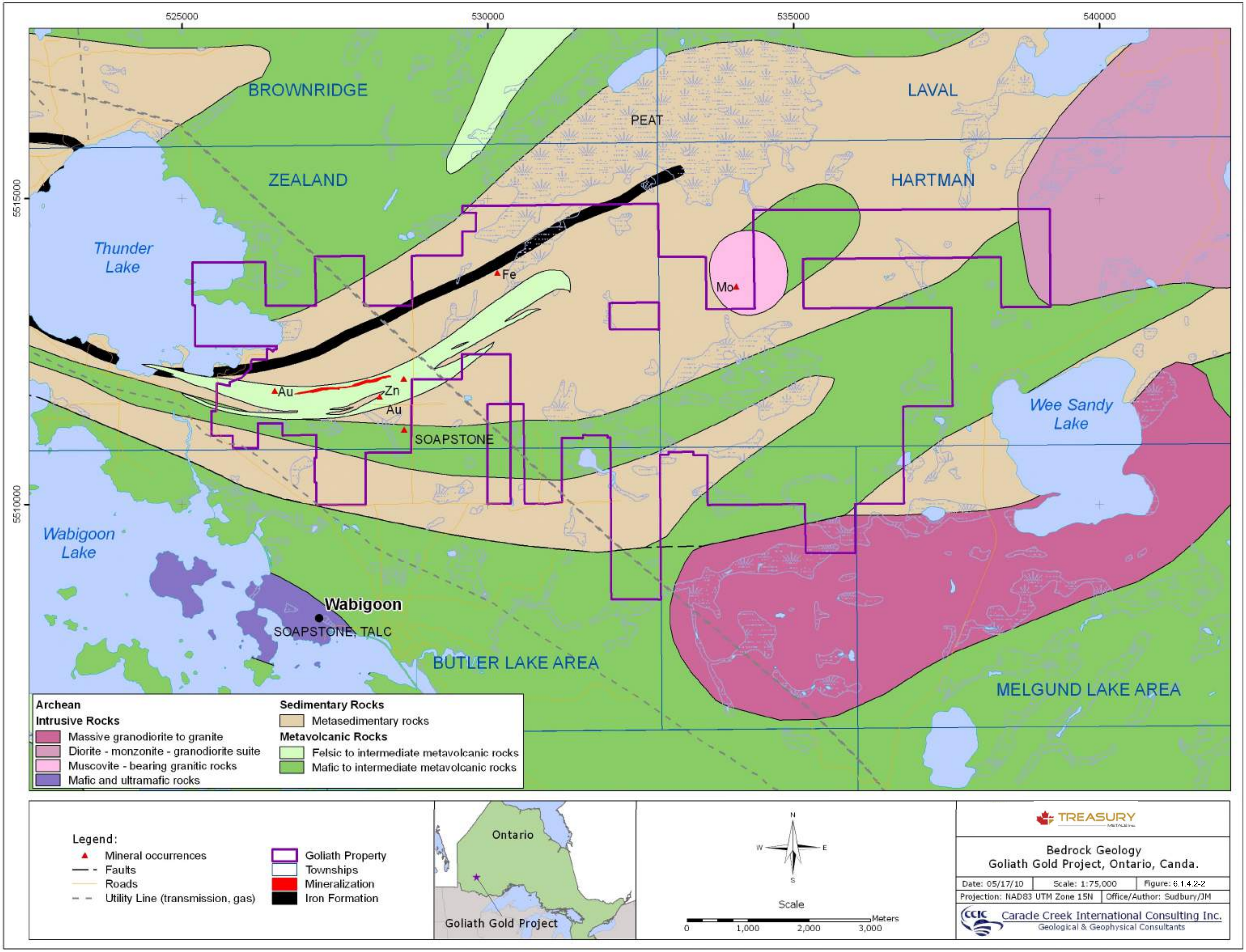
TREASURY
Regional Geology
Goliath Gold Project, Ontario, .
Date: 05/17/10
Scale: 1:1,650,000
Figure: 6.1.4.2-1
Projection: NAD83 UTM Zone 15N
Office/Author: Sudbury/JM
CCIC Caracle Creek International Consulting Inc.
Geological & Geophysical Consultants



525000
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BROWNRIDGE
LAVAL
PEAT
ZEALAND
HARTMAN
Thunder Lake
Fe
Mo
Au
Zn
Au
SOAPSTONE
Wee Sandy Lake
Wabigoon Lake
Wabigoon
SOAPSTONE, TALC
BUTLER LAKE AREA
MELGUND LAKE AREA
Archean
Intrusive Rocks
Massive granodiorite to granite
Diorite - monzonite - granodiorite suite
Muscovite - bearing granitic rocks
Mafic and ultramafic rocks
Sedimentary Rocks
Metasedimentary rocks
Metavolcanic Rocks
Felsic to intermediate metavolcanic rocks
Mafic to intermediate metavolcanic rocks
Legend:
Mineral occurrences
Faults
Roads
Utility Line (transmission, gas)
Goliath Property
Townships
Mineralization
Iron Formation
Ontario
Goliath Gold Project
N
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Scale
0
1,000
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Meters
TREASURY METALS Inc.
Bedrock Geology
Goliath Gold Project, Ontario, Canda.
Date: 05/17/10
Scale: 1:75,000
Figure: 6.1.4.2-2
Projection: NAD83 UTM Zone 15N
Office/Author: Sudbury/JM
CCIC
Caracle Creek International Consulting Inc.
Geological & Geophysical Consultants

6.1.4.3 Noise

The magnitude of sounds and vibration will decay with distance from a source. While additional factors can attenuate the magnitude of sounds and vibration, such as ground and air absorption, distance is the primary factor that is linked to the geometrical spreading and attenuation of the energy wave. Ground-borne vibration attenuates at a much faster rate than sound in air, and thus any study area defined for sound would also include vibration.

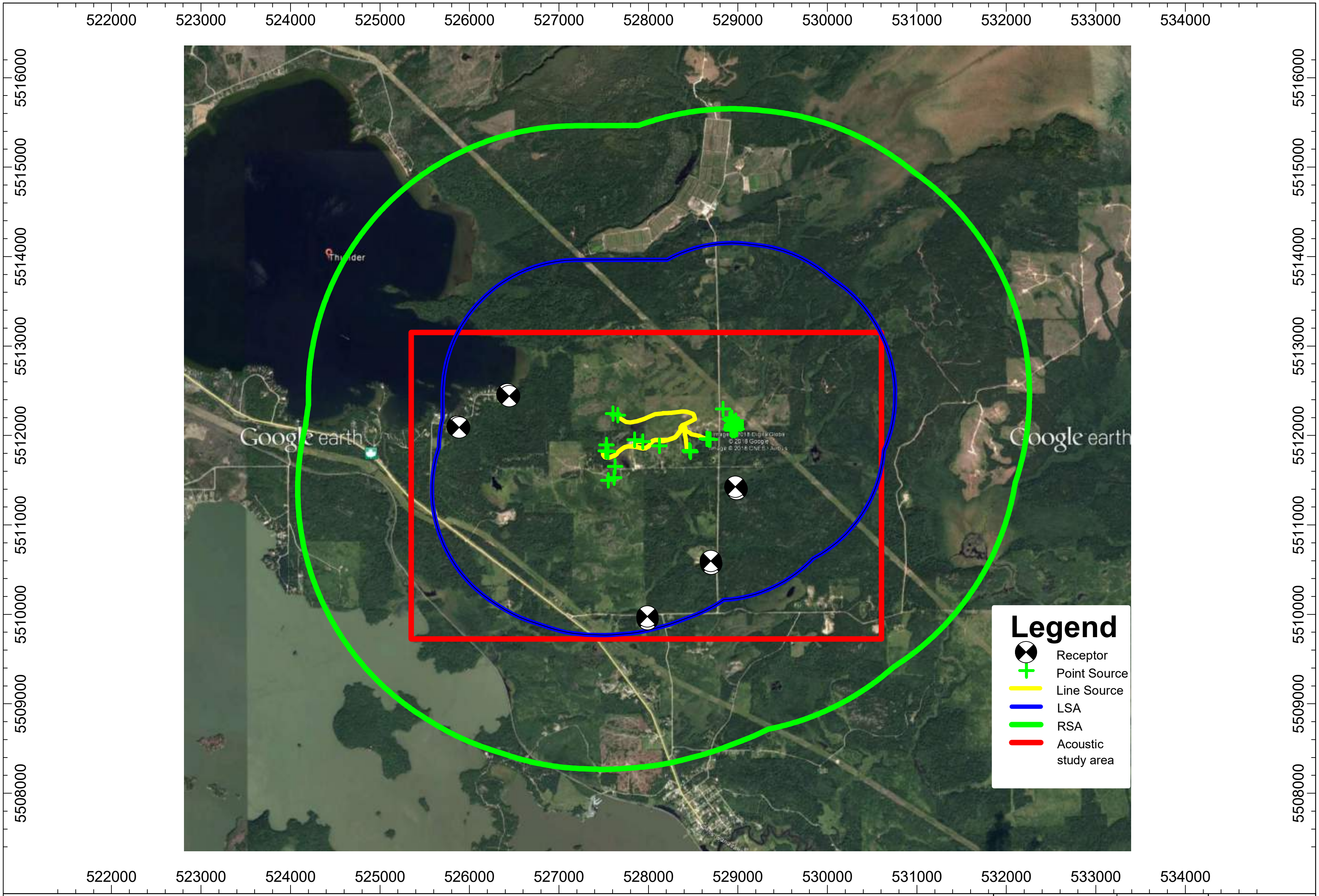
On the above basis, most industrial sources decay to a low sound level at distances great than 3,000 m from a source. For example, a source sound power level of 100 dBA (i.e., typical of the sound emissions from a project of this type) conservatively results in a sound pressure level of 22 dBA at a distance of 3,000 m, based on distance attenuation only. Ten such sources would result in a combined sound level of 32 dBA (summing of sounds is logarithmic, therefore ten sources of equal sound result in a 10 dB increase), which is still well-below typical regulatory limits of 40 dBA. In other words, ten similar projects/sources would result in a combined influence well below standard regulatory limits.

A regional study area (RSA) for sound can thus be defined as a 3,000 m setback from the nearest active Project area, with sources beyond this range not contributing significantly to total sound levels as noted above. The RSA for noise is shown as a green line in Figure 6.1.4.3-1. This buffer was reviewed for major sources of stationary sound unrelated to the project that could contribute to total sound. No sources were identified; hence, no combined effects from other sources were considered.

The local study area (LSA) was defined within the RSA for detailed acoustic assessment based on a setback of 1,500m (see the blue line Figure 6.1.4.3-1). At this setback distance, sound sources such as those given in the above example would result in sound levels on the order of 28 dBA. These levels could reasonably begin to influence the local background conditions in a rural area which are commonly in the 30–35 dBA range. This distance also aligns to the valid range of most sound propagation algorithms used in detailed assessment, including the ISO 9613-2 “Attenuation of Sound During Propagation Outdoors” algorithm used in this assessment, which also reflects industry-standard practice.

However, noise is managed in Ontario at points of reception (PORs), located on noise-sensitive land uses. Noise-sensitive land uses are defined in the MOECC’s environmental noise guideline, publication NPC-300 (MOE 2013), as:

- A property of a person that accommodates a dwelling and includes a legal nonconforming residential use; or
- A property of a person that accommodates a building used for a noise sensitive commercial purpose; or
- A property of a person that accommodates a building used for a noise sensitive institutional purpose.



Study Areas for Noise and Vibration

Figure 6.1.4.3-1

Treasury Metals - Goliath Gold Project

Project #1602163

Drawn by: KAH	Figure: 1
Scale:	1:60,000
Date:	Mar 13, 2018

A noise-sensitive land use may have one or more receptors. The PORs used in an acoustic assessment are those locations where sound from the facility is received and assessed against the applicable limits. Sound levels may be assessed at the façade of the building and/or outdoor areas, depending on the type of sensitive land use assessed. Outdoor PORs are only assessed for dwellings and are not assessed for commercial and institutional noise-sensitive land uses.

Residential receptors include houses, cottages, and the like, whether continuously occupied or seasonal. For existing residential properties, sound levels are assessed at the façade of the building at a height of 4.5 m above local grade and an outdoor POR at a height of 1.5 m. The point of assessment for the outdoor receptors is a point 30 m from the building façade, or the property line in cases where the 30 m setback would exceed the size of the property.

Commercial and institutional receptors include hotels, churches, daycares, schools, clinics, and the like. The point of assessment for these types of receptors is at the façade of the building only; Outdoor receptors are not assessed for commercial and institutional noise-sensitive land uses.

Properties that are zoned to permit a noise-sensitive land use, but are currently vacant need to be assessed as if a noise-sensitive land use exists at that location. For these noise sensitive areas, the receptors are typically considered in a location consistent with typical local building patterns, at a height of 4.5 m above local grade. In the case of unincorporated land without a minister's zoning order, the land is generally understood to allow noise-sensitive uses, and would be assessed in the same way as land that is zoned for a noise sensitive use. All land within the vicinity of the Project is either crown land, or unincorporated land. No zoning information is available for these areas.

There is currently a house located to the West of the low grade ore (LGO) stockpile, which is owned by Treasury Metals, and will not be occupied during the life of the Project. A house located on the northwest corner of Normans Road and Nursery Road is also owned by Treasury Metals and will not be occupied during the life of the Project. The house located approximately 400 m east of the intersection of Normans Road and Nursery Road, on the North side of Normans Road is currently occupied, and will be vacated prior to the commencement of the Project.

Vacant land on the south side of Normans Road, immediately to the south of the low grade stockpile is apparently accessible by road as judged from aerial photographs. This section of Normans Road, west of Nursery Road, is controlled by Treasury Metals, and will result in this land being inaccessible for the life of the Project.

Forty-four individual noise-sensitive receptors were identified within the LSA. Where the surface mining rights have been secured by Treasury Metals, land use was assumed not to be noise-sensitive, and no receptors were identified. All other vacant lands in the vicinity of the Project that were found to be inaccessible (except by a rough cut-in through the forest) were not considered as receptors. Forty-two of the receptors were identified as houses. One was identified as the campground at Aaron Provincial Park. One receptor is a trailer located on otherwise vacant land. There are no receptors identified roughly within 2 km to the north or 8 km to the east. Access is limited, and Treasury Metals has exploration claims to the majority of the land in those directions. The location of the 44 sensitive noise receptors considered in the noise assessment are shown on Figure 6.1.4.3-2.

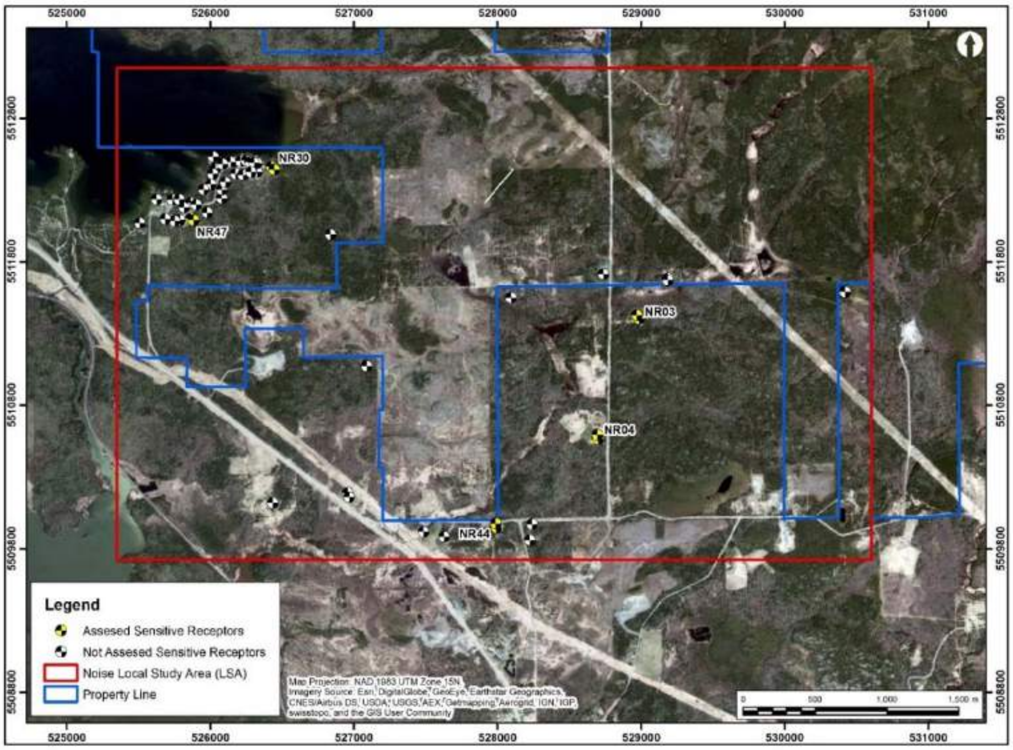


Figure 6.1.4.3-2: Location of Sensitive Noise Receptors

Since noise effects decrease with distance from the source, the nearest receptors to the Project are considered the worst-case, and are evaluated explicitly. Other receptors are not evaluated explicitly, but effects would be comparable to, or less than those for the worst-case receptors. None of these worst-case noise receptors were specifically identified as being Aboriginal receptors. However, any of these locations could be Aboriginal receptors. If the closest Aboriginal receptor is further from the Project than these worst case receptors then the resulting noise effects would be less than experienced at the worst case receptors.

Areas and land uses that do not meet the definitions provided by MOECC were not explicitly evaluated as part of the noise assessment. However, predicted noise levels have been used elsewhere in this report to determine the potential effects of noise from the Project on other receivers, such as wildlife (Section 6.12) and Aboriginal people practicing traditional uses of the land (Section 6.21).

The following questions, raised as part of the Round 1 IRs, referred to the noise study areas used in the EIS:

- TMI_183-AE(1)-21: Study area definitions;
- TMI_188-AE(1)-26: Receptors for traditional land uses;
- TMI_194-HE(1)-01: Identification of Aboriginal receptors;
- TMI_466-AC(1)-140: Extent of baseline noise measurements; and
- TMI_715-PC(1)-30: Consideration of a specific residence as a receptor.

6.1.4.4 Light

For the light assessment, an LSA extending 1 km from the Project property boundaries was identified. The reason for selecting this LSA was that light effects beyond 1 km are typically comparable to general lighting (Section 5.3.2.1 of the revised EIS). In addition to the LSA, the light assessment also focussed on specific receptor locations. A total of 12 receptor locations were identified for use in the light assessment, and were used in the collection of baseline light conditions against which the light effects of the Project were compared. The location of the receptors used for evaluating light, and the portions of the light LSA near where receptors were identified was shown in Figure 2 of Appendix I-1 to the revised EIS, and is reproduced as Figure 6.1.4.4-1.

Figure 6.1.4.4-1: Location of Light Receptors and the Light LSA

It should be noted that receptors R1 and R2 are located within the operations area for the Project, and would not represent light receptors once construction activities commence. Receptor R3 is a residence on Tree Nursery Road. Receptors R4 through R8 and R12 are neighbouring residences or cottages within 1 km of the property boundary on the shoreline of Thunder Lake. Receptors R9 through R11 are the representative receptors for clusters of cottages located on the far (west) shoreline of Thunder Lake from the Project Site, and were grouped for reasons of sharing similar viewscapes and topographic features.

6.1.4.5 Air Quality

The Local Study Area (LSA) for air quality was chosen to enclose the dispersion modelling domain used for evaluating air quality effects associated with the Project. The LSA for air quality was a rectangular area 20 km by 20 km generally centred on the main mine features (e.g., open pit mine, mill, underground vent raise). The section for this size for the LSA was based on the understanding that air quality effects from a Project would be indistinguishable from background air quality at a distance of 10 km (response to TMI_174-AE(1)-12). The LSA for air quality is shown in Figure 6.1.4.5-1.

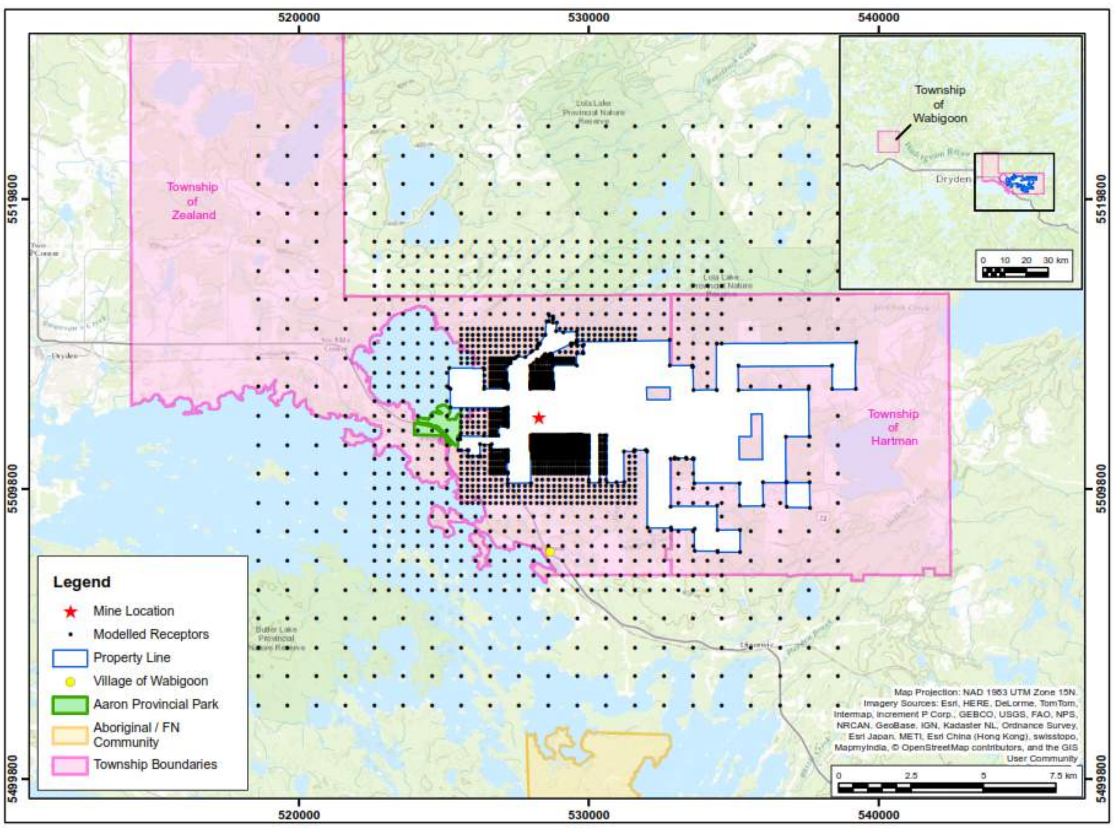


Figure 6.1.4.5-1: Air Quality LSA

The figure illustrates the area of air modelling coverage, which responds with the LSA, showing the gridded receptor locations where air quality predictions were made. The area of modelling coverage was designed to meet the requirements outlined in Section 14 of the Ontario air regulations (O.Reg. 419/05). The receptor grid, which provides suitable receptor coverage for this assessment, includes a multi-tiered receptor grid consistent with the Ontario Air Dispersion Modelling Guidelines (MOECC 2009b). In accordance with the Ontario guidance (MOECC 2009a), modelling receptors are not placed within the property boundary, which is also shown on Figure 6.1.4.5-1. The highest predicted concentrations at the property boundary are referred to as Maximum Point of Impingement (MPOI) predictions. This is because the concentrations at the property line will be higher than concentrations at greater distances from the Project.

The highest predicted concentrations at the property boundary are referred to as Maximum Point of Impingement (MPOI) predictions. This is because the concentrations at the property line will be higher than concentrations at greater distances from the Project. During the site preparation and construction, operations, closure, and portions of the post-closure phases, access to the active Project areas will be restricted for safety and security reasons. The active Project areas correspond to the property boundary in the areas with the most densely spaced receptors shown in Figure 6.1.4.5-1. Therefore, the MPOI concentrations predicted in the air quality assessment represent the highest concentrations that members of the public could be exposed to during the life of the Project. Treasury Metals recognizes Aboriginal rights to conduct traditional land uses, such as gathering and hunting, on Crown lands not occupied by the Project. Such locations would be further from the sources of air emissions, and thus would experience lower air concentrations than the MPOI predictions.

The air quality assessment was completed at receptors across the LSA (Figure 6.1.4.5-1), which cover most of the Township of Hartman, portions of the Township of Zealand, Aaron Provincial Park and the Village of Wabigoon. However, the maximum predicted concentrations at 44 sensitive receptors represent the highest concentrations at any “community-oriented locations” (CCME 2000) and the maximum concentrations predicted at the property line represent the highest concentrations beyond the active mining area. Predicted concentrations and resulting effects at more distant receptor locations (e.g., the Village of Wabigoon) would be lower than the maximum values presented in the assessment. Additionally, the town of Dryden is located approximately 15 km west of the Project, beyond the LSA. At those distances the predicted effects of the Project would not be distinguishable from background values.

In addition to the gridded receptors, 44 sensitive receptors were identified in the LSA. These sensitive receptors represent the closest community-oriented locations to the air emission sources, and include: a campground within Aaron Provincial Park; a trailer on otherwise vacant land; and 42 residences, mostly in the developments along the shores of Thunder Lake. Sensitive receptor locations, from an air quality perspective, were defined based on any inhabited location that would be used for residential or other purposes. This is consistent with the authors of the Canada-Wide Standards acknowledge that achievement of the standards were to be based on “community-oriented locations” (CCME 2000), with an emphasis on areas “where people live, work and play” (CCME 2000). For the purpose of the air quality assessment, the definition of sensitive receptors is appropriate when comparing predictions to criteria, as described by the CCME (2000). The locations of these sensitive receptors are illustrated on Figure 6.1.4.5-2.

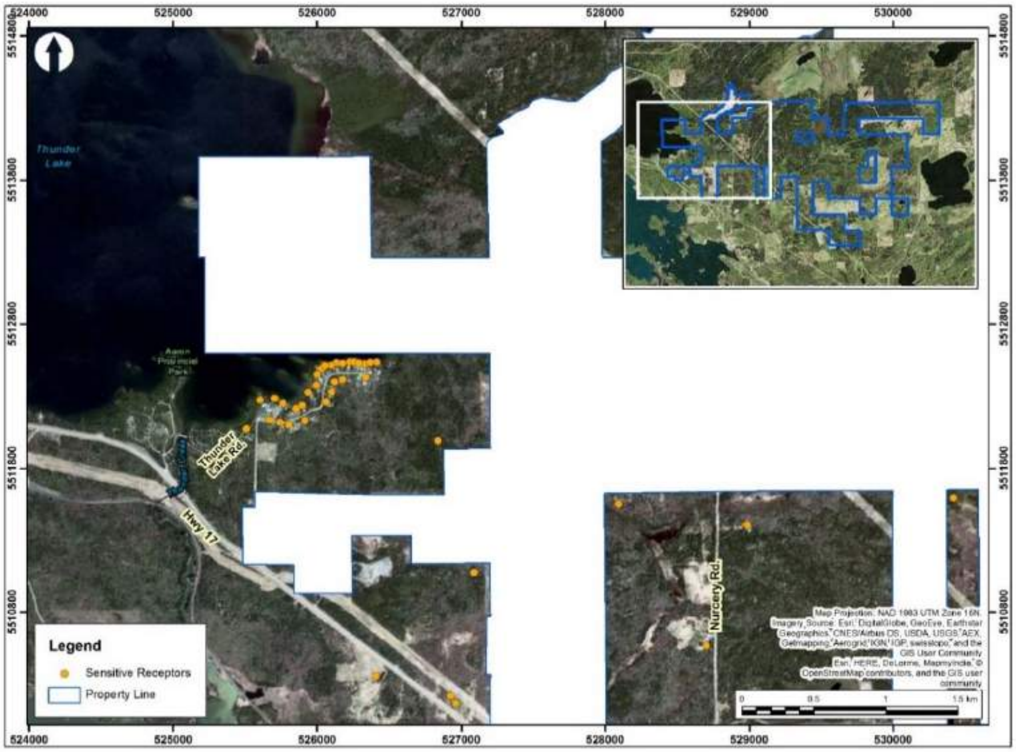


Figure 6.1.4.5-2: Location of Sensitive Air Receptors

Although the effects of the Project on air quality would be indistinguishable from background levels at distances of 10 km (Appendix J-2: Section 1.4), a larger Regional Study Area (RSA) is used when describing the existing air quality conditions in the region. Specifically, background air quality concentrations were derived from ambient air monitoring data from the MOE monitoring stations in Thunder Bay (Section 5.2.1). In addition, meteorological data from the stations at International Falls and Thunder Bay were used in the dispersion modelling (Appendix J-2: Section 3.2; Appendix J-2: Section 3.5.4). The resulting RSA, and the relative location of these stations to the Project is shown on Figure 6.1.4.5-3.

The following questions, raised as part of the Round 1 IRs, specifically asked about the study areas and receptors used for assessing air quality:

- TMI_172-AE(1)-10: Identification of sensitive receptors;
- TMI_174-AE(1)-12: City of Dryden and Village of Wabigoon as receptors;
- TMI_1941-HE(1)-01: Aboriginal receptors;
- TMI_339-AC(1)-13: Nearby residents and the Village of Wabigoon;

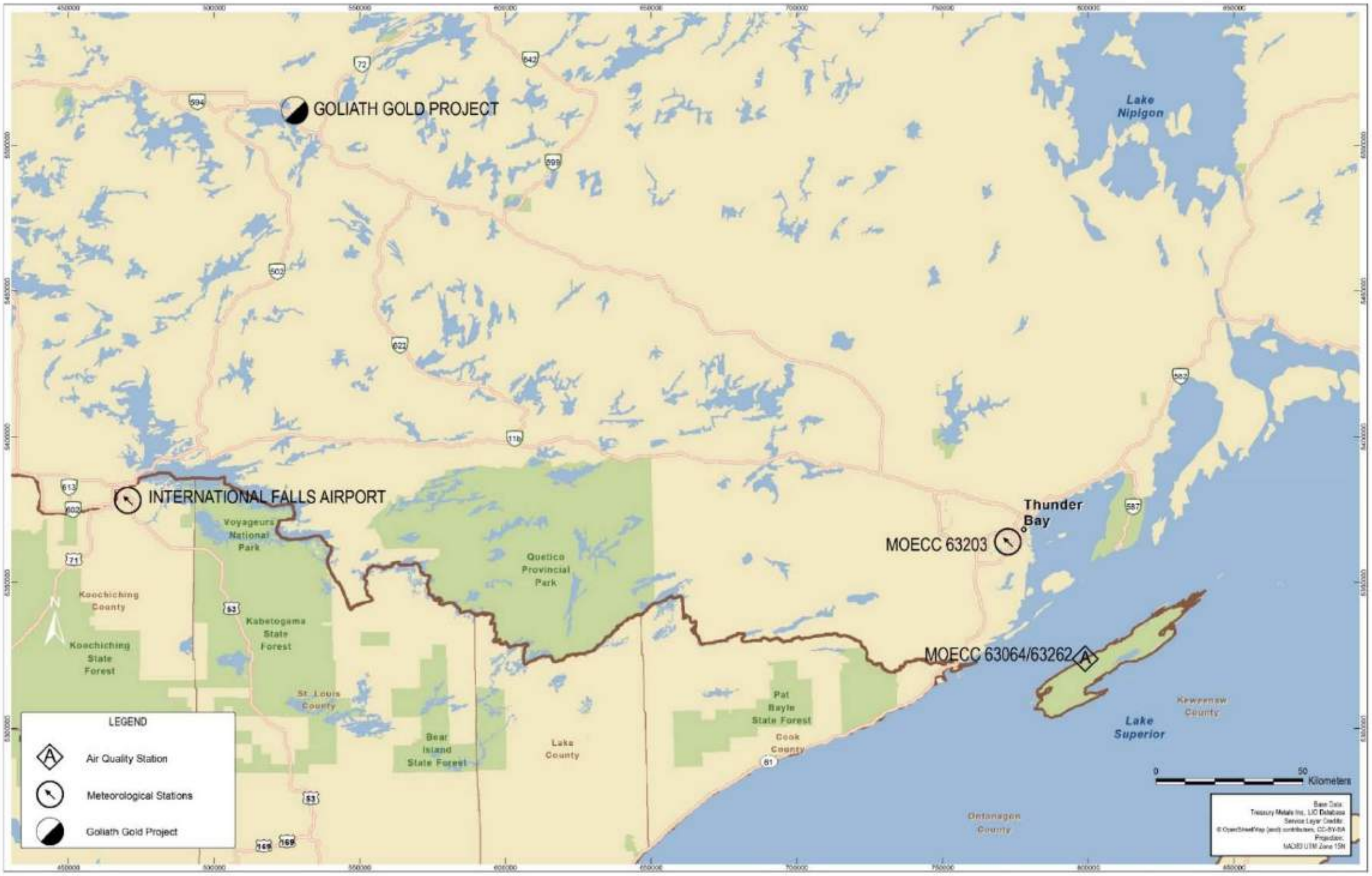


Figure 6.1.4.5-3: Air Quality RSA

- TMI_470-AC(1)-144: Size of local study area;
- TMI_539-AC(1)-213: Definition of spatial boundaries; and
- TMI_597-AC(1)-271: Receptors for traditional uses of the land.

6.1.4.6 Climate

When considering the potential effects of the Project with respect to climate, the study areas need to relate to the potential effects of the Project and the VCs used to describe those effects (i.e., “Project GHG emissions”, “changes in climate due to the Project”). For the Project GHG emissions VC, the study areas would need to consider the scope of the management initiatives related to GHG emissions (i.e., LSA: provincial, RSA: national). For changes on climate due to the Project, the scale would need to be global, as the contribution of GHG emissions from the Project would need to be put into the perspective of the emissions driving the predicted changes in climate.

6.1.4.7 Surface Water Quality

The Local Study Area (LSA) for surface water quality was selected to include those watercourses and catchment areas that could be directly affected by Project activities. Specifically, the LSA includes the following catchment areas: Thunder Lake Tributary 2 and Tributary 3, Hoffstrom’s Bay Tributary, Little Creek, and Blackwater Creek. The reasons for including these catchment areas are as follows:

- Thunder Lake Tributary 2 and Tributary 3: It is anticipated there will be surface water runoff or seepage during the site preparation and construction, operations, or closure phase, however but there will be water withdrawals during operations which will affect the flow. Also, seepage from the TSF during the post-closure phase may reach Thunder Lake Tributary 3.
- Hoffstrom’s Bay Tributary: During the post-closure phase, seepage from the TSF may reach this watercourse.
- Little Creek: It is anticipated there will be no discharges to this creek (i.e., surface water runoff or seepage) during the life of the Project but there will be a reduction in catchment area as a result of the Project footprint and therefore a reduction of flow.
- Blackwater Creek: During the operations phase, surface water runoff from the Project site will be treated and discharged to Blackwater Creek. Additionally, seepage from the TSF during the post-closure phase may also reach this watercourse.

In addition to the direct effects, there is the possibility that changes in surface water quality within the LSA could have effects on downstream waterbodies. To capture this, a regional study area (RSA) has been selected to include the downstream waterbodies of Thunder Lake and Wabigoon Lake. Additionally, the RSA includes baseline surface water quality stations that were located beyond the areas likely to be directly affected by the Project activities (i.e., SW1 located in Hughes

Creek and SW3 in McHughes Creek). The LSA and RSA for surface water quality is shown in Figure 6.1.4.7-1.

As shown in Figure 6.1.4.7-1, the current RSA used for assessing the effects of the Project on surface water quality includes all of Wabigoon Lake, all of Thunder Lake, as well as the watersheds for those streams potentially affected by the Project.

In determining the potential surface water quality effects from the Project, it was necessary to identify locations for which surface water quality in the receiving environment was evaluated. Surface water quality was evaluated at nine locations in the surrounding waterbodies of the Project site. The location of all the nodes for which receiver surface water quality has been evaluated for is shown on Figure 6.1.4.7-2. These nine locations (also referred to as “nodes” in the model) are listed below (in order of upstream to downstream location) along with a brief description for each node:

- **Node TL1**: Thunder Lake Tributary 2, downstream of irrigation pond;
- **Node TL2**: Thunder Lake Tributary 3, downstream of the Tree Nursery Ponds;
- **Node TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **Node HB1**: Hoffstrom’s Bay Tributary at Thunder Lake;
- **Node LC1**: Little Creek at Thunder Lake;
- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location;
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake;
- **Node TL**: Thunder Lake; and
- **Node WL**: Wabigoon Lake.

Of these nodes, the first seven are located within the LSA, while Thunder Lake (TL) and Wabigoon Lake (WL) are within the RSA for surface water quality. Five of the stream nodes (i.e., HB1, TL1, TL2, TL3 and LC1) are within the Thunder Lake watershed area, along with the node for Thunder Lake (TL). The remaining two stream are located within the Blackwater Creek sub-watershed, which drains into Wabigoon Lake. Ultimately, all of the nodes evaluated, including Wabigoon Lake (WL) fall within the Wabigoon Lake watershed area.

Only the following question from the Round 1 information requests specifically commented on the study areas for surface water quality:

- TMI_686-AC(1)-358: RSA must be revised as current RSA only includes a small portion of Wabigoon Lake.

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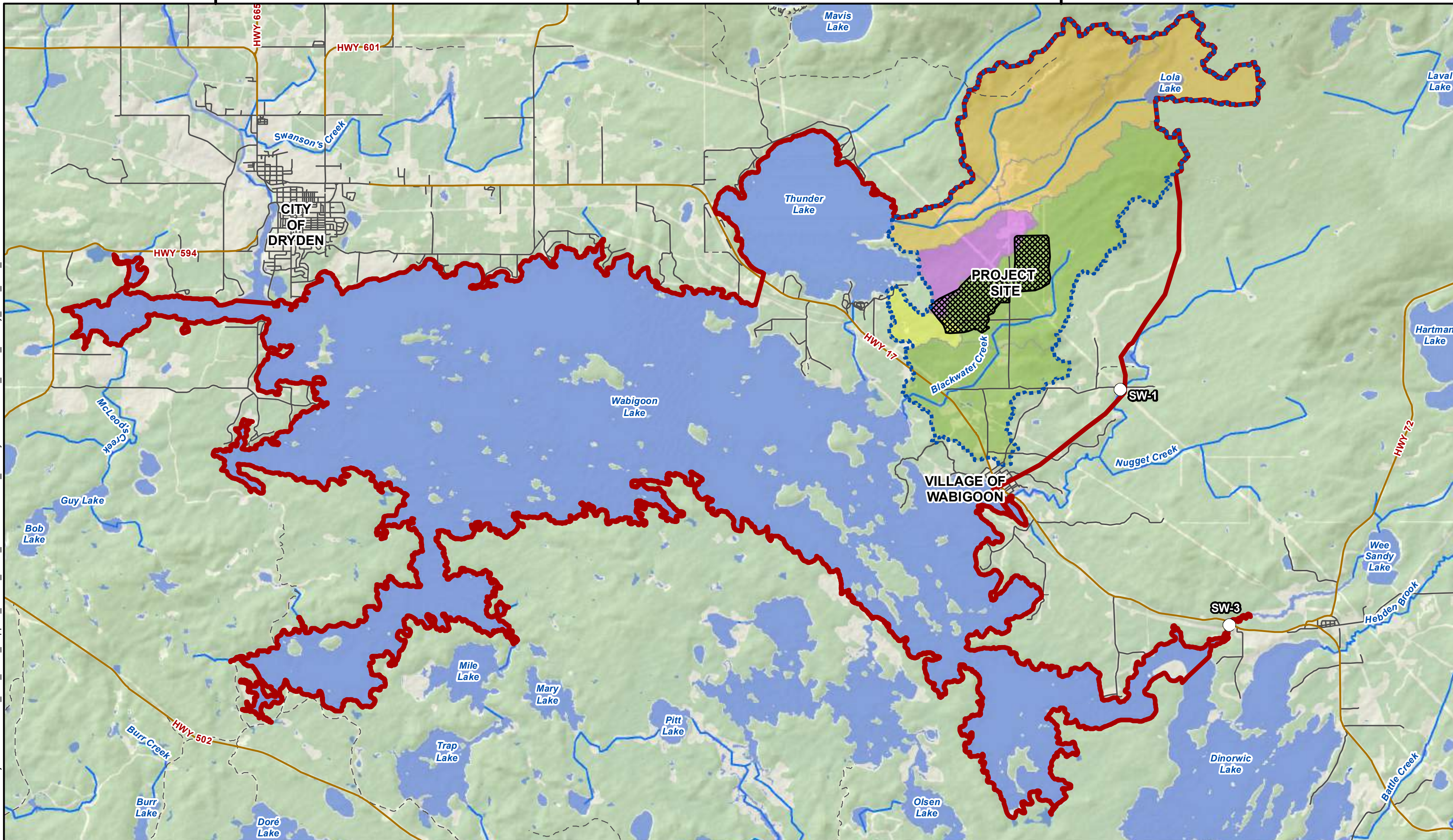

LEGEND

- Local Study Area (LSA)
- Regional Study Area (RSA)
- Operations Area

Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

- Baseline Surface Water Quality Sampling Locations
- Highway
- Local Road
- Resource / Recreation

0 5 10 15 20 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

Datum & Projection:
NAD 1983 UTM Zone 15N

N S E W

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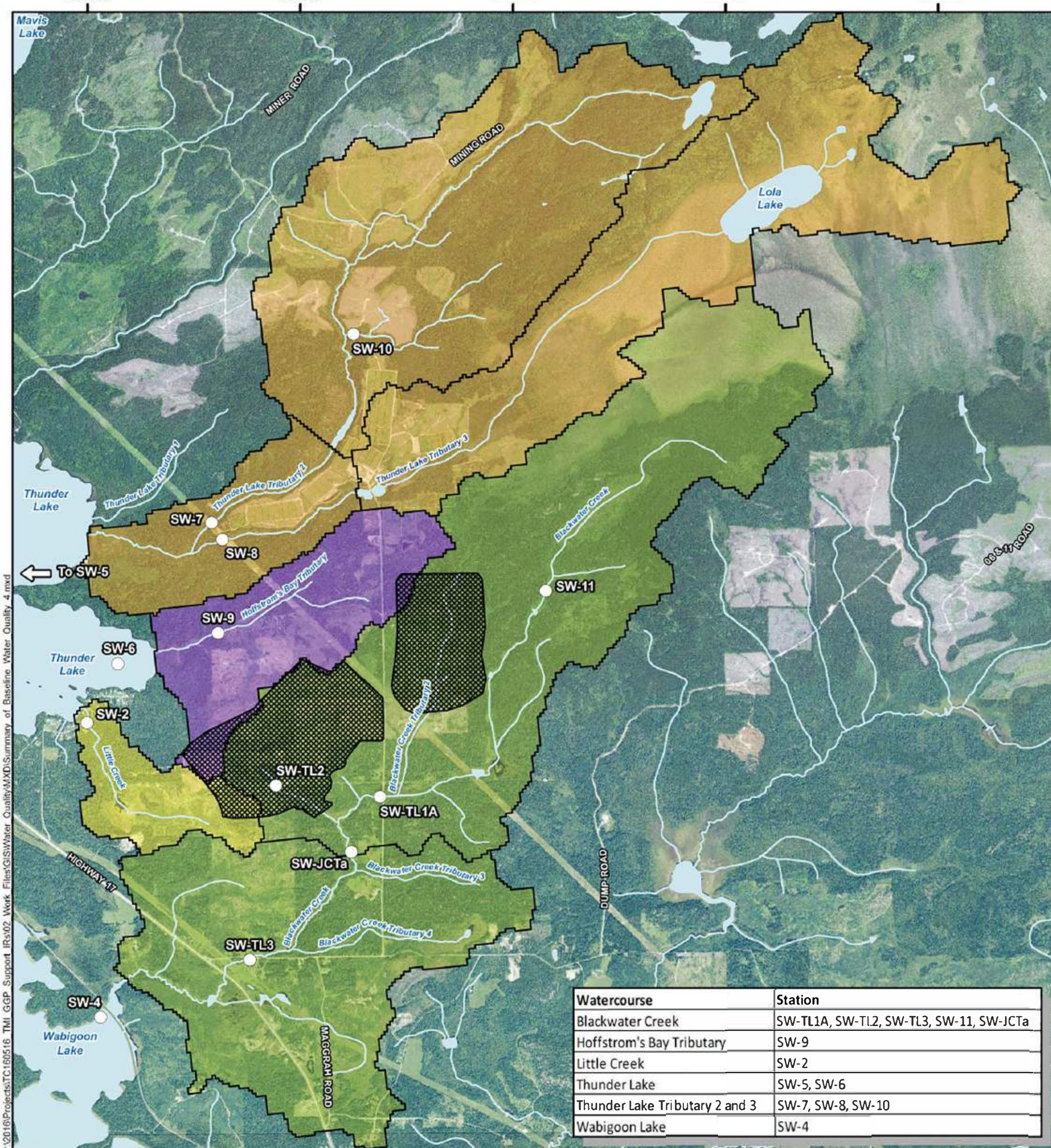
GOLIATH GOLD PROJECT

Surface Water Quality RSA and LSA

PROJECT N°: TC160516	FIGURE: 6.1.4.7-1
SCALE: 1:130,000	DATE: April 2018



Watercourse	Station
Blackwater Creek	SW-TL1A, SW-TL2, SW-TL3, SW-11, SW-JCTa
Hoffstrom's Bay Tributary	SW-9
Little Creek	SW-2
Thunder Lake	SW-5, SW-6
Thunder Lake Tributary 2 and 3	SW-7, SW-8, SW-10
Wabigoon Lake	SW-4

LEGEND

- Baseline Surface Water Quality Sampling Locations
- Operations Area

Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.
- Imagery extracted from Agriculture Information Atlas, OMAFRA.
- Baseline locations from Appendix P of the EIS.

Datum: NAD83
Projection: UTM Zone 15N

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Surface Water Quality Modelling Nodes

PROJECT N°

SCALE: 1:50,000

FIGURE: 6.1.4.7-2

DATE: April 2018

6.1.4.8 Surface Water Quantity

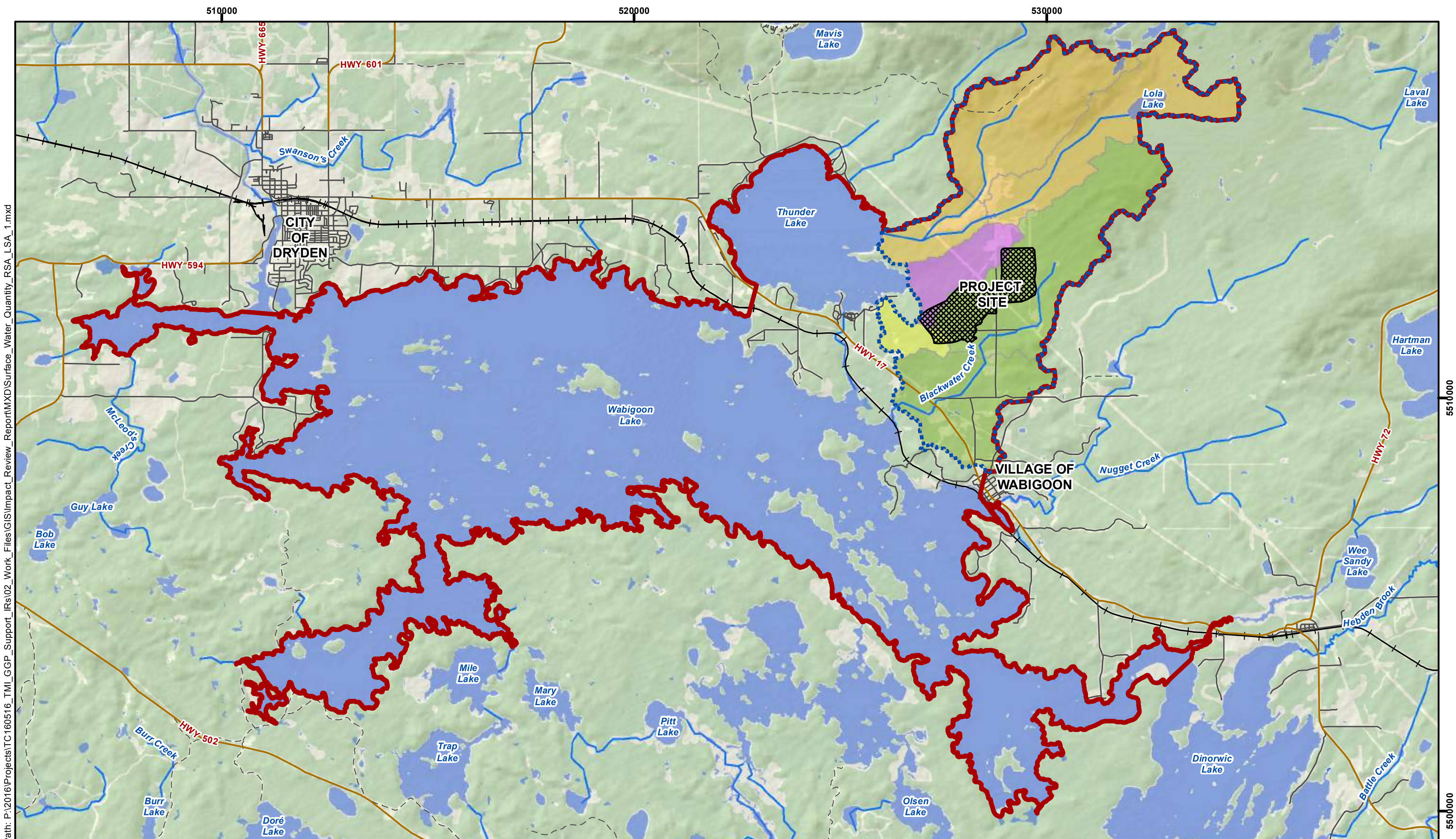
The Project is located east of Thunder Lake and north-east of Wabigoon Lake. The regional study area (RSA) for the Project comprises watersheds which drain to either Thunder Lake or Wabigoon Lake. Thunder Lake ultimately discharges to Wabigoon Lake via Thunder Creek. The RSA, which is illustrated in Figure 6.1.4.8-1, incorporates those areas where the potential effects of the Project on surface water hydrology are anticipated.

On a local scale, the sub-watersheds surrounding the Project Site include Thunder Lake Tributaries 2 and 3, Hoffstrom's Bay Tributary, and Little Creek in the Thunder Lake watershed, and Blackwater Creek in the Wabigoon Lake watershed are considered to comprise the local study are (LSA), which is illustrated in Figure 6.1.4.9-2. These are the areas where the Project water management activities are likely to affect surface water hydrology (quantity). Within the LSA, surface water quantity predictions were made at the following seven locations (illustrated in Figure 6.1.4.9-2), which also correspond to the stream-based nodes discussed in the surface water quality (Section 6.1.4.9):

- **Node TL1**: Thunder Lake Tributary 2, downstream of irrigation pond;
- **Node TL2**: Thunder Lake Tributary 3, downstream of the Tree Nursery Ponds;
- **Node TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **Node HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **Node LC1**: Little Creek at Thunder Lake;
- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake;

6.1.4.9 Groundwater Quality

The LSA for the groundwater quality component corresponds with the hydrogeological modelling domain described in Appendix M to the revised EIS. The LSA enclosed 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 the LSA is shown on Figure 6.1.4.9-1. No RSA was used for groundwater data as the effects would be restricted to the LSA used for the modelling.



LEGEND

- Local Study Area (LSA)
- Regional Study Area (RSA)
- Operations Area

Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

- Highway
- Local Road
- Resource / Recreation
- Railway

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

Datum & Projection:
NAD 1983 UTM Zone 15N

0 5 10 15 20
Kilometres

N W E S

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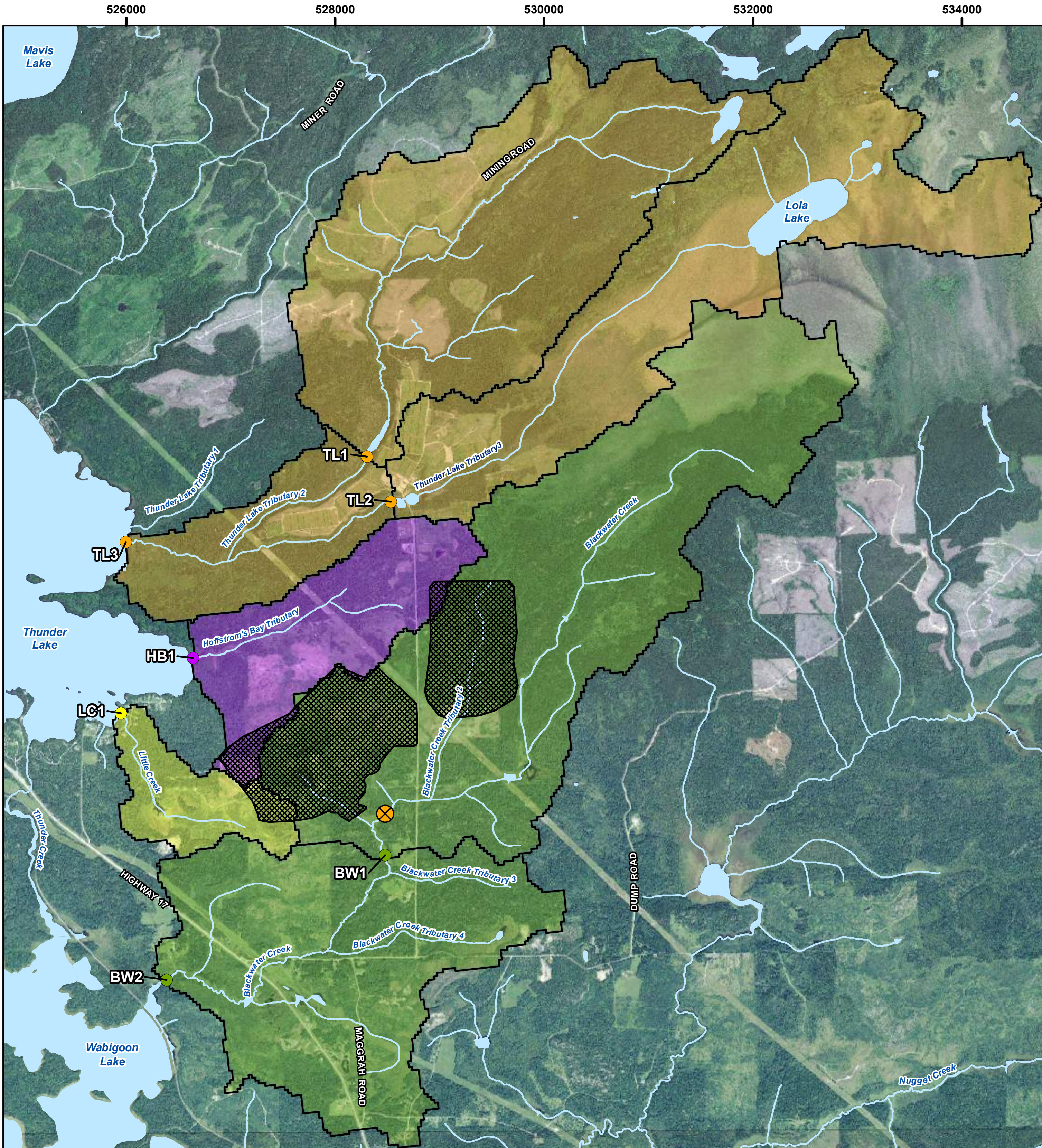
amec foster wheeler

GOLIATH GOLD PROJECT

Surface Water Quantity Study Areas

PROJECT N°: TC160516	FIGURE: 6.1.4.8-1
SCALE: 1:130,000	DATE: April 2018



LEGEND

Operations Area — Effluent Discharge Location

Sub-Watershed Outlet Locations	Sub-Watershed
Blackwater Creek	Blackwater Creek
Hoffstrom's Bay Tributary	Hoffstrom's Bay Tributary
Little Creek	Little Creek
Thunder Lake Tributary 2	Thunder Lake Tributary 2 and 3

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

Datum: NAD83
Projection: UTM Zone 15N

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

N W E S

TREASURY METALS Inc.

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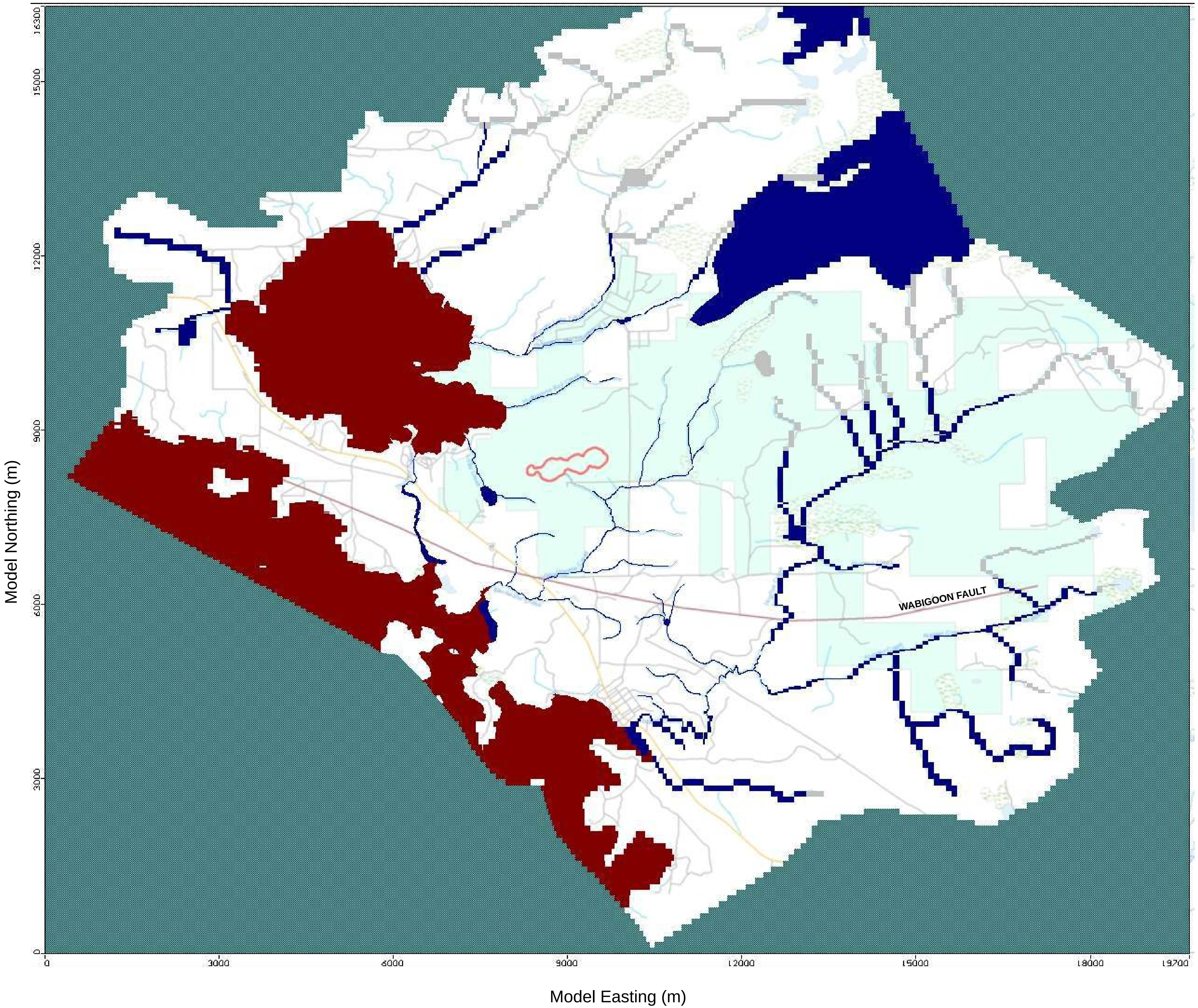
GOLIATH GOLD PROJECT

Surface Water Quantity Modelling Nodes

PROJECT N^{o}: TC160516	FIGURE: 6.1.4.8-2
SCALE: 1:50,000	DATE: April 2018



GOLIATH GOLD PROJECT

Figure 6.1.4.9-1

Hydrogeology LSA and RSA

Legend

- Constant Head Nodes
- River Nodes
- Drain Nodes

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project #: TC160516
Date: April 2018
Client: Treasury Metals Inc.

UTM NAD 83
Zone 15N

6.1.4.10 Groundwater Quantity

As described in Section 6.1.4.9, the LSA for groundwater corresponds to the modelling domain used for the hydrogeological modelling presented in Appendix M to the EIS. The same LSA applies for both groundwater quantity and quality. No RSA was used for groundwater as the expected effects of the Project are restricted to the LSA.

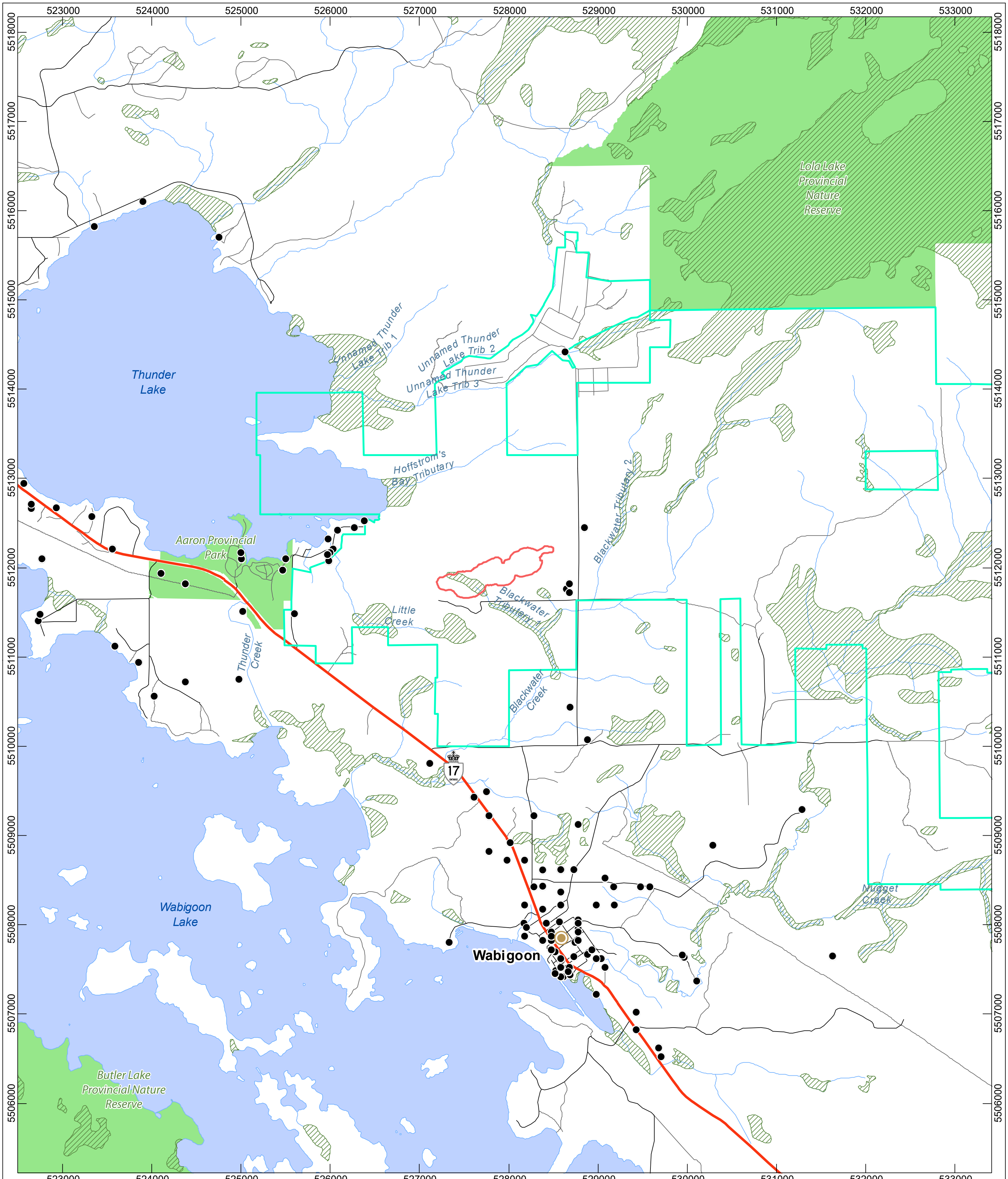
In addition to the LSA used for groundwater quality and quantity are a number of discrete receptor locations that correspond with private water wells. The location of the wells within the hydrogeological LSA are shown on Figure 6.1.4.10-1. These wells are identified by the Ontario Ministry of Environment and Climate Change (MOECC), however, the MOECC does not provide details on the owners of the wells, or whether the wells represent drinking water sources for either Aboriginal peoples or non-Aboriginals (response to TMI_197-HE(1)-04).

6.1.4.11 Wildlife and Wildlife Habitat

For evaluating the potential effects of the project on wildlife and wildlife habitat, a local study area (LSA) was defined as the lands and waters of the watersheds in which the proposed development footprint. The wildlife RSA is defined by the Wabigoon Ecoregion. An Ontario Ecoregion is defined as “A unique area of land and water nested within an ecozone that is defined by a characteristic range and pattern in climatic variables, including temperature, precipitation, and humidity. The climate within an ecoregion has a profound influence on the vegetation types, substrate formation, and other ecosystem processes, and associated biota that live there.” (Crins 2009). The LSA and RSA used for evaluating the potential effects of the Project on wildlife and wildlife habitat are illustrated on Figure 6.1.4.11-1.

The following specific questions regarding the studies for wildlife and wildlife habitat were raised as part of the Round 1 information requests:

- TMI_12-AC(1)-03: study areas for SAR;
- TMI_144-WL(1)-01: study areas for wildlife and wildlife habitat;
- TMI_145-WL(1)-02: study areas for wildlife and wildlife habitat;
- TMI_479-AC(1)-153: study areas for mammals;
- TMI_480-AC(1)-154: study areas for birds;
- TMI_481-AC(1)-155: study areas for significant wildlife habitat; and
- TMI_484-AC(1)-158: study areas for Species at Risk (SAR).



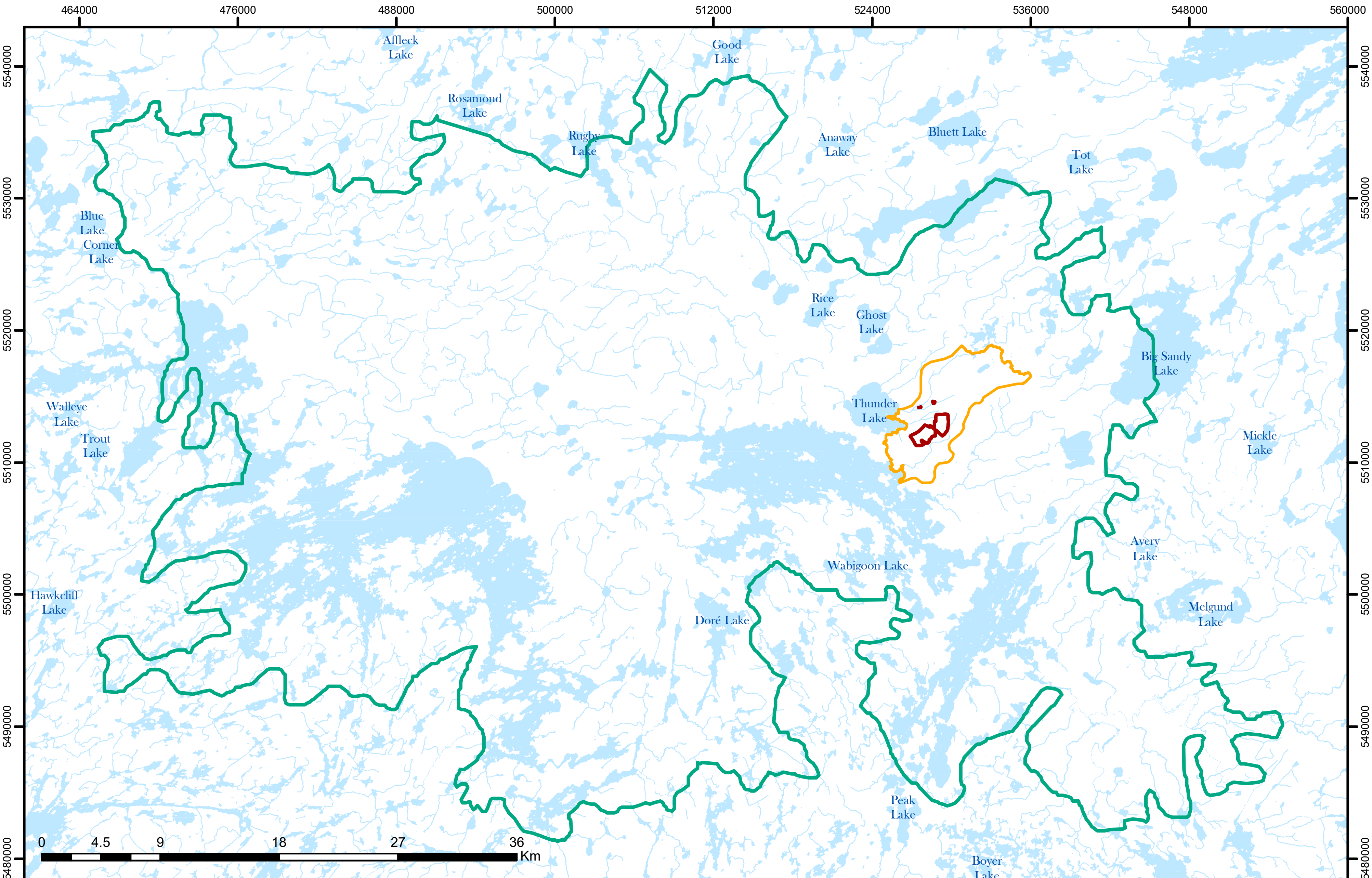
GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	SCALE: 55 000 TREASURY METALS INC.
PRIVATE WATER WELLS AND SURFACE WATER FEATURES	DESIGN: AT 06 FEB. 2014 GIS: AT 10 OCT. 2014 CHECK: AT 10 OCT. 2014
FIGURE 6.1.4.10-1 REV.00	

Populated Area
Private MOE Water Well
Proposed Open Pit Shell
Property Boundary
Wetland
Arterial Road
Highway
Local Road
Recreational Road
Waterbody
Provincial Park
Watercourse

N E S W

0 500 1,000 1,500
Meters

REFERENCE
Projection: NAD83 UTM Zone 15N
Base Data: OBM
Wells Provided by AMEC



Legend

- Development Footprint
- Local Study Area
- Regional Study Area

Figure 6.1.4.11-1
Wildlife and Wildlife Habitat Study Areas

1:391,728
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11

KBM RESOURCES GROUP

6.1.4.12 Migratory Birds

The inclusion of migratory birds as a distinct discipline in the revised EIS at the request of the Agency to facilitate their review process. Migratory birds uses the same study areas as were used for wildlife and wildlife habitat, as described in Section 6.1.4.11.

6.1.4.13 Fish and Fish Habitat

For fish and fish habitat, the Local Study Area (LSA) includes the watercourses where direct effects associated with the Project could potentially occur and the lake habitats in the immediate vicinity of the mouths of these creeks. The Project design has taken a watershed approach and the Project activities are now confined to the watersheds of Blackwater Creek and four tributaries to Thunder Lake. These include Hoffstrom’s Bay tributary, Little Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3. Thunder Lake Tributary 3 is the south branch of Thunder Lake Tributary 2, which drains from Lola Lake into Thunder Lake. Hughes Creek, which was included in the LSA in the original EIS, is no longer considered part of the LSA as no activities will take place in the watershed, and no effects are expected to occur. The Regional Study Area (RSA) for fish and fish habitat includes the LSA, as well as Wabigoon Lake and Thunder Lake to which the watercourse in the LSA are tributaries. The LSA and RSA for fish and fish habitat are shown on Figure 6.1.4.13-1.

The following specific questions regarding the study areas for fish and fish habitat were raised as part of the Round 1 information requests:

- TMI_129-FH(1)-20: LSA and RSA selection;
- TMI_141-FH(1)-20: study areas for fish and fish habitat; and
- TMI_472-AC(1)-146: study areas for fish and fish habitat.

6.1.4.14 Wetlands and Vegetation

For evaluating the potential effects of the Project on wetlands and vegetation, a local study area (LSA) was defined as the lands and waters of the watersheds in which the proposed development footprint is located. The wetlands and terrestrial vegetation LSA is the same as the LSA for wildlife and wildlife habitat (Section 6.1.4.12). A second LSA is used in wetlands and vegetation for evaluating the effects of the Project on wild rice. The wild rice LSA corresponds to the fisheries RSA described in Section 6.1.4-13. The wild rice LSA is shown on Figure 6.1.4.14-1. The RSA for wetlands and vegetation, along with the two LSAs are shown on Figure 6.1.4.14-2.

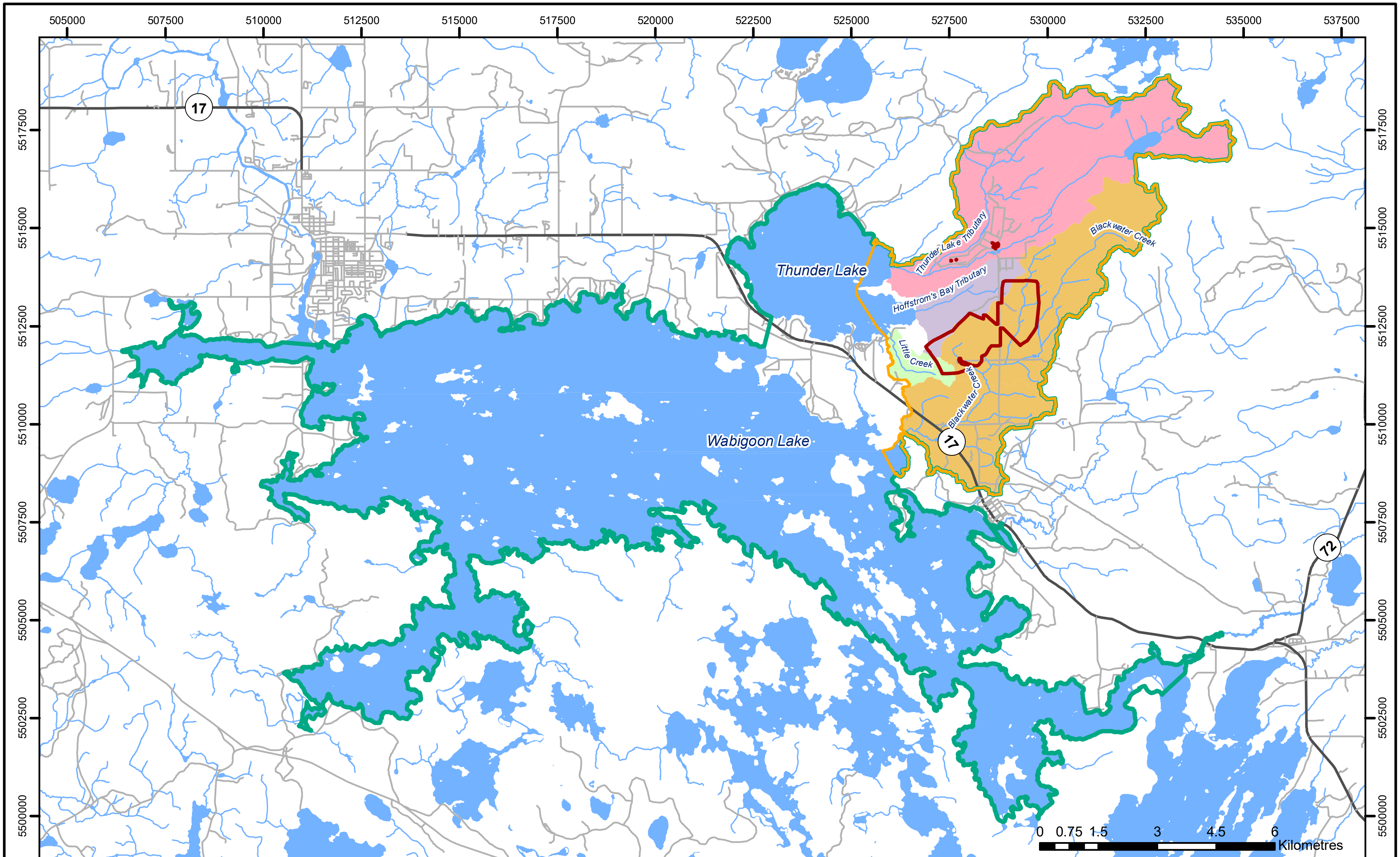


Figure 6.1.4.13-1
Fish and Fish Habitat Study Areas

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-12
SCALE: 1:130,589

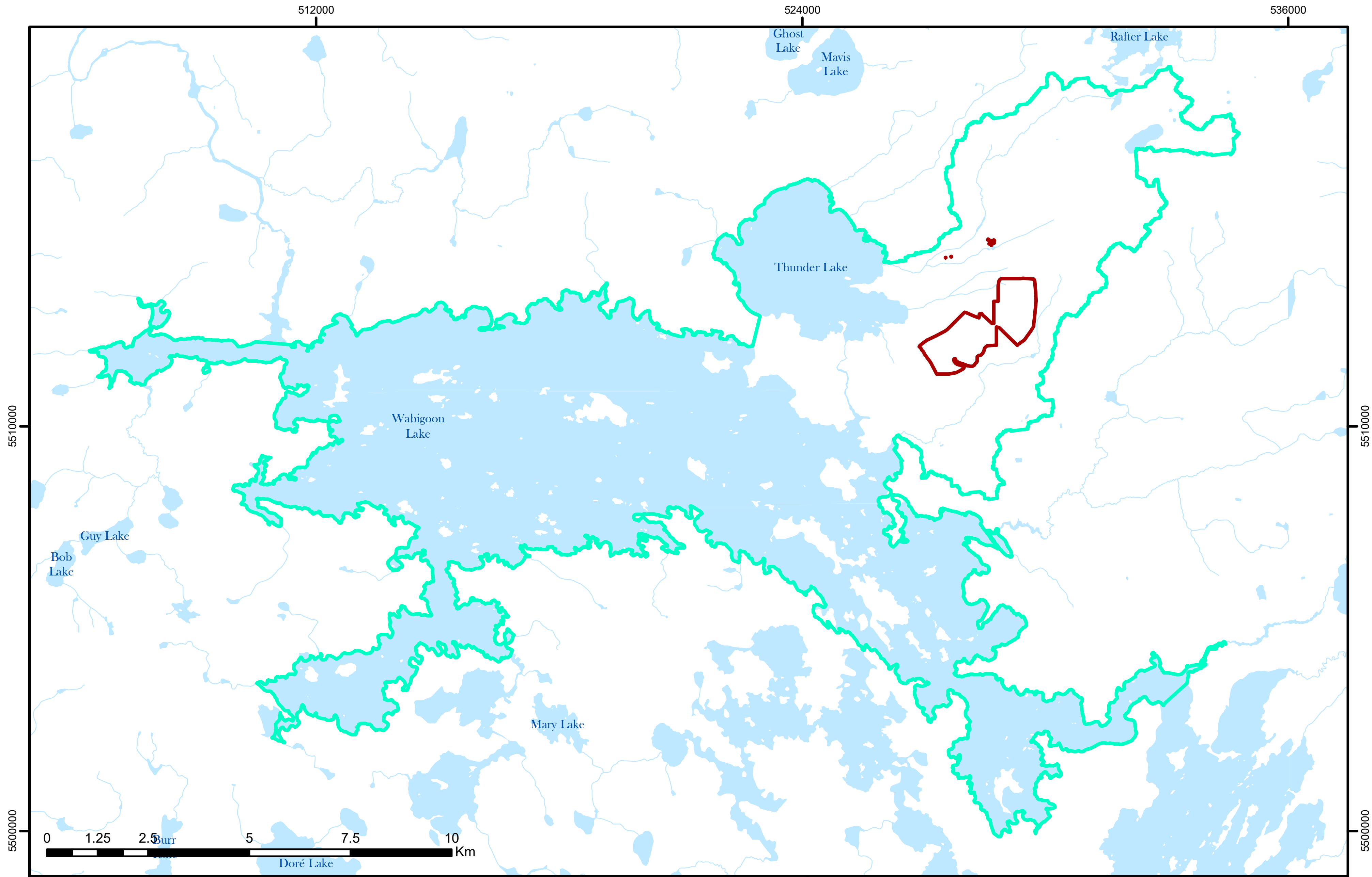
Legend

- Project Footprint
- Local Study Area
- Regional Study Area
- Road
- Highway
- Stream
- Waterbody

Watersheds

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

KBM RESOURCES GROUP



Legend

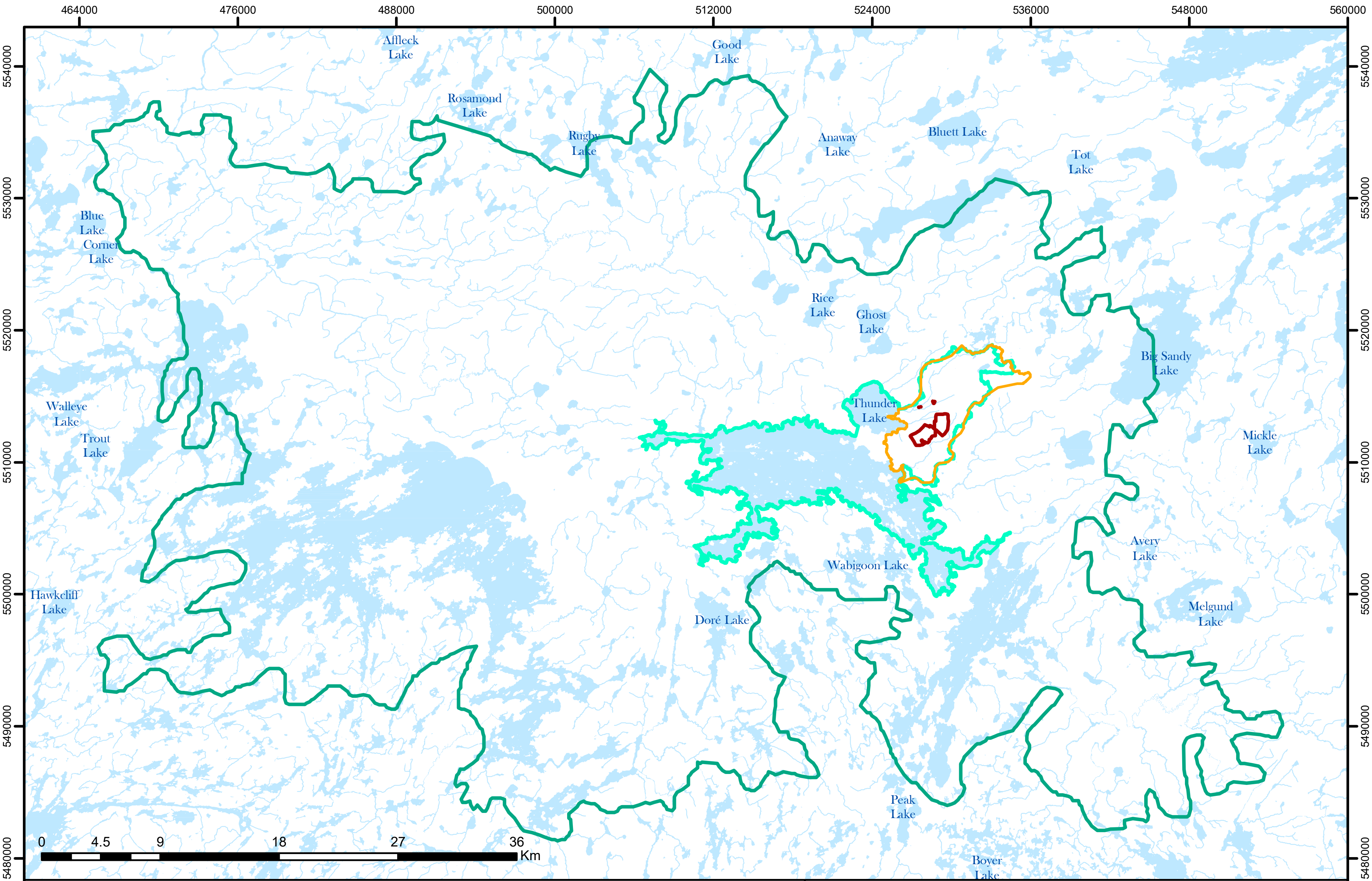
Development Footprint

Wild Rice Local Study Area

Figure 6.1.4.14-1
LSA for Wild Rice

1:127,189
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11

KBM RESOURCES GROUP



Legend

Development Footprint

Local Study Area

Regional Study Area

Wild Rice Local Study Area

Figure 6.1.4.14-2
Vegetation and Wetlands Study Areas

1:391,728
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11

KBM RESOURCES GROUP

The following specific questions regarding the study areas for wetlands and vegetation were raised as part of the Round 1 information requests:

- TMI_476-AC(1)-150: study areas for vegetation; and
- TMI_478-AC(1)-152: study areas for wetlands.

6.1.4.15 Land and Resource Use

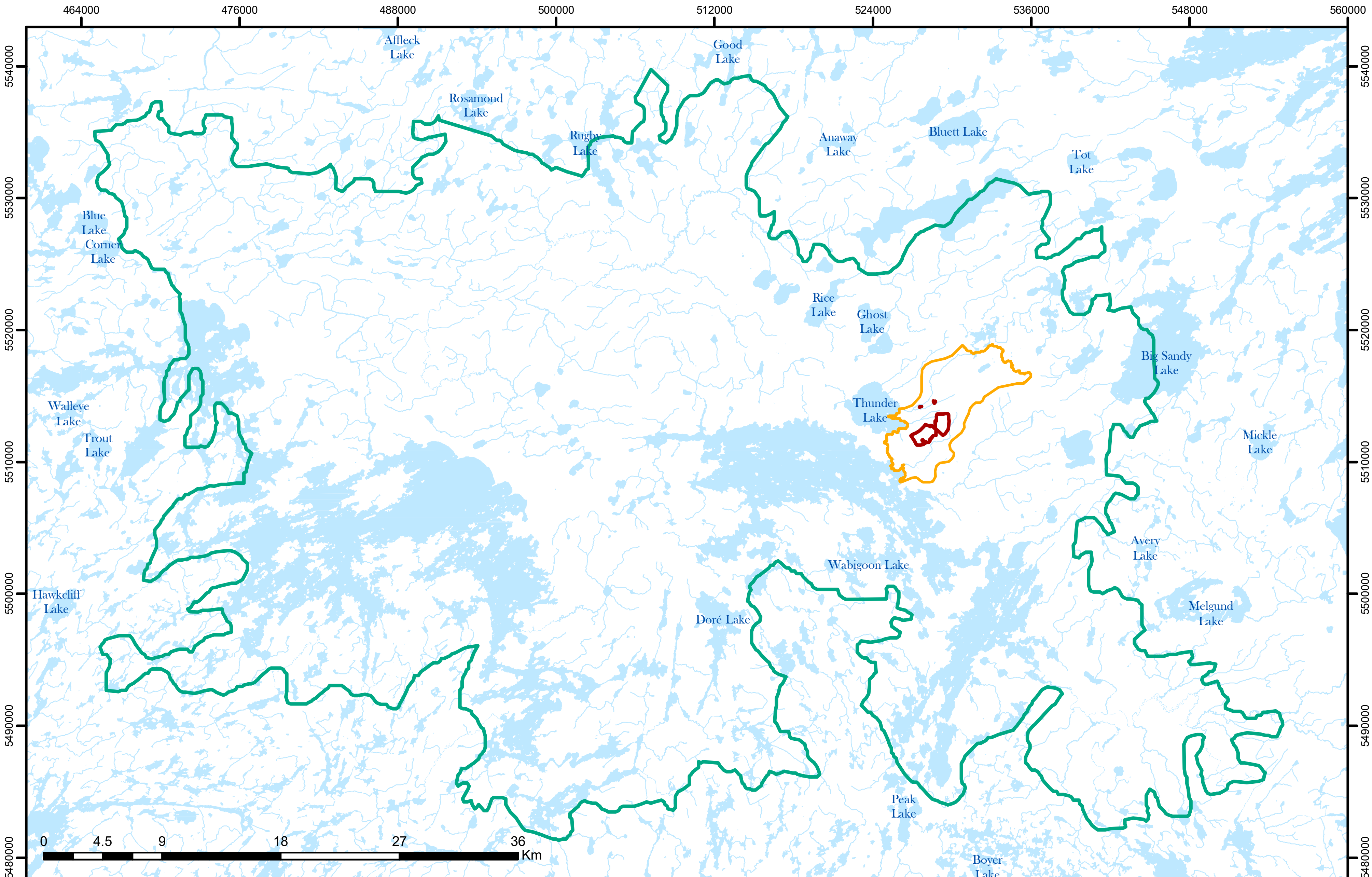
Depending on the type of land and resource use, the local and regional study areas for terrestrial or aquatic biology disciplines were used to set parameters for land and resource uses. For example, potential effects on recreational and commercial fishing are predicted in the regional study area (RSA) and local study area (LSA) for the aquatic biology disciplines, while the terrestrial biology RSA and LSA are used to predict the potential effects on recreational hunting.

The LSA and RSA for terrestrial-based land and resource uses is defined using the same study areas used for wildlife and wildlife habitat (Section 6.1.4.12) and wetlands and vegetation (6.1.4.15) disciplines. The LSA and RSA used for evaluating terrestrial land and resource use effects is illustrated on Figure 6.1.4.15-1.

The local study area for the aquatic-based land and resource uses (fishing and bait fish harvesting) includes areas where there is potential for measurable effects as a result of Project activities on waterbodies, as well as downstream waterbodies that may receive water discharged from the Project, or may be affected by watercourse realignments. The extent of the water bodies included in the assessment was based on the currently defined Project, the expected extents of potential changes to the aquatic ecosystems and the expected changes associated with the Project. The proposed fish and fish habitat LSA, which is defined in Section 6.1.4.13, includes those catchments directly affected by the Project through either discharges, alterations to flow or physical alterations. The aquatic LSA also includes portions of Thunder Lake and Wabigoon Lake at the mouths of the watercourses affected by the Project. The RSA for aquatics (Section 6.1.4.13) includes the remainder of both Thunder Lake and Wabigoon Lake, as well as being extended to the east to incorporate the baseline fisheries would Hughes Creek and McHughes Creek. The LSA and RSA used for the aquatic-based land and resource use is illustrated in Figure 6.1.4.15-2.

6.1.4.16 Social

For the assessment of potential Project-related social, economic and Aboriginal people effects, a single study area is appropriate. Distinguishing between a local study area (LSA) and a regional study area (RSA) is not practical for the assessment of socio-economic VCs. The socio-economic study area report includes a more complete list of communities and Aboriginal communities than was included in the original EIS. The Project and the major local population centres, Dryden (15 km from the Project) and Kenora (150 km from the Project) are within the Kenora District and the Kenora census district. The Kenora District covers an extensive territory from near the Canada – United States border in the south to James Bay in the north.



Legend

- Development Footprint
- Local Study Area
- Regional Study Area

Figure 6.1.4.15-1
Land and Resource Use (Terrestrial) Study Areas

1:391,728
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11

KBM RESOURCES GROUP

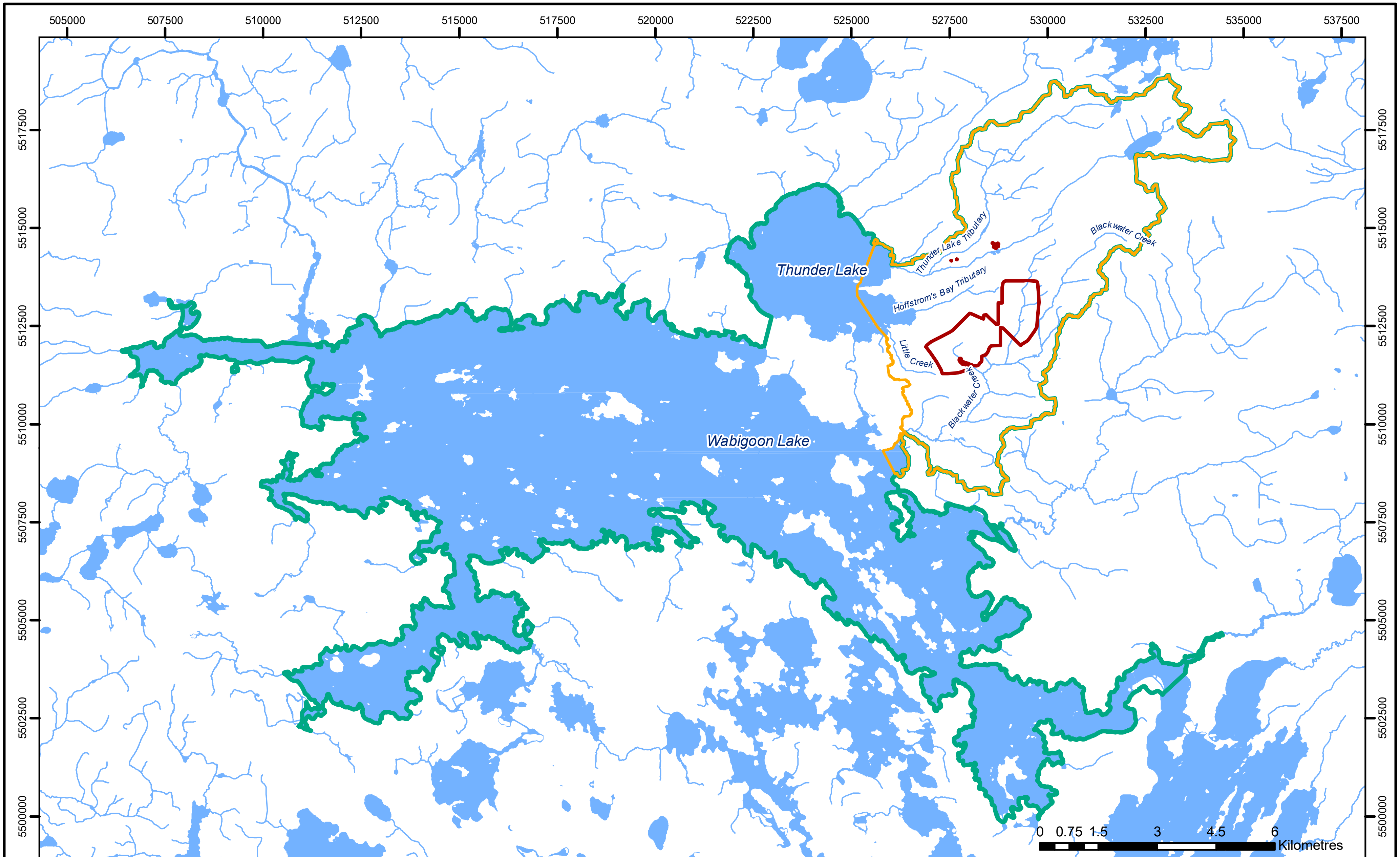


Figure 6.1.4.15-2
Land and Resources
(Aquatic) Study Areas

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11
SCALE: 1:130,589

Legend

- Project Footprint
- Stream
- Waterbody
- LSA Aquatic
- RSA Aquatic

KBM RESOURCES GROUP

The communities in the southernmost portion the District which could experience direct and indirect Project socio-economic effects and provide labour, goods and services to the Project, are identified in the list below. Effects may be most noticeable in the Dryden area, including the Village of Wabigoon, and in the nearby Aboriginal communities but may extend throughout the study area, including to Kenora which has a larger population and is relatively close to the Project site. A map of the socio-economic study area is presented in Figure 6.1.4.16-1.

The communities included in the socio-economic study area are:

- City of Dryden;
- City of Kenora;
- Municipality of Sioux Lookout;
- Municipality of Machin;
- Township of Ignace; and
- Village of Wabigoon.

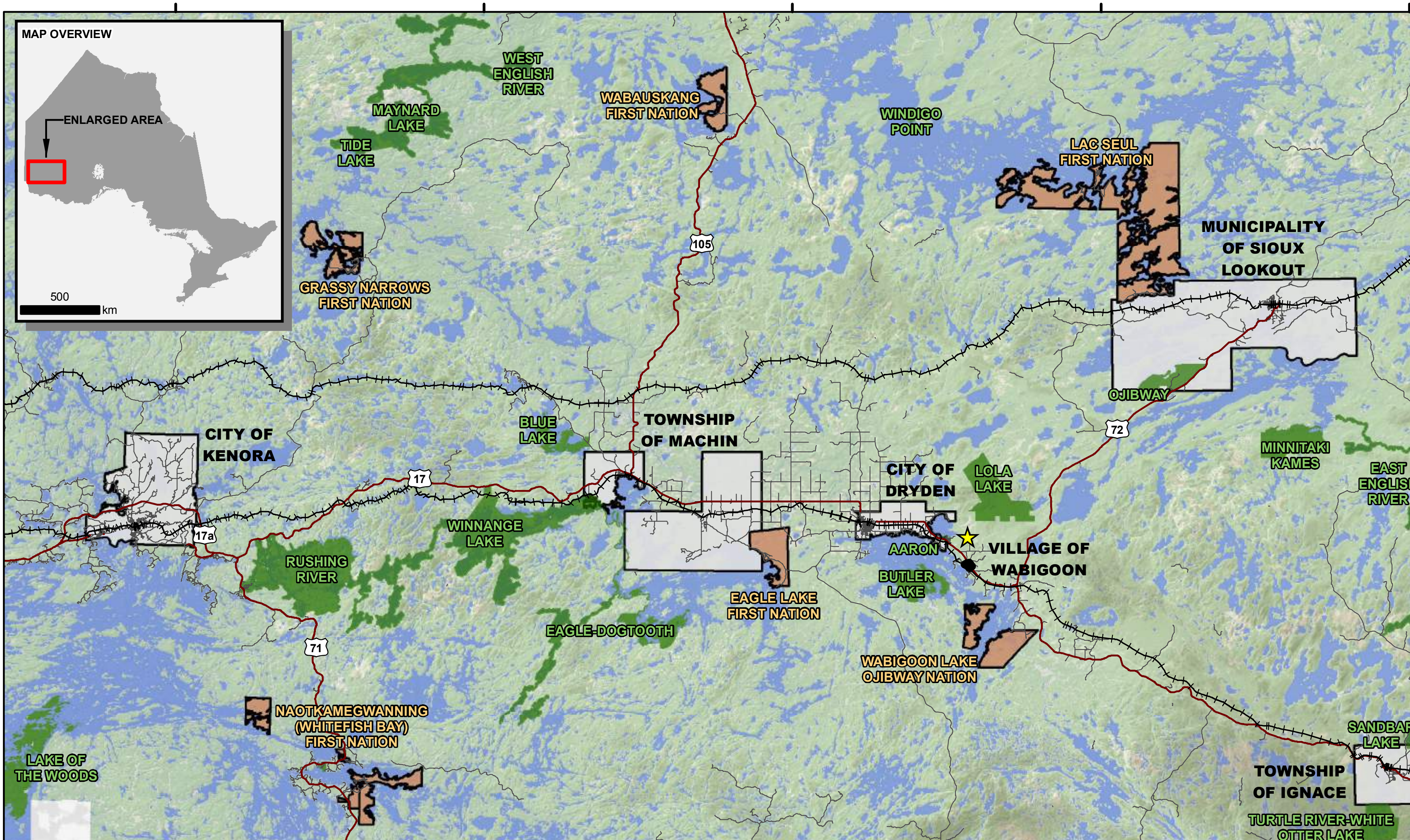
The study area also includes the following Aboriginal communities which were identified by the Canadian Environmental Assessment Agency and Ministry of Northern Development and Mines:

- Wabigoon Lake Ojibway Nation;
- Eagle Lake First Nation;
- Lac Seul First Nation;
- Naotkamegwanning (Whitefish Bay) First Nation;
- Wabauskang First Nation;
- Grassy Narrows (Asubpeeschoseewagong) First Nation; and
- Métis Nation of Ontario – Region 1.

It is anticipated that Project-related social effects will be most noticeable within the socio-economic study area communities considered to be within commuting distance from the Project site (estimated 100 km). Effects occurring beyond the study area could occur anywhere within the province of Ontario or in other provinces.

6.1.4.17 Economic

The study area for economic effects is the same as used for the other socio-economic components as described in Section 6.1.4.16.



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LEGEND

- Project Location
- Socio-economic Study Area
- First Nation Reserves*
- Communities*
- Provincial Parks
- Railway
- Highway
- Local Road
- Waterbody

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

* Only communities and reserves located within the study area are shown.

Datum: NAD83
Projection: UTM Zone 15N

N E S W

0 10 20 40 60 80 100 Km

amec foster wheeler

GOLIATH GOLD PROJECT

Socio-Economic Study Area

PROJECT Nº: TC160516	FIGURE:6.1.4.16-1
SCALE: 1:880,000	DATE: April 2018

6.1.4.18 Human Health

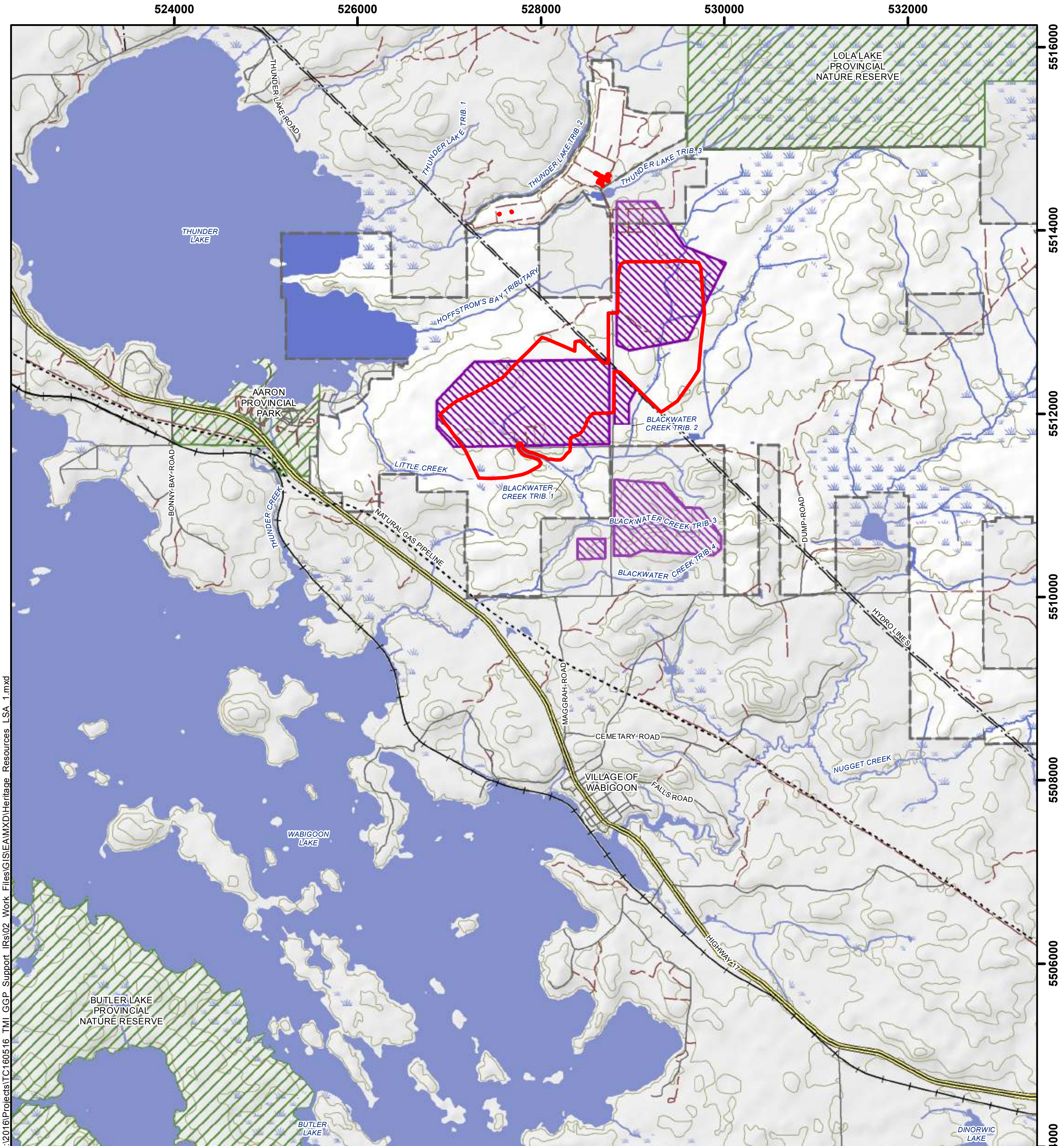
The study areas for the evaluation of the effects of the Project on human health are dictated by the study areas for those disciplines that will contribute, directly or indirectly, to potential health effects. For this reason, the local study area (LSA) for air quality (Figure 6.1.4.5-1) has been selected as the LSA for health effects. The air quality and health LSA is sufficiently large to capture virtually all of the effects of the Project on air quality. As described in Section 6.1.4.5, the predicted effects of the Project on air quality are effectively at background levels at the limits of the LSA.

As part of the description of the air quality study areas (Section 6.1.4.5), a series of 44 sensitive receptors were introduced. These receptors correspond with the closest residential locations to the Project and represent the locations likely to experience the highest prolonged exposures to emissions and associated changes in air quality. Information is not readily available to determine which of these sensitive receptors represent Aboriginal receptors, and which represent non-Aboriginal receptors.

The health assessment also considers the potential effects of changes in water quality and changes in food quality on human health. Given the nature of the Project, these effects will all be higher the closer to the Project the individual exposed is located. Therefore, the majority of these effects will be captured within the air quality LSA.

6.1.4.19 Heritage Resources

As described in Section 6.1.3.19, the heritage resources component of the assessment focusses on those components of the environment regulated under the *Ontario Heritage Act*. As such, the heritage resources assessment focussed on the areas where there was a potential for the Project to result in physical disturbance of the ground, which could, in turn, affect any archaeological of historic heritage sites. The local study area (LSA) for the archaeological assessment was presented in Appendix U to the EIS, and has been reproduced as Figure 6.1.4.19-1. This archaeological LSA covers the areas where the open pit, waste rock storage area (WRSA), tailings storage facility (TSF) are proposed. The LSA also included one area to the south of proposed Project where one of the alternative locations that was originally being considered for the storage of tailings. The archaeological evaluation also considered the potential for areas adjacent to the subject property to confirm the accuracy of evaluations made, and to identify whether there were nearby areas that would have been the preferred locations for settlement, with an emphasis on factors such as available food resources (e.g., fish, rice), and access (travel routes).



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LEGEND

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

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 W E S

amec foster wheeler

GOLIATH GOLD PROJECT

Heritage Resources Local Study Area (LSA)

PROJECT N°: TC160516

FIGURE: 6.1.4.19-1

SCALE: 1:57,000

DATE: March 2018

The scope of the LSA used for the assessment of the effects of the Project on heritage and culture VCs is considered appropriate given the nature of the Project and the areas where physical disturbances will occur. Expanding the geographic scope of the archaeological and heritage assessment LSA beyond the development footprint area, as was suggested in one reviewer in the Round 1 information requests (TMI_664-AC(1)-337) would not substantively change the results of the assessment or evaluation of impacts. The archaeological assessment completed was done using a methodology developed by Ministry of Tourism, Culture and Sport (MTCS), and is based on common archaeological practice. The reports prepared were submitted to MTCS for review, who expressed satisfaction at the recommendations made.

As part of the Round 1 information requests, the following questions was asked that specifically addressed the study areas used for the evaluation of effects of the Project on heritage resources:

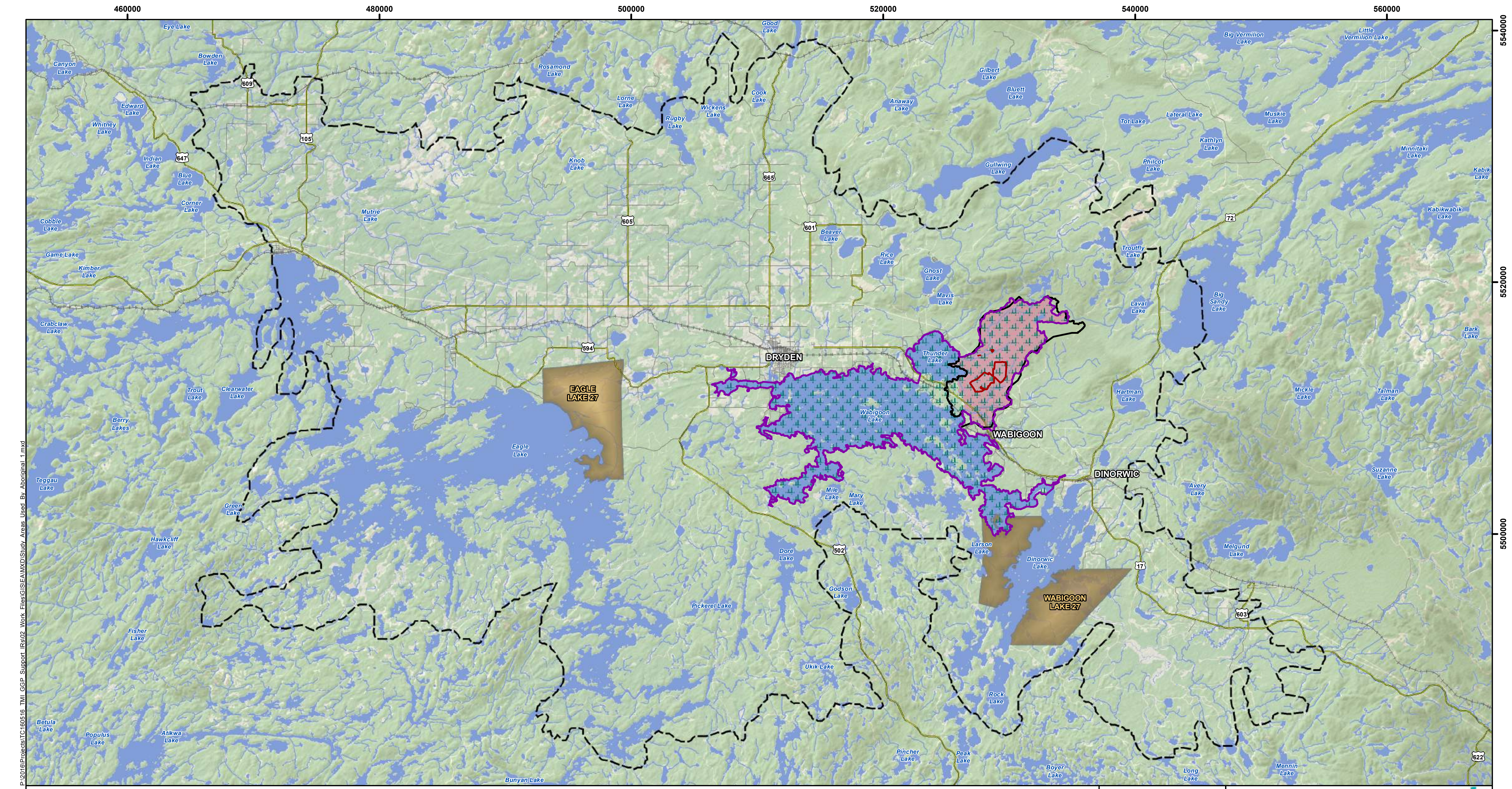
- TMI_664-AC(1)-337: expand the study area.

As part of the Round 1 information requests, questions were also raised with sites and activities considered to be culturally important by Aboriginal peoples. The importance of these effects is recognized by Treasury Metals, and the potential effects on these resources to Aboriginal peoples are assessed as part of the Aboriginal peoples VCs discussed in Section 6.1.3.20. The study areas for the Aboriginal peoples VCs is discussed in Section 6.1.4.20.

6.1.4.20 Aboriginal Peoples

In evaluating the potential effects of the Project to Aboriginal peoples, an emphasis has been placed on describing how to how changes in the environment as a result of the Project could affect the resources traditionally relied on by members of Indigenous communities, or how the Project could affect the ability to practice their current or historic use of lands and resources for traditional purposes. For this reason, a series of study areas, corresponding to the individual study areas for the physical and biological disciplines are used. For example, the effects of the Project on the Aboriginal peoples VC “fishing”, corresponds to the LSA and RSA used for evaluating the effects of the Project on fish and fish habitat (described in Section 6.1.4.13, and illustrated on Figure 6.1.4.13-1). The revised EIS also looked at the effects of the Project on the health of members of Indigenous communities. The study area for the Aboriginal peoples VC “human health” is the same as the LSA for air quality (described in Section 6.1.4.5, and illustrated on Figure 6.1.4.5-1). Finally, the revised EIS looks at how the Project might affect the social wellbeing of members of Indigenous communities. This evaluation was done using the socio-economic study area described in Section 6.1.4.16, and illustrated on Figure 6.1.4.16-1.

Figure 6.1.4.20-1 illustrates the various study areas used for evaluating the effects of Project on the Aboriginal peoples VCs, which were in-turn used for evaluating the effects of the Project on the members of Indigenous communities. The socio-economic study presented as Figure 6.1.4.16-1 is the same socio-economic study areas used in the assessment of socio-economic effects specifically for Aboriginal peoples.



LEGEND

- Operations Area
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Wildrice Local Study Area
- Aquatic Regional Study Area
- Aquatic Local Study Area
- First Nation Reserves
- Canadian Pacific Railway
- Highway
- Local Road

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 5 10 20 30 40 50 Kilometres

TREASURY METALS Inc.

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GOLIATH GOLD PROJECT

Study Areas Used for Aboriginal Peoples VCs

PROJECT N°: TC160516	**FIGURE: 6.1.4.20-1**
SCALE: 1:280,000	DATE: April 2018

6.1.5 Selection of Temporal Boundaries

The total lifespan of the Project is approximately 17 years, beginning with preparation of then site for construction activities and ending with the completion of the closure activities (EIS: Executive Summary). For the purposes of the EIS, the Project life has been divided into the following four phases, which are described below:

- Site preparation and construction phase;
- Operations phase;
- Closure phase; and
- Post-closure phase.

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.

6.1.5.1 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 tailings storage facility (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.

6.1.5.2 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.

6.1.5.3 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 closure plan be filed 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 the closure plan 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 while different from the existing environment, is capable of supporting plant, wildlife and fish communities, and other land uses. Treasury Metals expects the active closure period at the Project will take approximately two years after operations cease.

6.1.5.4 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. During the Post-closure Phase, Treasury Metals will hold the site in care maintenance. Environmental monitoring and potentially effluent quality management will occur during this passive period of reclamation of post-closure. Once the pit is flooded, an additional period of active reclamation may occur to remove remaining Project infrastructure that was retained to facilitate the maintenance, monitoring, and final post-closure activities.

6.1.5.5 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, the following questions asked for information, clarification and/or justification for the temporal boundaries used in the EIS:

- TMI_235-HE(1)-42: Define temporal boundaries;
- TMI_388-AC(1)-63: Define temporal boundaries;
- TMI_524-AC(1)-198: Define temporal boundaries;
- TMI_539-AC(1)-213: Define temporal boundaries; and
- TMI_559-AC(1)-233: Define temporal boundaries.

6.1.6 Approaches for Prediction/Description of Project Effects

As part of the Round 1 information requests, Treasury Metals noted that there were a number of questions from the Agency and other reviewers related to the approach used in the EIS for organizing and presenting information regarding the potential effects of the Project. One notable group of questions focused on the presentation of the description of the Project effects presented in Section 6.4 of the original EIS. Within the original EIS, the predicted effects and the determination of the significance of those effects was done collectively. In order to effectively address this, the revised EIS organizes the information in accordance with the EIS Guidelines using the following steps:

- **Likely Effects of the Project on the Environment**: The likely effects of the Project during each of the four Project phases (described in Section 6.1.5) are identified, along with the possible linkages between the various components. This is important as it should help the reviewers understand the connectivity between aspects of the environment that have been considered as part of the assessment.
- **Effects Prediction Methods**: Depending on the component and VC, effects can be predicted using quantitative methods (e.g., modelling), qualitative methods, or a combination of both. The methods used for predicting or describing the effects of the Project will be outlined, along with descriptions of models used, inputs to the models, assumptions used in the modelling and sources of data relied on.
- **Project Effects Avoidance Measures Used in Predictions**: As part of the Project design, there are aspects of the Project that will help avoid effects on the environment, and are incorporated into the effects predictions. These avoidance measures will be set out and described. Additionally, each of the avoidance measures will be provided as unique identifier. In some cases, a single measure will be associated with multiple disciplines, and appears several locations throughout Section 6. , and if appropriate, the efficacy of the avoidance measured provided.
- **Predicted Effects**: The presentation of the predicted effects will make use of table to present the predicted effects in a way that can be related to the VCs being considered, and can be traced through the various stages of the assessment process.
- **Mitigation Measures**: In keeping with the objectives identified in the EIS Guidelines, Treasury Metals has adopted an approach to their Project that would avoid effects whenever practical. Where residual effects remain, Treasury Metals will identify and clearly list enforceable measures that can be used to mitigate those effects. In keeping with the EIS Guidelines, such mitigation should be technically and economically feasible. The identified technically and economically feasible mitigation measure will be listed, along with those measures employed to help avoid effects so as to provide a clear outline of the actions to be used by Treasury Metals to avoid or mitigate the effects of the Project for each component of the assessment.

To facilitate the review process, and to facilitate the management activities once the Project is operational, each of the avoidance measures and mitigation measures are provided with a unique identifier. In some cases, a single measure will be associated with multiple disciplines, and appears several locations throughout Section 6. A summary of all of the mitigation measures relied on to avoid or lessen the predicted effects has been provided in Section 6.23. This summary is presented in a format identified by the Agency as being suitable to facilitate their review of how the predicted effects, mitigation measures, commitments, and ultimately residual adverse effects are related. A listing of all of the unique commitments and mitigation measures associated with the Project has also been provided in Section 10.

- **Residual Effects**: Residual adverse effects are those that remain after technically and economically feasible mitigation measures are applied. The residual effects that remain after mitigation are those that are carried forward for consideration of possible cumulative effects (Section 7) and ultimately for the determination of significance (Section 8). Where the identified residual effects have a spatial component, these have been presented graphically in the context of where the predicted effects of the Project are identified as having the potential to impact traditional uses of the land.

The prediction/description of Project effects for each of the components evaluated in the EIS are presented in Sections 6.2 through 6.21. As described in Section 6.2.1, questions raised as part of the Round 1 information requests regarding the approach for predicting the effects, the effects themselves or the mitigation measures will be listed for easy cross reference. Responses to the information requests have been provided separately, and the relevant information incorporated into the text for the relevant components.

Section 6.21 provides the description of the effects of the Project on Aboriginal peoples. This evaluation is considered from a pan-Aboriginal perspective, focussing on changes to the environment, health or social conditions as a result of the Project using a series of VCs and indicators described in Section 6.1.3.20. Treasury Metals has also provided an evaluation of the effects of the Project on the ability of individual Indigenous communities to continue to practice their current use of the land and resources for traditional purposes. This information is presented in Section 6.22, and combines the predicted residual effects of the Project on the Aboriginal peoples' VCs, with the available information about the Indigenous communities' current use of the lands and resources for traditional purposes provided in Section 5.13.

6.1.7 Approach for Evaluating Cumulative Effects

In response to questions raised as part of the Round 1 information requests, the assessment of cumulative effects was revised, and done in a different manner than was used in the original EIS. The approach used for assessing the potential cumulative effects in this revised EIS are 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). It also uses the information set out in the operational policy statement entitled "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act*, 2012" (CEAA 2015). The revised assessment of cumulative effects has been presented in Section 7.

6.1.8 Approach for Determination of Significance

All residual and cumulative effects identified for the Project will be advanced for the determination of significance. This will be done giving consideration to the following, as required in Section 13.1 of the EIS Guidelines (CEAA 2013):

- Magnitude;
- Geographic extent;
- Timing, duration and frequency;
- Reversibility;
- Ecological and social context; and
- Existence of environmental standards, guidelines or objectives for assessing the impact.

The determination of significance has been presented in Section 8 of this report and is organized in the following manner.

- **Methodology for Assigning Significance for Residual Adverse Effects**: This will include a detailed description as to how the above assessment measures were determined. In some cases, such as magnitude, the determination varies by component and VC. In other cases, such as geographic extent, a common approach for all components and VCs. Where feasible, the approach for assigning measures will be quantitative, or clearly described if qualitative.
- **Determination of significance of residual adverse effects for each component**: The determination of significance will be completed for each of the components using the methods set out at the beginning of Section 8 of the revised EIS. In each case, the residual adverse effects and cumulative will be restated, the assessment measures outlined above will be assigned, and finally a determination of significance will be made. This determination will be made in two ways. Firstly, the decision tree introduced in Section 6.1.4 of the original EIS will be re-applied using the newly determined effects levels. Secondly, a "reasoned argument" approach will be applied where a hypothesis is provided of what would constitute a significant adverse effect for the component or VC, and the predicted residual adverse effects of the Project tested against that hypothesis.

6.2 Terrain and Soils

6.2.1 Potential Effects of the Project on the Environment

The potential effects of the Project on terrain and soils will commence during the site preparation and construction phase, with some effects continuing through into post-closure. The following lists the potential effects of the Project on terrain and soils by phase:

- **Site preparation and construction phase:**
    - The stripping of overburden in preparation for mining activities, and their storage in stockpiles will expose soils to the risk of erosion.
    - The construction of the overburden stockpiles produce features that extend above the surrounding terrain.
- **Operations phase:**
    - The overburden stockpiles created during the site preparation and construction phase will remain features that extend above the surrounding terrain throughout the operations phase.
    - The continued storage of soils in the overburden stockpiles will expose them to the risk of erosion.
    - The construction of the waste rock storage area (WRSA) as the mining of the open pit advances will produce a feature that will extend above the surrounding terrain.
    - The construction and operation of the low-grade ore (LGO) stockpile will produce a feature that will extend above the surrounding terrain.
    - The mining activities will involve the use of chemicals and fuels that could affect the chemical compositions of soils in the event of spills.
- **Closure phase:**
    - The overburden stockpiles will be decommissioned and the soils used in the closure and reclamation of the site.
    - The LGO stockpile will be exhausted at the end of operations, with any remaining material will be removed and placed within the open pit mine.
    - The WRSA will remain after the closure of the Project. The surface of the WRSA capped with a low permeability cover to reduce the potential for acid generation. Once the cap is in place, the WRSA will be covered with soil and re-vegetated.
- **Post-closure phase:**
    - The closed and vegetated WRSA will remain as a permanent feature on the landscape.

The potential effects of the Project on terrain and soils have been described using a simple linkage diagram on Figure 6.2.1-1. The figure illustrates the terrain and soil VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. Additionally, the figure indicates those other components of the environment (shown in red in the figure) where the predicted effects of the Project on terrain and soils will act as an input for determining the effects on other VCs. For example, the physical features constructed during the various phases of the Project (i.e., overburden stockpiles, WRSA, LGO stockpile) will be used as an input for determining the potential effects of the Project on Aboriginal peoples, and on land and resource use. There are no other components or VCs that provide inputs to the assessment of Project effects on terrain and soils.

6.2.2 Effects Prediction Methods

The effects of the Project on terrain and soils are generally described using qualitative and semi-qualitative methods consistent with the nature of the potential effects. The descriptions potential effects of the Project on the “natural landscapes” VC considered the heights of the constructed landscape features at the Project (i.e., overburden stockpiles, WRSA, LGO stockpile) to the existing terrain and vegetation. This analysis made use of geographic information system (GIS) modelling tools for identifying where the surface features would be visible, and how those features would look from the perspective The potential effects of the Project on the “overburden” VC are described qualitatively, focussing on the activities to manage the overburden stripped during the site preparations and constructions phase, and stored in stockpiles until closure activities occur at the end of mining. Finally, the potential effects of the Project on the “soil chemistry” VC are also described qualitatively. These effects would only occur in the event there are spills of fuels or chemicals at the Project, and the potential effect on “soil chemistry” VC is dependent on the activities to manage any spill and remediate the effects.

6.2.3 Project Effects Avoidance Measures Used in Predictions

6.2.3.1 Natural Landscapes

As part of the design of the Project, Treasury Metals have incorporated the following to help mitigate the potential effects of the Project on the “natural landscapes” VC:

- Reduce the overall height of the constructed landscape features, to the extent possible. [Mit_001].
- Use an overall slope of 3:1 (horizontal to vertical) for the WRSA to maintain a more natural looking slope. [Mit_002].
- Use of a program in which the WRSA construction and revegetation is initiated on the western edge as soon as possible. This helps create a natural looking feature when viewed from Thunder Lake. [Mit_003, Mit_004].

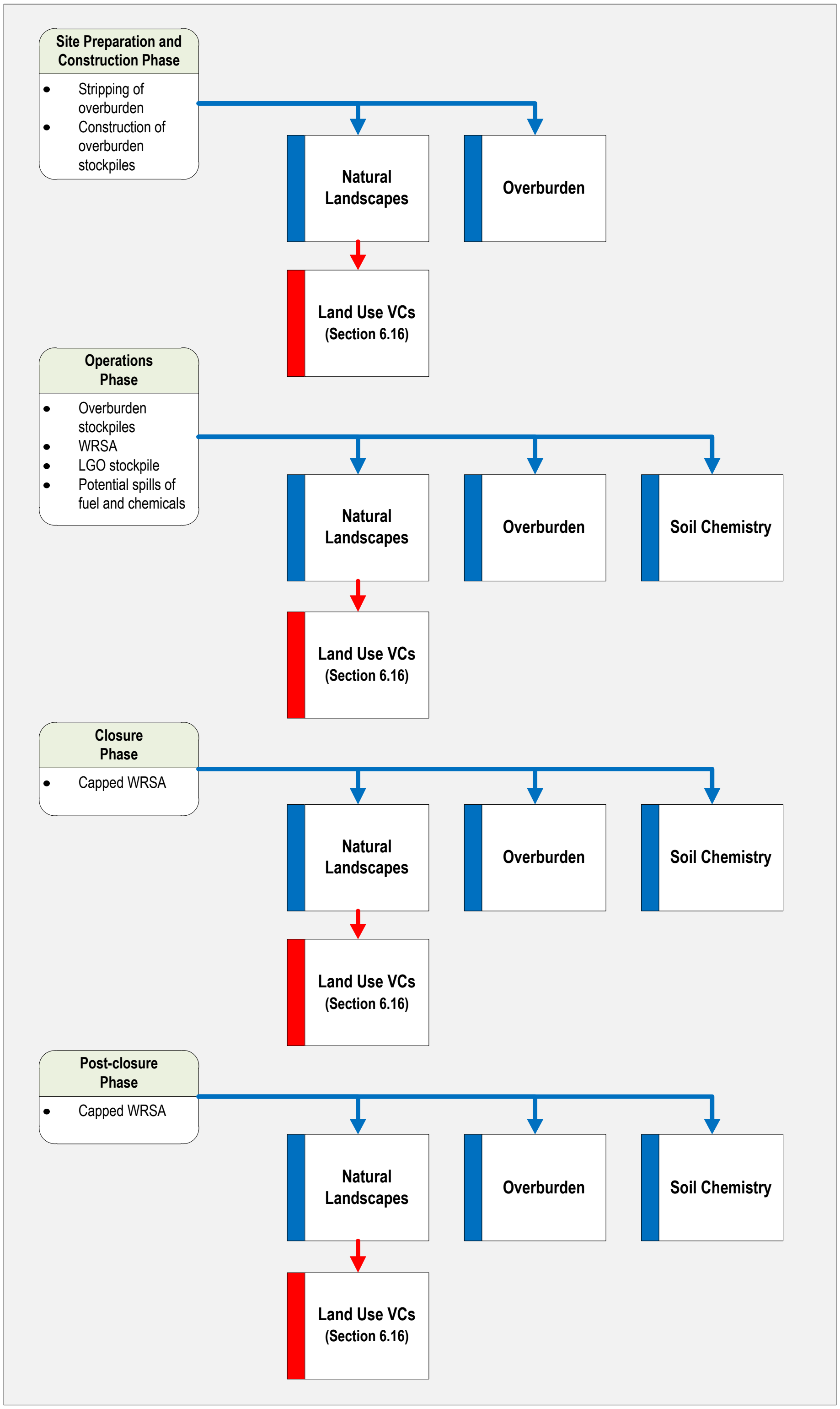


Figure 6.2.1-1: Terrain and Soils Linkage Diagram

- Once the overburden stockpiles are constructed, during the site preparation and construction phase, they will be vegetated to avoid the potential for erosion and make the features appear as natural as possible. [Mit_005].
- At the end of mining, the low-grade ore (LGO) stockpile will be exhausted of materials, or if materials remain they will be removed and disposed of in the open pit prior to flooding. [Mit_006].

6.2.3.2 Overburden

As part of the design of the Project, Treasury Metals have incorporated the following to help mitigate the potential effects of the Project on the "overburden" VC:

- Overburden materials (clay, sand or organic material) stripped during the site preparation and construction phase will placed in the overburden stockpiles located directly to the south of the proposed open pits. [Mit_007].
- Construct WRSA and overburden stockpiles with an overall a 3:1 (horizontal to vertical) side slope to maintain a more natural appearance. [Mit_002].
- Slopes may be protected from erosion by vegetation until needed for reclamation. [Mit_005].
- Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system. [Mit_008].

6.2.3.3 Soil Chemistry

The potential effects of the Project on soil chemistry are associated with the potential for spills or leaks of fuels and other chemicals. Such occurrences are not part of the planned operations of the Project, and represent upset conditions, the likelihood of which will be managed through the implementation of careful management procedures. In the unlikely event any spill does occur at the site, Treasury Metals will ensure that procedures are followed to contain any spilled materials, and remediate any effects on the soils at the site to ensure that all soils remain suitable for use at the closure of the Project. The following specific measures will be incorporated by Treasury Metals in the design and operations to avoid effects on the "soils chemistry" VC:

- Equipment will be maintained in good working order and inspected regularly to ensure the equipment is not leaking. [Mit_009].
- Re-fueling of equipment will be done in a manner to limit the potential for spills. Fuel will be stored in a lined, contained area. Fueling vehicles will be parked in a concrete lined area when not in use. [Mit_010, Mit_011. Mit_012].

- Emulsion explosives will be stored and dispensed in a lined, contained area. Trucks used for the delivery of emulsion explosives will be parked in a concrete lined area when not in use. [Mit_013, Mit_014].
- The processing plant area will be lined and equipped with seepage collection system and perimeter ditching to protect the soil beneath and adjacent from effects. [Mit_015].
- The low-grade ore (LGO) stockpile area will be lined and equipped with a seepage collection system and perimeter ditching to protect the soil beneath and adjacent from effects. [Mit_016].
- Activities on the overburden stockpiles will be minimized and the stockpiles left undisturbed until closure activities are underway. [Mit_017].

6.2.4 Predicted Effects

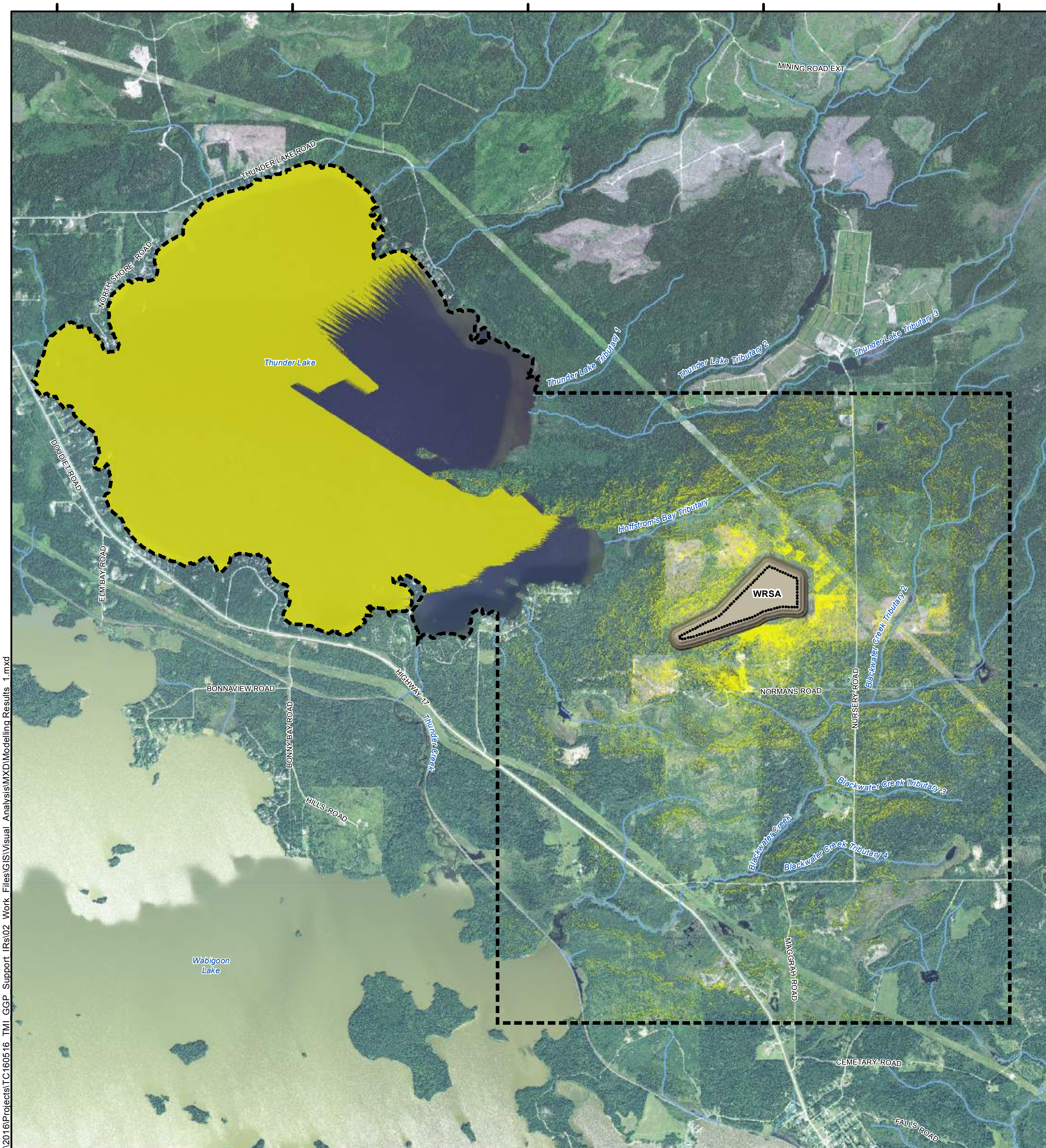
6.2.4.1 Natural Landscapes

The most prominent constructed landscape feature at the Project will be the waste rock storage area (WRSA), which will be constructed adjacent to the north of the open pit. To increase mining efficiency and help limit the size of the WRSA, waste rock will be placed in the mined-out areas of the open pit as the mining advances. The WRSA, which is described in Section 3.5.1, and covers area of 37 ha, and has a maximum height of 30 m above grade. The overburden stockpiles (see Section 3.5.2) will be constructed immediately to the south of the open pit and will be a maximum of 20 m above grade, and will cover an area of approximately 26 ha. Both the WRSA and the overburden stockpiles will be constructed with side slope of 3:1 (horizontal to vertical) to maintain a more natural looking slope. The low-grade ore (LGO) stockpile will be constructed adjacent to the crusher, and will have a maximum height of 15 m above grade and an area of approximately 9 ha (Section 3.5.3). Table 6.2.4.1-1 lists the key dimensions of the onsite features that could affect natural landscapes.

Table 6.2.4.1-1: Key Dimensions of Key Onsite Features

Feature	Area (ha)	Maximum Height Above Grade (m)
WRSA	37	30
Overburden stockpiles	26	20
Low-grade ore (LGO) stockpile	9	15

The use of GIS modelling was identified that the WRSA was the only onsite feature that would be visible beyond the site. Specifically, the GIS modelling identified that the WRSA would only be visible from portions of Thunder Lake (see Figure 6.2.4.1-1). The areas with solid shading on Figure 6.2.4.1-1 show where the WRSA would be visible from “ground-level”, while the speckled colouring shows where the WRSA would be visible from the top of the forest canopy.



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LEGEND

Visual Aesthetic Study Area

Outward Looking Modelled Observer Points

Locations Visible from Top of WRSA

Watercourse

Viewshed Analysis Interpretation Key:

Speckled colour area indicate forest canopy visual, not ground level visual

Solid colour areas indicate ground or water surface visual, not canopy visual

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

NOTES:
- Aerial imagery extracted from MNRF, Forest Resource Inventory, 2015.

Datum: NAD83
Projection: UTM Zone 15N

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GOLIATH GOLD PROJECT

Modeled Waste Rock Stockpile Area (WRSA) Visible Areas

PROJECT N°: TC160516	FIGURE: 6.2.4.1-1
SCALE: 1:45,000	DATE: April 2018

The explanation for the limited areas where the WRSA would be visible can be seen by looking at the terrain cross sections (these cross sections greatly exaggerate the vertical scale) shown in Figures 6.2.4.1-2 and 6.2.4.1-3. To understand what effect the WRSA would have on the views from Thunder Lake, a series of "visualizations" have been prepared to show how views from Thunder Lake towards the WRSA would change. These are provided in Figures 6.2.4.1-4, 6.2.4.1-5 and 6.2.4.1-6, from three different viewing locations. The first (top left) image shows the pre-development conditions, and would also be the situation during the site preparation and construction phase, prior to the development of the WRSA. The second (top right) image provides a visualization of the view from this location when the WRSA is fully developed, and prior to the placement of the capping materials and re-vegetation. This is the view during the later phases of operations, and before the closure of the WRSA. The third (bottom left) image shows the fully developed WRSA, once it has been re-vegetated. This is the view that would occur in post-closure. The final image on the figure (bottom right) illustrates the location of the viewing location and the direction of picture was taken.

6.2.4.2 Overburden

As described in Sections 3.5.2 and 6.2.3.2, Treasury Metals will implement practices that will protect and maintain the overburden materials removed during the site preparation and construction phase. The overburden stockpiles will be constructed immediately to the south of the proposed open pit, and will generally be built using relatively shallow side slopes of 3 horizontal width to 1 vertical height. Slopes will also be allowed to develop a cover of vegetation until the overburden is used in the reclamation activities at the closure of the Project. In addition, ditching and seepage collection will be installed around the edges of the stockpile to direct and collect surface water runoff and seepage. As a result, the overburden material removed during the site preparation and construction phase will largely all be available for use in the closure activities. Therefore, no adverse effects are predicted for the overburden VC.

Due to the conservative design factors placed on the overburden stock pile linked to the low seismicity potential in the Project area, there is an extremely low risk for failure of the slopes to the overburden stockpile due to either foundation conditions or a seismic event. Although the current design is considered to be well within a reasonable factor of safety, Treasury Metals continues to advance the engineering design of the Project such that it can be constructed in a safe and efficient manner. Part of this advancement is further geotechnical studies that will help to supplement a final Feasibility study. Subsequent to the Feasibility study and the formal descision to construct the Project Treasury Metals will complete an engineered design for all landscape features to be constructed at the Project, including the overburden stockpile. This will take into account the most current engineering practices and will require the approval of a professionally designated engineer prior to construction.

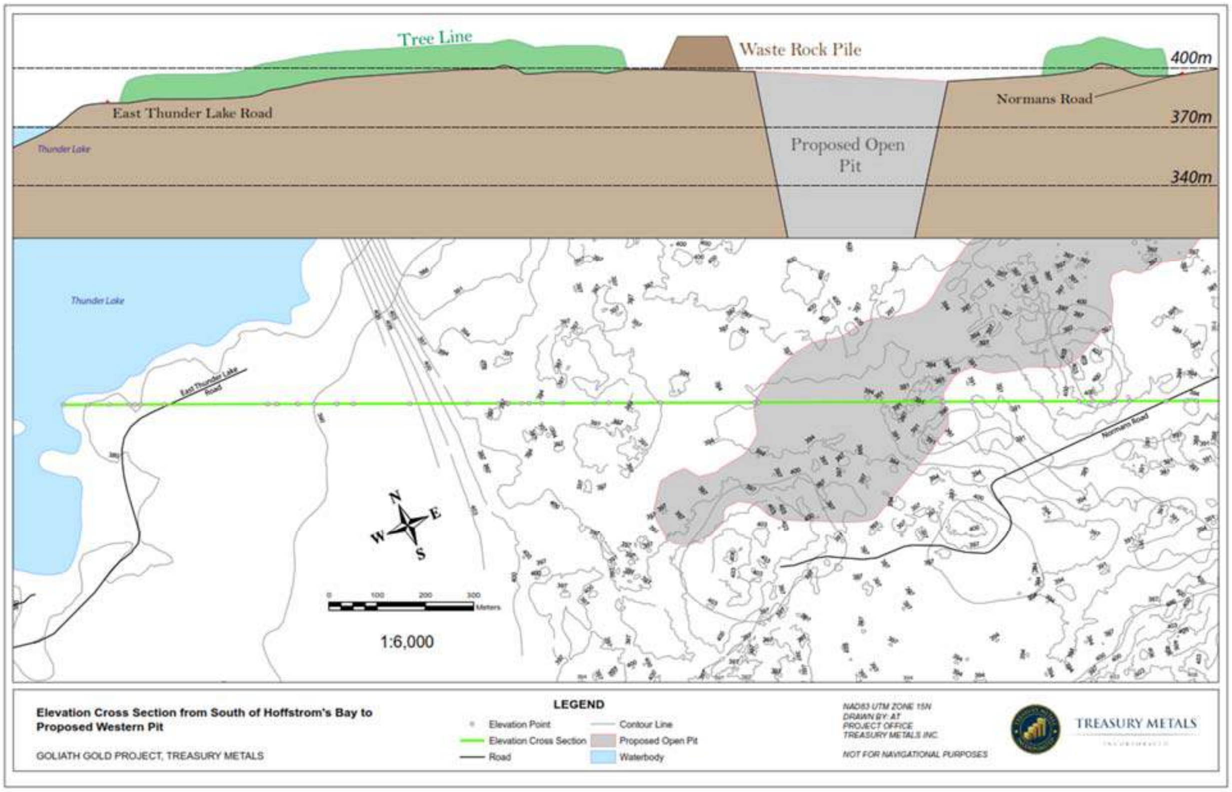


Figure 6.2.4.1-2: Cross Section from South Hoffstrom's Bay, Showing Relative Height of WRSA

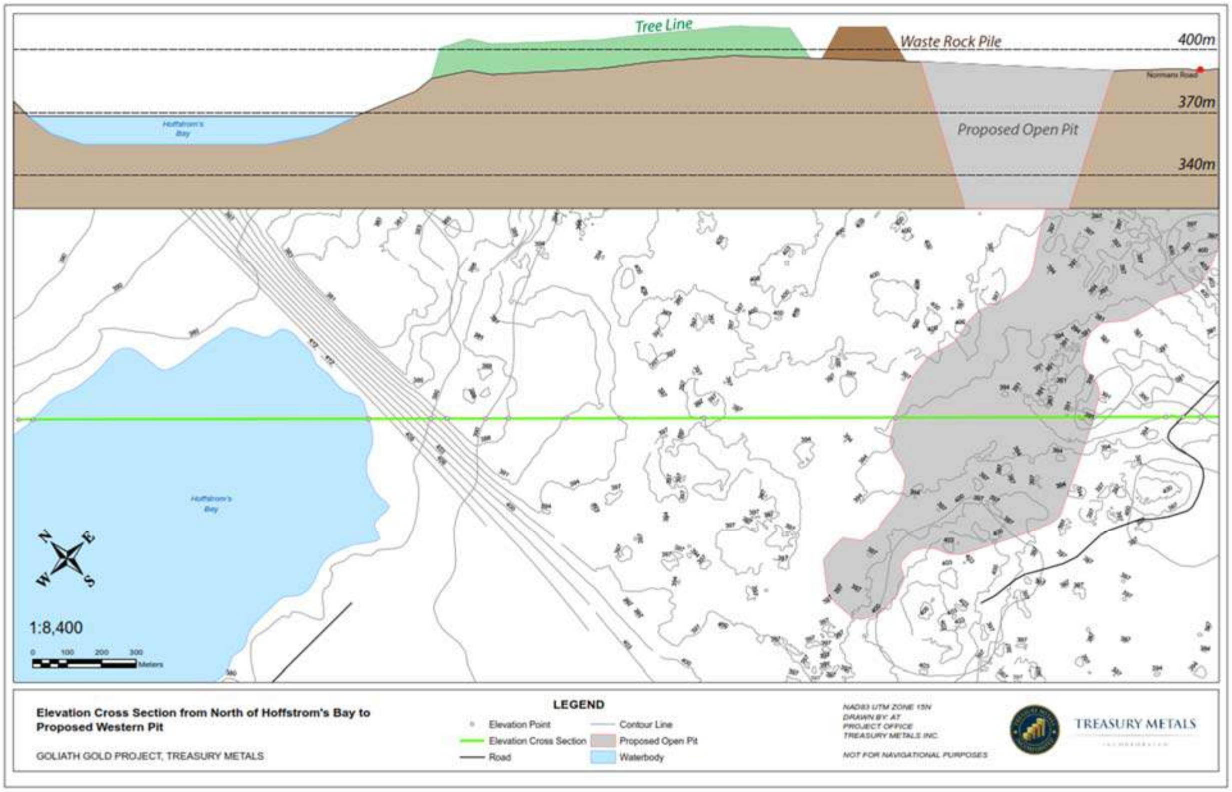
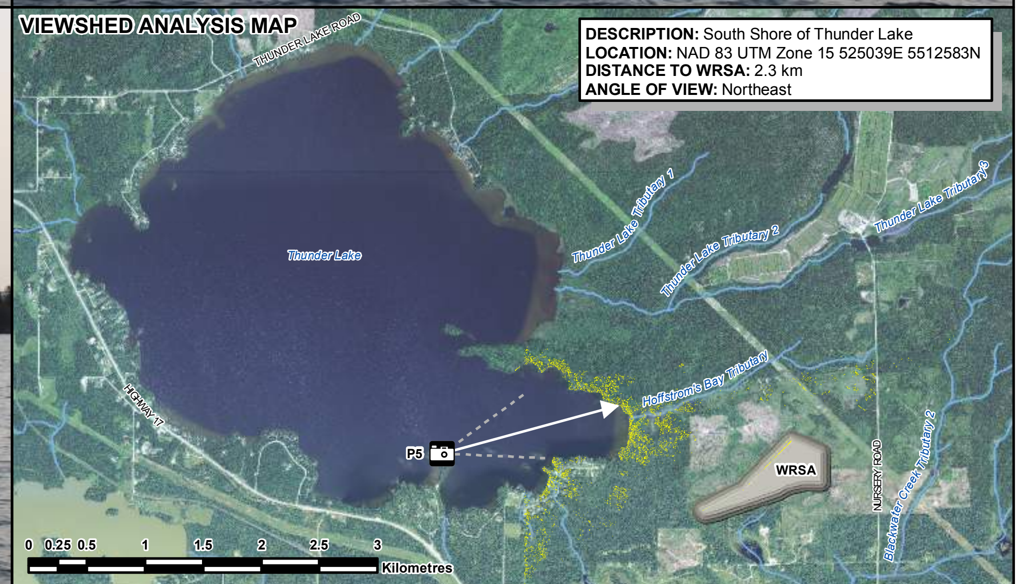


Figure 6.2.4.1-3: Cross Section from North of Hoffstrom's Bay, Showing Relative Height of WRSA



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LEGEND

- Receptor Location
- Line-of-Sight to Proposed Waste Rock Stockpile Areas (WRSA)
- Approximate Picture Viewfield Boundary
- Modeled Visible Areas from Receptor Location

NOTES:
- Aerial imagery extracted from MNRF, Forest Resource Inventory, 2015.
- Baseline receptor photograph taken on September 13, 2017.

Datum: NAD83
Projection: UTM Zone 15N

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Visual Analysis of Waste Rock Storage Area from Location 1

PROJECT N°: TC160516	**FIGURE:6.2.4.1-4**
SCALE: As shown	DATE: April 2018

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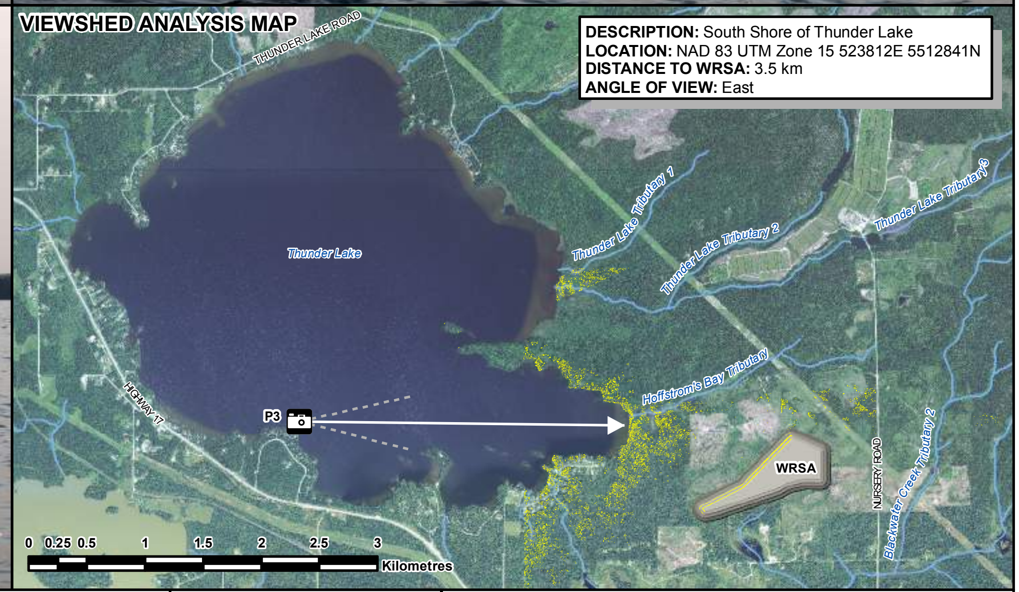
VIEW OF WRSA FROM THUNDER LAKE: PRE-DEVELOPMENT CONDITIONS

VIEW OF WRSA FROM THUNDER LAKE: WRSA UN-VEGETATED

VIEW OF WRSA FROM THUNDER LAKE: WRSA RE-VEGETATED

VIEWSHED ANALYSIS MAP



LEGEND

- Receptor Location
- Line-of-Sight to Proposed Waste Rock Stockpile Areas (WRSA)
- Approximate Picture Viewfield Boundary
- Modeled Visible Areas from Receptor Location

NOTES:
- Aerial imagery extracted from MNRF, Forest Resource Inventory, 2015.
- Baseline receptor photograph taken on September 13, 2017.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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GOLIATH GOLD PROJECT

Visual Analysis Waste Rock Storage Area from Location 2

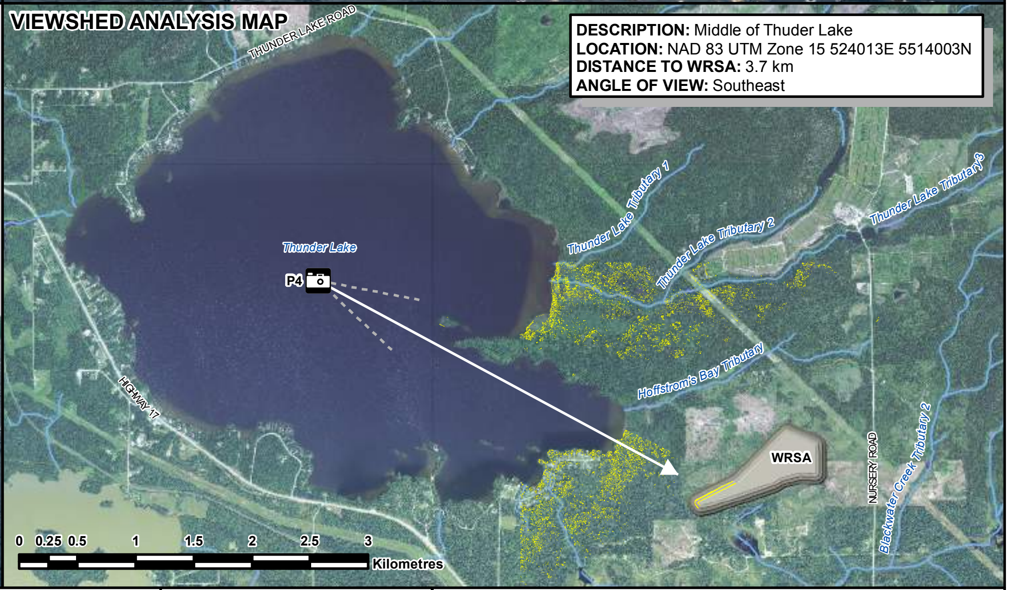
PROJECT N^{o}: TC160516	**FIGURE:6.2.4.1-5**
SCALE: As shown	DATE: April 2018

VIEW OF WRSA FROM THUNDER LAKE: PRE-DEVELOPMENT CONDITIONS

VIEW OF WRSA FROM THUNDER LAKE: WRSA UN-VEGETATED

VIEW OF WRSA FROM THUNDER LAKE: WRSA RE-VEGETATED

VIEWSHED ANALYSIS MAP



LEGEND

- Receptor Location
- Line-of-Sight to Proposed Waste Rock Stockpile Areas (WRSA)
- Approximate Picture Viewfield Boundary
- Modeled Visible Areas from Receptor Location

NOTES:
- Aerial imagery extracted from MNRF, Forest Resource Inventory, 2015.
- Baseline receptor photograph taken on September 13, 2017.

Datum: NAD83
Projection: UTM Zone 15N

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GOLIATH GOLD PROJECT

Visual Analysis Waste Rock Storage Area from Location 3

PROJECT N°: TC160516	**FIGURE: 6.2.4.1-6**
SCALE: As shown	DATE: April 2018

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6.2.4.3 Soil Chemistry

As described in Section 6.2.3.3, Treasury Metals will implement procedures at the Project to limit the potential for spills and leaks that could affect soil chemistry. In the unlikely event that a spill or leak does occur (Section 6.2.4), procedures will be put in place to either remediate any soils that are affected. Additionally, a perimeter ditch will be constructed around the operations area that will capture all of the runoff from the operations area for use in the water management system. Therefore, the effect of any spills that occur will be restricted to the operations area.

6.2.5 Identified Mitigation

The following design features and procedures will be implemented as part of the Project to minimize or avoid the effects of the Project on the terrain and soil VCs:

- **Natural Landscapes**
  - Limit the height of the constructed landscape features. [Mit_001].
  - Construct WRSA and overburden stockpiles with an overall a 3:1 (horizontal to vertical) side slope to maintain a more natural appearance. [Mit_002].
  - Vegetate the western edge of the WRSA to create a natural looking feature. [Mit_004].
  - Vegetate overburden stockpiles once constructed to make them appear natural as soon as practicable. [Mit_005].
  - The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
  - Remove material from the low-grade ore (LGO) stockpile during closure. [Mit_006].
- **Overburden**
  - Overburden materials (clay, sand or organic material) stripped during the site preparation and construction phase will be placed in the overburden stockpiles located directly to the south of the proposed open pits. [Mit_007].
  - Construct WRSA and overburden stockpiles with an overall a 3:1 (horizontal to vertical) side slope to maintain a more natural appearance. [Mit_002].
- **Soil Chemistry**
  - Maintain equipment in good working order and inspected regularly. [Mit_009].
  - Re-fueling done in a manner to limit the potential for spills. [Mit_010].
  - Store fuel in a lined, contained area. [Mit_011].
  - Fueling vehicles will be parked in a concrete lined area when not in use. [Mit_012].
  - Emulsion explosives will be stored and dispensed in a lined, contained area. [Mit_013].

- o Emulsion explosive delivery vehicles will be parked in a concrete lined area when not in use. [Mit_014].
- o The processing plant will be lined and equipped with runoff collections system and perimeter ditching to protect the soil beneath and adjacent from effects. [Mit_015].
- o The low-grade ore (LGO) stockpile area will be lined and equipped with runoff collections system and perimeter ditching to protect the soil beneath and adjacent from effects. [Mit_016].
- o Activities on the overburden stockpiles will be minimized and the stockpiles left undisturbed until closure activities are underway. [Mit_017].

In addition to these measures, Treasury Metals will regularly review their procedures and processes during the life of the Project to identify opportunities where practices can be modified, and new procedures put in place to further reduce and mitigate the potential effects of the Project.

6.2.6 Residual Adverse Effects

With consideration of the effects avoidance measures listed in Section 6.2.3 and the mitigation measures listed in Section 6.2.5, the following residual adverse effects remain for the terrain and soils VCs:

- **Natural Landscapes**: While smaller features on the site, including the overburden stockpiles and the LGO stockpile would not be visible from beyond the site, The WRSA area would be visible from portions of Thunder Lake (see Figure 6.2.4.1-1). The WRSA will be constructed with relatively shallow 3:1 (horizontal to vertical) side slopes to help make the feature appear more natural, and will be capped and re-vegetated following closure. As a result, the effects of the WRSA on views from Thunder Lake (Figures 6.2.4.1-4, 6.2.4.1-5 and 6.2.4.1-6) are relatively minimal, and hardly noticeable once re-vegetated.
- **Overburden**: There would be no residual effects on overburden as the material will be stockpiled during the site preparation and construction phase, and then covered to prevent erosion.
- **Soil Chemistry**: Finally, the soil chemistry will be protected through the implementation of procedures to minimize the potential for equipment leaks and spills at the Project. In the unlikely event leaks or spills occur, procedures to remediate any affected soils will be implemented. There would be no residual effects for soil chemistry.

The residual adverse effects for terrain and soils remain after the implementation of technically and economically feasible mitigation and avoidance measures are set out in Table 6.2.6-1.

Table 6.2.6-1: Residual Adverse Effects on Terrain and Soils

Valued Components (VCs)	Site Preparation and Construction	Operations	Closure	Post-closure
Natural landscapes	—	WRSA 30 m tall 3:1 slopes (h:v) Not vegetated	WRSA 30 m tall 3:1 slopes (h:v) Re-vegetated	WRSA 30 m tall 3:1 slopes (h:v) Fully re-vegetated
Overburden	—	—	—	—
Soil chemistry	—	—	—	—

Note: The "—" symbol indicates where there were no predicted residual adverse effects

6.2.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, the following questions were wholly, or partially, asking for information, clarification and/or justification for the approach used in predicting the effects of the Project on terrain and soils. Responses to the IRs were provided separately, and incorporated into the relevant sections of the Revised EIS. The following lists the Round 1 IRs related to the effects predictions for terrain and soils:

- TMI_39-MW(1)-01: dimensions of on-site features;
- TMI_229-HE(1)-36: Views of WRSA from Thunder Lake; and
- TMI_249-AM(1)-07: Stability of slopes.

6.3 Geology and Geochemistry

6.3.1 Potential Effects of the Project on the Environment

As described in Section 6.1.3.2, a single valued component "pit lake water quality" has been selected to help describe the potential effects of the Project related to geology and geochemistry. Geology and geochemistry were identified as being important as they determine the chemical transformations the mined material may experience when exposed over time. The following lists the potential geology and geochemistry effects by Project phase.

- **Site Preparation and Construction Phase**: There is expected to be no geochemical effects during the site preparation and construction phase as there will be no mining or processing activities underway during this relatively short phase of the Project.
- **Operations Phase**: During the initial stages of operations, waste rock will be mined and placed in the waste rock storage area (WRSA), immediately to the north of the proposed open pit. The material within the WRSA will be exposed to the elements until covered with a low permeability during closure activities.

  Once the open pit advances beyond pit 1, waste rock will be placed in the mined out sections of the open pit instead of in the WRSA. The waste rock in the open pit will be exposed to the elements until covered by water once the open pit is allowed to flood following closure.

Tailings and water from the processing of the ore will be treated to remove cyanide and then discharged to the tailings storage facility (TSF) sub-aqueously. The tailings within the TSF will be maintained below a water cover to prevent acidification throughout operations.

During operations, the open pit and underground mine will be dewatered to maintain a safe working environment. These dewatering activities will result in a drawdown zone of the water table, which will allow for groundwater and seepage within the drawdown zone to the open pit where it will managed as part of the minewater management system. This water will be used within the mining and processing operations, to the extent possible. Excess water will be treated to meet the Provincial Water Quality Objectives (PWQO), or background concentrations if background levels are greater than the PWQO, prior to discharge to Blackwater Creek.

During operations, seepage from the WRSA and TSF will be collected in perimeter seepage collection systems and incorporated into the minewater management system. Any seepage that escapes the seepage collection systems will be captured within the drawdown zone caused by the dewatering of the open pit and underground mine, and will report to the open pit where it will be collected and managed. No seepage from the on-site facilities would leave the site during the operations phase.

- **Closure Phase**: Following the end of mining activities, the process water covering the TSF will be withdrawn, treated and used to help fill the open pit. The tailings will be physically isolated with a granular cover and then chemically isolated using either a dry, low-permeability cover or a wet cover using non-process water.

  The WRSA will be covered with a dry, low-permeability cover to reduce the potential for acidification. The waste rock placed within the open pit will remain exposed until covered with water as the open pit is allowed to flood. Following closure, equipment, chemicals and fuel present in the open pit will be removed and the open pit prepared for flooding. Dewatering activities will cease and the open pit and underground mine will be allowed to fill with water. The water to fill the pit will come from a combination of site runoff, water from the TSF and groundwater. It is expected to take between 5 and 8 years to fully flood the open pit, depending on weather conditions. At closure, all site drainage will be directed towards the open pit to aid in filling it with water. Although the dewatering activities will cease following the end of mining, the drawdown zone created during operations will remain during the post-closure phase. Groundwater and seepage within the drawdown zone will continue to be directed to the open pit and contribute to the filling.

- **Post-closure Phase**: In post-closure, all site drainage will continue to be directed towards the open pit. The open pit will be fully flooded between 5 and 8 years after the dewatering activities cease. This will create a pit lake that will eventually be allowed to release to Blackwater Creek Tributary 1 through an engineered spillway. Following the flooding of the open pit, groundwater will continue to flow into the open pit, contributing to the water that will be eventually released to Blackwater Creek Tributary 1. Once the open pit is filled, the groundwater table will return to the pre-development conditions and seepage from the WRSA and TSF will be able to escape the site and eventually affect adjacent surface water bodies.

The potential geology and geochemistry effects of the Project have been described using a simple linkage diagram on Figure 6.3.1-1. The figure illustrates that the geology and geochemistry VC “pit lake water quality” (shown in blue on the figure) is only going to be affected during the post-closure phase of the Project. Additionally, the figure indicates those other components of the environment (shown in red in the figure) where the predicted geology and geochemistry effects of the Project will act as an input for determining the effects on other VCs. For example, the seepage from the WRSA and TSF in the post-closure phase will be used as an input for determining the potential effects of the Project on surface water quality. In the case of geology and geochemistry, there are also effects that will directly affect both the surface water quality and groundwater quality VCs. Specifically, seepage from the WRSA and TSF are not considered assessment endpoints but are important inputs to understanding how the Project could affect the VCs for both of these components. The estimates of effects on the “pit lake water quality” VC rely on estimates associated with the surface water quantity and groundwater quantity VCs.

It is also recognized that the effects of the Project on geochemistry will indirectly effect multiple of the disciplines and VCs as a result of the changes in pit lake quality, as well as the resulting changes in groundwater quality and surface water quality. These secondary effects are dealt with separately in the relevant sections of this EIS (e.g., linkages showing how changes in surface water quality could affect other VCs, such as fish and fish habitat VCs are provided in Section 6.8).

6.3.2 Effects Prediction Methods

As part of preparing the responses to the Round 1 Information Requests, a re-evaluation of the available geochemical data was done to determine whether more conservative assumptions regarding the available information (provided in Appendix K to the EIS) would alter the assumptions and conclusions regarding either the potential for acid rock drainage (ARD) or metals leaching (ML). The following details the revised assessment of geochemistry prepared as part of the process to respond to the Round 1 information requests. Additional details regarding the re-evaluation of the geochemical assumptions has been provided in Section 5 of Appendix JJ (Water Report) to the revised EIS.

6.3.2.1 Pit Lake Water Quality Model

The estimated effects of the Project on the “pit lake water quality” VC made use of a mass balance water quality model that made use of the site water balance combined with estimated mass loading rates from the various loading sources at the site. The model is based on various defined mine plan constraints, site specific baseline monitoring results, laboratory data and assumptions/ estimates where site-specific data was not available.

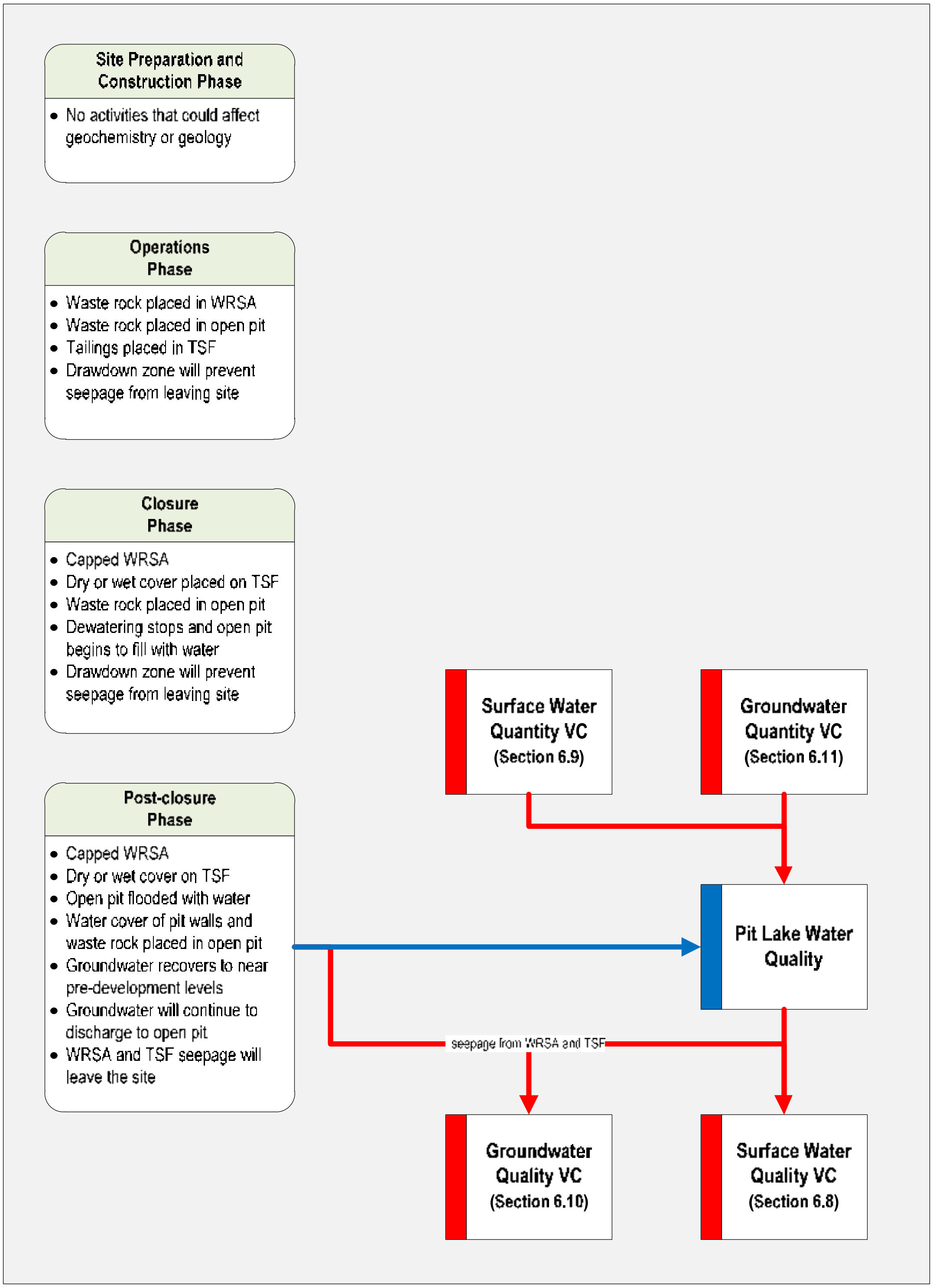


Figure 6.3.1-1: Geology and Geochemistry Linkage Diagram

Estimated loadings for each modelled constituent were determined on an annual basis. The post flooding pit water quality model applied the sum of the annual loads for each constituent while the pit floods to the final flooded volume of the open pit to determine each constituent concentration in an assumed completely mixed pit. The long-term pit water quality model applied the post flooding estimated annual load to the annual net pit in-flow to represent a steady-state average long-term water quality.

Open Pit Flooding Time

A flooded open pit is expected to limit sulphide oxidation on inundated pit walls and in-pit waste rock, therefore the time to flood the open pit was a key consideration in developing the water quality estimates. The water quality model therefore incorporated a simplified pit flooding scenario into the model design. The basis and assumptions for the pit flooding model included the following:

- The total pit volume to the spillway elevation (388 masl) is 11.9 Mm^3.
- The final in-pit waste rock volume of 12.5 Mt, with an assumed porosity of 19%.
- The rate of groundwater inflow will gradually decrease as the pit in filling and groundwater levels begin to recover. The average groundwater inflow during filling is 700 m^3/day.
- Surface catchment inflows assuming post-closure TSF dry cover hydrology that was adjusted in years 1 and 2 after end of mining for the uncovered WRSA and assumptions regarding run-off within the in-pit catchment.
- At closure, the supernatant water present in the TSF will be withdrawn, treated and used to help fill the open pit. This represents a one-time transfer of 970,000 m^3 during the first year of closure.
- All of the TSF runoff, as well as runoff from the balance of the operations area will be directed towards the open pit in the closure and post-closure period.

The estimated pit flooding time for the above assumptions is 6.7 years after completion of mining. This value is based on the average meteorological conditions for the area. The actual filling is expected to be in the range of 5 to 8 years, depending on the actual meteorological conditions that are encountered.

Long-term Open Pit Water Quality Model

The long-term pit water quality model assumes the following post-closure conditions including:

- The flooded open pit will have no legacy load inputs (no loads from in-pit waste rock or pit walls under water cover). This is consistent with the expectation that Treasury Metals will monitor the quality of the water in the pit lake during flooding, and apply batch treatment (as required) to help ensure that the pit lake quality can meet the PWQO prior to the pit being fully flooded.

- The WRSA will be covered with a low permeability cover.
- The base of the TSF will be lined using a low permeability layer (Section 3.7.2.1), that will control the rate that water will seep from the base of the TSF.
- The TSF will be covered with a low permeability dry cover, or a cover of non-process water. While there will be differences in the quality of the seepage depending on the type of cover (see Section 6.3.4.1) the volume of seepage through the HDPE lined will restrict the volume of seepage, regardless of the cover selected.
- All other steady-state surface and groundwater flows are based on the post-closure water balance.

6.3.2.2 Mass Loading Source Terms

Mass loading source terms were developed from site specific data or analogue site data as follows:

- Loadings from waste rock and open pit walls were derived based on surface area and scaled from laboratory humidity cell or field cell data.
- Due to a lack of site specific data, loadings from possible future acidic drainage from waste rock was estimated on an adjusted surface area basis from an unnamed analogue site with site specific adjustment of minor and trace metals based on acidic data from operating Project field cells.
- Loadings from tailings in the TSF were derived from estimated supernatant tailings water quality and laboratory tailings humidity cell data.
- Loadings from run-off on natural ground and the engineered WRSA and TSF covers were derived based on baseline surface water quality in natural drainage near the future mining development.
- Loadings from groundwater were derived from baseline groundwater quality data near the future open pit.
- Non-PAG and PAG rock source terms were based on the median (50^{th} percentile) of the available concentration data.

The basis and description of the mass loading source terms for the pit lake water quality estimates are described in detail in Section 5 of the Water Report.

6.3.2.3 Assumptions and Uncertainties

In addition to the definitions and constraints specified above, other key assumptions and uncertainties in the water quality estimates specifically include the following:

Mine Schedule

- All open pits are complete and all surface waste rock is placed in WRSA and in-pit by the end of year 2 of operations.
- Pit flooding begins once mining ceases (year 12).
- Transfer of excess TSF supernatant water occurs in year 12.
- The model assumes the TSF cover is effectively placed immediately after the end of mining (year 12).
- Covering of WRSA occurs at year 14 (the end of year 2 in the closure period).
- The in-pit mine rock and pit walls are progressively covered by the flooding open pit in the closure and post-closure period.

Mine Rock

- The proportions by rock type assumed for all open pit walls and stored waste rock was 70% BMS (BMS and BS rock types combined), 15% MSS and 15% MSED (Table 5.4.3.3-2), since detailed production schedules by rock type are not yet available.
- The proportion of non-PAG rock at all open pit walls and stored waste rock was 7% (Appendix K).
- A surface area of 50 m^2/t was assumed for the in-pit and WRSA mine rock.
- For unflooded mine rock including in-pit rock and the WRSA, a flushing factor of 40% of surfaces was applied with no accumulation of load on unflushed surfaces.
- For flooded mine rock 100% of the rock surface was assumed to be flushed.
- During operations, all flushed load was assumed to be removed from the open pit by ongoing dewatering and treatment activities.
- No allowance for flushing of accumulated load during operations was included in the model on the basis that the largest fraction of this load would be released to in-pit porewater and the net transfer rate of this pore water to pit water was expected to be relatively slow.
- Below 360 masl, Pits 1 and 2 are separate from Pit 3. Pit 3, which has no waste rock, has a relatively large volume of 1.95 Mm^3 below 360 masl. Therefore, the model was adjusted to initially fill the volume below 360 masl (2.3 years) for all three pits and then fill the remainder of the pits.
- For each square metre of exposed pit wall, a fracture factor of 50 m^2/m^2 was assumed.
- The time to acid on-set for waste rock and pit walls in the model was conservatively assumed to be only two years.

- The load released from the covered WRSA was conservatively assumed to be reduced only in direct proportion to the reduction in seepage rate with no further reduction due to restricted oxygen and water ingress by the cover.
- No legacy load from in-pit waste rock and pit walls was included in the long-term water quality estimate.
- Upon pit flooding to 388 masl, it was assumed all waste rock and pit walls are water covered with no further load release to the flooded open pit.

Tailings

- Operations and closure activities were successful at preventing acidic drainage within the covered tailings during the period of pit filling.
- Consideration of possible brines placed in the TSF during operations or in post-closure were specifically excluded from the current estimate based on insufficient information.
- Limited acidic loads were assumed to develop within the covered and lined tailings in the long-term from an average 2.5 cm thick active layer (thicker in the core and thinner at the periphery) within covered and lined, but unsaturated tailings. This load reported to the limited seepage defined for the liner and the balance of load was assumed to be directed to the open pit.
- The engineered tailings cover was assumed to be 90% efficient at limiting load release from the active tailings volume.
- High estimated lead loads from acidic leaching within the TSF in the long-term post-closure scenario were assumed to be solubility limited by precipitation of anglesite ($PbSO_4$).
- Aside from lead, no further equilibration/reductions were included in current estimates as may occur due to changing geochemical conditions along the flow-path down-stream of TSF seepage.

Surface Water

- Direct precipitation onto the filling open pit water surface was assumed to be proportional to the flooded pit volume/total pit volume with the remainder of the in-pit catchment assumed to be uncovered waste rock.
- Complete mixing of water in the flooding open pit was assumed to occur.

Groundwater

- During the period of pit flooding, all seepage from the WRSA and TSF was assumed to be captured by the filling open pit.

- In the long-term post-closure model:
  - 67% of the WRSA seepage (20 m^3/day) was captured by the open pit;
  - The remaining 33% of the WRSA seepage (10 m^3/d) was released offsite, and would eventually intercept with surface waters (i.e., Wabigoon Lake);
  - 67% of the TSF seepage (1.6 m^3/day) was captured by the open pit;
  - 20% of the TSF seepage (10 m^3/day) was captured by the open pit; and
  - The remainder of seepage was released off-site, and would eventually intercept with surface receiving waters in the following manner:
    - Blackwater Creek: 0.8 m^3/d
    - Thunder Lake: 0.1 m^3/d
    - Thunder Lake Tributary 3: 0.1 m^3/d
    - Hoffstrom's Bay Tributary: 0.1 m^3/d
- Net groundwater inflow rates to the open pit were assumed to be:
  - 700 m^3/day, on average, during pit filling, and
  - 100 m^3/day, on average, for the fully flooded open pit.

6.3.3 Project Effects Avoidance Measures Used in Predictions

There are a range of measures incorporated into the design for the Project that will avoid potential effects associates with geology and geochemistry, including the following:

- The geochemical properties of the waste rock will be evaluated and non-acid generating (NAG) waste rock will be segregated from potentially acid generating (PAG) waste rock, if feasible [Mit_019].
- The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the waste rock storage area (WRSA) [Mit_020].
- During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification [Mit_021].
- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022].

- At closure the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water [Mit_023].

The predicted effects of the Project on the “pit lake water quality” VC, as well as the long-term quality of the seepage from the TSF and WRSA consider the following two options for closure of the TSF:

- The dry cover option where the tailings will be covered with a low-permeability dry cover to limit the potential for acidification [Mit_023].

- The wet cover option where the tailings will be isolated from oxygen using a cover of non-process water to prevent acidification [Mit_023].

- 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 [Mit_024].

- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].

6.3.4 Predicted Effects

6.3.4.1 Seepage Quality Estimates from the WRSA and TSF

Dry Cover Option for the TSF

Estimates of the long-term TSF and WRSA seepage quality under post-closure conditions were determined since a portion of the seepage may not be captured by the open pit after flooding is complete. This seepage is not directly evaluated as an indicator for the “pit lake quality” VC, but the seepage entering the pit lake will affect the overall quality of the water within the pit lake. Additionally, seepage that leaves the site during post-closure is an important input to evaluate in the surface water quality modelling.

Model results (Table 6.3.4.1-1) indicate that seepage from the WRSA is expected to be acidic with elevated sulphate and metals, although the net loads released due to the presence of the cover are relatively modest due to low seepage rates. It is noted that estimated boron, chromium, molybdenum, silver and vanadium concentrations are primarily influenced by laboratory detection limit values in source terms.

Acidic and metal-rich waters have also been projected for long-term seepage from the TSF. However, the elevated loads for cadmium, copper, lead and particularly zinc in the estimated seepage quality may be driven by a particularly aggressive laboratory humidity cell source term that is based on the limited available data. It is noted that estimated antimony, chromium, molybdenum, silver and vanadium concentrations are primarily influenced by laboratory detection limit values in source terms. Given the HDPE liner proposed for the floor of the TSF, only a small quantity of seepage leaves the TSF to interact with surface waterbodies in the area.

Table 6.3.4.1-1: Seepage Quality Estimates for TSF and WRSA

Parameter	Dry Cover Option for TSF (mg/L)		Wet Cover Option for TSF (mg/L)	
	TSF	WRSA	TSF	WRSA
Sulphate	203	6,121	69	6,121
Aluminum	5	85	0.2	85
Antimony	0.0024	0.0011	0.0020	0.0011
Arsenic	0.016	0.038	0.018	0.038
Beryllium	0.0012	0.0049	0.0005	0.0049
Boron	0.06	0.12	0.02	0.12
Cadmium	0.1024	0.0074	0.0020	0.0074
Chromium	0.0006	0.0021	0.0001	0.0021
Cobalt	0.05	0.76	0.00	0.76
Copper	1.11	0.27	0.02	0.27
Iron	7	266	0.4	266
Lead	0.87 (1)	0.21	0.08	0.21
Mercury	—	0.00005	0.00	0.00005
Molybdenum	0.00029	0.00053	0.00100	0.00053
Nickel	0.16	5.76	0.02	5.76
Selenium	0.0041	0.0027	0.0005	0.0027
Silver	0.00006	0.00011	0.00005	0.00011
Thallium	0.00084	0.00058	0.03000	0.00058
Uranium	0.02	0.11	0.005	0.11
Vanadium	0.0059	0.0055	0.0040	0.0055
Zinc	50.7	3.4	0.04	3.4

Notes:
"— " Concentrations for mercury are not included due to incomplete source term data
(1) TSF seepage water quality estimate for lead is equilibrated (see text)
Un-equilibrated results except as indicated.

Wet Cover Option for the TSF

Estimates of the long-term TSF and WRSA seepage quality under post-closure conditions were determined for a wet closure option for the TSF (see Table 6.3.4.1-1). Estimates for the long-term WRSA seepage quality are the same as for the dry cover options, since there is no relationship between TSF management and the future WRSA. The TSF seepage water quality for a wet cover option assumes the seepage through the liner was non-acidic tailings porewater, which would have quality similar to tailings supernatant water (see Table 3.8.8-1).

Although seepage is not directly evaluated as an indicator for the “pit lake quality” VC, but the seepage entering the pit lake will affect the overall quality of the water within the pit lake. Additionally, seepage that leaves the site during post-closure is an important input to evaluate in the surface water quality modelling.

6.3.4.2 Pit Lake Water Quality Estimates

Dry Cover Option for the TSF

All results were conservative estimates in that they assume complete mixing of load within the open pit volume with no allowance for reactions that may occur within the flooded open pit. As described above, the initial results for elevated lead seepage from the covered TSF were equilibrated for solubility control by anglesite precipitation, which would be expected to occur. All other results are presented without geochemical equilibration. For this estimate, the predominant source of load (79 to 89%) for sulphate, aluminum, cobalt, iron, and nickel is from possible acidic seepage from the covered WRSA. The dominant source of load for cadmium, copper, lead, and zinc (87 to 97%) is from an assumed acidic load within the covered and lined TSF that may need to be intercepted and managed. The results are presented in Table 6.3.4.2-1. Treasury Metals realizes that they will need to monitor the quality of the water in the open pit as it is filling, and implement treatment to ensure the water quality will meet PWQO, or be less than background concentrations if background levels are greater than the PWQO, prior to it being discharged [Mit_024]. Treatment options such as batch lime addition to adjust the pH has been shown in other similar applications to be effective at reducing the metals concentrations dramatically. Additionally, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. To reflect this, Table 6.3.4.2-1 includes pit lake water quality predictions without mitigation, as well as the mitigated predictions.

Table 6.3.4.2-1: Pit Lake Water Quality

Parameter	Dry Cover Option for TSF (mg/L)		Wet Cover Option for TSF (mg/L)	
	Untreated	Treated to meet PWQO	Untreated	Treated to meet PWQO
Sulphate	53	53	59	59
Aluminum	0.81	0.08	0.84	0.08
Antimony	0.0012	0.0012	0.0011	0.0011
Arsenic	0.0017	0.0017	0.0014	0.0014
Beryllium	0.0010	0.0010	0.0010	0.0010
Boron	0.051	0.051	0.051	0.051
Cadmium	0.0022	0.0002	0.0001	0.0001

Table 6.3.4.2-1: Pit Lake Water Quality (continued)

Parameter	Dry Cover Option for TSF (mg/L)		Wet Cover Option for TSF (mg/L)	
	Untreated	Treated to meet PWQO	Untreated	Treated to meet PWQO
Chromium	0.00096	0.00096	0.00097	0.00097
Cobalt	0.0073	0.0009	0.0074	0.0009
Copper	0.027	0.005	0.004	0.004
Iron	2.5	0.3	2.8	0.3
Lead	0.02	0.01	0.003	0.003
Mercury	—	0.0002	0.00002	0.00002
Molybdenum	0.0010	0.0010	0.0010	0.0010
Nickel	0.049	0.025	0.055	0.025
Selenium	0.0010	0.0010	0.0010	0.0010
Silver	0.00010	0.00010	0.00010	0.00010
Thallium	0.00031	0.00030	0.00033	0.00030
Uranium	0.0060	0.0050	0.0059	0.0050
Vanadium	0.0011	0.0011	0.0010	0.0010
Zinc	1.09	0.03	0.04	0.03

Notes:
"— " Concentrations for mercury are not included due to incomplete source term data
(1) TSF seepage water quality estimate for lead is equilibrated (see text)
Un-equilibrated results except as indicated.

It has been identified that the acidic tailings source term for TSF seepage used in this estimate may be very high, especially for cadmium, lead and zinc. The single humidity cell that was the origin of this data was terminated during the initial on-set of acidic conditions and the elements in question may have been measured as a short-term transient condition in the test. The test was stopped at this point in analysis and therefore confirmation of a transient response cannot be ascertained without additional testing. It is also noted that estimated antimony, arsenic, boron, chromium, molybdenum, silver and vanadium concentrations are primarily influenced by laboratory detection limit values in source terms.

Wet Cover Option for TSF

The long-term post-closure open pit water quality model results, assuming a TSF wet cover option, are presented in Table 6.3.4.2-1. The results indicated long-term pit lake water quality will have slightly elevated sulphate (50 mg/L), but generally low metal concentrations. Overall pit water quality is projected to be similar to that of the TSF dry cover option for some parameters (e.g., sulphate, aluminum, antimony, arsenic, beryllium, chromium, cobalt, iron, molybdenum, nickel, selenium, thallium, uranium, and vanadium), but much lower for other elements (cadmium, copper, lead and zinc) upon elimination of acidic drainage from the TSF. Mercury was also able to be estimated for this scenario, since source term data was available. Estimated mercury concentrations were relatively low since they are largely based on detection limit values in the available source term data.

All pit water quality results are conservative estimates in that they assume complete mixing of load within only the annual estimated open pit discharge volume with no allowance for reactions and equilibration within the flooded open pit. For this estimate the predominant source of load (76 to 100%) for sulphate, aluminum, arsenic, cadmium, cobalt, copper, iron, lead, nickel and zinc is from possible acidic seepage from the covered WRSA. It is noted that in addition to mercury, estimated antimony, arsenic, boron, chromium, molybdenum, silver and vanadium concentrations are primarily influenced by laboratory detection limit values in source terms.

Treasury Metals realizes they will need to monitor the quality of the water in the open pit as it fills, and implement treatment to ensure the water quality will meet PWQO, or background concentrations if background levels are greater than the PWQO, prior to it being discharged [Mit_024]. Additionally, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].

6.3.4.3 Summary of Predicted Adverse Effects

As described in Section 3.14, the Project will result in the formation of a pit lake. There will be adverse effects predicted to the pit lake quality VC used to describe the effects of the Project on geology and geochemistry. These adverse effects will only occur during the post-closure phase of the Project, and there are no predicted adverse effects during the other three phases (i.e., site preparation and construction, operations, or closure phases). Treasury Metals acknowledge that they will need to test the quality of the water in the open pit as it is filling, and batch treat the water if necessary, in order to meet Provincial Water Quality Objectives (PWQO), or be less than background concentrations if background levels are greater than the PWQO, prior to water being released [Mit_024]. Additionally, Treasury Metals expects that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. The predicted adverse effects of the Project on the pit lake water quality VC are summarized in Table 6.3.4.3-1. The table shows the pit lake water quality predictions with and without required treatment to ensure that pit lake water quality discharge meets PWQO, or background concentrations if background levels are greater than the PWQO, prior to discharge [Mit_024; Mit_124]. The residual adverse effects are also provided for the following two closure options for the TSF:

- The dry cover option where the tailings will be covered with a low-permeability dry cover to limit the potential for acidification.
- The wet option where the tailings will be isolated from oxygen using a cover of non-process water to prevent acidification.

Table 6.3.4.3-1: Predicted Adverse Effects for Pit Lake Water Quality

Parameter	Open Pit Water Quality Dry TSF cover option (mg/L)		Open Pit Water Quality Wet TSF cover option (mg/L)	
	Untreated	Treated to meet PWQO	Untreated	Treated to meet PWQO
Sulphate	53	53	59	59
Aluminum	0.81	0.08	0.84	0.08
Antimony	0.0012	0.0012	0.0011	0.0011
Arsenic	0.0017	0.0017	0.0014	0.0014
Beryllium	0.0010	0.0010	0.0010	0.0010
Boron	0.051	0.051	0.051	0.051
Cadmium	0.0022	0.0002	0.0001	0.0001
Chromium	0.00096	0.00096	0.00097	0.00097
Cobalt	0.0073	0.0009	0.0074	0.0009
Copper	0.027	0.005	0.004	0.004
Iron	2.5	0.3	2.8	0.3
Lead	0.02	0.01	0.003	0.003
Mercury	—	0.0002	0.00002	0.00002
Molybdenum	0.0010	0.0010	0.0010	0.0010
Nickel	0.049	0.025	0.055	0.025
Selenium	0.0010	0.0010	0.0010	0.0010
Silver	0.00010	0.00010	0.00010	0.00010
Thallium	0.00031	0.00030	0.00033	0.00030
Uranium	0.0060	0.0050	0.0059	0.0050
Vanadium	0.0011	0.0011	0.0010	0.0010
Zinc	1.09	0.03	0.04	0.03

6.3.5 Identified Mitigation

The following will be employed as part of the Project to limit or avoid the effects on geology and geochemistry:

- The geochemical properties of the waste rock will be evaluated and NAG waste rock will be segregated from PAG waste rock, if feasible. [Mit_019].
- The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA. [Mit_020].
- During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification. [Mit_021].

- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification. [Mit_022].
- At closure the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. [Mit_023].
- 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. [Mit_024].
- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].

A review of the predicted adverse effects listed in Table 6.3.4.3-1 shows that for most indicators, the effects on the pit lake quality VC can be mitigated slightly, by using a wet cover closure option for the TSF. For this reason, the wet cover closure option over the TSF [Mit_023] as the preferred option. A wet cover prevents acidification of the tailings, which improves the quality of seepage in the long-term and would result in slightly improved pit lake water quality. As a result, the wet cover closure option over the TSF [Mit_023] would also benefits the quality of surface water in the receiving environment (see Section 6.8).

6.3.6 Residual Adverse Effects

Even with the application of avoidance measures (Section 6.3.3) and the mitigation measures summarized in Section 6.3.6, residual adverse effects on the pit lake water quality VC will remain. These residual adverse effects are summarized in Table 6.3.6-1.

Table 6.3.6-1: Residual Adverse Effects on Pit Lake Water Quality

Indicator	Pit Lake Water Quality (mg/L)			
	Site Preparation and Construction	Operations	Closure	Post-closure
Sulphate	—	—	—	59
Aluminum	—	—	—	0.08
Antimony	—	—	—	0.0011
Arsenic	—	—	—	0.0014
Beryllium	—	—	—	0.0010
Boron	—	—	—	0.051
Cadmium	—	—	—	0.0001
Chromium	—	—	—	0.00097

Table 6.3.6-1: Residual Adverse Effects on Pit Lake Water Quality (continued)

Indicator	Pit Lake Water Quality (mg/L)			
	Site Preparation and Construction	Operations	Closure	Post-closure
Cobalt	—	—	—	0.0009
Copper	—	—	—	0.004
Iron	—	—	—	0.3
Lead	—	—	—	0.003
Mercury	—	—	—	0.00002
Molybdenum	—	—	—	0.0010
Nickel	—	—	—	0.025
Selenium	—	—	—	0.0010
Silver	—	—	—	0.00010
Thallium	—	—	—	0.00030
Uranium	—	—	—	0.0050
Vanadium	—	—	—	0.0010
Zinc	—	—	—	0.03

Note:
The "—" symbol indicates where there were no predicted residual adverse effects.

The predicted spatial extent of the effects on the single geochemistry VC, pit lake quality, identified in Section 6.1.2 will be the footprint of the pit lake. Any potential effects of geochemical reaction on surface water or groundwater quality are dealt with explicitly in the surface water quality and groundwater quality assessments provided in Sections 6.8 and 6.10, respectively.

6.3.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, the following questions were wholly, or partially, asking for information, and clarification regarding the predicted the effects of the Project on geology and geochemistry. Responses to the IRs were provided separately, and incorporated into the relevant sections of the Revised EIS. The following lists the Round 1 IRs related to the predicted geology and geochemistry effects of the Project.

- TMI_47-MW(1)-09: chemical stability of overburden;
- TMI_49-MW(1)-11: ARD/ML, including quality of seepage from TSF;
- TMI_50-MW(1)-12: pit water quality geochemical modeling;
- TMI_53-MW(1)-15: methods for estimating time to ARD onset;
- TMI_58-MW(1)-20: revise estimates and compare results to regulatory objectives;
- TMI_134-FH(1)-13: provide predicted water quality of the pit lake;
- TMI_294-RG(1)-29: details of the geochemical modelling and relation to water quality;
- TMI_345-AC(1)-19: detailed analysis of open pit water quality;

- TMI_622-AC(1)-295: acid rock drainage; and
- TMI_693-PC(1)-08: acid rock drainage.

6.4 Noise

6.4.1 Potential Effects of the Project on the Environment

The potential effects of the Project on noise will vary by Project phase, and with varying levels of activity. The following lists the potential noise effects by Project phase:

- **Site preparation and construction phase:**
  - Environmental noise associated with the equipment and activities to complete the site clearing and preparation;
  - Blasting noise; and
  - Traffic noise associated with construction vehicles moving to and from the Project.
- **Operations phase:**
  - Environmental noise associated with the equipment and activities involved with mining and processing;
  - Blasting noise; and
  - Traffic noise associated with operational vehicles moving to and from the Project.
- **Closure phase:**
  - Environmental noise associated with the equipment and activities to complete the closure and reclamation activities; and
  - Traffic noise associated with closure vehicles moving to and from the Project.
- **Post-closure phase:**
  - No sources of noise anticipated.

The potential effects of the Project on noise have been described using a simple linkage diagram on Figure 6.4.1-1. The figure illustrates the noise VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. Additionally, the figure indicates those other components of the environment (shown in red in the figure) where the predicted effects of the Project on noise will be used as an input for determining the effects on other VCs. For example, noise effects will be used as an input for determining the effects of the Project on wildlife and wildlife habitat. There are no other components or VCs that provide inputs to the assessment of noise effects, however, the noise modelling did use information related to the expected traffic volumes presented in Appendix E.

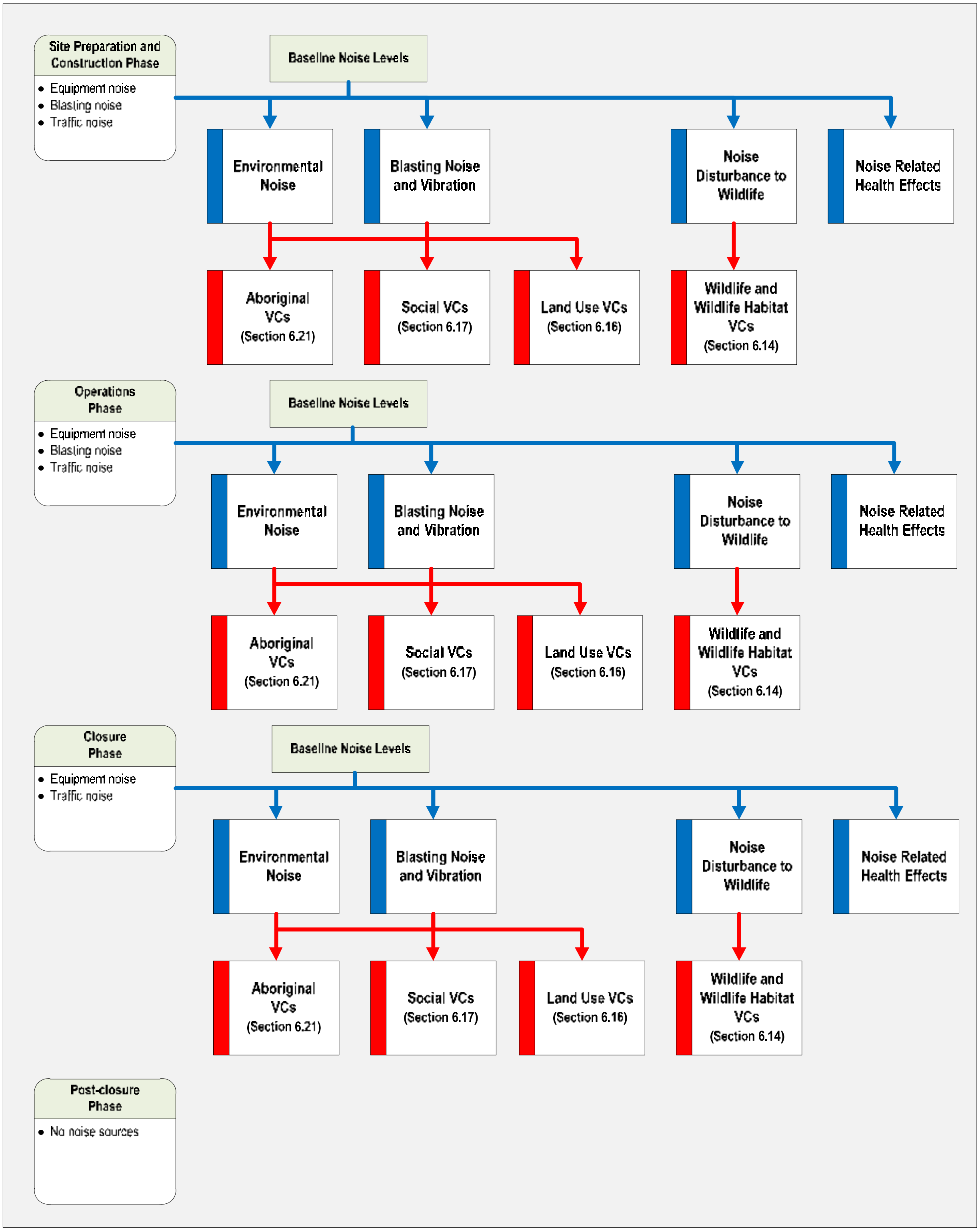


Figure 6.4.1-1: Noise Linkage Diagram

6.4.2 Effects Prediction Methods

The methods used to predict the noise effects of the Project are described in Section 3 of the Environmental Noise Assessment (included in Appendix H to the EIS). The general steps involved in predicting the noise effects are:

- Determine the sources of sound emissions;
- Use numerical models to predict the noise effects from continuous sources;
- Use numerical calculations to determine traffic noise effects; and
- Use numerical calculations to determine blasting noise effects.

6.4.2.1 Sources of Sound Emissions

As described in Section 3.2 of the Environmental Nosie Assessment (included in Appendix H-4 of the revised EIS), the best-available data regarding future construction, operations, and decommissioning were collected from Treasury Metals, and used to predict sound level emissions for the Project. The basis for model inputs was primarily obtained from the Project description, with further information gathered through discussions with Treasury Metals. Equipment sizes for sources such as the excavators and bulldozers have not yet been defined. Therefore, sizes were estimated from production levels and sound levels were predicted using numerical modelling techniques, or taken from manufacturer data for typical equipment. Where limited data was available on equipment, typical levels were selected from the RWDI library. Additional details on the sound level emissions is also provided in the Acoustic Assessment Report (Appendix H-3).

6.4.2.2 Noise Effects Predictions from Continuous Sources

As described in Section 3.3.1 of the Environmental Noise Assessment (Appendix H-4 of the revised EIS), the modelling of noise from continuous sources was conducted using Cadna/A, a commercially available implementation of the ISO 9613 (ISO 1994b and ISO 1996) algorithms. Cadna/A is produced by Datakustik GmbH. The ISO-9613 algorithms are the current international standard for airborne sound propagation, and are widely used in noise impact assessments in Ontario and Canadian jurisdictions. Modelling parameters have been selected to conform to the preferred parameters of the Ministry of Environment and Climate Change (MOECC). These parameters introduce some additional conservatism to the modelling beyond that which would be achieved with strict conformance to the ISO standard, meaning that sound levels are predicted to be slightly higher than they otherwise would be. The modelling considered the following:

- Source sound power level and directivity;
- Distance attenuation; Source-receptor geometry including heights, elevations and topography;
- Barrier effects of the site and surrounding buildings;

- Duration of events;
- Ground and air (atmospheric) attenuation; and
- Meteorological effects on sound propagation.

As described in the response to TMI_191-AE(1)-29, sound level adjustments per NPC-103 were not included in the calculations as the sources that would be present at the Project do not typically exhibit the sound characteristics to warrant adjustments (i.e., ventilation equipment, generators, building exhausts, on site vehicle traffic and rock crushing equipment). Note that backup alarms used on mobile equipment, depending on the variety, are tonal but are exempt from evaluation since they are a safety device. Further discussion is provided in a technical memorandum included as Appendix H-5.

The noise source summary tables for each of the Project phases are provided in the relevant sections of Appendix H-4 (Section 6.2: Site Preparation and Construction; Section 7.2: Operations; Section 8.2: Closure). Treasury Metals will ensure that equipment selected on site will either match or be quieter than the requirements outlined within the Environmental Noise Assessment (Appendix H-4).

6.4.2.3 Noise Effects from Traffic

The noise from vehicle traffic to and from the Project site (off-site traffic) was assessed using traffic modelling as described in response to TMI_186-AE(1)-24. Traffic information was extracted from the Goliath Gold Traffic Impact Study (i.e., "TIS" included as Appendix E in the EIS) to obtain the estimated daily traffic volumes on Highway 17 and Anderson Road / Nursery Road both with and without the Project. Traffic noise modelling was conducted using the Ontario Ministry of the Environment and Climate Change's ORNAMENT roadway model. Inputs to the ORNAMENT model were based on information available in the TIS, guidance from the Ontario Ministry of Transportation, and standard modelling practices. Model inputs are summarized in Table 6.4.2.3-1. The modelling approach is further outlined in the technical memorandum included in Appendix H of the EIS.

Table 6.4.2.3-1: Estimated Daily Traffic Volumes Used in Offsite Traffic Modelling

Phase	Road Segment [(a)]	AM / PM Peak Hour Volume [(b)]	Total Average Daily Volume	Total Daytime (0700–2200h) Volume [(f)]	Total Nighttime (2200–0700h) Volume [(e)]
Baseline	Anderson / Nursery Rd.	2 / 8	80 [(c)]	68	12
	Hwy 17 East of Anderson Rd.	339 / 359	3,590 [(c)]	30,52	539
	Hwy 17 West of Anderson Rd.	341 / 367	3,670 [(c)]	3,120	551
Construction	Anderson / Nursery Rd.	200 / 200	469 [(d)]	235	234
	Hwy 17 East of Anderson Rd.	110 / 332	2,987 [(e)]	2,822	165
	Hwy 17 West of Anderson Rd.	230 / 452	4,187 [(e)]	3,842	345
Operation	Anderson / Nursery Rd.	119 / 119	275 [(e)]	138	138

Table 6.4.2.3-1: Estimated Daily Traffic Volumes Used in Offsite Traffic Modelling (continued)

Phase	Road Segment [(a)]	AM / PM Peak Hour Volume [(b)]	Total Average Daily Volume	Total Daytime (0700–2200h) Volume [(f)]	Total Nighttime (2200–0700h) Volume [(e)]
	Hwy 17 East of Anderson Rd.	95 / 322	2,880 [(e)]	2,737	143
	Hwy 17 West of Anderson Rd.	166 / 393	3,590 [(e)]	3,341	249

Notes:

(a) Anderson Rd. and Nursery Rd. assumed to have same volumes due to route layout.
(b) Peak hour values determined from turning movement volumes in Traffic Impact Study (Appendix E of the revised EIS).
(c) Average daily traffic (ADT) determined by assuming PM peak hour is 10% of total.
(d) ADT determined from Table 9 of Traffic Impact Study for trips associated with Project.
(e) ADT determined using combination of mine AM peak (5am, nighttime) and mine PM peak (6pm, daytime).
(f) Day/Night split assumed to be 85%/15% based on typical MTO value for provincial highways. Similar truck splits assumed to be 5% medium and 8% heavy trucks per MTO for provincial highways.

6.4.2.4 Noise Effects from Blasting

As described in Section 3.3.2 of the Environmental Noise Assessment (Appendix H-4 of the revised EIS), the modelling of blasting sound levels was conducted using numerical modelling techniques presented in the International Society of Explosives Engineers Blaster's Handbook (ISEE 2011). Airborne vibration due to blasting activities attenuates from a site at a slower rate than ground vibrations. The distribution of this air vibration energy from a blast is also strongly influenced by the prevailing weather conditions during the blast. Factors considered in the calculations include:

- Charge-weight per delay;
- Depth of burial;
- Volume of displaced rock;
- Delay time intervals;
- Type of explosive;
- Atmospheric conditions; and
- Topography.

The additive effect of blasting to the overall Project sound levels were also considered in response to TMI_190-AE(1)-28 which was assessed in accordance with Annex B to ISO 1996-1:2003 by converting peak blasting pressures in to sound exposure levels using conservative assumptions. Further discussion is provided in the technical memorandum included as Appendix H-5.

6.4.3 Project Effects Avoidance Measures Used in Predictions

Those aspects of the Project that will that will help avoid or reduce the predicted noise effects (Sections 6.4, 7.4 and 8.4 of Appendix H-4 to the revised EIS). There were no predicted noise effects during the post-closure phase. In order to achieve compliance with MOECC criteria at all of the worst case receptors, the sound power levels of equipment were limited in some cases. The limited power levels used in the assessment are still within the accepted range of power levels from this type of equipment from different manufacturers and of different ages, but are quieter than average. Treasury Metals will ensure that sound levels from these pieces of equipment meet these requirements. The noise avoidance measures include the following:

- Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025].
- Advise nearby residents of significant noise-causing activities, such as blasting, and endeavour to schedule those events to reduce disruption to residents [Mit_026, Mit_027].
- Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028].
- Implement a modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay. [Mit_029].
- The location of the WRSA and overburden stockpiles will effectively act as noise berms where possible to reducing the levels of noise off-site [Mit_032].

6.4.4 Predicted Effects

The predicted noise effects associated with the Project were described in the Environmental Noise Assessment (included in Appendix H to the EIS). The predicted effects of the Project were presented separately for the site preparation and construction phase, operations phase, and closure phase to reflect the differing levels of activity, locations of activity in each phase. As no noise sources were identified in the post-closure phase, no post-closure predictions were made.

6.4.4.1 Site Preparation and Construction Phase

As described in Section 6.1.3.3, the assessment of the potential effects of the Project on noise considers following four VCs:

- Environmental noise levels;
- Noise disturbance to wildlife, including SAR;
- Blasting noise levels; and
- Noise related health effects.

In evaluating the effects of the Project on the environmental noise levels VC, a single indicator of equivalent noise levels (L_{EQ}) was used. Table 6.4.4.1-1 presents the predicted 1-hour L_{EQ} values at the worst case receptors during the site preparation and construction phase for comparison to the provincial guideline limit of 40 dBA.

Table 6.4.4.1-1: Environmental Noise Predictions, Site Preparations and Construction

Rec #	Description	Predicted 1-Hour L_{EQ} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	40	39
NR04	House – owned by Nystrom	33	32
NR30	House – East Thunder Lake Road	33	32
NR44	House – near Trans-Canada Highway	29	28
NR47	House – East Thunder Lake Road	29	28

For evaluating the effects of the Project on the noise disturbance to wildlife VC, a single indicator of equivalent noise levels (L_{EQ}) was also used. During the site preparation and construction phase the Project activities were predicted to result in areas with noise levels above the 50 dBA, threshold identified by Environment Canada. Figure 6.4.4.1-1 presents the predicted 50 dBA noise contour line during the site preparation and construction phase.

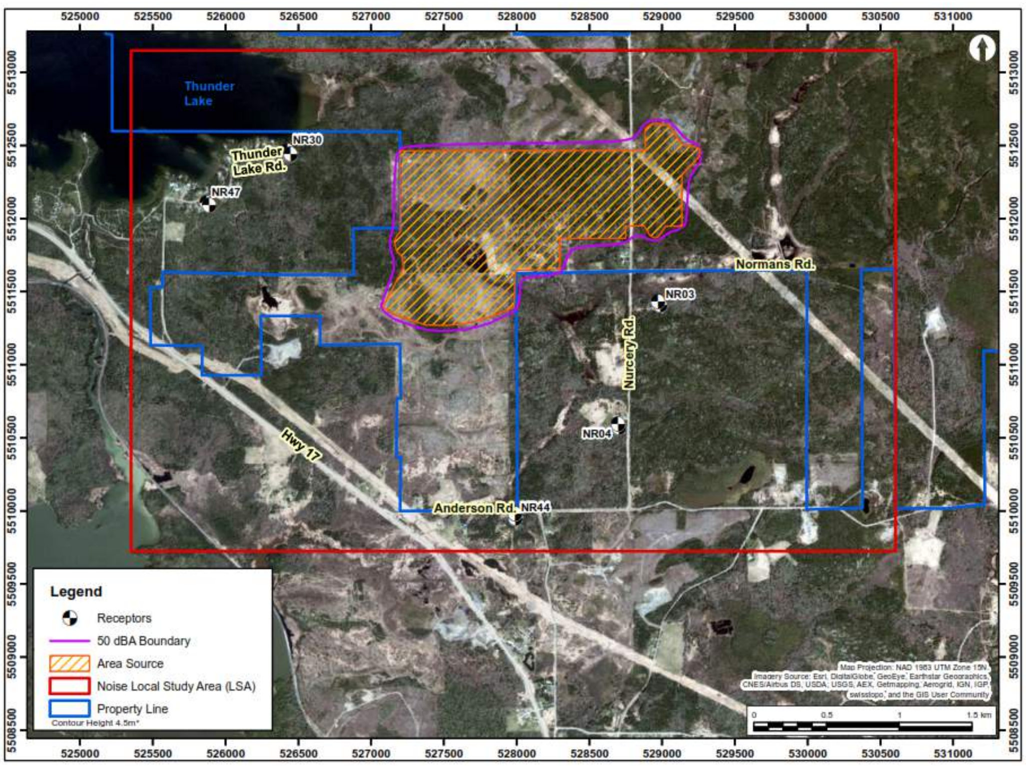


Figure 6.4.4.1-1: Predicted 50 dBA Contour, Site Preparation and Construction

The areal extents are set out in Table 6.4.4.1-2. The table indicates the areas above 50 dBA within the Project site, the areas beyond the Project site but within the LSA predicted to exceed 50 dBA, and the areas beyond the LSA where noise is predicted to exceed 50 dBA.

Table 6.4.4.1-2: Areas with Noise Predicted above 50 dBA, Site Preparations and Construction

Measure	Project Site	LSA	RSA
Area > 50 dBA (ha)	430.1	0	0

During the site preparation and construction phase, blasting will be occurring at the open pit. Treasury Metals has committed that open pit blasting will occur only once per day, and only on selected days during the week. As described in Section 6.1.3.3, two indicators were identified for evaluating the blasting noise and vibration VC, namely the peak sound pressure and the peak particle velocity. The predicted peak sound pressure during the site preparations and construction phase are provided in Table 6.4.4.1-3, while Table 6.4.4.1-4 provides the predicted peak particle velocities.

Table 6.4.4.1-3: Blasting Noise Predictions, Site Preparations and Construction

Rec #	Description	Distance (m)	Peak Sound Pressure (dB)
NR03	House - owned by McLeish	1,813	78
NR04	House - owned by Nystrom	3,000	71
NR30	House - East Thunder Lake Road	2,373	75
NR44	House - near Trans-Canada Highway	3,734	68
NR47	House - East Thunder Lake Road	3,187	70

Table 6.4.4.1-4: Blasting Vibration Predictions, Site Preparations and Construction

Rec #	Description	Distance (m)	Peak Particle Velocity (cm/s)
NR03	House - owned by McLeish	1,813	0.123
NR04	House - owned by Nystrom	3,000	0.057
NR30	House - East Thunder Lake Road	2,373	0.082
NR44	House - near Trans-Canada Highway	3,734	0.041
NR47	House - East Thunder Lake Road	3,187	0.052

To ensure the potential effects of noise on human health was captured, the EIS followed the guidance provided by Health Canada (2010; 2016). Three indicators were used when evaluating the noise related human health effects from the Project. The predictions for the site preparation and construction phase for these indicators are provided in Table 6.4.4.1-5 (absolute sound pressure) and Table 6.4.4.1-6 (change in percent highly annoyed). As Round 1 information requests (TMI_190-AE(1)-28), these values were updated to include the influence of blasting resulting in an increase in predicted L_{DN} of 1 dB or less, and an increase in predicted change in%HA of 0.2% or less.

Table 6.4.4.1-5: Absolute Sound Pressure Predictions, Site Preparations and Construction

Rec #	Description	Predicted L_{DN} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	57	56
NR04	House - owned by Nystrom	50	49
NR30	House - East Thunder Lake Road	50	49
NR44	House - near Trans-Canada Highway	46	45
NR47	House - East Thunder Lake Road	46	45

Table 6.4.4.1-6: Change in Percent Highly Annoyed, Site Preparations and Construction

Rec #	Description	Predicted Change in%HA	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	1.7	1.6
NR04	House – owned by Nystrom	0.4	0.3
NR30	House – East Thunder Lake Road	0.4	0.3
NR44	House – near Trans-Canada Highway	0.2	0.1
NR47	House – East Thunder Lake Road	0.2	0.1

The effect of the change in traffic noise on human health was also assessed at the three most-affected receptors located along the access road route of Anderson Road and Nursery Road, NR03, NR04, and NR44 as requested in TMI_186-AE(1)-24. Receptors further away from the access road would experience less effect. The results are presented in Table 6.4.4.1-7 and represent the cumulative influence of steady-state sources, blasting noise, and traffic noise for site preparations and construction.

Table 6.4.4.1-7: Influence of Traffic Noise, Site Preparations and Construction

Rec #	Description	Predicted L_{DN} (dBA) without Project	Predicted L_{DN} (dBA) with Project	Predicted Change in% HA
NR03	House - owned by McLeish	58	60	2.2%
NR04	House - owned by Nystrom	60	61	0.9%
NR44	House - near Trans-Canada Highway	64	65	1.3%

6.4.4.2 Operations Phase

Table 6.4.4.2-1 presents the predicted 1-hour L_{EQ} values, the indicator for the environmental noise VC, at the worst case receptors during the operations phase for comparison to the provincial guideline limit of 40 dBA.

Table 6.4.4.2-1: Environmental Noise Predictions, Operations

Rec #	Description	Predicted 1-Hour L_{EQ} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	40	38
NR04	House - owned by Nystrom	34	33
NR30	House - East Thunder Lake Road	34	33
NR44	House - near Trans-Canada Highway	30	30
NR47	House - East Thunder Lake Road	31	30

Figure 6.4.4.2-1 presents the predicted 50 dBA noise contour during the operations phase. During the operations phase the Project activities were predicted to result in areas with noise levels above 50 dBA, as set out in Table 6.4.4.2-2.

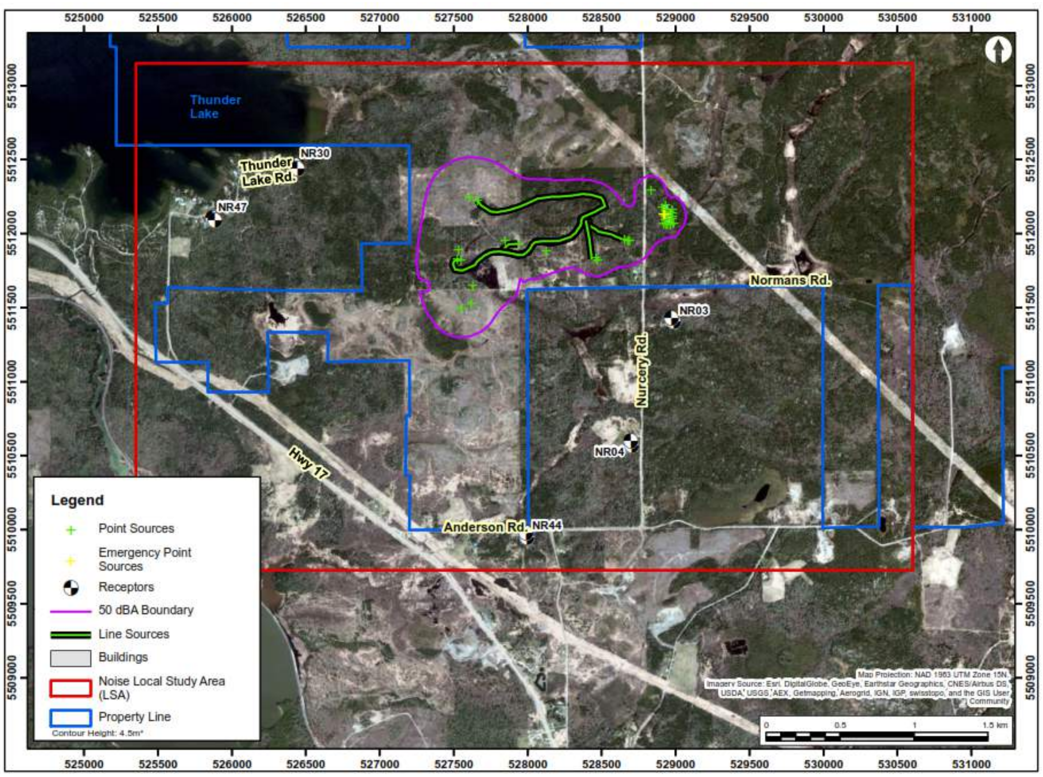


Figure 6.4.4.2-1: Predicted 50 dBA Contour, Operations

Table 6.4.4.2-2: Areas with Noise Predicted above 50 dBA, Operations

Measure	Project Site	LSA	RSA
Area > 50 dBA (ha)	198.9	0	0

During the operations, blasting will be occurring once per day, on selected days during the week. The two indicators were identified for evaluating the blasting noise and vibration VC are the peak sound pressure and the peak particle velocity. The predicted peak sound pressure during the operations phase are provided in Table 6.4.4.2-3, while Table 6.4.4.2-4 provides the predicted peak particle velocities.

Table 6.4.4.2-3: Blasting Noise Predictions, Operations

Rec #	Description	Distance (m)	Peak Sound Pressure (dB)
NR03	House - owned by McLeish	1,813	78
NR04	House - owned by Nystrom	3,000	71
NR30	House - East Thunder Lake Road	2,373	75
NR44	House - near Trans-Canada Highway	3,734	68
NR47	House - East Thunder Lake Road	3,187	70

Table 6.4.4.2-4: Blasting Vibration Predictions, Operations

Rec #	Description	Distance (m)	Peak Particle Velocity (cm/s)
NR03	House - owned by McLeish	1,813	0.123
NR04	House - owned by Nystrom	3,000	0.057
NR30	House - East Thunder Lake Road	2,373	0.082
NR44	House - near Trans-Canada Highway	3,734	0.041
NR47	House - East Thunder Lake Road	3,187	0.052

To ensure the potential effects of noise on human health was captured, the EIS followed the guidance provided by Health Canada (2010; 2016). Three indicators were used when evaluating the noise related human health effects from the Project. The predictions for the operations phase absolute sound pressure and change in percent highly annoyed in Tables 6.4.4.2-5 and 6.4.4.2-6, respectively. These results include the influence of blasting noise as well as steady state noise sources as requested in TMI_190-AE(1)-28, resulting in an increase in predicted L_{DN} of 1 dB or less, and an increase in predicted change in%HA of 0.2% or less.

Table 6.4.4.2-5: Absolute Sound Pressure Predictions, Operations

Rec #	Description	Predicted L_{DN} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	57	56
NR04	House - owned by Nystrom	51	50
NR30	House - East Thunder Lake Road	51	50
NR44	House - near Trans-Canada Highway	47	46
NR47	House - East Thunder Lake Road	48	47

Table 6.4.4.2-6: Change in Percent Highly Annoyed, Operations

Rec #	Description	Predicted Change in%HA	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	2.0	1.5
NR04	House - owned by Nystrom	0.5	0.4
NR30	House - East Thunder Lake Road	0.5	0.4
NR44	House - near Trans-Canada Highway	0.2	0.2
NR47	House - East Thunder Lake Road	0.2	0.2

The effect of the change in traffic noise on human health was also assessed at the three most-affected receptors located along the access road route of Anderson Road and Nursery Road, as requested in TMI_186-AE(1)-24. Receptors further away from the access road would experience less effect. The results are presented in Table 6.4.4.2-7 and represent the cumulative influence of steady-state sources, blasting noise, and traffic noise for site preparations and construction.

Table 6.4.4.2-7: Influence of Traffic Noise, Operations

Rec #	Description	Predicted L_{DN} (dBA) without Project	Predicted L_{DN} (dBA) with Project	Predicted Change in% HA
NR03	House - owned by McLeish	58	60	1.8%
NR04	House - owned by Nystrom	60	61	0.7%
NR44	House - near Trans-Canada Highway	64	65	1.1%

6.4.4.3 Closure Phase

During the closure phase, Treasury Metals will be undertaking activities to decommission the Project and return the site to a condition that can function ecologically. Table 6.4.4.3-1 presents the predicted L_{EQ} values, the indicator for the environmental noise VC, at the worst case receptors during the closure phase.

Table 6.4.4.3-1: Environmental Noise Predictions, Closure

Rec #	Description	Predicted L_{EQ} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	39	39
NR04	House - owned by Nystrom	31	31
NR30	House - East Thunder Lake Road	31	30
NR44	House - near Trans-Canada Highway	27	25
NR47	House - East Thunder Lake Road	27	26

Figure 6.4.4.3-1 presents the predicted 50 dBA noise contour the closure phase. During the closure phase the Project activities were predicted to result in areas with noise levels above 50 dBA, as set out in Table 6.4.4.3-2.

Table 6.4.4.3-2: Areas with Noise Predicted above 50 dBA, Closure

Measure	Project Site	LSA	RSA
Area > 50 dBA (ha)	122.1	0	0

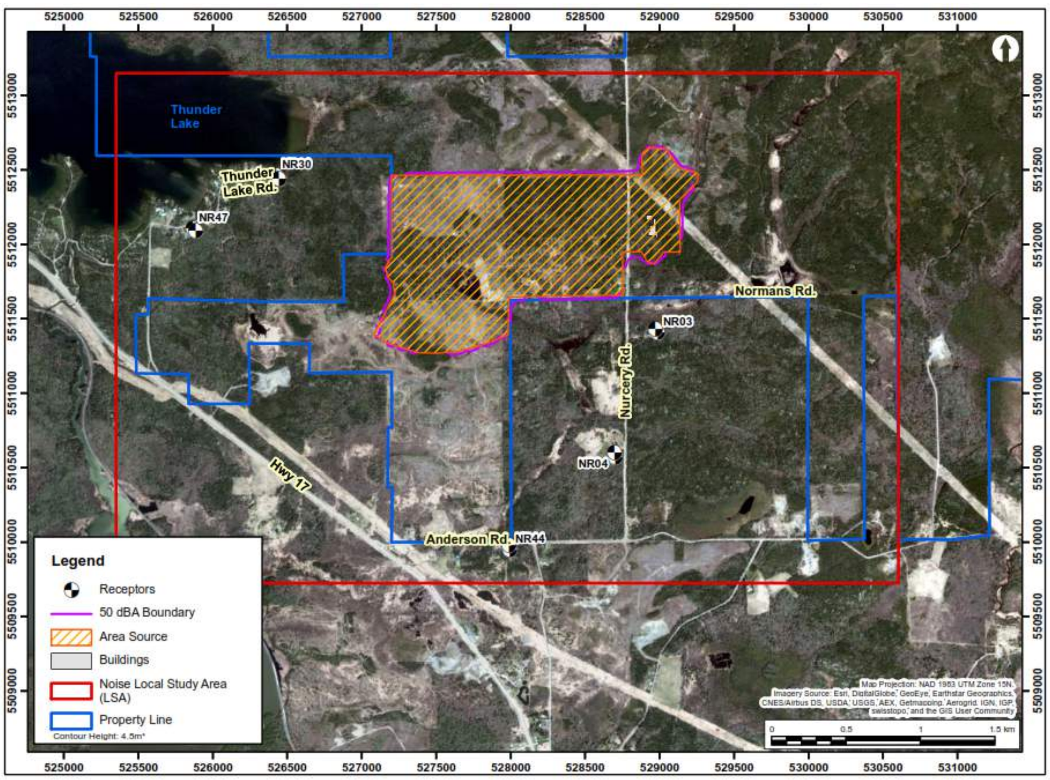


Figure 6.4.4.3-1: Predicted 50 dBA Contour, Closure

During the closure phase, no blasting will occur at the site. Therefore, there are no predicted effects for the blasting noise and vibration VC.

To ensure the potential effects of noise on human health was captured, three indicators were used to evaluate the noise related human health effects from the Project. The respective closure phase predictions of absolute sound pressure and change in percent highly annoyed are presented in Tables 6.4.4.3-3 and 6.4.4.3-4, respectively.

Table 6.4.4.3-3: Absolute Sound Pressure Predictions, Closure

Rec #	Description	Predicted L_{DN} (dBA)	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	55	55
NR04	House - owned by Nystrom	48	47
NR30	House - East Thunder Lake Road	47	46
NR44	House - near Trans-Canada Highway	43	42
NR47	House - East Thunder Lake Road	43	42

Table 6.4.4.3-4: Change in Percent Highly Annoyed, Closure

Rec #	Description	Predicted Change in%HA	
		Residence	Outdoor Receptor
NR03	House - owned by McLeish	1.3	1.2
NR04	House - owned by Nystrom	0.3	0.2
NR30	House - East Thunder Lake Road	0.2	0.2
NR44	House - near Trans-Canada Highway	0.1	0.1
NR47	House - East Thunder Lake Road	0.1	0.1

Specific traffic information was not available for the closure phase, but is expected to be equivalent or less than the construction phase as a conservatism. The effect of the change in traffic noise on human health for the closure phase is presented in Table 6.4.4.3-5 and represent the cumulative influence of steady-state sources, blasting noise, and traffic noise for site preparations and construction.

Table 6.4.4.3-5: Influence of Traffic Noise, Closure

Rec #	Description	Predicted L_{DN} (dBA) without Project	Predicted L_{DN} (dBA) with Project	Predicted Change in% HA
NR03	House - owned by McLeish	58	60	1.8%
NR04	House - owned by Nystrom	60	61	0.7%
NR44	House - near Trans-Canada Highway	64	65	1.1%

6.4.4.4 Post-closure Phase

As described in Section 6.4.4.1, there were no sources of noise that would result in a measurable effect during the post-closure phase.

6.4.5 Identified Mitigation

The Project will employ best practices that will help reduce and mitigate noise effects, including the following:

- Blasting conducted in phased manner that optimizes the amount of explosives needed for a given area to be blasted, the amount of explosives detonated for a given time delay within the detonating procedure and that minimizes the area being blasted [Mit_029].
- Where potential effects of vibration to spawning shoals is identified, blasting practices will be adjusted to mitigate the effects [Mit_030].
- Advise nearby residents of significant noise-causing activities, such as blasting, and endeavour to schedule those events to reduce disruption to residents [Mit_026, Mit_027].
- Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025].
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031].
- Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028].

In addition to these measures, Treasury Metals is exploring the feasibility of using other possible forms of noise mitigation such as the following:

- Possible rubber bedding material currently being investigated.
- Employing white noise backup alarms for surface equipment to reduce the tonal noise compared to traditional backup alarms. It should be noted that backup alarms are not included in the noise that is regulated in Ontario due to their importance for ensuring worker health and safety.
- In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033].

6.4.6 Residual Adverse Effects

Even with the identified mitigation measures summarized in Section 6.4.5, residual adverse effects are predicted to remain for each of the noise VCs and indicators. Residual adverse effects on the environmental noise levels, wildlife noise effects, and noise-related health effects VCs are predicted during the site preparation and construction, operations, and closure phases. Residual adverse effects on blasting noise and vibration VC will only occur during the site preparation and construction, and operations phases. The predicted residual adverse effects are shown in Table 6.4.6-1.

Table 6.4.6-1: Residual Adverse Effects for Noise

Valued Components (VCs)	Indicators	Measures	Predicted Noise Effects			
			Site Preparation Construction	Operations	Closure	Post-Closure
Environmental noise levels	L_{EQ}	dBA	40	40	39	N/A(2)
Noise disturbance to wildlife	Area > 50 dBA	ha	430 within Project Site	199 within Project Site	122 within Project Site	N/A(2)
			0 LSA	0 LSA	0 LSA	
			0 RSA	0 RSA	0 RSA	
Blasting noise and vibration	Peak sound pressure	dB	78	78	N/A(1)	N/A(2)
	Peak particle velocity	cm/s	0.123	0.123	N/A(1)	N/A(2)
Noise related health effects	L_{DN}	dBA	65	65	65	N/A(2)
	Δ%HA	%HA	2.2	1.8	2.2	N/A(2)

Notes:
(1) There will be no blasting during the closure phase
(2) There will be no sources of noise during the post-closure phase.

It is important to keep in mind the following when considering these residual adverse effects:

- The noise predictions during operations are based on the maximum levels of activity, activities occurring in the open pit closest to the receptors, and activities with the least amount of natural shielding (i.e., mining near or at the surface). Therefore, the residual adverse effects on noise will be less than shown as mining progresses deeper into the open pit, and once mining activities move underground.
- Even though there are residual adverse effects predicted for both of the indicators for the noise related health effects VC, this does not mean that there would be residual adverse health effects. In keeping with the process set out in the EIS Guidelines, the predicted adverse effects indicate that the predicted levels for these indicators will change relative to the baseline conditions as a result of the Project, even with the consideration of the identified mitigation measures.

For three of the noise VCs (i.e., environmental noise levels, blasting noise and vibration, health related noise effects), effects and the assessment of the effects are specifically tied to established sensitive receptor locations, such as residences. For these VCs, it is not appropriate to define effects and impacts where there are no sensitive receptors. However, changes in environmental noise resulting from the Project could be disruptive for individuals practicing traditional uses of the land. Figure 6.4.6-1 show those areas where the predicted noise levels during operations could exceed 40 dBA (green shading), a level at which noise levels could be noticeable to people practicing traditional uses of the land.

Figure 6.4.6-1: Spatial Extents of Predicted Noise Effects

Published literature (including data published by Environment Canada) suggest noise levels greater than 50 dBA would be disruptive to wildlife, especially migratory birds, causing changes in behaviour or avoidance of affected areas. As a result, areas with noise above 50 dBA (shown with gold shading on Figure 6.4.6-1) would likely not be suitable for traditional harvesting as species could be displaced or behave abnormally.

The data presented in Figure 6.4.6-1 represent the spatial extent of highest residual noise effects the operations phase, when mining activities are occurring relatively close to the surface in the open pit. Once mining advances lower in the pit or moves underground, the residual noise effects would be considerably less. Similarly, the residual effects on noise would be less during both the site preparation and construction, and the closure phases. As there would be no sources of noise during the post-closure phase, there would be no residual effects.

6.4.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, there were several questions that were wholly, or partially, asking for information, clarification and/or justification for the approach used in predicting the effects of the Project on noise. Responses to the IRs were provided separately, and incorporated into the relevant sections of the Revised EIS. The following lists the Round 1 IRs related to the noise predictions:

The following lists the Round 2 IRs related to the noise predictions:

- TMI_183-AE(1)-21: LSA/RSA Definition;
- TMI_184-AE(1)-22: Vibration from blasting;
- TMI_186-AE(1)-24: Inclusion of noise due to traffic to and from the Project;
- TMI_186-AE(1)-24: Traffic noise;
- TMI_190-AE(1)-28: Adjustment of sound levels for blasting; and
- TMI_190-AE(1)-28: Implications of new guidelines and standards;
- TMI_191-AE(1)-29: Adjust sound characteristics;
- TMI_191-AE(1)-29: Consideration of source sound characteristics.
- TMI_192-AE(1)-30: Provide 50 dBA contour line;
- TMI_193-AE(1)-31: Revise noise modeling if equipment differs;
- TMI_302-RG(1)-37: Detailed listing of stationary noise sources;
- TMI_303-RG(1)-38: Adjust sound characteristics;
- TMI_304-RG(1)-39: Detailed listing of stationary noise sources;
- TMI_322-SD(1)-17: Implications of new guidelines and standards;

- TMI_323-SD(1)-18: Implications of new guidelines and standards;
- TMI_515-AC(1)-189: Blasting noise;
- TMI_526-AC(1)-200: Blasting noise;
- TMI_527-AC(1)-201: Linkages of noise with Aboriginal people VCs;
- TMI_539-AC(1)-213: Blasting noise;
- TMI_540-AC(1)-214: Linkages of noise with Aboriginal people VCs;
- TMI_565-AC(1)-239: Effects of nose on traditional uses of the land; and
- TMI_588-AC(1)-262: Effects of nose on traditional uses of the land.

6.5 Light

6.5.1 Potential Effects of the Project on the Environment

The potential effects of the Project on light relate to the exterior lighting will be installed to help ensure the safety of the workers and the security of the operations. Light is not identified as a contaminant such as noise or certain air compounds, but the light that is emitted from the Project (known as light trespass) can be regarded as a nuisance by adjacent property owners and residents. The potential for the Project to affect light, specifically the “light trespass” VC will vary by phase of the Project. The following lists the potential light effects by Project phase:

- **Site Preparation and Construction Phase**: There will be no permanent lighting structures during the site preparation and closure phase. Site preparation and construction activities are not expected to occur around the clock, but there may be some times of the year when portable lighting would be required to ensure the safety of the workers.
- **Operations Phase**: During operations, the processing plant and mining operations would occur 24-hours per day. However, deliveries and major significant work at the plant site would be restricted to daylight hours. Permanent lighting will be required at the processing plant and at key areas within the Project to ensure the safety of workers, and the security of the operations. Portable lighting may be required within the open pit for safety reasons, however, the light from the open pit would only affect the light trespass levels when mining is occurring at the surface. Lighting will be required for the underground mining operations, but this light would not affect light trespass levels at the surface.
- **Closure Phase:** There will be no permanent lighting structures during closure. Generally, closure activities will occur during the day. However, local portable lighting systems may be required to ensure the safety of workers.
- **Post-closure Phase**: Once the closure activities are completed, there will be no artificial lights at the project and therefore no light effects.

The potential effects of the Project on light have been described using a simple linkage diagram on Figure 6.5.1-1. The figure illustrates that the light VC (shown in blue on the figure) can be potentially affected during site preparation and construction, operations, and closure phases of the Project. For example, the predicted illuminance levels from the project will act as inputs to the wildlife and wildlife habitat VCs. No other VCs provide inputs to the light VC.

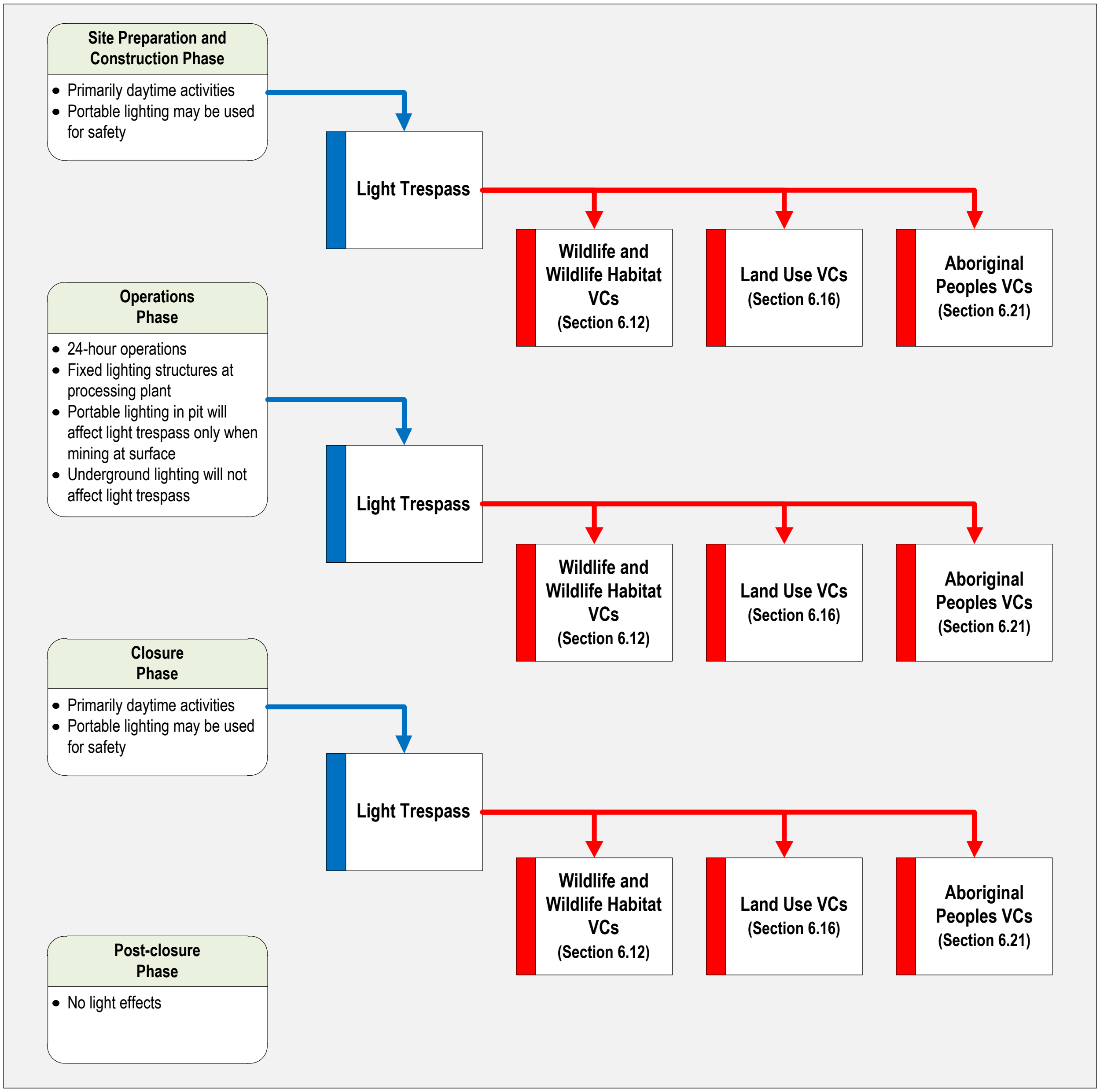


Figure 6.5.1-1: Light Linkage Diagram

6.5.2 Effects Prediction Methods

The predicted light effects of the Project will be determined quantitatively by calculating the levels of illuminance, in units of lux, resulting from the artificial lighting used at the Project site. The lighting plan and layout was modelled using software program AGi32. This is an industry standard lighting calculation software program and is widely accepted as a very accurate tool in determining the expected light levels for any specific plot plan.

The general steps involved in predicting the light effects of the Project are:

- Determine the number, configuration and intensity of artificial lights required to meet the lighting requirements for the Project; and
- Calculate the resulting illuminance levels at selected locations on-site and at sensitive receptors (Section 6.1.4.5).

Night-time lighting will be provided to sustain the safe operation of the Project 24-hours a day. On-site night-shift staff numbers will be significantly lower than during the day and the majority of operations and maintenance tasks will be within the process plant buildings. In addition, all site deliveries and process plant bulk chemical and warehouse deliveries will be scheduled for daylight hours. Night-time lighting will therefore be designed to provide the minimum illumination levels necessary to support the night-time operation, knowing that no significant work at the plant site will be performed outside during “normal operations”.

Table 6.5.2-1 provides a listing of the illumination design criteria used to develop the preliminary lighting plan.

Table 6.5.2-1: Plant and Mine Infrastructure Illumination Design Criteria

Area	Minimum Average Maintenance Illuminance (Lux)	Maximum Working Plane(m)
Switchrooms and control rooms	160	0.75
MCC control panels	160	0.75
Feeders	160	On Pan
Compressors and pumps	160	On Drive
Processing equipment, i.e., screens, etc.	160	On Deck/Drives
Milling area	160	On Drive
Hydraulic power packs	160	On Drive
Transfer chutes	80	0.75
Intermittent inspection area/tasks	80	0.75
Plant bunkers and pits	80	0.75
Internal stairs (within plant buildings)	80	0
Internal walkways (within plant buildings)	40	0
Platforms	40	0
Conveyors, gantries and tunnels	40	0
External stairs and catwalks	20	0

Table 6.5.2-1: Plant and Mine Infrastructure Illumination Design Criteria (continued)

Area	Minimum Average Maintenance Illuminance (Lux)	Maximum Working Plane(m)
Building access	10	0
Access roadways	5	0
Stockpile area lighting	5	0
Building surrounds	5	0

A preliminary night-time lighting layout has been designed to provide the minimum night-time illumination levels for the process plant and mine infrastructure. The lighting layout (Figure 6.5.2-1) outlines the external operations lighting. The key elements of the preliminary lighting plan includes the following:

- A single 6 m high mounted floodlight (132.2 Watts) will be installed on the Run Of Mine (ROM) pad above the ROM Bin to provide an area illumination level of 40 Lux over the ROM Bin to provide the Haul Truck drivers and Front End Loader (FEL) operators sufficient lighting for ore tipping. A 6 m high area light (56.9 Watts) also provides an illumination level of 5 Lux to the ground surface in front of the ROM Bin.
- There will be no external lighting for the enclosed raw ore conveyor galleries as these will be fully enclosed structures, with internal lighting provided.
- An area light (56.9 Watts) will be mounted at a height of 15m on each of the three external sides of the Primary Crusher Building to provide a surrounding ground illumination level of 5 Lux. A single floodlight (132.2 Watts) will be mounted at a height of 22 m off the Ore Feed Bin to provide a minimum stockpile illumination level of 5 Lux for the Bin overflow stockpile area. Two additional floodlights will be mounted at a height of 22 m off the Ore Feed Bin structure which will illuminate the stockpile reclaim hopper below to a level of 40 Lux.
- Fourteen area lights (56.9 Watts) will be mounted at a height of 15 m around the perimeter of the Process Plant Building, with an approximate distance of 18.5 m between each light. This lighting set-up will provide a ground perimeter illumination of 5 Lux.
- An area light (56.9 Watts) will be mounted at a height of 5 m on each side of the main HV switch room located beside the plant. A light will be installed above each main access door either side of the switch room. One light will then be located on each remaining side. This lighting arrangement will provide a ground perimeter illumination level of 5 Lux.
- Two 10 m high mounted floodlights (132.2 Watts) will be installed adjacent to the truck line-up area to provide a sufficient ground illumination of 5 Lux for the waiting mine haul trucks and operations equipment.
- Four area lights (56.9 Watts) will be mounted at a height of 10 m on the front of the truck workshop and maintenance building. There will be an approximate distance of 11 m

Table 6.5.2-1: Plant and Mine Infrastructure Illumination Design Criteria (continued)

between each light. These mounted workshop lights, together with one 10 m high floodlight (132.2 Watts) located beside the fuel tank area will provide a ground illumination of 5 Lux for the area in front of the workshop.

- Four 10 m high mounted floodlights (132.2 Watts) will be located at the fuel tank area to provide an fuel tank ground illumination level of 40 Lux
- Five 10 m high floodlights (132.2 Watts) will be mounted from the mine administration building to provide a perimeter ground illumination level of 5 Lux.
- Two 10 m high mounted floodlights (132.2 Watts) will be installed directly in front of the guard house to provide a sufficient illumination level of 40 Lux to the area adjacent the guardhouse and to the right of the site access road located off Nursery Tree Road. Two additional 10 m high mounted floodlights (132.2 Watts) will be located at either end of the plant parking lot outside of the perimeter fencing to provide a carpark ground illumination level of 5 Lux.

All plant area night-time lighting will be controlled by the process plant control system and will be automatically turned on/off from adjustable timers. The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings, which contains the process and electrical equipment. All externally mounted luminaires and their associated lamps will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC), and the Building Code of Ontario. In particular, tilt and cut-off angles shall be such as to minimize the effect of the lighting system on the nearby residents and sensitive receivers. External light fixtures will be installed at a tilt angle of 45º. The technical specifications for the external plant and infrastructure light fixtures are detailed in Table 6.5.2-2.

In calculating the illuminance from the lighting fixtures, no credit was taken for shielding provided by the intervening topography, vegetation or the presence of the waste rock storage area (WRSA) and overburden stockpile that would effectively block any light from the process plant being visible to residents on Thunder Lake.

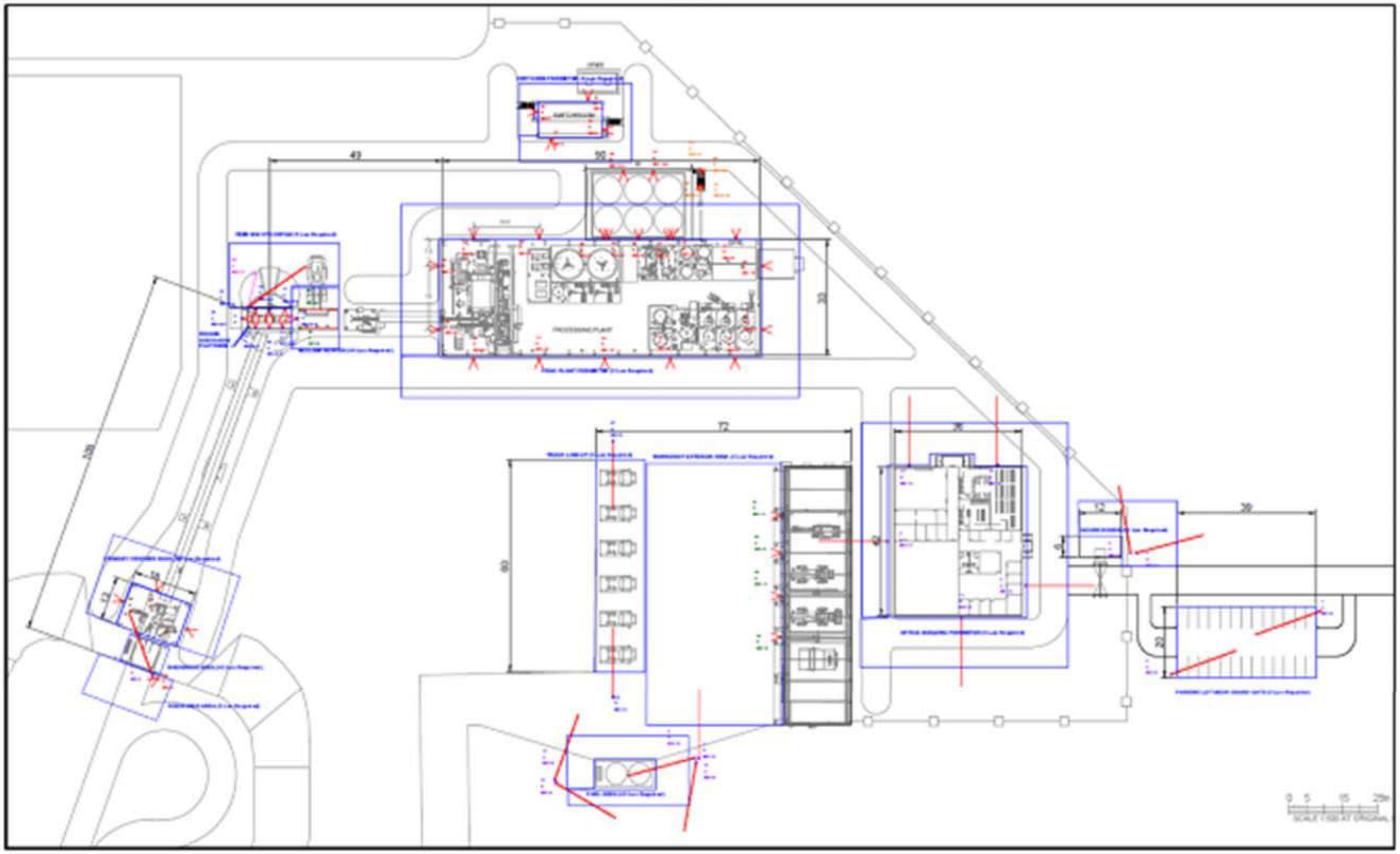


Figure 6.5.2-1: Process Plant and Mine Infrastructure, Lighting Plan

6.5.3 Project Effects Avoidance Measures Used in Predictions

The following elements built into the design of the lighting layout and the configuration of the Project will help avoid potential effects of the Project on light:

- Activities during the site preparation and construction phase will generally occur during the daytime. If there are times when lighting is required to ensure the safety of the workers, portable lighting will be used in required areas only. Portable lighting will be directed downward to minimize any off-site effects. [Mit_034, Mit_035].
- The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings, which contains the process and electrical equipment. [Mit_036].
- All externally mounted luminaires and their associated lamps will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC), and the Building Code of Ontario. [Mit_037].
- External light fixtures will be installed at a tilt angle of 45º to minimize the off-site effect of the lighting system. [Mit_038].
- Cut off angles for external lightings will be designed to minimize the off-site effect of the lighting system. [Mit_039].
- Nighttime illumination will not be provided at the tailings storage facility (TSF). [Mit_040].
- Some activities in the open pit may require portable lighting to ensure the safety of the workers, portable lighting will be used in required areas only. Portable lighting will be directed downward to minimize off-site effects. Lighting within the open pit should not be visible to adjacent residents as it will be occurring below grade. [Mit_035, Mit_041].
- Lighting required to support the underground mining operations will not be visible at the surface.
- Activities during the closure phase will generally occur during the daytime. If there are times when lighting is required to ensure the safety of the workers, portable lighting will be used in required areas only. [Mit_035, Mit_042].

Table 6.5.2-2: Process Plant and Mine Infrastructure Light Fixture Technical Specifications

Cat.	Description	Plant Areas	#	Light Loss Factor	Lamp Lumen Depreciation	Luminaire Level (LUM)	Watts (W)	Tilt Angle (º)
A	Flood light, NEMA 6, very wide optic	Entry carpark and security gatehouse	4	0.903	0.950	6,427	56.9	45
		Mine administration building	5	0.903	0.950	6,427	56.9	45
		Fuel tanks	5	0.903	0.950	6,427	56.9	45
		ROM pad	1	0.903	0.950	6,427	56.9	45
B	Area light	Process plant building and CIL tanks	14	0.903	0.950	6,427	56.9	45
		HV switch room	4	0.903	0.950	6,427	56.9	45
		ROM pad	1	0.903	0.950	6,427	56.9	45
D	Area light	Truck workshop	4	0.903	0.950	6,427	56.9	45
E	Area light	Primary crusher building	3	0.903	0.950	6,427	56.9	45
F	Flood light, NEMA 6, very wide optic	Feed bin stockpile	1	0.903	0.950	6,427	56.9	45
G	Flood light, NEMA 6, very wide optic	Haul truck line-up area	2	0.903	0.950	6,427	56.9	45
H	Flood light, NEMA 6, very wide optic	Raw ore emergency reclaim hopper	2	0.903	0.950	6,427	56.9	22.5

6.5.4 Predicted Effects

Using the preliminary lighting plan and the configuration of the proposed light fixtures described in Section 6.5.2, predicted illuminance levels over the areas near the processing plant were calculated and used to produce a Lux plot (Figure 6.5.4-1) and a rendered plan view showing the illuminance levels (Figure 6.5.4-2). To put the spatial extents of the predicted light effects into perspective, the predicted light trespass on the local scale is shown in Figure 6.5.4-3.

The methods were also used to calculate the light trespass as a result of the project at the 11 light receptors introduced in Section 6.1.4.5. These results are presented in Table 6.5.4-1. Only the results for the off-site receptor locations have been provided as the on-site receptors will not be there once mining activities commence. Both the plots and the tabular results confirm that illuminance from the Project lighting would not extend more than 100 to 200 m from the process plant infrastructure, and that there would be no light trespass at the neighbouring residences.

Table 6.5.4-1: Predicted Light Effects at Sensitive Receptor Locations

Sensitive Receptor	Baseline Illuminance (Lux)	Predicted Light Trespass (Lux)
R1 – Center of Proposed Pit	0 to 0	—
R2 – East of Proposed Pit	0 to 0	—
R3 – Nystrom House on Tree Nursery Road	0 to 0.01	0
R4 – Field to east of East Thunder Lake Road	0 to 0.01	0
R5 – 249 East Thunder Lake Road	2.4 to 4.3	0
R6 – East Thunder Lake Road near Little Creek	0.21 to 3.2	0
R7 – 352 East Thunder Lake Road	0 to 0.03	0
R8 – Thunder Lake Road near Highway 17	0 to 0.5	0
R9 – 65 Thunder Lake Road	0 to 15.2	0
R10 – North Shore and Thunder Lake Road	0 to 4.4	0
R11 – North side of Thunder Lake	0.02 to 0.22	0

It should be noted that the closest off-site receptor to the artificial lighting at the processing plant will R3 (Nystrom house on Tree Nursery Road), which is located approximately 1.6 km from the proposed process plant and mine infrastructure location. The calculated output from the lighting model showed the plant lux levels converging to 0 at distances between 100 to 200 m from the process plant boundary. As shown in Table 6.5.4-1, the modelled light trespass at receptor R3 is 0.0 lux. Based on the modelling, it is highly unlikely that light originating from the Project site would, or could, be measurable beyond the property boundaries.

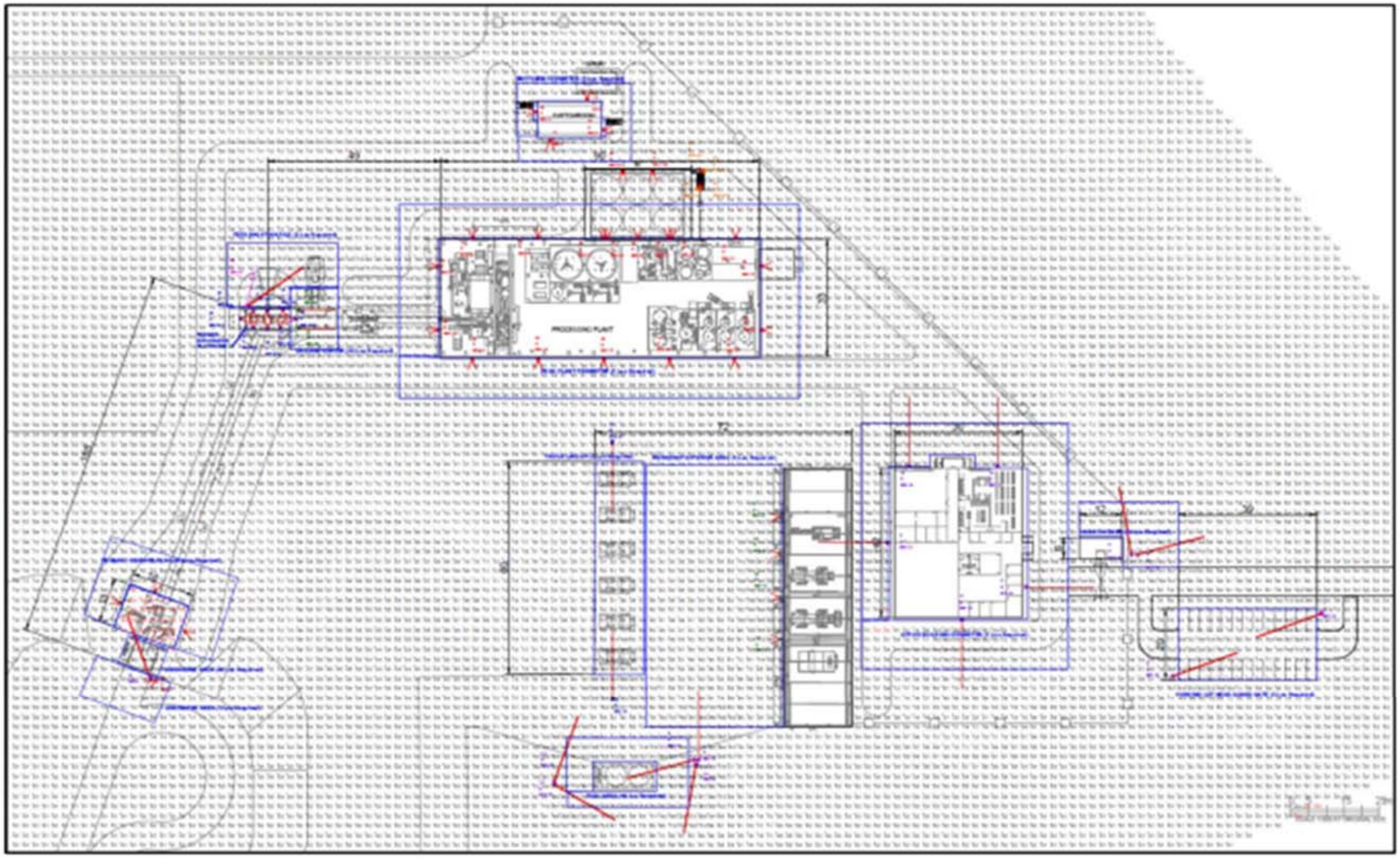


Figure 6.5.4-1: Process Plant and Infrastructure, Lux Plot

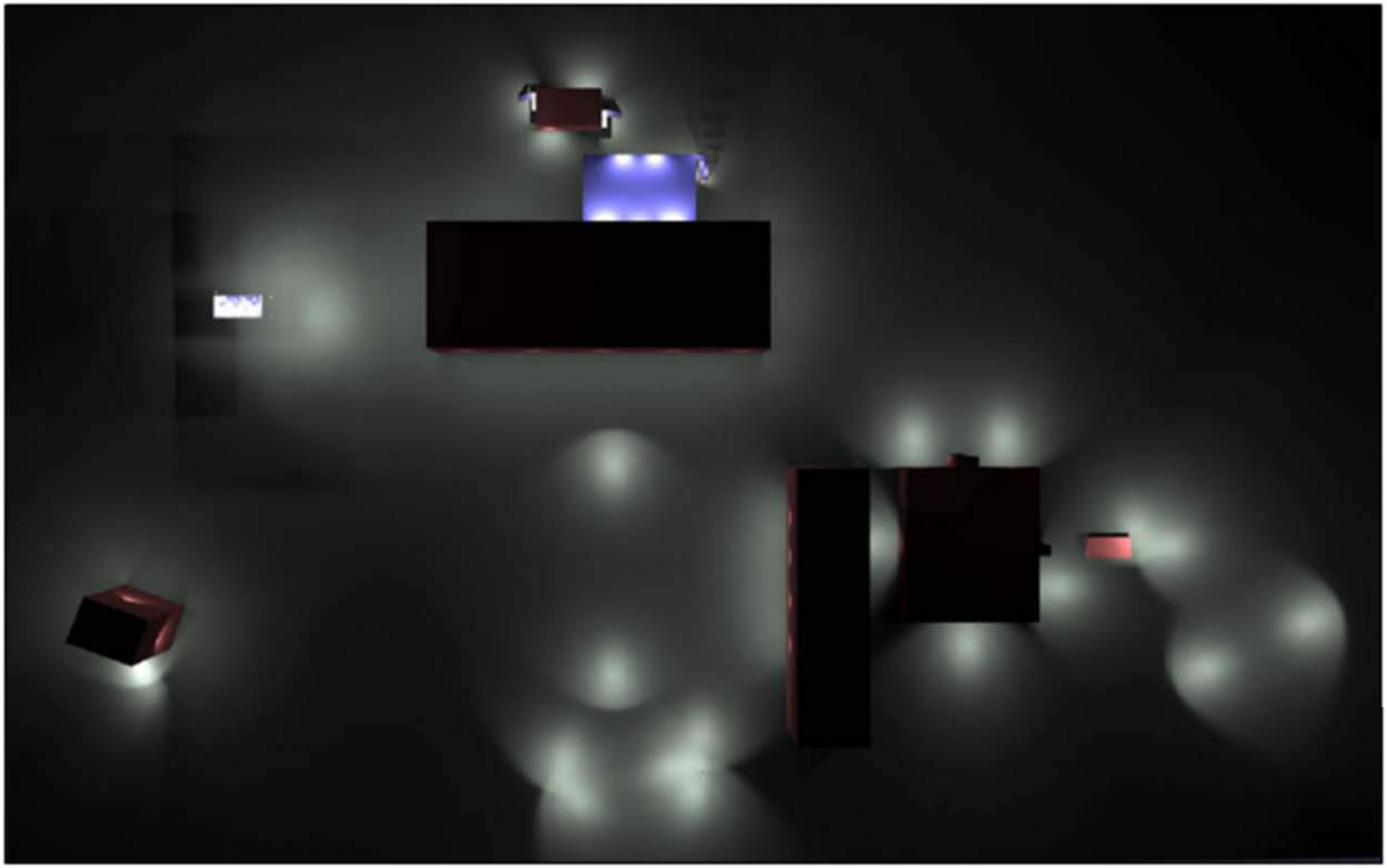


Figure 6.5.4-2: Process Plant and Infrastructure, Rendered Plan View

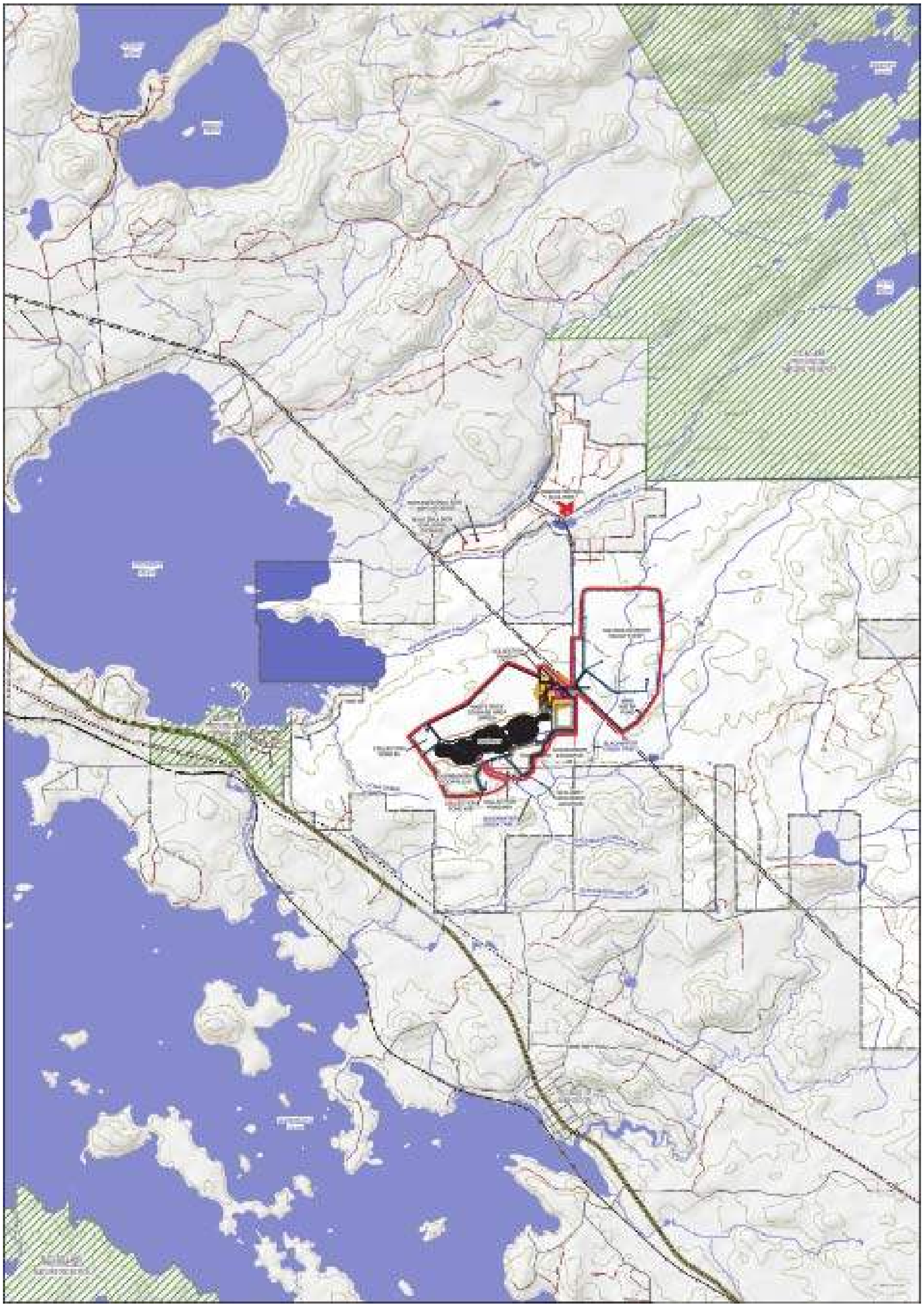


Figure 6.5.4-3: Predicted Light Trespass on the Local Scale

6.5.5 Identified Mitigation

The following elements built into the design of the lighting layout and the configuration of the Project will help avoid potential effects of the Project on light:

- Activities during the site preparation and construction phase will generally occur during the daytime. If there are times when lighting is required to ensure the safety of the workers, portable lighting will be used in required areas only. Portable lighting will be directed downward to minimize any off-site effects. [Mit_034, Mit_035].
- The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings, which contains the process and electrical equipment. [Mit_036].
- All externally mounted luminaires and their associated lamps will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC), and the Building Code of Ontario. [Mit_037].
- External light fixtures will be installed at a tilt angle of 45º to minimize the off-site effect of the lighting system. [Mit_038].
- Cut off angles for external lightings will be designed to minimize the off-site effect of the lighting system. [Mit_039].
- Nighttime illumination will not be provided at the tailings storage facility (TSF). [Mit_040].
- Some activities in the open pit may require portable lighting to ensure the safety of the workers, portable lighting will be used in required areas only. Portable lighting will be directed downward to minimize off-site effects. Lighting within the open pit should not be visible to adjacent residents as it will be occurring below grade. [Mit_035, Mit_041].
- Activities during the closure phase will generally occur during the daytime. If there are times when lighting is required to ensure the safety of the workers, portable lighting will be used in required areas only. [Mit_035, Mit_042].

6.5.6 Residual Adverse Effects

As described in Section 6.1.3.4, a single VC, namely light trespass, was used for evaluating the effects of the Project on light. During operations, the mining and processing activities will occur 24-hours a day. Night-time lighting will be required to provide safe working conditions in and around the processing plant. The effects of the Project on light trespass at the nearby residences were modelled using the AGi32 software program and the preliminary night-time lighting layout designed to provide the minimum night-time illumination levels for the process plant and mine infrastructure (Section 6.5.2). Table 6.5.5-1, show that with consideration for the avoidance (Section 6.5.3) and mitigation (Section 6.5.5) measures, there will be no predicted residual adverse effects on the light trespass for nearby for the residences as a result of the Project.

Table 6.5.5-1: Predicted Light Trespass Levels

Sensitive Receptor	Predicted Light Trespass (Lux)	Effects
R3 – Nystrom House on Tree Nursery Road	0	no adverse effect
R4 – Field to east of East Thunder Lake Road	0	no adverse effect
R5 – 249 East Thunder Lake Road	0	no adverse effect
R6 – East Thunder Lake Road near Little Creek	0	no adverse effect
R7 – 352 East Thunder Lake Road	0	no adverse effect
R8 – Thunder Lake Road near Highway 17	0	no adverse effect
R9 – 65 Thunder Lake Road	0	no adverse effect
R10 – North Shore and Thunder Lake Road	0	no adverse effect
R11 – North side of Thunder Lake	0	no adverse effect

6.5.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, the following questions were asked regarding the predictions of effects on light:

- TMI_178-AE(1)-16: quantitative prediction of light effects;
- TMI_443-AC(1)-117: linkage between light and Aboriginal peoples;
- TMI_468-AC(1)-142: night-time illumination levels;
- TMI_527-AC(1)-201: linkage between light and Aboriginal peoples;
- TMI_540-AC(1)-214: linkage between light and Aboriginal peoples; and
- TMI_705-PC(1)-20: illumination of tailings pond.

6.6 Air Quality

6.6.1 Potential Effects of the Project on the Environment

The potential effects of the Project on air quality will vary during the Project life, depending on the Project phase, and with varying levels of activity. The following lists the potential air quality effects by Project phase:

- **Site Preparation and Construction Phase**: The activities that could result in air emissions during the site preparation and construction phase were described in Section 6.1 of the Environmental Air Quality Assessment (RWDI 2014e), included as part of Appendix J to the EIS. The early stages of site preparation would include tree clearing, grubbing, and the stripping of overburden. There would be limited blasting (at a reduced level compared to operations), the excavation and crushing of aggregate for road construction, as well as the construction of the Project facilities. The possible use of portable diesel-fired generators was also considered, for operations such as crushing before connection to line power is established. The specific sources of air emissions considered during the site preparation and construction phase included:

- o Haul roads (including road dust and tailpipe emissions)
- o Operations of dozers (including tailpipe emissions)
- o Operation of loaders (including tailpipe emissions)
- o Material handling (loading and unloading of waste rock and overburden)
- o Excavator (tailpipe emissions)
- o Crusher
- o Blasting, at 25% of the level during operations
- o Portable generators for local power (assumed similar to the emergency generators proposed for the operations phase).

- **Operations Phase**: The activities that could result in air emission during the operation phase were described in Section 7.1 of the Environmental Air Quality Assessment (RWDI, 2014e). The operational phases will include both underground and open pit mining activities. The activities in the open pit mine will include drilling, blasting, dozing, excavating and the transportation of rock material on-site. The underground activities will also include the operation of intake and exhaust vent raises and the transportation of rock material to the surface. A crusher is located adjacent to the processing plant to prepare the ore for processing. There is an existing 115 kV transmission line adjacent to the proposed processing plant that will avoid the need for on-site power generation. The site will be equipped with emergency power generation, which will be used when power supply from the 115 kV transmission line is not available. Testing of emergency generators will also occur periodically. The specific sources of air emissions considered during the operations phase included:

- o Haul roads (including road dust and tailpipe emissions)
- o Operations of dozers (including tailpipe emissions)
- o Operation of loaders (including tailpipe emissions)
- o Material handling (loading and unloading of waste rock and overburden)
- o Excavator (tailpipe emissions)
- o Crusher
- o Wind erosion of tailings
- o Blasting
- o Vent raises

  - o Heaters
  - o Emergency generators.

- **Closure Phase:** The activities that could result in air emission during closure were described in Section 8.1 of the Environmental Air Quality Assessment (RWDI, 2014e). The closure would include the activities to rehabilitate the site, as well as disassembling and removal of infrastructure and equipment. The possible use of a small portable generator was also considered, once connection to line power is severed. The specific sources of air emissions considered during the operations phase included:
  - o Haul roads (including road dust and tailpipe emissions)
  - o Operations of dozers (including tailpipe emissions)
  - o Operation of loaders (including tailpipe emissions)
  - o Material handling (loading and unloading of waste rock and overburden)
  - o Excavator (tailpipe emissions)
  - o Portable generator for local power (assumed similar to the smaller of the two emergency generators proposed for the operations phase).

- **Post-closure Phase**: Once the closure activities are completed there are not expected to be any sources of air emissions at the Project.

As shown above, the assessment considered the emissions from on-site traffic including haul trucks and other heavy equipment. The emissions from personal vehicles, and other smaller vehicles travelling to and from the site were deemed insignificant with respect to air quality. Smaller vehicles are usually are limited to 1 or two trips a day, with the weight, number of wheels, and engine sizes combining to produce emissions that will have a minimal effect on air quality compared to the heavy mine trucks assumed to be operating constantly at the Project.

The potential effects of the Project on air quality have been described using a simple linkage diagram on Figure 6.6.1-1. The figure illustrates the air quality VC (shown in blue on the figure) potentially be affected during each phase of the Project life. Additionally, the figure indicates those other components of the environment (shown in red on the figure) where there will be a reliance on information about the effects of the Project on air quality as an input for determining the effects on other VCs. For example, air quality predictions will be used as an input to the human health component. There are no other components or VCs that provide inputs to the assessment of air quality effects.

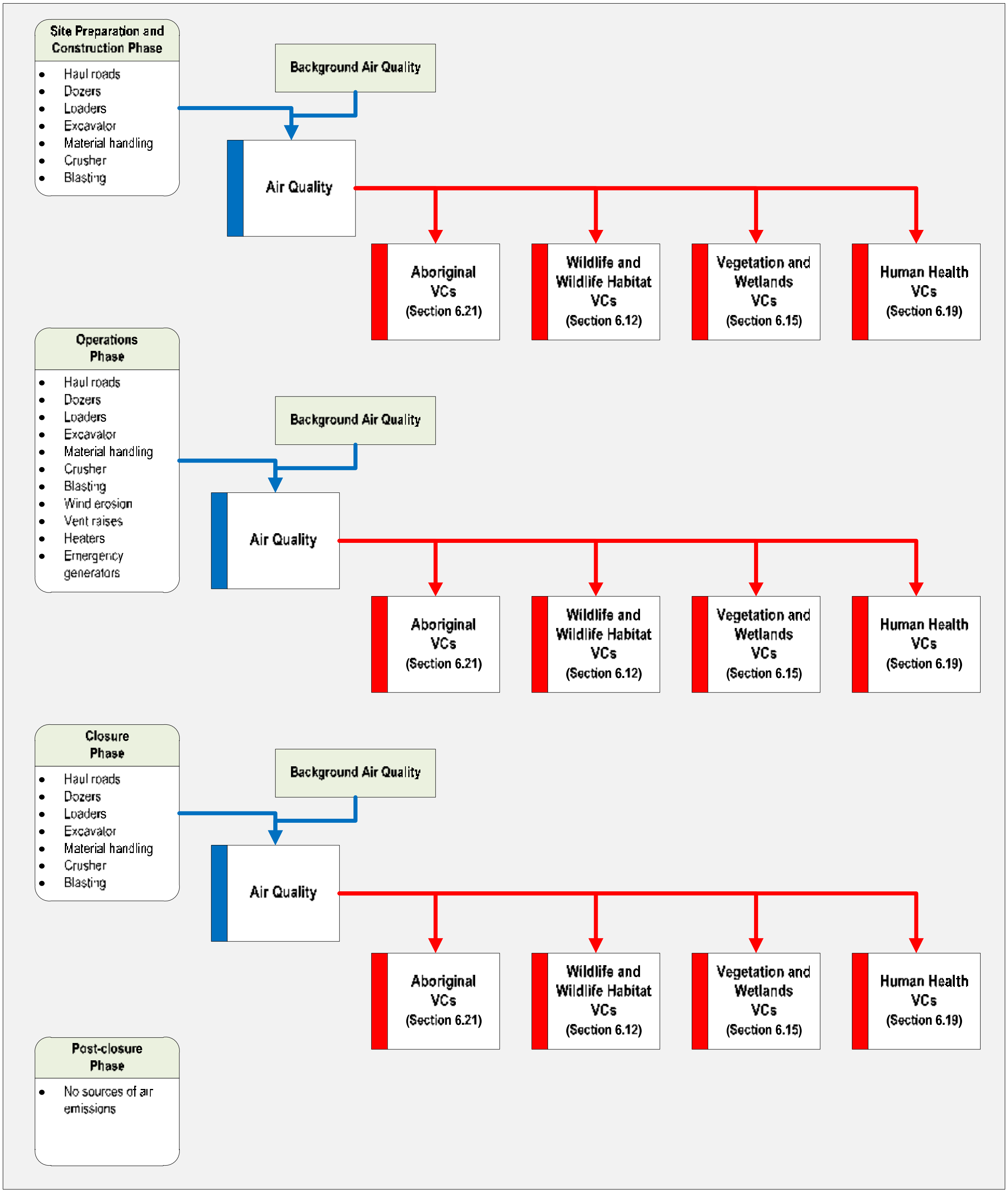


Figure 6.6.1-1: Air Quality Linkage Diagram

6.6.2 Effects Prediction Methods

The methods used to predict the air quality effects of the Project are described in Section 3 of the Environmental Air Quality Assessment (RWDI 2014e). The general steps involved in predicting the air quality effects of the Project are:

- Determine the air emissions from the Project; and
- Use a numerical model to predict the air concentrations and deposition rates.

6.6.2.1 Determining Air Emissions

A description of the methods used for determining the air emissions from project was provided in Section 3.3 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS). These emissions were assumed to apply for all phases of the Project where those activities occur, with the total emissions varying on the basis of the mine processing and material handling rates. Detailed calculations for all of the emissions from the Project are provided in the various sections of Appendix B to the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS), as shown in Table 6.6.2.1-1.

Table 6.6.2.1-1: Appendices Listing Detailed Emission Calculations

Emission Category	Site Preparation and Construction	Operations	Closure
Dust from unpaved roads	Appendix B1	Appendix B6	Appendix B17
Tailpipe emissions	Appendix B2	Appendix B7	Appendix B18
Material handling	Appendix B3	Appendix B8	Appendix B19
Blasting	Appendix B4	Appendix B9	—
Dozers	Appendix B5	Appendix B10	Appendix B20
Wind erosion of tailings	—	Appendix B11	—
Diesel-fired generators	Appendix B2/B12/B13	Appendix B7/B12/B13	Appendix B12/B13/B18
Heaters	—	Appendix B14/B15	—
Vent raises	—	Appendix B16	—

Note: The above listing refers to the specific appendices of the Environmental Air Quality Assessment where the detailed calculations can be found. The Environmental Air Quality Assessment (RWDI, 2014e) was included as part of Appendix J to the EIS.

Dust from Unpaved Roads

Section 3.3.2 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) provides a description of the approach used for calculating the particulate emissions from the vehicles traveling on unpaved roads at the Project. The emissions were estimated using the method described in the Chapter 13.2.2 of AP-42 (U.S. EPA 2014). The emission rates depend on the surface material silt content (%) of the roadway and mean vehicle weight. The surface silt content for the unpaved roads was assumed to be 5.8%. A. The values in the assessment used reflect taconite mining and processing, as shown on Table 13.2.2-1 of AP-42 (U.S. EPA 2014).

This was used a suitable surrogate for mining operations in the region, as the measurements reflects metal ore mining operations and were taken at the Erie Mining Company near Hoyt Lakes, MN, which is roughly 250 km south of the Project. The other value provided on Table 13.2.2-1 of AP-42 (U.S. EPA 2014) are from facilities that are not comparable to the proposed Project. Facilities with higher silt contents are often indicative of that are expected to handle softer material than at the Project (e.g., limestone quarries) that would be more likely to abrade into silt.

The estimated emissions incorporate the effects if water and chemical suppressants will be used for dust control on the haul roads at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant, as required, to minimize fugitive dust emissions. The control efficiency for each haul roads was conservatively assumed to be 75%.

Tailpipe Emissions

Section 3.3.4 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) provides a description of the approach used for calculating the particulate emissions from the tailpipe emissions at the Project. Emissions of products of combustion (particulate matter, NO_X and CO) were calculated for diesel fuelled non-road equipment such as bulldozers, haul trucks, loaders and excavators based on equipment horsepower, load factor, and emissions factors. Each piece of equipment was assumed to be manufactured in 2010 and was expected to comply with the phase in periods for emission standards. Load factors and the emissions factors for vehicles of different emission standard tiers were obtained from the U.S. EPA (2010).

Emissions of SO_2 were estimated using the brake horsepower specific fuel consumption for the different vehicles (U.S. EPA, 2010), and the sulphur content in diesel fuel. The sulphur content in diesel fuel was based on compliance with the sulphur content in diesel fuel limit in Canada for off-road engines (0.0015%). It was assumed that all the sulphur was converted to SO_2 during combustion.

Material Handling

Section 3.3.1 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) provides a description of the approach used for calculating the particulate emissions from material handling at the Project. Fugitive particulate emissions (TSP, PM_{10} and $PM_{2.5}$) were estimated using the emission factors obtained from Chapter 13.2.4 of the AP-42 (U.S. EPA 2014). These factors depend primarily on the mean wind speed and moisture content of the material handled. A moisture content of 10% was used to estimate fugitive dust emissions from the material handling sources. As the emission estimates depend on wind speed, the hourly wind speeds from the meteorological data set used for the dispersion modelling were used to create an hourly-varying emission file to account for changing meteorological conditions

Blasting

As shown in Appendices B4 and B9 to Environmental Air Quality Assessment (Appendix J-2 to the revised EIS), the emissions from blasting were estimated using Sections 11.9 and 13.3 of AP-42 (U.S. EPA 2014).

Bulldozing

Section 3.3.6 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) describes the approach for estimating the emissions from bulldozing operations that would occur at the ore dump, low grade ore stockpile and at waste rock stockpile. Fugitive emissions generated from the bulldozing at the mine site were estimated based on emission factors for bulldozing overburden in Chapter 11.9 of AP-42 (U.S. EPA 2014). The emissions depend on both silt content (%) and moisture content (%). The average silt content was assumed to be the same as that occurring on truck haul roads, described above. The moisture content of waste rocks and ore was estimated by Treasury Metals to be 10%.

Wind Erosion of Tailings

Section 3.3.3 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) describes the approach for estimating the emissions from wind erosions from the exposed areas of the tailings storage facility (TSF) at the Project. The total area of the TSF at the Project is expected to cover 750,000 m^2 which is expected to be water covered or vegetated. Therefore wind erosion of particulate matter from tailings at the mine site was estimated for 75,000 m^2 of dry, un-vegetated tailings (10% of the tailings area as a conservative approximation). The emissions of wind eroded particulate matter were calculated as per equation 15 of a paper by Nickling (1989), which is based on tests of tailings disposal areas in Arizona.

Wind erosion of the tailings takes place only when the friction velocity at the surface is above an identified threshold velocity. For this study, the friction velocity was assumed to be 0.2 m/s, which is the average of the threshold velocities for the two tailing sites in the paper (Nickling 1989). The roughness length of the tailing surface was assumed to be 0.016 cm, which is the average roughness length of the two tailing sites in the paper (Nickling 1989).

The emission estimates are also dependent on hourly wind speeds at the mine site. This results in a variable emission file that was used in the dispersion modelling to account for changing meteorological conditions and, hence, changing magnitudes in fugitive dust emissions. It was assumed that no wind erosion of the tailings took place when there was precipitation or snow cover on the ground. Snow cover for the region was obtained from the Climate Normals for Dryden (Environment Canada 2012), where snow cover has been recorded from October to April. Hourly precipitation data was obtained from International Falls, which is approximately 145 km away from the mine site.

Emissions from Backup Generators

Section 3.3.6 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) describes the approach used for calculating the emissions from the emergency generators at the Project. These generators are present to provide back-up power in case of a power failure of the power supplied by the 115 kV transmission line that runs adjacent to the proposed plant site. Emissions were estimated using emission factors obtained from Chapter 11.9 of AP-42 (U.S. EPA 2014). The AP-42 factors pre-date the implementation of the U.S EPA Tier 1-4 emission standards. It is expected that the actual generators used at the site will be at least meet the Tier 1 emission standards, therefore the AP-42 factors are considered conservative.

Heaters

As shown in Appendices B14 and B15 to Environmental Air Quality Assessment (Appendix J-2 to the revised EIS), the emissions from the gas fired heaters during operations were estimated using detailed combustion spreadsheets developed by RWDI.

Mine Vent Emissions

Emissions from underground mining activities are released to the atmosphere through two vent raises. Emission factors from underground activities released to atmosphere are obtained from a report summarizing mine vent exhaust testing in Falconbridge, Ontario (Bovar 1996) are used to estimate emissions from the underground vent raises.

6.6.2.2 Numerical Air Dispersion Modelling

AERMOD Dispersion Model

Dispersion modelling was conducted using the estimated emission rates discussed in the preceding section in conjunction with the U.S. EPA's AERMOD dispersion model to predict concentrations of all contaminants at all off-site receptor locations. The AERMOD model is the most advanced of the models currently approved for use in regulatory dispersion modelling assessments in Ontario, and has been used extensively to study potential impacts from mining operations in Ontario. The use of latest MOECC approved version of AERMOD is consistent with the air modelling guidance from the Ontario Ministry of Environment and Climate Change (MOECC), which requires the use of AERMOD for predicting concentrations of both gases and particulates. Both gases and particulates adhere to the same fundamental dispersion physics in the atmosphere.

All dispersion models have inherent inaccuracies, but due to the wide-scale use of the AERMOD model for many years, in a wide variety of applications, these inaccuracies are now well-understood. The U.S. EPA reviewed various studies of dispersion model accuracy with comparison between models and field measurements. Generally AERMOD and other dispersion models are more reliable at predicting longer time-averaged concentrations (e.g., annual averages) than short-term concentrations (e.g., 1-hour and 24-hour periods) at specific locations. With respect to the short-term concentrations, however, the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. Typical accuracy in highest estimated concentrations is in the range of ±10% to ±40% (U.S. EPA 2003).

Modelling Particle Deposition

Particulate matter plumes differ from gaseous plumes in that the particles can settle out due to gravity. Heavier particles will tend to settle out quickly, reducing the particulate concentration in the plume as it moves farther from the source. The AERMOD model allows the user to account for this settling through the use of deposition plume depletion algorithms. The deposition results that are produced by the model represent the deposition flux rate, in mass per area (g/m^2/30 days). With the deposition algorithm, the model does not reduce the plume size by the deposition flux rate; it merely predicts the amount of deposition that could occurs from the plume at any receptor point. The AERMOD model also predicts the depletion of particulate concentrations as a result of particle deposition.

Since deposition rates depend on the mass of the particles contained within the plume, particle size ranges were included in the AERMOD model. These size ranges were based on the average mass of particles for each size category for each type of source. The particle size ranges were based on generic information from AP-42 (U.S. EPA 2014). Particle size ranges were used for all on-site sources included in the AERMOD model.

Scenario Selection

A comparison of the air emissions during the site preparation and construction phase, the operations phase, and the closure phase, demonstrates that during the operations phase, the combustion source emissions (fine particulate [$PM_{2.5}$] and NO_X, and by extension CO and SO_2) are higher than during the other phases of the Project. The operations phase will also will be the longest lasting phase.

During the site preparation and construction phase, and the closure phase, the emissions of TSP and PM_{10} will be higher than operations due to the nature of the activities (earth moving and clearing). However, the emissions during those phases will be spread out across the entire site and will be constantly moving. In contrast, the emissions for the operations phase are modelled in a conservative manner, with mining in the open pit occurring at the surface and close to the edge of the property, concurrent with activity on the overburden storage pile, and the low grade ore stock pile (Figure 6.6.2.2-1).

A comparison of the air emissions during the active life of the Project (i.e., site preparation, construction operations, and closure) are provided in Table 6.6.2.2-1. The modelling of air quality effects was performed for all three phases.

Table 6.6.2.2-1: Comparison of Air Emissions by Phase

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Site Preparation and Construction	684.03	201.95	28.40	184.14
Operations	309.36	112.48	43.53	165.24
Closure	616.99	166.44	22.68	111.35

Source Configuration

Fugitive sources were modelled as a series of volume and line sources with parameters based on information obtained from Treasury Metals and typical dimensions of processing equipment and vehicles used at other facilities of this nature. The modelled source parameters are consistent with guidance from the National Stone, Sand & Gravel Association (NSSGA 2004). Internal haul roads were modelled as adjacent volume sources, also in accordance with guidance from the NSSGA and the U.S. EPA (2012). Point sources were modelled with parameters based on information obtained from Treasury Metals. The relative locations of modelled sources for the site preparation and construction phase are provided on Figure 6.6.2.2-1.

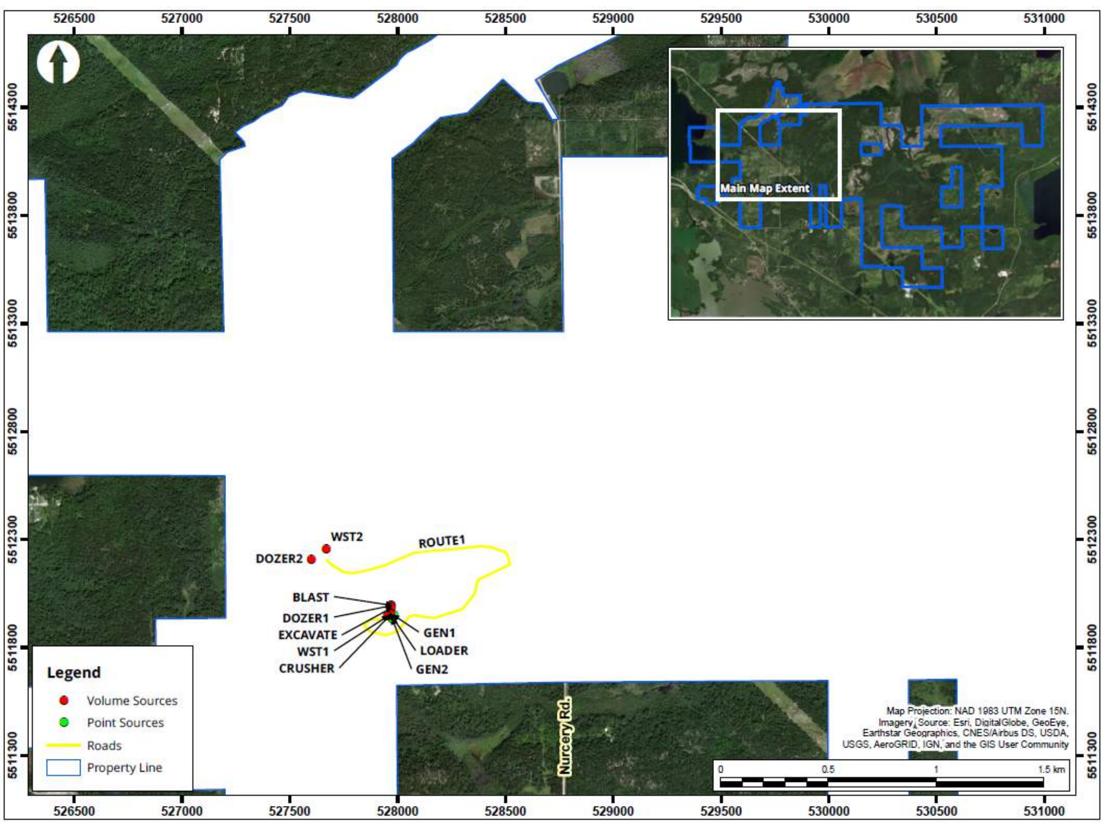


Figure 6.6.2.2-1: Modelled Source Configuration, Site Preparation and Construction

The modelled air quality sources during the operations phase were provided on Figure 4 of the Environmental Air Quality Assessment (Appendix J-2), which is replicated below as Figure 6.6.2.2-2. Since the filing of the EIS, Treasury Metals has been advancing the engineering for the Project and have refined the Project configuration to help reduce the overall effects on the environment. One of these refinements, which are detailed in Section 3.16, is the re-location of the processing plant to a location to the west of Tree Nursery Road. This change avoids the need to realign the lower reaches of Blackwater Creek Tributary 2, and provides a slightly more compact footprint overall. As a result of this change, the sources of air emissions at the processing plant will move about 300 m closer to the sensitive receptors located to the west of the Project, along the east shoreline of Thunder Lake. The sources at the processing plant will also move further away from the closest sensitive receptors, which are located to the south of the Project, along Tree Nursery Road.

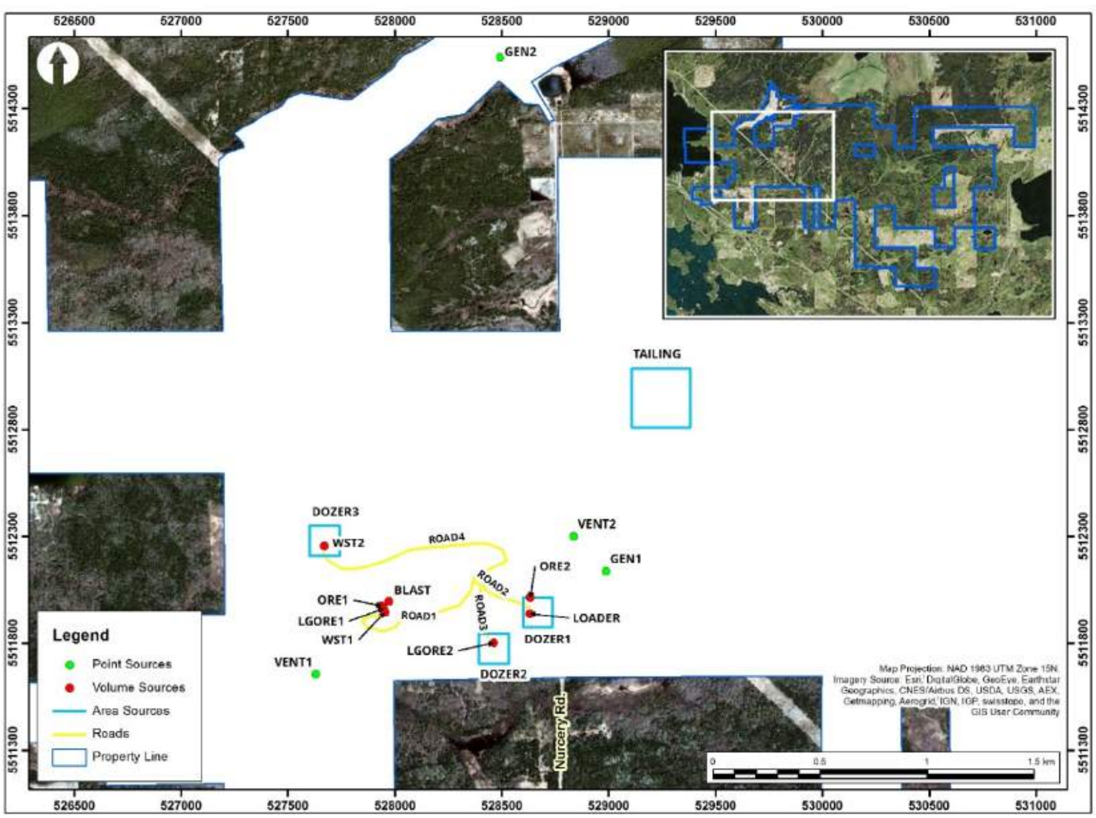


Figure 6.6.2.2-2: Modelled Source Configuration, Operations

The effects of these changes on the air modelling predictions presented in the Environmental Air Quality Assessment (Appendix J-2) would be relatively minor, as the changes would only affect the emissions sources at the processing plant (about 7% of the total emissions during operations). The concentrations due to processing plant emissions at sensitive receptors to the west of the Project could increase by as much as 12%; however, since these sources represent less than 7% of the overall emissions, the overall change in concentrations at sensitive receptors to the west of the Projects would be less than 1% from the results in the Environmental Air Quality Assessment (Appendix J-2), which are relied on in the subsequent sections. These changes would not alter the conclusions regarding the results in the subsequent sections.

The modelled noise sources during the closure phase are provided on Figure 6.6.2.2-3. The site preparation and construction phase, and the closure phase sources are assessed in the same location as the operations phase sources.

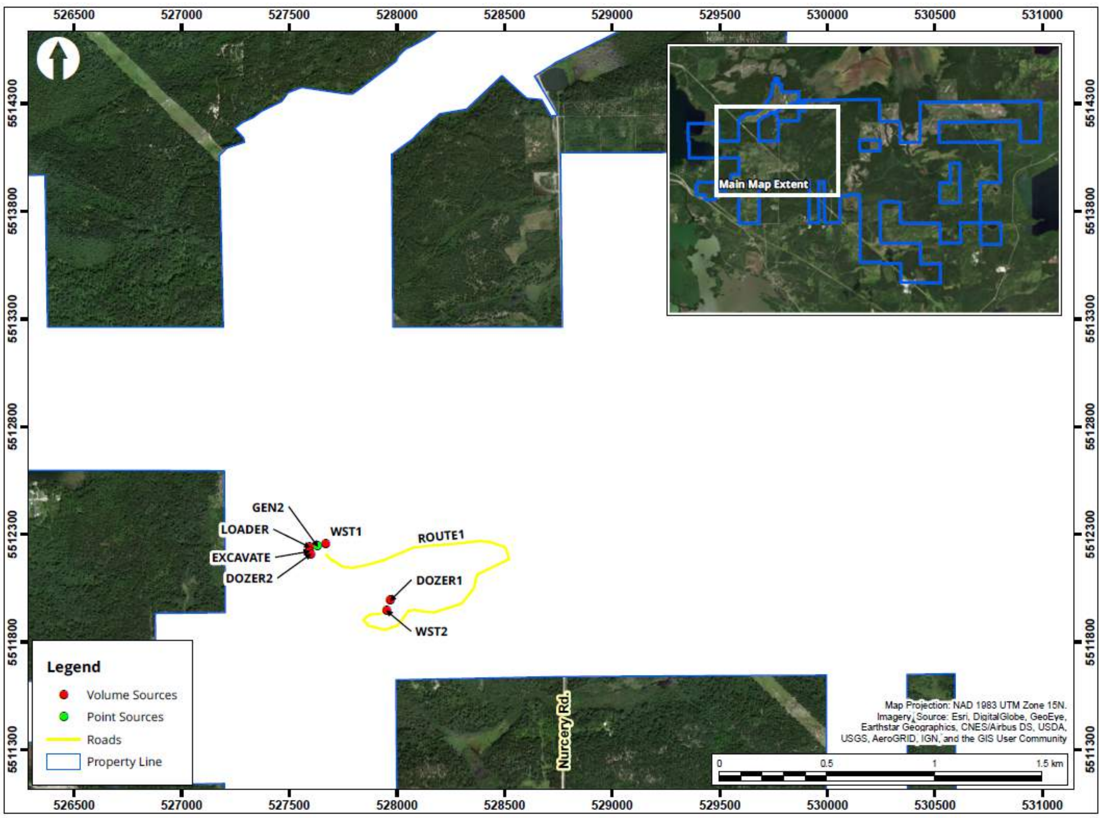


Figure 6.6.2.2-3: Modelled Source Configuration, Closure

Meteorological Data

Section 3.5.4 of the Environmental Air Quality Assessment (Appendix J-2 to the revised EIS) describes the meteorological data used in the dispersion modelling. Under the requirements of O. Reg. 419/05, the Ontario Ministry of Environment and Climate Change (MOECC) provides a series of pre-processed meteorological data sets for use in dispersion modelling assessments in Ontario. These data sets use surface observations and upper air data from airports that represent major geographical areas of Ontario.

The site is located near Dryden, therefore the Northern Region (Thunder Bay, Kenora) meteorological data set (MOECC 2017) is recommended by the Ontario Ministry of Environment and Climate Change (MOECC) for use at this site. This includes both surface data and upper air data from International Falls, Minnesota. Within each region, the MOE provides alternative data sets with the choice of data set depending on the character of the terrain at the study site. The area surrounding the site is typically forested, with some areas of open water and clear-cuts. The default data set for “forest” was used based on the land use patterns surrounding the site. Figure 5 of the Environmental Air Quality Assessment (Appendix J-2) provides a wind rose for the pre-processed meteorological data used. Figure 6.6.2.2-4 replicates this wind rose.

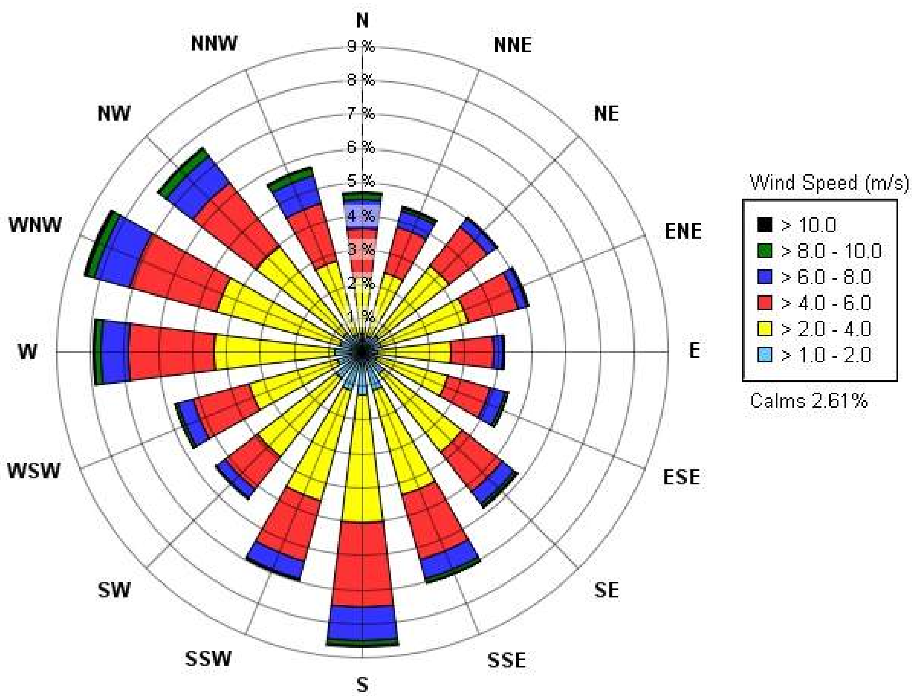


Figure 6.6.2.2-4: Wind Rose for Dispersion Meteorological Data

Terrain Data

Section 3.5.6 of the Environmental Air Quality Assessment (Appendix J-2) describes the terrain information used in the dispersion modelling. Terrain information for the area surrounding the facility was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data is based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.

6.6.3 Project Effects Avoidance Measures Used in Predictions

Section 6.3 of the Environmental Air Quality Assessment (Appendix J-2) lists the following measures incorporated in the air modelling that reduce the air emissions from the Project and thus help avoid or reduce air quality effects:

- Blasting will be conducted in a phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted. Modern blasting methods used in mining are designed to direct the energy from the blasts into the rock. This reduces the amount of blasting agents required to achieve the desired blast objectives, and ultimately reduces the amount of dust generated. The dust generated from modern blasting result primarily from the physical impact of the displaced rock. The proposed blasting at the Project will likely be restricted to once per day, and only a few days during each week. [Mit_029, Mit_043].
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck). [Mit_031].
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order. [Mit_044].
- A best management practices plan for dust will be implemented on the site to provide specific directions for operators. A draft Best Practices Plan for Dust was included as part of Appendix J to the EIS. Water and chemical suppressants will be used for dust control on the haul roads when temperatures are above freezing. This program would be supplemented with the application of other approved dust suppressant, as required, to minimize fugitive dust emissions. [Mit_046].

6.6.4 Predicted Effects

6.6.4.1 Site Preparation and Construction Phase

Emissions

During the site preparation and construction phase there will be a variety of air emissions sources at the Project. These emission sources will be moving about the site and will be distributed over the operations area of the Project. As a result, the emission will be less concentrated, and maximum effects are expected to be further away from the sensitive receptor locations. The air emissions during the site preparation and construction phase are presented in Table 6.6.4.1-1. The emission are calculated using the methods described in Section 6.6.2.1, and detailed in the Environmental Air Quality Assessment (Appendix J-2).

Table 6.6.4.1-1: Air Emissions – Site Preparation and Construction

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul Roads (Including tailpipe)	547	147	18	30
Dozers (including tailpipe)	19	4	2.6	3.5
Loader (including tailpipe)	49	13	1.8	2.8
Material Handling (load/unload)	5.1	2.4	0.36	—
Excavator (tailpipe)	0.12	0.12	0.12	0.67
Crusher	4.7	2.1	0.32	--
Blasting	2.5	1.3	0.075	0.073
Total:	584	159	22	84

The table presents air emissions for the indicator compounds of TSP, PM_{10}, $PM_{2.5}$ and NO_X. The NO_X is used as a surrogate for other combustion related emissions (CO and SO_2) as it is normally the most significant with respect to the relative evaluation criteria than any other combustion compounds. The metal emissions are directly proportional to the level of TSP, thus are implicitly included.

Predicted Effects

As described in Section 6.1.4.5, the air quality effects of the Project were predicted at a series of gridded receptor locations covering the LSA (Figure 6.1.4.5-1) and at 44 sensitive receptor locations (Figure 6.1.4.5-2). The maximum predicted effects at the gridded receptors are considered to be the maximum point of impingement (MPOI) concentrations, and correspond to the maximum predicted concentrations at the property boundary. The maximum predicted concentrations at the sensitive receptor locations represents the maximum predicted effects at the closest “community-oriented receptors” as defined by the CCME (2000). Table 6.6.4.1-2 presents the maximum predicted air quality effects of the Project during the site preparation and construction phase at both the MPOI (based on the gridded receptor results), and at the nearby sensitive receptors (as defined by CCME [2000]).

Table 6.6.4.1-2: Predicted Air Quality Effects – Site Preparation and Construction

Compound	Averaging Period	Maximum at Gridded Receptors (MPOI)			Maximum at Sensitive Receptors		
		Modelled Prediction	Background (1)	Cumulative Prediction	Modelled Prediction	Background (1)	Cumulative Prediction
TSP	24-hour	124.6	33.0	157.6	90.1	33.0	123.1
	Annual	24.6	14.0	38.6	16.9	14.0	30.9
PM_{10}	24-hour	34.5	15.0	49.5	24.9	15.0	39.9
$PM_{2.5}$	24-hour	4.9	10.0	14.9	3.6	10.0	13.6
	Annual	1.1	4.3	5.4	0.7	4.3	5.0
Dustfall (2)	30 day	6.5	— (3)	6.5	4.6	—	4.6
	Annual	5.4	—	5.4	3.7	—	3.7

Table 6.6.4.1-2: Predicted Air Quality Effects: Site Preparation and Construction (continued)

Compound	Averaging Period	Maximum at Gridded Receptors (MPOI)			Maximum at Sensitive Receptors		
		Modelled Prediction	Background (1)	Cumulative Prediction	Modelled Prediction	Background (1)	Cumulative Prediction
CO	1-hour	29.4	1,248.0	1,277.4	26.0	1,248.0	1,274.0
	8-hour (4)	17.6	1,248.0	1,265.6	15.6	1,248.0	1,263.6
NO_2	1-hour	114.8	33.0	147.8	103.4	33.0	136.4
	24-hour	39.1	33.0	72.1	25.4	33.0	58.4
SO_2	1-hour	2.9	4.0	6.9	2.3	4.0	6.3
	24-hour	0.7	4.0	4.7	0.4	4.0	4.4
	Annual	0.1	1.0	1.1	0.08	1.0	1.1
Arsenic	24-hour	0.004	0.001	0.005	0.003	0.001	0.004
Barium	24-hour	0.058	—	0.058	0.042	—	0.042
Beryllium	24-hour	0.0003	—	0.0003	0.0002	—	0.0002
Cadmium	24-hour	0.0004	—	0.0004	0.0003	—	0.0003
Chromium	24-hour	0.018	0.005	0.023	0.013	0.005	0.018
Cobalt	24-hour	0.001	—	0.001	0.001	—	0.001
Lead	24-hour	0.014	0.005	0.019	0.010	0.005	0.015
Manganese	24-hour	0.070	0.019	0.089	0.051	0.019	0.070
Nickel	24-hour	0.005	—	0.005	0.003	—	0.003
	Annual	0.0009	—	0.0009	0.0006	—	0.0006
Phosphorous	24-hour	0.063	—	0.063	0.046	—	0.046
Platinum	24-hour	0.003	—	0.003	0.002	—	0.002
Rhodium	24-hour	0.0007	—	0.0007	0.0005	—	0.0005
Thallium	24-hour	0.002	—	0.002	0.002	—	0.002
Titanium	24-hour	0.226	—	0.226	0.163	—	0.163
Uranium	24-hour	0.001	—	0.001	0.001	—	0.0009
	Annual	0.0002	—	0.0002	0.0002	—	0.0002
Vanadium	24-hour	0.001	—	0.001	0.004	—	0.004

Notes:

(1) The 1-hour and 24-hour background values were based on 90th percentile of the monitoring data. The annual background values were based on the highest of the annual mean value over the latest 5 years of available monitoring data (see Section 5.2.4)

(2) Predicted dustfall values are in units of g/m²/30 days.

(3) The "—" in the table indicates that background values were not available for the compound.

(4) The 8-hour predicted CO concentration is calculated from 1-hr predicted concentration using a published conversion factor [Ontario Regulation 419/05, 17(2)].

The "community-oriented receptors" defined by the CCME (2000), which correspond with the sensitive air receptors used in the air modelling (see Figure 6.1.4.5-2), were identified by CCME (2000) as the appropriate locations for determining compliance with ambient air quality criteria. Therefore, the tabular results presented above are the most appropriate means for providing the air quality modelling results.

6.6.4.2 Operations Phase

Emissions

During the operations phase, there will be the greatest number of air emissions sources occurring at the Project. In addition, the emission sources will be more concentrated during this phase, and generally closer to the property line and sensitive receptors (Section 6.1.4.5) than during the other phases of the Project. The primary emissions associated with operations phase of the Project are presented in Table 6.6.4.2-1. These emission are calculated in accordance with the methods described in Section 6.6.2.1. Detailed emission calculations are appended to the Environmental Air Quality Assessment (Appendix J-2).

Table 6.6.4.2-1: Air Emissions: Operations

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul roads (Including tailpipe)	484	131	17.4	46.93
Dozers (including tailpipe)	29.85	6.55	4.58	26.94
Loader (including tailpipe)	0.07	0.08	0.07	2.28
Material handling (load/unload)	6.41	3.03	0.46	0
Excavator (tailpipe)	0.02	0.02	0.02	0.3
Wind erosion of tailings	22.32	17.66	10.26	0
Crusher	0.18	0.18	0.18	0
Blasting	10.04	5.22	0.3	0.07
Vent raises	18.94	18.94	18.94	86.79
Heaters	0.1	0.1	0.1	1.35
Back-up generators	0.02	0.02	0.02	0.58
Total:	572	183	52	165

Predicted Effects

As described in Section 6.1.4.5, the air quality effects of the Project were predicted at a series of gridded receptor locations covering the LSA (Figure 6.1.4.5-1) and at 44 sensitive receptor locations (Figure 6.1.4.5-2). The maximum predicted effects at the gridded receptors are considered to be the maximum point of impingement (MPOI) concentrations, and correspond to the maximum predicted concentrations at the property boundary. The maximum predicted concentrations at the sensitive receptor locations represents the maximum predicted effects at the closest “community-oriented receptors” as defined by the CCME (2000). Table 6.6.4.2-2 presents the maximum predicted air quality effects of the Project during the operations phase at both the MPOI (based on the gridded receptor results) and at the nearby sensitive receptors (as defined by CCME [2000]).

Table 6.6.4.2-2: Predicted Air Quality Effects – Operations

Compound	Averaging Period	Maximum at Gridded Receptors (MPOI)			Maximum at Sensitive Receptors		
		Modelled Prediction	Background (1)	Cumulative Prediction	Modelled Prediction	Background (1)	Cumulative Prediction
TSP	24-hour	104.6	33.0	137.6	77.8	33.0	110.8
	Annual	20.5	14.0	34.5	14.5	14.0	28.5
PM_{10}	24-hour	69.3	15.0	84.3	21.6	15.0	36.6
$PM_{2.5}$	24-hour	40.2	10.0	50.2	5.1	10.0	15.1
	Annual	1.2	4.3	5.5	1.1	4.3	5.4
Dustfall (2)	30 day	5.6	— (3)	5.6	4.2	—	4.2
	Annual	4.7	—	4.7	3.3	—	3.3
CO	1-hour	42.4	1,248.0	1,290.4	29.6	1,248.0	1,277.6
	8-hour (4)	25.4	1,248.0	1,273.4	17.7	1,248.0	1,265.7
NO_2	1-hour	138.3	33.0	171.3	115.5	33.0	148.5
	24-hour	46.2	33.0	79.2	56.1	33.0	89.1
SO_2	1-hour	5.5	4.0	9.5	0.3	4.0	4.3
	24-hour	2.6	4.0	6.6	0.1	4.0	4.1
	Annual	0.75	1.0	1.8	0.01	1.0	1.0
Arsenic	24-hour	0.003	0.001	0.004	0.002	0.001	0.003
Barium	24-hour	0.049	—	0.049	0.036	—	0.036
Beryllium	24-hour	0.0002	—	0.0002	0.0002	—	0.0002
Cadmium	24-hour	0.0004	—	0.0004	0.0003	—	0.0003
Chromium	24-hour	0.015	0.005	0.020	0.011	0.005	0.016
Cobalt	24-hour	0.001	—	0.001	0.001	—	0.001
Lead	24-hour	0.012	0.005	0.017	0.009	0.005	0.014
Manganese	24-hour	0.059	0.019	0.078	0.044	0.019	0.063
Nickel	24-hour	0.004	—	0.004	0.003	—	0.003
	Annual	0.0008	—	0.0008	0.0006	—	0.0006
Phosphorous	24-hour	0.053	—	0.053	0.039	—	0.039
Platinum	24-hour	0.002	—	0.002	0.002	—	0.002
Rhodium	24-hour	0.0006	—	0.0006	0.0005	—	0.0005
Thallium	24-hour	0.002	—	0.002	0.001	—	0.001
Titanium	24-hour	0.189	—	0.189	0.141	—	0.141
Uranium	24-hour	0.001	—	0.001	0.0008	—	0.0008
	Annual	0.0002	—	0.0002	0.0001	—	0.0001
Vanadium	24-hour	0.001	—	0.001	0.004	—	0.004

Notes:

(1) The 1-hour and 24-hour background values were based on 90th percentile of the monitoring data. The annual background values were based on the highest of the annual mean value over the latest 5 years of available monitoring data (see Section 5.2.4)

(2) Predicted dustfall values are in units of g/m²/30 days.

(3) The "—" in the table indicates that background values were not available for the compound.

(4) The 8-hour predicted CO concentration is calculated from 1-hr predicted concentration using a published conversion factor [Ontario Regulation 419/05, 17(2)].

The “community-oriented receptors” defined by the CCME (2000), which correspond with the sensitive air receptors used in the air modelling (see Figure 6.1.4.5-2), were identified by CCME (2000) as the appropriate locations for determining compliance with ambient air quality criteria. Therefore, the tabular results presented above are the most appropriate means for providing the air quality modelling results. In addition to the receptor based prediction, the dispersion modelling results provided in the Environmental Air Quality Assessment (Appendix J-2) also provides graphical representations of the spatial distribution of predicted air quality (Figures 6 through 19 of Appendix J-2).

6.6.4.3 Closure Phase

Emissions

During the closure phase there will be a decreased level of activity at the Project relative to the operations phase. In fact, the emissions are comparable to those during the site preparation and construction phase with the exception of the crushing and blasting emissions, which are absent during closure. During the closure phase, the emission sources will be moving about the site and will be distributed over the operations area of the Project. As a result, the emission sources are less concentrated than during operations, and predicted effects are expected to be further away from the sensitive receptor locations. The air emissions during the closure phase are presented in Table 6.6.4.3-1. The emissions are calculated using the methods described in Section 6.6.2.1, and detailed in the Environmental Air Quality Assessment (Appendix J-2).

Table 6.6.4.3-1: Air Emissions: Closure

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul Roads (Including tailpipe)	547	147	18	30
Dozers (including tailpipe)	19	4	2.6	3.5
Loader (including tailpipe)	48	13	0.1	2.8
Material Handling (load/unload)	4.8	2.3	0.35	—
Excavator (tailpipe)	0.12	0.12	0.24	0.67
Total:	584	159	22	84

Predicted Effects

As described in Section 6.1.4.5, the air quality effects of the Project were predicted at a series of gridded receptor locations covering the LSA (Figure 6.1.4.5-1) and at 44 sensitive receptor locations (Figure 6.1.4.5-2). The maximum predicted effects at the gridded receptors are considered to be the maximum point of impingement (MPOI) concentrations, and correspond to the maximum predicted concentrations at the property boundary. The maximum predicted concentrations at the sensitive receptor locations represents the maximum predicted effects at the closest “community-oriented receptors” as defined by the CCME (2000). Table 6.6.4.3-2 presents the maximum predicted air quality effects of the Project during the closure phase at both the MPOI (based on the gridded receptor results), and at the nearby sensitive receptors (as defined by CCME [2000]).

Table 6.6.4.3-2: Predicted Air Quality Effects – Closure

Compound	Averaging Period	Maximum at Gridded Receptors (MPOI)			Maximum at Sensitive Receptors		
		Modelled Prediction	Background (1)	Cumulative Prediction	Modelled Prediction	Background (1)	Cumulative Prediction
TSP	24-hour	110.9	33.0	143.9	81.7	33.0	114.7
	Annual	21.7	14.0	35.7	15.1	14.0	29.1
PM_{10}	24-hour	30.1	15.0	45.1	22.2	15.0	37.2
$PM_{2.5}$	24-hour	4.0	10.0	14.0	3.0	10.0	13.0
	Annual	0.8	4.3	5.1	0.6	4.3	4.9
Dustfall (2)	30 day	5.7	— (3)	5.7	4.1	—	4.1
	Annual	4.8	—	4.8	3.3	—	3.3
CO	1-hour	11.6	1,248.0	1,259.6	8.8	1,248.0	1,256.8
	8-hour (4)	7.0	1,248.0	1,255.0	5.3	1,248.0	1,253.3
NO_2	1-hour	40.4	33.0	73.4	27.6	33.0	60.6
	24-hour	16.0	33.0	49.0	10.9	33.0	43.9
SO_2	1-hour	2.0	4.0	6.0	1.1	4.0	5.1
	24-hour	0.5	4.0	4.5	0.2	4.0	4.2
	Annual	0.06	1.0	1.1	0.02	1.0	1.0
Arsenic	24-hour	0.004	0.001	0.005	0.003	0.001	0.004
Barium	24-hour	0.052	—	0.052	0.038	—	0.038
Beryllium	24-hour	0.0003	—	0.0003	0.0002	—	0.0002
Cadmium	24-hour	0.0004	—	0.0004	0.0003	—	0.0003
Chromium	24-hour	0.016	0.005	0.021	0.012	0.005	0.017
Cobalt	24-hour	0.001	—	0.001	0.001	—	0.001
Lead	24-hour	0.012	0.005	0.017	0.009	0.005	0.014
Manganese	24-hour	0.062	0.019	0.081	0.046	0.019	0.065
Nickel	24-hour	0.004	—	0.004	0.003	—	0.003
	Annual	0.0008	—	0.0008	0.0006	—	0.0006
Phosphorous	24-hour	0.056	—	0.056	0.041	—	0.041
Platinum	24-hour	0.002	—	0.002	0.002	—	0.002
Rhodium	24-hour	0.0007	—	0.0007	0.0005	—	0.0005
Thallium	24-hour	0.002	—	0.002	0.001	—	0.001
Titanium	24-hour	0.201	—	0.201	0.148	—	0.148
Uranium	24-hour	0.001	—	0.001	0.0008	—	0.0008
	Annual	0.0002	—	0.0002	0.0002	—	0.0002
Vanadium	24-hour	0.001	—	0.001	0.004	—	0.004

Notes:

(1) The 1-hour and 24-hour background values were based on 90th percentile of the monitoring data. The annual background values were based on the highest of the annual mean value over the latest 5 years of available monitoring data (see Section 5.2.4)

(2) Predicted dustfall values are in units of g/m^2/30 days.

(3) The "—" in the table indicates that background values were not available for the compound.

(4) The 8-hour predicted CO concentration is calculated from 1-hr predicted concentration using a published conversion factor [Ontario Regulation 419/05, 17(2)].

The "community-oriented receptors" defined by the CCME (2000), which correspond with the sensitive air receptors used in the air modelling (see Figure 6.1.4.6-2), were identified by CCME

(2000) as the appropriate locations for determining compliance with ambient air quality criteria. Therefore, the tabular results presented above are the most appropriate means for providing the air quality modelling results.

6.6.4.4 Post-closure Phase

As described in Section 6.6.1, there are not expected to be any sources of air emissions at the Project during the post-closure phase.

6.6.5 Identified Mitigation

The Project will employ best practices that will help reduce and mitigate air quality effects, including the following:

- Blasting will be conducted in a phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted. Modern blasting methods used in mining are designed to direct the energy from the blasts into the rock. This reduces the amount of blasting agents required to achieve the desired blast objectives, and ultimately reduces the amount of dust generated. The dust generated from modern blasting result primarily from the physical impact of the displaced rock. The proposed blasting at the Project will likely be restricted to once per day, and only a few days during each week. [Mit_029, Mit_043].
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck). [Mit_031].
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order. [Mit_044].
- A best management practices plan for dust will be implemented on the site to provide specific directions for operators. A draft Best Practices Plan for Dust was included as part of Appendix J to the EIS. Water and chemical suppressants will be used for dust control on the haul roads is used at the mine site, when temperatures are above freezing. [Mit_046].

6.6.6 Residual Adverse Effects

Although the identified mitigation measures summarized in Section 6.6.5 will help to reduce the Project effects on air quality, predicted residual adverse effects on air quality will remain. A summary of the residual adverse air quality effects associated with the Project is provided in Table 6.6.6-1. The results in the table represent the maximum predicted values of the indicator compounds at the sensitive receptor locations. The sensitive receptor locations (Section 6.1.4.5. and Figure 6.1.4.5-2) correspond with the description of “community-oriented locations” considered by the CCME (2000) as the appropriate locations for determination compliance with ambient air quality standards. The predicted effects of the Project on air quality were set out in Sections 6.6.4.1 (site preparation and construction), 6.6.4.2 (operations) and 6.6.4.3 (closure), and include the contribution of background concentrations that are described in Section 5.2.4. As described in Section 6.6.4.4, there are no sources of air emissions identified at the Project during the post-closure phase. In Table 6.6.6-1 the highest concentrations for each compound are highlighted with grey shading. In virtually all cases, the highest predicted concentrations occur during the operations phase, when activity levels are expected to be greatest. The two exceptions are SO_2 and dustfall, where the maximums were predicted to occur during the site preparation and construction phase. However, neither the maximum predicted dustfall levels nor the maxim SO_2 concentrations exceed the relevant ambient criteria (see Table 5.2.2-1).

Table 6.6.6-1: Residual Adverse Air Quality Effects

Compound	Averaging Period	Maximum Cumulative Prediction at Sensitive Receptors (1)			
		Site Preparation (2) and Construction	Operations	Closure (3)	Post-closure (4)
TSP	24-hour	123.1	110.8	114.7	—
	Annual	30.9	28.5	29.1	—
PM_{10}	24-hour	39.9	36.6	37.2	—
$PM_{2.5}$	24-hour	13.6	15.1	13.0	—
	Annual	5.0	5.4	4.9	—
Dustfall (2)	30 day	4.6	4.2	4.1	—
	Annual	3.7	3.3	3.3	—
CO	1-hour	1,274.0	1,277.6	1,256.8	—
	8-hour (4)	1,263.6	1,265.7	1,253.3	—
NO_2	1-hour	136.4	148.5	60.6	—
	24-hour	58.4	89.1	43.9	—
SO_2	1-hour	6.3	4.3	5.1	—
	24-hour	4.4	4.1	4.2	—
	Annual	1.1	1.0	1.0	—
Arsenic	24-hour	0.0039	0.0035	0.0036	—
Barium	24-hour	0.0423	0.0365	0.0383	—
Beryllium	24-hour	0.0002	0.0002	0.0002	—
Cadmium	24-hour	0.0003	0.0003	0.0003	—
Chromium	24-hour	0.0179	0.0162	0.0167	—
Cobalt	24-hour	0.0011	0.0009	0.0010	—
Lead	24-hour	0.0150	0.0137	0.0141	—
Manganese	24-hour	0.0697	0.0627	0.0650	—
Nickel	24-hour	0.0035	0.0030	0.0031	—
	Annual	0.0006	0.0006	0.0006	—
Phosphorous	24-hour	0.0456	0.0394	0.0414	—
Platinum	24-hour	0.0018	0.0016	0.0016	—
Rhodium	24-hour	0.0005	0.0005	0.0005	—
Thallium	24-hour	0.0015	0.0013	0.0014	—

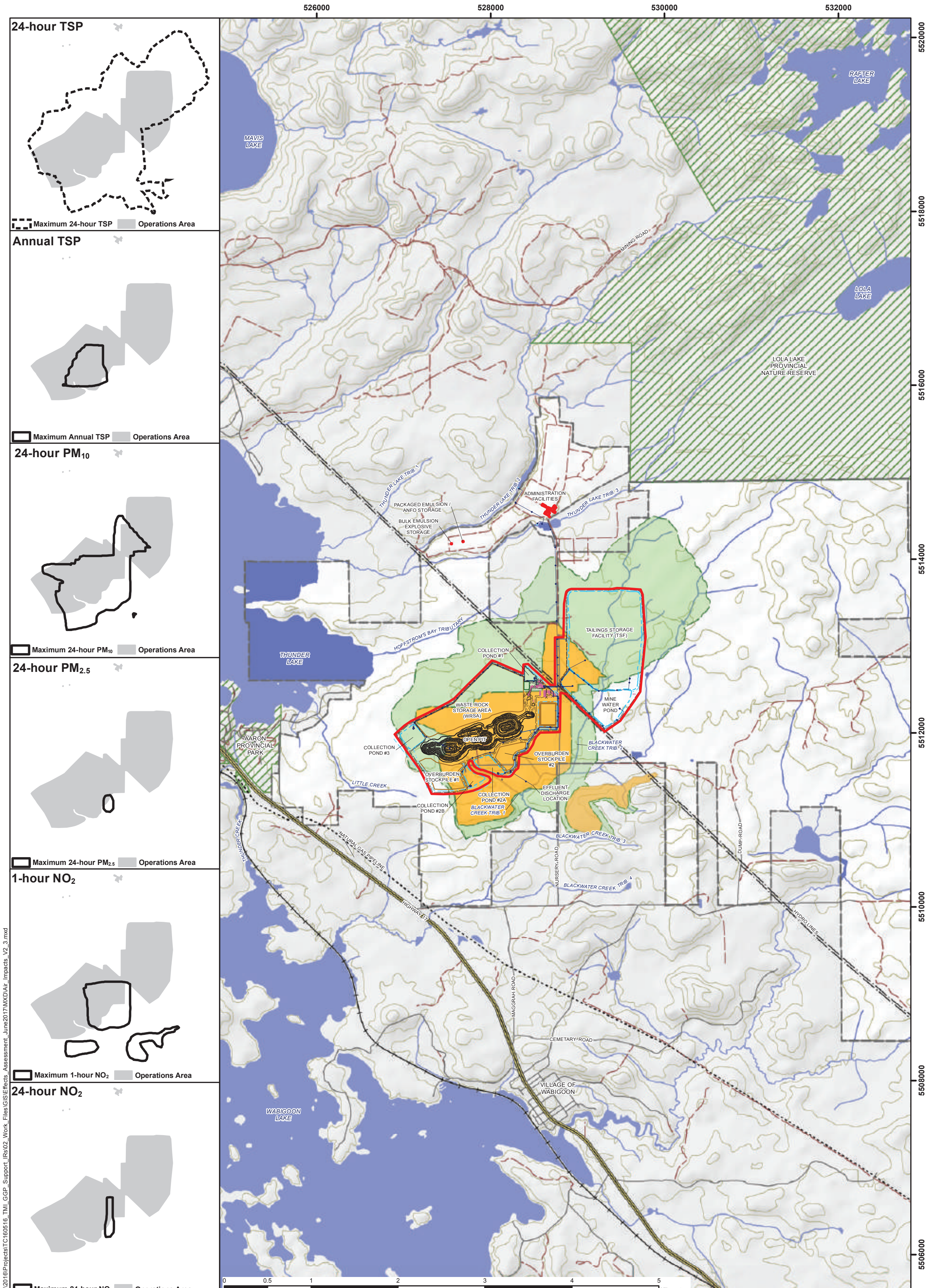
Table 6.6.6-1: Residual Adverse Air Quality Effects (continued)

Compound	Averaging Period	Maximum Cumulative Prediction at Sensitive Receptors [1]			
		Site Preparation [2] and Construction	Operations	Closure [3]	Post-closure [4]
Titanium	24-hour	0.1631	0.1408	0.1479	—
Uranium	24-hour	0.0009	0.0008	0.0008	—
	Annual	0.0002	0.0001	0.0002	—
Vanadium	24-hour	0.0043	0.0037	0.0039	—

Notes:
(1) The air quality effects are presented at the sensitive receptor locations, which correspond to the definition of "community-oriented locations" used by CCME (2000). The cumulative predictions include background air concentrations.
(2) Predicted effects during the site preparation and construction phase are based on the operations phase modelling.
(3) Predicted effects during the closure phase are based on the operations phase modelling.
(4) There are no sources of air emissions during the post-closure phase.

As described by the by the CCME (2000), "community-oriented locations" are the appropriate locations for determination compliance with ambient air quality standards. The sensitive air receptor locations described in Section 6.1.4.5, and shown in Figure 6.1.4.5-2, correspond with "community-oriented locations" described by CCME (2000). These are the locations used for assessing the effects of the Project on air quality. Maximum concentrations were also predicted at the property line of the Project (Tables 6.6.4.1-2, 6.6.4.2-2, and 6.6.4.3-2). Treasury Metals recognizes that not all changes in air quality can be captured by using only sensitive receptors or receptors along the property line. For example, there will be areas outside of the operations area and within the property line that will continue to be accessible to members of the public, or members of Indigenous communities practicing traditional uses of the land.

The dispersion modelling for the operations phase was used to identify those areas where maximum concentrations were predicted to exceed the health-based ambient air quality criteria (AAQC). Figure 6.6.6-1 illustrates the areas where the maximum annual TSP, 24-hour PM_{10}, 24-hour $PM_{2.5}$, 1-hour NO_2 and 24-hour NO_2 were predicted to exceed relevant health-based criteria anywhere in the dispersion modelling domain, despite the CCME (2000) indicating that determining compliance with those criteria is only appropriate at "community-oriented locations". These areas are shown individually with solid lines on the inserts down the left side of the figure, and then combined in the main figure as the area shaded in gold. It should be noted that predicted concentrations in excess of these health-based criteria do not indicate that health impacts will occur as the criteria are established with margins of safety to protect the public. Figure 6.6.6-1 also illustrates the areas where the modelling identified 24-hour TSP concentrations were predicted to exceed the AAQC established to protect against visibility effects. These areas are shown with a dashed line on the insert down the left side of the figure, and shown as a shaded green area on the main figure.



LEGEND

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

Site Infrastructure
- Access Haul Roads
- Pipeline
- Ditching
- Emergency Spillway
- Processing Plant and Ancillary Facilities
- Security Fence
- Stockpile

- Operations Area
- Air Quality Impact Footprint
- Air Quality Affected Area

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

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Spatial Distribution of Residual Air Quality Effects

PROJECT N°: TC160516

FIGURE: 6.6.6-1

SCALE: 1:40,000

DATE: April 2018

6.6.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, there were a number of questions that were wholly, or partially, asking for information, clarification and/or justification for the approach used in predicting the effects of the Project on air quality, or the predicted effects themselves. Responses to the IRs were provided separately, and incorporated into the relevant sections of the Revised EIS. The following lists the Round 1 IRs related to the air quality predictions:

- TMI_165-AE(1)-03: potential for O_3 formation;
- TMI_166-AE(1)-04: background data used;
- TMI_167-AE(1)-05: use of Ontario AAQS;
- TMI_169-AE(1)-07: potential effects during site preparation and construction phase;
- TMI_170-AE(1)-08: air emissions from Project;
- TMI_171-AE(1)-09: sensitive receptors and CCME (2000) guidance;
- TMI_172-AE(1)-10: sensitive receptors and CCME (2000) guidance;
- TMI_174-AE(1)-12: model predictions at the limits of LSA;
- TMI_175-AE(1)-13: applicability of AERMOD for gaseous and particulate dispersion;
- TMI_176-AE(1)-14: air emissions from Project;
- TMI_194.1-HE(1)-01: sensitive receptors and CCME (2000) guidance;
- TMI_219-HE(1)-26: background data used;
- TMI_338-AC(1)-12: air emissions from Project;
- TMI_339-AC(1)-13: potential effects of dust;
- TMI_421-AC(1)-96: background data used;
- TMI_463-AC(1)-137: background data used;
- TMI_527-AC(1)-201: linkages to Aboriginal interests;
- TMI_540-AC(1)-214: linkages to Aboriginal interests;
- TMI_565-AC(1)-239: linkages to Aboriginal interests;
- TMI_598-AC(1)-263: linkages to Aboriginal interests;
- TMI_607-AC(1)-280: linkages to Aboriginal interests;
- TMI_611-AC(1)-284: potential air quality effects;
- TMI_616-AC(1)-289: potential air quality effects;
- TMI_655-AC(1)-328: linkages to Aboriginal interests;

- TMI_710-PC(1)-25: compliance with regulatory criteria;
- TMI_713-PC(1)-28: odours, dust from blasting, accidental releases;
- TMI_714-PC(1)-29: potential effects of dust; and
- TMI_751-PC(1)-66: consideration of sources in Dryden.

6.7 Climate

6.7.1 Potential Effects of the Project on the Environment

The effects of the Project on climate are related to its contribution towards greenhouse gas (GHG) emissions. These GHG emissions will result from the use of fossil fuels as part of the Project operations. Diesel fuel will be used in the mobile equipment used both in the open pit and underground mine. Additionally, natural gas will be used to heat the underground mine and ensure suitable working conditions. The Project will not have to generate its own electricity as there is an existing 115 kV transmission line that runs adjacent to the proposed processing plant. The Project will be equipped with backup diesel-fired generators that will be used in the event of a power outage to maintain key equipment and allow for the safe and orderly shutdown of operations. The backup generators are expected to be tested for about 1 hour every month. The potential effects of the Project on climate will vary during the Project life, depending on the phase, and the levels of activity. The following lists the potential climate effects by Project phase:

- **Site Preparation and Construction**: Mobile equipment used for tree clearing, grubbing, and the stripping of overburden, as well as the construction of roads and Project facilities will all require the use of diesel fuel, and will result in the generation of GHG emissions.
- **Operations**: During operations, the mine operations will rely on equipment that burns diesel fuel and generates GHG emissions. Additionally, natural gas will be used to heat the underground mine, generating additional GHG emissions. Finally, GHG emissions will result from the testing of the diesel fired backup generators, which will be operated an hour each month.
- **Closure:** Mobile equipment used to rehabilitate the site, and disassembling and removal of infrastructure and equipment will be diesel-fired and will generate GHG emissions.
- **Post-closure**: Once the closure activities are completed there are not expected to be any sources of combustion or GHG emissions at the Project.

The potential effects of the Project on air quality have been described using a simple linkage diagram on Figure 6.7.1-1. The figure illustrates the climate VCs (shown in blue on the figure) potentially be affected during each phase of the Project life. Climate VCs will not directly affect any of the other components or VCs, nor will other components or VCs affect the climate VCs.

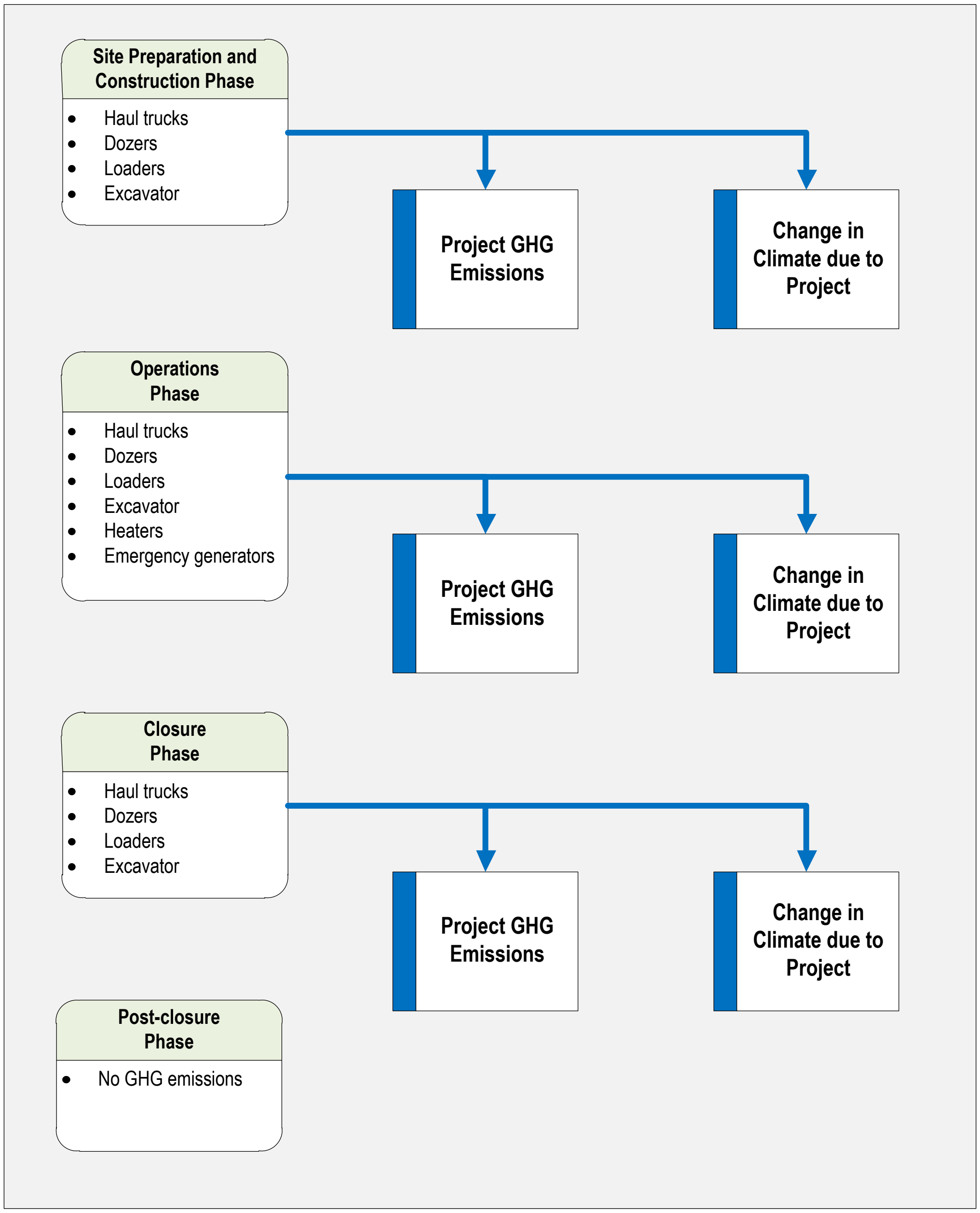


Figure 6.7.1-1: Climate Linkage Diagram

6.7.2 Effects Prediction Methods

6.7.2.1 Methods for Calculating Project GHG Emissions

The approach used for calculating the Project GHG emissions relies on the methods and emission factors used by the Environment and Climate Change Canada for compiling the latest annual GHG emission report (ECCC 2017a), which was submitted to the United Nations Framework Convention on Climate Change in 2017. The steps involved in the calculation included the following:

- Determine the annual usage of diesel fuel in mobile equipment;
- Determine the annual usage of diesel fuel in the backup generators; and
- Determine the annual usage of natural gas for heating the underground mine.

The fuel consumption rates were based on the air emissions data presented in Section 6.6.4, and detailed in Appendix J-2 to the revised EIS. Table 6.7.2.1-1 lists the fuel consumption used to calculate the Project GHG emissions.

Table 6.7.2.1-1: Fossil Fuel Consumption

Source Category	Site Prep. and Construction	Operations	Closure
Diesel combustion in mobile equipment (L/y)(1)	3.63×10^6	3.86×10^6	4.04×10^6
Diesel combustion in backup generators (L/y)(2)	0	4.42×10^5	0
Natural gas combustion for heating (m³/y)(1)	0	8.41×10^5	0

Notes:
(1) The fuel volumes for heating and mobile equipment are based on the maximum activity levels, and assumed continuous activity throughout the year.
(2) The fuel for the backup generators is based on running the units for 1 hour each month.

Once the base quantities are established, appropriate emission factors need to be identified in the Environment and Climate Change Canada reference report (ECCC 2017b). The following emission factors were used to calculate Project GHG emissions:

Table 6.7.2.1-2 lists the emission factors for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), the three primary compounds considered when calculating Project GHG emissions.

Table 6.7.2.1-2: GHG Emission Factors

Source Category	GHG Emission Factors		
	CO_2	CH_4	N_2O
Diesel combustion in mobile equipment (g/L)	2,690	0.15	1.0
Diesel combustion in backup generators (g/L)	2,753	0.18	0.031
Natural gas combustion for heating (g/m³)	1,888	0.037	0.033

It is generally considered more convenient to discuss GHG emission using a single parameter referred to as the equivalent CO_2 emissions (eCO_2). The equivalent CO_2 is calculated by combining the CO_2, CH_4 and N_2O using the following greenhouse gas equivalency factors:

- Carbon dioxide (CO_2): 1;
- Methane (CH_4): 21; and
- Nitrous oxide (N_2O): 310.

6.7.2.2 Methods for Estimating Effects of the Project on Climate

Although the levels of GHG emissions Project are important to understand, the real concern with respect to climate is how those emissions could affect the climate in the future. To understand how the Project could contribute to changes in climate, it is necessary to understand both how the climate is projected to change (with an emphasis on the region in which the Project is located) and the GHG emissions provincially, nationally and globally that would be contributing to the predicted changes in climate.

Projections of Regional Changes in Climate

There is a wealth of scientific literature and research available regarding the projections for future climate change over the planet. For describing the potential changes in climate in northwestern Ontario, two documents compiled by, or for the Ontario government, have been relied on, namely climate change reports CCRR-05 (Colombo et al. 2007) and CCRR-44 (McDermid et al. 2015).

The summary report (Colombo et al. 2007) made use of data from the Canadian Coupled Global Climate Model (CGCM2) forecasts for emission scenarios presented in the Fourth Assessment Report (AR4) from the Intergovernmental Panel for Climate Change (IPCC 2007). Specifically, Colombo et al (2007) presented the climate projections associated with the A2 emission scenarios, which is one of the four socio-economic scenarios relied on in AR4 (IPCC 2007). Although the IPCC has not stated which of these scenarios are most likely to occur, the A2 scenario most closely reflects the current global socio-economic situation. In relation to the A2 scenario, scenarios A1, B1 and B2 result in lower long-term GHG emissions over the next century. Climate projections are presented as changes from the 1971–2000 baseline period, and are provided for the 2011–2040, 2041–2070, and 2071–2100 time horizons. These projections were used to compile the expected changes in summer and winter temperature and precipitation for the region near the Project. Changes in annual climate were not provided.

Generally, the picture presented for future climate in the area is one of increasing temperatures in both the winter and summer periods for all of the forecast horizons. For precipitation, the summer rates are projected to increase for the 2011 to 2040 horizon, changing to a decrease for the 2041 to 2070 and 2071 to 2100 horizons. During the winter, future precipitation is projected to decrease for the 2011 to 2040 and 2041 to 2070 time horizons, but increasing the 2071 to 2100 time horizon. The results (Colombo et al. 2007), presented in Table 6.7.2.2-1, suggest that the future climate for the region will continue to warm, with precipitation decreasing slightly except in the later stages of the century.

Table 6.7.2.2-1: Projections of Climate Change (AR4) in Northwestern Ontario

Forecast Horizon	Projected Changes in Climate (relative to 1971 to 2000)			
	Temperatures		Precipitation	
	Summer	Winter	Summer	Winter
2011 to 2040	+1 to +2°C	+1 to +2°C	0% to +10%	-10% to 0%
2041 to 2070	+2 to +3°C	+3 to +4°C	-10% to 0%	-10% to +10%
2071 to 2100	+4 to +5°C	+5 to +6°C	-10% to 0%	0% to +20%

Source: Colombo et al. 2007

In the updated summary for policymakers (McDermid et al. 2015), use was made of data from the Fifth Assessment Report (AR5) from the IPCC (2013), which replaces the socio-economic emission scenarios relied on in AR4 (IPCC 2007) with new scenarios thought to better represent climate processes used in the modelling. The updated summary considered the RCP 2.6, RCP 4.5, and RCP 8.5 emission scenarios, and shows the 2011 to 2040, 2041 to 2070, and 2071 to 2100 time horizons. The updated summary also relies on statistically downscaled data from Earth Systems Models rather than data from a single GCM. The data relied on by McDermid et al. (2015) are described more fully by McKenney et al. (2006; 2011; 2013). The Project is located within the Nelson River watershed.

The updated picture for future climate in the region (McDermid et al. 2015) is one of warming annual, summer and winter temperatures. The annual and winter precipitation projections show increasing precipitation. In contrast, the projections for summer precipitation show a decreasing trend. These predictions are summarized in Table 6.7.2.2-2.

Table 6.7.2.2-2: Projections of Climate Change (AR5) in Northwestern Ontario

Forecast Horizon	Scenario	Projected Changes in Climate (relative to 1971 to 2000)					
		Temperatures (°C)			Precipitation (mm)		
		Annual	Summer	Winter	Annual	Summer	Winter
2011 to 2040	RPC 2.6	+2.3	+2.2	+2.3	+18.1	-18.6	+21.7
	RPC 4.5	+2.2	+2.1	+2.1	+28.7	-19.1	+19.4
	RPC 8.5	+2.4	+2.3	+2.7	+32.8	-20.8	+18.8
2041 to 2070	RPC 2.6	+3.0	+2.7	+3.2	+51.8	-7.4	+24.0
	RPC 4.5	+4.0	+3.4	+4.7	+37.5	-19.8	+21.6
	RPC 8.5	+4.8	+4.6	+5.6	+54.3	-27.7	+30.6
2071 to 2100	RPC 2.6	+3.1	+2.9	+3.6	+57.5	-2.9	+21.9
	RPC 4.5	+5.0	+4.4	+5.6	+40.6	-24.1	+30.6
	RPC 8.5	+8.3	+7.8	+9.3	+64.0	-43.6	+39.7

Note: Data derived from McDermid et al. 2015

Canadian and Global GHG Emissions Associated with Changes in Climate

Each year, Canada submits a report summarizing its annual GHG emissions to the United Nations Framework Convention on Climate Change. The report, which is compiled by Environment and Climate Change Canada lists the total GHG emissions, GHG emissions by province/territory, GHG emissions by sector and by activity (ECCC 2017a). Table 6.7.2.2-3 lists the total Canadian GHG emissions, as well as the provincial and territorial emissions for the latest reporting year (2015), as well as the emissions dating back to 2005.

Table 6.7.2.2-3: Canadian GHG Emissions by Province

Province or Territory	Annual GHG Emissions (kt/y)(1)(2)						
	2005	2010	2011	2012	2013	2014	2015
Newfoundland and Labrador	10,100	10,300	10,300	9,900	9,600	10,600	10,300
Prince Edward Island	2,100	2,000	2,200	2,100	1,800	1,800	1,800
Nova Scotia	23,000	20,000	21,000	19,000	18,000	16,000	16,000
New Brunswick	20,000	19,000	19,000	17,000	15,000	14,000	14,000
Quebec	89,000	82,000	84,000	81,000	82,000	80,000	80,000
Ontario	204,000	175,000	175,000	171,000	171,000	168,000	166,000
Manitoba	21,000	20,000	19,000	21,000	21,000	21,000	21,000
Saskatchewan	70,000	70,000	69,000	72,000	74,000	75,000	75,000
Alberta	233,000	241,000	246,000	260,000	272,000	276,000	274,000
British Columbia	64,000	59,000	60,000	61,000	62,000	61,000	61,000
Yukon	400	400	400	400	400	300	300
Northwest Territories	1,600	1,300	1,400	1,500	1,400	1,300	1,400
Nunavut	500	500	500	600	600	700	600
Canada(3)	**738,000**	**701,000**	**707,000**	**716,000**	**729,000**	**727,000**	**722,000**

Notes:
(1) Data derived from ECCC (2017a), Table S-4
(2) Emissions are provided in units of kilotonnes per year (10^9 g/y)
(3) Totals may not appear to add up due to rounding in the source information

The annual report also provides a breakdown of the GHG emissions by sector, as provided in Table 6.7.2.2-4. This table does not specifically break out the emissions for the mining sector, which are included as a component of the "heavy industry" category.

Table 6.7.2.2-4: Canadian GHG Emissions by Sector

Sector	Annual GHG Emissions (kt/y)(1)(2)						
	2005	2010	2011	2012	2013	2014	2015
Oil and gas	158,000	158,000	160,000	161,000	174,000	185,000	190,000
Electricity	117,000	95,000	96,000	89,000	85,000	82,000	80,000
Transportation	163,000	163,000	171,000	171,000	173,000	176,000	173,000
Heavy industry(3)	86,000	71,000	73,000	80,000	79,000	77,000	77,000
Buildings	85,000	84,000	81,000	87,000	85,000	85,000	88,000

Table 6.7.2.2-4: Canadian GHG Emissions by Sector (continued)

Sector	Annual GHG Emissions (kt/y)(1)(2)						
	2005	2010	2011	2012	2013	2014	2015
Agriculture	74,000	70,000	70,000	70,000	71,000	74,000	72,000
Waste and others	54,000	49,000	50,000	50,000	49,000	49,000	48,000
Canada(4)	**738,000**	**701,000**	**707,000**	**716,000**	**729,000**	**727,000**	**722,000**

Notes:
(1) Data derived from ECCC (2017a), Table S-3
(2) Emissions are provided in units of kilotonnes per year (10^9 g/y)
(3) Heavy Industry represent emissions arising from non-coal, -oil and -gas mining activities, smelting and refining, and the production and processing of industrial goods such as paper or cement
(4) Totals may not appear to add up due to rounding in the source information

A breakdown of the "heavy industry" sector GHG emissions, highlighting the GHG emissions from the mining sector (exclusive of emissions associated with oil sands mining) have been provided in Table 6.7.2.2-5.

Table 6.7.2.2-5: Canadian GHG Emissions within the Heavy Industry Sector

Sub-sector	Annual GHG Emissions (kt/y)(1)(2)						
	2005	2010	2011	2012	2013	2014	2015
Mining	7,000	7,000	8,000	8,000	8,000	8,000	8,000
Smelting and refining (non ferrous metals)	17,000	14,000	11,000	11,000	10,000	11,000	10,000
Pulp and paper	15,000	9,000	7,000	7,000	7,000	7,000	6,000
Iron and steel	16,000	16,000	14,000	17,000	17,000	15,000	16,000
Cement	10,000	13,000	10,000	10,000	11,000	10,000	10,000
Lime and gypsum	3,000	3,000	3,000	3,000	3,000	2,000	3,000
Chemicals and fertilizers	29,000	23,000	21,000	23,000	24,000	24,000	24,000
Heavy industry(3)	**97,000**	**86,000**	**73,000**	**80,000**	**79,000**	**77,000**	**77,000**

Notes:
(1) Data derived from ECCC (2017a), Table 2-12.
(2) Emissions are provided in units of kilotonnes per year (10^9 g/y)
(3) Totals may not appear to add up due to rounding in the source information

Unlike most environmental issues, climate change is affected on a global issue, rather than a local scale. That is to say that changes in climate are not most noticeable where the emissions are highest. While managing emissions on a provincial and national scale is important, this does not mean that the benefits of these reductions will occur locally. To understand the importance of the Project GHG emission to climate change, it is also important to understand the global emissions of GHGs. Table 6.7.2.2-6 provides a listing of the historic GHG emission totals globally.

Table 6.7.2.2-6: Historic Global GHG Emissions

Region or Sub-region	Annual GHG Emissions (kt/y)(1)(2)					
	1990	2005	2010	2011	2012	2013
Global Total(3)	23,541,006	32,027,075	36,843,140	41,288,274	42,790,113	43,634,306
UNFCCC Annex I	13,133,637	17,086,012	17,310,563	16,648,866	16,435,891	16,426,111
UNFCCC Non-Annex I	10,407,369	14,941,063	19,532,577	24,639,408	26,354,222	27,208,195
Asia	8,356,448	12,159,691	16,051,944	20,473,123	22,304,085	23,057,991
Africa	1,541,992	1,928,479	2,344,747	2,655,382	2,583,410	2,638,075
Europe	4,799,884	7,477,058	7,628,612	7,356,455	7,167,227	7,106,652
Northern America	6,426,680	7,408,118	7,472,876	7,170,425	6,911,848	7,018,219
Latin America and the Caribbean	1,857,959	2,374,784	2,686,793	2,974,156	3,075,389	3,132,597

Notes:
(1) Historic emissions data derived from WRI (2017)
(2) Emissions are provided in units of kilotonnes per year (10^9 g/y)
(3) Totals global emissions are based on the totals for the CAIT countries.

In order to estimate what the climate could be in the future, international organizations have developed forecasts of the future GHG emission based on varying estimates of economic behaviour globally and the success in mitigation emissions. The most comprehensive document was published by the IPCC (Nakicenovic 2000), and was used as the basis for climate modelling up to the fourth assessment (AR4), and included the following four families of scenarios:

- The A1 scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies.
- The A2 scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Economic development is primarily regionally oriented and per capita economic growth.
- The B1 scenario family describes a convergent world with the same global population that peaks in mid-century and declines thereafter. There are rapid changes in economic structures toward a service and information economy. The emphasis is on global solutions to economic, social, and environmental sustainability.
- The B2 scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability.

The Projected increases in global GHG emissions for 2020, 2050, and 2100 associated with the above scenario families have been summarized in Table 6.7.2.2-7.

Table 6.7.2.2-7: Projected AR4 Increases in Global GHG Emissions

Forecast Horizon	Change in Annual GHG Global Emissions(1)					
	A1FI	A1B	A1T	A2	B1	B2
Increases relative to 1990 baseline						
2020	167%	164%	138%	163%	142%	167%
2050	301%	205%	164%	230%	148%	301%

Table 6.7.2.2-7: Projected AR4 Increases in Global GHG Emissions (continued)

Forecast Horizon	Change in Annual GHG Global Emissions[1]					
	A1FI	A1B	A1T	A2	B1	B2
2100	354%	165%	67%	373%	65%	354%
Increases relative to 2000 baseline						
2020	144%	141%	119%	141%	122%	106%
2050	260%	177%	141%	198%	128%	130%
2100	306%	142%	58%	322%	56%	156%

Notes:
(1) Data derived from IPCC (2000).

The latest analyses form the IPCC were presented as the Fifth Assessment Report (AR5) (IPCC 2013). In the AR5 reports, the socio-economic emission scenarios relied on in AR4 (IPCC 2007) have been replaced with four new scenarios referred to as Reference Concentrations Pathways (RCP), which are described as follows:

- RCP 2.6 is a low emissions scenario that is not comparable to any of the scenarios used in the AR4 analyses. The anthropogenic CO_2 emissions would remain relatively constant until 2020, then decline and become negative in 2100.
- RCP 4.5 is an intermediate emissions scenario that is comparable to the B1 scenario used in AR4. The anthropogenic CO_2 emissions would increase slightly relative to the current levels before starting to decline by 2040.
- RCP 6 is also an intermediate emissions scenario, which would be comparable to the B2 scenario from AR4. Anthropogenic CO_2 would continue to increase, reaching a peak above 75% above the current emissions by 2060. Emissions would then decrease to a level about 25% above the current emission levels
- RCP 8.5 is referred to as the high emissions, and would be comparable to scenario A1FI from AR4. Anthropogenic would reach three times the current levels by 2100. There would also be a rapid increase in methane emissions.

6.7.3 Project Effects Avoidance Measures Used in Predictions

The primary methods to avoid the effects of the Project on climate relate to the management of the GHG emissions from the Project. Some of the actions incorporated in the Project that will help avoid GHG emissions include the following:

- Using the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047].
- Placing the waste rock storage area immediately to the north of the open pit to reduce the haul distances. Shorter haul distances will reduce the fuel consumed and the associated GHG emissions [Mit_048].

- Once mining is complete in pit 1, waste rock will be placed in the mined out areas of the open pit. This reduces haul distances, fuel consumption and GHG emissions [Mit_020].
- Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions [Mit_049].
- The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050].

6.7.4 Predicted Effects

6.7.4.1 Project GHG Emissions

The GHG emissions from the Project will vary by phase and the amount of fossil fuel used. During the site preparation and construction phase there will be diesel-fired mobile equipment grubbing trees, stripping overburden, and preparing the site for mining activities, as constructing the Project facilities. Table 6.7.4.1-1 lists the Project GHG emissions during the site preparation and construction phase. The total equivalent CO_2 emissions (eCO_2) from the Project during this phase would be in excess of the 10,000 tonnes per year reporting limit under Section 46 of the Canadian Environmental Protection Act. As there would be no stationary source emissions during the site preparation and construction phase, there would be no requirement to report under the Ontario Cap and Trade Program (O.Reg. 144/16), which focusses on the management of GHG emissions from stationary sources. The GHG emissions associated with mobile sources under O.Reg. 144/16 are managed as part of the fuel sector.

Table 6.7.4.1-1: Project GHG Emissions, Site Preparation and Construction Phase

Source Category	Project GHG Emissions (t/y)[(1)]			
	CO_2	CH_4	N_2O	eCO_2
Mobile equipment[(2)]	9,771	0.54	3.63	10,909
Backup generators[(3)]	0	0.00	0.00	0
Natural gas heating[(3)]	0	0.00	0.00	0
Project Totals	**9,771**	**0.54**	**3.63**	**10,909**

Notes:

(1) Emissions are provided in units of tonnes per year (10^6 g/y)
(2) GHG emissions for mobile equipment are calculated on the basis of maximum activity levels, and continuous operations throughout the year
(3) There will be no backup generators or mine heating during the site preparation and construction phase

During the operations phase, mining activities would commence and the processing plant would begin operations. Mobile equipment would still be required to mine the ore and waste rock, as well as to deliver the mine materials to the processing plant. Most of the processing operations would rely on electrical power that would be supplied from the 115 kV electrical power line running through the site. Backup generators would be required to ensure that critical equipment can continue to operate and the process plant can be shut down safely in the event of a power outage. The GHG emissions during operations are provided in Table 6.7.4.1-2. The total equivalent CO_2

emissions (eCO_2) from the Project exceed the 10,000 tonnes per year reporting limit federally. However, the majority of these emissions are from mobile sources. The 2,820 tonnes of annual emissions from stationary sources is less than the 10,000 tonne reporting limit for the Ontario Cap and Trade Program (O.Reg. 144/16).

Table 6.7.4.1-2: Project GHG Emissions, Operation Phase

Source Category	Project GHG Emissions (t/y)(1)			
	CO_2	CH_4	N_2O	eCO_2
Mobile equipment(2)	10,377	0.58	3.86	11,585
Backup generators(3)	1,216	0.08	0.01	1,222
Natural gas heating(2)(4)	1,589	0.03	0.03	1,598
Project Totals	**13,182**	**0.69**	**3.90**	**14,405**

Notes:
(1) Emissions are provided in units of tonnes per year (10^6 g/y)
(2) GHG emissions for mobile equipment and mine heating are calculated on the basis of maximum activity levels, and continuous operations throughout the year
(3) GHG emissions for the backup generators are calculated assuming 1 hour of operations per month
(4) Mine heating emissions would not occur until the underground mine starts operations. Annual GHG emissions associated with mine heating would be lower than the values in the table as heating may not be required throughout the year

Once the mining activities cease, the Project will enter the closure phase where the site will be rehabilitated. Mobile equipment will be required to decommission and remove project facilities, as well as to help grade the site such that are runoff will report to the open pit. The GHG emissions from the Project during the closure phase are presented in Table 6.7.4.1-3. The total equivalent CO_2 emissions (eCO_2) from the Project exceed the 10,000 tonnes per year reporting limit federally. However, there would be no stationary source emissions during the site preparation and construction phase, and thus no requirement to report under the Ontario Cap and Trade Program (O.Reg. 144/16).

Table 6.7.4.1-3: Project GHG Emissions, Closure Phase

Source Category	Project GHG Emissions (t/y)(1)			
	CO_2	CH_4	N_2O	eCO_2
Mobile equipment(2)	10,857	0.61	4.04	12,121
Backup generators(3)	0	0.00	0.00	0
Natural gas heating(3)	0	0.00	0.00	0
Project Totals	**10,857**	**0.61**	**4.04**	**12,121**

Notes:
(1) Emissions are provided in units of tonnes per year (10^6 g/y)
(2) GHG emissions for mobile equipment are calculated on the basis of maximum activity levels, and continuous operations throughout the year
(3) There will be no backup generators or mine heating during the closure phase

6.7.4.2 Effects of the Project on Climate

The first step in understanding the potential for the Project to affect the climate is to put the Project emissions into context with the emissions contributing to changes in climate. Based on the peak level of activity and GHG emissions (i.e., during operations), the project would represent 0.002% increase in the Canadian GHG emission levels, a 0.18% increase in the GHG emissions levels for the mining sector in Canada, and a 0.009% increase in the GHG emissions for Ontario. A comparison of the GHG emissions from the Project to the national and provincial totals has been provided in Table 6.7.4.2-1.

Table 6.7.4.2-1: Comparison of Project to Canadian and Ontario GHG Emissions

Project Phase	Annual GHG Emissions (kt/y)(1)			
	Project	Canada(2)	Canadian Mining(2)	Ontario(2)
Site preparation and construction	10.9	722,000	8,000	166,000
Operations	14.4			
Closure	12.1			
Post-closure	0.0			

Notes:
(1) Emissions are provided in units of kilotonnes per year (10^9 g/y)
(2) Based on the reported GHG emissions for 2015 (ECCC 2107a)

Although the emissions from the Project are extremely small compared to the total GHG emissions in Canada, changes in climate are expected to be related to global emissions rather than emissions in a single country or region. Although comparing emissions from the Project to the global GHG emissions is not a direct analogue for the expected climate effects, the comparison is useful in understanding how insignificant the emissions are on a global scale.

Table 6.7.4.2-2 compares the changes in climate estimated as part of AR4 (IPCC 2013) along with the corresponding change in global emissions associated with those changes. Only the 2011 to 2040 forecast information has been provided as the proposed Project will only have a life of 15 years from site preparation and construction through closure. The effects of the relatively minor amount of Project GHG emissions on climate would not be measurable. This is consistent with the current federal guidance for incorporating climate impacts in environmental assessments (FPTCCCEA 2003), which states that "…unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured."

Table 6.7.4.2-2: Comparison of Project GHG Emissions to Changes in Global Emissions

Forecast Horizon	Parameter	Estimated Change in Climate(1)	Modelled Change in Global Emissions(2)	Change in Global Emissions due to the Project(3)
2011 to 2040	Temperature (summer)	+1 to +2°C	141%	0.00005%
	Temperature (winter)	+1 to +2°C		
	Precipitation (summer)	0% to +10%		
	Precipitation (winter)	-10% to 0%		

Notes:
(1) Based on the data presented in CCRR-05 (Colombo et al. 2007) (Table 6.6.2.2-1)
(2) Based on the changes calculated relative to 2000 AR4 data (Table 6.6.2.2-7)
(3) Calculated using the 2000 global emissions (WRI 2017) (Table 6.6.2.2-6)

6.7.5 Identified Mitigation

The following measures will be incorporated into the Project to mitigate and avoid GHG emissions:

- Using the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site. [Mit_047].
- Placing the waste rock storage area immediately to the north of the open pit to reduce the haul distances. Shorter haul distances will reduce the fuel consumed and the associated GHG emissions. [Mit_048].
- Once mining is complete in pit 1, waste rock will be placed in the mined out areas of the open pit. This reduces haul distances, fuel consumption and GHG emissions. [Mit_020].
- Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions. [Mit_049].
- The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project. [Mit_050].

6.7.6 Residual Adverse Effects

As described in Section 6.1.3.6, the effects of the Project on climate were evaluated using two VCs, namely; Project GHG emissions, and changes in climate due to the Project. The predicted effects of the Project on climate, described in Section 6.7.4.2, identified that there would be adverse effects for the Project GHG emissions VC during the site preparation and construction, operations, and closure phases of the Project. There would be no adverse effects for the Project GHG emissions VC during the post-closure phase. No adverse effects were predicted for the "changes in climate due to the Project" VC. Even with the application of the mitigation measures summarized in Section 6.7.5, the Project will still emit GHG emissions. As a result, residual adverse effects were predicted for the Project GHG emissions VC during the site preparation and construction, operations, and closure phases of the Project. There would be no GHG emissions from the Project during the post-closure phase. There are no residual adverse effects for the "changes in climate due to the Project" VC. The residual adverse effects of the Project on climate are summarized in Table 6.7.6-1.

Table 6.7.6-1: Predicted Residual Adverse Effects for Climate

Valued Components (VCs)	Project GHG Emissions (t/y)(1)(2)			
	Site Preparation and Construction	Operations	Closure	Post-Closure
Project GHG emissions	10,909 (0)	14,405 (2,820)	12,121 (0)	—
Changes in climate due to the Project	—	—	—	—

Notes:

The "—" symbol indicates where no adverse effects were predicted.

(1) The GHG emissions are provided as equivalent carbon dioxide (eCO_2) in units of tonnes per year (106 g/y). The eCO_2 combines the emissions of CO_2, methane (CH_4) and nitrous oxide (N_2O) using equivalency factors described in Section 6.7.2.1.

(2) The numbers listed in parentheses represent the GHG emissions from the stationary sources at the Project. Under the Ontario Cap and Trade Program (O.Reg. 144/16), emissions from mobile sources are managed as part of the fuel production and distribution sector.regulated

6.7.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, the following questions were asked regarding the predictions of effects on climate:

- TMI_263-EE(1)-06: quantitative assessment of changing climate;
- TMI_439-AC(1)-114: provide information on changing climate;
- TMI_539-AC(1)-213:potential effects for parameters, including climate.
- TMI_586-AC(1)-260: provide information on changing climate; and
- TMI_738-PC(1)-53: characterizing the effect on climate.

6.8 Surface Water Quality

6.8.1 Potential Effects of the Project on the Environment

The potential effects of the Project on surface water quality will vary during the Project life, depending on the Project phase, and with varying levels of activity. The following lists the potential surface water quality effects by Project phase:

- **Site Preparation and Construction Phase**: As described in the Section 3, one of the first activities during the site preparation and construction phase will be the construction of a perimeter ditch around the operations area that will effectively capture all site runoff and direct this runoff to the on-site ponds. This water will be used on-site to help initiate the tailings storage facility (TSF) and provide an inventory for when processing commences. There will be effectively no discharges during this phase. As the perimeter ditches are being constructed, soils will be disturbed and rainfall could cause eroded material to be transported of site. To mitigate against this, industry standard practices for erosion and sediment control will be implements as the perimeter ditches are being constructed.
- **Operations Phase**: During operations, there will be a single point of surface water discharge from the Project, through an engineered structure into Blackwater Creek. All runoff from the operations area will be captured during the operations phase and used in the minewater management system. To the extent possible, this water will be used in the mine and the processing plant. Excess water within the operations area will be treated to meet Provincial Water Quality Objectives (PWQO), or background concentrations if background levels are greater than the PWQO, prior to discharge to Blackwater Creek.

  The waste rock storage area (WRSA) and TSF will be equipped with a perimeter ditches and seepage collection systems to capture the majority of seepage, which will then be incorporated in the minewater management system. During operations, the open pit and underground mine will be dewatered to provide a safe working environment, which will create a drawdown zone in the water table where groundwater will be directed towards the open pit. Seepage from the WRSA and TSF that escapes the seepage collection systems will be captured within the drawdown zone, and will ultimately report to the open pit where it will be incorporated into the minewater management system.

There will be no surface water discharges to Thunder Lake or any of the tributaries to Thunder Lake during operations. Although Hoffstrom's Bay Tributary and Little Creek will have a small reduction in catchment size as a result of the Project, it is anticipated this will affect surface water quality. In addition, it is expected that periodic water taking from Thunder Lake Tributary 2 and 3 will occur to support Project requirements. Although this will affect the flow in these tributaries, there will be no discharges and no expected changes in surface water quality.

- **Closure Phase:** There will be no discharges to surface water during the closure phase. The site will be graded as part of the closure activities so that all of the runoff from the site will be directed towards the open pit. The process water in the TSF will be withdrawn, treated and used to help fill the open pit. Although dewatering activities will cease at the end of mining activities, the drawdown zone created during operations will continue to direct groundwater and seepage from the WRSA and TSF to the open pit until it is filled. The perimeter ditches will remain in place during this phase.
- **Post-closure Phase:** In the post-closure phase, all site runoff will continue to be directed to the open pit, and the open pit will continue to experience an influx of groundwater. Once the pit is fully flooded, excess water will be released through a spillway into a tributary of Blackwater Creek. Once the pit is flooded, groundwater levels will return to near pre-development conditions. At that point, a portion of the seepage from the TSF and WRSA will escape from the site, and will ultimately report to various nearby waterbodies during this phase.

The potential effects of the Project on surface water quality have been described using a simple linkage diagram on Figure 6.8.1-1. The figure illustrates the surface water quality VC (shown in blue on the figure) and how it can be potentially affected during each phase of the Project life. Additionally, the figure indicates those other components of the environment (shown in red on the figure) where there will be a reliance on information about the effects of the Project on surface water quality as an input for determining the effects on other VCs. For example, surface water quality predictions will be used as an input to the human health component. The prediction of effects on surface water quality will also rely on inputs from other component VCs. For example, surface water quantity predictions will be relied on in predicting potential effect on surface water quality.

6.8.2 Effects Prediction Methods

Surface water quality was predicted for the waterbodies surrounding the Project using a mass balance equation that considers background water quality as well as the discharges from the Project. A fulsome description of the model used is provided in Section 6 of the Water Report, included as Appendix JJ to the revised EIS.

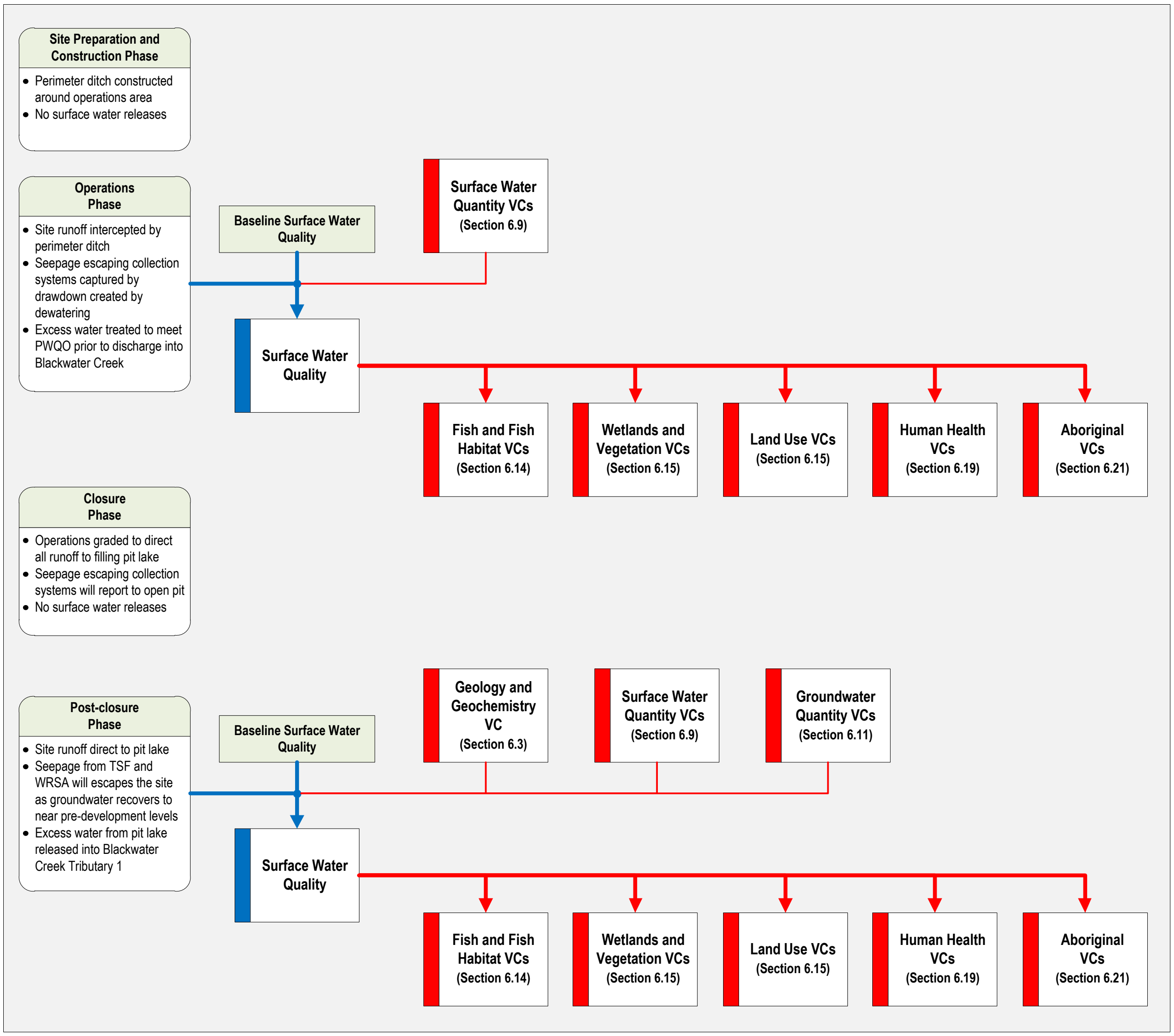


Figure 6.8.1-1: Surface Water Quality Linkage Diagram

6.8.2.1 Determining Background Surface Water Quality

One of the inputs required in the model is the background water quality. Background surface water quality was determined for each watercourse or waterbody potentially affected by the Project. Background water quality was based on background data collected in 2012 and 2013 (Appendix P of the EIS). For example, the determination of background water quality in Blackwater Creek was comprised of five water quality sampling stations within the Blackwater Creek catchment area.

Background water quality for each watercourse was determined by calculating the 50th percentile concentrations for each key parameter. For Blackwater Creek, this included taking the

50th percentile for all data of the following five stations: SW-TL1A, SW-TL2, SW-TL3, SW-JCTa, and SW-11. The location for these five stations is shown on Figure 6.8.2.1-1. This figure also includes a table listing each watercourse and corresponding sampling stations from Appendix P that were used for establishing background water quality. The background water quality at nodes BW1 and BW2, both located in Blackwater Creek, would be equal to and would be based on all of the background water quality presented in Appendix P of the EIS for Blackwater Creek. The background water quality used in the model also corresponds to the information provided in Table 5.8.1.3-2. The background surface water quality by waterbody information is reproduced in Table 6.8.2.1-1.

6.8.2.2 Determining Existing Surface Water Quality

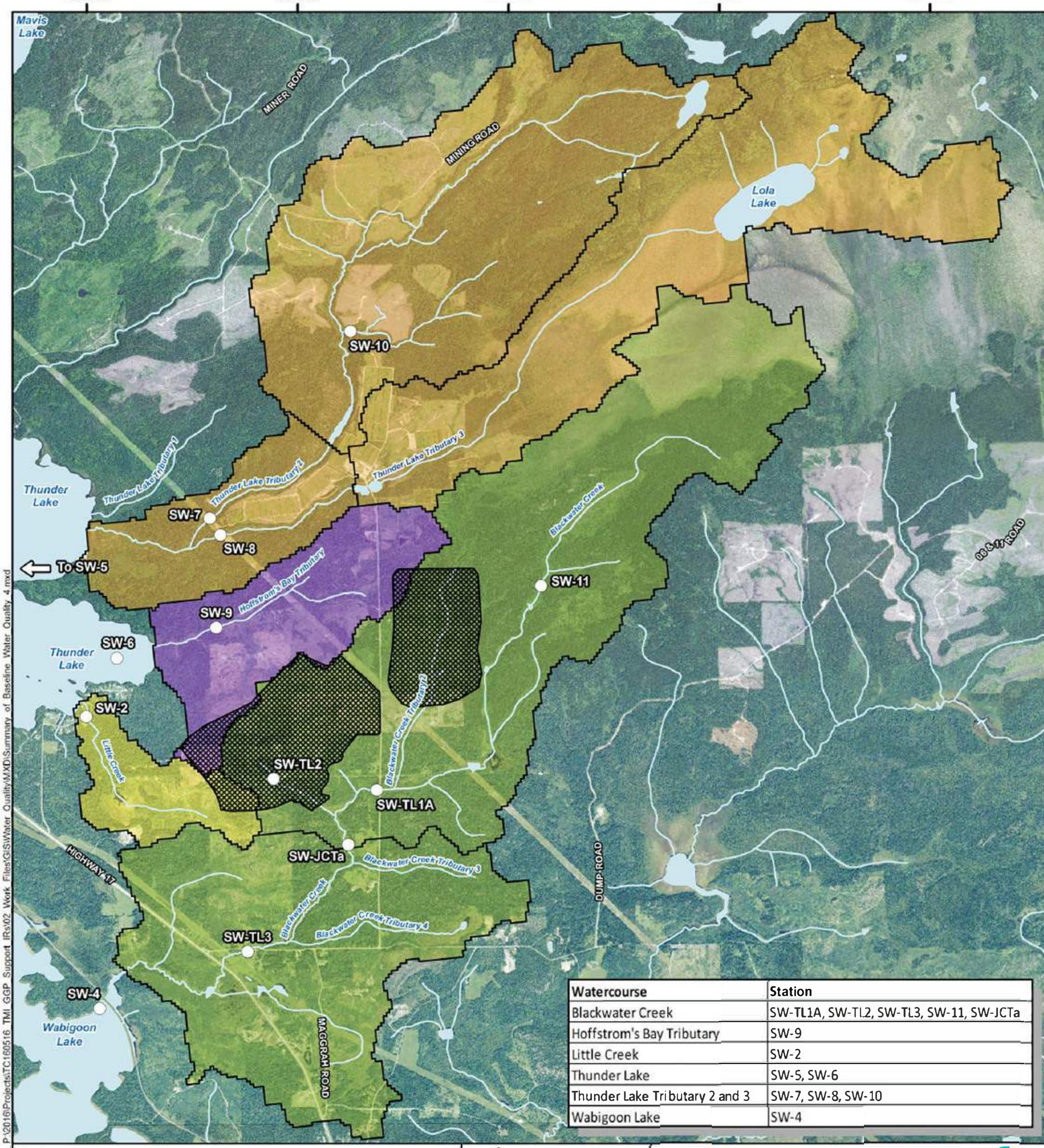
Existing water quality data was use to established representative water quality level for each node (node locations shown on Figure 6.8.2.2-1) against which predictions for the various phases of the Project could be compared. The surface water quality model is an annual mass balance model that combines volume-weighted quality inputs for each of the modelled nodes. A schematic diagram representing input parameters for each node (i.e., natural runoff, tributary flow and groundwater) is shown in Figure 6.8.2.2-2. For the existing conditions, the key input parameters to the model are the background surface water quality (described above in Section 6.8.2.1) and the surface water quantities, as flows. The surface water flows are described in Section 6.10. For reference, Table 6.8.2.2-1 provides the annual flows at each of the surface water quality nodes. The table lists a range of hydrologic predictions, including a dry year, wet year and average year. The predictions are described more fully in Section 6.10.

6.8.2.3 Determining Site Preparation and Construction Phase Surface Water Quality

As described in Section 6.8.1, there will be no water discharges from the Project site to the receiving environment during this phase. Therefore, surface water quality modelling was not completed during the site preparation and construction phase. A perimeter ditch will be constructed around the operations area of the Project site that will effectively capture all site runoff and direct it to onsite ponds where it will be held until it can be suitably released to the environment.

6.8.2.4 Determining Operations Phase Surface Water Quality

During operations, there will be a single point of discharge from the Project to Blackwater Creek (Figure 6.8.2.2-1). All site runoff from within the operations area will be collected and directed to the mine water management system. To the extent possible, the water will be used in the mine and processing plant. Excess water will be treated and discharged as effluent to Blackwater Creek. Treasury Metals has committed that treated effluent during operations will meet the provincial Water Quality Objectives (PWQO), or be less than background concentrations if background levels are greater than the PWQO, .



Watercourse	Station
Blackwater Creek	SW-TL1A, SW-TL2, SW-TL3, SW-11, SW-JCTa
Hoffstrom's Bay Tributary	SW-9
Little Creek	SW-2
Thunder Lake	SW-5, SW-6
Thunder Lake Tributary 2 and 3	SW-7, SW-8, SW-10
Wabigoon Lake	SW-4

LEGEND

Baseline Surface Water Quality Sampling Locations

Operations Area

Watershed

Blackwater Creek

Hoffstrom's Bay Tributary

Little Creek

Thunder Lake Tributary 2 and 3

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.
- Imagery extracted from Agriculture Information Atlas, OMAFRA.
- Baseline locations from Appendix P of the EIS.

Datum: NAD83
Projection: UTM Zone 15N

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GOLIATH GOLD PROJECT

Locations of Background Water Quality Sampling

PROJECT N°

SCALE: 1:50,000

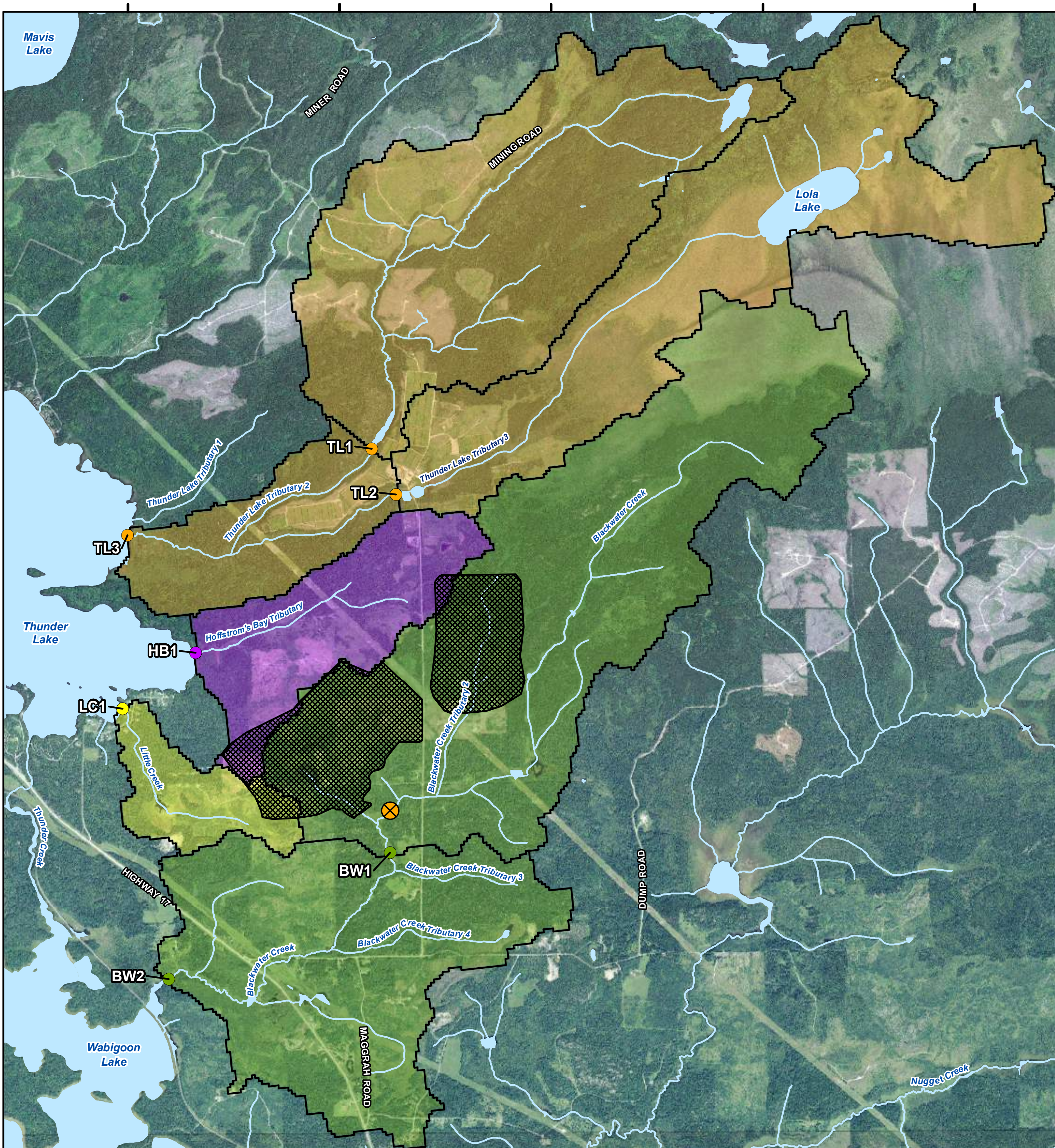
FIGURE: 6.8.2.1-1

DATE: April 2018

Table 6.8.2.1-1: Background Surface Water Quality

Parameter	Thunder Lake Tributary 2/3 (mg/L)	Hoffstrom's Bay Tributary (mg/L)	Little Creek (mg/L)	Blackwater Creek (mg/L)	Thunder Lake (mg/L)	Wabigoon Lake (mg/L)
Aluminum	0.077	0.078	0.555	0.251	0.016	0.692
Antimony	0.001	0.001	0.001	0.001	0.001	0.001
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0.3	0.4	1.2	0.9	4.2	3.2
Chromium	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.001	0.001	0.001	0.001	0.001	0.001
Copper	0.001	0.001	0.002	0.001	0.001	0.002
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.862	0.365	1.010	1.450	0.036	0.459
Lead	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.090	0.101	0.039	0.030	0.030	0.030
Phosphorus	0.011	0.011	0.047	0.027	0.008	0.024
Selenium	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.002	0.001	0.001	0.001
Zinc	0.003	0.003	0.005	0.004	0.003	0.003

Note:
Background surface water quality based on 50th percentile data



LEGEND

- Operations Area
- Effluent Discharge Location

Sub-Watershed Outlet Locations

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2

Sub-Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

N E S W

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GOLIATH GOLD PROJECT

Locations of Water Quality Modeling Node

PROJECT N°: TC160516	FIGURE: 6.8.2.2-1
SCALE: 1:50,000	DATE: April 2018

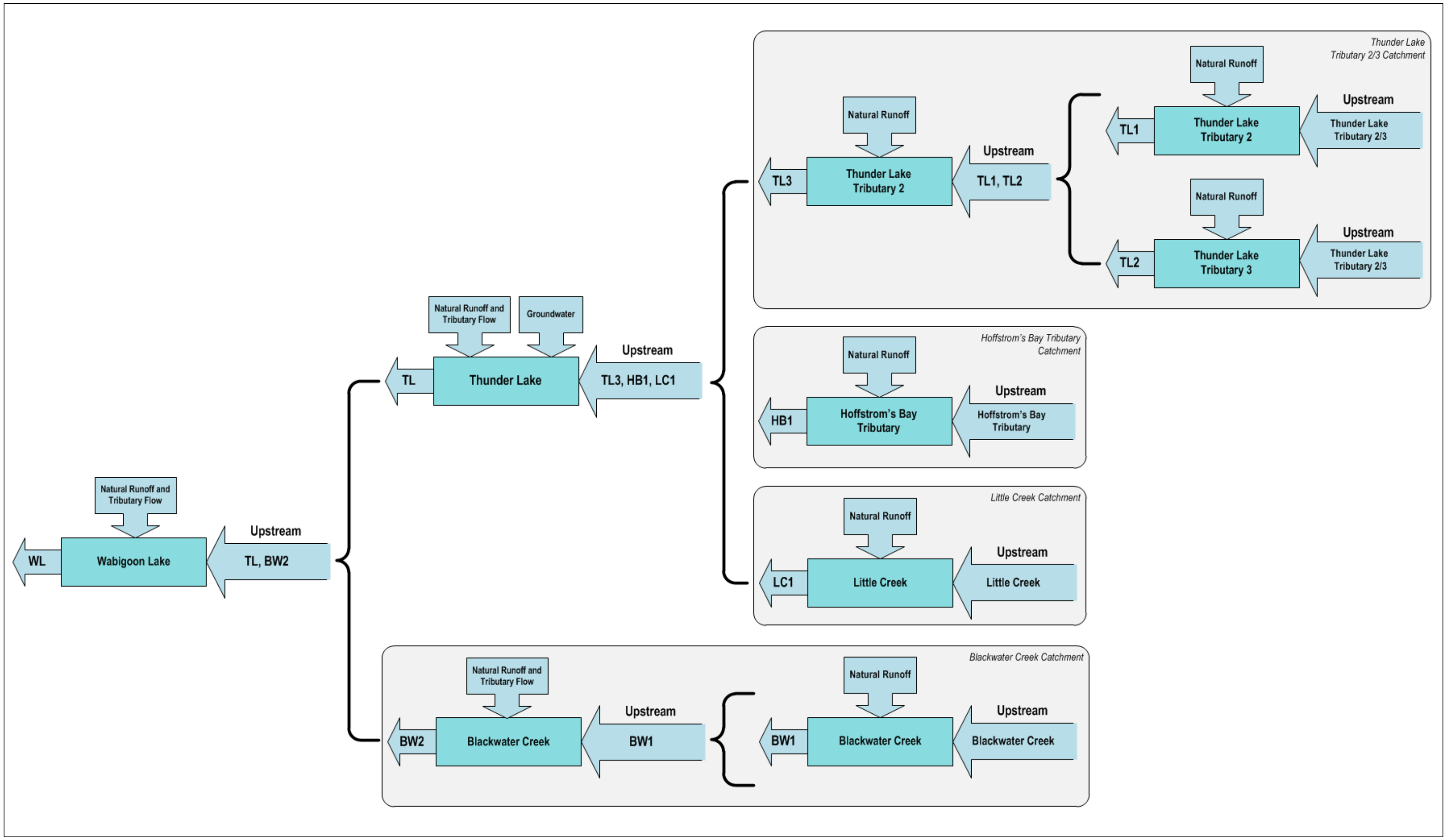


Figure 6.8.2.2-2: Surface Water Quality Model Schematic, Existing Conditions

Table 6.8.2.2-1: Flow Data used for Modelling Surface Water Quality

Modelling Node	Project Phase	Annual Flow Rate (m^3/s)		
		Dry Year	Average Year	Wet Year
BW1	Existing	0.02387	0.08509	0.14630
	Operations	0.02228	0.08177	0.14376
	Post-closure (TSF Dry Cover)	0.02967	0.09409	0.16479
	Post-closure (TSF Wet Cover)	0.02855	0.08993	0.16251
BW2	Existing	0.03786	0.13493	0.23200
	Operations	0.03511	0.12747	0.22413
	Post-closure (TSF Dry Cover)	0.04366	0.14393	0.25050
	Post-closure (TSF Wet Cover)	0.04254	0.13977	0.24822
HB1	Existing	0.00607	0.02164	0.03720
	Operations	0.00560	0.01996	0.03431
	Post-closure (TSF Dry Cover)	0.00563	0.02007	0.03452
	Post-closure (TSF Wet Cover)	0.00563	0.02007	0.03452
TL1	Existing	0.01781	0.06346	0.10911
	Operations	0.01691	0.06311	0.10911
	Post-closure (TSF Dry Cover)	0.01781	0.06346	0.10911
	Post-closure (TSF Wet Cover)	0.01781	0.06346	0.10911
TL2	Existing	0.01641	0.05849	0.10056
	Operations	0.01556	0.05805	0.10036
	Post-closure (TSF Dry Cover)	0.01641	0.05849	0.10056
	Post-closure (TSF Wet Cover)	0.01641	0.05849	0.10056
TL3	Existing	0.03927	0.13996	0.24065
	Operations	0.03707	0.13754	0.23766
	Post-closure (TSF Dry Cover)	0.03927	0.13996	0.24065
	Post-closure (TSF Wet Cover)	0.03927	0.13996	0.24065
LC1	Existing	0.00270	0.00962	0.01654
	Operations	0.00246	0.00878	0.01510
	Post-closure (TSF Dry Cover)	0.00250	0.00890	0.01531
	Post-closure (TSF Wet Cover)	0.00250	0.00890	0.01531

The same model used for estimating existing surface water quality was used for predicting surface water quality during operations. Modelling of the surface water quality during operations was done for each of the nine nodes shown on Figure 6.8.2.2-1. A schematic for the method used for modelling surface water quality during operations is provided as Figure 6.8.2.4-1. The following lists the key assumptions for modelling operations surface water quality:

- Seepage not captured by perimeter collection ditches will be captured within the drawdown zone caused by active mine dewatering, and will ultimately report to the open pit.
- Site runoff will be collected from within the Project site boundary area and treated prior to being discharged to Blackwater Creek. The effluent discharge point is located immediately upstream of node BW1 (Figure 6.8.2.2-1).
- The water quality of natural runoff from those areas outside of the operations area is assumed to be equivalent.

The key input information required by the model includes the following:

- Background water quality (Section 6.8.2.1 and Table 6.8.2.1-1);
- Annual flows at the model nodes (Section 6.7.2.2 and Table 6.8.2.2-1);
- Annual discharges of treated effluent to Blackwater Creek (Table 6.8.2.4-1); and
- Quality of the treated effluent (Table 6.8.2.4-2).

As previously described, surface water quality was modeled under three different hydrologic scenarios: an average year, a wet year, and a dry year. The annual volume of treated effluent discharged for each hydrologic scenario will vary as shown in Table 6.8.2.4-1.

Table 6.8.2.4-1: Surface Water Discharge Volumes during Operations

Node	Source	Climate Conditions	Waterbody Receiver	Volume of Discharge (m^3/d)
BW1	Effluent from Project	Dry year	Blackwater Creek	384
BW1		Average year	Blackwater Creek	1,573
BW1		Wet year	Blackwater Creek	2,829

Note: During operations, effluent will be treated and discharged to Blackwater Creek from a single point discharge location upstream of node BW1.

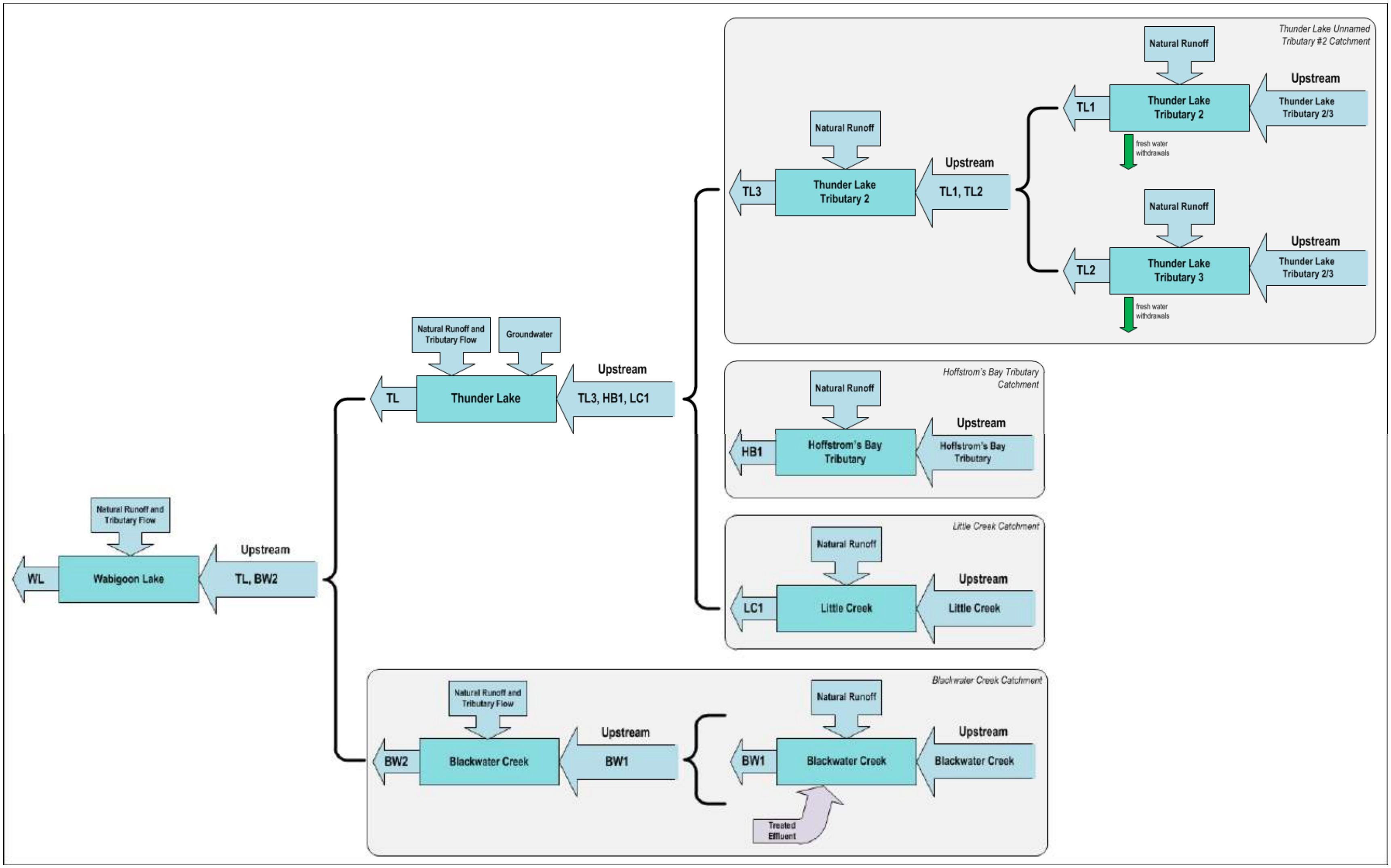


Figure 6.8.2.4-2: Surface Water Quality Model Operations Phase

Table 6.8.2.4-2: Treated Effluent Discharge Quality

Parameter	Effluent Concentration (mg/L)
Aluminum	0.075
Antimony	0.020
Arsenic	0.10
Beryllium	0.011
Boron	0.20
Cadmium	0.0002
Chloride	120
Chromium	0.0089 (1)
Cobalt	0.0009 (1)
Copper	0.005
Cyanide	0.005
Iron	0.30
Lead	0.005
Mercury	0.00002
Molybdenum	0.040 (1)
Nickel	0.025
Nitrate	13
Phosphorus	0.030
Selenium	0.10
Silver	0.0001
Thallium	0.0003
Uranium	0.005
Vanadium	0.006 (1)
Zinc	0.030

Source: Table 9.0.1 of the EIS
Note: (1) Chromium, cobalt, molybdenum and vanadium have been updated from Table 9.0.1 of the oiginal EIS to reflect current PWQO criteria (or interim PWQO when there is no firm PWQO criteria).

There will be no discharges to the surface water in any of the tributaries to Thunder Lake, however, fresh water will be withdrawn periodically from the irrigation ponds at the former MNRF tree nursery. These ponds are located on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. Any seepage from the TSF and WRSA that escapes the seepage collection systems will be captured by the drawdown zone created by the dewatering of the open pit and underground mine, and will report to the open pit.

The following section provides detailed descriptions for the water quality schematic shown in Figure 6.8.2.4-2. The text is organized by the four watershed areas and two lakes covered by the nine modelling nodes (Figure 6.8.2.2-1).

Thunder Lake Tributary 2 and Tributary 3 Catchment

The surface water quality at node TL1, for Thunder Lake Tributary 2, was based on the following input parameters: upstream Thunder Lake Tributary 2 and Tributary 3 and natural runoff. The ‘upstream’ and ‘natural runoff’ input parameters for concentration were determined by taking the

50th percentile concentration of all background samples collected in Thunder Lake Tributaries 2 and 3 (SW-7, SW-8 and SW-10 from Figure 6.8.2.1-1). The input flow rates for TL1 were taken from Table 6.8.2.2-1. Using a mass-balance equation described above, the surface water quality concentration at node TL1 was determined. The water quality for node TL2 was determined in the same manner as described above for node TL1, however, input variables (i.e., flow rate and concentration) specific for node TL2 were used. The surface water quality and flow rates previously calculated for nodes TL1 and TL2 serve as inputs to determine the surface water quality at node TL3; representative of the 'upstream' input parameter. The second input parameter, natural runoff, was calculated by subtracting the sum of the flow rates associated at nodes TL1 and TL2 from the flow rate associated with node TL3 (Table 6.8.2.2-1). The water quality concentration associated with the natural runoff component was assumed to be the same as background water quality concentration determined for Thunder Lake Tributary 2 (based on data collected from SW-7 and SW-10 shown on Figure 6.8.2.1-1). Figure 6.8.2.4-1 shows the Thunder Lake Tributary 2 catchment area and summarizes the input and output variables and relationship between nodes TL1, TL2 and TL3. The determination of surface water quality at nodes TL1 and TL2 also took into account a fresh water withdrawal from Thunder Lake Tributaries 2 and 3 that occurs during the operations phase.

Hoffstrom's Bay Tributary Catchment

The water quality in Hoffstrom's Bay Tributary, at node HB1, was calculated using the same method as described above for nodes TL1 and TL2, but with flow and water quality data specific to HB1. Hoffstrom's Bay Tributary natural runoff and upstream input parameters (Figure 6.8.2.2-1) were the same in terms of water quality, and were based on station SW-9 background water quality data (Figure 6.8.2.1-1).

Little Creek Catchment

The water quality for node LC1 in Little Creek was determined in the same manner as described for the nodes above (i.e., for TL1, TL2 and HB1), however, input variables specific for node LC1 were used. Flow data from Table 6.8.2.2-1 and 50th percentile background water quality data for Little Creek (station SW-2 shown on Figure 6.8.2.1-1) were used as input parameters for calculating receiving water quality at node TL2. A schematic diagram depicting the input variables used to calculate the receiving water quality at node LC1 is shown on Figure 6.8.2.4-1.

Blackwater Creek Catchment

The determination of surface water quality at node BW1 was based on the following input parameters: upstream Blackwater Creek, natural runoff and treated effluent discharge. Surface water quality at node BW2 was based on the following inputs: natural runoff and tributary flow and water quality, and flow and water quality previously calculated for node BW1. Therefore, the outputs determined at node BW1 served as inputs for determining surface water quality at node BW2. Figure 6.6.13.4-2 illustrates this relationship between the two nodes BW1 and BW2 in the Blackwater Creek catchment. Water quality of the natural runoff and tributary flow was assumed to be equivalent to background concentrations determined for Blackwater Creek that included the data collected for stations SW-TL1A, SW-TL2, SW-TL3, SW-JCTa and SW-11 (Figure 6.8.2.1-1).

Thunder Lake

Water quality in Thunder Lake for node TL, was determined based on the following input parameters and assumptions made for input water quality:

- Previously calculated flow rates and concentrations for nodes TL3, HB1 and LC1, which are upstream of TL, served as input parameters.
- It was assumed that groundwater quality directed to Thunder Lake was equal to background water quality in Thunder Lake (based on 50th percentile data collected at stations SW-5 and SW-6, as shown on Figure 6.8.2.1-1).
- Natural runoff and tributary flow water quality to Thunder Lake was assumed to be equal to Thunder Lake Tributary 2 and Tributary 3 background water quality (based on 50th percentile data collected at stations SW-7, SW-8 and SW-10, as shown on Figure 6.8.2.1-1).

Wabigoon Lake

Water quality for node WL, in Wabigoon Lake, was based on two input parameters, with the following assumptions:

- Previously calculated flow rates and concentrations for nodes TL and BW2 served as upstream input parameters.
- It was assumed that natural runoff and tributary flow water quality to Wabigoon Lake is the same as the background water quality and to the same as the 50th percentile data collected at stations SW-4 as per Figure 6.8.2.1-1).

6.8.2.5 Determining Closure Phase Surface Water Quality

As described in Section 6.8.1, there will be no discharges to surface water during the closure phase. The site will be graded as part of the closure activities so that all of the runoff from the site will be directed towards the open pit. The process water in the TSF will be withdrawn, treated and used to help fill the open pit. Although dewatering activities will cease at the end of mining activities, the drawdown zone created during operations will continue to direct groundwater and seepage from the WRSA and TSF to the open pit until it is filled. The perimeter ditches will remain in place during this phase. As there will be no discharges during this phase, no surface water quality modelling was completed for the closure phase.

6.8.2.6 Determining Post-closure Phase Surface Water Quality

During post-closure there will be no mining operations at the site and therefore no effluent. All site runoff will continue to be directed to the open pit, and the open pit will continue to experience an influx of groundwater. One the pit is fully flooded, excess water will be released through a spillway into a tributary of Blackwater Creek. The expected rate at which the pit lake will release water to the receiving environment is provided in Table 6.8.2.6-1.

Table 6.8.2.6-1: Surface Water Discharge Volumes during Post-closure

Node	Source	Climate Conditions	Waterbody Receiver	Volume of Discharge (m^3/d)
BW1	Passive discharge from pit lake	dry year	Blackwater Creek	950
BW1		average year	Blackwater Creek	2,333
BW1		wet year	Blackwater Creek	4,234

Note: During operations, effluent will be treated and discharged to Blackwater Creek from a single point discharge location upstream of node BW1

Once the pit is flooded, groundwater levels will return to near pre-development conditions. At that point, a portion of the seepage from the TSF and WRSA will escape from the site, and will ultimately report to various nearby waterbodies during this phase. The volumes of seepage to various waterbodies was provided in Table 6.11.4.4-1, and have been provided for reference in Table 6.8.2.6-2. The table lists the respective seepage rates from both the TSF and WRSA, as well as identifying the modelling node where the seepage is predicted to report, for both TSF closure options. As described in the effects predictions for geology and geochemistry (Section 6.3), the following two options are being considered for the closure of the TSF [Mit_023]:

- The dry cover option assumes that the process water in the TSF will be withdrawn at closure, treated and used to help fill the pit. The tailings will then be physically isolated using a granular cover. Finally, the tailings will be covered with a low-permeability dry cover to limit the potential for acidification.
- The wet cover option is similar in many ways to the dry cover option. The process water in the TSF will be withdrawn at closure, treated and used to help fill the pit. The tailings will then be physically isolated using a granular cover. Finally, the tailings will be isolated from oxygen using a cover of non-process water to prevent acidification.

Table 6.8.2.6-2: Seepage Discharge Volumes to Receiving Waters during Post-closure

Node	Source	Waterbody Receiver	Volume of Seepage (m^3/d)
TL	WRSA (capped)	Thunder Lake	10
TL	TSF (dry cover)	Thunder Lake	0.1
TL2		Thunder Lake Tributary 3	0.1
HB1		Hoffstrom's Bay Tributary	0.1
BW1		Blackwater Creek	0.7
BW2		Blackwater Creek	0.1

Table 6.8.2.6-2: Seepage Discharge Volumes to Receiving Waters during Post-closure (continued)

Node	Source	Waterbody Receiver	Volume of Seepage (m^3/d)
TL	TSF (wet cover)	Thunder Lake	0.1
TL2		Thunder Lake Tributary 3	0.1
HB1		Hoffstrom's Bay Tributary	0.1
BW1		Blackwater Creek	0.7
BW2		Blackwater Creek	0.1

Notes:
(1) During operations, seepage from the WRSA and TSF not captured by perimeter collection ditches will be captured within the drawdown zone caused by active dewatering, and will ultimately report to the open pit
(2) During operations, there will be no discharge from the pit lake to the surrounding environment

The quality of the water in the pit lake as well as the quality of the seepage from the WRSA and TSF was determined as part of the effects assessment for geology and geochemistry. Specifically, Tables 6.3.4.1-1 and 6.3.4.2-1 provide the predictions for the dry cover option for the TSF and the wet cover option for the TSF, respectively.

The following sections provide detailed descriptions for the water quality schematic shown in Figure 6.8.2.6-1. The text is organized by the four watershed areas and two lakes covered by the nine modelling nodes (Figure 6.8.2.2-1).

Thunder Lake Tributary 2 and 3 Catchment

Surface water quality for nodes TL1, TL2 and TL3 for the post-closure phase was determined using a similar method described above for the operations phase but with flow data specific to post-closure (Table 6.8.2.2-1), and with the following key changes listed below:

- There is no fresh water withdrawal from Thunder Lake Tributaries 2 and 3; and
- There is seepage from the covered TSF to Thunder Lake Tributary 3 at node TL2.

Figure 6.8.2.6-1 provides the input and output variables summarized above for nodes TL1, TL2 and TL3.

Hoffstrom's Bay Tributary Catchment

Surface water quality in Hoffstrom's Bay Tributary for node HB1 was determined using a similar method described above for HB1 for operations, however, a seepage component from the TSF was included for this phase and not relevant for operations. Figure 6.8.2.6-1 provides a schematic diagram, which depicts all of the input parameters used to determine surface water quality for HB1.

Little Creek Catchment

The water quality for node LC1 in Little Creek was determined in the same manner as TL1 and TL2 described above, however, input variables specific for node LC1 were used. Flow data from Table 6.8.2.2-1 of this report and 50th percentile background water quality data for Little Creek (station SW-2 shown on Figure 6.6.13.1-1) was assumed to represent natural runoff water quality, which is shown as an input parameter on Figure 6.8.2.6-1.

Blackwater Creek Catchment

Surface water quality was determined at nodes BW1 and BW2 for the post-closure phase. The method used to determine water quality during post-closure was based on a similar method described above for the same water catchment during operations, with the following key changes:

- Treated effluent (collection of site runoff from the Project site area) is no longer being discharged to Blackwater Creek (BW1) during the post-closure phase;
- Pit lake discharge occurs via a spillway and ditch into Blackwater Creek during post-closure (BW1);
- Seepage component from the TSF to Blackwater Creek (BW1); and
- Seepage component from the TSF to Blackwater Creek (BW2).

These key changes are summarized in Figure 6.8.2.6-1 for the Blackwater Creek Catchment. Pit lake discharge and TSF seepage volumes to the receiving environment are provided in Tables 6.8.2.6-1 and 6.8.2.6-2, respectively.

Thunder Lake

Surface water quality at TL in Thunder Lake was determined in a similar method described above for the same node during the operations phase. However, the following key change to the post-closure phase model was made: inclusion of a seepage component from the WRSA to Thunder Lake during the post-closure phase.

Wabigoon Lake

Surface water quality for node WL in Wabigoon Lake for post-closure was determined using the same method described above for the operations phase (as the input parameters are the same for both the operations and post-closure phases). However, flow data specific to post-closure (Table 6.8.2.2-1) instead of flow data corresponding to the operations phase was used. Figure 6.8.2.6-1 provides the input and output variables for the post-closure phase for the node WL

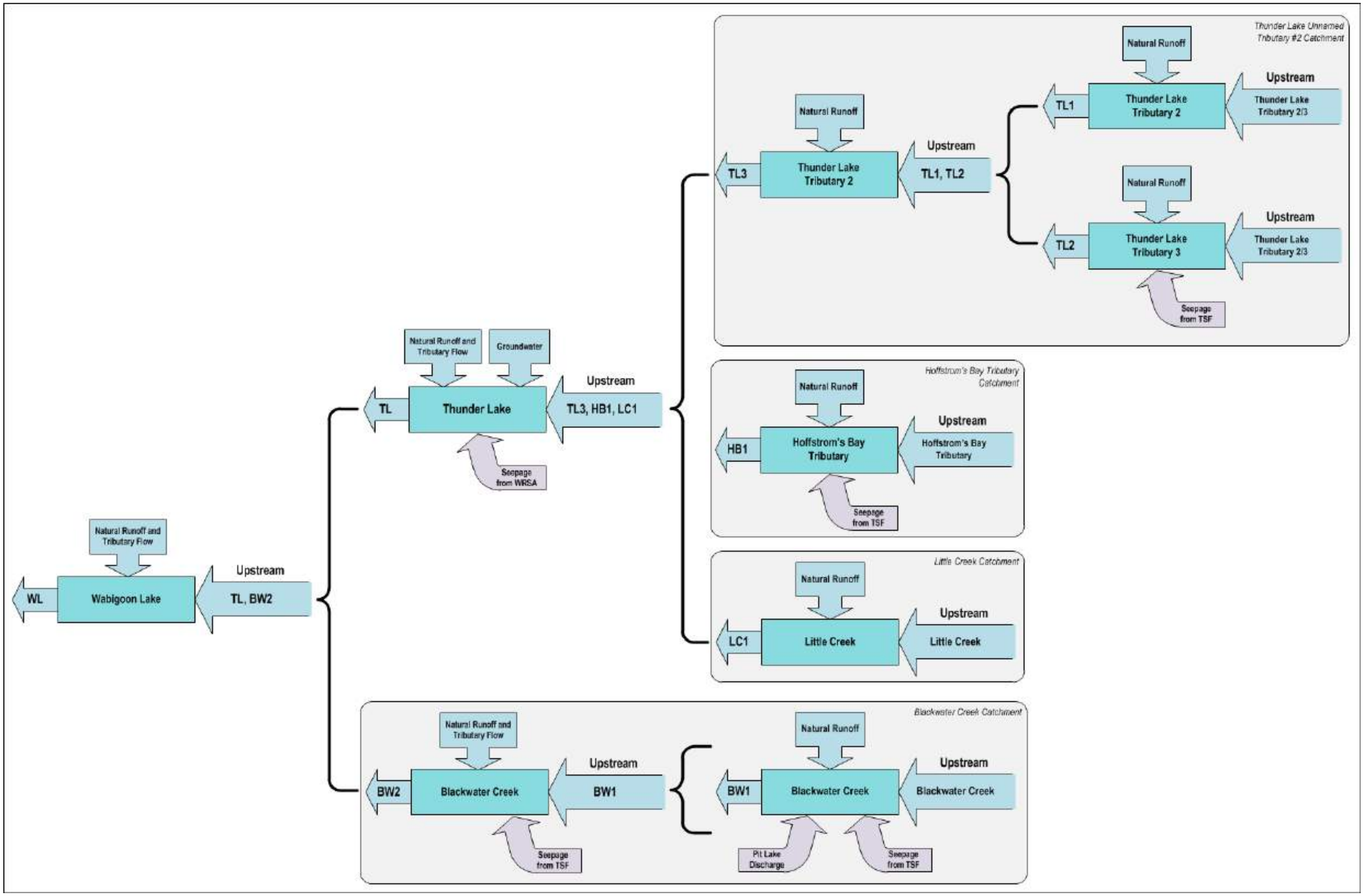


Figure 6.8.2.6-1: Surface Water Quality Model Post-Closure Phase

6.8.3 Project Effects Avoidance Measures Used in Predictions

The following measures have been incorporated into the surface water quality modelling to help avoid or reduce surface water quality effects:

- A perimeter runoff and seepage collection ditch will be progressively constructed around the operations area. This system will capture all of the runoff from the developed site area, which will be directed to the water management system for use at the site and in the process [Mit_008].
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
- Dewatering of the open pit and underground mine workings will provide dry working conditions and safe working environment. These dewatering activities will lower the groundwater table around the perimeter of the open pit and mine workings, creating what is referred to as a drawdown zone. Within this drawdown zone, groundwater will migrate towards the open pit. Therefore, seepage that escapes the seepage collection systems will be captured within the drawdown zone, and ultimately report to the open pit [Mit_052].
- During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases [Mit_056].
- 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].

6.8.4 Predicted Effects

6.8.4.1 Site Preparation and Construction Phase

Discharges

As described in Section 6.8.1, there will be no discharges from the Project during the site preparation and construction phase.

Predicted Effects

There are no predicted effects during the site preparation and construction phase as there will be no discharges from the Project.

6.8.4.2 Operations Phase

Discharges

As described in Section 6.8.1, there will be a single point of discharge to surface water during the operations phase. All runoff from the site will be collected by perimeter ditches around the operations area and the collected water directed to the minewater management system. To the extent possible, the water collected will be used in the mine and processing plant. Any excess water collected during operations will be treated and discharged to Blackwater Creek at a single point location (Figure 6.8.2.4-1). Effluent will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) for the protection of aquatic life, or be less than background concentrations if background levels are greater than the PWQO, prior to discharge to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek prior to discharge to the environment. It is anticipated that there could be some level of treated effluent discharge throughout the year.

During operations, dewatering will occur in the open pit and underground mine workings in order to maintain a safe working environment. The dewatering activities will lower the groundwater table around the perimeter of the open pit and mine workings, creating what is referred to as a drawdown zone. Within this drawdown zone, groundwater will migrate towards the open pit. During operations, seepage from on-site structures, such as the TSF, WRSA will be captured largely by the perimeter seepage collection systems around each structure. The seepage that escapes the seepage collection systems will be captured within the drawdown zone caused by dewatering and will ultimately report to the open pit.

Predicted Effects

Estimated surface water quality during the operations phase was modelled, as described in Section 6.8.2.4. Modelled surface water quality for the nine modelling nodes shown on Figure 6.8.2.4-1 are provided in Tables 6.8.4.2-1 to 6.8.4.2-9. Although the model provides results for all modelling nodes and all parameters, the Project is only predicted to result in decreased surface water quality (i.e., higher concentrations) for certain parameters at the following modelling nodes:

- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location;
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake; and
- **Node WL**: Wabigoon Lake.

The effects during the operations phase of the Project are predicted to result directly from the treated effluent that will be discharged into Blackwater Creek upstream of node BW1 (Figure 6.8.2.2-1).

Table 6.8.4.2-1: Receiving Water Quality Results for TL1

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0	0	0	0	0	0	0	0	0	0	0	0
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Phosphorus	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Table 6.8.4.2-2: Receiving Water Quality Results for TL2

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.077	0.077	0.077	0.077	0.077	0.077	0.078	0.077	0.077	0.077	0.077	0.077
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0	0	0	0	0	0	—	—	—	0	0	0
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.861	0.861	0.861
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Phosphorus	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.007	0.004	0.004	0.003	0.003	0.003

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-3: Receiving Water Quality Results for TL3

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0	0	0	0	0	0	—	—	—	0	0	0
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.862	0.861	0.861	0.861
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Phosphorus	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-4: Receiving Water Quality Results for HB1

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.078	0.078	0.078	0.078	0.078	0.078	0.079	0.078	0.078	0.078	0.078	0.078
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00004	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0	0	0	0	0	0	—	—	—	0	0	0
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.365	0.365	0.365	0.365	0.365	0.365	0.366	0.365	0.365	0.365	0.365	0.365
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Phosphorus	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.013	0.006	0.005	0.003	0.003	0.003

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-5: Receiving Water Quality Results for LC1

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	1	1	1	1	1	1	1	1	1	1	1	1
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010	1.010
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Phosphorus	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Zinc	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

Table 6.8.4.2-6: Receiving Water Quality Results for BW1

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.251	0.251	0.251	0.219	0.212	0.211	0.187	0.201	0.199	0.189	0.206	0.200
Antimony	0.00060	0.00060	0.00060	0.00408	0.00487	0.00505	0.00081	0.00077	0.00077	0.00079	0.00074	0.00075
Arsenic	0.001	0.001	0.001	0.019	0.023	0.024	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.003	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.077	0.083	0.084	0.051	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00005	0.00006	0.00006	0.00011	0.00008	0.00008	0.00005	0.00004	0.00004
Chloride	1	1	1	22	27	28	—	—	—	43	31	35
Chromium	0.001	0.001	0.001	0.002	0.003	0.003	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
Copper	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002
Cyanide	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Iron	1.450	1.450	1.450	1.244	1.197	1.186	1.025	1.120	1.108	1.047	1.156	1.117
Lead	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00002	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.008	0.010	0.010	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.006	0.007	0.007	0.011	0.009	0.009	0.010	0.008	0.009
Nitrate	0.03	0.03	0.03	2.36	2.89	3.01	4.84	3.75	3.89	4.57	3.35	3.78
Phosphorus	0.027	0.027	0.027	0.027	0.027	0.027	0.028	0.028	0.028	0.028	0.027	0.028
Selenium	0.001	0.001	0.001	0.019	0.023	0.024	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.004	0.004	0.004	0.009	0.010	0.010	0.028	0.016	0.014	0.013	0.011	0.012

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-7: Receiving Water Quality Results for BW2

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.251	0.251	0.251	0.231	0.226	0.225	0.208	0.218	0.217	0.210	0.222	0.218
Antimony	0.00060	0.00060	0.00060	0.00281	0.00334	0.00346	0.00075	0.00071	0.00071	0.00073	0.00069	0.00070
Arsenic	0.001	0.001	0.001	0.012	0.015	0.016	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.067	0.071	0.072	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00004	0.00004	0.00004	0.00009	0.00006	0.00006	0.00004	0.00003	0.00003
Chloride	1	1	1	14	18	18	—	—	—	29	20	23
Chromium	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0006	0.0006	0.0007	0.0006	0.0006
Copper	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.003
Iron	1.450	1.450	1.450	1.319	1.288	1.281	1.161	1.235	1.225	1.179	1.261	1.232
Lead	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.005	0.007	0.007	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.005	0.005	0.005	0.008	0.006	0.007	0.007	0.006	0.006
Nitrate	0.03	0.03	0.03	1.51	1.86	1.94	3.30	2.46	2.57	3.08	2.16	2.49
Phosphorus	0.027	0.027	0.027	0.027	0.027	0.027	0.028	0.027	0.027	0.027	0.027	0.027
Selenium	0.001	0.001	0.001	0.012	0.015	0.016	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.004	0.004	0.004	0.007	0.008	0.008	0.022	0.012	0.011	0.010	0.009	0.009

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-8: Receiving Water Quality Results for TL

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.025	0.026	0.027	0.025	0.026	0.027	0.028	0.029	0.029	0.028	0.029	0.029
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	4	4	4	4	4	4	—	—	—	—	—	—
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.152	0.150	0.148	0.151	0.149	0.147	0.160	0.158	0.156	0.160	0.158	0.156
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Phosphorus	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.4.2-9: Receiving Water Quality Results for WL

Parameter (total metals)	Existing Concentrations (mg/L)			Operations Concentrations (mg/L)			Post-closure Concentrations TSF Dry Cover (mg/L)			Post-closure Concentrations TSF Wet Cover (mg/L)		
	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year	Dry Year	Avg. Year	Wet Year
Aluminum	0.671	0.669	0.666	0.671	0.669	0.666	0.671	0.668	0.665	0.671	0.668	0.665
Antimony	0.00060	0.00060	0.00060	0.00060	0.00062	0.00064	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	3	3	3	3	3	3	—	—	—	—	—	—
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.452	0.457	0.463	0.451	0.456	0.460	0.452	0.456	0.461	0.452	0.456	0.461
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—	0.00001	0.00001	0.00001
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Nitrate	0.03	0.03	0.03	0.03	0.04	0.06	0.04	0.05	0.07	0.04	0.05	0.07
Phosphorus	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Note: "—" indicates that surface water quality was not modelled due to insufficient source data

6.8.4.3 Closure Phase

Discharges

As described in Section 6.8.1, there will be no discharges from the Project during the closure phase.

Predicted Effects

There are no predicted effects during the active closure phase as there will be no discharges from the site to surface water.

6.8.4.4 Post-closure Phase

Discharges

As described in Section 6.8.1, there will be no mining activities during the post-closure phase. All site runoff will be directed to the open pit, and the open pit will continue to experience an influx of groundwater. Once the pit is fully flooded, excess water will be released through a spillway into a tributary of Blackwater Creek and groundwater levels will return to near pre-development conditions. At that point, a portion of the seepage from the TSF and WRSA will escape from the site, and will ultimately report to various nearby waterbodies during this phase. Estimates of surface water quality for the post-closure phase have been made for the following closure options for the TSF. [Mit_023]:

- The dry cover option assumes that the process water in the TSF will be withdrawn at closure, treated and used to help fill the pit. The tailings will then be physically isolated using a granular cover. Finally, the tailings will be covered with a low-permeability dry cover to limit the potential for acidification.
- The wet cover option assumes that the process water in the TSF will be withdrawn at closure, treated and used to help fill the pit. The tailings will then be physically isolated using a granular cover. Finally, the tailings will be isolated from oxygen using a cover of non-process water to prevent acidification.

Predicted Effects

Estimated surface water quality during the post-closure phase was modelled, as described in Section 3.8.2.6. Modelled surface water quality for the nine modelling nodes shown on Figure 6.8.2.2-1 are provided in Tables 6.8.4.2-1 through 6.8.4.2-9, respectively. Although the model provides results for all modelling nodes and all parameters, the Project is only predicted to result in decreased surface water quality (i.e., higher concentrations) for certain parameters in at the following modelling nodes:

- **Node TL2**: Thunder Lake Tributary 3, downstream of the Tree Nursery Ponds;

- **Node TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **Node HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location;
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake;
- **Node TL**: Thunder Lake; and
- **Node WL**: Wabigoon Lake.

6.8.4.5 Predicted Adverse Effects

The predicted effects on surface water quality (Sections 6.8.4.1 through 6.8.4.4) varied by modelling node and indicator compound evaluated, as well as by varying the phase of the Project. Adverse effects on surface water quality were considered to occur in those cases where the predicted effects with the Project resulted in receiving water quality was degraded (i.e., had higher predicted concentrations) that the existing conditions. Depending on the phase of the Project, adverse effects were not predicted for all of the modelling nodes. The reasons for this vary include the following:

- The releases from the Project for a particular indicator could be lower than or equivalent to the existing conditions at a particular node. For example, Treasury Metals has committed that the effluent released during operations will meet the Provincial Water Quality Objectives (PWQO), or be less than background concentrations if background levels are greater than the PWQO, prior to release into Blackwater Creek. Therefore, the effluent released from the Project may have lower concentrations for some indicators than the receiving waters.
- For a particular phase, there may be no releases from the Project to a particular watercourse. For example, the Project will not result in any releases to Hoffstrom's Bay Tributary during operations. There will be no surface runoff from the operations area as this will all be collected by the perimeter runoff and seepage collection system and used in the water management system. Additionally, there will be no seepage from the site during operations as any seepage from the TSF and WRSA that escapes the seepage collection system will be captured by the drawdown zone created by the dewatering of the open pit and underground mine. This seepage will report to the open pit and be used in the water management system.

Site Preparation and Construction Phase

There are no predicted adverse effects to surface water quality during the site preparation and construction phase as described in Section 6.8.4.1. All runoff from the site will be collected by a perimeter runoff and seepage collection system, and used to initiate the TSF and provide water for the start-up of processing.

Operations Phase

During operations, the Project will release treated effluent into Blackwater Creek. As a result, the modelling has identified adverse effects on surface water quality at three of the modelling nodes:

- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location;
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake; and
- **Node WL**: Wabigoon Lake.

The predicted adverse effects on surface water quality are detailed in the following three locations (nodes) based on surface water quality modelling. The three locations are: BW1 and BW2 in Blackwater Creek and WL in Wabigoon Lake for some parameters as shown in Table 6.6.16.2-1. Results presented in Table 6.8.4.5-1 are based on an average year, dry year and wet year.

Table 6.8.4.5-1: Adverse Effect for Surface Water Quality during Operations

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—
Antimony	0.00487	0.00408	0.00505	0.00334	0.00281	0.00346	—	—	0.00064
Arsenic	0.023	0.019	0.024	0.015	0.012	0.016	0.001	—	0.001
Beryllium	0.003	0.003	0.003	0.002	0.002	0.002	—	—	—
Boron	0.083	0.077	0.084	0.071	0.067	0.072	—	—	—
Cadmium	0.00006	0.00005	0.00006	0.00004	0.00004	0.00004	—	—	—
Chloride	27	22	28	18	14	18	—	—	3
Chromium	0.003	0.002	0.003	0.002	0.002	0.002	—	—	—
Cobalt	0.0007	0.0006	0.0007	0.0006	0.0006	0.0006	—	—	—
Copper	0.002	0.002	0.002	0.002	0.002	0.002	—	—	—
Cyanide	0.003	0.003	0.003	0.002	0.002	0.002	—	—	—
Iron	—	—	—	—	—	—	—	—	—
Lead	0.002	0.002	0.002	0.002	0.001	0.002	—	—	—
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—
Molybdenum	0.010	0.008	0.010	0.007	0.005	0.007	—	—	0.001
Nickel	0.007	0.006	0.007	0.005	0.005	0.005	—	—	—
Nitrate(a)	2.89	2.36	3.01	1.86	1.51	1.94	0.04	0.03	0.06
Phosphorus	—	—	—	—	—	—	—	—	—
Selenium	0.023	0.019	0.024	0.015	0.012	0.016	0.001	—	0.001
Silver	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—
Vanadium	0.002	0.002	0.002	0.002	0.002	0.002	—	—	—
Zinc	0.010	0.009	0.010	0.008	0.007	0.008	—	—	—

Note: The "—" symbol indicates were no adverse effects predicted (i.e., predicted effects were less than or equal to existing conditions)

6.8.4.6 Closure Phase

There are no predicted adverse effects anticipated during the active closure phase as described in Section 6.8.1 as there will be no water discharges to the environment during this phase. Although dewatering activities will cease, the drawdown zone will continue to direct groundwater and seepage from the WRSA and TSF to the open pit until it is filled. The perimeter ditches will remain in place to collect surface runoff during this phase.

6.8.4.7 Post-closure Phase

Adverse effects on surface water quality during the post-closure phase will vary depending on the type of cover used for the TSF. For both a dry and wet cover on the TSF, adverse effects are predicted for the following modelling nodes:

- **Node TL2**: Thunder Lake Tributary 3, downstream of the Tree Nursery Ponds;
- **Node TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **Node HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **Node BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location;
- **Node BW2**: Blackwater Creek, upstream of Wabigoon Lake;
- **Node TL**: Thunder Lake; and
- **Node WL**: Wabigoon Lake.

The post-closure phase adverse effects for the dry cover on the TSF are presented in Table 6.8.5.4-1. The post-closure adverse effects for a wet cover over the TSF are presented in Table 6.8.5.4-2.

6.8.5 Identified Mitigation

The Project will employ best practices that will assist in a reduction and mitigate surface water quality effects, which are outlined below:

- Site Preparation and Construction Phase:
    - A perimeter runoff and seepage collection system will be progressively constructed around the operations area. There will be no runoff from the operations area to the environment. [Mit_008].
    - Industry standard erosion and sediment controls, such as sediment traps within ditches, will be implemented during the site preparations and construction phase. [Mit_054].
    - Once the perimeter ditch has been completed, there would be no discharges to surface water during this phase. [Mit_055].

Table 6.8.5.4-1: Adverse Effects for Surface Water Quality Effects during Post-closure (TSF dry cover)

Parameter	BW1: Blackwater Creek (Downstream of Project)			BW2: Blackwater Creek (Discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL2: Thunder Lake Tributary #3 (Downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.029	0.028	0.029	—	—	—
Antimony	0.00077	0.00081	0.00077	0.00071	0.00075	0.00071	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00008	0.00011	0.00008	0.00006	0.00009	0.00006	0.00002	0.00004	0.00002	0.00002	0.00002	0.00002	—	0.00002	—	—	—	—	—	—	—
Chloride	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.0007	0.0007	0.0007	0.0006	0.0007	0.0006	—	—	—	—	—	—	—	—	—	0.0005	0.0005	0.0005	—	—	—
Copper	0.002	0.003	0.002	0.002	0.002	0.002	0.001	0.001	—	—	0.001	—	—	—	—	—	—	—	—	—	—
Cyanide	0.003	0.003	0.003	0.003	0.003	0.003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.158	0.160	0.156	—	—	—
Lead	0.002	0.003	0.002	0.002	0.002	0.002	—	0.001	—	—	0.001	—	—	—	—	—	—	—	—	—	—
Mercury	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.009	0.011	0.009	0.006	0.008	0.007	—	—	—	—	—	—	—	—	—	0.002	0.002	0.002	—	—	—
Nitrate(a)	3.75	4.84	3.89	2.46	3.30	2.57	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.04	0.07
Phosphorus	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.016	0.028	0.014	0.012	0.022	0.011	0.006	0.013	0.005	0.004	0.007	0.004	0.003	0.004	0.003	—	—	—	—	—	—

Notes:

The "—" symbol indicates there were no adverse effects predicted (i.e., predicted effects were less than or equal to existing conditions)

The "†" indicates that surface water quality was not modelled due to insufficient source data

Table 6.8.5.4-2: Adverse Effects for Surface Water Quality Effects during Post-closure (TSF wet cover)

Parameter	BW1: Blackwater Creek (Downstream of Project)			BW2: Blackwater Creek (Discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL2: Thunder Lake Tributary #3 (Downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.029	0.028	0.029	—	—	—
Antimony	0.00074	0.00079	0.00075	0.00069	0.00073	0.00070	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00004	0.00005	0.00004	0.00003	0.00004	0.00003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride(a)	31	43	35	20	29	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.0007	0.0007	0.0007	0.0006	0.0007	0.0006	—	—	—	—	—	—	—	—	—	0.0005	0.0005	0.0005	—	—	—
Copper	0.002	0.002	0.002	0.002	0.002	0.002	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.003	0.003	0.003	0.002	0.003	0.003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.158	0.160	0.156	—	—	—
Lead	0.002	0.002	0.002	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.008	0.010	0.009	0.006	0.007	0.006	—	—	—	—	—	—	—	—	—	0.002	0.002	0.002	—	—	—
Nitrate(a)	3.35	4.57	3.78	2.16	3.08	2.49	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.04	0.07
Phosphorus	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.011	0.013	0.012	0.009	0.010	0.009	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes:
The "—" symbol indicates there were no adverse effects predicted (i.e., predicted effects were less than or equal to existing conditions)
The "†" indicates that surface water quality was not modelled due to insufficient source data

- Operations Phase:
  - All runoff from the operations area will be collected by the perimeter runoff and seepage collection system constructed at the start of the site preparation and construction phase. [Mit_008].
  - Effectively manage water collected on-site using constructed storage facilities, reducing the need for fresh water withdrawals and discharges of treated water. [Mit_057].
  - During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
  - A perimeter runoff and seepage collection systems will be constructed around the TSF. [Mit_051].
  - Seepage that escapes the seepage collection systems will be captured by the drawdown zone created by the dewatering of the open pit and underground mine. This captured seepage will report to the open pit. [Mit_052].
  - The process will employ a thickener to help recover cyanide solution from the tailings for reuse in processing. The resulting tailings will then be treated using the SO_2-air process to reduce cyanide in the tailings directed to the TSF so as to meet MMER requirements over a long-term basis. [Mit_061].

- Closure Phase:
  - During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases. [Mit_056].
  - 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
  - Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].
  - Although dewatering will stop at the end of operations, the drawdown zone will remain until the open pit fills with water and the groundwater returns to near pre-development levels. Seepage that escapes the collection systems will be captured by the drawdown zone caused by the dewatering of the open pit and underground mine during operations. This captured seepage will report to the open pit. [Mit_052].

- o There will be no discharges to surface water during this phase. [Mit_055].
- Post-closure Phase:
  - o A wet cover is the preferred closure option over the TSF. A wet cover prevents acidification of the tailings, which improves the quality of seepage in the long-term and results in improved surface water quality in the receiving environment. [Mit_023].
  - o 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
  - o Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].

6.8.6 Residual Adverse Effects

Residual adverse effects during the operations and post-closure phases are predicted to remain after the application of the mitigation measures summarized in Section 6.8.5, which includes the use of a wet cover closures option for the TSF. The predicted residual adverse effects of the Project on surface water quality for the operations phase are presented in Table 6.8.6-1. The modelling results show that while there are residual adverse effects (i.e., concentrations increase from existing conditions), the resulting concentrations are less than the respective PWQO (or CWQG where no PWQO are available). Table 6.8.6-2 presents the residual adverse effects on surface water quality during the post-closure phase. Although the wet cover option for closing the TSF was identified as the preferred option as the effects on the receiving environment were lessened, the modelling results presented in Tables 6.8.5.4-1 (dry TSF closure) and 6.8.5.4-2 (wet TSF closure) indicate that while there are residual effects, the resulting concentrations are less than the respective PWQO (or CWQG where no PWQO are available).

Table 6.8.6-1: Residual Adverse Effects on Surface Water Quality during Operations

Indicator	BW1: Blackwater Creek (Downstream of Project)			BW2: Blackwater Creek (Discharge to Wabigoon Lake)			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—
Antimony	0.0047	0.0039	0.0049	0.0032	0.0027	0.0033	—	—	0.00064
Arsenic	0.022	0.018	0.023	0.014	0.012	0.015	0.0011	—	0.0012
Beryllium	0.0031	0.0027	0.0032	0.0023	0.0021	0.0024	—	—	—
Boron	0.081	0.076	0.083	0.070	0.066	0.071	—	—	—
Cadmium	0.00006	0.00005	0.00006	0.00004	0.00004	0.00004	—	—	—
Chloride	25.9	21.2	27.3	16.7	13.6	17.6	—	—	3.4
Chromium	0.0027	0.0024	0.0028	0.0020	0.0018	0.0021	—	—	—
Cobalt	0.0006	0.0006	0.0007	0.0006	0.0006	0.0006	—	—	—

Table 6.8.6-1: Residual Adverse Effects on Surface Water Quality during Operations (continued)

Indicator	BW1: Blackwater Creek (Downstream of Project)			BW2: Blackwater Creek (Discharge to Wabigoon Lake)			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Copper	0.0020	0.0018	0.0020	0.0017	0.0016	0.0017	—	—	—
Cyanide	0.0026	0.0025	0.0027	0.0024	0.0023	0.0024	—	—	—
Iron	—	—	—	—	—	—	—	—	—
Lead	0.0018	0.0017	0.0019	0.0015	0.0014	0.0016	—	—	—
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	—	—	—
Molybdenum	0.0092	0.0077	0.0096	0.0062	0.0052	0.0065	—	—	0.0011
Nickel	0.0068	0.0059	0.0071	0.0051	0.0045	0.0052	—	—	—
Nitrate	2.8	2.2	2.9	1.8	1.4	1.9	0.044	0.033	0.056
Phosphorus	—	—	—	—	—	—	—	—	—
Selenium	0.022	0.018	0.023	0.014	0.012	0.015	0.0011	—	0.0012
Silver	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—
Vanadium	0.0022	0.0020	0.0023	0.0018	0.0017	0.0019	—	—	—
Zinc	0.0097	0.0087	0.010	0.0078	0.0071	0.0080	—	—	—

Note: The "—" symbol indicates there were no adverse effects predicted (i.e., predicted effects were less than or equal to existing conditions)

6.8.7 Information to Address Round 1 Information Requests

As part of the Round 1 IRs, there were a number of questions that were wholly, or partially, asking for information, clarification and/or justification for the approach used in predicting the effects of the Project on surface water quality, or the predicted effects themselves. Responses to the IRs were provided separately, and incorporated into the relevant sections of the Revised EIS. The following lists the Round 1 IRs related to the surface water quality predictions:

- TMI_92-SW(1)-06: assess effects of seepage on surface water quality;
- TMI_105-SW(1)-19: describe the effluent discharges through the Project life;
- TMI_349-AC(1)-23: identify potential impacts to water quality;
- TMI_514-AC(1)-188: measures to avoid or minimize effects;TMI_516-AC(1)-190: effects on surface water quality; and
- TMI_531-AC(1)-205: selection of water quality as a VC.

Table 6.8.6-2: Residual Adverse Effects on Surface Water Quality during Post-Closure

Indicator	BW1: Blackwater Creek (Downstream of Project)			BW2: Blackwater Creek (Discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL2: Thunder Lake Tributary #3 (Downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year	Avg. Year	Dry Year	Wet Year
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.029	0.028	0.029	—	—	—
Antimony	0.00074	0.00079	0.00075	0.00069	0.00073	0.00070	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00004	0.00005	0.00004	0.00003	0.00004	0.00003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride(a)	31	43	35	20	29	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.0007	0.0007	0.0007	0.0006	0.0007	0.0006	—	—	—	—	—	—	—	—	—	0.0005	0.0005	0.0005	—	—	—
Copper	0.002	0.002	0.002	0.002	0.002	0.002	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.003	0.003	0.003	0.002	0.003	0.003	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.158	0.160	0.156	—	—	—
Lead	0.002	0.002	0.002	0.001	0.001	0.001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.008	0.010	0.009	0.006	0.007	0.006	—	—	—	—	—	—	—	—	—	0.002	0.002	0.002	—	—	—
Nitrate(a)	3.35	4.57	3.78	2.16	3.08	2.49	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.04	0.07
Phosphorus	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†	†
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.011	0.013	0.012	0.009	0.010	0.009	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes:
The numbers table incorporate the mitigation provided by using a wet cover for the closure of the TSF
The "—" symbol indicates that there was no adverse effect predicted (i.e., predicted effects were less than or equal to the existing conditions
The "† " symbol indicates that surface water quality was not modelled due to insufficient source data

6.9 Surface Water Quantity

6.9.1 Potential Effects of the Project on the Environment

As described in Section 6.1.3.8 of this Revised EIS, the single valued component (VC) "surface water quantity" was used for evaluating the effects of the Project. The potential surface water quantity effects of the Project are described below by Project phase:

- **Site Preparation and Construction Phase**: There will be no discharges to surface water during this phase. The construction of a perimeter ditch around the operations area during this phase will effectively capture all site runoff and direct it to the on-site ponds. This water will be used to help establish the TSF and provide a supply of water for use in the processing plant once operations start. This perimeter ditch will enclose a portion of the watershed areas of Blackwater Creek Tributaries 1 and 2, as well as watershed areas for Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek.

- **Operations Phase**: Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area. The footprint of the operations area will overlay small portions of the Hoffstrom's Bay and Little Creek sub-watersheds, diverting runoff towards the Blackwater Creek sub-watershed. The majority of the Project footprint will be located within the Blackwater Creek watershed. Blackwater Creek Tributaries 1 and 2 will be partially overprinted by the open pit and tailings storage facility (TSF), respectively.

  To the extent possible, water within the Project footprint will be managed to maximize the use of water available for use in the process and minimize the need to take fresh water from adjacent watercourses. The majority of the water used at the Project will be comprised of surface runoff within the operations area, and water from the dewatering of the open pit and underground mine. Effluent from the processing plant will be treated and discharged to the TSF where a portion of the water will be bound in within the tailings and will be unavailable for use. Excess water not required in the process will be treated and discharged to the environment into Blackwater Creek.

  During operations, fresh water will be required periodically to support the processing plant requirements. This water will come from two dug ponds along Thunder Lake Tributary 3, referred to as the tree nursery ponds (bordering Tree Nursey Road), as well as a pond on Thunder Lake Tributary 2. Thunder Lake Tributary 3 flows into Thunder Lake Tributary 2 prior to feeding Thunder Lake.

  During operations, dewatering of the open pit and underground mine will be required to provide a safe working environment. This will result in a decrease in the water table, referred to as a drawdown zone, where groundwater will flow towards the open pit. There is a potential for the drawdown of the water table to reduce any groundwater discharge that contributes to flows in the adjacent watercourses.

- **Closure Phase**: There will be no discharges to surface water during the closure phase. At closure, runoff from within the operations area will be directed to the open pit. There will be no water discharges from the Project site until the open pit fills with water. The changes in catchment areas of Blackwater Creek Tributaries 1 and 2, as well as the watershed areas in Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek during site preparation and construction will remain during this phase.

- **Post-closure Phase**: All runoff from the operations area will continue to be directed to the open pit. Groundwater will continue to flow into the open pit, even after the open pit is filled with water. Once the open pit is fully flooded, during post-closure, the excess water flowing into the pit will be allowed to passively discharge to a tributary of Blackwater Creek.

The potential effects of the Project on surface water quantity have been described using a simple linkage diagram on Figure 6.9.1-1. The figure illustrates the surface water quantity VC (shown in blue on the figure) and how it can be potentially affected during the Project life. The evaluation of Project effects on surface water quantities focused on the operations and post-closure phases, when there will be releases from the Project to surface waters. The figure also indicates the other components of the environment (shown in red on the figure) where surface water quantity predictions are relied on as inputs for other VCs. For example, the surface water quantity predictions will be relied on in predicting potential effects on the surface water quality VC.

6.9.2 Effects Prediction Methods

Since the submission of the original EIS, several Project features have been refined (detailed in the Section 3.16) that affect the surface hydrology predictions for the Project. Additionally, feedback provided as part of the Round 1 information requests highlighted several concerns based on the (IRs), reviewers had several concerns regarding the earlier hydrologic modelling given the limited surface water data available for model calibration. To capture the changes to the Project and address the concerns raised as part of the Round 1 information requests, a new surface water hydrologic model was developed and based on long-term flow statistics from a representative, regional Water Survey of Canada (WSC) station.

The updated surface water hydrologic model includes estimates of monthly flows in Thunder Lake Tributaries 2 and 3, Little Creek, Hoffstrom's Bay Tributary, and Blackwater Creek for establishing existing flow conditions. The hydrologic model also predicted flow rates for the operations and post-closure phases of the Project at the various waterbodies listed above; these flows were compared to existing conditions to quantify the changes in flows as a result of the Project during these two phases. The hydrologic model did not predict surface water flows for either the site preparation and construction phase nor the closure phase as there will be no discharges as described Section 6.9.1.

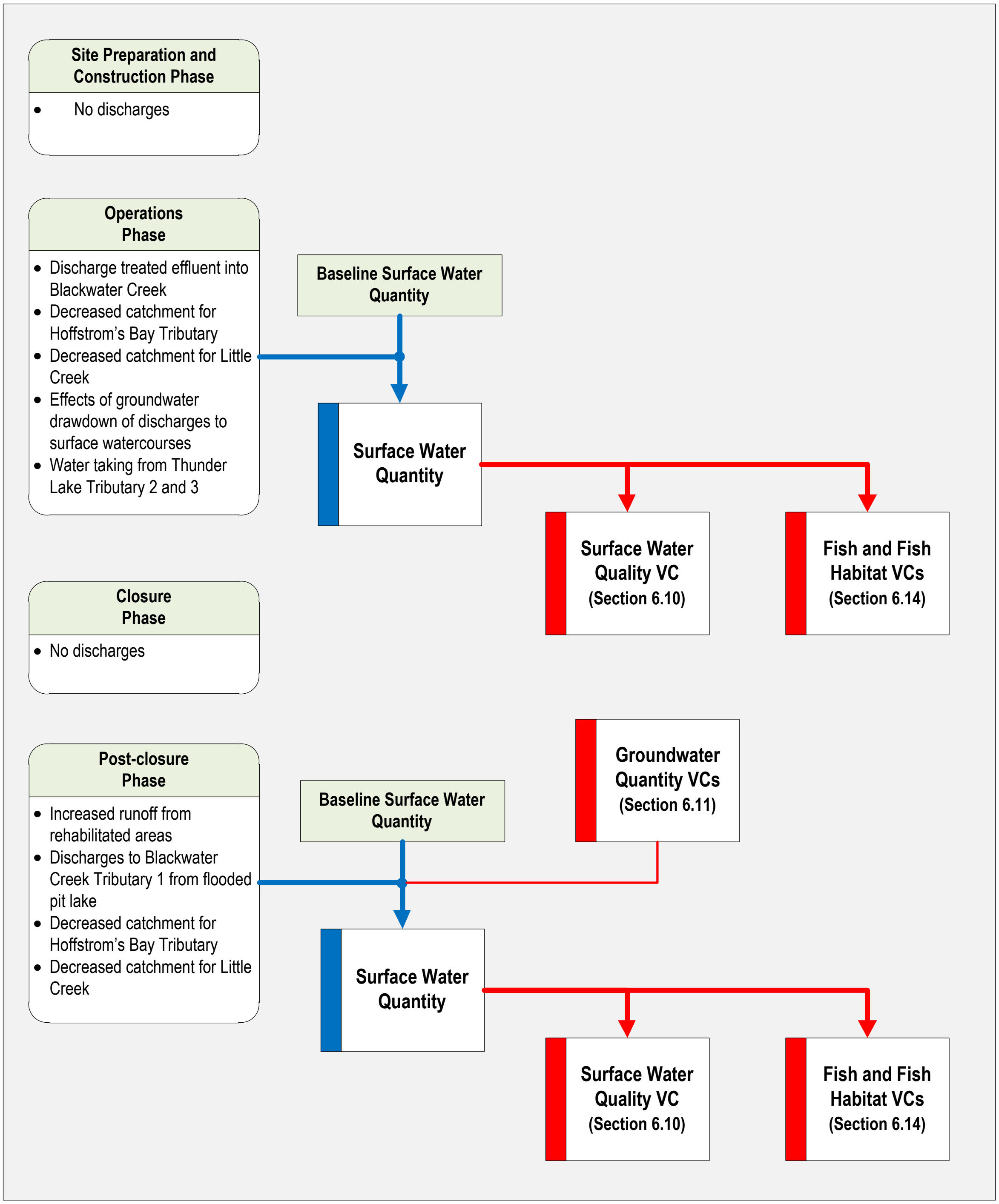


Figure 6.9.1-1: Surface Water Quantity Linkage Diagram

The hydrologic model also predicted annual average flow rates for existing conditions as well as for the operations and post-closure phases of the Project at Thunder Creek and Wabigoon River. The flow rate in Thunder Creek is assumed to be representative of water flowing into and out of Thunder Lake (assuming year over year change in lake level is negligible) and similarly, the flow rate in Wabigoon River is assumed to be representative of water flowing into and out of Wabigoon Lake (assuming year over year change in lake level is negligible). These flow rates were modelled on an annual basis as monthly data was not available.

6.9.2.1 Determining Flow Rates for Existing Conditions

The long term flow statistics for existing conditions have been developed based on regional runoff estimates. This approach estimates flow in the tributaries within the Project site area by directly prorating the data developed from a representative Water Survey of Canada (WSC) station.

Three WSC stations in relative close proximity to the site were considered. Wabigoon River at Dryden (05QD016) was considered since it is located on the same watershed as the Project Site, and would therefore have similar hydrologic characteristics (albeit at a much larger watershed size). North Current River (02AB015) was selected since it is a much smaller watershed compared the Wabigoon River at Dryden. Lake 240 Outlet near Kenora (05PD015) was the third station selected since it has a watershed area similar to those on the Project site (approximately 10 km^2), and is relatively close to the project site (only 83 km away).

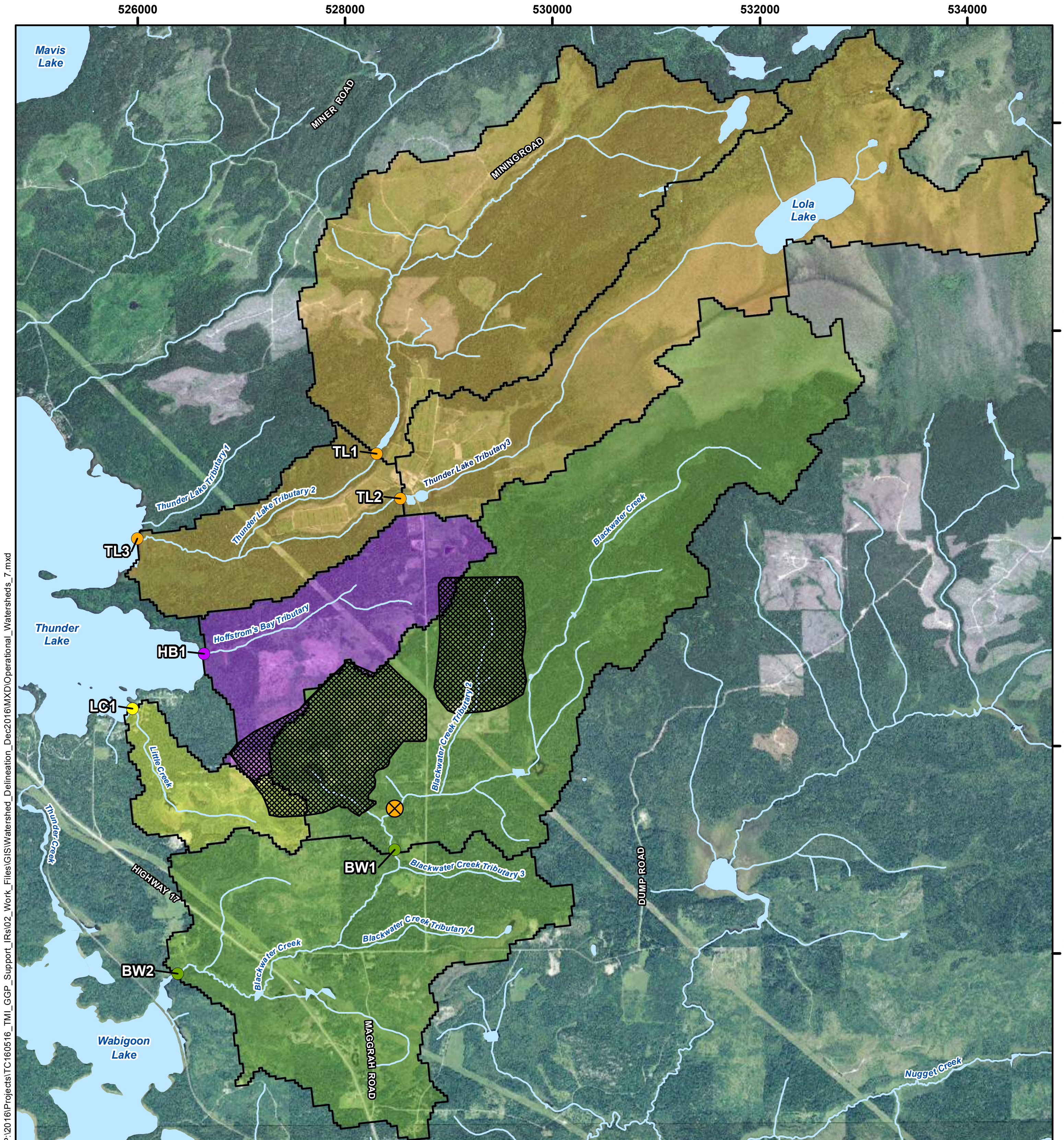
The WSC Station Lake 240 Outlet near Kenora (05PD015) was considered to be the most applicable regional station to Project site sub-watershed conditions and was selected as the representative WSC Station for determining flow rates for existing conditions. Further details on the selection of this WSC Station are provided in Section 4 of the Water Report.

6.9.2.2 Determining Flow Rates for the Site Preparation and Construction Phase

As previously described in Section 6.9.1, no surface water quantity modelling was completed during the site preparation and construction phase as there will be no water discharges from the Project site to the receiving environment. A perimeter ditch will be constructed around the operations area of the Project site that will effectively capture all site runoff and direct it to onsite ponds where it will be held until it can be suitably released to the environment.

6.9.2.3 Determining Flow Rates for the Operations Phase Conditions

During the operations phase of the Project, the footprint of the mine site will overlap onto several of the existing sub-watersheds (Hoffstrom’s Bay, Little Creek and Blackwater Creek) as shown in Figure 6.9.2.3-1. The mine site footprint shown in Figure 6.9.2.3-1 is based on the layout provided by WSP. Runoff from the un-affected portion of the sub-watersheds is calculated using the same methodology as that used for the existing conditions.



LEGEND

Operations Area

Effluent Discharge Location

Sub-Watershed Outlet Locations

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2

Sub-Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

0 0.25 0.5 1 1.5 2 2.5 3 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

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GOLIATH GOLD PROJECT

Overlay of Project on Local Watersheds

PROJECT Nº: TC160516	FIGURE: 6.9.2.3-1
SCALE: 1:50,000	DATE: April 2018

During operations, water takings from Thunder Lake Tributary 2 and 3 will be required for mine process water. Water taking rates have been estimated in the conceptual water balance provided in Table 6.9.2.3-1. The maximum flow taking at any given time has been limited to 5% of the available flow. No water taking is anticipated during a wet year, and only during some months in an average year.

During operations, all runoff from the operations area will be collected, managed, treated, and discharged to Blackwater Creek. Any seepage not captured by perimeter collection ditches will be captured within the drawdown zone generated by active mine dewatering, and will ultimately report to the open pit. Discharge to Blackwater Creek has been estimated in the conceptual water balance, which utilizes monthly runoff coefficients to generate average monthly flows. Anticipated discharge rates of treated effluent to Blackwater Creek are provided in Table 6.9.2.3-2. During average and wet years, effluent will be discharged to Blackwater Creek throughout the entire year, however during a dry year, no effluent is predicted to discharge between May and October. The effluent discharge to Blackwater Creek is combined with the runoff from the un-affected portion of the watershed to determine expected total monthly Blackwater Creek flows.

6.9.2.4 Determining Flow Rates for the Closure Phase

At closure, the tailings storage facility (TSF) and waste rock storage area (WRSA) will be capped with a low permeability cover to reduce infiltration. This will also have the effect of maximizing the runoff from these areas. All runoff and seepage from the TSF and WRSA, as well as from the rest of the operations area, will be directed towards the open pit. There will be no discharges from the Project during the closure phase and therefore hydrologic modelling was not undertaken for this phase.

Table 6.9.2.3-1: Fresh Water Takings from Thunder Lake Tributary 2 and 3 during Operations

Hydrologic Event	Monthly Water Takings (m^3/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Year	158	119	138	11	0	0	0	0	0	0	0	274
Dry Year	45	33	40	337	382	204	189	74	122	147	118	78
Wet Year	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.9.2.3-2: Effluent Discharge Volumes during Operations

Hydrologic Event	Treated Effluent Discharge to Blackwater Creek (m^3/day)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Year	715	799	1,276	3,556	924	1,558	1,335	1,277	2,637	2,124	1,963	749
Dry Year	206	258	662	2,548	0	0	0	0	0	0	918	71
Wet Year	740	850	1,474	4,549	2,945	4,925	3,915	3,213	4,451	3,362	2,720	785

6.9.2.5 Determining Flow Rates for the Post-closure Phase

Once the open pit has been filled, about seven years after dewatering activities stop, excess water from the open pit will be passively released to a tributary of Blackwater Creek. Anticipated discharge rates of post-closure discharge to Blackwater Creek are provided in Table 6.9.2.5-1. All runoff from the former operations area will continue be directed towards the open pit, such that no runoff will be directed towards Little Creek and Hoffstrom's Bay. There will be no water taking from Thunder Lake Tributaries 2 or 3 during the post-closure phase. The post-closure watershed map and associated land uses for the dry TSF cover option are provided in Figure 6.9.2.5-1. A comparable figure for the wet TSF cover option is provided in Figure 6.9.2.5-2.

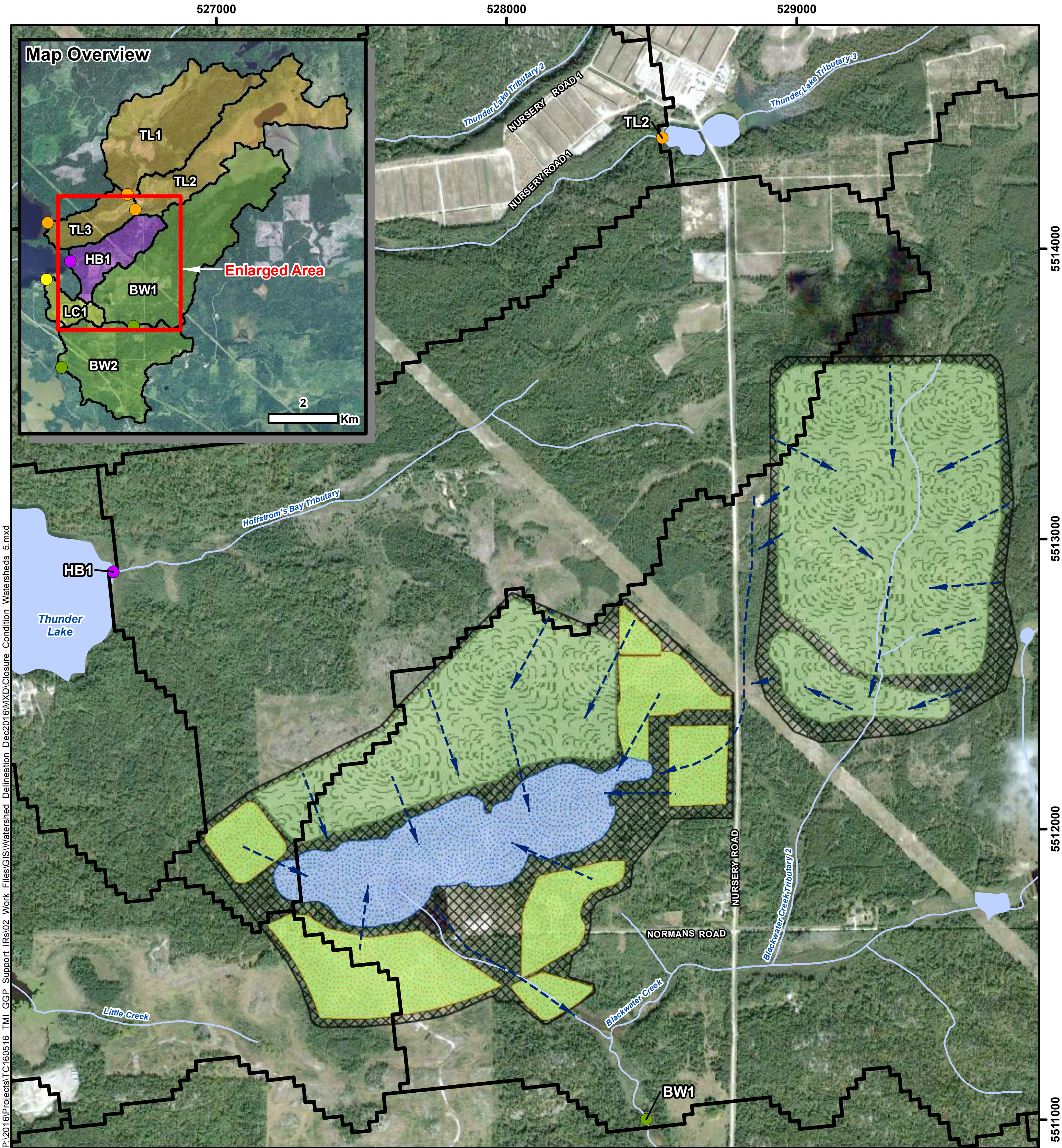
Table 6.9.2.5-1: Discharge Rates from Open Pit to Blackwater Creek during Post-closure

Month	Average Year	Dry Year	Wet Year
January	0.011	0.007	0.018
February	0.009	0.006	0.013
March	0.010	0.006	0.016
April	0.071	0.038	0.118
May	0.069	0.029	0.126
June	0.030	0.006	0.062
July	0.026	0.003	0.056
August	0.005	0.000	0.019
September	0.020	0.001	0.039
October	0.029	0.014	0.051
November	0.026	0.015	0.043
December	0.018	0.011	0.029
Annual	**0.027**	**0.011**	**0.049**

As a result of the change in land use within the mine site footprint, runoff from these areas will be calculated using an annual runoff coefficient, as opposed to the prorated runoff from WSC station (05PD015). The natural runoff coefficients have been calculated based on observed runoff data from the WSC station (05PD015). Other applicable post-closure runoff coefficients were estimated based on engineering judgement.

Monthly precipitation data and lake evaporation data were based on the existing data sources. Monthly precipitation data was redistributed to match the distribution of flows to the annual total at the WSC station (05PD015) flow gauge. This redistribution of precipitation produces potential runoff that accounts for the effects of the spring freshet.

Groundwater will discharge to the open pit as it is filling, and is estimated to continue once the pit has been fully flooded. This groundwater discharge has been conservatively estimated at 100 m^3/day and will combine with the runoff from the site being passively released to Blackwater Creek from the pit lake.



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LEGEND

Post Closure Land Use
- Flooded Open Pit
- Restored Operations Area
- Return to Prior State
- Semi-impervious Membrane

- Post Closure Flow Direction
- Sub-Watershed Boundary

Sub-Watershed Outlet Locations
- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2

Sub-Watershed
- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

0 0.25 0.5 1 1.5 Kilometres

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.
- Imagery extracted from Google Earth Pro, 2006

Datum: NAD83
Projection: UTM Zone 15N

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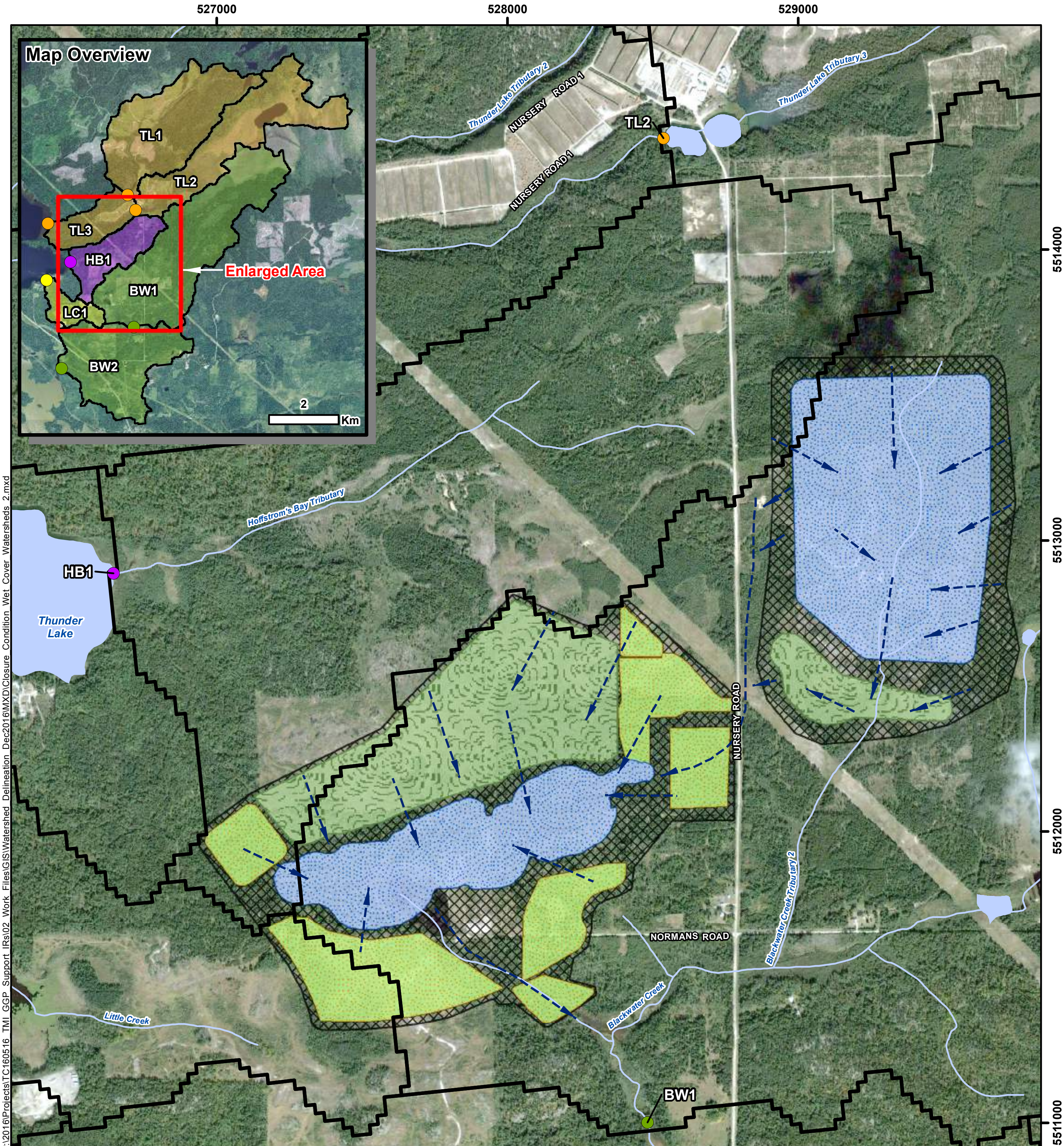
Post-Closure Watersheds and Land Use (Dry Cover)

PROJECT N°: TC160516 | FIGURE: 6.9.2.5-1

SCALE: 1:18,000 | DATE: April 2018



LEGEND

Post Closure Land Use

- Flooded Open Pit/Wet TSF Cover
- Restored Operations Area
- Return to Prior State
- Semi-impervious Membrane
- Post Closure Flow Direction
- Sub-Watershed Boundary

Sub-Watershed Outlet Locations

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2

Sub-Watershed

- Blackwater Creek
- Hoffstrom's Bay Tributary
- Little Creek
- Thunder Lake Tributary 2 and 3

NOTES:
- Topographic data extracted from Land Information Ontario, MNRF.
- Imagery extracted from Google Earth Pro, 2006

Datum: NAD83
Projection: UTM Zone 15N

0 0.25 0.5 1 1.5 Kilometres

N S E W

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GOLIATH GOLD PROJECT

Post-Closure Watersheds and Land Use (Wet Cover)

PROJECT N°: TC160516

FIGURE: 6.9.2.5-2

SCALE: 1:18,000

DATE: April 2018

6.9.3 Project Effects Avoidance Measures Used in Predictions

The following measures have been incorporated into the surface water quantity model to help avoid or reduce surface water quantity effects during the various phases of the Project:

- **Site Preparation and Construction Phase**:
  - Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system. [Mit_008].
  - Industry standard erosion and sediment controls will be implemented during the site preparations and construction phase. [Mit_054].
  - Once the perimeter ditch has been completed, there would be no discharges to surface water during this phase. [Mit_055].
- **Operations Phase**:
  - A perimeter ditch around the operations area will capture all runoff during the site preparation and construction phase. [Mit_008].
  - The operations area will be minimized to the extent possible to reduce the amount of runoff directed from the Little Creek and Hoffstrom's Bay watersheds. [Mit_050].
  - On-site storage facilities will allow for the effective management of water, reducing the need for discharges, especially during periods when conditions are not suitable. On-site storage facilities will allow for the effective management of water, reducing the amount for water taken from adjacent watercourses. [Mit_057].
  - Excess water not required for processing will be treated and discharged to Blackwater Creek through an engineered structure designed to dissipate flows and avoid erosion. [Mit_058].
  - Periodically, fresh water will be required to support Project operations. Fresh water withdrawals will be taken from two existing ponds on Thunder Lake Tributary 3 (referred to as the tree nursery ponds) and an existing pond on Thunder Lake Tributary 2. Fresh water takings from these ponds will not exceed 5% of the flow entering the ponds. [Mit_059].
- **Closure Phase**:
  - A perimeter ditch around the operations area will capture all runoff during the closure phase [Mit_008].
  - There will be no surface water discharges during this phase, thus, no mitigation measures are proposed [Mit_055].

- **Post-closure Phase**:
  - o During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases [Mit_056].
  - o Once the open pit has been filled, excess water from the open pit will be passively released through an engineered spillway into the existing channel of Blackwater Creek Tributary 1 [Mit_060].

6.9.4 Predicted Effects

6.9.4.1 Site Preparation and Construction Phase

As described in Section 6.8.1, there will be no discharges or withdrawals as a result of the Project during the site preparation and construction phase. Therefore, effects have not been predicted during this phase as they relate to surface water quantity but effects on fish and fish habitat have been predicted and are provided in Section 6.14.

6.9.4.2 Operations Phase

Changes in Flows

As described in Section 6.8.1, a perimeter ditch will be constructed around the operations area, which will collect all of the runoff from the enclosed area. The operations area will overprint small portions of the watersheds for Hoffstrom's Bay Tributary and Little Creek, reducing the size of those watersheds. These areas within the operations area will slightly increase the size of the watershed for Blackwater Creek, within which the majority of the Project resides (Figure 6.9.2.3-1). The runoff from within the operations area will be combined with the water from dewatering the open pit and underground mine and used in the processing of ore. Excess water will be treated and discharged, as effluent, to Blackwater Creek.

Table 6.9.2.3-2 provides a listing of the effluent volumes expected to be released from the site during operations. During operations, fresh water will be withdrawn from Thunder Lake Tributaries 2 and 3 on an as required basis to support Project processing requirements. The expected water taking volumes are provided in Table 6.9.2.3-1.

Estimated flows during the operations phase were modelled as described in Section 6.9.2.3. The results of the modelling and flows were predicted for the operations phase and compared to existing conditions. Results are provided in Tables 6.9.4.2-1 to 6.9.4.2-3 and indicate there is a change in surface flow between existing conditions and operations flows for all of the sub-watersheds that were modelled:

- **TL1**: Thunder Lake Tributary 2 downstream of reservoir;
- **TL2**: Thunder Lake Tributary 3 downstream of Three Nursery Ponds;

Table 6.9.4.2-1: Surface Water Hydrology Results for Operations, Average Year Conditions

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063	—	—
	Post-closure	0.018	0.014	0.016	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.032	0.063	0.000	-0.6
TL2	Existing	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058	—	—
	Post-closure	0.017	0.013	0.015	0.133	0.151	0.080	0.075	0.029	0.048	0.058	0.046	0.029	0.058	0.000	-0.8
TL3	Existing	0.043	0.032	0.037	0.319	0.362	0.193	0.179	0.070	0.116	0.139	0.111	0.074	0.140	—	—
	Post-closure	0.040	0.030	0.035	0.315	0.357	0.190	0.177	0.069	0.114	0.138	0.110	0.070	0.138	-0.002	-1.7
HB1	Existing	0.007	0.005	0.006	0.049	0.056	0.030	0.028	0.011	0.018	0.022	0.017	0.011	0.022	—	—
	Post-closure	0.006	0.005	0.005	0.046	0.052	0.027	0.025	0.010	0.016	0.020	0.016	0.011	0.020	-0.002	-7.8
LC1	Existing	0.003	0.002	0.003	0.022	0.025	0.013	0.012	0.005	0.008	0.010	0.008	0.005	0.010	—	—
	Post-closure	0.003	0.002	0.002	0.020	0.023	0.012	0.011	0.004	0.007	0.009	0.007	0.005	0.009	-0.001	-8.7
BW1	Existing	0.026	0.019	0.023	0.194	0.2198	0.117	0.109	0.043	0.070	0.085	0.068	0.045	0.085	—	—
	Post-closure	0.028	0.024	0.032	0.186	0.1749	0.106	0.097	0.047	0.083	0.088	0.073	0.042	0.082	-0.003	-3.9
BW2	Existing	0.041	0.031	0.036	0.308	0.349	0.186	0.172	0.068	0.111	0.134	0.107	0.071	0.135	—	—
	Post-closure	0.042	0.034	0.044	0.290	0.293	0.168	0.155	0.070	0.121	0.133	0.110	0.067	0.127	-0.007	-5.5

Table 6.9.4.2-2: Surface Water Hydrology Results for Operations, Dry Year Conditions

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018	—	—
	Post-closure	0.005	0.004	0.005	0.039	0.044	0.023	0.022	0.008	0.014	0.017	0.013	0.009	0.017	-0.001	-5.0
TL2	Existing	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016	—	—
	Post-closure	0.005	0.004	0.004	0.035	0.040	0.021	0.020	0.008	0.013	0.016	0.012	0.008	0.016	-0.001	-5.2
TL3	Existing	0.012	0.009	0.010	0.090	0.101	0.054	0.050	0.020	0.032	0.039	0.031	0.021	0.039	—	—
	Post-closure	0.011	0.008	0.010	0.085	0.096	0.051	0.047	0.019	0.031	0.037	0.029	0.020	0.037	-0.002	-5.6
HB1	Existing	0.002	0.001	0.002	0.014	0.016	0.008	0.008	0.003	0.005	0.006	0.005	0.003	0.006	—	—
	Post-closure	0.002	0.001	0.001	0.013	0.014	0.008	0.007	0.003	0.005	0.006	0.004	0.003	0.006	0.000	-7.8
LC1	Existing	0.001	0.001	0.001	0.006	0.007	0.004	0.003	0.001	0.002	0.003	0.002	0.001	0.003	—	—
	Post-closure	0.001	0.001	0.001	0.006	0.006	0.003	0.003	0.001	0.002	0.002	0.002	0.001	0.002	0.000	-8.7
BW1	Existing	0.007	0.005	0.006	0.054	0.062	0.033	0.030	0.012	0.020	0.024	0.019	0.013	0.024	—	—
	Post-closure	0.008	0.007	0.012	0.070	0.046	0.025	0.023	0.009	0.015	0.018	0.025	0.010	0.022	-0.002	-6.7
BW2	Existing	0.012	0.009	0.010	0.086	0.098	0.052	0.048	0.019	0.031	0.038	0.030	0.020	0.038	—	—
	Post-closure	0.012	0.010	0.016	0.099	0.079	0.042	0.039	0.015	0.025	0.031	0.035	0.017	0.035	-0.003	-7.3

Table 6.9.4.2-3: Surface Water Hydrology Results for Operations, Wet Year Conditions

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	—	—
	Post-closure	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	0.000	0.0
TL2	Existing	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.101	—	—
	Post-closure	0.031	0.023	0.027	0.229	0.259	0.138	0.128	0.050	0.083	0.100	0.080	0.053	0.100	0.000	-0.2
TL3	Existing	0.073	0.054	0.064	0.549	0.622	0.331	0.307	0.121	0.199	0.240	0.191	0.127	0.241	—	—
	Post-closure	0.072	0.054	0.064	0.542	0.614	0.327	0.304	0.119	0.196	0.237	0.189	0.126	0.238	-0.003	-1.2
HB1	Existing	0.011	0.008	0.010	0.085	0.096	0.051	0.048	0.019	0.031	0.037	0.030	0.020	0.037	—	—
	Post-closure	0.010	0.008	0.009	0.078	0.089	0.047	0.044	0.017	0.028	0.034	0.027	0.018	0.034	-0.003	-7.8
LC1	Existing	0.005	0.004	0.004	0.038	0.043	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.017	—	—
	Post-closure	0.005	0.003	0.004	0.034	0.039	0.021	0.019	0.008	0.012	0.015	0.012	0.008	0.015	-0.001	-8.7
BW1	Existing	0.045	0.033	0.039	0.334	0.378	0.201	0.187	0.073	0.121	0.146	0.116	0.078	0.146	—	—
	Post-closure	0.042	0.035	0.047	0.306	0.321	0.210	0.187	0.093	0.143	0.150	0.120	0.068	0.144	-0.003	-1.7
BW2	Existing	0.071	0.053	0.062	0.529	0.599	0.319	0.296	0.117	0.191	0.231	0.185	0.123	0.232	—	—
	Post-closure	0.067	0.053	0.068	0.489	0.529	0.321	0.290	0.133	0.209	0.230	0.184	0.110	0.224	-0.008	-3.4

- **TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

Changes in Lake Levels

The same hydrologic model used for determining changes in stream flows was also used for determining the changes in inflow to both Thunder Lake and Wabigoon Lake. The resulting changes are provided in Table 6.9.4.2-4. The results indicated there would be a negligible change in inflows to both Thunder Lake and Wabigoon Lake as a result of the Project. Therefore, there would be a negligible change in water levels in both lakes. Furthermore, both Thunder Lake and Wabigoon Lake have control structures that are used to help control the water levels in the lakes.

Table 6.9.4.2-4: Changes in Surface Water Inflows to Lakes during Operations

Lake	Total Surface Water Inflow (m^3/s)		Change in Annual Surface Water Inflow (%)
	Existing Conditions	Operations Phase	
Thunder Lake	0.492	0.487	-1.01%
Wabigoon Lake	16.849	16.837	+0.07%

6.9.4.3 Closure Phase

As described in Section 6.8.1, there will be no discharges, withdrawals as a result of the Project during the closure phase. Therefore, effects have not been predicted during this phase as they relate to surface water quantity but effects on fish and fish habitat have been predicted for the closure phase and are provided in Section 6.14.

6.9.4.4 Post-closure Phase

Changes in Flows

Following the closure of the Project, all runoff from the former operations area will continue be directed towards the open pit. This will include those portions of the catchments of Little Creek and Hoffstrom's Bay that is captures within the perimeters ditches. There will be no water taking from Thunder Lake Tributaries 2 or 3 during the post-closure phase. Once the open pit is fully flooded, excess water will be released through a spillway into a tributary of Blackwater Creek.

The hydrologic modelling for the post-closure phase has been completed for two alternative closure scenarios for the TSF, namely the dry closure options and the wet closure option. Because of the differing land uses and runoff coefficients with each option, the predictions of surface water quantities will be different for each of the options.

Table 6.9.2.5-1 provides a listing of water expected to be released from the open once pit is fully flooded. Estimated flows during the post-closure phase were modelled according to the methods described in Section 6.9.2.5. The results of the modelling for the dry cover option are provided in Tables 6.9.4.4-1 to 6.9.4.4-3. The modelling indicates that there will be a change in surface flow between existing conditions and post-closure flows for the following sub-watersheds:

- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

The hydrologic model also predicted flow rates for the same sub-watersheds with a wet cover option over the TSF. Results for post-closure with a wet cover option are provided in Tables 6.9.4.4-4 to 6.9.4.4-6 and indicate a change in flow compared to existing conditions for the same sub-watersheds:

- **TL2**: Thunder Lake Tributary 3, downstream of the Tree Nursery Ponds;
- **TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

Changes in Lake Levels

The same hydrologic model used for determining changes in stream flows was also used for determining the changes in inflow to both Thunder Lake and Wabigoon Lake. The resulting changes are provided in Table 6.9.4.4-7. The results indicated there would be a negligible change in inflows to both Thunder Lake and Wabigoon Lake as a result of the Project. Therefore, there would be a negligible change in water levels in both lakes. Furthermore, both Thunder Lake and Wabigoon Lake have control structures that are used to help control the water levels in the lakes.

Table 6.9.4.4-1: Surface Water Hydrology Results for Post-Closure, Average Year Conditions (dry cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063	—	—
	Post-closure	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063	0.000	0.0
TL2	Existing	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058	—	—
	Post-closure	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058	0.000	+0.0
TL3	Existing	0.043	0.032	0.037	0.319	0.362	0.193	0.179	0.070	0.116	0.139	0.111	0.074	0.140	—	—
	Post-closure	0.043	0.032	0.037	0.319	0.362	0.193	0.179	0.070	0.116	0.139	0.111	0.074	0.140	0.000	+0.0
HB1	Existing	0.007	0.005	0.006	0.049	0.056	0.030	0.028	0.011	0.018	0.022	0.017	0.011	0.022	—	—
	Post-closure	0.006	0.005	0.005	0.046	0.052	0.028	0.026	0.010	0.017	0.020	0.016	0.011	0.020	—0.002	—7.2
LC1	Existing	0.003	0.002	0.003	0.022	0.025	0.013	0.012	0.005	0.008	0.010	0.008	0.005	0.010	—	—
	Post-closure	0.003	0.002	0.002	0.020	0.023	0.012	0.011	0.004	0.007	0.009	0.007	0.005	0.009	—0.001	—7.5
BW1	Existing	0.026	0.019	0.023	0.194	0.220	0.117	0.109	0.043	0.070	0.085	0.068	0.045	0.085	—	—
	Post-closure	0.031	0.024	0.028	0.224	0.243	0.122	0.111	0.038	0.076	0.096	0.080	0.053	0.094	0.009	+10.6
BW2	Existing	0.041	0.031	0.036	0.308	0.349	0.186	0.172	0.068	0.111	0.134	0.107	0.071	0.135	—	—
	Post-closure	0.047	0.035	0.041	0.338	0.372	0.191	0.175	0.063	0.117	0.145	0.119	0.080	0.144	0.009	+6.7

Table 6.9.4.4-2: Surface Water Hydrology Results for Post-Closure, Dry Year Conditions (dry cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018	—	—
	Post-closure	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018	0.000	0.0
TL2	Existing	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016	—	—
	Post-closure	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016	0.000	+0.0
TL3	Existing	0.012	0.009	0.010	0.090	0.101	0.054	0.050	0.020	0.032	0.039	0.031	0.021	0.039	—	—
	Post-closure	0.012	0.009	0.010	0.090	0.101	0.054	0.050	0.020	0.032	0.039	0.031	0.021	0.039	0.000	+0.0
HB1	Existing	0.002	0.001	0.002	0.014	0.016	0.008	0.008	0.003	0.005	0.006	0.005	0.003	0.006	—	—
	Post-closure	0.002	0.001	0.002	0.013	0.015	0.008	0.007	0.003	0.005	0.006	0.004	0.003	0.006	0.000	—7.2
LC1	Existing	0.001	0.001	0.001	0.006	0.007	0.004	0.003	0.001	0.002	0.003	0.002	0.001	0.003	—	—
	Post-closure	0.001	0.001	0.001	0.006	0.006	0.003	0.003	0.001	0.002	0.002	0.002	0.001	0.002	0.000	—7.5
BW1	Existing	0.007	0.005	0.006	0.054	0.062	0.033	0.030	0.012	0.020	0.024	0.019	0.013	0.024	—	—
	Post-closure	0.012	0.009	0.011	0.080	0.077	0.032	0.027	0.010	0.016	0.032	0.029	0.020	0.030	0.006	+24.3
BW2	Existing	0.012	0.009	0.010	0.086	0.098	0.052	0.048	0.019	0.031	0.038	0.030	0.020	0.038	—	—
	Post-closure	0.016	0.013	0.015	0.112	0.114	0.051	0.045	0.017	0.027	0.046	0.041	0.028	0.044	0.006	+15.3

Table 6.9.4.4-3: Surface Water Hydrology Results for Post-Closure, Wet Year Conditions (dry cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	—	—
	Post-closure	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	0.000	0.0
TL2	Existing	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.101	—	—
	Post-closure	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.101	0.000	+0.0
TL3	Existing	0.073	0.054	0.064	0.549	0.622	0.331	0.307	0.121	0.199	0.240	0.191	0.127	0.241	—	—
	Post-closure	0.073	0.054	0.064	0.549	0.622	0.331	0.307	0.121	0.199	0.240	0.191	0.127	0.241	0.000	+0.0
HB1	Existing	0.011	0.008	0.010	0.085	0.096	0.051	0.048	0.019	0.031	0.037	0.030	0.020	0.037	—	—
	Post-closure	0.011	0.008	0.009	0.079	0.089	0.048	0.044	0.017	0.028	0.034	0.027	0.018	0.035	—0.003	—7.2
LC1	Existing	0.005	0.004	0.004	0.038	0.043	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.017	—	—
	Post-closure	0.005	0.003	0.004	0.035	0.040	0.021	0.020	0.008	0.013	0.015	0.012	0.008	0.015	—0.001	—7.5
BW1	Existing	0.045	0.033	0.039	0.334	0.378	0.201	0.187	0.073	0.121	0.146	0.116	0.078	0.146	—	—
	Post-closure	0.052	0.039	0.046	0.382	0.425	0.222	0.204	0.076	0.135	0.166	0.135	0.090	0.165	0.018	+12.6
BW2	Existing	0.071	0.053	0.062	0.529	0.599	0.319	0.296	0.117	0.191	0.231	0.185	0.123	0.232	—	—
	Post-closure	0.079	0.059	0.069	0.578	0.647	0.340	0.313	0.119	0.205	0.251	0.203	0.135	0.250	0.018	+8.0

Table 6.9.4.4-4: Surface Water Hydrology Results for Post-Closure, Average Year Conditions (wet cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063	—	—
	Post-closure	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063	0.000	0.0
TL2	Existing	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058	—	—
	Post-closure	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058	0.000	+0.0
TL3	Existing	0.043	0.032	0.037	0.319	0.362	0.193	0.179	0.070	0.116	0.139	0.111	0.074	0.140	—	—
	Post-closure	0.043	0.032	0.037	0.319	0.362	0.193	0.179	0.070	0.116	0.139	0.111	0.074	0.140	0.000	+0.0
HB1	Existing	0.007	0.005	0.006	0.049	0.056	0.030	0.028	0.011	0.018	0.022	0.017	0.011	0.022	—	—
	Post-closure	0.006	0.005	0.005	0.046	0.052	0.028	0.026	0.010	0.017	0.020	0.016	0.011	0.020	—0.002	—7.2
LC1	Existing	0.003	0.002	0.003	0.022	0.025	0.013	0.012	0.005	0.008	0.010	0.008	0.005	0.010	—	—
	Post-closure	0.003	0.002	0.002	0.020	0.023	0.012	0.011	0.004	0.007	0.009	0.007	0.005	0.009	—0.001	—7.5
BW1	Existing	0.026	0.019	0.023	0.194	0.220	0.117	0.109	0.043	0.070	0.085	0.068	0.045	0.085	—	—
	Post-closure	0.029	0.022	0.026	0.228	0.237	0.113	0.103	0.035	0.070	0.089	0.074	0.050	0.090	0.005	+5.7
BW2	Existing	0.041	0.031	0.036	0.308	0.349	0.186	0.172	0.068	0.111	0.134	0.107	0.071	0.135	—	—
	Post-closure	0.045	0.033	0.039	0.341	0.366	0.182	0.167	0.060	0.111	0.139	0.114	0.076	0.140	0.005	+3.6

Table 6.9.4.4-5: Surface Water Hydrology Results for Post-Closure, Dry Year Conditions (wet cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018	—	—
	Post-closure	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018	0.000	0.0
TL2	Existing	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016	—	—
	Post-closure	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016	0.000	+0.0
TL3	Existing	0.012	0.009	0.010	0.090	0.101	0.054	0.050	0.020	0.032	0.039	0.031	0.021	0.039	—	—
	Post-closure	0.012	0.009	0.010	0.090	0.101	0.054	0.050	0.020	0.032	0.039	0.031	0.021	0.039	0.000	+0.0
HB1	Existing	0.002	0.001	0.002	0.014	0.016	0.008	0.008	0.003	0.005	0.006	0.005	0.003	0.006	—	—
	Post-closure	0.002	0.001	0.002	0.013	0.015	0.008	0.007	0.003	0.005	0.006	0.004	0.003	0.006	0.000	—7.2
LC1	Existing	0.001	0.001	0.001	0.006	0.007	0.004	0.003	0.001	0.002	0.003	0.002	0.001	0.003	—	—
	Post-closure	0.001	0.001	0.001	0.006	0.006	0.003	0.003	0.001	0.002	0.002	0.002	0.001	0.002	0.000	—7.5
BW1	Existing	0.007	0.005	0.006	0.054	0.062	0.033	0.030	0.012	0.020	0.024	0.019	0.013	0.024	—	—
	Post-closure	0.014	0.011	0.012	0.091	0.069	0.027	0.024	0.010	0.016	0.023	0.027	0.018	0.029	0.005	+19.6
BW2	Existing	0.012	0.009	0.010	0.086	0.098	0.052	0.048	0.019	0.031	0.038	0.030	0.020	0.038	—	—
	Post-closure	0.018	0.014	0.016	0.123	0.105	0.047	0.042	0.017	0.027	0.037	0.038	0.026	0.043	0.005	+12.4

Table 6.9.4.4-6: Surface Water Hydrology Results for Post-Closure, Wet Year Conditions (wet cover TSF)

Sub-watershed ID	Scenario	Calculated Flows (m^3/s)														ΔQ (%)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	ΔQ	
TL1	Existing	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	—	—
	Post-closure	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109	0.000	0.0
TL2	Existing	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.101	—	—
	Post-closure	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.101	0.000	+0.0
TL3	Existing	0.073	0.054	0.064	0.549	0.622	0.331	0.307	0.121	0.199	0.240	0.191	0.127	0.241	—	—
	Post-closure	0.073	0.054	0.064	0.549	0.622	0.331	0.307	0.121	0.199	0.240	0.191	0.127	0.241	0.000	+0.0
HB1	Existing	0.011	0.008	0.010	0.085	0.096	0.051	0.048	0.019	0.031	0.037	0.030	0.020	0.037	—	—
	Post-closure	0.011	0.008	0.009	0.079	0.089	0.048	0.044	0.017	0.028	0.034	0.027	0.018	0.035	—0.003	—7.2
LC1	Existing	0.005	0.004	0.004	0.038	0.043	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.017	—	—
	Post-closure	0.005	0.003	0.004	0.035	0.040	0.021	0.020	0.008	0.013	0.015	0.012	0.008	0.015	—0.001	—7.5
BW1	Existing	0.045	0.033	0.039	0.334	0.378	0.201	0.187	0.073	0.121	0.146	0.116	0.078	0.146	—	—
	Post-closure	0.054	0.041	0.048	0.393	0.423	0.209	0.189	0.071	0.125	0.162	0.139	0.093	0.163	0.016	+11.1
BW2	Existing	0.071	0.053	0.062	0.529	0.599	0.319	0.296	0.117	0.191	0.231	0.185	0.123	0.232	—	—
	Post-closure	0.080	0.060	0.070	0.589	0.644	0.327	0.299	0.114	0.196	0.247	0.207	0.138	0.248	0.016	+7.0

Table 6.9.4.4-7: Changes in Surface Water Inflows to Lakes during Post-closure

Lake	Total Surface Water Inflow (m^3/s)		Change in Annual Surface Water Inflow (%)
	Existing Conditions	Operations Phase	
Thunder Lake	0.492	0.490	-0.4
Wabigoon Lake	16.849	16.857	+0.005

6.9.4.5 Description of Predicted Adverse Effects

Hydrologic modelling was used to predict surface water flows for all seven sub-watershed areas, and for three hydrologic scenarios (i.e., average year, dry year, wet year). Surface water flows were calculated for the operations phase, as well as the post-closure phase. For the modelling of post-closure flows, predictions were made for each of the two dry closure options considered for the TSF, namely a dry cover and a wet cover. No predictions were made for either the site preparation and construction phase or the closure phase as there would be no surface water discharges or withdrawals during these phases. However, during the site preparation and construction and closure phases, there will be changes in catchment areas as a result of the Project to Blackwater Creek Tributaries 1 and 2 and watershed areas in Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek. A description of predicted adverse effects on fish and fish habitat for these two phases are provided in Section 6.14. The results of the modelling, which were provided in Sections 6.8.4.1 through 6.8.4.4, were used to calculate the changes in flows from existing conditions as a result of the Project. Adverse effects on surface water quantity were considered to occur in those cases where a non-negligible change was predicted in the surface flows.

The predicted changes in surface water quantity during the operations phase are provided in Table 6.9.4.5-1. During operations, hydrologic modelling predicted adverse effects on surface water quantity for all seven sub-watersheds modelled for the dry and average year, specifically in the following sub-watersheds:

- **TL1**: Thunder Lake Tributary 2 downstream of reservoir;
- **TL2**: Thunder Lake Tributary 3 downstream of Three Nursery Ponds;
- **TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

Table 6.9.5-1: Adverse Effects for Surface Water Quantity during Operations

Scenario	Calculated Change in Flows, ΔQ (m^3/s)													Annual ΔQ (%)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Average Year														
TL1	-0.0010	-0.0007	-0.0008	-0.0001	—	—	—	—	—	—	—	-0.0017	-0.0004	-0.55%
TL2	-0.0009	-0.0007	-0.0008	-0.0003	-0.0003	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0016	-0.0004	-0.75%
TL3	-0.0024	-0.0018	-0.0021	-0.0041	-0.0045	-0.0024	-0.0022	-0.0009	-0.0014	-0.0017	-0.0014	-0.0041	-0.0024	-1.73%
HB1	-0.0005	-0.0004	-0.0004	-0.0038	-0.0043	-0.0023	-0.0021	-0.0008	-0.0014	-0.0017	-0.0013	-0.0009	-0.0017	-7.77%
LC1	-0.0003	-0.0002	-0.0002	-0.0019	-0.0022	-0.0012	-0.0011	-0.0004	-0.0007	-0.0008	-0.0007	-0.0004	-0.0008	-8.74%
BW1	+0.0017	+0.0044	+0.0090	-0.0079	-0.0449	-0.0116	-0.0120	+0.0040	+0.0128	+0.0031	+0.0056	-0.0027	-0.0033	-3.90%
BW2	+0.0004	+0.0034	+0.0079	-0.0174	-0.0556	-0.0173	-0.0173	+0.0019	+0.0093	-0.0010	+0.0023	-0.0049	-0.0075	-5.53%
Dry year														
TL1	-0.0003	-0.0002	-0.0002	-0.0020	-0.0023	-0.0012	-0.0011	-0.0004	-0.0007	-0.0009	-0.0007	-0.0005	-0.0009	-5.00%
TL2	-0.0003	-0.0002	-0.0002	-0.0019	-0.0022	-0.0012	-0.0011	-0.0004	-0.0007	-0.0008	-0.0007	-0.0005	-0.0009	-5.20%
TL3	-0.0007	-0.0005	-0.0006	-0.0050	-0.0057	-0.0030	-0.0028	-0.0011	-0.0018	-0.0022	-0.0018	-0.0012	-0.0022	-5.60%
HB1	-0.0001	-0.0001	-0.0001	-0.0011	-0.0012	-0.0006	-0.0006	-0.0002	-0.0004	-0.0005	-0.0004	-0.0002	-0.0005	-7.77%
LC1	-0.0001	-0.0001	-0.0001	-0.0005	-0.0006	-0.0003	-0.0003	-0.0001	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-8.74%
BW1	+0.0005	+0.0016	+0.0060	+0.0157	-0.0156	-0.0083	-0.0077	-0.0030	-0.0050	-0.0060	+0.0058	-0.0024	-0.0016	-6.66%
BW2	+0.0002	+0.0014	+0.0057	+0.0131	-0.0186	-0.0099	-0.0092	-0.0036	-0.0059	-0.0072	+0.0049	-0.0030	-0.0028	-7.27%
Wet Year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	-0.0001	-0.0000	-0.0001	-0.0005	-0.0005	-0.0003	-0.0003	-0.0001	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-0.20%
TL3	-0.0009	-0.0007	-0.0008	-0.0068	-0.0077	-0.0041	-0.0038	-0.0015	-0.0025	-0.0030	-0.0024	-0.0016	-0.0030	-1.24%
HB1	-0.0009	-0.0007	-0.0008	-0.0066	-0.0075	-0.0040	-0.0037	-0.0015	-0.0024	-0.0029	-0.0023	-0.0015	-0.0029	-7.77%
LC1	-0.0004	-0.0003	-0.0004	-0.0033	-0.0037	-0.0020	-0.0018	-0.0007	-0.0012	-0.0014	-0.0012	-0.0008	-0.0014	-8.74%
BW1	-0.0022	+0.0019	+0.0076	-0.0278	-0.0571	+0.0084	+0.0002	+0.0195	+0.0224	+0.0037	+0.0034	-0.0096	-0.0025	-1.74%
BW2	-0.0038	+0.0006	+0.0062	-0.0400	-0.0708	+0.0011	-0.0066	+0.0168	+0.0180	-0.0016	-0.0008	-0.0124	-0.0079	-3.39%

Note: The "—" symbol indicates where no adverse effects were predicted.

For the wet year scenario, only the following watersheds experienced adverse effects:

- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

The modelling indicated there would be no adverse effect on lake levels in either Thunder Lake or Wabigoon Lake during operations.

The predicted changes in surface water flows for the post-closure phase with the dry cover option for TSF closure are provided in Table 6.9.5-2. The modelling predicted adverse effects for the following four sub-watershed areas:

- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.

The predicted changes in surface water quantities for the post-closure phase and a wet cover closure option for the TSF are provided in Table 6.9.5-3. Adverse effects were predicted for the following six sub-watershed areas:

- **TL2**: Thunder Lake Tributary 3 downstream of Three Nursery Ponds;
- **TL3**: Thunder Lake Tributary 2 at Thunder Lake;
- **HB1**: Hoffstrom's Bay Tributary at Thunder Lake;
- **LC1**: Little Creek at Thunder Lake;
- **BW1**: Blackwater Creek; downstream of the Project site and effluent discharge location; and
- **BW2**: Blackwater Creek, upstream of Wabigoon Lake.The modelling indicated there would be no adverse effect on lake levels in either Thunder Lake or Wabigoon Lake during post-closure.

Table 6.8.5-2: Adverse Effects for Surface Water Quantity during Post-closure (dry TSF cover)

Scenario	Calculated Change in Flows, ΔQ (m^3/s)													Annual ΔQ (%)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Average Year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0005	-0.0004	-0.0004	-0.0036	-0.0040	-0.0022	-0.0020	-0.0008	-0.0013	-0.0016	-0.0012	-0.0008	-0.0016	-7.22%
LC1	-0.0002	-0.0002	-0.0002	-0.0016	-0.0019	-0.0010	-0.0009	-0.0004	-0.0006	-0.0007	-0.0006	-0.0004	-0.0007	-7.49%
BW1	+0.0054	+0.0044	+0.0049	+0.0302	+0.0234	+0.0051	+0.0027	-0.0045	+0.0054	+0.0109	+0.0118	+0.0084	+0.0090	+10.58%
BW2	+0.0054	+0.0044	+0.0049	+0.0302	+0.0234	+0.0051	+0.0027	-0.0045	+0.0054	+0.0109	+0.0118	+0.0084	+0.0090	+6.67%
Dry year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.01%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0001	-0.0001	-0.0001	-0.0010	-0.0011	-0.0006	-0.0006	-0.0002	-0.0004	-0.0004	-0.0003	-0.0002	-0.0004	-7.20%
LC1	-0.0001	-0.0000	-0.0001	-0.0005	-0.0005	-0.0003	-0.0003	-0.0001	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-7.49%
BW1	+0.0049	+0.0040	+0.0045	+0.0261	+0.0157	-0.0012	-0.0038	-0.0025	-0.0042	+0.0082	+0.0105	+0.0075	+0.0058	+24.29%
BW2	+0.0049	+0.0040	+0.0045	+0.0261	+0.0157	-0.0012	-0.0038	-0.0025	-0.0042	+0.0082	+0.0105	+0.0075	+0.0058	+15.32%
Wet Year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0008	-0.0006	-0.0007	-0.0061	-0.0069	-0.0037	-0.0034	-0.0013	-0.0022	-0.0027	-0.0021	-0.0014	-0.0027	-7.22%
LC1	-0.0004	-0.0003	-0.0003	-0.0028	-0.0032	-0.0017	-0.0016	-0.0006	-0.0010	-0.0012	-0.0010	-0.0007	-0.0012	-7.49%
BW1	+0.0078	+0.0062	+0.0070	+0.0487	+0.0472	+0.0201	+0.0171	+0.0030	+0.0139	+0.0198	+0.0182	+0.0126	+0.0185	+12.64%
BW2	+0.0078	+0.0062	+0.0070	+0.0487	+0.0472	+0.0201	+0.0172	+0.0030	+0.0139	+0.0198	+0.0182	+0.0126	+0.0185	+7.97%

Note: The "—" symbol indicates where no adverse effects were predicted.

6.9.5 Identified Mitigation

The Project will employ best practices that will assist in a reduction and mitigate surface water quantity effects, which are outlined below for each of the four Project phases.

- **Site Preparation and Construction Phase**:
  - o Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system. [Mit_008].
  - o Industry standard erosion and sediment controls will be implemented during the site preparations and construction phase. [Mit_054].
  - o Once the perimeter ditch has been completed, there would be no discharges to surface water during this phase. [Mit_055].
- **Operations Phase**:
  - o A perimeter ditch around the operations area will capture all runoff during the site preparation and construction phase. [Mit_008].
  - o The operations area will be minimized to the extent possible to reduce the amount of runoff directed from the Little Creek and Hoffstrom's Bay watersheds. [Mit_050].
  - o On-site storage facilities will allow for the effective management of water, reducing the need for discharges, especially during periods when conditions are not suitable. On-site storage facilities will allow for the effective management of water, reducing the amount for water taken from adjacent watercourses. [Mit_057].
  - o Excess water not required for processing will be treated and discharged to Blackwater Creek through an engineered structure designed to dissipate flows and avoid erosion. [Mit_058].
  - o Periodically, fresh water will be required to support Project operations. Fresh water withdrawals will be taken from two existing ponds on Thunder Lake Tributary 3 (referred to as the tree nursery ponds) and an existing pond on Thunder Lake Tributary 2. Fresh water takings from these ponds will not exceed 5% of the flow entering the ponds. [Mit_059].
- **Closure Phase**:
  - o A perimeter ditch around the operations area will capture all runoff during the closure phase. [Mit_008].
  - o There will be no surface water discharges during this phase, thus, no mitigation measures are proposed. [Mit_055].
- **Post-closure Phase**:
  - o During closure, the site will be graded such that runoff for the operations area will be directed to the open pit during closure and post-closure phases [Mit_056].
  - o Once the open pit has been filled, excess water from the open pit will be passively released through an engineered spillway into the existing channel of Blackwater Creek Tributary 1. [Mit_060].

Table 6.9.5-3: Adverse Effects for Surface Water Quantity during Post-closure (wet TSF cover)

Scenario	Calculated Change in Flows, ΔQ (m^3/s)													Annual ΔQ (%)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Average Year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0005	-0.0004	-0.0004	-0.0036	-0.0040	-0.0022	-0.0020	-0.0008	-0.0013	-0.0016	-0.0012	-0.0008	-0.0016	-7.22%
LC1	-0.0002	-0.0002	-0.0002	-0.0016	-0.0019	-0.0010	-0.0009	-0.0004	-0.0006	-0.0007	-0.0006	-0.0004	-0.0007	-7.49%
BW1	+0.0034	+0.0029	+0.0032	+0.0335	+0.0172	-0.0039	-0.0057	-0.0078	+0.0000	+0.0043	+0.0066	+0.0049	+0.0048	+5.69%
BW2	+0.0034	+0.0029	+0.0032	+0.0335	+0.0172	-0.0039	-0.0057	-0.0078	+0.0000	+0.0043	+0.0066	+0.0049	+0.0048	+3.59%
Dry year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.01%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0001	-0.0001	-0.0001	-0.0010	-0.0011	-0.0006	-0.0006	-0.0002	-0.0004	-0.0004	-0.0003	-0.0002	-0.0004	-7.20%
LC1	-0.0001	-0.0000	-0.0001	-0.0005	-0.0005	-0.0003	-0.0003	-0.0001	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-7.49%
BW1	+0.0067	+0.0053	+0.0060	+0.0369	+0.0075	-0.0056	-0.0063	-0.0025	-0.0041	-0.0008	+0.0079	+0.0058	+0.0047	+19.61%
BW2	+0.0067	+0.0053	+0.0060	+0.0369	+0.0075	-0.0056	-0.0063	-0.0025	-0.0041	-0.0008	+0.0080	+0.0058	+0.0047	+12.37%
Wet Year														
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
TL3	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.0000	+0.00%
HB1	-0.0008	-0.0006	-0.0007	-0.0061	-0.0069	-0.0037	-0.0034	-0.0013	-0.0022	-0.0027	-0.0021	-0.0014	-0.0027	-7.22%
LC1	-0.0004	-0.0003	-0.0003	-0.0028	-0.0032	-0.0017	-0.0016	-0.0006	-0.0010	-0.0012	-0.0010	-0.0007	-0.0012	-7.49%
BW1	+0.0095	+0.0074	+0.0085	+0.0597	+0.0447	+0.0074	+0.0024	-0.0029	+0.0042	+0.0158	+0.0225	+0.0155	+0.0162	+11.08%
BW2	+0.0095	+0.0074	+0.0085	+0.0597	+0.0447	+0.0075	+0.0024	-0.0029	+0.0042	+0.0158	+0.0225	+0.0155	+0.0162	+6.99%

Note: The "—" symbol indicates where no adverse effects were predicted.

6.9.6 Residual Adverse Effects

Even with the mitigation measures summarized in Section 6.9.5, residual adverse effects are predicted for surface water quantity during the operations and post-closure phases. The predicted adverse effects to surface water during the operations phase are presented in Tables 6.9.6-1. The two following closure options were considered in the EIS for the TSF:

- **Dry cover**: With the dry cover option, the supernatant water present in the TSF would be withdrawn at the end of operations, treated, and used to help fill the open pit. The tailings would be covered with a granular layer to physically isolate the tailings. The tailings would then be capped with a low permeability cover to help chemically isolate the tailings. A layer of overburden would be placed over the low permeability cover and revegetated.
- **Wet cover**: With the wet cover option, the supernatant water present in the TSF would be withdrawn at the end of operations, treated, and used to help fill the open pit. The tailings would be covered with a granular layer to physically isolate the tailings. The tailings would then be covered with a layer of non-process water to chemically isolate the tailings and prevent acid rock drainage (ARD). A review of description of ponds within the operations area (Section 3.8.11) shows that the collection and minewater pond have a combined capacity of 320,000 m³, which is a sufficient volume of non-process water to maintain a water cover over the TSF (Appendix JJ), even during an extreme dry year.

As described in Section 6.3.6 (geology and geochemistry), the wet cover option for the closure of the TSF results in seepage and pit lake quality that generally have slightly lower concentrations of the indicator compounds that the dry cover TSF closure option. For this reason, the wet cover closure option was selected as the preferred option, and the residual adverse effects during operations and post-closure with that option presented in Tables 6.9.6-1 and 6.9.6-1, respectively.

6.9.7 Information to Address Round 1 Information Requests

The following questions regarding the predicted effects on surface water quantity were received as part of the Round information requests:

- TMI_27-AA(1)-08: water requirements and sources;
- TMI_72-GW(1)-09: drainage and catchment areas;
- TMI_85-GW(1)-22: analyze effects to the surface water regime;
- TMI_102-SW(1)-16: flows in Blackwater Creek;
- TMI_113-SW(1)-27: runoff coefficients;
- TMI_114-SW(1)-28: infiltration loss calculation;
- TMI_115-SW(1)-29: sensitivity of prediction to different condition;
- TMI_117-SW(1)-31: predicted flow rates through Project life;

Table 6.9.6-1: Residual Adverse Effects for Surface Water Quantity during Operations

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	-4.92%	-4.99%	-4.90%	-0.05%	—	—	—	—	—	—	—	-4.91%	-0.55%
TL2	-5.11%	-5.19%	-5.10%	-0.24%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-5.11%	-0.75%
TL3	-5.53%	-5.59%	-5.51%	-1.28%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-5.52%	-1.73%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	+6.59%	+22.71%	+39.65%	-4.08%	-20.43%	-9.91%	-11.08%	+9.29%	+18.16%	+3.69%	+8.27%	-6.07%	-3.90%
BW2	+1.09%	+11.25%	+21.93%	-5.65%	-15.96%	-9.32%	-10.06%	+2.78%	+8.38%	-0.74%	+2.14%	-6.90%	-5.53%
Dry year													
TL1	-4.99%	-4.93%	-5.06%	-5.00%	-5.00%	-5.01%	-5.01%	-4.98%	-5.00%	-4.99%	-5.02%	-4.98%	-5.00%
TL2	-5.19%	-5.13%	-5.26%	-5.20%	-5.20%	-5.21%	-5.20%	-5.18%	-5.20%	-5.19%	-5.21%	-5.18%	-5.20%
TL3	-5.59%	-5.54%	-5.66%	-5.60%	-5.60%	-5.61%	-5.61%	-5.59%	-5.60%	-5.59%	-5.62%	-5.58%	-5.60%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	+7.45%	+29.96%	+94.79%	+28.87%	-25.30%	-25.30%	-25.30%	-25.30%	-25.30%	-25.30%	+30.65%	-18.80%	-6.66%
BW2	+1.63%	+15.82%	+56.70%	+15.14%	-19.02%	-19.02%	-19.02%	-19.02%	-19.02%	-19.02%	+16.26%	-14.93%	-7.27%
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%	-0.20%
TL3	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%	-1.24%
HB1	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%	-7.77%
LC1	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%	-8.74%
BW1	-4.92%	+5.59%	+19.52%	-8.34%	-15.10%	+4.18%	+0.13%	+26.49%	+18.55%	+2.57%	+2.93%	-12.40%	-1.74%
BW2	-5.40%	+1.23%	+10.01%	-7.55%	-11.82%	+0.34%	-2.21%	+14.41%	+9.40%	-0.68%	-0.45%	-10.11%	-3.39%

Note: The “—” symbol indicates where no residual adverse effects were predicted.

Table 6.9.6-2: Residual Adverse Effects for Surface Water Quantity during Post-closure

Scenario	Calculated Change in Flows, ΔQ (%)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.01%	+0.01%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
TL3	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
HB1	-7.20%	-7.20%	-7.20%	-7.22%	-7.22%	-7.22%	-7.22%	-7.21%	-7.21%	-7.22%	-7.21%	-7.21%	-7.22%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+13.11%	+15.00%	+13.88%	+17.29%	+7.81%	-3.36%	-5.27%	-18.31%	+0.01%	+5.07%	+9.74%	+10.79%	+5.69%
BW2	+8.27%	+9.46%	+8.75%	+10.90%	+4.93%	-2.12%	-3.32%	-11.54%	+0.01%	+3.20%	+6.15%	+6.81%	+3.59%
Dry year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.02%	+0.03%	+0.03%	+0.00%	+0.00%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%	+0.01%
TL3	+0.01%	+0.01%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.01%	+0.00%	+0.00%	+0.00%	+0.01%	+0.00%
HB1	-7.16%	-7.14%	-7.15%	-7.21%	-7.21%	-7.21%	-7.21%	-7.18%	-7.20%	-7.20%	-7.20%	-7.18%	-7.20%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+91.69%	+98.31%	+94.38%	+67.76%	+12.10%	-16.92%	-20.76%	-20.76%	-20.76%	-3.53%	+41.86%	+45.60%	+19.61%
BW2	+57.82%	+62.00%	+59.52%	+42.73%	+7.63%	-10.67%	-13.09%	-13.09%	-13.09%	-2.23%	+26.40%	+28.76%	+12.37%
Wet Year													
TL1	—	—	—	—	—	—	—	—	—	—	—	—	—
TL2	+0.00%	+0.01%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
TL3	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%	+0.00%
HB1	-7.21%	-7.21%	-7.21%	-7.22%	-7.22%	-7.22%	-7.22%	-7.21%	-7.22%	-7.22%	-7.22%	-7.21%	-7.22%
LC1	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%	-7.49%
BW1	+21.27%	+22.35%	+21.71%	+17.89%	+11.82%	+3.69%	+1.26%	-3.98%	+3.51%	+10.82%	+19.35%	+19.95%	+11.08%
BW2	+13.41%	+14.10%	+13.69%	+11.28%	+7.46%	+2.33%	+0.80%	-2.51%	+2.21%	+6.83%	+12.20%	+12.58%	+6.99%

Note: The "—" symbol indicates where no residual adverse effects were predicted.

- TMI_118-SW(1)-32: water balance and effects;
- TMI_119-SW(1)-33: evaporation inputs to model;
- TMI_138-FH(1)-17: water taking rates and locations;
- TMI_344-AC(1)-18: water use at Project;
- TMI_383-AC(1)-57: water use over Project life;
- TMI_559-AC(1)-233: lake levels; and
- TMI_704-PC(1)-19: effects to Thunder Lake.

6.10 Groundwater Quality

6.10.1 Potential Effects of the Project on the Environment

Section 6.1.3.9 introduces the "groundwater quality" VC that will be used for evaluating the effects of the Project. Rock excavated as part of the mining and processing at the Project has the potential to undergo chemical reactions when exposed to the environment. As described in Section 6.3, much of the rock targeted for mining has exhibited potential acid generating (PAG) characteristics that could result in acid rock drainage (ARD) and associated metals leaching (ML). As a result, there is a potential that seepage from onsite facilities such as the waste rock storage area (WRSA) and tailings storage facility (TSF) to have seepage that could affect groundwater quality should it leave the site. The potential effects of the Project on the "groundwater quantity" for the various Project phase are as follows:

- **Site Preparation and Construction Phase**: As described in the Section 3, a perimeter ditch and seepage collection system will be constructed around the operations area during the early stages of the site preparation and construction activities. There will be no mining activities occurring during this phase of the Project so no potential effects on groundwater quality are identified.
- **Operations Phase**: Prior to the start of mining the open pit, active dewatering of the open pit and underground workings will provide a safe and dry working environment. These dewatering activities will result in a lowering of the water table around the mine, creating a drawdown zone. Within the drawdown zone, groundwater will flow inwards towards the open pit. The dewatering activities will continue throughout the operations phase, as mining advances from the open pit to the underground mine. The open pit will remain free of water, and act as a sink for groundwater flow until mining activities cease and the dewatering is stopped.

  During operations, waste rock excavated from the open pit will be excavated and stored in the WRSA. As mining advances, waste rock will be stored in the mined out areas of the open pit to minimize the footprint of the WRSA. Waste from the ore processing will be treated to remove cyanide and will be discharged to the TSF sub-aqueously. The TSF will have a permanent water cover throughout the operations period. The materials in both the

WRSA and TSF will likely contain PAG materials, and can produce seepage that would be affected by ARD/ML. The TSF will be equipped with a perimeter ditch and seepage collection system [Mit_051] to capture the majority of the seepage. A perimeter ditch and seepage collection system will also be constructed around the operations area [Mit_008]. The runoff and seepage collected will be incorporated into the water management system. Seepage from the WRSA and TSF that escapes the seepage collection systems will be captured within the drawdown zone, and will ultimately report to the open pit [Mit_052] where it will be incorporated into the water management system.

- **Closure Phase**: Following the end of mining activities, the process water covering the TSF will be withdrawn, treated and used to help fill the open pit. The tailings will be physically isolated with a granular cover and then chemically isolated using either a dry, low-permeability cover or a wet cover using non-process water. The WRSA will be covered with a dry, low-permeability cover to reduce the potential for acidification. The waste rock placed within the open pit will remain exposed until covered with water as the open pit is allowed to flood. The PAG materials present will continue to contribute to seepage, although the rate of ARD/ML will be reduced as a result of the closure activities.

  At the end of mining operations, the dewatering activities will cease and the open pit and underground mine will be allowed to fill with water. Although the dewatering activities will cease following the end of mining, the drawdown zone created during operations will remain until the post-closure phase. Groundwater and seepage within the drawdown zone will continue to be directed to the open pit.

- **Post-closure Phase:** Once the pit is flooded, groundwater levels will return to near pre-development conditions. At that point, a portion of the seepage from the TSF and WRSA will escape from the site, and potentially affect the quality of groundwater in wells at adjacent properties.

The potential effects of the Project on groundwater quality have been described using a simple linkage diagram on Figure 6.10.1-1. The figure illustrates the groundwater quality VC (shown in blue on the figure) and how it can be potentially affected during each phase of the Project life. The figure also indicates the other components of the environment (shown in red on the figure) that can be affected by the groundwater quality VC. For example, the surface water quality predictions will rely on information regarding the groundwater quality during the post-closure phase. The groundwater quality VC relies on the predicted effects for geochemistry.

6.10.2 Effects Prediction Methods

Groundwater quality effects were based on information generated as part of the geochemical and groundwater quantity assessments described in Sections 6.3 and 6.11, respectively.

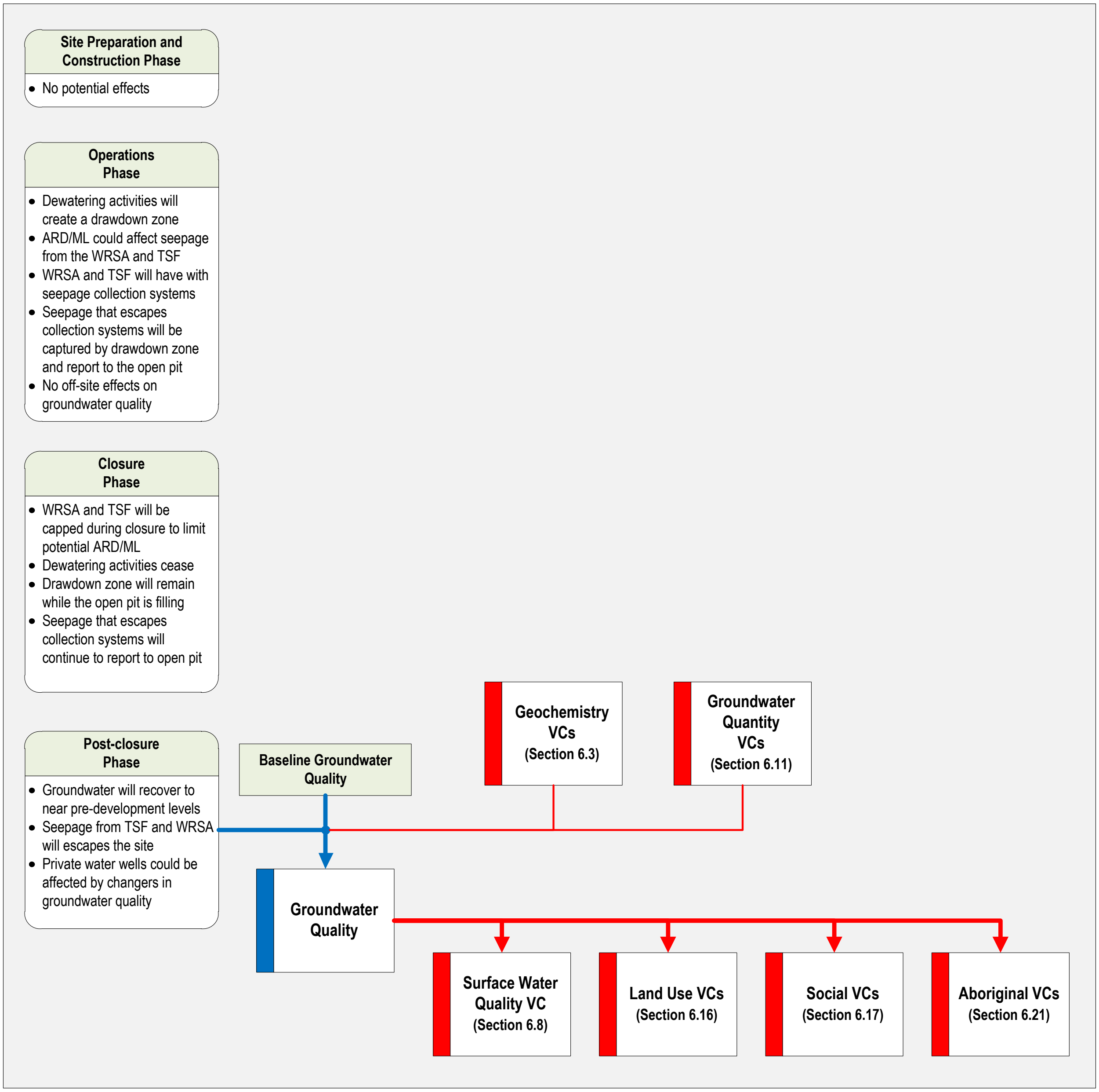


Figure 6.10.1-1: Groundwater Quality Linkage Diagram

6.10.3 Project Effects Avoidance Measures Used in Predictions

The following measures incorporated into the Project to avoid of minimize the effects of the Project on groundwater quality have been considered in the modelling:

- Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system. [Mit_008].
- The geochemical properties of the waste rock will be evaluated and non-acid generating (NAG) waste rock will be segregated from potentially acid generating (PAG) waste rock, if feasible [Mit_019].
- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020].
- At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022].
- During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification [Mit_021].
- At closure the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water [Mit_023].
- Dewatering of the open pit and underground mine workings will provide dry working conditions and safe working environment. These dewatering activities will lower the groundwater table around the perimeter of the open pit and mine workings, creating what is referred to as a drawdown zone. Within this drawdown zone, groundwater will migrate towards the open pit. Therefore, seepage that escapes the seepage collection systems will be captured within the drawdown zone caused by dewatering and ultimately report to the open pit (operations phase) [Mit_052].
- The floor of the tailings storage facility (TSF) will be a low-permeability layer capable of achieving seepage rates that ensures receiving surface water quality are equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HPDE liner laid over a prepared basin of sand or comparable material [Mit_062].
- The TSF will be equipped with a perimeter seepage collection system [Mit_051].

6.10.4 Predicted Effects

6.10.4.1 Site Preparation and Construction Phase

During the site preparation and construction phase, the emphasis of the Project is on clearing and preparing the site for the mining activities during operations. One of these activities will be the removal of the overburden from the open pit and subsequent placement in the overburden storage piles for use in the reclamation of the site during closure. The clearing of the overburden would require limited dewatering of the surficial layer that would only have a localized effect on the shallow groundwater. These effects are not expected to extend beyond the mine footprint. There will be no material during the site preparation and construction phase that could result in seepage. Therefore, there will be no effects on groundwater quality during the site preparation and construction phase.

6.10.4.2 Operations Phase

Some of the waste rock and the tailings associated with the Project have been identified as being potentially acid generating (PAG). As a result, the materials within the waste rock storage area (WRSA) and tailings storage facility (TSF) have the potential to experience acid rock drainage and metals leaching (ARD/ML) over time that could produce seepage with elevated levels of metals. This seepage, if transported off-site could affect the quality of groundwater reaching nearby private wells. Additionally, if the seepage reaches surface watercourses, the seepage could affect the quality of surface water in the receiving environment.

Seepage from the on-site structures (e.g., WRSA and TSF) will be managed by a series of perimeter seepage collection systems. These seepage collection systems will capture the majority of the seepage, which will be collected and incorporated into the water management system. However, no system can be relied on to capture 100% of the seepage. The seepage that escapes the seepage collections systems during the operations phase will be captured by the drawdown zone created by the dewatering of the open pit and underground mine. This seepage will be directed towards the open pit where it will be collected and incorporated into the water management system. There will be no seepage from the on-site structures during the operations phase that will leave the site. Therefore there will be no effects on groundwater quality.

6.10.4.3 Closure Phase

At the end of mining operations, the dewatering activities will cease and the open pit and underground mine will be allowed to start filling with water. Although the dewatering will no longer be occurring during the closure phase, the drawdown of the groundwater during operations will take decades to fully recover to near pre-development conditions. As a result, the seepage from the on-site structures (i.e., WRSA and TSF) that escape the seepage collection systems will continue to be captured by the drawdown zone created by the dewatering during operations, and will be directed towards the open pit. There will be no seepage from the on-site structures during the closure phase that will leave the site. Therefore there will be no effects on groundwater quality.

6.10.4.4 Post-closure Phase

Over time, the groundwater levels drawn down during operations will recover to near pre-development levels. It is expected to take decades following the end of dewatering for the levels to fully recover. The groundwater modelling completed to support the Project (Appendix M) indicates that groundwater inflow to the open pit will continue to occur, even after the open pit is completely flooded. Therefore, the open pit will not be a source of seepage following the closure of the Project.

Once the open pit is flooded and the groundwater levels return to near pre-development conditions, seepage from the on-site structures (i.e., WRSA and TSF) that escapes the seepage collection systems will leave the site. However, only a small volume of seepage from the onsite structures will escape the site to interact with groundwater (Table 6.10.4.4-1). The seepage from the WRSA and TSF (Table 6.10.4.4-2) has generally higher concentrations of the indicator compounds than are found in the existing groundwater. Therefore, the seepage from the WRSA and TSF could eventually have an effect on the quality of groundwater in the area. The groundwater modelling indicates that the seepage from the TSF will eventually reach Thunder Lake (travel times from the WRSA to Thunder Lake were estimated in the order of fifteen years; Appendix M-3 it is assumed travel times form the TSF would be similar), potentially affecting the quality of the groundwater for the private wells along the shore of Thunder Lake. However, the seepage from the WRSA will be diluted by between a factor of 5 and 25 (Appendix M-3), meaning the effects of seepage may not be noticeable. The effects of seepage from the WRSA and TSF on surface waterbodies, including Thunder Lake, have been described in surface water quality section (Section 6.8.4).

Table 6.10.4.4-1: Estimated Seepage Quantities during Post-Closure

Waterbody Receiver	Volume of Discharge (m^3/day)		
	Capped WRSA (1)	Capped TSF (2) (dry cover)	Uncapped TSF (2) (wet cover)
Thunder Lake	10	0.1	0.1
Thunder Lake Tributary 3	—	0.1	0.1
Hoffstrom's Bay Tributary	—	0.1	0.1
Blackwater Creek	—	0.8	0.8
Open Pit	20	1.6	1.6
Total Seepage	**30**	**2.7**	**2.7**

Notes:
(1) Seepage quantity for capped WRSA from Figure 25 of Appendix M-1.
(2) Seepage quantities for the wet and dry cover TSF are based on the design of the HDPE liner, as described in Appendix M-2. The distributed from Figures 24 and 22 of Appendix M-1. Although the HDPE liner is only expected to allow 2.4 m^3/d of seepage to leave the TSF, a nominal amount of seepage was conservatively included to capture the potential effects to Thunder Lake, Thunder Lake Tributary 3 and Hoffstrom's Bay Tributary.

6.10.4.5 Predicted Adverse Effects

As described in Section 6.1.3.9, the effects of the Project on groundwater quality were evaluated using a single VC, namely groundwater quality. There were no adverse effects of the Project on groundwater quality predicted during the site preparation and construction phase.

Some of the waste rock and the tailings have been identified as potentially acid generating (PAG), and are likely to experience acid rock drainage and metals leaching (ARD/ML) over time if exposed to oxygen and moisture. As a result, the materials within the waste rock storage area (WRSA) and tailings storage facility (TSF) have the potential to produce seepage with elevated levels of metals. During the operations and closure phases, this seepage will be captured by either the perimeter seepage collection systems around each structure, or by the drawdown zone created by the dewatering of the open pit and underground mine. As no seepage from the on-site structures will leave the site, there will be no adverse effects on groundwater quality during the operations and closure phases.

Once the open pit is flooded and the groundwater levels return to near pre-development conditions during the post-closure phase, seepage from the on-site structures (i.e., WRSA and TSF) that escapes the seepage collection systems will leave the site. The groundwater quantity modelling (Appendix M-1) indicated that the seepage leaving the site will eventually report to nearby watercourses; however, seepage towards Thunder Lake could affect the quality of the groundwater in private wells along the eastern shore of Thunder Lake. Based on the small volumes of seepage, and modelled groundwater recharge rates (Appendix M-1) the seepage from the Project will be diluted by between a factor of 5 and 25 (Appendix M-3) by the time it reaches these wells. As a result, the effects of seepage on the groundwater quality in the private wells along the eastern shore of Thunder Lake may not be noticeable.

6.10.5 Identified Mitigation

The following measures have been incorporated into the Project to avoid or minimize the effects of the Project on groundwater quality have been considered in the modelling:

- A perimeter runoff and seepage collection ditch will be progressively constructed around what is referred to as the operations area. [Mit_008].
- The geochemical properties of the waste rock will be evaluated and non-acid generating (NAG) waste rock will be segregated from potentially acid generating (PAG) waste rock, if feasible. [Mit_019].
- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the waste rock storage area (WRSA). [Mit_020].

- At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification. [Mit_022].
- The floor of the tailings storage facility (TSF) will be a low-permeability layer capable of achieving seepage rates that ensures receiving surface water quality are equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HPDE liner laid over a prepared basin of sand or comparable material. [Mit_062].
- The TSF will be equipped with a perimeter seepage collection system. [Mit_051].
- During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification. [Mit_021].
- At closure, the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. [Mit_023].
- Dewatering of the open pit and underground mine workings will provide dry working conditions and a safe working environment. These dewatering activities will lower the groundwater table around the perimeter of the open pit and mine workings, creating what is referred to as a drawdown zone. Within this drawdown zone, groundwater will migrate towards the open pit. Therefore, seepage that escapes the seepage collection systems will be captured within the drawdown zone caused by dewatering and ultimately report to the open pit (operations and closure phases). [Mit_052].
- The use of a wet cover as a closure option over the TSF is the preferred option. A wet cover prevents acidification of the tailings, which improves the quality of seepage in the long-term. The mitigation also benefits the quality of surface water in the receiving environment. [Mit_023].
- As part of the EIS follow-up program (Section 13.10), a network of groundwater monitoring wells will be established that will be able to provide an early indication of changes in groundwater quality as a result of the Project well before the seepage from the onsite facilities (i.e., WRSA and TSF) reach any of the private groundwater wells along the eastern shoreline of Thunder Lake. In the event that the follow-up program identified significant degradation of groundwater quality, this may trigger investigations, comprising:
  - Recalibration of the groundwater model and update of predictions incorporating any changes to the mine plan. With the respect to groundwater quality this may include an assessment of post-closure conditions when the open pit no longer acts to capture groundwater.
  - Installation of new monitoring wells and/or increase of frequency of monitoring.
  - Other investigations.

If the investigation determines a mine-related cause, mitigation measures to be completed, may include the following:

- o Suitable replacement of private water supply until groundwater level recovery has occurred on completion of mining depending on location and requirements (e.g., deepening of existing water wells, drilling of new water wells, installation of cistern and supply of potable water).
- o Containment measures if significant post closure adverse groundwater quality is predicted.

6.10.6 Residual Adverse Effects

As described in Section 6.10.5, no residual adverse effects to groundwater quality during the site preparation and construction, the operations, or the closure phases of the Project. During the site preparation and construction phase, there will be no seepage generated from the Project. During operations and closure, the seepage generated from the waste rock storage area (WRSA) and tailings storage facility (TSF) will be captured by the perimeter seepage collections systems or will be captured within the drawdown zone created by the dewatering of the open pit and underground mine during operations.

As set out in Section 6.10.4.5, there may be changes in groundwater quality during the post-closure phase at nearby drinking wells; however, the changes are not expected to be noticeable given the levels of dilution that seepage from the WRSA will experience. Should the follow-up program identify significant degradation in the quality of groundwater (Section 6.10.5), mitigation measures would be implemented to provide a suitable replacement of private water supplies affected. Therefore, no residual adverse effects to groundwater quality would remain.

6.10.7 Information to Address Round 1 Information Requests

The following questions were asked as part of the Round 1 Information Requests regarding the predicted effects of the Project on groundwater quality:

- TMI_70-GW(1)-07: effects of seepage on groundwater
- TMI_345-AC(1)-19: effects on groundwater
- TMI_512-AC(1)-186: groundwater quality
- TMI_617-AC(1)-290: protection of groundwater
- TMI_629-AC(1)-302: risks for underground water contamination
- TMI_632-AC(1)-305: effects of seepage on wells
- TMI_703-PC(1)-18: effects of seepage on wells
- TMI_718-PC(1)-33: effects on quality of water in private wells

- TMI_767-PC(1)-82: effects on private wells on East Thunder Lake Road

6.11 Groundwater Quantity

6.11.1 Potential Effects of the Project on the Environment

Section 6.1.3.10 introduces the "groundwater quantity" VC that will be used for evaluating the effects of the Project. As part of the operations of the Project, both the open pit mine and underground workings will need to be dewatered in order to provide a safe and dry working environment. As a result of these activities, the water table will be lowered, resulting in potential effects on groundwater quantities. The potential effects of the Project on the "groundwater quantity" for the various Project phase are as follows:

- **Site Preparation and Construction Phase**: As part of the site preparation and construction activities, overburden will be stripped from the area of the open pit mine to prepare for the start of mining operations. As part of this process, water present in the overburden will be collected and stored on site for use in initiating the tailings storage facility and for use in the processing plant once operations begin. The dewatering of the overburden will have a localized effect within the footprint of the open pit.
- **Operations Phase**: As the mining of the open pit starts, the water table will need to be lowered in order to provide a safe working environment. These dewatering activities will result in a lowering of the water table around the mine, creating a drawdown zone. Within the drawdown zone, groundwater will flow inwards towards the open pit. The dewatering activities will continue throughout the operations phase, as mining shifts from the open pit to the underground mine. The open pit will remain free of water, and act as a sink for groundwater flow until mining activities cease and the dewatering is stopped.
- **Closure Phase**: At closure, the dewatering activities will cease and the open pit and underground mine will be allowed to start refilling with water. The drawdown zone created by the dewatering will remain after dewatering activities stop, and throughout the closure phase as the open pit is filling with water.
- **Post-closure Phase**: Once the open pit is fully flooded, the groundwater will gradually return to near the pre-development conditions. However, groundwater will continue to flow into the open pit, even after it has filled with water. It will take tens of years following the flooding of the open pit for the groundwater quantities to return to the levels prior to the development of the Project.

The potential effects of the Project on groundwater quantity have been described using a simple linkage diagram on Figure 6.11.1-1. The figure illustrates the groundwater quantity VC (shown in blue on the figure) and how it can be potentially affected during each phase of the Project life. The figure also indicates the other components of the environment (shown in red on the figure) that can be affected by the groundwater quantity VC. For example, the surface water quality predictions will rely on information regarding the groundwater quantities. The groundwater quantity VC does not rely on information from other VCs.

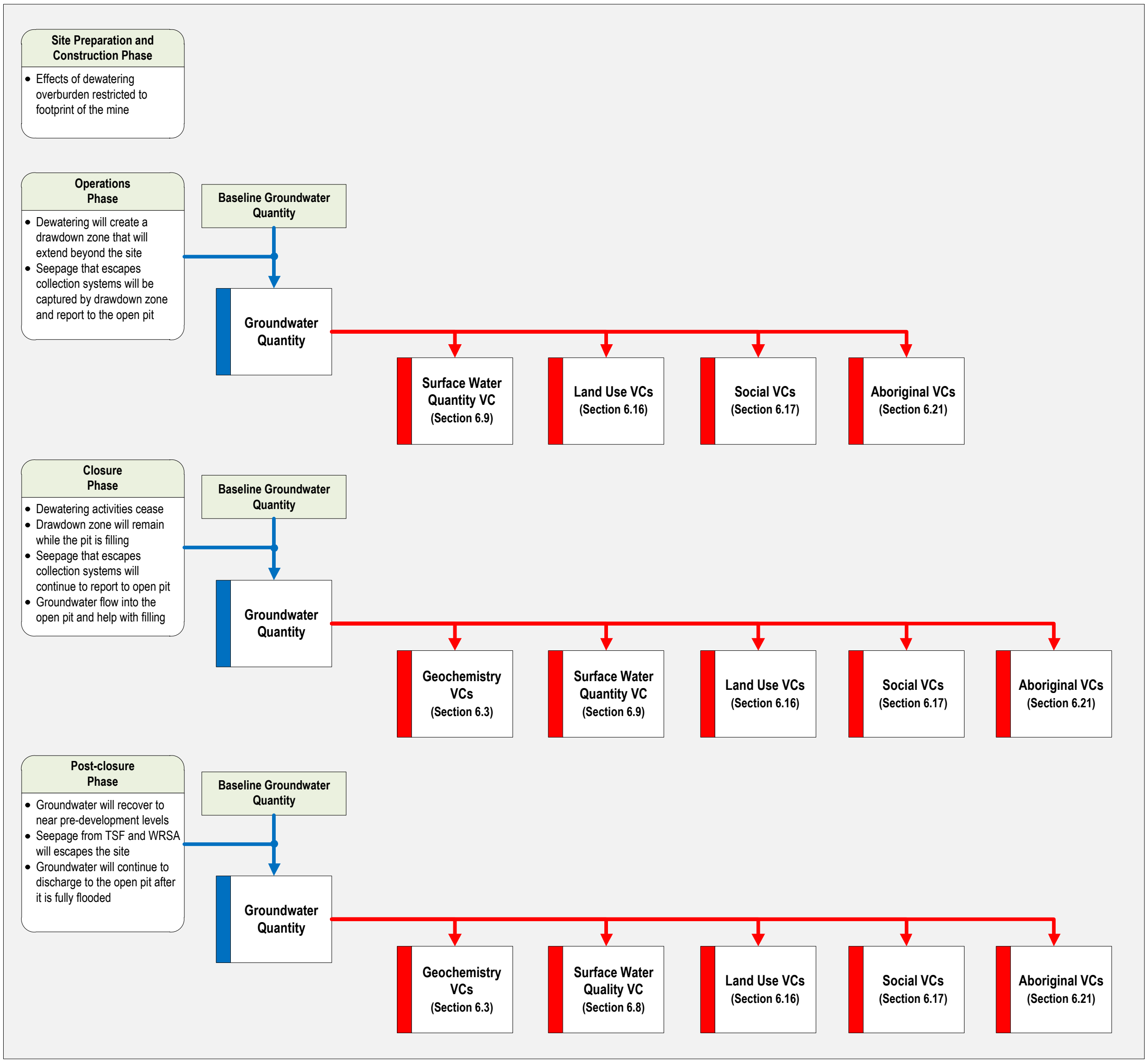


Figure 6.11.1-1: Groundwater Quantity Linkage Diagram

6.11.2 Effects Prediction Methods

6.11.2.1 Conceptual Understanding of Hydrogeological Conditions

The hydrogeology of the proposed Project site has been based on the overburden and rock characteristics and the data obtained from a hydrogeological investigation undertaken primarily during the period from 2012 to 2013. Details of the groundwater modelling is provided in the hydrogeological appendix (Appendix M-1) to the revised EIS.

Physiographic Setting

As described in Appendix M-1, the Project is located within the Wabigoon Basin. The Upper English Basin Watershed lies immediately to the northeast of the project area. The area is characterised by gently undulating topography with elevations generally between 370 and 430 metres above sea level (masl). Topography has been strongly influenced by glaciation, which on higher ground has left bedrock exposed, and in lower lying areas has thicker sedimentary deposits primarily of glacial origin. The overburden thickness is generally thin (<10 m) and mostly of glaciolacustine. In the north-eastern part of the study area, a regionally mapped end-moraine, known at the Hartman Moraine, occurs. There are no large creeks in the vicinity of the Project.

The area of the Project site is drained primarily by Blackwater Creek and its tributaries, which drains into Wabigoon Lake. Wabigoon Lake is the most prominent waterbody in the area and has elevations regulated between elevations of 368.5 and 369.2 masl (MNRF 2013). The Project area is also drained by the following four watercourses that drain into Thunder Lake:

- Thunder Lake Tributary 2;
- Thunder Lake Tributary 3;
- Hoffstrom's Bay Tributary; and
- Little Creek.

Overburden and Shallow Bedrock Geology

The surficial deposits of the study area are predominantly glacial in origin, with the area have undergone a number of glaciations. The deposits are considered to be mainly associated with the last period of glaciation (Minning et al. 1994). The surficial deposits are broadly subdivided into two the following main deposit types:

- In the north east, surficial deposits are predominantly sandy and coarser grained deposits including boulders of the Hartman Moraine; a major regionally mapped end moraine trending north-west to south-east and marked by a ridge at an elevation of 430 to 450 masl. The north-eastern extent of the watersheds of Blackwater Creek is formed by the Hartman Moraine;
- In the south-west, surficial deposits are predominantly clay and silt deposited in pro-glacial Lake Agassiz (Minning et al. 1994). Progressively finer sediments would be expected in the deeper parts of the Wabigoon Basin towards the south-west.

The characterization of the overburden geology in the study area is the mapping by the Ontario Geologic Service, or OGS (Roed 1980), and by the geologic Service of Canada, or GSC (Cowan and Sharpe 1991). Since the publication of both the Cowan and Sharpe (1991) and the Roed (1980) surficial geology maps, the following additional data has become available, or been collected by Treasury Metals:

- The water well records from wells drilled after publication of these maps (note these have occurred around Thunder Lake and Wabigoon are not a significant addition to areas immediately around the proposed Goliath open pit).
- The Beakhouse and Pigeon (2003) map, which has delineated locations of bedrock outcrops (Figure 4 of Appendix M-1), and has provided some localized comments on sediments at surface.
- Bedrock outcrop mapping under taken by Treasury Metals in the immediate vicinity of the proposed Goliath open pit (Figure 4 of Appendix A to Appendix M-1). This information is taken to be more accurate than the outcrop location data from Beakhouse and Pigeon (2003) and is used in preference where mapped as indicated on Figure 4 of Appendix M-1 to the EIS.
- The overburden thickness from the exploration boreholes, whose locations are clustered around the east – west trending zone of mineralization that runs through the proposed Goliath open pit.
- Nine groundwater quality wells drilled by Treasury Metals in May 2013 (Appendix A of Appendix M-1 for borehole logs).
- Twenty geotechnical boreholes drilled by Treasury Metals in March 2014 (Appendix B of Appendix M-1 for borehole logs).

A combination of the above information was used to create the 3D delineation of superficial deposits used in the groundwater model (Figure 4 in Appendix M-1). As both the Cowan and Sharpe (1991) and Roed (1980) maps are 1:100,000 scale maps, neither provide detailed information on the surficial geology in the area of interest around the proposed open pit. It is noteworthy that around the proposed Goliath open pit and immediately to the west and north, the Cowan and Sharpe (1991) map is discordant with the detailed site-specific data as discussed in Section 3.1.1 of Appendix M to the revised EIS. Overall, the Roed (1980) map is more consistent with the site specific geologic data. The Roed (1980) map was used in preference to the Cowan and Sharpe (1991) to provide supplemental information as it is known to be more accurate in the vicinity of the proposed Goliath open pit. Ultimately, this led to the identification of a larger extent of clay cover around the proposed open pit that was considered to present a conservative assessment of effects for the following reasons:

- It leads to a greater predicted drawdown zone (inflows are controlled by the transmissivity at the open pit); and
- Overall groundwater flow rates are predicted to be lower, which limits the dilution potential of any contaminants entering the groundwater.

From a hydrogeological perspective, the surficial deposits can be subdivided into the following five units:

- Clay: Fine-grained glaciolacustrine deposits of dominantly clay composition (clay, silty clay, layered clay and silt) are located around the Project site and dominate the southern part of the Project area. This unit is an aquitard providing little or no flow to creeks rising on it. The effectiveness of this aquitard is expected increase towards the south-west where the Wabigoon basin deepens.
- Basal Sand: This is a relatively thin discontinuous sand layer at the base of the clay that is on average 3 to 4 m thick, when present. This is a minor aquifer that has limited groundwater flow with a hydraulic conductivity around 1×10-6 m/s.
- Bedrock knolls: These represent areas where the bedrock is exposed or covered with a very thin sand layer.
- Sand-Clay/Silt-Sand: These are units with generally silty sand, overlying a largely continuous clay/silt, overlying the basal sand. These units occur in the north-western part of the Blackwater Creek Watershed (top of Blackwater Creek Tributary 2). The upper sand provides some baseflow to Blackwater Creek and is expected to have a similar hydraulic conductivity as the basal sand.
- Sand and Gravel: These coarser glacial deposits are located mainly on the northern to north-eastern edge of the Project. These are the only reasonable aquifer present within the vicinity of the Project, and are providing baseflow to Thunder Lake Tributary 2 and Thunder Lake Tributary 3.

Overall, it appears that groundwater levels are relatively close to surface and approximately follow topography. Groundwater flow from the Project site follows the surface drainage with flow both to the west towards Thunder Lake and to the south towards Wabigoon Lake. The information further suggests that the groundwater regime has limited groundwater flow that groundwater provides minimal baseflow to creeks in the immediate vicinity of the Project site, and for much of the Project area. The creeks in the area of the proposed Project are runoff dominated. Groundwater baseflow represents a small proportion of the total flow in the surface watercourses near the Project.

6.11.2.2 Prediction Method for Groundwater Flow

A numerical three-dimensional steady-state groundwater flow model was developed, based on surficial and bedrock geology and used to predict the potential effects of the Project on groundwater quantity. The modelling is based on the Modular Finite-Difference Groundwater Flow Model (MODFLOW) platform originally developed by McDonald and Harbaugh (1988) for the United States Geological Survey (USGS). The MODFLOW modelling platform is a groundwater flow simulator that has been accepted by regulatory agencies and used extensively for a variety of applications. Specifically, the fully integrated Visual MODFLOW (Version 4.6) platform developed by Schlumberger Water Services (SWS 2011), was used to assemble the input data for the groundwater flow model and to present the MODFLOW output results. Simulations were conducted by using the MODFLOW-NWT version of MODFLOW (Niswonger et al. 2011).

Steady-state groundwater flow models were developed for the pre-mining (i.e., existing conditions), fully mined and post-closure conditions. The model corresponding to the existing conditions was calibrated to observed groundwater water levels and baseflow contribution to some of the creeks. The developed model was used to simulate groundwater flow in both the overburden and bedrock aquifer zones. Although MODFLOW was primarily developed to simulate flow in porous media it is often used for groundwater flow modelling in fractured rocks if they behave as equivalent porous media at the scale of study.

The conceptual understanding of the hydrogeological conditions was compiled, and used to construct the numerical groundwater flow model. The model considered the following hydrostratigraphic units:

- Clay;
- Basal sand;
- Sand-clay/silt-sand;
- Sand and gravel;
- Shallow bedrock;
- Intermediate bedrock; and
- Deep bedrock

The application of these hydrostratigraphic units the model was constructed in the following way:

- Where surficial clay is absent, it was replaced by sand and gravel (i.e., kame and glaciofluvial outwash) or bedrock outcrop (bedrock knolls);
- The sand-clay/silt-sand unit was simulated as two layers. The upper layer represents sand above clay/silt and has a horizontal hydraulic conductivity the same as the Basal Sand unit and a vertical hydraulic conductivity the same as the Clay unit. The lower layer is treated the same as the Basal Sand unit.

The overburden unit contact elevations for the groundwater model have been derived from the geological data available. The bedrock unit surface elevations are based on data available from the hydrogeological and geomechanical investigations, as well as information from the Treasury Metals' resource model.

The deformation zone of the Central Unit, coinciding in the Project area with the Main Zone and C subzone (Figure 11 in Appendix M to the EIS) was simulated as a bedrock zone with increased hydraulic conductivity, compared with the surrounding country rock. The deformation zone was assumed to extend north-east and further west, towards Thunder Lake, from the project site, based on the aeromagnetic anomalies mapped by Caracle Creek (2008a) and Beakhouse and Pigeon (2003).

The regional-scale Wabigoon fault (Figure 6 in Appendix M to the EIS) was assumed to act as discrete vertical feature with lower hydraulic conductivity reducing groundwater flow in bedrock across the fault. The Wabigoon Fault is an inferred structure in the Thunder Lake – Wabigoon Lake area and its geological characteristics are not well known. It may be considered a ductile shear zone based on the brief overview of the surrounding geology given by Beakhouse (2000; 2001). Ductile shear zones are characterized by crystal plastic deformation with generally no development of brittle fractures. Such a shear zone may have lower hydraulic conductivity than the surrounding bedrock, particularly in the direction perpendicular to the shear zone foliation (in this case east – west).

6.11.3 Project Effects Avoidance Measures Used in Predictions

Dewatering of the open pit and underground is needed in order to provide a safe working environment, and is thus essential to the success of the Project. There are no credible ways to avoid the need or requirement for dewatering. However, the following natural features of the local geology help avoid the effects of the dewatering and associated drawdown zone:

- Groundwater baseflow is not an important component of the baseflows in Little Creek or Hoffstrom's Bay Tributary. These tributaries are runoff dominated, sit atop clay, and have little or no baseflow from groundwater.
- Although Blackwater Creek appears to have a higher contribution of groundwater baseflow than either Little Creek or Hoffstrom's Bay Tributary, the baseflow is not a significant contributor as flows in Blackwater Creek have been shown to cease during dry years (e.g., 2011).

6.11.4 Predicted Effects

6.11.4.1 Site Preparation and Construction Phase

During the site preparation and construction phase, the emphasis of the Project is on clearing and preparing the site for the mining activities during operations. One of these activities will be the removal of the overburden from the open pit and subsequent placement in the overburden storage piles for use in the reclamation of the site during closure. The clearing of the overburden would require limited dewatering of the surficial layer that would only have a localized effect on the shallow groundwater. These effects are not expected to extend beyond the mine footprint.

6.11.4.2 Operations Phase

Once operations start, dewatering activities of the open pit will commence. The amount of water that will flow into the open pit and underground mine workings will increase to a maximum level once the mine is fully developed.

The dewatering activities will continue throughout the operations phase will create a drawdown of the groundwater tables that will extend beyond the limits of the mine footprint. The predicted drawdown within the basal sand/shallow bedrock aquifer as a result of dewatering was modelled as described in Section 6.11.3 and detailed Appendix M to the revised EIS. The results, which are presented in Figure 6.11.4.2-1, show two drawdown lines. The first line is the zone of influence that defines the limits of where the effects of the Project on groundwater quantities would be experienced. The second contour represents the limit of the predicted 5 m drawdown.

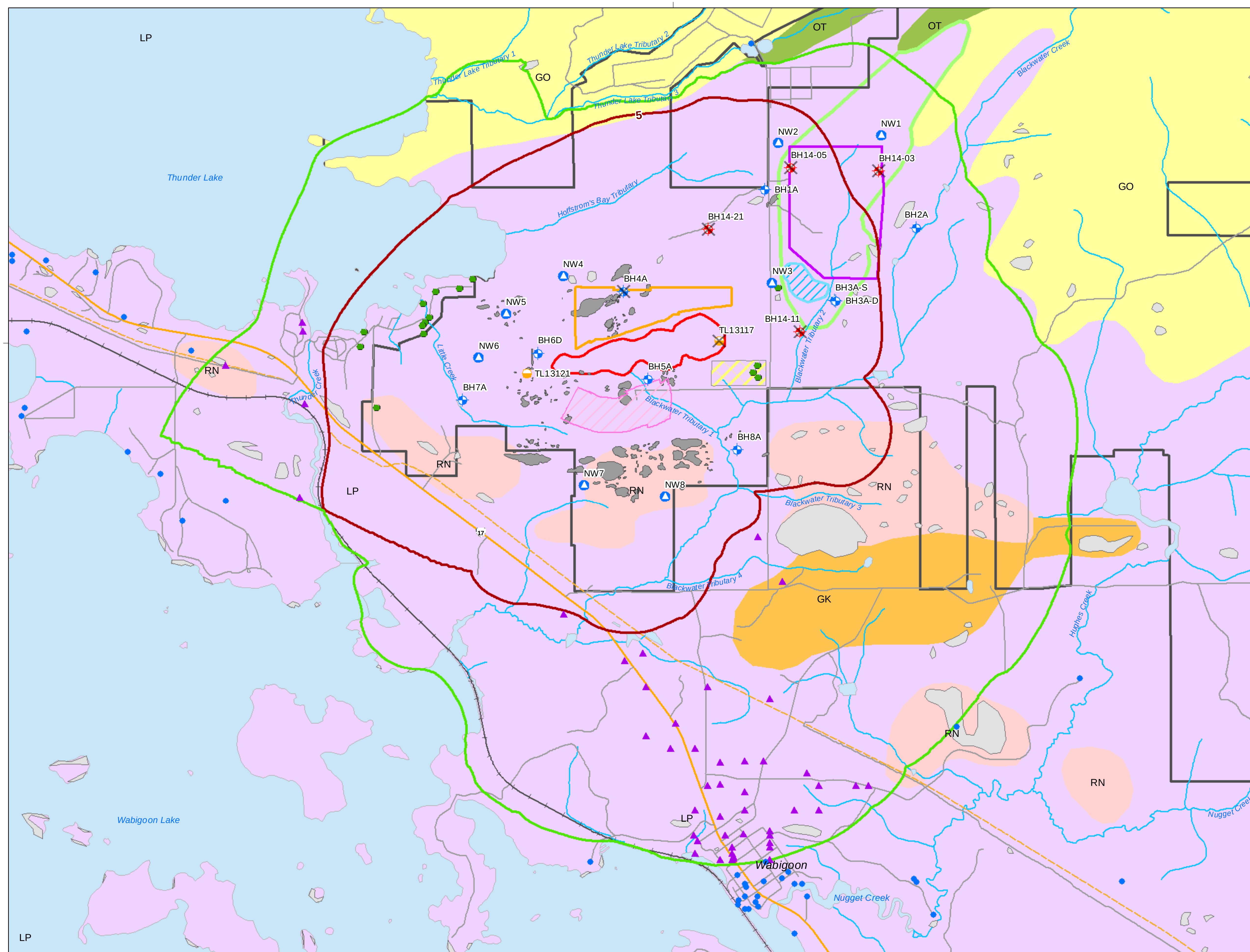
Effects on Water Levels in Private Wells

Of the private water wells identified in the LSA (Figure 6.1.4.11-1), 77 wells are located within the zone of influence (ZOI) of the drawdown caused by the dewatering of the open pit and the underground mine. All these wells have some potential to be affected by groundwater drawdown, however, the degree to which they could be affected depends on the following factors:

- The hydrogeological unit from which the groundwater is sourced;
- The depth of the well compared to static water level, specific capacity of well and pump intake depth;
- The amount of drawdown at the well location; and
- The local hydrogeological setting of the well, specifically the proximity and connection to recharge boundaries and/or sources.
- The risk of the dewatering activities affecting the wells within the ZOI were characterized primarily based on the level of drawdown and the potential recharge, as described in Table 6.11.4.2-1.

Table 6.11.4.2-1: Potential Risk to Private Wells

Group of Wells	Description	Mitigating Factor	Risk of Effects to Private Wells
55 wells within ZOI but outside 5 m drawdown	5 wells near Thunder Creek	Thunder Creek hydraulically connected to bedrock and basal sand	Low to very low
	35 wells around Wabigoon	Located close to Kame sand and gravel deposit	Low to very low
	15 wells to southwest of Project	—	Low to moderate
22 wells within the 5 m drawdown	5 wells within the Project	NA	NA
	17 wells outside the Project	5 wells > 30 m deep	low
		12 wells < 25 m deep	Moderate to high



GOLIATH GOLD PROJECT

Figure 6.11.4.2-1

Predicted Groundwater Drawdown during Operations

Legend

- 2013 Monitoring Well
- 2014 Geotechnical Hole with Standpipe
- Proposed New Well Locations for Groundwater Monitoring Network
- Exploration Hole with Vibrating Wire Piezometer
- Private MOE Water Well outside of ZOI
- Private MOE Water Well within ZOI boundary
- Private MOE Water Well within 5 m ZOI
- Base Case 5 m Drawdown
- Extent of Zone of Influence
- Proposed Open Pit
- Lowgrade Stockpile
- Overburden Stockpile
- Waste Rock Storage Area
- Tailings Management Area
- Tailings Management Pond
- Treasury Metals Property Boundary

Surficial Geology

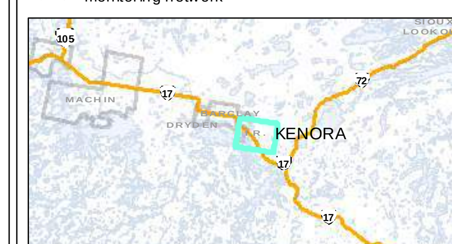
- Sand - Clay / Silt - Sand Boundary

Landform

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

Bedrock Outcrop Mapping

- Beakhouse and Pigeon, 2003
- Treasury Metals
- idicates well not proposed for future groundwater monitoring network



Source: National Topographic Database, 052F09, 052F10, 052F15, and 052F16, 1:10 000 nominal scale.
Source: Ontario Geological Survey, Ministry of Northern Development and Mines, and Northeast Science and Information Section, Ministry of Natural Resources 2005. Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS); Ontario Geological Survey, Miscellaneous Release--Data 160. 1:100,000 scale

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project #: TB124004
Date: August, 2014
Client: Ontario Infrastructure & Lands

Drawn by: DF
Checked by: MS
Revision No.: 2

UTM NAD 83
Zone 15N
1:30,000

Kilometers
0 0.2 0.4 0.6 0.8 1

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Effects on Surface Water Flow Patterns

Most of the watercourses in the vicinity of the Project are runoff dominated creeks that have watersheds that sit predominantly on clay. Therefore, groundwater discharge to these waterbodies is unlikely to be an important component of the flow in the nearby waterbodies. The two exceptions identified in the hydrogeological analysis were Blackwater Creek and Thunder Lake Tributaries 2 and 3, as discussed below:

- **Blackwater Creek**: Although Blackwater Creek has been shown to have intermittent flows, with flows ceasing under certain conditions as was experienced in 2011 (Section 3.2 of Appendix M-1), this waterbody is in a watershed with a mixture of basal materials. To evaluate the effects of dewatering activities on Blackwater Creek, the Goliath groundwater flow model was run to simulate Blackwater Creek in a steady-state mode using the MODFLOW 'drain' and 'river' nodes. This simulation provides an estimation of average groundwater discharges to Blackwater Creek. In predictive mode, the Base Case simulation with the ultimate mine estimates that discharges to Blackwater Creek will be potentially reduced by approximately 700 m^3/d. During dry conditions it may be expected that the reduction in groundwater discharge will be several hundred m^3/d lower and approach zero under very dry conditions when there is minimal or no flow in Blackwater Creek. Under wetter than average conditions the reduction in groundwater discharge to Blackwater Creek may be expected to be several hundred m^3/d higher.

- **Thunder Lake Tributaries 2 and 3**: With coarser material associated with the Hartman Moraine beneath portions of the watershed for Thunder Lake Tributary 2 and Thunder Lake Tributary 3, these waterbodies are likely to be affected by changes in the groundwater regime. The groundwater modelling indicates that the dewatering of the open pit and underground mine could reduce the total groundwater discharge to Thunder Lake Tributaries 2 and 3 by as much as 150 m^3/d, on average.

Groundwater Discharge and Seepage

During the operations phase, when active dewatering is occurring, groundwater will discharge to the open pit and underground workings where it will be collected and used in the minewater management system. The estimated discharge rates for the base modelling case (Appendix M-1) were 1,320 m^3/d. Sensitivity analyses completed on the groundwater modelling presented in Appendix M to the EIS indicated that these inflow rates could range between 1,000 and 1,900 m^3/d.

Seepage from the on-site structures (e.g., waste rock storage area (WRSA) and tailings storage facility (TSF)) will be managed by a series of perimeter seepage collection systems around each structure. These seepage collection systems will capture the majority of the seepage, which will be collected and incorporated into the minewater management system. However, no system can be relied on to capture 100% of the seepage. The seepage that escapes the seepage collections systems during the operations phase will be captured by the drawdown zone created by the dewatering of the open pit and underground mine. The seepage will be directed towards the open pit where it will be collected and incorporated into the minewater management system. There will be no seepage from the on-site structures during the operations phase that will leave the site.

6.11.4.3 Closure Phase

At the end of mining operations, the dewatering activities will cease and the open pit and underground mine will be allowed to start filling with water. Although the dewatering will no longer be occurring during the closure phase, the drawdown of the groundwater during operations will take decades to fully recover to near pre-development conditions. Therefore the effects described for operations will remain throughout the closure phase.

Effects on Water Levels in Private Wells

The ZOI and drawdown zone created by the dewatering of the open pit and underground mine will not have had sufficient time to recover during the closure phase; therefore, the effects on private wells are expected to be the same as during operations. The number of wells at risk, and the level of risk to effects related to the groundwater drawdown were provided in Table 6.11.4.2-1.

Effects on Surface Water Flow Patterns

The ZOI and drawdown zone created by the dewatering of the open pit and underground mine will not have had sufficient time to recover during the closure phase, therefore the potential effects of groundwater drawdown on surface water flows are expected to be the same as during operations.

Groundwater Discharge and Seepage

Once mining operations end and dewatering activities cease, the open pit will be allowed to start refilling with water. The groundwater modelling indicates a groundwater discharge rate to the open pit will gradually reduce as the open pit begins to fill with water. Over the period when the pit lake is filling, an average volume of approximately 700 m^3/day has been calculated.

The drawdown of groundwater during the operations phase will continue through to the closure phase. Seepage from the on-site structures (e.g., WRSA and TSF) that escapes the seepage collection systems will be captured by the drawdown zone created by the dewatering during operations, and will be directed towards the open pit. There will be no seepage from the on-site structures during the closure phase that will leave the site.

6.11.4.4 Post-closure Phase

Over time, the groundwater will recover to near pre-development levels. It is expected to take decades following the end of dewatering for groundwater levels to fully recover. Therefore the effects caused by dewatering will remain until the groundwater levels recover.

Effects on Water Levels in Private Wells

As the groundwater levels recover with time, the number of private wells potentially affected by the groundwater drawdown will diminish. The effects predicted for private wells are expected to be similar to those effects during the operations phase and at the start of the post-closure phase then decrease over time to no effects.

Effects on Surface Water Flow Patterns

As the groundwater levels recover with time, any effects of drawdown on surface water will decrease to return to pre-development conditions.

Groundwater Discharge and Seepage

As the open pit is filling with water, the modelling estimates that groundwater will discharge to the open pit at an average about 700 m^3/day. Once the open pit is completely flooded, the modelling indicates that there will continue to be a discharge of groundwater to the open pit, at an estimated rate of 100 m^3/day.

Once the open pit is flooded and the groundwater levels return to near pre-development conditions, seepage from the on-site structures (e.g., WRSA and TSF) that escape the seepage collection systems will leave the site. Groundwater modelling estimated the volumes of seepage leaving the site, as well as the surface watercourses where the seepage will report. The effects of this seepage have been incorporated into the surface water quality modeling described in Section 6.8.4. The estimated volumes of seepage and the surface waterbodies where the seepage is predicted to report are summarized in Table 6.11.4.4-1.

Table 6.11.4.4-1: Estimated Seepage Quantities during Post-Closure

Waterbody Receiver	Volume of Discharge (m^3/day)		
	Capped WRSA (1)	Capped TSF (2) (dry cover)	Uncapped TSF (2) (wet cover)
Thunder Lake	10	0.1	0.1
Thunder Lake Tributary 3	—	0.1	0.1
Hoffstrom's Bay Tributary	—	0.1	0.1
Blackwater Creek	—	0.8	0.8
Open Pit	20	1.6	1.6
Total Seepage	**30**	**2.7**	**2.7**

Notes:

(1) Seepage quantity for capped WRSA from Figure 25 of Appendix M-1.

(2) Seepage quantities for the wet and dry cover TSF are based on the design of the HDPE liner, as described in Appendix M-2. The distributed from Figures 24 and 22 of Appendix M-1. Although the HDPE liner is only expected to allow 2.4 m³/d of seepage to leave the TSF, a nominal amount of seepage was conservatively included to capture the potential effects to Thunder Lake, Thunder Lake Tributary 3 and Hoffstrom's Bay Tributary.

6.11.5 Identified Mitigation

The following mitigation measures are available for managing the effects of the Project on groundwater quantity:

- In the event that unexpected adverse groundwater level drawdown is recorded from the groundwater monitoring network, this may trigger investigations, comprising:
    - Recalibration of the groundwater model and update of predictions incorporating any changes to the mine plan. With the respect to groundwater quality this may include an assessment of post-closure conditions when the open pit no longer acts to capture groundwater;
    - Installation of new monitoring wells and/or increase of frequency of monitoring (e.g. installation; and
    - Other investigations.
- If the investigation determines a mine-related cause, mitigation measures to be completed, may include the following:
    - Suitable replacement of private water supply until groundwater level recovery has occurred on completion of mining depending on location and requirements (e.g., deepening of existing water wells, drilling of new water wells, installation of cistern and supply of potable water) [Mit_063].

6.11.6 Residual Adverse Effects

The application of the identified mitigation measures would eliminate the adverse effects of the Project caused by the decrease in elevations in private wells. As a requirement of the permitting process for the Project, Treasury Metals will be required to mitigate adverse effects on adjacent wells due to the drawdown of the water caused by the dewatering during operations. Therefore, there would be no residual adverse effects to private water wells as a result of changes in groundwater quantity.

However, the decrease contribution of groundwater to the flows in the Thunder Lake Tributary 2 and Thunder Lake Tributary 3 catchment will remain as a residual adverse effect. The residual adverse effects of the Project on groundwater quantities as summarized in Table 6.11.6-1.

The spatial extent of the effects to groundwater quantity as a result of the Project are limited to flow reductions in Thunder Lake Tributaries 2 and 3. The remaining watercourses located within the drawdown zone of the Project have been identified as being underlain by clay and silt substrates, which large isolates these watercourses from the drawdown effects of the Project. Additionally, there are no adverse effects to groundwater levels in private drinking wells as Treasury Metals is required to deepen those wells that become dry as a result of the Project.

Table 6.11.6-1: Residual Adverse Effects on Groundwater Quantity

Indicator	Site Preparation and Construction	Operations	Closure	Post-closure
Decreasing elevations in private wells	— (1)	— (2)	— (2)	— (2)

Note:

(1) The "—" symbol indicates where no residual adverse effects predicted.

(2) Any adverse effects to private water wells due to changes in groundwater quantity would be mitigated by Treasury Metals as a requirement of their provincial permits.

6.11.7 Information to Address Round 1 Information Requests

The following questions regarding the predicted effects on groundwater quantity were received as part of the Round information requests:

- TMI_49-MW(1)-11: seepage from TSF;
- TMI_62-MW(1)-24: effects of the Wabigoon Fault;
- TMI_70-GW(1)-07: amounts and effects of seepage;
- TMI_71-GW(1)-08: effects of surficial geology on modelling;
- TMI_72-GW(1)-09: recharge rates in modelling;
- TMI_73-GW(1)-10: characteristics of the Wabigoon Fault;
- TMI_74-GW(1)-11: sensitivity analysis of modelling;
- TMI_77-GW(1)-14: control of infiltrations from the WSRA;
- TMI_82-GW(1)-19: effects of Wabigoon fault and surficial geology on modelling;
- TMI_83-GW(1)-20: travel times for seepage to surface water;

- TMI_84-GW(1)-21: effects of drawdown zone on surface water;
- TMI_85-GW(1)-22: effects of drawdown zone on surface water;
- TMI_86-GW(1)-23: groundwater contribution to flooding of pit;
- TMI_91-SW(1)-05: seepage from overburden and low-grade ore (LGO) stockpiles;
- TMI_103-SW(1)-17: groundwater contribution to flooding of pit;
- TMI_340-AC(1)-14: groundwater quantity effects on surface water and private wells;
- TMI_341-AC(1)-15 groundwater quantity effects and mitigation for private wells;
- TMI_625-AC(1)-298: groundwater effects on TSF;
- TMI_629-AC(1)-302: groundwater flow and quality;
- TMI_632-AC(1)-305: groundwater flow and quality;
- TMI_641-AC(1)-314: interactions between groundwater and surface water;
- TMI_700-PC(1)-15: effects of drawdown on water levels in Thunder Lake;
- TMI_716-PC(1)-31: effects of blasting on wells;
- TMI_717-PC(1)-32: effects and mitigation of water quantity in private wells; and
- TMI_767-PC(1)-82: effects of groundwater on private wells.

6.12 Wildlife and Wildlife Habitat

6.12.1 Potential Effects of the Project on the Environment

The wildlife and wildlife habitat VCs used for assessing the effects of the Project were introduced in Section 6.1.3.11. The Project, as proposed, will involve the clearing of lands and vegetation to accommodate the Project structures and facilities (e.g., processing plant, tailings storage facility [TSF]), as well as for the open pit mine. In addition, the mine will include equipment and activities that can have a direct or indirect effect on wildlife. The potential effects of the Project on the wildlife and wildlife habits VCs for the various Project phase are as follows:

- **Site Preparation and Construction Phase**: Most of the removal of vegetation, displacement of wildlife and disturbance and of soils and overburden will occur during the site preparation and construction phase. The potential effects of these activities on wildlife and wildlife habitat includes the following:
  - Direct loss of habitat as a result of vegetation clearing and overburden stripping;
  - Functional loss of habitat as a result of fragmentation and noise levels;
  - Direct mortality of species due site clearing and construction activities; and
  - Direct mortality of species as a result of vehicle collisions.

- **Operations Phase**: Once mining starts, most of the activities at the site will be occurring within the limits of the areas disturbed during the site preparation and construction phase. As operations progress, waste rock will continue to be added to the waste rock storage area (WRSA) until the mined out portions of the open pit can be used. As operations continue, the footprint of the TSF will continue to grow as additional tailings are added. The potential effects of these activities on wildlife and wildlife habitat includes the following:
    - The effects of direct habitat loss during the site preparation and construction phase will continue through operations;
    - The functional loss of habitat as a result of fragmentation during the site preparation and construction phase will continue through operations;
    - Direct habitat loss due to the expansion of the WRSA and TSF footprints;
    - Functional loss of habitat as a result of light and noise; and
    - Direct mortality of species as a result of vehicle collisions.

- **Closure Phase**: Following the end of mining activities, the Project facilities will be decommissioned and removed and the site will be re-graded to ensure all runoff drains towards the open pit. The process water covering the TSF will be withdrawn, treated and used to help fill the open pit. The TSF will be covered with a granular layer to isolate the tailings, and then covered with either a dry low permeability cover, or a wet cover with non-process water to prevent acidification. Suitable plant species will be used to help re-vegetate the site and return it to a condition suitable to support a functioning ecosystem. The potential effects of these activities on wildlife and wildlife habitat includes the following:
    - The effects of direct habitat loss during the site preparation and construction and operations phase will continue until the reclaimed landscape is able to provide replacement habitat;
    - The functional loss of habitat as a result of fragmentation during the site preparation and construction phase will continue until the reclaimed landscape can return some of the habitat functionality;
    - Functional loss of habitat as a result of noise;
    - Direct mortality of species due reclamation and closure activities; and
    - Direct mortality of species as a result of vehicle collisions.

- **Post-closure Phase**: Once the closure activities are complete there will be no further disturbance of habitat or habitat function at the site. With time, the reclaimed closure landscape will begin to replace the loss of habitat and habitat function. The potential effects of the Project on wildlife and wildlife habitat during this phase includes the following:

- o The effects of direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat; and
- o The effects of the of habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality.

The potential effects of the Project on wildlife and wildlife habitat have been described using a simple linkage diagram in Figures 6.13.1-1 and 6.12.1-2. The figures illustrate the wildlife and wildlife habitat VCs (shown in blue on the figure) and how it can be potentially affected during each phase of the Project life. The figure also indicates the other components or VCs (shown in red on the figure) that can be affected by effects to wildlife and wildlife habits. For example, effects on wildlife and wildlife habitat will be relied on for evaluating the effects of the Project on Aboriginal peoples. Similarly, other components that provide inputs to the evaluation of the effects of the Project on wildlife and wildlife habitat are shown in red on the figure. For example, the effects of the Project on noise are used in determining the effects on the wildlife and wildlife habitat VCs.

6.12.2 Effects Prediction Methods

A numerical geographic information system (GIS) approach was used for predicting the effects of the Project on wildlife and wildlife habitat. Modelled wildlife habitat suitability for most VCs using the Ontario Landscape Tool (OLT) (2016, build 3.5.6117), a modeling program developed by the Ontario Ministry of Natural Resources and Forests (MNRF). A variety of habitat suitability models are incorporated into the software (e.g., Holloway 2004). These models are applied to digital Forest Resources Inventory (FRI) data. Specifically, the OLT overlays a grid of hexagons on the FRI data (as well as built-in datasets with climate information and the location of roads, urban areas, and waterbodies) and determines the suitability of each hexagon as a function of ecosite (forest type) and development stage (forest age class) and — for some species — patch size and climate. Depending on the species, the hexagons are either 0.1 or 0.8 ha in size. These results are then summarized over larger hexagons (normally 1 ha in size) and then averaged and reported for each inventory polygon (Elkie et al. 2013). For moose, two different models are available in the OLT; as the wildlife LSA and RSA is best described as Boreal forest, the modelling used the “bioclimatic” moose models developed by the Centre for Northern Forest Ecosystem Research rather than the OWHAM (Ontario Wildlife Habitat Assessment Model), which was originally built for the Great Lakes-St. Lawrence forest region.

For some VCs, modelled results are not available within the OLT. For these VCs, a habitat suitability models was constructed in ArcGIS (v10.4) using the FRI and other spatial layers available through Land Information Ontario (LIO). Habitat for terrestrial invertebrate species was considered to be suitable throughout the study areas, excepting water bodies and bedrock. All areas except water were considered suitable for small mammals. For reptiles and amphibians, potential habitat was considered to include wetlands and 120 m around all wetlands surrounded by forests.

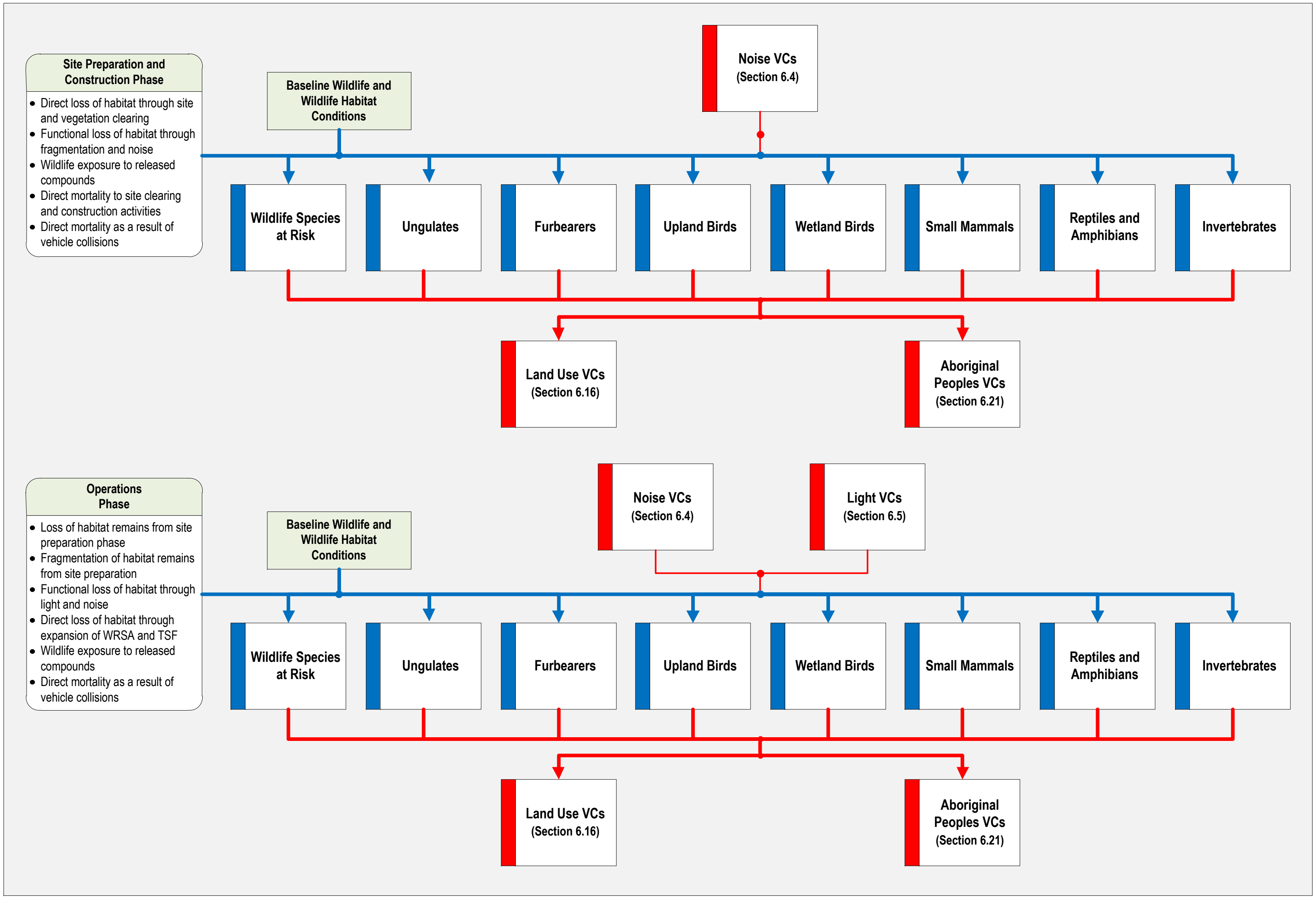


Figure 6.12.1-1: Wildlife and Wildlife Habitat Linkage Diagram

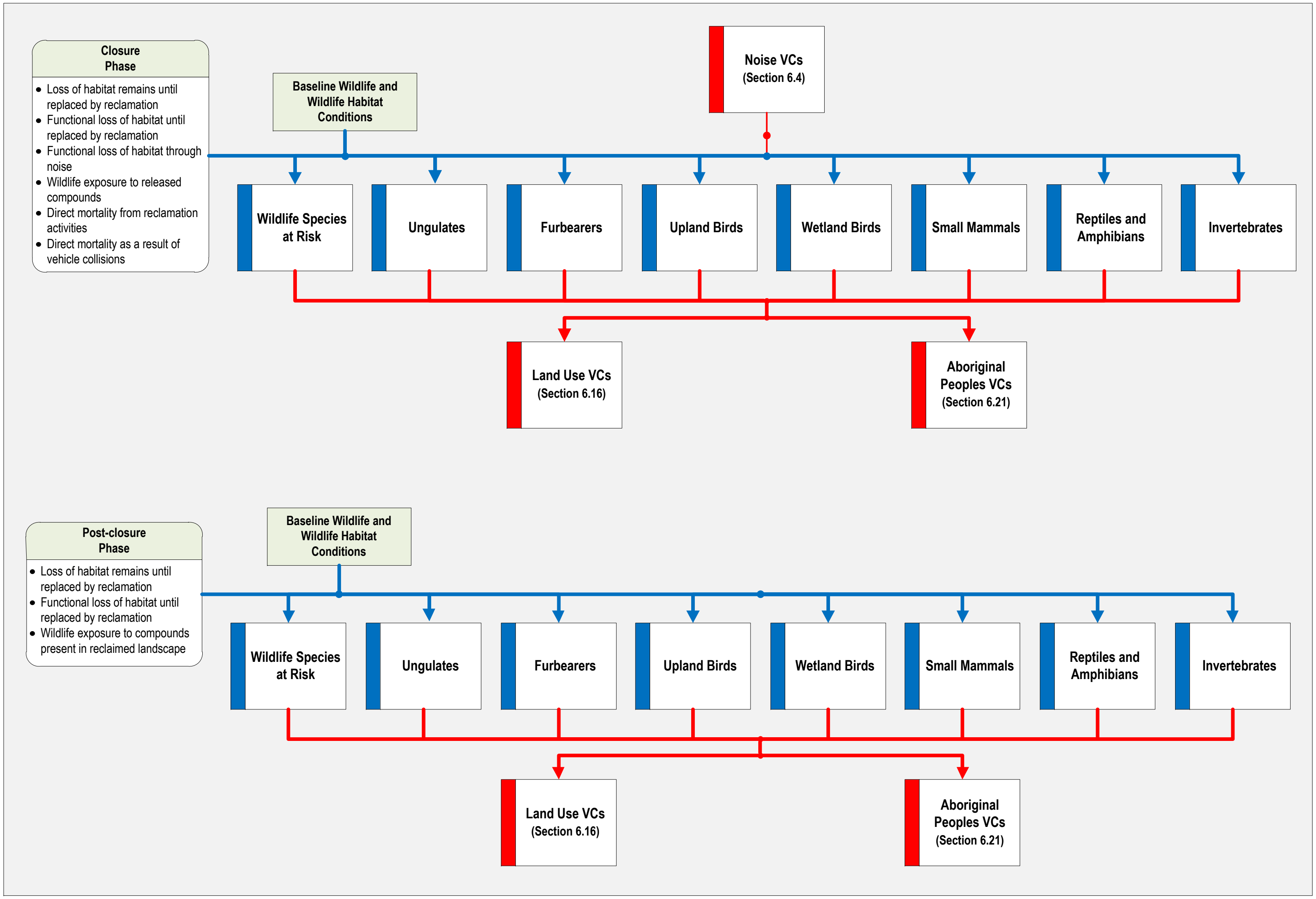


Figure 6.12.1-2: Wildlife and Wildlife Habitat Linkage Diagram (continued)

For bats, we selected the following ecosites, which the MNRF indicates provide suitable roosting and maternity roost habitats (see also MNRF 2011):

- B015-019 Very Shallow: Dry to Fresh: Mixedwood/hardwood;
- B023-028 Very Shallow: Humid: Conifer/Mixedwood;
- B039-043 Dry, Sandy: Hardwood/Mixedwood;
- B054-059 Dry to Fresh: Coarse: Mixedwood/Hardwood;
- B069-076 Moist, coarse: Mixedwood/Hardwood;
- B087-092 Fresh, Clayey: Mixedwood/hardwood;
- B103-108 Fresh, Silty to Fine Loamy: Mixedwood/Hardwood;
- B118-125 Moist. Fine: Mixedwood/Hardwood; and
- B130-133: Swamps.

As roosting habitat is primarily in tree snags and cavities, potential bat habitat was further refined by selecting those polygons with forests greater than 40 years in age, at least 10 m in height, and not simply single-storied (i.e., are two-tiered, complex, and/or contain veteran trees).

6.12.3 Project Effects Avoidance Measures Used in Predictions

The following are effects avoidance measures that will be utilized to reduce potential adverse effects to wildlife and wildlife habitat.

- Project design incorporates a compact footprint. [Mit_050].
- Minimized the amount of habitat clearing required for the Project by siting Project infrastructure, to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways. [Mit_065].
- Provide vegetated buffers of 120 m along rivers creeks and wetlands wherever feasible. [Mit_066].
- Conducting timber clearing outside of the breeding bird window (May 1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats. [Mit_067].
- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species. [Mit_068].
- Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions. [Mit_069].
- Protection of suitable bird breeding habitat, where possible. [Mit_070].

- Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviour and their presence. [Mit_071].
- Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area. [Mit_072].
- Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF. [Mit_073].
- Implementation of noise abatement strategies to limit the negative effects of sound on wildlife. [Mit_025, Mit_028, Mit_029, Mit_031].
- Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation). [Mit_074].
- Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].

6.12.4 Predicted Effects

The predicted effects of the Project on wildlife and wildlife habitat will vary throughout the Project life, depending on the Project phase, and will vary according to specific levels of activity. Project effects will also vary by VC.

6.12.4.1 Site Preparation and Construction Phase

Wildlife Species at Risk

Common Nighthawks are currently listed as Threatened federally, and Special Concern provincially, therefore they are afforded general habitat protection under the *Ontario Species at Risk Act*, and under the Migratory Birds Convention Act. Two Common Nighthawk were recorded calling in the tree nursery in 2011 and a single Common Nighthawk was heard during WPW surveys in 2012 on Tree Nursery Road. Suitable nesting habitat occurs in the sandy openings in the tree nursery grounds as well as the cutover immediately to the north. The species likely nests in the LSA. Common Nighthawks nest in a wide range of habitats including open and vegetated sites such as sand dunes, beaches, recently harvested sites, burned areas, rocky outcrops, grasslands, peat bogs, marshes and mixed and coniferous stands (Environment Canada 2012). Common Nighthawks have also been known to nest on manmade structures and in aggregate pits and quarries.

Vegetation clearing and construction will remove a total of 300 ha of forested habitat, which may provide suitable nesting and feeding habitat for Common Nighthawk. However, based on the survey results, none of the vegetation clearing for the construction of Project components will occur in the areas where Common Nighthawks have been heard (i.e., the former MNRF tree nursery). Sound disturbance during site preparation and construction can have a negative effect on this species as it may interfere with the ability of calling breeding males to attract mates. Sound levels above ambient levels may have an influence on Common Nighthawk behaviour within affected areas, through a reduction in habitat suitability. The total area that may be affected by increased noise levels during this phase of the project is 198 ha of potential habitat. None of the affected habitat lies in the areas where Common Nighthawks have been heard.

Northern Myotis, Big Brown Myotis and Little Brown Myotis have all been recorded within the project area. These species are known to be cavity-roosting species. Northern Myotis and Little Brown Myotis were added to the Species at Risk in Ontario List as Endangered in October of 2012, and as such, are currently protected by the ESA. These species require a high density of mature cavity trees (>25 cm at dbh), which they utilize for summer roosting sites and maternity roosting sites. The identification of potential roost habitat involved the Ecological Land Classification (ELC) of key areas potentially impacted by development. A map of the proposed Project footprint for the mine infrastructure was overlaid with Forest Resource Inventory (FRI) data to search for the following ELC communities and ELC codes:

- Deciduous Forests (FOD);
- Mixedwood Forests (FOM);
- Coniferous Forests (FOC);
- Deciduous Swamp (SWD);
- Mixedwood Swamps(SWM);
- Coniferous Swamps (SWC).
- ELC Codes:
- G/B015-019 Very Shallow: Dry to Fresh: Mixedwood/hardwood;
- G/B023-028 Very Shallow: Humid: Conifer/Mixedwood;
- G/B039-043 Dry, Sandy: Hardwood/Mixedwood;
- G/B054-059 Dry to Fresh: Coarse: Mixedwood/Hardwood;
- G/B069-076 Moist, coarse: Mixedwood/Hardwood;
- G/B087-092 Fresh, Clayey: Mixedwood/hardwood;
- B103-108 Fresh, Silty to Fine Loamy: Mixedwood/Hardwood;
- B118-125 Moist. Fine: Mixedwood/Hardwood; and
- B130-133: Swamps.

Forest stands possessing this ELC information were highlighted by the MNRF as having potential for bat roost habitat. The FRI data (Wabigoon [2010] and Dryden [2015]) Forest Resource Inventory) were searched using ArcMap (v.10.3.1) to determine the locations of the aforementioned ELC communities and codes, which led to the identification of three stands as having the potential for maternity roost habitat. These stands were then ground surveyed to determine the potential for roost sites. Once potential roost sites were located, an exit survey was conducted to determine its use. Two exit surveys were completed, which investigated all potential roost sites. A total of 2 bats were observed, but failed to be recorded on the ultrasonic recorder. The site preparation and construction phase of this Project will remove approximately 15.85 ha of potential roosting habitat.

It is not anticipated that the sound levels generated by site clearing and construction will interfere with the echolocation, and therefore the hunting success, of these bat species. Sound pulses generated by bat species are generally above 18 kHz, which is well above the frequency of any traffic or construction activities that will be associated with the Project.

Although vehicle/bat collisions are uncommon, collisions with vehicles will be a risk to bats found in the project area, and this risk will increase as traffic during this phase of the project increases.

Bats are insectivores, and as such, they tend to feed in areas of high insect density. Natural sources of these areas include forest edges and wetlands, lakes and ponds. Any reduction to wetlands as a result of the project may reduce potential feeding areas for bats. A total of 33 ha of wetlands are planned for removal during the site preparation and construction phase. Lights can be considered an anthropogenic source of high insect densities. The use of lights during site preparation and construction activities are expected to be limited as the majority of these activities will occur during the day. There will, however, be period when localized sources of light will be required for safety reasons. The use of artificial light sources during construction may produce areas of high insect densities, as nocturnal insects are commonly attracted to artificial light sources.

Barn Swallows are listed as Threatened provincially and federally. As such, they are provided protection under the ESA and the SARA. Barn Swallows have been observed in the buildings at the tree nursery as well as in some out buildings at a residence within the Project area. A concerted effort was made to close all doors and windows of the buildings at the tree nursery, which eliminated nesting opportunities for Barn Swallows. Barn Swallows are known to nest in human-built structures such as barns, sheds and the overhangs of houses. They will also nest in culverts and under bridges, as well as natural rock faces. The residence and associated outbuildings will be removed as part of the site preparation and construction phase of the project. The removal of these buildings will displace approximately 3 to 5 breeding pairs of Barn Swallow.

Mortality as a result of vehicle collisions is a serious risk to Barn Swallows, as their behaviour is directly linked to anthropomorphic structures and activities. Barn Swallows are aerial insectivores, and this behaviour puts them at high risk for collisions with vehicles.

Ungulates

White-tailed deer and moose both occur within the LSA and the RSA, however, both are rare occurrences within the LSA due to a low amount of suitable habitat. Moose were chosen as the indicator for representing ungulates because of the greater availability of moose habitat compared to deer habitat. There is an extremely low amount of summer or winter deer habitat located within the LSA. Moose populations have benefitted from anthropogenic alterations to the landscape, primarily forestry operations and forest management planning.

Moose are the primary ungulate species managed by the MNRF in Ontario. The emphasis is on moose habitat management. The Project is located in the MNRFs Cervid Ecological Zone (CEZ) C1. The management direction for this zone is to maintain moderate to high density populations of moose through the provincial moose management program. The management direction for White-tailed deer for CEZ C1 is to maintain low density populations through the provincial deer management program (MNRF 2009).

Areas of potential moose densities >0.3/km^2 were modelled for the LSA and RSA through the use of the Ontario Landscape Tool (OLT). The OLT uses Landscape Scripting Language, which is a proprietary tool for Geographic Information Systems (GIS) developed by the OMNR (Elliot et al. 2010). Potential moose densities were estimated by accessing standard forest unit classifications found in Forest Resource Inventory (FRI) data, biogeoclimatic models, and a moose habitat suitability index. A full description of the models and inputs can be found in Elkie et al. (2013).

The total area of potential moose densities >0.3/km^2 for the RSA is 22,632 ha (7% of the RSA), and 220 ha for the LSA (4% of the LSA). It is estimated that a total of 84 ha of moose habitat with the potential to support densities of >0.3/km^2 will be displaced during site preparation and construction phase. This could result in loss of habitat with the potential to support 0.25 moose within the LSA. An additional 57 ha of habitat could be affected during construction through noise levels above 50 dBA. This could result in loss of habitat with the potential to support an additional 0.17 moose within the LSA. This would result in an overall potential loss of 0.42 moose within the LSA throughout this phase of the project.

Increased traffic during the site preparation and construction phase may increase vehicle collisions with ungulates. This may affect local moose populations as well as humans. It is not anticipated that the increased traffic will affect any moose habitat linkages, as the existing site is already highly fragmented through harvesting, anthropogenic developments, utility corridors and access roads, and is not currently used as a travel corridor by moose.

Furbearers

American Marten are currently managed through the forest management planning process, whereby forest management planning teams develop long-term marten core areas in order to support marten populations. By managing for the habitat requirements of this species, many other boreal species are also provided suitable habitat. American Marten can be considered an umbrella species. Marten habitat was mapped for the RSA, LSA and Project footprint using the OLT. American Marten habitat appears to be abundant throughout the RSA (30,552 ha), and the LSA (1,297 ha). Site preparation and construction will remove approximately 62 ha of American Marten habitat. American Marten densities tend to be between 0.4 and 1.2/km^2 (Watt et al. 1996), therefore, this phase of the Project would potentially displace 0.25 to 0.74 individuals. An additional 14 ha of habitat could be affected during construction through noise levels above 50 dBA. Increased noise levels can cause habitat to become unsuitable resulting in avoidance. Sound disturbance can also mask the sound of nearby predators or prey; affecting predation avoidance and hunting success (Blickley and Patricelli 2010). This could result in loss of habitat with the potential to support an additional 0.06 to 0.17 individuals within the LSA. This would result in an overall potential displacement of 0.31 to 0.91 American Marten within the LSA throughout this phase of the Project.

Project site preparation and construction may also affect American Marten through the unintended provision of attractants such as plastics and garbage. This can result in mortalities through the consumption of non-edible materials, and the need to trap and relocate or destroy nuisance animals. Although traffic volume is expected to increase during this phase of the Project, marten vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Beaver are a keystone species within the boreal ecosystem, creating a mosaic of habitat conditions across watersheds which lead to an increase in species richness and biodiversity. Beaver are currently managed through the forest management planning process on crown land as well as through local trapping organizations. Historical and current beaver lodges and dams were mapped throughout the LSA and the Project footprint. Beaver activity is abundant throughout the LSA, with extensive beaver meadow complexes being created over time.

There will be little to no indirect effects of the Project on Beaver populations (i.e., noise/sensory disturbance) as Beaver coexist well with most industrial activities, often building lodges within sight of major highways and developed areas. The effects on Beaver will be primarily be direct, related to dewatering or drawing down of wetlands. The wetland areas on Blackwater Creek tributary 1 that will be overprinted by the open pit will need to be drained prior to the start of overburden removal. As shown in Figure 6.12.4.1-1, this area was historically used by beaver and 3.8 ha of impoundments remain that will need to be removed. The figure indicates that this is not a location of current beaver activity. There is current beaver activity identified on the portions of Blackwater Creek Tributary 2 that will be overprinted by the TSF. As part of the site preparation activities, the beaver and 0.15 ha of impoundments will need to be removed. This will be done with engagement of the local trapper, and members local Indigenous communities. Animals that would use these overprinted watercourses will be forced to relocate to and adjacent non-impacted water body to establish a new home range. There is a prevalence of historical beaver meadows as well as potential new areas to establish a pond within the LSA, therefore, no negative effects to Beaver populations due to the loss of these areas are expected.

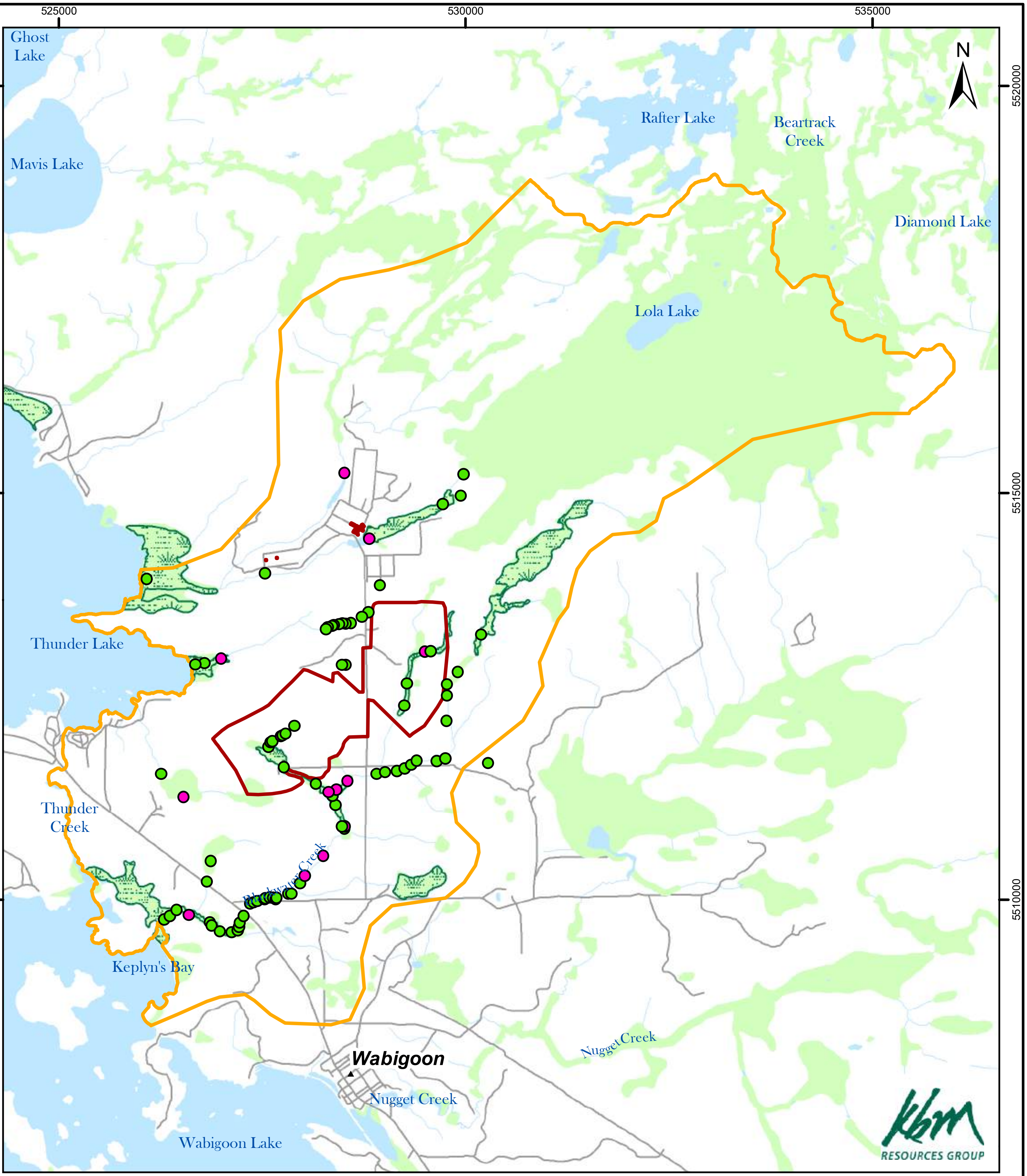


Figure 6.12.4.1-1
Beaver Activity in the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-22

Legend

- LSA
- Development Footprint
- Road
- Wetland
- Waterbody
- Stream
- Surveyed Wetlands
- Active Beaver Observations
- Historic Beaver Observations

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

Although traffic volume is expected to increase during the site preparation and construction phase of the project, beaver vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Upland Birds

For the purposes of this Project, upland habitat was considered to be all ecosites with a dry to fresh moisture regime, that also have well drained soils (northwestern Ontario ecosites: ES1 to ES17) and all developed areas (as these are generally agricultural or meadow type habitats). Upland habitats constitute 34,710 ha within the RSA, and 448 ha within the LSA. Common bird species associated with the upland habitats during point count surveys included many of the warblers and thrushes, as well as some sparrows (Clay-coloured sparrow, Savannah sparrow, LeConte’s sparrow) and northern harrier as examples.

The site development and construction phase of this project will result in the loss of 95 ha of upland habitat (all of which is currently considered developed areas). Some upland avian species have been shown to decline at sound thresholds above 48 dBA, while other studies (Dooling and Popper 2007) have shown that sound masking for avian species can occur at 50 dBA. Modelling for this project indicated that site preparation and construction sounds greater than 50 dBA will disturb 3.21 ha of habitat. The most common adverse effect of sound includes masking important communication signals which reduces the chances of breeding males to attract mates and to defend their territories. Sound disturbance can also mask the sound of nearby predators; increasing mortality through predation (Blickley and Patricelli 2010).

Increased traffic volume also has the potential to increase avian mortality of upland species through increased collisions with vehicles.

Wetland Birds

Despite the name “Marsh Birds”, these species are not exclusively associated with marshes, but can be associated with any wetland area provided it has suitable vegetative habitat (primarily robust emergent vegetation). Between 2011 and 2016, Marsh Bird Surveys took place at 11 locations throughout the LSA. Although many wetland associated bird species were observed or heard during the surveys, on one Marsh Bird target species was heard (a single Sora in 2012).

The site preparation and construction phase of the project will require the removal of 33 total ha of wetlands, which in turn will eliminate the associated Marsh Bird habitat. During the site preparation and construction phase, an additional 2.9 ha of Marsh Bird habitat may be affected by noise levels above 50 dBA.

Small Mammals

Small mammal trapping occurred throughout the LSA in 2012 and 2016, with 32 and 11 individuals captured respectively. Six species were captured including southern red-backed voles, deer mice, northern short-tailed shrew, red squirrel, least chipmunks, and a meadow jumping mouse.

For the purposes of this Project, potential small mammal habitat was considered to be the entire LSA with the exception of any waterbody. Potential small mammal habitat constitutes 226,164 ha of the RSA, and 4,401 ha of the LSA.

The site development and construction phase of the Project will result in small mammal habitat alteration, opposed to habitat loss, as seen for other species. This is due to the fact that small mammals occupy many niches in the ecosystem. Some require mature undisturbed forest, while others thrive in anthropogenically altered landscapes. A total footprint of 310 ha will altered as a result of this phase of the Project. Few studies have investigated the effects of noise on small mammals, and in fact, the range of sound frequencies heard by small mammals is unknown (Bissonette and Rosa 2009). For the purposes of this project, and to potentially err on the side of caution, we have assumed that noise levels of 50 dBA or greater may have a negative impact on small mammal communities. Modelling for this project indicated that site preparation and construction sounds greater than 50 dBA will disturb 181 ha of habitat. Sound disturbance can also mask the sound of nearby predators; increasing mortality of some species through predation (Blickley and Patricelli 2010).

Collisions with vehicles can impact a significant number of small mammals breeding and dispersion periods. Given that small mammals commonly attempt to cross roads, increased vehicular traffic will likely cause increased mortality in the LSA during site development and construction, particularly in the fall, when dispersion of young small mammals is highest.

Reptiles and Amphibians

A total of seven amphibian species were observed in the LSA during baseline surveys between 2011 and 2012. None of these species are considered SAR. Two reptile species, the Western Painted Turtle (*Chrysemys picta belli*) and the Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) were observed during the 2011, 2012, and 2016 field programs, neither of which are SAR. These two reptile species were frequently seen in the LSA.

For the purposes of this project, potential reptile and amphibian habitat was considered to be wetlands and the adjacent forested habitat up to 120 m from the wetland edge. Potential reptile and amphibian habitat constitutes a total of 216,568 ha in the RSA, and 3,538 ha in the LSA.

The site development and construction phase of this project will result in the loss of 162 ha of potential reptile and amphibian habitat. Few studies have investigated the effects of noise on reptiles and amphibians, with most studies to date looking at the effects of low flying aircraft. Of the few investigations to be completed, a variety of effects have been determined. Minton (1968) found suburban noise to have no significant effect on calling anurans, and Brattstrom and Bondello (1983) found that sustained traffic noise of 98 dBA caused adverse effects to some species. For the purposes of this project, and to potentially err on the side of caution, we have assumed that noise of 50 dBA or greater may have a negative impact on the ability of calling amphibians to attract mates and to defend their territories. Modelling for this project indicated that site preparation and construction sounds greater than 50 dBA will disturb 89 ha of habitat. Sound disturbance can also mask the sound of nearby predators; increasing mortality through predation (Blickley and Patricelli 2010).

Collisions with vehicles can impact a significant number of amphibians and reptiles during seasonal movements between breeding and wintering habitats, and during reptile nesting periods. Given that amphibians and reptiles commonly attempt to cross roads, increased vehicular traffic will likely cause increased mortality in the LSA during site development and construction, particularly in the spring and fall. No distinct locations of significant movements of reptiles or amphibians across roads was observed during field surveys.

Terrestrial Invertebrates

Field observations of invertebrates focused on dragonflies, damselflies, and butterflies. For the purposes of this project, invertebrate habitat was considered to be the entire LSA with the exception of waterbodies and watercourses (i.e., all terrestrial areas).

The site development and construction phase of the Project will result in invertebrate habitat alteration, opposed to habitat loss, as seen for other species. This is due to the fact that invertebrate occupy many niches in the ecosystem. A total of 400 ha of invertebrate habitat will be altered as a result of this phase of the Project. Few studies have investigated the effects of noise on invertebrates. For the purposes of this project, it is being assumed that noise will not have any negative effect on terrestrial invertebrates.

Collisions with vehicles can impact a significant number of terrestrial invertebrates. Given that many invertebrates, particularly flying invertebrates, are commonly found on roads, increased vehicular traffic will likely cause increased mortality in the LSA during site development and construction, particularly in the spring and early summer, when flying insects are most abundant.

6.12.4.2 Operations Phase

Wildlife Species at Risk

The operations phase of the Project is anticipated to occur both day and night, and therefore will require artificial lighting. Common nighthawk have exceptional eye sight, therefore, bright, artificial lights may negatively impact this species, causing them to avoid habitat in or adjacent to the Project site. This, in turn, may affect their foraging efficiency and overall reproductive success. Similar to the site preparation and construction phase, sound disturbance may also have a negative impact on this species. The total area that may be affected by increased noise levels during this phase of the project is 122 ha of potential habitat. None of the affected habitat lies in the areas where Common Nighthawks have been heard. Habitat lost during the site preparation and construction phase will remain unavailable during the operations phase.

It is not anticipated that the sound levels generated by operations will interfere with the echolocation, and therefore the hunting success, of the bat species. Although vehicle/bat collisions are uncommon, collisions with vehicles will be a risk to bats found in the project area, and this risk will continue during this phase of the project. The use of lights during operations may produce artificial sources of high insect densities, as nocturnal insects are commonly attracted to artificial light sources at night. Bat habitat lost during the site preparation and construction phase will remain unavailable during the operations phase.

As previously mentioned, Barn swallows are known to nest in human-built structures such as barns, sheds and the overhangs of houses. They will also nest in culverts and under bridges, as well as natural rock faces. Mortality as a result of vehicle collisions will continue to be a risk to Barn Swallow. Barn swallow habitat lost during the site preparation and construction phase will remain unavailable during the operations phase.

Ungulates

The potential effects to moose as a result of direct habitat loss will continue through the operation phase of this Project. An additional 34 ha of habitat could be affected with noise levels above 50 dBA during operations. This could result in loss of habitat with the potential to support an additional 0.10 moose within the LSA.

Increased traffic during the operations phase of the project will continue to have the potential for increased vehicle collisions with ungulates. This may affect local moose populations as well as humans. It is not anticipated that the increased traffic will affect any moose habitat linkages, as the effects of the site preparation and construction phase will persist.

Furbearers

Effects from the site preparation and construction phase of this Project will persist throughout the operations phase. During this phase, 8 ha of American Marten habitat could be affected during operations through noise levels above 50 dBA. This could result in loss of habitat with the potential to support an additional 0.02 to 0.06 individuals within the LSA.

Project operations may also affect American Marten through the unintended provision of attractants such as plastics and garbage. This can result in mortalities through the consumption of non-edible materials, and the need to trap and relocate or destroy nuisance animals. Although traffic volume is expected to increase during this phase of the project, marten vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Effects to Beaver habitat from the site preparation and construction phase of this Project will persist throughout the operations phase. No additional impacts to Beaver are anticipated during the operations phase with the exception of the need to trap and relocate or destroy nuisance animals, as Beaver tend to increase the likelihood of flooding roads through plugging culverts. Although traffic volume is expected to increase during the site preparation and construction phase of the project, beaver vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Upland Birds

Effects from the site preparation and construction phase of this Project will persist throughout the operations phase. Modelling for this Project indicated that operations phase sounds greater than 50 dBA will disturb 4.3 ha of habitat. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Wetland Birds

Effects from the site preparation and construction phase of this Project will persist throughout the operations phase. During this phase of the Project, a total of 7.5 ha of potential wetland habitat may be affected by noise levels above 50 dBA. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Small Mammals

Alterations to small mammal habitat discussed in the site preparation and construction phase of this Project will persist through the operations phase. Modelling for this Project indicated that site preparation and construction sounds greater than 50 dBA will disturb 109 ha of habitat. The risk of collisions with vehicles will persist during the operations phase, and will be of highest risk in the fall, when dispersion of young small mammals is highest.

Reptiles and Amphibians

Impacts to reptile and amphibian habitat discussed in the site preparation and construction phase of this Project will persist through the operations phase. Modelling for this Project indicated that site preparation and construction sounds greater than 50 dBA will disturb 60 ha of potential habitat. The risk of collisions with vehicles will persist during the operations phase, and will be of highest concern in the spring and fall.

Terrestrial Invertebrates

Impacts to terrestrial invertebrate habitat discussed in the site preparation and construction phase of this Project will persist through the operations phase. The risk of collisions with vehicles will persist during the operations phase, and will be highest in the spring and fall.

6.12.4.3 Closure Phase

Wildlife Species at Risk

Effects from the site preparation and construction phase of this Project will persist throughout the closure phase for all wildlife species at risk.

Similar to the site preparation and construction phase, sound disturbance may continue to have a negative impact on Common Nighthawk. The total area that may be affected by increased noise levels during this phase of the project is 192 ha of potential habitat. None of the affected habitat lies in the areas where Common Nighthawks have been heard.

It is not anticipated that the sound levels generated by closure will interfere with the echolocation, and therefore the hunting success, of the bat species. Although vehicle/bat collisions are uncommon, collisions with vehicles will be a risk to bats found in the project area, and this risk will continue during this phase of the Project.

As previously mentioned, Barn swallow are known to nest in human-built structures such as barns, sheds and the overhangs of houses. They will also nest in culverts and under bridges, as well as natural rock faces. Mortality as a result of vehicle collisions will continue to be a risk to Barn Swallow during the closure phase of this Project.

Ungulates

Effects from the site preparation and construction phase of this Project will persist throughout the closure phase. . An additional 53 ha of habitat could be affected during closure through noise levels above 50 dBA. This could result in loss of habitat with the potential to support an additional 0.16 moose within the LSA.

Increased traffic during the closure phase will continue to have the potential for increased vehicle collisions with ungulates. This may affect local moose populations as well as humans. It is not anticipated that the increased traffic will affect any moose habitat linkages, as the effects of the site preparation and construction phase will persist.

Furbearers

Effects from the site preparation and construction phase of this Project will persist throughout the closure phase. During this phase, 14 ha of American Marten habitat could be affected during closure through noise levels above 50 dBA. This could result in loss of habitat with the potential to support an additional 0.06 to 0.17 individuals within the LSA.

Project closure may also affect American Marten through the unintended provision of attractants such as plastics and garbage. This can result in mortalities through the consumption of non-edible materials, and the need to trap and relocate or destroy nuisance animals. Although traffic volume is expected to be increased above current levels during this phase of the project, marten vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Effects to Beaver habitat from the site preparation and construction phase of this Project will persist throughout the operations phase. No additional impacts to Beaver are anticipated during the operations phase with the exception of the need to trap and relocate or destroy nuisance animals, as Beaver tend to increase the likelihood of flooding roads through plugging culverts. Although traffic volume is expected to increase during the site preparation and construction phase of the project, beaver vehicle collisions are not expected to increase, as the effects of traffic mortality on mid-sized mammals has been shown to be neutral (Fahrig and Rytwinski 2009).

Upland Birds

Effects from the site preparation and construction phase of this Project will persist throughout the closure phase. Modelling for this project indicated that closure sounds greater than 50 dBA will disturb 2.6 ha of habitat. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Wetland Birds

Effects from the site preparation and construction phase of this Project will persist throughout the closure phase. During this phase of the project, a total of 0.7 ha of potential wetland habitat may be affected by noise levels above 50 dBA. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Small Mammals

Alterations to small mammal habitat discussed in the site preparation and construction phase of the Project will persist through the closure phase. Modelling for this project indicated that closure sounds greater than 50 dBA will disturb 172 ha of habitat. The risk of collisions with vehicles will persist during the closure phase, and will continue to be of highest risk in the fall, when dispersion of young small mammals is highest.

Reptiles and Amphibians

Effects to reptile and amphibian habitat discussed in the site preparation and construction phase of this Project will persist through the closure phase. Modelling for this Project indicated that site preparation and construction sounds greater than 50 dBA will disturb 88 ha of potential habitat. The risk of collisions with vehicles will persist during the closure phase, and will be of highest concern in the spring and fall.

Terrestrial Invertebrates

Effects to terrestrial invertebrate habitat discussed in the site preparation and construction phase of this Project will persist through the closure phase. The risk of collisions with vehicles will persist during the closure phase, and will be highest in the spring and early summer.

6.12.4.4 Post-closure Phase

Once the closure activities are complete there will be no further disturbance of habitat or habitat function at the site. With time, the reclaimed closure landscape will begin to replace the loss of habitat and habitat function. The potential effects of the Project on wildlife and wildlife habitat during the post-closure phase includes the following:

- The effects of direct habitat loss and alteration will continue for all species until the reclaimed landscape is able to provide replacement habitat;
- The effects of the habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality; and
- Wildlife exposure to compounds present in the reclaimed landscape (e.g., reclaimed TSF and WRSA).

6.12.4.5 Predicted Adverse Effects

The predicted effects of the Project on wildlife and wildlife habitat were set out by phase of the Project in Sections 6.12.4.1 through 6.12.4.4. Adverse effects of the Project on wildlife and wildlife habitat were predicted for each of eight wildlife and wildlife habitat VCs (Section 6.1.3.11), but varied by VC, measures and phase of the Project. Adverse effects of the Project on wildlife and wildlife habitat were predicted during the site preparation and construction, operations, and closure phases of the Project. No adverse effects were predicted during the post-closure phase as new habitats will be established once mine and closure activities are completed. A summary of the predicted adverse effects of the Project wildlife and wildlife habitat is provided in Table 6.15.4.5-1.

Table 6.12.4.5-1: Predicted Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	300	300	300	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
	Northern Myotis/ Little Brown Myotis	Habitat loss (ha)	15.85	15.85	15.85	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for Mortality (%)	Low	Low	Low	—
	Barn Swallow	Habitat loss (ha)	Several structures	Several structures	Several structures	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Ungulates	Moose	Habitat loss (ha)	84	84	84	—
		Habitat alteration or disruption (ha)	57	34	53	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Furbearers	American Marten	Habitat loss (ha)	62	62	62	—
		Habitat alteration or disruption (ha)	14	8	14	—
		Potential for Mortality (%)	Low	Low	Low	—
	American Beaver	Habitat loss (ha)	< 4	< 4	< 4	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for Mortality (%)	Low	Low	Low	—
Upland Birds	Upland Birds	Habitat loss (ha)	95	95	95	—
		Habitat alteration or disruption (ha)	3.21	4.3	2.6	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	33	33	—
		Habitat alteration or disruption (ha)	2.9	7.5	0.7	—
		Potential for Mortality (%)	Low	Low	Low	—
Small mammals	Small Mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	109	172	—

Table 6.12.4.5-1: Predicted Adverse Effects on Wildlife and Wildlife Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
		Potential for Mortality (%)	Medium	Medium	Medium	—
Reptiles and Amphibians	Reptiles and Amphibians	Habitat loss (ha)	162	162	162	—
		Habitat alteration or disruption (ha)	89	60	88	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Invertebrates	Terrestrial Invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	400	400	—
		Potential for Mortality (%)	Medium	Medium	Medium	—

Note: (1) The "—" symbol indicates there were no predicted adverse effects.

6.12.5 Identified Mitigation

The following mitigation measures will be implemented as part of the Project to help avoid potential effects on wildlife and wildlife habitat:

- Project design incorporates a compact footprint. [Mit_050].
- Minimized the amount of habitat clearing required for the Project by siting Project infrastructure, to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways. [Mit_065].
- Provide vegetated buffers of 120 m along rivers creeks and wetlands wherever feasible [Mit_066].Conducting timber clearing outside of the breeding bird window (May 1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats. [Mit_067].
- The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species. [Mit_068].
- Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions. [Mit_069].
- Protection of suitable bird breeding habitat, where possible. [Mit_070].
- Wildlife awareness training for all staff including SAR identification / legislation and education regarding seasonal changes in animal behaviour and their presence. [Mit_071].
- Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area. [Mit_072].
- Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF. [Mit_073].
- Implementation of noise abatement strategies to limit the negative effects of sound on wildlife. [Mit_025, Mit_028, Mit_029, Mit_031].
- Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation). [Mit_074].
- Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].
- Construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses. [Mit_008].
- Implement sediment and erosion control during the site preparation and construction phase. [Mit_054].

In addition to the above, the following specific mitigation measures will be implemented to address adverse effects should they arise:

- If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow). [Mit_075].
- Providing acceptable buffers around any raptor nests identified throughout all Project phases. [Mit_076].

6.12.6 Residual Adverse Effects

In the context of the CEAA, 2012, the offsetting of habitat for Barn Swallow would be considered mitigation that would offset and mitigate the adverse effects of the Project on this indicator. Therefore, following offsetting there are no residual adverse effects due to the Project related to habitat loss for Barn Swallow, an indicator for the Wildlife Species at Risk VC. The adverse effects for wildlife and wildlife habitat that remain after the mitigation are set out in Table 6.12.6-1.

6.12.7 Information to Address Round 1 Information Requests

The following lists the questions from the Round 1 information requests that relate to the effects of the Project on wildlife and wildlife habitat:

- TMI_145-WL(1)-02: effects of Project on wildlife habitat;
- TMI_148-WL(1)-05: exposure of wildlife to compounds in TSF;
- TMI_181-AE(1)-19: effects of light on wildlife;
- TMI_192-AE(1)-30: effects of noise on wildlife;
- TMI_337-AC(1)-11: exposure of birds to compounds in TSF;
- TMI_359-AC(1)-33: effects on ungulates and furbearers;
- TMI_375-AC(1)-49: effects on moose;
- TMI_527-AC(1)-201: link wildlife effects to Aboriginal peoples;
- TMI_540-AC(1)-214: link wildlife effects to Aboriginal peoples;
- TMI_543-AC(1)-217: effects on SAR and ungulates;
- TMI_546-AC(1)-220: effects on upland birds;
- TMI_547-AC(1)-221: effects on upland birds;
- TMI_548-AC(1)-222: effects on wetland birds;
- TMI_549-AC(1)-223: effects on wetland birds;
- TMI_588-AC(1)-262: effects of blasting noise on wildlife;

Table 6.12.4.5-1: Residual Adverse Effects on Wildlife and Wildlife Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wildlife SAR	Common Nighthawk	Habitat loss (ha)	300	300	300	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
	Northern Myotis/ Little Brown Myotis	Habitat loss (ha)	15.85	15.85	15.85	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for Mortality (%)	Low	Low	Low	—
	Barn Swallow	Habitat loss (ha)	Several	Several	Several	—
		Habitat alteration or disruption (ha)	198	122	192	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Ungulates	Moose	Habitat loss (ha)	84	84	84	—
		Habitat alteration or disruption (ha)	57	34	53	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Furbearers	American Marten	Habitat loss (ha)	62	62	62	—
		Habitat alteration or disruption (ha)	14	8	14	—
		Potential for Mortality (%)	Low	Low	Low	—
	American Beaver	Habitat loss (ha)	< 4	< 4	< 4	—
		Habitat alteration or disruption (ha)	—	—	—	—
		Potential for Mortality (%)	Low	Low	Low	—
Upland Birds	Upland Birds	Habitat loss (ha)	95	95	95	—
		Habitat alteration or disruption (ha)	3.21	4.3	2.6	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	33	33	—
		Habitat alteration or disruption (ha)	2.9	7.5	0.7	—
		Potential for Mortality (%)	Low	Low	Low	—
Small mammals	Small Mammals	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	109	172	—

Table 6.12.6-1: Residual Adverse Effects on Wildlife and Wildlife Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
		Potential for Mortality (%)	Medium	Medium	Medium	—
Reptiles and Amphibians	Reptiles and Amphibians	Habitat loss (ha)	162	162	162	—
		Habitat alteration or disruption (ha)	89	60	88	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Invertebrates	Terrestrial Invertebrates	Habitat loss (ha)	—	—	—	—
		Habitat alteration or disruption (ha)	400	400	400	—
		Potential for Mortality (%)	Medium	Medium	Medium	—

Note: (1) The "—" symbol indicates there were no predicted residual adverse effects.

- TMI_589-AC(1)-263: effects of noise and blasting on wildlife;
- TMI_615-AC(1)-288: site preparation effects on wildlife habitat;
- TMI_644-AC(1)-317: effects on migratory birds and alienation of wetlands;
- TMI_671-AC(1)-344: effects on moose and migratory bird habitat;
- TMI_716-PC(1)-31: noise effects on wildlife; and
- TMI_748-PC(1)-63: wildlife mortality.

6.13 Migratory Birds

6.13.1 Potential Effects of the Project on the Environment

As part of the Round 1 information request process, the Agency required that a separate discipline be included in the revised EIS to describe the potential effects of the Project on migratory birds. This section is in addition to the assessment on wildlife and wildlife habits (Section 6.12), which also included the effects of the Project on birds, as a part of wildlife and wildlife habitat. The migratory birds VCs used for assessing the effects of the Project were introduced in Section 6.1.3.12. The Project, as proposed, will involve the clearing of lands and vegetation to accommodate the Project structures and facilities (e.g., processing plant, tailings storage facility [TSF]), as well as for the open pit mine. In addition, the mine will include equipment and activities that can have a direct or indirect effect on migratory birds. The potential effects of the Project on the migratory birds VCs for the various Project phase are as follows:

- **Site Preparation and Construction Phase**: Most of the removal of vegetation, displacement of wildlife and disturbance and of soils and overburden will occur during the site preparation and construction phase. The potential effects of these activities on migratory birds includes the following:
  - Direct loss of habitat as a result of vegetation clearing and overburden stripping;
  - Functional loss of habitat as a result of fragmentation and noise levels;
  - Direct mortality of migratory birds due site clearing and construction activities; and
  - Direct mortality of migratory birds as a result of vehicle collisions.
- **Operations Phase**: Once mining starts, most of the activities at the site will be occurring within the limits of the areas disturbed during the site preparation and construction phase. As operations progress, waste rock will continue to be added to the waste rock storage area (WRSA) until the mined out portions of the open pit can be used. As operations continue, the footprint of the TSF will continue to grow as additional tailings are added to it. The potential effects of these activities on migratory birds includes the following:
  - The effects of direct habitat loss during the site preparation and construction phase will continue through operations;

- The functional loss of habitat as a result of fragmentation during the site preparation and construction phase will continue through operations;
- Direct habitat loss due to the expansion of the WRSA and TSF footprints;
- Functional loss of habitat as a result of light and noise; and
- Direct mortality of migratory birds as a result of vehicle collisions.

- **Closure Phase**: Following the end of mining activities, the Project facilities will be decommissioned and removed and the site will be re-graded to ensure all runoff drains towards the open pit. The process water covering the TSF will be withdrawn, treated and used to help fill the open pit. The TSF will be covered with a granular layer to isolate the tailings, and then covered with either a dry low permeability cover, or a wet cover with non-process water to prevent acidification. Suitable plant species will be used to help re-vegetate the site and return it to a condition suitable to support a functioning ecosystem. The potential effects of these activities on migratory birds includes the following:
  - The effects of direct habitat loss during the site preparation and construction and operations phase will continue until the reclaimed landscape is able to provide replacement habitat;
  - The functional loss of habitat as a result of fragmentation during the site preparation and construction phase will continue until the reclaimed landscape can return some of the habitat functionality;
  - Functional loss of habitat as a result of noise;
  - Direct mortality of migratory birds due reclamation and closure activities; and
  - Direct mortality of migratory birds as a result of vehicle collisions.

- **Post-closure Phase**: Once the closure activities are complete there will be no further disturbance of habitat or habitat function at the site. With time, the reclaimed closure landscape will begin to replace the loss of habitat and habitat function. The potential effects of the Project on migratory birds during this phase includes the following:
  - The effects of direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat; and
  - The effects of the habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality.

The potential effects of the Project on migratory birds habitat have been described using a simple linkage diagram in Figures 6.13.1-1 and 6.12.1-2. The figures illustrate the migratory bird VCs (shown in blue on the figure) and how it can be potentially affected during each phase of the Project life. The figure also indicates the other components or VCs (shown in red on the figure) that can be affected by effects to migratory birds. For example, effects on migratory birds could be relied on when evaluating the effects of the Project on Aboriginal peoples. Similarly, other components that provide inputs to the evaluation of the effects of the Project on wildlife and wildlife habitat are shown in red on the figure. For example, the effects of the Project on noise are used in determining the effects on the migratory birds VCs.

6.13.2 Effects Prediction Methods

A numerical geographic information system (GIS) approach was used for predicting the effects of the Project on wildlife and wildlife habitat. Modelled wildlife habitat suitability for most VCs using the Ontario Landscape Tool (OLT) (2016, build 3.5.6117), a modeling program developed by the Ontario Ministry of Natural Resources and Forests (MNRF). A variety of habitat suitability models are incorporated into the software (e.g., Holloway, 2004). These models are applied to digital Forest Resources Inventory (FRI) data. Specifically, the OLT overlays a grid of hexagons on the FRI data (as well as built-in datasets with climate information and the location of roads, urban areas, and waterbodies) and determines the suitability of each hexagon as a function of ecosite (forest type) and development stage (forest age class) and — for some species — patch size and climate. Depending on the species, the hexagons are either 0.1 or 0.8 ha in size. These results are then summarized over larger hexagons (normally 1 ha in size) and then averaged and reported for each inventory polygon (Elkie et al., 2013). Where modelled results are not available within the OLT, a habitat suitability models was constructed in ArcGIS (v10.4) using the FRI and other spatial layers available through Land Information Ontario (LIO).

6.13.3 Project Effects Avoidance Measures Used in Predictions

The following are effects avoidance measures that will be utilized to reduce potential adverse effects to migratory birds.

- Project design incorporates a compact footprint. [Mit_050].
- Minimized the amount of habitat clearing required for the Project by siting Project infrastructure, to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways. [Mit_065].
- Provide vegetated buffers of 120 m along rivers creeks and wetlands wherever feasible. [Mit_066].
- Conducting timber clearing outside of the breeding bird window (May 1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats. [Mit_067].

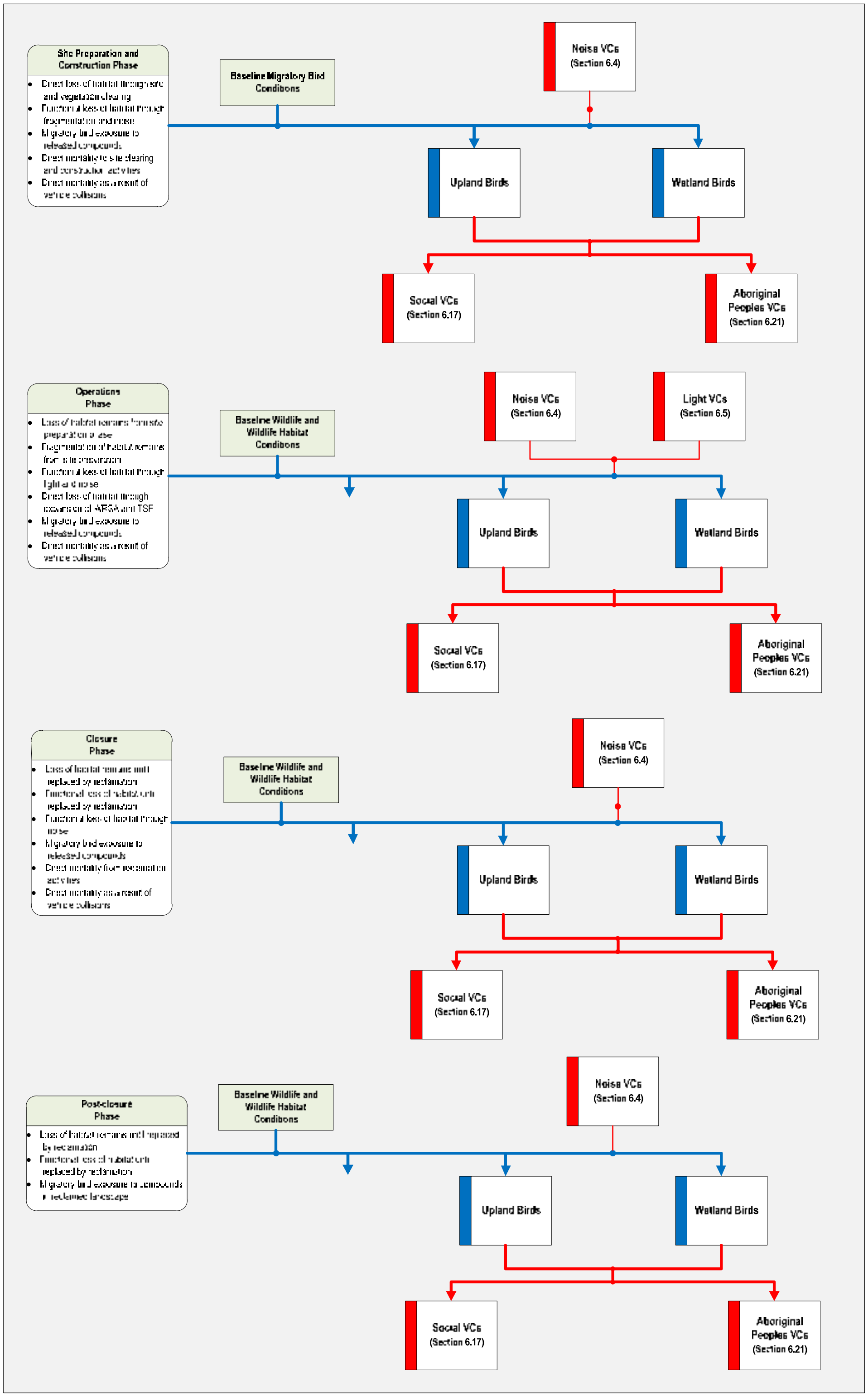


Figure 6.13.1-1: Migratory Birds Linkage Diagram

- Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of migratory bird species. [Mit_068].
- Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions. [Mit_069].
- Protection of suitable bird breeding habitat, where possible. [Mit_070].
- Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviour and their presence. [Mit_071].
- Implementation of noise abatement strategies to limit the negative effects of sound on wildlife. [Mit_025, Mit_028, Mit_029, Mit_031].
- Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].

6.13.4 Predicted Effects

The predicted effects of the Project on migratory birds will vary throughout the Project life, depending on the Project phase, and will vary according to specific levels of activity. Project effects will also vary by VC.

6.13.4.1 Site Preparation and Construction Phase

Upland Birds

For the purposes of this Project, upland habitat was considered to be all ecosites with a dry to fresh moisture regime, that also have well drained soils (northwestern Ontario ecosites: ES1 to ES17) and all developed areas (as these are generally agricultural or meadow type habitats). Upland habitats constitute 34,710 ha within the RSA, and 448 ha within the LSA. Common bird species associated with the upland habitats during point count surveys included many of the warblers and thrushes, as well as some sparrows (Clay-coloured sparrow, Savannah sparrow, LeConte’s sparrow) and northern harrier as examples.

The site development and construction phase of this project will result in the loss of 95 ha of upland habitat (all of which is currently considered developed areas). Some upland avian species have been shown to decline at sound thresholds above 48 dBA, while other studies (Dooling and Popper 2007) have shown that sound masking for avian species can occur at 50 dBA. Modelling for this project indicated that site preparation and construction sounds greater than 50 dBA will disturb 3.21 ha of habitat. The most common adverse effect of sound includes masking important communication signals which reduces the chances of breeding males to attract mates and to defend their territories. Sound disturbance can also mask the sound of nearby predators; increasing mortality through predation (Blickley and Patricelli 2010).

Increased traffic volume also has the potential to increase avian mortality of upland species through increased collisions with vehicles.

Wetland Birds

Despite the name “Marsh Birds”, these species are not exclusively associated with marshes, but can be associated with any wetland area provided it has suitable vegetative habitat (primarily robust emergent vegetation). Between 2011 and 2016, Marsh Bird Surveys took place at 11 locations throughout the LSA. Although many wetland associated bird species were observed or heard during the surveys, on one Marsh Bird target species was heard (a single Sora in 2012).

The site preparation and construction phase of the project will require the removal of 33 total ha of wetlands, which in turn will eliminate the associated Marsh Bird habitat. During the site preparation and construction phase, an additional 2.9 ha of Marsh Bird habitat may be affected by noise levels above 50 dBA.

6.13.4.2 Operations Phase

Upland Birds

Lost habitat occurring as a result of the site preparation and construction phase of this Project will remain unavailable throughout the operations phase. Modelling for this project indicated that operations sounds greater than 50 dBA will disturb 4.3 ha of habitat. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Wetland Birds

Lost habitat occurring as a result of the site preparation and construction phase of this Project will remain unavailable throughout the operations phase During this phase of the project, a total of 7.5 ha of potential wetland habitat may be affected by noise levels above 50 dBA. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

6.13.4.3 Closure Phase

Upland Birds

Lost habitat occurring as a result of the site preparation and construction phase of this Project will remain unavailable throughout the operations phase. Modelling for this project indicated that closure sounds greater than 50 dBA will disturb 2.6 ha of habitat. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

Wetland Birds

Lost habitat occurring as a result of the site preparation and construction phase of this Project will remain unavailable throughout the operations phase. During this phase of the project, a total of 0.7 ha of potential wetland habitat may be affected by noise levels above 50 dBA. Increased traffic volume may continue to pose a threat to the mortality of upland species through increased collisions with vehicles.

6.13.4.4 Post-closure Phase

Once the closure activities are complete there will be no further disturbance of habitat or habitat function at the site. With time, the reclaimed closure landscape will begin to replace the loss of habitat and habitat function. The potential effects of the Project on migratory birds during the post-closure phase includes the following:

- The effects of direct habitat loss and alteration will continue for all species until the reclaimed landscape is able to provide replacement habitat;
- The effects of the of habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality; and
- Migratory bird exposure to compounds present in the reclaimed landscape (e.g., reclaimed TSF and WRSA).

6.13.4.5 Predicted Adverse Effects

The predicted effects of the Project on migratory birds were set out by phase of the Project in Sections 6.13.4.1 through 6.13.4.4. Adverse effects of the Project on migratory birds were predicted for each of the migratory birds VCs (Section 6.1.3.12), but varied by VC, measures and phase of the Project. Adverse effects of the Project on migratory birds were predicted during the site preparation and construction, operations, and closure phases of the Project. No adverse effects were predicted during the post-closure phase. A summary of the predicted adverse effects of the Project migratory birds is provided in Table 6.13.4.5-1.

6.13.5 Identified Mitigation

The following mitigation measures will be implemented as part of the Project to help avoid potential effects on migratory birds:

- Project design incorporates a compact footprint [Mit_050].
- Minimized the amount of habitat clearing required for the Project by siting Project infrastructure, to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways. [Mit_065].
- Provide vegetated buffers of 120 m along rivers creeks and wetlands wherever feasible [Mit_066].

Table 6.13.4.5-1: Predicted Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland Birds	Upland Birds	Habitat loss (ha)	95	95	95	—
		Habitat alteration or disruption (ha)	3.21	4.3	2.6	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	33	33	—
		Habitat alteration or disruption (ha)	2.9	7.5	0.7	—
		Potential for Mortality (%)	Low	Low	Low	—

Note: (1) The "—" symbol indicates there were no predicted adverse effects.

- Conducting timber clearing outside of the breeding bird window (May 1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats. [Mit_067].
- Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species. [Mit_068].
- Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions. [Mit_069].
- Protection of suitable bird breeding habitat, where possible. [Mit_070].
- Implementation of noise abatement strategies to limit the negative effects of sound on migratory birds. [Mit_025, Mit_028, Mit_029, Mit_031].
- Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].
- Construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses. [Mit_008].
- Implement sediment and erosion control during the site preparation and construction phase. [Mit_054].

In addition to the above, the following specific mitigation measures will be implemented to address adverse effects should they arise:

- Providing acceptable buffers around any raptor nests identified throughout all Project phases. [Mit_076].

6.13.6 Residual Adverse Effects

The residual adverse effects predicted for migratory birds that remain after the implementation of mitigation measures are set out in Table 6.13.6-1.

6.13.7 Information to Address Round 1 Information Requests

The following lists the questions from the Round 1 information requests that relate to the effects of the Project on migratory birds:

- TMI_145-WL(1)-02: effects of Project on wildlife habitat;
- TMI_148-WL(1)-05: exposure of wildlife to compounds in TSF;
- TMI_181-AE(1)-19: effects of light on wildlife;
- TMI_192-AE(1)-30: effects of noise on wildlife;
- TMI_337-AC(1)-11: exposure of birds to compounds in TSF;

Table 6.13.6-1: Residual Adverse Effects on Migratory Birds

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Upland Birds	Upland Birds	Habitat loss (ha)	95	95	95	—
		Habitat alteration or disruption (ha)	3.21	4.3	2.6	—
		Potential for Mortality (%)	Medium	Medium	Medium	—
Wetland Birds	Marsh Birds	Habitat loss (ha)	33	33	33	—
		Habitat alteration or disruption (ha)	2.9	7.5	0.7	—
		Potential for Mortality (%)	Low	Low	Low	—

Note: (1) The "—" symbol indicates there were no predicted adverse effects.

- TMI_546-AC(1)-220: effects on upland birds;
- TMI_547-AC(1)-221: effects on upland birds;
- TMI_548-AC(1)-222: effects on wetland birds;TMI_549-AC(1)-223: effects on wetland birds;
- TMI_615-AC(1)-288: site preparation effects on wildlife habitat;
- TMI_644-AC(1)-317: effects on migratory birds and alienation of wetlands; and
- TMI_671-AC(1)-344: effects on moose and migratory bird habitat.

6.14 Fish and Fish Habitat

6.14.1 Potential Effects of the Project on the Environment

The potential effects of the Project on the fish and fish habitat VCs, which were introduced Section 6.1.3.12, will vary by phase of Project and the activities that are occurring. These effects will either effect the fish directly (e.g., mortality of fish during the draining of Blackwater Creek Tributary 1 to allow the construction of the open pit) or indirectly through the loss or alteration of habitat (e.g., overprinting Blackwater Creek Tributary 1 to allow the construction of the open pit and overburden storage piles). The potential effects of the Project on the fish and fish habitat VCs for the various Project phases are as follows:

- **Site Preparation and Construction Phase**: Most of the physical disturbance to watercourses and watersheds will occur during the site preparation and construction phase of the Project. The potential effects of these activities on fish and fish habitat includes the following:
  - During mining of the open pit, portions of Blackwater Creek Tributary 1 will be overprinted. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 1 that will be overprinted and they will be drained. This will result in the direct loss of habitat and the reduction of flows in the downstream reaches of the tributary. Fish mortality could occur when the isolated reaches are drained and flows are reduced in the downstream reaches.
  - Construction of the tailings storage facility (TSF) and minewater pond will overprint sections of Blackwater Creek Tributary 2. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 that will be overprinted and they will be drained. This will result in the direct loss of habitat and the effective elimination of flow in the downstream reaches of the tributary. Fish mortality could occur when the isolated reaches are drained and flows are reduced in the downstream reaches. Drainage from portions of the headwaters of Blackwater Creek Tributary 2 will be blocked by the perimeter ditch and associated berm. Water from this area, which is referred to as the upstream catchment area, will be conveyed to Blackwater Creek via a new, constructed watercourse. This diversion will be permanent.

  - o Construction of the perimeter ditch will affect the watershed areas in Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek.
  - o Construction of the water discharge structure in Blackwater Creek will result in habitat alterations.
  - o Construction of the water intakes in the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3 will result in minor habitat alterations.
  - o Blasting during site preparation and construction could cause mortality of fish.
  - o All runoff from the site will be collected during the site preparation and construction phase. There will be no discharges to surface water.

- **Operations Phase:** During the operations phase, mining activities will begin within an open pit, and progress to an underground mine. Mined ore will be processed within the plant to recover gold. Tailings and water from the processing will be treated and discharged to the TSF where the solids will be allowed to settle. A portion of the water from the TSF will be recovered for use, along with collected runoff and water from the dewatering of the open pit and underground mine in the process. Excess water will be treated to meet Provincial Water Quality Objectives (PWQO), or be less than background concentrations if background levels are greater than the PWQO, prior to being discharged to Blackwater Creek through an engineered structure. There would be no new direct effects on fish habitat during the operations phase. The potential effects of these activities on fish and fish habitat includes the following:
  - o Habitat lost on Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 during the site preparation and construction phase will remain lost throughout operations. Flow will continue to be reduced to the reaches of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 that are downstream from the Project.
  - o Drainage from the upstream catchment area of Blackwater Creek Tributary 2 will be continue to be conveyed to Blackwater Creek via a new, constructed watercourse.
  - o The catchment areas enclosed within the perimeter ditch will continue to result in decreased flows in Hoffstrom's Bay Tributary and Little Creek.
  - o Excess water not required in the processing will be treated to meet PWQO, or be less than background concentrations if background levels are greater than the PWQO, prior to being discharged into Blackwater Creek through an engineered structure. These releases could affect both the surface water quality and surface water quantity downstream of the Project.
  - o Periodically, fresh water to support the process will be taken from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3, decreasing the flows in those watercourses.
  - o Dewatering of the open pit and underground mine will result in a drawdown zone that could affect flows in the portions of Blackwater Creek, Thunder Lake Tributary 2 and

Thunder Lake Tributary 3 that underlain with granular materials. Most of the watercourses near the Project are underlain with fine silts and clays, and are thus insensitive to changes in groundwater levels.

- o Blasting during operations could cause mortality of fish.

- **Closure Phase**: During the closure phase, the facility will be decommissioned, dewatering activities will cease, and the open pit and underground mine will be allowed to start filling with water. Runoff from the operations area will be directed to the open pit. The water within the TSF will be withdrawn, treated and used to help fill the pit. During the closure phase, there will be no discharges of surface water to the surrounding watercourses. There would be no new direct effects on fish habitat during the closure phase. The potential effects of these activities on fish and fish habitat during closure includes the following:
  - o Habitat in Blackwater Creek Tributary 1 lost during the site preparation and construction phase will remain lost throughout closure. The section of Blackwater Creek Tributary 1 downstream of the open pit will be rehabilitated, but will not have sufficient flow during closure to support fish.
  - o Habitat in Blackwater Creek Tributary 2 lost during the site preparation and construction phase will remain lost throughout closure.
  - o Drainage from the upstream catchment area of Blackwater Creek Tributary 2 will be continue to be conveyed to Blackwater Creek via a new, constructed watercourse.
  - o The catchment areas enclosed within the perimeter ditch will continue to result in decreased flows in Hoffstrom's Bay Tributary and Little Creek.
  - o Decommissioning of the water discharge structure in Blackwater Creek will result in habitat alterations.
  - o Decommissioning of the water intakes in the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3 will result in minor habitat alterations.
  - o While dewatering activities will cease at the end of operations, the groundwater drawdown will continue to affect flows in the portions of Blackwater Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3 that areunderlain with granular materials.
  - o There will be no blasting during the closure phase.

- **Post-closure Phase**: Following closure, all of the runoff from the site will continue to be directed to the open pit. There will be no discharges of surface water until the pit is fully flooded. Groundwater inflow will continue to the open pit during this period. Once the pit is fully flooded, water from the open pit will be released passively into Blackwater Creek Tributary 1 through an engineered spillway. These releases will help to re-establish the flows in this watercourse. Although groundwater will continue to inflow to the pit lake even after it is fully flooded, the groundwater levels will gradually return to near pre-development conditions and seepage from the TSF and waste rock storage area (WRSA) will escape the site and report to surface watercourses near the Project. The potential effects of the Project on fish and fish habitat during post-closure includes the following:

- Habitat in Blackwater Creek Tributary 2 lost during the site preparation and construction phase will be permanently lost.
- Drainage from the upstream catchment area of Blackwater Creek Tributary 2 will continue to be conveyed to Blackwater Creek, via a new, constructed watercourse.
- The decrease in catchment areas for Hoffstrom's Bay Tributary and Little Creek will be permanent, as will be the resulting decrease in flows.
- The open pit is expected to fill between 5 and 9 years after dewatering activities stop, at which point it will be allowed to passively discharge through an engineered spillway into Blackwater Creek Tributary 1. Discharges from the pit lake will affect the surface water quality and quantity downstream of the engineered spillway, as well as re-establishing flows in Blackwater Creek Tributary 1.
- Seepage from the TSF and WRSA could affect surface water quality in the adjacent watercourses.

The potential effects of the Project on fish and fish habitat have been described using a simple linkage diagram in Figure 6.14.1-1. The figure illustrates the fish and fish habitat VCs (shown in blue on the figure) and how they can be potentially affected during each phase of the Project life. The figure also indicates the other components or VCs (shown in red on the figure) that can be affected by effects to fish and fish habits. For example, effects on fish and fish habitat will be relied on for evaluating the effects of the Project on Aboriginal peoples. Similarly, other components that provide inputs to the evaluation of the effects of the Project on fish and fish habitat are shown in red on the figure. For example, the effects of the Project on surface water quality are used in determining the effects on the fish and fish habitat VCs.

6.14.2 Effects Prediction Methods

Effects of the Project on fish and fish habitat are predicted based on knowledge of the existing fish habitat and fish communities present and the direct predicted effects of the Project. The predictions of direct effects are primarily qualitative, with quantitative estimates of changes in habitat made where applicable, using GIS. The prediction of effects of the Project on fish and fish habitat also relies on quantitative predictions made for physical disciplines (e.g., surface water quality).

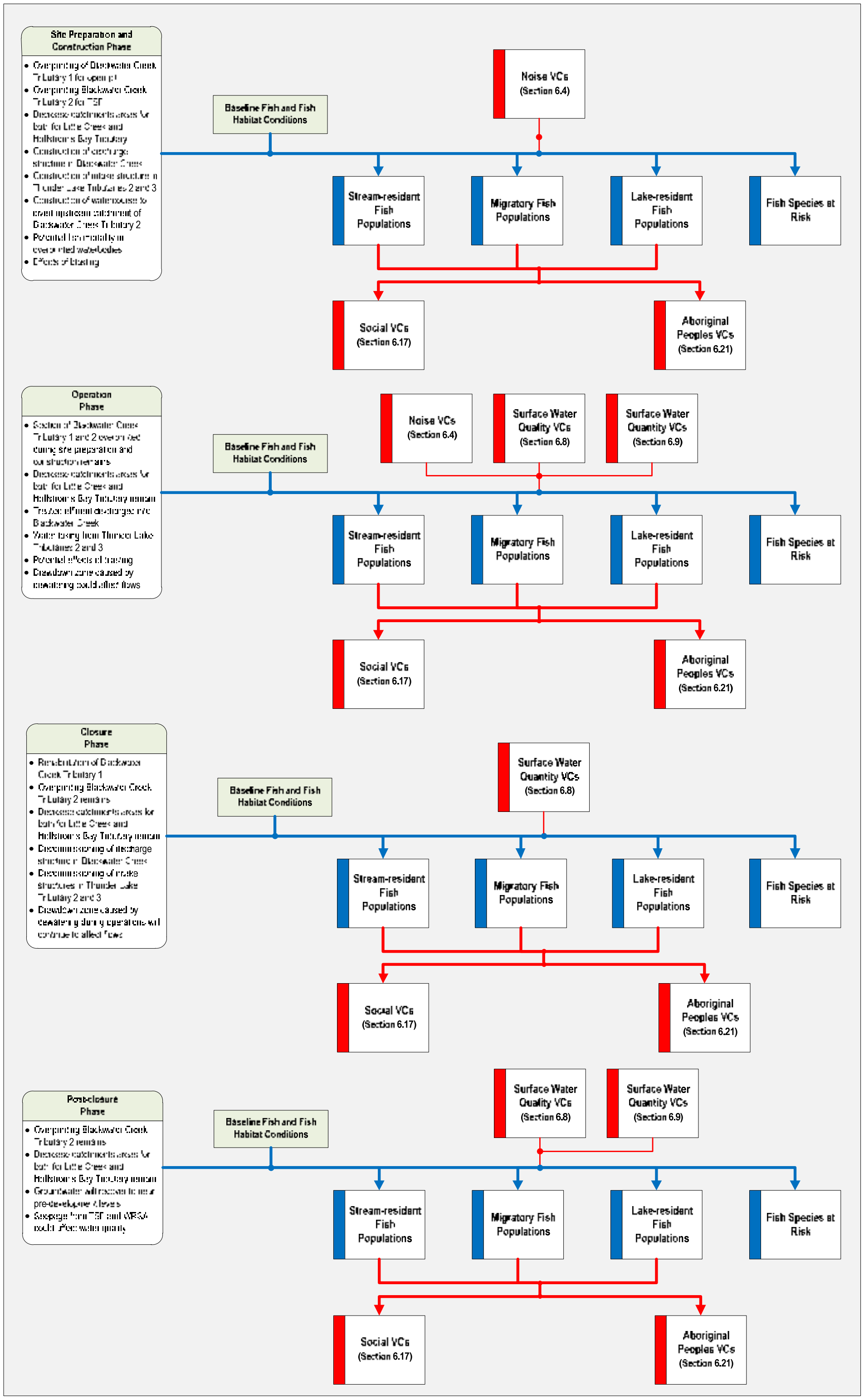


Figure 6.14.1-1: Fish and Fish Habitat Linkage Diagram

6.14.3 Project Effects Avoidance Measures Used in Predictions

A number of measures have been incorporated into the Project that help avoid or minimize the potential effects to fish and fish habitat, which include the following.

- As part of the refinements to the Project since the filing of the EIS (discussed in Section 3.16), the plant site and laydown area have been relocated to west of Tree Nursery Road, eliminating the need to divert the lower reaches of Blackwater Creek Tributary 2.
- As part of the refinements to the Project since the filing of the EIS (discussed in Section 3.16), the overburden stockpile has been modified to avoid infilling the lower reaches of Blackwater Creek Tributary 1.
- As part of the refinements to the Project since the filing of the EIS (discussed in Section 3.16), a perimeter berm and ditch will be constructed around the operations area. The berm and ditch have been constructed so as to avoid infilling the lower reaches of Blackwater Creek Tributary 1.
- Prior to overburden removal, any beaver dams within the Project footprint will be removed and the impoundments will be allowed to draw down. This will reduce the number of fish that will remain in isolated sections of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2. [Mit_077].
- Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted. [Mit_078].
- To the extent practicable, fish in the sections of Blackwater Creek Tributary 1 that will be isolated by the construction of the perimeter ditch and overprinted by the removal of overburden from the open pit will be captured and relocated to the same tributaries downstream from the operations area, or to the main branch of Blackwater Creek. [Mit_079].
- To the extent practicable, fish in the sections of Blackwater Creek Tributary 2 that will be isolated by the construction of the perimeter ditch and overprinted by the construction of the TSF will be captured and relocated to the same tributaries downstream from the operations area, or to the main branch of Blackwater Creek. [Mit_080].
- Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary. [Mit_050].
- Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system. [Mit_008].

- The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project. [Mit_057].
- The fresh water needs for the Project will be met by withdrawals from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The withdrawals will not exceed 5% of the flows in either of the two creeks. Pump intakes will be fitted with fish screens to prevent entrainment. [Mit_059, Mit_081].
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
- Treated effluent will be discharged to Blackwater Creek through an engineered structure designed to minimize erosion risks. [Mit_058].
- 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 concentrations if background levels exceed the PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].
- Once the pit has filled during the post-closure phase, excess water will be allowed to passively discharge through a spillway into the former channel of Blackwater Creek Tributary 1. [Mit_060].
- As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage. [Mit_082].

6.14.4 Predicted Effects

Effects of the Project to fish and fish habitat VCs can occur as a result of direct loss or physical alteration of habitat, changes to flow, changes to water quality and blasting. The predicted effects from each phase of the Project are presented below.

6.14.4.1 Site Preparation and Construction Phase

Direct Loss or Alteration of Habitat

Blackwater Creek

Installation of the effluent discharge structure (the diffuser) in Blackwater Creek will result in localized habitat alterations. This is not expected to cause serious harm to fish or fish habitat.

Blackwater Creek Tributary 1

In preparation of for mining the open pit, portions of Blackwater Creek Tributary 1 will be overprinted. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 1 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary. This will result in the direct loss of 1.34 km of stream, 0.59 km of habitat in the overprinted areas, and 0.75 km in the downstream sections where flow will be eliminated. This construction could also result in direct fish mortality.

There are, at present, three beaver ponds along the portion of Blackwater Creek Tributary 1 that will be overprinted. These ponds cover a total of 3.79 ha. The beaver dams will be breached to draw down these ponds prior to overprinting. It is expected that most of the fish present, which are likely to include a number of common bait species, will move downstream as the water levels are reduced. Relocation of the fish that remain within the isolated portion of Blackwater Creek Tributary 1 will be undertaken but, given the habitat conditions (soft substrates, dense riparian vegetation) and the difficulty that they will pose to fish capture, mortality of fish will occur after these sections are isolated. In the downstream reaches of Blackwater Creek Tributary 1, most fish are expected to move downstream to Blackwater Creek as flows diminish. This reach will be examined and fish relocation will be undertaken if required, but some mortality of fish that do not leave voluntarily may occur there as well.

Blackwater Creek Tributary 2

Construction of the tailings storage facility (TSF) and minewater pond will overprint sections of Blackwater Creek Tributary 2. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 overprinted by the Project. This will result in the direct loss of habitat. This will result in the direct loss of 3.01 km of stream, 2.29 km of habitat in the overprinted areas, and 0.72 km in the downstream sections where flow will be eliminated. This construction could also result in direct fish mortality. This activity will also result in mortality of stream-resident fish in the overprinted section and possibly in the downstream section where flow is eliminated or reduced.

The areas of the Blackwater Creek Tributary 2 catchment that is upstream from the TSF will be connected to Blackwater Creek via a new watercourse that will be constructed, east of the TSF.

It is not known for certain if the White Sucker that spawn where Blackwater Creek is crossed by Anderson Road are stream-resident or migratory but is has been assumed for the purposes of the assessment that they are migratory. There is no known White Sucker spawning habitat farther upstream in Tributary 2, so it is assumed that migratory White Sucker would only use the portion of Blackwater Creek that is downstream from Anderson Road.

There is, at present, one beaver pond along the portion of Blackwater Creek Tributary 2 that will be overprinted (0.15 ha). The beaver dam will be breached to draw down the water level prior to overprinting. It is expected that most of the fish present, which are likely to include a number of common bait species, will move downstream as the water levels are reduced. Relocation of the fish that remain within the isolated portion of Blackwater Creek Tributary 2 will be undertaken but, as is the case for Blackwater Creek Tributary 1, the habitat conditions (soft substrates, dense riparian vegetation) will make fish capture difficult and mortality of fish will occur after these sections are isolated. In the downstream reaches of Blackwater Creek Tributary 2 most fish are expected to move downstream to Blackwater Creek as flows diminish. This reach will be examined and fish relocation will be undertaken if required, but some mortality of fish that do not leave voluntarily may occur there are well.

Wabigoon Lake

There will be no construction activities that would directly affect or alter Wabigoon Lake.

Thunder Lake Tributary 2

Construction of the water intakes in the irrigation ponds on Thunder Lake Tributary 2 will result in minor habitat alterations. Their installation is not expected to cause serious harm to fish or fish habitat.

Thunder Lake Tributary 3

Construction of the water intakes in the irrigation ponds on Thunder Lake Tributary 3 will result in minor habitat alterations. Their installation is not expected to cause serious harm to fish or fish habitat.

Hoffstrom's Bay Tributary

There would be no construction activities that would directly affect Hoffstrom's Bay Tributary. No surface features are within the watercourse, and none of the watercourse is overprinted.

Little Creek

There would be no construction activities that would directly affect Little Creek. No surface features are within the watercourse, and none of the watercourse is overprinted.

Thunder Lake

There will be no construction activities that would directly affect or alter Thunder Lake.

Changes in Flows or Water Levels

Blackwater Creek

A perimeter ditch will be constructed at the start of the site preparation and construction phase to collect all site runoff from the operations area. There will be no releases from the operations area during the site preparation and construction phase as all collected water will be retained to help establish the TSF and provide water once processing starts. There will be diminished flows in Blackwater Creek for this period of time. Changes in flows in Blackwater Creek during the site preparation and construction phase are calculated based on the relative percentage of the watershed enclosed within the perimeter ditch (Appendix JJ, Table 4-11). A reduction in flow of 20.6% is predicted on Blackwater Creek immediately downstream of the planned discharge point and a reduction in flow of 13.0% is predicted near the point where Blackwater Creek discharges into Wabigoon Lake. These reductions will persist until operations when excess water from the site will be treated to meet PWQO, or background concentrations if background levels are greater than the PWQO, and released into Blackwater Creek (about 2 years of the after construction of the perimeter ditch). During this period there may be a reduction in the number of stream-resident fish that the stream can support beginning downstream from the confluence with Blackwater Creek Tributary 2am.

Blackwater Creek Tributary 1

In preparation of for mining the open pit, portions of Blackwater Creek Tributary 1 will be overprinted. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 1 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary. This will result in the direct loss of habitat in the overprinted portions and the reduction of flows in the downstream reaches of the tributary. For the purposes of this effects assessment, it has been assumed that the reduction in flow in the downstream sections will render them unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Blackwater Creek Tributary 2

Construction of the tailings storage facility (TSF) and minewater pond will overprint sections of Blackwater Creek Tributary 2. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary. This will result in the direct loss of habitat and the effective elimination of flow in the downstream reaches of the tributary. For the purposes of this effects assessment, it has been assumed that the reduction in flow in the downstream sections will render them unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Flow in the areas of the Blackwater Creek Tributary 2 catchment that is upstream from the TSF will be unaffected during the site preparation and construction phase once this area is connected to Blackwater Creek via a new watercourse that will be constructed, east of the TSF.

Wabigoon Lake

The construction of the perimeter ditch and enclosure of a portion of the Blackwater Creek watershed will reduce the flows entering Wabigoon Lake. However, the watershed area enclosed represents just 0.1% of the watershed for Wabigoon Lake (Appendix JJ, Table 4-11). Such a small change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Wabigoon Lake are controlled artificially by a dam located at the outflow in the City of Dryden.

Thunder Lake Tributary 2

There would be no changes in flow due to the Project within Thunder Lake Tributary 2 during the site preparation and construction phase.

Thunder Lake Tributary 3

There would be no changes in flow due to the Project within Thunder Lake Tributary 3 during the site preparation and construction phase.

Hoffstrom's Bay Tributary

A portion of the Hoffstrom's Bay Tributary watershed would be enclosed within the perimeter ditch constructed to collect all site runoff from the operations area. Changes in flows in Hoffstrom's Bay Tributary were calculated based on the relative percentage of the watershed enclosed within the perimeter ditch (Appendix JJ, Table 4-11). A permanent reduction in flow of 7.8% is predicted.

Little Creek

A portion of the Little Creek watershed would be enclosed within the perimeter ditch constructed to collect all site runoff from the operations area. Changes in flows in Little Creek were calculated based on the relative percentage of the watershed enclosed within the perimeter ditch (Appendix JJ, Table 4-11). A permanent reduction in flow of 9.1% is predicted.

Thunder Lake

The portion of the Little Creek and Hoffstrom's Bay Tributary watersheds enclosed within the the perimeter ditch constructed around the operations areas will result in a reduction in surface flows entering Thunder Lake. Based on the relative watershed sizes (Appendix JJ, Table 4-11), this would represent a 0.6% reduction in surface inflow into Thunder Lake. Such a small change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Thunder Lake are controlled artificially by a dam located at the outflow in Aaron Provincial Park.

Changes in Water Quality

During the site preparation and construction phase the water from the operations area will be collected in the perimeter ditch and retained on the site. No effect on water quality is predicted during the site preparations and construction phase.

Blasting

Fish habitat within the operations area will be isolated and fish will be relocated at the outset of the Project. Therefore it is not expected that there will be fish in proximity to blasting. Should this not be the case, DFO guidelines for the use of explosives in or near Canadian fisheries waters (Wright and Hopky 1998) will be adhered to in order to ensure that no harm to fish occurs.

Summary of Site Preparation and Construction Phase Effects

Using the above information describing the effects of the Project on individual watercourses during the site preparation and construction phase, the following information describing the effects of the Project on the fish and fish habitat VCs during the site preparation and construction phase was compiled. The results are summarized in Table 6.14.4.1-1.

Stream-Resident Fish

Stream-resident fish in the waterways affected by the Project will experience a combination of effects associated with the direct loss and alteration caused by the overprinting of sections of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2. The perimeter ditch constructed around the operations area will effectively eliminate flows in the downstream reaches of these tributaries, which is assumed to render them unsuitable as fish habitat. The overprinting of these watercourses will also overprint four (4) beaver ponds.

Water intakes will be constructed in the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3, while an effluent diffuser will be constructed in Blackwater Creek. These activities are not expected to cause serious harm to fish or fish habitat.

The construction of the perimeter ditch will enclose a portion of the watersheds of Blackwater Creek, Hoffstrom's Bay Tributary and Little Creek, reducing the flows in these watercourses.

There will be no releases from the Project during the site preparation and construction phase once the perimeter ditch is constructed around the operations area. Runoff from the operations area will be collected for use in initiating the TSF and providing a supply pf water for when operations commence.

Migratory Fish

Migratory fish have been identified to use the main branch of Blackwater Creek, but fisheries surveys and netting programs have identified that migratory fish do not use either Blackwater Creek Tributary 1, or Blackwater Creek Tributary 2. Therefore, migratory fish would not be affected by the overprinting of these watercourses and the elimination of flows downstream of the perimeter ditch around the operations area that will render the portions of the watercourse downstream of the perimeter ditch unsuitable for fish.

The construction of the perimeter ditch around the operations area will enclose a portion of the watersheds of Blackwater Creek, Hoffstrom's Bay Tributary and Little Creek, reducing the flows in these watercourses. These reduced flows could affect migratory fish populations.

Lake-Resident Fish

There were not predicted effects of the Project during the site preparation and construction phase that would affect lake-resident fish. There are no physical features associated with the Project that would be constructed in either Thunder Lake or Wabigoon Lake.

The construction of the perimeter ditch around the operations area will enclose a portion of the watersheds of Blackwater Creek, Hoffstrom's Bay Tributary and Little Creek, will reduce flows reducing the flows in these watercourses. However, the amount of flow reduction would not result in any measurable changes in lake levels. In addition, the water levels in both Thunder Lake and Wabigoon Lake are artificially controlled by dams in Aaron Provincial Park and the City of Dryden, respectively.

Fish Species at Risk

As described in Section 5.8.4, no aquatic species at risk were identified within the aquatic local study area (LSA) or regional study areas (RSA).

Table 6.14.4.1-1: Summary of Predicted Effects during Site Preparation and Construction

Valued Components (VCs)	Indicators	Measures	Blackwater Creek Main Branch	Blackwater Creek Tributary 1	Blackwater Creek Tributary 2	Wabigoon Lake	Thunder Lake Tributary 2	Thunder Lake Tributary 2	Hoffstom's Bay Tributary	Little Creek	Thunder Lake
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0 (1)	1.34	3.01	0	0 (2)	0 (2)	0	0	0
		Pond area (ha)	0 (1)	3.79	0.15	0	0 (2)	0 (2)	0	0	0
		Fish mortality proportion (%)	0 (1)	50%	50%	0	0 (2)	0 (2)	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	‡ (3)	‡ (3)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	‡ (3)	‡ (3)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Pond area (ha)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Fish mortality proportion (%)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
	Blasting	Fish mortality proportion (%)	0	‡ (3)	‡ (3)	0	0	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0 (5)	0 (5)	0	0	0	0	0	0
		Pond area (ha)	0	0 (5)	0 (5)	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0 (5)	0 (5)	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	0 (5)	0 (5)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	0 (5)	0 (5)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Pond area (ha)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Fish mortality proportion (%)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
	Blasting	Fish mortality proportion (%)	0	0 (5)	0 (5)	0	0	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
	Changes water levels	Lake area (ha)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
	Changes in water quality	Lake area (ha)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
	Blasting	Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Changes in flows or water levels	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Changes in water quality	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Blasting	Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)

Notes:

(1) The effluent discharge structure (the diffuser) will be installed in Blackwater Creek. This is not expected to cause serious harm to fish or fish habitat.
(2) The construction of the water intakes in the irrigation ponds on Thunder Lake Tributaries 2 and 3 are not expected to cause serious harm to fish or fish habitat.
(3) The effects to stream-resident fish in the portions of Blackwater Creek Tributaries 1 and 2 overprinted and where flows are effectively eliminated due to the overprinting of the upstream catchment are captured as part of the calculated “direct loss or alteration of habitat”.
(4) There will be no releases from the Project during the site preparation and construction phase. Therefore, there will be no effects on water quality.
(5) Fish surveys and netting confirm that migratory fish only use the lower reaches of Blackwater Creek. Therefore, migratory fish could not be affected be changes within Blackwater Creek Tributary 1 or Tributary 2.
(6) Lake-resident fish are only present in Wabigoon Lake and Thunder Lake.
(7) As described in Section 5.8.4, there are no fish species at risk in the RSA.

6.14.4.2 Operations Phase

Direct Loss or Alteration of Habitat

There will be no additional direct alterations of habitat during the operations phase.

Changes in Flow

Flows in the sub-watersheds affected by the Project have been calculated as part of the assessment of the Project effects on surface water quantities (Section 6.8). Alteration in flows during operations will result from the following:

- The Project will result in the enclosure of watershed areas. Portion of the watersheds for Hoffstrom's Bay Tributary and Little Creek will be enclosed within the perimeter ditch around the operations area resulting in decreased flows.
- Excess water not required in the process will be treated to meet PWQO, or background concentrations if background levels are greater than the PWQO, prior to discharge into Blackwater Creek through an engineered structure.
- Periodic withdrawals of freshwater will be required from the irrigation ponds at the former MNRF tree nursery. These ponds are located on Thunder Lake Tributary 2 and Thunder Lake Tributary 3.
- Dewatering of the open pit and underground mine will create a drawdown zone that could affect the flows in Blackwater Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3.

Blackwater Creek

During operations, flow in Blackwater Creek will be affected the by overprinting of portions of the drainage areas of Blackwater Creek Tributaries 1 and Blackwater Creek Tributary 2. The dewatering activities will create a drawdown zone that could reduce the groundwater discharge to Blackwater Creek. Groundwater modelling estimates that discharges to Blackwater Creek will be potentially reduced by approximately 700 m^3/d. During dry conditions it may be expected that the reduction in groundwater discharge will be several hundred m^3/d lower and approach zero under very dry conditions when there is minimal or no flow in Blackwater Creek. Under wetter than average conditions the reduction in groundwater discharge to Blackwater Creek may be expected to be several hundred m^3/d higher. Excess water from the operations will be treated and discharged to Blackwater Creek through a diffuser.

Modelling of surface water quantities (Section 6.9) indicates that downstream from the confluence with Blackwater Creek Tributary 1 (surface water quantity node BW1), a decrease in annual flows of -3.9%, -6.66% and -1.74%, during average, dry and wet climatological conditions, respectively.

In wet and average years, the range in average monthly flows in Blackwater Creek is reduced. Generally, in those years, during the months with the lowest discharge (January to April, August and September) the effluent discharge is greater than the reduction due to overprinting and dewatering therefore flows are higher. Conversely, in the months with the highest flows (May and June), the reduction in surface flow due to overprinting is more than the effluent discharges and flows are lower. In a dry year the average monthly flows are, similarly, higher in January through April but are lower in all other months except November because the volume of effluent being discharged is also reduced during dry summers.

Overall, during the operations phase little effect on fish and fish habitat is expected in Blackwater Creek due to changes in flow. In some years and some months there will be increases in the amount of habitat available due to higher flows and in others there will be reductions. In all years, peak spring flows will be reduced, and therefore there should be no adverse effects on spawning migrations in the event that existing culverts are barriers or impediments due to high velocities.

Blackwater Creek Tributary 1

The effects of overprinting during the site preparation and construction phase will continue during operations. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 1 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary, which will render them unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Blackwater Creek Tributary 2

The effects of overprinting for the construction of the TSF be permanent, and will continue through operations. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary, which will render them unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Flow in the areas of the Blackwater Creek Tributary 2 catchment that is upstream from the TSF will be unaffected during the site preparation and construction phase once this area is connected to Blackwater Creek via a new watercourse that will be constructed, east of the TSF.

Wabigoon Lake

The changes in flows as a result of the Project will alter the volume of water flowing into Wabigoon Lake. The calculated change reduction in inflows to Wabigoon Lake (Table 6.9.4.2-4) is 0.07%. Such a small change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Wabigoon Lake are controlled artificially by a dam located at the outflow in the City of Dryden.

Thunder Lake Tributary 2

The flows in Thunder Lake Tributary 2 would be affected the periodic withdrawal of fresh water from the former MNRF irrigation pond, as well as being affected by the reduction in groundwater discharge to the watercourse resulting from the drawdown caused by dewatering activities. The reduction in annual flow downstream of the irrigation pond is -0.75%, while the reduction at the mouth of the tributary -1.75%. These flow reductions are small enough that no effects on fish or fish habitat are predicted.

Thunder Lake Tributary 3

The flows in Thunder Lake Tributary 3 would be affected the periodic withdrawal of fresh water from the former MNRF irrigation pond, as well as being affected by the reduction in groundwater discharge to the watercourse resulting from the drawdown caused by dewatering activities. The reduction in annual flow downstream of the irrigation pond is -0.55%. This flow reduction is small enough that no effects on fish or fish habitat are predicted.

Hoffstrom's Bay Tributary

The portion of the Hoffstrom's Bay Tributary watershed enclosed within the perimeter ditch during the site preparation and construction phase will be permanent. This change in watershed results in reduction in flow of 7.8%.

Little Creek

The portion of the Little Creek watershed enclosed within the perimeter ditch results in a permanent reduction in flow of 9.1%.

Thunder Lake

Changes in flows to the tributaries of Thunder Lake will reduce the surface water inflow during the operations phase by 1.01%. Such a change in lake inflow would be small enough to not have a measurable effects on water levels. Additionally, the water levels in Thunder Lake are controlled artificially by a dam located at the outflow in Aaron Provincial Park.

Effects of Changes in Water Quality

During the operations phase changes to the concentrations of various compounds will occur in Blackwater Creek and Wabigoon Lake due to the discharge of treated effluent into Blackwater Creek. The effluent will be treated to meet the PWQO for the protection of aquatic life, or background concentrations if background levels are greater than the PWQO, prior to release into Blackwater Creek. Modelling shows that the resulting water quality will be equivalent to existing conditions or will meet PWQO. Therefore, no adverse effects on fish will occur in the receiving environment. As the entire operations area is enclosed by the perimeter ditch and there is only one point of effluent discharge there are no other locations where changes in water quality will occur during operations.

Blasting

Fish habitat within the operations area will be isolated and fish will be relocated at the outset of the Project. Therefore it is not expected that there will be fish in proximity to blasting. Should this not be the case, DFO guidelines for the use of explosives in or near Canadian fisheries waters (Wright and Hopky 1998) will be adhered to in order to ensure that no harm to fish occurs.

Summary of Operations Phase Effects

Using the above information describing the effects of the Project on individual watercourses during the operations phase, the effects of the Project on the fish and fish habitat VCs during the operations phase was compiled, and summarized in Table 6.14.4.2-1.

Stream-Resident Fish

Stream-resident fish in the waterways affected by the Project will experience a combination of effects associated with the direct loss and alteration during the site preparation and construction phase that will remain during operations.

Changes in flows will occur in the surrounding watercourse as a result of the alteration of watersheds, the discharge of treated effluent to Blackwater Creek, and the reduction in groundwater discharge to Blackwater Creek, Thunder Lake Tributary 2, and Thunder Lake Tributary 3 due to drawdown caused by dewatering. The changes in flows in Thunder Lake Tributaries 2 and 3 are small enough that no effects are predicted to fish and fish habitat.

There will be releases of treated effluent from the Project through a diffuser into Blackwater Creek, Seepage from onsite facilities (i.e., WRSA and TSF) that escapes the collection systems will be captured by the drawdown created by dewatering activities and report to the open pit. Runoff from the operations area will be collected and used onsite.

Table 6.14.4.2-1: Summary of Predicted Effects during Operations

Valued Components (VCs)	Indicators	Measures	Blackwater Creek Main Branch	Blackwater Creek Tributary 1	Blackwater Creek Tributary 2	Wabigoon Lake	Thunder Lake Tributary 2	Thunder Lake Tributary 2	Hoffstom's Bay Tributary	Little Creek	Thunder Lake
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0	1.34	3.01	0	0	0	0	0	0
		Pond area (ha)	0	3.79	0.15	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0 (1)	0 (1)	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	‡ (2)	‡ (2)	0	2.79	1.57	2.58	1.94	0
		Pond area (ha)	0	‡ (2)	‡ (2)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (3)	‡ (2)	‡ (2)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
		Pond area (ha)	0 (3)	‡ (2)	‡ (2)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
		Fish mortality proportion (%)	0 (3)	‡ (2)	‡ (2)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
	Blasting	Fish mortality proportion (%)	0	‡ (2)	‡ (2)	0	0	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0 (4)	0 (4)	0	0	0	0	0	0
		Pond area (ha)	0	0 (4)	0 (4)	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0 (4)	0 (4)	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	0 (4)	0 (4)	0	2.79	1.57	2.58	1.94	0
		Pond area (ha)	0	0 (4)	0 (4)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (3)	0 (3, 4)	0 (3, 4)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
		Pond area (ha)	0 (3)	0 (3, 4)	0 (3, 4)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
		Fish mortality proportion (%)	0 (3)	0 (3, 4)	0 (3, 4)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)	0 (3)
	Blasting	Fish mortality proportion (%)	0	0 (4)	0 (4)	0	0	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0 (5)	0 (5)	0 (5)	0	0 (5)	0 (5)	0 (5)	0 (5)	0
		Fish mortality proportion (%)	0 (5)	0 (5)	0 (5)	0	0 (5)	0 (5)	0 (5)	0 (5)	0
	Changes water levels	Lake area (ha)	0 (5)	0 (5)	0 (5)	0	0 (5)	0 (5)	0 (5)	0 (5)	0
	Changes in water quality	Lake area (ha)	0 (5)	0 (5)	0 (5)	0 (3)	0 (5)	0 (5)	0 (5)	0 (5)	0 (3)
		Fish mortality proportion (%)	0 (5)	0 (5)	0 (5)	0 (3)	0 (5)	0 (5)	0 (5)	0 (5)	0 (3)
	Blasting	Fish mortality proportion (%)	0 (5)	0 (5)	0 (5)	0	0 (5)	0 (5)	0 (5)	0 (5)	0
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
		Pond or lake area (ha)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
	Changes in flows or water levels	Stream length (km)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
		Pond or lake area (ha)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
	Changes in water quality	Stream length (km)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
		Pond or lake area (ha)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)
	Blasting	Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)

Notes:

(1) There would be no additional direct loss or alteration of habitat during operations; therefore, there would be no fish mortality.
(2) The effects to stream-resident fish in the portions of Blackwater Creek Tributaries 1 and 2 overprinted and where flows are effectively eliminated due to the overprinting of the upstream catchment are captured as part of the calculated "direct loss or alteration of habitat".
(3) Modelling shows that receiving water quality will be equivalent to existing conditions or meet PWQO. Therefore, no effects to fish are predicted to result from changes in water quality.
(4) Fish surveys and netting confirm that migratory fish only use the lower reaches of Blackwater Creek. Therefore, migratory fish could not be affected be changes within Blackwater Creek Tributary 1 or Tributary 2.
(5) Lake-resident fish are only present in Wabigoon Lake and Thunder Lake.
(6) As described in Section 5.8.4, there are no fish species at risk in the RSA.

Migratory Fish

Migratory fish have been identified to use the main branch of Blackwater Creek, but fisheries surveys and netting programs have identified that migratory fish do not use either Blackwater Creek Tributary 1, or Blackwater Creek Tributary 2. Therefore, migratory fish would not be affected by the overprinting of these watercourses and the elimination of flows downstream of the perimeter ditch around the operations area that will render the portions of the watercourse downstream of the perimeter ditch unsuitable for fish.

Changes in flows predicted in Blackwater Creek, Hoffstrom's Bay Tributary and Little Creek, reducing the flows in these watercourses. These reduced flows could affect migratory fish populations. The changes in flows in Thunder Lake Tributaries 2 and 3 are small enough that no effects are predicted to fish and fish habitat.

Lake-Resident Fish

Predicted changes in flows during the operations phase will result in a slight decrease in the surface water inflows to Thunder Lake and Wabigoon Lake. However, the amount of flow reduction would not result in any measurable changes in lake levels. In addition, the water levels in both Thunder Lake and Wabigoon Lake are artificially controlled by dams in Aaron Provincial Park and the City of Dryden, respectively.

Fish Species at Risk

As described in Section 5.8.4, no aquatic species at risk were identified within the aquatic local study area (LSA) or regional study areas (RSA).

6.14.4.3 Closure Phase

Direct Loss or Alteration of Habitat

During the Closure Phase the effluent diffuser will be removed from Blackwater Creek and the water intakes will be removed from Thunder Lake Tributary 2 and Thunder Lake Tributary 3. No negative effects to fish or fish habitat will result.

During the Closure Phase the portion of Blackwater Creek Tributary 1 that is downstream from the pit lake outlet will be restored to a form that can accept water and convey it to Blackwater Creek once the pit lake is filled. There will, however, be no fish habitat created there until the pit lake begins to overflow.

The effects on flow in Hoffstrom's Bay Tributary and Little Creek watersheds which occurred during the Construction Phase due to portions of their drainage areas being overprinted by proposed mine site facilities will persist.

Changes in Flow

Blackwater Creek

During closure there will be no effluent discharged from the site. All runoff from the site will be directed towards the open pit to accelerate the rate of filling and therefore flows in Blackwater Creek will be reduced. Based on the drainage area directed towards the open pit at closure. A reduction in flow of 20.8% is predicted downstream of the confluence of Blackwater Creek Tributary 1 (surface water quantity node BW1) and 13.1% at upstream from where Blackwater creek enters Wabigoon Lake. It is estimated that it will take between 5 and 8 years to fill the open pit. During this period there will be a reduction in the amount of fish habitat in Blackwater Creek beginning downstream from the confluence with Blackwater Creek Tributary 2. This effects diminishing as more tributaries enter Blackwater Creek farther downstream. During this period there may be a reduction in the number of stream-resident fish that the stream can support.

Blackwater Creek Tributary 1

The effects of overprinting during the site preparation and construction phase will continue during closure phase. The restored portion of Blackwater Creek Tributary 1 downstream of the pit lake will remain dry until the pit lake is flooded and passively discharges into this watercourse (5 to 9 years following the cessation of dewatering,

Blackwater Creek Tributary 2

The effects of overprinting for the construction of the TSF be permanent, and will continue through operations. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary, which will render them unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Flow in the areas of the Blackwater Creek Tributary 2 catchment that is upstream from the TSF will be unaffected during the site preparation and construction phase once this area is connected to Blackwater Creek via a new watercourse that will be constructed, east of the TSF.

Wabigoon Lake

The changes in flows as a result of the Project will alter the volume of water flowing into Wabigoon Lake. The small change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Wabigoon Lake are controlled artificially by a dam located at the outflow in the City of Dryden.

Thunder Lake Tributary 2

The periodic withdrawals of freshwater will cease with the end of operations. The reduction in groundwater discharge to the watercourse resulting from the drawdown will gradually decrease with time as the groundwater levels recover.

Thunder Lake Tributary 3

The periodic withdrawals of freshwater will cease with the end of operations. The reduction in groundwater discharge to the watercourse resulting from the drawdown will gradually decrease with time as the groundwater levels recover.

Hoffstrom's Bay Tributary

The portion of the Hoffstrom's Bay Tributary watershed enclosed within the perimeter ditch during the site preparation and construction phase will be permanent. This change in watershed results in reduction in flow of 7.8%.

Little Creek

The portion of the Little Creek watershed enclosed within the perimeter ditch results in a permanent reduction in flow of 9.1%.

Thunder Lake

Changes in flows to the tributaries of Thunder Lake will reduce the surface water inflow during the closure phase. However, the small change in lake inflow would be small enough to not have a measurable effects on water levels. Additionally, the water levels in Thunder Lake are controlled artificially by a dam located at the outflow in Aaron Provincial Park.

Changes in Water Quality

During the closure phase all runoff from the site will be directed towards the open pit to accelerate the rate of filling. There will be no effluent discharged from the site to surface water. Seepage from onsite facilities (i.e., WRSA and TSF) that escapes the collection systems will be captured by the drawdown created by dewatering activities and report to the open pit. Therefore, there would be no effect on fish and fish habitat caused by changes in water quality.

Blasting

No blasting is anticipated during closure. Fish habitat within the operations area will be isolated and fish will be relocated at the outset of the Project. Therefore it is not expected that there will be fish in proximity to blasting in the event that it is necessary. Should this not be the case, DFO guidelines for the use of explosives in or near Canadian fisheries waters (Wright and Hopky 1998) will be adhered to in order to ensure that no harm to fish occurs.

Summary of Closure Phase Effects

Using the above information describing the effects of the Project on individual watercourses during the closure phase, the effects of the Project on the fish and fish habitat VCs during the closure phase was compiled, and summarized in Table 6.14.4.3-1.

Stream-Resident Fish

Stream-resident fish in the waterways affected by the Project will continue to experience effects associated with the direct loss and alteration during the site preparation and construction phase. The removal of the diffuser from Blackwater Creek and water intakes from Thunder Lake Tributaries 2 and 3 are not predicted to have negative effects to fish or fish habitat.

Changes in flows will occur in the surrounding watercourse as a result of the alteration of watersheds. There will be no discharges from the Project during closure. The reduction in groundwater discharge to Blackwater Creek, Thunder Lake Tributary 2, and Thunder Lake Tributary 3 due to drawdown caused by dewatering will diminish during closure and groundwater levels begin to recover.

Seepage from onsite facilities (i.e., WRSA and TSF) that escapes the collection systems will be captured by the drawdown created by dewatering activities and report to the open pit. Runoff from the operations area will be directed to the open pit to help with filling.

Migratory Fish

Migratory fish have been not been identified as using either Blackwater Creek Tributary 1, or Blackwater Creek Tributary 2. Therefore, migratory fish would not be affected by the overprinting of these watercourses and the elimination of flows downstream of the perimeter ditch.

Changes in flows predicted in Blackwater Creek, Thunder lake Tributary 2, Thunder Lake Tributary 3, Hoffstrom's Bay Tributary and Little Creek could affect migratory fish populations.

Lake-Resident Fish

Predicted changes in flows during the closure phase will result in decreases of inflows to Thunder Lake and Wabigoon Lake. However, the flow reduction would not result in measurable changes in lake levels. In addition, the water levels in both Thunder Lake and Wabigoon Lake are artificially controlled by dams in Aaron Provincial Park and the City of Dryden, respectively.

Fish Species at Risk

As described in Section 5.8.4, no aquatic species at risk were identified within the aquatic local study area (LSA) or regional study areas (RSA).

Table 6.14.4.3-1: Summary of Predicted Effects during Closure

Valued Components (VCs)	Indicators	Measures	Blackwater Creek Main Branch	Blackwater Creek Tributary 1	Blackwater Creek Tributary 2	Wabigoon Lake	Thunder Lake Tributary 2	Thunder Lake Tributary 2	Hoffstom's Bay Tributary	Little Creek	Thunder Lake
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0 (1)	1.34	3.01	0	0 (2)	0 (2)	0	0	0
		Pond area (ha)	0 (1)	3.79	0.15	0	0 (2)	0 (2)	0	0	0
		Fish mortality proportion (%)	0 (1)	0 (3)	0 (3)	0	0 (2)	0 (2)	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	‡ (4)	‡ (4)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	‡ (4)	‡ (4)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (5)	‡ (4)	‡ (4)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)
		Pond area (ha)	0 (4)	‡ (4)	‡ (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Fish mortality proportion (%)	0 (4)	‡ (4)	‡ (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
	Blasting	Fish mortality proportion (%)	0	‡ (4)	‡ (4)	0	0	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0 (6)	0 (6)	0	0	0	0	0	0
		Pond area (ha)	0	0 (6)	0 (6)	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0 (6)	0 (6)	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	4.50	0 (6)	0 (6)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	0 (6)	0 (6)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (5)	0 (5, 6)	0 (5, 6)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)
		Pond area (ha)	0 (5)	0 (5, 6)	0 (5, 6)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)
		Fish mortality proportion (%)	0 (5)	0 (5, 6)	0 (5, 6)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)	0 (5)
	Blasting	Fish mortality proportion (%)	0	0 (6)	0 (6)	0	0	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0 (7)	0 (7)	0 (7)	0	0 (7)	0 (7)	0 (7)	0 (7)	0
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0	0 (7)	0 (7)	0 (7)	0 (7)	0
	Changes water levels	Lake area (ha)	0 (7)	0 (7)	0 (7)	0	0 (7)	0 (7)	0 (7)	0 (7)	0
	Changes in water quality	Lake area (ha)	0 (7)	0 (7)	0 (7)	0 (5)	0 (7)	0 (7)	0 (7)	0 (7)	0 (5)
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (5)	0 (7)	0 (7)	0 (7)	0 (7)	0 (5)
	Blasting	Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0	0 (7)	0 (7)	0 (7)	0 (7)	0
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
		Pond or lake area (ha)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
		Fish mortality proportion (%)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
	Changes in flows or water levels	Stream length (km)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
		Pond or lake area (ha)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
	Changes in water quality	Stream length (km)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
		Pond or lake area (ha)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
		Fish mortality proportion (%)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)
	Blasting	Fish mortality proportion (%)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)	0 (8)

Notes:

(1) The effluent discharge structure (the diffuser) will be removed from Blackwater Creek. This is not expected to cause harm to fish or fish habitat.
(2) The removal of the water intakes in the irrigation ponds on Thunder Lake Tributaries 2 and 3 are not expected to cause harm to fish or fish habitat.
(3) There would be no additional direct loss or alteration of habitat during operations; therefore, there would be no fish mortality.
(4) The effects to stream-resident fish in the portions of Blackwater Creek Tributaries 1 and 2 overprinted and where flows are effectively eliminated due to the overprinting of the upstream catchment are captured as part of the calculated “direct loss or alteration of habitat”.
(5) There will be no releases from the Project during the closure phase. Seepage escaping the collection systems would be captured by the drawdown and report to the open pit. Therefore, there will be no effects on water quality.
(6) Fish surveys and netting confirm that migratory fish only use the lower reaches of Blackwater Creek. Therefore, migratory fish could not be affected be changes within Blackwater Creek Tributary 1 or Tributary 2.
(7) Lake-resident fish are only present in Wabigoon Lake and Thunder Lake.
(8) As described in Section 5.8.4, there are no fish species at risk in the RSA.

6.14.4.4 Post-closure Phase

Direct Loss Alteration of Habitat

Once the open pit is fully flooded, there will be a passive overflow from the pit to Blackwater Creek Tributary 1. This will create fish habitat in Blackwater Creek Tributary 1 from the overflow structure downstream to Blackwater Creek.

Changes in Flow

Once the pit lake is fully flooded, it will be allowed to passively discharge into Blackwater Creek Tributary 1. Because a portion of the Hoffstrom's Bay and Little Creek watersheds were enclosed within the operations area, the watershed feeding into the tributary is larger than pre-development conditions. The reclaimed surfaces will also result in greater runoff that prior to disturbance. Groundwater modelling shows that groundwater discharge to the open pit will continue once the pit lake is filled, and that the groundwater discharges to Blackwater Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3 will return to near pre-development levels once the groundwater levels recover.

<u>Blackwater Creek</u>

Once the open pit is fully flooded, there will be a passive overflow from the pit lake to Blackwater Creek Tributary 1, which will flow into Blackwater Creek. Post-closure there will be a reduction in flow in Blackwater Creek between Tributary 1 and Tributary 2. This may result in a reduction in the number of fish that this reach can support. Post-closure, increases in annual flows are predicted for Blackwater Creek downstream from Blackwater Creek Tributary 1, which receives the outflow from the pit lake, under all flow conditions. This is the result of higher runoff from the rehabilitated mine site (e.g., semi-impervious membrane with vegetated cover). For a dry cover TSF scenario, the increase in annual flow downstream from the confluence with Blackwater Creek Tributary 1 is predicted to be 10.6% in an average year, 24.3% in a dry year, and 12.6% in a wet year. In a dry year the flows are decreased during the June to September period with a predicted maximum reduction of 20% in September; flows are increased during the rest of the year. In an average year, flows are decreased in August by 5.9% and increased in other months. In a wet year flows are predicted to increase in every month. The increase in flow in the lower reaches of Blackwater Creek may increase the number of stream-resident fish that this reach can support.

The changes in average flow in May, which is the month during which upstream migrations of fish is most likely to occur, upstream from where Blackwater Creek enters Wabigoon Lake (surface water quantity node BW2), are 6.6%, 16.3% and 8% for an average, dry and wet year, respectively. There is insufficient information to determine whether the increases in flow could affect upstream fish passage through existing culverts. As part of the detailed engineering for the Project, determinations of the capacity of the downstream culverts to handle changes in flow, which would include the effects on fish passage, will be evaluated. If adverse effects to fish passage due to increased flows will occur, the downstream structures will be mitigated so that there is no negative effect on fish or fish habitat.

For a wet cover TSF scenario, the increase in annual flow at BW1 is predicted to be 19.0% in a dry year, 8.0% in an average year, and 12.4% in a wet year. In a dry year the flows are decreased during the June to September period with a predicted maximum reduction of 20% in September; flows are increased during the rest of the year. In an average year flows are decreased in June, July and August with a maximum reduction of 14.0% in August; flows are increased in other months. In a wet year flows are predicted to increase in every month except August when a small (1.3%) increase is predicted.

For a wet cover TSF scenario, the changes in average flow in May, which is the month during which upstream migrations of fish are most likely to occur, at BW2, are 5.4%, 9.2% and 7.8% for an average, dry and wet year, respectively. This will be evaluated as the Project moves forward and if negative effects to fish passage due to increased flows will occur, the downstream structures will be mitigated so that there is no negative effect on fish or fish habitat.

Blackwater Creek Tributary 1

Once the pit lake fills, flows will be restored to the portion of Blackwater Creek Tributary 1 downstream of the pit lake.

Blackwater Creek Tributary 2

The effects of overprinting for the construction of the TSF be permanent. The sections of Blackwater Creek Tributary 2 downstream of the overprinted by the Project will continue to experience the effective elimination flow, rendering these areas unsuitable as fish habitat. The portion of the stream downstream of the Project has been included in the calculated direct losses.

Flow in the areas of the Blackwater Creek Tributary 2 catchment that is upstream from the TSF will be unaffected during the site preparation and construction phase once this area is connected to Blackwater Creek via a new watercourse that will be constructed, east of the TSF.

Wabigoon Lake

The changes in flows as a result of the Project will alter the volume of water flowing into Wabigoon Lake. The small change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Wabigoon Lake are controlled artificially by a dam located at the outflow in the City of Dryden.

Thunder Lake Tributary 2

The reduction in groundwater discharge to the watercourse resulting from the drawdown will have returned to pre-development levels once the pit lake floods and groundwater levels recover.

Thunder Lake Tributary 3

The reduction in groundwater discharge to the watercourse resulting from the drawdown will have returned to pre-development levels once the pit lake floods and groundwater levels recover.

Hoffstrom's Bay Tributary

The portion of the Hoffstrom's Bay Tributary watershed enclosed within the perimeter ditch during the site preparation and construction phase will be permanent. This change in watershed results in reduction in flow of 7.8%.

Little Creek

The portion of the Little Creek watershed enclosed within the perimeter ditch results in a permanent reduction in flow of 9.1%.

Thunder Lake

The permanent loss of watershed areas in Hoffstrom's Bay Tributary and Little Creek means there will be a small permanent reduction of surface water inflow to Thunder Lake. However, the change in lake inflow would not have a measurable effects on water levels. Additionally, the water levels in Thunder Lake are controlled artificially by a dam located at the outflow in Aaron Provincial Park.

Effects of Changes in Water Quality

During the Post-closure Phase there will be a passive overflow from the pit to Blackwater Creek Tributary 1 and via it to Blackwater Creek. Treasury Metals will test the water in the open pit as it is filling and, if necessary, batch treatment will be used to ensure that the water to be discharged from the pit lake meets PWQO or background levels. Once the open pit has filled with water and the groundwater table returns to near pre-development conditions, seepage from the TSF and WRSA will be able to escape the site and will eventually reach adjacent surface water courses.

The effects of the releases from the pit lake and the seepage from the TSF and WRSA have been incorporated into the surface water quality modelling presented in Section 6.8. The modelling confirms that receiving water quality during the post-closure phase will be equivalent to existing conditions, or will meet PWQO. The situation is the same for both the dry cover and wet cover closure options for the TSF. Consequently there would be no adverse effects on fish or fish habitat.

Blasting

No blasting will occur during the Post-closure Phase.

Summary of Closure Phase Effects

Using the above information describing the effects of the Project on individual watercourses during the post-closure phase, the effects of the Project on the fish and fish habitat VCs during the post-closure phase was compiled, and summarized in Table 6.14.4.4-1.

Stream-Resident Fish

Stream-resident fish in the waterways affected by the Project will continue to experience effects associated with the direct loss and alteration during the site preparation and construction phase. The pit lake will passively discharge water to the portions of Blackwater Creek Tributary 1 downstream of the pit lake, re-establishing fish habitat.

Changes in flows will occur in the surrounding watercourse as a result of the alteration of watersheds will remain, and the pit lake will passively discharge into Blackwater Creek Tributary 1, and then into Blackwater Creek. Once the groundwater levels recover to pre-development levels, seepage from the WRSA and TSF will escape the site and report to surface waterbodies. Surface water quality modelling (Section 6.8) shows that post-closure water quality will be equivalent to existing conditions or will meet PWQO. Therefore, there would be no water quality effects to fish or fish habitat.

Migratory Fish

Migratory fish have been not been identified as using either Blackwater Creek Tributary 1, or Blackwater Creek Tributary 2. Therefore, migratory fish would not be affected by the overprinting of these watercourses and the elimination of flows downstream of the operations area.

Changes in flows predicted in portions of Blackwater Creek, Hoffstrom's Bay Tributary and Little Creek could affect migratory fish populations.

Lake-Resident Fish

Predicted changes in flows during the post-closure phase will result in a slight decrease of inflows to Thunder Lake and a slight increase of inflows to Wabigoon Lake. However, the changes in inflows would not result in measurable changes in lake levels. In addition, the water levels in both Thunder Lake and Wabigoon Lake are artificially controlled by dams in Aaron Provincial Park and the City of Dryden, respectively.

Fish Species at Risk

As described in Section 5.8.4, no aquatic species at risk were identified within the aquatic local study area (LSA) or regional study areas (RSA).

Table 6.14.4.4-1: Summary of Predicted Effects during Post-closure

Valued Components (VCs)	Indicators	Measures	Blackwater Creek Main Branch	Blackwater Creek Tributary 1	Blackwater Creek Tributary 2	Wabigoon Lake	Thunder Lake Tributary 2	Thunder Lake Tributary 2	Hoffstom's Bay Tributary	Little Creek	Thunder Lake
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0	0.59 (1)	3.01	0	0	0	0	0	0
		Pond area (ha)	0	3.79	0.15	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0.69 (2)	‡ (3)	‡ (3)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	‡ (3)	‡ (3)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Pond area (ha)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Fish mortality proportion (%)	0 (4)	‡ (3)	‡ (3)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
	Blasting	Fish mortality proportion (%)	0	‡ (3)	‡ (3)	0	0	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0 (5)	0 (5)	0	0	0	0	0	0
		Pond area (ha)	0	0 (5)	0 (5)	0	0	0	0	0	0
		Fish mortality proportion (%)	0	0 (5)	0 (5)	0	0	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0.69 (2)	0 (5)	0 (5)	0	0	0	2.58	1.94	0
		Pond area (ha)	0	0 (5)	0 (5)	0	0	0	0	0	0
	Changes in water quality	Stream length (km)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Pond area (ha)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
		Fish mortality proportion (%)	0 (4)	0 (4, 5)	0 (4, 5)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)	0 (4)
	Blasting	Fish mortality proportion (%)	0	0 (5)	0 (5)	0	0	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
	Changes water levels	Lake area (ha)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
	Changes in water quality	Lake area (ha)	0 (6)	0 (6)	0 (6)	0 (4)	0 (6)	0 (6)	0 (6)	0 (6)	0 (4)
		Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0 (4)	0 (6)	0 (6)	0 (6)	0 (6)	0 (4)
	Blasting	Fish mortality proportion (%)	0 (6)	0 (6)	0 (6)	0	0 (6)	0 (6)	0 (6)	0 (6)	0
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Changes in flows or water levels	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Changes in water quality	Stream length (km)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Pond or lake area (ha)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
		Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)
	Blasting	Fish mortality proportion (%)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)	0 (7)

Notes:

(1) Once the pit lake is flooded, flows will be re-established in the portion of Blackwater Creek Tributary 1 downstream of the open pit.
(2) Once the pit lake is flooded, flows in Blackwater Creek downstream of the confluence with Blackwater Creek Tributary 1 will increase. Only the portion of Blackwater Creek between Blackwater Creek Tributary 2 downstream to Blackwater Creek Tributary 1 will continue to experience decreased flows and effects to fish and fish habitat.
(3) The effects to stream-resident fish in the portions of Blackwater Creek Tributaries 1 and 2 overprinted and where flows are effectively eliminated due to the overprinting of the upstream catchment are captured as part of the calculated “direct loss or alteration of habitat”.
(4) Modelling shows that receiving water quality will be equivalent to existing conditions or meet PWQO. Therefore, no effects to fish are predicted to result from changes in water quality.
(5) Fish surveys and netting confirm that migratory fish only use the lower reaches of Blackwater Creek. Therefore, migratory fish could not be affected be changes within Blackwater Creek Tributary 1 or Tributary 2.
(6) Lake-resident fish are only present in Wabigoon Lake and Thunder Lake.
(7) As described in Section 5.8.4, there are no fish species at risk in the RSA.

6.14.4.5 Predicted Adverse Effects

The predicted effects of the Project on fish and fish habitat for the various phases on the Project are provided in Sections 6.14.4.1 through 6.14.4.4, were determined using four VCs; namely stream-resident fish populations, migratory fish populations, lake-resident fish populations, and fish species-at-risk. As there are no fish species at risk present in the RSA, no adverse effects were predicted for this VC. There were also no predicted adverse effects on lake-resident fish populations. There are predicted adverse effects for both the stream-resident fish populations and the migratory fish populations. The predicted adverse effects of the Project on fish and fish habitat were predicted during the site preparation and construction, operations, closure, and post-closure phases of the Project. The predicted adverse effects of the Project on fish and fish habitat have been summarized in Table 6.14.4.5-1, which provided the quantitative predictions for adverse effects. This table summarizes the effects for all waterbodies during each phase of the Project. Details for effects per waterbody are provided in Sections 6.14.4.1 through 6.14.4.4.

6.14.5 Identified Mitigation

The following mitigation measures are incorporated into the design and planned implementation of the Project to avoid the effects to fish and fish habitat:

- Prior to overburden removal, any beaver dams within the Project footprint will be removed and the impoundments will be allowed to draw down. This will reduce the number of fish that will remain in isolated sections of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2. [Mit_077].
- Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted. [Mit_078].
- To the extent practicable, fish in the sections of Blackwater Creek Tributary 1 that will be isolated by the construction of the perimeter ditch and overprinted by the removal of overburden from the open pit will be captured and relocated to the same tributary downstream from the operations area, or to the main branch of Blackwater Creek. [Mit_079].
- To the extent practicable, fish in the sections of Blackwater Creek Tributary 2 that will be isolated by the construction of the perimeter ditch and overprinted by the construction of the TSF will be captured and relocated to the same tributary downstream from the operations area, or to the main branch of Blackwater Creek. [Mit_080].
- Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary. [Mit_050].
- A perimeter ditch around the operations area will prevent the release of runoff. [Mit_008].

Table 6.14.5-1: Predicted Adverse Effects for Fish and Fish Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	4.35	4.35	4.35	3.60 (1)
		Pond area (ha)	3.94	3.94	3.94	3.94
		Fish mortality proportion (%)	50% (2)	0	0	0
	Changes in flows or water levels	Stream length (km)	9.02	9.02	9.02	5.21 (3)
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	9.02	9.02	9.02	5.21 (3)
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes water levels	Lake area (ha)	0	0	0	0
	Changes in water quality	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0

Table 6.14.5-1: Predicted Adverse Effects for Fish and Fish Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0

Notes:

(1) Once the pit lake is fully flooded, it will passively discharge to Blackwater Creek Tributary 1. Once the flows recover, fish habitat should be re-established in the portions of Blackwater Creek Tributary 1 downstream of the pit lake.

(2) It was predicted that there would be a 50% mortality for those stream-resident fish that remained in the portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 overprinted as a result of the Project.

(3) Once the pit lake is flooded, flows in Blackwater Creek downstream of the confluence with Blackwater Creek Tributary 1 will increase. Only the portion of Blackwater Creek between Blackwater Creek Tributary 2 downstream to Blackwater Creek Tributary 1 will continue to experience decreased flows and effects to fish and fish habitat.

- The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057].
- The fresh water needs for the Project will be met by withdrawals from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The withdrawals will not exceed 5% of the flows in either of the two creeks. Pump intakes will be fitted with fish screens to prevent entrainment [Mit_059, Mit_081].
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
- Treated effluent will be discharged to Blackwater Creek through an engineered structure designed to minimize erosion risks [Mit_058].
- 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].
- Once the pit has filled during the post-closure phase, excess water will be allowed to passively discharge through a spillway into the former channel of Blackwater Creek Tributary 1 [Mit_060].
- As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082].

In addition, the Project will likely require a *Fisheries Act* authorization and will likely require Treasury Metals to mitigate the losses of fish habitat that it causes as a condition of that authorization. Typically, the offsetting involves the creation of new habitat or the enhancement of existing habitat that is commensurate with the habitat losses. The *Fisheries Act* authorization, which is issued by DFO, details the offsetting measures to be completed and, typically also specifies monitoring to be conducted. DFO uses a letter of credit to provide a financial assurance mechanism in the event that an offsetting plan is not completed [Mit_083].

6.14.5.1 Fish Salvage

Fish salvage, the physical removal of fish from an isolated in-water work area, will only occur in Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 and only during the site preparation and construction phase of the project. The locations of these watercourses are shown in Figure 6.14.5.1.

Fish salvage will occur along the entire length of Blackwater Creek Tributary 1. In preparation for mining the open pit, portions of Blackwater Creek Tributary 1 will be overprinted. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 1 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary. This will result in the direct loss of habitat in the overprinted portions and the reduction of flows in the downstream reaches of the tributary. For the purposes of this effects assessment, it has been assumed that the reduction in flow in the downstream sections will render them unsuitable as fish habitat.

Drawdown of beaver ponds along Tributary 1 will be undertaken prior to construction of the perimeter ditch, to encourage fish to leave (i.e. move downstream). Fish remaining in Reach 2 of Blackwater Creek Tributary 1 will be collected using a variety of methods (minnow traps, seines, electofishing) and transported to Blackwater Creek where they will be released. In the downstream reach of Blackwater Creek Tributary 1, most fish are expected to move downstream to Blackwater Creek as flows diminish. This reach will be examined, and fish salvage will be undertaken as described above if fish are present.

Construction of the tailings storage facility (TSF) and minewater pond will overprint sections of Blackwater Creek Tributary 2. The construction of the perimeter ditch will isolate those sections of Blackwater Creek Tributary 2 overprinted by the Project, effectively eliminating flow in the downstream sections of the tributary. This will result in the direct loss of habitat and the effective elimination of flow in the downstream reaches of the tributary. For the purposes of this effects assessment, it has been assumed that the reduction in flow in the downstream sections will render them unsuitable as fish habitat.

Drawdown of the beaver pond along this reach of stream will be undertaken prior to construction of the perimeter ditch to encourage fish to leave (i.e. move downstream). Fish salvage will be undertaken in the isolated portion of Blackwater Creek Tributary 2 (reach 2). Fish remaining in Reach 2 of Blackwater Creek Tributary 2 will be collected using a variety of methods (minnow traps, seines, electrofishing) and transported to Blackwater Creek where they will be released. In the downstream reach of Blackwater Creek Tributary 2 (Reach 1), most fish are expected to move downstream to Blackwater Creek as flows diminish. This reach will be examined, and fish salvage will be undertaken as described above if fish are present.

6.14.5.2 Fish Habitat Offsetting Plan

In addition, the Project will likely require a *Fisheries Act* authorization and will likely require Treasury Metals to offset the losses of fish habitat that it causes as a condition of that authorization. Typically, the offsetting involves the creation of new habitat or the enhancement of existing habitat that is commensurate with the habitat losses. The *Fisheries Act* authorization, which is issued by DFO, details the offsetting measures to be completed and, typically also specifies monitoring to be conducted. DFO uses a letter of credit from the proponent to provide a financial assurance mechanism in the event that an offsetting plan is not completed [Mit_083].

Treasury has developed a conceptual fish habitat offsetting plan (Appendix II), which includes three potential offsetting measures:

- Shoreline stabilization on Wabigoon Lake;
- Creation of fish habitat, after mine closure, in ponds adjacent and connected to Blackwater Creek Tributary 1; and
- Removal of the dam on Thunder Lake Tributary 2, to allow upstream fish passage.

Each of these concepts is deemed to be worthy of consideration as offsetting for the project by MNRF Dryden, recognizing that the final offsetting plan will be determined during the detailed design phase of the project and that consultation will occur during its preparation. MNRF Dryden also indicated that there are no other habitat restoration projects that are considered a management priority at this time that should be considered as potential offsetting (J. Van Wallegham, Management Biologist, MNRF Dryden District. Personal communication with C. Portt, March 21, 2018).

Treasury Metals current plans for managing, or offsetting, potential losses of fish habitat do not include consideration of the removal of an existing dam on Thunder Creek, which flows from Thunder Lake to Wabigoon Lake. The removal of that dam, which was suggested by a stakeholder as a possible method to restore upstream fish passage between the two lakes, would not be effective because there is a natural falls in Thunder Creek that blocks upstream fish migration.

6.14.6 Residual Adverse Effects

In the context of the CEAA, 2012, the fisheries offsetting would be considered mitigation that would offset and mitigate the adverse effects of the Project on fish habitat. Therefore, following offsetting the only residual adverse effects that remains would be the potential for mortality of stream-resident fish during the site preparation and construction phase. Specifically these would be the stream-resident fish in the portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 that remained in the portions of these watercourses that would be overprinted by the Project and could not be salvaged. Table 6.14.6-1 summarizes the residual adverse effects for fish and fish habitat.

Table 6.14.6-1: Residual Adverse Effects for Fish and Fish Habitat

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Stream-resident fish population	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	50% (2)	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Migratory fish populations	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0
Lake-resident fish populations	Direct loss or alteration of habitat	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes water levels	Lake area (ha)	0	0	0	0
	Changes in water quality	Lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0

Table 6.14.6-1: Residual Adverse Effects for Fish and Fish Habitat (continued)

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Fish species-at-risk	Direct loss or alteration of habitat	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Changes in flows or water levels	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
	Changes in water quality	Stream length (km)	0	0	0	0
		Pond or lake area (ha)	0	0	0	0
		Fish mortality proportion (%)	0	0	0	0
	Blasting	Fish mortality proportion (%)	0	0	0	0

Notes:

(1) It was predicted that there would be a 50% mortality for those stream-resident fish that remained in the portions of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 overprinted as a result of the Project.

6.14.7 Information to Address Round 1 Information Requests

The following lists the questions from the Round 1 information requests that relate to the effects of the Project on fish and fish habitat:

- TMI_520-AC(1)-194: effects of liquid discharges on fish and fish habitat;
- TMI_121-SW(1)-35: effect of flows on fish and fish habitat;
- TMI_123-FH(1)-02: effects of laydown area on fish and fish habitat;
- TMI_126-FH(1)-05: effects of groundwater reductions to fish and fish habitat;
- TMI_14-PD(1)-01: effects of dewatering on fish and fish habitat;
- TMI_331-AC(1)-05: effects to fish in Wabigoon and Thunder Lakes; and
- TMI_332-AC(1)-06: potential effects to fish and fish habitat

6.15 Wetlands and Vegetation

6.15.1 Likely Effects of the Project on the Environment

As described in Section 6.1.3.14 of this Revised EIS, a total of two VCs were used for evaluating the effects of the Project; wetlands and vegetation communities. The potential effects of the Project on these VCs are described below by Project phase:

- **Site Preparation and Construction Phase**: Most of the physical disturbance, clearing of land and alteration to watercourses will occur during the site preparation and construction phase of the Project. Activities and equipment associate with the site preparation and construction will create dust. The potential effects of these activities on wetlands and vegetation includes the following:
  - Direct loss of wetlands as a result of draining and infrastructure development;
  - Discharge of sediments in watercourses;
  - Alteration of natural flows and water levels; and
  - Deposition of dust from equipment and vehicles on roadside vegetation.
- **Operations Phase**: During the operations phase, mining activities will begin within an open pit, and progress to an underground mine. The open pit and underground mine will be dewatered to provide a safe work environment, which will result in a development of a drawdown zone in the local water table. Mining operations will create dust. The potential effects of these activities on wetlands and vegetation includes the following:
  - Continued loss of wetlands affected during site preparation and construction;
  - Loss of wetlands caused by groundwater drawdown due to dewatering;

- Discharge of sediments in watercourses;
- Alteration of natural flows and water levels; and
- Deposition of dust from equipment and vehicles on roadside vegetation

- **Closure Phase**: During the closure phase, the facility will be decommissioned, dewatering activities will cease, and the open pit and underground mine will be allowed to start filling with water. The site will be reclaimed and graded so all runoff will drain towards the open pit. The potential effects of these activities on wetlands and vegetation includes the following:
  - Continued loss of wetlands affected during site preparation and construction;
  - Discharge of sediments in watercourses;
  - Alteration of natural flows and water levels; and
  - Deposition of dust from equipment and vehicles on roadside vegetation
- **Post-closure Phase**:
  - No anticipated effects

The potential effects of the Project on wetlands and vegetation have been described using a simple linkage diagram in Figure 6.15.1-1. The figure illustrates the vegetation and wetland VCs (shown in blue on the figure) and how they can be potentially affected during each phase of the Project life. The figure also indicates the other components or VCs (shown in red on the figure) that can be affected by effects to wetlands and vegetation. For example, effects on vegetation and wetlands will provide input for evaluating the effects of the Project on Aboriginal peoples. Similarly, other components that provide inputs to the evaluation of the effects of the Project on vegetation and wetlands are shown in red on the figure. For example, the effects of the Project on surface water quality are used in determining the effects on the vegetation and wetlands VCs.

6.15.2 Effects Prediction Methods

A footprint analysis was used to identify which Project areas and components would interact with wetlands and vegetation. Background research was conducted to identify public sources of information regarding plant communities, wetlands, significant ecological features, Natural Heritage areas and provincially rare or SAR. Standard spatial provincial data from the Land Information Ontario (LIO) website was used as the basis of all existing wetlands and vegetation in the LSA and RSA. Field surveys were completed to confirm vegetation communities, conduct plant inventories, verify ecosites, characterize and evaluate wetlands, and to conduct SAR and rare plant surveys.

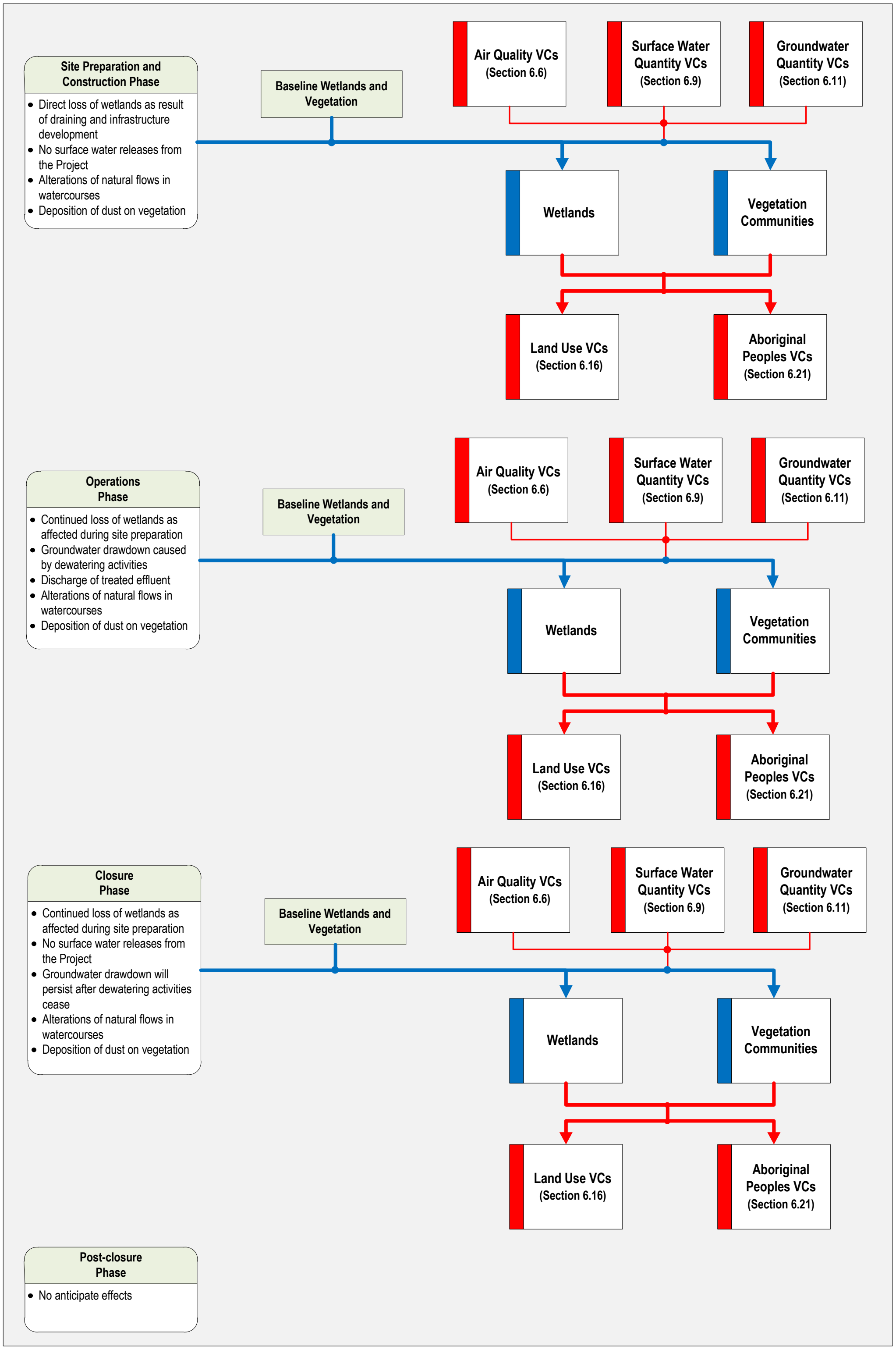


Figure 6.15.1-1: Wetlands and Vegetation Linkage Diagram

To determine the Project effects on wetlands and vegetation, the information gathered through database searches and field inventories was coupled with the provincial spatial data and overlain with the Project footprint. This was done using the Project footprint to assess the maximum extent of disturbance.

Where interactions were identified during the site preparation and construction phase they were carried through to the closure. Site reclamation will include wetland construction and revegetation, however, this is not expected to occur until the closure phases, so certain effects identified on wetlands and vegetation during the site preparation and construction phase will remain through until reclamation activities occur. The assessment looked at the maximum possible extent of disturbance, but also considered the phase at which the effects were expected to occur.

6.15.3 Project Effects Avoidance Measures Used in Predictions

The following effects avoidance measures have been considered when determining the potential effects of the Project on vegetation and wetlands:

- Minimized the amount of wetland and vegetated area clearing required for the Project by optimizing the pit design and siting Project infrastructure in previously disturbed areas, to the extent practicable. [Mit_050, Mit_065].
- Retention of forested areas wherever feasible. [Mit_084].
- Identification and protection of known vegetative SAR locations. [Mit_085].
- Construction of a perimeter ditch around the operations area, which will collect all of the site runoff for use in the processing. [Mit_008].
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
- Avoid broadcast spraying of herbicides for vegetation management. [Mit_086].
- Ensure proper culvert sizing for all new water crossing installations, allowing for maintenance of existing flows and water levels. [Mit_082].
- Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF. [Mit_066].
- Develop sediment and erosion plans which will reduce sedimentation into wetlands and reduce the potential for dust cover on roadside vegetation. [Mit_008, Mit_046, Mit_054].
- Restoration of all disturbed habitats upon closure to the extent feasible. [Mit_068].

- Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (i.e., draining wetlands to discourage hibernation). [Mit_074].
- Re-vegetation of all slopes after closure with a focus on riparian habitat in the open pit. [Mit_068, Mit_087].
- Reclamation and re-vegetation of the mining footprint to be carried out in accordance with O.Reg. 240/00. [Mit_088].
- Seeding or hydro-seeding of the reclaimed areas with native seed mix. [Mit_089].

6.15.4 Predicted Effects

The predicted effects of the Project on wetlands and vegetation will vary throughout the Project life, depending on the Project phase, and will vary according to specific levels of activity. Project effects will also vary for each VC. Table 6.15.4-1 lists the two VCs used for evaluating the effects of the Project on wetlands and vegetation, as well as the three (3) indicators selected for evaluating wetlands and the four (4) indicators selected for evaluating vegetation communities and species.

Table 6.15.4-1: Wetlands and Vegetation VCs, Indicators and Measures

Valued Components (VCs)	Indicators	Measures
Wetlands	Wetland extent	Change in area (ha)
	Wild rice	Loss of identified habitat (ha)
		Changes in water level (m)
		Changes in water quality
	Floating Marsh Marigold (*Caltha natans*)	Change in potential habitat (ha)
Vegetation communities	Predominantly coniferous forest	Change in area (ha)
	Predominantly deciduous forest	Change in area (ha)
	Successional areas	Change in area (ha)
	Potential berry harvesting areas	Change in area (ha)

6.15.4.1 Site Preparation and Construction Phase

Wetland Extent

The effects to wetland extent will occur primarily during the site preparation and construction phase of the Project (Figure 6.15.4.1-1). The loss of these wetland areas result from being overprinted by the Project of Project features (e.g., the wetlands located within the operations area), which includes the wetlands on the portions of Blackwater Creek Tributary 1 overprinted by the open pit mine, and the wetlands on the portion of Blackwater Creek Tributary 2 (and its tributaries) overprinted by the TSF and minewater pond. Additionally, there are portions of wetlands that will have the upstream catchment enclosed within the perimeter ditch constructed around the operations area. This perimeter ditch will collect all of the runoff from the site, resulting in the draining of the wetlands immediately downstream. Nearly 33 ha of wetland (marsh and swamp ecosites) will experience direct effects from the site preparation and construction phase, as shown in Table 6.15.4.1-1.

Table 6.15.4.1-1: Direct Effects on Wetlands during Site Preparation and Construction Phase

Wetland Type	Extent of Wetland in LSA (ha)	Project Affected Wetland (ha)	% of Wetland Affected
Fen	817.2	0.2	0
Marsh	145.3	6.3	4.3
Swamp	476.6	26.1	5.5
Total	**1,439.1**	**32.6**	**2.3**

Loss of wetland extent may affect wetland habitat functions through direct loss, fragmentation and edge effects. In this case the losses are relatively small, representing 4.3% of total marsh and 5.5% of total swamp area present in the LSA. Wetland hydrological functions may be altered where roads change surface and groundwater flow. Dust inputs and sedimentation from road operation, upgrades, and maintenance may alter biochemical and habitat functions and could result in changes to functional diversity as ecosystem changes occur. Adjacent to the road are extensive windrows of exposed soil; these may, until successfully re-vegetated, erode, and sediment will be delivered to adjacent wetlands, streams, waterbodies, and terrestrial vegetation.

Wild rice is an important resource to Aboriginal communities near the Project. Wild rice grows in shallow lakes and wetlands, typically with water depths of 15–90 cm of water and soft substrates. A separate LSA for evaluating potential effects on wild rice that includes both Thunder Lake and Wabigoon Lake was used to assess Project effects on wild rice (Figure 6.15.4.1-2). Wild rice was identified in WLD6, associated with Blackwater Creek, during field surveys. WLD6 (8.3 ha) falls completely within the terrestrial LSA, but the Project footprint does not intersect it (Figure 6.15.4.1-1). The LIO data identified a further 14 wild rice stands associated with Wabigoon Lake (Figure 6.15.4.1-2). There will be no surface water releases from the Project during the site preparation and construction phase as a perimeter ditch will be constructed around the operation area to intercept runoff from the site.

Floating Marsh Marigold was found at the mouth of Thunder Creek at Wabigoon Lake in 2011 (Figure 6.15.4.1-2). Floating marsh marigold is considered provincially rare (ranked S2 by the NHIC) and has documented occurrences throughout the RSA. No site preparation and construction phase activities are expected near the known location of the Floating Marsh Marigold.

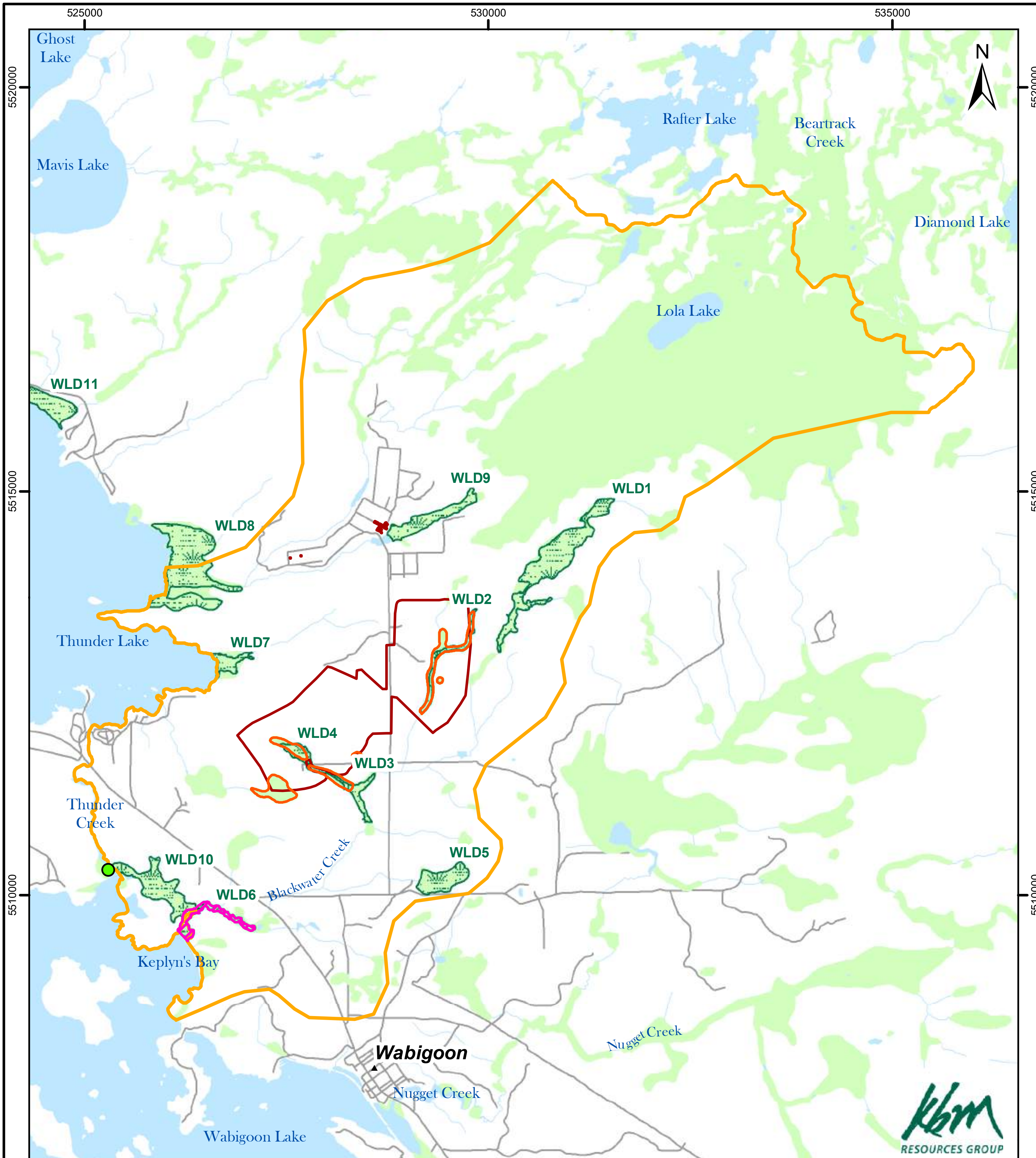


Figure 6.15.4.1-1
Site Preparation and Construction Phase Impacted Wetlands Within the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-02-27

Legend

- Town
- Road
- Local Study Area
- Development Footprint
- Waterbody
- Stream
- Wetland
- Surveyed Wetlands
- Impacted Wetlands
- Floating Marsh Marigold
- Wild Rice

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

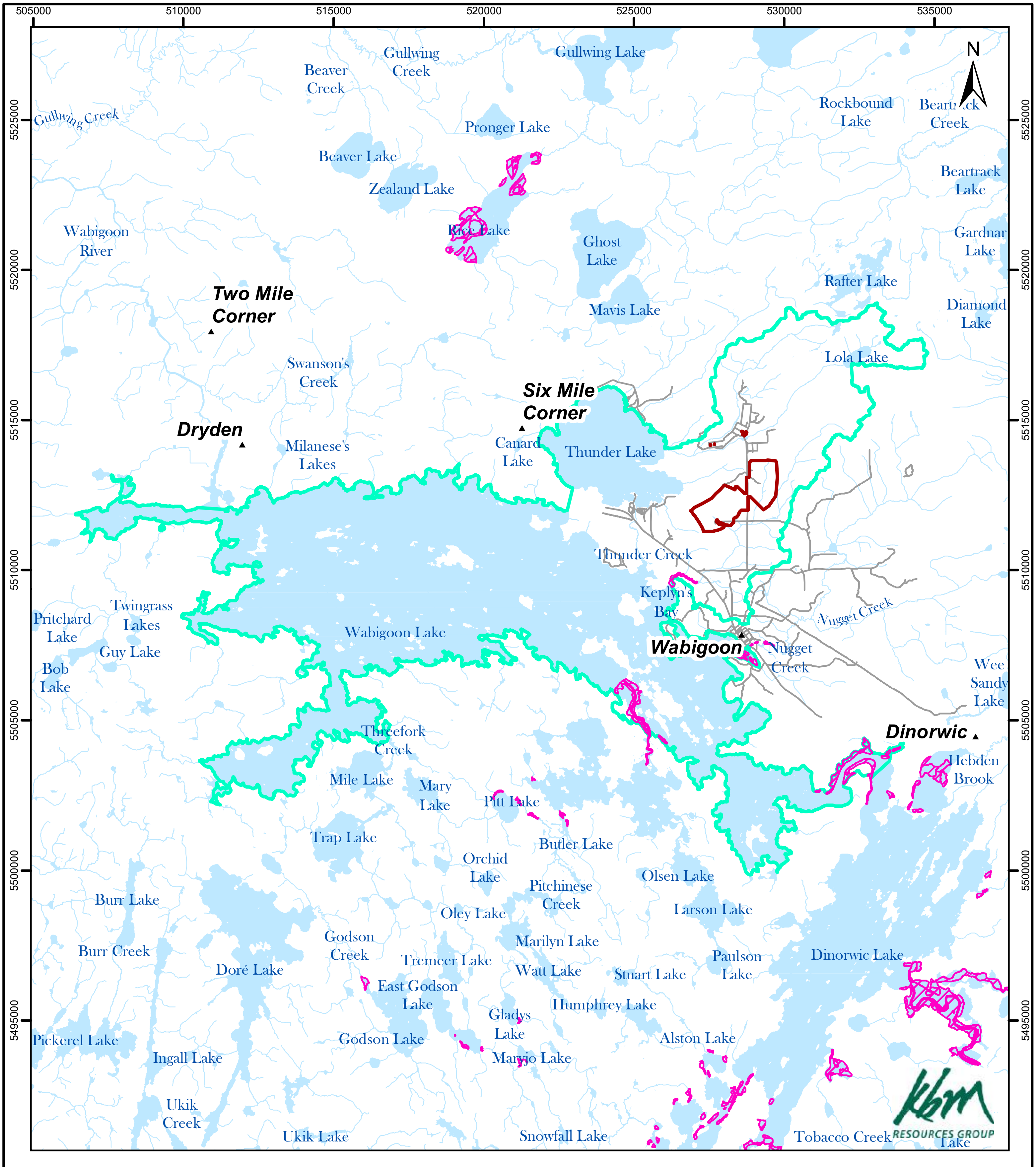


Figure 6.15.4.1-2: Wild Rice LSA for the Goliath Gold Project

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

Legend

- Wild Rice LSA
- Development Footprint
- Road
- Wild Rice Stand
- Waterbody
- Stream

SCALE: 1:166,984

0 1 2 4 6 8 Km

Floating marsh marigold is found in shallow water in creeks, pools, ditches and sheltered lake margins. It also tends to be found at slow flowing stream mouths, especially those influenced by beaver activities. It typically roots in mud, sild or clay. Floating marsh marigold is sensitive to water quality and eutrophication, as well as fluctuations in water levels and soil disturbance, particularly from rutting (WDNR 2016). There will be no surface water releases from the Project during the site preparation and construction phase as a perimeter ditch will be constructed around the operation area to intercept runoff from the site.

Vegetation Communities

Vegetation may also be affected during the site preparation and construction phase through dust loading from vehicles driving on access roads. The Site Preparation and Construction Phase will result in the direct loss of 208 ha of vegetation cover (Figure 6.15.4.1-3). This represents a 5.9% loss of coniferous forest, a 5.9% loss of deciduous forest, and a 21.9% loss of successional areas within the LSA. The results are provided in Table 6.15.4.1-2 Site Preparation and Construction Phase of the Project will result in the removal of 95 ha of coniferous forest, 43 ha of deciduous forest, and 70 ha of successional areas. Floral invasive species can also be a concern in areas adjacent to the roads.

Table 6.15.4.1-2: Direct Effects on Vegetation during Site Preparation and Construction Phase

Vegetation Type	Extent of Vegetation Type LSA (ha)	Project Affected Vegetation (ha)	% of Vegetation Affected
Predominantly coniferous forest	1,610	95	5.9
Predominantly deciduous forest	730	43	5.9
Successional areas	320	70	21.9

Edible berries represent an important resource for traditional land use and represent an important food source for many wildlife species. Blueberries, both Velvet-leaf Blueberry (*Vaccinium myrtilloides*) and Low Sweet Blueberry (*Vaccinium angustifolium*), are widely collected in northwestern Ontario. The potential effects of the Project on berry harvesting was evaluated by characterizing the effects of the Project on two edible berries, Blueberries and Dwarf Raspberry (*Rubus pubescens*). Potential berry habitat was determined by ecosites for which these species are indicators (both Blueberry species were pooled together for this exercise; Table 6.15.4.1-3). These ecosites comprise most of the habitats within the LSA, and in this way these two berry species serve as “umbrella species”, where managing for blueberries and dwarf raspberries will also manage for the habitat for most other berry species potentially affected by the Project.

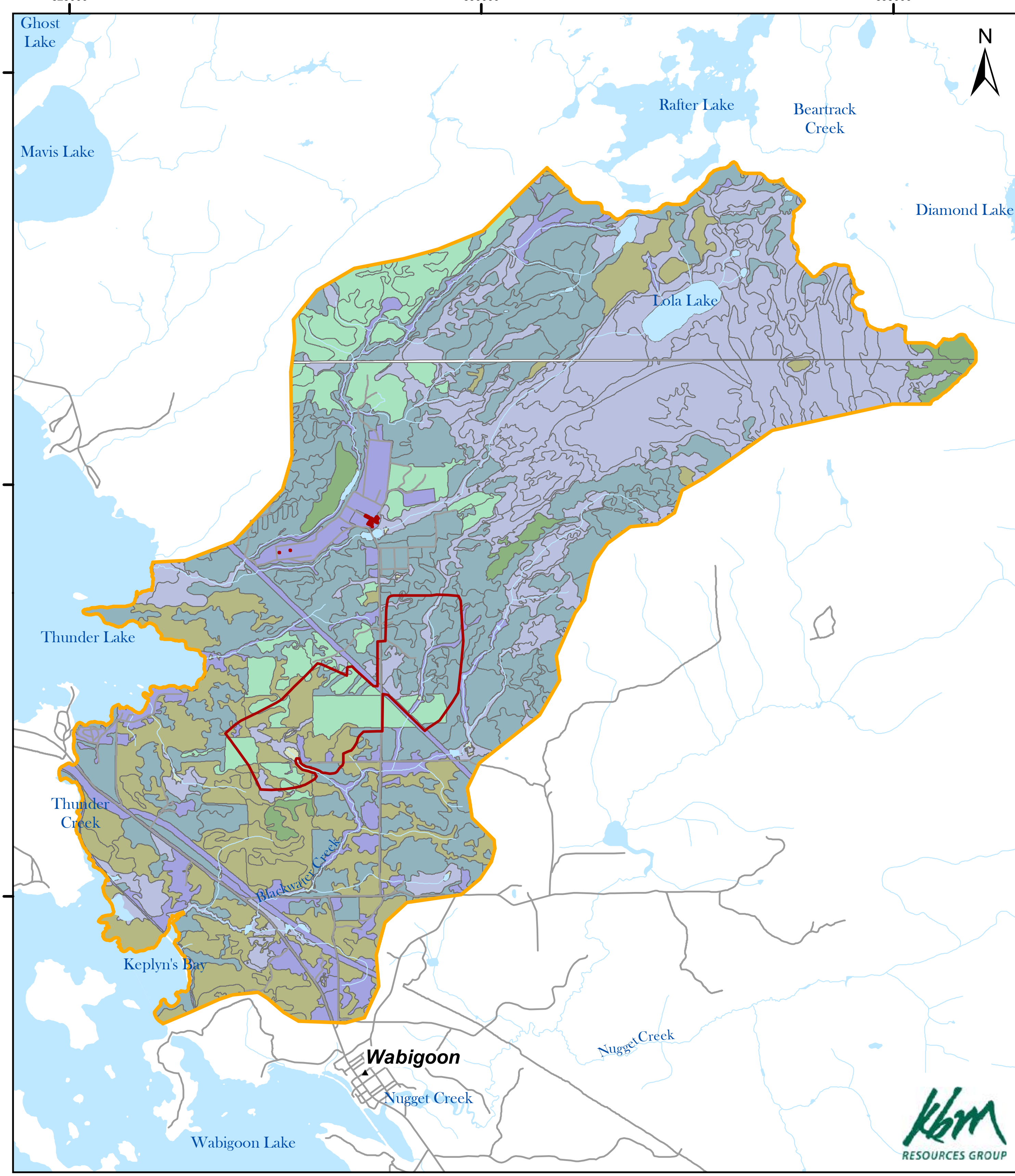


Figure 6.15.4.1-3
Site Preparation and Construction Phase Impacted Vegetation Within the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-02-27

Legend

- Town
- Road
- Local Study Area
- Development Footprint

Vegetation Type

- CON
- DEC
- DEV
- SUC
- UPL
- WAT
- WET
- Stream
- Waterbody

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

Table 6.15.4.1-3: Berry Habitat Ecosites

Blueberry	Dwarf Raspberry
B012	B055
B034	B070
B048	B071
B049	B101
B050	B104
B065	B113
B098	B116
B099	B119
B114	B130
B127	—

The Site Preparation and Construction Phase will result in the direct loss of 185 ha of Blueberry habitat and roughly 75 ha of Dwarf Raspberry habitat, representing 9% and 8% of the total of each category of habitat available in the LSA, respectively. These effects are summarized in Table 6.15.4.1-4, and shown on Figure 6.15.4.1-4.

Table 6.15.4.1-4: Direct Effects on Berry Habitat during Site Preparation and Construction Phase

Berry Type	Extent of Habitat in the LSA (ha)	Project Affected Habitat (ha)	% of Habitat Affected
Blueberry	2,066	185	9
Dwarf Raspberry	937	75	8

6.15.4.2 Operations Phase

During the operations phase of the Project, the effects of site preparation and construction will persist on wetlands and vegetation communities. No additional vegetation clearing will take place during the Operations Phase, but there will be an increased potential for degradation of water quality as ore is stockpiled and effluent is discharged. However, Treasury Metals has committed to treat all effluent released from the site during operations to meet PWQO, or background concentrations if background levels are greater than the PWQO, before discharge. As a result of being found in topographical depressions, wetlands may become the endpoint for contaminated runoff from mine operations. As waterfowl and wildlife are attracted to wetlands for foraging and breeding, concentrations of contaminants could constitute an attractive nuisance to such species.

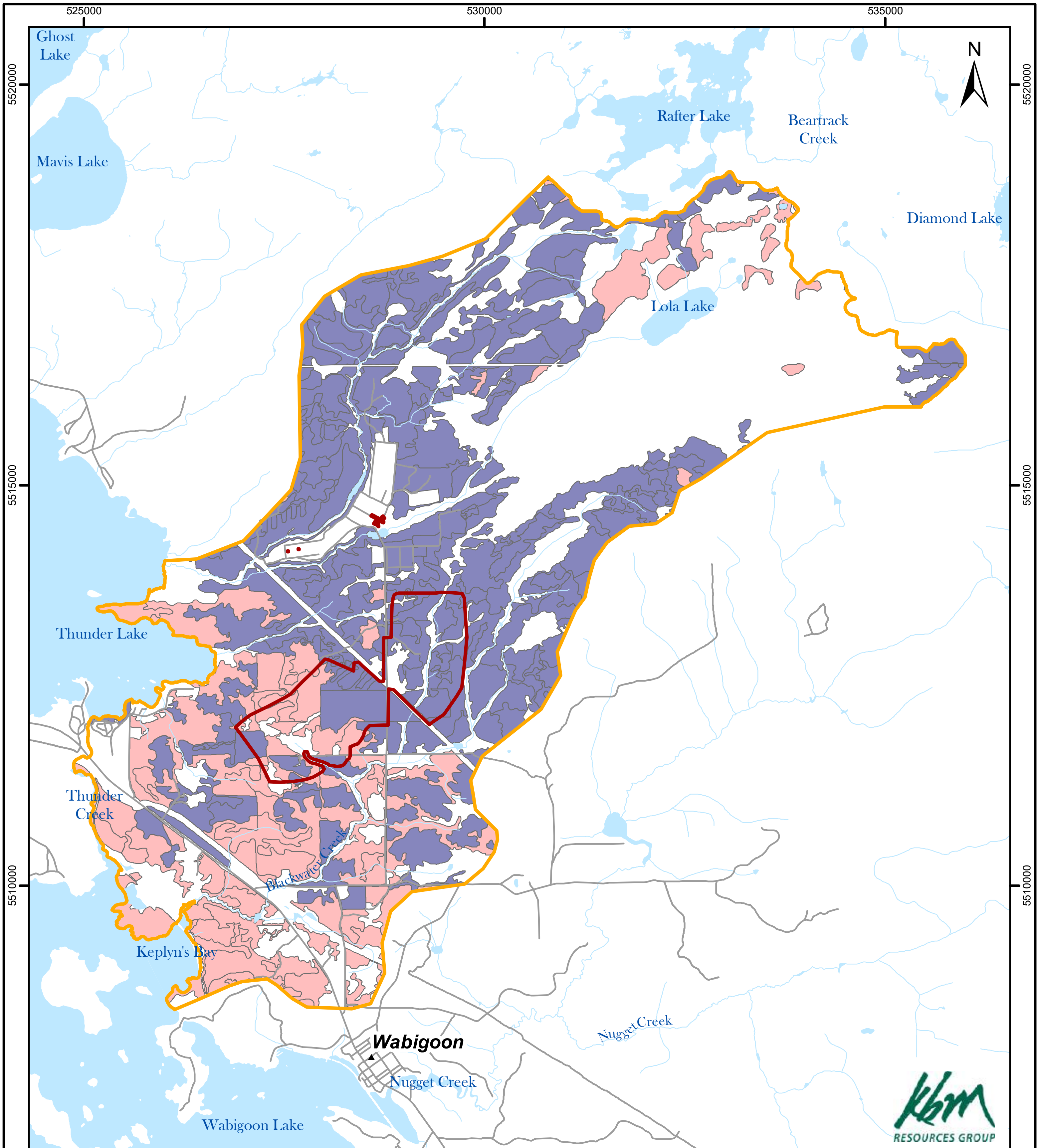


Figure 6.15.4.1-4
Site Preparation and Construction Phase Impacted Berry Habitat Within the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-14

Legend

- LSA
- Development Footprint
- Road
- Waterbody
- Blueberry
- Dwarf Raspberry
- Stream

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

Dewatering wetlands during the Operation Phase is expected to create a drawdown zone that will extend beyond the Project footprint. Most wetlands within the LSA are underlain with clay and tills. Making them resistant to water table drawdown. However, WLD5 at the headwater of Blackwater Creek Tributary 4 sits above a granular deposit, and is susceptible to drawdown (Figure 6.15.4.2-1). For the purposes of this assessment, the whole of WLD5 (14.4 ha) will be considered as affected, although it will be degraded due to the change in water table rather than lost entirely.

Water quality modelling (Section 6.8) shows that the quality of water in the receiving environments, including Blackwater Creek, Thunder Lake and Wabigoon Lake, will be equivalent to existing conditions, or will meet the Provincial Water Quality Objectives (PWQO). Modelling of surface water quantities (Section 6.9) shows that flows in Blackwater Creek will be altered by the Project (a decrease in average flows 5.5% during the operations phase). No measurable changes in the levels were predicted for either Wabigoon Lake or Thunder Lake.

6.15.4.3 Closure Phase

During the closure phase of the Project, the effects of site preparation and construction will persist on wetlands and vegetation communities. During Closure, the Project infrastructure will be decommissioned, and disturbances reclaimed. As such, effects are no longer considered for major Project components as presented above. No additional impacts to wetland or vegetation community indicators should occur during this phase. There will be no surface water releases from the Project during the closure phase as site runoff will be directed towards the open pit.

6.15.4.4 Post-closure Phase

It is not anticipated that wetland or vegetative community indicators will be further affected in the Post-Closure Phase. In fact, wetland functions should begin to recover following the implementation of reclamation activities that will assist wetland restoration objectives. While some wetlands lost during the site preparation and construction phase will not recover (i.e., the wetlands along Blackwater Creek Tributary 2 overprinted by the TSF), new wetlands will be generated around the pit lake.

Additionally, some wetlands affected during the active Project life will recover once surface flows are re-established following closure. For example, WLD5 should re-establish itself once the groundwater levels return to near pre-development conditions following the flooding of the open pit. The dewatered portions of WLD3 outside of the footprint should return to pre-development conditions once the pit lake fills and begins to discharge into the former channel of Blackwater Creek Tributary 1. Habitat features, and functions associated with wetlands will begin to recover and continue to develop as wetland vegetation moves along its successional trajectory.

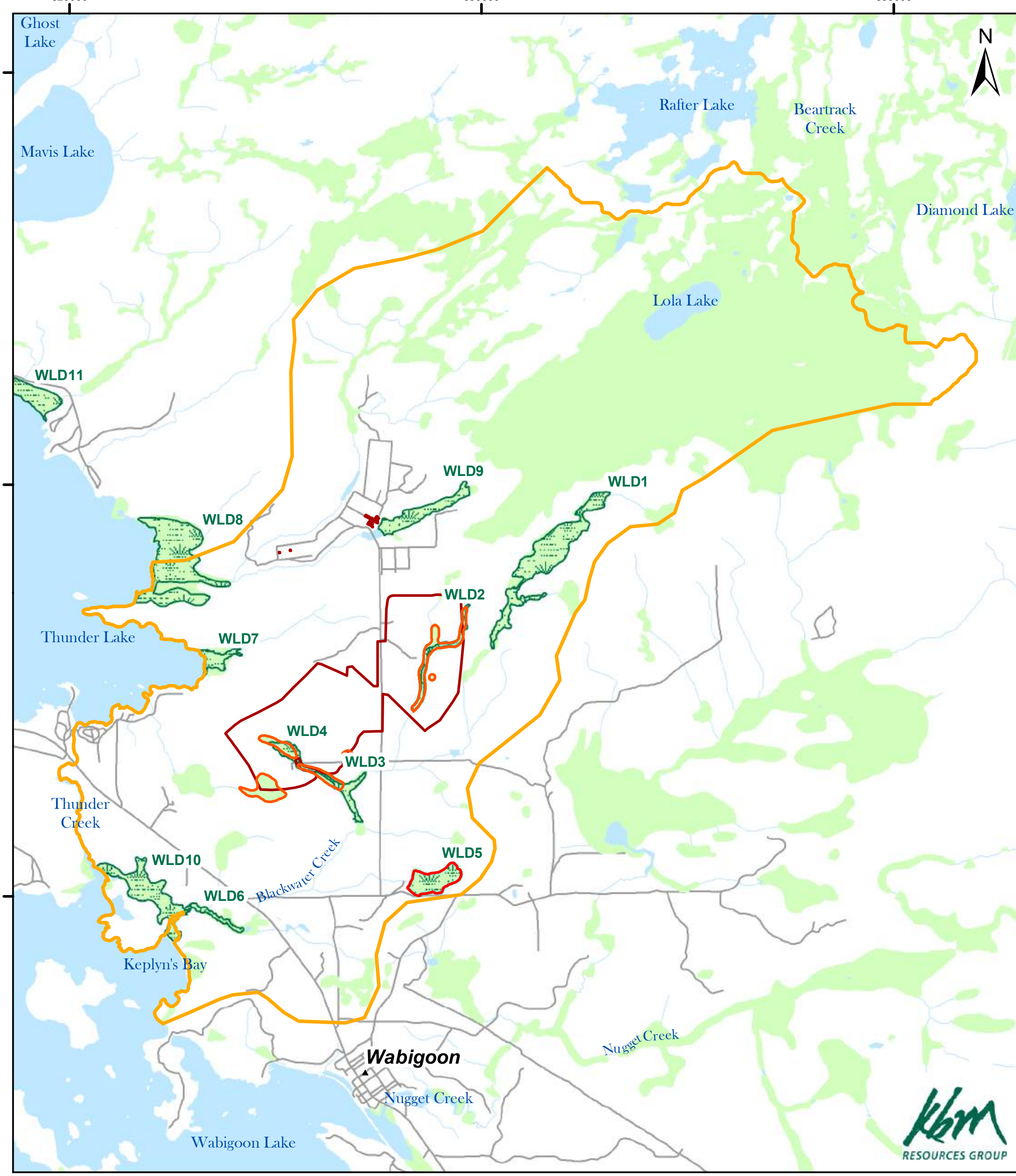


Figure 6.15.4.2-1
Operations Phase
Impacted Wetlands Within the
Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-02-27

Legend

- Town
- Road
- Local Study Area
- Development Footprint
- Waterbody
- Stream
- Wetland
- Surveyed Wetlands

Impacted Wetlands by Project Phase

- Site Preparation and Construction
- Operations

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

As the groundwater levels recover, seepage from the WRSA and TSF will escape the site. The effects of this seepage on surface water quality was modelled (Section 6.8), and the results show that the quality of water in the receiving environments will be equivalent to existing conditions, or will meet the PWQO. Modelling of surface water quantities (Section 6.9) shows that flows in Blackwater Creek will be altered by the Project (an increase of 3.6% during the post-closure phase). However, no measurable changes in the levels were predicted for either Wabigoon Lake or Thunder Lake.

6.15.4.5 Predicted Adverse Effects

The predicted effects of the Project on wetlands and vegetation for each phase of the Project are were set out in Sections 6.15.4.1 through 6.15.4.4. Adverse effects of the Project on wetlands and vegetation communities were predicted during the site preparation and construction, operations, and closure phases of the Project. No adverse effects were predicted during the post-closure phase. A summary of the predicted adverse effects of the Project on wetlands and vegetation is provided in Table 6.15.4.5-1.

6.15.5 Identified Mitigation

The following mitigation measures will be implemented as part of the Project to help avoid potential effects on wetlands and vegetation:

- Minimized the amount of wetland and vegetated area clearing required for the Project by optimizing the pit design and siting Project infrastructure in previously disturbed areas. [Mit_050, Mit_065].
- Retention of forested areas wherever feasible. [Mit_084].
- Identification and protection of known vegetative SAR locations. [Mit_085].
- Avoid broadcast spraying of herbicides for vegetation management. [Mit_086].
- Ensure proper culvert sizing for all new water crossing installations, allowing for maintenance of existing flows and water levels. [Mit_082].
- Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF. [Mit_066].
- Develop sediment and erosion plans which will reduce sedimentation into wetlands and reduce the potential for dust cover on roadside vegetation. [Mit_008, Mit_046, Mit_054].
- Restoration of all disturbed habitats upon closure to the extent feasible. [Mit_068].

Table 6.15.4.5-1: Predicted Adverse Effects for Wetlands and Vegetation

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland extent	Change in area (ha)	33	47 (1)	47 (2)	— (3)
	Wild Rice	Loss of identified habitat (ha)	—	—	—	—
		Changes in water level (m)	—	—	—	—
		Changes in water quality	—	—	—	—
	Floating Marsh Marigold (*Caltha natans*)	Loss of identified habitat (ha)	—	—	—	—
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	95	95 (3)	95 (3)	— (3)
	Predominantly deciduous forest	Change in area (ha)	43	43 (3)	43 (3)	— (3)
	Successional areas	Change in area (ha)	70	70 (3)	70 (3)	— (3)
	Potential berry harvesting areas	Change in area (ha)	260	260 (3)	260 (3)	— (3)

Notes:
The "—" symbol indicates there were no predicted adverse effects
(1) The increase in wetland extent reflects the effects of dewatering on WLD5.
(2) The effects due to dewatering are expected to persist until the open pit floods and groundwater returns to near pre-development levels.
(3) The areas lost during the site preparation and construction phase will not recover until post-closure.

- Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (i.e., draining wetlands to discourage hibernation). [Mit_074].
- Re-vegetation of all slopes after closure with a focus on riparian habitat in the open pit. [Mit_068, Mit_087].
- Reclamation and re-vegetation of the mining footprint will be carried out in accordance with O.Reg. 240/00. [Mit_088].
- Seeding or hydroseeding with native seed mix. [Mit_089].
- All runoff from the operations area will be collected by the perimeter runoff and seepage collection system constructed at the start of the site preparation and construction phase. [Mit_008].
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053].
- A wet cover is the preferred closure option over the TSF. A wet cover prevents acidification of the tailings, which improves the quality of seepage in the long-term and results in improved surface water quality in the receiving environment. [Mit_023].
- 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits. [Mit_124].

In addition, Treasury Metals will:

- Identify and protect the locations of any known SAR or provincially significant plant [Mit_085].

6.15.6 Residual Adverse Effects

The adverse effects for wetlands and vegetation communities that remain after the implementation of mitigation and avoidance measures are set out in Table 6.15.6-1.

Table 6.15.6-1: Predicted Residual Adverse Effects for Wetlands and Vegetation

Valued Components (VCs)	Indicators	Measures	Site Preparation and Construction	Operations	Closure	Post-closure
Wetlands	Wetland extent	Change in area (ha)	33	47 (1)	47 (2)	— (3)
	Wild Rice	Loss of identified habitat (ha)	—	—	—	—
		Changes in water level (m)	—	—	—	—
		Changes in water quality	—	—	—	—
	Floating Marsh Marigold (*Caltha natans*)	Loss of identified habitat (ha)	—	—	—	—
Vegetation Communities	Predominantly coniferous forest	Change in area (ha)	95	95 (3)	95 (3)	— (3)
	Predominantly deciduous forest	Change in area (ha)	43	43 (3)	43 (3)	— (3)
	Successional areas	Change in area (ha)	70	70 (3)	70 (3)	— (3)
	Potential berry harvesting areas	Change in area (ha)	260	260 (3)	260 (3)	— (3)

Notes:
The "—" symbol indicates there were no predicted adverse effects
(1) The increase in wetland extent reflects the effects of dewatering on WLD5.
(2) The effects due to dewatering are expected to persist until the open pit floods and groundwater returns to near pre-development levels.
(3) The areas lost during the site preparation and construction phase will not recover until post-closure.

6.15.7 Information to Address Round 1 Information Requests

The following lists the Round 1 IRs related to the assessment of potential effects to wetlands and vegetation:

- TMI_282-RG(1)-17: hydrology of Lola Lake;
- TMI_283-RG(1)-18: fen inventories, vegetation, and SAR surveys;
- TMI_333-AC(1)-07: water quality impacts to Lola Lake;
- TMI_478-AC(1)-152: define spatial boundary for wetlands; and
- TMI_534-AC(1)-208: better identification of wetland and vegetation VCs.

6.16 Land Use

6.16.1 Potential Effects of the Project on the Environment

The Project area, due to its close proximity to populated areas and its accessibility via Tree Nursery Road, is currently used for a number of different land and resource uses that could potentially be affected by Project works and activities. The land and resource uses assessed under the land use discipline only refers to those that are practiced by Non-aboriginal peoples and other industry. A fulsome assessment of the potential effects of the Project to Aboriginal peoples is provided in Section 6.21. The following works and activities of the Project contribute to the potential effects on land use, by the various phases of the Project:

- **Site preparation and construction phase:**
  - Clearing of trees;
  - Construction of perimeter ditch;
  - Dewatering of overburden;
  - Stripping of overburden and development of overburden stockpile;
  - Development of site infrastructure;
  - Construction of processing plant;
  - Initiate construction of TSF;
  - Potential spills of fuels and chemicals;
  - On-site vehicle exhaust;
  - Construction traffic; and
  - Construction workforce.

- **Operations phase:**
    - Development of the open pit;
    - Development of underground mine;
    - Continued development of TSF;
    - Development of the WRSA;
    - Development and depletion of LGO stockpile;
    - Operations traffic;
    - Operations workforce;
    - Potential spills of fuels and chemicals;
    - Operations of site infrastructure;
    - Operations of processing plant;
    - Dewatering of mine workings;
    - Water taking for operations; and
    - Discharge of treated water to Blackwater Creek.
- **Closure phase:**
    - Cease dewatering activities;
    - Grading of the site to direct runoff towards open pit;
    - Closure of the TSF;
    - Closure of the WRSA;
    - Initiate filling of open pit;
    - Construction of open pit spillway;
    - Underground mine closure;
    - Decommissioning of site infrastructure;
    - Decommissioning of LGO stockpile;
    - Use of overburden and depletion of overburden stockpile;
    - Revegetate site;
    - On-site vehicle exhaust;
    - Closure traffic; and
    - Closure workforce.

- **Post-closure phase:**
  - Presence of the closure WRSA;
  - Presence of closure TSF;
  - Flooding of open pit;
  - Passive discharge from the open pit into Blackwater Creek Tributary 1;
  - Groundwater recovers to near pre-development levels; and
  - Seepage from the WRSA and TSF leaving the site.

The potential effects of the Project on land and resource use will vary by Project phase, and have been described using the nine VCs introduced in Section 6.1.3.15. The potential effects for the land use VCs are listed and described in Table 6.16.1-1.

Table 6.16.1-1: Potential Effects on Land and Resource Use

Valued Component	Potential Effect	Project Phase	Described Effect
Land Use Planning and Policies	Potential for conflict with accepted land uses as stipulated in approved land use plans.	• Site preparation and construction • Operations	Existing land use planning and policies could conflict with the Project's use of the land. Specific requirements or information related to these existing planning and policies may require consideration in the Project planning and operation.
		• Closure	Existing land use planning and policies may have specific requirements or information related to closure.
		• Post closure	Existing land use planning and policies could have specific requirements or information related to future use of the land.
	Overlap with protected areas.	• Site preparation and construction • Operations • Closure	There is the potential for the Project footprint to overlap with protected areas.
Aggregate Operations	Change in access to aggregate resources	• Site preparation and construction • Operations • Closure	The Project could change the access to existing aggregate resources.
	Potential for change in demand for aggregate resources extraction.	• Site preparation and construction • Operations • Closure	The construction of the Project could place increased demand on aggregate resources in the area.

Table 6.16.1-1: Potential Effects on Land and Resource Use (continued)

Valued Component	Potential Effect	Project Phase	Described Effect
Forestry	Potential for a change in access to forestry resources for management.	• Site preparation and construction • Operations • Closure	The Project could restrict access to forestry resources currently being managed under a Sustainable Forest Licence.
	Loss of forestry resources.	• Site preparation and construction • Operations • Closure	Site clearing activities could remove forestry resources currently being managed under a Sustainable Forest Licence.
		• Post-closure	Permanent Project features (i.e., WRSA, open pit and TSF) could remove potential forestry resources in perpetuity.
Mineral Exploration	Potential change in access to mineral claims for exploration and production.	• Site preparation and construction • Operations • Closure	Change in access to mineral claims for exploration or production could impact the claims holder by limiting or stopping exploration and/or production.
Fishing - Recreational and Commercial	Change in access to fishing areas	• Site preparation and construction • Operations • Closure	Change in access to fishing areas could reduce fishing success for food or income.
	Change in abundance of fish	• Site preparation and construction • Operations • Closure • Post-closure	The loss of fish, fish habitat and the displacement of fish populations could reduce fishing success and reduce food or income.
	Change in contamination levels of fish	• Site preparation and construction • Operations • Closure • Post-closure	Contamination of fish could reduce the amount of fish suitable for consumption and could affect income.
	Diminished experience of being on the land.	• Site preparation and construction • Operations • Closure • Post-closure	Increased noise, vibration, air quality (dust) and light and a change to the viewscape could diminish the on-the-land experience and reduce the amount of fishing activity.
Hunting	Change in access to hunting areas.	• Site preparation and construction • Operations • Closure	Change in access to hunting areas could reduce hunting success and reduce food or income source.
	Change in abundance of wildlife	• Site preparation and construction	The loss of wildlife habitat and displacement of wildlife species could

Table 6.16.1-1: Potential Effects on Land and Resource Use (continued)

Valued Component	Potential Effect	Project Phase	Described Effect
		• Operations • Closure	reduce hunting success and reduce food or income sources.
	Diminished experience of being on the land.	• Site preparation and construction • Operations • Closure • Post-closure	Increased noise, vibration, air quality (dust) and light and a change to the viewscape could diminish the on-the-land experience and reduce the amount of hunting activity.
Trapping	Change in access to trapline areas.	• Site preparation and construction • Operations • Closure	Change in access to trapline areas could reduce trapping success and reduce an income source.
	Change in abundance of wildlife.	• Site preparation and construction • Operations • Closure	The loss of habitat and displacement of wildlife species could reduce trapping success and reduce an income source.
	Diminished experience of being on the land.	• Site preparation and construction • Operations • Closure	Increased noise, vibration, air quality (dust) and light and a change to the viewscape could diminish the on-the-land experience and reduce the amount of trapping activity.
Cottagers and Outfitters	Diminished experience of being on the land.	• Site preparation and construction • Operations • Closure • Post-closure	Increased noise, vibration, air quality (dust) and light and a change to the viewscape could diminish the on-the-land experience and reduce the amount of related activities.
	Change in the access to areas outfitters had previously used.	• Site preparation and construction • Operations • Closure	Change in access to areas used by outfitters could reduce hunting and fishing success and reduce income source.
	Change in the clientele for outfitters with lodges in the area	• Site preparation and construction • Operations • Closure	Outfitters with lodges located near the Project site may experience an increase in clientele related to the demand for the accommodations of temporary visitors/workers/contractors at the Project site.
Other Recreational Uses	Change in access to public lands for non-consumptive uses (e.g. motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).	• Site preparation and construction • Operations • Closure	Other recreational users that may have previously used the area may no longer have access to these areas.

Table 6.16.1-1: Potential Effects on Land and Resource Use (continued)

Valued Component	Potential Effect	Project Phase	Described Effect
	Change in access to public lands for the collection of berries, mushrooms or other vegetation for consumptive uses	• Site preparation and construction • Operations • Closure	Other recreational users that may have previously used the area may no longer have access to these areas.
	Change in the abundance of consumptive foods.	• Site preparation and construction • Operations • Closure • Post-closure	The Project may change the abundance of berries and/or mushrooms and/or other vegetation used for consumptive purposes.
	Diminished experience of being on the land.	• Site preparation and construction • Operations • Closure • Post-closure	Increased noise, vibration, air quality (dust) and light and a change to the viewscape could diminish the on-the-land experience and reduce the amount of related activities.

The relationship between the Project and potential effects on land and resource use have been described using a simple linkage diagram (Figures 6.16.1-1 and 6.16.1-2). The figures illustrate the land and resource use VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. The figures also indicate other components of the environment (shown in red in the figure) where the predicted effects of the Project on land and resource use will be used as an input for determining the effects on other VCs. Other VCs that provide inputs to the assessment of land and resource use effects are shown in red in the figure. The figures illustrate that land and resource use is closely related to, and dependent on those effects predicted for the physical and biological components of the environment.

6.16.2 Effects Prediction Methods

Information on the land and resource uses in the vicinity of the Project were obtained through community meetings, feedback received from local stakeholders following their review of the original EIS, and research of the industry in the area. This information was used to develop the nine VCs that effectively encompass the current and potential land and resource uses that could be affected by the Project.

To assess the potential effects of the Project on the nine land and resource use VCs, the effects assessment completed for the physical disciplines provided in Section 6.2 to Section 6.15 were referenced to provide context for the qualitative assessments, and provide data when quantitative assessments were available.

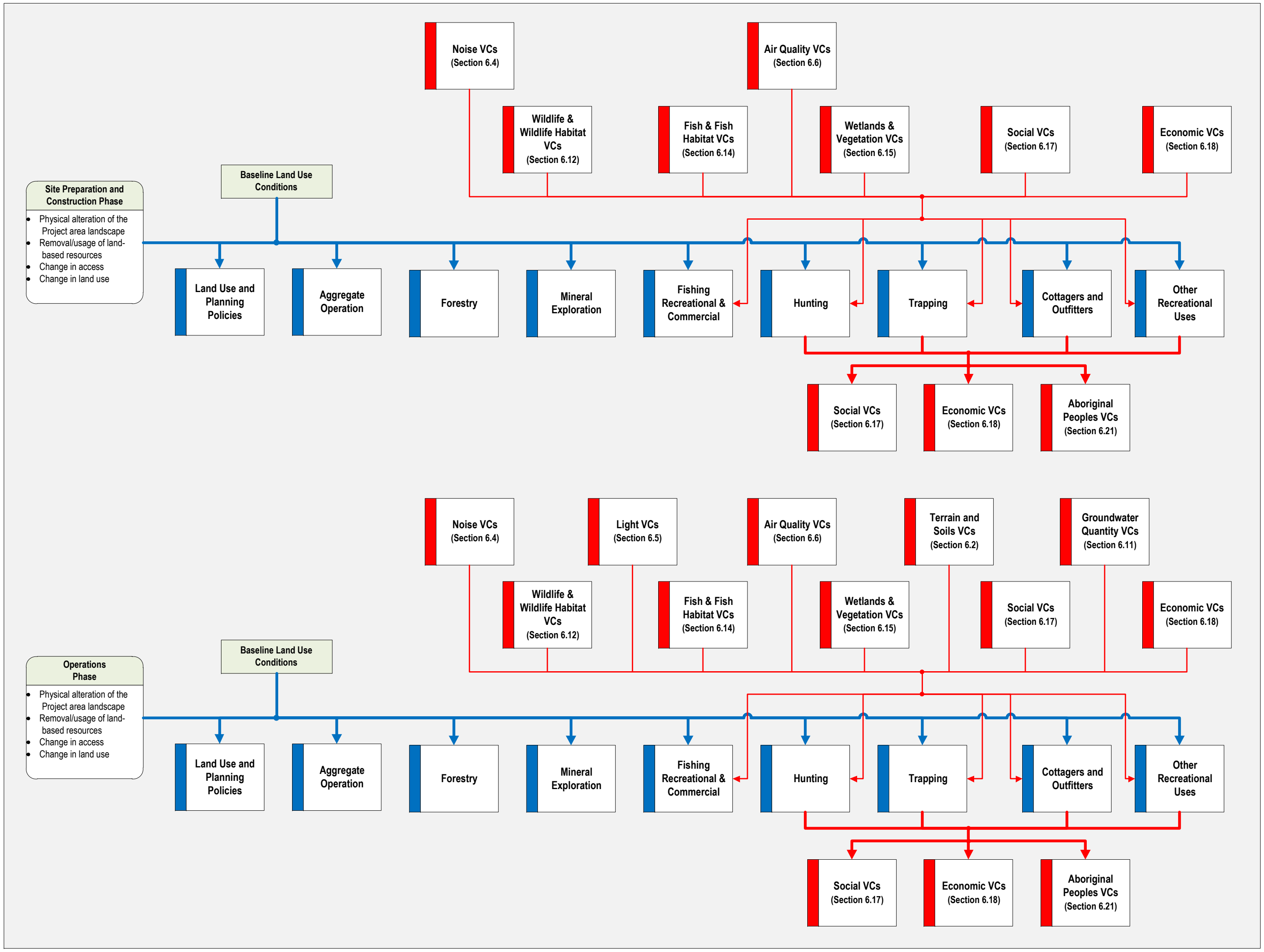


Figure 6.16.1-1: Land and Resource Use Linkage Diagram

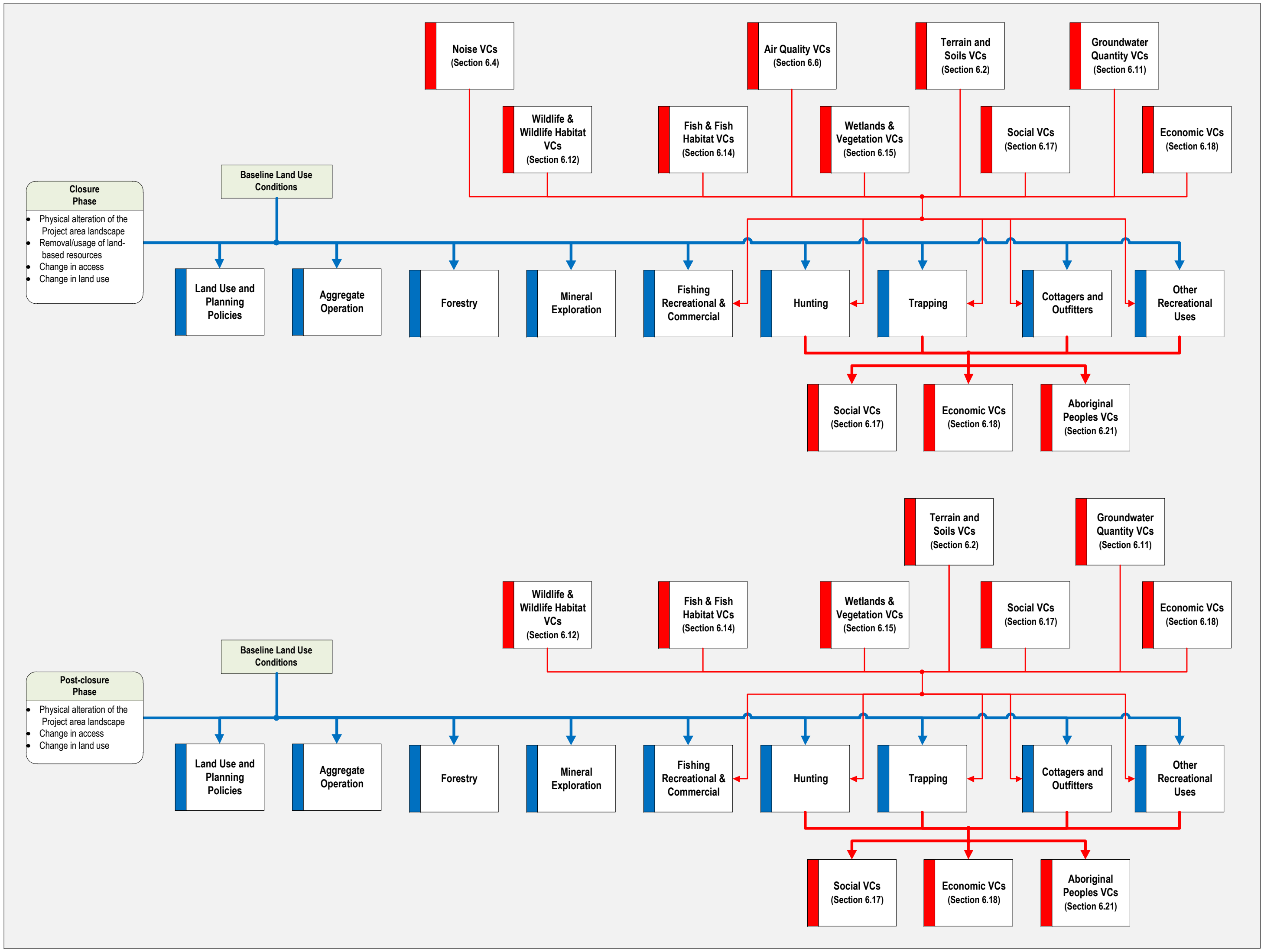


Figure 6.16.1-2: Land and Resource Use Linkage Diagram (continued)

Quantitative data sources from the Project effects assessment include:

- Changes in natural landscape predictions (Section 6.2 – Terrain and soils);
- Noise and vibration modelling results (Section 6.4);
- Light trespass modelling results (Section 6.5);
- Air quality modelling results (Section 6.6); Wildlife and wildlife habitat loss / alteration determinations (Section 6.12); and
- Fish and fish habitat loss / alteration determinations (Section 6.14).

All other land and resource use effects predictions were based on qualitative analysis and includes a clear rationale for the predictions.

6.16.3 Project Effects Avoidance Measures Used in Predictions

Aspects of the Project design, as well as the avoidance measures incorporated into the assessment of effects for the various physical and biologic disciplines that affect land use will have the benefit of helping avoid potential land use effects of the Project. The avoidance measures used in predicting the effects of the Project on the Land Use VCs:

- Project design incorporates a compact footprint. [Mit_050].
- Minimize crown land in the Project footprint. [Mit_090].
- Minimize activities on the eastern portion of the Project property. [Mit_091].
- During the operating life of the Project, the operations area will be fenced and no access will be permitted for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited. [Mit_092].
- Avoidance measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site. [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006].
- Air quality avoidance measures (Section 6.6.3) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_046].
- Noise and blasting avoidance measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032].
- Light avoidance measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].

- Avoidance measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality. [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Mit_124].
- Avoidance measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat. [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074].
- Avoidance measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat. [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].
- Avoidance measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project. [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].

6.16.4 Predicted Effects

Predicted effects, as described below, are those effects that are predicted to occur once taking into consideration avoidance measures designed to limit potential effects. The predicted effects of the Project on land and resource use will vary throughout the Project phases, and will vary by VC.

6.16.4.1 Land Use Planning and Policies

There are no existing land use planning policies that could conflict with the Project's use of the land. The Project is located in the Hartman and Zealand townships on unincorporated land. There is no potential effect to residential or cottage development as the policy of the MNRF only considers disposing of Crown land for cottage lots when the Crown lands fall within municipal boundaries.

6.16.4.2 Aggregate Operations

Based on the alternatives assessment of the aggregate supply for the Project (see Section 2.4.13), the preferred source of aggregate is the use of non-PAG waste rock from the open pit. This would reduce the height and visibility of the WRSA and reduce the vehicle emissions from transporting aggregate material from off-site suppliers. If the quantity of non-PAG waste rock is determined to be insufficient for Project requirements, an off-site source of aggregate material will be used. This could increase the local demand on the aggregate resources in the area and could provide an economic boon to the local aggregate industry.

There are three aggregate permits located to the south of the Project (Site ID 46764, 500242, and 500427). These aggregate permits will not be affected or have access restricted as a result of Project development. As Treasury metals currently possesses the mine claim or leasehold to mineral rights in the areas to the east of the Project, there is no potential for aggregate quarries to be developed in these areas.

During the site preparation and construction phase of the Project, Tree Nursery Road will be gated and access restricted for safety and security reasons. Tree Nursery Road is the main road providing access to the area north of the Project site. However, there would still be access to the areas north of the Project site via a network of forestry roads to access aggregate resources. There are no predicted effects for change in access to possible aggregate resources as a result of the Project.

6.16.4.3 Forestry

Prior to the site preparation and construction phase, the operations area will be clear cut so that earth works at the site can begin. Treasury Metals has obtained a licence to forest the area of privately held patent land in the operations area and has already discussed the removal of trees with the Forestry Licence holder on the areas of Crown Land. Based on the wetland and vegetation effects assessment (see Section 6.15) 138 ha of forest habitat will be removed during the site preparation and construction phase. Once the operations area has been forested, the area would be unavailable to forestry until the post-closure phase of the Project, once the trees planted in the closure phase are mature enough to harvest. However, there would be 168 ha of land previously available to forestry that would be permanently unavailable. These are the areas taken up by the open pit, the WRSA and the TSF. The WRSA and TSF would be vegetated in the closure phase with shallow root species that could not affect the integrity of the WRSA and TSF covers. The area no longer available for forestry is marginal compared to the 136,000 ha licence held by the Dryden Forest Management Company and represents a 0.1% loss.

During the site preparation and construction phase of the Project, Tree Nursery Road will be gated and access restricted for safety and security reasons. Tree Nursery Road is the main road providing access to the area north of the Project site. However, there would still be access to the areas north of the Project site via a network of forestry roads to access potential resources. There are no predicted effects for change in access to possible forestry resources as a result of the Project.

6.16.4.4 Mineral Exploration

Treasury Metals has mineral claims or mineral rights on the majority of the area surrounding the Project and extents east to Highway 72 (see Figure 1.2.3-1). Treasury Metals has an obligation to continue to explore the viability of these mineral claims. During the site preparation and construction phase of the Project, Tree Nursery Road will be gated and access restricted by Treasury Metals for safety and security reasons and will remain gated until closure activities cease. However, there would still be access to the areas north of the Project site via forestry roads for mineral exploration or potential mineral claims.

6.16.4.5 Fishing – Recreational and Commercial

As stated in Section 6.14, the Project will result in the loss of fish habitat during the site preparation and construction phase, specifically sections of Blackwater Creek Tributaries 1 and 2. These tributaries are not suitable sport fish habitat or sport fish spawning habitat and only bait fish would be affected in these tributaries as a result of the Project. The potential mortality is predicted to be 50% of the population in the stretches of tributaries that are being drained for the construction of Project components. The removal of these aquatic habitat would need to be offset by constructing new fish habitat that is generally proportional to the amount and quality of habitat lost. Therefore, there are no residual effects to fish abundance for harvest as a result of Project activities. That stated, the tributaries that will be affected by the Project are located on patent land owned by Treasury Metals and would be unavailable for bait fishing without permission.

Downstream of the Project, the water quality and flows to surrounding watercourse will be affected as a result of discharges from the Project, water taking from the irrigation ponds, change in catchment areas of sub-watersheds, and changes in groundwater due to mine dewatering. As stated in Section 6.8.6, the surface water quality modelling results show that water quality in the surrounding environment will be equivalent to existing conditions or meet PWQO for the protecting of aquatic life. During site preparation and construction and closure, there will be no discharges of water leaving the operations area as all water in the operations area will be captured by the perimeter ditch. During the operations phase, changes to the concentrations of various compounds will occur in Blackwater Creek and Wabigoon Lake due to the discharge of treated effluent into Blackwater Creek. The effluent will be treated to meet PWQO for the protection of aquatic life prior to release into Blackwater Creek. Therefore, no adverse effects on fish will occur in the receiving environment as a result of the changes to water quality. As the entire operations area is enclosed by the perimeter ditch and there is only one point of effluent discharge, there are no other locations where changes in water quality will occur during operations. During post-closure, water will overflow from the open pit into Blackwater Creek Tributary 1. This water will either meet PWQO or be less than background and will therefore not have an effect on fish contaminant concentrations in any surrounding surface waterbodies. Changes in surrounding surface water flows as a result of the Project should not impact fish or fish habitat, but may need to be offset. The changes in flows are not anticipated to cause any measurable change in the water levels of Thunder Lake and Wabigoon Lake.

As water quality will be equivalent to existing conditions or meet PWQO, there are no residual effects to fish contaminant concentrations as a result of changes to surrounding surface water quality from the Project. That stated, as described in Section 5.1.12.5 “Eating Ontario Fish”, there is a fish consumption advisory in effect in the regional area to protect human receptors from mercury toxicity. The Project will not alter this fish consumption advisory as it will discharge at mercury concentrations below background. There are therefore no predicted effects to the contaminant concentration in fish as a result of the Project.

There is the potential that the Project could limit access to bait fishing areas north of the Project. During the site preparation and construction phase, Tree Nursery Road will be gated and access restricted by Treasury Metals for safety and security reasons. Tree Nursery Road is the main road providing access to the area north of the Project site. However, there would still be access to the areas north of the Project site via forestry roads for fishing that is not on private property owned by Treasury Metals. There are therefore no predicted effects on access to potential fishing areas as a result of the Project.

In addition to areas inaccessible to fishing due to safety and security reasons, there are areas around the Project where the Project will be noticeable, with relatively small changes to the environment, but that would not alter the ability to fish in those areas. These areas could be considered as having a diminished experience on the land to those that fish around the Project. The potential effects to diminished experience on the land is limited to the visibility of the WRSA from Sections of Thunder Lake during the operations phase into post-closure. However, although the WRSA will be visible from Thunder Lake, it will be covered and vegetated to look like a natural feature of the landscape in the closure phase and may not be discernable from the surrounding landscape. The area where the WRSA may be visible is provided in Figure 6.2.4.1-1. The total area that could have a diminished experience on the land is 852 ha.

6.16.4.6 Hunting

Hunting is a common practice in northern Ontario, with moose being the most important game species. Other species that are regularly hunted include deer, partridge, waterfowl and rabbits; however, it is unknown to Treasury Metals what specific hunting is done in the vicinity of the Project site by local stakeholders.

In evaluating the effects of the Project on the hunting VC for land and resource use, consideration was given to the change in the abundance of the listed key species (ungulates, furbearers, and waterfowl), as well as the changes in access and changes to the experience of being on the land. The effects assessment completed for wildlife and wildlife habitat (Section 6.12) provides areas that will be lost as available hunting area.

For ungulates, moose was selected as the indicator given the importance placed on this species in feedback from the Indigenous communities, as well as the emphasis placed on the management of moose populations by the government. In total, 84 ha of moose habitat would be cleared in the site preparation and construction phase. This area would remain unavailable for moose until the post-closure phase when reclamation activities have been successful in returning the site to a usable ecosystem. In total, 0.4% of the available ungulate habitat in the RSA (22,632 ha, per Section 6.12.4.1) would be affected by the Project.

Furbearers have been represented using two indicators, namely the American marten and the American beaver. During the site preparation and construction phase, 62 ha of American marten habitat will be cleared. The Project is predicted to affect 4.8% of the available American marten habitat in the LSA (1,297 ha, per Section 6.12.4.1). For American beaver, the Project will result in the loss of 3.95 ha of impoundments during the site preparation and construction phase. Of this area, only 0.15 ha is associated with current beaver activity. The clearing of these impoundments and the associated beaver will be done following engagement with the local trapper, Dryden Trappers Council, the Indigenous communities and the MNRF. No negative effects on the population of American beaver are predicted as there is ample alternative habitat available within the local study area.

The third indicator used for the hunting VC is waterfowl. During the site preparation and construction phase, 32.6 ha of wetland will be overprinted or drained as a result of the Project. A further 14.4 ha of wetland will potentially be affected during operations by the change in groundwater due to the dewatering activities. In total, the Project could affect as much as 3.3% of the available wetlands in the LSA (1,439 ha, per Table 6.15.4.1-1).

Access to most areas within the LSA is also readily available to hunters by way of regional, local and forest access roads, as well as by waterways. Considerable alternative hunting areas are therefore available, such that the removal of a comparatively small area for hunting, associated with Project development, is unlikely to meaningfully diminish hunting potentials in the region. Treasury Metals is not currently aware of recent hunting activities on Project lands, but understand that there could be the potential to hunt in these areas.

Additionally, there are areas where hunters would have access and the Project would be noticeable. These areas could be considered as having a diminished on-the-land experience for those that hunt. The total area that could have a diminished on-the-land experience is 157 ha.

6.16.4.7 Trapping

The terrestrial LSA is intersected by three traplines (DR026, DR027 and DR021). The ownership of these traplines is currently not known to Treasury Metals, but there is the potential that they are owned by Non-aboriginal peoples in the area of the Project. The primary species of interest to trappers in the area are marten and beaver, but several other species are also trapped.

The proposed Project development area is mostly contained within trapline DR026. This trapline covers an area of 22,711 ha, of which 309 ha would be directly overprinted by the proposed development zone Trapline DR027 covers an area of 21,990 ha, which will only have 0.5 ha overprinted by the Project, and a further 4 ha could potentially be affected by habitat disturbance based on the 50 dBA noise threshold. Therefore, from a potential disturbance perspective approximately 1.3% of trapline DR026 and approximately 0.02% of trapline DR027 is expected to be affected to some level by Project development and operation. Trapline DR021 is located outside of potential Project development and disturbance zones.

Furbearers have been represented using two indicators, namely the American marten and the American beaver. During the site preparation and construction phase, 62 ha of American marten habitat will be cleared. The Project is predicted to affect 4.8% of the available American marten habitat in the LSA (1,297 ha, per Section 6.12.4.1). For American beaver, the Project will result in the loss of 3.95 ha of impoundments during the site preparation and construction phase. Of this area, only 0.15 ha is associated with current beaver activity. The clearing of these impoundments and the associated beaver will be done following engagement with the local trapper, Dryden Trappers Council, the Indigenous communities and the MNRF. No negative effects on the population of American beaver are predicted as there is ample alternative habitat available within the local study area.

Additionally, there are areas where trappers would have access and the Project would be noticeable. These areas could be considered as having a diminished on-the-land experience for those that trap. The total area that could have a diminished on-the-land experience is 157 ha.

6.16.4.8 Cottagers and Outfitters

During the site preparation and construction, operations and closure phases of the Project, there is the potential for a change in clientele for outfitters with lodges located near the Project. Due to the increase in contractors and general workforce for the Project, outfitters may experience an increase in business related to the need for accommodations, which could benefit their business in the off-season. This increase in clientele from Project labourers could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere. This is considered a neutral effect to the local outfitters near the Project site.

It is Treasury Metals understanding that the Project area is not used as an access route to cottages or outfitter lodges. As most of the Project area is located on patent land owned by Treasury Metals, the Project area is not anticipated to restrict access to cottages or outfitter lodges. There is the potential that cottage and outfitter would utilize Tree Nursery Road as an access route to areas north of the Project site but it should be noted that the final portion of Tree Nursery Road is wholly owned by Treasury Metals. Tree Nursery Road is proposed to be gated and access restricted during the site preparation and construction, operations and closure phases of the Project for safety and security reasons.

In addition to areas inaccessible to cottagers and outfitters due to safety and security reasons, there are areas around the Project where the Project will be noticeable, with relatively small changes to the environment, but that would not alter the ability to use the land in those areas. These areas could be considered as having a diminished experience on the land to those that use the land around the Project. The potential effects include the aesthetics of the Project from off-site, and the areas where the Project would be audible. The total area that could have a diminished experience on the land is 157 ha.

6.16.4.9 Other Recreational Uses

Treasury Metals understands that local stakeholders may use the area around the Project site for non-consumptive recreational uses (e.g., motorized recreational vehicles, canoeing, wildlife view, walking and hiking) and consumptive recreational uses (e.g., picking berries, mushrooms and other vegetation for consumptive purposes). These potential recreational land uses could be affected by the Project by limiting access to certain areas, changing the abundance of consumptive plants, or a diminished experience of being on the land.

The abundance of consumptive plant reduction in the LSA is predicted to be marginal. For example, blueberry and other berry types are widespread and common throughout the region, and are frequently associated with previously cutover, or burned areas where there is more light, especially where sandy type soils occur. With forest regrowth to a more mature state, berry patches tend to be eliminated or greatly diminished due to forest canopy shading effects. Within the LSA and estimated 3003 ha of suitable berry habitat has been identified. Of this amount an estimated 260 ha would be removed as a result of Project development. This includes identified, readily accessible blueberry harvest areas within the TSF footprint.

In addition to areas inaccessible to recreational activities due to safety and security reasons, there are areas around the Project where the Project will be noticeable, with relatively small changes to the environment, but that would not alter the ability to use the land in those areas. These areas could be considered as having a diminished experience on the land to those that use the land around the Project. The potential effects include the aesthetics of the Project from off-site, and the areas where the Project would be audible. The total area that could have a diminished experience on the land is 157 ha.

6.16.5 Identified Mitigation

The Project measures identified to mitigate the potential adverse effects or enhance positive effects on land and resource uses are listed in Table 6.16.6-1. Some mitigation measures are applicable to more than one predicted effect.

- Project design incorporates a compact footprint. [Mit_050].
- Minimize crown land in the Project footprint. [Mit_090].
- Minimize activities on the eastern portion of the Project property. [Mit_091].
- During the operating life of the Project, the operations area will be fenced and no access will be permitted for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited. [Mit_092].
- Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process. [Mit_093].
- Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site. [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006].

- Air quality mitigation measures (Section 6.6.3) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_046].
- Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032].
- Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].
- Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality. [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Mit_124].
- Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat. [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074].
- Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat. [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].
- Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project. [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].

6.16.6 Residual Effects

Despite the implementation of the mitigation measures described in Section 6.15.5, residual effects will remain for the land and resource use VCs. Table 6.16.6-1 summarizes the residual effects for each of the VC introduced in Section 6.1.3.15.

Several of the residual effects for land and resource use are regional in nature, and could occur anywhere within the terrestrial and aquatic study areas presented on Figures 6.1.4.16-1 and 6.1.4.16-2, respectively. There are some effects that will be spatially tied to the effects of the Project on the biophysical environment. This is the case for VCs such as “fishing - recreational and commercial” and “other recreational uses”. For these VC, the spatial effects of the Project can be characterized by identifying the areas where harvesting or traditional uses of the land may be affected.

Table 6.16.6-1: Residual Effects for Land and Resource Use

Valued Components (VCs)	Indicators	Predicted Land and Resource Use Residual Effects			
		Site Preparation and Construction	Operations	Closure	Post-Closure
Land Use Planning and Policies	Conflict with accepted land uses as stipulated in approved land use plans.	None	None	None	None
	Overlap with protected areas.	None	None	None	None
Aggregate Operations	Change in access to aggregate resources.	None	None	None	None
	Change in demand of aggregate resources extraction.	Increase demand leading to economic benefit	Increase demand leading to economic benefit	None	None
Forestry	Change in access to forestry resources for management.	None	None	None	None
	Loss of forestry resources	Operations area will be logged. No loss in forestry resources	138 ha of forest will not be available. Constitutes a 0.1% loss to the forestry licence.	138 ha of forest will not be available. Constitutes a 0.1% loss to the forestry licence.	168 ha of forest will not be available in perpetuity. Constitutes a 0.1% loss to the forestry licence.
Mineral Exploration	Change in access to mineral claims for exploration and production.	None	None	None	None
Fishing - Recreational and Commercial	Change in access to fisheries resources, affecting the ability to fish.	None	None	None	None
	Change in the abundance of fisheries resources, affecting the ability to fish	None	None	None	None
	Change in contaminant levels in fish, affecting the suitability for harvesting	None	None	None	None
	Diminished experience of being on the land and conducting fishing activities	None	852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake.	852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake.	852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake.

Table 6.16.6-1: Residual Effects for Land and Resource Use (continued)

Valued Components (VCs)	Indicators	Predicted Land and Resource Use Residual Effects			
		Site Preparation and Construction	Operations	Closure	Post-Closure
Hunting	Change in access to wildlife resources, affecting the ability to hunt.	743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA	743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA	743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA	None
	Change in abundance of wildlife resources, affecting the ability to hunt	84 ha of ungulate habitat removed (0.4% of the RSA) 62 ha of terrestrial furbearer habitat removed (4.8% of the LSA) 47 ha of waterfowl habitat removed (3.3% of the LSA)	84 ha of ungulate habitat removed (0.4% of the RSA) 62 ha of terrestrial furbearer habitat removed (4.8% of the LSA) 47 ha of waterfowl habitat removed (3.3% of the LSA)	84 ha of ungulate habitat removed (0.4% of the RSA) 62 ha of terrestrial furbearer habitat removed (4.8% of the LSA) 47 ha of waterfowl habitat removed (3.3% of the LSA)	None
	Diminished experience of being on the land and conducting hunting activities	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	None
Trapping	Change in access to wildlife resources, affecting the ability to trap.	309 ha will be unavailable for trapping on trapline licence DR026	309 ha will be unavailable for trapping on trapline licence DR026	309 ha will be unavailable for trapping on trapline licence DR026	None
	Change in abundance of wildlife resources, affecting the ability to trap.	62 ha of terrestrial furbearer habitat removed (4.8% of the LSA)	62 ha of terrestrial furbearer habitat removed (4.8% of the LSA)	62 ha of terrestrial furbearer habitat removed (4.8% of the LSA)	None
	Diminished experience of being on the land and conducting trapping activities.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	None

Table 6.16.6-1: Residual Effects for Land and Resource Use (continued)

Valued Components (VCs)	Indicators	Predicted Land and Resource Use Residual Effects			
		Site Preparation and Construction	Operations	Closure	Post-Closure
Cottagers and Outfitters	Diminished experience of being on the land.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake.	1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake.	852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake.
	Change in access to cottage and/or outfitter areas.	None	None	None	None
	Change in clientele for outfitters with lodges located near the Project	There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere.	There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere.	There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere.	None
Other Recreational Uses	Change in access for residents and visitors to public lands for non-consumptive purposes (e.g., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).	None	None	None	None
	Change in access for residents and visitors to pick berries and/or mushrooms and/or other	742 ha will be unavailable for consumptive recreational purposes	742 ha will be unavailable for consumptive recreational purposes	742 ha will be unavailable for consumptive recreational purposes	742 ha will be unavailable for consumptive recreational purposes

Table 6.16.6-1: Residual Effects for Land and Resource Use (continued)

Valued Components (VCs)	Indicators	Predicted Land and Resource Use Residual Effects			
		Site Preparation and Construction	Operations	Closure	Post-Closure
	vegetation for consumptive purposes.				
	Change in abundance of berries and/or mushrooms and/or other vegetation used for consumptive purposes.	The percentage of berry habitat loss in the LSA is 8.7% or 260 ha	The percentage of berry habitat loss in the LSA is 8.7% or 260 ha	The percentage of berry habitat loss in the LSA is 8.7% or 260 ha	None
	Diminished experience of being on the land.	157 ha will have diminished experience of being on the land due to noise emissions from the Project.	1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake.	1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake.	852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake.

6.16.7 Information to Address Round 1 Information Requests

Several IRs were received (2015) related to the VCs identified. These are categorized below by VC and organization.

Land Use Planning and Policies

- Government Agency - CEA Agency:
  - TMI_194.2-HE(1)-01 – Land use
  - TMI_235-HE(1)-42 – Land use
  - TMI_237-HE(1)-44 – Land use
  - TMI_112-SW(1)-26 – Provincial Park
  - TMI_84-GW(1)-21 – Provincial Park
- Government Agency - MNRF:
  - TMI_282-RG(1)-17 – Provincial Park
  - TMI_283-RG(1)-18 – Provincial Park
- Government Agency - City of Dryden residents
  - TMI_736-PC(1)-51 – Provincial Park
- Government Agency - Thunder Lake residents
  - TMI_736-PC(1)-51 – Provincial Park

Aggregate Operations

- Government Agency - CEA Agency:
  - TMI_46-MW(1)-08 – Aggregates
  - TMI_252.1-CE(1)-02 – Aggregates, forestry, cumulative effects
- Government Agencies – MNRF:
  - TMI_278-RG(1)-13 – Aggregates
  - TMI_279-RG(1)-14 – Aggregates

Forestry

- Government Agency - CEA Agency:
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping
  - TMI_252.1-CE(1)-02 – Aggregates, forestry, cumulative effects

Mineral Exploration

- Government Agency - CEA Agency:
  - TMI_253-CE(1)-03– Exploration, cumulative effects
- Thunder Lake residents:
  - TMI_715-PC(1)-30 – Surface mining rights
  - TMI_760-PC(1)-75 – Claims
- City of Dryden resident:
  - TMI_760-PC(1)-75 – Claims
- Sundry:
  - TMI_318-SD(1)-13 – Patent and leases

Fishing - Recreational and Commercial

- Government Agency - CEA Agency:
  - TMI_8-EA(1)-08 – Non-Aboriginal
  - TMI_127.1-FH(1)-06 – Fishing
  - TMI_194.1-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping
- City of Dryden residents:
  - TMI_687-PC(1)-02 – Fishing
  - TMI_721-PC(1)-36 – Fishing
    - Thunder Lake residents:
  - TMI_687-PC(1)-02 – Fishing
  - TMI_721-PC(1)-36 – Fishing
- Member of the public:
  - TMI_688-PC(1)-03 – Fishing

Hunting

- Government Agency - CEA Agency:
  - TMI_8-EA(1)-08 – Non-Aboriginal
  - TMI_151-WL(1)-08 – Hunting
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping , Bear Management Area

- TMI_194.1-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters

Trapping

- Government Agency - CEA Agency:
  - TMI_8-EA(1)-08 – Non-Aboriginal
  - TMI_194.1-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_252.1-CE(1)-02 – Fishing, hunting, trapping, cumulative effects
  - TMI_257-CE(1)-07 – Fishing, hunting, trapping, other recreational uses, cumulative effects
- Government Agency – MNRF:
  - TMI_281-RG(1)-16 – Trapping

Cottagers and Outfitters

- Government Agency - CEA Agency:
  - TMI_8-EA(1)-08 – Non-Aboriginal
  - TMI_194.1-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_172.1-AE(1)-10 – Sensitive receptors
  - TMI_228-HE(1)-35 – Forestry, fishing, hunting, trapping , Bear Management Area
  - TMI_302-RG(1)-37 – Noise-sensitive land uses
  - TMI_302-RG(1)-39 – Noise-sensitive land uses
- Thunder Lake residents:
  - TMI_712-PC(1)-27 – Residence, noise
  - TMI_715-PC(1)-30 – Cottage

Other Recreational Uses

- Government Agency - CEA Agency:
  - TMI_8-EA(1)-08 – Non-Aboriginal
  - TMI_194.1-HE(1)-01 – Fishing, hunting, trapping, other recreational uses, cottages and outfitters
  - TMI_231.1-HE(1)-38 – Mushroom, berry

- City of Dryden residents:
    - TMI_731-PC(1)-46 – Mushroom
    - TMI_732-PC(1)-47 – Wild rice
- Member of the public:
    - TMI_745-PC(1)-60 – Berry

6.17 Social Factors

6.17.1 Potential Effects of the Project on the Environment

The potential effects of the Project on the Social environment will vary by Project phase, and with varying levels of activity. The following lists the potential social effects by Project phase:

- **Site preparation and construction phase:**
    - Direct employment;
    - Indirect employment; and
    - Use of municipal services.
- **Operations phase:**
    - Direct employment;
    - Indirect employment; and
    - Use of municipal services.
- **Closure phase:**
    - Decreased direct employment;
    - Decreased indirect employment; and
    - Use of municipal services.
- **Post-closure phase:**
    - Loss of direct employment; and
    - Loss of indirect employment.

The potential effects of the Project on the Social environment have been described using a simple linkage diagram (Figure 6.17.1-1). The figure illustrates the Social VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. Additionally, the figure indicates those other components of the environment (shown in red in the figure) where the predicted effects of the Project on the Social environment will be used as an input for determining the effects on other VCs. Other VCs that provide inputs to the assessment of Social effects are shown in red in the figure.

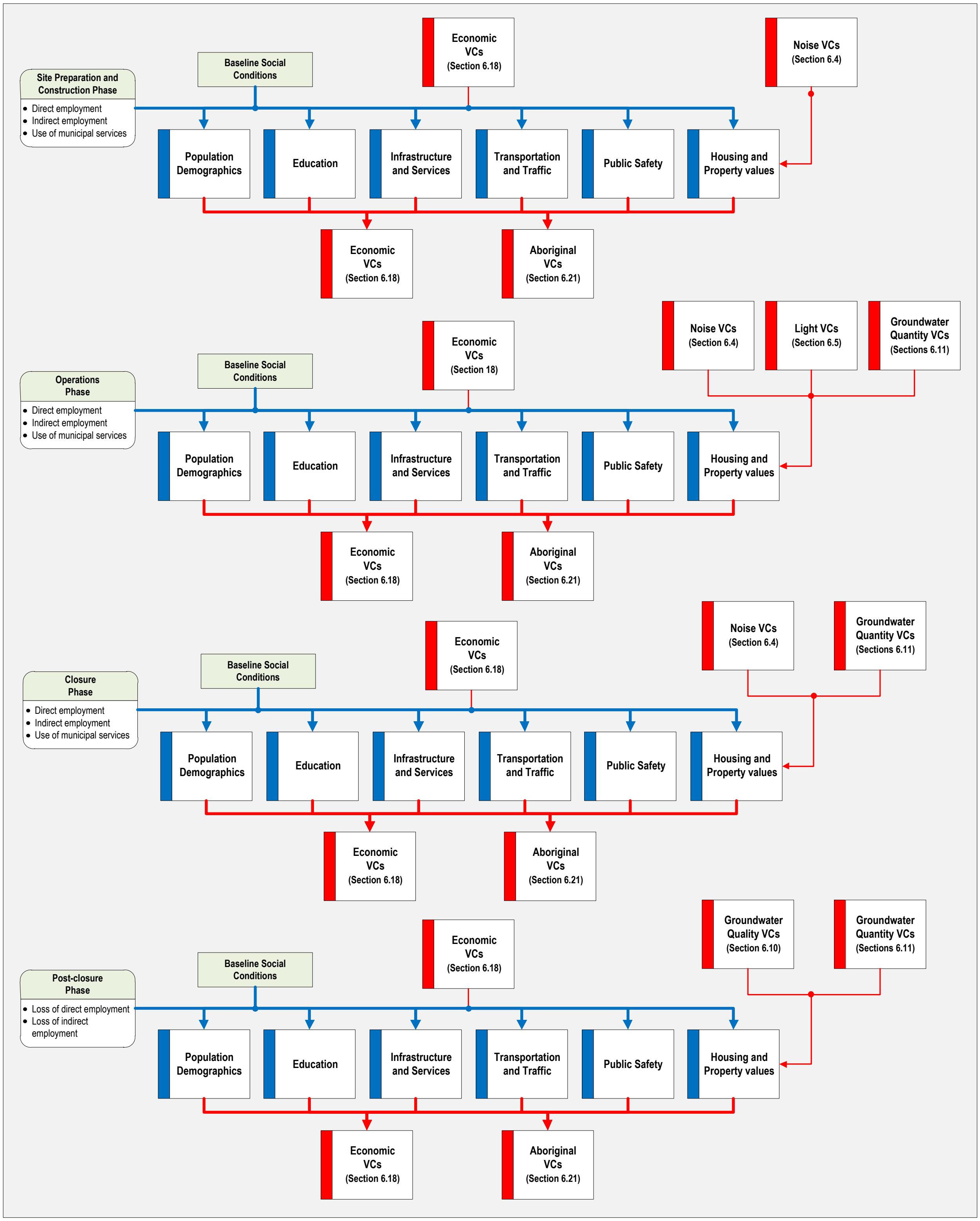


Figure 6.17.1-1: Social Linkage Diagram

6.17.2 Effects Prediction Methods

The qualitative social effects predictions, as they relate to the social VCs outlined in Section 6.1.3.16, were based upon:

- EIS guidelines for the Project;
- Baseline data collected for Aboriginal and non-Aboriginal communities within the socio-economic study area (EIS Appendix T);
- Elements of the Project description that may intersect with social conditions in the socio-economic study area;
- Information gathered through Aboriginal engagement and stakeholder consultation pre-EIS and post-EIS submission; and

Industry knowledge and understanding of social interactions of mining projects in Canada and Ontario, including northwestern Ontario.

It is recognized that there are some gaps in the baseline social conditions and these were compensated for by industry knowledge and application of global best practices.

6.17.3 Project Effects Avoidance Measures Used in Predictions

Avoidance measures used in predicting potential Project-related social effects are presented in Table 6.17.3-1.

Table 6.17.3-1: Social Effects Avoidance/Enhancement Measures Considered

Valued Component	Potential Effect	Project Phase	Avoidance/Enhancement Measure Considered
Population demographics	Potential for increase in demand on existing infrastructure and services such as utilities, municipal infrastructure, communication services and recreation facilities	Site preparation and construction Operations	None
Education	Increased demand for education services at all levels	Site preparation and construction Operations	None
	Motivation to stay in or leave school	Site preparation and construction Operations	None
Housing	Increased demand for temporary accommodations	Site preparation and construction	None
	Increased demand for permanent accommodation due to in-migration	Site preparation and construction Operations	None

Table 6.17.3-1: Social Effects Avoidance/Enhancement Measures Considered (continued)

Valued Component	Potential Effect	Project Phase	Avoidance/Enhancement Measure Considered

	Positive and negative changes in real estate values due to in-migration and proximity to Project location	Site preparation and construction
		Operations
		Closure
			• No mitigation measures were identified to manage the effects of in-migration
			• Proximity to the Project is relevant with respect to changes in air quality and noise levels:
			  • Noise effects will be managed and mitigated as detailed in Section 6.4
			  • Predicted noise levels at the most affected receptors comply with the relevant MOECC criteria
			  • Air and dust levels will be managed using mitigation measures and best management practices
			  • Predicted air quality effects at the most affected sensitive receptors comply with relevant ambient air quality criteria

Public safety	Potential for increase in demand for public safety services due to increased traffic volumes related to the Project and population increases	Site preparation and construction Operations Closure	None
	Potential increase in crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	Site preparation and construction Operations	• Include contracted security services to help promote a secure and safe worksite environment • Develop a mine closure plan that identifies strategies and actions to aid residents
Transportation and traffic	Potential impact on transportation infrastructure due to potential population increases and transportation of goods and services throughout the life of the Project	Site preparation and construction Operations Closure	• Regulatory and cautionary signage • Shifts are scheduled to avoid the AM and PM peak traffic activities on Highway 17 (Appendix E)

6.17.4 Predicted Effects

The predicted social effects of the Project for each of the Project phases are listed in Table 6.17.4-1. It is anticipated that Project-related social effects will be most noticeable within the socio-economic study area communities considered to be within commuting distance from the Project site (estimated 100 km).

Table 6.17.4-1: Predicted Social Effects by Project Phase

Valued Component	Predicted Effect	Project Phase	Description of Effect
Population demographics	Changes to population demographics – population increase	Site preparation and construction	• In-migration could occur in the socio-economic study area associated with site preparation and site preparation and construction-related employment opportunities. This may help to reverse the pattern of out-migration in the socio-economic study area; however, it is expected that not all in-migrants will permanently locate to the area. Effects will be influenced by factors including, but not limited to: location, availability of housing, personal decision-making and location of origin of workers.
	Changes to population demographics – population increase	Operations	• In-migration could occur in the socio-economic study area associated with site preparation and construction-related employment opportunities. This may help to reverse the trend of out-migration in the socio-economic study area, positively affect the aging demographic profile and promote retention of the area's younger population. Effects will be influenced by factors including, but not limited to: location, availability of housing, personal decision-making and location of origin of workers.
	Changes to population demographics – population decline	Closure	• Out-migration could occur as the mine moves towards closure and the workforce composition and size change to align with closure activities and associated workforce requirements.
	Changes to population demographics – population decline	Post-closure	• Out-migration effects are expected to be most prominent once workforce requirements are confined to post-closure monitoring activities.
Education	Increased demand for education services at all levels	Site preparation and construction Operations	• Project-specific training requirements may positively affect demand for education and training services. Skills acquired through Project-specific pre-employment and on-the-job training may be transferrable to other economic sectors and will help to diversify and strengthen the local economy. • In-migration of working age population in response to Project-related employment opportunities may bring school-aged children to the area, increasing enrollments.

Table 6.17.4-1: Predicted Social Effects by Project Phase (continued)

Valued Component	Predicted Effect	Project Phase	Description of Effect
	Decreased demand for education services at all levels	Closure Post-closure	• Out-migration of working age population may result in decreased school enrollments.
	Motivation to stay in or leave school	Site preparation and construction Operations	• Individuals may be motivated to stay in school to further their education related to Project-related employment opportunities. Conversely, individuals may decide to leave or postpone their studies to pursue direct or indirect employment related to the Project.
Infrastructure and services	Potential for increase in demand on existing infrastructure and services such as utilities, municipal infrastructure, communication services and recreation facilities	Site preparation and construction Operations	• In-migration of workers and their families may increase the demand on existing infrastructure and services.
Housing	Increased demand for temporary accommodations	Site preparation and construction	• Due to the proximity of local communities, an accommodation camp is not included in the Project design. In-migration during Project site preparation and construction may put pressure on availability of temporary accommodations in the socio-economic study area. Effects will be influenced by factors including, but not limited to: location, availability of housing, personal decision-making and location of origin of workers.
	Increased demand for permanent accommodation due to in-migration	Site preparation and construction Operations	• It is anticipated that much of the needed workforce required during operations will be sourced from within the socio-economic study area communities, apart from highly specialized positions whose experience requirements exceed local labour force capabilities. Some non-local workers who take up employment during site preparation and construction may permanently locate to the socio-economic study area and continue employment through operations. Effects will be influenced by factors including, but not limited to: location, availability of housing, personal decision-making and location of origin of workers.
	Positive and negative changes in real estate values due to in-migration and proximity to Project location	Site preparation and construction Operations	• Real and perceived effects of Project-related activities (e.g., traffic, blasting) could negatively affect the value of houses that are closest to the Project's property boundary.

Table 6.17.4-1: Predicted Social Effects by Project Phase (continued)

Valued Component	Predicted Effect	Project Phase	Description of Effect
			• Increased demand for housing because of in-migration to the area may lead to an increase in real estate values.
		Closure	• Real estate values may be negatively affected by mine closure if individuals and families leave the area to pursue other employment, resulting in increased housing availability and decreased demand.
Public Safety	Potential for increase in demand for public safety services due to increased traffic volumes related to the Project and population increases	Site preparation and construction Operations	• Potential changes within the population and increased traffic volumes may increase pressure and demand on fire protection services, emergency services and police services.
		Closure	• Although potential out-migration of population following mine closure may occur, decreases in income levels due to mine closure and personal decision-making and behaviours could result in a continued increased demand for public safety services.
	Potential increase in crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	Site preparation and construction Operations	• Behaviour of non-local labour force during Project site preparation and construction could lead to an increased demand for public safety services. • Personal decision-making related to spending Project-related income may positively or negatively affect public safety within the affected communities.
		Operations	• Personal decision-making related to spending Project-related income may positively or negatively affect public safety within the affected communities.
		Closure	• Although potential out-migration of population following mine closure may occur, decreases in income levels due to mine closure and personal decision-making and behaviours could negatively affect the crime rate within the affected socio-economic study area communities.
Transportation and Traffic	Increased traffic on the roads leading to the Project site	Site preparation and construction	• Increased traffic during site preparation and construction could lead to higher incidences of traffic collisions involving other vehicles or wildlife. • Peak hours for traffic flow to/from the Project site will not overlap with existing baseline peak hours for Highway 17 traffic flows; the existing levels of service will be

Table 6.17.4-1: Predicted Social Effects by Project Phase (continued)

Valued Component	Predicted Effect	Project Phase	Description of Effect
			maintained on both Highway 17 and Anderson Road with additional anticipated Project-related traffic. • The current projected peak traffic volume during site preparation and construction will include approximately 469 daily trips down Anderson Road and Tree Nursery Road.
		Operations	• Increased traffic will be due mostly to shift changes and will involve smaller vehicles. • Regular transport of supplies and services to support mine operations will occur but on a much less noticeable scale than during site preparation and construction. • Vehicle traffic to and from the site during operations will be predominantly small vehicle traffic (94-96% of the annual trips are employee traffic and office supply trips), with larger vehicles accounting for 4 to 6% of the total annual traffic, which is approximately 15 to 19 trips per 24-hour period. The finished product leaving the mine site will be infrequent (less than once daily).
	Potential impact on transportation infrastructure due to potential population increases and transportation of goods and services throughout the life of the Project	Site preparation and construction Operations Closure	• Increased traffic through all phases of the Project could result in increased wear of road surfaces.

6.17.5 Identified Mitigation

The Project measures identified to mitigate the potential adverse social effects and/or enhance positive social effects are listed in Table 6.17.5-1.

Table 6.17.5-1: Mitigation Measures Applicable to Social Effects

Mitigation Measure Title	Mitigation Measure Description
Communications	Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project.
Socio-economic monitoring and management	Treasury Metals will work with potentially affected stakeholders and Aboriginal peoples to develop a socio-economic monitoring and management plan designed to address potential Project-related socio-economic effects, including optimization of benefits, identified through the environmental assessment process and/or at later stages of the Project.

Table 6.17.5-1 Mitigation Measures Applicable to Social Effects (continued)

Mitigation Measure Title	Mitigation Measure Description
Socio-economic baseline	Treasury Metals will undertake an update of the socio-economic baseline (GCK Consulting 2014) to establish a pre-construction baseline of the affected communities prior to commencing Project site preparation and construction. This will serve as the basis for future monitoring and management of socio-economic effects throughout the life of the Project.
Local hiring	Treasury Metals will develop and implement employment practices that give preference to local and regional labour to the extent possible.
Workforce development	Treasury Metals will develop training policies and job transfer plans to support workforce development in the socio-economic study area.
	Treasury Metals will develop training programs for unemployed and under employed residents and non-workers.
Education enrollments	• Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. • Treasury Metals will communicate education requirements needed for employment on the site to discourage dropouts. Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed.
Infrastructure and services	Treasury will work with local and regional governments to minimize the effects of in-migration and out-migration, as appropriate, communicating with government agencies as appropriate, including but not limited to: Project plans, proposed transportation volumes and workforce requirements.
Public safety	Include contracted security services to help promote a secure and safe worksite environment.
	Treasury will work with public safety services to develop safety and work policy guidelines for mine workers, including a policy of no alcohol or drugs onsite and policies and guidelines to support a respectful work environment.
	Develop a mine closure plan that identifies strategies and actions to aid residents.
	Included in the development of a socio-economic monitoring and management plan, Treasury will work with local agencies to assist in monitoring community wellbeing and take corrective actions where appropriate.
	The need to engage local fire services from the socio-economic study area communities will be mitigated through onsite fire suppression equipment will be provided to support trained responders in extinguishing and/or ensuring exposure protection from natural fires. Site hydrants will ensure that cooling water can be applied if threatened by external fire source.
Transportation infrastructure	• Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure. Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road.
Traffic safety	• Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents. • As part of the traffic and site control policy, Treasury Metals will continue to evolve its current practices and take into consideration all comments from the public, Aboriginal peoples and stakeholders.

Table 6.17.5-1 Mitigation Measures Applicable to Social Effects (continued)

Mitigation Measure Title	Mitigation Measure Description
	• Treasury Metals as part of the suitability assessment associated with CSAS-23 standards for Anderson Road and Highway 17 will discuss the options presented within Appendix E for the snow plough turnaround with MTO. Treasury Metals will move forward with the change suggested by MTO if deemed necessary, to ensure that snow removal equipment can use the turn-around in a safe efficient manner. • Treasury Metals will work with MTO to ensure that the proper lighting structures are in place to support the projected traffic volumes associated with the Project. Treasury Metals will clear shrubbery, trees, soil mounds, etc. that could cause a visual obstruction between vehicles on Anderson Road and Highway 17.

6.17.6 Residual Effects

The residual social effects are presented in Table 6.17.6-1 together with the applicable avoidance and mitigation measures. The social effects associated with the Project will be occur to varying degrees across the socio-economic study area introduced in Section 6.1.4.17. There would not be a spatial pattern associated with the social effects.

Table 6.17.6-1 Social Residual Effects

Predicted Effect	Project Phase	Avoidance and Mitigation Measures	Residual Effect	Direction
Population Demographics				
Increased demand on existing community housing, infrastructure and services due to in-migration of Project workers	Site preparation and construction Operations Closure Post-closure	Socio-economic monitoring and management Traffic safety	Potential increased demand on existing community housing, infrastructure and services. A noticeable change may result but it is expected that the current infrastructure within the communities most likely to be affected (City of Dryden and Village of Wabigoon) would be able to accommodate increased population. Population levels may decline to pre-Project conditions during Closure and Post-closure.	• Positive during Site preparation and construction and operations. • Negative during closure and post-closure.
Education				
Increased training opportunities	Site preparation and construction Operations Closure	Education and training policies and plans	Increased training and education opportunities for unemployed and under-employed residents and non-resident workers. It is anticipated that any increase in training would be able to be accommodated within existing education and training facilities.	• Positive during Site preparation and construction, operations and closure. • Adverse during post-closure.
Increased education enrollment	Site preparation and construction Operations	Communication with school districts	Potential increased demand on education services. It is anticipated that any increase in enrollments could be accommodated within existing education system.	• Adverse during Site preparation and construction and operations. • Positive during closure and post-closure.
Infrastructure and Services				
Increased demand on various infrastructure and services	Site preparation and construction Operations Closure	Communicate with government agencies as appropriate, including but not limited to: Project plans, proposed transportation volumes and workforce requirements. Socio-economic monitoring and management plan	Potential increased demand on infrastructure and services may be noticeable but are anticipated to be within the current capacity.	• Adverse during Site preparation and construction and operations. • Positive during closure and post-closure.

Table 6.17.6-1 Social Residual Effects (continued)

Predicted Effect	Project Phase	Avoidance and Mitigation Measures	Residual Effect	Direction
Housing and Property Values				
Increased demand for temporary accommodations	Site preparation and construction	Socio-economic monitoring and management plan	Potential for demand to limit supply or lead to price increases for temporary accommodations. It is anticipated that this effect will be noticeable during Site preparation and construction but is unlikely to exceed current capacity.	• Adverse during Site preparation and construction.
Increased demand for permanent accommodation	Site preparation and construction Operations	Socio-economic monitoring and management plan	Potential for increase in property values may be noticeable.	• Adverse or positive during Site preparation and construction and operations depending on whether effect is experienced by potential buyers or sellers of real estate.
Change in property values	Site preparation and construction Operations Closure Post-closure	Socio-economic monitoring and management plan Noise and vibration measures Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed	Real and perceived effects of Project-related activities (e.g., traffic, blasting) could negatively affect the value of houses that are closest to the Project's property boundary. Increased demand for housing because of in-migration to the area may lead to an increase in real estate values.	• Adverse during Site preparation and construction and operations. • Positive and adverse during closure and post-closure.
Public Safety				
Potential for increase in demand for public safety services due to increased traffic volumes related to the Project and population increases	Site preparation and construction Operations Closure	Contracted security services onsite Safety and work policy guidelines Mine closure planning Socio-economic monitoring and management plan Onsite fire suppression Traffic safety	Project-related effects may be noticeable during Site preparation and construction and Operations phases, less noticeable during Closure and are expected to cease following Closure.	Adverse.

Table 6.17.6-1 Social Residual Effects (continued)

Predicted Effect	Project Phase	Avoidance and Mitigation Measures	Residual Effect	Direction
Potential increase in crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	Site preparation and construction Operations Closure Post-closure	Socio-economic monitoring and management plan	Personal decision-making related to spending Project-related income may positively or negatively affect public safety within the affected communities. Although potential out-migration of population following mine closure may occur, decreases in income levels due to mine closure and personal decision-making and behaviours could negatively affect the crime rate within the affected socio-economic study area communities.	Adverse.
Transportation and Traffic				
Increased level of traffic	Site preparation and construction Operations Closure Post-closure	Socio-economic monitoring and management plan Schedule shifts to avoid peak travel periods Traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans	The existing levels of service will be maintained on both Highway 17 and Anderson Road with additional anticipated Project-related traffic. There is no anticipated residual effect.	• Adverse during Site preparation and construction and operations. • Positive during closure and post-closure.

Note:
For additional avoidance and mitigation measures related to potential effects on housing (e.g., noise, water, light), please refer to the noise, water and light sections of this report

6.17.7 Information to Address Round 1 Information Requests

The following lists the Round 1 IRs related to the assessment of social effects:

Population Demographics

- Government Agencies:
  - TMI_227-HE(1)-34: Potential for population increases.

Housing

- Métis Nation of Ontario:
  - TMI_590- AC(1)-264: Property values.
- Eagle Lake First Nation:
  - TMI_611-AC(1)-284: Property damage.
- Other Stakeholders:
  - TMI_708-PC(1)-23: Property values.
  - TMI_715-PC(1)-30: Noise.
  - TMI_716-PC(1)-31: Noise and vibration.
  - TMI_716-PC(1)-31: Noise and vibration / property damage.
  - TMI_722-PC(1)-37: Property values.
  - TMI_724-PC(1)-39: Property values.

Public Safety

- Métis Nation of Ontario:
  - TMI_492-AC(1)-166: Inadequate baseline to determine crime effects.

Transportation and Traffic

- Government Agencies:
  - TMI_227-HE(1)-34: Potential for increased traffic.
  - TMI_17-PD(1)-04: Redirection of Tree Nursery Road.
  - TMI_186-AE(1)-24: Noise from vehicle traffic.

6.18 Economic Factors

6.18.1 Potential Effects of the Project on the Environment

The potential effects of the Project on the economy will vary by Project phase, and with varying levels of activity. The following lists the potential economic effects by Project phase:

- **Site preparation and construction phase:**
  - Direct employment;
  - Indirect employment;
  - Project expenditures; and
  - Training for employment.
- **Operations phase:**
  - Direct employment;
  - Indirect employment;
  - Project expenditures; and
  - Training for employment.
- **Closure phase:**
  - Decreased direct employment;
  - Decreased indirect employment;
  - Decreased Project expenditures; and
  - Decreased training for employment.
- **Post-closure phase:**
  - Loss of direct employment;
  - Loss of indirect employment;
  - Loss of Project expenditures;
  - Loss of Project-related training.

The potential effects of the Project on Economics have been summarized in Table 6.18-1, and described using a simple linkage diagram (Figure 6.18.1-1). The figure illustrates the Economic VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. Additionally, the figure indicates those other components of the environment/human environment (shown in red in the figure) where the predicted effects of the Project on Economics will be used as an input for determining the effects on other VCs. For example, Economic effects will be used as an input for determining the effects of the Project on social and Aboriginal VCs.

Table 6.18-1: Potential Economic Effects by Project Phase

Valued Component	Potential Effect	Project Phase
Labour force, labour participation and employment	The Project will affect labour income, change labour participation and change employment opportunities in the region.	Site preparation and construction Operations Closure and post-closure
Income levels	The Project affect income levels in the region.	Site preparation and construction Operations Closure and post-closure
Cost of living	The Project through employment and contacting opportunities will affect cost of living.	Site preparation and construction Operations Closure and post-closure
Real estate	The Project through employment and contacting opportunities will affect real estate prices.	Site preparation and construction Operations Closure and post-closure
Economic development	The Project will change government taxes which will affect economic development in the region.	Site preparation and construction Operations Closure and post-closure
Existing businesses	The Project through employment and contacting opportunities will affect existing businesses.	Site preparation and construction Operations Closure and post-closure
Government revenues	The project through expenditures and employment will affect government revenues.	Site preparation and construction Operations Closure and post-closure

6.18.2 Effects Prediction Methods

The methods used to identify the economic effects are similar to the methods identified in the EIS particularly those under Social Factors. Quantitative methods to calculate the economic effects of the Project are explained below.

6.18.2.1 Methods Used in the Economic Effects Assessment

The Model used to estimate the economic effects of the Project is derived from Dungan and Murphy (2014) 'Representative' project: *An Authentic Opportunity: The Economic Impacts of a New Gold Mine in Ontario.* Dungan and Murphy estimated, using conservative assumptions, the impact on GDP, employment and government revenues of both the construction and the ongoing operation of a new gold mine in a relatively remote region of Northern Ontario.

The results of their assessment represent the impacts for the Ontario economy as a whole and, more generally, for the region in which the project is sited. Impacts are also shown for Canada and selected other provinces. These results are of particular importance to all stakeholders including miners, Aboriginal and other local communities, governments and developer.

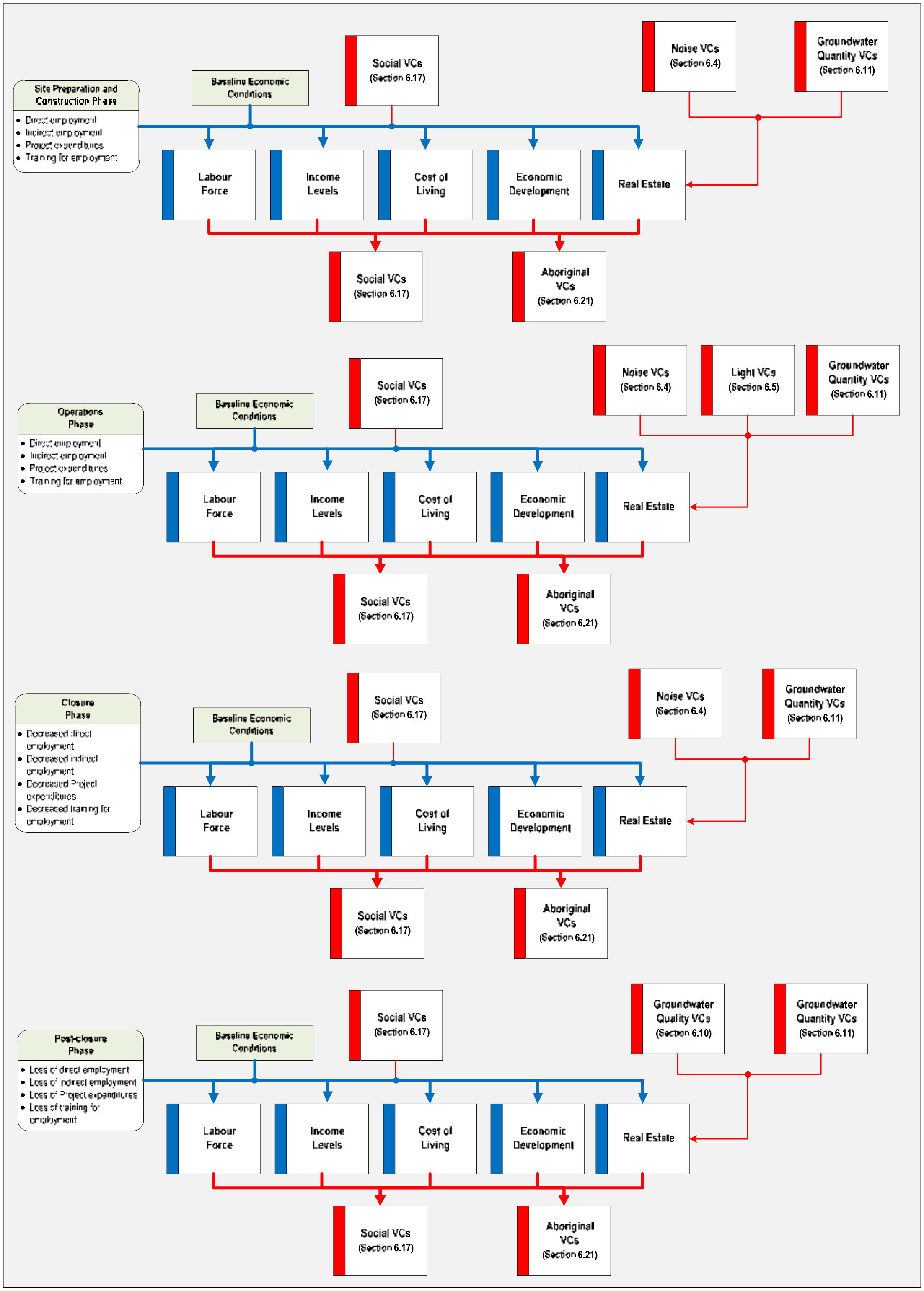


Figure 6.18.1-1: Economic Linkage Diagram

6.18.2.2 Reference for the Selected Model

The ‘Representative’ project considered a new open pit gold mine with a construction cost of $750 million spread over three years (after and excluding all exploration, planning, permitting and other preconstruction expenditures). The mine then generates sales of $300 million per year, potentially for over 20 years into the future, and employs 440 persons on site with total compensation of $142,200 per worker. The combined direct, indirect and induced economic impacts of an open pit gold mine are extremely large. In its construction phase the mine adds about $183 million to Ontario GDP and generates over 1,900 jobs annually. In its production phase, for each year of operation, the mine adds approximately $300 million to Ontario GDP and increases Ontario’s employment by over 1,800 at a rate of compensation per employee well above the provincial average.

The combined impact on government revenues of a new open pit gold mine is also large. In the construction phase governments collect a total of $60 million a year from the mine’s direct, indirect and induced activity, while in the production phase this rises to $95 million per year. The provincial government’s share is $25 million in the construction phase, and over $38 million in the production phase.

The ‘Representative’ project also considered a new underground gold mine with a construction cost of $600 million also spread over three years. This mine also generates $300 million in sales per year over an extended period with on-site employment of 620 and total compensation per worker of $145,500. The combined direct, indirect and induced impacts of an underground mine are also very large. In the construction phase the mine adds almost $150 million to Ontario GDP and generates over 1,500 jobs in each of the three years.

In production, the mine contributes over $330 million per year to Ontario GDP and generates 2,200 additional jobs annually, again with a very high average rate of labour compensation.

In the construction phase of a new underground gold mine, governments collect just under $50 million a year from the direct, indirect and induced impacts, with the provincial government receiving $20 million. In the production phase, all governments receive over $100 million per year, with over $40 million going to the provincial government (Dungan and Murphy 2014).

6.18.2.3 Justification for the Selected Model

The ‘Representative’ project is used in this economic effect assessment to calculate the economic effects of a new gold mine during both the Construction and Operations phases of the Project. Both the Project and the ‘Representative’ project are geographically located in Northern Ontario. The ‘Representative’ project includes estimates of economic effects for both an open pit mine and an underground mine. This is of specific importance and relevance to the Project which plans to operate an open pit mine in the first five years of operations followed by an underground mine in the second 5 to 7 years of operations.

6.18.2.4 Assumptions for the Project Economic Model

The following assumptions were built into the development of the Project economic model:

- Treasury will initiate the construction phase of the Project once the site preparation activities are completed. Some of the construction activities may overlap with the site preparation phase. 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 accessible terrains, are best carried out under frozen ground conditions. The duration of the construction phase is expected to be 1 year;
- The Project operations phase commences with an open pit mine with an expected mine life of 5 years. During years 3 to 5, underground development and mining will commence and continue to the end of the total 10 to 12-year mine life (11 on average). The underground and open pit mines will be running simultaneously during years 3 to 5. Accordingly, two assessments were done; one for an Open Pit and one for an Underground mine:
  - Economic effects assessment for an Open pit during Construction and Operations; and
  - Economic effects assessment for an Underground Mine during Operations;
- The impacts from Dungan and Murphy's 'Representative' mines are largely 'scalable', meaning that if twice as much were spent to construct the new mine then the impacts would be roughly twice as big. The same would be true for the operations of the new mine (Dungan and Murphy 2014).

6.18.2.5 Project Inputs for the Economic Effects Assessment

The following Project inputs were used for the economic effects assessment:

- *Site preparation and construction:* In the economic effects assessment of the Project, Treasury Metals estimated that total site preparation and construction expenditure is approximately $200 M ($100 M in capital construction and $100 M in sustaining capital over the life of the mine; sustaining capital is less than $10 M/year during operations). Mine construction expenditure is $100 M; this represents 40% of the 'Representative' project capital expenditures (100/250*100=40%). Accordingly, construction economic effects of the Project are 40% of the 'Representative' project identified economic effects during construction, for both open pit and underground mines. Construction of the underground operation is integrated into the operation of the operation of the open pit. There are no separate estimates for the construction of the underground operation.
- *Operations:* Treasury Metals estimated that total mine operations expenditure is $579 M over 11 years (approximately $53M/year). This represents 17.5% of the 'Representative'

project operations expenditures (53/300*100=17.5%). Accordingly, the Project operations economic effects are 17.5% of the 'Representative' project identified economic effects during operations, for both open pit and underground mines.

- *Closure and post closure:* During closure and post closure and decommissioning, up to $20 M will be spent. Given that nature of work that will be done during Closure and Post Closure and decommissioning and lack of estimates from the 'Representative' project on economic effects during Closure and Post Closure, a qualitative assessment is included only.

6.18.2.6 Outputs of the Project Economic Effects Assessment

The outputs are presented for each component (open pit and underground) and each phase below:

Open Pit Mine

- Site preparation and construction Phase:
  - Annual Economic Impacts
  - Annual Employment Impacts by Skill Category
  - Annual Government Revenues
- Operations Phase:
  - Annual Economic Impacts
  - Annual Employment Impacts by Skill Category
  - Annual Government Revenues

Underground Mine

- Operations Phase:
  - Annual Economic Impacts
  - Annual Employment Impacts by Skill Category
  - Annual Government Revenues

6.18.2.7 Confidence and Uncertainty Related to the Modelling Approach

In the 'Representative' project Model by Dungan and Murphy, the authors included a discussion of confidence/uncertainty; this discussion is summarized below. It is noted here that with the identified confidence/uncertainty in the modeling approach, the Model is still appropriate to use in the economic impact assessment of the Project.

- The Model uses information from the Mining Industry Human Resources Council (MiHR) and the National Occupational Classification (NOC) system of Human Resources and Skills Development Canada, it captures the skill mix required to perform the jobs from the creation of a new gold mine.
- Given the difficult nature of trying to measure the skills required in jobs across all of the sectors that are inputs into the new gold mine, the results should be viewed as reasonable estimates.
- The Model estimates provide an important input for all parties to utilize in understanding the type of training required for local Aboriginals to participate in a new mine.
- The Model estimates the economic impact on output, employment and earnings, and also on tax revenues of the various levels of government, on an annualized basis. The Model attempts, in more cautious manner, to isolate the local impacts within a region of Ontario surrounding the new mine.
- During the Model development, determining a 'Representative' size of mine was difficult because the size of mines in production, as well as those that have been proposed to be opened in northern Ontario, ranged from tens of millions of dollars in investment to more than $1.5 billion.
- Both the open pit and underground gold mines are meant to be 'Representative', and as such, do not reflect any company's existing or announced future operations. The ultimate choice between open-pit or underground gold mining will be determined by geology.
- During the Model development, to maintain reliability, cautious assumptions have been used where necessary in determining elements such as tax take at the various levels, or production and re-spending by consumers. Estimates presented in the Model are reliable and conservative as possible.
- Third level of impacts, within a region of Ontario surrounding the new mine are limited to a province-wide basis. However, some techniques estimated how much of the economic activity spun off from the new mine actually stays within the region or community surrounding the mine. Because the Model assumes that the new gold mine will be built in a relatively remote area of Northern Ontario, third level impacts are more regional in nature than local (Dungan and Murphy 2014).

6.18.2.8 Key Model Inputs by Phase

Site Preparation and Construction

- Site preparation and construction of the mine will require an average of 400 (peak of 450) workers. The majority of the mine construction workforce is anticipated to be recruited from within the socio-economic study area which will increase employment in the region.
- The Project is anticipated to require a wide range of workers with varying levels of education and skills; it expects to implement a training program for open pit and

underground miners as a significant part of the Project labour recruitment program. This training will enhance labour force skills in the region.

- Mine workers from within the socio-economic study area will have access to additional labour income that they can use to either improve housing and style of living or to invest in the economic development of the region. Additional income could have positive effects when used to enhance and improve style of living or negative effects depending on spending decisions.
- The Project expenditures will create economic effects in the regional and local communities, which may in turn stimulate some demographic changes in these communities. Possible population changes and additional demand for goods and services by Project and along with additional labour income generated by Project's employment could increase current cost of living and lead to some inflation.
- Municipal government will receive additional income through taxes. Taxes may be used for the development or rehabilitation of residential and/or commercial land and buildings within the Municipality, community downtowns, and business improvement areas and other opportunities identified by the Municipality.
- Site preparation and construction expenditures are estimated to occur over a one-year period. The majority of the goods and services required for the Project are expected to be procured within the local and regional communities. This is expected to improve existing business and allow them to grow to supply the required goods and services.
- No on-site camp is proposed. Non-resident workers are expected to stay in houses and temporary accommodation within the socio-economic study area. This will create positive economic effects on existing local and regional businesses.
- The Project will generate additional taxes to all three levels of government: federal, provincial and municipal. Additional government revenues can improve community services and infrastructure and creates additional jobs and labour income.

Operations

- Operations of the mine will require an average of 200 workers annually for 11 years. The majority of the mine operations workforce is anticipated to be recruited from within the socio-economic study area.
- The Project is anticipated to require a wide range of workers with varying levels of education and skills; it expects to implement a training program for open pit and underground miners as a significant part of the Project labour recruitment program. This training will enhance labour force skills in the region.
- Mine workers from within the socio-economic study area will have access to additional labour income that they can use to either improve housing and style of living or to invest in the economic development of the region. Additional income could have positive effects

when used to enhance and improve style of living or negative effects depending on spending decisions.

- The Project expenditures will create economic effects in the regional and local communities, which may in turn stimulate some demographic changes in these communities. Possible population changes and additional demand for goods and services by Project and along with additional labour income generated by Project's employment could increase current cost of living and lead to some inflation.
- Municipal government will receive additional income through taxes. Taxes may be used for the development or rehabilitation of residential and/or commercial land and buildings within the Municipality, community downtowns, and business improvement areas and other opportunities identified by the Municipality.
- Operations are expected to last 11 years. During those 11 years, there will be regular demand to supply goods and services required for operations including regular maintenance. This is expected to improve existing business and allow them to grow to supply the required goods and services.
- No on-site camp is proposed. Non-resident workers are expected to stay in houses and temporary accommodation within the socio-economic study area. This will create positive economic effects on existing local and regional businesses.
- The Project will generate additional taxes to all three levels of government: Federal, Provincial and Municipal. Additional government revenues can improve community services and infrastructure and creates additional jobs and labour income.

Closure

- During the closure phase the expenditures and employment by the Project will be reduced. This will have effects on other economics VCs.
- There will be loss in employment and labour income as well as loss in the demand for local goods and services. This may result in a potential reduction to cost of living.
- Demand for housing is expected to drop and housing prices are expected to drop if workers choose to sell their houses and leave the socio-economic study area to move elsewhere. Project taxes will drop which may affect economic development in the socio-economic study area.
- Project taxes will decline and then stop completely which may affect economic development within the socio-economic study area.
- Project demand for goods and services will decrease slowly. This will affect existing businesses.
- Project taxes will decrease slowly. This will affect government revenues.

Post Closure

- During the post closure phase the expenditures and employment by the Project will stop. This will have effects on other economics VCs.
- There will be permanent loss in employment and labour income as well as loss in the demand for local goods and services. This may result in a potential reduction to cost of living.
- Demand for housing by the Project will stop. Housing prices are expected to drop if workers choose to sell their houses and leave the socio-economic study area to move elsewhere.
- Project taxes will stop which may affect economic development within the socio-economic study area.
- Project demand for goods and services will stop. This may affect existing businesses.
- Project taxes will stop. This will affect government revenues.
- Project training during construction and operations will enhance labour force skills in the region and improve their participation in other employment opportunities during the Project post closure.

6.18.3 Effects Avoidance/Enhancement Measures Used in Predictions

There are no avoidance or enhancement measures as part of the physical design of the Project applicable to economic effects.

6.18.4 Predicted Effects

6.18.4.1 Economic Effects

The economic impacts of the open pit mine during construction and operations as well as the underground mine operations are presented in Table 6.18.4.1-1.

Table 6.18.4.1-1 Economic Effects

Parameter	Open Pit Construction	Open Pit Operations	Underground Operations
Mine Construction Expenditure	$100.0	$53.0	$53.0
Direct Impacts			
Employment	400	200	200
Total Labour Compensation	$26.2	$11.0	$15.7
Gross Domestic Product	$36.6	$26.9	$31.5
Labour Compensation/Employee ($ '000)	$65.9	$142.2	$145.5
Indirect Impacts			
Employment	202	385	288
Total Labour Compensation	$11.2	$10.3	$9.6

Table 6.18.4.1-1 Economic Effects (continued)

Parameter	Open Pit Construction	Open Pit Operations	Underground Operations
Gross Domestic Product	$19.2	$16.4	$14.7
Labour Compensation/Employee ($ '000)	$55.9	$69.1	$60.9
Induced Impacts			
Employment	165	244	223
Total Labour Compensation	$7.2	$4.1	$5.2
Gross Domestic Product	$17.2	$9.8	$12.5
Labour Compensation/Employee ($ '000)	$43.6	$43.5	$43.5
Total - Direct, Indirect and Induced Impacts			
Employment	765	828	711
Total Labour Compensation	$44.7	$25.5	$30.6
Gross Domestic Product	$73.0	$53.3	$58.8
Labour Compensation/Employee ($ '000)	$58.5	$84.9	$79.3
Local Area Impacts			
Employment	539	621	545
Total Labour Compensation	$31.5	$20.1	$25.3
Gross Domestic Product	$46.7	$42.8	$48.0
Labour Compensation/Employee ($ '000)	$58.6	$83.6	$85.3

Notes:
All dollar amounts are in millions of 2014 Canadian dollars, unless otherwise stated
Employment is in person-years

Open Pit Construction

Direct employment generated during the open pit construction is 400 person-years of employment, with total labour compensation of almost $26.2 M. The annual labour compensation per employee is about $66,000 – considerably above the provincial average rate of roughly $55,000. Ontario GDP is directly increased by $36.6 M during the one year construction phase.

The total direct, indirect and induced impacts generated during the open pit construction includes 765 persons-years of employment, $44.7 M in labour compensation with an average annual labour compensation of $58,500 annually and up to $73 M in additional Ontario GDP. Of that total economic impacts up to 539 person-years of employment and up to $31.5 M in labour compensation are expected to be local/regional.

Open Pit Operations

Direct employment generated during the open pit operations is 200 persons-years of employment annually, with total labour compensation of almost $11 M. The annual labour compensation per employee is about $142,200 (this includes employee benefits, pension contributions, WSIB premiums and the employer portion of Canada Pension Plan contributions and Employment Insurance premium). Ontario GDP is directly increased by $26.9 M annually during the operations phase.

The total direct, indirect and induced impacts generated during the open pit operations includes 828 person-years of employment, $25.5 M in labour compensation with an average annual labour compensation of $84,900 annually and up to $53.3 M in additional Ontario GDP. Of the total economic impacts, up to 621 person-years of employment and up to $20.1 M in labour compensation are expected to be local/regional.

Underground Operations

Direct employment generated during the underground operations is 200 persons-years of employment annually, with total labour compensation of almost $15.7 M. The annual labour compensation per employee is about $142,500 (this includes employee benefits, pension contributions, WSIB premiums and the employer portion of Canada Pension Plan contributions and Employment Insurance premium). Ontario GDP is directly increased by $31.5 M annually during the operations phase.

The total direct, indirect and induced impacts generated during the underground operations includes 711 persons-years of employment, $30.6 M in labour compensation with an average annual labour compensation of $79,300 annually and up to $58.8 M in additional Ontario GDP. Of the total economic impacts, up to 545 person-years of employment and up to $25.3 M in labour compensation are expected to be local/regional.

6.18.4.2 Employment Effects

Using the annual job creation numbers generated in 6.18.4.1-1 and using the NOC measures of 'skills' required to perform persons-years of employment in the Ontario economy, Table 6.18.4.2-1 includes the measure of the 'skill mix' for the direct job impacts from the construction of a new open pit mine, the operations of a new open pit mine and the operations of a new underground mine.

Table 6.18.4.2-1 Employment Effects

Parameter	Open Pit Construction	Open Pit Operations	Underground Operations
Direct Impacts			
Total Employment	400	200	200
Management	54	9	9
Skill Level A - University Degree	10	19	19
Skill Level B - College or Apprenticeship Certification	216	116	116
Skill Level C - Secondary School and/or Specific Occupation Training	83	41	41
Skill Level D - On-the-Job Training Usually Provided	37	15	15
Indirect Impacts			
Total Employment	202	385	288
Management	15	37	27
Skill Level A - University Degree	40	45	44
Skill Level B - College or Apprenticeship Certification	72	161	111

Table 6.18.4.2-1 Employment Effects (continued)

Parameter	Open Pit Construction	Open Pit Operations	Underground Operations
Skill Level C - Secondary School and/or Specific Occupation Training	56	106	72
Skill Level D - On-the-Job Training Usually Provided	19	35	34
Induced Impacts			
Total Employment	165	244	223
Management	17	25	23
Skill Level A - University Degree	21	31	28
Skill Level B - College or Apprenticeship Certification	51	75	68
Skill Level C - Secondary School and/or Specific Occupation Training	50	74	68
Skill Level D - On-the-Job Training Usually Provided	26	39	36
Total - Direct, Indirect and Induced Impacts			
Total Employment	765	829	711
Management	86	71	59
Skill Level A - University Degree	71	96	92
Skill Level B - College or Apprenticeship Certification	338	351	294
Skill Level C - Secondary School and/or Specific Occupation Training	189	221	181
Skill Level D - On-the-Job Training Usually Provided	81	89	85
Local Area Impacts			
Total Employment	539	619	546
Management	66	54	46
Skill Level A - University Degree	47	71	68
Skill Level B - College or Apprenticeship Certification	246	271	234
Skill Level C - Secondary School and/or Specific Occupation Training	116	152	132
Skill Level D - On-the-Job Training Usually Provided	64	71	66

Note: Employment is in person-years

Open Pit Construction

Direct employment impacts during the open pit construction show that over half (216) of the annual 400 jobs directly created by the construction of the open pit mine require the equivalent of college or apprenticeship accreditation (Level B). About 83 jobs (21%) need secondary school or specific occupation training (Level C) and approximately 37 jobs require only on-the-job training (Level D).

Total direct, indirect and induced employment impacts during the open pit construction show that up to 338 jobs require college or apprenticeship certification (Level B), up to 189 jobs require secondary school and/or specific occupation training (Level C) and 81 jobs require on-the-job training (Level D). Of that total employment (765 jobs), up to 539 jobs are expected to be local/ regional; 45% of these jobs require college or apprenticeship certification (Level B), 116 jobs require secondary school and/or specific occupation training (Level C) and 64 jobs require on-the-job training (Level D).

Open Pit Operations

Direct employment impacts during the open pit operations show that over half (116) of the annual 200 jobs directly created by the operations of the open pit mine require the equivalent of college or apprenticeship accreditation (Level B). About 41 jobs (20%) need secondary school or specific occupation training (Level C) and approximately 15 jobs require only on-the-job training (Level D).

Total direct, indirect and induced employment impacts during the open pit operations show that up to 351 jobs require college or apprenticeship certification (Level B), up to 212 jobs require secondary school and/or specific occupation training (Level C) and 89 jobs require on-the-job training (Level D). Of that total employment (829 jobs), up to 619 jobs are expected to be local/regional; 271 jobs (43%) require college or apprenticeship certification (Level B), 152 jobs require secondary school and/or specific occupation training (Level C) and 71 jobs require on-the-job training (Level D).

Underground Operations

Direct employment impacts during the underground operations show that over half (116) of the annual 200 jobs directly created by the operations of the open pit mine require the equivalent of college or apprenticeship accreditation (Level B). About 41 jobs (20%) need Secondary school or specific occupation training (Level C) and approximately 15 jobs require only on-the-job training (Level D).

Total direct, indirect and induced employment impacts during the underground operations show that up to 294 jobs require college or apprenticeship certification (Level B), up to 181 jobs require secondary school and/or specific occupation training (Level C) and 85 jobs require on-the-job training (Level D). Of that total employment (711 jobs), up to 546 jobs are expected to be local/regional; 234 jobs (43%) require college or apprenticeship certification (Level B), 132 jobs require secondary school and/or specific occupation training (Level C) and 66 jobs require on-the-job training (Level D).

6.18.4.3 Government Revenues

Table 6.18.4.3-1 summarizes the annual government revenue effects by level of government for the construction of a new open pit mine and the operations of an open pit and an underground mine.

Table 6.18.4.3-1: Annual Government Revenues

Parameter	Open Pit Construction	Open Pit Operations	Underground Operations
Total Annual Mine Construction Expenditure	$100.0	$53.0	$53
Federal Government (annually)			
Personal Income Tax	$4.6	$2.9	$3.5
Corporate Income Tax	$1.4	$2.4	$1.8
Employment Insurance Premiums	$1.0	$0.5	$0.6
Other Federal Taxes	$1.5	$0.8	$0.9
Total:	$8.7	$6.7	$6.9
Provincial Government (annually)			
Personal Income Tax	$2.2	$1.4	$1.8
Corporate Income Tax	$1.0	$2.0	$1.6
of which: Mining Tax		$0.4	$0.4
Workplace Safety (WSIB) Premiums	$1.1	$0.8	$1.1
Employer Health Tax	$0.6	$0.3	$0.4
Other Provincial Taxes	$4.9	$2.0	$2.5
Total:	$10.0	$6.7	$7.5
Local Governments (annually)			
All Local Taxes	$2.7	$2.0	$2.2
(Taxes in Mine Locality)	$1.7	$1.6	$1.8
Canada Pension Plan Contributions (annually)	$2.5	$1.9	$1.4
Ontario Total - All Governments (annually)	$24.0	$16.3	$17.9

Note: All dollar amounts are in millions of 2014 Canadian dollars

Open Pit Construction

From the $100 M expenditure on the open pit mine's construction, the federal government earns about $8.7 M in revenue, with over half coming from the personal income tax, and the remainder spread almost evenly across the corporate income tax, Employment Insurance premiums and all other federal taxes.

The provincial government is estimated to take in about $10 M in revenue and the local governments in the province should derive about $2.7 M in revenue. The Canada Pension Plan gains $2.5 M in Ontario in new contributions while the mine construction is occurring. The total Ontario impact on government revenues through all levels of activity is about $24 M.

Open Pit Operations

From the $53 M expenditure on the open pit mine's operations, the federal government earns about $6.7 M in revenue, with $2.9 M coming from the personal income tax, and 2.4 M from corporate tax. The remainder is Employment Insurance premiums ($0.5 M) and all other federal taxes ($0.8 M).

The provincial government is estimated to take in about $6.7 M in revenue and the local governments in the province should derive about $2 M in revenue. The Canada Pension Plan gains $1.9 M in Ontario in new contributions while the mine operations is occurring. The total Ontario impact on government revenues through all levels of activity is about $16.3 M.

Underground Operations

From the $53 M expenditure on the underground mine's operations, the federal government earns about $6.9 M in revenue, with $3.5 M coming from the personal income tax, and 1.8 M from corporate tax. The remainder is Employment Insurance premiums ($0.6 M) and all other federal taxes ($0.9 M).

The provincial government is estimated to take in about $7.5 M in revenue and the local governments in the province should derive about $2.2 M in revenue. The Canada Pension Plan gains $1.4 M in Ontario in new contributions while the mine operations is occurring. The total Ontario impact on government revenues through all levels of activity is about $17.9 M.

Life-of-Mine Government Revenues

The life-of-mine government tax revenue to accrue from the Goliath Gold Project has presented in Table 6.18.4.3-2. The life-of-mine tax revenues are calculated by combining the annual expenditures and tax revenues (Table 6.18.4.3-1) with the duration of the mining phases (see Section 3.2).

6.18.5 Identified Mitigation

Treasury Metals is committed to the following mitigation measures that maximise the local/ regional positive economic effects of the Project and reduce the negative ones, such as job loss during closure. These measures include but are not limited to the following:

- *Site preparation and construction phase and operations phase:* To promote the participation of local residents in employment and contacting opportunities, Treasury has policies for hiring and purchasing locally. Treasury has demonstrated deep commitment to both of these policies as evidenced by the makeup of its local workforce and purchasing record.

- *Site preparations and construction and operations phase:* To promote the use of local goods, services and businesses, Treasury purchases the majority of its goods and services locally and within the Province of Ontario (Appendix CC of the EIS).
- *Site preparation and construction phase and operations phases:* To promote the participation of local residents in the economic activities of the Project, multiple skill category/level training including on the job training will be provided.
- *Closure and post closure phase:* Training work experience and additional skills gained through involvement in the Project are expected to result in abilities that are transferrable to other economic sectors including forestry and manufacturing. This will be of value to Treasury and its employees for the life of mine and post-Closure.
- *Closure and post closure phase:* Many of the skills developed while working at Treasury will be transferrable to other mining operations and industries, should people either choose to move or be compelled to move following Closure and/or Post Closure. The skill building associated with the Project will thereby allow the region's economic base to take advantage of other future employment and business opportunities well beyond the life of the Project.
- *Post Closure:* The Project will help encourage other mineral development projects in the region, and enhance Dryden's economic role a support service and supply hub for other similar regional exploration and mining projects.

Table 6.18.4.3-2: Life-of-Mine Government Revenues

Parameter	Open Pit Construction		Open Pit Operations		Underground Operations		Life-of-mine Expenditures/Taxes (millions of 2014 Canadian dollars)
	Annual Expenditures/taxes (millions of 2014 Canadian dollars)	Duration	Annual Expenditures/taxes (millions of 2014 Canadian dollars)	Duration	Annual Expenditures/taxes (millions of 2014 Canadian dollars)	Duration	
Total Annual Mine Expenditure	$100.0	2	$53.0	4	$53.0	7	$783.0
Federal Government							
Personal Income Tax	$4.6	2	$2.9	4	$3.5	7	$45.3
Corporate Income Tax	$1.4	2	$2.4	4	$1.8	7	$25.0
Employment Insurance Premiums	$1.0	2	$0.5	4	$0.6	7	$8.2
Other Federal Taxes	$1.5	2	$0.8	4	$0.9	7	$12.5
Canada Pension Plan Contributions	$1.7	2	$1.6	4	$1.8	7	$22.4
Total:	**$10.2**	**2**	**$8.2**	**4**	**$8.6**	**7**	**$113.4**
Provincial Government							
Personal Income Tax	$2.2	2	$1.4	4	$1.8	7	$22.6
Corporate Income Tax	$1.0	2	$2.0	4	$1.6	7	$21.2
(of which: Mining Tax)	*$0.0*	*2*	*$0.4*	*4*	*$0.4*	*7*	*$4.4*
Workplace Safety (WSIB) Premiums	$1.1	2	$0.8	4	$1.1	7	$13.1
Employer Health Tax	$0.6	2	$0.3	4	$0.4	7	$5.2
Other Provincial Taxes	$4.9	2	$2.0	4	$2.5	7	$35.3
Total:	**$9.8**	**2**	**$6.5**	**4**	**$7.4**	**7**	**$97.4**
Local Governments							
All Local Taxes	**$2.7**	**2**	**$2.0**	**4**	**$2.2**	**7**	**$28.8**
(Taxes in Mine Locality)	$1.7	2	$1.6	4	$1.8	7	$22.4

A listing of the mitigation measures for the economic factor VCs is provided in Table 6.18.5-1.

Table 6.18.5-1 Mitigation Measures Applicable to Economic Effects

Mitigation Measure Title	Mitigation Measure Description
Employment – local hiring policy	• Develop and implement employment practices that give preference to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. The application of this policy is dependent upon the skills and workforce being available locally.
Purchasing – local purchasing policy	• Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers.
Socio-economic Management Plan	• Plan to ensure socio-economic commitments are implemented, adverse socio-economic effects are minimized, positive effects are optimized, results are monitored, and effects are adaptively managed.
Education and training plans	• Develop training programs for unemployed and under employed resident and non-resident workers. • Training would be done through in-house programs and in conjunction with local and regional educational institutes. • Make educational attainment or the equivalent competencies a hiring requirement for the mine workers. • At closure, ensure ongoing training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere.
In-migration effects	• Closely and frequently communicating with government agencies and service providers to ensure that the appropriate information (e.g. proposed transportation volumes, potential variation to the local population) are considered in the planning of future services and response capabilities. • Work with local and regional governments to minimize the effects of in-migration where possible.
Employment at closure	• Closure mitigation measures will focus on working with the affected communities and government agencies to develop a mine closure plan that includes a strategy for buffering the effects of eventually losing direct mine-related jobs and assist in the placement of potentially affected employees.

6.18.6 Residual Effects

The economic residual effects are described in Table 6.18.6-1. The economic effects associated with the Project will be occur to varying degrees across the socio-economic study area introduced in Section 6.1.4.17. On balance the residual economic effects of the Project are beneficial, especially during the site preparation, and operation phases. During the closure phase of the Project, expenditure levels begin to reduce, and the benefits of the Project decrease. Following closure, Project expenditures would cease, and the identified adverse effects are really just a reversal of the annual benefits during the mine life back to neutral or the levels that are currently being seen.

Table 6.18.6-1: Economic Residual Effects

Predicted Effect	Project Phase	Enhancement and Mitigation Measures	Residual Effect	Direction
The Project will affect labour income, change labour participation and change employment opportunities in the region.	Site preparation and construction Operations Closure and post-closure	Site Preparations and Construction and Operations: • Treasury will have policies for hiring and purchasing locally. • Treasury will purchase a majority of its goods and services locally and within the Province of Ontario • Treasury will offer training including on the job training. Closure and Post Closure: • Upon mine closure and loss of jobs, Treasury's employees will be able to utilize their experience and training skills gained from the Project in other economic sectors in the region including forestry and manufacturing.	Site Preparation and construction and Operations will create a demand for workers and increase in employment and labour income in the Project area. Closure and Post Closure will cause a reduction in Project area employment and labour income as Project employees are laid off.	Construction and Operations: Positive Closure and Post Closure: Negative
The Project will affect income levels in the region.	Site preparation and construction Operations Closure and post-closure	Construction and Operations: • Treasury will have policies for hiring and purchasing locally. • Treasury will purchase a majority of its goods and services locally and within the Province of Ontario • Treasury will offer training including on the job training. Closure and Post Closure: • Upon mine closure and loss of jobs, Treasury's employees will be able to utilize their experience and training skills gained from the Project in other economic sectors in the region including forestry and manufacturing	Site Preparation and Construction and Operations employment will Increase in labour income in the Project area. Closure and Post Closure and the reduction in Project employees will cause a reduction in labour income in the Project area	Construction and Operations: Positive Closure and Post Closure: Negative
The Project through employment and contacting opportunities will affect cost of living	Site preparation and construction Operations Closure and post-closure	Construction and Operations: • Treasury will have policies for hiring and purchasing locally. • Treasury will purchase a majority of its goods and services locally and within the Province of Ontario	During Site Preparation and Construction and Operations demand for labour, goods and services by the Project and by	Construction and Operations: Positive Closure and Post Closure: Neutral

Table 6.18.6-1: Economic Residual Effects (continued)

Predicted Effect	Project Phase	Enhancement and Mitigation Measures	Residual Effect	Direction
		• Treasury will offer training including on the job training. Closure and Post Closure: • Upon mine closure and loss of jobs, Treasury's employees will be able to utilize their experience and training skills gained from the Project in other economic sectors in the region including forestry and manufacturing	workers moving into the Project area will could increase prices and the cost of living. During Closure and Post Closure, the Project demand for labour, goods and services will decline and reduce the cost of living	
The Project through employment and contacting opportunities will affect real estate prices	Site preparation and construction Operations Closure and post-closure	Construction and Operations: • Treasury will have policies for hiring locally to the extent possible. Workers recruited from elsewhere and workers with additional income who like to improve their housing are expected to create additional demands for housing and therefore affect real estate prices. See additional discussion on housing and temporary housing capacity in the Social Factors. Closure and Post Closure: • Workers from outside the region may choose to leave and move elsewhere and sell their properties. This is a life style decision and its mitigation is beyond the control of the Project.	Site Preparation and Construction and Operations will cause workers to move into the Project area and cause an increase in the demand for housing At Closure and Post Closure former Project employees may move away from the area causing a reduction in demands for housing	Construction and Operations: Positive Closure and Post Closure: Neutral-Negative
The Project will change government taxes which will affect economic development in the region	Site preparation and construction Operations Closure and post-closure	Construction and Operations: • Treasury will have policies for hiring and purchasing locally. • Treasury will purchase a majority of its goods and services locally and within the Province of Ontario • Treasury will offer training, including on the job training. Closure and Post Closure:	During Site Preparation and Construction and Operations the Project employment, purchases and operation will increase in government taxes which could be used for local development	Construction and Operations: Positive Closure and Post Closure: Negative

Table 6.18.6-1: Economic Residual Effects (continued)

Predicted Effect	Project Phase	Enhancement and Mitigation Measures	Residual Effect	Direction
		• During Project closure and post closure, there will be a decrease in government revenues from the Project; but since this drop is expected after 12 of years of Project operations in the region and given market uncertainty it is hard to determine whether other projects will be proposed and or operational in the region to substitute that loss in government tax. This is driven by the market and is outside Project control.	At Closure and Post Closure, there will be reduction in government taxes and funds for local development as Project expenditures decrease.	
The Project, through employment and contacting opportunities, will affect existing businesses	Site preparation and construction Operations Closure and post-closure	Construction and Operations: • Treasury will have policies for hiring and purchasing locally. • Treasury will purchase a majority of its goods and services locally and within the Province of Ontario • Treasury will offer training, including on the job training. Closure and Post Closure: • During the Project's Closure and Post Closure, there will be a decrease in labour income, employment opportunities and Project purchase to goods and services; this may affect local businesses. However, Treasury's employees training work experience and additional skills gained through involvement in the Project are transferrable to other economic sectors and will benefit local businesses either directly or indirectly. Other factors that determine Project's Closure and Post Closure effects and required mitigation are driven by the market and are outside Treasury's control.	During Site Preparation and Construction and Operations, the Project will increase the Project area demand for goods and services from local businesses At Closure and Post Closure, there will be a reduction in Project demand for local goods and services	Construction and Operations: Positive Closure and Post Closure: Negative
The project through expenditures and employment will affect government revenues	Site preparation and construction Operations	Construction and Operations: • Treasury will have policies for hiring and purchasing locally.	During Site Preparation and Construction and Operations there will be an increase in government	Construction and Operations: Positive

Table 6.18.6-1: Economic Residual Effects (continued)

Predicted Effect	Project Phase	Enhancement and Mitigation Measures	Residual Effect	Direction
	Closure and post-closure	• Treasury will purchase a majority of its goods and services locally and within the Province of Ontario • Treasury will offer training including on the job training. • The above policies will maximize and enhance the Project's contribution to additional government revenues at the Federal, Provincial and Municipal level through both income and corporate tax. Closure and Post Closure: • During Project Closure and Post Closure, there will be a decrease in government revenues from the Project; but since this drop is expected after 12 of years of Project operations in the region and given market uncertainty it is hard to determine whether other projects will be proposed and or operational in the region to substitute that loss in government revenues. This is driven by the market and is outside Project control.	revenues through the payment of Project-related business and employment taxes At Closure and Post Closure, there will be a reduction in Project's contribution to government revenues due to reduced spending and employment	Closure and Post Closure: Negative

6.18.7 Information to Address Round 1 Information Requests

The following lists the Round 1 IRs related to the assessment of economic effects:

- CEA Agency
  - TMI_3-EA(1)-03: General VC and Assessment Criteria
  - TMI_227-PC(1) 42: Socio-economic Effects
  - TMI_230-HE(1)-37: General TML
- Métis Nation of Ontario
  - TMI_507-AC(1)-181: Socio-economic VC
- City of Dryden, Thunder Lake, and Village of Wabigoon residents
  - TMI_228-PC(1)-43: Socio-economic Effects
- Wabigoon Lake Ojibway Nation
  - TMI_348-AC(1)-22: Socio-economic Effects
  - TMI_728-PC(1)-43: Socio-economic Effects

6.19 Human Health

6.19.1 Potential Effects of the Project on the Environment

Treasury Metals are committed to ensuring the project is safe, and will not cause impact or harm to individuals working at the Project, or those who live in the vicinity of the Project. However, there will be activities throughout the life of the Project will alter the physical and biological environment in way that could have a potential effect on human health, especially those individuals who work on the Project, reside near to the Project, or consume country foods that may have been exposed to compounds released into the environment as a result of the Project activities. The following outlines the potential effects of the Project on human health by Project phase:

- **Site Preparation and Construction Phase**: During the site preparation and construction phase, activities equipment and activities at the Project will result in changes to noise levels and to air quality. A perimeter ditch and seepage collection system will be constructed around the operations area at the start of this phase will capture any runoff from the site. There will be no effects to surface water quality of groundwater quality during this phase of the Project.
- **Operations Phase**: Access to the site during operations would be restricted for safety and security reasons, so members of the public would not be directly affected by operations. During the operations phase, equipment and activities to support the mining will continue to affect noise levels and air quality. During operations, waste rock excavated from the

open pit will be excavated and stored in the WRSA. As mining advances, waste rock will be stored in the mined out areas of the open pit to minimize the footprint of the WRSA. Waste from the ore processing will be treated to remove cyanide and will be discharged to the TSF sub-aqueously. The TSF will have a permanent water cover throughout the operations phase. Both the WRSA and the TSF will be equipped with seepage collection systems. Any seepage that escapes the seepage collections systems would be captured by the drawdown zone created by the dewatering of the open pit and underground mane and would be directed to the open pit. All runoff from the site will be collected and used in the processing of the ore. Any excess water not required in the process will be treated to meet the Provincial Water Quality Objectives (PWQO) prior to being discharged to Blackwater Creek. With the exception of nuisance animals, wildlife would be allowed to use the Project site during operations, where they would be able to access the TSF, and its cover of treated process water.

- **Closure Phase**: Following the end of mining activities, the process water covering the TSF will be withdrawn, treated and used to help fill the open pit. The tailings will be physically isolated with a granular cover and then chemically isolated using either a dry, low-permeability cover or a wet cover using non-process water. The WRSA will be covered with a dry, low-permeability cover to reduce the potential for acidification. The waste rock placed within the open pit will remain exposed until covered with water as the open pit is allowed to flood. Although the dewatering activities will be stopped at the end of mining, the drawdown zone created during operations will remain until through the closure phase, capturing any seepage from the WRSA and TSF and directing it to the open pit. Closure activities to return the site to a functioning ecosystem will affect noise levels and air quality throughout closure. There will be no discharges to surface water during closure as all runoff will be directing to the open pit to help with filling.
- **Post-closure Phase**: There will be no equipment operating during post-closure, so there will be no effects on noise levels or air quality. All site runoff will continue to be directed to the open pit, and the open pit will continue to experience an influx of groundwater. Once the pit is fully flooded, excess water will be released through a spillway into a tributary of Blackwater Creek, and the pit lake will start to function as a waterbody. Once the pit is flooded, groundwater levels will return to near pre-development conditions, allowing seepage from the TSF and WRSA to leave the site, and will ultimately report to various nearby waterbodies. For a period of time following closure, access to the site by people will continue to be restricted for safety purposes, but wildlife will be allowed unrestricted access to the site.

The potential effects of the Project on human health have been described using a simple linkage diagram on Figure 6.19.1-1. The figure illustrates the human health VCs (shown in blue on the figure) that are potentially affected during each phase of the Project.

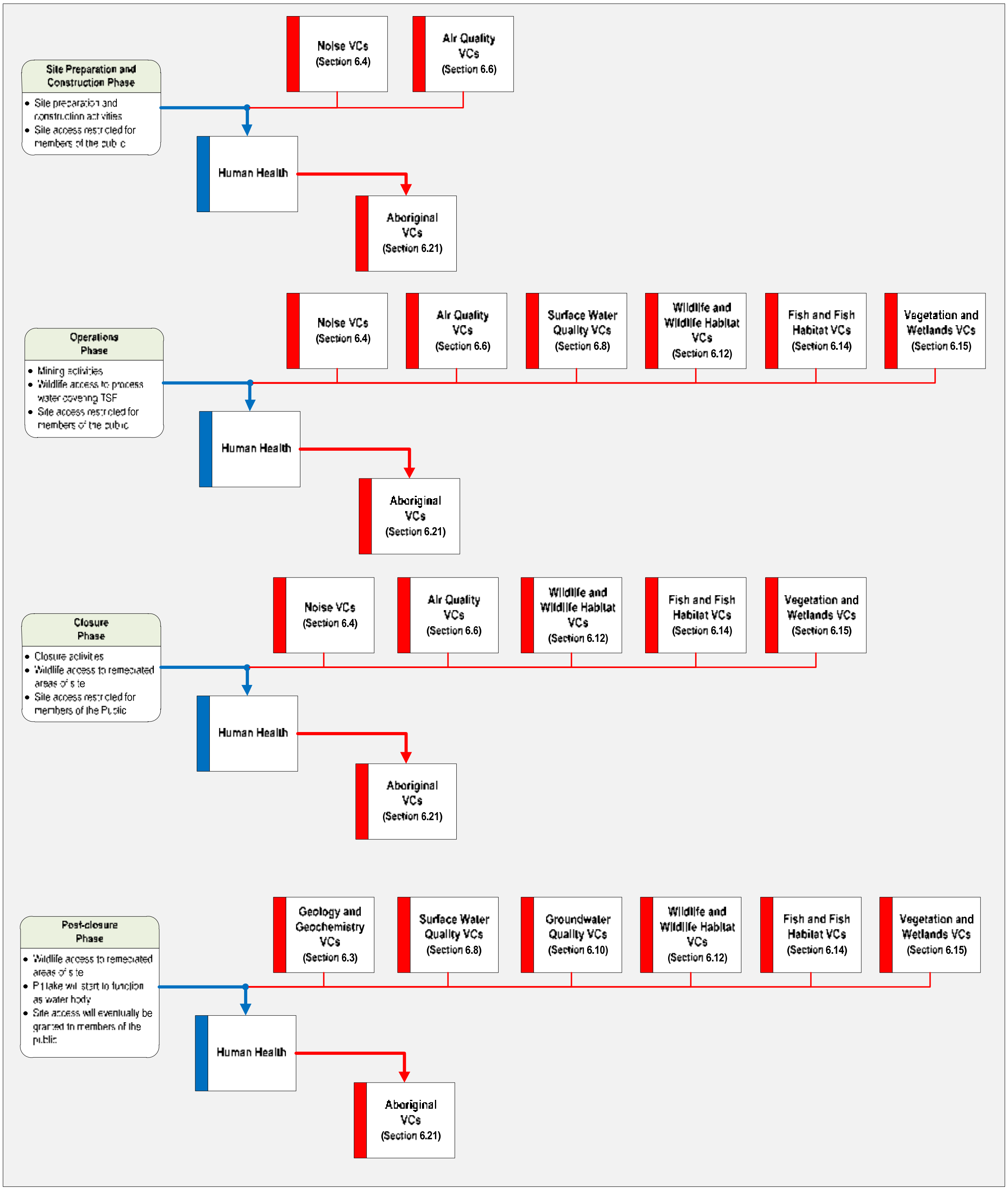


Figure 6.19.1-1: Human Health Linkage Diagram

The figure indicates those other components of the environment (shown in red in the figure) where the predicted effects of the Project on human health will be used as an input for determining the effects on other VCs. For example, human health will be used as an input for determining the effects of the Project on Aboriginal peoples. The human health VCs are affected by a range of other VCs throughout the life of the Project.

6.19.2 Effects Prediction Methods

The potential effects of the Project on human health were evaluated in the EIS by completing a screening level risk assessment, or SLRA. The results of the SLRA were provided as Appendix W to the EIS. An SLRA is intended to be an inherently conservative approach for calculating the potential effects of the Project, therefore the SLRA focussed on the operations and post-closure phases of the Project when the potential effects to human health are expected to be highest because of activity levels and expected releases, resulting in potential higher exposures. The potential risks to human health during the site preparation and construction, and closure phases of the Project are expected to be similar to, but lower than the effects associated with the operations phase.

To ensure the assessment was done appropriately, the consultants retained by Treasury Metals (TetraTech Inc.) approached Health Canada prior to completing the SLRA to obtain their recommendation on applicable guidance and spreadsheet models for evaluating risk to human health at a screening level. At that time, Health Canada provided the current "*Spreadsheet Tool for Human Health Detailed Quantitative Risk Assessment (DQRA)*" dated December 12, 2011, which has been used in this assessment. Although the DQRA Spreadsheet tool is no longer accepted for use by Health Canada, Treasury Metals has ensured that the exposure estimates, risk calculations, and overall conclusions remain valid as per the current Health Canada Preliminary Quantitative Risk Assessment (PQRA) and DQRA guidance documents, as well as associated toxicity data.

- Part I: Guidance of Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, dated 2010 and revised 2012; and
- "Part V: Guidance on Human Health Detailed Qualitative Risk Assessment for Chemicals", dated September 2010.

The Human Health Risk Assessment (HHRA) completed as part of the SLRA, was conducted in accordance with the accepted Health Canada PQRA/DQRA procedure with additional consideration given to Schedule C of Ontario Regulation 153/04, which outlines the official regulatory requirements of a risk assessment in Ontario as defined by the Ontario Ministry of Environment and Climate Change (MOECC). For projects in Ontario, the definition of an acceptable cancer risk associated with a carcinogenic chemical is an incrementation of lifetime cancer risk (ILCR) of one in one million (1×10^{-6}), and for characterizing acceptable risks associated with non-carcinogenic chemicals, a hazard quotient (HQ) of 0.2. The procedure evaluates potential hazards, receptors, and exposure pathways to determine if the potential risk identified, exceeds Health Canada/MOECC acceptable risk benchmarks. The identification of risks above the level of acceptability does not mean that health effects will occur, but rather that predicted/modelled concentrations of parameters are sufficiently elevated to warrant risk management measures or a more detailed risk assessment including a higher degree of site-specific considerations. A screening level risk assessment is performed with the greatest degree of conservatism which in turn may lead to an over estimation of potential risk.

In the case of this SLRA completed as part of the EIS (Appendix W), the objective was to conduct a conservative, screening level risk assessment to identify which chemicals or contaminants of concern (COCs) may have the potential to cause adverse health effects to human and ecological receptors, based on understanding of the Project, the effects of the Project and the scenarios used to characterize the use of the land, and thus potential levels of exposure. Chemicals or contaminants of potential concern (COCs) were selected based on their exceedances of their respective federal or provincial guidelines/ standards which is provided in detail in Section 6.19.2.2. Contaminant transport, toxicity, and fate mechanisms are determined by the chemical structure, therefore there is typically a secondary qualitative screening process where COCs are differentiated by their intrinsic toxicity to human health, or ecological health, and in some cases both. Based on a number of Information Requests regarding the COC and pathway selection presented in Appendix W, a supplemental human health screening in support of the EIS is included in Section 6.19.2.3. Chemicals that exceed their qualitative screening process or for pathways in which there were no qualitative screening criteria available, are carried forward for quantitative risk assessment and/or require the implementation of risk management measures for the protection of human and or environmental health.

The SLRA presented in Appendix W to the EIS focussed on the potential effects of the Project on human health as a result of the exposure to chemical compounds generated, and released, as a result of the Project. Two valued components were utilized in the assessment of effects of the project on human health: Non-Indigenous human health, and Indigenous human health. The SLRA does not explicitly look at other determinants of health, such as social and economic, as these factors are addressed separately in Sections 6.17 and 6.18, respectively.

6.19.2.1 Problem Formulation and Conceptual Site Model

The problem formulation is used to identify how the predicted chemicals might adversely affect human health. It requires a detailed understanding of the predicted activities at the Project during operations and post-closure, identification of COCs specific to human health, identification of potential human receptor groups and specific receptor, and characterization of the exposure pathways. The outcome of the problem formulation step is a detailed conceptual site model (CSM), which represents the current understanding of potential sources of human health COCs, release and transport mechanisms within and between environmental media, and exposure pathways by which COCs may contact identified human receptors.

Where exposure pathways can be reasonable assumed to be complete, a more detailed examination or quantification of potential risk is conducted. The detailed assessment involves the remaining stages of a PQRA/DQRA including exposure and toxicity assessment, and risk characterization.

Identification of Potential Receptor Groups and Exposure Pathways

The risk assessment considered valued components non-Indigenous and Indigenous members of the population. For each of these valued components receptor groups were identified to be Residents, Workers, and Site Visitors/Harvesters. For each of these receptor groups potential risk was assessed via number of pathways for both commercial/ industrial land use (on-site) and residential land use (off-Site) scenarios to provide an assessment for those who work on or live near the project site (or both), respectively. The Worker exposure scenario differs for Subsurface, Outdoor, and Indoor Workers and depending on which risk assessment guidance document is being followed (i.e., Health Canada or MOECC), however is generally less than 24 hours per day and only 5 days per week. The residential land use scenario assumes that the human receptors are exposed 24 hours a day for 7 days a week for 52 weeks per year and may include a toddler. Toddlers are considered the most sensitive human receptor with respect to direct contact with soil because they eat, drink, and breathe more in proportion to body size, and exhibit behaviours (e.g., hand-to-mouth activity) that increased exposure to media such as soil. Therefore, the residential land use scenario provides a conservative amount of protection to a Site Visitor and Harvester who may also be a toddler, but who would visit the site for a shorter amount of time than a Resident.

The overall CSM for valued components and associated human receptor groups is presented in Table 6.19.2.1-1, and a visual description of the CSM during operations and post closure is provided in Figures 6.19.2-1 and 6.19.2-2, respectively.

Table 6.19.2.1-1: Human Health Conceptual Site Model

Valued Component	Land Use	Receptor Group	Receptor	Pathway
Non-Indigenous Human Health	Commercial/ Industrial (on-Site land use)	Subsurface/Construction Worker	Adult, short term exposure	• Inhalation of trench air impacted by subsurface vapour intrusion, • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Direct contact with groundwater.
		Outdoor Worker	Adult	• Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.

Table 6.19.2.1-1: Human Health Conceptual Site Model (continued)

Valued Component	Land Use	Receptor Group	Receptor	Pathway
		Indoor Worker	Adult	• Inhalation of indoor air impacted by subsurface vapour intrusion; and/or • Ingestion of groundwater as drinking water.
	Residential (off-Site land use)	Site Visitor, or Harvester	Toddler or Adult	• 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 (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.
		Resident	Toddler or Adult	• 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 (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.
Indigenous Human Health	Residential (off-Site land use)	Resident	Toddler or Adult	• 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 (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.
		Site Visitor, or Harvester	Toddler or Adult	• Ingestion of country foods (plants, fish, wild game); • Inhalation of outdoor air impacted by subsurface vapour intrusion;

Table 6.19.2.1-1: Human Health Conceptual Site Model (continued)

Valued Component	Land Use	Receptor Group	Receptor	Pathway
				• Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.
	Commercial/ Industrial (on-Site land use)	Subsurface/Construction Worker	Adult, short term exposure	• Inhalation of trench air impacted by subsurface vapour intrusion, • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Direct contact with groundwater.
		Outdoor Worker	Adult	• Inhalation of outdoor air impacted by subsurface vapour intrusion; • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock); • Inhalation of soil particulates (fugitive dust); and/or • Ingestion of groundwater as drinking water.
		Indoor Worker	Adult	• Inhalation of indoor air impacted by subsurface vapour intrusion; and/or • Ingestion of groundwater as drinking water.

Concentrations of Chemicals in Environmental Media

Contaminants of concern (COCs) were selected based on their exceedance of the applicable regulatory guideline or standard. Measured or predicted concentrations in baseline soils, waste rock, and tailings were compared to the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Air quality parameters were selected based on exceedances of the Ontario Ambient Air Quality Objectives. Surface water COCs were selected based on exceedances of the Provincial Water Quality Objectives (PWQO) for the protection of freshwater aquatic life, and in the absence of PWQO (nitrate and chloride), the Canadian Water Quality Guidelines (CWQG) for the protection of freshwater aquatic life. No groundwater data were available however a qualitative discussion has been provided.

The following paragraphs describe in detail, the environmental media, regulatory criteria, and COC selection process.

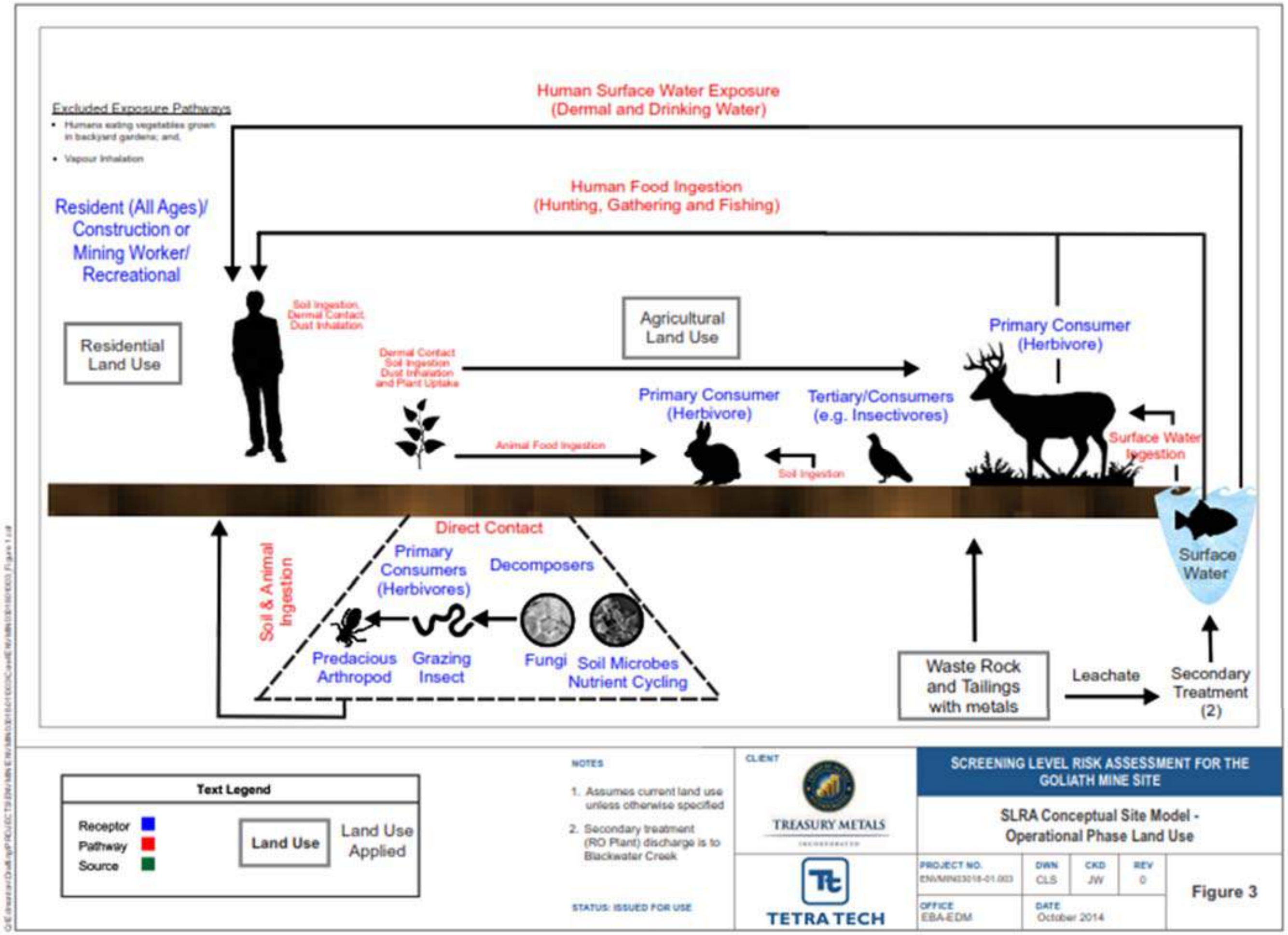


Figure 6.19.2-1: Conceptual Risk Model for Operations

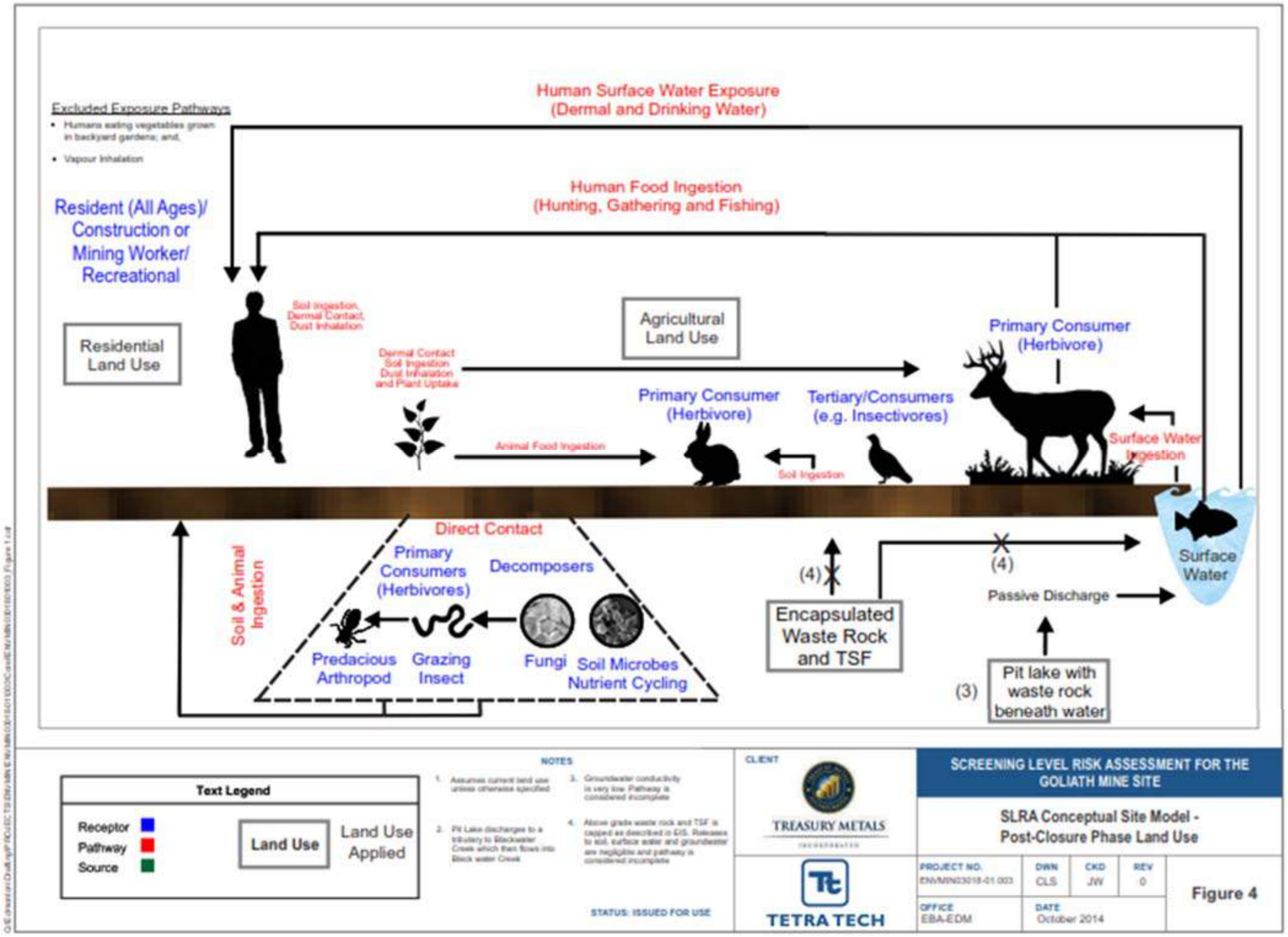


Figure 6.19.2-2: Conceptual Risk Model for Post-closure

Environmental Media

The following sources of potential COCs were identified as having the potential for the Project to affect human health:

- **Waste rock**: During the mining in the open pit, waste rock will be initially placed in the waste rock storage area (WRSA). Once practical, the waste rock will be placed in the mined out areas of the open pit. Following closure, the WRSA will be covered with a low permeability layer to isolate the waste rock and limit acidifications. This will then be covered with a layer of overburden and vegetated. The waste rock placed in the open pit will be covered with water when the open pit is allowed to flood.
- **Tailings**: During operations, tailings will be discharged with treated water from the process plant to the tailings storage facility (TSF), where they will be allowed to settle. During operations, a water cover will be maintained over the TSF to prevent acidification of the tailings. Following closure, the process water in the TSF will be withdrawn, treated and used to help fill the open pit. A granular layer will be placed over the TSF to physically isolate the tailings. The TSF will then be covered with either a low permeability synthetic cover, or a wet cover of non-process water.
- **Air and dust**: Activities at the Project during operations will generate particulate and gaseous emissions, which will affect the local air quality.
- **Water**: During operations tailings and treater process water will be discharged to the TSF, where the tailings will settle and the process water will be partially recovered for re-use in the process. The TSF will be lined to prevent groundwater contamination. A cover of process water will be retained over the TSF throughout operations to prevent acidification. All minewater and runoff water within the operations area will be collected, and to the extent possible, used in the process. Excess water will be treated to meet Provincial Water Quality Objectives (PWQO), the Canadian Water Quality Guidelines (CWQG) when there are no PWQO, or background concentrations if background levels are greater than the PWQO. Dewatering of the open pit and underground mine will lower the groundwater elevations, creating a drawdown zone. The small volume of seepage from the WRSA and TSF that escape the seepage collection systems will be captured in the drawdown zone and will be directed to the open pit. Then release of treated effluent into Blackwater Creek will affect the quality of water in Blackwater Creek, and further downstream in Wabigoon Lake.

  At closure, the dewatering of the open pit and underground mine will stop and the pit will be allowed to fill with water. The site will be graded to direct all runoff from the site towards the open pit. As the pit is filling, Treasury Metals will regularly test the quality of water and, if necessary, implement batch treatment to ensure that the quality of water in the pit lake will meet PWQO once filled. It is estimated to take between 5 and 8 years for the pit lake to fill, depending on weather conditions. Once the pit lake is filled, excess water will be allowed to passively discharge through a spillway into a former tributary of Blackwater Creek. Once the pit lake fills, and the groundwater elevations will recover to near predevelopments levels and seepage from the WRSA and TSF that escape the seepage collection systems will leave the site and discharge to surface watercourses around the Project. The passive discharges from the pit lake, and seepage from the TSF will affect the quality of water in Blackwater Creek, and further downstream in Wabigoon Lake. Seepage from the WRSA and TSF will affect the quality of water in Thunder Lake and its tributaries.

At the time of the SLRA (Appendix W) groundwater quality predictions were unavailable and therefore only surface water impacts were assessed as part of the risk assessment.

Contaminant of Concern (COC) Selection

Waste Rock

The screening for potential COCs in the waste rock was provided in Table 1 of Appendix W, and the information is summarized in Table 6.19.2.1-2. The screening approach is as follows:

- If the concentrations of a compound in the waste rock is less than the mean concentrations in the mean baseline soils concentrations, the compound is not identified as a COC.
- If the concentration of a compound in the waste rock exceeds the mean baseline soils concentration, but is less than the screening guidelines, the compound is not identified as a COC.
- If the concentration of a compound in the waste rock exceeds the mean baseline soils concentration and one of the screening guidelines, the compound is identified as a COC.

The following waste rock COCs were identified requiring additional assessment and/or risk management measures as part of the SLRA:

- Aluminum
- Arsenic
- Cadmium
- Chromium (total)
- Cobalt
- Copper
- Iron
- Lead
- Mercury
- Nickel
- Zinc

Table 6.19.2.1-2: Selection of COCs in Waste Rock

Compound	Waste Rock				Baseline Soil Mean Concentration	Screening Guidelines (1)			
	Geometric Mean	Average	Minimum	Maximum		CCME SQG RL	CCME SQG AL	OMOE SCS (Table 2) RL	OMOE SCS (Table 2) AL
Aluminum	*12,047*	*14,713*	*3,175*	*38,665*	18,552	—	—	—	—
Antimony	—	—	—	—	<1	20	20	7.5	7.5
Arsenic	*7.06*	*13.85*	*0.55*	*92.25*	2.9	12	12	18	11
Barium	—	—	—	—	96	500	750	390	390
Beryllium	—	—	—	—	0.57	4	4	4	4
Bismuth	—	—	—	—	<1	—	—	—	—
Boron (total)	—	—	—	—	5.8	—	2	120	120
Cadmium	*0.14*	*0.74*	*0.02*	*22.60*	1.4	10	1.4	1.2	1
Calcium	—	—	—	—	12,780	-	-	-	-
Chromium (total)	*17.99*	*33.01*	*1.31*	*116.30*	48	64	64	160	160
Cobalt	*49.17*	*112.72*	*3.44*	*338.00*	9.9	50	40	22	22
Copper	*13.79*	*24.37*	*0.64*	*190.85*	20	63	63	140	140
Gallium	-	-	-	-	—	—	—	—	—
Iron	*15,408*	*17,453*	*5,055*	*45,270*	23,674	—	—	—	—
Lanthanum	-	-	-	-	—	—	—	—	—
Lead	*17.6*	*82.0*	*1.1*	*2,362.85*	8.1	140	70	120	45
Lithium	—	—	—	—	19	—	—	—	—
Magnesium	—	—	—	—	9435	—	—	—	—
Manganese	—	—	—	—	471	—	—	—	—
Mercury	-	*0.05*	*0.005*	*0.62*	0.11	6.6	6.6	0.27	0.25
Molybdenum	—	—	—	-	1.2	10	5	6.9	6.9
Nickel	*10.24*	*16.10*	*2.59*	*69.68*	27	50	50	100	100
Phosphorus	—	—	—	—	490	—	—	—	—
Potassium	—	—	—	—	2199	—	—	—	—
Scandium	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	<1	1	1	2.4	2.4
Silver	*0.24*	*0.73*	*0.01*	*16.09*	0.26	20	20	20	20
Sodium	—	—	—	—	543	—	—	—	—

Table 6.19.2.1-2: Selection of COCs in Waste Rock (continued)

Compound	Waste Rock				Baseline Soil Mean Concentration	Screening Guidelines [1]			
	Geometric Mean	Average	Minimum	Maximum		CCME SQG RL	CCME SQG AL	OMOE SCS (Table 2) RL	OMOE SCS (Table 2) AL
Strontium	—	—	—	—	36	—	—	—	—
Sulphur	—	—	—	—	—	—	—	—	—
Thallium	*0.24*	*0.28*	*0.05*	*0.65*	<0.5	1	1	1	1
Thorium	—	—	—	—	—	—	—	—	—
Tin	—	—	—	—	<5	50	5	—	—
Titanium	—	—	—	—	1,354	—	—	—	—
Tungsten	—	—	—	—	—	—	—	—	—
Uranium	*0.52*	*0.75*	*0.13*	*2.96*	1	23	23	23	23
Vanadium	*12.2*	*16.5*	*1.2*	*52.5*	49	130	130	86	86
Zinc	*94.3*	*305.3*	*24.3*	*9,414.9*	56	200	200	340	340

Notes:

All values presented in mg/kg - milligrams per kilograms
'—' no guideline available or not analysed
COC - Contaminant of Concern
Waste Rock results from Table 3.1 from EcoMetrix Geochemistry draft report (Sept, 2013), except for Mercury. Calculated totals using 15% MSS, 70% BMS and 15% MSED as stated in EcoMetrix Geochemistry draft report (Sept, 2013). Mercury Waste Rock results from Table 7.10 from KCB draft report (2012). Calculated totals using 15% MSS, 70% BMS and 15% MSED.
Background soil results from Table 6.7 from KCB report Baseline Study Nov 2010 to Nov 2011, Dated September 2012 (25 samples used).
CCME SQG- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (PEHH) by Canadian Council of Ministers of the Environment (CCME), 2007, revised 2010.
OMOE SCS (Generic) - Ontario Ministry of Environment, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
(1) Values represent most stringent human health or ecological screening value available from given source.
Shade and Italics: Exceeds Background
Shade and Bold: Exceeds a Guideline.

Tailings

The screening for potential COCs in the tailings was provided in Table 2 of Appendix W, and the information is summarized in Table 6.19.2.1-3. The screening approach is as follows:

- If the concentrations of a compound in the tailings is less than the mean concentrations in the mean baseline soils concentrations, the compound is not identified as a COC.
- If the concentration of a compound in the tailings exceeds the mean baseline soils concentration, but is less than the screening guidelines, the compound is not identified as a COC.
- If the concentration of a compound in the tailings exceeds the mean baseline soils concentration and one of the screening guidelines, the compound is identified as a COC.

Table 6.19.2.1-3: Selection of COCs in Tailings

Compound	Tailings Composite	Baseline Soil Mean Concentration	Screening Guidelines [1]			
			CCME SQG RL	CCME SQG AL	OMOE SCS (Table 2) RL	OMOE SCS (Table 2) AL
Aluminum	5,000	18,552	—	—	—	—
Antimony	11	<1	20	20	7.5	7.5
Arsenic	**46**	2.9	12	12	18	11
Barium	—	96	500	750	390	390
Beryllium	—	0.57	4	4	4	4
Bismuth	—	<1	—	—	—	—
Boron (total)	—	5.8	—	2	120	120
Cadmium	**5.3**	1.4	10	1.4	1.2	1
Calcium	—	12,780	-	-	-	-
Chromium (total)	9.6	48	64	64	160	160
Cobalt	11	9.9	50	40	22	22
Copper	**81**	20	63	63	140	140
Gallium	—	—	—	—	—	—
Iron	19,000	23,674	—	—	—	—
Lanthanum	—	—	—	—	—	—
Lead	**870**	8.1	140	70	120	45
Lithium	—	19	—	—	—	—
Magnesium	—	9435	—	—	—	—
Manganese	—	471	—	—	—	—
Mercury	**0.62**	0.11	6.6	6.6	0.27	0.25
Molybdenum	—	1.2	10	5	6.9	6.9
Nickel	14	27	50	50	100	100
Phosphorus	—	490	—	—	—	—
Potassium	—	2199	—	—	—	—
Scandium	—	—	—	—	—	—
Selenium	—	<1	1	1	2.4	2.4
Silver	3.4	0.26	20	20	20	20
Sodium	—	543	—	—	—	—
Strontium	—	36	—	—	—	—

Table 6.19.2.1-3: Screening for COCs in Tailings (continued)

Compound	Tailings Composite	Baseline Soil Mean Concentration	Screening Guidelines (1)			
			CCME SQG RL	CCME SQG AL	OMOE SCS (Table 2) RL	OMOE SCS (Table 2) AL
Sulphur	—	—	—	—	—	—
Thallium	0.17	<0.5	1	1	1	1
Thorium	—	—	—	—	—	—
Tin	—	<5	50	5	—	—
Titanium	—	1,354	—	—	—	—
Tungsten	—	—	—	—	—	—
Uranium	0.46	1	23	23	23	23
Vanadium	6.0	49	130	130	86	86
Zinc	**2,000**	56	200	200	340	340
Zirconium	—	—	—	—	—	—

Notes:
All values presented in mg/kg - milligrams per kilograms.
'-' no guideline available or not analysed
COC - Contaminant of Concern
Waste Rock results from Table 3.1 from EcoMetrix Geochemistry draft report (Sept, 2013), except for Mercury. Calculated totals using 15% MSS, 70% BMS and 15% MSED as stated in EcoMetrix Geochemistry draft report (Sept, 2013). Mercury Waste Rock results from Table 7.10 from KCB draft report (2012). Calculated totals using 15% MSS, 70% BMS and 15% MSED.
Background soil results from Table 6.7 from KCB report Baseline Study Nov 2010 to Nov 2011, Dated September 2012 (25 samples used).
CCME SQG- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (PEHH) by Canadian Council of Ministers of the Environment (CCME), 2007, revised 2010.
OMOE SCS (Generic) - Ontario Ministry of Environment, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
(1) Values represent most stringent human health or ecological screening value available from given source.
Shade and Italics: Exceeds Background
Shade and Bold: Exceeds a Guideline

The following tailings COCs were identified requiring additional assessment and/or risk management measures as part of the SLRA:

- Arsenic
- Cadmium
- Cobalt
- Lead
- Mercury
- Zinc

Air and Dust

The screening for potential COCs in air quality, including dust, was originally provided in Table 3 of Appendix W. As part of the process to respond to the Round 1 information requests, a refined screening of the air compounds has been completed using the maximum modelled concentrations at the sensitive receptors, which correspond to the closest “community-oriented receptors” as defined by the CCME (2000).

Regulatory agencies provide screening criteria including the CCME and MOECC provide health based screening criteria for chemicals who are known to pose potential human health risks via peer reviewed toxicity information. For chemicals that do not have health based screening criteria (for example gold, bismuth, gallium, lanthanum, scandium, and thorium) it is assumed that based on risk assessment science, at this time there is insufficient toxicity information available to suggest human health risks would occur, and as such no potential human health risk are anticipated. No further assessment of these chemicals is required at this time. In the event new toxicity information emerges, a revised contaminant screening and COC selection would occur as part of a follow-up program (as discussed in Section 13).

The modelling results provided in Table 6.19.2.1-4, which include background concentrations for air quality (as per TMI_213-HE(1)-20), were screened against their respective Ontario Ambient Air Quality Objectives. The results presented in in Table 6.19.2.1-4 indicate that none of the predicted concentrations exceed their respective screening criteria, with the exception of total suspended particulate (TSP). The maximum 24-hour TSP concentration during the site preparation and construction phase was shown to marginally exceed (by 2.6%) it's Ontario Ambient Air Quality Objective. The Ontario Ambient Air Quality Objective was set based on visibility (i.e. aesthetic) criteria and not the protection of human health. Therefore, no COCs relevant to human health are identified in air and dust, and a quantitative assessment of potential human health risks via the dust/air pathway is not warranted. The SLRA in Appendix W conservatively included fugitive dust as an operable pathway as mercury had not been included directly as part of the air dispersion modelling.

Table 6.19.2.1-4: Selection of COCs in Air and Dust

Compound	Averaging Period	Maximum Cumulative Concentrations at Sensitive Receptors				Screening Criteria (5)
		Site Preparation and Construction	Operations	Closure	Post-closure (4)	
TSP	24-hour	**123.1**	110.8	114.7	—	120
	Annual	30.9	28.5	29.1	—	60
PM_{10}	24-hour	39.9	36.6	37.2	—	50
$PM_{2.5}$	24-hour	13.6	15.1	13.0	—	27
	Annual	5.0	5.4	4.9	—	8.8
Dustfall (3)	30 day	4.6	4.2	4.1	—	7
	Annual	3.7	3.3	3.3	—	4.6
CO	1-hour	1,274.0	1,277.6	1,256.8	—	36,200
	8-hour (4)	1,263.6	1,265.7	1,253.3	—	15,700
NO_2	1-hour	136.4	148.5	60.6	—	400
	24-hour	58.4	89.1	43.9	—	200
SO_2	1-hour	6.3	4.3	5.1	—	690
	24-hour	4.4	4.1	4.2	—	275
	Annual	1.1	1.0	1.0	—	55
Arsenic	24-hour	0.0039	0.0035	0.0036	—	0.3
Barium	24-hour	0.0423	0.0365	0.0383	—	10
Beryllium	24-hour	0.0002	0.0002	0.0002	—	0.1

Table 6.19.2.1-4: Selection of COCs in Air and Dust (continued)

Compound	Averaging Period	Maximum Cumulative Concentrations at Sensitive Receptors				Screening Criteria (5)
		Site Preparation and Construction	Operations	Closure	Post-closure (4)	
Cadmium	24-hour	0.0003	0.0003	0.0003	—	0.025
Chromium	24-hour	0.0179	0.0162	0.0167	—	0.1
Cobalt	24-hour	0.0011	0.0009	0.0010	—	0.5
Lead	24-hour	0.0150	0.0137	0.0141	—	0.5
Manganese	24-hour	0.0697	0.0627	0.0650	—	0.4
Nickel	24-hour	0.0035	0.0030	0.0031	—	0.2
	Annual	0.0006	0.0006	0.0006	—	0.04
Phosphorous	24-hour	0.0456	0.0394	0.0414	—	0.35 (2)
Platinum	24-hour	0.0018	0.0016	0.0016	—	0.03
Rhodium	24-hour	0.0005	0.0005	0.0005	—	2
Thallium	24-hour	0.0015	0.0013	0.0014	—	0.4 (2)
Titanium	24-hour	0.1631	0.1408	0.1479	—	0.2
Uranium	24-hour	0.0009	0.0008	0.0008	—	0.3
	Annual	0.0002	0.0001	0.0002	—	0.06
Vanadium	24-hour	0.0043	0.0037	0.0039	—	0.24

Notes:

(1) The 1-hour, ½-hour, and 24-hour background values were based on 90th percentile of the monitoring data. The annual background values were based on the highest of the annual mean value over the latest 5 years of available monitoring data.
(2) Background metals per TMI_163-AE(1)-01.
(3) Predicted dustfall values are in units of g/m²/30 days.
(4) There are no source of air emissions during the post-closure phase, therefore there were no concentrations predicted.
(5) The screening criteria are based on the relevant Ontario Ambient Air Quality Objectives, with the exception of $PM_{2.5}$. The Canadian Ambient Air Quality Standards for $PM_{2.5}$ will be reduced to 27 (24-hour) and 8.8 (annual) after 2020.

Shade and Bold: Exceeds screening criteria and identified as a COC

Water

The screening for potential COCs in the water associated with the Project was done in Tables 5 and 6 of Appendix W. This screening made use of the water quality information available in the EIS. Since the submission of the EIS, Treasury Metals have refined their engineering for the Project, which has resulted in changes in the site water balance and corresponding changes in the water quality predictions. The refined water quality predictions for the pit lake are provided in Section 6.2 of this Revised EIS, while the surface water predictions are provided in Section 6.7. These refined water quality numbers have been used to screen for COCs in surface water, using the following approach:

- If the modelled concentrations of a compound in the receiving water is less than or equal to the existing conditions, the compound is not identified as a COC.

- If the concentration of a compound in the receiving water exceeds the existing conditions, but is less than the screening guidelines, the compound is not identified as a COC. For surface water, the Provincial Water Quality Objectives (PWQO) for the protection of aquatic life are used. Where PWQO are not available, the Canadian Water Quality Guidelines (CWQG) are used as screening criteria.
- If the concentration of a compound in the receiving water exceed the existing conditions and exceed the screening criteria, the compound is identified as a COC.

The screening criteria used are established to be protective of sensitive aquatic receptors, and are more stringent that the requirements for drinking water or recreational uses. Therefore, only one set of water quality screening is required for each phase of the Project. During the operations phase, the only releases from the Project to surface water will be the excess water from the site that will be treated to meet PWQO, or background concentrations if background levels are greater than the PWQO, prior to discharge to Blackwater Creek through an engineered structure. Therefore, only water in Blackwater Creek downstream of the Project, as well as Wabigoon Lake into which Blackwater Creek discharges could be affected. The predicted operations phase surface water quality for the two modelling locations on Blackwater Creek downstream of the Project discharge (see Section 6.8), as well as Wabigoon Lake are provided in Table 6.19.2.1-5.

There were no COCs identified for surface water during operations, as all of the predicted concentrations are either less than or equal to the existing conditions or meet the screening criteria, which are based on the PWQO and CWQG.

Table 6.19.2.1-5: Operations Phase Surface Water Predictions

Compound	Predicted Surface Water Concentrations (mg/L) (1)						Screening Criteria (2) (mg/L)
	BW1: Blackwater Creek (downstream of Project)		BW2: Blackwater Creek (discharge to Wabigoon Lake)		WL: Wabigoon Lake (mg/L)		
	Existing	Operations	Existing	Operations	Existing	Operations	
Aluminum	0.251	0.212	0.251	0.226	0.669	0.669	0.075
Antimony	0.00060	*0.00487*	0.00060	*0.00334*	0.00060	0.00062	0.020
Arsenic	0.001	*0.023*	0.001	*0.015*	0.001	0.001	0.100
Beryllium	0.001	*0.003*	0.001	*0.002*	0.001	0.001	0.011
Boron	0.050	*0.083*	0.050	*0.071*	0.050	0.050	0.200
Cadmium	0.00002	0.00006	0.00002	0.00004	0.00002	0.00002	0.0002
Chloride	1	*27*	1	*18*	3	*3*	120
Chromium	0.001	*0.003*	0.001	*0.002*	0.001	0.001	0.0089
Cobalt	0.0006	0.0007	0.0006	0.0006	0.0005	0.0005	0.0009
Copper	0.001	0.002	0.001	0.002	0.002	0.002	0.005
Cyanide	0.002	0.003	0.002	0.002	0.002	0.002	0.005
Iron	1.450	1.197	1.450	1.288	0.457	0.456	0.300
Lead	0.001	0.002	0.001	0.002	0.001	0.001	0.020
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.0002
Molybdenum	0.001	*0.010*	0.001	*0.007*	0.001	0.001	0.040
Nickel	0.002	*0.007*	0.002	*0.005*	0.002	0.002	0.025
Nitrate	0.03	*2.89*	0.03	*1.86*	0.03	*0.04*	13

Table 6.19.2.1-5: Operations Phase Surface Water Predictions (continued)

Compound	Predicted Surface Water Concentrations (mg/L) (1)						Screening Criteria (2) (mg/L)
	BW1: Blackwater Creek (downstream of Project)		BW2: Blackwater Creek (discharge to Wabigoon Lake)		WL: Wabigoon Lake (mg/L)		
	Existing	Operations	Existing	Operations	Existing	Operations	
Phosphorus	0.027	*0.027*	0.027	*0.027*	0.023	0.023	0.030
Selenium	0.001	*0.023*	0.001	*0.015*	0.001	0.001	0.100
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	*0.002*	0.001	0.002	0.001	0.001	0.006
Zinc	0.004	*0.010*	0.004	*0.008*	0.003	0.003	0.030

Notes:

(1) Predictions in the above table represent predictions for the average hydrologic year.

(2) The Provincial Water Quality Objectives (PWQO) for protecting aquatic life are used as screening criteria, where available. The Canadian Water Quality Guidelines (CWQG) for protecting aquatic life are used for nitrate and chloride, for which there are no PWQO.

(3) The *italicized* values in the above table indicate those parameters where the predictions exceed existing levels.

The **Shaded and Bold** values in table indicates where the predicted levels exceed both existing conditions and the screening criteria.

The predicted post-closure phase water quality predications are provided in Table 6.19.2.1-6 (pit lake quality, Blackwater Creek and Wabigoon Lake) and Table 6.19.2.1-7(Thunder Lake and its tributaries).

There were no COCs identified for surface water during post-closure phase, as all of the predicted concentrations are either less than or equal to the existing conditions or meet the screening criteria, which are based on the PWQO and CWQG. The modelling of pit lake quality (Section 6.3) and surface water quality (Section 6.8) include the contributions of seepage from the WRSA and TSF.

Table 6.19.2.1-6: Post-closure Phase Water Predictions for Blackwater Creek Catchment

Compound	Predicted Surface Water Concentrations (mg/L) (1)							Screening Criteria (2) (mg/L)
	Post-closure Pit Lake Quality	BW1: Blackwater Creek (downstream of Project)		BW2: Blackwater Creek (discharge to Wabigoon Lake)		WL: Wabigoon Lake (mg/L)		
		Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	
Aluminum	0.075	0.251	0.201	0.251	0.218	0.669	0.668	0.075
Antimony	0.00117	0.00060	*0.00077*	0.00060	*0.00071*	0.00060	0.00060	0.020
Arsenic	0.002	0.001	*0.001*	0.001	*0.001*	0.001	0.001	0.100
Beryllium	0.051	0.050	0.050	0.050	0.050	0.050	0.050	0.011
Boron	0.00020	0.00002	*0.00008*	0.00002	*0.00006*	0.00002	0.00002	0.200
Cadmium	120	1	—	1	—	3	—	0.0002
Chloride	0.001	0.001	0.001	0.001	0.001	0.001	0.001	120
Chromium	0.0009	0.0006	*0.0007*	0.0006	*0.0006*	0.0005	0.0005	0.0089
Cobalt	0.005	0.001	*0.002*	0.001	*0.002*	0.002	0.002	0.0009
Copper	0.005	0.002	*0.003*	0.002	*0.003*	0.002	0.002	0.005
Cyanide	0.300	1.450	1.120	1.450	1.235	0.457	0.456	0.005
Iron	0.005	0.001	*0.002*	0.001	*0.002*	0.001	0.001	0.300

Table 6.19.2.1-6: Post-closure Phase Water Predictions for Blackwater Creek Catchment (continued)

Compound	Predicted Surface Water Concentrations (mg/L) [1]							Screening Criteria [2] (mg/L)
	Post-closure Pit Lake Quality	BW1: Blackwater Creek (downstream of Project)		BW2: Blackwater Creek (discharge to Wabigoon Lake)		WL: Wabigoon Lake (mg/L)		
		Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	
Lead	0.00020	0.00001	—	0.00001	—	0.00001	—	0.020
Mercury	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0002
Molybdenum	0.025	0.002	*0.009*	0.002	*0.006*	0.002	0.002	0.040
Nickel	13.00	0.03	*3.75*	0.03	*2.46*	0.03	*0.05*	0.025
Nitrate	0.030	0.027	0.028	0.027	0.027	0.023	0.023	13
Phosphorus	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.030
Selenium	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.100
Silver	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001
Thallium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0003
Uranium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005
Vanadium	0.030	0.004	*0.016*	0.004	*0.012*	0.003	0.003	0.006
Zinc	0.075	0.251	0.201	0.251	0.218	0.669	0.668	0.030

Notes:
(1) Predictions in the above table represent predictions for the average hydrologic year
(2) PWQO, and CWQG for nitrate and chloride
(3) The *italicized* values the predictions exceed existing levels
The **Shaded and Bold** values exceed both existing conditions and the screening criteria

Table 6. 19.2.1-7: Post-closure Phase Water Predictions for Thunder Lake Catchment

Compound	Predicted Surface Water Concentrations (mg/L) [1]								Screening Criteria [2] (mg/L)
	HB1: Hoffstrom's Bay Tributary (at Thunder Lake)		TL2: Thunder Lake Tributary 3 (downstream of Tree Nursery Ponds)		TL3: Thunder Lake Tributary 2 (at Thunder Lake)		TL: Thunder Lake		
	Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	
Aluminum	0.078	0.078	0.077	0.077	0.077	0.077	0.026	*0.029*	0.075
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.020
Arsenic	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.100
Beryllium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.011
Boron	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.200
Cadmium	0.00002	0.00002	0.00002	*0.00002*	0.00002	0.00002	0.00002	0.00002	0.0002
Chloride	0	0	0	—	0	—	4	—	120
Chromium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0089
Cobalt	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*0.0005*	0.0009
Copper	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005
Cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.005
Iron	0.365	0.365	0.862	0.862	0.862	0.862	0.150	*0.158*	0.300
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.020
Mercury	0.00001	0.00001	0.00001	—	0.00001	—	0.00001	—	0.0002

Table 6. 19.2.1-7: Post-closure Phase Water Predictions for Thunder Lake Catchment (continued)

Compound	Predicted Surface Water Concentrations (mg/L) (1)								Screening Criteria (2) (mg/L)
	HB1: Hoffstrom's Bay Tributary (at Thunder Lake)		TL2: Thunder Lake Tributary 3 (downstream of Tree Nursery Ponds)		TL3: Thunder Lake Tributary 2 (at Thunder Lake)		TL: Thunder Lake		
	Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	Existing	Post-closure	
Molybdenum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.040
Nickel	0.002	0.002	0.002	0.002	0.002	0.002	0.002	*0.002*	0.025
Nitrate	0.10	0.10	0.09	0.09	0.09	0.09	0.04	0.04	13
Phosphorus	0.011	0.011	0.011	0.011	0.011	0.011	0.008	0.008	0.030
Selenium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.100
Silver	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Uranium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.006
Zinc	0.003	0.003	0.003	*0.004*	0.003	*0.003*	0.003	0.003	0.030

Notes:
(1) Predictions in the above table represent predictions for the average hydrologic year
(2) PWQO, and CWQG for nitrate and chloride
(3) The *italicized* values the predictions exceed existing levels
The **Shaded and Bold** values exceed both existing conditions and the screening criteria

Supplemental Human Health Screening for Soils

For the purposes of the SLRA, soils are defined as baseline soils, waste rock, or tailings. According to Health Canada PQRA/DQRA guidance, supplemental screening for human health COCs is advised where scientific data allows.

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. Briefly, 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 1/5th of the tolerable daily intake was allocated for the component values which is consistent with the most recent Health Canada PQRA/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 baseline soils, waste rock, and tailings that exceeded their CCME soil quality guideline were further assessed herein against the most conservative MOCC Table 2 Soil Components- Potable Water Scenario (Coarse -Textured Soil) for the following:

- S1-Direct soil contact- dermal contact and incidental ingestion- Toddler (Resident, Indigenous and Non-Indigenous). 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 Visitors and Harvesters (Indigenous and Non-Indigenous).
- 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 results of the supplemental screening for human health COCs are provided in Table 6.19.2.1-8.

Table 6.19.2.1-8: Human Health COC Supplemental Screening

Contaminant of Concern (COC)	Concentration (µg/g)				MOECC Table 2 Human Health Component Value (µg/g)					
	Waste Rock	Tailings	Baseline Soil	Maximum Concentration	S1	S2[a]	S3[a]	S-GW1	S-OA	S/IA
Aluminum	38,665	5,000	18,552	38,665	NV	NV	NV	NV	NV	NV
Antimony	-	**11**	-	**11**	**7.5**	63	63	NV	NV	NV
Arsenic	**92.25**	**46**	**2.9**	**92.25**	**0.95**	**1.3**	**47**	NV	NV	NV
Cadmium	22.60	5.3	1.4	22.60	0.69	7.9	7.9	NV	NV	NV
Chromium (total)	116.30	9.6	48	116.30	28,000	240,000	240,000	NV	NV	NV
Cobalt	**338**	11	9.9	**338**	**22**	**250**	2,500	NV	NV	NV
Copper	190.85	81	20	**191**	600	5,600	5,600	NV	NV	NV
Iron	45,270	19,000	23,674	45,270	NV	NV	NV	NV	NV	NV
Lead*	**2362.85**	**870**	8.1	**2,363**	**200 (120)**	**1,000 (120)**	**1,000 (120)**	NV	NV	NV
Mercury	**0.62**	**0.62**	0.11	**0.62**	9.8	67	670	550	36 36 [(a)]	**0.25 3.9 [(a)]**
Nickel	69.68	14	27	69.7	330	2200	510	NV	NV	NV
Zinc	**9,414.9**	2,000	56	**9,415**	**5,600**	47,000	47,000	NV	NV	NV

Notes:

Contaminants of Concern (COC) selected based on exceedance of CCME or "OMOE" criteria as shown in Tables 1 and 2 of Appendix W. Note, "OMOE" is more correctly referred to as MOECC.

MOECC Table 2 Component Values are taken from Soil Components for Table 2- Full Depth, Potable Water Scenario, coarse textured soil and residential land use

'a' Soil Components for Table 2- Full Depth, Potable Water Scenario, coarse textured soil and commercial/industrial land use

'NV' No Value- insufficient toxicity and/or contaminant transport data to support pathway evaluation. Qualitative discussion only

'—' No value modelled

'*' New lead components are in the process of derivation as a new interpretation of lead toxicity has been accepted by the scientific community suggested that lead now be interpreted as a non-threshold substance as per Wilson and Richardson 2016. In the interim 120 µg/g is suggested.

S1 Direct soil contact- dermal contact and incidental ingestion- Toddler

S2 Direct soil contact- dermal contact and incidental ingestion- Outdoor Worker

S3 Direct soil contact- dermal contact and incidental ingestion- Subsurface Worker

S-GW1 Soil migrating to groundwater used for drinking water (Resident)

S-OA Soil to Outdoor Air via Soil Vapour Pathway (Resident and [Worker])

S-IA Soil to Indoor Air via Soil Vapour Pathway (Resident and [Worker])

Shaded and Bold: Exceeds Human Health Component, Quantitative Assessment or Risk Management Measures are Required.

The results of the supplemental screening above identify that Antimony, Arsenic, Cobalt, Lead, Mercury and Zinc in tailings and/or waste rock exceeded their MOECC Table 2 human health component values. A detailed discussion for each pathway is included below.

For pathways/chemicals without component criteria (including aluminum and iron) there is either insufficient human toxicity information available to assess these chemicals for these pathways, or contaminant transport and fate mechanisms indicate that these COCs are not sufficiently soluble or volatile to be a concern to leaching to groundwater and inhalation of indoor air, respectively. The potential human health risks via the "NV" pathways are inheritably low, and no potential risk to human health is likely as well the same risk management measures protective of other COCs are expected to provide sufficient protection for these chemicals. No potential human health risks are specifically identified via the pathways identified as having NV. Should new toxicity data or technical guidance emerge from the MOECC or Health Canada, the SLRA would be updated to reflect the new scientific data.

Specifically, for the following receptors and exposure pathways identified in the CSM, the supplemental screening indicates that:

Soils Leaching to Drinking Water Sources

- None of the parameters in baseline soils, waste rock, or tailings exceeded their MOECC Table 2 component criteria for the protection of soil leaching to groundwater and downgradient surface water bodies. No potential risks are identified to Indigenous and non-Indigenous human receptors via the ingestion of groundwater or surface water as drinking water pathway and no further assessment or risk management measures are required at this time.

Inhalation of Outdoor Air

- None of the parameters in baseline soils, waste rock, or tailings exceeded their MOECC Table 2 component criteria for the protection of outdoor air via the soil vapour pathway. Many of the parameters are not considered sufficiently volatile to warrant the derivation of a protection value for this pathway. No potential risks are identified to Indigenous and non-Indigenous human receptors via the inhalation of outdoor air pathway and no further assessment or risk management measures are required at this time.

Inhalation of Indoor Air

- The concentration of mercury predicted in waste rock and tailings exceeded the Table 2 component criteria for the protection of indoor air for the residential setting only. No residential dwellings are located within 30 m of the Project site; therefore inhalation of residential indoor air is not an operational pathway. The modelled concentration of mercury in waste rock and tailings did not exceed the MOECC Table 2 component criteria for the protection of indoor air in a commercial/ industrial setting. As such, no potential risks are identified to Indigenous and non-Indigenous human receptors via inhalation of indoor air, no further assessment or risk management measures are required at this time

Direct Soil Contact (Dermal Contact and Incidental Ingestion)

- Antimony- antimony concentrations in tailings exceeded the MOECC Table 2 component criteria protective of a toddler exposed via direct contact. The residential toddler receptor in this risk assessment are also conservatively protective of a Resident and Site Visitor/ Harvester.
- Arsenic- arsenic concentrations in waste rock and tailings exceeded their respective MOECC Table 2 component criteria for all human receptors.
- Cobalt- cobalt concentrations in waste rock exceeded the MOECC Table 2 component criteria for direct dermal contact to toddlers and outdoor workers. The residential toddler receptor in this risk assessment are also conservatively protective of a Resident and Site Visitor/ Harvester.
- Lead- the concentrations of lead exceed the interim MOECC guideline for lead in soils of 120 µg/g for all human receptors.
- Zinc- the concentration of zinc in waste rock exceeded the MOECC Table 2 component value protective of toddlers. The residential toddler receptor in this risk assessment are also conservatively protective of a Resident and Site Visitor/ Harvester.

Risk management measures are required for the protection of Residents, Site Visitors and Harvesters, Subsurface Workers, and/or Outdoor Workers for select metals in waste rock or tailings via the direct contact pathway. As part of the project design, during operations, administrative risk management measures including a Health and Safety Plan will be implemented with restricted access to the waste rock storage area and the tailings storage facility. Only workers with the required health and safety training and personal protective equipment (PPE) would have access to the waste rock storage area or TSF during operations, and therefore this is an inoperable pathway for a Resident and a Site Visitor and Harvester. Furthermore, Workers (Subsurface and Outdoor) would receive sufficient risk protection via the implementation of PPE which may include long pants, sleeves, hazardous materials suit, respirator, dust mask or face shield. During post-closure the waste rock storage area and TSF will be entirely encapsulated and subsequently direct dermal contact with tailings and waste rock is an inoperable pathway.

With these risk management measures in place, no operable pathways exist for exposure and no potential risks are identified to Indigenous and non-Indigenous human receptors (Residents, Workers, and Site Visitors and Harvesters) via direct dermal contact with COCs in waste rock and tailings as a result of the project and no further assessment is required.

Supplemental Human Health Screening for Water

As shown in the Tables above, none of the parameters exceeded their respective regulatory criteria for operations and as such no surface water COCs are identified. During post-closure water quality will be monitored and treated if necessary to ensure that water quality continues to meet PWQO, as such no COCs are identified in surface water for post-closure.

Groundwater quality was not discussed in the SLRA in Appendix W, as groundwater quality data were unavailable. The expectation is that there will be very minor impacts on groundwater quality given that the TSF is lined to prevent impacts, and all surface water site on the Project site is being collected and treated if required. As part of the follow-up program, groundwater monitoring will be ongoing and any potential impacts will be mitigated, as such no potential risks are anticipated via groundwater impacts. In the event new scientific rationale warrants an assessment of the groundwater pathway, the risk assessment should be updated as part of a Follow-Up and Monitoring program as described in Section 13.

No supplemental screening of surface water or groundwater is required. No potential human health risks are anticipated to any human receptor via these pathways, and no additional risk management measures (aside from those designed as part of the project) are required at this time.

Pathways Requiring Quantitative Risk Assessment

No MOECC component criteria are available for supplemental screening for ingestions of country foods, and inhalation of chemicals adhered to fugitive dust. These two pathways were carried forward for quantitative assessment as described in Appendix W.

- Inhalation of Soil Particulates: TetraTech completed a quantitative assessment for mercury and lead in fugitive dust as described in Appendix W. As shown in Table 6.19.2.1-4, all the modelled chemical concentrations in dust were below their health-based screening criteria by nearly one order of magnitude or more, however mercury in dust was not modelled. Health Canada in Section 2.5.5 of the PQRA guidance document states that it is anticipated that contaminant intake due to the inhalation of fugitive dust will be insignificant relative to the ingestion of soil and water, and to dermal contact. Given that with the appropriate risk management measures in place no potential risks were identified to any human receptor via direct contact, and none of the modelled parameters exceeded their health-based Ontario Ambient Air Quality Screening Value, a quantitative assessment of the fugitive dust pathway was not required as part of the SLRA. TetraTech conservatively included a quantitative assessment of fugitive dust during operations and post-closure for:
    - Lead- which exceeded MOECC interim soil standards. The risk assessment was performed using predicted concentration modelled by RWDI; and

- o Mercury- based on stakeholder interest in mercury contamination, using predicted concentrations modelled using the Health Canada default calculation and the maximum concentrations measured in waste rock/tailings.

- Ingestion of Country Foods: Given that there were no supplemental screening criteria for the country foods ingestion pathway, this pathway was conservatively assessment via a quantitative risk assessment in Appendix W. This pathway may be specifically described as contaminant uptake from soil or soil leaching to surface water and bioaccumulation within plants, fish, and wild game which may be ingested by Residents and Site Visitors and Harvesters who may be non-Indigenous or Indigenous community members. There is an expectation that a site-specific exposure scenario would be derived for the Indigenous peoples' receptor group based on engagement activities with the local Indigenous communities. This is outside of the scope of what may be considered as part of a SLRA, however may be included in additional Follow-Up risk assessments as defined in Section 13. For the purposes of the SLRA, the Health Canada default exposure characteristics for members of Indigenous communities were applied.

6.19.2.2 Exposure Assessment

Exposure Point Concentrations

The exposure point concentrations used by TetraTech in the quantitative assessment of inhalation of dust and ingestion of country foods are provided in Table 6.19.2.2-1 below.

Dust

The modelled air concentration of lead in dust was determined by RWDI to be 0.166 µg/m³. As stated in Section 4.2.2 of Appendix W (Identification of COCs) mercury concentrations in dust were not modelled directly as part of the air quality modelling completed by RWDI. Thus, the exposure point concentration for mercury in dust was calculated to be 4.71×10^{-10} mg/m^3 using the Health Canada default particulate concentration in outdoor air of 7.6×10^{-10} kg/m^3 (Health Canada 2004), multiplied by the maximum concentration of mercury in the soil (i.e., 0.62 mg/kg)

Country Foods

The values used are predictive rather than measured, as the mine is in the planning stages and no applicable tissue samples are available to gauge impacts of the mine processes on the surrounding flora and fauna. For that reason, the predicted concentration of mercury and lead in soil or water (adjusted for foraging range and habitat quality) were used to estimate the concentration of each analyte to which a human could be exposed through the harvesting of game. For the harvesting of plants from the tailings area, a spatial adjustment was used to account for the portion of plants that could be harvested from the mine-impacted area relative to all harvesting area.

At the request of the CEA Agency as part of an Information Request (TMI_217-HE(1)-24) the assessment in Appendix W was revised herein to also include total concentrations of mercury and lead (i.e. sum of baseline and incremental contributions) in fish to calculate hazard quotients, to ensure that potential health risks are not underestimated. The exposure point concentrations used in the SLRA were the maximum concentrations measures or predicted as part of the project.

The exposure point concentrations of lead and mercury in the various environmental media used in the SLRA and the supplemental risk assessment for fish, are included in Table 6.19.2.2-1.

Table 6.19.2.2-1: Exposure Point Concentrations Used in Human Health Risk Assessment

Environmental Media	Mercury	Lead	Methylmercury
OPERATIONS (INCREMENTAL)			
Soil (mg/kg)	0.62	2362.85 (870[1])	
Dust (mg/m^3)	4.71×10^{-10}	1.66×10^{-4}	
Root Vegetables (mg/kg wet weight)	0	0	
Other vegetables (mg/kg wet weight)	0	0	
Fish (mg/kg wet weight)	4.06×10^{-5}	7.39×10^{-6}	4.10×10^{-5}
Wild game (mg/kg wet weight)	2.89×10^{-3}	1.16×10^{-2}	
POST CLOSURE (INCREMENTAL)			
Soil (mg/kg)	0.62	870	
Dust (mg/m^3)	NA	NA	
Root Vegetables (mg/kg wet weight)	8.14×10^{-5}	5.71×10^{-3}	
Other vegetables (mg/kg wet weight)	1.54×10^{-4}	1.06×10^{-2}	
Fish (mg/kg wet weight)	5.28×10^{-6}	1.56×10^{-5}	5.28×10^{-5}
Wild game (mg/kg wet weight)	5.89×10^{-9}	2.18×10^{-7}	
MEASURED BASELINE			
Fish (mg/kg wet weight)	0.3251	0.036	0.3251
TOTAL OPERATIONS (Baseline+ Project Incremental			
Fish (mg/kg wet weight)	0.3251	3.6×10^{-2}	0.3251
TOTAL POST-CLOSURE (Baseline+ Project Incremental			
Fish (mg/kg wet weight)	3.25×10^{-1}	3.6×10^{-2}	3.25×10^{-1}

Notes:
1 Post-closure soil concentration of lead used in operations country food scenario during operations because site access will be controlled, and therefore harvesting of country foods in areas impacted by tailings would not occur.
NA Not applicable. No dust will be created post-closure as the TSF and waste rock will be completely encapsulated.

Receptor Characterization

The physical characteristics of each receptor group required for exposure calculations were provided by Health Canada in the DQRA model (Health Canada 2011) or PQRA and DQRA guidance documents (Health Canada 2012 and 2010, respectively). Table 6.19.2.2-2 presents the specific values employed for each receptor in the exposure assessment

Exposure Frequency and Duration

Exposure frequency and duration assumptions for the SLRA are outlined in Table 6.19.2.2-3. These assumptions are generic and follow the assumptions recommended by Health Canada guidance for residential, recreational, commercial, and construction work land use in the 2012 PQRA guidance document.

Table 6.19.2.2-2: Characterization of Human Receptors

Receptor	Units	Infant	Toddler	Child	Teen	Adult	Construction/Utility Worker
Age		0 - 6 mo.	7 mo. - 4 y	5 - 11 y	12 - 19 y	>= 20 y	>= 20 y
Lifestage Length	year	0.5	4.5	7	8	60	60
Body weight	kg	8.2	16.5	32.9	59.7	70.7	70.7
Soil ingestion rate	g/day	0.02	0.08	0.02	0.02	0.02	0.1
Inhalation rate	m^3/day	2.2	8.3	14.5	15.6	16.6	33.6
Water ingestion rate	L/day	0.3	0.6	0.8	1	1.5	1.5
Time spent outdoors	hours/day	1.5	1.5	1.5	1.5	1.5	10
Time spent outdoors	hours/day	1.5	1.5	1.5	1.5	1.5	10
Skin surface area	cm^2						
- hands		320	430	590	800	890	890
- arms		550	890	1480	2230	2500	2500
- legs		910	1690	3070	4970	5720	5720
- total		3620	6130	10140	15470	17640	17640
Soil loading to exposed skin (g/cm2/event)							
- hands		1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-03
- surfaces other than hands		1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-04
Soil monolayer loading rate	mg/cm^2	5	5	5	5	5	5
Food ingestion	g/day						
- root vegetables		83	105	161	227	188	0
- other vegetables		72	67	98	120	137	0
- fish		0	56	90	104	111	0
Indigenous food ingestion	g/day						
- fish		0	95	170	200	220	0
- wild game		0	85	125	175	270	0

Reference:

Health Canada 2010	Guidance of Human Health Detailed Quantitative Risk Assessment (DQRA) for Chemicals, 2010
Health Canada 2012	Guidance of Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, 2012

Table 6.19.2.2-3: Exposure Frequency and Duration Assumptions

Scenario	Residential	Urban Recreational	Commercial	Industrial	Industrial - Outdoors	Construction/ Utility Work
Hours per day	24	2	8	10	0	10
Hours per day (outdoors)		2			10	10
Days per week	7	2	5	5	5	5
Weeks per year	52	35	52	48	48	13
Dermal exposure events per day	1	1	1	1	1	1
Water contact events per day	1	1	1	1	1	1
Duration of water contact event (h)	0.5	0.5	0.5	0.5	0.5	0.5
Days/year of contaminated food ingestion	365	365	0	0	0	0
Exposure Duration (years)	80	80	35	35	35	35
Years for carcinogen amortization	80	80	80	80	80	80

Reference:

Health Canada 2010 Guidance of Human Health Detailed Quantitative Risk Assessment (DQRA) for Chemicals, 2010

Health Canada 2012 Guidance of Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, 2012

TetraTech applied the default Health Canada PQRA/DQRA inputs from Tables 6.19.2.2-2 and 6.19.2.2-3 for each of their exposure scenarios as summarized in Table 6.19.2.2-4.

Table 6.19.2.2-4: Health Canada Default Exposure Scenarios Assessed in the SLRA

Scenario	Pathway	Project Phase	Receptor Group	Health Canada DQRA Model Input Exposure Scenario (Table 6.19.2.2-3 above)	Canadian Indigenous Community Defaults for Country Foods applied?
1	Fugitive Dust	Operations	Resident; and Worker	Residential	No
2	Fugitive Dust	Operations	Recreational/ Site Visitor	Urban Recreational	No
3	Country Foods	Operations	Resident; and Worker	Residential	Yes
	Country Foods	Post-Closure	Resident; and Worker	Residential	Yes

Exposure Equations

The exposure equations for each operable pathway (i.e. inhalation of fugitive dust (operations) and ingestion of country foods (operations and post-closure)) were those defined by Health Canada in the PQRA/DQRA guidance documents. Although TetraTech utilized the DQRA spreadsheet tool in their quantitative assessment, and that model is no longer recommended for use, the equations used to calculate exposure remain valid and current as per Health Canada PQRA and DQRA guidance documents.

Table 6.19.2.2-5 summarizes the exposure equations utilized in the quantitative assessment of potential risk. Worked calculations are included in Appendix W as well as in the revised response provided in the Information Request entitled “TMI_218-HE(1)-25”.

Table 6.19.2.2-5: Exposure Equations Used in SLRA

Pathway	Health Canada Equation
Fugitive Dust Exposure Equation	**Inhalation Dose (mg/kg bw/day) = $C_s \times P_{air} \times IR_A \times RAF_{inh} \times D_1 \times D_2 \times D_3 \times D_4 / BW \times LE$** Where: C_s = soil concentration (mg/kg) P_{air}= HC particulate in air (kg/m^3) IR_A= receptor inhalation rate (m^3/day) RAF_{inh}= relative absorption factor by inhalation (unitless) D1= hours/day/24 hrs D2= days per week exposed/7 days D3= weeks per year exposed/52 weeks

Table 6.19.2.2-5: Exposure Equations Used in SLRA (continued)

Pathway	Health Canada Equation
	D4= total years exposed to site (to be employed for carcinogens only) BW= body weight (kg) LE= life expectancy (years) (to be employed for carcinogens only)
Ingestion of Plant Material	**Ingestion Dose (mg/kg-day) = $C_{plant(adst)}$ x FIR / BW / 1000 g/kg** Where: BW = Body Weight FIR = Food Ingestion Rate – root veg = 105 g/d FIR = Food Ingestion – other veg = 67 g/d
Ingestion of Wild Game	**Dose (mg/kg/day) = $C_{Wild\ Game}$ x $IR_{Wild\ Game}$ x RAF_{GIT} x ET)/BW** Where: $C_{Wild\ Game}$= Total Wild Game Concentration (mg/kg wet weight) =∑ Concentration (mg/kg wet weight) in Moose + Deer + Grouse+ Hare Appendix Q, Table P $IR_{wild\ game}$= 85 g/day (0.085 kg/day) of Wild Game $RAFG_{IT}$= 1 ET= D2= 7 days per week exposed/7 days * D3= 52 weeks per year exposed/52 weeks BW= body weight (kg)
Ingestion of Fish	**Dose (mg/kg/day) = C_{Fish} x IR_{Fish} x RAF_{GIT} x ET)/BW** Where: C_{Fish}= Total Concentration Mercury in Fish (mg/kg wet weight)-Appendix W, Table T IR_{Fish}= 95 g/day (0.095 kg/day) of Fish RAF_{GIT}= 1 ET= D2= 7 days per week exposed/7 days * D3= 52 weeks per year exposed/52 weeks BW= body weight (kg)

Reference:
Health Canada 2010 Guidance of Human Health Detailed Quantitative Risk Assessment (DQRA) for Chemicals, 2010
Health Canada 2012 Guidance of Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, 2012

6.19.2.3 Toxicity Assessment

The toxicity assessment involves identification of the potentially toxic effects of the COCs and the determination of the amount of the COCs that can be taken into the body without experiencing adverse health effects. This value is called a toxicity reference value (TRV). For chemicals that do not cause cancer (i.e., non-carcinogenic), there is a threshold exposure level below which no observable adverse health effects occur. Above the threshold, adverse health effects may occur, and can increase in severity with increasing exposure to the substance.

For chemicals that can cause cancer (carcinogens), a non-threshold TRV is considered applicable. Even at low doses, carcinogenic compounds pose some risk of genetic damage. In order to establish whether the identified COCs are carcinogenic or not, the authors of Appendix W to the EIS (Section 4.4, Appendix W) reviewed the available literature and determined that both lead and mercury would be assessed as a non-carcinogenic. The default TRV values for lead and mercury provided in the DQRA model (HC 2011b) were used in the risk assessment. These TRV are listed in Table 6.19.2.3-1.

The TRVs selected for lead, mercury, and methylmercury were obtained from Health Canada's guidance document entitled "*Part II- Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0",* dated 2010 with consideration being given to any updated toxicological interpretation by the scientific community since the time of that publication.

It should be noted that although the TRV for lead provided in the table below was used in the quantitative risk assessment present in Appendix W, the current risk assessment science in Canada and Ontario specifically is that lead may now be considered a non-threshold chemical (Wilson and Richardson 2013) and subsequently the TRV for lead is under review and any conclusions drawn from its use will be subject to a high degree of uncertainty. For methylmercury there are two TRVs provided for use the Health Canada TRV document, the TRV chosen was the more conservative TRV for women of child-bearing age, and children less than 12 years given the residential and recreational potential land uses of the area surrounding the Project.

The TRVs provided below were used in the assessment of all receptors (toddler through adult).

6.19.3 Project Effects Avoidance Measures Used in Predictions

Most of the mitigation measures used to reduce the effects of the Project on the environment will have a benefit in reducing or avoiding the effects of the Project on human health. Some of the more notable avoidance measures are as follows:

- Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area. [Mit_008].
- Industry standard erosion and sediment controls will be implemented during the site preparations and construction phase. [Mit_054].
- The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA. [Mit_020].
- During operations, tailings will be maintained in saturated conditions, with a water cover maintained over the majority of the TSF to prevent the onset of acidification. [Mit_021].
- As part of the closure activities, the WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure. [Mit_018].
- At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification. [Mit_022].
- At closure, the tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover. [Mit_023].
- Reclaimed will carried out in accordance with O.Reg. 240/00. [Mit_088].

Table 6.19.2.3-1: Toxicity Reference Values (TRVs) used in Health Assessment

Parameter	Non-Carcinogenic TRV		Carcinogenic TRV		Critical Effect	Carcinogenicity
	Reference Dose (mg/kg/day)	Reference Concentration (mg/m^3)	Oral Slope Factor $(mg/kg/day)^{-1}$	Inhalation Unit Risk $(mg/m^3)^{-1}$		
Mercury	0.0003	NV	NV	NV	Nephrotoxicity	Non-Carcinogen
Methylmercury	0.0002**	NV	NV	NV	Neurodevelopmental toxicity	Non-Carcinogen
Lead*	0.0036*	NV	NV	NV	Behavioral and learning disabilities in children. Systolic blood pressure increases in adults	Non-Carcinogen

Notes:
'*' Both Health Canada and the MOECC are reviewing the toxicological reference value of lead. The value presented was obtained from the DQRA spreadsheet tool which is no longer advised for use. According to MOECC, until the review of lead is complete, any lead concentrations above 120 µg/g are to be considered to present potential risk, and require risk management measures.
'**' TRV for women of child-bearing age, and children less than 12 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 concentrations if background levels are greater than the PWQ, prior to the discharge from the pit lake to a tributary of Blackwater Creek. [Mit_024].
- Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044].
- Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046].
- Seepage that escapes the seepage collection systems will be captured by the drawdown zone caused by the dewatering of the open pit and underground mine, and will report to the open pit [Mit_052]. The drawdown zone will last until groundwater levels recover to near pre-development conditions in the post-closure phase.
- During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek. [Mit_053]
- There will be no discharges to surface water during the closure phase [Mit_055].
- The floor of the tailings storage facility (TSF) will be a low-permeability layer capable of achieving seepage rates that ensures receiving surface water quality are equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HPDE liner laid over a prepared basin of sand or comparable material [Mit_062].
- Administrative risk management measures including a Health and Safety Plan will be implemented with restricted access to the waste rock storage area and the tailings storage facility. Only Project Workers with the required health and safety training and personal protective equipment (PPE) will have access to the waste rock storage area or tailings storage facility during operations. In doing so, this will eliminate any potential exposure via direct dermal contact of waste rock or tailings to both a Resident and a Site Visitor and Harvester [Mit_130].
- Project Workers (Subsurface and Outdoor) will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE which may include long pants, sleeves, hazardous materials suit, respirator, dust mask or face shield [Mit_129].

- There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127].
- The Fish consumption advisories put in effect by the Ministry of Environment and Climate Change (MOECC) for Thunder Lake and Wabigoon Lake, as provided in “The Guide to Eating Ontario Fish”, will be adhered to [Mit_128].

6.19.4 Predicted Effects

6.19.4.1 Risk Characterization

Risk characterization is the final step of the risk assessment process, during which the exposure estimate and the toxicity assessment are integrated to provide a numerical risk estimate value. The following paragraphs describe how to interpret the risk characterization results.

For each exposure pathway, the estimated dose is compared to the TRV for oral or inhalation exposure. For non-carcinogens, the ratio of the predicted exposure to the TRV is the hazard quotient (HQ). As outlines in Health Canada PQRA guidance, 20% of the reference dose or reference concentrations should be allocated to each environmental media for each compound. That is, the target (or “acceptable”) HQ is equal to 0.2. In doing this, an additional chemical exposure from background sources up to 80% of the TRV is permitted without exceeding the tolerable daily intake.

The potential risk due to COCs that are threshold toxicants (i.e., non-carcinogens) is estimated by calculating the ratio (HQ) of the dose and the applicable TRV using the following equation:

$$Hazard\ Quotient = \frac{Estimated\ Exposure}{Toxicity\ Reference\ Value}$$

For carcinogens, Health Canada and MOECC consider the upper bound of acceptable lifetime cancer risks to be on in one million (1.0×10^{6}) per environmental media for each carcinogen (Health Canada 2012). That is, the target (or “acceptable”) cancer risk in 1×10^{-6}.

The potential risk due to COCs that are non-threshold toxicants (i.e., carcinogens) is estimated by calculating the product or ILCR of the dose and the applicable TRV using the following equation:

$$Incremental\ Lifetime\ Cancer\ Risk = Toxicity\ Reference\ Value\ \times Estimated\ Exposure$$

All of the COCs carried forward conservatively for quantitative assessment are considered non-carcinogens based on their toxicity data available to-date.

6.19.4.2 Potential Risk Estimates

Health Canada's DQRA model was used to estimate daily intakes (EDIs) and HQs for non-carcinogens for all human receptors within each receptor group for the operable pathways quantitatively assessed as part of the SLRA. Although the use of the DQRA model is no longer an approved tool, the equations and assumptions outlined in Section 6.19.2.2 as part of the exposure assessment remain valid to the current Health Canada guidance on completing a PQRA and DQRA for human health.

The SLRA presented the individual hazard quotients of each food item (Appendix W, Table U). The results indicated that hazard quotients for the ingestion of country foods (wild game, plants (vegetative and root/berry, and fish) were below the Health Canada/MOECC target HQ of 0.2 for both the operations and post-closure stages of the project.

No potential risk was identified to any human receptors via ingestion of country foods impacted as a result of the project. Using the total exposure calculated assuming ingestion of all country foods (i.e., plants, wild game, and fish), an overall assessment of potential risk was calculated as summarized in Table 6.19.4.2-1 below.

Table 6.19.4.2-1: Potential Risk Estimate Summary

Parameter and Exposure Pathway	Hazard Quotient		
	Scenario 1	Scenario 2	Scenario 3
	Resident; and Worker	Site Visitor	Resident; and Worker
Mercury			
Fugitive Dust-*Operations*	4.9×10^{-8}	1.27×10^{-8}	Not Assessed
Country Foods-*Operations*	Not Assessed	Not Assessed	5.04×10^{-2}
Country Foods-*Post-Closure*	Not Assessed	Not Assessed	7.25×10^{-3}
Lead*			
Fugitive Dust-*Operations*	1.45×10^{-3}	1.45×10^{-3}	Not Assessed
Country Foods-*Operations*	Not Assessed	Not Assessed	1.66×10^{-2}
Country Foods-*Post-Closure*	Not Assessed	Not Assessed	4.19×10^{-2}

Notes:
Shaded and Bold: Risk Estimate exceeds Health Canada/MOECC HQ target of 0.2.
'*' Lead TRV currently under review by Health Canada and MOECC.
'Not assessed' Not considered an operable pathway requiring quantitative assessment

The calculated HQs or risk estimates for mercury and lead were below the risk threshold during the Operational Phase of the Project for all Residents and Recreational users (Site Visitors/Harvesters) potentially exposed to mercury and lead via fugitive dust. Country foods ingestion in the operations and post-closure phase were below the Health Canada/MOECC risk benchmark, and therefore no potential risks were identified.

No potential risks in exceedance of Health Canada/ MOECC risk benchmarks are identified as a result of the Project, no additional risk management measures are required for the protection of human heath. Therefore, the Project will result in no adverse effects to human health.

6.19.4.3 Supplemental Risk Assessment

The CEA Agency as part of the Round 1 Information Requests (TMI_217-HE(1)-24), a revised assessment be completed using total concentrations of mercury and lead (i.e., sum of baseline and incremental contributions) in fish to calculate hazard quotients, so potential health risks are not underestimated. The results of that revised assessment are included herein using the exposure point concentration table provided in Section 6.19.2.2 which included measured concentrations of mercury and lead in fish (i.e., baseline) as well as predicted incremental concentrations in fish for the project alone, and total concentrations (i.e., sum of baseline concentrations and incremental concentrations).

The supplemental risk assessment included assessment of a toddler (the most critical receptor in all 3 scenarios assessed above) and an adult, assuming a rate of fish consumption for an Indigenous community member (i.e. higher than for the general population) and a residential exposure scenario (i.e. most conservative exposure scenario). The results of the calculated hazard quotients for baseline, project alone and total are provided in Table 6.19.4.3-1 below.

Table 6.19.4.3-1: Supplemental Risk Characterization for Fish Consumption

Parameter	Measured/ Baseline	Incremental Operations	Incremental Post-Closure	Total Operations (Baseline+ Project Incremental)	Total Post Closure (Baseline+ Project Incremental)
Toddler					
Lead**	0.05758	0.00001	0.00003	0.05759	0.05760
Mercury	**6.23929**	0.00079	0.00010	**6.24008**	**6.23939**
Methyl Mercury*	**9.35894**	0.00118	0.00015	**9.36012**	**9.35909**
Adult					
Lead**	0.03112	0.00001	0.00001	0.03112	0.03113
Mercury	**3.37209**	0.00043	0.00005	**3.37251**	**3.37214**
Methyl Mercury*	**5.05813**	0.00064	0.00008	**5.05877**	**5.05822**

Notes:
Shaded and Bold: Risk Estimate exceeds Health Canada/MOECC HQ target of 0.2.
'*' assumption that all mercury becomes methyl mercury- this is an overly conservative assumption that may result in an overestimation of potential risk
'**' Lead TRV currently under review by Health Canada and MOECC. The HQ for lead is calculated with a high degree of uncertainty.

The results indicate that the baseline concentrations of mercury (and by association methylmercury) in the regional area are sufficiently high to pose potential risk to human health. The HQ exceedances identified in the "Total Operations (Baseline+ Project Incremental)" and "Total Post Closure (Baseline+ Project Incremental) are as a result of the baseline HQ exceedances not the project. The Project contributes a negligible amount (0.001–0.04%.) to the HQ identified for Total Operations and Total Post-Closure.

As described in Section 5.1.12.5 "Eating Ontario Fish", there is a fish consumption advisory in effect in the regional area to protect human receptors from mercury toxicity. The results in Table 6.19.4.1-2 confirm that the baseline measured concentrations of mercury in fish are sufficiently high to warrant risk management measures. The risk management measure already implemented in the regional area is "The Guide to Eating Ontario Fish" provided by the MOECC which provides easy-to-use information to help choose fish caught from Ontario lakes and rivers to minimize exposure to toxins including mercury and methylmercury. Consumption advice in the guide is based on guidelines provided by Health Canada. Given that the advisory is already in effect providing effective risk management and that the project contributes a negligible amount to potential risk, there is no need for additional risk management measures as part of the Project.

6.19.5 Identified Mitigation

As described in Section 6.19.4.2, the Project was predicted to resulted in no adverse effects, and no additional mitigation measures beyond the avoidance measures outlined in Section 6.19.3 have been identified.

6.19.6 Residual Adverse Effects

As described in Section 6.19.4.2, the results of the risk assessment determined there would be no adverse effects for the human health VCs (non-Indigenous human health and Indigenous human health) as a result of the Project. Therefore, there would be no residual adverse effects for human health.

6.19.7 Information to Address Round 1 Information Requests

The following provides a listing of the questions raised as part of the Round 1 information requests that were, in whole or in part, relating to the methods used for predicting the effects of the Project on human health, or the predicted effects:

- TMI_195-HE(1)-02: screening process for COCs;
- TMI_196-HE(1)-03: consideration of direct soils contact;
- TMI_199-HE(1)-06: exposure frequencies;
- TMI_200-HE(1)-07: dose averaging of exposures;
- TMI_201-HE(1)-08: age groups and food ingestion rates;

- TMI_202-HE(1)-09: current fish guidance on fish ingestion rates;
- TMI_203-HE(1)-10: forms of mercury considered;
- TMI_204-HE(1)-11: more recent lead TRVs;
- TMI_205-HE(1)-12: rationale for spatially adjusting concentrations and uptake rates;
- TMI_206-HE(1)-13: depth of soil cap on WRSA and TSF;
- TMI_209-HE(1)-16: use of site-specific data;
- TMI_210-HE(1)-17: antimony as a potential COC;
- TMI_211-HE(1)-18: mercury exposure point concentrations;
- TMI_212-HE(1)-19: screening using MOE POI limits;
- TMI_213-HE(1)-20: screening total air concentrations;
- TMI_214-HE(1)-21: justification for excluding COCs;
- TMI_215-HE(1)-22: screen using total water concentrations;
- TMI_216-HE(1)-23: baseline concentrations for whole fish consumption;
- TMI_217-HE(1)-24: use of total mercury exposures;
- TMI_218-HE(1)-25: worked examples for non-carcinogen and carcinogen;
- TMI_220-HE(1)-27: dry weight concentrations of lead in vegetation;
- TMI_221-HE(1)-28: clarify MOE POI for carbon monoxide;
- TMI_222-HE(1)-29: use current guidance for risk calculations;
- TMI_223-HE(1)-30: summing concentrations across species;
- TMI_224-HE(1)-31: apparent inconsistency for post-closure total hazard quotient (HQ);
- TMI_225-HE(1)-32: rationale for lead HQs used;
- TMI_325-SD(1)-20: modify PM_{10} and $PM_{2.5}$ air screening criteria;
- TMI_326-SD(1)-21: rational for substances without guidelines;
- TMI_327-SD(1)-22: adjust units for lead and mercury TRVs;
- TMI_328-SD(1)-23: update selenium CDWQG;
- TMI_329-SD(1)-24: update to reflect country food risk assessment;
- TMI_338-AC(1)-12: potential human health effects from air quality;
- TMI_347-AC(1)-21: potential contamination of food sources;
- TMI_374-AC(1)-48: contaminants in sport fish (e.g., walleye) already high ;
- TMI_556-AC(1)-230: effects of air compounds on Aboriginal peoples;

- TMI_557-AC(1)-231: assumptions related to uptake by grouse;
- TMI_710-PC(1)-25: effects of air quality on health;
- TMI_714-PC(1)-29: carcinogenic dust;
- TMI_719-PC(1)-34: water quality and health;
- TMI_731-PC(1)-46: perceived safety of chanterelle mushroom; and
- TMI_732-PC(1)-47" perceived safety of wild rice.

6.20 Heritage Resources

6.20.1 Potential Effects of the Project on the Environment

As described in Section 6.1.3.19, the assessment of heritage resources focusses on those aspects of the Project regulated under the *Ontario Heritage Act*, namely archaeological sites historic heritage sites. Potential effects of the Project on cultural activities and practices are addressed as part of the Aboriginal peoples assessment presented in Section 6.21. The following lists potential effects of the Project during the various phases identified for heritage resources:

- **Site Preparation and Construction Phase**: Most of the physical disturbance to soils, overburden and layers likely to hold heritage resources, should they be present, will occur during the site preparation and construction phase. These activities include the following:
  - Construction of perimeter ditches;
  - Clearing and grubbing of vegetation;
  - Clearing of overburden from the open pit;
  - Initial construction of the overburden stockpiles;
  - Construction of the initial tailings storage facility (TSF) footprint;
  - Clearing and initial construction of the waste rock storage area (WRSA); and
  - Construction of site facilities, roads and structures.
- **Operations Phase**: Once mining starts, most of the activities at the site will be occurring within the limits of the areas disturbed during the site preparation and construction phase. Those activities that could affect heritage resources during operations are as follows:
  - Placement of waste rock in the WRSA until waste rock can be placed in the mined out portions of the open pit;
  - Continued placement of overburden in the overburden stockpiles; and
  - Expansion of the footprint of the TSF.
- **Closure Phase**: Following the end of mining activities, the Project facilities will be decommissioned and removed and the site will be regraded to ensure all runoff drains

towards the open pit. Suitable materials will be used to help re-vegetate the site and return it to a condition suitable to support a functioning ecosystem. Those activities that could affect heritage resources during operations are as follows:

- o The regrading of the site, especially areas not previously disturbed during the site preparation and construction phase, or during the operations.

- **Post-closure Phase**: Once the closure activities are complete there will be no further disturbance of the soils that could affect heritage resources.

The potential effects of the Project on noise have been described using a simple linkage diagram on Figure 6.20.1-1. The figure illustrates the heritage resources VCs (shown in blue on the figure) that are potentially affected during each phase of the Project. Additionally, the figure indicates those other components of the environment (shown in red in the figure) where the predicted effects of the Project on heritage resources will be used as an input for determining the effects on other VCs. For example, effects on heritage resources will be considered in the effects of the Projects on Aboriginal peoples. There are no other components or VCs that provide input the heritage resources effects.

6.20.2 Effects Prediction Methods

The prediction of potential effects on heritage resources was done by identifying the presence, or potential for the presence within the areas to be disturbed by the Project. The determination of the likelihood for archaeological resources to be present within the Project footprint was done in accordance with the requirements of the Ontario Heritage Act, and included the completion of a Stage 1 and Stage 2 archaeological assessment in accordance with the methodologies developed by the Ministry of Tourism, Culture and Sport (MTCS). The findings of the assessments were assessment were documented (provided as Appendix U to the EIS), and reviewed by MTCS have, who expressed satisfaction at the recommendations made. The MTCS describes a Stage 1 assessment in the following manner (MTCS 2017: website):

> "*The consultant archaeologist determines whether there is potential for archaeological sites on the property. He or she reviews geographic, land use and historical information for the property and the relevant surrounding area, visits the property to inspect its current condition and contacts this ministry to find out whether or not there are any known archaeological sites on or near the property. A Stage 2 assessment is required when the consultant archaeologist identifies areas of archaeological potential.*"

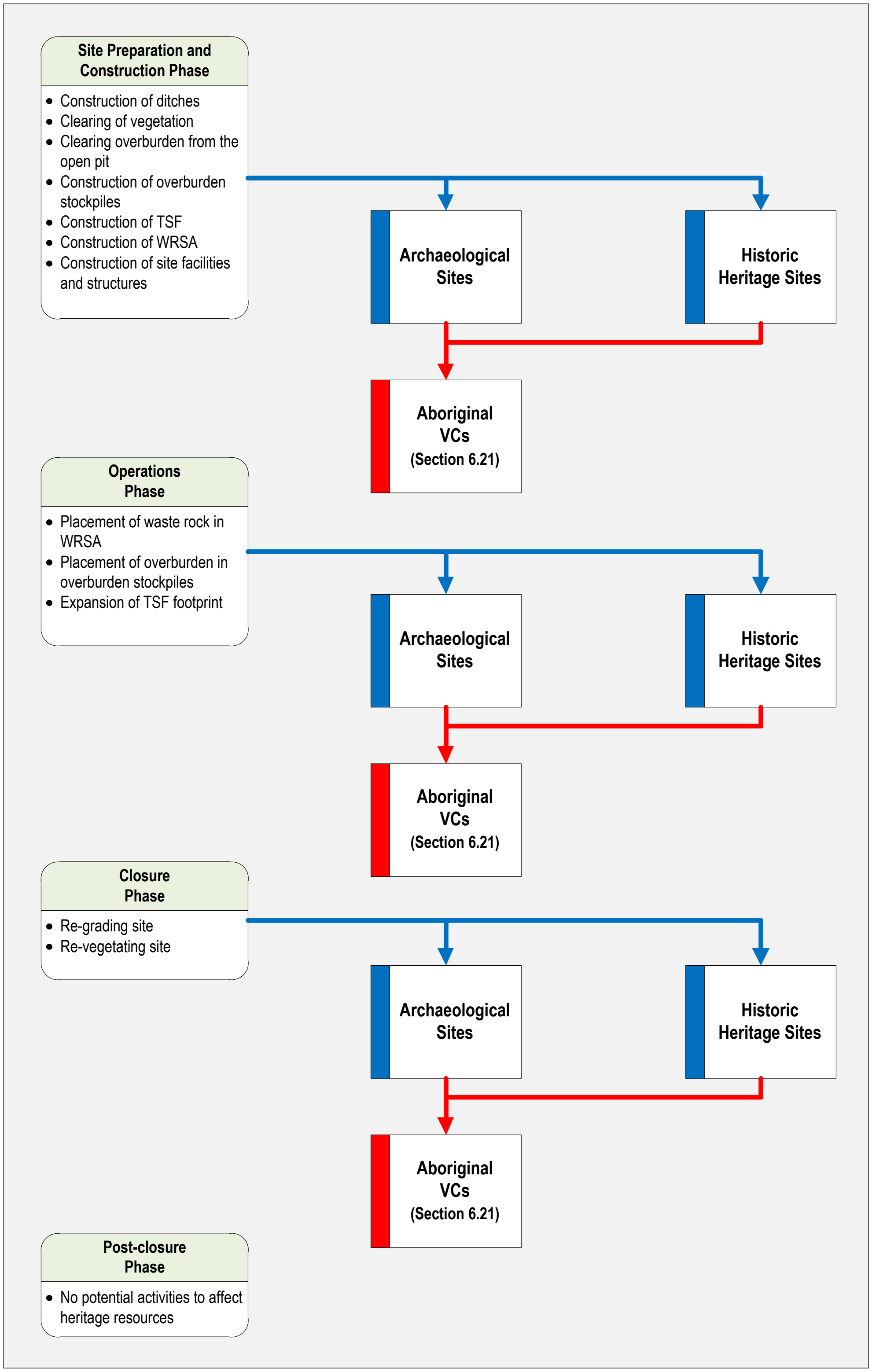


Figure 6.20.1-1: Heritage Resources Linkage Diagram

The steps involved in completing the Stage 1 assessment included the following:

- A review of the historic context for the site, based on literature:
- A review of the archaeological context for the site, based on literature;
- A review of the geographic and land use context, based on literature;
- Contact MTCS to determine the presence of known, proximate archaeological sites; and
- Conduct a site visit to inspect the current conditions (this occurred on May 10, 2012).

A Stage 2 assessment in described is described by MTCS as follows (MTCS 2017: website):

> *"The consultant archaeologist surveys the land to identify any archaeological resources on the property being developed. For a ploughed field, he or she will walk back and forth over it looking for artifacts on the surface. In forests, overgrown pasture areas or any other places that cannot be ploughed, he or she will dig parallel rows of small holes, called test pits, down to sterile subsoil at regular intervals and sift the soil to look for artifacts. He or she may use other strategies if properties are paved, covered in fill or have deeply buried former topsoils (such as floodplains or former sand dunes). The consultant archaeologist will help determine whether any archaeological resources found are of sufficient cultural heritage value or interest to require Stage 3 assessment."*

The Stage 2 work was undertaken during a site visit on May 10, 2012, and the work was further reviewed on September 12, 2012 when the site was re-visited.

The archaeological assessment focused on the development area, the parts of the property that will be directly affected by the construction of the open pit mine and associated infrastructure. However, all evaluations of archaeological potential also consider the areas adjacent to the subject property to confirm the accuracy of evaluations made.

6.20.3 Project Effects Avoidance Measures Used in Predictions

The following measures have been incorporated into the Project that help avoid, or minimize, the potential effects to heritage resources:

- Minimize the overall footprint of the Project. [Mit_050].
- Leave a 50 m buffer zone around remaining watercourses within the Project area. [Mit_118].

6.20.4 Predicted Effects

As described in Appendix U to the EIS, the archaeological assessment for the Project identified the following:

- The location of the Project is 500 m from major watercourses of waterbodies.
- The property is comprised of low lying areas, interspersed with higher areas of clay capped bedrock.
- Much of the site has been disturbed by previous past and present mining explorations activities, as well as by forestry practices in the area.
- The former Ministry of Natural Resources tree nursery, which was located on the property, does not represent a historic feature.
- There were no historic settlements or historic transportation routes within the site.
- A request for information from the site registration database regarding the presence of other identified archaeologic sites near the Project was made to MTCS, specifically information was requested for the DgJc Borden block. According to MTCS, there are no sites have been reported within 2 km of the Project.
- The Stage I study indicated a low potential for archaeological resources at the Project based the identification from 1:50,000 topographic maps of the presence of terrain features and several small, intermittent watercourses on the property.
- A Stage 2 was required to be able to assess these locations.
- The Stage 2 property survey indicated a low potential for archaeological resources as the several intermittent watercourses are seasonal, and flow through dense scrub brush.
- A raised knoll on the property was examined and found to be disturbed.
- No other features of archaeological potential were identified.
- It was determined that there was no potential for archaeological resources within the Project footprint.

The archaeological assessment was focused on the development area, the parts of the property that will be directly impacted by the construction of the open pit mine and associated infrastructure. Evaluation of archaeological potential for any property considers areas adjacent to the property under consideration to confirm the evaluations made. The low archaeological potential evaluated for the Project is also supported the proximity to Thunder Lake and Wabigoon Lake. These areas would have been the preferred locations for settlement, and this settlement would have been related to available food resources (fish, rice), and access (canoe routes) among other variables.

As part of the Round 1 information requests and engagement efforts, information was shared regarding a traditional canoe route between Wabigoon Lake, through Thunder Lake and Ghost Lake to access Rice Lake. The importance of this route from a cultural perspective is recognized by Treasury Metals. However, the canoe route identified lies beyond the area of anticipated to be directly affected by the development of the Project, and this route and should not be compromised. The information shared that Elders camped on sandy beaches along the route is valuable, and confirms the general approach taken in evaluating archaeological potential. Areas in close proximity to navigable waters represent areas of higher potential, while areas that are distant from navigable waterways, like the Project site, will have a lower archaeological potential.

Based on the findings of the archeological studies completed for the Project (Appendix U to the EIS), it was concluded that the area of the Project "…does not exhibit archaeological potential, therefore it is recommended that the location does not require further archaeological assessment." The archaeological report was submitted to MTCS for review, who expressed satisfaction at the recommendations made.

Therefore, the absence of archaeological potential at the Project means there would be no predicted adverse effects of the Project on heritage resources.

6.20.5 Identified Mitigation

The following measures incorporated into the Project design and implementation will help avoid adverse effects, or mitigate any effects that arise:

- Minimize the overall footprint of the Project [Mit_050].
- Leave a 50 m buffer zone around remaining watercourses within the Project area [Mit_118].

In addition to the above avoidance measures, mitigation measures will be put in place, as part of the Archaeological and Cultural Heritage Resource Management Plan to respond to archaeological resources that may be encountered in the execution of the Project. These would include the following:

- If previously undocumented archaeological resources be discovered, the person discovering the resources must stop alteration of the site immediately of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (I) of the Ontario Heritage Act. [Mit_119].
- If human remains are discovered, alteration of the site must stop and the person making the discovering must immediately notify the police, or coroner, and the Registrar of cemeteries, at the Ministry of Consumer Services, as required under the *Cemeteries Act*, R.S.O. 1990 c.C.4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (when proclaimed in force). [Mit_120].
- Restrict activities and development within 300 m of major water sources and within 300 m of historical travel routes, to only those areas where an archeological assessment has been completed. [Mit_121].
- Do not allow new ground altering activities to occur in areas where an archaeological assessment has not been completed. [Mit_122].

6.20.6 Residual Adverse Effects

As there were no predicted adverse effects of the Project on heritage resources (Section 6.20.4) there will be no residual adverse effects heritage resources.

6.20.7 Information to Address Round 1 Information Requests

The following lists the questions received as part of the Round 1 information requests that relate to the predicted effects, and prediction methods, for heritage resources:

- TMI_354-AC(1)-28: assess traditional canoe route to Rice Lake;
- TMI_354-AC(1)-28: spiritual and ceremonial sites should be assessed separately;
- TMI_355-AC(1)-29: presence of underwater sites in Thunder Lake and Wabigoon Lake;
- TMI_681-AC(1)-353: concerned about potential for archeological resources on site;
- TMI_739-PC(1)-54: concerned about potential for archeological resources on site; and
- TMI_743-PC(1)-58: concerned about potential for archeological resources on site;
- TMI_241-HE(1)-48: mitigation for heritage resources; and
- TMI_242-HE(1)-49: Archaeological and Cultural Heritage Resource Management Plan.

6.21 Aboriginal Peoples

6.21.1 Potential Effects of the Project on the Environment as these Relate to Aboriginal Peoples

'Aboriginal peoples' is a collective name for the original peoples of North America and their descendants. Often, 'Indigenous peoples' is also used. The Canadian Constitution recognizes three groups of Indigenous peoples: First Nations, Inuit, and Métis. These are three distinct peoples with unique histories, languages, cultural practices and spiritual beliefs. The terms "Aboriginal peoples" and "Indigenous peoples", and "Indigenous communities" and Aboriginal Communities" are used interchangeably in this document, and both refer to those peoples who identify themselves as First Nations, Métis, or Inuit.

Based on information available through primary and secondary sources, members of several local and regionally based Indigenous communities utilize lands and resources in the general vicinity of the Project (Section 5.13.3). Of particular note in this regard are the community members of Wabigoon Lake Ojibway Nation, Eagle Lake First Nation and the Aboriginal Peoples of Wabigoon, which are the closest communities to the Project site. Wabigoon Lake Ojibway Nation and the Whitefish Bay First Nation (Naotkamegwanning First Nation) also hold commercial fishing licences on Wabigoon and Thunder Lakes; the Wabigoon Lake Ojibway Nation harvests wild rice from Wabigoon Lake; and area lakeshore residents use Wabigoon and Thunder Lakes as a drinking water source. There is consequently considerable interest among community members regarding water quality and aquatic life protection.

Members of other Indigenous communities (Wabauskang First Nation, Lac Seul First Nation, and Métis Nation of Ontario) also use resources in the Project area; and members of the Grassy Narrows First Nation have expressed concerns about water quality, as they are downstream of Wabigoon Lake (Section 5.13.3). Based on information available to date, it is unclear if members of the Lacs des Mille Lacs First Nation conduct traditional activities in the general vicinity of the Project, but regional transportation systems support the potential for such use.

In evaluating potential effects of the Project on Aboriginal peoples, an emphasis has been placed on describing how changes in the environment, as a result of the Project, could affect the resources traditionally relied on by members of Indigenous communities, or how the Project could affect the ability of Aboriginal peoples to practice their current or historic use of lands and resources for traditional purposes. In addition, this revised EIS looks at how the Project might affect the health or social wellbeing of members of Indigenous communities.

Under subparagraph 5(1)(c)(iii) of CEAA 2012, effects from a designated project on the current use of lands and resources for traditional purposes are considered through a change in the environment. The current use of lands and resources for traditional purposes, as well as the exercise of Treaty Rights, is associated with an Indigenous community's practices, traditions or customs, which are part of an Indigenous community's distinctive culture and fundamental to their social organization and the sustainment of present and future generations. Practices, traditions and customs are general!y defined as follows:

- Practice: a way of doing something that is common, habitual or expected;
- Tradition: a custom, opinion or belief handed down primarily orally or by practice; and
- Custom: a particular, established way of behaving.

For the purposes of the EIS, Aboriginal and Treaty Rights are defined as the historic and current uses of lands and resources for traditional purposes by members of Indigenous communities. 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.

This scope of assessment is consistent with the Round 1 information requests that included questions regarding the potential impact of the Project on Aboriginal and Treaty Rights, as defined by the right for a continued ability to use lands and resources for traditional purposes, including gathering, harvesting and cultural activities. The Round 1 information requests also re-enforces the need to consider potential effects of the Project on the socio-economic and health effects on Aboriginal people.

The following valued components (VCs) were defined in Section 6.1.3.20 for focussing the evaluation of the effects of the Project on Aboriginal peoples:

- Human health;
- Harvesting and gathering of plant materials;
- Hunting;
- Trapping;
- Fishing;
- Cultural and spiritual; and
- Socio-economic factors.

These valued components were selected with consideration for the available traditional knowledge (presented as part of Section 5.1 through 5.12, and Section 9.XXX to 9.XXX), and information regarding the current use of the land and resources for traditional purposes by members of the Indigenous communities, as described in Section 5.13.

The potential effects of the Project on the Aboriginal peoples VCs will vary by phase through the Project life, and can be linked to the following activities:

- **Site preparation and construction phase**:
  - Air and noise emissions;
  - Noise and vibration from blasting;
  - Loss of habitat due to the clearing of vegetation;
  - Draining or overprinting of wetlands;
  - Overprinting of waterbodies;
  - Construction of the perimeter ditch/berm;
  - Enclosure of watershed areas;
  - No surface water releases from Project; and
  - Change in access for traditional use of lands and resources.
- **Operations phase**:
  - Mining activities, including extraction and processing of ore;
  - Air, noise and light emissions;
  - Noise and vibration from blasting;
  - Continued loss of cleared habitat;

- Continued loss of overprinted or drained wetlands;
- Continued loss of overprinted waterbodies;
- Continued enclosure of watershed areas;
- Dewatering activities and the drawdown of groundwater levels;
- Discharge of treated effluent to Blackwater Creek; and
- Change in access for traditional use of lands and resources.

- **Closure phase:**
  - Air and noise emissions;
  - Grading of operations area to drain towards the open pit;
  - Reclamation of operations area;
  - Closure and capping of the WRSA and TSF;
  - Continued loss of overprinted or drained wetlands;
  - Continued loss of overprinted waterbodies;
  - Continued enclosure of watershed areas;
  - Cease dewatering activities and allow groundwater recovery;
  - Allow the underground mine and open pit to start filing with water; and
  - Change in access for traditional use of lands and resources.
- **Post-closure phase**:
  - Excess water allowed to passively drain from pit lake to Blackwater Creek;
  - Continued loss of overprinted wetlands;
  - Continued loss of overprinted waterbodies;
  - Continued enclosure of watershed areas;
  - Some recovery of drained wetlands;
  - Some recovery of downstream sections of overprinted watercourses;
  - Groundwater levels recover to near-predevelopment levels;
  - Continued change in access for traditional use of lands and resources.

The potential effects on Aboriginal peoples have been described using a linkage diagram (Figure 6.21.1-1), which shows the linkages between the Aboriginal peoples VCs (shown in blue on the figure) and the VCs associated with the other disciplines (shown I red on the figure). Figure 6.21.1-1 illustrates how the Aboriginal peoples VCs focus the predicted effects of the {Project for the other disciplines (Section 6.2 through 6.20) to describe how the changes to the environment as a result of the Project could alter or affect the Aboriginal peoples VCs. In describing the effects of the Project on the Aboriginal peoples VCs in this section of the EIS, a pan-Aboriginal approach has been taken shown in blue, recognizing that effects to human health, noise levels, surface water, groundwater, vegetation (including wild rice, berries, medicinal plants), wildlife (including moose, beaver and waterfowl), fish and fish habitat may adversely affect the ability of Aboriginal peoples to continue to practice their current use of lands and resource for traditional purposes. The effects of the Project on members of each Indigenous community ability to practice their current land and resource use for traditional purposes is specifically discussed in Section 6.22 of the EIS, which combines the predicted effects on the resources and lands described in this section of the EIS, with the information in Section 5.13 describing how the Indigenous communities are using the lands and resources.

6.21.2 Effects Prediction Methods

Information on land and resource use for traditional purposes was obtained directly through community engagement activities such as community meetings, phone calls, emails and feedback received from Indigenous communities following their review of the original EIS (i.e., primary source information, Appendix DD). Traditional knowledge regarding each of the disciplines assessed in the EIS and information regarding the current land and resource use for traditional purposes was provided in each subsection of Section 5. In additional to primary sources of information, information was also obtained from secondary information sources such as:

- Other projects proposed or currently being undertaken in the area;
- Forest management plans;
- Government documents;
- Materials posted on websites, including community websites; and
- Specific studies and reports.

Information gathered from these secondary sources complimented, and in some cases expanded upon, primary source materials.

Quantitative assessments relating to other VCs that potentially affect Aboriginal VCs are provided in Sections 6.2 through 6.15. Potential human health risks to non-Aboriginal receptors and Aboriginal human receptors are assessed in Section 6.19. In cases where quantitative data are not available, adverse effects have been assessed on the basis via qualitative analysis.

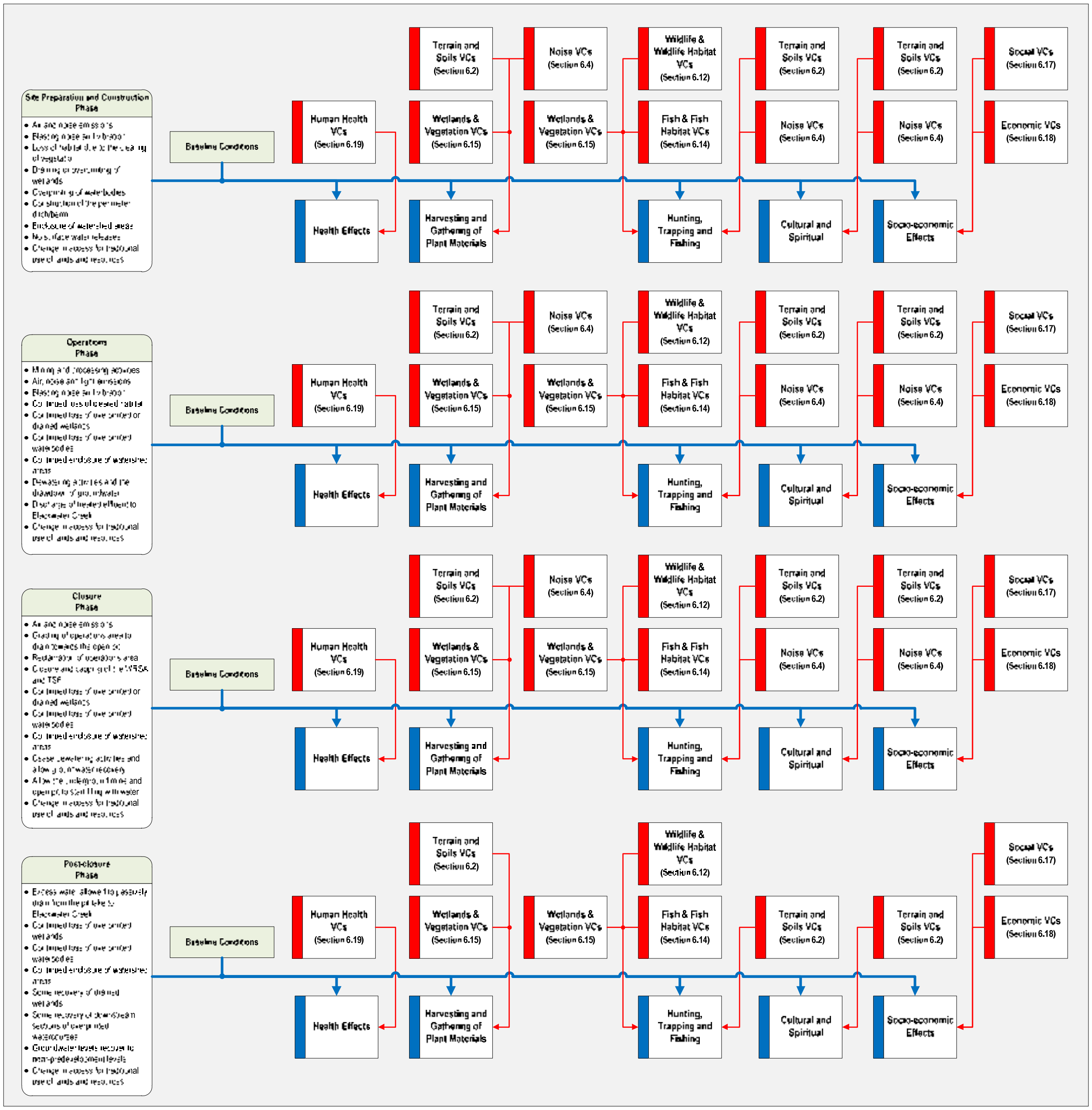


Figure 6.21.1-1: Aboriginal Peoples Linkage Diagram

6.21.3 Project Effects Avoidance Measures Used in Predictions

Aspects of the Project design have the effect of reducing potential effects through avoidance. Avoidance measures within the Project design affecting Aboriginal people valued components are listed below. Many of the avoidance measures listed will have the effect of limiting potential adverse effects to several VCs.

- Development of a compact site. [Mit_050].
- Develop the Project with appropriate setbacks from waterbodies. [Mit_118; Mit_121].
- Use of existing infrastructure for site access. [Mit_065].
- Avoidance measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site. [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006].
- Air quality avoidance measures (Section 6.6.3) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_046].
- Noise and blasting avoidance measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032].
- Light avoidance measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].
- Avoidance measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality. [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024].
- Avoidance measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat. [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074].
- Avoidance measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat. [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].
- Avoidance measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project. [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].
- Avoidance measures for effects to human health (Section 6.19.5) will help to minimize any human health effect to Aboriginal peoples from Project activities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128].
- Avoidance measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project. [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].

- Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project. [Mit_046, Mit_093, Mit_095, Mit_097, Mit_099, Mit_102, Mit_103, Mit_104, Mit_105, Mit_106, Mit_108, Mit_109, Mit_110, Mit_111, Mit_112, Mit_114, Mit_115, Cmt_017, Cmt_038].

- Avoidance measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the Project. [Cmt_003, Cmt_004, Mit_103, Mit_104, Mit_105, Mit_123].

- Implementation of a Health and Safety Plan including additional personal protective equipment for workers, and restricted site access for all non-worker receptors. [Mit_129; Mit_130].

6.21.4 Predicted Effects

Predicted effects, described in this section, are those effects which are predicted to occur taking into consideration avoidance measures that have been designed to limit potential effects. The assessment is informed by primary and secondary traditional land and resource data documented in Section 5.13.3, as well as by experience with other similar resource projects in northern Ontario.

Human Health

The potential effects of the Project on the human health of Aboriginal peoples were in part evaluated in the EIS by completing a screening level risk assessment, or SLRA. The results of the SLRA were provided as Appendix W to the EIS. An SLRA is intended to be an inherently conservative approach for calculating the potential effects of the Project, therefore the SLRA focussed on the operations and post-closure phases of the Project when the potential effects to human health are expected to be highest because of activity levels and expected releases, resulting in potential higher exposures. The potential risks to human health during the site preparation and construction, and closure phases of the Project are expected to be similar to, but lower than the effects associated with the operations phase.

The Human Health Risk Assessment (HHRA) completed as part of the SLRA, was conducted in accordance with the accepted Health Canada PQRA/DQRA procedure with additional consideration given to Schedule C of Ontario Regulation 153/04, which outlines the official regulatory requirements of a risk assessment in Ontario as defined by the Ontario Ministry of Environment and Climate Change (MOECC). For projects in Ontario, the definition of an acceptable cancer risk associated with a carcinogenic chemical is an incrementation of lifetime cancer risk (ILCR) of one in one million (1×10^{-6}), and for characterizing acceptable risks associated with non-carcinogenic chemicals, a hazard quotient (HQ) of 0.2. The procedure evaluates potential hazards, receptors, and exposure pathways to determine if the potential risk identified, exceeds Health Canada/MOECC acceptable risk benchmarks. The identification of risks above the level of acceptability does not mean that health effects will occur, but rather that predicted/modelled concentrations of parameters are sufficiently elevated to warrant risk management measures or a more detailed risk assessment including a higher degree of site-specific considerations. A screening level risk assessment is performed with the greatest degree of conservatism which in turn may lead to an over estimation of potential risk.

In the case of this SLRA completed as part of the EIS (Appendix W), the objective was to conduct a conservative, screening level risk assessment to identify which chemicals or contaminants of concern (COCs) may have the potential to cause adverse health effects to human and ecological receptors, based on understanding of the Project, the effects of the Project and the scenarios used to characterize the use of the land, and thus potential levels of exposure. Chemicals or contaminants of potential concern (COCs) in soil (baseline soils, waste rock, and tailings), water, and air and dust were selected based on their exceedances of their respective federal or provincial guidelines/ standards which is provided in detail in Section 6.19.2.2. Contaminant transport, toxicity, and fate mechanisms are determined by the chemical structure, therefore there is typically a secondary qualitative screening process where COCs are differentiated by their intrinsic toxicity to human health, or ecological health, and in some cases both. Based on a number of Information Requests regarding the COC and pathway selection presented in Appendix W, a supplemental human health screening in support of the EIS is included in Section 6.19.2.3. Chemicals that exceed their qualitative screening process or for pathways in which there were no qualitative screening criteria available, are carried forward for quantitative risk assessment and/or require the implementation of risk management measures for the protection of human and or environmental health.

The human health risk assessment provided in Appendix W, and summarized in Section 6.14, specifically included in the assessment, changes to COC concentrations in surface water, groundwater, and ambient air quality, in addition to soils and country foods (e.g., plants, wild game, fish).

The results of the human health risk assessment identified that with the appropriately designed risk management measured the following can be concluded regarding human health:

- There is no potential risk as a result of the Project to an Indigenous community member (Aboriginal people) who may be a Resident, Worker, or Site Visitor/Harvester as a result of direct dermal contact or ingestion of soils, tailings, waste rock, or water which may become impacted as part of the Project;
- There is no potential risk as a result of the Project to an Indigenous community member (Aboriginal people) who may be a Resident, Worker, or Site Visitor/Harvester as a result of inhalation of outdoor air, indoor air, or fugitive dust which may become impacted as part of the Project;
- There is no potential risk as a result of the Project to an Indigenous community member (Aboriginal people) who may be a Resident, Worker, or Site Visitor/Harvester as a result of ingestion of country foods including plants, berries, fish, and wild game.

The result so the human health risk assessment did confirm that the mercury concentrations in waterways and fish pose sufficient potential risk to members of non-Indigenous communities and Indigenous communities to warrant the fish consumption advisory administered by the Government of Ontario for the regional area. The MOECC "The Guide to Eating Ontario Fish" discussed in Section 5.12.1.5 should be adhered to for the protection of human health of non-Aboriginal and Aboriginal people.

Harvesting and Gathering of Plant Material

Based on primary and secondary traditional land and resource use data, plant harvesting and the gathering of plant materials is focused on timber harvesting, wild rice harvesting, berry harvesting (particularly blueberries), and medicinal plant gathering. Potential adverse effects to these activities include chemical contamination, habitat loss and/or degradation, access limitation, and diminished on-the-land experience.

Several wild rice stands have been identified on Wabigoon Lake and on adjacent Dinorwic Lake (5.9.2.2-2). Figure 5.9.2.2-2 only shows the more prominent wild rice stands. Additional smaller wild rice stands are also known to occur, such as at the mouth of Blackwater Creek (Section 5.13.3). Wabigoon Lake Ojibway Nation and Eagle Lake First Nation hold the rights to Registered Wild Rice Harvesting Areas 9 and 10, which encompass Wabigoon and Dinorwic Lakes. The Aboriginal Peoples of Wabigoon also identified wild rice harvesting in the local area as a traditional activity. The Wabigoon Lake Ojibway Nation is a major wild rice harvester in the local area and has an on-reserve processing facility, the Kagiwiosa Manomin facility, which ships product to markets worldwide. Other wild rice harvesting areas occur downstream on the Wabigoon River system. Wild rice harvesting is a long-standing tradition for several of the area's Aboriginal communities, and its importance cannot be overstated.

The effects assessment completed in Section 6.15 for wild rice indicates that there would be no residual effects to wild rice as a result of habitat loss, changes in water level, or changes to water quality as a result of the Project. Therefore, there are no anticipated adverse effects to the local wild rice beds, or associated harvesting activities.

Berry harvesting, and particularly blueberry harvesting, was identified as a traditional land and resource use activity in the LSA by several Indigenous communities including Wabigoon Ojibway Nation, Eagle Lake First Nation, Wabauskang First Nation, and the Métis Nation of Ontario. Blueberry and other berry types are widespread and common throughout the region, and are frequently associated with previously harvested forestry cutover or burned areas where there is more light, especially where sandy type soils occur. With forest regrowth to a more mature state, berry patches tend to be eliminated or greatly diminished due to forest canopy shading effects. In Section 6.15 (Wetlands and Vegetation), effects to the potential berry harvesting area measured was evaluated by characterizing the effects of the Project on two edible berries, blueberries and dwarf raspberry. Potential berry habitat was determined by ecosites for which these species are indicators, which are also considered habitat for most other berry species potentially affected by the Project.

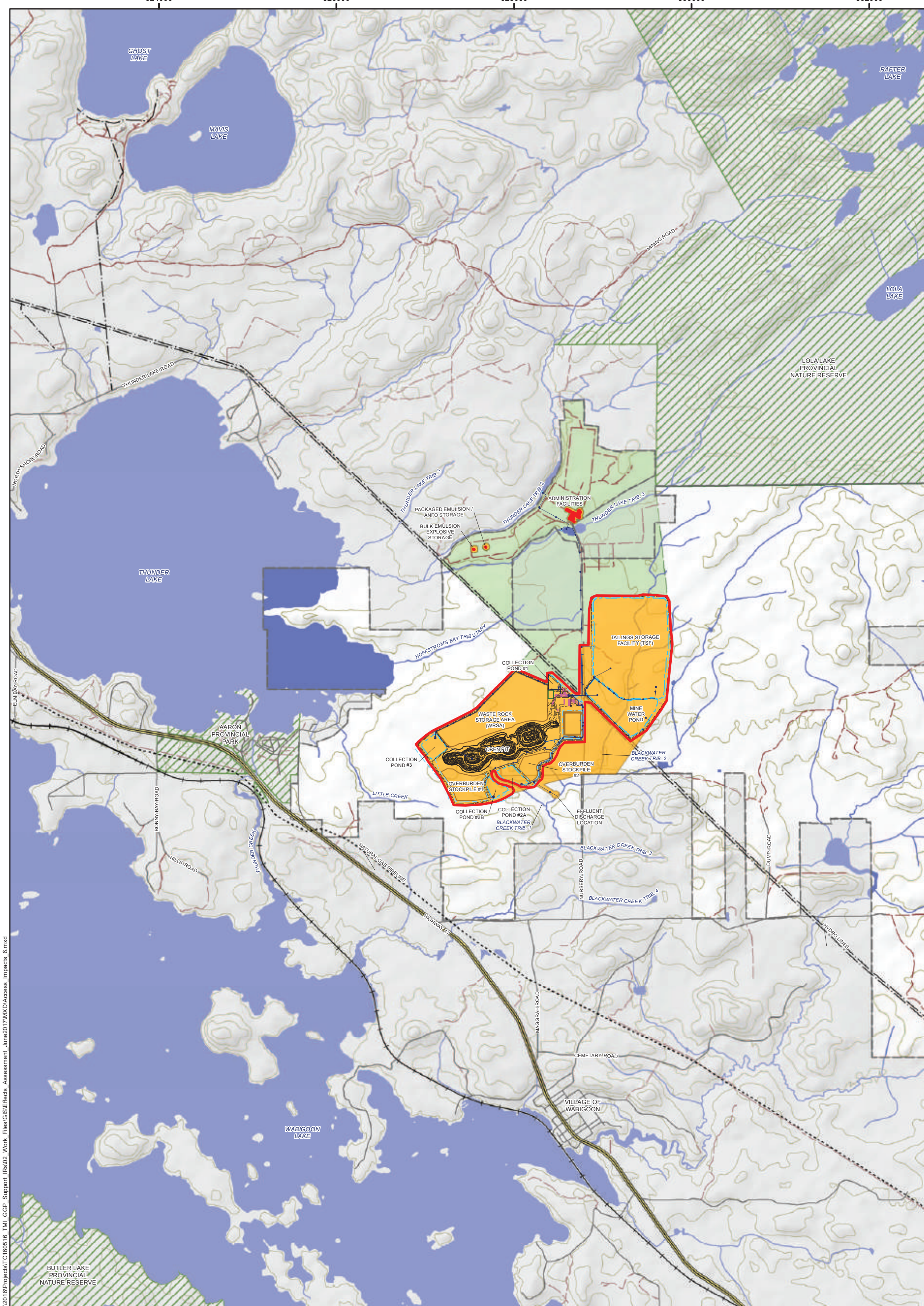
Within the terrestrial LSA, an estimated 3003 ha of suitable berry habitat has been identified (see Table 6.15.4.1-4). Of this amount an estimated 260 ha would be removed as a result of Project development, representing an 8.7% reduction in the available berry habitat in the terrestrial LSA. This includes the identified blueberry harvest areas within the TSF footprint.

The consideration of changes in the quality of country foods, including berries, was incorporated as part of the human health risk assessment described in Section 6.19. The human health risk assessment for country foods (see Section 6.19.4) determined that country foods ingestion in the operations and post-closure phases were below the Health Canada/MOECC risk benchmark for all residents and recreational users (site visitors/harvesters). Therefore, no health impacts were predicted with the consumption of country foods, including the ingestion of berries.

Medicinal plants that have been identified in the LSA and RSA include cedar, white birch, red osier dogwood and Labrador tea (Section 5.13.3), but other medicinal plants are also expected to occur. Experience from other similar projects suggests that medicinal plants tend to be gathered opportunistically in areas where there is good accessibility, but historically preferred and well-defined collection areas may also be present. To date, no such well-defined medicinal plant gathering areas have been identified on the Project site. Due to the variety of medicinal plants that could be collection in the area of the Project and the number of different ecosites that could contain medicinal plants, a conservative assumption that all forest and wetland loss as a result of the Project could contain medicinal plants. The loss of area for the collection of medicinal plants is predicted to be 47 ha of wetland and 208 ha of forest and successional habitat (see Table 6.15.6-1), which constitutes a 3.2% reduction of wetland habitat and 7.8% reduction of forest and successional habitat in the LSA. Additionally, as previously stated, the human health risk assessment for country foods (see Section 6.19.4) determined that country foods ingestion in the operations and post-closure phases were below the Health Canada/MOECC risk benchmark for all residents and recreational users (site visitors/harvesters), and therefore no predicted effects to medicinal plant ingestion were identified.

There is the potential that the Project could limit access to the harvesting and gathering of plant material designed to protect public safety. There were two separate areas where access will be changed to Aboriginal peoples as a result of the Project (see Figure 6.21.4-1).

The figure identifies two areas related to access. The first is the area (364 ha, shaded in gold) where no access will be permitted to non-workers for safety and security reasons. The second area (379 ha) is shown in Figure 6.19.4-1 as green shading represents areas where access will be restricted. Treasury Metals will allow escorted access to members of Indigenous communities who wish to practice traditional used of land and resources in this area. However, for safety reasons, the use of firearms would not be permitted in these areas with controlled access.



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LEGEND

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

Site Infrastructure

- Access Haul Roads
- Pipeline
- Ditching
- Emergency Spillway
- Processing Plant and Ancillary Facilities
- Security Fence
- Stockpile

- Operations Area
- Access Impact Footprint
- Access Affected Areas

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

0 0.5 1 2 3 4 5 Kilometres

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Areas Where Access Wil be Affectedl

PROJECT N°: TC160516	FIGURE: 6.21.4-1
SCALE: 1:40,000	DATE: April 2018

In addition to the change in access of the area surrounding the Project for safety and security reasons, there are areas around the Project where the Project will be noticeable with relatively small changes to the environment, but that would not alter the ability of harvesters to gather plant material in those areas. These areas could be considered as having a diminished contemporary experience on the land to those that harvest plant material around the Project. The predicted effects to diminished experience on the land is limited to the area of Thunder Lake where the WRSA would be visible, which would start during the operations phase and continue through the post-closure phase, and the area where the Project is audibility (i.e., environmental noise levels above 40 dBA). The noticeable noise associated with the Project would be restricted to an area of 171 ha outside of the operations area, and would occur from the site preparation and construction phase through the closure phase. There would be no sources of noise during the post closure phase. Once enough waste rock is placed in the WRSA, it will be visible from portions (852 ha) of Thunder Lake (see Section 6.2). The GIS modelling used to evaluate the effects of the Project on viewscapes identified than none of the other stockpiles at the Project would be visible offsite, and that the WRSA would only be visible at ground level from Thunder Lake. Although the WRSA will be visible from portions of Thunder Lake, it will be a prominent feature on the horizon (see Figures 6.2.4.1-4 through 6.2.4.1-6). Additionally, the surface will be vegetated following the closure of the WRSA, which will make the feature look like a natural component of the landscape, not readily discernable from the surrounding area.

Although not identified as an indicator, timber harvesting in its current form may or may not be considered as a traditional land and resource use, but clearly timber resources have been utilized by local Aboriginal peoples for a variety uses throughout time, including for construction and heating purposes, as well as for certain medicinal and ceremonial purposes. More recently, timber harvesting by at least some community members has taken on commercial proportions. This includes the Noopimiing Anokeewin Inc. forestry operation, which is a privately owned Indigenous forestry enterprise operated on the Wabigoon Lake Ojibway Nation reserve (Section 5.13.3.1). The Wabigoon Lake Ojibway Nation also maintains a tree nursey on the reserve. WLON is not the current license holder for the forest resources within the Crown forest resources affected by the Project. Additionally, there are forest resources that would be affected by the Project that are on current land owned by Treasury Metals. An estimated 95 ha of coniferous forest and 43 ha of deciduous forest will be removed for mine development, some of which is on private land and some on Crown land. The areas of private land to be cut are being coordinated by Dryden Forest Management Company, with engagement with all Indigenous communities such that any timber harvest values will be salvageable.

Hunting

Hunting is commonly practiced by members of all of the area Aboriginal communities, with moose identified as the most important game species. Other species that are regularly hunted include deer, waterfowl and rabbits. Aboriginal hunters which currently, or historically, hunted in the general vicinity of the Project area include those from the Wabigoon Lake Ojibway Nation, Eagle Lake First Nation, Whitefish Bay First Nation, Wabauskang First Nation, Lac Seul First Nation and the Métis Nation of Ontario.

In evaluating the effects of the Project on the hunting VC for Aboriginal people, consideration was given to the change in the abundance of key species (ungulates, furbearers, and waterfowl), as well as to changes in access and changes to the experience of being on the land.

For ungulates, moose was selected as the indicator given the importance placed on this species in feedback from the Indigenous communities, as well as the emphasis placed on the management of moose populations by the government. In total, 84 ha of moose habitat would be cleared in the site preparation and construction phase. This area would remain unavailable for moose until the post-closure phase when reclamation activities have been successful in returning the site to a usable ecosystem. In addition to the areas cleared by the Project, there would be up to an additional 57 ha where the environmental noise levels would be in excess of 50 dBA. Literature has identified that, when noise levels exceed 50 dBA, wildlife behaviour can change. In total, 0.6% of the available ungulate habitat in the RSA (22,632 ha, per Section 6.12.4.1) would be affected by the Project.

Furbearers have been represented using two indicators, namely the American marten and the American beaver. During the site preparation and construction phase, 62 ha of American marten habitat will be cleared. Modelling identified that environmental noise levels were predicted to exceed 50 dBA over an additional 34 ha (during operations). In total, the Project is predicted to affect 7.4% of the available American marten habitat in the LSA (1,297 ha, per Section 6.12.4.1). For American beaver, the Project will result in the loss of 3.95 ha of impoundments during the site preparation and construction phase. Of this area, only 0.15 ha is associated with current beaver activity. The clearing of these impoundments and the associated beaver will be done following engagement with the local trapper, Dryden Trappers Council, the Indigenous communities and the MNRF. No negative effects on the population of American beaver are predicted as there is ample alternative habitat available within the local study area.

The third indicator used for the hunting VC is waterfowl. During the site preparation and construction phase, 32.6 ha of wetland will be overprinted or drained as a result of the Project. A further 14.4 ha of wetland will potentially be affected during operations by the change in groundwater due to the dewatering activities. In addition, there will be a further 7.5 ha of wetland area where noise levels will exceed 50 dBA. In total, the Project could affect as much as 3.8% of the available wetlands in the LSA (1,439 ha, per Table 6.15.4.1-1).

The consideration of changes in the quality of country foods was incorporated as part of the human health risk assessment described in Section 6.19. The human health risk assessment for country foods (see Section 6.19.4) determined that country foods ingestion in the operations and post-closure phases were below the Health Canada/MOECC risk benchmark for all residents and recreational users (site visitors/harvesters). Therefore, no health impacts were predicted with the consumption of country foods, including the ingestion of meats harvested by hunting near the Project.

Finally, there is the potential that the Project could affect the access for hunting by members of Indigenous communities. Figure 6.21.4-1 illustrates two separate areas where access will be changed for members of Indigenous communities. The first is the area (364 ha, shaded in gold) where no access will be permitted to non-workers for safety and security reasons. The second area (379 ha, shaded in green) shows where access will be restricted. For safety reasons, hunting would not be permitted within either the gold or green areas (743 ha). Given the compact footprint of the Project, this means that access for Aboriginal hunters to most (85%) of the local study area (LSA) would remain unchanged as a result of the Project. On a regional scale, the Project would affect access to less than 0.3% of the RSA. Considerable alternative hunting areas are available locally and regionally; therefore, the removal of access to a comparatively small area for hunting is unlikely to meaningfully diminish Aboriginal hunting potentials in the region. Treasury Metals is not currently aware of recent hunting activities on Project lands, but local Aboriginal hunters have indicated that they have hunted in this area in the past.

A summary of the residual adverse effects to each of the hunting indicators is provided in Table 6.21.4-1.

Trapping

The LSA is intersected by three traplines (DR026, DR027 and DR021). The ownership of these traplines is currently not known to Treasury Metals, but it is known that a large proportion of the trapping licences in the area are held by Aboriginal peoples, such that for the purpose of this assessment it is assumed that the three traplines are currently held by Aboriginal peoples, or that they could potentially be held by Aboriginal peoples at some point in the future. The primary species of interest to trappers in the area are marten and beaver (furbearers), but several other species are also trapped.

In evaluating the effects of the Project on wildlife and wildlife habitat (see Section 6.12), furbearers have been represented using two indicators, namely the American marten and the American beaver. During the site preparation and construction phase, 62 ha of American marten habitat will be cleared. Modelling identified that environmental noise levels were predicted to exceed 50 dBA over an additional 34 ha (during operations). In total, the Project is predicted to affect 7.4% of the available American marten habitat in the LSA (1,297 ha, per Section 6.12.4.1). For American beaver, the Project will result in the loss of 3.95 ha of impoundments during the site preparation and construction phase. Of this area, only 0.15 ha is associated with current beaver activity. The clearing of these impoundments and the associated beaver will be done following engagement with the local trapper, the Indigenous communities and the MNRF. No negative effects on the population of American beaver are predicted as there is ample alternative habitat available within the local study area.

The proposed Project development area is mostly contained within trapline DR026. This trapline covers an area of 22,711 ha, of which 309 ha would be directly overprinted by the proposed development zone. Trapline DR027 covers an area of 21,990 ha, which will only have 0.5 ha overprinted by the Project, and a further 4 ha could potentially be affected by habitat disturbance based on the 50 dBA noise threshold. Therefore, from a potential disturbance perspective approximately 1.3% of trapline DR026 and approximately 0.02% of trapline DR027 is expected to be affected to some level by Project development and operation. Trapline DR021 is located outside of potential Project development and disturbance zones.

Treasury Metals is not currently aware of recent trapping activities on Project lands, but members of Wabigoon Lake Ojibway Nation, and Eagle Lake First Nation have indicated that they have trapped this area in the past, particularly for marten and beaver.

Additionally, there is the potential that the Project could affect the access for trapping by members of Indigenous communities. Figure 6.21.4-1 illustrates two separate areas where access will be changed for members of Indigenous communities. The first is the area (364 ha, shaded in gold) where no access will be permitted to non-workers for safety and security reasons. The second area (379 ha, shaded in green) shows where access will be restricted. For safety reasons, hunting would not be permitted within either the gold or green areas (743 ha). Given the compact footprint of the Project, this means that access for Aboriginal trappers to most (85%) of the local study area (LSA) would remain unchanged as a result of the Project. On a regional scale, the Project would affect access to less than 0.3% of the RSA. Considerable alternative hunting areas are available locally and regionally; therefore, the removal of access to a comparatively small area for trapping is unlikely to meaningfully diminish Aboriginal trappers' potentials in the region. Treasury Metals is not currently aware of recent trapping activities on Project lands, but members of Wabigoon Lake Ojibway Nation have indicated that they have trapped in this area in the past.

In addition to the change in access of the area surrounding the Project for safety and security reasons, there are areas around the Project where the Project will be noticeable with relatively small changes to the environment, but that would not alter the ability of harvesters to trap in those areas. These areas could be considered as having a diminished experience on the land to those that trap around the Project. The predicted effects to diminished experience on the land is limited to the area of Thunder Lake where the WRSA would be visible during the operations phase into the post-closure phase, and the area where the Project is audibility (above 40 dBA) during the site preparation and construction, operations and closure phases. However, although the WRSA will be visible from Thunder Lake, it will be covered and vegetated to look like a natural feature of the landscape in the closure phase and may not be discernable from the surrounding landscape. The area where the WRSA may be visible and where the Project would be audible is shaded in green over Thunder Lake in Figure 6.21.6-1. The total area that could have a diminished experience on the land is 1023 ha (852 ha from the visibility of the WRSA and 171 ha from the audibility of the Project).

Fishing

Wabigoon Lake and Thunder Lake are important sustenance fisheries to Aboriginal peoples. In addition, members of Wabigoon Lake Ojibway Nation and the Whitefish Bay First Nation (Naotkamegwanning First Nation) also hold commercial fishing licences on Wabigoon and Thunder Lakes. There is consequently considerable interest among Indigenous community members regarding water quality and aquatic life protection.

As stated in Section 6.14, the Project will result in the loss of fish habitat during the site preparation and construction phase, specifically sections of Blackwater Creek Tributaries 1 and 2. These tributaries are not suitable sport fish habitat or sport fish spawning habitat and only bait fish would be affected in these tributaries as a result of the Project. The potential mortality is predicted to be 50% of the population during fish salvage in the stretches of tributaries that are being drained for the construction of Project components. The removal of these aquatic habitat environments would need to be offset by constructing new fish habitat that is generally proportional to the amount and quality of habitat lost. Therefore, there are no predicted effects to fish abundance for harvest as a result of Project activities.

Downstream of the Project, the water quality and flows to surrounding watercourse will be affected as a result of discharges from the Project, water taking from the irrigation ponds, change in catchment areas of sub-watersheds, and changes in groundwater due to mine dewatering. As stated in Section 6.8.6, the surface water quality modelling results has shown that water quality in the surrounding environment will be equivalent to existing conditions or meet PWQO for the protecting of aquatic life. During the site preparation and construction and closure phases, there will be no discharges of water leaving the operations area as all water in the operations area will be captured by the perimeter ditch. During the operations phase, changes to the concentrations of various compounds will occur in Blackwater Creek and Wabigoon Lake due to the discharge of treated effluent into Blackwater Creek. The effluent will be treated to meet PWQO for the protection of aquatic life or background concentrations if background conditions are higher prior to release into Blackwater Creek. Therefore, no adverse effects on fish will occur in the receiving environment as a result of the changes to water quality. As the entire operations area is enclosed by the perimeter ditch and there is only one point of effluent discharge, there are no other locations where changes in water quality will occur during operations. During post-closure, water will overflow from the open pit into Blackwater Creek Tributary 1. This water will either meet PWQO or be less than background and will therefore not have an effect on residual fish contaminant concentrations in any surrounding surface waterbodies. Changes in surrounding surface water flows as a result of the Project should not impact fish or fish habitat, but may need to be offset. The changes in flows are not anticipated to cause any measurable change in the water levels of Thunder Lake and Wabigoon Lake. Therefore, there are no predicted effects to the abundance of sport fish in Wabigoon or Thunder Lake for subsistence or commercial uses.

As water quality will be equivalent to existing conditions or meet PWQO, there are no residual effects to fish contaminant concentrations as a result of changes to surrounding surface water quality from the Project. That stated, as described in Section 5.1.12.5 “Eating Ontario Fish”, a fish consumption advisory in effect in the regional area to protect human receptors from mercury toxicity. The Project will not alter this fish consumption advisory as it will discharge at mercury concentrations below background. There are therefore no predicted effects to the contaminant concentration in fish as a result of the Project.

There is the potential that the Project could limit access to bait fishing areas directly adjacent to the Project. Members of Wabigoon Lake Ojibway Nation, Eagle Lake First Nation, Whitefish Bay First Nation, and Wabauskang First Nation have identified that baitfishing (minnow trapping) occurs at two locations within the Project area, outside of the proposed Project footprint; baitfish have been found in the irrigation pond as well as other ponds in the area, and along local creeks including Blackwater Creek. The identified ponds in the Project area where baitfishing currently occurs are the two Tree Nursery Ponds. These are the only ponds in the immediate Project area, outside of beaver ponds on the local creeks. The two Tree Nursey Ponds are proposed as a water supply source for the Project, but a commitment has been made not to take more than five percent of the inflow to these ponds, and to use fish screens at the water taking locations. A commitment has also been made to continue to allow Aboriginal peoples access to the Tree Nursey Ponds so that they can continue to harvest baitfish from the ponds.

Cultural and Spiritual Components

Traditional knowledge obtained through primary and secondary sources has been integrated into the existing environment component of the EIS (Sections 5.2 through 5.12). Based on the information provided by Indigenous communities, there were a number of cultural and spiritual components identified in the vicinity of the Project, and in the Dryden area. The following components were identified by Indigenous communities as cultural and spiritual components:

- Cultural sites of spiritual significance identified proximal to the Project area (Wabigoon Lake Ojibway Nation);
- Archaeological sites in Thunder Lake and Wabigoon Lake could be underwater (Wabigoon Lake Ojibway Nation);
- Mavis and Ghost Lakes where there is a sacred site called The Serpent (Eagle Lake First Nation);
- Areas of cultural significance (spirit rocks) on Wabigoon Lake (Eagle Lake First Nation);
- Historical travel route through Eagle Lake (Naotkamegwanning First Nation);
- Rocks and boulders south of the community of Wabigoon [on Wabigoon Lake] are of cultural significance (Naotkamegwanning First Nation);
- Thunder Lake was used as a traditional canoe route to Rice Lake. Elders camped throughout on the sandy beaches. Travel routes identified from Wabigoon to Thunder Lake to Ghost Lake to Rice Lake to gather wild rice (Naotkamegwanning First Nation);
- Ceremonial sites in the area include stone circles found on residential properties around the Project site (Naotkamegwanning First Nation);
- Wabigoon Lake is the biggest wild rice area in Canada and is used as a spiritual and teaching area (Naotkamegwanning First Nation); and
- Identified sacred aspects of the environment in the Project area, including turtles, frogs, rocks and boulders, and that there are sacred sites south of Wabigoon. The community has a strong connection to the land, and the community cannot relocate if there are impacts from the Project to the environment (Naotkamegwanning First Nation).

No other cultural or spiritual components have been identified by Indigenous communities in the vicinity of the Project site, or in the Dryden area. As none of these spiritual or cultural components will be affected by the Project based on the effects assessment provided in Sections 6.2 through 6.21, there are no predicted effects to spiritual and cultural components.

Additionally, there are areas around the Project where the Project will be noticeable with relatively small changes to the environment, but that would not alter the ability of harvesters to trap in those areas. These areas could be considered as having a diminished contemporary, cultural or spiritual experience of being on the land. The predicted effects to diminished cultural or spiritual experience on the land is limited to the area of Thunder Lake where the WRSA would be visible during the operations phase into the post-closure phase, and the area where the Project is audibility (above 40 dBA) during the site preparation and construction, operations and closure phases. However, although the WRSA will be visible from Thunder Lake, it will be covered and vegetated to look like a natural feature of the landscape in the closure phase and may not be discernable from the surrounding landscape. The total area that could have a diminished experience on the land is 1023 ha (852 ha from the visibility of the WRSA and 171 ha from the audibility of the Project). There are no identified cultural or spiritual sites where the Project will be audible or visible, including the identified sacred site by Eagle Lake First Nation known as The Serpent.

Socio-economic Factors

The demand for employees, goods and services will increase in the study area during the construction and operations phases. Training opportunities will also be available to assist Aboriginal peoples with employment readiness [Mit_104 and Mit_105]. During closure, this demand will decline and during post-closure the demand will terminate. These aspects are regarded as positive effects in that there is currently a need for additional employment and business opportunities in the region, and especially among Aboriginal peoples. Once operations of the mine cease and there is no longer employment from the Project, the training and experience obtained by the employees will be transferable to other employment opportunities. Additionally, communities such as the Wabigoon Lake Ojibway Nation have already demonstrated an aptitude for business ventures through development of forestry and wild rice processing operations, and as such would also be expected to take advantage of business opportunities afforded by Project development and day-to-day operations. It is therefore projected that the Project will have a positive impact on the economics of the region during the site preparation and construction, operations and closure phases, and will have a neutral impact during the post-closure phase.

In-migration could occur in the socio-economic study area associated with site preparation and construction-related employment opportunities. This may help to reverse the pattern of out-migration in the socio-economic study area; however, it is expected that not all in-migrants will permanently locate to the area. Effects will be influenced by factors including, but not limited to: location, availability of housing, personal decision-making and location of origin of workers.

In-migration of workers and families into the local could also place additional demands on housing availability, emergency services, and infrastructure. The change in housing availability and demand could increase property values in the area, which could be considered both a positive or adverse effect. It is a positive effect for people selling their property in the Project area and a negative effect for people looking to buy property in the Project area. There would also be an increase on the demand for emergency services within the Project area, which could adversely affect the services provided.

Based on the traffic study completed for the Project (see Appendix E), there will be a slight increase in the volume of traffic on the small stretch of Highway 17 from Dryden to the turnoff on Anderson Rd. However, the road network capacity will be adequate to handle the slight increase in traffic volume.

There have been identified concerns from Indigenous communities about the jobs that will be created by the Project, and the education requirements needed to apply for the jobs. Based on the employment effects of the Project (see Table 6.18.4.2-1) there are a number of jobs that will be created as a result of the Project for varying levels of educational requirements.

6.21.5 Identified Mitigation

A number of avoidance measures have been factored into Project designs and operational procedures to limit the potential for adverse effects to Aboriginal peoples, as per Section 6.21.3. Mitigation measures are measures which can be implemented to further reduce potential adverse effects which go beyond avoidance. An example would be fish habitat offsets to minimize potential adverse effects to baitfish by providing compensatory fish habitat to offset the unavoidable overprinting of tributary creek habitats.

Mitigation measures listed below will have to effect of further limiting potential adverse effects to several VCs. Some mitigation measures are applicable to more than one predicted effect.

- Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process. [Mit_093].
- Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan. [Cmt_031].
- Treasury Metals will undertake a land and resources use baseline to establish a pre-construction baseline of the land and resource users. This will serve as the basis for future monitoring and management of land and resources uses effects throughout the life of the Project. [Mit_094].

- Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site. [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006].
- Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046].
- Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043].
- Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].
- Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality. [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024].
- Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat. [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074].
- Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat. [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].
- Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project. [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].
- Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project.
- Mitigation measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the Project.
- Mitigation measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project. [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].
- Plan to ensure socio-economic commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed. [Mit_095].

- Continue to collect traditional land use information for the Project area through meetings and traditional land use studies to identify any additional areas of plant gathering, hunting, trapping, fishing, and cultural activities. [Mit_096].
- During the operating life of the Project, the operations area will be fenced and no access will be permitted for security and safety reasons. Access to the former MNRF Tree Nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited. [Mit_092].
- Develop and implement employment practices that give preference to local and regional labour where possible, including Aboriginal communities. This includes participation in job fairs and the direct distribution of employment opportunities to local First Nation and Aboriginal administration offices to encourage qualified Aboriginal persons to seek employment opportunities with Treasury Metals. The application of this policy is dependent upon the skills and workforce being available locally. [Mit_103].
- Closure mitigation measures will focus on working with the affected communities and government agencies to develop a mine closure plan that includes a strategy for buffering the effects of eventually losing direct mine-related jobs and assist in the placement of potentially affected employees. [Mit_098].
- Develop training programs for unemployed and under employed resident and non-resident workers. Training would be done through in-house programs and in conjunction with local and regional educational institutes. [Mit_105].
- Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers. [Mit_116].
- Closely and frequently communicate with government agencies and service providers to ensure that the appropriate information (e.g., proposed transportation volumes, potential variation to the local population) are considered in the planning of future services and response capabilities. Work with Aboriginal communities and other local and regional governments to minimize the in-migration workforce where possible. [Mit_109].
- Work with public safety services to develop safety and work policy guidelines for mine workers. [Mit_110].
- Work with local agencies to assist in monitoring community wellbeing and take corrective actions where appropriate. [Mit_111].

6.21.6 Residual Effects

The residual effects on Aboriginal peoples are presented in Table 6.21.6-1.

Table 6.21.6-1 Aboriginal Peoples Residual Effects

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
Human Health	Risk Assessment for Indigenous Human Health	Potential risk relative to Health Canada risk benchmarks	No residual effect: No potential human health risks were identified via any of the exposure pathways as a result of the Project.	No residual effect: No potential human health risks were identified via any of the exposure pathways as a result of the Project.	No residual effect: No potential human health risks were identified via any of the exposure pathways as a result of the Project.	No residual effect: No potential human health risks were identified via any of the exposure pathways as a result of the Project.
Harvesting and Gathering of Plant Material	Wild Rice	Loss of wild rice areas	No residual effect: There will be no loss in wild rice area as a result of the Project.	No residual effect: There will be no loss in wild rice area as a result of the Project.	No residual effect: There will be no loss in wild rice area as a result of the Project.	No residual effect: There will be no loss in wild rice area as a result of the Project.
		Change in water quality	No residual effect: Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project.	No residual effect: Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project.	No residual effect: Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project.	No residual effect: Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project.
		Changes in water levels	No residual effect: There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project.	No residual effect: There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project.	No residual effect: There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project.	No residual effect: There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project.
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
	Berry Harvesting	Loss of potential harvest areas	Residual effect: 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA.	Residual effect: 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA.	Residual effect: 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA.	Residual effect: 168 ha of berry habitat loss in perpetuity due to the WRSA, open pit and TSF. Constitutes 5.6% of the available berry habitat in the terrestrial LSA.
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
	Medicinal Plant Harvesting	Loss of forest	Residual effect: 208 ha loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA.	Residual effect: 208 ha loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA.	Residual effect: 208 ha loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA.	Residual effect: 168 ha loss for potential medicinal plant harvesting in perpetuity due to the open pit, WRSA and TSF. Constitutes 6.3% of forest habitat in the LSA.
		Loss of wetland	Residual effect: 32.6 ha loss for potential medicinal plant harvesting. Constitutes 2.3% of wetland habitat in the LSA.	Residual effect: 47.0 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of wetland habitat in the LSA.	Residual effect: 47.0 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of wetland habitat in the LSA.	Residual effect: 47.0 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of forest habitat in the LSA.
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
			identified in human health risk assessment as a result of the Project.	identified in human health risk assessment as a result of the Project.	identified in human health risk assessment as a result of the Project.	foods identified in human health risk assessment as a result of the Project.
	Changes in Access	Land where access is controlled	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	No residual effect: No access restrictions in the post-closure phase.
		Land removed from access	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	No residual effect: No access restrictions in the post-closure phase
	Diminished on-the-land Experience	Changed views	No residual effect: Project features will not be visible off-site	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable
		Noticeable changes in noise	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	No residual effect: There will be no source of noise from the Project
Hunting	Ungulates	Habitat Loss	Residual effect: 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA.	Residual effect: 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA.	Residual effect: 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA.	No residual effect: Habitat in the post-closure phase will return.
		Quality for consumption	No residual effect:	No residual effect:	No residual effect:	No residual effect:

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
			No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
	Furbearers	Habitat Loss	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect: Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect: Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect: Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	No residual effect: Habitat in the post-closure phase will return.
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
	Waterfowl	Habitat Loss	Residual effect: 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA.	Residual effect: 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA.	Residual effect: 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA.	No residual effect: Habitat in the post-closure phase will return.
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country foods	No residual effect: No residual effects via ingestion of country

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects: Site Preparation and Construction	Operations	Closure	Post-Closure
			identified in human health risk assessment as a result of the Project.	identified in human health risk assessment as a result of the Project.	identified in human health risk assessment as a result of the Project.	foods identified in human health risk assessment as a result of the Project.
	Changes in Access	Land where access is controlled	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	No residual effect: No access restrictions in the post-closure phase.
		Land removed from access	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	No residual effect: No access restrictions in the post-closure phase
	Diminished on-the-land Experience	Change views	No residual effect: Project features will not be visible off-site	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable
		Noticeable changes in noise	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	No residual effect: There will be no source of noise from the Project
Trapping	Furbearers	Habitat Loss	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect:	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect:	Residual effect: 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. No residual effect:	No residual effect: The operations area will be reclaimed to productive habitat available for trapping.

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
			Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	Ample beaver habitat in the LSA not a meaningful amount of habitat removed.	
	Changes in Access	Land where access is controlled	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons	No residual effect: No access restrictions in the post-closure phase.
		Land removed from access	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	No residual effect: No access restrictions in the post-closure phase
	Diminished on-the-land Experience	Change views	No residual effect: Project features will not be visible off-site	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable
		Noticeable changes in noise	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	No residual effect: There will be no source of noise from the Project
Fishing	Sport Fish	Change in abundance	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
		Quality for consumption	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.	No residual effect: No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
	Baitfish	Change in abundance	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.
	Commercial Fishing	Fish for consumption (sport fish)	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.	No residual effect: Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake.
		Bait fishing	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.	No residual effect Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
	Changes in Access	Land where access is controlled	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons. The irrigation ponds at the former MNRF Tree Nursery will still be accessible.	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons. The irrigation ponds at the former MNRF Tree Nursery will still be accessible.	Residual effect: 379 ha where access will require a Treasury escort for safety and security reasons. The irrigation ponds at the former MNRF Tree Nursery will still be accessible.	No residual effect: No access restrictions in the post-closure phase.
		Land removed from access	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	Residual effect: 364 ha where access will be removed for safety and security reasons	No residual effect: No access restrictions in the post-closure phase
	Diminished on-the-land Experience	Change views	No residual effect: Project features will not be visible off-site	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable
		Noticeable changes in noise	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	No residual effect: There will be no source of noise from the Project
Cultural and Spiritual	Cultural and Spiritual Sites	Loss or disturbance to known sites	No residual effect: No identified cultural or spiritual site will be affected by the Project	No residual effect: No identified cultural or spiritual site will be affected by the Project	No residual effect: No identified cultural or spiritual site will be affected by the Project	No residual effect: No identified cultural or spiritual site will be affected by the Project
		Restriction to access	No residual effect: There will be no restriction to access to any identified cultural or	No residual effect: There will be no restriction to access to any identified cultural or	No residual effect: There will be no restriction to access to any identified cultural or	No residual effect: There will be no restriction to access to any identified cultural or

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects: Site Preparation and Construction	Operations	Closure	Post-Closure
			spiritual sites due to the Project	spiritual sites due to the Project	spiritual sites due to the Project	spiritual sites due to the Project
	Traditional Travel Routes	Interruption – discontinued	No residual effect: There are no known traditional travel routes through the immediate Project site.	No residual effect: There are no known traditional travel routes through the immediate Project site.	No residual effect: There are no known traditional travel routes through the immediate Project site.	No residual effect: There are no known traditional travel routes through the immediate Project site.
		Interference – close to Project	No residual effect: Traditional travel routes to Rice Lake via Thunder Lake will not be affected.	No residual effect: Traditional travel routes to Rice Lake via Thunder Lake will not be affected.	No residual effect: Traditional travel routes to Rice Lake via Thunder Lake will not be affected.	No residual effect: Traditional travel routes to Rice Lake via Thunder Lake will not be affected.
	Diminished on-the-land Experience	Change views	No residual effect: Project features will not be visible off-site	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable	Residual effect: The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable
		Noticeable changes in noise	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	Residual effect: The Project will be audible from 171 ha around the operations area	No residual effect: There will be no source of noise from the Project
Socio-economic Factors	Economic Effects	Aboriginal employment opportunities	Residual positive effect: The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1)	Residual positive effect: The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1)	Residual positive effect: The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1)	Residual neutral effect: Although the jobs from the Project will no longer exist in the post-closure phase, the experience and training that Aboriginal peoples received can easily

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
						transfer to jobs in industry.
		Cost of living	Residual positive effect: Demand for labour, goods, and services by the Project and by workers moving into the Project area will increase the cost of living.	Residual positive effect: Demand for labour, goods, and services by the Project and by workers moving into the Project area will increase the cost of living.	Residual adverse effect: The demand for labour, goods, and services by the Project will decline and reduce the cost of living.	Residual adverse effect: The demand for labour, goods, and services by the Project will decline and reduce the cost of living.
		Project purchases from Aboriginal Businesses	Residual positive effect: Treasury Metals has committed to a local purchasing policy, which will provide business to Aboriginal people owned businesses.	Residual positive effect: Treasury Metals has committed to a local purchasing policy, which will provide business to Aboriginal people owned businesses.	Residual neutral effect: The benefits of purchases made by Treasury Metals in the local communities will cease.	Residual neutral effect: The benefits of purchases made by Treasury Metals in the local communities will cease.
	Social Effects	In- and out-migration	Residual positive effect: The Project could result in an in-migration of workers to could help reverse the pattern of out-migration in the socio-economic study area.	Residual positive effect: The Project could result in an in-migration of workers to could help reverse the pattern of out-migration in the socio-economic study area.	Residual adverse effect: The out-migration of workers leaving the area would be most prominent during this phase.	Residual adverse effect: The pattern of out-migration of the area would return to pre-project conditions.
		Capacity of education services	Residual adverse effect: Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system	Residual adverse effect: Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system	Residual adverse effect: Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system	No residual effect: The demand on education services will return to pre-project conditions.

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
		Education attainment	Residual positive effect: The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education	Residual positive effect: The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education	Residual positive effect: The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education	Residual neutral effect: Although the jobs from the Project will no longer exist in the post-closure phase, the education, experience and training that Aboriginal peoples received can easily transfer to jobs in industry.
		Project-specific Training	Residual positive effect: There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers	Residual positive effect: There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers	Residual positive effect: There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers	No residual effect: There will be no training opportunities following closure from the Project
		Housing availability	Residual adverse effect: There could be additional stresses on community housing due to in-migration of workers.	Residual adverse effect: There could be additional stresses on community housing due to in-migration of workers.	Residual adverse effect: There could be additional stresses on community housing due to in-migration of workers.	No residual effect: Housing availability will return to pre-project levels.
		Property values (off-reserve)	Residual neutral effect: There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property.	Residual neutral effect: There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property.	Residual neutral effect: There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property.	Residual neutral effect: There could be a decrease in property values to pre-project conditions. This is a negative effect to people trying to sell their property and a positive

Table 6.21.6-1 Aboriginal Peoples Residual Effects (continued)

Valued Component	Indicators	Measures	Predicted Aboriginal Residual Effects			
			Site Preparation and Construction	Operations	Closure	Post-Closure
						effect to people trying to buy property.
		Capacity of emergency services	Residual adverse effect: There could be additional stresses on the emergency services in the area due to the in-migration of workers.	Residual adverse effect: There could be additional stresses on the emergency services in the area due to the in-migration of workers.	Residual adverse effect: There could be additional stresses on the emergency services in the area due to the in-migration of workers.	No residual effect: Emergency services use would return to pre-project conditions.
		Road network capacity and conditions	No residual effect: Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.	No residual effect: Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.	No residual effect: Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.	No residual effect: Traffic on Highway 17 will return to pre-project conditions.

Several of the residual effects for Aboriginal peoples are regional in nature, and could occur anywhere within the terrestrial and aquatic study areas presented on Figures 6.1.4.16-1 and 6.1.4.16-2, respectively. There are some effects that will be spatially tied to the effects of the Project on the biophysical environment. This is the case for VC such as "hunting, trapping and fishing" and "gathering of plant material". For these VC, the spatial effects of the Project have been, to the extent possible, characterized by identifying the areas where harvesting or traditional uses of the land may be affected.

6.21.7 Information to Address Round 1 Information Requests

The following lists the questions received as part of the Round 1 information requests that relate to the predicted effects, and prediction methods, for Aboriginal peoples:

Aboriginal Health

- Government Agencies
  - TMI_169-AE(1)-07 Aboriginal health
  - TMI_194.2-HE(1)-01 Aboriginal health
  - TMI_199-HE(1)-06 Aboriginal health
  - TMI_200-HE(1)-07 Aboriginal health
  - TMI_216-HE(1)-23 Aboriginal health
  - TMI_246.1-AM(1)-04 Aboriginal health
- Eagle Lake First Nation; Wabigoon Lake Ojibway Nation
  - TMI_347-AC(1)-21 Aboriginal health
- Wabigoon Lake Ojibway Nation
  - TMI_361-AC(1)-35 Aboriginal health

Métis Nation of Ontario

Aboriginal and Treaty Rights

- Government Agencies
  - TMI_11-AC(1)-02 Impacts on Aboriginal and treaty rights
  - TMI_21-AA(1)-02 Impacts on Aboriginal and treaty rights
  - TMI_22-AA(1)-03 Impacts on Aboriginal and treaty rights
  - TMI_231.1-HE(1)-38 Impacts on Aboriginal and treaty rights
- Wabauskang First Nation; Aboriginal People of Wabigoon
  - TMI_364-AC(1)-38 Impacts on Aboriginal and treaty rights

- Wabauskang First Nation
  - TMI_396-AC(1)-71 Impacts on Aboriginal and treaty rights
- Eagle Lake First Nation
  - TMI_607.1-AC(1)-280 Impacts on Aboriginal and treaty rights
- Naotkamegwanning (Whitefish Bay) First Nation
  - TMI_642-AC(1)-315 Impacts on Aboriginal and treaty rights
  - TMI_643-AC(1)-316 Impacts on Aboriginal and treaty rights
  - TMI_679-AC(1)-351 Impacts on Aboriginal and treaty rights
  - TMI_680-AC(1)-352 Impacts on Aboriginal and treaty rights
  - TMI_684-AC(1)-356 Impacts on Aboriginal and treaty rights
- Métis Nation of Ontario
  - TMI_448-AC(1)-122 Impacts on Aboriginal and treaty rights
  - TMI_511-AC(1)-185 Impacts on Aboriginal and treaty rights
  - TMI_537-AC(1)-211 Impacts on Aboriginal and treaty rights
  - TMI_581-AC(1)-255 Impacts on Aboriginal and treaty rights
  - TMI_584-AC(1)-258 Impacts on Aboriginal and treaty rights
  - TMI_598-AC(1)-263 Impacts on Aboriginal and treaty rights
  - TMI_599-AC(1)-272 Impacts on Aboriginal and treaty rights

Traditional Land Use

- Government Agencies
  - TMI_17-PD(1)-04 Access
  - TMI_229-HE(1)-36 Traditional land use
- Eagle Lake First Nation
  - TMI_362-AC(1)-36 Traditional land use
  - TMI_618-AC(1)-291 Traditional land use study
- Wabauskang First Nation
  - TMI_363-AC(1)-37 Traditional land use
- Naotkamegwanning First Nation
  - TMI_659-AC(1)-332 Traditional land use study
  - TMI_673-AC(1)-345 Traditional land use
  - TMI_675-AC(1)-347 Traditional land use study

  - TMI_678-AC(1)-350 Traditional land use
- Multiple Aboriginal peoples
  - TMI_390-AC(1)-65 Traditional land use study
- Métis Nation of Ontario
  - TMI_415-AC(1)-90 Traditional lands
  - TMI_422-AC(1)-97 Traditional land use study
  - TMI_426-AC(1)-101 Traditional land use study
  - TMI_428-AC(1)-103 Traditional land use study
  - TMI_433-AC(1)-108 Traditional land use study
  - TMI_449-AC(1)-123 Traditional land use
  - TMI_457-AC(1)-131 Traditional land use
  - TMI_479-AC(1)-153 Traditional land use
  - TMI_485-AC(1)-159 Traditional land use
  - TMI_494-AC(1)-168 Traditional land use
  - TMI_563-AC(1)-237 Traditional land use
  - TMI_582-AC(1)-256 Traditional land use
  - TMI_585-AC(1)-259 Traditional land use study
  - TMI_600-AC(1)-273 Traditional land use

Traditional Harvesting

- Government Agencies
  - TMI_151-WL(1)-08 Traditional harvesting
  - TMI_181-AE(1)-19 Traditional harvesting
  - TMI_238.1-HE(1)-45 Traditional harvesting
  - TMI_264-EE(1)-07 Traditional harvesting
- Naotkamegwanning First Nation
  - TMI_651-AC(1)-324 Traditional harvesting
  - TMI_654-AC(1)-327 Traditional harvesting
  - TMI_665-AC(1)-338 Traditional harvesting
  - TMI_667-AC(1)-340 Traditional harvesting
- Métis Nation of Ontario
  - TMI_438-AC(1)-113 Traditional harvesting
  - TMI_500-AC(1)-174 Traditional harvesting

- City of Dryden resident
  - TMI_732-PC(1)-47 Traditional harvesting
  - TMI_733-PC(1)-48 Traditional harvesting
  - TMI_742-PC(1)-57 Traditional harvesting
  - TMI_747-PC(1)-62 Traditional harvesting

Cultural Resources

- Government agencies
  - TMI_240.1-HE(1)-47 Cultural resources
- Wabigoon Lake Ojibway Nation
  - TMI_354-AC(1)-28 Cultural resources
- Naotkamegwanning First Nation
  - TMI_664-AC(1)-337 Cultural resources
  - TMI_683-AC(1)-355 Cultural resources

Socio-economic Effects on Aboriginal people

- Government Agencies
  - TMI_226-HE(1)-33 Aboriginal socio-economic study area
  - TMI_228-HE(1)-35 Aboriginal socio-economic effects
  - TMI_265-PB(1)-1 Aboriginal socio-economic effects
- Métis Nation of Ontario
  - TMI_407-AC(1)-82 Aboriginal socio-economic conditions
  - TMI_446-AC(1)-120 Aboriginal socio-economic effects
  - TMI_496-AC(1)-170 Aboriginal socio-economic conditions
  - TMI_560-AC(1)-234 Aboriginal socio-economic effects
  - TMI_575-AC(1)-249 Aboriginal socio-economic conditions
  - TMI_578-AC(1)-252 Aboriginal socio-economic conditions

6.22 Indigenous Communities Current Land and Resource Use for Traditional Purposes

‘Aboriginal peoples' is a collective name for the original peoples of North America and their descendants. Often, ‘Indigenous peoples’ is also used. The Canadian Constitution recognizes three groups of Indigenous peoples: First Nations, Inuit, and Métis. These are three distinct peoples with unique histories, languages, cultural practices and spiritual beliefs.

As described in Section 5 of CEAA 2012, “environmental effects” to be considered include:

- Effects of any changes to the environment on Aboriginal peoples related to health and socio-economic conditions; physical and cultural heritage; current use of lands and resources for traditional purposes; or any structure, site or thing that is of historical, archeological, paleontological or architectural significance.

The environmental effects of the Project on Aboriginal Peoples were assessed in Section 6.21 of the EIS. The specific purpose of this sub-section is to address subparagraph 5(1)(c)(iii) of CEAA 2012 “with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on the current use of lands and resources for traditional purposes”. This section uses the information obtained via meaningful engagement activities with respect to current use of lands and resources for traditional purposes (Appendix DD and as summarized in Section 5.13) as per paragraph 4(1)(d) of CEAA, 2012.

The current use of lands and resources for traditional purposes by Aboriginal peoples is specific to each Indigenous community. The following Indigenous communities are included as part of the environmental assessment for the Project:

- First Nations
  - Wabigoon Lake Ojibway Nation;
  - Eagle Lake First Nation;
  - Wabauskang First Nation;
  - Lac Seul First Nation;
  - Whitefish Bay First Nation (Naotkamegwanning First Nation);
  - Grassy Narrows First Nation;
  - Lacs des Mille Lacs First Nation; and
  - Grand Council Treaty #3.
- Métis Nation of Ontario
  - Northwest Métis Council;
  - Kenora Métis Council;
  - Sunset Country Métis Council;
  - Atikokan Métis Council; and
  - The Aboriginal People of Wabigoon.

Under subparagraph 5(1)(c)(iii), effects from a designated project on the current use of lands and resources for traditional purposes are considered through a change in the environment. The current use of lands and resources for traditional purposes, as well as the exercise of treaty rights, is associated with an Aboriginal group's practices, traditions or customs, which are part of an Aboriginal group's distinctive culture and fundamental to their social organization and the sustainment of present and future generations. Practices, traditions and customs are generally defined as follows:

- Practice: a way of doing something that is common, habitual or expected;
- Tradition: a custom, opinion or belief handed down primarily orally or by practice; and
- Custom: a particular, established way of behaving.

For the purposes of the EIS, Aboriginal and Treaty Rights are defined as the historic and current uses of lands and resources for traditional purposes by members of Indigenous communities. 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.

Treasury Metals recognizes that Aboriginal 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 a 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 as they relate to traditional land and resource use activities and practices; and acknowledges that the Project may affect the availability of resources or practices within the Project area. Treasury Metals is committed to working with all communities to identify, mitigate, and avoid, or otherwise minimize, these potential effects to the extent practicable.

6.22.1 Project Description and Effects on Indigenous Communities

The Goliath Gold Project has been designed using industry best practices to ensure that any potential impacts on the environment and by association the current use of the lands by Aboriginal Peoples for traditional purposes.

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. Treasury Metals recognizes the current use of these lands by Indigenous communities for traditional purposes as part of their Aboriginal and Treaty Rights as per Treaty #3. The Operations Area of the project will be surrounded by a perimeter ditch, which will prevent direct discharges to the environment. The overall Project footprint will cover approximately 310 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). At closure, Treasury Metals will reclaim the site in accordance with best practices and regulatory requirements.

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 overall size of the Project is relatively small relative to other mining operations in Ontario with an overall Project footprint of approximately 310 ha during the maximum of extent of operations. The Project is proposed on land that is previously developed, and utilizes a number of existing components including roads, buildings, and power sources. The total lifespan of the Project is approximately 18 to 20 years beginning with site preparation and ending with the completion of care and maintenance during post-closure. The operations phase is anticipated to occur for approximately 12 of those years with progressive site reclamation ongoing, where practical.

Treasury Metals has been participating in meaningful engagement activities with the local Indigenous Communities since as early as 2008, and has considered the traditional knowledge, and information regarding current use of the land and resources for traditional purposes shared, in the design of the Project (refer to Appendix DD for a record of engagement activities). Treasury Metals is committed to continued engagement with all Indigenous communities during all Project phases to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set and that it does not have an overall meaningful adverse impact. To ensure that Indigenous communities most affected by the Project have input into the effectiveness of the Environmental Management Plans (Section 12) and Follow-up and Monitoring Programs (Section 13), designed to mitigate the impacts of the Project and to confirm the predictions made in the EIS, Treasury Metals proposes to form an Environmental Management Committee. This committee would be made up of members from Indigenous communities and would meet with representatives from Treasury Metals on a to-be-determined basis, possibly quarterly or semi-annually. Treasury Metals would present any reportable information on the management plans as well as the results of the follow-up programs. If exceedances or issues arise that show mitigation measures have not been as effective as expected, the potential for further actions would be discussed with the committee. The Environmental Management Committee would also provide a forum for discussing other environmental matters with the potentially affected Indigenous communities such as upcoming permits, additional traditional knowledge that might have been collected since completion of the EA process, and any other environmental matters of relevance to the committee including financial support for operation of the committee.

6.22.2 Summary of Adverse Residual Project Effect on Aboriginal Peoples

The effects of the project on Aboriginal Peoples were assessed in Section 6.21 using information and conclusions drawn from effects assessments described in the previous sub-sections of Section 6 including terrain and soils, geology and geochemistry, noise, light, air quality, climate, surface water quality, surface water quantity, groundwater quality, groundwater quantity, wildlife and wildlife habitat, migratory birds, fish and fish habitat, wetlands and vegetation, land use, social factors, economic factor, human health, and heritage resources. Conclusions were drawn on each of these disciplines in Section 6 using valued components (Section 6.1.3) chosen via the inclusion of traditional knowledge and information regarding the current use of the land for traditional purposes via the Indigenous communities as described in Section 5.

Overall, the project is anticipated to have very few adverse environmental effects on Aboriginal Peoples which mainly had to do with loss of access or habitat. Due to the relatively small size of the project, what few adverse effects may exist, are not anticipated to have a meaningful effect on the ability of Aboriginal Peoples' overall ability to use lands and resources for traditional purposes.

The following valued components were used in the assessment of effects of the Project on Aboriginal Peoples, a brief description of the outcome for each is provided.

6.22.2.1 Human Health

The results of the human health assessment in Section 6.19 indicated that there were no contaminants of concern identified in water (drinking water and surface water) as a result of the project, and in some cases water quality even improved via the elaborate treatment system included as part of the design of the Project. There were no potential risks identified via direct dermal contact to soil, tailings, or waste rock pathway, no potential risks identified via the inhalation of fugitive dust pathway, and no potential risk identified via the ingestion of country foods (i.e., plants, fish and wild game). With respect to water quantity, Treasury Metals has committed to off-setting any residual effect that may occur such that human heath will not be impacted. Furthermore, follow-up programs and monitoring including fish surveys and site-specific human health risk assessments designed to confirm the prediction of the EIS, may provide substantive value to updating the fish consumption advisory in the regional area to further support improved human health.

6.22.2.2 Harvesting and Gathering of Plant Material

In terms of harvesting /gathering of plant material, the Project will result in minor loss of habitat and loss of access for some plants including berries. Treasury Metals during engagement activates has offered guided access to areas of restricted access where Project operations may safety allow access to berry patches. In addition, via engagement activities and based on the terrestrial habitat studies completed as part of the project the areas of berry habitat are widespread such that there are an ample supply of alternative berry harvesting sites. No medicinal plant species were identified within the Project footprint, however if via future engagement activities, or during follow-up and monitoring programs medicinal plant species are identified, Treasury Metals will adhere to their best practices and commitment to working with all communities to identify, mitigate, and avoid, or otherwise minimize, these potential effects to the extent practicable.

6.22.2.3 Trapping

The wildlife and wildlife habitat LSA (Figure 5.12.1.3-2) is intersected by three traplines (DR026, DR027 and DR021). Treasury Metals is not currently aware of recent trapping activities on Project lands, but members of one Indigenous community indicated that they have trapped this area in the past, particularly for marten and beaver. There is consequently some potential to diminish the fur harvest potential of trapline DR0026, and to much lesser extent that of trapline DR027. However, given the relatively small footprint of the Project, there is substantial opportunity for alternative areas of trapping.

6.22.2.4 Hunting

There will be minor losses to habitat for wildlife species hunted, however, there is considerable alternative hunting areas are therefore available, such that the removal of a comparatively small area for hunting, associated with Project development, is unlikely to meaningfully diminish hunting potentials in the region for members of Indigenous communities.

6.22.2.5 Fishing

A commitment has been made to treat the final effluent discharged to Blackwater Creek from the site to a level consistent with the Provincial Water Quality Objectives (PWQO) for the protection of aquatic life, or background concentrations in background conditions are greater. Adverse effects to larger fish species inhabiting Wabigoon and Thunder Lakes, and associated downstream waters, is therefore not anticipated. With the effluent treatment process as proposed, adverse effects to spawning fish are not anticipated. Baitfishing (minnow trapping) occurs at two locations within the Project area, but outside of the proposed Project footprint. A commitment has also been made to continue to allow Indigenous community members access to these areas so that they can continue to harvest baitfish from the ponds. Otherwise, the only potential adverse effects to baitfish populations in the Project site area will be that associated with the overprinting of portions of Blackwater Creek Tributaries 1 and 2. Alternative fish habitats offsets will be provided for this loss, as described in Appendix II. As a result, any potential adverse effect to baitfishing operations carried out by Aboriginal peoples is considered to be minor. There are numerous other creek systems in the RSA where baitfish can be acquired.

6.22.2.6 Cultural and Spiritual Components

As discussed in Section 5, there has been a relatively small amount of information shared with Treasury Metals with respect to the project overlapping with spiritual and cultural sites. The archaeological assessment completed in support of the EIS determined that there was no potential for archaeological resources within the Project footprint. The low archaeological potential evaluated for the Project is also supported the proximity to Thunder Lake and Wabigoon Lake. These areas would have been the preferred locations for settlement, and this settlement would have been related to available food resources (fish, rice), and access (canoe routes) among other variables. The project may result in alternations of travel routes, however given the relatively small size of the Project, alternative routes are available and changes in access routes will not be eliminated rather altered slightly due to the Project footprint.

6.22.2.7 Socio-economic Factors

The demand for employees and goods and services will increase in the study area during the construction and operations phases of the Project. Treasury has mitigated these impacts by agreeing to work with local and regional governments to minimize the effects of in-migration and out-migration, as appropriate, communicating with government agencies as appropriate, including but not limited to: Project plans, proposed transportation volumes and workforce requirements.

Treasury Metals will adhere to their best practices and commitment to working with all Indigenous communities to identify, mitigate, and avoid, or otherwise minimize, these potential effects to the extent practicable. The following subsections, organized by Indigenous community describe the potential residual adverse effects of the project on the ability of each Indigenous community described in the EIS guidelines and referred to in previous sections of the EIS to practice their current land and resource use for traditional purposes.

6.22.3 Wabigoon Lake Ojibway Nation

Wabigoon Lake Ojibway Nation is the Indigenous community in closest proximity to the Goliath Gold Project site. Treasury Metals has history of communications with Wabigoon Lake Ojibway Nation beginning in 2008. Full records of engagement activities are summarized in Section 9. Contacts have included telephone conversations, emails, letters, and in-person meetings. Topics discussed have included information about the Project, a Memorandum of Understanding hereto referred to as a Memorandum of Agreement, preliminary Impact Benefits Agreement discussions, Traditional Knowledge Study, training, potential impacts and effects of the Project, including the application of mitigation measures and monitoring, and potential employment and business opportunities associated with the Project.

Based on the meaningful engagement activities to-date, Treasury Metals understands that traditional land and resource use activities of the Wabigoon Lake Ojibway Nation include harvesting of plants, hunting and trapping of animals, collection of potable water, fishing, and the practice of cultural and spiritual aspects. Wabigoon Lake Ojibway Nation community members are specifically concerned about the quality of aquatic based resources, large game hunting, and timber harvesting. Aquatic based resources include wild rice harvesting (for domestic and commercial purposes), fishing (for domestic purposes), waterfowl hunting, and trapping of aquatic furbearers (beaver, muskrat and otter). Moose, and to a lesser extent deer, are important game species. Walleye (pickerel), northern pike, and whitefish are the more important fish species taken. Commercial forestry and tree nursey operations are an important mainstay of the community.

Changes to species habitat and access as a result of the project are anticipated to impact the current use of the land for traditional purposes greatest for members of the Wabigoon Lake Ojibway Nation relative to all Indigenous communities assessed, due to the fact they are geographically located closest to the Project.

The Project has the potential to have altered experience to the ability of members of Wabigoon Lake Ojibway Nation to practice their current land and resource uses for traditional purposes primarily via changes in access and minor losses in habitat. Table 6.22.3-1 provides a summary of residual adverse effects identified based on the information shared via meaningful engagement activities as provided in Section 5.13.

Table 6.22.3-1 Effects on Wabigoon Lake Ojibway Nation Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Harvesting of Plants	Plants-proximity to the project	Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery area for berry and other plant harvesting activities
	Blueberries- North of Project area and directly south of Tree Nursery (and Tree Nursery itself), area of proposed TSF. Berries were harvested in Johnsons Beach area	
	Mushrooms- chanterelles and morels	
	Wild Rice	
	Medicinal plants such as cedar and white birch	
	Firewood (to heat homes and supplement income)	
Water Resources	Spring Water	No residual adverse effect identified
	Wabigoon residents use wells for drinking water, and lakeshore residents use Wabigoon Lake and Thunder lake for drinking water. Private and artesian wells located in the vicinity of the Project	
Hunting and Trapping	Hunting and trapping within LSA along secondary roads and those used for timber forest access	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA; • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety;
	Hunting (moose, deer, rabbit)	
	Trapping American Marten within the proposed Project area	

Table 6.22.3-1 Effects on Wabigoon Lake Ojibway Nation Current Use of Lands and Resources (continued)

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
		• Only minor portions of traplines DR026 and DR027 will potentially be affected; little or no current trapping on Project site
Fishing	Fishing of Pike + other species	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set); • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing
	Fishing of Walleye + other species	
	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint	
	Fishing for food consumption	
Cultural	Cultural sites of spiritual significance identified proximal to the Project area	No residual adverse effect identified
	Trails- Historically passed through Thunder Lake as part of rice (and other wild edibles) gathering efforts at Rice Lake	
	Traditional land and resource use areas with spiritual, historical and sustenance value include Wabigoon chain of lakes, Thunder Lake and Thunder Creek, Aaron Park, Mavis Lake, Ghost Lake, Rice Lake, Tree Nursery and area north of present landfill	
	Camping	
	View of/from Thunder Lake	
	Rocks and boulders south of the community of Wabigoon [on Wabigoon Lake] are of cultural significance	

Although the effects assessment has identified the above noted residual adverse effects on the ability of member of Wabigoon Lake Ojibway Nation to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively minimial due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project, may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Wabigoon Lake Ojibway Nation to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is

Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Wabigoon Lake Ojibway Nation based on the relatively small footprint of the Project, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.4 Eagle Lake First Nation

Eagle Lake First Nation is located on the northeast shore of Eagle Lake, approximately 25 km west southwest of Dryden. Treasury Metals has had ongoing contact with Eagle Lake First Nation since 2009. Full records of engagement activities are summarized in Section 9. Topics discussed have included information about the Project, a Traditional Knowledge Study, training opportunities, potential impacts and effects of the Project, including the application of mitigation measures and monitoring, and potential employment and business opportunities associated with the Project.

Treasury Metals understands that traditional land and resource use activities of the Eagle Lake First Nation include harvesting of plants, hunting and trapping of animals, fishing, and for cultural and spiritual purposes. Information obtained from Eagle Lake First Nation regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.4-1.

Table 6.22.4-1 Effects on Eagle Lake First Nation Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Harvesting	Plants-proximity to the project	• Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery area for berry and other plant harvesting activities
	Blueberries- North of Project area and directly south of Tree Nursery (and Tree Nursery itself), area of proposed TSF	
	Mushrooms- chanterelles and morels	
	Wild Rice	
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA • Waterfowl habitat limited to scattered beaver ponds, with no meaningful resource potential; alternative hunting opportunities for waterfowl are readily available elsewhere in the RSA; • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety • Only minor portions of traplines DR026 and DR027 will potentially be affected; little or no current trapping on Project site
	Hunting white-tail deer- within general project area	
	Hunting partridge - within general project area	
	Hunting moose- within general project area	
	Duck hunting- Rice Lake, Sandy lake, Table Rock Lake, and Tom Chief Lake	

Table 6.22.4-1 Effects on Eagle Lake First Nation Current Use of Lands and Resources (continued)

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Fishing	Fishing of Pike + other species	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set); • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing
	Fishing of Walleye + other species	
	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint	
	Commercial fishing license- Wabigoon and Whitefish Bay First Nations have commercial fishing licenses on Wabigoon and Thunder Lakes	
Cultural and Spiritual	Historical travel route through Eagle Lake	No residual adverse effect identified
	Areas of cultural significance (spirit rocks) on Wabigoon Lake	

Although the effects assessment has identified the above noted residual adverse effects on the ability of members of Eagle Lake First Nation to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively minimal due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Eagle Lake First Nation to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Eagle Lake First Nation based on the relatively small footprint of the Project, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.5 Whitefish Bay First Nation (Naotkamegwanning First Nation)

Whitefish Bay First Nation (Naotkamegwanning First Nation) is located on the east side of Lake of the Woods close to the community of Sioux Narrows. By road (Highway 17/Highway 71), Whitefish Bay First Nation is located slightly more than 200 km from the proposed Project site. Treasury has been in contact with Whitefish Bay First Nation since November of 2012. Full records of engagement activities are summarized in Section 9.

Treasury Metals has been in ongoing communications with Whitefish Bay First Nation in regards to presenting the revised material supporting the EIS. In conjunction to this Treasury Metals has provided a significant amount of documentation to Whitefish Bay First Nation regarding Project effects and development.

Treasury Metals understands that traditional land and resource use activities of the Whitefish Bay First Nation (Naotkamegwanning First Nation) include hunting and trapping of animals, fishing, and cultural and spiritual purposes. Information obtained from the Whitefish Bay First Nation (Naotkamegwanning First Nation) regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.5-1.

Table 6.22.5-1: Effects on the Whitefish Bay First Nation (Naotkamegwanning First Nation) Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA; • Waterfowl habitat limited to scattered beaver ponds, with no meaningful resource potential; alternative hunting opportunities for waterfowl are readily available elsewhere in the RSA; • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety;
	Hunting partridge - within general project area	
	Hunting moose- within general project area	
Fishing	Commercial fishing license- Wabigoon and Whitefish Bay First Nations have commercial fishing licenses on Wabigoon and Thunder Lakes	No residual adverse effects are identified to commercial fishing operations
	Whitefish Bay First Nation holds commercial fishing license on Manitou Lake and Blackwater Creek	
Cultural	May be burial sites near Rice Lake	No residual adverse effects identified
	Overwintering camps on Rice Lake	

Although the effects assessment has identified the above noted residual adverse effects on the ability of member of Whitefish Bay First Nation (Naotkamegwanning First Nation) to practice their current use of the lands and resources for traditional purposes, the magnitude of these effects is considered to be relatively minimal due to the small size of the Project and the 200 km distance between the community and the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Whitefish Bay First Nation (Naotkamegwanning First Nation) to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Whitefish Bay First Nation (Naotkamegwanning First Nation) based on the relatively small footprint of the Project, the large distance between the Project and the majority of the community members, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.6 Wabauskang First Nation

Wabauskang First Nation (WFN) lies on the shores of Wabauskang Lake approximately 38 km south of Ear Falls, Ontario. By road (Highway 17 - Highway 105), Wabauskang First Nation is located approximately 135 km from the Goliath Gold Project site. Wabauskang First Nation notes that some members live in the Wabigoon and Dryden area. Treasury has been in contact with Wabauskang First Nation with respect to the Project since November of 2012. Full records of engagement activities are summarized in Section 9. Topics of the discussion during meetings have included details about the Project, employment opportunities, training, financial opportunities, and impact and effects of the Project, including mitigation measures and monitoring.

Treasury Metals understands that traditional land and resource use activities of the Wabauskang First Nation include hunting and trapping of animals, fishing, and for cultural and spiritual purposes, further to this Wabauskang First Nation has identified that it holds traditional ecological knowledge for the regional area. Information obtained from Wabauskang First Nation regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.6-1.

Treasury Metals acknowledges that this community expressed particular interest in the protection of water resources from contamination. Treasury Metals has committed to ensuring that all effluent discharged during operations to Blackwater Creek will meet PWQO, or background concentrations if background levels are greater than PWQO. Follow-up and Monitoring programs will be completed to ensure/ confirm that the Project does not pose human health risks. Thereby, the Project is not anticipated to alter the current land and resource use for traditional purposes such as drinking water for a member of the Wabauskang First Nation.

Table 6.22.6-1: Effects on Wabauskang First Nation Current Use of Lands and Resources

Traditional Land and resource use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA; • Waterfowl habitat limited to scattered beaver ponds, with no meaningful resource potential; alternative hunting opportunities for waterfowl are readily available elsewhere in the RSA; • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety;
	Hunting white-tail deer- within general project area	
	Hunting partridge - within general project area	
	Hunting moose- within general project area	
Fishing	Fishing of Pike + other species	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set); • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing
	Fishing of Walleye + other species	
	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint	
Cultural	Camping and access roads	No residual adverse effect identified

Although the effects assessment has identified the above noted residual adverse effects on the ability of member of Wabauskang First Nation to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively miminal due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project, may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Wabauskang First Nation to ensure that any potential effect of the project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Wabauskang First Nation based on the relatively small footprint of the Project, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.7 Lac Seul First Nation

Lac Seul First Nation lies on the shores of Lac Seul approximately 40 km from the community of Sioux Lookout and over 100 km by road from the Project site. By road (Highway 17/Highway 72/Highway 664). Treasury Metals has been in contact with Lac Seul First Nation since June of 2012. Full records of engagement activities are summarized in Section 9.

Treasury Metals understands that traditional land and resource use activities of the Lac Seul First Nation include but are not limited to harvesting of plants, hunting and trapping of animals, and fishing. Information obtained from the Lac Seul First Nation regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.7-1.

Table 6.22.7-1: Effects on the Lac Seul First Nation Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Harvesting	Blueberries- North of Project area and directly south of Tree Nursery (and Tree Nursery itself), area of proposed TSF	Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery area for berry and other plant harvesting activities
	Mushrooms- chanterelles and morels	
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA • Waterfowl habitat limited to scattered beaver ponds, with no meaningful resource potential; alternative hunting opportunities for waterfowl are readily available elsewhere in the RSA • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety
	Hunting white-tail deer- within general Project area	
	Hunting partridge - within general project area	
	Hunting moose- within general project area	
Fishing	Fishing of Pike + other species	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing
	Fishing of Walleye + other species	
	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint	

Although the effects assessment has identified the above noted residual adverse effects on the abilities of members of Lac Seul First Nation to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively minimal due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the protect, may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Lac Seul First Nation to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Lac Seul First Nation based on the relatively small footprint of the Project, the identified mitigation measures, positive socio-economic effects of the Project, and commitment to ongoing engagement activities.

6.22.8 Grassy Narrows First Nation

Grassy Narrows First Nation is located 80 km to the northeast of Kenora. By road (Highway 17 and Highway 671) Grassy Narrows is approximately 240 km from the Project site. This community is downstream from the Project site located on the Wabigoon River system. During the 1960s and 1970s, Grassy Narrows First Nation was adversely impacted by mercury contamination of the Wabigoon River that has been attributed to discharges from the pulp and paper mill in Dryden.

Treasury Metals has been in contact with Grassy Narrows First Nation began in 2012. Full records of engagement activities are summarized in Section 9. To date, the only information Treasury Metals has been able to receive from Grassy Narrows First Nation, is that the community is concerned with water management, and the downstream impacts of the Project specifically with respect to mercury.

From secondary sources of information, it is Treasury Metals understanding that members of the Grassy Narrows First Nation may use the land for gathering of plants, hunting and trapping, and cultural and spiritual purposes in addition to the collection of potable water and fishing. Information obtained from Grassy Narrows First Nation regarding traditional land and resource use included:

- Harvesting/ Gathering of Plants: Picking of berries and wild rice, growing vegetables on their summer lands. Used a lot of land for needing food. i.e. they would live where there was food, or where there was wild rice;
- Hunting and Trapping: Spring- hunting of beavers, muskrats, and ducks, Winter- hunting of big game, and moving along trap lines;
- Fishing: Walleye- eating less or eating out of a lake system (e.g. Slant Lake) versus the Wabigoon/English Lake river system and consumption of Sturgeon, Lake Pike;
- Spiritual: eating fish has spiritual values; and
- The village of Grassy Narrows First Nation was originally located 8 kilometers northwest of where it is presently located, and its relocation occurred in 1963 as supplies would be more accessible. This relocation had an effect on their traditional land and resource use which included fishing, drying of meat, hunting and trapping of beavers, muskrats, ducks,

and big game, picking berries and wild rice and grow vegetables. Soon after the relocation, the mercury contamination was identified and the commercial fisheries were eliminated.

Treasury Metals is mindful of the legacy mercury contamination in the English/ Wabigoon River system due to the improper release of mercury into the environment from the Dryden Pulp Mill. The results of the human health risk assessment confirmed the current potential human health risks associated with the regional area via mercury impacts in fish. Treasury Metals highlights that the effects of the Project will not meaningfully increase the potential risk via the fish ingestion pathways, and in many ways the follow-up and monitoring programs which may include a site-specific risk assessment may aid all communities in more appropriately identifying potential risks. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training which members of Grassy Narrows First Nation are welcomed in participating in.

Treasury Metals is committed to continued engagement with Indigenous members of the Grassy Narrows First Nation to ensure that any potential effect of the project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Grassy Narrows First Nation based on the relatively small footprint of the Project, the large distance between the Project and the majority of the community members, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.9 Lacs des Mille Lacs First Nation

Lac des Mille Lacs First Nation is comprised of two separate reserve lands located 185 kilometers and 145 kilometers to the southeast of the Project. Each land package can be accessed via road (Highway 17). Engagement with Lac des Mille Lacs First Nation was initiated in 2017 following a request for information by Lac des Mille Lacs First Nation on April 5, 2016 and the formal listing of engagement needs with Lac des Mille Lacs First Nation on Dec 7, 2016.

Lac des Mille Lacs First Nation has expressed concerns regarding the overall environmental impact of the Project, impacts to economic and cultural pursuits and the practice of traditional activities. However no other information has been shared by members of the Lac des Mille Lacs First Nation. In addition, Lac des Mille Lacs First Nation did not provide any specific comments on the original EIS document provided to them by Treasury Metals.

Secondary traditional land and resource use data available from MRN (2009), pertaining to the English River Forest, indicate that members of the Lac des Mille Lacs First Nation are involved in hunting, fishing, trapping, and the gathering of plants and berries, together with other recreational and cultural pursuits.

The Project is anticipated to result in altered access within the Project area and habitat for some species traditionally hunted/trapped which may alter the current use of the land and resources for traditional purposes for a member of Lac des Mille Lacs First Nation.

Treasury Metals is committed to continued engagement with Indigenous members of the Lac des Mille Lacs First Nation to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall minimal adverse outcome for members of Lac des Mille Lacs First Nation based on the relatively small footprint of the Project, the large distance between the Project and the majority of the community members, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.10 Métis Nation of Ontario

The Métis Nation of Ontario (MNO) was established in 1993, with the goal of all Métis communities coming together throughout Ontario to create specific Métis governance structures. Based on the existing research on Métis communities in Ontario and the criteria established by the Supreme Court of Canada in R. v. Powley ("Powley"), a historic Métis community developed from the inter-connected Métis populations along Rainy Lake and Rainy River at Lac La Pluie (Fort Frances) and Hungry Hall (Rainy River) as well as at Rat Portage (Kenora) and Eagle Lake (Dryden/Wabigoon) in the Lake of the Woods area. The Lake of the Woods area also includes White Fish Lake, Northwest Angle, Wabigoon and Long Sault (collectively known as the "Historic Rainy Lake/Lake of the Woods Métis Community"). It is estimated that area outposts within the Wabigoon/Dryden area were established in the 1850s. Currently 452,600 Canadians self-identified as Métis, and with 86,020 Ontario residents identifying as Métis. Currently, the members of the Métis Nation of Ontario do not live in a specific community but reside in various locations throughout the region. The closest regional office of the Northwest Métis Council is located in Dryden.

Treasury Metals has been in contact with the Métis Nation of Ontario with respect to the Project since June of 2009. Full records of engagement activities are summarized in Section 9. Topics of discussion with Métis Nation of Ontario include meeting scheduling, Memorandum of Understanding, Traditional Knowledge study, consultation scope and budget, employment opportunities, event funding requests, and impact and effects of the Project. The Métis Nation of Ontario in response to these discussions is preparing an updated Memorandum of Understanding document associated with a Traditional Knowledge Study, consultation aspects, and communication protocols.

Treasury Metals highlights that a formal traditional knowledge/ traditional land and resource use study is in progress with the Métis Nation of Ontario. It is Treasury Metals' understanding that traditional land and resource use activities of the Métis Nation of Ontario include harvesting of wild food, gathering of plants for consumption and medicinal purposes, camping on the land and other spiritual and cultural purposes, hunting and trapping, and fishing. Preliminary aspects of these land use practices have been communicated to Treasury Metals.

Information obtained from the Métis Nation of Ontario regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.10-1.

Table 6.22.10-1: Effects on Métis Nation of Ontario Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Harvesting of Plants	MNO has established places where they gather from berry patches	Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery area for berry and other plant harvesting activities
	MNO gathers many varieties of berries	
	MNO Harvesting does use consistent berry locales	
	There is regular harvest in the area by Métis who come from Atikokan and Fort Frances to fish, harvest and hunt moose	
	MNO has preliminary indicated as part of a TKLUS that plant gathering activities occur in proximity to the Project. It was noted that harvest includes berries, and mushrooms. No details as it relates to water resources shared at this time by MNO	
Hunting and Trapping	Beaver is an important species to MNO that is traditionally hunted and commercially trapped.	• Minor loss of habitat that could support moose and deer populations; little or no current hunting on Project site; alternative hunting opportunities are readily available elsewhere in the RSA; • Hunting/trapping access restrictions will apply to the mine site area for public and mine worker safety;
	There is regular harvest in the area by Métis who come from Atikokan and Fort Frances to fish, harvest and hunt moose	
	Métis hunting moose just south of the project area and hunting deer just to the north of the project area.	
	Additionally, MNO has noted as part of preliminary results from the TKLUS that hunting for small and large game inclusive of waterfowl is conducted in proximity of the Project footprint. Trapping activities have also been recognized, within the regional area	• Waterfowl habitat limited to scattered beaver ponds, with no meaningful resource potential; alternative hunting opportunities for waterfowl are readily available elsewhere in the RSA;
Fishing	Thunder Lake, Wabigoon Lake, and Big Sandy Lake were captured as locales for fishing activities as part of the preliminary results of the TKLU shared with Treasury	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set; • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing
	There is regular harvest in the area by Métis who come from Atikokan and Fort Frances to fish, harvest and hunt moose	

Table 6.22.10-1: Effects on Métis Nation of Ontario Current Use of Lands and Resources (continued)

Traditional Land and Resource Use	Specific Detail Shared/Collected	Residual Adverse Effect Identified
Cultural	MNO has indicated that cultural aspects including historical, spiritual, contemporary, access and travel route are present in the study area defined within the TKLUS.	No residual adverse effect identified
	No cultural values indicated within the Project footprint in findings shared as part of the preliminary TKLUS	

Although the effects assessment has identified the above noted residual adverse effects on the ability of member of Métis Nation of Ontario to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively minimal due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project, may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with the citizens of the Métis Nation of Ontario to ensure that any potential effect of the Project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members Métis Nation of Ontario based on the relatively small footprint of the Project, the identified mitigation measures, positive effects of the project, and commitment to ongoing engagement activities.

6.22.11 Aboriginal People of Wabigoon

Engagement with the Aboriginal People of Wabigoon began in March 2013. Full records of engagement activities are summarized in Section 9.

Treasury Metals understands that traditional land and resource use activities of the Aboriginal People of Wabigoon include harvesting or gathering of plants and fishing, together with hunting and possibly trapping, and other cultural pursuits. Information obtained from Aboriginal People of Wabigoon regarding traditional land and resource use along with identified residual adverse effects is summarized in Table 6.22.11-1.

Table 6.22.11-1: Effects on Aboriginal People of Wabigoon Current Use of Lands and Resources

Traditional Land and Resource Use	Specific Detail Shared	Residual Adverse Effect Identified
Harvesting	Plants-proximity to the project	Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery area for berry and other plant harvesting activities
	Wild Rice	
Fishing	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint	• Some baitfishing habitat on the project Site will be lost (temporarily and then off-set); • Access restrictions will apply to the mine site area for public safety; Aboriginal people will be able to arrange access to the Tree Nursery and other site areas for baitfishing

Given the close proximity of the Project with the Village of Wabigoon, which is the official mailing address of the Aboriginal People of Wabigoon, it is reasonable to expect that similar residual adverse effects to current use of land and resource for traditional purposes would be similar to those experience by members of Wabigoon Lake Ojibway First Nation as described in Section 6.22.1.3.

Although the effects assessment has identified the above noted residual adverse effects on the ability of member of Aboriginal People of Wabigoon to practice their current use of the lands for traditional purposes, the magnitude of these effects is considered to be relatively minimal due to the small size of the Project. In addition, given that the Project is proposed for development on a parcel of previously disturbed and there are water quality concerns in the wider geographic area, the best practices of Treasury Metals and proposed mitigation measures for the protection of the environment associated with the Project, may lead to substantial improvements in environmental quality. Project development will also provide positive economic opportunities for Indigenous communities in terms of employment, business, and training

Treasury Metals is committed to continued engagement with Indigenous members of the Aboriginal People of Wabigoon to ensure that any potential effect of the project on their ability to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members of Aboriginal People of Wabigoon based on the relatively small footprint of the Project, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.12 Grand Council Treaty #3

The Grand Council Treaty #3 represents the general interests of 28 First Nation communities, including those identified for engagement on the Project. Contact between Treasury Metals and Grand Council Treaty #3 began in 2009.

In July 2015, the Agency responded to a letter from Grand Council Treaty #3 that acknowledged a Grand Council Treaty #3 comment that Treaty #3 First Nations could potentially be impacted by the Project. The Agency went on to say that CEAA would continue to consult directly with Treaty #3 First Nations, and if Grand Council Treaty #3 desired to act on behalf of all of the First Nations, formal written communications to that effect would be required from each of the First Nations. Subsequent to the above noted communications, Treasury has included Grand Council Treaty #3 in communications. As the representatives to 28 Treaty #3 communities, including those designated communities as it relates to the Goliath Project, traditional land use aspects reflect those communicated to date by the applicable Nations.

Treasury Metals is committed to continued engagement with Grand Council Treaty #3 to ensure that any potential effect of the Project on the ability of the represented Nations to practice the current use of lands and resources for traditional purposes is sufficiently off-set. It is Treasury Metals' opinion that any residual adverse effect identified in Section 6.21 as a result of the Project will not have an overall meaningful adverse outcome for members represented by Grand Council Treaty #3 based on the relatively small footprint of the Project, the large distance between the Project and the majority of the community members, the identified mitigation measures, positive socio-economic effects of the project, and commitment to ongoing engagement activities.

6.22.13 Information to Address Round 1 Information Requests

The following lists the questions received as part of the Round 1 information requests that relate to changes in current land and resource use for traditional purposes by Indigenous communities.

Aboriginal and Treaty Rights

- Government Agencies
  - TMI_11-AC(1)-02 Impacts on Aboriginal and treaty rights
  - TMI_21-AA(1)-02 Impacts on Aboriginal and treaty rights
  - TMI_22-AA(1)-03 Impacts on Aboriginal and treaty rights
  - TMI_231.1-HE(1)-38 Impacts on Aboriginal and treaty rights
- Wabauskang First Nation; Aboriginal People of Wabigoon
  - TMI_364-AC(1)-38 Impacts on Aboriginal and treaty rights
- Wabauskang First Nation

- TMI_396-AC(1)-71 Impacts on Aboriginal and treaty rights
- Eagle Lake First Nation
  - TMI_607.1-AC(1)-280 Impacts on Aboriginal and treaty rights
- Naotkamegwanning (Whitefish Bay) First Nation
  - TMI_642-AC(1)-315 Impacts on Aboriginal and treaty rights
  - TMI_643-AC(1)-316 Impacts on Aboriginal and treaty rights
  - TMI_679-AC(1)-351 Impacts on Aboriginal and treaty rights
  - TMI_680-AC(1)-352 Impacts on Aboriginal and treaty rights
  - TMI_684-AC(1)-356 Impacts on Aboriginal and treaty rights
- Métis Nation of Ontario
  - TMI_448-AC(1)-122 Impacts on Aboriginal and treaty rights
  - TMI_511-AC(1)-185 Impacts on Aboriginal and treaty rights
  - TMI_537-AC(1)-211 Impacts on Aboriginal and treaty rights
  - TMI_581-AC(1)-255 Impacts on Aboriginal and treaty rights
  - TMI_584-AC(1)-258 Impacts on Aboriginal and treaty rights
  - TMI_598-AC(1)-263 Impacts on Aboriginal and treaty rights
  - TMI_599-AC(1)-272 Impacts on Aboriginal and treaty rights

Traditional Land Use

- Government Agencies
  - TMI_17-PD(1)-04 Access
  - TMI_229-HE(1)-36 Traditional land use
- Eagle Lake First Nation
  - TMI_362-AC(1)-36 Traditional land use
  - TMI_618-AC(1)-291 Traditional land use study
- Wabauskang First Nation
  - TMI_363-AC(1)-37 Traditional land use
- Naotkamegwanning First Nation
  - TMI_659-AC(1)-332 Traditional land use study
  - TMI_673-AC(1)-345 Traditional land use
  - TMI_675-AC(1)-347 Traditional land use study

  - TMI_678-AC(1)-350 Traditional land use
- Multiple Aboriginal peoples
  - TMI_390-AC(1)-65 Traditional land use study
- Métis Nation of Ontario
  - TMI_415-AC(1)-90 Traditional lands
  - TMI_422-AC(1)-97 Traditional land use study
  - TMI_426-AC(1)-101 Traditional land use study
  - TMI_428-AC(1)-103 Traditional land use study
  - TMI_433-AC(1)-108 Traditional land use study
  - TMI_449-AC(1)-123 Traditional land use
  - TMI_457-AC(1)-131 Traditional land use
  - TMI_479-AC(1)-153 Traditional land use
  - TMI_485-AC(1)-159 Traditional land use
  - TMI_494-AC(1)-168 Traditional land use
  - TMI_563-AC(1)-237 Traditional land use
  - TMI_582-AC(1)-256 Traditional land use
  - TMI_585-AC(1)-259 Traditional land use study
  - TMI_600-AC(1)-273 Traditional land use

Traditional Harvesting

- Government Agencies
  - TMI_151-WL(1)-08 Traditional harvesting
  - TMI_181-AE(1)-19 Traditional harvesting
  - TMI_238.1-HE(1)-45 Traditional harvesting
  - TMI_264-EE(1)-07 Traditional harvesting
- Naotkamegwanning First Nation
  - TMI_651-AC(1)-324 Traditional harvesting
  - TMI_654-AC(1)-327 Traditional harvesting
  - TMI_665-AC(1)-338 Traditional harvesting
  - TMI_667-AC(1)-340 Traditional harvesting

- Métis Nation of Ontario
  - TMI_438-AC(1)-113 Traditional harvesting
  - TMI_500-AC(1)-174 Traditional harvesting
- City of Dryden resident
  - TMI_732-PC(1)-47 Traditional harvesting
  - TMI_733-PC(1)-48 Traditional harvesting
  - TMI_742-PC(1)-57 Traditional harvesting
  - TMI_747-PC(1)-62 Traditional harvesting

Cultural Resources

- Government agencies
  - TMI_240.1-HE(1)-47 Cultural resources
- Wabigoon Lake Ojibway Nation
  - TMI_354-AC(1)-28 Cultural resources
- Naotkamegwanning First Nation
  - TMI_664-AC(1)-337 Cultural resources
  - TMI_683-AC(1)-355 Cultural resources

6.23 Summary of Mitigation and Residual Effects

Throughout this EIS, efforts have been made to clearly indicate the elements of the Project that help avoid environmental effects, as well as those measures that will be taken to mitigate those effects that cannot be reasonably avoided. A series of tables have been prepared, at the request of the Agency, to show the linkages between the potential effects of the Project, the measures relied on to avoid or mitigate the effects and the resulting residual effects that are expected to remain after mitigation measures are applied. These following tables summarize the description of Project effects for each of the 20 disciplines used in the EIS, and information presented in Sections 6.2 through 6.21:

- Table 6.23-1: Summary of Mitigation and Residual Effects for Terrain and Soil;
- Table 6.23-2: Summary of Mitigation and Residual Effects for Geology and Geochemistry;
- Table 6.23-3: Summary of Mitigation and Residual Effects for Noise;
- Table 6.23-4: Summary of Mitigation and Residual Effects for Light;
- Table 6.23-5: Summary of Mitigation and Residual Effects for Air Quality;

- Table 6.23-6: Summary of Mitigation and Residual Effects for Climate;
- Table 6.23-7: Summary of Mitigation and Residual Effects for Surface Water Quality;
- Table 6.23-8: Summary of Mitigation and Residual Effects for Surface Water Quantity;
- Table 6.23-9: Summary of Mitigation and Residual Effects for Groundwater Quality;
- Table 6.23-10: Summary of Mitigation and Residual Effects for Groundwater Quantity;
- Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat;
- Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds;
- Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat;
- Table 6.23-14: Summary of Mitigation and Residual Effects for Wetlands and Vegetation;
- Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use;
- Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors;
- Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors;
- Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health;
- Table 6.23-19: Summary of Mitigation and Residual Effects for Heritage Resources; and
- Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples.

Table 6.23-1: Summary of Mitigation and Residual Effects for Terrain and Soil

<table>
<tr><th>Project Phase</th><th>Project Works and Activities</th><th>Valued Components</th><th>Potential Effect</th><th>Mitigation / Commitment</th><th>Residual Adverse Effect</th></tr>
<tr><td rowspan="3">Site Preparation and Construction</td><td rowspan="3">• Clearing of trees
• Construction of perimeter ditch
• Dewatering of overburden
• Stripping of overburden and development of overburden stockpile
• Development of site infrastructure
• Construction of processing plant
• Initiate construction of TSF
• Potential spills of fuels and chemicals
• On-site vehicle exhaust
• Construction traffic
• Construction workforce</td><td>Natural landscapes</td><td>Change in viewscapes
• Overburden stockpile could be visible off-site</td><td>• Limit height of overburden stockpile [Mit_001]
• Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002]
• Vegetate overburden stockpiles [Mit_005]</td><td>No residual adverse effect:
• Overburden stockpile will not be visible offsite</td></tr>
<tr><td>Overburden</td><td>Loss of overburden
• Erosion of overburden material during stripping and stockpiling</td><td>• Overburden placed in stockpiles located directly to the south of the proposed open pit [Mit_007]
• Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002]
• Vegetated overburden stockpiles [Mit_005]
• Construct perimeter ditch and seepage collection system around the edges of the stockpile [Mit_008]</td><td>No residual adverse effect:
• Overburden will be stockpiled and covered</td></tr>
<tr><td>Soil chemistry</td><td>Soil Chemistry
• Change in soil chemistry due to spills</td><td>• Maintain equipment in good working order [Mit_009]
• Re-fuel equipment in way that limits spills [Mit_010]
• Fuel will be stored in a lined, contained area [Mit_011]
• Fueling vehicles will be parked in a concrete lined area when not in use [Mit_012]
• Spills will be contained and the soil remediated in accordance with the Emergency and Spills Response Management Plan. [Mit_125]</td><td>No residual adverse effects:
• Collection ditching will capture all spills and contain them to within the operations area</td></tr>
<tr><td rowspan="3">Operations</td><td rowspan="3">• Development of the open pit
• Development of underground mine
• Continued development of TSF
• Development of the WRSA
• Development and depletion of LGO stockpile
• Operations traffic
• Operations workforce
• Potential spills of fuels and chemicals
• Operations of site infrastructure
• Operations of processing plant
• Dewatering of mine workings
• Water taking for operations
• Discharge of treated water to Blackwater Creek</td><td>Natural landscape</td><td>Change in viewscapes
• Overburden stockpile could be visible off-site
• WRSA could be visible offsite
• LGO stockpile could be visible offsite</td><td>• Limit height of constructed landscape features [Mit_001]
• Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002]
• Vegetate the western edge of the WRSA [Mit_004]
• Vegetate overburden stockpiles [Mit_005]
• Progressive reclamation of mine waste rock area will be undertaken, where practical, once maximum height has been reached [Cmt_037]</td><td>Residual adverse effect:
• WRSA will be visible from portions of Thunder Lake, but will be difficult to distinguish from surrounding features
No residual adverse effect:
• Overburden stockpile will not be visible off-site
• LGO stockpile will not be visible off-site</td></tr>
<tr><td>Overburden</td><td>Loss of overburden
• Erosion of overburden material from stockpile</td><td>• Overburden placed in stockpiles located directly to the south of the proposed open pit [Mit_007]
• Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002]
• Vegetated overburden stockpiles [Mit_005]
• Progressively construct perimeter ditch and seepage collection system around the edges of the stockpile [Mit_008]</td><td>No residual adverse effect:
• Overburden will be stockpiled and covered</td></tr>
<tr><td>Soil chemistry</td><td>Soil Chemistry
• Change in soil chemistry due to spills</td><td>• Maintain equipment in good working order [Mit_009]
• Re-fuel equipment in way that limits spills [Mit_010]
• Fuel will be stored in a lined, contained area [Mit_011]
• Fueling vehicles will be parked in a concrete lined area when not in use [Mit_012]
• Emulsion explosives will be stored and dispensed in a lined, contained area. [Mit_013]
• Trucks used for the delivery of emulsion explosives will be parked in a concrete lined area when not in use [Mit_014]
• The processing plant area will be lined and equipped with seepage collection system and perimeter ditching [Mit_015]
• The LGO stockpile area will be equipped with a seepage collection system and perimeter ditching [Mit_016]</td><td>No residual adverse effects:
• Collection ditching will capture all spills and contain them to within the operations area</td></tr>
</table>

Table 6.23-1: Summary of Mitigation and Residual Effects for Terrain and Soil (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
				• Activities on the overburden stockpiles will be minimized and the stockpiles left undisturbed until closure activities are underway. [Mit_017]	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Natural landscape	Change in viewscapes • Overburden stockpile could be visible offsite • WRSA could be visible offsite • LGO stockpile will be decommissions and any ore remaining disposed of as waste rock	• Limit the height of the constructed landscape features [Mit_001] • Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002] • The overburden stockpile will be decommissioned and soils used in the closure and reclamation of the site • Vegetate the western edge of the WRSA to create a natural looking feature [Mit_004] • Remove material from the low-grade ore (LGO) stockpile during closure [Mit_006] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Site will be reclaimed to a naturalized state per the mine closure plan [Cmt_038] • Progressive reclamation of WRSA will be undertaken once maximum height is reached [Cmt_037]	Residual adverse effect: • WRSA will be visible from portions of Thunder Lake, but will be difficult to distinguish from surrounding features No residual adverse effect: • Overburden stockpile will be removed • LGO stockpile will be removed
		Overburden	Loss of overburden • Overburden material will be reclaimed from stockpiles and used to rehabilitate the operations area	No mitigation measures or commitments required	No residual adverse effect: • The overburden stockpile will be depleted in the closure phase and overburden used in site reclamation.
		Soil chemistry	Soil Chemistry • Change in soil chemistry due to spills	• Maintain equipment in good working [Mit_009] • Re-fueling done in a manner to limit the potential for spills [Mit_010] • Store fuel in a lined, contained area [Mit_011] • Fueling vehicles will be parked in a concrete lined area when not in use [Mit_012]	No residual adverse effects: • Collection ditching will capture all spills and contain them to within the operations area
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Natural landscape	Change in viewscape • WRSA could be visible offsite	• Limit the height of the constructed landscape features [Mit_001] • Use slopes of 3:1 (horizontal to vertical) to maintain a natural looking slope [Mit_002] • Vegetate the western edge of the WRSA to create a natural looking feature [Mit_004] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]	Residual adverse effect: • WRSA will be visible from portions of Thunder Lake, but will be difficult to distinguish from surrounding features
		Overburden	Loss of overburden • Overburden material will be reclaimed from stockpiles and used to rehabilitate the operations area	No mitigation measures or commitments required	No residual adverse effect: • Overburden used in reclamation will be fully vegetated by post-closure
		Soil chemistry	Soil Chemistry • No potential for changes in soil chemistry in the post-closure	No mitigation measures or commitments required	No residual adverse effect: • There will be no equipment operating or storage of hazardous or non-hazardous waste on-site to alter the soil chemistry

Table 6.23-2: Summary of Mitigation and Residual Effects for Geology and Geochemistry

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site Preparation and Construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Pit lake water quality	<u>Pit lake water quality</u> • No potential effect as pit lake does not form until the closure phase	No mitigation measures or commitments required	<u>No residual adverse effect:</u> • Pit lake does not form until the closure phase
Operations	• Development of the open pit • Development of underground mine • Construction of the TSF • Development of the WRSA • Development of LGO • Construction / operations traffic • Construction / operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of water to Blackwater Creek	Pit lake water quality	<u>Pit lake water quality</u> • No potential effect as pit lake does not form until the closure phase	No mitigation measures or commitments required	<u>No residual adverse effect:</u> • Pit lake does not form until the closure phase
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Pit lake water quality	<u>Pit lake water quality</u> • Geochemistry would affect the quality of water in the pit lake.	• Non-acid generating (NAG) waste rock will be segregated from potentially acid generating (PAG) waste rock, if feasible [Mit_019]. • PAG waste rock will be placed in the available areas of the open pit, to the extent possible [Mit_020] • During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification [Mit_021]. • The WRSA will be capped with a low-permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]. • The open pit will be allowed to flood, isolating the exposed mine faces and waste rock placed in the open pit [Mit_022] • The tailings within the TSF will be isolated using either a low-permeability dry cover, or a wet cover of non-process water [Mit_023]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024].	<u>Residual adverse effect:</u> • Pit lake water quality will be influenced by geochemistry

Table 6.23-2: Summary of Mitigation and Residual Effects for Geology and Geochemistry (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Pit lake water quality	<u>Pit lake water quality</u> • Geochemistry would affect the quality of water in the pit lake	• Decommission the LGO stockpile at the end of operations [Mit_006]. • Non-acid generating (NAG) waste rock will be segregated from potentially acid generating (PAG) waste rock, if feasible [Mit_019]. • PAG waste rock will be placed in the available areas of the open pit, to the extent possible [Mit_020] • During operations, tailings will be maintained in saturated conditions, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification [Mit_021] • The WRSA will be capped with a low-permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • The open pit will be allowed to flood, isolating the exposed mine faces and waste rock placed in the open pit [Mit_022] • The tailings within the TSF will be isolated using either a low-permeability dry cover, or a wet cover of non-process water [Mit_023] • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>Residual adverse effect:</u> • Pit lake water quality will be influenced by geochemistry

Table 6.23-3: Summary of Mitigation and Residual Effects for Noise

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site Preparation and Construction	Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Environmental noise levels	Environmental noise levels • Changes to equivalent noise levels (L_{EQ}) at worst case receptor	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025]. • Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Advise nearby residents of significant noise-causing activities, such as blasting [Mit_027]. • Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028]. • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031]. • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • The worst case L_{EQ} from the Project measured at the nearest receptor would be 40 dBA.
		Noise disturbance to wildlife (including SAR)	Noise disturbance to wildlife • Noise emissions from the Project that exceed 50 dBA could cause disturbance of wildlife	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025]. • Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028] • Where potential effects to vibration to spawning shoals is identified, blasting practices will be adjusted to mitigate the effects [Mit_030] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031] • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • There would be 430 ha within the Project site that would exceed 50 dBA and could cause disturbance of wildlife.
		Blasting noise and vibration	Blasting noise and vibration effects • Peak sound pressure due to blasting • Peak particle velocity due to blasting	• Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Implement modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Blasting will likely be restricted to once per day, and only a few days per week. [Mit_043] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018] • A blasting schedule and plan will be developed to notify the public when blasting will occur and to describe all blasting activities on site. This plan will be developed though	Residual adverse effect: • Peak sound pressure of 78 dB • Peak particle velocity of 0.123 cm/s.

Table 6.23-3: Summary of Mitigation and Residual Effects for Noise (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
				consultation with local stakeholders and regulatory officials [Cmt_025].	
Site Preparation and Construction (cont'd)		Noise related health effects	Noise related health effects • Change in absolute sound pressure due to noise from the Project • Change in percent highly annoyed due to noise from the Project	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025]. • Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Advise nearby residents of significant noise-causing activities, such as blasting [Mit_027]. • Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028]. • Implement modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031]. • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Blasting will likely be restricted to once per day, and only a few days per week. [Mit_043] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • Change in absolute sound pressure of 65 dBA • Change in percent highly annoyed of 2.2 %HA
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Environmental noise levels	Environmental noise levels • Changes to equivalent noise levels (L_{EQ}) at worst case receptor	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025]. • Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Advise nearby residents of significant noise-causing activities, such as blasting [Mit_027]. • Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028]. • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031]. • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • The worst case L_{EQ} from the Project measured at the nearest receptor would be 40 dBA.
		Noise disturbance to wildlife (including SAR)	Noise disturbance to wildlife • Noise emissions from the Project that exceed 50 dBA could cause disturbance of wildlife	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025].	Residual adverse effect: • There would be 199 ha within the Project site that would exceed 50 dBA and could cause disturbance of wildlife.

Table 6.23-3: Summary of Mitigation and Residual Effects for Noise (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028] • Where potential effects to vibration to spawning shoals is identified, blasting practices will be adjusted to mitigate the effects [Mit_030] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031] • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	
		Blasting noise and vibration	Blasting noise and vibration effects • Peak sound pressure due to blasting • Peak particle velocity due to blasting	• Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Implement modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Blasting will likely be restricted to once per day, and only a few days per week. [Mit_043] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018] • A blasting schedule and plan will be developed to notify the public when blasting will occur and to describe all blasting activities on site. This plan will be developed though consultation with local stakeholders and regulatory officials [Cmt_025].	Residual adverse effect: • Peak sound pressure of 78 dB • Peak particle velocity of 0.123 cm/s.
		Noise related health effects	Noise related health effects • Change in absolute sound pressure due to noise from the Project • Change in percent highly annoyed due to noise from the Project	• Conduct heavy equipment activity between the hours of 07:00 and 22:00, if possible, to reduce the noise effects to neighbouring residents [Mit_025]. • Endeavor to schedule noise causing events, such as blasting, to reduce disruption to residents [Mit_026]. • Advise nearby residents of significant noise-causing activities, such as blasting [Mit_027]. • Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028]. • Implement modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031]. • In the event that complaints can lead to the identification of specific sources of concern, source-specific abatement	Residual adverse effect: • Change in absolute sound pressure of 65 dBA • Change in percent highly annoyed of 1.8 %HA

Table 6.23-3: Summary of Mitigation and Residual Effects for Noise (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				such as noise walls, berms, or operational restrictions will be employed, as appropriate [Mit_033]. • Blasting will likely be restricted to once per day, and only a few days per week. [Mit_043] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Environmental noise levels	Environmental noise levels • Changes to equivalent noise levels (L_{EQ}) at worst case receptor	• Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031] • The location of the WRSA and overburden stockpiles will effectively act as noise berms reducing the levels of off-site noise [Mit_032] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • The worst case L_{EQ} from the Project measured at the nearest receptor would be 39 dBA.
		Noise disturbance to wildlife (including SAR)	Noise disturbance to wildlife • Noise emissions from the Project that exceed 50 dBA could cause disturbance of wildlife	• Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031] • The location of the WRSA and overburden stockpiles will effectively act as noise berms reducing the levels of off-site noise [Mit_032] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • There would be 122 ha within the Project site that would exceed 50 dBA and could cause disturbance of wildlife.
		Blasting noise and vibration	Blasting noise and vibration effects • There will be no blasting during the closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no blasting during the closure phase
		Noise related health effects	Noise related health effects • Change in absolute sound pressure due to noise from the Project • Change in percent highly annoyed due to noise from the Project	• Ensure that all internal combustion engines are fitted with appropriate muffler systems [Mit_028] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator to the bed of the truck [Mit_031] • The location of the WRSA and overburden stockpiles will effectively act as noise berms reducing the levels of off-site noise [Mit_032] • Treasury will design the operation to meet noise emission regulatory requirements (NPC-103, MOECC) [Cmt_018]	Residual adverse effect: • Change in absolute sound pressure of 65 dBA • Change in percent highly annoyed of 2.2 %HA

Table 6.23-3: Summary of Mitigation and Residual Effects for Noise (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Ambient noise levels	Ambient noise emission • There will be no sources of noise from the Project during the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no sources of noise from the Project during the post-closure phase
		Noise disturbance to wildlife (including SAR)	Disturbance of noise emission to wildlife • There will be no sources of noise from the Project during the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no sources of noise from the Project during the post-closure phase
		Blasting noise and vibration	Blasting noise emission and vibration • There will be no blasting during the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no blasting in the post-closure phase
		Noise related health effects	Noise emission affecting human health • There will be no sources of noise from the Project during the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no sources of noise from the Project during the post-closure phase

Table 6.23-4: Summary of Mitigation and Residual Effects for Light

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Light trespass	<u>Light trespass emissions</u> • Portable lighting may be required to ensure the safety and security of workers.	• Activities will occur during the daytime, if feasible. If there are times when lighting is required, portable lighting will be used in required areas only [Mit_034] • Portable lighting will be directed downward to minimize any off-site effects [Mit_035] • The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings [Mit_036] • External mounted luminaries will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC) and the Building Code of Ontario [Mit_037] • External light fixtures will be installed at a tilt angle of 45º [Mit_038] • Cut off angles for external lightings will be designed to minimize the off-site effect of the lighting system [Mite 039] • Nighttime illumination will not be provided at the TSF [Mit_040] • Nighttime illumination will only be provided in the open pit when required. Portable lighting will be used in these situations [Mit_041]	<u>No residual adverse effect:</u> • Modelled light levels do not exceed 0 lux outside of the operations area.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Light trespass	<u>Affects from light trespass</u> • Permanent light will be required at the processing plant and at key areas within the Project to ensure safety and security of workers • Portable lighting may be required within the open pit for the safety of workers • Lighting will be required for the underground mining operations	• Activities will occur during the daytime, if feasible. If there are times when lighting is required, portable lighting will be used in required areas only [Mit_034] • Portable lighting will be directed downward to minimize any off-site effects [Mit_035] • The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings [Mit_036] • External mounted luminaries will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC) and the Building Code of Ontario [Mit_037] • External light fixtures will be installed at a tilt angle of 45º [Mit_038] • Cut off angles for external lightings will be designed to minimize the off-site effect of the lighting system [Mite 039] • Nighttime illumination will not be provided at the TSF [Mit_040] • Nighttime illumination will only be provided in the open pit when required. Portable lighting will be used in these situations [Mit_041]	<u>No residual adverse effect:</u> • Modelled light levels do not exceed 0 lux outside of the operations area.

Table 6.23-4: Summary of Mitigation and Residual Effects for Light (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Light trespass	Affects from light trespass • Portable lighting may be required to ensure the safety and security of workers.	• Activities will occur during the daytime, if feasible. If there are times when lighting is required, portable lighting will be used in required areas only [Mit_034] • Portable lighting will be directed downward to minimize any off-site effects [Mit_035] • The higher Lux illumination levels (>80) will be placed within the process plant and mine infrastructure buildings [Mit_036] • External mounted luminaries will be designed to meet the requirements and recommendations of the Canadian Electrical Code (CEC) and the Building Code of Ontario [Mit_037] • External light fixtures will be installed at a tilt angle of 45º [Mit_038] • Cut off angles for external lightings will be designed to minimize the off-site effect of the lighting system [Mite 039] • Nighttime illumination will not be provided at the TSF [Mit_040] • Nighttime illumination will only be provided in the open pit when required. Portable lighting will be used in these situations [Mit_041] • Activities during the closure phase will generally occur during the daytime. If there are times when lighting is required to ensure the safety of the workers, portable lighting will be used in required areas only. [Mit_042]	No residual adverse effect: • Modelled light levels do not exceed 0 lux outside of the operations area.
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Light trespass	Affects from light trespass • There will be no artificial light use at the site during the post-closure phase.	No mitigation measures or commitments required	No residual adverse effect: • There would be no source of light trespass in the post-closure phase

TREASURY METALS Inc.

Table 6.23-5: Summary of Mitigation and Residual Effects for Air Quality

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Air quality	<u>Changes to air quality:</u> • Potential for changes in ambient air quality	• Implement a modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck [Mit_031] • Blasting will likely be restricted to once per day, and only a few days per week [Mit_043] • All internal combustion engines will be properly maintained and all emission control systems (e.g., diesel particulate filters) will be kept in good working order [Mit_044] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017]	<u>Residual adverse effect:</u> • There will be changes in ambient air quality
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Air quality	<u>Changes to air quality</u> • Potential for changes in ambient air quality	• Implement a modern blasting program that minimizes the blast area, the overall amount of explosives required, and through detonating procedures, minimize the amount of explosives per delay [Mit_029] • Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck [Mit_031] • Blasting will likely be restricted to once per day, and only a few days per week [Mit_043] • All internal combustion engines will be properly maintained and all emission control systems (e.g., diesel particulate filters) will be kept in good working order [Mit_044] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017]	<u>Residual adverse effect:</u> • There will be changes in ambient air quality

Table 6.23-5: Summary of Mitigation and Residual Effects for Air Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• All final effluent and point source air discharge points will be sampled and results reported to the appropriate authorities in accordance with environmental permit requirements [Cmt_036]	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Air quality	Changes to air quality • Potential for changes in ambient air quality	• Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck [Mit_031] • All internal combustion engines will be properly maintained and all emission control systems (e.g., diesel particulate filters) will be kept in good working order [Mit_044] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017] • All final effluent and point source air discharge points will be sampled and results reported to the appropriate authorities in accordance with environmental permit requirements [Cmt_036]	Residual adverse effect: • There will be changes in ambient air quality
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Air quality	Changes to air quality • There are no activities that contribute to changes to air quality during the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There are no activities that contribute to changes to air quality during the post-closure phase

Table 6.23-6: Summary of Mitigation and Residual Effects for Climate

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Project GHG emissions	Project GHG emissions • GHG emissions from mobile equipment	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions [Mit_049] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	Residual adverse effect: • Modelled results indicate 10,909 t/y of GHG emissions during the site preparation and construction phase
		Changes in climate due to the Project	Changes in climate due to the Project • GHG emissions from the Project contribution to climate change	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions [Mit_049] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	No residual adverse effect: • The GHG emissions from the Project are not substantive enough to change the climate of the region.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Project GHG emissions	Project GHG emissions • Emissions from mobile equipment • Natural gas used to heat the underground mine • Diesel fired backup generators, which will operate one hour each month	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Once mining is complete in pit 1, waste rock will be placed in the mined out areas of the open pit. This reduces the haul distances, fuel consumption and GHG emissions [Mit_020] • Placing the waste rock storage area immediately to the north of the open pit to reduce the haul distance. Shorter haul distances will reduce the fuel consumed and the associated GHG emissions [Mit_048] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	Residual adverse effect: Modelled results indicate 14,405 t/y of GHG emissions during the operations phase
		Changes in climate due to the Project	Changes in climate due to the Project • GHG emissions from the Project contribution to climate change	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Once mining is complete in pit 1, waste rock will be placed in the mined out areas of the open pit. This reduces the haul distances, fuel consumption and GHG emissions [Mit_020] • Placing the waste rock storage area immediately to the north of the open pit to reduce the haul distance. Shorter haul distances will reduce the fuel consumed and the associated GHG emissions [Mit_048] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	No residual adverse effect: • The GHG emissions from the Project are not substantive enough to change the climate of the region.

Table 6.23-6: Summary of Mitigation and Residual Effects for Climate (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Project GHG emissions	Project GHG emissions • Emissions from mobile equipment used to rehabilitate the site	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions [Mit_049] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	Residual adverse effect: • Modelled results indicate 12,121 t/y of GHG emissions during the closure phase
		Changes in climate due to the Project	Changes in climate due to the Project • GHG emissions from the Project contribution to climate change	• Utilization of the 115 kV power line that runs adjacent to the Project for supplying electrical instead of generating electricity on-site [Mit_047] • Placing the overburden storage area immediately to the south of the open pit to reduce the haul distances. Reducing the haul distances reduces fuel consumption and GHG emissions [Mit_049] • The compact footprint of the Project reduces the distances travelled, which will ultimately reduce the GHG emissions from the Project [Mit_050]	No residual adverse effect: • The GHG emissions from the Project are not substantive enough to change the climate of the region
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Project GHG emissions	Changes in climate due to the Project • There will be no source of GHG emissions from the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no GHG emissions from this phase of the Project
		Changes in climate due to the Project	Changes in climate due to the Project • There will be no source of GHG emissions from the post-closure phase	No mitigation measures or commitments required	No residual adverse effect: • There will be no GHG emissions from this phase of the Project

Table 6.23-7: Summary of Mitigation and Residual Effects for Surface Water Quality

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Surface water quality	Changes to surface water quality off-site • Soils will be disturbed during construction of the perimeter ditches and rainfall could cause eroded material to be transported off-site into watercourses	• Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system [Mit_008] • Water and chemical suppressants will be used for dust control on the haul roads at the mine site when temperatures are above freezing [Mit_045] • Perimeter runoff and seepage collection systems will be constructed around the TSF [Mit_051] • Industry standard erosion and sediment controls, such as sediment traps within ditches, will be implemented during the site preparations and construction phase [Mit_054] • Effectively manage water collected on-site using constructed storage facilities reducing the need for fresh water withdrawals and discharges of treated water [Mit_057] • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013].	No residual adverse effect: • There will be no water discharges from the operations area during the site preparation and construction phase.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Surface water quality	Changes to surface water quality off-site • Excess water within the operations area will discharge through an engineered structure into Blackwater Creek • Seepage from the WRSA and TSF could migrate off-site and change surface water quality	• Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system [Mit_008] • Water and chemical suppressants will be used for dust control on the haul roads at the mine site when temperatures are above freezing [Mit_045] • Perimeter runoff and seepage collection systems will be constructed around the TSF [Mit_051] • The dewatering zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit. [Mit_052] • All excess water not required in the process will be treated to concentrations that meet PWQO or CWQG for the protection of aquatic life, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek [Mit_053] • Effectively manage water collected on-site using constructed storage facilities reducing the need for	Residual adverse effect: • There will be a change in surface water quality from discharge into Blackwater Creek, but will not exceed PWQO for the identified parameters or will not exceed background concentrations if background levels are above the PWQO. No residual adverse effect: • Seepage from the WRSA and TSF will be captured within the drawdown zone and will not reach nearby waterbodies.

Table 6.23-7: Summary of Mitigation and Residual Effects for Surface Water Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				fresh water withdrawals and discharges of treated water [Mit_057] • The process will employ a thickener to help recover cyanide solution from the tailings for reuse in the process. The resulting tailings will then be treated using the SO_2-air process to reduce cyanide in the tailings directed to the TSF so as to meet MMER requirements over a long-term basis [Mit_061] • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013]. • During operations, effluent discharged from the Project to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) for the parameters listed below, 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 [Cmt_034]. • All final effluent discharge points will have control structures to immediately cease discharge if and when necessary [Cmt_035]	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile	Surface water quality	<u>Changes to surface water quality off-site</u> • There will be no surface water discharges in the closure phase • Seepage from the WRSA and TSF could migrate off-site and change surface water quality	• Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system [Mit_008] • Tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023] • 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	<u>No residual adverse effect:</u> • There will be no water discharges from the operations area during the closure phase. • Seepage from the WRSA and TSF will continue to be captured within the drawdown zone until groundwater levels return to near pre-development levels.

Table 6.23-7: Summary of Mitigation and Residual Effects for Surface Water Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)	• Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce			if background levels exceed PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Water and chemical suppressants will be used for dust control on the haul roads at the mine site when temperatures are above freezing [Mit_045] • Perimeter runoff and seepage collection systems will be constructed around the TSF [Mit_051] • The dewatering zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit. [Mit_052] • Industry standard erosion and sediment controls, such as sediment traps within ditches, will be implemented during the site preparations and construction phase [Mit_054] • There will be no discharges to surface water during the closure phase [Mit_055] • During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases. [Mit_056] • The process will employ a thickener to help recover cyanide solution from the tailings for reuse in the process. The resulting tailings will then be treated using the SO_2-air process to reduce cyanide in the tailings directed to the TSF so as to meet MMER requirements over a long-term basis [Mit_061] • Once the pit lake is fully flooded, it is expected that monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Surface water quality	<u>Changes to surface water quality off-site</u> • Excess water from the open pit will be released through a spillway into Blackwater Creek • A portion of the seepage from the TSF and WRSA will escape from the site, and will ultimately report to various nearby waterbodies	• Tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023] • 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 PWQO, prior to the	<u>Residual adverse effect:</u> • There will be a change in surface water quality from excess water leaving the open pit into Blackwater Creek. Water quality in Blackwater Creek will either meet PWQO, or will be less than background concentrations if background levels are higher. • There will be changes to surface water quality in nearby waterbodies due to seepage from the TSF

Table 6.23-7: Summary of Mitigation and Residual Effects for Surface Water Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Perimeter runoff and seepage collection systems will be constructed around the TSF [Mit_051] • During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases. [Mit_056] • The process will employ a thickener to help recover cyanide solution from the tailings for reuse in the process. The resulting tailings will then be treated using the SO_2-air process to reduce cyanide in the tailings directed to the TSF so as to meet MMER requirements over a long-term basis [Mit_061] • Once the pit lake is fully flooded, it is expected that monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]	and WRSA. Water quality in these nearby waterbodies will either meet PWQO, or will be less than background concentrations if background levels are higher.

Table 6.23-8: Summary of Mitigation and Residual Effects for Surface Water Quantity

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Surface water quantity	Changes in surface water quantity for the site preparation and construction phase were not evaluated as there would be no releases from the Project.	• A perimeter ditch around the operations area will capture all runoff during the site preparation and construction phase [Mit_008] • Once the perimeter ditch has been completed, there would be no discharges to surface water during the site preparation and construction phase [Mit_045] • The Project design incorporates a compact footprint to limit the catchment area removed from sub-watersheds [Mit_050] • Industry standard erosion and sediment controls will be implemented during the site preparation and construction phase [Mit_054]	Changes in surface water quantity for the site preparation and construction phase were not evaluated as there would be no releases from the Project.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Surface water quantity	<u>Increase in surface water flows</u> • Diversion of Hoffstrom's Bay Tributary and Little Creek sub-watershed to Blackwater Creek • Excess water not required in the process will be treated and discharge to Blackwater Creek <u>Decrease in surface water flow</u> • Diversion of Hoffstrom's Bay Tributary and Little Creek sub-watershed to Blackwater Creek • Fresh water will be taken from two dug irrigation ponds along Thunder Lake Tributary 2 and 3 • Dewatering process may reduce any groundwater base flow currently entering adjacent watercourses <u>Change in lake levels</u> • Increase or decrease in lake levels of Wabigoon Lake or Thunder Lake	• Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system [Mit_008] • The Project design incorporates a compact footprint to limit the catchment area removed from sub-watersheds [Mit_050] • Effectively manage water collected on-site using constructed storage facilities reducing the need for fresh water withdrawals and discharges of treated water [Mit_057] • An engineered structure, designed to dissipate flows and avoid erosion, will be constructed to discharge effluent during operations into Blackwater Creek [Mit_058] • Fresh water takings from tree nursery irrigation ponds on Thunder Lake Tributaries 2 and 3 will not exceed 5% of the flow entering the ponds [Mit_059]	<u>Residual adverse effect:</u> • Both increases and decreases in flow to Blackwater Creek depending on discharge requirements from the Project • Decrease in flow to Thunder Lake Tributaries 1, 2 and 3 from water takings for the Project • Decrease in flow to Hoffstrom's Bay Tributary and Little Creek due to reduction in catchment area <u>No residual adverse effect:</u> • No measurable change to both Wabigoon Lake and Thunder Lake levels
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Surface water quantity	Changes in surface water quantity for the site preparation and construction phase were not evaluated as there would be no releases from the Project.	• Progressively construct a perimeter ditch and seepage collection system around the operations area to capture and direct all runoff from the site to the water management system [Mit_008] • The Project design incorporates a compact footprint to limit the catchment area removed from sub-watersheds [Mit_050] • There will be no surface water discharges during the closure phase [Mit_055]	Changes in surface water quantity for the site preparation and construction phase were not evaluated as there would be no releases from the Project.

Table 6.23-12: Summary of Mitigation and Residual Effects for Surface Water Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Surface water quantity	<u>Increase in surface water flows</u> • Diversion of Hoffstrom's Bay Tributary and Little Creek sub-watershed to Blackwater Creek <u>Decrease in surface water flow</u> • Diversion of Hoffstrom's Bay Tributary and Little Creek sub-watershed to Blackwater Creek <u>Change in lake levels</u> • Increase or decrease in lake levels of Wabigoon Lake or Thunder Lake	• The Project design incorporates a compact footprint to limit the catchment area removed from sub-watersheds [Mit_050] • During closure, the site will be graded such that runoff from the operations area will be directed to the open pit during closure and post-closure phases. [Mit_056] • Once the open pit has been filled, excess water from the open pit will be passively released through an engineered spillway into the existing channel of Blackwater Creek Tributary 1 [Mit_060]	<u>Residual adverse effect:</u> • Increase in flow to Thunder Lake Tributaries 2 and 3 • Increase in flow to Blackwater Creek • Decrease in flow to Hoffstrom's Bay Tributary and Little Creek <u>No residual adverse effect</u> • Negligible change to both Wabigoon Lake and Thunder Lake levels that is well within the natural range of variability

Table 6.23-9: Summary of Mitigation and Residual Effects for Groundwater Quality

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Groundwater quality	Changes in groundwater quality • No potential effect on groundwater quality as no mining activities will occur during this phase	No mitigation measures or commitments required	No residual adverse effect: • No potential effect on groundwater quality as no mining activities will occur during this phase
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Groundwater quality	Changes in groundwater quality • ARD/ML seepage from the WRSA and TSF could change groundwater quality.	• A perimeter runoff and seepage collection ditch will be constructed around what is referred to as the operations area [Mit_008] • Waste rock will be evaluated and segregated between PAG and NAG rock, if feasible [Mit_019] • The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical [Mit_020] • During operations, tailings will be maintained in a saturated condition, and a water cover will be maintained over the majority of the TSF to prevent the onset of acidification[Mit_021] • The TSF will be equipped with a perimeter seepage collection system [Mit_051]. • The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Groundwater monitoring wells will be installed across Project site (as described in Section 13 and Appendix M) [Cmt_023]	No residual adverse effect: • All of the seepage will be capture within the seepage collection system or within the drawdown zone
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile	Groundwater quality	Changes in groundwater quality • ARD/ML seepage from the WRSA and TSF could change groundwater quality.	• A perimeter runoff and seepage collection ditch will be constructed around what is referred to as the operations area [Mit_008] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical [Mit_020] • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022].	No residual adverse effect: • All of the seepage will be capture within the seepage collection system or within the drawdown zone

Table 6.23-9: Summary of Mitigation and Residual Effects for Groundwater Quality (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)	• Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce			• At closure the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water [Mit_023]. • The TSF will be equipped with a perimeter seepage collection system [Mit_051]. • The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Groundwater monitoring wells will be installed across Project site (as described in Section 13 and Appendix M) [Cmt_023]	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Groundwater quality	<u>Changes in groundwater quality</u> • ARD/ML could affect seepage from the WRSA and TSF and change groundwater quality	• A perimeter runoff and seepage collection ditch will be constructed around what is referred to as the operations area [Mit_008] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical [Mit_020] • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022]. • At closure the process water will be withdrawn from the TSF, treated and used to help fill the open pit. The tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water [Mit_023]. • The TSF will be equipped with a perimeter seepage collection system [Mit_051]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Groundwater monitoring wells will be installed across Project site (as described in Section 13 and Appendix M) [Cmt_023]	<u>No residual adverse effect:</u> There may be changes to groundwater quality at nearby drinking water wells. However, should the follow-up program identify significant degradation in the quality of groundwater, Treasury Metals would mitigation measures to provide suitable replacement of private water supplies affected.

Table 6.23-10: Summary of Mitigation and Residual Effects for Groundwater Quantity

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Groundwater Quantity	Changes in groundwater quantity • Decrease in groundwater elevations in private water wells		No residual adverse effect: • Dewatering of the overburden will not have effects extend past the operations area and will not affect private water wells
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Groundwater Quantity	Changes to groundwater quantity • Decrease in groundwater elevations in private water wells	• Deepen those wells where the drawdown affects the wells ability to provide the required water supply [Mit_063]	No residual adverse effect: • Private water wells will still provide the required water supply
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Groundwater Quantity	Changes to groundwater quantity • Decrease in groundwater elevations in private water wells	• Deepen those wells where the drawdown affects the wells ability to provide the required water supply [Mit_063]	No residual adverse effect: • Private water wells will still provide the required water supply

Table 6.23-10: Summary of Mitigation and Residual Effects for Groundwater Quantity (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Groundwater Quantity	Changes to groundwater quantity • Groundwater levels would return to pre-development levels	No mitigation measures or commitments required	No residual adverse effect: • Groundwater levels would return to pre-development levels

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Wildlife Species at Risk	Common Nighthawk Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions Northern Myotis/Little Brown Myotis Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions Barn Swallow Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow) [Mit_075] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	Common Nighthawk Residual adverse effect: • 300 ha of habitat loss • 198 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions Northern Myotis/Little Brown Myotis Residual adverse effect: • 15.85 ha of habitat loss • Low risk of mortality due to vehicle collisions No residual adverse effect: No habitat alteration or disruption Barn Swallow Residual adverse effect: • Several ha of habitat loss • 198 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions
		Ungulates	Moose Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065]	Moose Residual adverse effect: • 84 ha of habitat loss • 57 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)			• Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020].	
		Furbearers	American Martin Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions American Beaver Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034,	American Martin Residual adverse effect: • 62 ha of habitat loss • 14 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions American Beaver Residual adverse effect: • <4 ha of habitat loss • Low risk of mortality due to vehicle collisions No residual adverse effect: • No habitat alteration or disruption due to noise/sensory disturbance as beaver coexist well with most industrial activities.

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)			• Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020]. • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	
		Upland birds	<u>Upland Birds</u> <u>Habitat loss</u> • Direct loss of habitat as a result of vegetation clearing and overburden stripping <u>Habitat alternation or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels <u>Potential for mortality</u> • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	<u>Upland Birds</u> <u>Residual adverse effect</u> • 95 ha of habitat loss • 3.21 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Wetland birds	<u>Marsh Birds</u> <u>Habitat loss</u> • Direct loss of habitat as a result of vegetation clearing and overburden stripping <u>Habitat alternation or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels <u>Potential for mortality</u> • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	<u>Marsh Birds</u> <u>Residual adverse effect:</u> • 33 ha of habitat loss • 2.9 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions
		Small mammals	<u>Small Mammals</u> <u>Habitat loss</u> • Direct loss of habitat as a result of vegetation clearing and overburden stripping <u>Habitat alternation or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels <u>Potential for mortality</u> • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]	<u>Small Mammals</u> <u>Residual adverse effect:</u> • 400 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Some require mature undisturbed forest, while others thrive in anthropogenically altered landscapes

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
		Reptiles and amphibians	<u>Reptiles and Amphibians</u> <u>Habitat loss</u> • Direct loss of habitat as a result of vegetation clearing and overburden stripping <u>Habitat alternation or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels <u>Potential for mortality</u> • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	<u>Reptiles and Amphibians</u> <u>Residual adverse effect:</u> • 162 ha of habitat loss • 89 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions
		Invertebrates	<u>Terrestrial Invertebrates</u> <u>Habitat loss</u> • Direct loss of habitat as a result of vegetation clearing and overburden stripping <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels <u>Potential for mortality</u> • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072]	<u>Terrestrial Invertebrates</u> <u>Residual adverse effect:</u> • 400 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Few studies have investigated the effects of noise on invertebrates.

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Wildlife Species at Risk	<u>Common Nighthawk</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation • Functional loss of habitat as a result of light and noise emissions <u>Potential for mortality</u> • Direct mortality as a result of vehicle collisions <u>Northern Myotis/Little Brown Myotis</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation • Functional loss of habitat as a result of light and noise emissions <u>Potential for mortality</u> • Direct mortality as a result of vehicle collisions <u>Barn Swallow</u> <u>Habitat loss</u>	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow) [Mit_075] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031]	<u>Common Nighthawk</u> <u>Residual adverse effect:</u> • 300 ha of habitat loss • 122 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions <u>Northern Myotis/Little Brown Myotis</u> <u>Residual adverse effect:</u> • 15.85 ha of habitat loss • Low risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat alteration or disruption as it is not anticipated that the sound levels generated by site clearing and construction will interfere with the echolocation of these bat species <u>Barn Swallow</u> <u>Residual adverse effect:</u> • Several ha of habitat loss • 122 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)			• Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation • Functional loss of habitat as a result of light and noise emissions <u>Potential for mortality</u> • Direct mortality as a result of vehicle collisions	• Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
		Ungulates	<u>Moose</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise <u>Potential for mortality</u> • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020].	<u>Moose</u> <u>Residual adverse effect:</u> • 84 ha of habitat loss • 34 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions
		Furbearers	<u>American Martin</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065]	<u>American Martin</u> <u>Residual adverse effect:</u> • 62 ha of habitat loss • 8 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)			• Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions American Beaver Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020]. • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	American Beaver Residual adverse effect: • <4 ha of habitat loss • Low risk of mortality due to vehicle collisions No residual adverse effect: • No habitat alteration or disruption due to noise/sensory disturbance as beaver coexist well with most industrial activities.
		Upland birds	Upland Birds Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072]	Upland Birds Residual adverse effect • 95 ha of habitat loss • 4.3 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	
		Wetland birds	<u>Marsh Birds</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise <u>Potential for mortality</u> • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	<u>Marsh Birds</u> <u>Residual adverse effect:</u> • 33 ha of habitat loss • 7.5 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions
		Small mammals	<u>Small Mammals</u> <u>Habitat loss</u> • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint <u>Habitat alteration or displacement</u>	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066]	<u>Small Mammals</u> <u>Residual adverse effect:</u> • 109 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Some

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)			• Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	require mature undisturbed forest, while others thrive in anthropogenically altered landscapes
		Reptiles and amphibians	Reptiles and Amphibians Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	Reptiles and Amphibians Residual adverse effect: • 162 ha of habitat loss • 60 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Invertebrates	Terrestrial Invertebrates Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	Terrestrial Invertebrates Residual adverse effect: • 400 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions No residual adverse effect: • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Few studies have investigated the effects of noise on invertebrates.
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Wildlife Species at Risk	Common Nighthawk Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise Potential for mortality • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions Northern Myotis/Little Brown Myotis Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071]	Common Nighthawk Residual adverse effect: • 300 ha of habitat loss • 192 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions Northern Myotis/Little Brown Myotis Residual adverse effect: • 15.85 ha of habitat loss • Low risk of mortality due to vehicle collisions No residual adverse effect: • No habitat alteration or disruption as it is not anticipated that the sound levels generated by site clearing and construction will interfere with the echolocation of these bat species Barn Swallow Residual adverse effect: • Several ha of habitat loss • 192 ha of habitat alteration or disturbed • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)			• Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions <u>Barn Swallow</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow) [Mit_075] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020].	
		Ungulates	<u>Moose</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069]	<u>Moose</u> <u>Residual adverse effect:</u> • 84 ha of habitat loss • 53 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Dangerous wildlife awareness will be part of the site's safety program. Safety training will be provided to workers to raise awareness and to assist in protecting them from injury. Food waste will be managed in a manner that limits contact/attraction of potentially dangerous wildlife [Cmt_020]. • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	
		Furbearers	American Martin Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise Potential for mortality • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions American Beaver Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072]	American Martin Residual adverse effect: • 62 ha of habitat loss • 14 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions American Beaver Residual adverse effect: • <4 ha of habitat loss • Low risk of mortality due to vehicle collisions No residual adverse effect: • No habitat alteration or disruption due to noise/sensory disturbance as beaver coexist well with most industrial activities.

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)			Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise Potential for mortality • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	
		Upland birds	Upland Birds Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise Potential for mortality • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	Upland Birds Residual adverse effect • 95 ha of habitat loss • 2.6 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions
		Wetland birds	Marsh Birds Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066]	Marsh Birds Residual adverse effect: • 33 ha of habitat loss • 0.7 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)			• Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow) [Mit_075] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
		Small mammals	<u>Small Mammals</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072]	<u>Small Mammals</u> <u>Residual adverse effect:</u> • 172 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Some require mature undisturbed forest, while others thrive in anthropogenically altered landscapes

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
		Reptiles and amphibians	<u>Reptiles and Amphibians</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Restricting the clearing of potential terrestrial reptile and amphibian breeding habitats to periods outside the breeding season as directed by MNRF [Mit_073] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (e.g., draining wetlands to discourage hibernation) [Mit_074] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	<u>Reptiles and Amphibians</u> <u>Residual adverse effect:</u> • 162 ha of habitat loss • 88 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Invertebrates	<u>Terrestrial Invertebrates</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054] • Road-killed animals or any other carcasses found on-site will be removed in a timely and legal manner to limit the attraction of wildlife [Cmt_021]	<u>Terrestrial Invertebrates</u> <u>Residual adverse effect:</u> • 400 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions <u>No residual adverse effect:</u> • No habitat loss due to the fact that small mammals occupy many niches in the ecosystem. Few studies have investigated the effects of noise on invertebrates.
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Wildlife Species at Risk	<u>Common Nighthawk</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality Northern Myotis/Little Brown Myotis <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	<u>No residual adverse effect:</u> • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)			<u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality <u>Barn Swallow</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality		
		Ungulates	<u>Moose</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	<u>No residual adverse effect:</u> • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.
		Furbearers	<u>American Martin</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality <u>American Beaver</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	<u>No residual adverse effect:</u> • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.
		Upland birds	<u>Upland Birds</u> <u>Habitat loss</u> • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat <u>Habitat alteration or displacement</u> • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	<u>No residual adverse effect:</u> • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.

Table 6.23-11: Summary of Mitigation and Residual Effects for Wildlife and Wildlife Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Wetland birds	Marsh Birds Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	No residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.
		Small mammals	Small Mammals Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	No residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.
		Reptiles and amphibians	Reptiles and Amphibians Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	No residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.
		Invertebrates	Terrestrial Invertebrates Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	No residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.

Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Upland birds	Upland Birds Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]	Upland Birds Residual adverse effect • 95 ha of habitat loss • 3.21 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions
		Wetland birds	Marsh Birds Habitat loss • Direct loss of habitat as a result of vegetation clearing and overburden stripping Habitat alternation or displacement • Functional loss of habitat as a result of fragmentation and noise levels Potential for mortality • Direct mortality due to site clearing and construction activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Conducting timber clearing outside of the breeding bird window (May1 to August 15) to avoid potential mortality to birds. This will also protect roosting bats [Mit_067] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071]	Marsh Birds Residual adverse effect: • 33 ha of habitat loss • 2.9 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions

Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Upland birds	Upland Birds Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	Upland Birds Residual adverse effect • 95 ha of habitat loss • 4.3 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions
		Wetland birds	Marsh Birds Habitat loss • Direct loss of habitat continues from site preparation and construction • Direct loss of habitat due to the expansion of the WRSA and TSF footprint Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation and noise levels • Functional loss of habitat as a result of light and noise Potential for mortality • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070]	Marsh Birds Residual adverse effect: • 33 ha of habitat loss • 7.5 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions

Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Upland birds	<u>Upland Birds</u> <u>Habitat loss</u> • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality <u>Habitat alteration or displacement</u> • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise <u>Potential for mortality</u> • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Disposing of food waste generated on site in an appropriate manner to limit wildlife attraction to the area [Mit_072] • If habitat destruction / damage cannot be avoided, provide alternate nesting habitat as a provision of compensatory habitat for species protected under the ESA (e.g., Barn Swallow) [Mit_075] • Providing acceptable buffers around any raptor nests identified throughout all Project phases [Mit_076] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	<u>Upland Birds</u> <u>Residual adverse effect</u> • 95 ha of habitat loss • 2.6 ha of habitat alteration or disruption • Medium risk of mortality due to vehicle collisions

Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Wetland birds	Marsh Birds Habitat loss • Direct habitat loss from the site preparation and construction phase until the reclaimed landscape can return some of the habitat functionality Habitat alteration or displacement • Functional loss of habitat as a result of fragmentation until the reclaimed landscape can return some of the habitat functionality • Functional loss of habitat as a result of noise Potential for mortality • Direct mortality due to reclamation and closure activities • Direct mortality as a result of vehicle collisions	• Project design incorporates a compact site footprint [Mit_050] • Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Provide vegetation buffers of 120 m along rivers, creeks and wetlands wherever feasible [Mit_066] • The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068] • Enforcement of speed limits within the Project area to reduce the potential for wildlife/vehicle collisions [Mit_069] • Protection of suitable bird breeding habitat, where possible [Mit_070] • Wildlife awareness training for all staff including SAR identification/legislation and education regarding seasonal changes in animal behaviours and their presence [Mit_071] • Implementation of noise abatement strategies to limit the negative effects of sound on wildlife [Mit_025, Mit_028, Mit_029, Mit_031] • Where feasible, direct anthropogenic lighting to reduce excess production of light into the surrounding environment [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Progressively construct a perimeter ditch around the operations area to prevent the release of runoff from the mine site to adjacent wetlands and watercourses [Mit_008] • Implement sediment and erosion control during the site preparation and construction phase [Mit_054]	Marsh Birds Residual adverse effect: • 33 ha of habitat loss • 0.7 ha of habitat alteration or disruption • Low risk of mortality due to vehicle collisions
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels	Upland birds	Upland Birds Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	No residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.

Table 6.23-12: Summary of Mitigation and Residual Effects for Migratory Birds (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post closure (cont'd)	• Seepage from the WRSA and TSF leaving the site	Wetland birds	Marsh Birds Habitat loss • Direct habitat loss will continue until the reclaimed landscape is able to provide replacement habitat Habitat alteration or displacement • Habitat function as a result of fragmentation will continue until the reclaimed landscape can return habitat functionality	• The WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018] • Restoration of disturbed habitats at closure or encouraging development of habitats capable of supporting a diversity of wildlife species [Mit_068]	cNo residual adverse effect: • Reclaimed closure landscape will begin to replace the lost habitat and habitat function. There are no residual adverse effects once the site is fully reclaimed.

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Stream-resident fish population	Habitat loss or alteration of habitat • Loss of habitat by overprinting Blackwater Creek Tributary 1 by the open pit • Loss of habitat by overprinting of Blackwater Creek Tributary 2 by the TSF Habitat degradation due to changing flows or water levels • Construction of the perimeter ditch will affect watershed areas of Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek • Construction of water discharge structure in Blackwater Creek may affect fish habitat • Construction of water intakes in the irrigation ponds may affect fish habitat • Releases from the Project may cause fish habitat degradation Habitat degradation due to water quality • Releases from the Project may cause fish habitat degradation Blasting • Blasting may cause mortality of fish	• Prior to overburden removal, any beaver dams within the Project footprint will be removed and the impoundments will be allowed to draw down. This will reduce the number of fish that will remain in isolated sections of Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 [Mit_077]. • Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • To the extent practicable, fish in the sections of Blackwater Creek Tributary 1 that will be isolated by the construction of the perimeter ditch and overprinted by the removal of overburden from the open pit will be captured and relocated to the same tributaries downstream from the operations area, or to the main branch of Blackwater Creek [Mit_079]. • To the extent practicable, fish in the sections of Blackwater Creek Tributary 2 that will be isolated by the construction of the perimeter ditch and overprinted by the construction of the TSF will be captured and relocated to the same tributaries downstream from the operations area, or to the main branch of Blackwater Creek [Mit_080]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013].	Residual adverse effect: • Habitat loss of Blackwater Creek Tributary 1 and 2 may result in 50% mortality of stream-resident fish population in the stretches of tributary overprinted. No residual adverse effect: • No effect to stream-resident fish population due to the predicted small changes in flows and water levels. • No effect to stream-resident fish population due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to stream-resident fish population due to blasting.

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Migratory fish populations	<u>Habitat loss or alteration of habitat</u> • Loss of habitat by overprinting Blackwater Creek Tributary 1 by the open pit • Loss of habitat by overprinting of Blackwater Creek Tributary 2 by the TSF <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will affect watershed areas of Hoffstrom's Bay Tributary, Little Creek and Blackwater Creek • Construction of water discharge structure in Blackwater Creek may affect fish habitat • Construction of water intakes in the irrigation ponds may affect fish habitat • Releases from the Project may cause fish habitat degradation <u>Habitat degradation due to water quality</u> • Releases from the Project may cause fish habitat degradation <u>Blasting</u> • Blasting may cause mortality of fish	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013].	<u>No residual adverse effect:</u> • No effect to migratory fish populations due to direct loss or alteration of habitat • No effect to migratory fish populations due to the predicted small changes in flows and water levels • No effect to migratory fish populations due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to migratory fish populations due to blasting
		Lake-resident fish population	<u>Habitat loss or alteration of habitat</u> • No potential habitat loss to lake resident fish populations <u>Habitat degradation due to changing flows or water levels</u> • No potential habitat degradation <u>Habitat degradation due to water quality</u> • Releases from the Project may cause fish habitat degradation <u>Blasting</u> • Blasting may cause mortality of fish	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057]. • Excess water during operations will be treated to meet PWQO prior to being discharged to a single discharge point in Blackwater Creek [Mit_053]. • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013].	<u>No residual adverse effect:</u> • No effect to lake-resident fish populations due to direct loss or alteration of habitat • No effect to lake-resident fish populations due to the predicted small changes in flows and water levels • No effect to lake-resident fish populations due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to lake-resident fish populations due to blasting
		Fish species-at-risk	There were no identified fish species-at-risk in the surface water bodies around the Project	No mitigation measures identified	<u>No residual adverse effect:</u> • There are no identified fish species-at-risk in the surface water bodies around the Project.

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Stream-resident fish population	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Releases from the Project may cause fish habitat degradation • Water takings from the irrigation ponds will decrease the flows in Thunder Lake Tributaries 2 and 3. <u>Habitat degradation due to water quality</u> • Releases from the Project may cause fish habitat degradation <u>Blasting</u> • Blasting may cause mortality of fish	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057]. • The fresh water needs for the Project will be met by withdrawals from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The withdrawals will not exceed 5% of the flows in either of the two creeks. Pump intakes will be fitted with fish screens to prevent entrainment [Mit_059, Mit_081]. • Excess water during operations will be treated to meet PWQO prior to being discharged to a single discharge point in Blackwater Creek [Mit_053]. • Treated effluent will be discharged to Blackwater Creek through an engineered structure designed to minimize erosion risks [Mit_058]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013]. • During operations, effluent discharged from the Project to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) for the parameters listed below, 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	<u>No residual adverse effect:</u> • No effect to stream-resident fish populations due to direct loss or alteration of habitat as the habitat loss due to the Project will be offset • No effect to stream-resident fish populations due to the predicted small changes in flows and water levels • No effect to stream-resident fish populations due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to stream-resident fish populations due to blasting

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				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 [Cmt_034] • All final effluent discharge points will have control structures to immediately cease discharge if and when necessary [Cmt_035]	
		Migratory fish populations	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Releases from the Project may cause fish habitat degradation • Water takings from the irrigation ponds will decrease the flows in Thunder Lake Tributaries 2 and 3. <u>Habitat degradation due to water quality</u> • Releases from the Project may cause fish habitat degradation <u>Blasting</u> • Blasting may cause mortality of fish	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057]. • The fresh water needs for the Project will be met by withdrawals from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The withdrawals will not exceed 5% of the flows in either of the two creeks. Pump intakes will be fitted with fish screens to prevent entrainment [Mit_059, Mit_081]. • Excess water during operations will be treated to meet PWQO prior to being discharged to a single discharge point in Blackwater Creek [Mit_053]. • Treated effluent will be discharged to Blackwater Creek through an engineered structure designed to minimize erosion risks [Mit_058]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082].	<u>No residual adverse effect:</u> • No effect to migratory fish populations due to direct loss or alteration of habitat • No effect to migratory fish populations due to the predicted small changes in flows and water levels • No effect to migratory fish populations due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to migratory fish populations due to blasting

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013]. • During operations, effluent discharged from the Project to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) for the parameters listed below, 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 [Cmt_034]	
		Lake-resident fish population	<u>Habitat loss or alteration of habitat</u> • No potential lake habitat loss <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. <u>Habitat degradation due to water quality</u> • Releases from the Project may cause fish habitat degradation <u>Blasting</u> • Blasting may cause mortality of fish	• Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • The refined water balance for the Project looks to optimize the use of water collected within the operations area for use in the processing of ore. This limits the effects on surface water quantities by minimizing water taking and providing flexibility regarding the volumes discharged from the Project [Mit_057]. • The fresh water needs for the Project will be met by withdrawals from the irrigation ponds on Thunder Lake Tributary 2 and Thunder Lake Tributary 3. The withdrawals will not exceed 5% of the flows in either of the two creeks. Pump intakes will be fitted with fish screens to prevent entrainment [Mit_059, Mit_081]. • Excess water during operations will be treated to meet PWQO prior to being discharged to a single discharge point in Blackwater Creek [Mit_053]. • Ditching and drainage will be designed to collect and manage runoff from site, and will be established around stockpiles. All collection ponds will be integrated with the site water management plan [Cmt_013].	<u>No residual adverse effect:</u> • No effect to lake-resident fish populations due to direct loss or alteration of habitat • No effect to lake-resident fish populations due to the predicted small changes in flows and water levels • No effect to lake-resident fish populations due to the changes in water quality from the Project not exceeding PWQO or background concentrations if background levels are above the PWQO. • No effect to lake-resident fish populations due to blasting

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• During operations, effluent discharged from the Project to Blackwater Creek will meet the Provincial Water Quality Objectives (PWQO) for the parameters listed below, 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 [Cmt_034]	
		Fish species-at-risk	There were no identified fish species-at-risk in the surface water bodies around the Project	No mitigation measures identified	<u>No residual adverse effect:</u> • There are no identified fish species-at-risk in the surface water bodies around the Project.
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Stream-resident fish population	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Decommissioning of the water discharge structure in Blackwater Creek will result in habitat alterations. • Decommissioning of the water intakes in the irrigation ponds on Thunder Lake Tributary 2 and 3 will result in minor habitat alterations <u>Habitat degradation due to water quality</u> • There will be no release from the Project <u>Blasting</u> • There will be no blasting in the closure phase	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>No residual adverse effect:</u> • No effect to stream-resident fish populations due to direct loss or alteration of habitat • No effect to stream-resident fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the closure phase

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Migratory fish populations	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Decommissioning of the water discharge structure in Blackwater Creek will result in habitat alterations. • Decommissioning of the water intakes in the irrigation ponds on Thunder Lake Tributary 2 and 3 will result in minor habitat alterations <u>Habitat degradation due to water quality</u> • There will be no release from the Project <u>Blasting</u> • There will be no fish mortality during this phase	• Activities and the construction of Project components that will impact or overprint watercourses (i.e., the perimeter ditch, the effluent diffuser, water intakes) will occur during the fisheries timing window when in-stream work is permitted [Mit_078]. • Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>No residual adverse effect:</u> • No effect to migratory fish populations due to direct loss or alteration of habitat • No effect to migratory fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the closure phase
		Lake-resident fish population	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. <u>Habitat degradation due to water quality</u> • There will be no release from the Project <u>Blasting</u> • There will be no fish mortality during this phase	• Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • A perimeter ditch around the operations area will prevent the release of runoff [Mit_008]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>No residual adverse effect:</u> • No effect to lake-resident fish populations due to direct loss or alteration of habitat • No effect to lake-resident fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the closure phase
		Fish species-at-risk	There were no identified fish species-at-risk in the surface water bodies around the Project	No mitigation measures identified	<u>No residual adverse effect:</u> There are no identified fish species-at-risk in the surface water bodies around the Project.

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Stream-resident fish population	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quantity downstream of the spillway <u>Habitat degradation due to water quality</u> • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quality downstream of the spillway • Seepage from the TSF and WRSA could affect surface water quality in adjacent watercourses <u>Blasting</u> • There will be no fish mortality during this phase	• Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Once the pit has filled during the post-closure phase, excess water will be allowed to passively discharge through a spillway into the former channel of Blackwater Creek Tributary 1 [Mit_060]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>No residual adverse effect:</u> • No effect to stream-resident fish populations due to direct loss or alteration of habitat • No effect to stream-resident fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the post-closure phase
		Migratory fish populations	<u>Habitat loss or alteration of habitat</u> • Habitat lost during the site preparation and construction phase will remain lost throughout operations. <u>Habitat degradation due to changing flows or water levels</u> • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quantity downstream of the spillway <u>Habitat degradation due to water quality</u> • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quality downstream of the spillway • Seepage from the TSF and WRSA could affect surface water quality in adjacent watercourses <u>Blasting</u> • There will be no fish mortality during this phase	• Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Once the pit has filled during the post-closure phase, excess water will be allowed to passively discharge through a spillway into the former channel of Blackwater Creek Tributary 1 [Mit_060]. • As the Project advances, detailed engineering will be completed to ensure that all downstream culverts on Blackwater Creek can support any predicted increases in flows. This would include ensuring that the downstream culverts will continue to provide adequate fish passage [Mit_082]. • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	<u>No residual adverse effect:</u> • No effect to migratory fish populations due to direct loss or alteration of habitat • No effect to migratory fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the post-closure phase

Table 6.23-13: Summary of Mitigation and Residual Effects for Fish and Fish Habitat (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Lake-resident fish population	Habitat loss or alteration of habitat • Habitat lost during the site preparation and construction phase will remain lost throughout operations. Habitat degradation due to changing flows or water levels • Construction of the perimeter ditch will decrease flows in Hoffstrom's Bay Tributary and Little Creek. • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quantity downstream of the spillway Habitat degradation due to water quality • Discharge from the filled open pit into Blackwater Creek Tributary 1 will affect the surface water quality downstream of the spillway • Seepage from the TSF and WRSA could affect surface water quality in adjacent watercourses Blasting • There will be no fish mortality during this phase	• Optimize the layout of the Project to minimize the footprint, and to the extent possible, minimizing the catchment areas diverted from Little Creek and Hoffstrom's Bay Tributary [Mit_050]. • 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 PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek [Mit_024] • Once the pit has filled during the post-closure phase, excess water will be allowed to passively discharge through a spillway into the former channel of Blackwater Creek Tributary 1 [Mit_060]. • Treasury Metals expects that that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124].	No residual adverse effect: • No effect to lake-resident fish populations due to direct loss or alteration of habitat • No effect to lake-resident fish populations due to the predicted small changes in flows and water levels • There will be no water released from the Project during this phase • There will be no blasting in the post-closure phase
		Fish species-at-risk	There were no identified fish species-at-risk in the surface water bodies around the Project	No mitigation measures identified	No residual adverse effect: There are no identified fish species-at-risk in the surface water bodies around the Project.

Table 6.23-14: Summary of Mitigation and Residual Effects for Wetlands and Vegetation

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Wetlands	<u>Potential effects to wild rice</u> • Direct loss of wetlands as a result of draining and infrastructure development; • Discharge of sediments in watercourses; • Alteration of natural flows and water levels <u>Potential loss of Floating Marsh Marigold</u> • Direct loss of wetlands as a result of draining the infrastructure development • Alteration of natural flows and water levels <u>Loss of wetland extent</u> • Alteration of natural flows and water levels • Direct loss of wetlands as a result of draining the infrastructure development	• Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Construction of a perimeter ditch around the operations area, which will collect all of the site runoff for use in the processing [Mit_008]. • Ensure proper culvert sizing for all new water crossing installations, allowing for maintenance of existing flows and water levels [Mit_082]. • Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF [Mit_066]. • Develop a wetland clearing strategy with the local MNRF reduce the effects to overwintering frogs (i.e., draining wetlands to discourage hibernation) [Mit_074].	<u>Residual adverse effect:</u> • 33 ha of wetland will be removed as a result of the Project during the site preparation and construction phase due to construction activities <u>No residual adverse effect:</u> • Wild rice will not be affected as a result of changes to water quality or changes in water levels as a result of the Project • There will be no loss to Floating Marsh Marigold as a result of alterations of natural flows and water levels. The wetlands that will be lost as a result of the Project are not suitable Floating Marsh Marigold habitat.
		Vegetation communities	<u>Potential loss of vegetation communities</u> • Direct loss of predominantly coniferous forest • Direct loss of predominantly deciduous forest • Direct loos of predominantly successional area <u>Loss of potential berry harvesting habitat</u> • Direct loss of potential berry habitat	• Retention of forested areas wherever feasible [Mit_084]. • Identification and protection of known vegetative SAR locations [Mit_085]. • Avoid broadcast spraying of herbicides for vegetation management [Mit_086]. • Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF [Mit_066]. • Develop sediment and erosion plans which will reduce sedimentation into wetlands and reduce the potential for dust cover on roadside vegetation [Mit_008, Mit_046, Mit_054].	<u>Residual adverse effect:</u> • 95 ha of predominantly coniferous forest loss • 43 ha of predominantly deciduous forest loss • 70 ha of predominantly successional area loss • 260 ha of potential berry habitat loss
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings	Wetlands	<u>Potential effects to wild rice</u> • Continued loss of wetlands affected during site preparation and construction • Loss of wetlands caused by groundwater drawdown due to dewatering • Discharge of sediments in watercourses • Alteration of natural flows and water levels <u>Potential loss of Floating Marsh Marigold</u> • Direct loss of wetlands as a result of draining the infrastructure development • Alteration of natural flows and water levels	• Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Construction of a perimeter ditch around the operations area, which will collect all of the site runoff for use in the processing [Mit_008]. • During operations, excess site water will be treated to meet Provincial Water Quality Objectives (PWQO) prior to discharge into Blackwater Creek.	<u>Residual adverse effect:</u> • 47 ha of wetland will be removed as a result of the Project during the site preparation and construction phase due to construction activities <u>No residual adverse effect:</u> • Wild rice will not be affected as a result of changes to water quality or changes in water levels as a result of the Project • There will be no loss to Floating Marsh Marigold as a result of alterations of natural flows and water levels. The wetlands that will be lost as a result of

Table 6.23-14: Summary of Mitigation and Residual Effects for Wetlands and Vegetation (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)	• Water taking for operations • Discharge of treated water to Blackwater Creek		• Loss of wetlands caused by groundwater drawdown due to dewatering Loss of wetland extent • Alteration of natural flows and water levels • Direct loss of wetlands as a result of draining the infrastructure development • Loss of wetlands caused by groundwater drawdown due to dewatering	There will be no other discharges to surface water during operations [Mit_053]. • Ensure proper culvert sizing for all new water crossing installations, allowing for maintenance of existing flows and water levels [Mit_082]. • Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF [Mit_066]. • Develop sediment and erosion plans which will reduce sedimentation into wetlands and reduce the potential for dust cover on roadside vegetation [Mit_008, Mit_046, Mit_054].	the Project are not suitable Floating Marsh Marigold habitat.
		Vegetation communities	Potential loss of vegetation communities • Direct loss of predominantly coniferous forest • Direct loss of predominantly deciduous forest • Direct loos of predominantly successional area Loss of potential berry harvesting habitat • Direct loss of potential berry habitat	• Retention of forested areas wherever feasible [Mit_084]. • • Identification and protection of known vegetative SAR locations [Mit_085]. • Avoid broadcast spraying of herbicides for vegetation management [Mit_086]. • Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF [Mit_066].	Residual adverse effect: • 95 ha of predominantly coniferous forest loss • 43 ha of predominantly deciduous forest loss • 70 ha of predominantly successional area loss • 260 ha of potential berry habitat loss
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Wetlands	Potential effects to wild rice • Continued loss of wetlands affected during site preparation and construction; • Discharge of sediments in watercourses; • Alteration of natural flows and water levels; and • Deposition of dust from equipment and vehicles on roadside vegetation Potential loss of Floating Marsh Marigold • Direct loss of wetlands as a result of draining the infrastructure development • Alteration of natural flows and water levels • Loss of wetlands caused by groundwater drawdown due to dewatering Loss of wetland extent • Alteration of natural flows and water levels • Direct loss of wetlands as a result of draining the infrastructure development • Loss of wetlands caused by groundwater drawdown due to dewatering	• Minimize the amount of habitat clearing required for the Project by siting Project infrastructure to the extent practicable, in previously disturbed areas and optimizing the use of existing roadways [Mit_065] • Construction of a perimeter ditch around the operations area, which will collect all of the site runoff for use in the processing [Mit_008]. • Ensure proper culvert sizing for all new water crossing installations, allowing for maintenance of existing flows and water levels [Mit_082]. • Develop slope dependent vegetated buffers along rivers creeks and wetlands in conjunction with the MNRF [Mit_066]. • Develop sediment and erosion plans which will reduce sedimentation into wetlands and reduce the potential for dust cover on roadside vegetation [Mit_008, Mit_046, Mit_054]. • Restoration of all disturbed habitats upon closure to the extent feasible [Mit_068].	Residual adverse effect: • 47 ha of wetland will be removed as a result of the Project during the site preparation and construction phase due to construction activities No residual adverse effect: • Wild rice will not be affected as a result of changes to water quality or changes in water levels as a result of the Project • There will be no loss to Floating Marsh Marigold as a result of alterations of natural flows and water levels. The wetlands that will be lost as a result of the Project are not suitable Floating Marsh Marigold habitat.

Table 6.23-14: Summary of Mitigation and Residual Effects for Wetlands and Vegetation (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Vegetation communities	Potential loss of vegetation communities • Direct loss of predominantly coniferous forest • Direct loss of predominantly deciduous forest • Direct loos of predominantly successional area Loss of potential berry harvesting habitat • Direct loss of potential berry habitat	• Identification and protection of known vegetative SAR locations [Mit_085]. • Avoid broadcast spraying of herbicides for vegetation management [Mit_086]. • Restoration of all disturbed habitats upon closure to the extent feasible [Mit_068]. • Re-vegetation of final grade slopes after closure with a focus on riparian habitat in the open pit [Mit_068, Mit_087]. • Reclamation and re-vegetation of the mining footprint to be carried out in accordance with O.Reg. 240/00 [Mit_088]. • Seeding or hydro-seeding of the reclaimed areas with native seed mix [Mit_089].	Residual adverse effect: • 95 ha of predominantly coniferous forest loss • 43 ha of predominantly deciduous forest loss • 70 ha of predominantly successional area loss • 260 ha of potential berry habitat loss
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Wetlands	There were no identified potential effects to wetlands in the post-closure phase	No mitigation measures or commitments identified	No residual adverse effects • Effects to wetlands will not continue in the post-closure phase
		Vegetation communities	There were no identified potential effects to vegetation communities in the post-closure phase	No mitigation measures or commitments identified	No residual adverse effects • Vegetation communities will re-establish themselves in the post-closure phase to near pre-development conditions

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Land use planning	<u>Conflict with land use planning</u> • Potential for conflict with accepted land uses as stipulated in approved land use plans • Project overlap with protected areas	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • There are no existing land use planning policies that could conflict with the Project's use of the land.
		Aggregate operations	<u>Conflict with aggregate operations</u> • Change in access to aggregate resources • Potential for change in demand for aggregate resources extraction	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>Residual positive effect:</u> • There may potentially be an increase demand to local aggregate suppliers, which would result in a local economic boom to aggregate resources <u>No residual adverse effect:</u> • There will be no change in access to aggregate resources as a result of the Project
		Forestry	<u>Conflict with forestry</u> • Potential for a change in access to forestry resources for management • Loss of forestry resources	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	<u>No residual adverse effect:</u> • Treasury Metals has obtained a licence to forest the area of patent land in the operations area and has already discussed the removal of trees with the Forestry Licence holder on the areas of Crown Land. As the merchantable timber in the operations area will be used, there is no loss of forestry resources. • There will be no change in access to forestry resources around the Project
		Mineral Exploration	<u>Conflict with mineral exploration</u> • Potential change in access to mineral claims for exploration and production	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • Treasury Metals has mineral claims or mineral rights on the majority of the area surrounding the Project and has an obligation to continue to explore the viability of these mineral claims. There are no conflicts with mineral exploration as a result of the Project.
		Fishing – recreational and commercial	<u>Conflict with fishing for recreational or commercial purposes</u> • Change in access to fishing areas • Change in abundance of fish • Change in contamination levels of fish • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples	<u>No residual adverse effect:</u> • There will be no change in access to fisheries resources as a result of the Project. • There will be no change in the abundance of fish • There will be no adverse change in contamination levels of fish as the changes to water quality in the receiving environment will not exceed PWQO or will be below background. • There will be no diminished experience of being on the land for fishing purposes as a result of the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	
		Hunting	<u>Conflict with hunting activities</u> • Change in access to hunting areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples	<u>Residual adverse effect:</u> • 743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Trapping	<u>Conflict with trapping activities</u> • Change in access to trapline areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples	<u>Residual adverse effect:</u> • 309 ha will be unavailable for trapping on trapline licence DR026. • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Cottagers and outfitters	<u>Conflict with cottages and outfitters</u> • Diminished experience of being on the land • Change in the access to areas outfitters had previously used • Change in the clientele for outfitters with lodges in the area	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021].	<u>Residual adverse effect:</u> • 157 ha will have diminished experience of being on the land due to noise emissions from the Project. <u>Residual neutral effect:</u> • There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere. <u>No residual adverse effect:</u> • There will be no change in the access to cottages and/or outfitters in the area as a result of the Project.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
				• Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
Site preparation and construction (cont'd)		Other recreational users	<u>Conflict with other recreational uses</u> • Change in access to public lands for non-consumptive uses • Change in access to public lands for the collection of berries, mushrooms or other vegetation for consumptive uses • Change in the abundance of consumptive foods • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035,	<u>Residual adverse effect:</u> • 742 ha will be unavailable for consumptive recreational purposes • The percentage of berry habitat loss in the LSA is 8.7% or 260 ha. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project. <u>No residual adverse effect:</u> • There will be no change in access for residents and visitors to public lands for non-consumptive purposes (eg., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Land use planning	<u>Conflict with land use planning</u> • Potential for conflict with accepted land uses as stipulated in approved land use plans • Project overlap with protected areas	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • There are no existing land use planning policies that could conflict with the Project's use of the land.
		Aggregate operations	<u>Conflict with aggregate operations</u> • Change in access to aggregate resources • Potential for change in demand for aggregate resources extraction	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>Residual positive effect:</u> • There may potentially be an increase demand to local aggregate suppliers, which would result in a local economic boom to aggregate resources <u>No residual adverse effect:</u> • There will be no change in access to aggregate resources as a result of the Project
		Forestry	<u>Conflict with forestry</u> • Potential for a change in access to forestry resources for management • Loss of forestry resources	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	<u>Residual adverse effect:</u> • 138 ha of potential forest will not be available. Constitutes a 0.1% loss to the forestry licence. <u>No residual adverse effect:</u> • There will be no change in access to forestry resources around the Project
		Mineral Exploration	<u>Conflict with mineral exploration</u> • Potential change in access to mineral claims for exploration and production	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • Treasury Metals has mineral claims or mineral rights on the majority of the area surrounding the Project and has an obligation to continue to explore the viability of these mineral claims. There

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)					are no conflicts with mineral exploration as a result of the Project.
		Fishing – recreational and commercial	<u>Conflict with fishing for recreational or commercial purposes</u> • Change in access to fishing areas • Change in abundance of fish • Change in contamination levels of fish • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	<u>Residual adverse effect:</u> • 852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake <u>No residual adverse effect:</u> • There will be no change in access to fisheries resources as a result of the Project. • There will be no change in the abundance of fish • There will be no adverse change in contamination levels of fish as the changes to water quality in the receiving environment will not exceed PWQO or will be below background.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Hunting	<u>Conflict with hunting activities</u> • Change in access to hunting areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065,	<u>Residual adverse effect:</u> • 743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Trapping	Conflict with trapping activities • Change in access to trapline areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070,	Residual adverse effect: • 309 ha will be unavailable for trapping on trapline licence DR026. • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Cottagers and outfitters	<u>Conflict with cottages and outfitters</u> • Diminished experience of being on the land • Change in the access to areas outfitters had previously used • Change in the clientele for outfitters with lodges in the area	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035].	<u>Residual adverse effect:</u> • 1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake. <u>Residual neutral effect:</u> • There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere. <u>No residual adverse effect:</u> • There will be no change in the access to cottages and/or outfitters in the area as a result of the Project.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Other recreational users	<u>Conflict with other recreational uses</u> • Change in access to public lands for non-consumptive uses • Change in access to public lands for the collection of berries, mushrooms or other vegetation for consumptive uses • Change in the abundance of consumptive foods • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and	<u>Residual adverse effect:</u> • 742 ha will be unavailable for consumptive recreational purposes • The percentage of berry habitat loss in the LSA is 8.7% or 260 ha. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project. <u>No residual adverse effect:</u> • There will be no change in access for residents and visitors to public lands for non-consumptive purposes (eg., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Land use planning	Conflict with land use planning • Potential for conflict with accepted land uses as stipulated in approved land use plans • Project overlap with protected areas	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	No residual adverse effect: • There are no existing land use planning policies that could conflict with the Project's use of the land.
		Aggregate operations	Conflict with aggregate operations • Change in access to aggregate resources • Potential for change in demand for aggregate resources extraction	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	No residual adverse effect: • There will be no change in access to aggregate resources as a result of the Project • No aggregate resource is required during the closure phase of the Project. Therefore, there will be no change in the demand for aggregate resource extraction from pre-development conditions.
		Forestry	Conflict with forestry • Potential for a change in access to forestry resources for management • Loss of forestry resources	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065,	Residual adverse effect: • 138 ha of potential forest will not be available. Constitutes a 0.1% loss to the forestry licence. No residual adverse effect: • There will be no change in access to forestry resources around the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Mineral Exploration	<u>Conflict with mineral exploration</u> • Potential change in access to mineral claims for exploration and production	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • Treasury Metals has mineral claims or mineral rights on the majority of the area surrounding the Project and has an obligation to continue to explore the viability of these mineral claims. There are no conflicts with mineral exploration as a result of the Project.
		Fishing – recreational and commercial	<u>Conflict with fishing for recreational or commercial purposes</u> • Change in access to fishing areas • Change in abundance of fish • Change in contamination levels of fish • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008,	<u>Residual adverse effect:</u> • 852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake <u>No residual adverse effect:</u> • There will be no change in access to fisheries resources as a result of the Project. • There will be no change in the abundance of fish • There will be no adverse change in contamination levels of fish as the changes to water quality in the receiving environment will not exceed PWQO or will be below background.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	
		Hunting	<u>Conflict with hunting activities</u> • Change in access to hunting areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042].	<u>Residual adverse effect:</u> • 743 ha will be unavailable for hunting. Constitutes 18.1% of the terrestrial LSA • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Trapping	<u>Conflict with trapping activities</u> • Change in access to trapline areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035,	<u>Residual adverse effect:</u> • 309 ha will be unavailable for trapping on trapline licence DR026. • 4 ha may have the abundance of wildlife resources affected as a result of noise from the Project. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Cottagers and outfitters	<u>Conflict with cottages and outfitters</u> • Diminished experience of being on the land • Change in the access to areas outfitters had previously used • Change in the clientele for outfitters with lodges in the area	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable	<u>Residual adverse effect:</u> • 1010 ha will have diminished experience of being on the land due to noise emissions from the Project and the visibility of the WRSA from Thunder Lake. <u>Residual neutral effect:</u> • There could be a change in clientele for outfitters and lodges in the area with a potential increase in accommodations for temporary construction workers at the site. This could decrease the availability to long-time users of the outfitters and lodges in the area and cause them to find accommodations elsewhere. <u>No residual adverse effect:</u> • There will be no change in the access to cottages and/or outfitters in the area as a result of the Project.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				[Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Other recreational users	<u>Conflict with other recreational uses</u> • Change in access to public lands for non-consumptive uses • Change in access to public lands for the collection of berries, mushrooms or other vegetation for consumptive uses • Change in the abundance of consumptive foods • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • During the operating life of the Project, no access will be permitted to the operations area for security and safety reasons. Access to the former MNRF tree nursery will be controlled. Aboriginal peoples will be able to arrange for accompanied access to these areas with Treasury Metals. Appropriate signage will be placed around areas where access is limited [Mit_092]. • Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples	<u>Residual adverse effect:</u> • 742 ha will be unavailable for consumptive recreational purposes • The percentage of berry habitat loss in the LSA is 8.7% or 260 ha. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project. <u>No residual adverse effect:</u> • There will be no change in access for residents and visitors to public lands for non-consumptive purposes (eg., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking).

TREASURY METALS Inc.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.3) will minimize the areas where noise and vibration from the Project will be noticeable [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_032]. • Light mitigation measures (Section 6.5.3) will minimize the areas where light trespass from the Project will be noticeable [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Land use planning	<u>Conflict with land use planning</u> • Potential for conflict with accepted land uses as stipulated in approved land use plans • Project overlap with protected areas	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> There are no existing land use planning policies that could conflict with the Project's use of the land.
		Aggregate operations	<u>Conflict with aggregate operations</u> • Change in access to aggregate resources • Potential for change in demand for aggregate resources extraction	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • There will be no change in access to aggregate resources as a result of the Project • No aggregate resource is required during the closure phase of the Project. Therefore, there will

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)					be no change in the demand for aggregate resource extraction from pre-development conditions.
		Forestry	<u>Conflict with forestry</u> • Potential for a change in access to forestry resources for management • Loss of forestry resources	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	<u>Residual adverse effect:</u> • 168 ha of potential forest will not be available. Constitutes a 0.1% loss to the forestry licence. <u>No residual adverse effect:</u> • There will be no change in access to forestry resources around the Project
		Mineral Exploration	<u>Conflict with mineral exploration</u> • Potential change in access to mineral claims for exploration and production	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090].	<u>No residual adverse effect:</u> • Treasury Metals has mineral claims or mineral rights on the majority of the area surrounding the Project and has an obligation to continue to explore the viability of these mineral claims. There are no conflicts with mineral exploration as a result of the Project.
		Fishing – recreational and commercial	<u>Conflict with fishing for recreational or commercial purposes</u> • Change in access to fishing areas • Change in abundance of fish • Change in contamination levels of fish • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	<u>Residual adverse effect:</u> • 852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake <u>No residual adverse effect:</u> • There will be no change in access to fisheries resources as a result of the Project. • There will be no change in the abundance of fish • There will be no adverse change in contamination levels of fish as the changes to water quality in the receiving environment will not exceed PWQO or will be below background.
		Hunting	<u>Conflict with hunting activities</u> • Change in access to hunting areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001,	<u>No residual adverse effect:</u> • The land removed from hunting during the site preparation and construction, operations and closure phases will return to productive wildlife habitat.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Trapping	Conflict with trapping activities • Change in access to trapline areas • Change in abundance of wildlife • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	Residual adverse effect: • The land removed from hunting during the site preparation and construction, operations and closure phases will return to productive wildlife habitat.
		Cottagers and outfitters	Conflict with cottages and outfitters • Diminished experience of being on the land • Change in the access to areas outfitters had previously used • Change in the clientele for outfitters with lodges in the area	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of	Residual adverse effect: • 852 ha will have diminished experience of being on the land due to the visibility of the WRSA from Thunder Lake. Residual neutral effect: • There will be no change in clientele from pre-development conditions in the post-closure phase No residual adverse effect: • There will be no change in the access to cottages and/or outfitters in the area as a result of the Project.

Table 6.23-15: Summary of Mitigation and Residual Effects for Land and Resource Use (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	
		Other recreational users	<u>Conflict with other recreational uses</u> • Change in access to public lands for non-consumptive uses • Change in access to public lands for the collection of berries, mushrooms or other vegetation for consumptive uses • Change in the abundance of consumptive foods • Diminished experience of being on the land	• Project design incorporates a compact footprint [Mit_050]. • Minimize crown land in the Project footprint [Mit_090]. • Minimize activities on the eastern portion of the Project property [Mit_091]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089].	<u>Residual adverse effect:</u> • 742 ha will be unavailable for consumptive recreational purposes. • 157 ha will have diminished experience of being on the land due to noise emissions from the Project. <u>No residual adverse effect:</u> • There will be no change in access for residents and visitors to public lands for non-consumptive purposes (eg., motorized recreational vehicles, canoeing, wildlife viewing, walking and hiking). • Berry habitat will re-establish during the post-closure phase.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Population demographics	<u>Change in population demographics – population increase</u> • In-migration could occur in the socio-economic study area	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>Residual positive effect:</u> • Increase demand on existing community housing, infrastructure and services. A noticeable change may result but it is expected that the current infrastructure within the communities most likely to be affected (City of Dryden and Village of Wabigoon) would be able to accommodate increase population
		Education	<u>Increased demand for education services at all levels</u> • The in-migration of working age population may bring school-aged children in the area, increasing enrolment • Potential increase in demand for education and training services <u>Motivation to stay in or leave school</u> • Could be a change in the desire to stay in school or leave school due to job opportunities from the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual positive effect:</u> • Increased training and education opportunities for unemployed and under-employed residents and non-resident workers. It is anticipated that any increase in training would be able to be accommodated within existing education and training facilities <u>Residual adverse effect:</u> • Increase demand on education services. It is anticipated that nay increase in the enrollment could be accommodated within existing education system

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Infrastructure and services	Potential for increase in demand on existing infrastructure and services • There could be an increase in demand on utilities, municipal infrastructure, communication services and recreation facilities from changes in population demographics	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	Residual adverse effect: • There could be an increased demand on infrastructure and services that may be noticeable, but are anticipated to be within the current capacity.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099]	
		Housing and property values	<u>Increased demand for temporary accommodations</u> • Temporary construction works and contractors at the site will require temporary accommodations <u>Increased demand for permanent accommodation</u> • Due to in-migration <u>Positive and negative changes in real estate values</u> • Due to in-migration and proximity to Project location	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>Residual adverse effect:</u> • Increase demand to limit supply or lead to price increases for temporary accommodations. It is anticipated that his effect will be noticeable during Site preparation and construction but is unlikely to exceed current capacity. • Real and perceived effects of Project related activities could negatively affect the value of houses that are closest to the Project's property boundary <u>Residual neutral effect:</u> • Potential for increase in property values may be noticeable. Considered a positive effect for people trying to sell their property and a negative effect for people trying to buy property.
		Public safety	<u>Potential for increase in demand for public safety services</u> • Increased traffic volumes related to the Project and population increases <u>Potential increase in crime rate</u> • Crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-	<u>Residual adverse effect:</u> • Project related effects to increase traffic volume may be noticeable and may increase the demand on public safety services • Personal decision-making related to spending Project related income may positively or negatively affect public safety within the affected communities

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Contract security services to help promote a secure and safe worksite environment [Mit_097] • Treasury will work with public safety services to develop safety and work policy guidelines for mine workers, including a policy of no alcohol or drugs onsite and policies and guidelines to support a respectful work environment [Mit_110] • The site will be reclaimed and the land restored to a naturalized state per the mine closure plan approved by the Ministry of Northern Development and Mines [Cmt_038] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil	

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	
		Transportation and traffic	<u>Potential impact on transportation infrastructure</u> • Due to potential population increases and transportation of goods and services throughout the life of the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	<u>Residual adverse effect:</u> • The existing levels of services will be maintained on both Highway 17 and Anderson Road with additional anticipated Project-related traffic.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic	Population demographics	<u>Change in population demographics – population increase</u> • In-migration could occur in the socio-economic study area	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095]	<u>Residual positive effect:</u> • Increase demand on existing community housing, infrastructure and services. A noticeable change may result but it is expected that the current infrastructure within the communities most likely to be affected (City of Dryden and Village of Wabigoon) would be able to accommodate increase population

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)	• Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek			• Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Education	<u>Increased demand for education services at all levels</u> • The in-migration of working age population may bring school-aged children in the area, increasing enrolment • Potential increase in demand for education and training services <u>Motivation to stay in or leave school</u> • Could be a change in the desire to stay in school or leave school due to job opportunities from the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108]	<u>Residual positive effect:</u> • Increased training and education opportunities for unemployed and under-employed residents and non-resident workers. It is anticipated that any increase in training would be able to be accommodated within existing education and training facilities <u>Residual adverse effect:</u> • Increase demand on education services. It is anticipated that nay increase in the enrollment could be accommodated within existing education system

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Infrastructure and services	<u>Potential for increase in demand on existing infrastructure and services</u> • There could be an increase in demand on utilities, municipal infrastructure, communication services and recreation facilities from changes in population demographics	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099]	<u>Residual adverse effect:</u> • There could be an increased demand on infrastructure and services that may be noticeable, but are anticipated to be within the current capacity.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Housing and property values	<u>Increased demand for temporary accommodations</u> • Temporary construction works and contractors at the site will require temporary accommodations <u>Increased demand for permanent accommodation</u> • Due to in-migration <u>Positive and negative changes in real estate values</u> • Due to in-migration and proximity to Project location	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>Residual adverse effect:</u> • Increase demand to limit supply or lead to price increases for temporary accommodations. It is anticipated that his effect will be noticeable during Site preparation and construction but is unlikely to exceed current capacity. • Real and perceived effects of Project related activities could negatively affect the value of houses that are closest to the Project's property boundary <u>Residual neutral effect:</u> • Potential for increase in property values may be noticeable. Considered a positive effect for people trying to sell their property and a negative effect for people trying to buy property.
		Public safety	<u>Potential for increase in demand for public safety services</u> • Increased traffic volumes related to the Project and population increases <u>Potential increase in crime rate</u> • Crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Contract security services to help promote a secure and safe worksite environment [Mit_097] • Treasury will work with public safety services to develop safety and work policy guidelines for mine workers, including a policy of no alcohol or drugs onsite and policies and guidelines to support a respectful work environment [Mit_110]	<u>Residual adverse effect:</u> • Project related effects to increase traffic volume may be noticeable and may increase the demand on public safety services • Personal decision-making related to spending Project related income may positively or negatively affect public safety within the affected communities

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• The site will be reclaimed and the land restored to a naturalized state per the mine closure plan approved by the Ministry of Northern Development and Mines [Cmt_038] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Transportation and traffic	Potential impact on transportation infrastructure • Due to potential population increases and transportation of goods and services throughout the life of the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	Residual adverse effect: • The existing levels of services will be maintained on both Highway 17 and Anderson Road with additional anticipated Project-related traffic.
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure	Population demographics	Change in population demographics – population increase • In-migration could occur in the socio-economic study area	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-	Residual adverse effect: • Population levels may decline to pre-Project conditions during closure.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)	• Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce			construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Education	<u>Increased demand for education services at all levels</u> • The in-migration of working age population may bring school-aged children in the area, increasing enrolment • Potential increase in demand for education and training services <u>Motivation to stay in or leave school</u> • Could be a change in the desire to stay in school or leave school due to job opportunities from the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108]	<u>Residual positive effect:</u> • The increase demand on education services will return to pre-development conditions. <u>Residual adverse effect:</u> • The increased training and education opportunities for unemployed and under-employed residents and non-resident workers will return to pre-development conditions.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Infrastructure and services	Potential for increase in demand on existing infrastructure and services • There could be an increase in demand on utilities, municipal infrastructure, communication services and recreation facilities from changes in population demographics	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099]	No residual adverse effect: • The increased demand on infrastructure and services will return to pre-development conditions

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Housing and property values	<u>Increased demand for temporary accommodations</u> • Temporary construction works and contractors at the site will require temporary accommodations <u>Increased demand for permanent accommodation</u> • Due to in-migration <u>Positive and negative changes in real estate values</u> • Due to in-migration and proximity to Project location	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>Residual positive effect:</u> • The increase demand to limit supply or lead to price increases for temporary accommodations will return to pre-development conditions. • The real and perceived effects of Project related activities that could negatively affect the value of houses that are closest to the Project's property boundary will no remain in the closure phase. <u>Residual neutral effect:</u> • Potential increase in property values will return to pre-development conditions. Considered a negative effect for people trying to sell their property and a positive effect for people trying to buy property.
		Public safety	<u>Potential for increase in demand for public safety services</u> • Increased traffic volumes related to the Project and population increases <u>Potential increase in crime rate</u> • Crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Contract security services to help promote a secure and safe worksite environment [Mit_097] • Treasury will work with public safety services to develop safety and work policy guidelines for mine workers, including a policy of no alcohol or drugs onsite and policies and guidelines to support a respectful work environment [Mit_110] • The site will be reclaimed and the land restored to a naturalized state per the mine closure plan approved by the Ministry of Northern Development and Mines [Cmt_038]	<u>Residual positive effect:</u> • Increased traffic volumes during the site preparation and construction and operations phase will return to pre-development conditions • Personal decision-making related to spending Project related income may positively or negatively affect public safety within the affected communities

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	
		Transportation and traffic	<u>Potential impact on transportation infrastructure</u> • Due to potential population increases and transportation of goods and services throughout the life of the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-	<u>No residual adverse effect:</u> • Increase traffic volumes will return to pre-development conditions

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Population demographics	<u>Change in population demographics – population increase</u> • In-migration could occur in the socio-economic study area	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106]	<u>Residual adverse effect:</u> • Population levels may decline to pre-Project conditions during closure.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	
		Education	<u>Increased demand for education services at all levels</u> • The in-migration of working age population may bring school-aged children in the area, increasing enrolment • Potential increase in demand for education and training services <u>Motivation to stay in or leave school</u> • Could be a change in the desire to stay in school or leave school due to job opportunities from the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>Residual positive effect:</u> • The increase demand on education services will return to pre-development conditions. <u>Residual adverse effect:</u> • The increased training and education opportunities for unemployed and under-employed residents and non-resident workers will return to pre-development conditions.

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Infrastructure and services	<u>Potential for increase in demand on existing infrastructure and services</u> • There could be an increase in demand on utilities, municipal infrastructure, communication services and recreation facilities from changes in population demographics	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will communicate appropriate information (e.g., the timing and communities in which new residents may locate) to the school district(s) to assist with their resource planning process. [Mit_106] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099]	<u>No residual adverse effect:</u> • The increased demand on infrastructure and services will return to pre-development conditions
		Housing and property values	<u>Increased demand for temporary accommodations</u> • Temporary construction works and contractors at the site will require temporary accommodations <u>Increased demand for permanent accommodation</u> • Due to in-migration <u>Positive and negative changes in real estate values</u> • Due to in-migration and proximity to Project location	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095]	<u>Residual positive effect:</u> • The increase demand to limit supply or lead to price increases for temporary accommodations will return to pre-development conditions. • The real and perceived effects of Project related activities that could negatively affect the value of houses that are closest to the Project's property boundary will no remain in the closure phase. <u>Residual neutral effect:</u>

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Treasury Metals will work with specific affected homeowners to ensure that their concerns about potential Project-related effects are addressed [Mit_108] • Treasury Metals will work with local and regional governments to minimize the effects of in-migration and out-migration where possible [Mit_109] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	• Potential increase in property values will return to pre-development conditions. Considered a negative effect for people trying to sell their property and a positive effect for people trying to buy property.
		Public safety	<u>Potential for increase in demand for public safety services</u> • Increased traffic volumes related to the Project and population increases <u>Potential increase in crime rate</u> • Crime rate related to the behaviour of a non-local labour force and increased income and spending levels due to Project-related employment	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Contract security services to help promote a secure and safe worksite environment [Mit_097] • Treasury will work with public safety services to develop safety and work policy guidelines for mine workers, including a policy of no alcohol or drugs onsite and policies and guidelines to support a respectful work environment [Mit_110] • The site will be reclaimed and the land restored to a naturalized state per the mine closure plan approved by the Ministry of Northern Development and Mines [Cmt_038] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111] • Best management practices for dust control will be implemented. A plan will be prepared to identify all potential sources of dusts, outline mitigation methods to employ, and detail all records and inspections required by regulatory officials. Treasury will monitor air emissions through implementation of current industry standards to	<u>Residual positive effect:</u> • Increased traffic volumes during the site preparation and construction and operations phase will return to pre-development conditions • Personal decision-making related to spending Project related income may positively or negatively affect public safety within the affected communities

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				meet regulatory requirements (Ontario Reg. 419/05, AAQC, MOECC) [Cmt_017] • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations and closure [Mit_046] • Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	
		Transportation and traffic	<u>Potential impact on transportation infrastructure</u> • Due to potential population increases and transportation of goods and services throughout the life of the Project	• Ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project [Mit_093] • Develop a Socio-Economic Management Plan to help ensure commitments are implemented, adverse socio-economic effects are minimized, results are monitored, and effects are adaptively managed [Mit_095] • Treasury Metals will undertake an update of the socio-economic baseline to establish a pre-construction baseline of the affected communities prior to commencing the Project site preparation and construction [Mit_102] • Incorporate strategies and actions to help local agencies monitor community wellbeing and take corrective actions where appropriate. [Mit_111]	<u>No residual adverse effect:</u> • Increase traffic volumes will return to pre-development conditions

Table 6.23-16: Summary of Mitigation and Residual Effects for Social Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Treasury Metals will engage the Local Services Board in Wabigoon to acquire Tree Nursery Road in its entirety from north of Normans Road [Mit_112] • Treasury Metals will establish and enforce traffic safety protocols, regulatory and cautionary signage, road maintenance and emergency response plans on all Project roads to prevent collisions and accidents [Mit_099] • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding the need for lighting at the Anderson Rd. and Highway 17 intersection [Mit_114]. • Treasury Metals will approach MTO to discuss recommendations presented within the transportation study (Appendix E to the Revised EIS) regarding clearing of shrubbery, trees, soil mounds, etc. that could cause a visual obstruction for vehicles using the Anderson Rd. and Highway 17 intersection [Mit_115]	

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Labour force, labour participation and employment	The Project will affect labour income, change labour participation and change employment opportunities in the region	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual positive effect:</u> • The Project will create a demand for workers and increase in employment and labour income in the Project area.
		Income levels	The Project affect income levels in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual positive effect:</u> • The Project will create a demand for workers and increase in labour income in the Project area.

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Cost of living	The Project through employment and contacting opportunities will affect cost of living.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual positive effect:</u> • The demand for labour, goods and services by the Project and by workers moving into the Project area could increase prices and the cost of living.
		Real estate	The Project through employment and contacting opportunities will affect real estate prices.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103]	<u>Residual positive effect:</u> • The Project will cause workers to move into the Project area and cause an increase in the demand for housing
		Economic development	The Project will change government taxes which will affect economic development in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This	<u>Residual positive effect:</u> • The Project employment, purchases, and operation will increase in government taxes which could be used for local development

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Existing businesses	The Project through employment and contacting opportunities will affect existing businesses.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual positive effect: • The Project will increase the Project area demand for goods and services from local businesses.
		Government revenues	The Project through expenditures and employment will affect government revenues.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004]	Residual positive effect: • There will be an increase in government revenues through the payment of Project related business and employment taxes

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				• Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Labour force, labour participation and employment	The Project will affect labour income, change labour participation and change employment opportunities in the region	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual positive effect:</u> • The Project will create a demand for workers and increase in employment and labour income in the Project area.
		Income levels	The Project affect income levels in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004]	<u>Residual positive effect:</u> • The Project will create a demand for workers and increase in labour income in the Project area.

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Cost of living	The Project through employment and contacting opportunities will affect cost of living.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual positive effect: • The demand for labour, goods and services by the Project and by workers moving into the Project area could increase prices and the cost of living.
		Real estate	The Project through employment and contacting opportunities will affect real estate prices.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103]	Residual positive effect: • The Project will cause workers to move into the Project area and cause an increase in the demand for housing

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Economic development	The Project will change government taxes which will affect economic development in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual positive effect: • The Project employment, purchases, and operation will increase in government taxes which could be used for local development
		Existing businesses	The Project through employment and contacting opportunities will affect existing businesses.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual positive effect: • The Project will increase the Project area demand for goods and services from local businesses.

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)		Government revenues	The Project through expenditures and employment will affect government revenues.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual positive effect: • There will be an increase in government revenues through the payment of Project related business and employment taxes
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Labour force, labour participation and employment	The Project will affect labour income, change labour participation and change employment opportunities in the region	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual adverse effect: • There will be a reduction in Project area employment and labour income as Project employees are laid off in the closure phase.

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Income levels	The Project affect income levels in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual adverse effect:</u> • The reduction in Project employees will cause a reduction in labour income in the Project area.
		Cost of living	The Project through employment and contacting opportunities will affect cost of living.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104]	<u>Residual neutral effect:</u> • The Project demand for labour, goods and services will decline and reduce the cost of living

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Real estate	The Project through employment and contacting opportunities will affect real estate prices.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123]	Residual neutral effect: • Project employees may move away from the area causing a reduction in demands for housing
		Economic development	The Project will change government taxes which will affect economic development in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123]	Residual neutral effect: • There will be reduction in government taxes and funds for local development as project expenditures decrease

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Existing businesses	The Project through employment and contacting opportunities will affect existing businesses.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual adverse effect: • There will be a reduction in Project demand for local goods and services
		Government revenues	The Project through expenditures and employment will affect government revenues.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004]	Residual adverse effect: • There will be a reduction in Project's contribution to government revenues due to reduced spending and employment

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Labour force, labour participation and employment	The Project will affect labour income, change labour participation and change employment opportunities in the region	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual adverse effect:</u> • There will be a reduction in Project area employment and labour income as Project employees are laid off in the closure phase.

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Income levels	The Project affect income levels in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual adverse effect:</u> • The reduction in Project employees will cause a reduction in labour income in the Project area.
		Cost of living	The Project through employment and contacting opportunities will affect cost of living.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123]	<u>Residual neutral effect:</u> • The Project demand for labour, goods and services will decline and reduce the cost of living

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Real estate	The Project through employment and contacting opportunities will affect real estate prices.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123]	<u>Residual neutral effect:</u> • Project employees may move away from the area causing a reduction in demands for housing
		Economic development	The Project will change government taxes which will affect economic development in the region.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123]	<u>Residual neutral effect:</u> • There will be reduction in government taxes and funds for local development as project expenditures decrease

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	
		Existing businesses	The Project through employment and contacting opportunities will affect existing businesses.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	<u>Residual adverse effect:</u> • There will be a reduction in Project demand for local goods and services

Table 6.23-17: Summary of Mitigation and Residual Effects for Economic Factors (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Government revenues	The Project through expenditures and employment will affect government revenues.	• Treasury will maintain a local hiring policy, including First Nation communities. The application of this policy is dependent upon the skills and workforce being available locally [Cmt_003] • Treasury will maintain, where applicable, a local purchasing policy to purchase goods and services from local suppliers. This policy has the expectation that goods and services will be purchased locally assuming price, delivery and service is competitive with outside suppliers [Cmt_004] • Employment preference will be given to local and regional labour where possible, including Aboriginal and non-Aboriginal communities. This will be dependent upon the skills and workforce being available locally [Mit_103] • At closure, continue training opportunities to help residents to increase their competitiveness and chances to get employment elsewhere [Mit_123] • Develop training and job transfer policies to support workforce development in the socio-economic study area [Mit_104] • Develop training programs for unemployed and under employed residents and non-workers [Mit_105]	Residual adverse effect: • There will be a reduction in Project's contribution to government revenues due to reduced spending and employment

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Non-Indigenous Human Health	Risk to Non-Indigenous Human Health • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods (plants, fish, wild game)	• Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area [Mit_008]. • Industry standard erosion and sediment controls will be implemented during the site preparations and construction phase [Mit_054]. • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046]. • There will be no discharges to surface water during the closure phase [Mit_055]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129].	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.
		Indigenous Human Health	Risk to Indigenous Human Health • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods	• Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area [Mit_008]. • Industry standard erosion and sediment controls will be implemented during the site preparations and construction phase [Mit_054]. • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046]. • There will be no discharges to surface water during the closure phase [Mit_055]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129].	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Non-Indigenous Human Health	Risk to Non-Indigenous Human Health • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods (plants, fish, wild game)	• Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area [Mit_008]. • The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • During operations, tailings will be maintained in saturated conditions, with a water cover maintained over the majority of the TSF to prevent the onset of acidification [Mit_021]. • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046]. • The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052] • During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek [Mit_053] • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127].	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129]. • Access to the waste rock storage area (WRSA) and the tailings storage facility (TSF) during operations and closure will be restricted to those workers with the required health and safety training and personal protective equipment (PPE) [Mit_130].	
		Indigenous Human Health	<u>Risk to Indigenous Human Health</u> • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods	• Prior to operations, a perimeter ditch and seepage collection system will be established to collect all of the runoff from the operations area [Mit_008]. • The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • During operations, tailings will be maintained in saturated conditions, with a water cover maintained over the majority of the TSF to prevent the onset of acidification [Mit_021]. • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046]. • The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052] • During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to	<u>No residual adverse effect:</u> • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek [Mit_053] • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129]. • Access to the waste rock storage area (WRSA) and the tailings storage facility (TSF) during operations and closure will be restricted to those workers with the required health and safety training and personal protective equipment (PPE) [Mit_130].	

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Non-Indigenous Human Health	<u>Risk to Non-Indigenous Human Health</u> • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods (plants, fish, wild game)	• The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • 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 [Mit_024] • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046]. • The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052] • During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek [Mit_053]	<u>No residual adverse effect:</u> • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• There will be no discharges to surface water during the closure phase [Mit_055]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. • As part of the closure activities, the WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]. • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022]. • At closure, the tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023]. • Reclaimed will carried out in accordance with O.Reg. 240/00 [Mit_088]. • There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129]. • Access to the waste rock storage area (WRSA) and the tailings storage facility (TSF) during operations and closure will be restricted to those workers with the required health and safety training	

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				and personal protective equipment (PPE) [Mit_130].	
		Indigenous Human Health	<u>Risk to Indigenous Human Health</u> • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods	• The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • As part of the closure activities, the WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]. • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022]. • At closure, the tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023]. • Reclaimed will carried out in accordance with O.Reg. 240/00 [Mit_088]. • 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 [Mit_024] • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • Best management practices plan for dust control will be implemented on the site during site preparation and construction, operations, and closure phases [Mit_046].	<u>No residual adverse effect:</u> • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				• The drawdown zone of the dewatering process will capture all seepage that bypasses the seepage collection systems and will report to the open pit [Mit_052] • During operations, excess water not required in the process will be treated to concentrations that meet Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life, or background if background levels exceed the PWQO, prior to discharging to Blackwater Creek. In the case of mercury, effluent will be treated to meet the background concentrations in Blackwater Creek [Mit_053] • There will be no discharges to surface water during the closure phase [Mit_055]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. • There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128]. • Project workers and site visitors will receive sufficient risk protection from direct contact with soil and water and/or dust inhalation via the implementation of PPE and requirement for suitable clothing. [Mit_129]. • Access to the waste rock storage area (WRSA) and the tailings storage facility (TSF) during operations and closure will be restricted to those workers with the required health and safety training and personal protective equipment (PPE) [Mit_130].	

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Non-Indigenous Human Health	Risk to Non-Indigenous Human Health • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods (plants, fish, wild game)	• The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • As part of the closure activities, the WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]. • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022]. • At closure, the tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023]. • Reclaimed will carried out in accordance with O.Reg. 240/00 [Mit_088]. • 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 [Mit_024] • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • There will be no discharges to surface water during the closure phase [Mit_055]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. • There will be no drinking water wells installed on the Project during the operations, closure, or	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128].	
		Indigenous Human Health	Risk to Indigenous Human Health • Inhalation of trench/indoor/outdoor air impacted by subsurface vapour intrusion • Direct contact (dermal contact and incidental ingestion) of soil (baseline soils, tailings, or waste rock) • Inhalation of soil particulates (fugitive dust) • Direct contact with groundwater • Ingestion of groundwater as drinking water • Ingestion of country foods	• The PAG waste rock would be placed in the mined out areas of the open pit, to the extent practical, to minimize the volume of PAG material in the WRSA [Mit_020]. • As part of the closure activities, the WRSA will be capped with a low permeability cover, then a layer of overburden, then vegetated during closure [Mit_018]. • At closure, the open pit will be allowed to flood, isolating the exposed mine faces and the waste rock placed underneath a static cover of water to prevent acidification [Mit_022]. • At closure, the tailings within the TSF will be isolated using either a low permeability dry cover, or a wet cover of non-process water. The preferred option for limiting environmental effects is a wet cover [Mit_023]. • Reclaimed will carried out in accordance with O.Reg. 240/00 [Mit_088]. • 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 [Mit_024] • Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order [Mit_044]. • There will be no discharges to surface water during the closure phase [Mit_055]. • The floor of the TSF will be a low-permeability layer capable of achieving seepage rates that ensure receiving surface water quality is equivalent to baseline, or meet PWQO. The liner would be comprised of natural material, or if necessary, an HDPE liner laid over a prepared basin of sand or comparable material [Mit_062] • Once the pit lake is fully flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-18: Summary of Mitigation and Residual Effects for Human Health (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits [Mit_124]. • There will be no drinking water wells installed on the Project during the operations, closure, or during the portion of the post-closure phase when monitoring is required to confirm performance of the reclamation landscape [Mit_127]. • MOECC Fish consumption advisories for Thunder Lake and Wabigoon Lake will be adhered to [Mit_128].	

Table 6.23-19: Summary of Mitigation and Residual Effects for Heritage Resources

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Archaeological sites	Presence of an archaeological site • Potential presence of a site in the area of the Project Disturbance of an archaeological site • Potential disturbance of an archaeological site	• Minimize the overall footprint of the Project [Mit_050]. • Leave a 50 m buffer zone around remaining watercourses within the Project area [Mit_118].	No residual adverse effect: • The site was determined to have low archaeological potential and there were no archaeological sites identified that would be affected by the Project.
		Historic heritage sites	Presence of a historic heritage site • Potential presence of a site in the area of the Project Disturbance of a historic heritage site • Potential disturbance of a historic heritage site	• Minimize the overall footprint of the Project [Mit_050]. • Leave a 50 m buffer zone around remaining watercourses within the Project area [Mit_118].	No residual adverse effect: • The site was determined to have low archaeological potential and there were no historic heritage sites identified that would be affected by the Project.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals • Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek	Archaeological sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase
		Historic heritage sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Archaeological sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase
		Historic heritage sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase

Table 6.23-19: Summary of Mitigation and Residual Effects for Heritage Resources (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Archaeological sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase
		Historic heritage sites	No potential effects as there will be no further disturbance of land during this phase	No mitigation measures or commitments identified	No residual adverse effect: • No further disturbance of land during this phase

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction	• Clearing of trees • Construction of perimeter ditch • Dewatering of overburden • Stripping of overburden and development of overburden stockpile • Development of site infrastructure • Construction of processing plant • Initiate construction of TSF • Potential spills of fuels and chemicals • On-site vehicle exhaust • Construction traffic • Construction workforce	Health effects	<u>Health risk</u> • Potential risk to human health of Aboriginal peoples	• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	<u>No residual adverse effect:</u> • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.
		Harvesting and gathering of plant material	<u>Wild rice</u> • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption <u>Berry harvesting</u> • Potential loss of harvesting areas • Change in quality for consumption <u>Medicinal plant harvesting</u> • Loss of forest • Loss of wetland • Change in quality for consumption <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the	<u>Residual adverse effect:</u> <u>Berry harvesting</u> • 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA. <u>Medicinal plant harvesting</u> • 208 ha of forest loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA. • 32.6 ha loss for potential medicinal plant harvesting. Constitutes 2.3% of wetland habitat in the LSA. <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area <u>No residual adverse effect:</u> <u>Wild rice</u> • The Project will not overprint any area of wild rice habitat. • Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project. • There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128].	Berry harvesting • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Medicinal plant harvesting • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Diminished on-the-land experience • Project features will not be visible off-site
		Hunting	Change to Ungulates • Potential habitat loss • Change in quality for consumption Change to Furbearers • Potential habitat loss Change to Waterfowl • Potential habitat loss • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction	Residual adverse effect: Ungulates • 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA. Furbearers • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. Waterfowl • 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA. Change in access

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area <u>No residual adverse effect:</u> <u>Ungulates</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Furbearers</u> • Ample beaver habitat in the LSA not a meaningful amount of habitat removed. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Waterfowl</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Diminished on-the-land experience</u> • Project features will not be visible off-site

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Trapping	<u>Furbearers</u> • Potential habitat loss <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044,	<u>Residual adverse effect:</u> <u>Furbearers</u> • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area <u>No residual adverse effect:</u> <u>Furbearers</u> • Ample beaver habitat in the LSA not a meaningful amount of habitat removed. <u>Diminished on-the-land experience</u> • Project features will not be visible off-site

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)				Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128].	
		Fishing	<u>Sport fishing</u> • Potential change in abundance of sport fish • Change in quality for consumption <u>Baitfish</u> • Potential change in abundance of baitfish <u>Commercial fishing</u> • Quality of sport fish for consumption • Baitfish for commercial use <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	<u>Residual adverse effect:</u> <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area <u>No residual adverse effect:</u> <u>Sport fishing</u> • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Baitfish</u> • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. <u>Commercial fishing</u> • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. <u>Diminished -the-land experience</u> • Project features will not be visible off-site

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)		Cultural and spiritual	<u>Cultural or spiritual site</u> • Loss or disturbance to known sites • Restriction to access <u>Traditional travel routes</u> • Interruption of a known traditional travel route • Interference with a known traditional travel route <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].	<u>Residual adverse effect:</u> <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area <u>No residual adverse effect:</u> <u>Cultural and spiritual sites</u> • No identified cultural or spiritual site will be affected by the Project • There will be no restriction to access toy any identified cultural or spiritual sites due to the Project <u>Traditional Travel Routes</u> • There are no known traditional travel routes through the immediate Project site. • Traditional travel routes to Rice Lake via Thunder Lake will not be affected. <u>Diminished on-the-land experience</u> • Project features will not be visible off-site
		Socio-economic effects	<u>Economic effects</u> • Changes in Aboriginal employment opportunities • Changes in cost of living • Potential Project purchases from Aboriginal businesses <u>Social effects</u> • Potential for in- and out-migration • Capacity of education services • Change in education attainment • Project specific training opportunities • Change in housing availability	• Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project [Mit_046, Mit_093, Mit_095, Mit_097, Mit_099, Mit_102, Mit_103, Mit_104, Mit_105, Mit_106, Mit_108, Mit_109, Mit_110, Mit_111, Mit_112, Mit_114, Mit_115, Cmt_017, Cmt_038] • Mitigation measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the	<u>Residual positive effect:</u> <u>Economic Effects</u> • The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1) • Demand for labour, goods, and services by the Project and by workers moving into the Project area will increase the cost of living. • Treasury Metals has committed to a local purchasing policy, which will provide business to Aboriginal people owned businesses.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Site preparation and construction (cont'd)			• Change in property values (off reserve) • Capacity of emergency services • Road network capacity and condition	Project. [Cmt_003, Cmt_004, Mit_103, Mit_104, Mit_105, Mit_123]	Social Effects • The Project could result in an in-migration of workers to could help reverse the pattern of out-migration in the socio-economic study area. • The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education • There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers Residual neutral effect: Social Effects • There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property. Residual adverse effect: Social Effects • Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system • There could be additional stresses on community housing due to in-migration of workers. • There could be additional stresses on the emergency services in the area due to the in-migration of workers. No residual adverse effect: Social Effects • Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.
Operations	• Development of the open pit • Development of underground mine • Continued development of TSF • Development of the WRSA • Development and depletion of LGO stockpile • Operations traffic • Operations workforce • Potential spills of fuels and chemicals	Health effects	Wild rice • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption Berry harvesting • Potential loss of harvesting areas • Change in quality for consumption Medicinal plant harvesting • Loss of forest	• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	No residual adverse effect: No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)	• Operations of site infrastructure • Operations of processing plant • Dewatering of mine workings • Water taking for operations • Discharge of treated water to Blackwater Creek		• Loss of wetland • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise		
		Harvesting and gathering of plant material	Change to Ungulates • Potential habitat loss • Change in quality for consumption Change to Furbearers • Potential habitat loss Change to Waterfowl • Potential habitat loss • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008,	Residual adverse effect: Berry harvesting • 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA. Medicinal plant harvesting • 208 ha of forest loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA. • 47 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of wetland habitat in the LSA. Change in access • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Wild rice • The Project will not overprint any area of wild rice habitat. • Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project. • There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Berry harvesting • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Medicinal plant harvesting

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
		Hunting	<u>Furbearers</u> • Potential habitat loss <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036]	<u>Residual adverse effect:</u> <u>Ungulates</u> • 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA. <u>Furbearers</u> • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. <u>Waterfowl</u> • 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA. <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable <u>No residual adverse effect:</u> <u>Ungulates</u>

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Furbearers</u> • Ample beaver habitat in the LSA not a meaningful amount of habitat removed. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Waterfowl</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.
		Trapping	<u>Sport fishing</u> • Potential change in abundance of sport fish • Change in quality for consumption <u>Baitfish</u> • Potential change in abundance of baitfish <u>Commercial fishing</u> • Quality of sport fish for consumption • Baitfish for commercial use <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction	<u>Residual adverse effect:</u> <u>Furbearers</u> • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	<u>No residual adverse effect:</u> <u>Furbearers</u> • Ample beaver habitat in the LSA not a meaningful amount of habitat removed.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)			Cultural or spiritual site • Loss or disturbance to known sites • Restriction to access Traditional travel routes • Interruption of a known traditional travel route • Interference with a known traditional travel route Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	Residual adverse effect: Change in access • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Sport fishing • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Baitfish • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. Commercial fishing • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)				• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	
		Cultural and spiritual	Economic effects • Changes in Aboriginal employment opportunities • Changes in cost of living • Potential Project purchases from Aboriginal businesses Social effects • Potential for in- and out-migration • Capacity of education services • Change in education attainment • Project specific training opportunities • Change in housing availability • Change in property values (off reserve) • Capacity of emergency services • Road network capacity and condition	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].	Residual adverse effect: Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Cultural and spiritual sites • No identified cultural or spiritual site will be affected by the Project • There will be no restriction to access toy any identified cultural or spiritual sites due to the Project Traditional Travel Routes • There are no known traditional travel routes through the immediate Project site. • Traditional travel routes to Rice Lake via Thunder Lake will not be affected.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Operations (cont'd)			Wild rice • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption Berry harvesting • Potential loss of harvesting areas • Change in quality for consumption Medicinal plant harvesting • Loss of forest • Loss of wetland • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project [Mit_046, Mit_093, Mit_095, Mit_097, Mit_099, Mit_102, Mit_103, Mit_104, Mit_105, Mit_106, Mit_108, Mit_109, Mit_110, Mit_111, Mit_112, Mit_114, Mit_115, Cmt_017, Cmt_038] • Mitigation measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the Project. [Cmt_003, Cmt_004, Mit_103, Mit_104, Mit_105, Mit_123]	Residual positive effect: Economic Effects • The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1) • Demand for labour, goods, and services by the Project and by workers moving into the Project area will increase the cost of living. • Treasury Metals has committed to a local purchasing policy, which will provide business to Aboriginal people owned businesses. Social Effects • The Project could result in an in-migration of workers to could help reverse the pattern of out-migration in the socio-economic study area. • The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education • There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers Residual neutral effect: Social Effects • There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property. Residual adverse effect: Social Effects • Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system • There could be additional stresses on community housing due to in-migration of workers. • There could be additional stresses on the emergency services in the area due to the in-migration of workers. No residual adverse effect: Social Effects • Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure	• Cease dewatering activities • Grading of the site to direct runoff towards open pit • Closure of the TSF • Closure of the WRSA • Initiate filling of open pit • Construction of open pit spillway • Underground mine closure • Decommissioning of site infrastructure • Decommissioning of LGO stockpile • Use of overburden and depletion of overburden stockpile • Revegetate site • On-site vehicle exhaust • Closure traffic • Closure workforce	Health effects	Wild rice • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption Berry harvesting • Potential loss of harvesting areas • Change in quality for consumption Medicinal plant harvesting • Loss of forest • Loss of wetland • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	No residual adverse effect: • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.
		Harvesting and gathering of plant material	Change to Ungulates • Potential habitat loss • Change in quality for consumption Change to Furbearers • Potential habitat loss Change to Waterfowl • Potential habitat loss • Change in quality for consumption Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality	Residual adverse effect: Berry harvesting • 260 ha of berry habitat loss. Constitutes 8.7% of the available berry habitat in the terrestrial LSA. Medicinal plant harvesting • 208 ha of forest loss for potential medicinal plant harvesting. Constitutes 7.8% of forest habitat in the LSA. • 47 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of wetland habitat in the LSA. Change in access • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Wild rice • The Project will not overprint any area of wild rice habitat.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project. • There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Berry harvesting</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Medicinal plant harvesting</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Hunting	<u>Furbearers</u> • Potential habitat loss <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and	<u>Residual adverse effect:</u> <u>Ungulates</u> • 141 ha of ungulate habitat will be lost to hunting. Constitutes 0.6% of the available ungulate habitat in the RSA. <u>Furbearers</u> • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. <u>Waterfowl</u> • 54.5 ha of waterfowl habitat will be lost to hunting. Constitutes 3.8% of the available waterfowl habitat in the LSA. <u>Change in access</u> • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons <u>Diminished on-the-land experience</u> • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable <u>No residual adverse effect:</u> <u>Ungulates</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Furbearers</u> • Ample beaver habitat in the LSA not a meaningful amount of habitat removed. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Waterfowl</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	
		Trapping	Sport fishing • Potential change in abundance of sport fish • Change in quality for consumption Baitfish • Potential change in abundance of baitfish Commercial fishing • Quality of sport fish for consumption • Baitfish for commercial use Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001,	Residual adverse effect: Furbearers • 96 ha of American martin habitat will be lost to hunting. Constitutes 7.4% of the available American martin habitat in the LSA. Change in access • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Furbearers • Ample beaver habitat in the LSA not a meaningful amount of habitat removed.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Fishing	Cultural or spiritual site • Loss or disturbance to known sites • Restriction to access Traditional travel routes • Interruption of a known traditional travel route • Interference with a known traditional travel route Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area	Residual adverse effect: Change in access • 379 ha where access will require a Treasury escort for safety and security reasons • 364 ha where access will be removed for safety and security reasons Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Sport fishing • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. Baitfish • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. Commercial fishing • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)				where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	
		Cultural and spiritual	Economic effects • Changes in Aboriginal employment opportunities • Changes in cost of living • Potential Project purchases from Aboriginal businesses Social effects • Potential for in- and out-migration • Capacity of education services • Change in education attainment • Project specific training opportunities • Change in housing availability • Change in property values (off reserve) • Capacity of emergency services • Road network capacity and condition	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].	Residual adverse effect: Diminished on-the-land experience • The Project will be audible from 171 ha around the operations area • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Cultural and spiritual sites • No identified cultural or spiritual site will be affected by the Project • There will be no restriction to access toy any identified cultural or spiritual sites due to the Project Traditional Travel Routes • There are no known traditional travel routes through the immediate Project site. • Traditional travel routes to Rice Lake via Thunder Lake will not be affected.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Closure (cont'd)		Socio-economic effects	<u>Wild rice</u> • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption <u>Berry harvesting</u> • Potential loss of harvesting areas • Change in quality for consumption <u>Medicinal plant harvesting</u> • Loss of forest • Loss of wetland • Change in quality for consumption <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project [Mit_046, Mit_093, Mit_095, Mit_097, Mit_099, Mit_102, Mit_103, Mit_104, Mit_105, Mit_106, Mit_108, Mit_109, Mit_110, Mit_111, Mit_112, Mit_114, Mit_115, Cmt_017, Cmt_038] • Mitigation measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the Project. [Cmt_003, Cmt_004, Mit_103, Mit_104, Mit_105, Mit_123]	<u>Residual positive effect:</u> <u>Economic Effects</u> • The Project will create job opportunities for Aboriginal peoples with varying levels of educational requirements (Table 6.18.4.2-1) <u>Social Effects</u> • The Project will provide on-the-job training for individual with limited education, and provide opportunities to encourage others to attain higher levels of education • There will be increased training and education opportunities for unemployed and under-employed residents and non-resident workers <u>Residual neutral effect:</u> <u>Economic Effects</u> • The benefits of purchases made by Treasury Metals in the local communities will cease. <u>Social Effects</u> • There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property. <u>Residual adverse effect:</u> <u>Economic Effects</u> • The demand for labour, goods, and services by the Project will decline and reduce the cost of living. <u>Social Effects</u> • The out-migration of workers leaving the area would be most prominent during this phase. • Potential increased demand on education services. It is anticipated that any increase in enrollment could be accommodated within the existing education system • There could be additional stresses on community housing due to in-migration of workers. • There could be additional stresses on the emergency services in the area due to the in-migration of workers. <u>No residual adverse effect:</u> <u>Social Effects</u> • Based on the traffic study (Appendix E), the existing road network can handle the slight increase in traffic on Highway 17.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure	• Presence of the closed WRSA • Presence of closed TSF • Flooding of open pit • Passive discharge open pit into Blackwater Creek Tributary 1 • Groundwater recovers to near pre-development levels • Seepage from the WRSA and TSF leaving the site	Health effects	<u>Wild rice</u> • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption <u>Berry harvesting</u> • Potential loss of harvesting areas • Change in quality for consumption <u>Medicinal plant harvesting</u> • Loss of forest • Loss of wetland • Change in quality for consumption <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	<u>No residual adverse effect:</u> • No potential risk to human health exceeded the Health Canada/MOECC risk benchmark. Therefore, there are no adverse effects to human health.
		Harvesting and gathering of plant material	<u>Change to Ungulates</u> • Potential habitat loss • Change in quality for consumption <u>Change to Furbearers</u> • Potential habitat loss <u>Change to Waterfowl</u> • Potential habitat loss • Change in quality for consumption <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the	<u>Residual adverse effect:</u> <u>Berry harvesting</u> • 168 ha of berry habitat loss. Constitutes 5.6% of the available berry habitat in the terrestrial LSA. <u>Medicinal plant harvesting</u> • 168 ha of forest loss for potential medicinal plant harvesting. Constitutes 6.3% of forest habitat in the LSA. • 47 ha loss for potential medicinal plant harvesting. Constitutes 3.2% of wetland habitat in the LSA. <u>Diminished on-the-land experience</u> • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable <u>No residual adverse effect:</u> <u>Wild rice</u> • The Project will not overprint any area of wild rice habitat.

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to vegetation and wetlands (Section 6.15.5) will minimize the area of vegetation and wetlands effected by the Project [Mit_008, Mit_046, Mit_050, Mit_054, Mit_065, Mit_066, Mit_068, Mit_074, Mit_082, Mit_084, Mit_085, Mit_086, Mit_087, Mit_088, Mit_089]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• Water quality in the receiving environment will not exceed PWQO or background concentrations as a result of the Project. • There will be no measurable changes to water levels in Wabigoon Lake or Thunder Lake as a result of the Project. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Berry harvesting</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Medicinal plant harvesting</u> • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Change in access</u> • No access restrictions in the post-closure phase. <u>Diminished on-the-land experience</u> • There will be no source of noise from the Project
		Hunting	<u>Furbearers</u> • Potential habitat loss <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental	<u>Residual adverse effect:</u> <u>Diminished on-the-land experience</u> • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable <u>No residual adverse effect:</u> <u>Ungulates</u>

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
			• Noticeable change in noise	management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128]	• Habitat in the post-closure phase will return. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Furbearers</u> • Habitat in the post-closure phase will return. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Waterfowl</u> • Habitat in the post-closure phase will return. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Change in access</u> • No access restrictions in the post-closure phase <u>Diminished on-the-land experience</u> • There will be no source of noise from the Project

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
		Trapping	Sport fishing • Potential change in abundance of sport fish • Change in quality for consumption Baitfish • Potential change in abundance of baitfish Commercial fishing • Quality of sport fish for consumption • Baitfish for commercial use Change in access • Area where access is controlled • Area where access is restricted Diminished on-the-land experience • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to wildlife and wildlife habitat (Section 6.12.3) will minimize the area where there are Project affects to wildlife and wildlife habitat [Mit_018, Mit_050, Mit_065, Mit_066, Mit_067, Mit_068, Mit_069, Mit_070, Mit_071, Mit_072, Mit_073, Mit_074, Cmt_020, Cmt_021]. • Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044,	Residual adverse effect: Diminished on-the-land experience • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Furbearers • The operations area will be reclaimed to productive habitat available for trapping. Change in access • No access restrictions in the post-closure phase. Diminished on-the-land experience • There will be no source of noise from the Project

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
				Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128].	
Post-closure (cont'd)		Fishing	<u>Cultural or spiritual site</u> • Loss or disturbance to known sites • Restriction to access <u>Traditional travel routes</u> • Interruption of a known traditional travel route • Interference with a known traditional travel route <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Treasury Metals will undertake additional land and resources use studies to ensure a pre-construction baseline of the land and resource users as supported by local communities [Mit_094]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measures for changes to surface water quality (Section 6.8.3) will minimize the effects of the Project to surface water quality [Mit_008, Mit_053, Mit_052, Mit_056, Mit_024, Cmt_013, Cmt_034, Cmt_035]. • Mitigation measure for changes to fish and fish habitat (Section 6.14.3) will minimize the area where there are Project affects to fish and fish habitat [Mit_077, Mit_078, Mit_079, Mit_080, Mit_050, Mit_008, Mit_057, Mit_059, Mit_081, Mit_053, Mit_058, Mit_024, Mit_060, Mit_082].	<u>Residual adverse effect:</u> <u>Diminished on-the-land experience</u> • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable <u>No residual adverse effect:</u> <u>Sport fishing</u> • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • No residual effects via ingestion of country foods identified in human health risk assessment as a result of the Project. <u>Baitfish</u> • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. <u>Commercial fishing</u> • Change in water quality and quantity as a result of the Project will not affect sport fish abundance in Thunder Lake or Wabigoon Lake. • Baitfish habitat loss as a result of the Project will be offset by constructing new fish habitat. Project effects will not affect the abundance of baitfish in surrounding creeks and tributaries. <u>Change in access</u> • No access restrictions in the post-closure phase <u>Diminished on-the-land experience</u> • There will be no source of noise from the Project

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)				• Mitigation measures for changes to human health (Section 6.18.5) will minimize the potential effects to local Indigenous communities. [Mit_008, Mit_054, Mit_020, Mit_021, Mit_018, Mit_022, Mit_023, Mit_088, Mit_024, Mit_124, Mit_044, Mit_046, Mit_052, Mit_053, Mit_055, Mit_062, Mit_130, Mit_129, Mit_127, Mit_128].	
		Cultural and spiritual	Economic effects • Changes in Aboriginal employment opportunities • Changes in cost of living • Potential Project purchases from Aboriginal businesses Social effects • Potential for in- and out-migration • Capacity of education services • Change in education attainment • Project specific training opportunities • Change in housing availability • Change in property values (off reserve) • Capacity of emergency services • Road network capacity and condition	• Implement a Communications Management Plan to address ongoing engagement with potentially affected stakeholders and Aboriginal peoples throughout the life of the Project. The plan should include a transparent grievance process [Mit_093]. • Environmental aspects and potential impacts of the project will be managed within an environmental management plan (EMP) which integrates environmental performance with overall project management. The EMP will have measures to minimize the potential for the release of deleterious substances and will include a Spill Response Plan and a Waste Management Plan [Cmt_031]. • Mitigation measures for changes to natural landscapes (Section 6.2.3.1) will minimize the noticeability of the Project from off-site [Mit_001, Mit_002, Mit_003, Mit_004, Mit_005, Mit_006, Cmt_037]. • Air quality mitigation measures (Section 6.6.5) will minimize the areas where changes to air quality may affect land uses. [Mit_029, Mit_031, Mit_043, Mit_044, Mit_046, Cmt_017, Cmt_036] • Noise and blasting mitigation measures (Section 6.4.5) will minimize the areas where noise and vibration from the Project will be noticeable. [Mit_025, Mit_026, Mit_027, Mit_028, Mit_029, Mit_030, Mit_031, Mit_043, Cmt_018, Cmt_025] • Light mitigation measures (Section 6.5.5) will minimize the areas where light trespass from the Project will be noticeable. [Mit_034, Mit_035, Mit_036, Mit_037, Mit_038, Mit_039, Mit_040, Mit_041, Mit_042] • Mitigation measure for effects to heritage resources (Section 6.20.5) will minimize the predicted effects to Indigenous heritage resource from the Project [Mit_050, Mit_118, Mit_119, Mit_120, Mit_121, Mit_122].	Residual adverse effect: Diminished on-the-land experience • The WRSA will be visible from 852 ha of Thunder Lake, but likely will not be discernable No residual adverse effect: Cultural and spiritual sites • No identified cultural or spiritual site will be affected by the Project • There will be no restriction to access toy any identified cultural or spiritual sites due to the Project Traditional Travel Routes • There are no known traditional travel routes through the immediate Project site. • Traditional travel routes to Rice Lake via Thunder Lake will not be affected. Diminished on-the-land experience • There will be no source of noise from the Project

Table 6.23-20: Summary of Mitigation and Residual Effects for Aboriginal Peoples (continued)

Project Phase	Project Works and Activities	Valued Components	Potential Effect	Mitigation / Commitment	Residual Adverse Effect
Post-closure (cont'd)		Socio-economic effects	<u>Wild rice</u> • Potential loss of wild rice area • Change in water quality • Change in water levels • Change in quality for consumption <u>Berry harvesting</u> • Potential loss of harvesting areas • Change in quality for consumption <u>Medicinal plant harvesting</u> • Loss of forest • Loss of wetland • Change in quality for consumption <u>Change in access</u> • Area where access is controlled • Area where access is restricted <u>Diminished on-the-land experience</u> • Potential for changes in viewscape • Noticeable change in noise	• Mitigation measures for changes to social factors (Section 6.16.5) will minimize the predicted social effects to Aboriginal peoples by the Project [Mit_046, Mit_093, Mit_095, Mit_097, Mit_099, Mit_102, Mit_103, Mit_104, Mit_105, Mit_106, Mit_108, Mit_109, Mit_110, Mit_111, Mit_112, Mit_114, Mit_115, Cmt_017, Cmt_038] • Mitigation measure for changes to economic factors (Section 6.17.5) will minimize the predicted economic effects to local Indigenous communities and emphasize the positive economic effects of the Project. [Cmt_003, Cmt_004, Mit_103, Mit_104, Mit_105, Mit_123]	<u>Residual neutral effect:</u> <u>Economic Effects</u> • Although the jobs from the Project will no longer exist in the post-closure phase, the experience and training that Aboriginal peoples received can easily transfer to jobs in industry. • The benefits of purchases made by Treasury Metals in the local communities will cease. <u>Social Effects</u> • Although the jobs from the Project will no longer exist in the post-closure phase, the education, experience and training that Aboriginal peoples received can easily transfer to jobs in industry. • There could be an increase in property values as a result of the Project. This is a positive effect to people trying to sell their property and a negative effect to people trying to buy property. <u>Residual adverse effect:</u> <u>Economic Effects</u> • The demand for labour, goods, and services by the Project will decline and reduce the cost of living. <u>Social Effects</u> • The pattern of out-migration of the area would return to pre-project conditions. <u>No residual adverse effect:</u> <u>Social Effects</u> • The demand on education services will return to pre-project conditions. • There will be no training opportunities following closure from the Project • Housing availability will return to pre-project levels. • Emergency services use would return to pre-project conditions. • Traffic on Highway 17 will return to pre-project conditions.