5.0 EXISTING ENVIRONMENT

5.1 Climate and Meteorology

Climate and meteorology represent two important, and related aspects of the weather that are relied on in the EIS. Climate is defined by Environment and Climate Change Canada (2017) as the "prevalent or characteristic weather conditions of a place or region over a period of years", while meteorology is defined simply as the "…weather of a region" (Webster's 2017). In other words, climate is the weather you expect, while meteorology is the weather you get.

The long-term climate information is relied on the EIS for characterizing the expected rainfall, precipitation and evaporations patterns in the region that will be relied on for understanding the water budgets and balances for the Project. This information is directly relied on in evaluating the surface water quantity (hydrology) patterns, as well as providing information relied on in the design and sizing of the facilities and structures for managing the water at the Project.

The primary use for meteorological information is as inputs to the numerical modelling completed to assess the effects of the Project on air quality. For this reason, the discussion of meteorological data relied on the EIS has been described as part of the description of effects on air quality (Section 6.6) and further detailed in Appendix J-2.

5.1.1 Climate Data Sources

In characterizing the existing climatic conditions for the Project, it is necessary to find stations that provide a sufficiently long period of record (at least 30 years). It is also important that the selected stations have data that is representative of the current conditions within the region. A review of the information available from Environment and Climate Change Canada (formerly Environment Canada) identified that the closest relevant stations are located in Dryden Ontario. Over the years the stations in Dryden have moved several times, and have been upgraded to make use of advances in technology. The current station operated in Dryden is referred to as Dryden A (aut). The station is located at Dryden airport, and has been operating since 1999. This station was commissioned beside the Dryden A station, which was operating from at Dryden airport from 1970 through 2005. Other stations in operated in Dryden include the Dryden Regional (2010–2011) and Dryden (1914–1997). The Dryden A and Dryden A (aut) are considered to be the same station and are relied on in the assessment for characterizing the climate used in the assessment. Table 5.1.1-1 provides a listing of the available climate data for Dryden.

Table 5.1.1-1: Climate Data Availability for Dryden

EC Station	Station Number	Period of Record	Distance from Project	Elevation
Dryden Regional	6032125	2010–2011	12.2	412.7
Dryden	6032117	1914–1997	16.0	371.9
Dryden A (aut)	6032120	1999–2017	12.5	412.7
Dryden A	6032119	1970–2005	12.9	412.7

5.1.2 Climate Overview

The Project site is located in the west-central portion of the Boreal Shield Ecozone, experiencing a continental climate, generally characterized by short mild summers and long cold winters with relatively low precipitation. The terrain is generally flat and absent of orographic features which can block air masses or produce localized increases in precipitation.

5.1.3 Climate Conditions

Table 5.1.3-1 provides the long-term climate data relied on in the assessment in addition to the average (normal) conditions. The table lists the 1 in 20 dry year (5th percentile) and 1 in 20 wet year (95th percentile) precipitation data used to evaluate the range of conditions likely over the relatively short life of the Project.

5.1.4 Expected Changes in Climate

It is widely recognized that climate is changing, and that changes in climate over the life of the Project could potentially result in a shift in weather conditions and/or the frequency of extreme weather events. There are various climate change assessments that have been developed for northern Ontario, most of which generally predict that the temperatures will increase in the future, while precipitation will remain stable, or increase. The assessments also theorize that precipitation will become more episodic, and that there would be an increased risk of natural fires.

Although there are a multitude of sources available that describe the projections for future changes in climate in northwestern Ontario, the most comprehensive are the climate change research reports CCRR-05 (Colombo et al. 2007) and CCRA-44 (McDermid et al. 2015). The earlier policymaker 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 to 2000 baseline period, and are provided for the 2011 to 2040, 2041 to 2070, and 2071 to 2100 time horizons. These projections were used to compile the projected changes in summer and winter temperature and precipitation for the region near the Project.

Table 5.1.3-1: Climate Data Used in Assessment

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
Dryden A (6032119) 1981 - 2010 Climate Normals														
Precipitation (mm) (1,4)	26.5	20.0	29.9	39.6	73.4	115.2	103.1	83.7	88.9	63.6	46.7	29.1	719.7	100.0%
Rain (mm) (1)	0.2	2.1	6.7	24.7	69.2	115.2	103.1	83.5	87.7	49.2	13.0	1.2	555.8	77.2%
Snow (mm equivalent) (2)	26.3	17.9	23.2	14.9	4.2	0.0	0.0	0.2	1.2	14.4	33.7	27.9	163.9	22.8%
Monthly Distribution of Rain, Snow, and Precipitation as Percentage of Total Annual Precipitation														
Precipitation (%)	3.7	2.8	4.2	5.5	10.2	16.0	14.3	11.6	12.4	8.8	6.5	4.0	100.0	—
Rain (%)	0.0	0.3	0.9	3.4	9.6	16.0	14.3	11.6	12.2	6.8	1.8	0.2	77.2	—
Snow (%, mm equivalent)	3.7	2.5	3.2	2.1	0.6	0.0	0.0	0.0	0.2	2.0	4.7	3.9	22.8	—
Monthly Rain, Snow, and Precipitation for the Project – Average Year														
Precipitation (mm) (3,4)	24.7	18.7	27.9	36.9	68.5	107.5	96.2	78.1	82.9	59.3	43.6	27.1	671.4	100.0%
Rain (mm)	0.2	2.0	6.3	23.0	64.6	107.5	96.2	77.9	81.8	45.9	12.1	1.1	518.5	77.2%
Snow (mm equivalent)	24.5	16.7	21.6	13.9	3.9	0.0	0.0	0.2	1.1	13.4	31.4	26.0	152.9	22.8%
Monthly Rain, Snow, and Precipitation for the Project – Dry Year														
Precipitation (mm) (3)	17.1	12.9	19.3	25.6	47.4	74.4	66.6	54.1	57.4	41.1	30.2	18.8	465.1	100.0%
Rain (mm)	0.1	1.4	4.3	16.0	44.7	74.4	66.6	54.0	56.7	31.8	8.4	0.8	359.2	77.2%
Snow (mm equivalent)	17.0	11.6	15.0	9.6	2.7	0.0	0.0	0.1	0.8	9.3	21.8	18.0	105.9	22.8%
Monthly Rain, Snow, and Precipitation for the Project – Wet Year														
Precipitation (mm) (3)	32.3	24.4	36.5	48.3	89.5	140.5	125.7	102.1	108.4	77.6	57.0	35.5	877.7	100.0%
Rain (mm)	0.2	2.6	8.2	30.1	84.4	140.5	125.7	101.8	107.0	60.0	15.9	1.5	677.8	77.2%
Snow (mm equivalent)	32.1	21.8	28.3	18.2	5.1	0.0	0.0	0.2	1.5	17.6	41.1	34.0	199.9	22.8%

Notes:

(1) Environment Canada Climate Normals 1981 to 2010 for Dryden A (6032119) were obtained from Environment Canada's website: <http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=dryden&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=3953&dispBack=0>; accessed on December 6, 2016.

(2) Snow values are calculated as precipitation minus rainfall and are reported as mm of water equivalent. Values here do not directly match 1981 to 2010 climate normals for the Dryden A (6032119) station, which are reported as cm as snow, due to variation in snowfall density leading to some minor deviations from reported climate normals.

(3) Total annual precipitation values for average and 20 year wet and dry scenarios were determined from annual totals from three Environment Canada climate stations covering a period of 1970 - 2015. The stations were: Dryden A (6032119) from 1970 - 2004; Dryden A (AUT) (6032120) from 2005 - 2009; and Dryden Regional (6032125) from 2011 to 2015. Data for 2010 was excluded from the analysis as it was incomplete, missing values for October through December. A normally distributed random variable with a mean of 671.4 mm and a standard deviation of 125.4 mm was fit to the annual precipitation totals. The 20 year dry and wet scenarios are represented by the 5th and 95th percentiles, respectively, of the normally distributed random variable.

(4) It is noted that the 1981 to 2010 climate normals for Dryden A have a total annual precipitation of 719.7 mm, while the average annual precipitation for the 1970 to 2015 is only 671.4 mm (Note 3). This difference may be partially explained by the inclusion of 2011 to 2015 years, all of which had total annual precipitation below 600 mm, and which had an average annual precipitation of 497.5 mm. If only the years 1981 - 2010 are considered in the set of annual precipitation data generated in Note 3, then the annual average precipitation is 698.8 mm, which is still less than the 1981 to 2010 climate normals for Dryden A, but is a deviation of only 2.9%. This remaining difference is likely due to the merging of different data sets; however, this was necessary to do since access to the Dryden A precipitation data was not available from the Environment Canada website beyond the year 2004

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 5.4.1-1 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 5.4.1-1: Projections for Changes in Climate (relative to 1971 to 2000)

Period	Temperature		Precip[itation	
	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%

Note: Data derived from Coumbo 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 emission scenarios, but uses four new emission scenarios that 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. are described more fully by McKenney et al. (2006; 2011; 2013). The results are presented numerically for the three major watersheds in Ontario (i.e., Great Lakes, Hudson Bay, and Nelson River), the most relevant one for this project being 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 for all of the emission scenarios and forecast horizons. The annual and winter precipitation projections show increasing precipitation for all of the emission scenarios and forecast horizons. In contrast, the projections for summer precipitation show decreases for all of the emission scenarios and forecast horizons (Table 5.4.1-2).

Table 5.4.1-2: Projections for Mean Changes in Climate (relative to 1971 to 2000)

Period	Scenario	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

Table 5.4.1-2: Projections for Mean Changes in Climate (relative to 1971 to 2000) (continued)

Period	Scenario	Temperatures (°C)			Precipitation (mm)		
		Annual	Summer	Winter	Annual	Summer	Winter
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

5.1.5 Traditional Knowledge

Eagle Lake First Nation has identified that climate change, and its associated impacts is an aspect of long term concern. It should also be noted that while no specific information has been conveyed it has been anecdotally conveyed that climate is changing and the Project should take this into account.

5.2 Air Quality

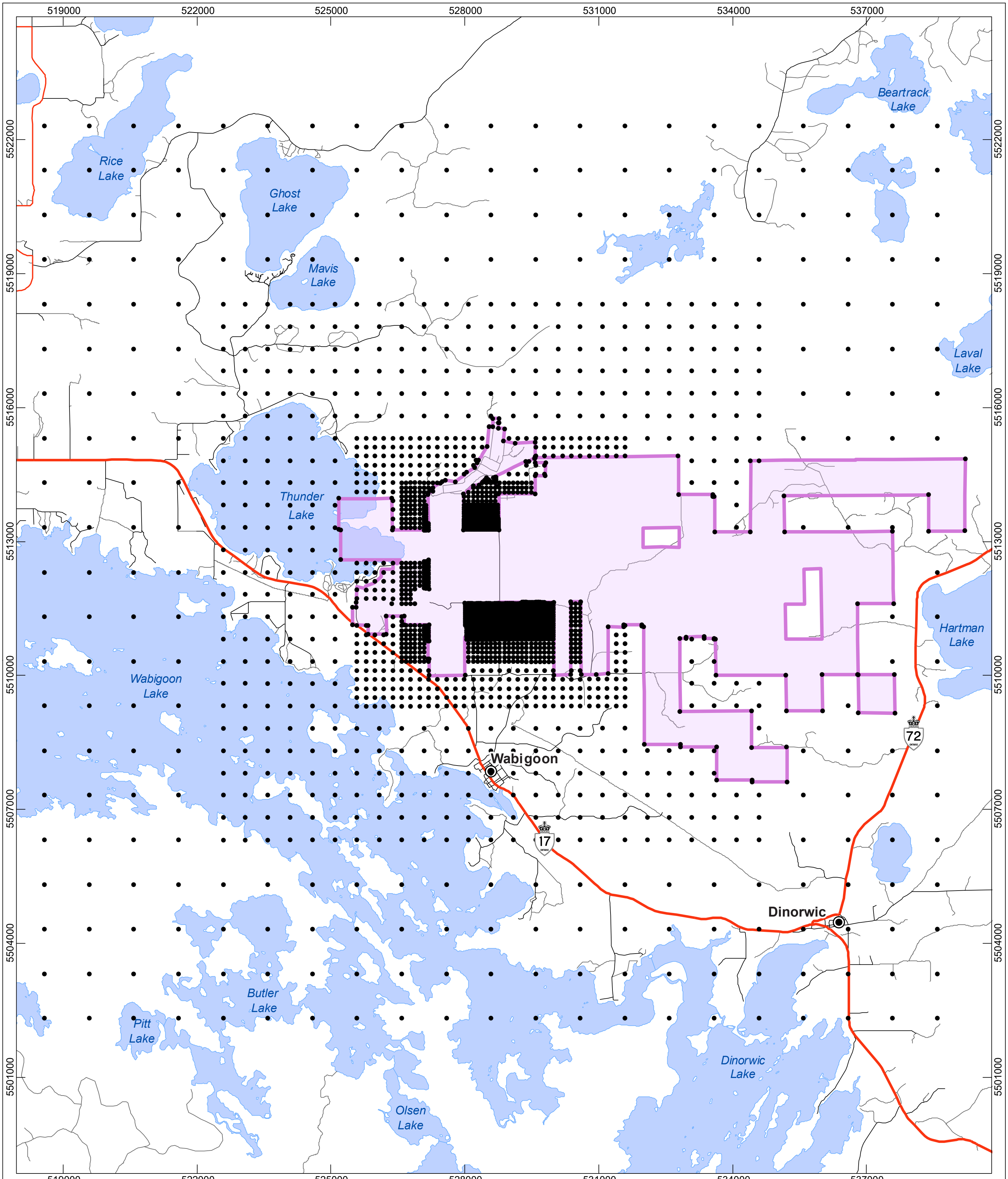
This section provides a description of the existing air quality conditions in the Project area. As part of the Environmental Air Quality Assessment (Appendix J-2), completed by RWDI Air Inc., an evaluation of baseline ambient air quality was completed. The relevant details have been summarized in the following sections. The full evaluation of baseline ambient air quality is presented in Section 3.2 of the Environmental Air Quality Assessment (Appendix J-2).

5.2.1 Description of the Project Airshed

The Project is located in a mostly forested area between the communities of Dryden and Wabigoon and north of Highway 17 (Figure 5.2.1-1). The proposed Project site is at least 10 km from any existing sources of significant air emissions. There are several aggregate operations on the east side of Airport Road in Dryden. The town of Dryden, located approximately 15 km to the west, is home to a kraft pulp mill operated by Domtar, which would contribute to the background air quality in the area, primarily due to emissions from the natural gas and wood-waste fired boilers, recovery boiler and lime kiln. Due to the distance between sources at the Domtar pulp mill, the aggregate operations and the Project site, significant interaction between these sources and the expected emissions from the Project are expected to be minimal.

5.2.2 Evaluation Criteria and Methods

The evaluation of the baseline ambient air quality has been completed by comparing the selected baseline air quality data to a combination of Canadian Ambient Air Quality Standards (CAAQSs), National Ambient Air Quality Objectives (NAAQOs) and the Ontario Ministry of the Environment and Climate Change (MOECC) Ontario Ambient Air Quality Criteria (OAAQC) including Schedule 3 Standards, Guidelines, and Jurisdictional Screening Levels (JSL's) as prescribed under Ontario Regulation 419/05 (O.Reg.419/05).



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

OVERVIEW OF THE PROJECT AIR QUALITY ASSESSMENT LOCAL STUDY AREA

FIGURE: 5.2.1-1 REV.00

SCALE: 110 000

TREASURY METALS INC.

DESIGN: AT 06 FEB. 2014
GIS: AT 20 FEB. 2014
CHECK: AT 09 OCT. 2014

LEGEND

- Air Quality Model Receptor
- Populated Area
- Property Boundary
- Waterbody
- Arterial Road
- Highway
- Local Road
- Recreational Road

REFERENCE
Base Data: OBM
Receptors: RWDI
Projection: NAD83 UTM Zone 15N

The evaluation criteria employed are presented in Table 5.2.2-1. These criteria are intended to guard against adverse effects including health, odour, vegetation, soiling, visibility, corrosion or other suitable end-points. A number of different averaging periods are required under the relevant regulatory regimes to account for potential short-term acute exposures and long-term chronic exposures. Where more than one criteria is presented, the most stringent criteria were selected as the threshold for evaluating each parameter.

Table 5.2.2-1: Baseline Air Quality Evaluation Criteria

Air Quality Parameter	Averaging Time	National Air Quality Objectives			Canadian Ambient Air Quality Standards (µg/m³)	Ontario Ambient Air Quality Criteria (µg/m³)	Threshold (µg/m³)
		Desirable (µg/m³)	Acceptable (µg/m³)	Tolerable (µg/m³)			
TSP	24 hr	-	120	400	-	120	120
	Annual	60	70	-	-	60	60
PM_{10}	24 hr	-	-	-	-	50	50
$PM_{2.5}$	24 hr	-	-	-	28 27 [2]	-	27
	Annual	-	-	-	10 8.8 [2]	-	8.8
Dustfall [1]	30 day	-	-	-	-	7	7
	Annual	-	-	-	-	4.6	4.6
SO_2	1 hr	450	900	-	-	690	450
	24 hr	150	300	800	-	275	150
	Annual	30	60	-	-	55	30
NO_2	1 hr	-	400	1000	-	400	400
	24 hr	-	200	300	-	200	200
	Annual	60	100	-	-	-	60
CO	1 hr	15,000	35,000	-	-	36,200	15,000
	8 hr	6,000	15,000	20,000	-	15,700	6,000
Aluminum	24 hr	-	-	-	-	4.8 (JSL)	4.8
Antimony	24 hr	-	-	-	-	25	25
Arsenic	24 hr	-	-	-	-	0.3	0.3
Barium	24 hr	-	-	-	-	10	10
Beryllium	24 hr	-	-	-	-	0.1	0.1
Bismuth	24 hr	-	-	-	-	-	N/A
Cadmium	24 hr	-	-	-	-	0.025	0.025
Calcium	24 hr	-	-	-	-	-	N/A
Chromium	24 hr	-	-	-	-	0.5	0.5
Cobalt	24 hr	-	-	-	-	0.1	0.1
Copper	24 hr	-	-	-	-	4	4
Gallium	24 hr	-	-	-	-	-	N/A
Gold	24 hr	-	-	-	-	-	N/A
Iron	24 hr	-	-	-	-	25	25
Lanthanum	24 hr	-	-	-	-	-	N/A
Lead	24 hr	-	-	-	-	0.5	0.5
Lithium	24 hr	-	-	-	-	20	20
Magnesium	24 hr	-	-	-	-	120	120
Manganese	24 hr	-	-	-	-	0.4	0.4

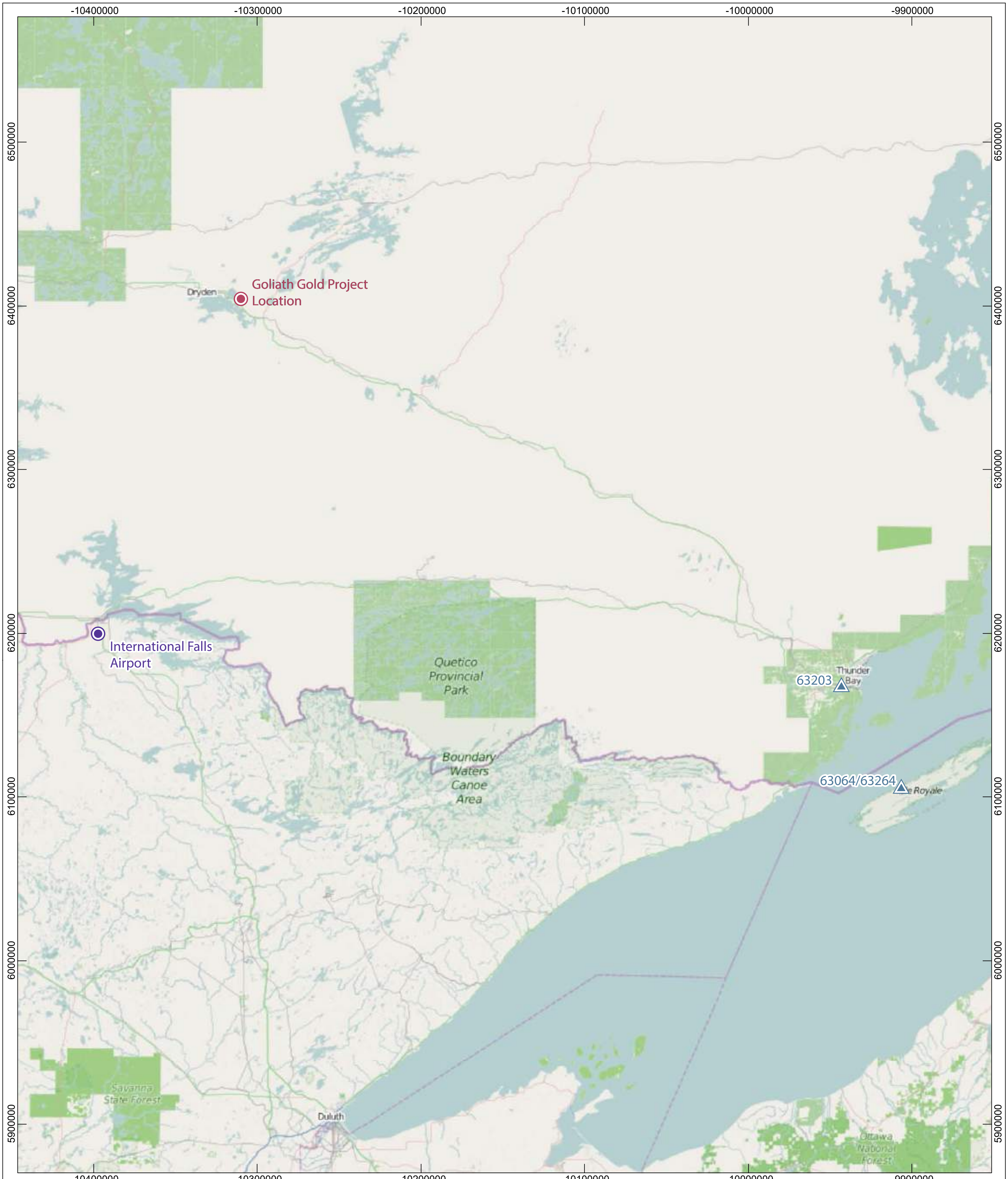
Table 5.2.2-1: Air Quality Assessment Criteria (continued)

Air Quality Parameter	Averaging Time	National Air Quality Objectives			Canadian Ambient Air Quality Standards (µg/m³)	Ontario Ambient Air Quality Criteria (µg/m³)	Threshold (µg/m³)
		Desirable (µg/m³)	Acceptable (µg/m³)	Tolerable (µg/m³)			
Molybdenum	24 hr	-	-	-	-	120	120
Nickel	24 hr	-	-	-	-	0.04	0.04
Palladium	24 hr	-	-	-	-	10	10
Phosphorous	24 hr	-	-	-	-	0.35 (JSL)	0.35
Platinum	24 hr	-	-	-	-	0.2	0.2
Potassium	24 hr	-	-	-	-	28	28
Rhodium	24 hr	-	-	-	-	0.4 (JSL)	0.4
Scadium	24 hr	-	-	-	-	-	N/A
Selenium	24 hr	-	-	-	-	10	10
Silver	24 hr	-	-	-	-	50	50
Sodium	24 hr	-	-	-	-	10	10
Strontium	24 hr	-	-	-	-	120	120
Sulphur	24 hr	-	-	-	-	20 (JSL)	20
Thallium	24 hr	-	-	-	-	0.24	0.24
Thorium	24 hr	-	-	-	-	-	N/A
Tin	24 hr	-	-	-	-	10	10
Titanium	24 hr	-	-	-	-	120	120
Tungsten	24 hr	-	-	-	-	4 (JSL)	4
Uranium	24 hr	-	-	-	-	0.03	0.03
Vanadium	24 hr	-	-	-	-	2	2
Yttrium	24 hr	-	-	-	-	2.4 (JSL)	2.4
Zinc	24 hr	-	-	-	-	120	120

5.2.3 Baseline Air Quality Sources

The existing baseline ambient air quality indicator levels at the Project site were estimated based on data from two (2) MOE monitoring stations in the Thunder Bay area (MOE Stations No. 63203 and 63064; Figure 5.2.3-1). The baseline ambient air concentrations are expected to be higher in Thunder Bay than near the Project site. Since the predicted air quality effects of the Project are determined by summing the predicted concentrations of indicator compounds with the corresponding baseline concentrations, using air quality baseline data from Thunder Bay provides a conservative estimate of Project effects.

As the maximum measured values represent peak events which occur infrequently, the 90th percentile values (i.e., exceeded <10% of the time), which are more representative of the typical maximum background conditions have been used. These 90th percentile values are more likely to coincide with maximum contributions from the project related emissions. These values are then compared against the relevant criteria.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

SCALE: 3 000 000

TREASURY METALS INC.

REGIONAL AIR QUALITY MONITORING STATIONS

DESIGN: AT 06 FEB. 2014
GIS: AT 10 OCT. 2014
CHECK: AT 10 OCT. 2014

FIGURE: 5.2.3-1 | REV.00

Goliath Gold Project
Environment Canada Monitoring Station
RWDI Meteorological Station

REFERENCE

Projection: NAD83 UTM Zone 15N
Base Data: OBM
Wells Provided by AMEC
Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA

TREASURY METALS Inc.

5.2.4 Existing Baseline Air Quality

The measured ambient air quality data from the MOE monitoring stations is presented in Table 5.2.4-1 along with a comparison of each value to the relevant assessment criteria. The MOE monitoring station results indicate that the existing baseline ambient air quality levels do not exceed the relevant assessment criteria.

Table 5.2.4-1: Measured Ambient Air Quality Data from the MOE Monitoring Stations

Air Quality Indicator	Monitoring Period	Averaging Period	90th Percentile Concentration (µg/m³)	Threshold (µg/m³)	Percent of Threshold
TSP	2007–2011	24 hr	33	120	28%
		Annual	14	60	23%
PM_{10}	2007–2011	24 hr	15	50	30%
$PM_{2.5}$	2007–2011	24 hr	10	27	37%
		Annual	4.3	8.8	49%
SO_2	1999–2003	1 hr	4	400	1%
		24 hr	4	200	2%
		Annual	1	60	2%
NO_2	2007–2011	1 hr	33	450	7%
		24 hr	33	150	22%
CO	2000–2003	1 hr	1,248	15,000	8%
		8hr	1,248	6,000	21%

There is very little variation in concentrations over the course of the day, as can be seen by the negligible variation in the 1 hour average and 24 hour average concentrations measured for NO_2 and SO_2. The existing ambient air quality levels near the Project site are expected to be typical of other forested areas of Northern Ontario. However; as the only available data near the Project site is from an urban area, this data is expected to be a conservative overestimate of current local conditions.

Although no ambient metals data were available from the existing stations, a conservative estimate of airborne metals for use to support the assessment was done using the metals assay results on waste rock material to represent the average crustal composition in the area for arsenic (As), chromium (Cr), manganese (Mn), and lead (Pb). The calculations are considered conservative as the actual surface soils in the area would contain a large portion of organic material, which would have virtually no metals present. Additionally, the background concentrations for airborne particulate matter was taken from the Thunder Bay Stations, which is expected to have higher background concentrations than we would collect in the relatively undeveloped area of the mine site. Table 5.2.4-2 provides the predicted background concentrations of airborne metals based on the background particulate levels from Thunder Bay, and the metals assay results for the waste rock.

Table 5.2.4-2: Estimated Background Concentrations of Airborne Metals

Compound	Average Composition in Waste Rock (ppm)	Background Concentration[a] ($\mu g/m^3$)
TSP	—	33
As	32	0.001056
Cr	143	0.004719
Mn	562	0.018546
Pb	143	0.004719

Note: (a) Background concentrations are calculated as the product of the background TSP value for Thunder Bay, and the relative metal assay composition for the waste rock.

As part of the process to respond to the Round 1 information requests, Treasury Metals were asked to evaluate the implications of using baseline data from Thunder Bay versus baseline data from a more remote and isolated site (e.g., Pickle Lake). To demonstrate the conservative nature of the evaluation, Treasury Metals has compared the baseline air quality data compiled from Thunder Bay to baseline air quality values used for other recent EAs in northern Ontario, specifically the EIS reports for the OSISKO Hammond Reef project and the Greenstone Gold Hardrock project in Table 5.2.4.2-3. The table indicates the following about the the baseline air quality selected for evaluating the effects of the Goliath Gold Project on air quality:

- The baseline SO_2 values used by Treasury Metals is roughly twice the value used on the other projects;
- The baseline NO_2 values used by Treasury Metals are considerably higher than used on the other projects;
- The baseline O_3 and $PM_{2.5}$ values used by Treasury Metals are comparable to the those used on the other projects; and
- The baseline PM_{10} values used by Treasury Metals are comparable to the values used on the Hammond Reef project but lower than used on the Hardrock project.

The following formula shows how the generally higher baseline values used in assessing the effects of the Goliath Gold Project lead to a conservative prediction of effects:

$$\mathrm{NO_2}=\mathrm{modelled}+\mathrm{background}\begin{cases}\mathrm{NO_2}=187.7+33.0=220.7\,\dfrac{\mu\mathrm{g}}{\mathrm{m}^3}\,(\mathrm{Goliath})\\ \mathrm{NO_2}=187.7+11.6=119.3\,\dfrac{\mu\mathrm{g}}{\mathrm{m}^3}\,(\mathrm{Hardrock})\\ \mathrm{NO_2}=187.7+2.32=190.2\,\dfrac{\mu\mathrm{g}}{\mathrm{m}^3}\,(\mathrm{Hammond})\end{cases}$$

Table 5.2.4-3: Comparison of Baseline Ambient Air Concentrations from Recent EAs

Air Quality Indicator	Averaging Period	Goliath Gold Project	Hardrock Project (Geralton)	Hammond Reef Project								
				Baseline	La Loche	Thunder Bay	Fraserdale	Pickle Lake	Senneterre	Brandon	Fort Chipewyan	Fort Liard
TSP	24 hr	33	—	—	—	—	—	—	—	—	—	—
PM_{10}	24 hr	15	26	17.81	17.81	102.09	—	—	—	—	47.44	-
$PM_{2.5}$	24 hr	10	9.2	4.93	6.77	8.86	8.5	—	—	8.21	-	4.93
SO_2	1 hr	4	2.2	2.62	3.19	2.62	-	—	—	—	2.62	2.62
	24 hr	4	1.9	1.77	3.21	1.77	-	—	—	—	2.73	2.73
NO_2	1 hr	33	11.6	2.32	2.32	11.29	33.86	—	—	—	22.57	5.64
	24 hr	33	12.2	2.32	2.32	9.48	28.29	—	—	—	18.73	5.32
CO	1 hr	1,248	—	1.15 (1)	—	1.15 (1)	—	—	—	—	—	—
	8hr	6,630	—	1.16 (1)	—	1.16 (1)	—	—	—	—	—	—
O_3	1 hr	79	—	74.57	76.79	74.57	78.5	80.46	84.39	—	78.5	76.54
	24 hr	79	—	69.18	73.22	72.68	69.18	75.51	82.01	—	70.2	74.66

Notes:

1. The CO values reported were taken from the Osisko report directly. This value would appear to be in parts per million (ppm), rather than µg/m³.

While ozone (O_3) baseline air quality numbers are presented in the above table, ozone has not been chosen as an indicator for assessing the effects of the Project on air quality. Although O_3 can form in the atmosphere through photochemical reactions with oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) emissions, the magnitude of these emissions from the Project is viewed as negligible from the perspective of O_3 formation. 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. Additionally, the following analysis of the nature of the potential ozone chemistry of the region was undertaken in response to the Round 1 information requests.

An area that is VOC-sensitive will experience increased ozone with increased VOC emissions, but little change with increasing NO_X emissions. In contrast, NO_X-sensitive areas will experience increased ozone with increased NO_X emissions but will show little change with increasing VOC emissions. Numerous publications (Silman 1995; Sillman and He 2002; and Sillman et al. 2003) are available that describe the possible linkage between ozone sensitivity and key indicators such as NO_y, $O_3/(NO_y\text{-}NO_x)$, $HCNO/NO_y$ and H_2O_2/HNO_3. While the relationships are described, the papers also point out that the indicators relied on to identify whether an area is NO_X-sensitive or VOC-sensitive are rarely available through monitoring. Most of the papers reviewed rely solely on modelled information. These limitations mean it is not feasible to provide a definitive indication of the expected direction of ozone formation. However, the following can be stated:

- While an increase in VOC concentrations could serve as a precursor to ozone formation, none of the mine activities are significant sources of VOCs emissions, and thus the VOC concentrations will not materially change as a result of the Project.
- The NO_X emissions associated with the Project will be a combination of nitrogen dioxide (NO_2) and nitric acid (NO), with the majority (95%, Dieselnet 2016c: website) of the emissions from diesel combustion being in the form of NO. While the percentage of NO_2 in diesel exhaust is increasing (Carslow et al. 2011), the vast majority of emissions remain NO, which in the atmosphere will result in a local scavenging reaction of the ground level ozone (O_3), converting the NO to NO_2. This relationship can be seen in the ambient monitoring data in Thunder Bay (see Figure 5.2.4-1), where the higher NO concentrations correspond to lower values of ozone.
- At first glance, the area where the Project is located could be considered potentially NO_X-sensitive as there appear to be sources of biogenic VOC emissions present. Section 5.9.2 characterizes the area near the Project as being largely (61%) forested, with a range of forest types (mixed forest 25%, sparse forest 24%, and coniferous forest 14%). However, there are also other sources of NO_X emissions in the area. These include the TransCanada Highway (Highway 17) and the Canadian Pacific railway, both of which run immediately to the south of the Project. There is also the community of Dryden and its associated airport.
- Ultimately, the most telling factor is the climate in the region, which is not conducive to ground-level ozone formation, which forms most readily on very hot day (i.e., days with

temperatures >30°C). Since 1970, the climate station at Dryden airport has recorded an average of five days per year with very hot temperatures (i.e., those with temperatures >30°C).

- Ultimately the discussion of whether the area is NO_X-sensitive or VOC-sensitive is largely an academic exercise. The Project will result in no measurable change in the VOC concentrations, and the NO_X emissions from the Project are likely to result in a local decrease in ozone due to scavenging. Finally, the climate is 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.

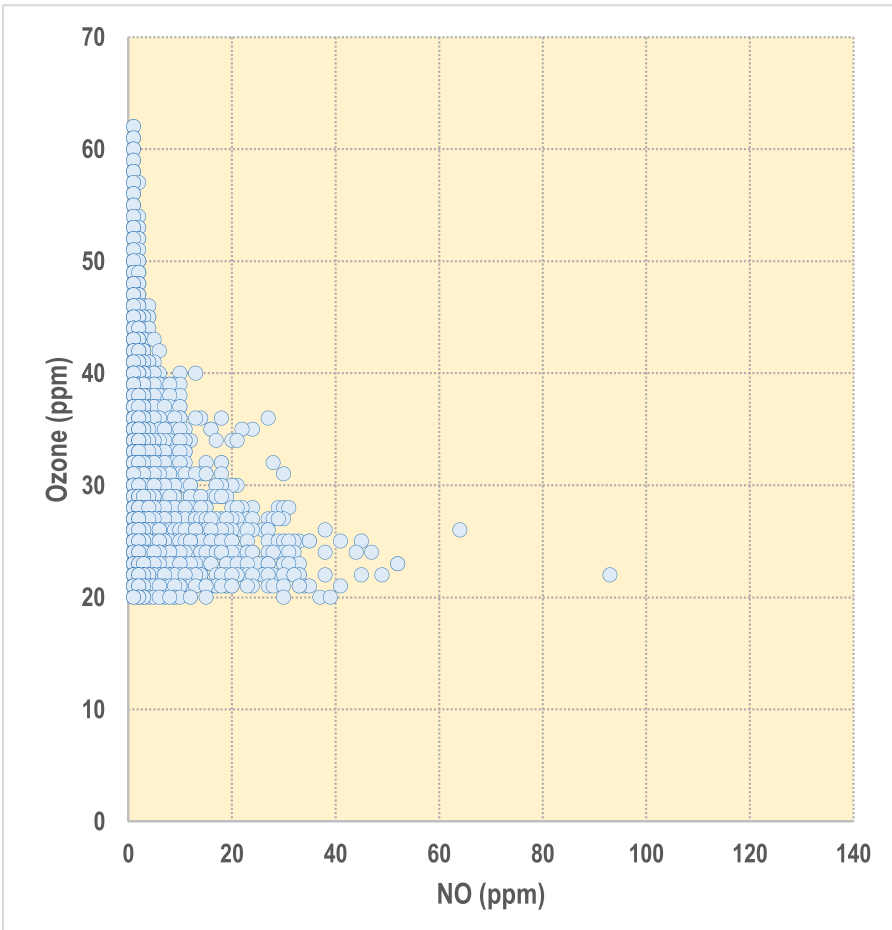


Figure 5.2.4-1: Relationship between O_3 and NO_X in Thunder Bay

5.2.5 Traditional Knowledge

However, Treasury Metals is mindful that members of Wabigoon Lake Ojibway Nation have expressed concerns regarding air quality conditions that may result due to the result of the Project.

5.3 Noise and Light Environment

This section provides a description of the existing noise and light conditions at the Project.

5.3.1 Baseline Noise Levels

A baseline noise study was conducted in December 2011 and July 2013 and the results have been summarized in the following sections. The full study report is presented in Appendix H-1.

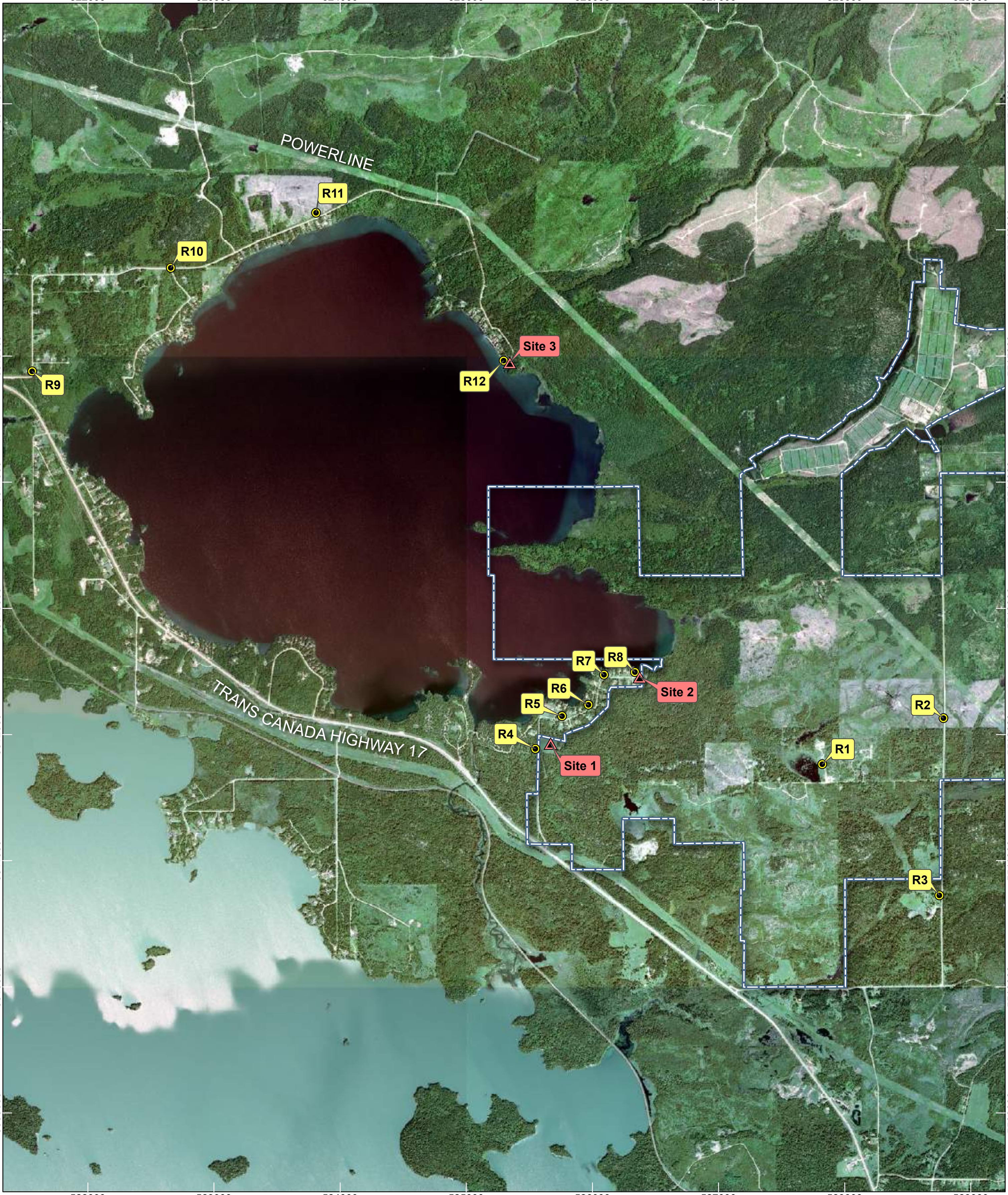
5.3.1.1 Project Area and Baseline Monitoring Locations

The Project study area is in a rural location between the communities of Dryden and Wabigoon and north of Highway 17 with characteristics of a Class 3 area (MOE 1995). Potential receptors include the City of Dryden, the community of Wabigoon, and Aaron Provincial Park and residential developments along Thunder Lake. Potential sources of noise include the above developments as well as Highway 17 and the mainline of the Canadian Pacific Railway. Sampling locations were selected based on the location of the emission sources, potential receptor locations, and the expected transport and propagation of noise (Figure 5.3.1.1-1).

5.3.1.2 Evaluation Criteria and Methods

In Class 3 areas, rural, recreational, or wilderness, the applicable MOE "Stationary Source" guidelines are provided in MOE Publication NPC-232 (MOE 1995). The guidelines state that one-hour sound exposures (L_{EQ}, 1-hr dBA values) from stationary noise shall not exceed that of the background, where the background is defined as the sound level present in the environment produced by noise sources other than those associated with the facility under assessment. The MOE Publication NPC-232 sound level limits are as follows:

- The higher of 45 dBA or background noise, during the daytime hours (0700 to 1900 h);
- The higher of 40 dBA or background noise, during the evening hours (1900 to 2300 h); and
- The higher of 40 dBA or background noise, during the night-time hours (2300 to 0700 h).



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	SCALE: 40000 *TREASURY METALS INC.*
Baseline Noise and Light Monitoring Stations	*DESIGN: AT 06 FEB. 2014* *GIS: AT 07 MAR. 2014* *CHECK: MP 07 MAR. 2014* *REVIEW: MP 07 MAR. 2014*
FIGURE: 5.3.1.1-1 — REV.00	

LEGEND

- Noise Monitoring Station
- Light Monitoring Location
- Property Boundary

N

0 500 1,000
Meters

REFERENCE

Data by Treasury Metals Inc.
Projection: NAD83 UTM Zone 15N
Imagery: MNR FRI Orthorectified 40cm (2010)

TREASURY METALS Inc.

The applicable guideline limit is the higher of the measured background sound level and the guideline minimum sound level limit. The above sound level limits are the applicable for the receptors surrounding the Project.

The basic procedures for the baseline assessment consists of long-term background sound level measurements of receptors near the Project, validation of measured hourly data based on weather information, and comparing the validated lowest hourly sound level data to the guideline limits. Long-term measurements of background ambient sound levels at one location were conducted from December 5 to December 7, 2011, near the Project site (Figure 5.3.1.1-1). Monitoring was also conducted at three representative locations from July 3 to July 9, 2013 (Figure 5.3.1.1-1). All measurements were conducted in accordance with the applicable requirements of MOE Publication NPC-103 (MOE 1977).

5.3.1.3 Existing Noise Levels

The measured ambient sound levels at the Project site (Tables 5.3.1.3-1) were similar to background ambient sound levels characteristic of remote areas (25 to 45 dBA). The sound from these levels would be described as faint. Noise observed during the study consisted mostly of wind, small animals, bird noise and vehicle noise from the TransCanada Highway. The difference between daytime and nighttime sound levels were generally small, and are attributed mainly to very low level of noise from human activity which could not be screened out. The noise measurement results indicate that the existing baseline sound levels did not exceed the guideline sound level limits (MOE 1995). The existing baseline noise levels are typical of northwestern Ontario conditions.

Table 5.3.1.3-1 Ambient Sound Levels at the Goliath Gold Project

Location	Time Period	L_{EQ} (1hr)	L_{MIN}	L_{MAX}	NPC-232 Minima (1)	Resultant Limit
Site 1	Day	39	30	70	45	45
	Evening	38	30	66	40	40
	Night	35	29	67	40	40
Site 2	Day	38	20	68	45	45
	Evening	37	27	63	40	40
	Night	32	19	68	40	40
Site 3	Day	32	21	69	45	45
	Evening	35	24	69	40	40
	Night	28	20	62	40	40

Note:
(1) MOE (1995)

5.3.2 Baseline Light Levels

A baseline light assessment study was conducted in July 2013 and the results have been summarized in the following sections. The full study report is presented in Appendix I.

5.3.2.1 Project Area and Baseline Monitoring Locations

The area surrounding the Project site is a mix of mostly forested and some open rural land cover. The topography in the area is generally low, rolling hills, with elevation decreasing along the shoreline of Thunder Lake to the west of the Project site, and again along Wabigoon Lake to the west/southwest of the Project site. The closest residences are located along East Thunder Lake Road, which runs along the western edge of the Project property boundary. Additionally, there are other pockets of houses/cottages along the shore of Thunder Lake and Wabigoon Lake further away from the Project site. Generally, the surrounding area is sparsely populated and the land is heavily treed.

Light effects beyond 1 km are typically comparable to general lighting in the vicinity of the receptor (e.g., streetlights, garage lights). A light study area extending 1 km from the Project property boundaries was therefore selected to determine receptors/sampling sites that could be directly affected by the Project. Representative receptors on the far side of Thunder Lake were also sampled since the lake body provides an unobstructed line of sight to the Project property. Therefore, the light study area was therefore conservative as the Project infrastructure will be centrally located on the property and screened from the potential receptors by terrain.

A total of 12 receptor locations were determined for the purpose of the baseline light assessment. Receptors R1 through R3 are located on/within the Project site boundary, while receptors R4 through R8 and R12 are neighbouring residences or cottages within 1 km of the property boundary on the shoreline of Thunder Lake (see Figure 5.3.1.1-1). 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.

5.3.2.2 Evaluation Criteria

In Ontario, there are no provincial guidelines or regulations governing light trespass. Therefore, the study relied on information from other sources. Lighting criteria for illuminance are available from the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED; USGBC 2007. The Illuminating Engineering Society (IES) of North America recommends a minimum lighting level of 5.4 lux for safety. The IES also recommends 5 to 22 lux for outdoor pedestrian walkways, and about 100 lux for interior stairways (malls). Interiors of buildings typically measure in the hundreds of lux.

The light that escapes the Project site (known as light trespass) can be regarded as a nuisance by property owners immediately adjacent or in relatively close proximity to the Project. For the baseline light assessment, only measurements of illuminance, the perceived power of light per unit area, were taken, which is the appropriate measurement to assess baseline conditions. Relative brightness, also known as glare, was not measured as the Project has not been constructed or exterior lighting installed.

5.3.2.3 Existing Light Levels

Existing (baseline) conditions represent the current light levels within the light study area and are presented in Table 5.3.2.3-1. Baseline illuminance measurements at the selected receptors were all below the LEED criteria for rural residential areas (1.1 lux) with the exception of sample sites that were directly influenced by a local light source such as a street light or exterior house light near the measurement location. Any areas, including the three sample sites that were on the Project property, that were away from these types of direct sources were generally measured to be 0.0 lux.

Table 5.3.2.3-1: Baseline Light Levels within the Light Study Area

Receptor ID	Site ID	Type	UTM Northing	Easting	Illuminance (lux)				Description
					Direct				
					2-Jul-13	2-Jul-13	3-Jul-13	3-Jul-13	
R1	1	Goliath Gold Site	527822	5511764	0.00	0.00	0.00	0.00	Center of Proposed Pit
R2	2	Goliath Gold Site	528782	5512129	0.00	0.00	0.00	0.00	East of Proposed Pit
R3	3	Goliath Gold Site	528751	5510726	0.00	0.00	0.01	0.00	Nystrom House on Tree Nursery Road
R4	4	Receptor	525549	5511888	0.00	0.00	0.01	0.00	Field to east of E Thunder Lake Road (Noise Site #1)
R5	5	Receptor	525760	5512145	2.40	4.00	2.70	4.30	249 E. Thunder Lake Road, next to street light on road, edge of pavement and gravel
R6	6	Receptor	525969	5512235	0.21	3.00	0.21	3.20	Measured ~14 m from road near the hydro station (SW2), next to street light near location 1A
R7	7	Receptor	526092	5512473	0.00	0.00	0.00	0.03	352 E. Thunder Lake Road
R8	8	Receptor	526338	5512493	0.00	0.50	0.00	0.00	At Noise Site # 2, light from resident, front door light on house
R9	9	Receptor	521559	5514880	0.00	15.20	0.00	15.10	65 Thunder Lake Road. Edge of road pavement to gravel. Pointed at streetlight.
R10	10	Receptor	522658	5515699	1.40	0.00	4.10	0.00	Taken under street light corner of North Shore and Thunder Lake Road (Stop sign)
R11	11	Receptor	523810	5516134	0.03	0.22	0.02	0.19	North side of Thunder Lake, pointed at residence, measured from edge of road, approximately 12 m from light source
R12	12	Receptor	525296	5514963	0.05	0.19	0.02	0.17	Johnsons Beach (by Noise Site 3)

5.3.3 Traditional Knowledge

No specific information has been shared with Treasury Metals with respect to noise and light. However, Treasury Metals is mindful that members of Wabigoon Lake Ojibway Nation, Eagle

Lake First Nation and Wabauskang First Nation have expressed concerns over the amount of noise and/or vibrations that may results as a result of the Project (Section 9).

5.4 Geology and Geochemistry

5.4.1 Geological Setting

Overburden throughout the area consists of fine grained lacustrine deposits and coarser grained glaciofluvial outwash deposits, distributed over a shallow irregular bedrock surface. Overburden thickness in the vicinity of the site is generally thin ranging from thin veneer and bedrock outcrop to depths around 15m in limited areas. Additional description of overburden materials and surficial geology are provided in Sections 5.5 and 5.6.

Bedrock for the Project area is located within the volcano-plutonic Eagle-Wabigoon-Manitou Greenstone Belt in the Wabigoon Subprovince of the Archaean Superior Province, and is on the north side of the regional Wabigoon fault. This Greenstone Belt consists of a 150 km-wide domain that has an exposed strike extent of 700 km. The full strike length of the Greenstone Belt is unknown since it is overlain by Palaeozoic strata on both ends.

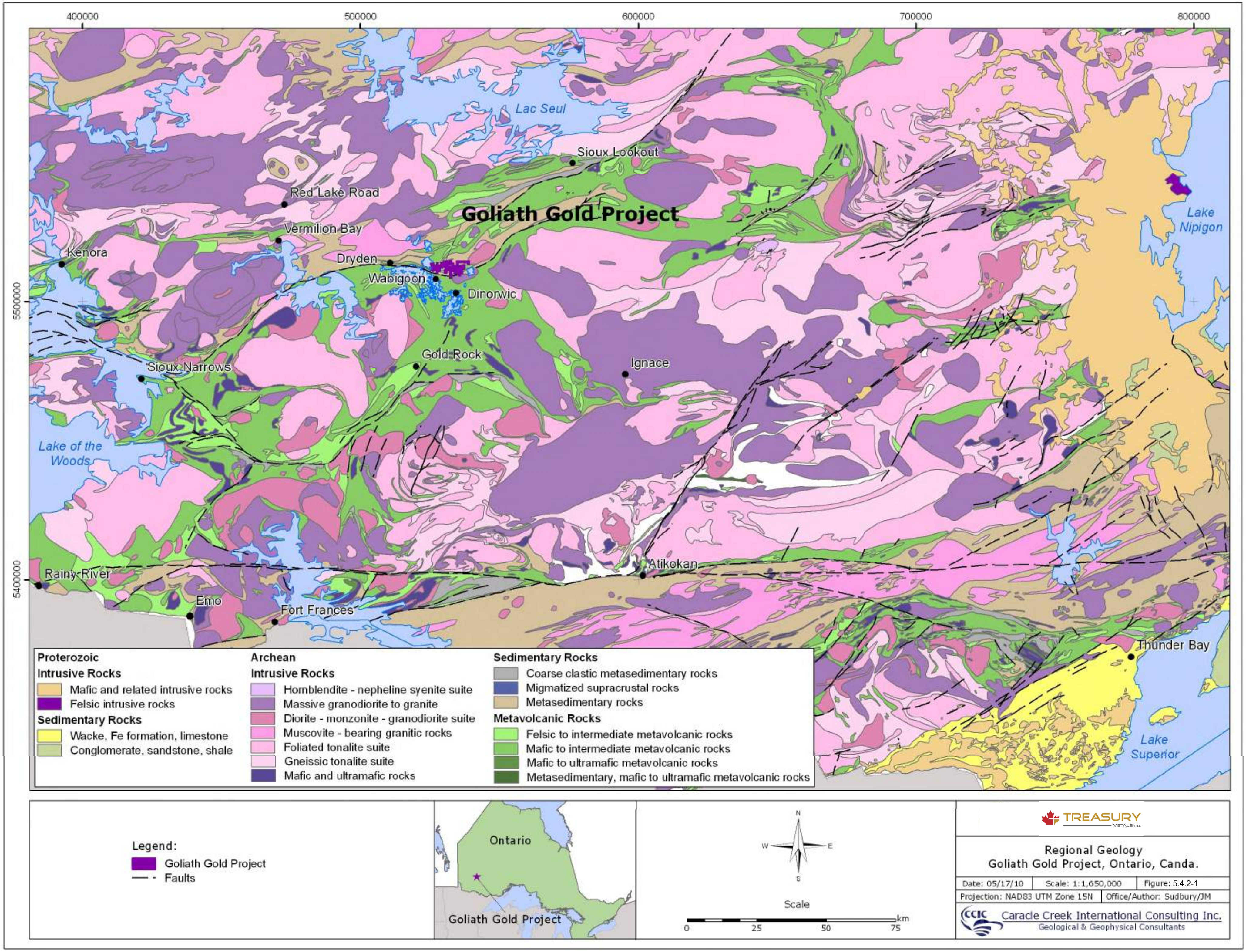
The geology on the northern side of the Wabigoon Fault is characterized by generally southward-facing, alternating panels of metavolcanic and metasedimentary rock.

Geohazards (e.g., landslides, avalanches) associated with mountainous environments are not expected due to the topographic characteristics of the Project site which is located in a relatively flat area within low relief surroundings with a 140 m vertical variability within 20 km of the site. In addition, the Project site is located within the Interior Platform Seismic Zone which is defined as a “Low” relative hazard region by Natural Resources Canada.

There are no known sites of paleontological or paleobotanical significance in the Project area.

5.4.2 Deposit Geology

Major lithological units within the project area were identified on the basis of visual examination of rock type in outcrops, drill core, and trenches. These rocks have been grouped into the Thunder Lake Assemblage; a volcanogenic-sedimentary complex of felsic metavolcanic rocks and clastic metasedimentary rocks that underlies much of the Project area, and the Thunder River Mafic metavolcanic rocks, which are generally massive but are pillowed locally and include amphibolite and mafic dykes, characterized as chlorite schists, and underlie the south part of the Project area (Figure 5.4.2-1).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Lac Seul
Sioux Lookout
Red Lake Road
Goliath Gold Project
Vermilion Bay
Kenora
Dryden
Wabigoon
Dinorwic
Lake Nipigon
Gold Rock
Sioux Narrows
Ignace
Lake of the Woods
Rainy River
Atikokan
Emo
Fort Frances
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
Metasedimentary, mafic to ultramafic metavolcanic rocks
Legend:
Goliath Gold Project
Faults
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Projection: NAD83 UTM Zone 15N
Office/Author: Sudbury/JM
Caracle Creek International Consulting Inc.
Geological & Geophysical Consultants

5.4.2.1 Thunder Lake Assemblage

The main sedimentary unit within the Thunder Lake Assemblage is described as being dominated by biotite-muscovite and biotite schist (greywackes) with subordinate inter-layered metasediment (probably pyroclastic siltstone and arkose sandstone) which exhibits highly strained and well-preserved primary sedimentary structures such as graded bedding, scour, rip-up clasts etc. This unit also includes ink blue magnetite layers that are closely associated with distinctive garnet-rich layers and calc-silicate rock. The felsic metavolcanic rocks within the Thunder Lake Assemblage comprise quartz-porphyritic felsic to intermediate metavolcanic rocks represented by biotite gneiss, mica schist and quartz-porphyritic mica schist, which are conformably inter-layered with wacke-siltstone, and with lenses of metasedimentary rocks, which are similar in composition to the main sedimentary unit.

All of the rocks have been subjected to folding and moderate to intense shearing with local hydrothermal alteration, quartz veining, and sulphide mineralization. Schistosity is commonly developed within both the metasedimentary rocks and volcanic rocks, exhibiting a similar orientation with a strikes of around 90° and dips from 70° to 80° south-southeast.

The primary components of the Thunder Lake Assemblage are described as follows:

- Biotite muscovite schist: Dark grey to grey, fine to medium grained mica schist. Usually it consists of intercalated leucocratic and melanocratic bands. This unit contains a high number of grey to milky white quartz veins. Most of the veins are 1 to 15 cm wide, parallel or crosscutting the foliation. Some veins are associated with highly chloritized and silicified intervals with tourmaline and sulphides.
- Muscovite sericite schist: Light grey to beige grey, fine to medium grained quartz- sericite schist. It is variably siliceous, commonly contains interbedded, dark grey biotite-muscovite bands and grey to milky white quartz veins. It is characterized by the presence of moderate to strong pervasive sericite alteration and gold and silver bearing disseminated sulphides.
- Iron formation: Dark greenish grey calc-silicate metamorphic rocks, which include coarse to medium grained gneiss, biotite schist, 10 to 15 cm wide distinctive layers enriched with garnet, chlorite and narrow ink blue magnetite bands. The rock unit is magnetic and contains disseminated pyrite.
- Metasediment: Grey to dark grey-green medium grained massive unit, which consists of biotite, feldspar, quartz, muscovite with a weak patchy potassium and sericite alteration and rare hematite (rusty brown) alteration. Foliation is poorly developed but more prominent in contact and altered areas. Quartz veins, parallel or crosscutting the foliation are very common. This unit can be distinguished by presence of numerous “quartz eyes” or quartz porphyroblast. This unit may contain 1 to 5% bleb-finely disseminated pyrite and chalcopyrite.
- Biotite schist: Dark grey to black, fine to medium grained, slightly, to well-foliated schist. Locally contains disseminated pyrite in the foliation planes and fractures.

- Chloritic-Biotite schist: Dark grey to greenish grey medium grained, slightly, to well-foliated schist. Locally it contains disseminated pyrite along foliation planes and fractures.

5.4.2.2 Thunder River Mafic Metavolcanics

The Thunder River Mafic Metavolcanic rocks are described as follows:

- **Mafic dyke**: Usually narrow dark green to almost black massive or slightly foliated fine to medium grained biotite-chlorite schist. The width of the layers can reach up to 5 m. The dykes can be either parallel to or crosscut the foliation.
- **Amphibolite**: Coarse to medium-grained, dark green to black to green units, which consist mainly of 30% to 50% amphibole (hornblende and actinolite), 30% to 40% feldspar and pyroxene with rare post genetic quartz veins and layers of chlorite schist. It has typical "salt and pepper" appearance and nematoblastic texture.
- **Green schist**: Usually dark green to almost black foliated fine to medium grained schist, which consists mainly of chlorite, biotite, feldspar, amphibole. The width of the layers can reach up to 5 m.

5.4.2.3 Deposit Area Geology

The bedrock geology for the deposit area is provided in Figure 5.4.2.3-1. The altered schists in the deposit have been grouped into two distinct geological units based on the relative modal abundance of biotite rich versus sericite rich layers, quartz (silicification) and sulphide mineral content. In general, the most altered and light coloured schists containing greater than 60% quartz-sericite felsic bands, are silicified and often contain base metal mineralization, have been mapped as MSS. Darker schist units containing less than 60% white mica have been mapped as biotite muscovite schist BMS. It should be noted that contacts are almost always gradational. Gold is usually associated with the MSS units in association with sphalerite and galena or occurs in smaller MSS bands hosted within the BMS units.

For the purpose of the exploration and development, the following four groupings are consistently recognized from south to north at the Goliath Gold Deposit:

- A Hanging Wall Unit of metasedimentary rocks (MSED), which share a sharp contact or may gradually grade to a biotite-quartz-feldspar-sericite schist (BMS) that have been intruded by quartz ± feldspar-porphyry intrusive rocks which may appear periodically along the strike length of the deposit.
- A Transitional Unit of biotite-quartz-feldspar-sericite schist (BMS), occasionally intruded by porphyry rocks.
- A Central Unit that consists of:
  - o A package of biotite-quartz-feldspar-sericite schist (BMS), occasionally intruded by porphyry rocks, interlayered with up to four hanging wall alteration zones (HW1 to

HW4) consisting of quartz-feldspar-sericite schist (MSS) that can have significant gold mineralization and are often silicified.

- A core section of rocks, approximately 100 to 150 m true thickness, that hosts the most significant gold concentrations in the deposit (the Main and C Zones) and consist of intensely deformed and variably altered felsic, fine to medium grained, quartz-feldspar-sericite schist (MSS) and biotite-quartz-feldspar-sericite schist (BMS) with minor metasedimentary rocks (MSED).
- A package of rocks similar to the upper most central unit that hosts the D and E Zones in silicified MSS rocks surrounded by BMS.

A Footwall Unit of predominantly metasedimentary rocks (MSED, BMS and weak iron formation) with some porphyritic intrusive bodies and minor felsic gneiss and schist rocks.

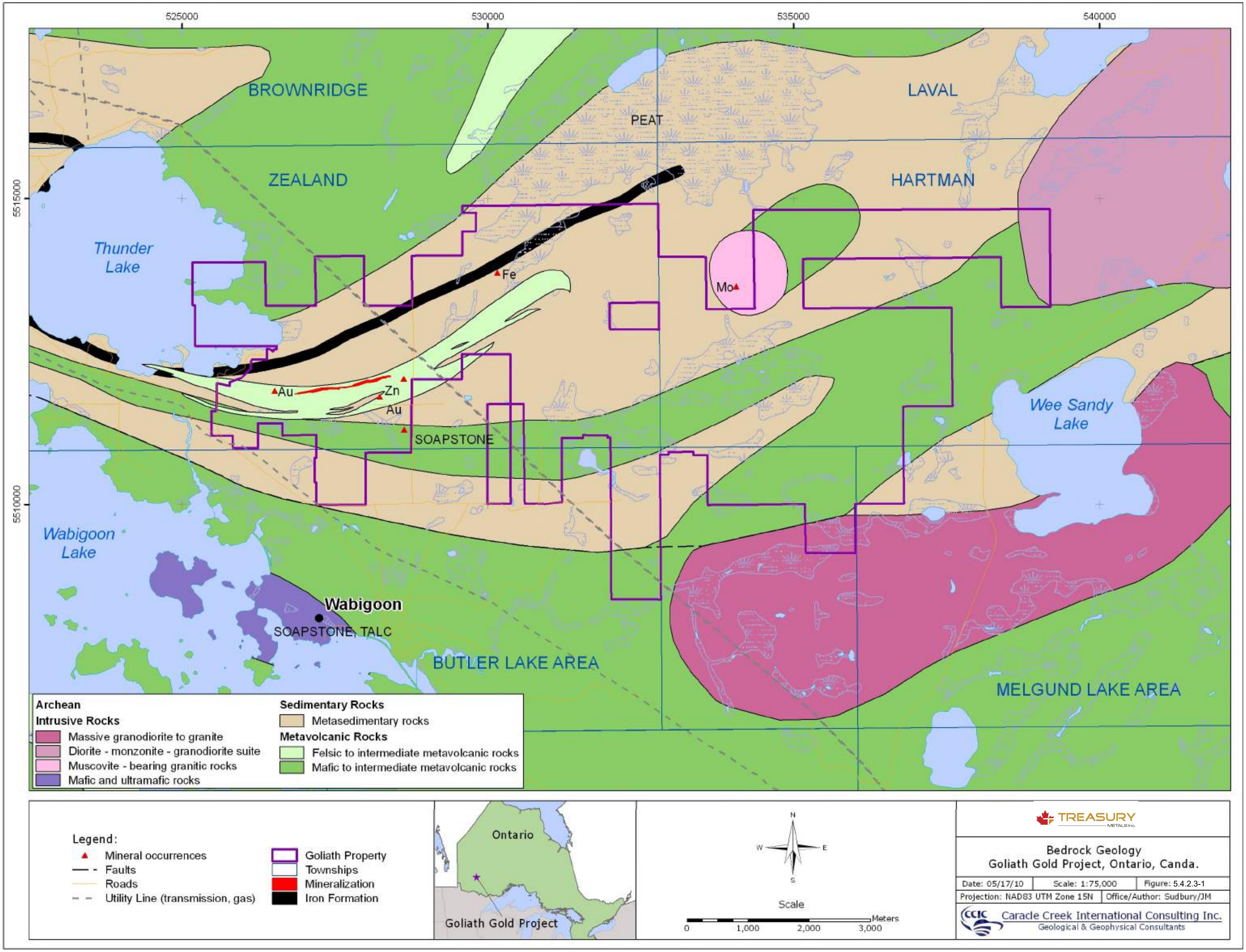
The gold mineralization is located primarily in the central unit, and is concentrated in a pyritic (phyllic) alteration zone, consisting of the muscovite sericite schist, quartz-eye gneiss and quartz-feldspar geniss. This area of mineralization appears to extend to a maximum drill-tested depth of 805 m below grade, over a strike length of approximately 2,300 m, with the possibility of this strike length extending to greater than 5,000 m (Figure 5.4.2.3-2).

5.4.3 Geochemistry

5.4.3.1 Acid Rock Drainage and Metal Leaching

Acid-rock drainage (ARD) is a natural process whereby sulphuric acid is produced when sulphides present in rocks are exposed to air and water. Metal leaching (ML) is the release of dissolved metal concentrations in rock leachate. The evaluation and understanding of ARD/ML risks related to overburden and mine rock materials exposed during mining is a critical component of mine planning so that adequate management measures can be implemented should they be required.

Mine rock related components of the project including ore, waste rock and tailings represents the greatest concern for ARD/ML for the project due to the associated sulphide mineralization. The risks associated ARD/ML of the overburden are notably low in comparison to that of mine rock. More specifically, the overburden in the vicinity of the future open pit is primarily a deep water glaciolacustrine clay sometimes with a thin 1 to 2 m thick sand layer in contact with the bedrock. The clay is also locally interbedded with thin shallow water deposits of silt and sand. These materials are expected to be primarily derived from distal mixed sources that are unlikely to result in concentration of local bedrock sourced materials. It is rare for locally sourced overburden materials to result in ARD/ML concerns and due to dilution and homogenization. Distally sourced materials exhibit even lower concern related to ARD/ML. Locally sourced till materials have not been mapped in the area. Characterization of shallow overburden materials that generally confirms the above assessment is described in Section 5.5.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LAVAL
PEAT
ZEALAND
HARTMAN
Thunder Lake
Fe
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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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3,000
Meters
TREASURY METALS Inc.
Bedrock Geology
Goliath Gold Project, Ontario, Canda.
Date: 05/17/10
Scale: 1:75,000
Figure: 5.4.2.3-1
Projection: NAD83 UTM Zone 15N
Office/Author: Sudbury/JM
CCIC
Caracle Creek International Consulting Inc.
Geological & Geophysical Consultants


S
N
Overburden
Metasediments
Intermediate to
Felsic Metavolcanics
Open Pit Outline
Alteration
Zones
HW
HW
MAIN
C
11.6m @ 2.6 g/t
16.7m @ 1.4 g/t
14.1m @ 1.5 g/t
16.7m @ 1.2 g/t
16.5m @ 6.2 g/t
12.5m @ 7.9 g/t
29.5m @ 1.5 g/t
27.5m @ 3.0 g/t
17.6m @ 32.7 g/t
17.7m @ 3.5 g/t
26.4m @ 5.0 g/t
10.9m @ 1.8 g/t
TL11141
TL11139
TL11133
TL238-12RE
TL236
TL225-12RE
TL222
TL13299
TL13302
TL91
TL10118
TL176-13RE
TL11132
TL145
TL11123
TL11150
TL11119
TL11122
TL11142
TL11161
TL11140
TL11135
TL11138
TL10117
TL141
TL11159
TL11146
TL11149
TL11143
TL126
0 Elev
5512000 N
FIGURE 5.4.2.3-2
CROSS-SECTIONAL VIEW OF THE EASTERN
HIGH GRADE SHOOT WITHIN THE
MAIN ZONE
Drill Hole Trace
Significant Au Interval
TREASURY
METALS Inc.
November 2013
Section L5+00W
Scale 1:1000
Datum NAD 83-15

Based on the information available ARD is highly unlikely for site overburden materials. However, a more detailed confirmatory assessment of ARD/ML risks related to overburden materials is planned for future studies in preparation for stripping and construction activities. In the event that specific overburden materials are identified with a risk for neutral metal leaching, they could be readily managed along with mine rock materials prone to metal leaching.

An ARD/ML geochemical characterization program was undertaken for the Goliath Gold Project mine rock components with the potential to leach acid and metals during mining. These data and information have been used in the development of the overall mine plan and applicable environmental management plans, as well as in the predictive water quality assessments to assist in predicting possible effects and mitigation requirements for the Project.

The ARD/ML characterization and prediction studies for mine rock were completed by EcoMetrix Inc. (EcoMetrix 2014: Appendix K) in accordance with recommendations presented in the Mine Environment Neutral Drainage (MEND) “Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, MEND Report 1.20.1 (MEND 2009). This document represents an update to the “Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia” prepared for the British Columbia Ministry of Energy and Mines (Price 1997), and referenced in Regulation 240/00 of the *Ontario Mining Act*.

History of Geochemical Characterization Studies

The first record of geochemical characterization for the Project site is from 1997 when NAR Environmental collected five rock samples for acid-base accounting (ABA) analyses as part of their closure plan (NAR 1997). The preliminary results from these five samples triggered the collection of an additional 25 samples for ABA analyses. There was limited activity on the Project between 1999 and 2008. Treasury assumed ownership of the Project in 2008, and initiated additional geochemical characterization analyses in 2012 as part of the environmental baseline studies.

As part of these baseline studies, 54 drill core samples were selected and submitted for ABA and whole rock metals analysis (KCB 2012). These studies subsequently led to the more comprehensive geochemical characterization work completed for the project (EcoMetrix 2014: Appendix K). Amec Foster Wheeler completed a reevaluation of the available mine rock geochemistry information in 2017 in support of further water quality estimates completed for the project which are documented in Appendix JJ. The following sections describe the current understanding of mine rock geochemistry for the Project based on currently available mine plan information and data and analysis provided in Appendix K and Appendix JJ. A further description of the relevant information summarized in those documents is provided in Table 5.4.3.1-1.

Table 5.4.3.1-1: Summary of Referenced Geochemistry Documents

EIS Referenced Document	Status
Appendix K of revised EIS	Provides primary supporting data for revised EIS. Sections pertaining to development of kinetic rates namely 2.4.3, 3.3 (and associated tables 3.8 to 3.14), and Appendices I and J are superseded by information and analysis in the Water Report (Appendix JJ).
Section 5 of Appendix JJ of revised EIS	Provides the following: • Section 5.1 – A review of site geology and mineralization • Section 5.2 – Assessment of the primary static and kinetic data from Appendix K (updated to include additional field cell data) • Section 5.3 – Open pit water quality estimates and results, including description of all assumptions and source terms used. • Section 5.4 – Long-term seepage water quality estimates from WRSA and TSF, including description of all assumptions and source terms used.

5.4.3.2 Deposit Geology and Geochemical Setting

The deposit mineralized zones are tabular composite units defined on the basis of anomalous to strongly elevated gold concentrations, increased sulphide content and distinctive altered rock units and are concordant to the local stratigraphic units. Stratigraphically, gold mineralization is contained in an approximately 100 m to 150 m wide central zone composed of intensely altered felsic metavolcanic rocks (quartz-sericite and biotite-muscovite schist) with minor metasedimentary rocks. Overlying hanging-wall rocks consist of altered felsic metavolcanic rocks (sericite schist, biotite-muscovite schist and metasedimentary rocks) with the footwall comprising metasedimentary rocks with minor porphyries, felsic gneiss and schist. Gold within the central unit is concentrated in a pyritic (phyllic) alteration zone, consisting of quartz-sericite schist (MSS), quartz-eye gneiss, and quartz-feldspar gneiss.

5.4.3.3 Project Components

The proposed open pit will produce ore and four primary types of mine waste rock. The ore processing component of the Project will generate tailings. Additional quarry sources have been identified to supply construction material needed for the Project. The geochemical characterization considers the range of rock materials generated over the life of the mine. Estimate volumes of mined materials are presented in Table 5.4.3.3-1.

Table 5.4.3.3-1: Estimated Volumes of Mined Materials

Mined Material	Relative Proportions of Each Mined Material Type	
	Tonnage (Millions of Metric Tonnes)	Proportion of Total (%)
Waste Material		
Biotite Muscovite Schist (BMS) and Biotite Schist (BS)	17.50	38%
Muscovite Sericite Schist (MSS)	3.75	8%
Meta-Sediment (MSED)	3.75	8%
Tailings	11.82	26%
Ore		
Open Pit Mill Feed	2.98	7%
Low-grade Stockpile	2.29	5%
Underground Mill Feed	3.70	8%
Total	**45.79**	**100%**

Mine Waste Rock

Mine waste rock is defined as rock that will be excavated from the active mining areas, and does not have sufficient ore grades to process for mineral extraction. It is estimated that approximately 25 million tonnes of mine waste rock will be generated from both underground and open pit operations over the over the life of the mine.

The mine waste rock (Table 5.4.3.3-2) has been subdivided into three primary rock types, which include Biotite Muscovite Schist (BMS), Muscovite Sericite Schist (MSS), and Meta-Sediment (MSED). A fourth unit, Biotite Schist (BS), was used in the geochemical characterization program to characterize samples. The BMS and BS are now grouped together because of geological similarity.

Table 5.4.3.3-2: Estimated Volumes of Mine Waste Rock

Waste Rock Type	Relative Proportions of each Waste Rock Type	
	Tonnage (millions of metric tonnes)	Proportion of Total (%)
Biotite Muscovite Schist (BMS) and Biotite Schist (BS)	17.5	70%
Muscovite Sericite Schist (MSS)	3.75	15%
Meta-Sediment (MSED)	3.75	15%
Total	**25**	**100%**

Tailings

Lycopodium Minerals Canada Ltd. produced a Process Optimization Study (Lycopodium 2014: Appendix B) for the Project, identifying the Project as a free-milling gold deposit with ore material containing coarse gold that is readily amenable to conventional processing options. The ore processing plant will process approximately 2,700 tonnes per day over the mine life using gravity concentration of free gold, followed by carbon-in-leach (CIL) cyanidation. Process tailings will be placed and stored in an engineered TSF. This study built on previous metallurgical studies in 2012 that included geochemical characterization of simulated representative tailings for the Project.

Low-grade Ore

A low-grade ore stockpile (LGO) will be maintained over the mine life to allow blending of lower grade and higher grade ores to ensure a more consistent grade of ore to the processing plant. The LGO will be maintained throughout the initial years of mining and will be used to blend with the underground material until it is wholly consumed and fed to the process plant at the end of the mine life. It is expected that the ore stockpiles will be temporary, and that there will be ongoing replacement and turnover as the stockpiled ore is processed, and new ore from mining is placed in the stockpile.

Geochemical characterization of the low grade ore has not yet been completed. For the purposes of geochemical characterization, the MSS host rock has been used as a surrogate for the low grade ore as a preliminary approximation. Up to three separate sub-stockpiles of varying grade will be used to feed the process plant.

Other Project Components

Mine rock produced for the project is primarily identified as potentially acid generating and metal leaching. Therefore, current plans are to source construction aggregate materials from a licensed off-site aggregate supply. It has been identified that outer zones of the open pit have not been characterized in detail. In the event that suitable materials that are not prone to ARD/ML are identified in these areas through additional sampling and geochemical analysis, a testing program (e.g., using analysis of blast-hole cuttings) would be developed to segregate suitable material for use in construction.

5.4.3.4 Materials Characterization and Management Studies

The geochemical characterization program has been an iterative process consisting of several sampling and analysis programs. The programs have served to obtain ARD/ML prediction information to be used for the water quality effects assessment and to determine mitigation requirements for the Project.

A preliminary geochemical assessment was completed in 2011 as part of the baseline studies for the site and involved the characterization of 54 drill core samples. An additional 112 drill core samples of potential mine rock material were selected and characterized in June 2012. Field cells constructed from waste rock drill core intersections were initiated in September 2012 and continue to operate at the site. Simulated tailings produced by metallurgical testing in 2012 were also included in geochemical testing programs for the project.

A summary of the characterization programs completed to date, including methodologies, analyses, and conclusions, are presented in Appendix K with selected additional analysis and interpretation provided in Appendix JJ. The geochemical characterization programs are ongoing with the intent and purpose of further refining the geochemical predictions and informing the mine rock management and handling strategies.

Methodology

The geochemical characterization program has included a suite of static and kinetic tests to evaluate short term static conditions and long term potential for acid generation and metal leaching. Characterization methods for the various Project components included static and kinetic geochemical characterization tests. This includes acid-base accounting (ABA), whole rock metals (ICP-MS), shake flask extraction (SFE), humidity cell tests (HCT) and field cell tests (Table 5.4.3.4-1). A complete summary of the available geochemical data and methodology for ARD/ML prediction is provided in Appendix K. Additional interpretation of this data related to the understanding of lag-time to acidic drainage of waste rock and tailings and future site water quality is provided in Appendix JJ.

Table 5.4.3.4-1: Sample Numbers for Static Tests on Waste Rock Material

Waste Rock Type	Number of Samples			
	Acid Base Accounting	Whole Rock Metals Analysis	Shake Flask Extraction	
			Deionized Water	0.1M HCl Acid
Biotite Muscovite Schist (BMS)	52	67	13	5
Biotite Schist (BS)	16	20	4	2
Muscovite Sericite Schist (MSS)	35	59	8	3
Meta-sediment (MSED)	9	15	3	1
Total	**112**	**161**	**28**	**11**

The ABA testing included paste pH, total sulphur, sulphate-sulphur, sulphide-sulphur, Modified Sobek NP, total carbon, total organic carbon, and total carbonate analyses. The results from these analyses were utilized to calculate the carbonate NP (Carb-NP), acid generating potential (AP), net neutralization potential (NNP), and Sobek NPR (ratio of Sobek NP to AP) and Carbonate NPR (Carb-NPR).

Elemental analysis was completed to quantify the concentration of elements in the rock samples. An aqua regia digestion process was followed by an Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) scan. Shake flask extraction (SFE) metal leaching tests were used to assess the presence of potentially soluble elements and to understand their release during the initial stages of weathering. The shake flask extraction leachate was evaluated for pH, conductivity, hardness, sulphate and dissolved metals. SFE tests were run using both deionized water and a 0.1 M HCl acid dissolution.

Three humidity cell tests (HCT) with different sulphur content ranges were initiated for each of the BMS, MSS, and BS materials, respectively. Drill core samples were selected to create composite samples representing humidity cell samples with sulphur ranges of less than 0.25%S, 0.25%S to 1.00%S, and greater than 1.00%S for each of the three rock types. For the MSED material, two humidity cells were initiated, one with less than 0.60%S and one with greater than 0.60%S. These ranges allow for appropriate evaluation of potential metal leaching from mine rock material and were designed to be suitable for water quality modeling required as part of a feasibility study and Environmental Assessment.

Four barrel tests were initiated in September 2012 at the Goliath Gold site. The barrels were constructed using one-half of a clean 170 L plastic barrel. Selected drill core segments (50 cm to 100 cm long), including both half cores and full cores, were placed in each barrel to represent mine rock material from each of the four material types. Approximately 78, 87, 90, and 88 kg of core samples were placed in the BMS, BS, MSS, and MSED barrels, respectively. The top of each barrel remained open so that mine rock samples were exposed to air and precipitation falling as rain or snow. Each barrel has a bottom drain spout connected with tubing to pails where water collects between sampling events. Leachates from the barrel tests were analyzed at an accredited lab for general chemistry (pH, hardness, conductivity, total dissolved solids, alkalinity, acidity, chloride, sulphate, phosphorus, nitrate/nitrate, and ammonium), cyanide (total, weak acid dissociable (WAD), and free), and total and dissolved trace metals.

Tailings samples were produced by metallurgical bench scale testing. Two duplicate HCTs were set-up using a single prepared composite tailings sample. A single composite tailings sample was submitted for ICP-MS (1 test), ABA (1 test) and SFE analysis (3 tests with deionized water, 2 tests with 0.1M HCl acid).

Classification Method and Screening Criteria

ARD classification criteria are as documented in the MEND guidelines (Price 2009) stipulating that material with an NPR value of less than 1 (i.e., NPR<1) is classified as potentially acid generating (PAG). Material with an NPR value of greater than 2 (i.e., NPR>2) is classified as non-acid generating (NAG). Material with an NPR value of between 1 and 2 (i.e., 1<NPR<2) is classified as uncertain.

Shake flask and humidity cell results were compared against the Ontario Provincial Water Quality Objectives (PWQO; MOEE 1994) to evaluate constituents of potential concern (COPCs).

Material Characterization for ARD/ML Potential

Waste Rock

All rock types were characterized by carbonate NPR (Carb-NPR) geomean values below 1.0. Similarly, with the exception of the BS samples, all mine rock samples had geomean values for

Sobek-NPR below 1.0. Therefore, all four mine rock types were classified as potentially acid generating (PAG), as per the MEND guidelines (Price 2009).

The average sulphide-sulphur contents amongst all the samples ranged between 0.01 and 8.6 percent sulphur (%S), whereas the average sulphate-sulphur contents ranged between 0.01 and 1.0 %S. The geomean sulphide-sulfur contents of BMS, BS, MSS, and MSED were 0.0.44, 0.40, 0.78, and 0.52 %S, respectively, while sulphate-sulphur values were 0.24, 0.22, 0.23, and 0.16%S, respectively. For all four mine rock types, the high sulphide-sulphur content standard deviation (0.43, 0.38, 1.24 and 0.53 %S) relative to the geomean values demonstrates the broad range of sulphide contents.

The total carbonate values for all four rock types, measured as percent carbon (%C), ranged between 0.01 and 0.71 %C. Total carbonate values were higher in BS and MSED samples with geomean values of 0.09 and 0.08 %C. Conversely, BMS and MSS samples both had geomean values of 0.03%C.

The measured Sobek-NP values were relatively low, ranging from 2.10 to 20.8 kg $CaCO_3$/t with geomeans of 7.19, 8.57, 5.69, and 8.90 kg $CaCO_3$/t for BMS, BS, MSS, and MSED, respectively. Typically, Carb-NP values were lower than and only represent less than one-half of the Sobek-NP values, ranging from 0.08 to 16.7 kg $CaCO_3$/t with geomean values for BMS, BS, MSS, and MSED of 0.74, 1.37, 0.72, and 1.87 kg $CaCO_3$/t, respectively.

Approximately 88% of samples had an NPR <2 and would be considered to be PAG or have an uncertain acid generating potential. Approximately 96% of samples had a Carb NPR <1 and would be considered PAG on this basis. On balance ARD/ML assessment (Appendix K) indicated that approximately 93% of waste rock materials should be considered PAG for management purposes.

As expected, higher soluble elemental concentrations were generally observed in samples for all four mine rock types in the acid extractions compared to those in the deionized water extractions. Deionized water extraction values exceeded acid-wash values for antimony and sulphate for the BMS samples; cadmium, zinc, and sulphate for the MSS sample; and sulphate for the MSED samples. The screening values were exceeded for aluminum (BS, MSED), copper (MSED), and lead (BMS, BS, MSED) in the acid-wash SFEs. Conversely, no screening values were exceeded for any of the deionized-water SFE for all four mine rock types.

Tailings

The tailings material was classified as PAG, as per the MEND guidelines (Price 2009), with an NPR ratio of well below one in the composite tailings sample (Appendix K). The tailings sample was analyzed with a total-sulphur content of 1.53 %S, occurring dominantly as sulphide sulphur (1.23 %S). All carbon in the sample was in the form of carbonate at a concentration of 0.02 %C.

Mineralogy information for ore material reported in the Lycopodium report (Appendix B) indicate that total sulphide accounts for ~2.1% of the sample mass, with 10% of the sulphide minerals occurring as pyrrhotite The dominant non-sulphide gangue minerals present were quartz (56%), micas (22%), and feldspars (22%).

Time for Onset of Acidic Conditions

All 11 waste rock humidity cells (Appendix K of the EIS) were operated for a minimum of 63 weeks with the highest sulphur humidity cell for each rock type continued to 83 weeks. Cells reached generally stable pH in the range of 6.5 to 7 between 20 and 44 weeks after which time some decline to distinct declines in pH were observed in most cells. Cells that continued operating to 83 weeks exhibited final pH in the range of pH 4.5 for the MSS-C, BMS-C and BS-C cells and a final pH of 5.4 for the MSED-B cell.

Sulphate and metal rates were generally stable after 20 weeks, but showed evidence of increasing oxidation and metal release generally consistent with the observed declines in pH especially after 60 weeks of operation in the continuing cells.

Initial evaluation of the time to acid on-set of waste rock for the project in 2014 identified the possibility of field scaled times to acid on-set of tens of years, but identified that a cautionary approach was recommended. Updated evaluation of waste rock kinetic data by Amec Foster Wheeler in 2017 to support water quality modelling for the project took a conservative approach in the absence of such data.

A further discussion of all waste rock kinetic results (humidity cells and field cells) is provided in Section 5.2.4 of the Appendix JJ (Water Report). Evaluation of NP depletion rates identified that low NP material as tested in humidity cells were projected go acid after 2 to 6 years. However, several low NP humidity cells exhibited a decline in pH below 6 in a little over a year with cells for BMS, BS and MSS as low as pH 4.5 after 80 weeks. Cells were terminated at that time so it is not clear if these declines would have progressed further with continued operation. For conservative project planning it was inferred that this could represent a relatively early acid on-set time for low NP mine rock. It was interpreted that at field rates some acidic leaching could develop within two years of exposure for some low NP waste rock. This was further supported by observations from field cells: one of which was observed to have a leachate pH <6 (and assumed to becoming acidic) after about two years of operation. Three cells BMS, BS and MSS when monitored after approximately four years of operation had leachate pH values ranging from 3.8 to 5.4. Based on these observations and in the absence of additional data, it has been conservatively assumed that potentially acid generating rock will become acidic after 2 years of exposure.

Based on humidity cell analysis of the 2012 simulated tailings samples, tailings are potentially acid generating and may go acid within one to two years of exposure. Tailings management including continual progressive covering of exposed tailings during operations is expected to limit progression to acidic conditions. Long-term closure of the tailings also needs to consider the future acid generating potential of the materials.

5.4.4 Traditional Knowledge

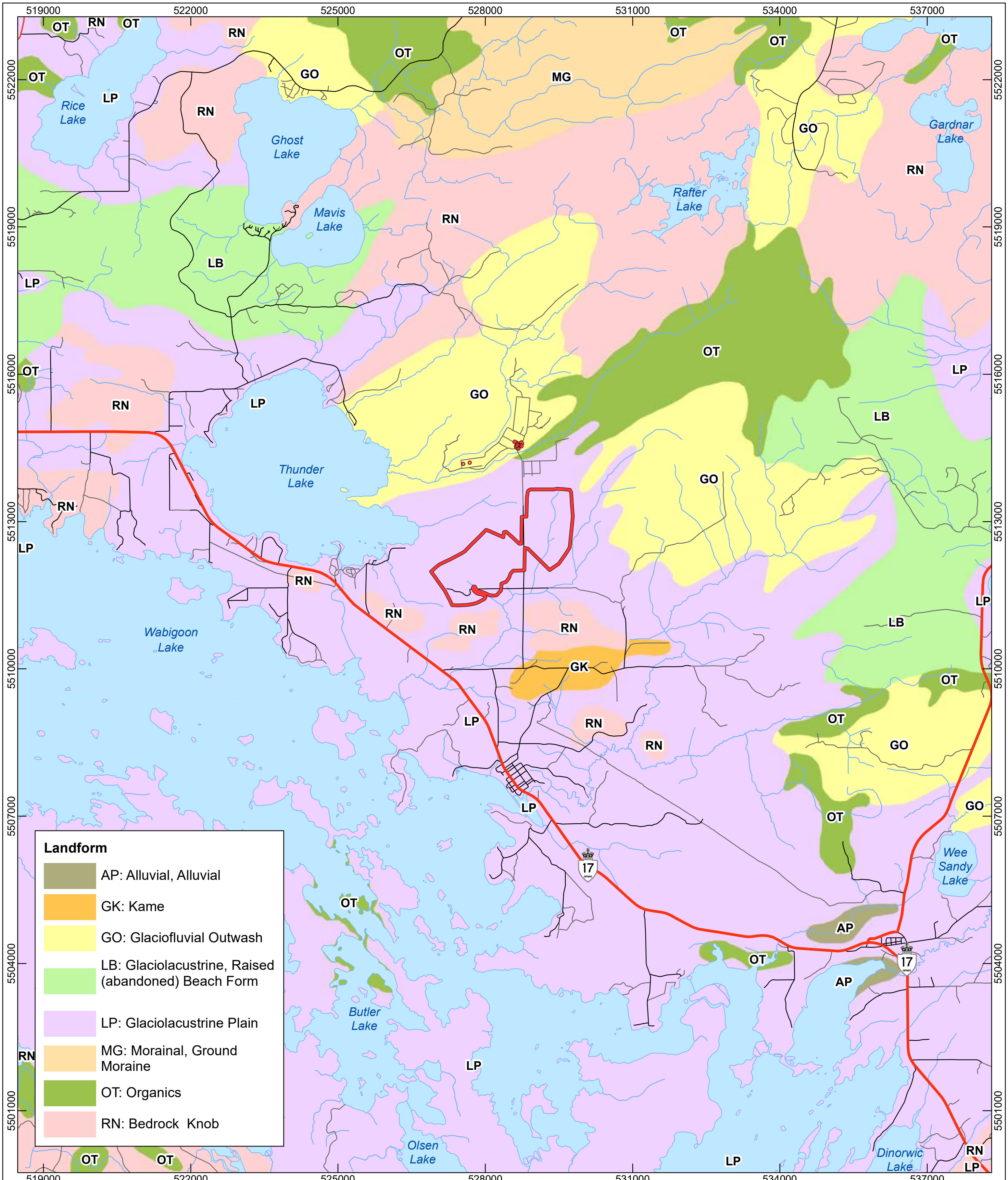
There was no traditional knowledge shared by the members of Indigenous communities regarding geology or geochemistry. However, Treasury Metals are aware that several Indigenous communities have expressed concerns regarding the potential effects of acid rock drainage on the environment, and their ability to continue to practice traditional land and resource use in the area.

5.5 Soils

5.5.1 Regional Soil Classification

The dominant regional landform in the vicinity of the Project is predominately a Glaciolacustrine Plain (Figure 5.5.1-1). The regional soils were categorized based on visual observations by Klohn Crippen Berger (KCB 2012) and by mapping available from the Ontario Institute of Pedology (OIP 1984) for the Dryden-Kenora Area. The three major soil classifications found in the regional study area (RSA) that will play a role in Project development, land use, reclamation, and water management are:

- Gray Luvisols: characterized by an illuviated Bt horizon (i.e., subsoil with accumulation of silicate clays). The typical gray luvisol in the Dryden-Kenora area has clay, clay loam, sand loam, or silt loam texture. They are well drained and have a moderate agricultural capability.
- Gleysols: characterized by their saturated nature and reducing conditions that occur either continuously or seasonally. Gleysols can be identified by hue and mottling in the lower horizons, which is an indication of reducing conditions, associated with saturation. The Gleysols of the Dryden-Kenora area are poorly drained and are silt loam to medium-coarse in texture. They are underlain by outwash that is calcareous and lacustrine in origin.
- Podzols: Soils of the Podzolic order have B horizons (i.e., subsoil) in which the dominant accumulation product is amorphous material composed mainly of humified organic matter combined in varying degrees of aluminum and iron. Typically these soils occur in coarse- to medium-textured, acid parent materials, under forest or heath vegetation in cool to very cold humid to perhumid climates (Soil Classification Working Group (SCWG) 1998). The podzols of the Dryden-Kenora area are well drained and overlay fine outwash material that is non-calcareous in origin.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Regional Landforms

Figure 5.5.1-1 | REV.00

SCALE: 100 000

TREASURY METALS INC.

DESIGN: AT 06 FEB. 2014
GIS: AT 14 NOV. 2014
CHECK: AT 14 NOV. 2014

Operations Area
Arterial Road
Highway
Local Road
Recreational Road
Waterbody
Watercourse

N E S W

0 1,000 2,000 3,000
Meters

REFERENCE
Projection: NAD83 UTM Zone 15N
Base Data: OBM
FMZ Data: MNR

5.5.2 Local Soil Classification

The soils found on a regional and local scale are fairly similar with a slight variation related to micro scale changes in ground elevation during the soil investigation by Klohn Crippen Berger (2012). The soils are characterized regionally by the Broadtail and Deception humo-ferric Podzols, the Minnitaki orthic Gleysol, and the Sioux grey Luvisol (Figures 5.5.2-1 and 5.5.2-2). All soil types were determined to be present locally; however, the difference in drainage and variable elevation allow for more local variation in soil type. An area of marshland was identified in the local survey and is evident in the topography surrounding Blackwater Creek and a beaver pond on the northwestern section of the open pit. The soils in the Broadtail group are limited in agricultural capability due to low fertility and moisture limitations with stoniness and bedrock. The Deception group is also limited in agricultural capability with an additional limitation due to topography. More capable land use areas are found in areas where the soil is less stony and the soils are less limited such as the Minnitaki group. The Minnitaki group has moderate capability and a limitation due to excess water. The Sioux soil group is limited in agricultural capability due to undesirable soil structure, topography, and erosion.

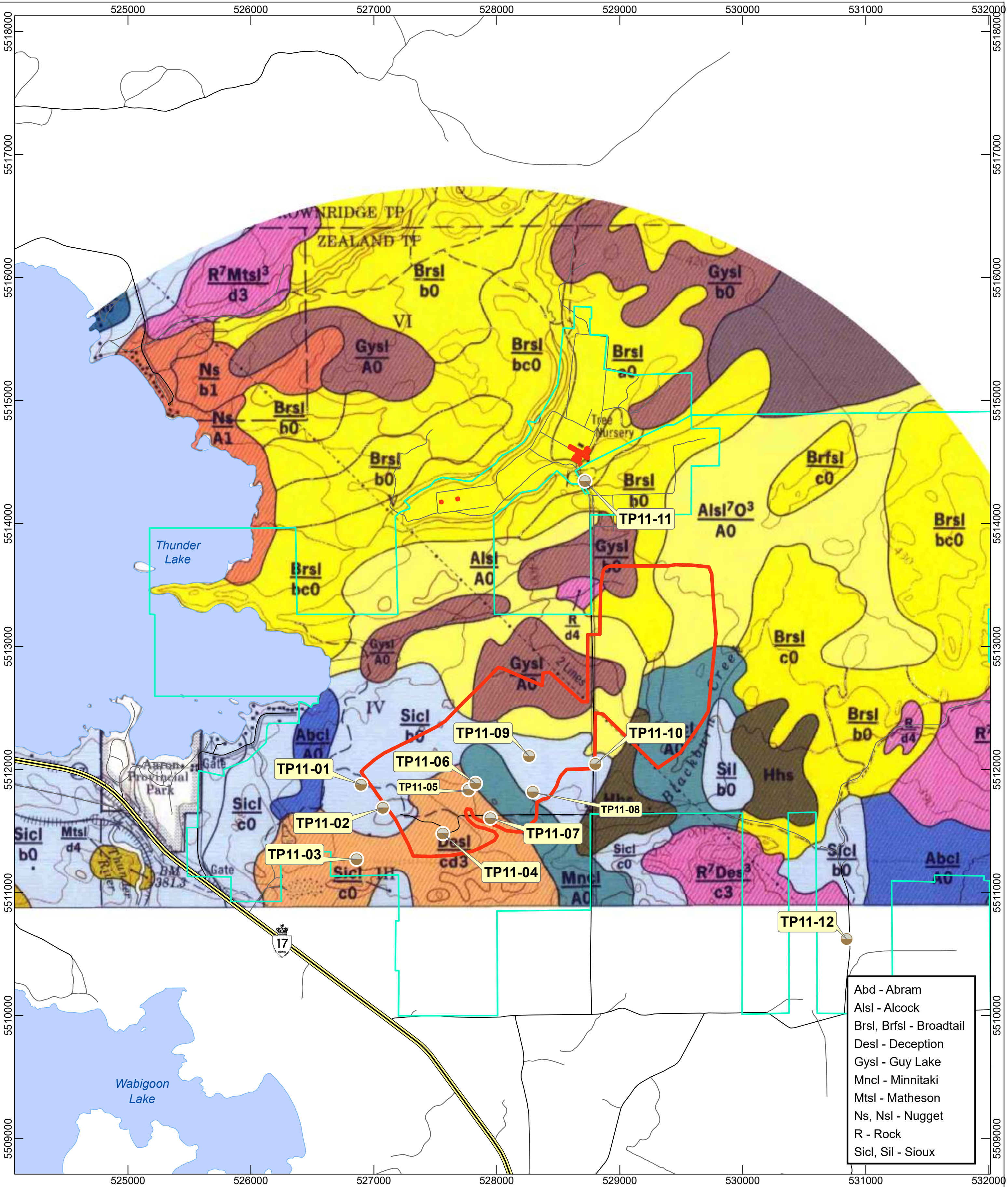
The local soil types range from loamy sand to silty clays. The soils with coarser textures are generally moderately to well-drained, and finer textures have poorer drainage due to hydraulic conductivities. The local soil types were confirmed during a drilling investigation by TBT Engineering Ltd. in March 2014 (Figures 5.5.2-3 and 5.5.2-4). The O horizon (i.e., organic material) was generally encountered to approximately 0.2 m below grade to a maximum depth of 1.4 m in some areas. The O horizon is underlain by B horizon (i.e., subsoil) of predominantly clay and/or silt to bedrock, which was encountered at depths ranging from 1.05 m to 18.6 m below grade.

5.5.3 Soil Nutrient Baseline

The purpose of the soil nutrient baseline by Klohn Crippen Berger (2012) was to determine the productivity level of current surface soils and to predict the potential productivity of the soils for reclamation.

5.5.3.1 Soil Organic Matter

Soil organic matter (SOM) improves both physical and chemical properties of the soil. SOM improves soil structure and particle stability, increase water retention capacity, increases aeration, and stores and supplies nutrients for plants and micro-organisms.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

Soil Sampling Test Pit Locations and Local Soil Classification

FIGURE 5.5.2-1 | REV.00

SCALE: 40 000

TREASURY METALS INC.

DESIGN: AT 06 FEB. 2014
GIS: AT 20 FEB. 2014
CHECK: AT 09 OCT. 2014

LEGEND

- Soil Sampling Location
- Operations Area
- Property Boundary
- Populated Area
- Arterial Road
- Highway
- Local Road
- Recreational Road
- Waterbody

0 500 1,000
Meters

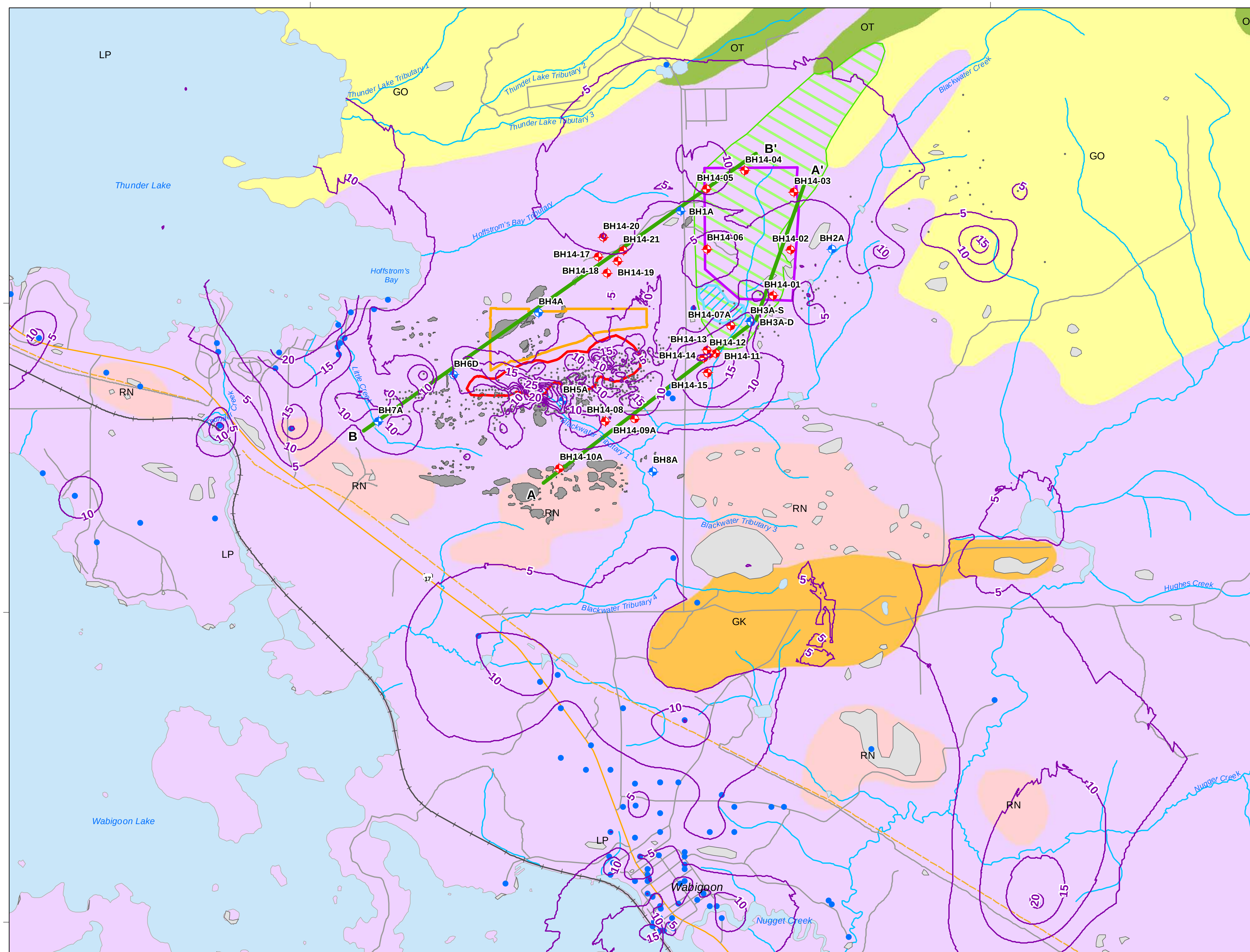
N E S W

REFERENCE
Projection: NAD83 UTM Zone 15N
Base Data: OBM
Soil classification: Ontario Institute of Pedology. Ontario Ministry of Agriculture and Food, 1987.

GOLIATH GOLD PROJECT

Figure 5.5.2-2

Project Site Overburden Geology and Soil Profile Location



Legend

- Overburden Thickness (meters below ground surface)
- Proposed Open Pit
- Waste Rock Storage Area
- Tailings Management Area
- Tailings Management Pond
- Cross Section Location
- Railway
- Pipeline

Surficial Geology

- Sand - Clay / Silt - Sand Boundary

Landform

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

Bedrock Outcrop Mapping

- Beakhouse and Pigeon, 2003
- Treasury Metals

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.

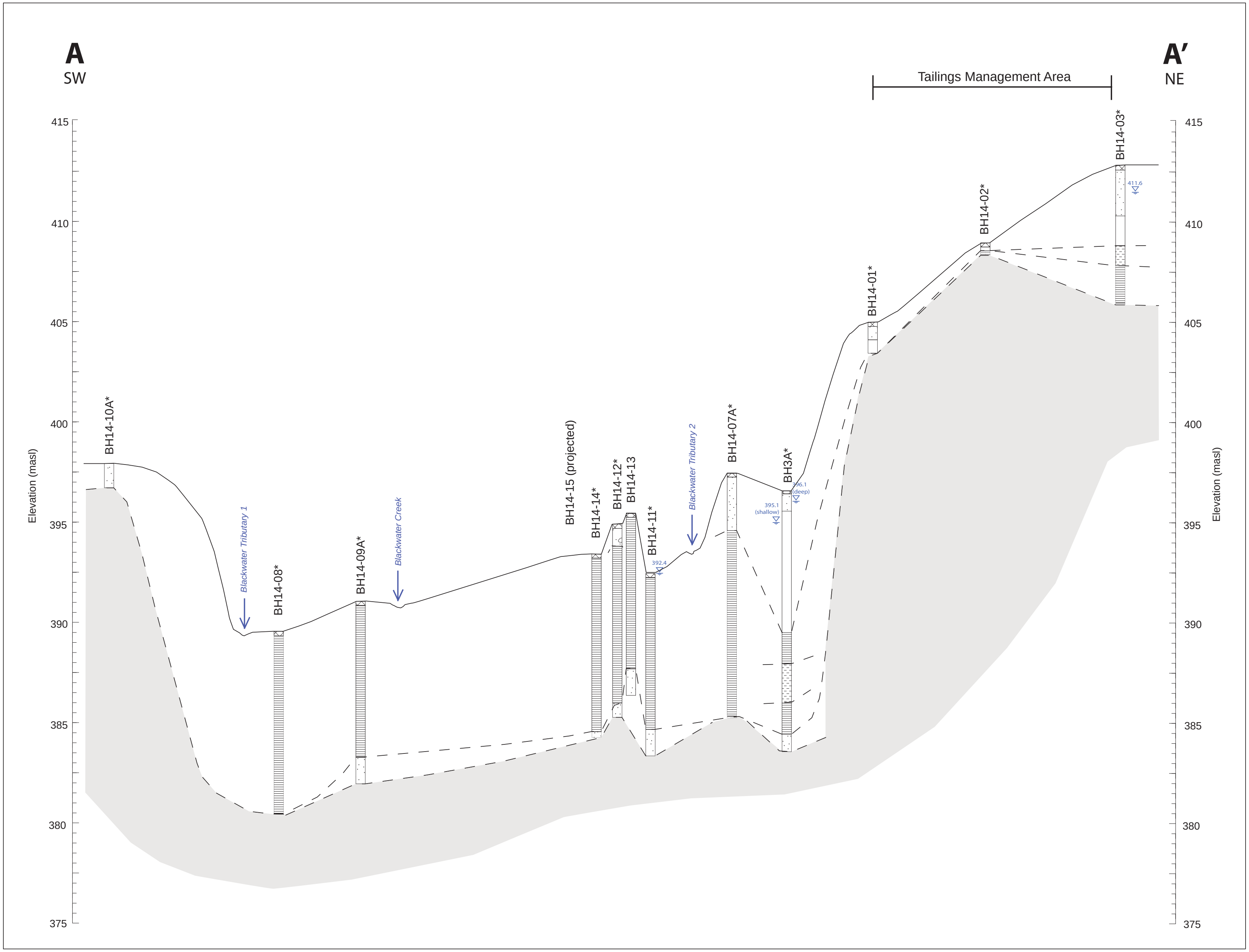
Project #: TB124004
Date: July, 2014
Client: Ontario Infrastructure & Lands
Drawn by: DF
Checked by: MS
Revision No.: 2

UTM NAD 83
Zone 15N
1:30,000

Meters 0 200 400 600 800 1,000

TREASURY METALS Inc.

amec foster wheeler



GOLIATH GOLD PROJECT

Figure 5.5.2-3

South-west to North-east Cross-section through Overburden (a) South-east of Proposed Open Pit

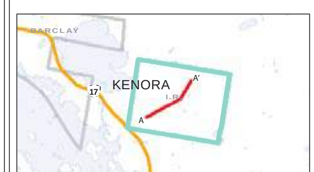
Legend

- Organics
- Sand
- Silty Sand
- Silt
- Clay
- Bedrock
- Waterlevel (masl)

Notes: "Clay" indicates lithology of predominantly clay but also includes silty clay and layered clay and silt.

Borehole with * indicates auger refusal (assumed bedrock).

BH14 water levels from May 2014, BH 2013 (BH1A - BH8A) water levels from July 2013.



Source: Treasury Metals Borehole Logs

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

Project #: TB124004
Date: June, 2014
Client: Ontario Infrastructure & Lands

Drawn by: DF
Checked by: MS
Revision No.: 1

0 100 200 300 400 500 Meters

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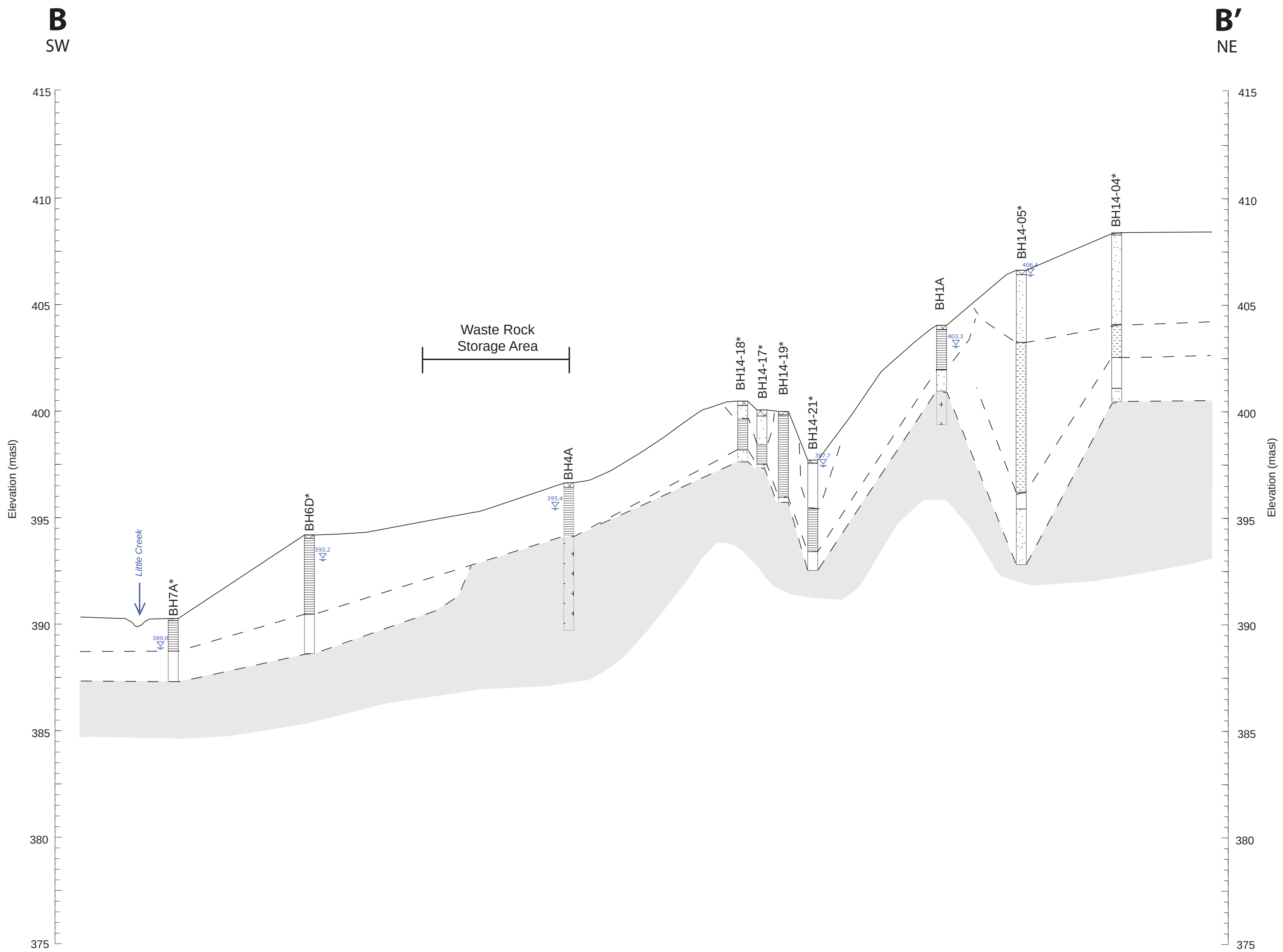


GOLIATH GOLD PROJECT

Figure 5.5.2-4

South-west to North-east Cross-section through Overburden (b) North-west of Proposed Open Pit

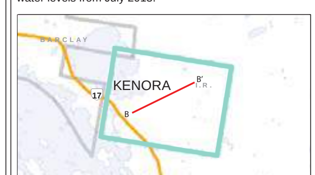
Legend

- Organics
- Sand
- Silty Sand
- Silt
- Clay
- Bedrock
- Waterlevel (masl)

Notes: "Clay" indicates lithology of predominantly clay but also includes silty clay and layered clay and silt.

Borehole with * indicates auger refusal (assumed bedrock).

BH14 water levels from May 2014, BH 2013 (BH1A - BH8A) water levels from July 2013.



Source: Treasury Metals Borehole Logs

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

Project #: TB124004
Date: July 2014
Client: Ontario Infrastructure & Lands

Drawn by: DF
Checked by: MS
Revision No.: 2

0 100 200 300 400 500 Meters

TREASURY METALS Inc.

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The SOM content correlates with the sampling horizon. The O horizon (i.e., organic matter) has the highest organic matter content at an average of 35%, followed by the Ah horizon (i.e., topsoil with illuvial accumulation of organic matter) at an average of 7%, and minimal to no organic matter in the mineral (B) horizons. Although there is an abundance of organic matter in the O horizons, the poor drainage often associated with the soil formation minimizes agricultural capability. The potential for use of these materials in reclamation is high because of the elevated organic matter and the ability of the SOM to improve the chemical and physical properties of soil.

5.5.3.2 Major Nutrients (N, P and K)

Available nitrogen (N) in the local soils is low and is typically less than the method of detection limit of 2 mg/kg. Nitrogen has only been detected in the O soil horizon due to the high organic matter content. The low nitrogen content in the local soils indicates little to no amendment done and/or low microbial activity. An increase in spring precipitation and runoff has also been known to decrease soil available nitrogen through leaching.

The available phosphorous (P) in the local soils ranges from below the detection limit of 2 mg/kg to 20 mg/kg. The higher available phosphorous levels are generally associated with the higher organic matter horizons. Soil phosphorous levels are relevant for soil fertility in relation to the crops produced. Excess phosphorous is a concern in terms of entry into surrounding water bodies. The relatively low concentration in these soils indicates that there should not be a concern of excess phosphorous entering the watershed. Phosphorous is generally most available in soil with a pH between 5.5 and 7.0.

The potassium (K) content was measured to be below the method of detection limit of 2 mg/kg.

Generally, the nutrient content of the soils is low with the highest measurable nutrients found in the organic containing O and Ah horizons.

5.5.3.3 Cation Exchange Capacity

The cation exchange capacity (CEC) is a measure of the nutrient or cation buffering capacity of the soil and is an important function of soil fertility as it is a measure of the capacity of the soil to adsorb and exchange nutrients (i.e., K^+, Ca^{2+}, Mg^{2+}, NH_4^+). The CEC of soil is primarily driven by organic matter content and secondarily by clay content. Plant available nutrients will only exist in soil pore water at minimal concentrations; therefore, it is important for the soil to have a reservoir of these nutrients to exchange when required by the plant.

The CEC of the soil ranges from 4.5 meq/100 g to 82 meq/100 g. Organic soils have a good degree of CEC for reclamation purposes; however, the deeper mineral horizons (i.e., the sandy loam soils) have a much lower CEC due to the low organic matter. The clay content of the local soils is low and therefore does not contribute significantly to CEC.

The optimal concentrations of calcium, magnesium, and sodium should have a higher proportion of Ca, followed by Mg, with smaller amounts (~5%) of Na. The exchangeable calcium (Ca) in the soil ranges from less than 2 meq/100 g to greater than 103 meq/100 g. Soils are considered to be Ca deficient if the exchangeable Ca value is less than 1 meq/100 g. The highest Ca contents were found in the C horizons (i.e., parent rock), which is likely related to the presence of carbonates in the parent material.

Local soils have exchangeable Mg ranging from less than 2 to 27 meq/100 g. Soils are considered to be Mg deficient if the exchangeable Mg value is less than 0.2 meq/100 g. The exchangeable sodium in the soil ranges from 5.2 meq/100 g to 18 meq/100 g. These values are generally low indicating that these soils are not sodic in nature, which is expected in the region, and beneficial for reclamation. Overall, the exchangeable cations are moderate throughout the local soil profile. The Ca:Mg ratios are predominantly greater than 1, indicating a generally healthy soil.

5.5.4 Soil Chemical Baseline

The purpose of the soil chemical baseline was intended to measure the baseline metal concentrations and measure the potential for large stockpiled volumes of soil to produce metal leaching. It is not common for soils to leach large quantities of metals, and the reducing nature of gleysols and the soils of the poorly drained areas on the LSA tend to keep metals and metalloids relatively immobile in their reduced forms. Some metals are mobile in this reduced state; however, the natural state of the soils maintains a balance in metal mobility/immobility. The stockpiling and draining of the soils will allow for oxidation and may alter the potential mobility of elements into the receiving environment.

5.5.4.1 Soil pH

The pH of the local soils ranges from 5.0 to 8.1 (KCB 2012). The more acidic pHs are typically related to the organic acid content of the soils, while the more alkaline pHs are related to the higher clay content and calcareous material present in some of the soil horizons. More acidic conditions are also found to be present in the Bf horizons (i.e., subsoil).

The pH of the soils are rarely low or high enough to present significant impacts of H^+ and OH^- ions on roots and microorganisms (McBride 1994). Soil pH below 5.5 will generally encourage an increase in the solubility levels of aluminum and manganese to the point of being biologically toxic. A pH value greater than 7 is often associated with low solubility of micronutrient cations, and pH higher than 8.5 is associated with high soluble and exchangeable Na^+ (McBride 1994). However, the relationship between soil pH and exchangeable nutrients (i.e., Ca^{2+}, Mg^{2+}, NH_4^+) in the LSA show no apparent trend.

5.5.4.2 Soil Metal Content (Solid Phase)

Characterization of shallow soil in the vicinity of the future open pit (24 samples representing the upper 1 to 1.7m of surficial soils) was completed in support of base-line sampling for the site (KCB

2012). Metal results from these soil samples have been compared to Ontario typical range background standards (MOE 2011) as provided in Table 5.5.4.2-1. This comparison was completed to identify the overall nature of the materials and whether they are generally typical of background and unmineralized soils. It is noted that, comparison of specific samples to the individual criteria under site condition standards is not considered relevant to this analysis. Results indicate materials have metal contents generally similar to typical background soils in Ontario and would not be expected to represent a risk for metal leaching on this basis.

A few marginal exceedances of the MOE background soil quality standards (MOE 2011) were identified, including: four of the 25 samples for total chromium at 69 to 78 µg/g (site condition standards (SCS) for various land uses ranges from 67 to 70 µg/g) and a single sample for cadmium at 1.39 µg/g (SCS for various land uses ranges from 1 to 1.2 µg/g). In addition, six of the 25 samples for nickel were above the agricultural site condition standard of 37 µg/g, but below the background standard for other land uses (82 µg/g). For the purposes of this assessment the overall results support materials being similar to background unmineralized soils which would have little risk for metal leaching.

Additional characterization of overburden materials to be stripped for the project will be completed in support of future planning to confirm appropriate management of overburden materials. Though unlikely, should any materials of concern be identified, they can be readily managed along with the PAG waste rock materials at the site. Only overburden materials that are not prone to metal leaching will be stockpiled and reclaimed at the end of mining.

5.5.4.3 Soil Metal Content in Soil Solution

The potential for metals to leach into solution is the more distinguishing factor for the potential for metal toxicity. Plants will take up metals from the soils through the soil solution and an accumulation of metals in the root zone.

The previous soil study by KCB (2012) included short-term metal leaching tests (Shake Flask Extraction). The concentrations of most metals analyzed were below the limit of detection in the extract, although detection limits were elevated in most samples apparently due to dilutions required in completing the analyses. The analyses appeared to suffer from high solids/colloids in the extract. We expect the shallow and often clay-rich soils were not good candidates for the shake flask extraction method as applied, and assessment of short-term metal leaching would have been better assessed by other techniques. As identified in Section 5.5.4.2 additional characterization of soils is to be completed to support future project planning and it is recognized that this should include further testing of the saturated, possibly reduced soils that may be prone to oxidation when excavated and stockpiled. However, there is generally little evidence of metal leaching risk based on the available (albeit limited) short-term leach results and total element contents of sampled materials. As discussed previously, should soils be identified with a risk of metal leaching, these can readily be managed along with PAG rock materials.

Table 5.5.4.2-1: Summary of Shallow Soil Sampling Results in the Vicinity of the Proposed Open Pit

Lab ID		SCS Standard (1)		L1031026-1	L1031026-2	L1031026-3	L1031026-4	L1031026-5	L1031026-6	L1031026-7	L1031026-8	L1031026-9	L1031026-10	L1031026-11	L1031026-12	L1031026-13
Date Sampled				11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11	11-Jul-11
	Depth (m)	Soil (Agricultural) (2)	Soil (R/P/I/I/C/C) (3)	0.25	0.85	0.4	Dup of 02-40	0.05	0.25	0.65	1	1.3	0.25	0.1	0.2-1.4	0.5-1.3
Sample ID				TP11-01-25	TP11-01-85	TP11-02-40	TP11-02-45	TP11-03-5	TP11-03-25	TP11-04-65	TP11-04-100	TP11-05-G	TP11-05-25	TP11-06-10	TP11-06-G	TP11-07-G
Parameter	Units															
Antimony (Sb)	µg/g	1	1.3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic (As)	µg/g	11	18	1.8	3.4	5.9	3.4	2.5	1.6	3.2	7.9	3	2.2	3.4	3.5	3
Barium (Ba)	µg/g	210	220	55	153	28.6	29.5	100	39.4	97.2	135	129	181	182	160	124
Beryllium (Be)	µg/g	2.5	2.5	0.5	0.52	0.5	0.5	0.5	0.5	0.5	0.5	0.58	0.5	0.58	0.63	0.5
Bismuth (Bi)	µg/g	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Boron (B)	µg/g	36	36	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.2	6.5	6.6	5.3	< 5
Cadmium (Cd)	µg/g	1	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*1.39*	< 0.5	< 0.5	< 0.5
Chromium (Cr)	µg/g	67	70	43.2	*77.9* (5)	24.7	24.1	43.7	30.8	66.3	65.2	68.6	23.9	69.9	*76.2*	66.6
Cobalt (Co)	µg/g	19	21	8.8	15.4	5.3	4.8	9.5	5.3	11.4	13.8	13.1	5.6	15.7	15.3	14.2
Copper (Cu)	µg/g	62	92	10	35.7	10.3	8	21	9	31.9	57.3	26	14.3	35.1	37.1	28.9
Iron (Fe)	µg/g	--	--	21100	37400	13100	11400	19400	13100	28900	32500	34000	11900	35100	37500	32500
Lead (Pb)	µg/g	45	120	6.2	8.4	4.5	4	8.3	3.9	5.4	13.8	8.4	17.5	9.6	9.6	7.4
Lithium (Li)	µg/g	--	--	14.2	27.7	7.3	7.4	16.3	10.5	19.7	49.5	28.7	8.1	29.7	32.4	24
Manganese (Mn)	µg/g	--	--	366	696	133	111	385	157	422	688	536	726	852	697	661
Mercury (Hg)	µg/g	0.16	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.095	< 0.05	< 0.05	< 0.05
Molybdenum (Mo)	µg/g	2	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	µg/g	37	82	21.1	45.1 (6)	12.5	12.3	22.9	14.7	35.4	52.1	37.9	14	41.3	44.3	37.1
Phosphorus (P)	µg/g	--	--	470	744	242	202	272	200	687	564	565	579	713	685	729
Selenium (Se)	µg/g	1.2	1.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Silver (Ag)	µg/g	0.5	0.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.26	< 0.2	< 0.2	< 0.2
Strontium (Sr)	µg/g	--	--	28.6	51.5	9	9.2	26.3	14.8	33.8	48.8	36.6	38.4	43.8	45	52.6
Thallium (Tl)	µg/g	1	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin (Sn)	µg/g	--	--	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Titanium (Ti)	µg/g	--	--	1240	2160	528	532	1040	781	1440	1770	1840	575	1890	2050	2030
Uranium (U)	µg/g	1.9	2.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1
Vanadium (V)	µg/g	86	86	47.1	75.7	25	23.4	39.7	29.3	58.3	63	66.1	25.3	70.1	74.5	69.3
Zinc (Zn)	µg/g	290	290	35.3	67.8	20.2	18.1	59.2	22.1	46.2	120	64.2	167	78	70.3	59

Notes:

(1) The MOE Table 1 Site Condition Standards (SCS) are background values derived from the Ontario Typical Range values for the land uses indicated and are considered representative of upper limits of typical province-wide background concentrations in soils that are not contaminated by point sources

(2) SCS soil (agricultural) standards for agricultural or other property uses.

(3) SCS soils (R/P/I/I/C/C) standards that apply for residential/ parkland/ institutional/ industrial/commercial/ community property uses.

(4) “n.a.” indicates where the depth of the sample was not available.

(5) *Value shown as bold, italicized and shaded* exceeds the SCS (R/P/I/I/C/C) standards.

(6) Value shown as shaded exceed the SCS (agricultural) standards.

Table 5.5.4.2-1: Summary of Shallow Soil Sampling Results in the Vicinity of the Proposed Open Pit (continued)

Lab ID		SCS Standard (1)		L1031026-14	L1031026-15	L1031026-16	L1031026-17	L1031026-18	L1031026-19	L1031026-20	L1031026-21	L1031026-22	L1031026-23	L1031026-24	L1031026-25
Date Sampled				11-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11	12-Jul-11
	Depth (m)	Soil (Agricultural) (2)	Soil (R/P/I/I/C/C) (3)	0.1	0.05	0.15	0.35-1.7	0.1	0.1	0.15-0.65	n.a. (4)	0.3	0.1	0.15	0.3
Sample ID				TP11-07-10	TP11-08-5	TP11-08-15	TP11-09-G	TP11-09-10	TP11-10-10	TP11-10-G1	TP11-10-G2	TP11-11-30	TP11-11-10	TP11-12-15	TP11-12-30
Parameter	Units														
Antimony (Sb)	µg/g	1	1.3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic (As)	µg/g	11	18	2.3	2.6	2.2	2.5	2.8	2.4	1.9	2.2	2.7	2.6	1.4	2
Barium (Ba)	µg/g	210	220	94.5	96.3	89.2	124	78.6	45.7	84.1	102	43.5	96.2	42.4	83.5
Beryllium (Be)	µg/g	2.5	2.5	0.5	0.55	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bismuth (Bi)	µg/g	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Boron (B)	µg/g	36	36	< 5	< 5	< 5	6.1	5.4	< 5	5.1	6	< 5	< 5	< 5	< 5
Cadmium (Cd)	µg/g	1	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Cr)	µg/g	67	70	65.3	53.5	57.9	59.2	21.8	21.7	43.7	48.9	16	48.4	24.2	53.6
Cobalt (Co)	µg/g	19	21	13.5	13.3	12.7	12.6	3.8	4.4	9.2	10.6	3.5	11.7	3.9	10.8
Copper (Cu)	µg/g	62	92	19.2	17.7	14.3	25.9	10.6	8.7	21.2	26.4	7	14.6	7.3	12.8
Iron (Fe)	µg/g	--	--	31000	26600	28900	30600	12100	11600	22000	25200	9440	24400	14200	27900
Lead (Pb)	µg/g	45	120	8	12.8	9.4	7.2	14.4	5.8	4.6	4.9	6	10.2	5.6	7.4
Lithium (Li)	µg/g	--	--	24.4	20.3	23.9	26.4	7.2	7.7	16.8	20.5	5.7	20.8	9.8	21
Manganese (Mn)	µg/g	--	--	601	808	637	620	236	247	382	420	197	637	139	409
Mercury (Hg)	µg/g	0.16	0.27	< 0.05	< 0.05	< 0.05	< 0.05	0.117	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum (Mo)	µg/g	2	2	< 1	< 1	< 1	< 1	1.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	µg/g	37	82	34.4	28.6	29.8	33.8	11.5	10.8	24.6	28.7	8	26.2	11	27.3
Phosphorus (P)	µg/g	--	--	487	468	362	607	618	451	673	621	384	481	201	243
Selenium (Se)	µg/g	1.2	1.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Silver (Ag)	µg/g	0.5	0.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Strontium (Sr)	µg/g	--	--	42.5	37.5	34	68.1	41.4	15.3	60.1	61.3	16.9	32.1	13.9	30.7
Thallium (Tl)	µg/g	1	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin (Sn)	µg/g	--	--	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Titanium (Ti)	µg/g	--	--	1980	1590	1920	2010	426	599	1480	1540	420	1420	808	1790
Uranium (U)	µg/g	1.9	2.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Vanadium (V)	µg/g	86	86	66.8	55.1	64.2	65.4	19.8	23.1	49.1	54.3	17.5	51.1	31.7	61.1
Zinc (Zn)	µg/g	290	290	65.4	80.8	70.9	59.1	31.7	19.8	37.6	42.3	13.1	73.5	24.4	42.3

Notes:

(1) The MOE Table 1 Site Condition Standards (SCS) are background values derived from the Ontario Typical Range values for the land uses indicated and are considered representative of upper limits of typical province-wide background concentrations in soils that are not contaminated by point sources
(2) SCS soil (agricultural) standards for agricultural or other property uses.
(3) SCS soils (R/P/I/I/C/C) standards that apply for residential/ parkland/ institutional/ industrial/commercial/ community property uses.
(4) “n.a.” indicates where the depth of the sample was not available.
(5) ***Value shown as bold, italicized and shaded*** exceeds the SCS (R/P/I/I/C/C) standards.
(6) Value shown as shaded exceed the SCS (agricultural) standards.

5.5.5 Summary of Local Soils

The potential for the local soils in the Project area to be used as material in reclamation is good. Soil management would be required for stockpiling to maintain the nutrient content and the physical and chemical stability of the organic material. Mixing the organic topsoil with the finer textured subsoils would be beneficial for soil structure and provide optimal rooting conditions and water holding capacity. Soils sampled had low metal contents generally at or below Ontario typical range soil conditions.

There were no unexpected land conditions or soil characteristics identified in the LSA. The potential for metal leaching is low and the nutrient content of the soils is moderate. Additional characterization of soils is to be completed in support of further project planning.

5.5.6 Traditional Knowledge

Wabigoon Lake Ojibway Nation, Eagle Lake First Nation, and Whitefish Bay First Nation (Naotkamegwanning First Nation) characterized soils as sandy northeast of Thunder Lake, including the proposed location for the tailings storage facility. These communicated that sandy soils are conducive to blueberry growth and denning for mammals such as the fox.

Additionally, MNO has indicated in secondary sources for traditional knowledge that the sandy soils were ideal for wild strawberries to grow.

5.6 Hydrogeology

The hydrogeology of the project area, as described below, has been adapted from the August 2014 report entitled *Hydrogeological Pre-Feasibility/EA Support Study Goliath Project*, AMEC Environment & Infrastructure, August, 2014. This report described the various initial hydrogeological investigations undertaken at the site, primarily in 2013, with limited site work done in 2012 and 2014. Supplementary work has been proposed to further develop and refine the understanding of the local hydrogeological conditions including the installation of additional groundwater monitoring wells in the basal sand unit and the shallow bedrock, continued groundwater elevation monitoring with both manual and automated methods, and quarterly groundwater quality sample analyses.

5.6.1 Hydrogeological Setting

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

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

5.6.2 Overburden Aquifer Conditions

As described in the 2014 study report, the hydrogeological investigations conducted to date for this area were based on the following infrastructure:

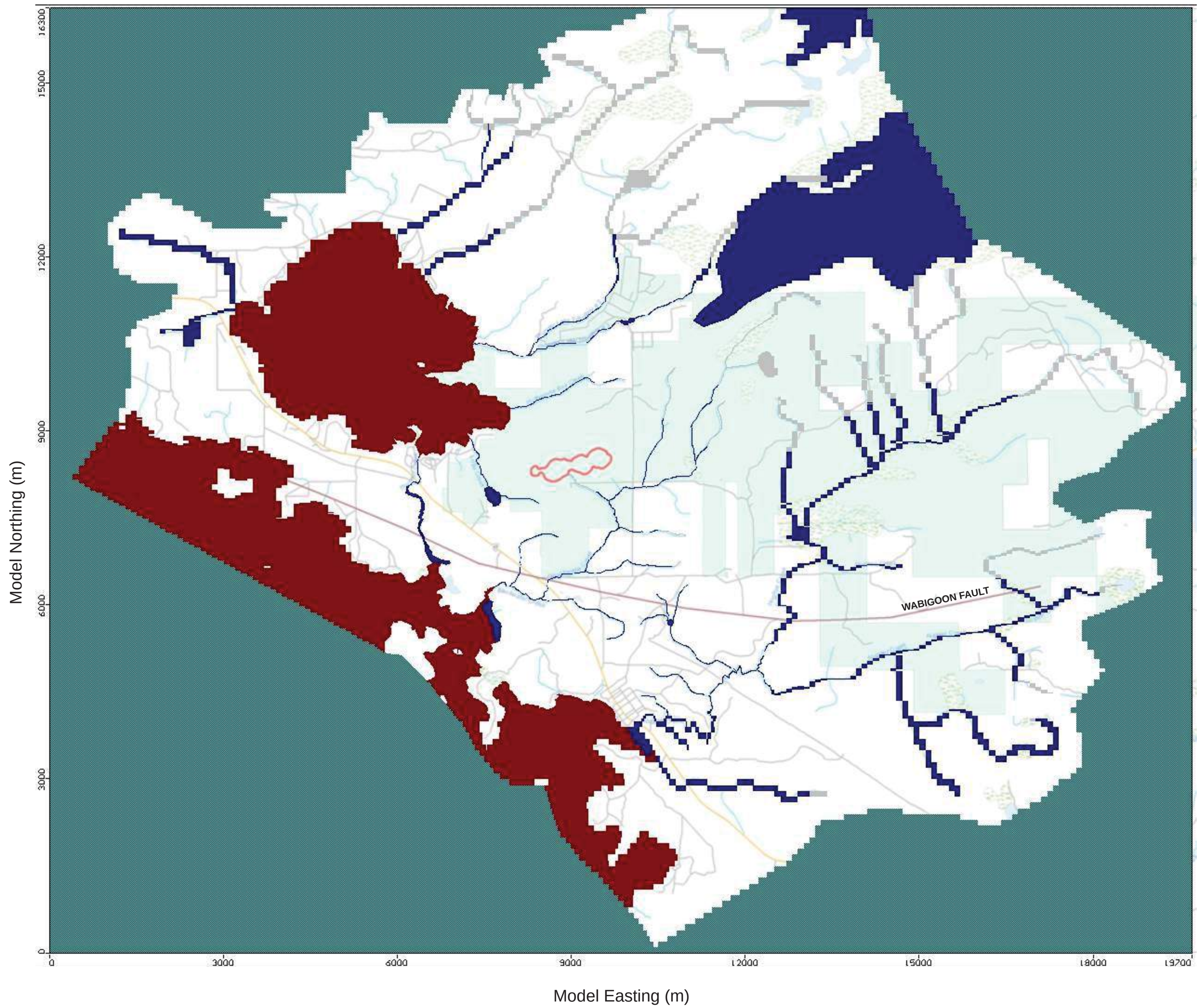
- Nine monitoring wells/groundwater quality wells were constructed in the overburden and bedrock contact in May 2013.
- 20 geotechnical boreholes were drilled in March/April 2014 with four of these completed with shallow stand pipes for groundwater monitoring.
- Groundwater elevations were manually recorded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

Borehole logs and well construction details for these monitoring wells are provided in the AMEC report.

5.6.2.1 Overburden Geology

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

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



GOLIATH GOLD PROJECT

Figure 5.6.1-1

Model Domain and Boundary Conditions

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 #: TB124004
Date: June 2014
Client: Ontario Infrastructure & Lands

Drawn by: DF
Checked by: MS
Revision No.: 1

UTM NAD 83
Zone 15N

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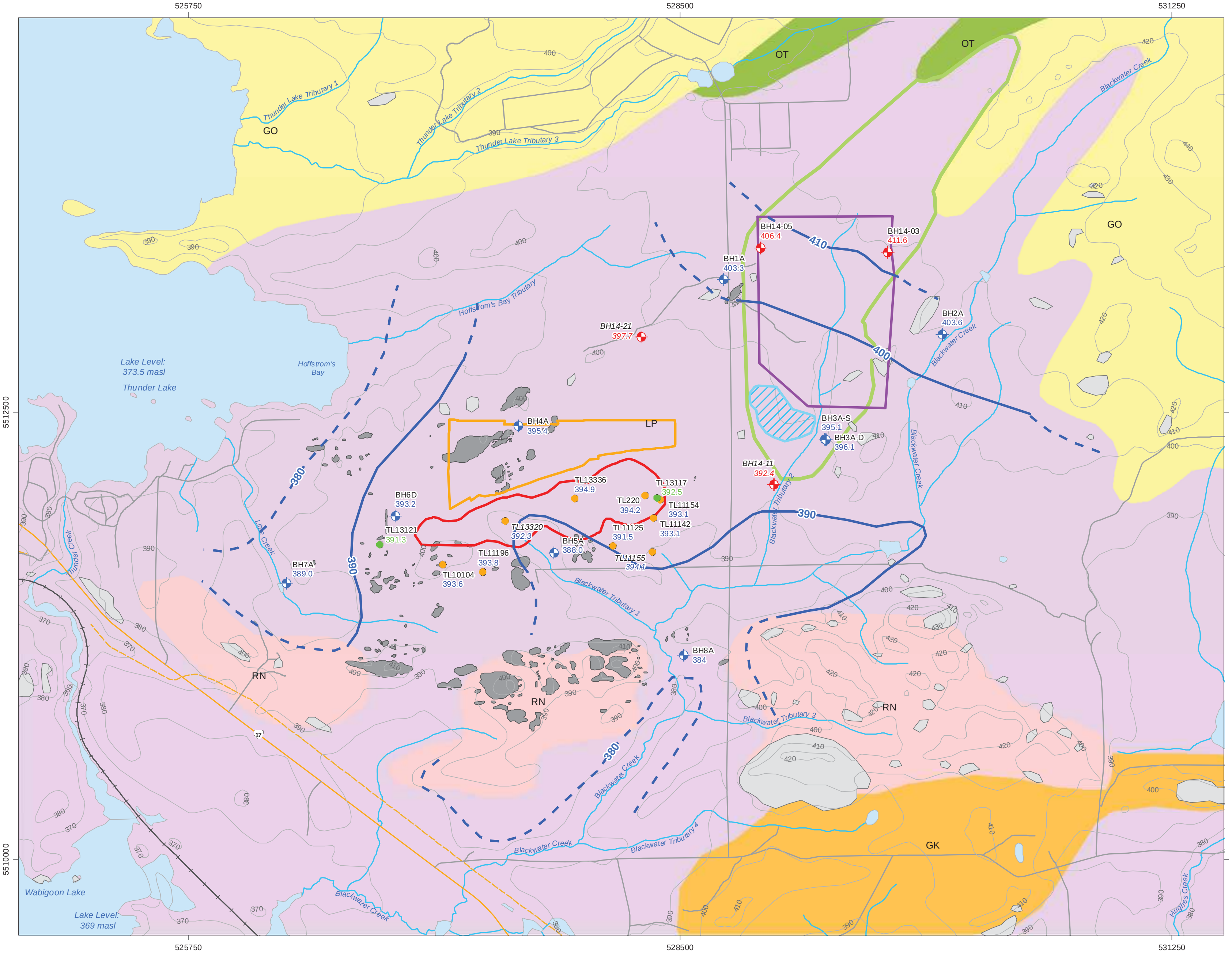
GOLIATH GOLD PROJECT

Figure 5.6.2.1-1
Groundwater Level Contours



Legend

- 2013 Monitoring Well (July 2013 water level labelled in blue)
- 2014 Geotechnical Hole (May 2014 water level labelled in red)
- 2013 Shallow Vibrating Wire Pezometer (July 2013 water level labelled in green)
- Exploration Borehole (July 2013 water level labelled in blue)
- Water Level Contour (masl)
- Inferred Water Level Contour (masl)
- Proposed Open Pit
- Waste Rock Storage Area
- Tailings Management Area
- Tailings Management Pond
- Elevation Contour (masl, 10 m intervals)

Surficial Geology

- Sand - Clay / Silt - Sand Boundary

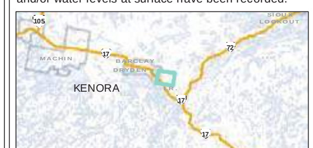
Landform

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

Bedrock Outcrop Mapping

- Beakhouse and Pigeon, 2003
- Treasury Metals

Note: holes in italics are where flowing conditions and/or water levels at surface have been recorded.



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: July, 2014
Client: Ontario Infrastructure & Lands
Drawn by: DF
Checked by: MS
Revision No.: 2

UTM NAD 83
Zone 15N
1:20,000
Meters
0 100 200 300 400 500

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

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

5.6.2.2 Aquifer Characteristics

In February 2014, rising head slug tests were conducted by Treasury on six of the groundwater quality wells installed in the overburden and overburden/ bedrock interface. Hydraulic conductivities ranged from 4.6E-07 m/s to 1.3E-06 m/s with a geometric mean of 9.2E-0.7 m/s and arithmetic mean of 9.8E-07 m/s. In most of the wells in which rising head slug tests were conducted, the screened portion of the well extended through a mixture of clay and sand immediately above the contact with the bedrock surface (location of auger refusal) or the screen straddled the basal sand and bedrock contact surface. Details relating to the well construction, stratigraphy and conductivity values are summarized in Table 5.6.2.2-1. The resulting hydraulic conductivity values are generally representative of silty sand conditions.

Table 5.6.2.2-1: Overburden Hydraulic Conductivity Testing Summary

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

5.6.2.3 Groundwater Flow

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

Based on limited monitoring of various wells (water quality monitoring and geotechnical boreholes) installed throughout the area, groundwater flow in the basal sand feature appears to be southwesterly, from the elevated wetland to the north, then splitting off in the general vicinity of the project site to the south towards Wabigoon Lake and to the west towards Thunder Lake, suggesting that this flow is largely controlled by local topography. The groundwater contours and apparent flow direction is shown in Figure 5.6.3 of the Hydrogeological Pre-Feasibility/EA Support Study Goliath Project, AMEC Environment & Infrastructure, August, 2014, report.

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

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

5.6.2.4 Groundwater Quality

Groundwater quality was monitored through sampling conducted on six occasions during 2013 from the groundwater quality wells which were screened within the basal sand and bedrock contact. These results indicated that the groundwater was typically calcium-magnesium-bicarbonate type water. Dissolved metal concentrations were found to exceed the Ontario PWQO for the Protection of Aquatic Life at one or more of the eight monitoring wells during one or more of the sampling events as follows: Aluminum (BH3A, BH6D, and BH7A), Arsenic (BH3A) Chromium (BH3A, BH6D), Cobalt (BH1A, BH2A, BH3A, BH4A, BH6D), Copper (BH3A, BH6D, BH8A), Iron (BH2A, BH3A, BH4A, BH5A, BH6D, BH7A), Tungsten (BH8A), Vanadium (BH3A, BH6D) and Zinc (BH3A, BH6D).

A summary of the groundwater quality is provided in Table 5.6.2.4-1.

5.6.3 Bedrock Aquifer Conditions

As described in the 2014 AMEC study report, the hydrogeological investigations conducted to date for the bedrock system were based on the following infrastructure:

- Records for available geological exploration boreholes were initially reviewed and six of these were incorporated in to the hydrogeological assessment program.

Table 5.6.2.3-1a: 2013/2014 Quality Monitoring Data

2013/2014 Groundwater Quality Monitoring Wells						Groundwater Levels[2,3]								
	Easting[1] (m)	Northing[1] (m)	Screened Units	Surface Elevation (masl)	Stick Up (m)	10-11/06/13 (masl)	9/7/13 (masl)	14/8/13 (masl)	16/10/13 (masl)	27/11/13 (masl)	28/11/13 (masl)	19/12/13 (masl)	30/1/14 (masl)	3/2/14 (masl)
BH1A	528705	5513251	Basal Sand/Bedrock	404.20	0.92	404.06	403.33	403.27	403.89			403.61		403.14
BH2A	529978	5512931	Clay/Basal Sand/Bedrock	403.91	0.99	403.79	403.57	403.00		403.77		403.57		
BH3A - S	529283	5512359	Sand (top Sand-Clay/Silt-Sand)	396.77	0.78	395.51	395.12	395.15	395.31		395.01	395.12	395.11	
BH3A - D	529281	5512360	Clay/Sand (bottom Sand-Clay/Silt-Sand)	397.00	0.86	396.26	396.11	395.95	396.23		395.73	395.09	395.80	
BH4A	527699	5512263	Clay/Bedrock	396.38	1.02	396.22	395.42	395.03	395.94		396.27	395.99	394.53	
BH5A	527800	5511717	Clay	389.07	0.87	388.31	387.98	387.87				387.97	387.07	
BH6D	526905	5511901	Clay/Basal Sand	394.25	0.88	393.93	393.24	393.14	393.20		392.95	392.81	392.34	
BH7A	526307	5511546	Clay/Basal Sand	390.28	0.64	389.64	388.99	388.73	389.02		388.38	389.01	388.85	
BH8A	528560	5511072	Basal Sand/Bedrock	388.63	0.85	384.73	384.03	383.91	383.94	383.63		383.33		382.81

Notes:
1. Coordinates in NAD 83, UTM Zone 15N
2. Groundwater levels shaded in grey used for groundwater model calibration
3. Groundwater levels italicized when water is at surface/hole is flowing

Table 5.6.2.3-1b: 2013/2014 Groundwater Monitoring Data

2014 Geotechnical Holes Shallow Standpipes						Groundwater Levels[2,3]
	Easting[1] (m)	Northing[1] (m)	Screened Units	Surface Elevation (masl)	Stick Up (m)	1/5/14 (masl)
BH14-03	529660	5513406	Silty Sand (top Sand-Clay/Silt-Sand)	411.87	0.17	411.57
BH14-05	528946	5513426	Silty Sand (top Sand-Clay/Silt-Sand)	406.64	0.31	406.41
BH14-11	529025	5512091	Clay	392.35		*392.35*
BH14-21	528280	5512927	Clay	397.65		*397.65*

Notes:
1. Coordinates in NAD 83, UTM Zone 15N
2. Groundwater levels shaded in grey used for groundwater model calibration
3. Groundwater levels italicized when water is at surface/hole is flowing

Table 5.6.2.3-1c: 2013/2014 Groundwater Monitoring Data

Exploration Boreholes (all in bedrock)								Groundwater Levels[2,3]						
	Easting[1] (m)	Northing[1] (m)	BH Length (m)	BH Dip (Degrees[4])	Azimuth (Degrees[5])	Surface Elevation (masl)	Stick Up (m)	21/3/12 (masl)	25/3/13 (masl)	12/4/13 (masl)	6/5/13 (masl)	27/5/13 (masl)	17/6/13 (masl)	5/7/13 (masl)
TL10,104	527173	5511648	321	-70	360	396.00	0.2		395.63	395.65	395.72	394.98	394.74	393.62
TL11,125	528124	5511753	411	-64	309	394.74	0.5		390.75	390.81	392.41	392.16	392.02	391.52
TL11,142	528352	5511909	447	-69	360	394.87	1.0	392.93	392.26	392.30	393.52	393.38	393.38	393.06
TL11,154	528389	5512010	249	-64	360	396.32	1.1	394.62	392.87	392.96	394.52	394.48	394.49	393.11
TL11,155	528342	5511720	585	-67	311	393.00	1.1		*394.13*	393.76	*394.13*	*394.13*	*394.13*	*394.13*
TL11,196	527396	5511608	429	-65	350	395.89	0.2		391.86	392.10	394.37	394.71	394.58	393.83
TL13,320	527521	5511892	123	-44	360	390.90	1.4		391.87	391.78	*392.27*	*392.27*	*392.27*	*392.27*
TL13,336	527910	5512018	105	-44	360	396.10	1.1		393.54	393.70		395.51	395.53	394.86
TL220	528302	5512035	66	-45	360	396.09	0.8		393.77	393.59	394.63	394.71	394.58	394.21

Notes:
1. Coordinates in NAD 83, UTM Zone 15N
2. Groundwater levels shaded in grey used for groundwater model calibration
3. Groundwater levels italicized when water is at surface/hole is flowing
4. Measured from ground surface
5. Measured from north

Table 5.6.2.4-1: Groundwater Quality

Station Name	Easting[1]	Northing[1]	Date	pH	Conductivity (µS/cm)	Total Ammonia As N (mg/L)	Dissolved Chloride (mg/L)	Nitrate As N (mg/L)	Nitrite As N (mg/L)	Nitrate + Nitrite As N (mg/L)	Sulphate (mg/L)	Alkalinity as $CaCO_3$ (mg/L)	Acidity as $CaCO_3$ (mg/L)	Total Cyanide (mg/L)	Hardness as $CaCO_3$ (mg/L)
BH1A	528742	5513247	11-Jun-13	6.88	319	< 0.020	48	0.33	< 0.020	0.33	18.3	63	24.8	< 0.0020	124
			10-Jul-13	6.84	339	< 0.020	49.6	0.304	< 0.020	0.304	21.5	73.1	15	< 0.0020	122
			14-Aug-13	7.14	321	< 0.020	48	0.22	< 0.020	0.22	20.1	61.2	11	< 0.0020	121
			17-Oct-13	6.79	321	< 0.020	46.6	0.153	< 0.020	0.153	21.7	66.9	19	< 0.0020	105
			28-Nov-13	6.79	306	< 0.020	46.5	0.104	< 0.020	0.104	18.8	60	15	< 0.0020	117
			19-Dec-13	6.8	316	< 0.020	46.2	0.066	< 0.050	0.066	14.7	65	12	< 0.0020	114
BH2A	529967	5512940	11-Jun-13	7.38	475	0.288	26.2	0.065	< 0.020	0.065	51.4	160	21.2	< 0.0020	231
			10-Jul-13	6.83	475	0.105	34.5	< 0.030	< 0.020	< 0.030	57.2	138	18	< 0.0020	219
			14-Aug-13	7.14	451	0.327	36.5	< 0.030	< 0.020	< 0.030	58	114	9	< 0.0020	203
			17-Oct-13	6.97	487	0.0999	45.9	< 0.030	< 0.020	< 0.030	75.1	98.9	22	< 0.0020	199
			28-Nov-13	6.84	494	0.195	51.7	< 0.030	< 0.020	< 0.030	86.6	94	18	< 0.0020	222
			19-Dec-13	6.95	555	0.106	59.6	< 0.050	< 0.050	< 0.050	101	77	8	< 0.0020	224
BH3 A-D	529308	5512354	11-Jun-13	8.11	356	0.237	6.33	< 0.030	< 0.020	< 0.030	30.2	1270	3.4	< 0.0020	314
			10-Jul-13	7.59	379	0.209	0.33	0.128	< 0.020	0.128	4.76	239	10	< 0.0020	203
			14-Aug-13	8.19	359	0.181	6.87	< 0.030	< 0.020	< 0.030	29.6	156	3	< 0.0020	172
			17-Oct-13	8	353	0.309	6.76	< 0.030	< 0.020	< 0.030	29.8	160	4	< 0.0020	154
			28-Nov-13	8.02	334	0.349	6.33	< 0.030	< 0.020	< 0.030	27.7	158	6	< 0.0020	178
			19-Dec-13	8	376	0.042	6.8	< 0.050	< 0.050	< 0.050	27.7	160	2	< 0.0020	177
BH3 A-S	529308	5512354	11-Jun-13	7.8	323	0.051	0.37	0.151	< 0.020	0.151	3.8	174	11.2	< 0.0020	169
			10-Jul-13	8.03	371	0.257	7.15	< 0.030	< 0.020	< 0.030	30.4	309	3	< 0.0020	186
			14-Aug-13	7.81	294	0.024	0.49	0.165	< 0.020	0.165	3.34	152	3	< 0.0020	156
			17-Oct-13	7.65	371	0.111	0.24	0.14	< 0.020	0.14	4.14	190	10	< 0.0020	175
			28-Nov-13	7.45	341	0.084	1.11	0.185	< 0.020	0.185	4.07	217	6	< 0.0020	200
			19-Dec-13	7.7	500	< 0.020	< 2 .0	< 0.105	< 0.050	< 0.105	4.7	251	7	< 0.0020	220
BH4A	527596	5512426	11-Jun-13	7.48	376	0.03	0.56	0.177	< 0.020	0.177	35.3	161	5	< 0.0020	159
			10-Jul-13	7.22	347	0.262	0.91	0.031	< 0.020	0.031	35	155	15	< 0.0020	168
			14-Aug-13	7.63	343	0.049	0.3	< 0.030	< 0.020	< 0.030	33.9	146	15	< 0.0020	170
			17-Oct-13	7.54	326	0.096	0.27	< 0.030	< 0.020	< 0.030	28	149	10	< 0.0020	140
			28-Nov-13	7.21	313	0.058	0.33	< 0.030	< 0.020	< 0.030	34.9	141	15	< 0.0020	143
			19-Dec-13	7.39	359	0.027	< 2 .0	< 0.050	< 0.050	< 0.050	34.2	152	9	< 0.0020	155
BH5A	527,794	5,511,715	11-Jun-13	7.71	486	0.346	0.91	< 0.030	< 0.020	< 0.030	17	430	15.2	< 0.0020	255
			10-Jul-13	7.7	517	0.362	3.54	< 0.030	< 0.020	< 0.030	18.1	593	12	< 0.0020	269
			14-Aug-13	7.82	503	0.322	0.76	< 0.030	< 0.020	< 0.030	17.5	264	11	< 0.0020	258
			17-Oct-13	7.6	506	0.42	0.52	< 0.030	< 0.020	< 0.030	19.4	276	12	< 0.0020	252
			28-Nov-13	7.57	499	0.394	0.52	< 0.030	< 0.020	< 0.030	19.9	274	10	< 0.0020	264
			19-Dec-13	7.67	538	0.326	< 2 .0	< 0.050	< 0.050	< 0.050	19.6	286	9	< 0.0020	267
BH6 D	526,907	5,511,924	11-Jun-13	7.77	393	0.119	0.94	0.619	< 0.020	0.619	24.2	2160	25	< 0.0020	301
			10-Jul-13	7.77	254	0.197	0.69	0.087	< 0.020	0.087	4.68	313	6	< 0.0020	116
			14-Aug-13	7.98	331	0.246	0.51	0.114	< 0.020	0.114	5.24	175	6	< 0.0020	133

Table 5.6.2.4-1: Groundwater Quality (continued)

Station Name	Easting[1]	Northing[1]	Date	pH	Conductivity (µS/cm)	Total Ammonia As N (mg/L)	Dissolved Chloride (mg/L)	Nitrate As N (mg/L)	Nitrite As N (mg/L)	Nitrate + Nitrite As N (mg/L)	Sulphate (mg/L)	Alkalinity as $CaCO_3$ (mg/L)	Acidity as $CaCO_3$ (mg/L)	Total Cyanide (mg/L)	Hardness as $CaCO_3$ (mg/L)
			17-Oct-13	7.9	225	0.115	0.41	0.1	< 0.020	0.1	4.58	99.3	15	< 0.0020	89.8
			28-Nov-13	7.25	228	0.098	0.53	0.205	< 0.020	0.205	6.99	100	14	< 0.0020	201
			19-Dec-13	7.43	255	0.17	< 2.0	0.244	< 0.050	0.244	7.8	158	5	< 0.0020	109
BH7A	526,298	5,511,547	11-Jun-13	8.14	540	0.255	0.29	0.037	< 0.020	0.037	8.57	671	11.8	< 0.0020	304
			10-Jul-13	7.77	457	0.203	0.64	< 0.030	< 0.020	< 0.030	12.2	1810	11	< 0.0020	245
			14-Aug-13	7.98	434	0.203	0.44	0.099	< 0.020	0.099	11.4	228	7	< 0.0020	175
			17-Oct-13	7.89	393	0.317	0.41	0.056	< 0.020	0.056	13.5	237	7	< 0.0020	222
			28-Nov-13	7.77	311	0.266	0.47	< 0.030	< 0.020	< 0.030	13.6	167	6	< 0.0020	182
			19-Dec-13	7.75	338	0.314	< 2 .0	< 0.050	< 0.050	< 0.050	14.1	169	4	< 0.0020	161
BH8A	528520	5,511,143	11-Jun-13	7.76	561	0.054	< 0.10	0.061	< 0.020	0.061	1.01	335	19	< 0.0020	318
			10-Jul-13	7.42	593	0.026	0.18	0.049	< 0.020	0.049	1.76	324	22	< 0.0020	327
			14-Aug-13	7.73	572	0.026	0.17	0.045	< 0.020	0.045	0.94	313	24	< 0.0020	334
			17-Oct-13	7.39	568	0.083	< 0.10	0.041	< 0.020	0.041	0.83	340	47	< 0.0020	301
			28-Nov-13	7.27	535	0.022	0.15	0.033	< 0.020	0.033	0.81	329	23	< 0.0020	313
			19-Dec-13	7.36	603	< 0.020	< 2.0	< 0.050	< 0.050	< 0.050	< 2.0	354	16	< 0.0020	302

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

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

5.6.3.1 Geology

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

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

5.6.3.2 Aquifer Characteristics

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

A total of six boreholes were tested in this way, with each borehole being tested over between five to nine intervals. The estimated bedrock hydraulic conductivities that resulted from the packer testing in the existing exploration boreholes ranged from 2E-06 m/s near the surface due to weathering and fracturing of the bedrock, down to 1E-08 m/s, decreasing with depth. The exception was within the central mineralized zone where hydraulic conductivity values were in the order of 1E-07 m/s. This coincided with anecdotal information from the construction of the portal which indicated that groundwater flow was associated with the mineralized zones.

A summary of the packer test results averaged over the length of the individual boreholes is provided in Table 5.6.3.2-1.

Table 5.6.3.2-1: Hydraulic Conductivity Summary of Bedrock Units

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

The locations of the boreholes in which packer testing was conducted is shown in Figure 5.6.2.1-1 displays. The table in Appendix D of the *Hydrogeological Pre-Feasibility/EA Support Study Goliath Project, AMEC Environment & Infrastructure,* August, 2014 provides additional details relating to the individual rising head tests performed.

5.6.3.3 Groundwater Flow

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

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

During excavation of the exploration ramp at the proposed mine site, few seeps were encountered, most of which contained a limited volume of water which drained out in 24 to 48 hours. Within the mineralized zone, increased groundwater inflow was noted; however this was readily controlled through pumping to small (20 m^2) on-site settling ponds.

5.6.3.4 Groundwater Quality

Groundwater samples have not been collected from any of the bedrock exploration wells for laboratory analysis so no information is available relating to water quality in the bedrock unit at the site.

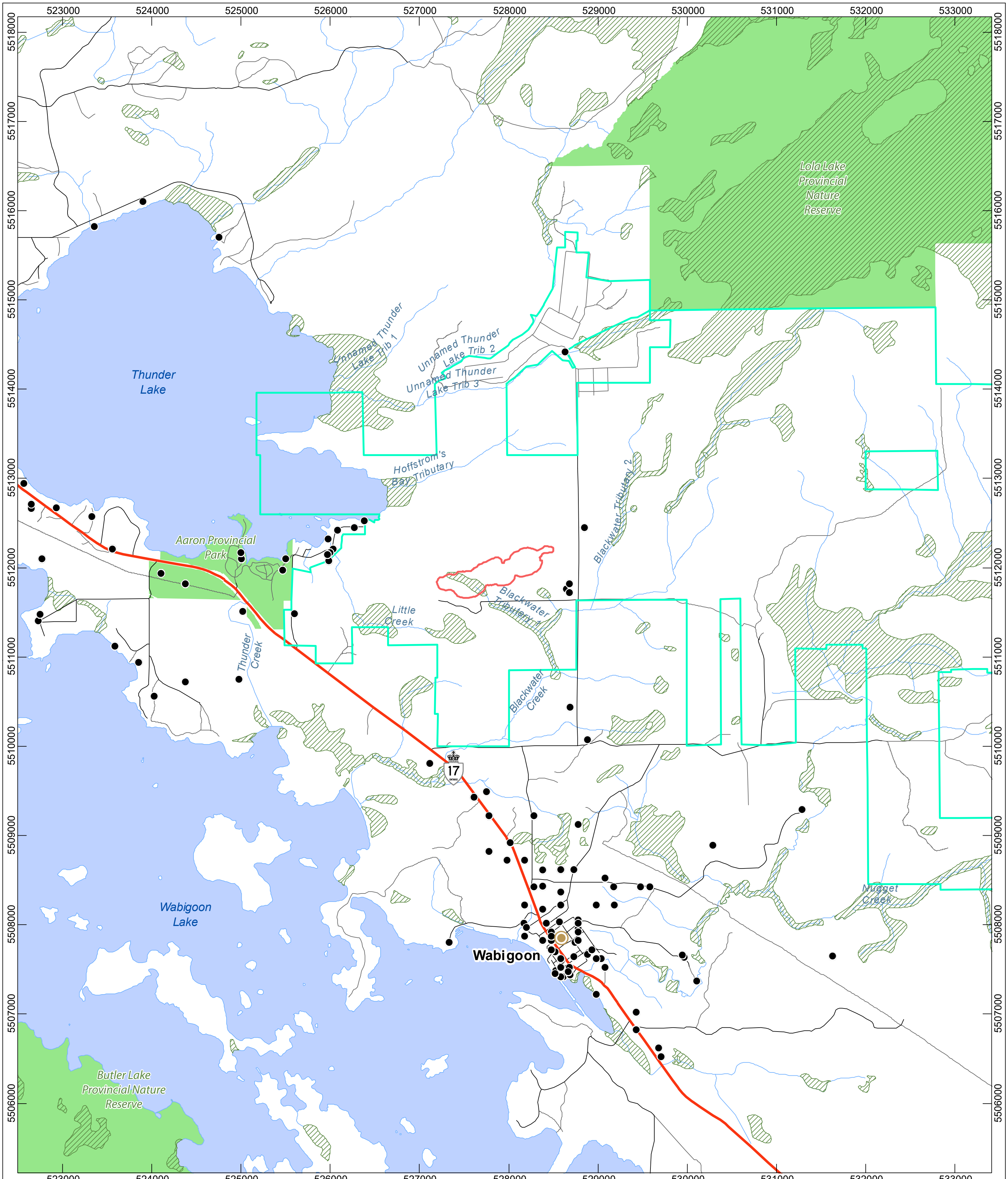
5.6.4 Groundwater Development

Groundwater development has occurred in the western and southern portions of the study area, primarily for private residential use, with approximately 140 well records identified for the area within 5 km of the proposed mine site. This development is concentrated to the south, in the vicinity of the community of Wabigoon, and to the east, along the shoreline of Thunder Lake. There are also a few wells are located in the central portions of the study area, as shown in Figure 5.6.4-1. These wells are completed in each of the potential water bearing zones, with the majority of the well development (70%) being in the shallow bedrock, to depths of up to 25 m below grade, and the remaining wells being completed in the overburden units with depths ranging from 7 m to 15 m below grade. Most of these overburden wells have been completed in the outwash sand and gravel deposits in the area around Thunder Lake.

5.6.5 Conceptual Hydrogeological Model

Based on data collected during 2012 to 2014, it appears that there is limited groundwater flow that provides a minimal contribution to creeks in the vicinity of the project site and across much of the project area.

There have been five hydro stratigraphic units identified during the investigation that contribute to the surface water interaction in the watershed and the shallow groundwater flow patterns in the project area. These five units are described in the following:



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA		SCALE: 55 000	Populated Area	Arterial Road
		TREASURY METALS INC.	Private MOE Water Well	Highway
PRIVATE WATER WELLS AND SURFACE WATER FEATURES		*DESIGN: AT 06 FEB. 2014* *GIS: AT 10 OCT. 2014* *CHECK: AT 10 OCT. 2014*	Proposed Open Pit Shell	Local Road
			Property Boundary	Recreational Road
			Wetland	Waterbody
				Provincial Park
FIGURE 5.6.4-1	REV.00			Watercourse

0 500 1,000 1,500
Meters

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

1. A clay unit consisting of fine grained glaciolacustrine deposits of dominantly clay composition (clay, silty clay, layered clay and silt) that is located around the project site and creating the main unit of the southern project area. This clay unit acts as an aquitard that provides little to no flow to creeks in the area.
2. A Basal sand unit which is a relatively thin discontinuous sand layer beneath the clay unit approximately 3 m to 4 m thick where present. This unit acts as a minor aquifer with a hydraulic conductivity of approximately 1E-06 m/s that provides limited groundwater flow.
3. Bedrock knolls where bedrock outcrops at the surface or has a very thin sand cover and therefore contains no overburden groundwater.
4. A sand-clay/silt-sand unit consisting mainly of silty sand overlying a mainly continuous silty clay above the basal sand unit. This unit is mainly found in the northwestern portion of the Blackwater Creek Watershed (near the top of Blackwater Tributary #2). This silty sand does provide some groundwater flow to Blackwater Creek and likely has a hydraulic conductivity similar to the basal sand.
5. A sand and gravel unit consisting of coarse glacial deposits located on the northern and northeastern edge of the project area. This unit provides the most groundwater flow to the unnamed tributaries leading to Thunder Lake.

The data collected from 2012 to 2014, appears to indicate that most of the groundwater flow with the project site follows the topography with greatest flow rates present along the contact between the upper weathered/fractured bedrock and basal sand units with groundwater flow rates being much lower in the deeper bedrock. There were four hydro stratigraphic units identified during the investigation in the bedrock:

1. The shallow bedrock unit occurring within the initial 10 m from the bedrock surface where a bulk hydraulic conductivity of 1E-06 m/s was recorded due to the near surface fractures and weathering.
2. The intermediate bedrock unit present from approximately 10 mbg to around 400 mbg where a range of bulk hydraulic conductivity of 1E-07 m/s to 1E-08 m/s was recorded.
3. The deep bedrock unit present below 400 mbg where there are very few fractures and low hydraulic conductivities of approximately 1E-09 m/s.
4. The deformation zone of the central unit – this unit is a steeply inclined zone occurring in all of the shallow, intermediate and deep bedrock units and likely has hydraulic conductivities up to an order of magnitude higher in the units that are not affected by near surface weather - the intermediate and deep bedrock.

5.6.6 Traditional Knowledge

The Wabigoon Lake Ojibway Nation indicated that:

- Wabigoon residents use wells for drinking water, and lakeshore residents use Wabigoon Lake and Thunder lake for drinking water; and
- Natural springs and artesian conditions wells are common throughout the regional study area and possibly the Project site.

Members of the Wabigoon Lake Ojibway Nation and the Aboriginal People of Wabigoon have expressed that they are particularity interested in seasonal flow measurement, ground and surface water interactions into Blackwater Creek, and the potential for groundwater contamination from effluent discharge from the project. These communities are also interested in potential effects of the project on artesian groundwater wells which have been stated to flow at 299.8 m³/d (55 gal/min) and that the water comes out at 8.3ºC (47ºF).

In addition, Treasury Metals is aware that members of Eagle Lake First Nation are concerned about the impact on groundwater quality in the event that seepage were to infiltrate the groundwater from the tailings storage facility. Wabauskang First Nation has also communicated concerns regarding groundwater seepage.

5.7 Surface Hydrology

The Project is located near two lakes (Thunder Lake and Wabigoon Lake) into which the watersheds affected by the Project flow. Wabigoon Lake is located to the south of the areas affected by the Project and Thunder Lake is located to the west of the properties affected by the Project (Figure 5.7-1).

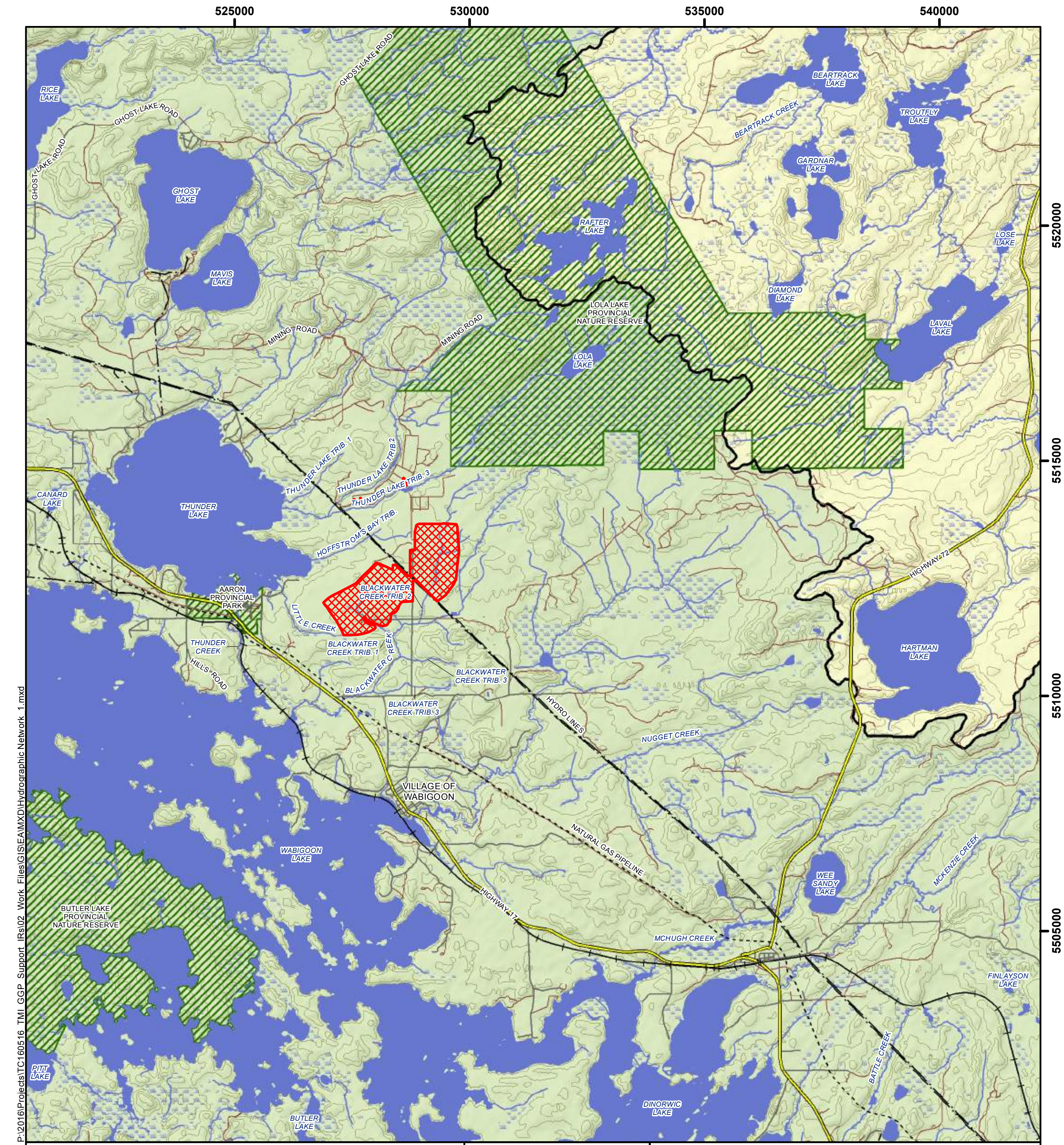
5.7.1 Baseline Hydrologic Data

The primary source of baseline hydrologic information relied on in the EIS is the report prepared by DST Consulting Engineers (DST 2014d) included as Appendix N. Detailed methodologies used to assess the hydrology of the Project area can be found in Appendix N. This baseline work built on the earlier investigations by Klohn Crippen Berger (KCB 2012).

Hydrological baseline studies conducted included hydrological monitoring measurements of stream flow at up to eight locations (hydrometric stations) within the local study area (LSA) dating back to November 2010. Four automatic stream water level logging devises were installed in March 2011 and an additional three were installed in 2012 in order to record stream (Figure 5.7-2).

Hydrometric monitoring stations were located as follows:

- The largest sub-watershed within the study area which discharges into Wabigoon Lake was monitoring by hydrometric stations TL1A, JCTA and TL3 located on Blackwater Creek.



LEGEND

- Operations Area
- Railway
- Hydro Line
- Natural Gas Pipeline
- Highway
- Local Street
- Resource / Recreation Trail
- Provincial Park
- Watercourse
- Waterbody
- Contours (10 m interval)

Tertiary Watershed

- Upper English
- Wabigoon

0 1 2 4 6 8 10 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

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Hydrographic Network in the Goliath Gold Project Area

PROJECT N^{o}: TC160516	**FIGURE: 5.7-1**
SCALE: 1:110,000	DATE: April 2018

- Hydrometric station HS4 was installed contributed monitoring data from the second largest sub-watershed located on unnamed tributary 2 of Thunder Lake.
- Hydrometric station HS7 was installed on the north branch of unnamed tributary to Thunder Lake. Hydrometric station HS5 was installed on Hoffstrom Bay Tributary in the fourth largest sub-watershed.
- Hydrometric station HS6 was installed on unnamed tributary 3 of Thunder Lake in the smallest of the sub-watersheds in the project area.

A summary of the average daily during 2012 and 2013 from each of the hydrometric stations can be found in Table 5.7-1.

Table 5.7-1: Average Daily Discharge, 2012 to 2013

Site	2012			2013		
	Min	Max	Mean	Min	Max	Mean
TL1A	0.1	173.3	27.0	9.6	356.3	53.0
TL3	2.7	81.4	17.2	19.9	100.6	66.2
HS4	13.1	77.2	26.8	26.5	569.2	111.6
HS5	0.4	6.2	1.9	0.003	46.6	1.9
HS6	9.2	12.5	10.6	0.1	22.0	3.6
HS7	19.7	127.7	53.0	15.2	791.6	91.0
JCTA				16.1	930.9	85.1

Note:

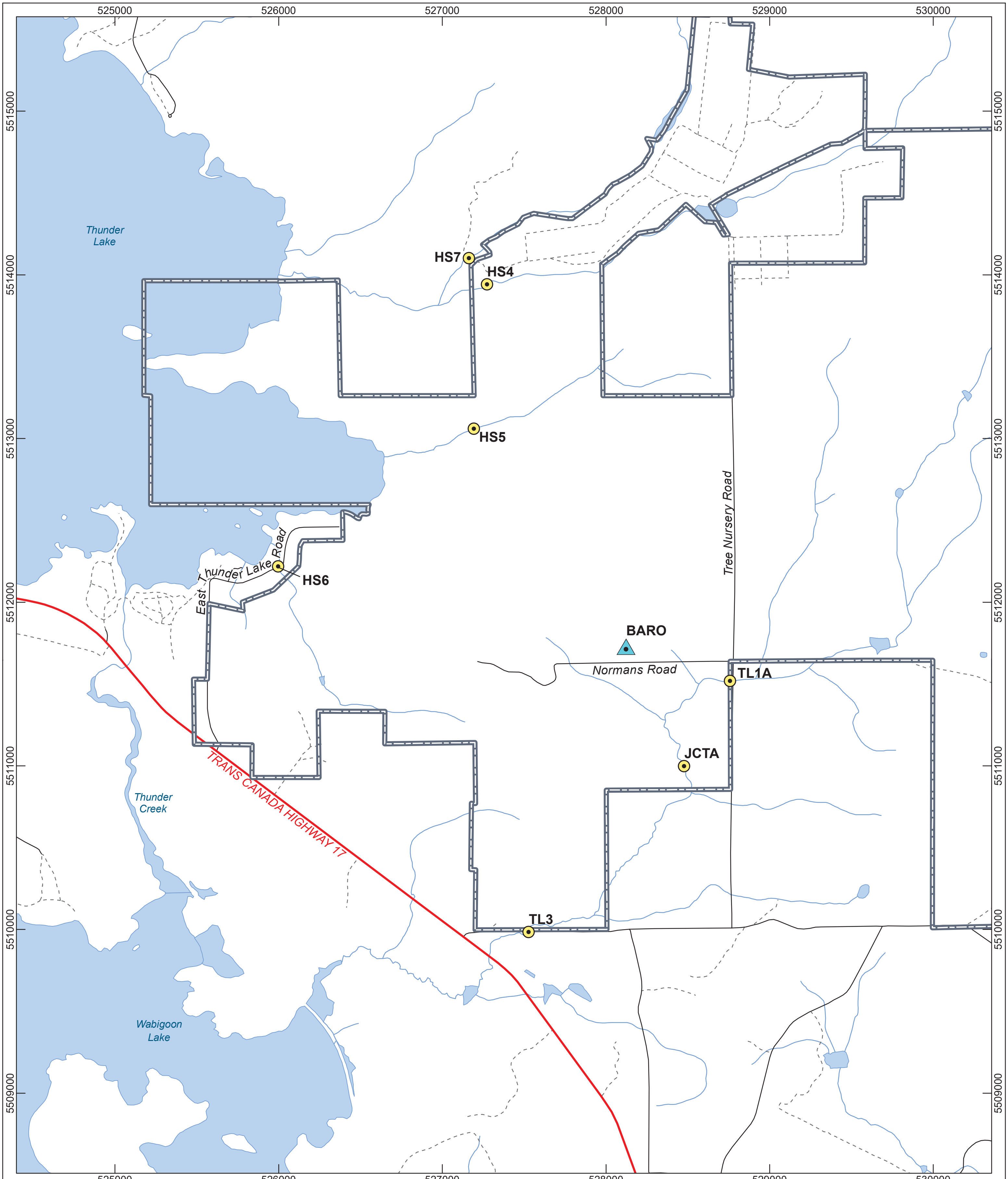
Average daily discharges are reported in L/s

Dryden Airport weather station recorded precipitation data and indicated significant amounts of rainfall in July, August and October 2012 and May, July, September and October in 2013 which generally corresponds to the maximum average daily discharges at several of the hydrometric stations.

Discharge data obtained from Environment Canada that was recorded at the Wabigoon River hydrometric monitoring station indicated the spring freshet occurring in April 2013.

Discharge yields from each of the sub-watersheds were compared and the higher discharge yields were observed at hydrometric stations TL1A, TL3, HS6 in 2012 and at JCTA and TL3 in 2013. The highest discharge yields observed were as follows:

- In 2012 were 26 L/s/km^2 (TL1A), 26 L/s/km^2 (TL3) and 12 L/s/km^2 (HS6); and
- In 2013 were 567 L/s/km^2 (JCTA) and 36 L/s/km^2 (TL3).



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	SCALE: 30000 *TREASURY METALS INC.*	**LEGEND** Barometer Location Hydrostation Location Local Study Area Property Boundary Expressway / Highway Local Resource / Recreation Waterbody Watercourse	N 0 250 500 750 Meters
Hydrostation and Barometer Locations	*DESIGN: AT 06 FEB. 2014* *GIS: AT 26 FEB. 2014* *CHECK: MP 14 MAR. 2014* *REVIEW: KB 14 MAR 2014*		TREASURY METALS Inc. ***REFERENCE*** *Data by Treasury Metals Inc.* *and DST Consuting Engineers* *Projection: NAD83 UTM Zone 15N*
FIGURE: 5.7-2 REV.01			

5.7.2 Traditional Knowledge

No specific information has been shared with Treasury Metals with respect to surface hydrology. However, Treasury Metals is mindful that members of a number of the Indigenous communities have expressed concerns over how potential changes in water volume or flow patterns may impact fish and fish habitat, and other traditional land uses such as wild rice as a result of the Project.

5.8 Aquatic Resources

The aquatic resources of the Project area, as described below, have been adapted from various reports prepared to support the EIS. The first of these was prepared by Klohn Crippen Berger (2012), and represent a broadly based evaluation of the existing environmental conditions. This report was included as Appendix G to the original EIS, but has been largely replaced by subsequent studies completed since 2012. Where information from the KCB (2012) report are still relied on in the EIS, the information has been incorporated into subsequent studies. Specifically, Appendix Q (Summary Fisheries Baseline Report [2011 to 2016]) to the revised EIS consolidates the fisheries information used from KCB (2012), the baseline fisheries information compiled by DST Consulting Engineers (included as Appendix Q to the original EIS), as well as additional fisheries work completed since the filing of the EIS. The surface water quality information is derived from the sampling work completed in 2012/2013 by DST (Appendix P to the revised EIS). The baseline sediment data are compiled from the following thee sources:

- Sediment sampling work completed in 2012 by DST (Appendix P to the revised EIS);
- Sediment sampling completed in 2011 by KCB (2012); and
- Sediment sampling completed in 1997 by NAR Environmental Consultants (NAR 1997), as presented by KCB (2012).

5.8.1 Surface Water Quality

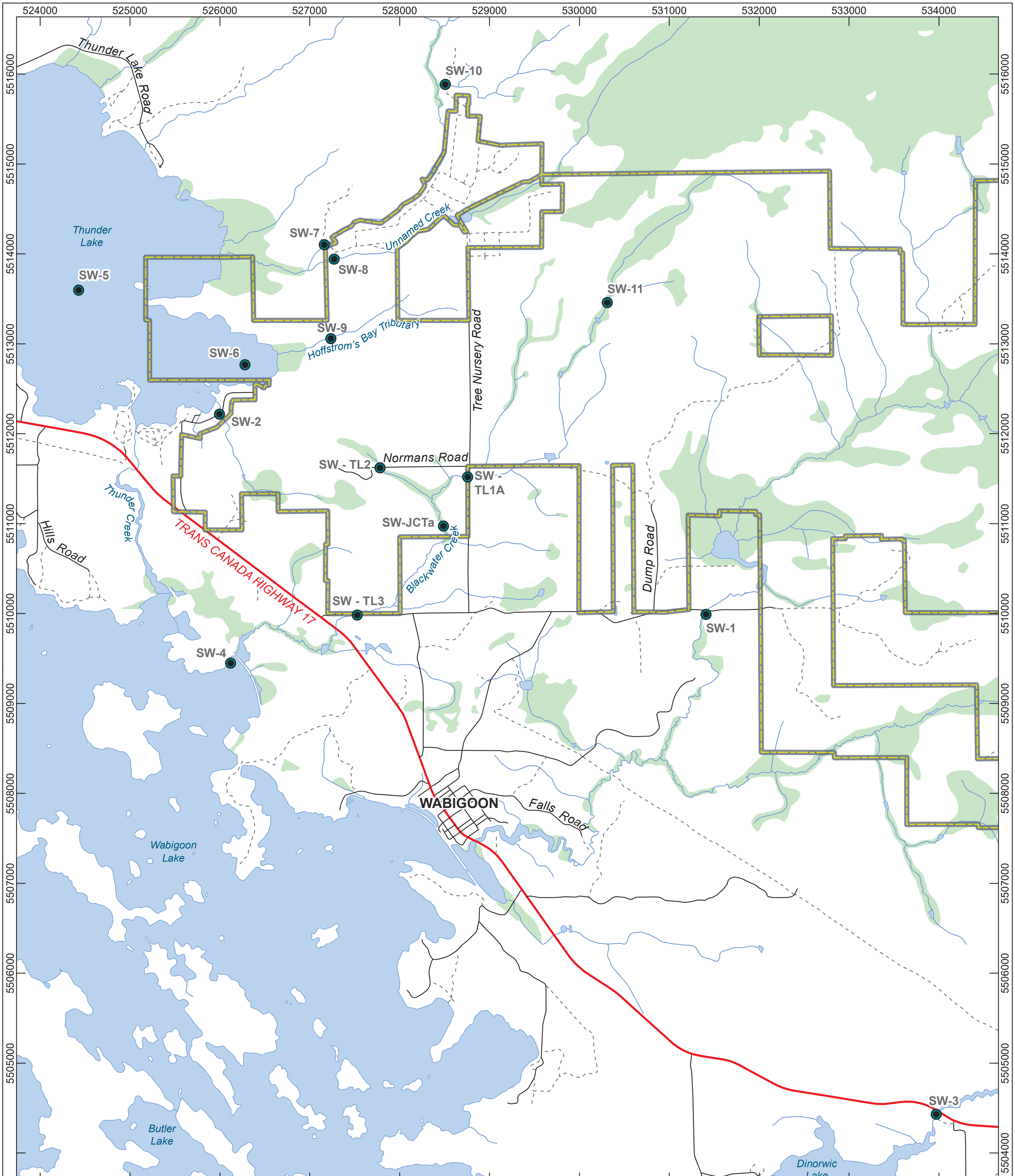
More than two years of surface water quality samples have been collected in or near the Project area beginning November 2010 (KCB 2012) and again in 2012/2013. Sites were initially selected to capture pre-development site conditions and, during the planning process, considered the distribution of catchments, creeks, rivers, and other waterbodies to characterize the spatial and/or temporal variability in water chemistry (KCB 2012). The 2010/2011 survey identified sample locations in the local study area (LSA) that included Blackwater Creek, which is of concern because it is the primary watercourse draining the proposed Project. Blackwater Creek drains into the Wabigoon Lake Watershed. The larger regional study area (RSA) also included areas of Blackwater Creek, Hughes Creek, and Thunder Lake sub-catchment and their associated tributaries. Also during the 2010/2011 survey, a far-field station (SW3 at McHugh Creek and Highway 17) was sampled to capture information in a catchment that will not likely be impacted by mining developments as planned at the time of study.

Following the 2010/2011 survey, the specific location of sampling sites evolved as additional information about the Project footprint was developed. Nine locations were added and three locations were discontinued during the 2012/2013 sampling program. Additional sites include tributaries to Thunder Lake and locations along Blackwater Creek. A summary of water quality sampling locations and for all sample years is provided in Table 5.8.1-1 and Figure 5.8.1-1.

Table 5.8.1-1: Location and Dates for Surface Water Sample Collection

Station	Description and Purpose	Sample Year	
		2010/2011	2012/2013
TL1	Located at a crossing of Norman's Road on Blackwater Creek and captures runoff upstream of the project site on Blackwater Creek	Yes	
TL1a	Located below the confluence of Blackwater Tributary 2 and Blackwater Creek		Yes
TL2	Located downstream of a roadway and beaver dam downstream of the unnamed tributary of Blackwater Creek south of the Project site. This station collects runoff from the Project site which drains southward	Yes	Yes
TL2a	Located downstream of Station TL2 is a stand of poplar trees. This Station was established to collect runoff from the Project Site	Yes	
TL3	Located at the crossing of Blackwater Creek and Anderson Road and captures runoff from the Project site including potential upstream influences to the east	Yes	Yes
JCT	Located at confluence of Blackwater Creek and the unnamed tributary immediately south of the Project site	Yes	
JCTa	Located downstream of the confluence of Blackwater Creek and the unnamed tributary south of the Project site	Yes	Yes
SW1	Located on Hughes Creek at the Anderson Road crossing. This was established as a local reference station	Yes	Yes
SW2	Located at the culvert crossing under Thunder Lake Road on the unnamed tributary to Thunder Lake southwest of the Project site. This location captures sample runoff from the LSA to the west	Yes	Yes
SW3	Located on McHughes Creek at the Hwy 17 crossing was established as a regional reference site. Samples are taken downstream of the box culvert	Yes	Yes
SW4	SW4 is the field duplicate station and rotates locations with the schedule	Yes	Yes
SW5	Located in the eastern end of Thunder Lake		Yes
SW6	Located in the southeast end of Thunder Lake. This area captures water coming into the lake from Hoffstrom's Bay Tributary		Yes
SW7	Located along Thunder Lake Tributary 2		Yes
SW8	Located along Thunder Lake Tributary 3		Yes
SW9	Located along Hoffstram's Bay Tributary prior to confluence with Thunder Lake.		Yes
SW10	Located along an unnamed tributary to Thunder Lake Tributary 2		Yes
SW11	Located along Blackwater Creek, upstream from Norman's Road		Yes

At each surface water sampling site, in situ field measurements included: water and air temperature, pH, conductivity, total dissolved solids, dissolved oxygen, and turbidity. Oxidation reduction potential was measured during 2012/2013 only. Samples were also collected and analyzed for physical and inorganic parameters, as well as total and dissolved metals (Table 5.8.1-2). Detailed sampling protocols and analytical methods are provided in Appendix P.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

SURFACE WATER QUALITY SAMPLING LOCATIONS

FIGURE: 5.8.1 | REV.01

SCALE: 55000

TREASURY METALS INC.

DESIGN: AT 06 FEB. 2014
GIS: AT 25 FEB. 2014
CHECK: AT 17 OCT. 2014

LEGEND

- Surface Water Quality Sampling Location
- Property Boundary
- Waterbody
- Watercourse
- Arterial
- Expressway / Highway
- Local
- Resource / Recreation
- Wetland

N

0 500 1,000
Meters

TREASURY METALS Inc.

REFERENCE
Data by Treasury Metals Inc.
Projection: NAD83 UTM Zone 15N

Table 5.8.1-2: Water Quality Parameters Measured

Analysis	Parameter	Sample Year	
		2010/2011	2012/2013
Conventional	pH	Yes	Yes
	Temperature	Yes	Yes
	Dissolved oxygen	Yes	Yes
	Conductivity	Yes	Yes
	Alkalinity	Yes	Yes
	Hardness (as $CaCO_3$)	Yes	Yes
	Oxidation-reduction Potential		Yes
	Total Suspended Solids (TSS)	Yes	Yes
Anions and Nutrients	Acidity (as $CaCO_3$)	Yes	Yes
	Ammonia, total (as N)	Yes	Yes
	Chloride (Cl)	Yes	Yes
	Nitrate-N (NO_3-N)	Yes	Yes
	Nitrite-N (NO_2-N)	Yes	Yes
	Phosphorus, total (TP)	Yes	Yes
	Sulphate (SO_4)	Yes	Yes
Other	Oil and Grease	Yes	
Cyanides	Cyanide, weak acid dissociable	Yes	Yes
	Cyanide, total	Yes	Yes
	Cyanide, free	Yes	Yes
Metals, total and dissolved	Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Sb, Se, Si, Sn, Sr, Te, Ti, Tl, U, V, W, Zn, Zr		Yes

There are two surface waterbodies in the LSA/RSA that are known to be sources for potable water: Wabigoon Lake and Thunder Lake. Wabigoon Lake provides raw water for the City of Dryden and some residences along the shore. The City of Dryden provides water treatment prior to distribution. Some residences along the shore of Thunder Lake draw water for residential use. As these are private dwellings it is unknown whether secondary treatment is conducted.

5.8.1.1 Quality Assurance/Quality Control

Details on blind field duplicate, trip blanks and field blanks were collected during each sampling event and submitted to the laboratory as part of a quality assurance/quality control (QA/QC) program.

5.8.1.2 Water Quality Regulatory Information

The results of inorganics and dissolved and total metals surface water analyses were compared to the Ministry of Environment and Energy Provincial Water Quality Objectives (PWQO) for the protection of aquatic life and recreation in freshwater (MOEE 1994) (Table 5.8.1.2-1). A firm objective for total phosphorus in surface water is not provided in the PWQOs; however, general guidelines are provided to avoid nuisance concentrations of algae in lakes, excessive plant growth, and general aesthetic deterioration.

Table 5.8.1.2-1: PWQO for Freshwater

Analysis	Parameter	Unit	PWQO
Inorganics	pH	n/a	6.5 – 8.5
	Phosphorus, total	mg/L	See note 1
	Cyanide, free	mg/L	0.002
Dissolved Metals	Aluminum (Al)	mg/L	0.075
	Mercury (Hg	mg/L	0.0002
Total Metals	Antimony (Sb)	mg/L	0.02
	Arsenic (As)	mg/L	0.005
	Beryllium (Be)	mg/L	0.011 – 1.1 (see note 2)
	Boron (B)	mg/L	0.2
	Cadmium (Cd)	mg/L	0.0001 – 0.0005 (see note 3)
	Cobalt (Co)	mg/L	0.0009
	Copper (Cu)	mg/L	0.005
	Iron (Fe)	mg/L	0.3
	Lead (Pb)	mg/L	0.001 – 0.005 (see note 4)
	Molybdenum (Mo)	mg/L	0.04
	Nickel (Ni)	mg/L	0.025
	Selenium (Se)	mg/L	0.1
	Silver (Ag)	mg/L	0.0001
	Thallium (Ti)	mg/L	0.0003
	Tungsten (W)	mg/L	0.03
	Uranium (U)	mg/L	0.005
	Vanadium (V)	mg/L	0.006
	Zinc (Zn)	mg/L	0.02

Notes:

1. For the ice-free period should not exceed 0.02 mg/L; a high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 0.01 mg/L or less. This should apply to all lakes naturally below this value; Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 0.03 mg/L.
2. Criteria is 0.011 mg/L if Hardness as $CaCO_3$ is = 75 mg/L; criteria is 1.1 mg/L if the sample hardness is >75 mg/L.
3. Criteria is 0.0001 mg/L if the sample hardness is = 0-100 mg/L; criteria is 0.0005 mg/L if the sample hardness is >100 mg/L.
4. Criteria is 0.001 mg/L if the sample hardness is 30 mg/L; criteria is 0.003 mg/L if the sample hardness is = 30-80 mg/L; criteria is 0.005 μg/L if the sample hardness is = >30-80 mg/L

5.8.1.3 Water Quality Results

A summary of the base water quality conditions has been provided in Table 5.8.3.1-1. The values in the table represent the 50th percentile of the available monitoring data available from the 2012/2013 monitoring program completed by DST (Appendix P). Of those watercourses and waterbodies, six (i.e., Blackwater Creek, Thunder Lake Tributary 2/3, Hoffstrom's Bay Tributary, Little Creek, Thunder lake, Wabigoon Lake) are potentially affected by the Project. Table 5.8.4.3-2 provides a summary of the baseline water quality by waterbody.

Table 5.8.1.3-1: Summary of Baseline Surface Water Quality Results

Parameter	SW-TL1a Blackwater Creek mg/L	SW-TL2 Blackwater Creek Tributary #1 mg/L	SW-TL3 Blackwater Creek mg/L	SW-JCTa Blackwater Creek mg/L	SW11 Blackwater Creek mg/L	SW1 Hughes Creek mg/L	SW2 Little Creek mg/L	SW3 McHughes Creek mg/L	SW4 Wabigoon Lake mg/L	SW5 Thunder Lake mg/L	SW6 Thunder Lake mg/L	SW7 Thunder Lake Tributary #2 mg/L	SW10 Thunder Lake Tributary #2 mg/L	SW8 Thunder Lake Tributary #3 mg/L	SW9 Hoffstrom's Bay Tributary mg/L
Aluminum	0.13700	0.31650	0.47000	0.17100	0.65400	0.06200	0.55500	0.07485	0.69150	0.01300	0.02100	0.10000	0.07180	0.06960	0.07805
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	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00115	0.00100	0.00100	0.00110	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00002	0.00003	0.00002	0.00002	0.00004	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0.44000	0.46000	1.67000	0.92000	0.44000	0.59000	1.21000	11.65000	3.23500	4.20000	4.21000	0.23000	0.24000	0.29500	0.38500
Chromium	0.00100	0.00205	0.00120	0.00100	0.00160	0.00100	0.00140	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00275	0.00077	0.00050	0.00050	0.00061	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00100	0.00480	0.00170	0.00100	0.00130	0.00100	0.00200	0.00100	0.00215	0.00115	0.00120	0.00100	0.00100	0.00110	0.00100
Cyanide	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Iron	1.90500	0.96550	1.05000	1.37000	1.70000	0.42750	1.01000	0.26150	0.45850	0.03250	0.03600	0.62000	1.28000	0.75600	0.36500
Lead	0.00100	0.00140	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
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	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00235	0.00200	0.00200	0.00200	0.00200	0.00210	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Nitrate	0.03000	0.03000	0.03000	0.04200	0.06300	0.03000	0.03900	0.03000	0.03000	0.03000	0.03000	0.12000	0.05800	0.10650	0.10050
Phosphorus	0.02240	0.04135	0.03110	0.02470	0.02450	0.00955	0.04720	0.01525	0.02360	0.00740	0.00770	0.01100	0.01060	0.01545	0.01055
Selenium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Silver	0.00010	0.00041	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00100	0.00185	0.00150	0.00100	0.00160	0.00100	0.00200	0.00100	0.00110	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Zinc	0.00305	0.00755	0.00440	0.00300	0.00640	0.00300	0.00500	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300
Alkalinity	34.10000	61.65000	57.80000	47.60000	6.00000	64.10000	63.30000	52.20000	—	45.90000	45.80000	50.00000	57.20000	68.70000	114.50000
Hardness	37.15000	66.95000	66.00000	57.00000	19.30000	63.65000	67.60000	55.50000	—	48.50000	48.00000	52.00000	60.00000	73.40000	116.00000
pH	6.81500	7.29500	7.42000	7.28500	5.76000	7.27500	7.56000	7.34000	7.68500	7.76000	7.76000	7.59000	7.54000	7.67000	7.87000

Table 5.8.1.3-2: Summary of Baseline Surface Water Quality by Waterbody

Parameter	Thunder Lake Tributaries 2 and 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

Field-measured pH was generally neutral with the occasional pH value below the PWQO for pH of 6.5 at TL1 (at 6.2) measured during the 2010/2011 survey. During the 2012/2013 survey, pH measurements were similarly neutral with several measurements below the PWQO at SW7 (one occurrence) and SW11 (eight occurrences). Measurements of pH at SW11 were below the MMER of 6.0 on six occurrences. Mean conductivity measured during the 2010/2011 survey ranged from 131 µS/cm at JCTa to 264 µS/cm at SW3 and from 23.6 µS/cm at SW7 to 450 µS/cm at SW3 in 2012/2013. Conductivity is a measurement of water's capacity to conduct electrical current which is positively correlated with increases in metal and salt content in water. Increased conductivity is common during spring runoff events as road salts applied during winter are washed away. Sites associated with the Project area with higher conductivity are more closely associated with or downstream roadways or infrastructure.

Laboratory results of samples collected during both surveys that exceeded PWQO are provided in Table 5.8.1.3-1. In general, PWQO exceedances were measured on at least one occasion for dissolved aluminum and total silver, cobalt, copper, iron, lead, selenium, zinc, and vanadium. Dissolved aluminum exceedances were found at TL1, TL2, TL3, JCTa, and SW2. Total cobalt exceedances were found at SW3, SW10, SW11, TL1a, TL2, TL2a, TL3, JCTa, and SW3. Total silver was exceeded in two of eight samples from TL2a. Dissolved aluminum exceeded PWQO at TL1, TL2, TL3, JCTa, and SW2. Total copper exceedances were found at TL1 (2010/2011) and SW1 (2012/2013); however, the measurement at TL1 is believed to be an outlier and the result from SW1 has a detection limit above the PWQO. Total iron exceedances were found at SW1, SW2, SW4, SW6, SW7, SW9, SW10, SW11, TL1, TL1a, TL2, TL2a, and JCTa. Total iron is often elevated in the Canadian Shield region of Ontario due to high iron presence in the bedrock and soils. One exceedance of total lead was found at TL2a as well as one exceedance of total selenium at JCTa. Exceedances of total zinc were found at SW3, SW7, SW9, SW10, SW11, and JCTa. One exceedance of vanadium was found at SW10.

Table 5.8.1.3-1: Surface Water PWQO Exceedances

Parameter	Station	Description of PWQO Exceedance (Range of Measurements)	
		2010/2011	2012/2013
pH	SW7	—	1 of 15 (6.24–7.95)
	SW11	—	8 of 9 (5.06–6.61)
	TL1	3 of 13 (6.2–7.41)	—
Total Phosphorus		See note 1	See note 2
Total Ag	TL2a	—	2 of 8 samples (0.00072–0.00083 mg/L)
Dissolved Al	**TL1**	12 of 13 samples (0.072–0.24 mg/L)	—
	TL2	5 of 13 (0.050–0.19 mg/L)	—
	TL3	1 of 13 samples (0.0050–0.11 mg/L)	—
	JCTa	2 of 13 samples (0.0098–0.11 mg/L)	—
	SW2	5 of 13 samples (0.033–0.15 mg/L)	—
Total Co	SW10	—	1 of 15 samples (0.00162 mg/L)
	SW11	—	1 of 9 samples (0.0011 mg/L)
	TL1	8 of 13 samples (0.00025–0.0030 mg/L)	—
	TL1a	—	8 of 16 samples (0.00216–0.00723 mg/L)
	TL2	6 of 13 samples (0.00025–0.0060 mg/L)	—
	TL2a	—	2 of 8 samples (0.00095–0.00103 mg/L)
	TL3	1 of 13 samples (0.00025–0.0016 mg/L)	—
	JCTa	3 of 13 samples (0.00025–0.0018 mg/L)	4 of 14 samples (0.0096–0.00314 mg/L)
	SW2	1 of 13 samples (0.00025–0.0015 mg/L)	—
	SW3	1 of 13 samples (0.00025–0.0016 mg/L)	—
Total Cu	TL2a	—	2 of 8 samples (0.0075–0.0087 mg/L)
	TL1	1 of 13 samples (0.00050–0.015 mg/L)	—
Total Fe	SW1	9 of 13 samples (0.21–1.3 mg/L)	11 of 16 samples (0.333–1.71 mg/L)
	SW2	11 of 13 samples (0.62–3.4 mg/L)	13 of 13 samples (0.658–2.34 mg/L)
	SW3	6 of 13 samples (0.064–3.0 mg/L)	4 of 14 samples (0.323–1.23 mg/L)
	SW4	—	8 of 10 samples (0.440–0.788 mg/L)
	SW6	—	1 of 9 samples (0.734 mg/L)
	SW7	—	14 of 15 samples (0.350–1.03 mg/L)
	SW9	—	9 of 14 samples (0.315–0.797 mg/L)
	SW10	—	15 of 15 samples (0.685–8.71 mg/L)
	SW11	—	9 of 9 samples (1.17–2.82 mg/L)

Table 5.8.1.3-1: Surface Water PWQO Exceedances (continued)

Parameter	Station	Description of PWQO Exceedance (Range of Measurements)	
		2010/2011	2012/2013
	TL1	13 of 13 samples (0.90–6.1 mg/L)	—
	TL1a	—	14 of 16 samples (0.353–10.40 mg/L)
	TL2	12 of 13 samples (0.23–2.9 mg/L)	—
	TL2a	—	8 of 8 samples (0.615–2.0 mg/L)
	TL3	13 of 13 samples (0.57–3.0 mg/L)	14 of 15 samples (0.301–6.47 mg/L)
	JCTa	3 of 13 samples (0.59–3.7 mg/L)	14 of 14 samples (0.305–9.11 mg/L)
Total Pb	TL2a	—	2 of 8 samples (0.00–0.0043 mg/L)
Total Se	**JCTa**	—	1 of 14 samples (1.1 mg/L)
Total Zn	SW3	—	1 of 14 samples (0.0267 mg/L)
	SW7	—	1 of 14 samples (0.158 mg/L)
	SW9	—	1 of 14 samples (0.0267 mg/L)
	SW10	—	1 of 14 samples (0.0267 mg/L)
	SW11	—	1 of 9 samples (0.051 mg/L)
	JCTa	—	1 of 14 samples (0.024 mg/L)
Total V	SW 10	—	1 of 15 samples (0.0096 mg/L)

Notes:

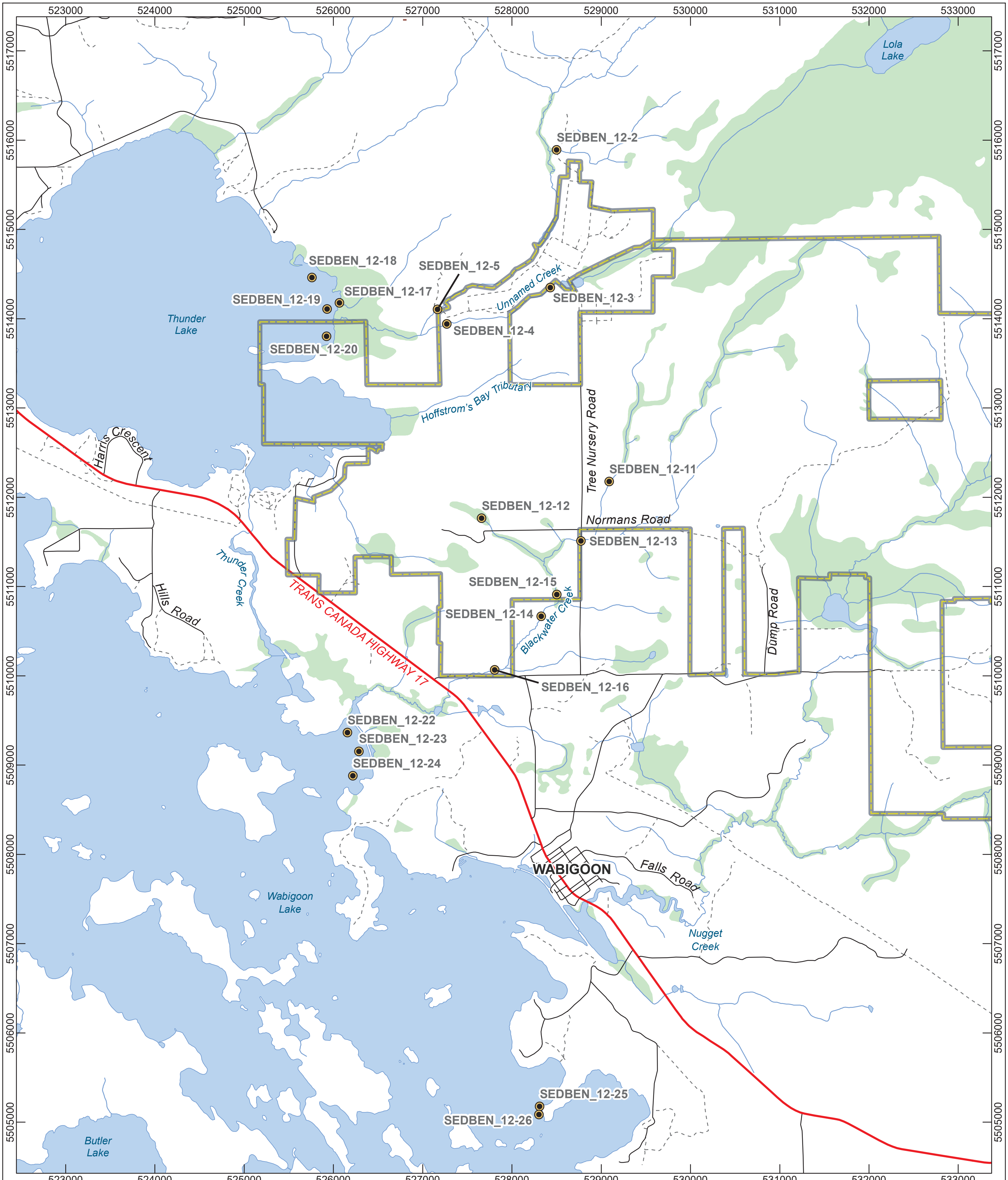
Stations in **bold** are associated with Blackwater Creek

1. All sample locations in 2010/2011 exceeded the interim PWQO guidance of 0.01 mg/L on nearly all sample occasions except SW1 which has the fewest exceedances.
2. All sample locations in 2012/2013 exceeded the interim PWQO guidance of 0.01 mg/L on nearly all sample occasions except SW5 which had no exceedances. SW1 had exceedances in less than half the samples collected.

Based on general guidelines provided in the interim PWQO for total phosphorus, nearly all samples from both survey years were in exceedance of the most conservative guidance (0.01 mg/L or less during the ice-free period to provide a high level of protection against aesthetic deterioration). Notable exceptions included SW1 which had the fewest exceedances during both survey periods and SW5 which had no exceedances in 2012/2013. Overall, the highest total phosphorus concentrations were measured from TL2 during 2011/2012 (average of 0.08 mg/L) and from SW2 during 2012/2013 (average 0.07 mg/L).

5.8.2 Sediment Sampling

Sediment samples were collected in 2012 from 19 locations (Figure 5.8.2-1) by DST Consulting Engineers (Appendix P). Sample sites were spread across the local study areas for aquatic resources (Section 6.1.4.8, surface water quality; Section 6.1.4.14, fish and fish habitat), with multiple sample locations within the same waterbodies. The sediment sampling locations used in 2012, some of which correspond to the earlier sediment sampling programs in 1997 (NAR 1997 as cited by KCB (2012)), are set out in Table 5.8.2-1.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	SCALE: 55000 *TREASURY METALS INC.*
SEDIMENT SAMPLING LOCATIONS	*DESIGN: AT 06 FEB. 2014* *GIS: AT 25 FEB. 2014* *CHECK: MP 17 OCT. 2014*
FIGURE 5.8.2-1 REV.02	

LEGEND

- Sediment and Benthic Invertabrate Sampling Location
- Property Boundary
- Waterbody
- Arterial
- Expressway / Highway
- Local
- Resource / Recreation
- Wetland
- Watercourse

N

0 500 1,000
Meters

TREASURY METALS Inc.

REFERENCE
Data by Treasury Metals Inc.
Projection: NAD83 UTM Zone 15N

Table 5.8.2-1: Sediment Sampling Locations

2012 Sampling Location	Description of Sampling Locations	2011/1997 Sampling Location
SB12-22	Wabigoon Lake, mouth of Blackwater Creek in Keplyn Bay	BC
SB12-23	Wabigoon Lake, Keplyn Bay	—
SB12-24	Wabigoon Lake, Keplyn Bay	—
SB12-25	Wabigoon Lake, reference location 2 km south of Village of Wabigoon	—
SB12-26	Wabigoon Lake, reference location 2 km south of Village of Wabigoon	—
SB12-17	Thunder Lake, mouth of Thunder Lake Tributary 1	—
SB12-18	Thunder Lake, north of Thunder Lake Tributary 1	—
SB12-19	Thunder Lake, between Thunder Lake Tributaries 1 and 2	—
SB12-20	Thunder Lake, south of Thunder Lake Tributary 2	—
SB12-11	Blackwater Creek Tributary 2	—
SB12-12	Blackwater Creek Tributary 1	TL2
SB12-13	Blackwater Creek, downstream of Blackwater Creek Tributary 2	—
SB12-14	Blackwater Creek, downstream of Blackwater Creek Tributary 3	—
SB12-15	Blackwater Creek, upstream of Blackwater Creek Tributary 3	JCTa
SB12-16	Blackwater Creek, downstream of Blackwater Creek Tributary 4	—
SB12-2	Thunder Lake Tributary 2, upstream of former MNRF tree nursery	—
SB12-3	Thunder Lake Tributary 3, downstream of irrigation ponds	—
SB12-4	Thunder Lake Tributary 3, downstream of former MNRF tree nursery	—
SB12-5	Thunder Lake Tributary 2, downstream of former MNRF tree nursery	—
—	Blackwater Creek, upstream of Blackwater Creek Tributary 2	TL1
—	Blackwater Creek, at culvert under Anderson Road	TL3

Specific analyses completed are presented in Table 5.8.2-2. Detailed sampling protocols and analytical methods, including method detection limits, are provided in Appendix P.

Table 5.8.2-1: Sediment Parameters Measured

Parameter		Sample Year		
		1997	2011	2012
Organics	PAH		Yes	
Inorganics	Br, Cl, F, Sulphate			Yes
Metals	As, Cd, Cr, Cu, Fe, Pb, Mg, Ni, Zn	Yes	Yes	
	Hg, Zr			Yes
Nutrients	Ammonia, total (as N)			Yes
	Nitrate-N (NO_3-N)			Yes
	Nitrite (NO_2-N)			Yes
	Phosphorus, total (TP)			Yes
	Nitrate + Nitrite (TN)			Yes
	Total Kjeldahl Nitrogen (TKN)			Yes
	TOC		Yes	

5.8.2.1 Sediment Quality Regulatory Information

Sediment samples (metals) were compared to the Ontario Provincial Sediment Quality Guidelines (PSQG) (MOE 1993). The guidelines have established three levels of effect – No Effect Level (NEL), Lowest Effect Level (LEL) and Severe Effect Level (SEL). The LEL and SEL are based on long-term effects which contaminants may have on sediment dwelling organisms (Table 5.8.2.1-1). The purpose of the PSQG is to protect the aquatic environment by setting safe levels for metals, nutrients and organic compounds (Fletcher et al. 2008).

Table 5.8.2.1-1: MOE Sediment Effects Levels

Effect Level	Description
No Effect Level (NEL)	This is the level at which the chemicals in the sediment do not affect fish of the sediment-dwelling organisms. At this level no transfer of chemicals through the food chain and no effect on water quality is expected.
	Sediment at the NEL rating is considered clean and no management decisions are required. Furthermore, it may be placed in rivers and lakes provided it does not physically affect the fish habitat or existing water uses.
Lowest Effect Level (LEL)	This indicates a level of contamination which has no effect on the majority of sediment-dwelling organisms. The sediment is deemed to be marginally polluted. Dredged sediments containing concentrations of organic contaminants - PCBs or pesticides, for example - that fall between the NEL and LEL may not be disposed of in an area where the sediment at the proposed disposal site has been rates at the NEL or better.
	Contamination in sediment that exceeds the LEL may require further testing and a management plan.
Severe Effect Level (SEL)	At this level, the sediment is considered heavily polluted and likely to affect the health of sediment-dwelling organisms. If the level of contamination exceeds the SEL then testing is required to determine whether or not the sediment is acutely toxic.
	At the SEL a management plan may be required. The plan may include controlling the source for the contamination and removing the sediment.

Source: MOE (1993)

5.8.2.2 Sediment Sampling Results

Sediment Particle Size

Sediment particle size can confound interpretation of sediment chemistry data (Lapota et al. 2000). That is, due to the high surface area to volume ratio of fine grain sediments, silts and clays are capable of transporting certain constituents compared to coarser grain sediments (Ongley 1996) and there is a strong positive correlation between decreased grain size and increased trace metal concentrations (Horowitz 1985). Sediments collected from three of the five sites in 2011 were dominated by silt, particularly TL2 and, to lesser degrees, JCTa and BC. Stream sites monitored in 2012 were typically dominated by sand; however, SB12-11a and SB12-12 were dominated by silt. Conversely, all sediments collected Wabigoon Lake were dominated by silt and clay while sediments from Thunder Lake were dominated by sand.

Sediment Quality (Metals)

There is a potential for effluent and releases from the Project to affect sediment quality, particularly the quality of the metals present in sediments. Table 5.8.2.2-1 provides a listing of the available sediment sampling results at each of the sampling locations. The table includes results for each of the sampling location indicated in Table 5.5.2-1. Sampling results are shown for each of the following sampling campaigns:

- Sediment sampling work completed in 2012 by DST (Appendix P to the revised EIS);
- Sediment sampling completed in 2011 by KCB (2012); and
- Sediment sampling completed in 1997 by NAR Environmental Consultants (NAR 1997), as presented by KCB (2012).

Measured Exceedances of Sediment Quality Guidelines

Some of the baseline sediment sampling indicated existing levels occasionally exceeded the Provincial Sediment Quality Guidelines (PSQG). These instances are outlined below, and summarized in Table 5.8.2.2-2.

> **Nutrients**: Total organic carbon (TOC) was measured from sediment samples collected in 2011. All samples exceeded the LEL of 1%, and one site, BC (located at the outlet of Blackwater Creek at Wabigoon Lake) also exceed the SEL of 10% (Table 5.8.2.2-1). During the 2012 study, three samples (SB12-3, SB12-25, and SB12-26) exceeded the total phosphorus (TP) LEL of 600 mg/kg Sediment samples collected in 2012 which were submitted for analysis of anions and nutrients were not compared to Sediment Quality Guidelines as the leachable anions and nutrients requested by Treasury Personnel cannot be compared to those guidelines.
>
> **Metals**: Of the 32 metals analyzed in sediment samples collected in 2011, nine are listed in the PSQG (arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc). With the exception of the following, all other constituents were detected below the LEL in sediments. Chromium concentrations at all 2011 sample sites was above the LEL of 26 µg/g but below the SEL guideline of 110 µg/g. Copper concentrations from sediments collected in 2011 from TL2, TL3 and BC were above the LEL of 16 µg/g but below the LEL of 110 µg/g. Manganese concentrations in sediments from sites TL2 and TL3 were above the LEL of 460 µg/g but below the SEL of 1100 µg/g. Nickel concentrations in sediments from sites TL2, TL3, and JCTa were above the LEL of 16 µg/g but below the SEL of 75 µg/g. The concentration of zinc collected from BC was above the LEL of 120 µg/g. The percentage of iron in samples collected from all sites except TL1 were above the LEL of 2%; however, all samples were below the SEL of 4%. Of the two metals analyzed in sediment samples collected in 2012, one (mercury) is listed in the PSQS. None of the sediment samples collected from any site in 2012 exceeded the LEL of 0.2 µg/g for mercury.

Table 5.8.2.2-1: Sediment Sampling Results for Metals

Sampling Location	As			Cd			Cr			Cu			Fe			Mg		
PSQG LEL	6			0.6			26			16			2%			31		
PSQG SEL	33			10			110			110			4%			250		
Year	1997	2011	2012	1997	2011	2012	1997	2011	2012	1997	2011	2012	1997	2011	2012	1997	2011	2012
SB12-22 (BC)	—	3.22	—	—	<0.50	—	—	48.5	—	—	51.6	—	—	2.41 %	—	—	21.4	—
SB12-23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-12 (TL2)	3.5	3.05	—	0.113	<0.50	—	47.2	54	—	19.6	29.2	—	1.91 %	2.94 %	—	6.9	9.8	—
SB12-13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-15 (JCTa)	—	3.08	—	—	<0.50	—	—	38.6	—	—	12.5	—	—	2.38 %	—	—	5.6	—
SB12-16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SB12-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— (TL1)	3.5	1.6	—	0.125	<0.50	—	33.2	27.7	—	13.8	7.6	—	2.57 %	1.82 %	—	7.2	5.6	—
— (TL3)	2.5	2.04	—	0.145	<0.50	—	41.8	46.7	—	15.9	19	—	2.17 %	2.41 %	—	7.1	7.1	—

Table 5.8.2.2-1: Sediment Sampling Results for Metals (continued)

Sampling Location	Parameter	Ni			Pb			Zn			Hg			Zr		
	PSQG LEL	460			16			120			0.2			—		
	PSQG SEL	1100			75			820			0			—		
	Year	1997	2011	2012	1997	2011	2012	1997	2011	2012	1997	2011	2012	1997	2011	2012
SB12-22 (BC)		—	303	—	—	34.4	—	—	268	—	—	—	0.05	—	—	6
SB12-23		—	—	—	—	—	—	—	—	—	—	—	0.034	—	—	9.3
SB12-24		—	—	—	—	—	—	—	—	—	—	—	0.033	—	—	6.2
SB12-25		—	—	—	—	—	—	—	—	—	—	—	0.039	—	—	8.3
SB12-26		—	—	—	—	—	—	—	—	—	—	—	0.044	—	—	11.7
SB12-17		—	—	—	—	—	—	—	—	—	—	—	0.011	—	—	<5.0
SB12-18		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-19		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-20		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-11		—	—	—	—	—	—	—	—	—	—	—	0.031	—	—	<5.0
SB12-12 (TL2)		519	616	—	27.4	30.8	—	49.8	77.6	—	—	—	0.042	—	—	7.1
SB12-13		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-14		—	—	—	—	—	—	—	—	—	—	—	0.011	—	—	<5.0
SB12-15 (JCTa)		—	1260	—	—	20.8	—	—	70.3	—	—	—	0.02	—	—	<5.0
SB12-16		—	—	—	—	—	—	—	—	—	—	—	0.025	—	—	8.5
SB12-2		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-3		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-4		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
SB12-5		—	—	—	—	—	—	—	—	—	—	—	<0.010	—	—	<5.0
— (TL1)		520	413	—	21.5	14.6	—	54.5	46.2	—	—	—	—	—	—	—
— (TL3)		533	637	—	26.8	26.8	—	58.5	67.4	—	—	—	—	—	—	—

Table 5.8.2.2-2: PSQG Exceedances

Parameter	Waterbody	Site(s)	Sample Year	Units	Analytical Result(s)	LEL	SEL
TOC	Blackwater Creek at Norman's Road	TL1	2011	%	2.32	1	10
TOC	Blackwater Creek below unnamed tributary	Tl2	2011	%	3.97	1	10
TOC	Blackwater Creek at Anderson Road	TL3	2011	%	2.62	1	10
TOC	Blackwater Creek below unnamed tributary; south of Project	JCTa	2011	%	3.7	1	10
TOC	Blackwater Creek at Wabigoon Lake	BC	2011	%	16.4	1	10
TP	Unnamed Creek	SB12-3	2012	mg/kg	680	600	2000
TP	Wabigoon Lake	SB12-24	2012	mg/kg	644	600	2000
TP	Wabigoon Lake Reference	SB12-25	2012	mg/kg	853	600	2000
TP	Wabigoon Lake Reference	SB12-26	2012	mg/kg	793	600	2000
Cr	Various creeks	TL1, TL2, TL2, JCTa, and BC	2011	µg/g	27.7 - 54.0	26	110
Cu	Various creeks	TL3 and BC	2011	µg/g	19.0 - 51.6	16	110
Mn	Various creeks	TL2 and TL3	2011	µg/g	616 - 637	460	1100
Ni	Various creeks	TL2, TL2 and JCTa	2011	µg/g	20.8 - 30.8	16	75
Zn	Outlet of Blackwater Creek to Wabigoon Lake	BC	2011	µg/g	268	120	820
Fe	Various creeks	TL2, TL2, JCTa, and BC	2011	%	2.38 - 2.94	2	4

5.8.3 Benthic Invertebrate Community

Benthic invertebrate samples were collected in October of 2011 and 2012 at the locations shown in Listed in Table 5.8.3-1 and shown in Figure 5.8.3-1. In 2011, three replicate samples were collected from six locations in the Blackwater Creek watershed using a Ponar grab. In 2012, samples were collected from 6 locations in the Blackwater Creek watershed and four locations in the Thunder Lake Tributary 2 and Tributary 3 watershed using the Ontario Benthic Biomonitoring Network travelling kick and sweep method, with samples from two riffles and one pool at each location combined in the field to form one composite sample. In 2012 benthic invertebrates samples, consisting of three composited Ponar grabs, were also collected from the bay in Thunder Lake that Unnamed Tributary 2 drains to and from two locations in Wabigoon Lake. The lake samples were collected for possible use as ‘before’ stations in future monitoring and were not intended to characterize existing habitat quality in Wabigoon Lake or Thunder Lake. As those samples were not relied upon in the EIS they are not discussed in this report. The raw data are, however, provided in Appendix Q to the revised EIS.

The preserved benthic samples were sent to ALS Environmental, a certified laboratory, for benthic invertebrate sorting and identification to family level. A number of metrics were calculated for the stream samples including taxon richness, relative abundance, percent EPT (Ephemeroptera, Plecoptera, Tricoptera), percent oligochaete worms and percent chironomids.

Table 5.8.3-1: Benthic Invertebrate Sample Locations

Site No.	Description and Purpose	Sample Year	
		2010/2011	2012/2013
13	Blackwater Creek upstream of the Project site	Yes	
6	Blackwater Creek Tributary 1	Yes	
65	Confluence of Tributary 1 and Blackwater Creek	Yes	
28	Blackwater Creek downstream of the Project site at Anderson Road	Yes	
23	Outlet of Blackwater Creek into Wabigoon Lake	Yes	
SB12-11A	Blackwater Creek Tributary 2		Yes
SB12-12	Blackwater Creek Tributary 1		Yes
SB12-13	Blackwater Creek downstream of confluence with Tributary 2		Yes
SB12-14	Blackwater Creek downstream of the project site		Yes
SB12-15A	Blackwater Creek downstream of the project site		Yes
SB12-16	Blackwater Creek downstream of the project site		Yes
SB12-2	Unnamed Thunder Lake Tributary 3		Yes
SB-3	Unnamed Thunder Lake Tributary 2		Yes
SB-4	Unnamed Thunder Lake Tributary 2		Yes
SB-5	Unnamed Thunder Lake Tributary 3		Yes
SB12-22	Wabigoon Lake		Yes
SB12-23	Wabigoon Lake		Yes
SB12-24	Wabigoon Lake		Yes
SB12-25	Wabigoon Lake Reference		Yes
SB12-26	Wabigoon Lake Reference		Yes
SB12-17	Thunder Lake		Yes
SB12-18	Thunder Lake		Yes
SB12-19	Thunder Lake		Yes
SB12-20	Thunder Lake		Yes

5.8.3.1 Benthic Invertebrate Quality Assurance/Quality Control

Identification to Family level was completed by ALS, where possible. The QA/QC process for invertebrate identification involves periodic testing of Senior Taxonomists with voucher samples, and resampling by third parties.

5.8.3.2 Benthic Invertebrate Results

The 2011 benthic invertebrate metrics are summarized in Table 5.8.3.2-1. The raw data are provided in the Appendix Q. The mean number of individuals in the 2011 benthic invertebrate samples ranged 26 to 200. The samples from the Blackwater Creek sites were composed primarily of oligochaete worms and chironomids with few or, at site 13, no EPT taxa. This is consistent with the low gradient habitat with fine substrates and, at least in the beaver ponds, low dissolved oxygen concentrations. The sample from location 23, where Blackwater Creek enters Wabigoon Lake, had the most taxa and EPT taxa accounted for 13.6% of the sample. The lake/wetland habitat at that location is quite different from the stream habitats at the other locations.

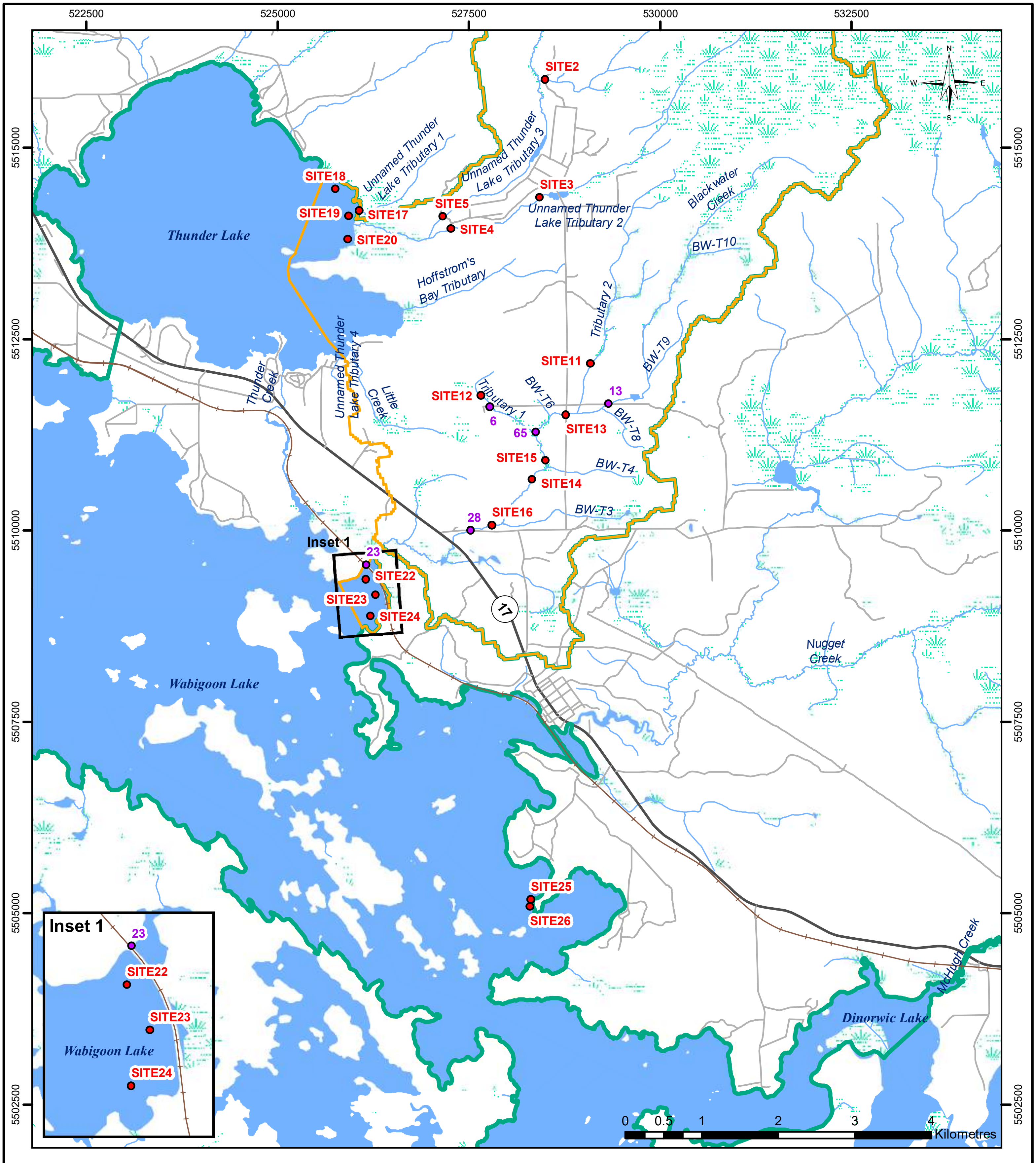


Figure 5.8.3-1
Locations of benthic invertebrate sampling

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

SCALE: 1:65,263

Legend

- 2011
- 2012
- Railway
- Road
- Highway
- Stream
- Waterbody
- Wetland
- LSA Aquatic
- RSA Aquatic

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Table 5.8.3.2-1: Summary Indices for Benthic Invertebrate from Blackwater Creek, 2011

Description	Site				
	13	6	65	28	23
Mean # individuals	26	107	200	141	94
Mean # of taxa per sample	4	7	11	12	15
Mean % oligochaetes per sample	64	40	35	10	7
Mean % chironomids per sample	34	26	45	56	54
Mean % EPT taxa per sample	0.0	0.1	1.4	1.0	13.6

The 2012 benthic invertebrate metrics for the Blackwater Creek sites are provided in Table 5.8.3.2-2, which also provides the substrate particle size data. The number of individuals in the samples ranged from 147 to 568 and the number of taxa ranged from 9 to 23. The samples were composed primarily of chironomids at Sites 11, 13, 14 and 15. More than 80 % of the sample at site 12 was composed of fingernail clams belonging to the family Pisiidae. Hydropsychid caddisflys were abundant at site 16, where they accounted for 50% of the sample.

Table 5.8.3.2-2: Summary Indices for Benthic Invertebrate from Blackwater Creek, 2012

Description	Sampling Site					
	11	12	13	14	15	16
Number of individuals	196	147	329	277	568	206
Number of taxa	15	9	21	18	23	15
% oligochaetes	21	3	5	10	5	5
% Chironomids	64	7	57	55	63	21
% EPT taxa	1	1	3	1	5	50
% Pisiidae	7	82	1	1	1	1

The lower number of taxa and higher proportion of oligochaetes in the 2011 samples from Blackwater Creek, compared to the samples from 2012, is thought to be a reflection of the different sampling methods. The 2011 samples were collected by Ponar grab, presumably from slow moving locations dominated by soft substrates. The 2012 samples were composites of kick and sweep samples from two riffles, which presumably would have coarser and/or firmer substrate, and from one pool.

The 2012 benthic invertebrate data for the Thunder Lake Tributary 2 and Thunder Lake Tributary 3 sites are summarized in Table 5.8.3.2-3. The number of individuals in the samples ranged 156 to 2744. The number of taxa in the samples was, on average, higher than in Blackwater Creek and ranged from 23 to 31. Chironomids and EPT taxa accounted for most of the samples, with EPT taxa dominant at two sites and chironomids dominant at the other two.

Table 5.8.3.2-3: Summary Indices for Benthic Invertebrate from Thunder Lake Tributary 2 and Thunder Lake Tributary 3, 2012

Description	Site			
	2	3	4	5
Number of individuals	156	2744	249	357
Number of taxa	23	22	31	27
% oligochaetes	3.8	0.2	12.9	0.3
% Chironomids	28.2	46.9	24.5	68.9
% EPT taxa	52.6	32.4	46.6	19.0
% Pisiidae	0.0	13.3	3.2	2.2

The greater percentage of EPT taxa in Thunder Lake Tributary 2 and 3, relative to Blackwater Creek, suggests better habitat conditions are present in the former. This is consistent with less beaver activity (and thus fewer ponds with low dissolved oxygen) and may also reflect the finer substrates in Blackwater Creek, which is underlain by lacustrine deposits, compared to the outwash deposits that underlay Thunder Lake Tributary 2.

5.8.4 Fish and Fish Habitat

The proposed project is in the English River watershed, which is tributary to the Winnipeg River and in the Nelson River primary watershed. There are two large lakes in the vicinity of the Project, Thunder Lake and Wabigoon Lake. There are also a number of small streams and tributaries in the vicinity of the Project that drain to Thunder Lake and Wabigoon Lake. The primary watercourse is Blackwater Creek, which runs generally north to south through the Project area, draining into Keplyn's Bay on Wabigoon Lake. Based on the current Project design, two tributaries of Blackwater Creek (referred to as Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2) will be partially overprinted by the Project and directly impacted. In addition, Blackwater Creek and its tributaries will experience changes in flows as a result of the Project, and will also be the recipient of the treated effluent discharged during operations. Thunder Lake Tributary 2 and Thunder Lake Tributary 3 are located to the north of the Project and drain into Thunder Lake. During operations, fresh water needed to supplement the Project will be withdrawn from the former MNRF tree nursery irrigation ponds located on these watercourses. Additionally, there is the potential that the dewatering of the open pit and underground mine required to provide a safe working environment could affect flows in these watercourses that are underlain by glacial outflow deposits. As part of the refined Project design, a perimeter berm and inboard perimeter ditch will be constructed around the operations area to isolate it from surrounding environment. The perimeter berm and ditch will enclose a small portion of the catchments for Hoffstrom's Bay Tributary and Little Creek, resulting in decreased flows in each watercourse. The fisheries field investigations were focused on those waterbodies likely to be affected by the Project, including Blackwater Creek and its tributaries, Thunder Lake Tributary 2, Thunder Lake Tributary 3, Little Creek and Hoffstrom's Bay Tributary, as well as those portions of Thunder Lake and Wabigoon Lake in the vicinity of those waterbodies. These features are illustrated on Figure 5.8.4-1.

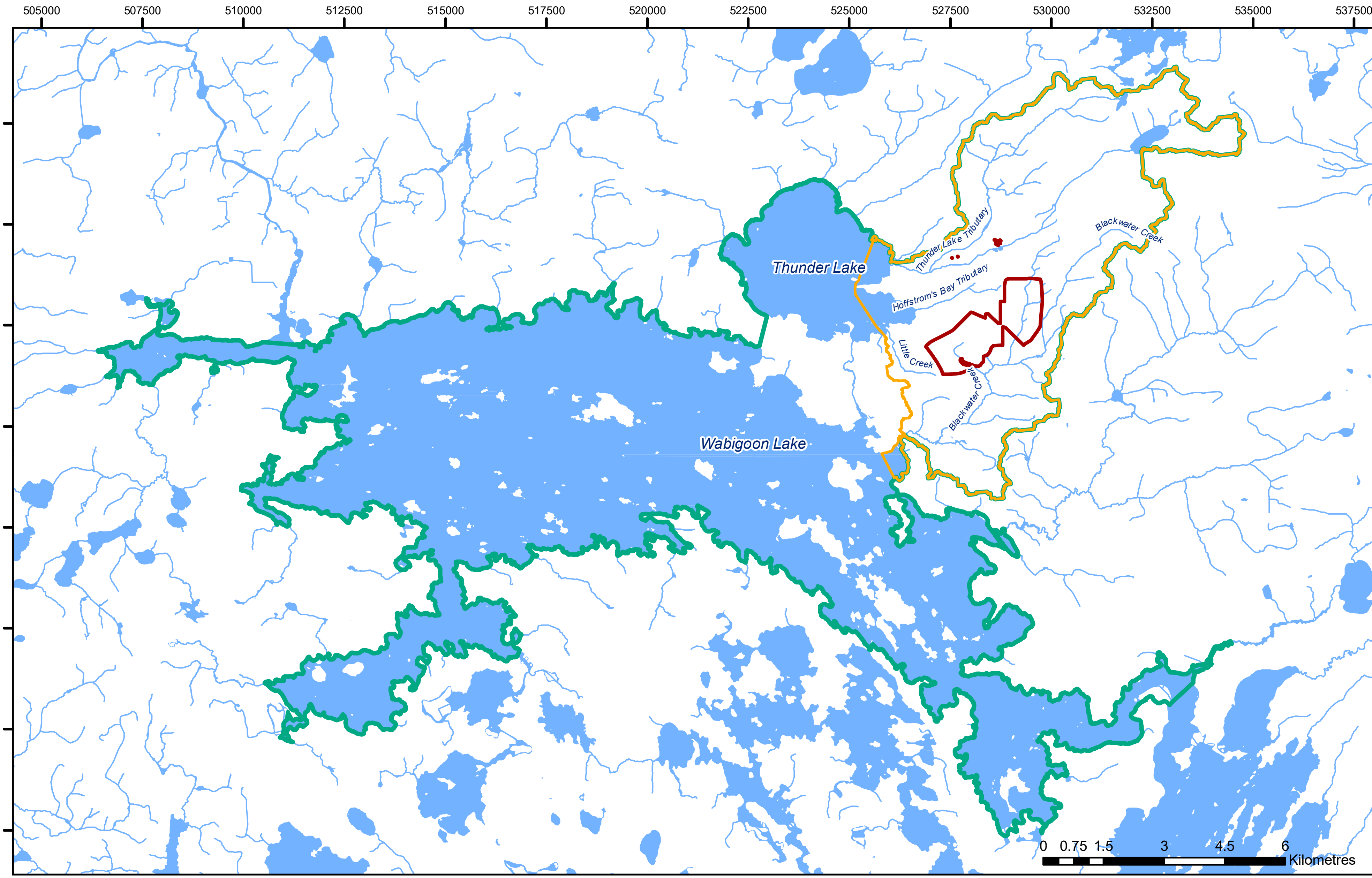

Figure 5.8.4-1
Key Waterbodies Considered in the Fisheries Investigation

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

Legend

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

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Baseline fish and fish habitat investigations were conducted by Klohn Crippen Berger Ltd. in 2010 and 2011 (KCB 2012) and DST Consulting Engineers Inc. in 2012 and 2013 (DST 2014). Additional fish sampling was conducted by TMI staff in 2014. C. Portt and Associates (KBM 2016) conducted reconnaissance level investigations at a number of locations and side-scan sonar investigations of Keplyn's Bay on Wabigoon Lake and an unnamed bay of Thunder Lake in 2016. The relevant fish and fish habitat information from the KCB (2012) and DST (2014) reports and additional fish and fish habitat baseline information acquired by Treasury Metals in 2014 and C. Portt and Associates in 2016 was consolidated in a single summary report, which is provided as Appendix Q. The baseline information relied upon in preparing the description of Project effects presented in Section 6.14 is summarized below.

5.8.4.1 Thunder Lake

Thunder Lake is a coldwater lake and has a surface area of 1,123 ha, a mean depth of 11.1 m and a maximum depth of 23.5 m. It supports a coldwater fish community including populations of Lake Trout, Lake Whitefish and Lake Cisco and also populations of coolwater species including Walleye, Northern Pike, Yellow Perch and Smallmouth Bass. A list of fish species documented to occur in Thunder Lake is presented in Table 5.8.4.1-1. Thunder Lake drains to Wabigoon Lake via Thunder Creek. Water levels in Thunder Lake are controlled by a small dam at the head of Thunder Creek in Aaron Provincial Park.

Table 5.8.4.1-1: Fish Species Present in Thunder Lake

Common name	Scientific name
Lake Trout	*Salvelinus namaycush*
Lake Whitefish	*Coregonus clupeaformis*
Cisco	*Coregonus artedii*
Walleye	*Sander vitreus*
Sauger	*Sander canadensis*
Northern Pike	*Esox lucius*
Smallmouth Bass	*Micropterus dolomieu*
Yellow Perch	*Perca flavescens*
Burbot	*Lota lota*
Rock Bass	*Ambloplites rupestris*
White Sucker	*Catostomus commersonii*
Trout Perch	*Percopsis omiscomaycus*
Johnny Darter	*Etheostoma nigrum*
Mottled Sculpin	*Cottus bairdii*
Deepwater sculpin[1]	*Myoxocephalus thompsonii*

Note: First reported in 2015. (D. Brunner, MNRF biologist. Personal communication with C. Portt. May 1, 2017).

The east shore of Thunder Lake is largely undeveloped in comparison to the remaining shoreline of the lake which is dominated by private homes, seasonal camps and public campgrounds.

The east end of Thunder Lake consists of two shallow (less than 2 m deep) sandy bays separated by a bedrock point. Cobble and boulder shoals extending out from the bedrock point between the two bays and from the island off that point (Figure 5.8.4.1-1) are known Lake Trout and Lake Whitefish spawning areas and may also be Walleye spawning areas although this has not been confirmed. Other areas of potential Lake Trout and Lake Whitefish spawning habitat have been identified by MNRF based on the presence of coarse substrate but spawning has not been confirmed.

Fish habitat in Hoffstrom's Bay was described and mapped by DST (Figure 5.8.4.1-2). The peninsula that forms the north shore of Hoffstrom's Bay has a generally rocky shoreline composed of a mix of bedrock, cobble and gravel with small areas of sparse aquatic vegetation. At the western end of the peninsula there is a large area of rock and cobble that has been identified as one of several areas where habitat improvement work was conducted by MNRF to enhance Lake Whitefish spawning habitat. Most of the northwest facing inlets along the south shore of the bay are similar and have sandy/silty substrates, sparse aquatic vegetation and sandy shorelines. Other areas along the south shore are a mix of rock and sparse aquatic vegetation similar to those observed on the north shore. The peninsula that forms the southwest boundary of the study area has a large area of boulders and cobble that has been also been identified as a habitat improvement area.

There are four small islands in Hoffstrom's Bay. The three smallest islands are predominantly rocky and have very little aquatic vegetation. The largest island has a rocky shoreline with sparse aquatic vegetation and coarse woody debris. The northwest tip of the large island has a large bedrock cobble shoal extending northwest into deeper water.

At the head of Hoffstrom's Bay a large area has been flooded by beaver activity. The area upstream of the beaver dam is dominated by aquatic vegetation, coarse woody debris and a mix of willow (*Salix* sp.) and alder (*Alnus* Sp.) shrubs around the margins. The shoreline in front of the dam is mostly sandy and silty with sparse submergent aquatic vegetation. Potential Northern Pike spawning habitat is present in meadow marsh and shore fen communities at the mouth of the Hoffstrom's Bay Tributary; however, a beaver dam across the mouth of the stream prevented fish access to the potential spawning area in 2013.

The bay which Thunder Lake Tributaries 1 and 2 flow into is separated from Hoffstrom's Bay by the peninsula described above. With the exception of one shoal of boulder and cobble shown on Figure 5.8.4.1-2, that was mapped using side-scan Sonar on August 4, 2016, the substrate in this bay is composed of sand and silt. There are extensive emergent reed beds and scattered beds of submergent vegetation in the inner portion of the bay. Potential Northern Pike spawning habitat is present in meadow marsh and shore fen communities associated with the mouth of Tributary 2 and a young-of-the-year Northern Pike was observed in this bay in 2011.

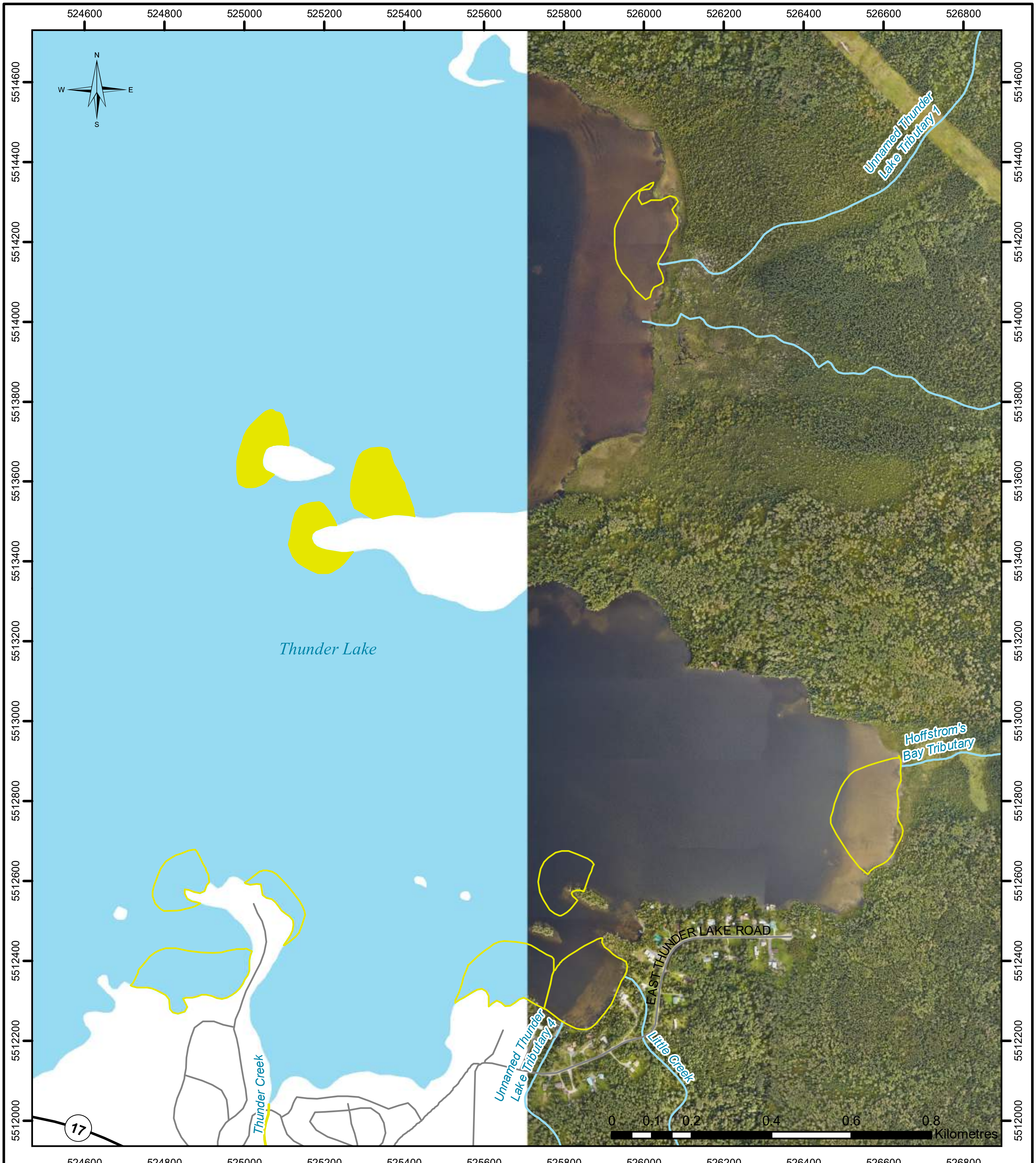

Figure 5.8.4.1-1
Hoffstrom's Bay Known and Potential Spawning Habitat

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

SCALE: 1:12,500

Image source: KBM, 2016

Legend

- Road
- Highway
- Stream
- Known Lake Trout and Lake Whitefish Spawning Habitat
- Potential Lake Trout and Lake Whitefish Spawning Habitat
- Waterbody

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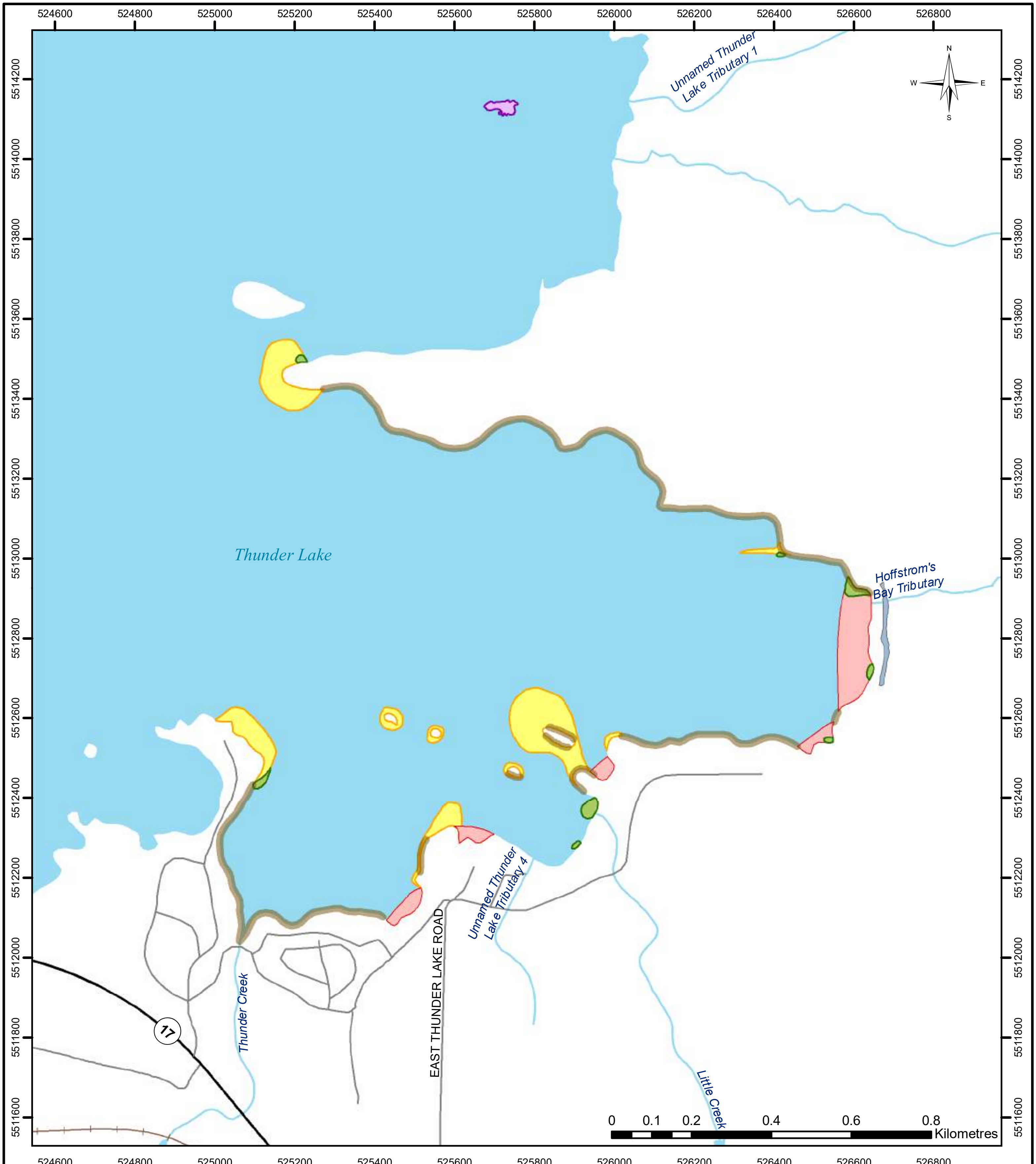

Figure 5.8.4.1-2 General Fish Habitat Observations, Hoffstrom's Bay

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

SCALE: 1:12,500

Legend

- Road
- Highway
- Railway
- Stream
- Rocky with Sparse Aquatic Vegetation
- Aquatic Vegetation
- Soft Substrates (sand, silt, organics)
- Beaver Dam
- Bedrock/Boulder/Cobble
- Cobble/Boulder Shoal
- Waterbody

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5.8.4.2 Wabigoon Lake

Wabigoon Lake is a coolwater lake with a surface area of 9,922 ha, a mean depth of 6.1 m and a maximum depth of 14.6 m. A list of fish species in Wabigoon Lake is provided in Table 5.8.4.2-1. The lake has an irregular shoreline that is 204 km in length including islands; this in combination with the generally shallow depth results in a high proportion of littoral zone. The water level of Wabigoon Lake is controlled by a dam at the outflow into the Wabigoon River in Dryden, Ontario. Water Levels range between 368.5 and 369.23 metres above sea level (mASL) annually. Changing water levels due to the dam have caused erosion along the shoreline of Wabigoon Lake releasing sediments that contribute to the turbidity of the lake.

Table 5.8.4.2-1: Fish Species Present in Wabigoon Lake

Common name	Scientific name
Lake Whitefish	*Coregonus clupeaformis*
Cisco	*Coregonus artedii*
Walleye	*Sander vitreus*
Sauger	*Sander canadensis*
Northern Pike	*Esox lucius*
Muskellunge	*Esox masquinongy*
Smallmouth Bass	*Micropterus dolomieu*
Black Crappie	*Pomoxis nigromaculatus*
Yellow Perch	*Perca flavescens*
Burbot	*Lota lota*
Rock Bass	*Ambloplites rupestris*
White Sucker	*Catostomus commersonii*
Longnose Sucker	*Catostomus catostomus*
Shorthead Redhorse	*Moxostoma macrolepidotum*
Trout-perch	*Percopsis omiscomaycus*
Johnny Darter	*Etheostoma nigrum*
Mottled Sculpin	*Cottus bairdii*
Emerald Shiner	*Notropis atherinoides*
Mimic Shiner	*Notropis volucellus*
Fathead Minnow	*Pimephales promelas*
Spottail Shiner	*Notropis hudsonius*
Logperch	*Percina caprodes*
Nine-spine Stickleback	*Pungitius pungitius*

There are a number of private homes and seasonal camps on Wabigoon Lake, primarily along the Trans-Canada Highway and in other road accessible areas. There are also eight active tourist outfitters operating on Wabigoon Lake. Wabigoon Lake is one of six Specially Designated Waters in FMZ 5 and receives enhanced management and supports an active sport fishery focused on Walleye and Muskellunge angling.

There are two fish sanctuaries on Wabigoon Lake that were created to protect spawning Walleye and Sauger. One of these is along the shoreline of Christie Island, which is just outside (west) of Keplyn's Bay where Blackwater Creek enters the lake. The other is at the mouth of Nugget Creek. Nugget Creek itself, upstream to the spawning area, is also part of that sanctuary. Walleye are also known to spawn in Thunder Creek, which flows from Thunder Lake to Wabigoon Lake. Potential muskellunge spawning areas in Keplyn's Bay and the vicinity, identified by MNRF based on the habitat, are presented in Figure 5.8.4.2-1.

Fish habitat observations in Keplyn's Bay are summarized in Figure 5.8.4.2-2. The north and south shorelines of Keplyn's Bay are mainly composed of sand, silt and gravel. The shoreline of the rail causeway that forms the East shore of the bay is composed of rip-rap and boulder/cobble. The bay has a soft bottom composed of a mix of sand, silt, gravel and organic material with sparse submergent vegetation. It is generally flat and shallow with a maximum recorded depth of 4.9 m. In the northeast corner of the bay near the inflow of Blackwater Creek there is a large area of aquatic vegetation and another is present on the southwest corner at the entrance to the bay. Submergent vegetation was also observed across the head of Keplyn's Bay during an August 3, 2016, site visit.

A portion of Keplyn's Bay was separated from Wabigoon Lake by the construction of the railway (Figure 5.8.4.2-2) and flow from Blackwater Creek is conveyed beneath the railway in two corrugated steel culverts (based on observations from the surface). The area upstream from the railway is described below as Reach 1 of Blackwater Creek but it could, alternatively, be considered part of Wabigoon Lake.

5.8.4.3 Blackwater Creek

The main branch of Blackwater Creek originates in an area of glaciofluvial outwash and flows southwest across a glaciolacustrine plain (Figure 5.8.4.3-1), before discharging into Keplyn's Bay of Wabigoon Lake. The main creek is 10.4 km long and has several tributaries. Most of the watershed is within the flat, silty-clay glaciolacustrine plain with low relief and fine substrates.

As indicated in the previous section, flow from Blackwater Creek is conveyed under the railway by at least two corrugated steel pipes. Under the conditions observed on August 3, 2016, it appeared that fish would be able to move freely through the culverts. It is possible, however, that during periods of high flow the culverts are a barrier to upstream fish migration due to high velocities.

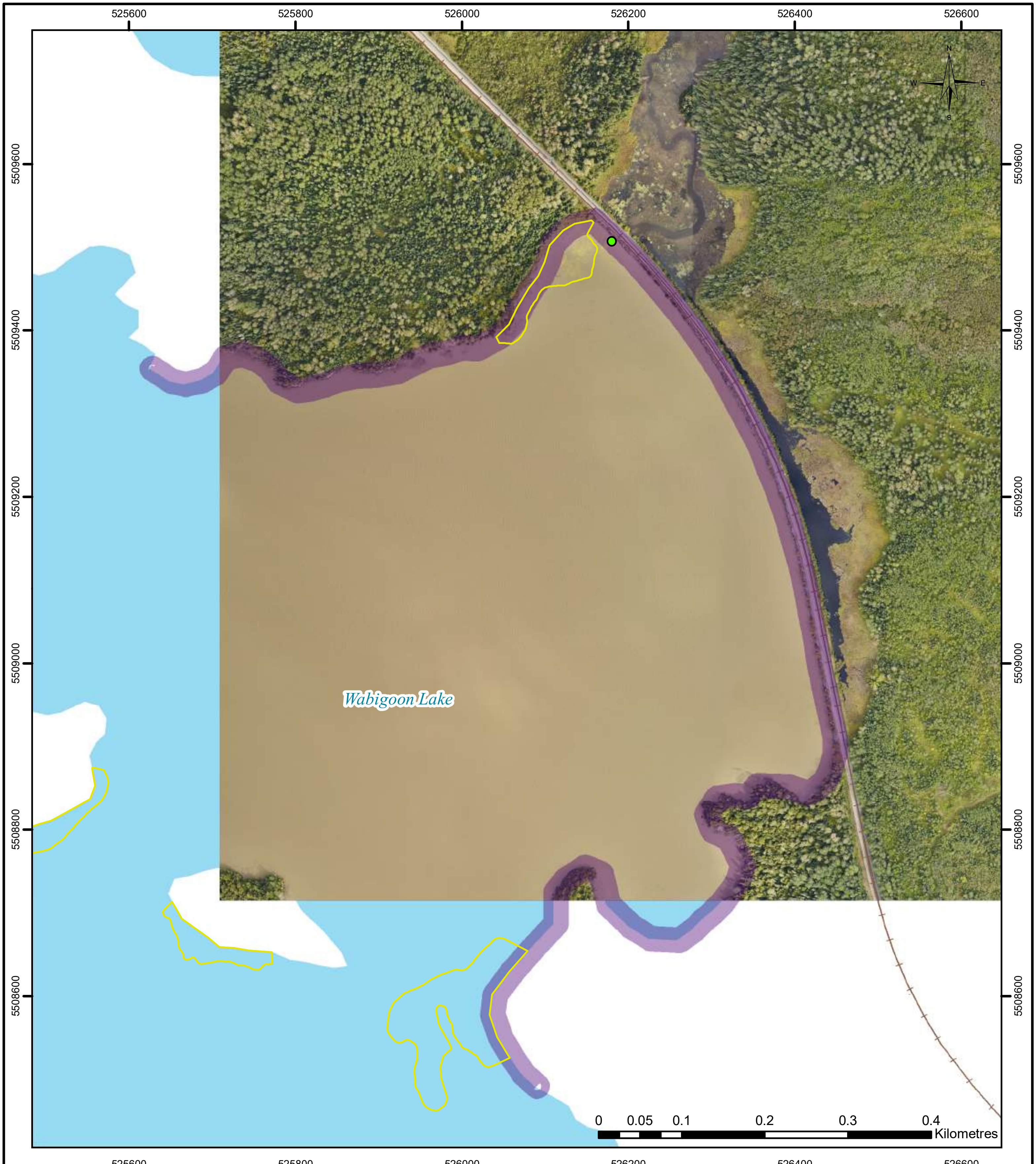

Figure 5.8.4.2-1
Keplyn's Bay Potential Spawning Habitat

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

SCALE: 1:6,000

Image source: KBM, 2016

Legend

- Culverts from Blackwater Creek
- Spring Spawning Survey Area
- Railway
- Waterbody
- Potential Muskellunge/Northern Pike Spawning Habitat

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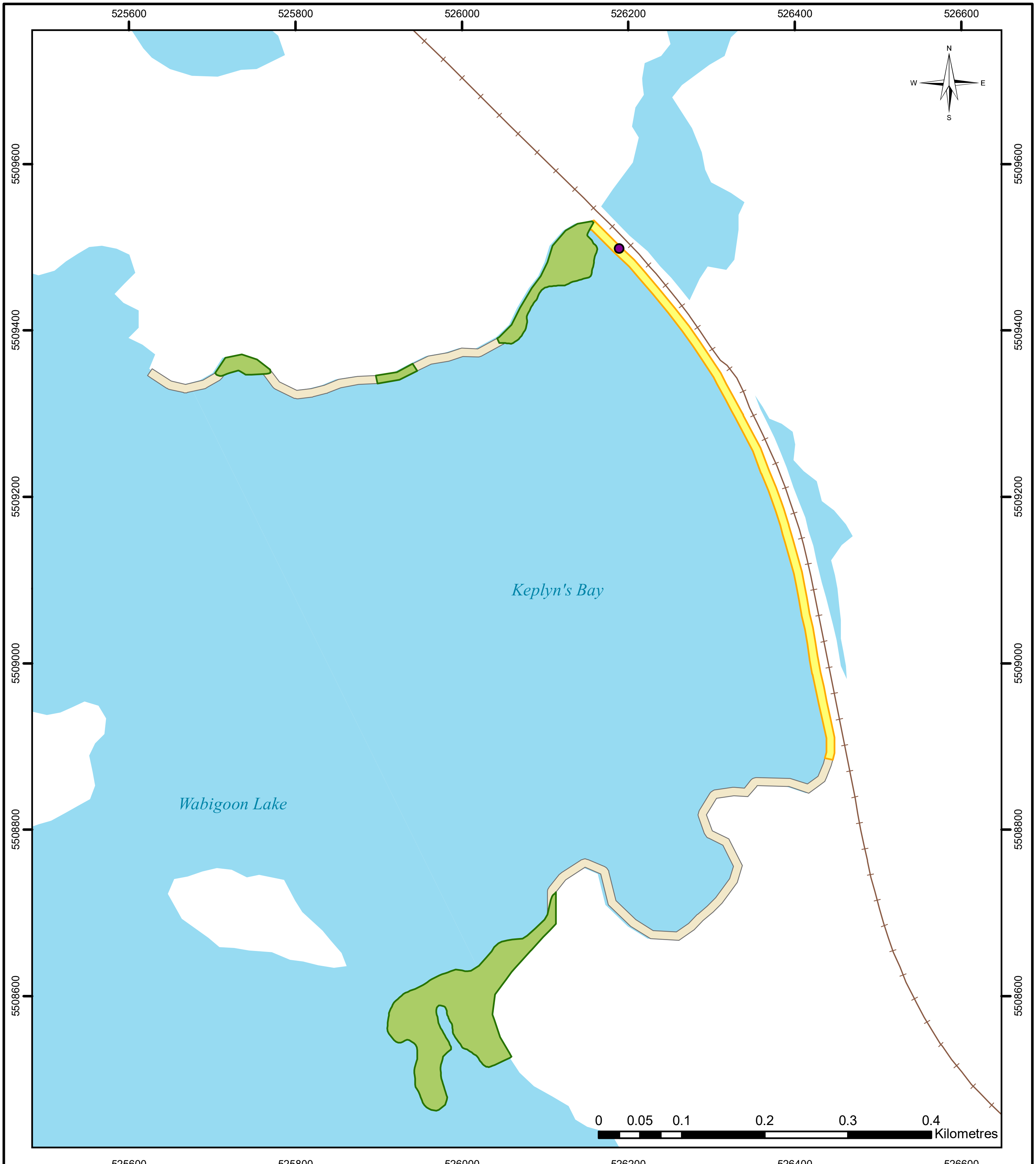

Figure 5.8.4.2-2
General Fish Habitat Observations, Keplyn's Bay

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-03-15
SCALE: 1:6,000

Legend

- Culverts from Blackwater Creek
- Railway
- Waterbody
- Aquatic Vegitation
- Sand/Cobble/Gravel/Organics Mix
- Bedrock/Boulder Cobble

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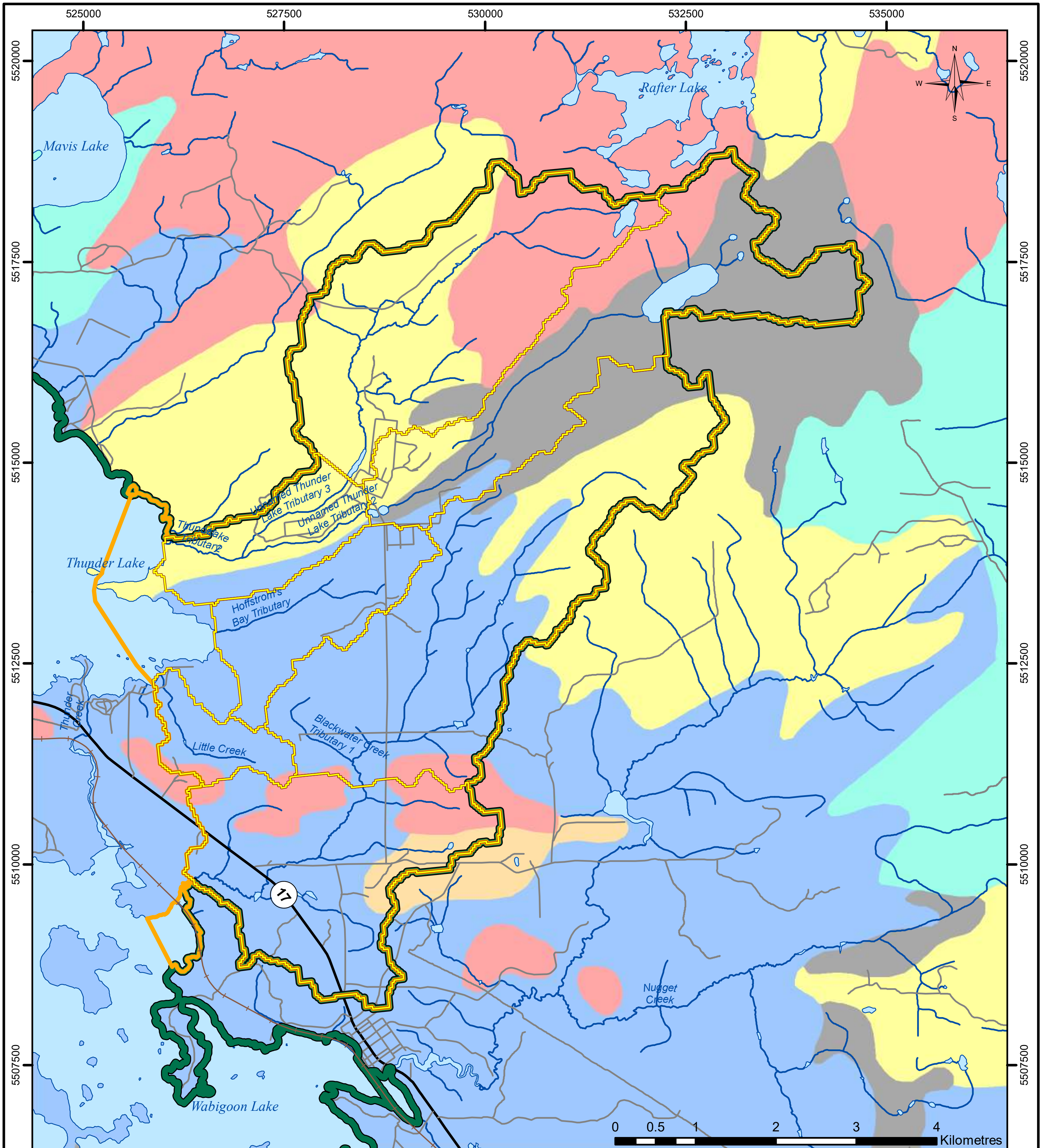


Figure 5.8.4.3-1
Surficial Geology

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-04-11

SCALE: 1:62,500

Legend

- Railway
- Road
- Highway
- Stream
- Waterbody
- Watershed
- LSA Aquatic
- RSA Aquatic

Landform

- Kame
- Outwash plain
- Raised beach
- Glaciolacustrine plain
- Organics
- Bedrock knob

KBM RESOURCES GROUP

The reach of Blackwater Creek from the railway upstream to approximately the limit of lake water level influence includes the portion of Keplyn's Bay that was separated from Wabigoon Lake by the construction of the railway. The water velocities in this reach are low and most of the reach can be characterized as sheltered coastal wetland habitat. The substrates are soft organics and dense beds of submergent and emergent aquatic vegetation are present over most of the area. The maximum depth is 2.6 m. On August 7, 2011, the dissolved oxygen concentration was 8.22 mg/L at 0.3 m depth and 0.39 mg/L at 2.0 m depth. Given the dense aquatic vegetation, night-time oxygen depletion is to be expected during the summer when aquatic vegetation is abundant and may also occur during the winter.

Many schools of minnows and many juvenile fish were observed here in August 2011. Potential Northern Pike spawning habitat (flooded grasses and sedges) is common in this reach. Based on the habitat characteristics, if fish are able to pass through the culverts into this area in the spring, Reach 1 may provide spawning and nursery habitat for a number of species that are present in Wabigoon Lake and spawn in wetlands, including Northern Pike and Muskellunge.

The remainder of Blackwater Creek and its tributaries provide low gradient stream habitat punctuated by active and inactive beaver dams and ponds. The creek channels are sinuous and primarily pool and run habitat, which is consistent with the low gradient. Consistent with the surficial geology, the substrates are primarily fine silt and clay. Only three areas of gravel, each located downstream from road crossings and thought to have originated from road construction and maintenance, were observed during the 2011 field investigations. A reach with cobble substrate was identified at a pipeline crossing between Anderson Road and Highway 17 and is thought to have been placed there during the reconstruction of the creek channel through the pipeline right-of-way. Woody debris is plentiful, in part as a consequence of beaver activity.

As is expected, channel width decreases with distance upstream. Wetted widths of the main branch measured during field investigations in 2011 ranged from approximately 3.5 m downstream from Highway 17, to 0.5 – 2.5 m between Highway 17 and Norman Road, and were generally less than 1 m upstream from Norman Road.

The effect of past and current beaver activity is evident in the pattern of riparian wetland vegetation that includes terrestrial habitats such as dense thickets of willows and alders and open 'beaver meadows' with dense grasses and sedges, and active beaver ponds. Beaver ponds provide fish habitat, but in a transient way. A review of historical imagery (Google Earth) indicates that there were no beaver ponds on Blackwater Creek Tributary 1 or Blackwater Creek Tributary 2 in April of 2002. In September of 2006, there was one beaver pond on Blackwater Creek Tributary 1 and none on Blackwater Creek Tributary 2. In August of 2012, there were three beaver ponds on Blackwater Creek Tributary 1 and one on Blackwater Creek Tributary 2. Aerial photography from 2016 shows the same number of beaver ponds as the photography from 2012. The area of the aquatic habitat in beaver ponds present in 2016, determined from aerial photograph using GIS, is 3.79 ha on Blackwater Creek Tributary 1 and 0.15 ha on Blackwater Creek Tributary 2.

No permanent obstructions to fish passage were identified during the 2010 and 2011 field investigations although beaver dams can be impediments and create temporary barriers to upstream movement, depending on flows. In the spring of 2017, three beaver dams on Blackwater Creek between Highway 17 and Wabigoon Lake appeared to be barriers to upstream movement by large fish, as did a fourth beaver dam located upstream from Anderson Road. An existing culvert on Blackwater Creek Tributary 2 is probably a barrier to upstream fish migration under some flow conditions, based on observations in August 2016.

Fish sampling was conducted in the Blackwater Creek watershed in 2010, 2011, 2012 and 2014. Most of the sampling was conducted with minnow traps (152 trap sets) supplemented with electrofishing (3 sites). One short-duration gill net set, which caught one Yellow Perch, was conducted near the mouth, just upstream from the railway. One seine haul, which caught two White Suckers, was conducted on Blackwater Creek Tributary 2 near its confluence with the main branch.

The fish catches are summarized in Table 5.8.4.3-1. In total, 8,182 fish were captured in the Blackwater Creek watershed. The most abundant and widely distributed taxa were the *Chrosomus* species (Northern Redbelly Dace and Finescale Dace; 63% of the total catch), Brook Stickleback (22% of the total catch), and Pearl Dace (10% of the total catch). Fathead Minnow was captured less frequently and in lower numbers (2% of total catch). White Sucker (1% of the total catch) were more common in catches from the downstream reaches of Blackwater Creek; 59 of the 80 individuals captured were in a single minnow trap set. A single Burbot was captured by electrofishing on two occasions between Highway 17 and Anderson Road. In addition, there were 42 Cyprinids captured that were not identified to species.

Four taxa were identified in 23 minnow trap sets in Blackwater Creek Tributary 1 (Table 5.8.4.3-1). *Chrosomus* spp. dominated the catches (78% of total catch), followed by Brook Stickleback (34% of total catch) and Pearl Dace (18% of total catch). Fathead Minnow were also present (2% of total catch) and 11 captured fish were identified as “shiners”. No White Sucker were captured in Tributary 1.

Four taxa were identified in catches from 56 minnow trap sets in Blackwater Creek Tributary 2 (Table 5.8.4.3-1). *Chrosomus* spp. dominated the catches (48% of total catch), followed by Pearl Dace (11.6% of total catch) and Brook Stickleback (8.5% of total catch). In addition, 11 fish were captured that were identified as “shiners”. Catches were lower in the upper reaches of Blackwater Creek Tributary 2, where only Brook Stickleback and Pearl Dace were captured and there was no catch in many of the minnow trap sets.

Table 5.8.4.3-1: Fish Catches in Blackwater Creek and Thunder Lake Tributaries

Common and Scientific Names	Blackwater Creek Watershed			Thunder Lake Watershed				
	All Locations except Tributaries 1 and 2	Tributary 1	Tributary 2	Tributary 2 - from dam to Thunder Lake	Tributary 2 - tree nursery pond	Tributary 3	Hoffstrom's Bay Tributary	Little Creek
Northern Redbelly and Finescale Dace *Chrosomus* spp.	2857	2032	306	61	63	101	28	61
Brook Stickleback (*Culaea inconstans*)	1393	224	217	11	138	92	14	12
Pearl Dace (*Margariscus nachtriebe*)	434	304	113	42	101	156	8	—
Fathead Minnow (*Pimephales promelas*)	127	50	—	11	167	91	—	106
White Sucker (*Catostomus commersonii*)	78	—	2	5	—	12	—	—
Burbot (*Lota lota*)	2	—	—	1	—	—	—	—
Yellow Perch (*Perca flavescens*)	1	—	—	—	—		72	—
Central Mudminnow (*Umbra limi*)	—	—	—	6	—	13	—	—
Blacknose Shiner (*Notropis heterolepis*)	—	—	—	9	—	—	—	—
Creek Chub (*Semotilus atromaculatus*)	—	—	—		—	6	—	—
Iowa Darter (*Etheostoma exile*)	—	—	—	1	2	1	—	—
Rock Bass (*Ambloplites rupestris*)	—	—	—	—	—		2	—
Trout- perch (*Percopsis omiscomaycus*)	—	—	—	—	—	2	—	—
Mottled Sculpin (*Cottus bairdii*)	—	—	—	—	—	1	1	—
Cottus sp.	—	—	—	—	—	1	—	—
Cyprinid sp.	25	—	—	—	—	1	—	—
Shiner sp.	6	11	—	—	—	1	20	—

A small number of spawning White Sucker were observed in Blackwater Creek Tributary 2 at Normans Road during a spawning survey in the spring of 2011. It is not known if these fish were resident in Blackwater Creek or migrants from Wabigoon Lake. A small number of eggs, considered to be from White Sucker, based on their size, were collected at this location and from an area of coarse substrate where Tree Nursery Road crosses Blackwater Creek. Both of these locations were examined during the White Sucker spawning period in 2017 and no White Sucker or areas of disturbed substrate that could indicate White Sucker spawning were observed. A fyke net was set in Blackwater Creek, with the wings extending from bank to bank, downstream from Anderson Road, from May 8 – 16, 2017. No White Sucker were captured. Large numbers of White Sucker were observed spawning in nearby Thunder Creek during this period, which confirms that the timing of the observations was correct.

Based on the absence of suitable spawning habitat and it is unlikely that Walleye spawn in Blackwater Creek.

5.8.4.4 Thunder Lake Tributaries

There are three tributaries potentially affected by the Project that drain to Thunder Lake. They are, from north to south, Thunder Lake Tributary 2, Hoffstrom's Bay Tributary, and Little Creek. Thunder Lake Tributary branches to the forming the northern boundary of the former MNRF tree nursery. The south branch of Thunder Lake Tributary 2, which passes through the former MNRF tree nursery, is referred to as Thunder Lake Tributary 3. The location of these tributaries relative to the Project are shown on Figure 5.8.4.4-1.

Thunder Lake Tributary 2

Thunder Lake Tributary originates in a small unnamed waterbody within the organic deposits in the Lola Lake nature reserve (see Figure 5.8.4.3-1). Thunder Lake Tributary 2, flows through the outwash plain for most of its length. There is a dam on Thunder Lake Tributary 2, on the former tree nursery property, which creates a pond and is a complete barrier to upstream fish migration. Except for a short section of cobble and gravel downstream from this dam, the substrate from the dam downstream is primarily fine sands and silt.

Thirteen fish species were captured Tributary 2 (Table 5.8.4.3-1). Catches were dominated by Pearl Dace, *Chrosomus* spp., Brook Stickleback, and Fathead Minnow. No fish were captured in two short gill net sets (1.6 hr and 0.4 hr) in the former tree nursery pond.

The areas of coarse substrate downstream from the dam on Thunder Lake Tributary 2 is potential Walleye and White Sucker spawning habitat but no spawning runs have been reported to occur in these streams. A fyke net was set in Thunder Lake Tributary 2, downstream from the confluence with Thunder Lake Tributary 3, with wings stretched from bank to bank, from May 8 to 16, 2017. No fish were captured.

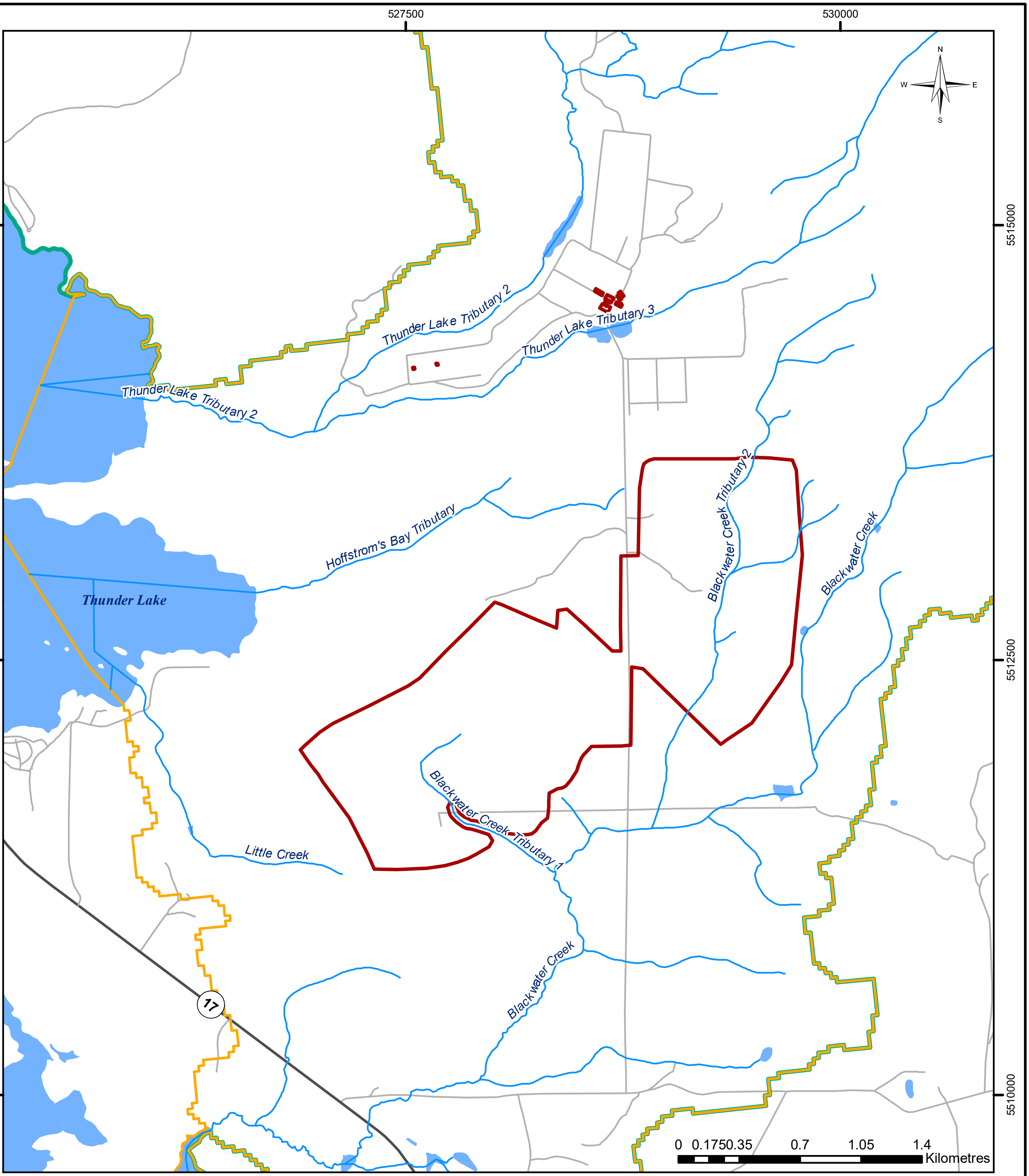


Figure 5.8.4.4-1
Watercourses in the Goliath Gold LSA

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-16

SCALE: 1:29,328

Legend

- Project Footprint
- RSA Aquatic
- Road
- Highway
- Waterbody
- LSA Aquatic

KBM RESOURCES GROUP

The substrate then changes to fine silts and sands which are the predominant substrates from that point downstream to Thunder Lake. The stream is sinuous and consists primarily of runs and pools with abundant fine and coarse woody debris. The channel becomes braided after it enters the wetland adjacent to Thunder Lake. Iron precipitates were observed at several points in the watershed of Tributary 2, indicating groundwater discharge (KCB 2012). The outlet of Unnamed Thunder Lake Tributary 2 is densely vegetated with marsh vegetation and is considered to be potential Northern Pike spawning habitat (KCB 2012).

A total of nine taxa were identified in catches in Thunder Lake Tributary 2 between the dam that forms the former tree nursery pond and Thunder Lake (Table 5.8.4.3-1). Pearl dace and *Chrosomus* spp. were the most abundant species.

In the former tree nursery pond on Tributary 2 Fathead Minnow, Brook Stickleback, Pearl Dace and *Chrosomus* spp. were all common and two Iowa Darter were captured. Only Pearl Dace were captured in a short (2 hr) gill net set in the former tree nursery pond.

The areas of coarse substrate downstream from the falls on Thunder Lake Tributary 2 is potential Walleye and White Sucker spawning habitat but no spawning runs have been reported to occur in these streams. This reach was examined during the White Sucker spawning season in 2017 and no White Sucker were observed. A fyke net was set in Thunder Lake Tributary 2, downstream from the confluence with Thunder Lake Tributary 3, with wings stretched from bank to bank, from May 8 to 16, 2017. No fish were captured.

Unnamed Thunder Lake Tributary 3

Thunder Lake Tributary 3 originates in the organic deposits associated with the Lola Lake wetland (Figure 5.8.4.3-1). From the pond on the former tree nursery property downstream to the confluence with Thunder Lake Tributary 2, it flows through the sandy soils of the outwash plain (KCB 2012). There is a waterfall approximately 1.7 m high, created by a bedrock outcrop, just downstream from the pond on the former tree nursery. Both the falls and the concrete dam that creates the pond are complete barriers to upstream fish migration.

There is a section of coarse substrate for a short distance downstream from the bedrock outcrop. The substrate then changes to fine silts and sands which are the predominant substrates from that point downstream to the confluence with Thunder Lake Tributary 2. The stream is sinuous and consists primarily of runs and pools with abundant fine and coarse woody debris.

A total of nine taxa were identified in catches in Thunder Lake Tributary 2 between the dam that forms the former tree nursery pond and Thunder Lake (Table 5.8.4.3-1). Pearl dace and *Chrosomus* spp. were the most abundant species. In the former tree nursery pond on Tributary 2 Fathead Minnow, Brook Stickleback, Pearl Dace and *Chrosomus* spp. were all common and two Iowa Darter were captured. Only Pearl Dace were captured in a short (2 hr) gill net set in the former tree nursery pond.

The areas of coarse substrate downstream from the falls on Thunder Lake Tributary 2 is potential Walleye and White Sucker spawning habitat but no spawning runs have been reported to occur in these streams. This reach was examined during the White Sucker spawning season in 2017 and no White Sucker were observed. A fyke net was set in Thunder Lake Tributary 2, downstream from the confluence with Thunder Lake Tributary 3, with wings stretched from bank to bank, from May 8 to 16, 2017. No fish were captured.

Hoffstrom's Bay Tributary

The Hoffstrom's Bay Tributary has not been characterized in detail as it lies entirely within the glaciolacustrine plain (Figure 5.8.4.3-1: Surficial Geology and Watercourses in the Local Study Area). It can be anticipated that the substrate is fine throughout. Aerial imagery indicates that beaver activity occurs. The outlet of Hoffstrom's Bay Tributary is densely vegetated with marsh vegetation and is considered potential northern pike spawning habitat. Many schools of juvenile fish were observed there during the field work.

The fish catches are summarized in Table 5.8.4.3-1. Yellow Perch were the most abundant species in the catches from 2 seine hauls at the mouth of the Hoffstrom's Bay tributary, where a Rock Bass was also captured and a Mottled Sculpin was caught in a minnow trap. Further from the lake, in the Hoffstom's Bay Tributary proper, only *Chrosomus* spp. and Brook Stickleback were captured in 8 minnow trap sets.

Little Creek

Little Creek, which flows into Thunder Lake south of Hoffstrom's Creek, also lies entirely within the glaciolacustrine plain (Figure 5.8.4.3-1), which results in a low gradient watercourse with fine substrates. Active beaver dams were observed in at least two locations in 2011. In Little Creek only Fathead Minnow, *Chrosomus* spp. and Brook Stickleback were captured in 16 minnow trap sets (Table 5.8.4.3-1).

5.8.4.5 Metals in Fish Tissue

Metal concentrations were determined in muscle tissue samples taken from 11 Walleye from Thunder Lake and from 30 Walleye and one Sauger from Wabigoon Lake. The total mercury results (Table 5.8.4.5-1) were compared to the guidelines provided in Ontario Ministry of Environment and Climate Change (MOECC) *Guide to Eating Ontario Sport Fish 2013-2014* ("MOE Guidelines") and to Canadian Council of Ministers of the Environment (CCME) *Tissue Residue Guideline Values for the Protection of Wildlife Consumers of Aquatic Biota: Methylmercury* (2000) ("CCME Guidelines"). MOE guidelines consider two populations: sensitive (includes children under 15 and women of childbearing age) and general. Two restriction categories were applied within each population: minimum levels that result in recommended consumption limits and "do not eat" advisory levels.

Table 5.8.4.5-1: Total Mercury Concentrations in Walleye and Sauger Muscle

Waterbody	Species/Sample ID	# Submitted	Mercury Concentration (mg/kg)
Thunder Lake	**Walleye**	**11**	
	F31		**0.108**
	F32		**0.121**
	F33		**0.155**
	F34		**0.0975**
	F35		**0.105**
	F36		**0.0978**
	F37		**0.136**
	F38		**0.114**
	F39		**0.105**
	F40		**0.143**
	F41		**0.142**
Wabigoon Lake	**Walleye**	**30**	
	F1		**0.228**
	F10		**0.335**
	F11		**0.184**
	F12		**0.245**
	F13		**0.24**
	F14		**0.194**
	F16		**0.0865**
	F18		**0.117**
	F19		**0.176**
	F2		**0.149**
	F20		**0.165**
	F21		**0.241**
	F22		**0.196**
	F23		**0.442**
	F24		**0.18**
	F25		**0.195**
	F26		**0.173**
	F27		**0.245**
	F28		**0.206**
	F29		**0.207**
	F3		**0.23**
	F30		**0.14**

Table 5.8.4.5-1: Total Mercury Concentrations in Walleye and Sauger Muscle (continued)

Waterbody	Species/Sample ID	# Submitted	Mercury Concentration (mg/kg)
Wabigoon Lake (cont'd)	F4		***0.331***
	F5		**0.102**
	F6		**0.157**
	F7		***0.272***
	F8		**0.195**
	F9		***0.261***
	GN1		**0.191**
	GN3		***0.503***
	Sauger	1	
	F17		***0.473***

Guidelines:			
Ontario MOE	Guide To Eating Ontario Sport Fish		
	Sensitive Population	Minimum Level	0.26 mg/kg
		"Do Not Eat" Advisory	0.52 mg/kg
	General Population	Minimum Level	0.61 mg/kg
		"Do Not Eat" Advisory	1.84 mg/kg
CCME	Values for the Protection of Wildlife Consumers of Aquatic Biota (Methylmercury)		0.033 mg/kg

Legend:

BOLD	Result exceeds CCME Guideline
Italic/shaded	Result exceeds MOE Guideline (Minimum Level in a Sensitive Population)

Total mercury concentrations exceeded the CCME methylmercury guideline for the protection of wildlife consumers in all of the Walleye and Sauger muscle samples. None of the Thunder Lake walleye exceeded the MOE Guideline Minimum Level of 0.25 mg/kg for a sensitive population but six of the 30 Walleye samples and the one Sauger sample from Wabigoon Lake exceeded that value. There were too few large walleye captured to generate reliable mercury concentrations standardized for length.

Elevated mercury levels are known throughout the region. Mercury occurs naturally (at low levels) and historical industrial effluents were introduced to the Wabigoon River System between 1962 and 1970. The point of discharge has been attributed to the Dryden pulp mill and chemical plants downstream of Wabigoon Lake and the Dryden dam prevents the upstream movement of fish into Wabigoon Lake.

Table 5.8.4.5-2: Collection Location and Year, Species Composition and Mercury Concentration of Forage Fish 2011 and 2012

Location	Sampling site	Year	Species				Total Mercury (mg/kg wet weight)
			Pearl Dace	*Chrosomus* spp.	White Sucker	Fathead Minnow	
Blackwater Creek at Anderson Road	28	2011		10			**0.082**
	28	2011	10				**0.105**
	TS-2	2012	2		3		**0.111**
Blackwater Creek Tributary 1	6	2011				10	0.025
	6	2011		10			**0.043**
	TS-7	2012		12			**0.045**
Blackwater Creek at Tree Nursery Road	TS-5	2012		8			**0.088**
Thunder Lake Tributary 3	TS-13	2012		3			**0.098**
Thunder Lake Tributary 3 Tree Nursery pond	4 and 5	2011	10				0.033
	4 and 5	2011		10			0.027
	TS-15	2012	5	8			0.030
Blackwater Creek Tributary 7	12				1		**0.064**
	12	2011			1		**0.092**
	TS-16	2012	4	1			**0.123**
Isolated pond beside Tree Nursery Road	TS-21	2012		9			**0.057**
Unknown location	TS-22	2012	5				**0.067**

Note: Total mercury values exceeding 0.033 mg/kg are in bold

Whole body total mercury concentrations in composite forage fish samples ranged from 0.027 mg/kg to 0.123 mg/kg and most samples exceeded the CCME methylmercury guideline for the protection of wildlife consumers of 0.033 mg/kg (Table 5.8.4.5-2). The total mercury concentrations were lowest in the samples from the Tree Nursery ponds and Blackwater Creek Tributary 1. The highest concentrations were in samples from the Blackwater Creek at Anderson Road and Blackwater Creek Tributary 2. When the same species was sampled at the same general locations in both 2012 and 2013, the results were similar. For example, the total mercury concentration *Chrosomus* spp. from Blackwater Creek Tributary 1 was 0.043 mg/kg wet weight in the 2011 sample and 0.045 mg/kg wet weight in the 2012 sample.

5.8.5 Traditional Knowledge

Members of the Wabigoon Lake Ojibway Nation identified the following with respect to their traditional knowledge of aquatic resources:

- Fishing continues to be a critical activity year-round, with pike and walleye being the preferred species, but other species taken as well;
- Water quality is important to the preservation of their fisheries;
- Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint;
- Fish spawning occurs in Blackwater Creek mouth area;
- Reference to local fish spawning and a sanctuary;
- Wabigoon residents use wells for drinking water, and lakeshore residents use Wabigoon Lake and Thunder lake for drinking water;
- Blackwater Creek supports baitfish, and sucker spawn as far upstream as Tree Nursery and Norman Roads;
- Thunder Creek is a spawning area for sucker and walleye;
- Mouth of Thunder Creek supports musky and northern pike spawning; and
- Fishing supports tourism and businesses in the area providing fishing and guiding experiences.

Members of the Eagle Lake First Nation identified the following with respect to their traditional knowledge of aquatic resources:

- Fish spawning occurs in Blackwater Creek mouth area;
- Blackwater Creek a spawning area for pike and musky;
- Their diet is comprised of fish, moose, deer; and

- Wabigoon Lake First Nation and Whitefish Bay First Nations have fishing licenses on Thunder and Wabigoon Lake.

In addition members of the Eagle Lake First Nation also expressed particular interest in the potential effects of the Project on the following:

- The Lola Nature Reserve;
- Mavis and Ghost lake where there is a sacred site called The Serpent; and
- Walleye who use Streams in the project area in June.

Members of the Métis Nation of Ontario have verbally indicated that members of this indigenous community come from Atikokan and Fort Frances to fish, harvest, and hunt moose. A formal Traditional Knowledge and Land Use study (TKLUS) is currently underway with the Métis Nation of Ontario. As it relates to fishing activities the areas of Thunder Lake, Wabigoon Lake, and Big Sandy Lake were captured as locales for fishing activities, further to the area of Keplyns Bay was identified as a spawning area for large bodied fish.

Members of Whitefish Bay First Nation have shared with Treasury Metals that there is a registered fish buyer from Thunder Lake. This community also has a history with Rice Lake where they established base camps in the area, and there overall interests ensuring that the project does not negatively impact their fisheries and that mine drainage does not impact Lac Seul (and presumably other lakes in the area).

Members of Wabigoon Lake Ojibway Nation, Eagle Lake First Nation, Whitefish Bay First Nation, and Wabauskang First Nation have indicated:

- Fish spawning and sanctuaries are located in areas surrounding the project;
- Thunder Lake is cold water trout habitat;
- Fish spawning area around Christie Island. Two waterways drain into this fish spawning area;
- Minnows and shiners can be found in almost every creek;
- Baitfish have been found in the irrigation ponds, other ponds in the area, and along creeks;
- Suckers have also been found on the site;
- Thunder Lake is clear and spring water fed, and flows into Wabigoon Lake. The water flows through the water bodies in the region in a counterclockwise direction;
- Spawning areas in Thunder Creek and Nugget Creek (walleye), Blackwater Creek (sucker), and along the shoreline of Wabigoon Lake (northern pike); and
- Blackwater Creek has one main bed that branches off into at least 10 other creeks, then into bogs. Identified baseline conditions are not adequately described in the EIS. More

detailed mapping of potentially affected habitat is needed, including a scaled figure delineating the potentially affected watershed. The EIS is missing fishing areas in Wabigoon Lake and within the project area. Requested that mitigation measures for prevention of contamination of water bodies and impacts on fish and fish habitat be described.

Members of Grassy Narrows Fist Nation and Wabauskang First Nation both commented that there is known mercury contamination in English River/Wabigoon River system due to pulp and paper operations including those in Dryden.

Other information with respect to traditional knowledge and aquatic resources shared via the original EIS review process, however the specific community was not specified included concerns over discharge from the Project as Wabigoon Lake is downstream and this lake supports a number of large bodied fish species of value to the public and First Nations. Particular species of interest included:

- Walleye;
- Muskellunge;
- Northern Pike; and
- Non-fish aquatic mammals of particular interest included fur bearing species such as beaver, muskrat, and otter.

5.9 Terrestrial Resources

As part of the work to respond to the Round 1 information requests, the terrestrial baseline information relied on in the EIS was compiled into the following two baseline summary documents:

- Summary Wildlife Baseline Report (2011–2016), included as Appendix R to the revised EIS; and
- Wetlands Baseline Study (2016), included as Appendix S to the revised EIS.

These reports compile the baseline information still relied on from the baseline reports prepared by Klohn Crippen Berger (KCB 2012), included as Appendix G to the original EIS, and DST Consulting Engineers (DST 2014b), included as Appendix R to the original EIS, as well as DST (2014c), included as Appendix S to the original EIS. The original EIS relied on a common Local Study Area (LSA) and Regional Study Area (RSA) for all of the biological disciplines. The biological LSA and RSA were originally defined by Klohn Crippen Berger (KCB) in 2012. These study areas were kept for use during data collection from 2012 to 2014 so that the collected data would be comparable to previously collected data. In 2015, Treasury Metals retained KBM to gather additional biological baseline data. As part of this work, the LSA and RSA were redefined by KBM to better represent the Project and to make the LSA and RSA more ecologically meaningful. The LSA was defined as the lands and waters of the watershed in which the proposed development footprint is located. The RSA was defined as the Ontario Ministry of Natural Resources and Forests (MNRF) defined Ecodistrict within which the LSA was located. The LSA and RSA for terrestrial biology are shown in Figure 5.9-1, and are described further in Sections 6.1.4.12, 6.1.4.13, 6.1.4.15.

5.9.1 Natural Heritage Areas

No internationally recognized areas (e.g., UNESCO Biosphere Reserve) or nationally protected sites (e.g., National Park) are located within the RSA. Two provincial parks occur within the LSA. Aaron Provincial Park is a 117 ha recreation-class park situated at the Thunder Lake outflow, approximately 2.5 km west of the middle of the proposed open pit. Lola Lake Provincial Park is a large (6,572 ha) Class 1 Strict Nature Reserve/Scientific Reserve-classed park that serves to protect an extensive peatland. Access and usage of this class of protected area are strictly regulated. This park partially overlaps the LSA to the northeast of the existing portal.

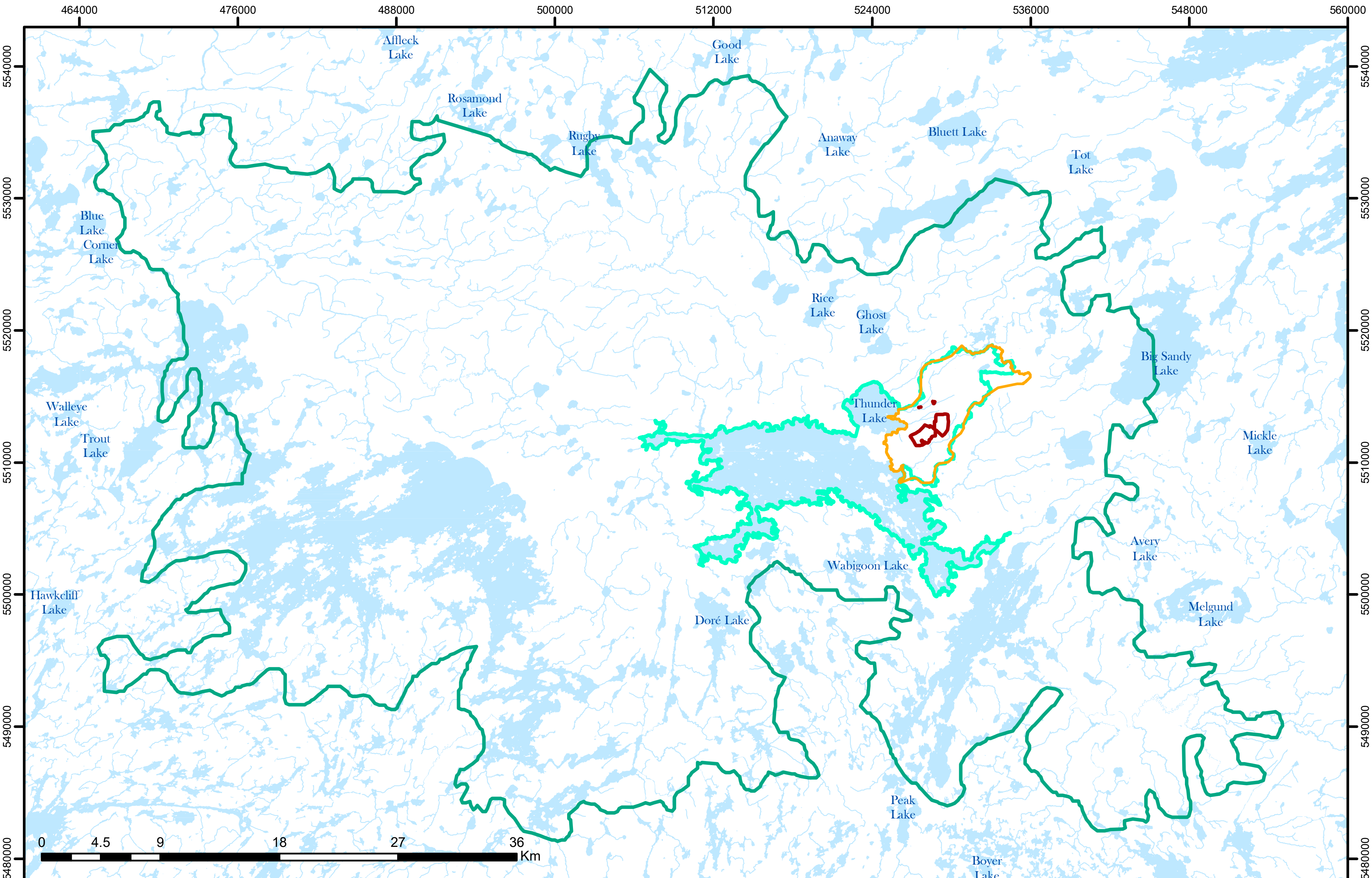
5.9.2 Vegetation

5.9.2.1 Environmental Setting

The Project is located within the Ontario Shield Ecozone, which is characterised by extensive wetlands and boreal forests. Within the ecozone, the Project occurs within the Wabigoon Ecoregion (Ecoregion 4S) in the Lower English River Section of the Boreal Forest Region. This ecoregion is composed of a range of forest types (mixed forest 25%, sparse forest 24%, and coniferous forest 14%) and open water (24%; Crins et al. 2009). Typical tree species include trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), white and black spruces (*Picea glauca*, *Picea marina*), white birch (*Betula papyrifera*) and willow (*Salix* spp.).

The Project area lies within the Dryden Forest Management Unit (FMU), but a portion of the RSA extends into the adjacent Wabigoon FMU (MNRF 2014). Both FMUs fall within the boundaries of the Wabigoon Ecoregion and are located on the Precambrian Shield. The bedrock in the area is primarily granite and greenstone composed of metavolcanic and metasedimentary rocks, with granitoid intrusions. The landscape of the Wabigoon Ecoregion is a gently sloping plain of shallow tills over bedrock in conjunction with moraine of varying depths. Sediments consist of sandy-silt, sand and gravel deposits overlain by lacustrine sand, silt and varved clays. Localized pockets of clay and silt are scattered in low-lying areas.

The MNRF defines ecological units on the basis of bedrock, climate (temperature, precipitation), physiography (soils, slope, aspect) and corresponding vegetation. The ELC of Ontario is used for descriptive, planning, and resource management purposes. The upper levels in its hierarchy may be relevant for provincial and municipal land-use planning initiatives. The lower (finer-scale) levels of the hierarchy are most useful for detailed resource management prescriptions and other local and site planning applications. Using the ELC of Ontario, the distribution of ecosites over the RSA and LSA were characterized, and the results summarized in Table 5.9.2.1-1. A visual representation of the ELS mapping is provided on Figure 5.9.2.1-1.



Legend

- Development Footprint
- Local Study Area
- Regional Study Area
- Wild Rice Local Study Area

Figure 5.9-1
Regional Study Area (RSA) and Local Study Area (LSA) for Terrestrial Resources

1:391,571
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-11

KBM RESOURCES GROUP

Table 5.9.2.1-1: Ecosites of the RSA and LSA

Ecosite	RSA		LSA	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
B007	464.2	0.1%	22.0	0.4%
B011	44.1	0.0%	56.8	1.1%
B012	5367.8	1.7%	0.0	0.0%
B014	29.7	0.0%	0.0	0.0%
B016	170.2	0.1%	0.0	0.0%
B031	15.7	0.0%	0.0	0.0%
B032	7.6	0.0%	0.0	0.0%
B033	637.1	0.2%	0.0	0.0%
B034	2569.0	0.8%	34.6	0.7%
B035	1125.0	0.4%	0.0	0.0%
B037	22.2	0.0%	0.0	0.0%
B039	41.6	0.0%	0.0	0.0%
B040	448.6	0.1%	0.0	0.0%
B046	34.4	0.0%	0.0	0.0%
B047	61.6	0.0%	0.0	0.0%
B048	2488.3	0.8%	3.5	0.1%
B049	18577.7	5.9%	759.6	15.2%
B050	27990.7	8.9%	341.4	6.8%
B051	539.2	0.2%	0.0	0.0%
B052	3386.4	1.1%	69.2	1.4%
B053	169.0	0.1%	0.0	0.0%
B054	434.5	0.1%	0.0	0.0%
B055	26063.8	8.3%	171.0	3.4%
B062	1.5	0.0%	0.0	0.0%
B063	5.5	0.0%	0.0	0.0%
B064	98.3	0.0%	0.0	0.0%
B065	2165.7	0.7%	155.4	3.1%
B066	215.6	0.1%	0.0	0.0%
B067	300.4	0.1%	0.0	0.0%
B068	62.2	0.0%	0.0	0.0%
B070	1427.8	0.5%	14.3	0.3%
B071	196.0	0.1%	8.7	0.2%
B081	5.7	0.0%	0.0	0.0%
B082	302.6	0.1%	0.0	0.0%
B083	860.1	0.3%	0.0	0.0%
B084	22.1	0.0%	0.0	0.0%
B085	65.8	0.0%	0.0	0.0%
B088	1479.2	0.5%	0.0	0.0%
B093	6191.0	2.0%	72.3	1.4%
B095	2364.6	0.8%	24.1	0.5%
B096	606.9	0.2%	9.9	0.2%
B097	892.9	0.3%	0.0	0.0%
B098	5691.2	1.8%	297.6	6.0%
B099	17312.3	5.5%	117.2	2.3%

Table 5.9.2.1-1: Ecosites of the RSA and LSA (continued)

Ecosite	RSA		LSA	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
B100	1633.5	0.5%	4.2	0.1%
B101	4396.5	1.4%	56.8	1.1%
B102	350.5	0.1%	0.0	0.0%
B103	250.0	0.1%	0.0	0.0%
B104	45165.0	14.4%	651.4	13.1%
B105	24.7	0.0%	0.0	0.0%
B109	112.8	0.0%	0.0	0.0%
B111	39.5	0.0%	0.0	0.0%
B112	398.9	0.1%	6.1	0.1%
B113	40.7	0.0%	4.5	0.1%
B114	2913.3	0.9%	240.4	4.8%
B115	705.2	0.2%	0.0	0.0%
B116	681.2	0.2%	23.8	0.5%
B117	145.7	0.0%	0.0	0.0%
B118	5.3	0.0%	0.0	0.0%
B119	3814.6	1.2%	2.6	0.1%
B120	342.0	0.1%	0.0	0.0%
B126	26.1	0.0%	0.0	0.0%
B127	1306.0	0.4%	58.9	1.2%
B128	18298.9	5.8%	405.2	8.1%
B129	3052.0	1.0%	31.0	0.6%
B130	1272.1	0.4%	4.0	0.1%
B133	39.1	0.0%	0.0	0.0%
B134	60.0	0.0%	0.0	0.0%
B135	5902.8	1.9%	136.6	2.7%
B136	3147.3	1.0%	640.3	12.8%
B138	2.5	0.0%	0.0	0.0%
B139	3412.5	1.1%	98.5	2.0%
B140	904.9	0.3%	16.2	0.3%
B141	62.3	0.0%	62.3	1.2%
B142	8238.9	2.6%	91.9	1.8%
B144	109.2	0.0%	53.3	1.1%
B146	2154.7	0.7%	0.0	0.0%
B147	3.3	0.0%	0.0	0.0%
B165	12.3	0.0%	0.0	0.0%
B189	7.4	0.0%	0.0	0.0%
B191	44.6	0.0%	0.0	0.0%
B195	69.9	0.0%	0.0	0.0%
B197	3900.5	1.2%	0.0	0.0%
B198	13.9	0.0%	0.0	0.0%
B199	1.5	0.0%	0.0	0.0%
B200	7.0	0.0%	0.0	0.0%
B222	16.5	0.0%	0.0	0.0%
B223	77.3	0.0%	0.0	0.0%

Table 5.9.2.1-1: Ecosites of the RSA and LSA (continued)

Ecosite	RSA		LSA	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
B224	19.2	0.0%	0.0	0.0%
Unidentified Coniferous Forest	434.6	0.1%	0.0	0.0%
Unidentified Deciduous Forest	113.6	0.0%	0.0	0.0%
Unidentified Successional Forest	148.4	0.0%	0.0	0.0%
Unidentified Wetland	3.8	0.0%	0.0	0.0%
Developed	5281.2	1.7%	180.9	3.6%
Open Water	63727.7	20.3%	63.2	1.3%
TOTAL	**313,846.8**		**4,989.7**	

5.9.2.2 Forest Composition

The Dryden Forest is composed of coniferous (53%), mixed wood (42%) and broadleaf (5%) forests, 29% of which is considered mature or late stage forest (DFMC 2010). The relative abundance of forest types within the RSA and LSA match that of the larger Dryden Forest (Figure 5.9.2.2-1).

5.9.2.3 Other Terrestrial Land Cover

The non-forested areas within the RSA and LSA are primarily agricultural lands (i.e., pasture or hayfield). A former tree nursery is located at the north edge of the LSA. Other developed areas within the LSA include the Village of Wabigoon (south LSA) and the local landfill site (central-east LSA).

Additionally, potential Blueberry (Vaccinium sp.) and Dwarf Raspberry (Rubus pubescens) habitat was included in the vegetation effects assessment (Section 6.15). These berries were selected because of their use as ecosite indicator species, non-overlapping habitat preferences, and their value to Indigenous communities. Potential Blueberry habitat accounted for 2,065.5 ha of the LSA, with Dwarf Raspberry habitat accounting for 936.9 ha (see Figure 5.9.2.3-1).

5.9.2.4 Field Surveys

Vegetation surveys were conducted at 300 local sites during the 2010-2011 field season. Sampling methods were based on the MNRF Ontario Parks Inventory and Monitoring Program (McCaul et al. 2008). A total of 270 vascular plant species were identified in the vicinity of the Project (KCB 2102), 25 of which were introduced species commonly associate with disturbed habitats. Most of the remaining species are typical of Ontario's southern boreal forest.

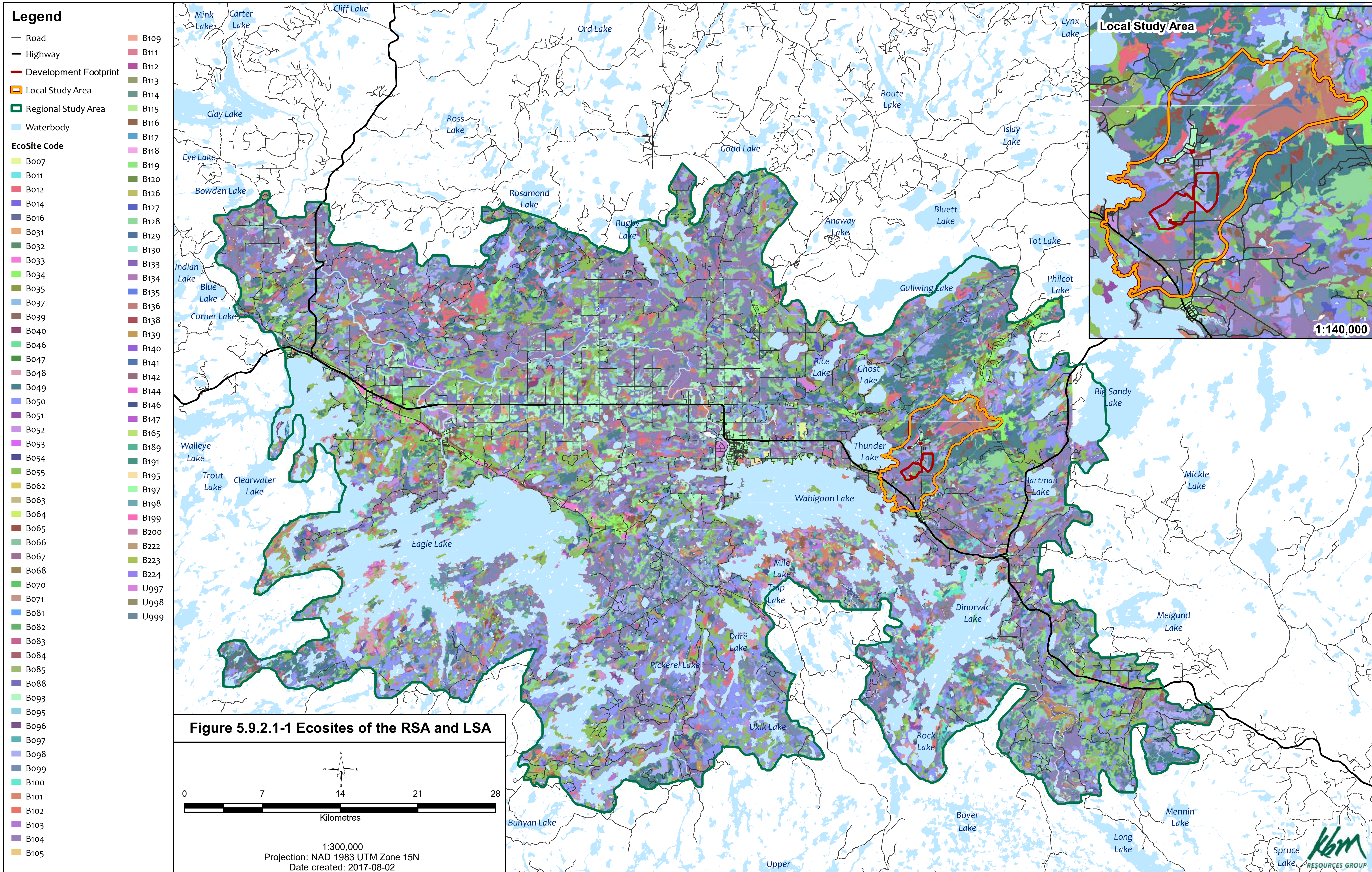


Figure 5.9.2.1-1 Ecosites of the RSA and LSA

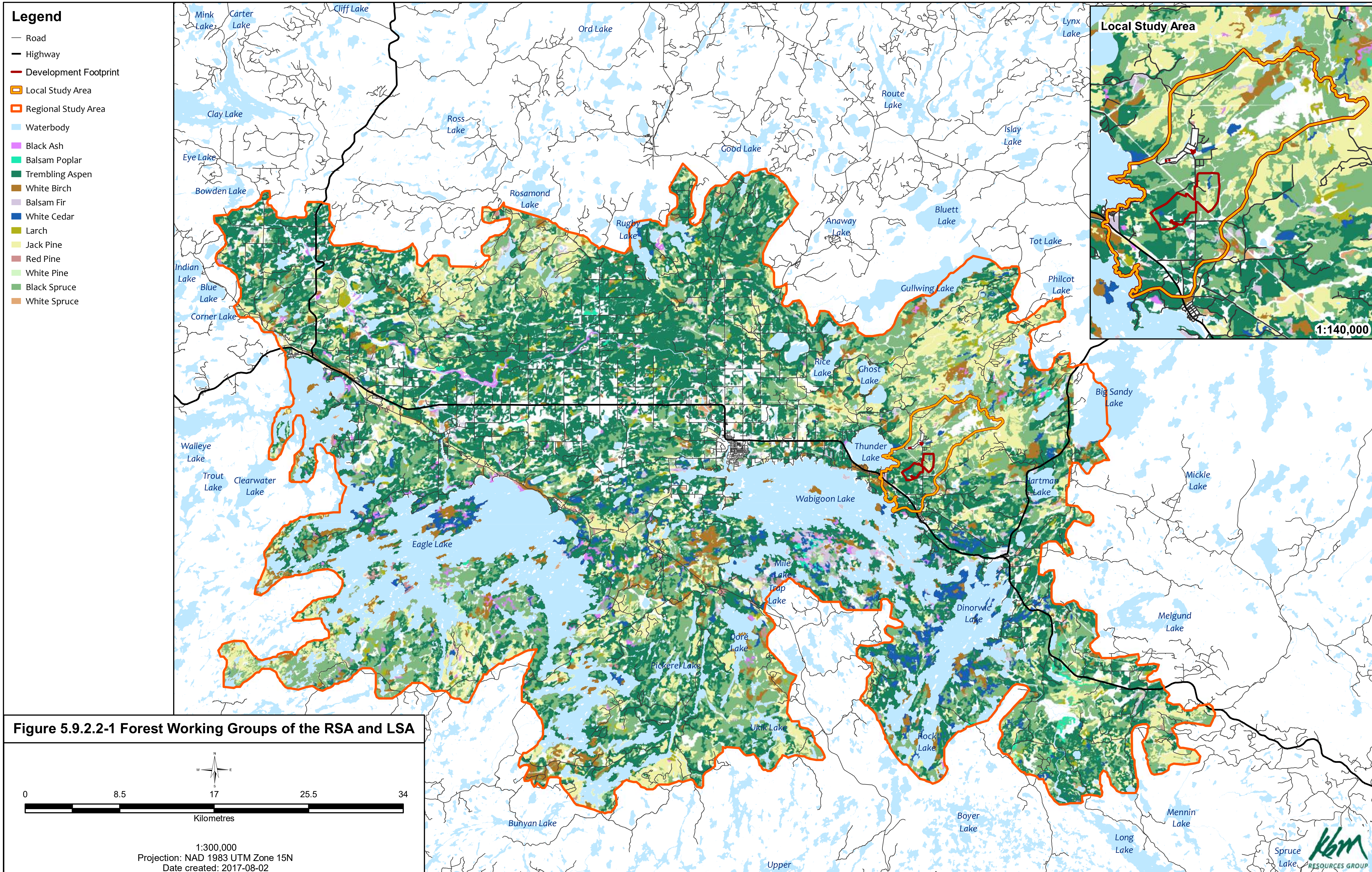


Figure 5.9.2.2-1 Forest Working Groups of the RSA and LSA

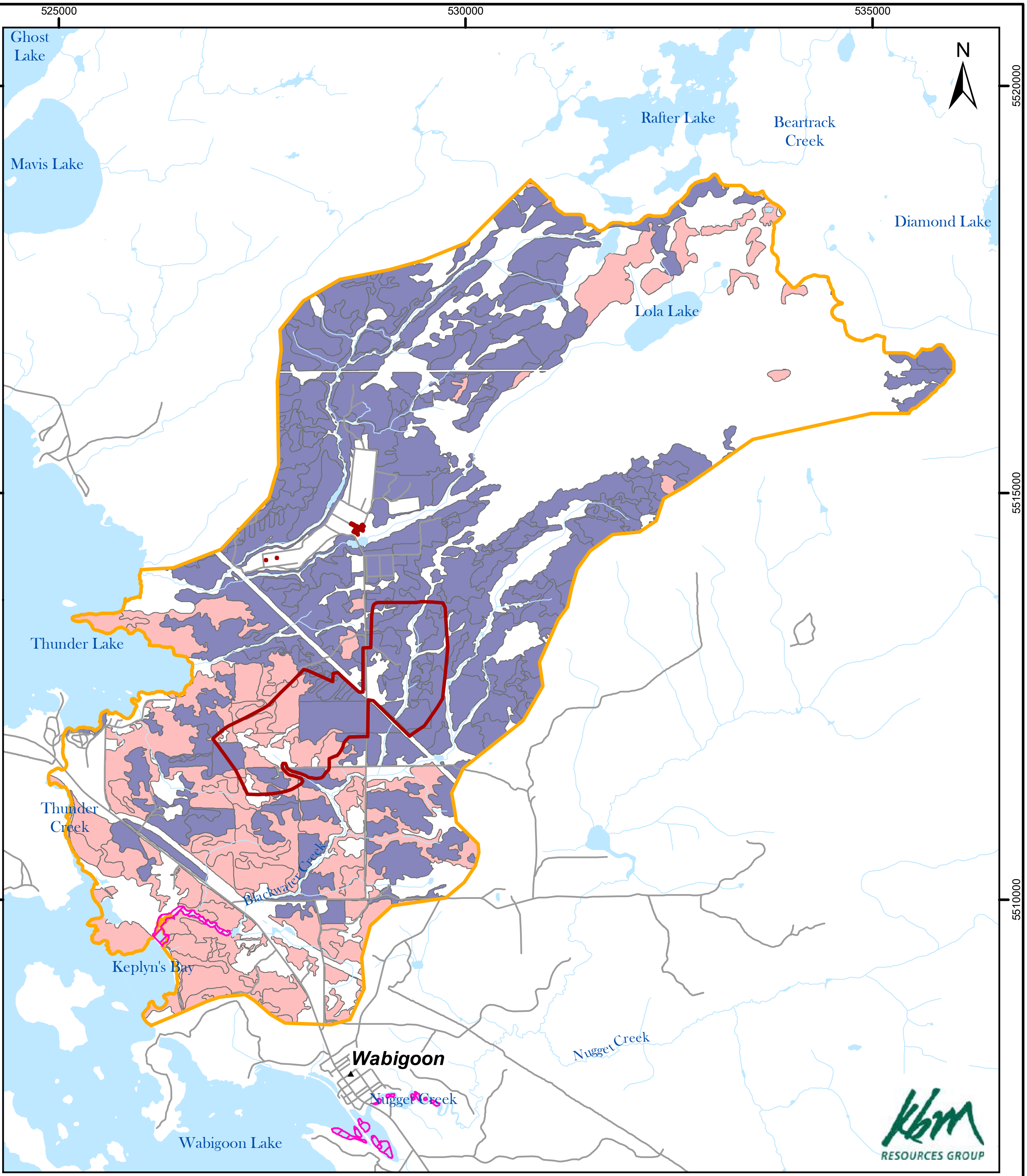


Figure 5.9.2.3-1: Potential Berry Habitat Within the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

Legend

- LSA
- Development Footprint
- Road
- Wild Rice Stand
- Waterbody
- Blueberry
- Dwarf Raspberry
- Stream

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

5.9.3 Wetlands

5.9.3.1 Environmental Setting

The environmental setting of the Project area is described in detail in Section 5.9.2, and descriptions of wildlife and associated habitat are presented in subsequent sections.

5.9.3.2 Assessment Methods

Initial surveys of nine wetlands were conducted in 2012 by DST. Wetlands were selected based on the potential for adjacent developments. Supplementary surveys were conducted in 2016, which expanded data collection to 11 wetlands (Figure 5.9.3.2-1). Upon request, KBM also compiled all available historical data for Lola Lake Provincial Nature Reserve. The purpose of completing the wetland evaluations within the Project area was to acquire baseline data on all wetlands, peatlands, and riparian plant communities, as well as to map and describe wetlands following the Ontario Wetland Evaluation System (OWES). The specific objectives were to:

- Characterize all riparian/wetland vegetation communities according to the appropriate classification guides (OWES).
- Describe individual wetland vegetation community distribution, structure, and diversity.
- Identify any provincially significant wetlands (PSWs).
- Wetlands are defined by OWES as “lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case, the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants.” There are four recognized OWES wetland types: bog, fen, swamp and marsh. Any discrete wetland may be composed of one or more of these wetland types.
- Prior to fieldwork, Forest Resource Inventory (FRI) data and 1:6,500 Google Earth satellite images of each wetland were examined. A first estimate of wetland boundaries and vegetation community boundaries were interpreted and marked onto each image. All vegetation communities were visited in the field to confirm vegetation community boundaries and to identify vegetation forms and species. Wetland boundaries on satellite images were corrected as required in the field.

Each wetland evaluation included an in-depth information gathering phase, which involved contact with the following organizations, agencies, and resources:

- Forest Resource Inventory (FRI) maps;
- LIDAR digital imagery aerial photography;
- Watershed data from Land Information Ontario (LIO);

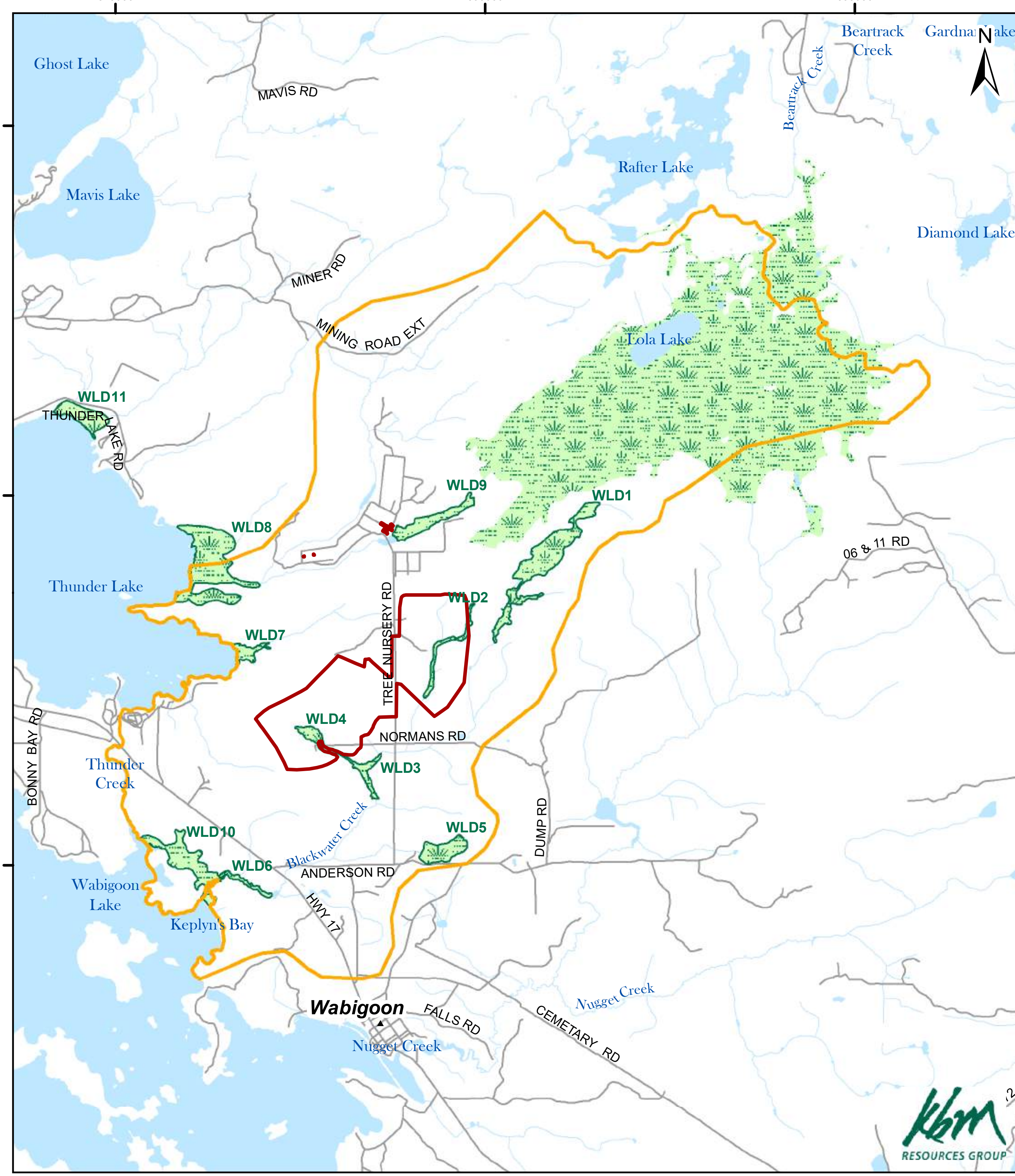


Figure 5.9.3.2-1
Assessed Wetlands within the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2017-08-02

Legend

- Town
- Stream
- Development Footprint
- Local Study Area
- Surveyed Wetlands
- Wetlands
- Waterbody

SCALE: 1:70,000

0 0.5 1 2 3 4 Km

- Dryden District OMNRFF;
- Ontario Parks;
- Natural Resources Values Information System (NRVIS), Land Information Ontario (LIO), Crown Land Use Policy Atlas (CLUPA);
- Wabigoon Lake Ojibway Nation, Eagle Lake First Nation, Whitefish Bay First Nation, Wabaskang First Nation, Lac Seul First Nation, Grassy Narrows First Nation, Aboriginal Peoples of Wabigoon and Métis Nation of Ontario;
- Natural Heritage Information Centre (NHIC);
- Review of topographic and soil maps; and
- Previous studies including fish habitat, waterfowl surveys, breeding bird surveys, and vegetation surveys.

Wetlands with areas greater than 0.5 ha were considered for evaluation. Data collected during field observations included:

- Plant surveys (vegetation forms, common species and identification of rare plants);
- Soil/substrate types;
- Wetland boundaries;
- Delineating wetland types;
- Delineating vegetation communities;
- Identifying presence of special features, wildlife, furbearers, wild rice etc.; and
- Recording fish habitat information.

The OWES evaluation procedure involved assigning points to the different features of a wetland, based on four components: social, hydrological, biological and special features. As the score for each component is capped at 250 points, a wetland can score a maximum of 1,000 points. Wetlands that achieve a total score of 600 or more points, or score 200 or more points in either the biological or special features components are considered to be provincially significant.

During the wetland surveys, efforts were made to identify any observations of wild rice. As identified during the engagement process (see Section 5.9.9) wild rice represents an important resource to Indigenous communities. The locations of the wild rice stands within the vicinity of the Project are shown on Figure 5.9.3.2-2. The figure also illustrates the local study area used for evaluating the potential effects of the Project on wild rice (see Section 6.1.4.15). One wild rice stand was identified in during wetland surveys (see Section 5.9.3.3), and a further 14 stands were identified in the wild rice LSA from LIO data.

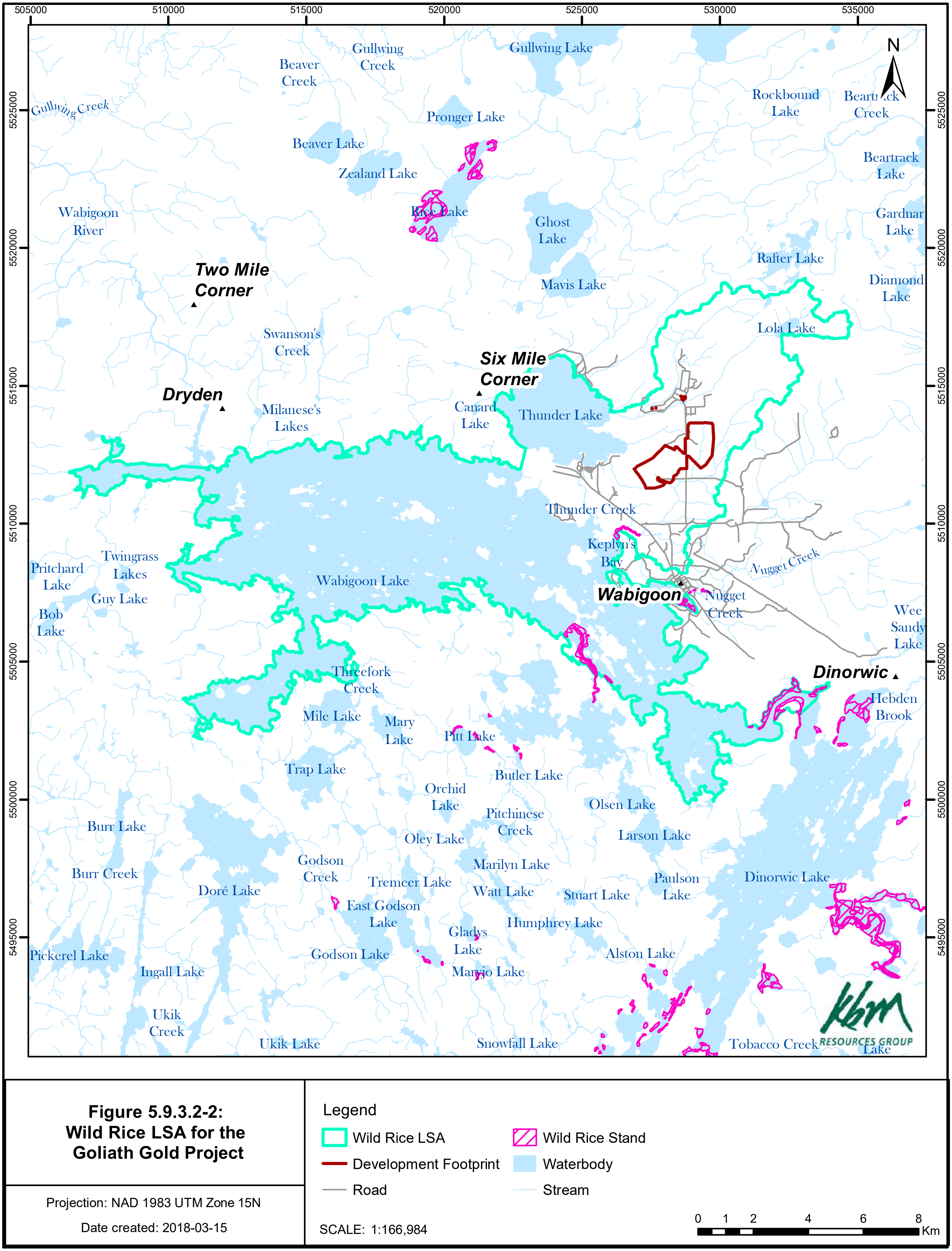


Figure 5.9.3.2-2: Wild Rice LSA for the Goliath Gold Project

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-15

5.9.3.3 Findings

Lola Lake Provincial Nature Reserve

For the purposes of this report, the Lola Lake wetland complex was not surveyed in the field due to: a) the availability of previous surveys and reports on the wetland; b) the vast size and inaccessibility of large portions of the wetland; and c) the fact that the entire wetland lies upstream of any proposed Project components and will have a very small chance of being negatively affected by the Project after all necessary mitigation measures are in place.

The Lola Lake wetland is a large wetland complex, approximately 1,487 ha in size, surrounding Lola Lake. The peatland supports open graminoid bogs, open low-shrub bogs, and treed bog communities, including raised bogs and some basin bogs. Black spruce is the dominant tree species, and leatherleaf (*Chamaedaphne calyculata*), sweet gale (*Myrica gale*), and/or bog birch (*Betula pumila* var. *glandulifera*) are the dominant shrub species. Few-seeded sedge (*Carex oligosperma*) dominates the graminoid bogs. Sphagnum mosses are abundant throughout.

The wetland complex also includes sloping, patterned fen formations (string or ladder fens). Larch, birch, speckled alder (*Alnus rugose*), willow (*Salix* spp.), alder-leaved buckthorn (*Rhamnus alnifolia*), tussock bulrush (*Scirpus cespitosus*), and wiregrass (*Carex lasiocarpa*) are the main species in the fens, with relative prevalence depending on the amount of open water and overall saturation of the site. The moss layer thickness varies and is dominated by sphagnum and/or ribbed bog moss (*Aulacomnium palustre*).

Wetland Evaluation

As per the description in the methodology there are four major components within the data scoring record: biological, social-economic, hydrological, and special features. Although the KCB (2012) report identifies four wetland communities of significance: Lola Lake Wetland, Hughes Creek Wetland, Thunder Lake Wetland and Thunder Lake, Blackwater Creek and Nugget Creek Wetlands. However, these wetlands have not been identified “provincially significant”. Further, the original nine wetlands surveyed and the two additional wetlands surveyed in 2016 did not score greater than 600 points on OWES criteria, and are not considered provincially significant either. All scores by components and subsections are summarized in Table 5.9.3.3-1. The average score across all 11 wetlands evaluated was 362, the maximum score was 448 (WLD8), and the minimum score calculated was 277 (WLD2). Individual wetland maps, wetland species lists and wetland scoring records can be found in Appendix S.

The 11 surveyed wetlands ranged in size from 5 ha to 54 ha and included swamps, fens, and marshes. The Swamp wetland type occupied the largest area of all the wetlands evaluated (112 ha), followed by Fen (58 ha), and Marsh (30 ha). All wetlands were either palustrine (inland with no flow or intermittent inflow and either permanent or intermittent outflow), or lacustrine (associated with a lake - Thunder Lake or Wabigoon Lake, in this case).

Table 5.9.3.3-1: Summary of OWES Scores for Evaluated Wetlands

Wetland ID:		WLD1	WLD2	WLD3	WLD4	WLD5	WLD6	WLD7	WLD8	WLD9	WLD10	WLD11
BIOLOGICAL COMPONENT												
Productivity	Growing Degree-Day/soils (max 30)	8	7	10	9	8	8	13	9	8	11	9
	Wetland Type (max 15)	7	8	9	13	7	15	11	8	9	8	10
	Site Type (max 5)	2	2	2	2	2	5	2	2	2	5	3
Biodiversity	Number of Wetland types (max 30)	20	13	13	13	13	9	13	20	20	20	13
	Vegetation Communities (max 45)	5	5	3	5	5	3	5	5	7	7	5
	Diversity of Surrounding Habitat (max 7)	6	7	6	7	7	7	7	7	6	7	7
	Proximity to other wetlands (max 8)	8	8	8	8	8	8	8	8	8	8	8
	Interspersion (max 30)	9	6	9	12	12	15	12	18	6	9	9
	Open water type (max 30)	8	0	14	20	8	30	30	14	14	8	8
	Size (max 50)	10	7	9	17	8	25	25	21	9	8	7
Total Biological Component (not to exceed 250)		83	63	83	106	78	125	126	112	89	91	79
SOCIAL COMPONENT												
Economically Valuable Products	Wood products (max 14)	0	0	0	0	0	0	0	6	4	4	4
	Low Bush Cranberry (max 2)	2	2	0	0	2	0	0	0	2	0	0
	Wild rice (max 10)	0	0	0	0	0	10	0	0	0	0	0
	Commercial fish (max 12)	0	12	12	12	0	12	12	12	12	12	12
	Furbearers (max 12)	3	0	3	3	0	3	6	0	3	0	0
Recreational Activities	Hunting/Fishing/Nature (max 80)	0	0	0	0	0	8	0	0	0	16	36
	Landscape Distinctness (max 3)	3	3	3	3	3	3	3	3	3	3	3
	Absence of human disturbance (max 7)	7	4	4	4	7	4	7	7	4	4	4
	Educational Uses (max 20)	0	0	0	0	0	0	0	0	0	0	0
	Facilities and Programs (8)	0	0	0	0	0	0	0	0	0	0	0
	Research and Studies (max 12)	8	5	5	5	0	5	5	5	5	5	5
	Proximity to human settlement (max 40)	10	10	10	10	10	10	10	10	10	10	8
	Ownership (max 10)	8	5	4	8	4	4	8	8	4	8	8
	Size (max 20)	7	2	2	2	3	5	5	11	7	5	7
	Aboriginal and cultural (max 30)	0	0	0	0	0		0	0	0	0	0
Total Social Component (not to exceed 250)		48	43	43	47	29	64	56	62	54	67	87

Table 5.9.3.3-1: Summary of OWES Scores for Evaluated Wetlands (continued)

Wetland ID:		WLD1	WLD2	WLD3	WLD4	WLD5	WLD6	WLD7	WLD8	WLD9	WLD10	WLD11
HYDROLOGICAL COMPONENT												
Groundwater Recharge	Flood attenuation (max 100)	59	35	10	14	34	0	0	0	30	0	0
	Site type (20)	20	20	20	20	20	0	0	0	20	0	0
	Hydrological Soils (max 10)	7	7	4	4	4	0	0	0	7	0	0
Downstream Water Quality improvement	Watershed Improvement (max 30)	30	30	30	30	21	30	30	30	30	30	16
	Adjacent Watershed Land Use (max 60)	4	4	4	4	14	29	14	29	4	29	29
	Vegetation form (max 10)	8	8	8	10	8	10	10	8	8	8	8
	Carbon Sink (max 15)	15	9	9	9	0	9	9	9	9	9	9
	Shoreline erosion control (max 15)	0	0	0	0	0	8	15	8	0	8	15
	Groundwater Discharge (max 30)	22	21	18	17	12	22	17	17	21	17	17
Total Hydrological Component (not to exceed 250)		165	134	103	108	113	108	95	101	129	101	94
SPECIAL FEATURES												
Rarity	Wetlands (max 70)	50	30	30	30	40	20	30	50	50	50	30
	Endangered/Threatened spp. Breeding habitat (no max.)	0	0	0	0	0	0	0	0	0	0	0
	Traditional use by endangered/ threated species (no max.)	0	0	0	0	0	0	0	0	0	0	0
	Provincially significant animals (no max.)	0	0	0	50	0	50	50	80	50	0	0
	Provincially significant plants (no max.)	0	0	0	0	0	0	0	0	0	0	0
	Regionally significant spp. (no max)	0	0	0	0	0	0	0	0	0	0	0
	Locally significant spp. (no max.)	0	0	0	0	0	0	0	0	0	0	0
	Species of Species Status (Black Duck) (max 25)	0	0	0	10	0	10	10	10	0	10	10

Table 5.9.3.3-1: Summary of OWES Scores for Evaluated Wetlands (continued)

Wetland ID:		WLD1	WLD2	WLD3	WLD4	WLD5	WLD6	WLD7	WLD8	WLD9	WLD10	WLD11
Significant Features and Habitat	Colonial Waterbirds (max 50)	0	0	0	0	0	0	0	0	0	0	0
	Winter Cover for Wildlife (max 100)	0	0	0	0	0	0	0	0	0	0	0
	Waterfowl Staging/Moulting (max 150)	0	0	0	0	0	0	0	0	0	0	0
	Waterfowl Breeding (max 100)	0	0	0	10	0	10	10	10	0	10	10
	Migratory Passerine, Shorebird or Raptor stopover (max 100)	0	0	0	0	0	0	0	0	0	0	0
	Ungulate habitat (max 100)	0	0	0	0	0	0	0	0	0	20	20
	Fish nursery habitat (max 100)	2	1	4	1	1	7	3	1	1	9	7
	Fish staging/migration habitat present (max 25)	5	0	0	1	0	25	5	5	5	25	25
	Ecosystem age (max 25)	16	6	30	1	18	0	1	17	6	6	2
	Great lake coastal wetlands (max 75)	0	0	0	0	0	0	0	0	0	0	0
Total Special Features (not to exceed 250)		73	37	74	103	59	122	109	173	112	130	104
TOTAL		**369**	**277**	**303**	**364**	**279**	**419**	**386**	**448**	**384**	**392**	**364**

A total of 177 plant species were identified across the 11 wetlands, though several were only identified to genus. Although the 2012 baseline report identified 21 provincially tracked plant species occurring within the LSA or RSA, an updated search of the Natural Heritage Information Centre (NHIC) database in 2016 resulted in occurrence records for only three plant species within the Dryden District: heart-leaved Alexander (*Zizipa aptera*), Vasey's rush (*Juncus vaseyi*), and western wheat grass (*Pascopyrum smithii*). These occurrences were all located outside of the LSA and the RSA. The other species listed in 2012 occurred in neighbouring forest management units, even further from the LSA and RSA. Species at Risk are further discussed in Section 5.11.

As indicated in the Dryden Forest Management Plan (2010), there are several locally rare tree species in the Dryden FMU, including yellow birch (*Betula alleghaniensis*), burr oak (*Quercus macrocarpa*), and white elm (*Ulmus laevis*). None of these species were observed during 2012 nor 2016 baseline field studies, and burr oak is not typically associated with wetland habitats.

Three wildlife SAR were also encountered during wetland surveys, all of which were birds (Table 5.9.3.3-2).

Table 5.9.3.3-2: Species at Risk Encountered During Wetland Surveys

Wetland ID	Scientific Name	Common Name
WLD9	*Contopus cooperi*	Olive-sided Flycatcher
WLD4, WLD7, WLD6, WLD 8	*Haliaeetus leucocephalus*	Bald Eagle
WLD 8	*Wilsonia canadensis*	Canada Warbler

5.9.4 Mammals

Several mammal surveys were conducted within the LSA, including:

- Encounter surveys (i.e., meandering transects through potential habitat) focused on key ungulate habitats (e.g., winter deer yards, potential calving areas, mineral licks, and potential denning sites) and SAR habitats (e.g., grasslands for American Badger, Taxidea taxus taxus);
- Moose Aquatic Feeding Area surveys (2012, 2016);
- Presence/absence acoustic monitoring for bats (2011 and 2012); and
- An extensive monitoring program established to identify bat maternity roost (2015).

Twenty mammal species were documented in the LSA across the 2011 to 2016 field seasons. Several large mammals and furbearers were regularly observed in the Project area (Table 5.9.4-1).

Table 5.9.4-1. Summary of Large Mammals and Furbearers identified in the LSA

Large Mammals		Furbearers	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Moose	*Alces alces*	American Beaver	*Castor canadensis*
White-tailed Deer	*Odocoileus virginianus*	Mink	*Mustela vison*
Black Bear	*Ursus americanus*	River Otter	*Lontra canadensis*
Gray Wolf	*Canis lupus*	Red Fox	*Vulpes vulpes*
		Muskrat	*Ondantra zibethicus*
		Woodchuck	*Marmota monax*
		Snowshoe Hare	*Lepus americanus*

Small mammal trapping surveys in October 2012 and July 2016 documented six species over a total of 119 and 160 trap-nights, respectively (Table 5.9.4-2).

Table 5.9.4-2. Small Mammal Trapping Summary

Common Name	Scientific Name	2012	2016
Southern Red-Backed Vole	*Clethrionomys gapperi*	18	7
Deer Mouse	*Peromyscus maniculatus*	12	
Northern Short-tailed Shrew	*Blarina brevicauda*	1	
Red Squirrel	*Tamiasciurus hudsonicus*	1	
Least Chipmunks	*Tamias minimus*		2
Meadow Jumping Mouse	*Zapus hudsonius*		1

Passive acoustic monitoring of bat activity in 2011 and 2012 detected five species: Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat (*Lasionycteris noctivagans*), Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*) and Big Brown Bat (*Eptesicus fuscus*). Both the Little Brown Myotis and Northern Myotis are listed as endangered in Canada.

Potential bat maternal roosts were sparse within the Project area. Although snag density ranged from 40-50 snags/ha, only five high quality roosts were identified in roughly 22 ha of forest assessed. These snags represent a highly limited resource. No bat species were observed using the roosts during an exit survey in 2015, but two bats of unknown species were observed flying over the area.

Beaver activity was recorded opportunistically as encountered in the field (dams, lodges). Figure 5.9.4-1 presents the locations of current (at the time of fieldwork) and historical beaver activity in the LSA. Historical beaver activity was determined through a review of past satellite imagery.

The MAFA survey located one potential high quality MAFA in wetland WLD9. This wetland, which is situated on Thunder Lake Tributary 3, upstream from the irrigation ponds at the former MNRF tree nursery, is highlighted on Figure 5.9.4-2.

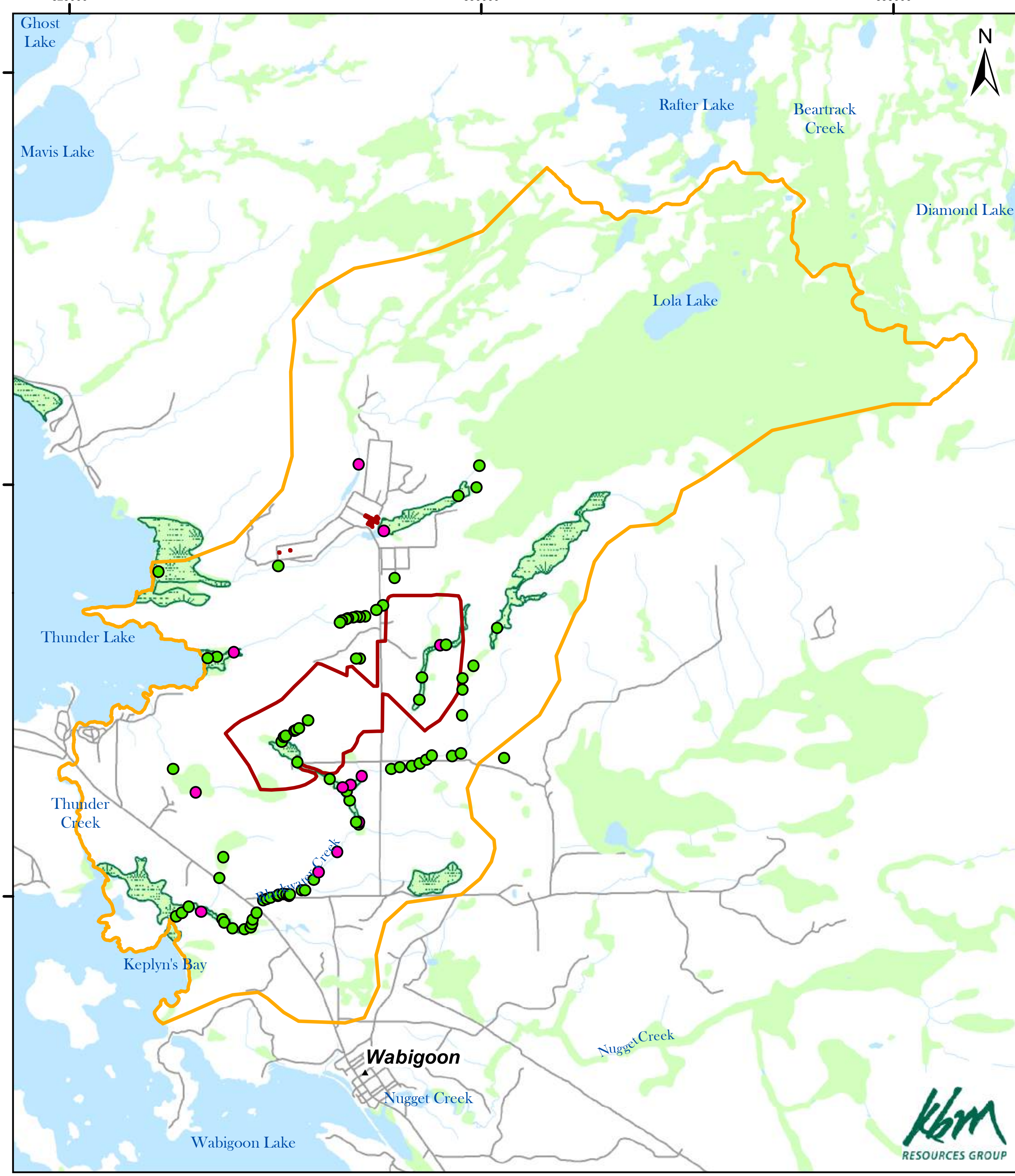


Figure 5.9.4-1
Beaver Activity in
the Goliath Gold Project Area

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

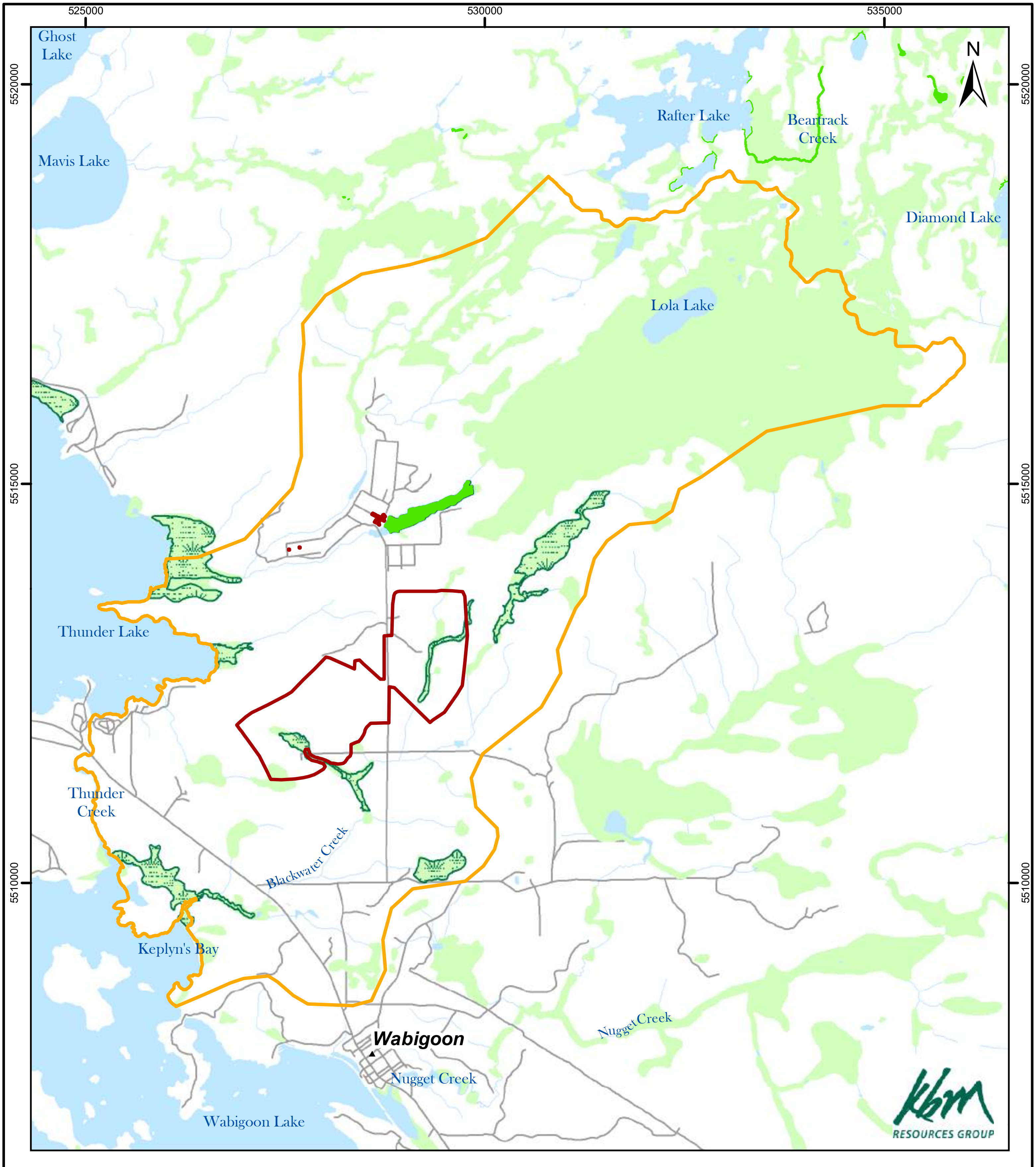


Figure 5.9.4-2
Moose Aquatic Feeding Areas in the Goliath Gold Project Area

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-03-22

Legend

LSA
Development Footprint
Road
Wetland
Surveyed Wetlands
Moose Aquatic Feeding Area
Waterbody
Stream

SCALE: 1:62,770

0 0.45 0.9 1.8 2.7 3.6 Km

No targeted moose calving surveys were completed during the field program; however, efforts to observe evidence of moose calving while conducting other field surveys was made, particularly when surveying wetlands, and peninsulas (i.e., suitable calving areas). No evidence of moose calving was observed during any field surveys. Searches were made for calving evidence during all wetland evaluations and moose aquatic feeding area (MAFA) surveys. One Category 4 (High Potential) MAFA was observed in the LSA (Figure 5.9.4-2). During other field surveys (e.g., bird surveys, small mammal trapping) no signs of calving areas were observed. At no time during any field surveys were calf tracks or calf scat observed anywhere in the LSA.

No targeted mineral lick or den site field surveys were completed during the field program. According to the MNRF's Significant Wildlife Habitat Technical guide, observing and locating mineral licks and den sites, is extremely difficult. With regard to denning sites, The Significant Wildlife Habitat Technical Guide states "*Exhaustive searches are not recommended, since feeding and denning sites for all these mammals are usually very hard to find. Long-term survival of these species and other carnivores with large ranges is best assured by taking a broad, landscape approach to Natural Heritage System planning by identifying and protecting large natural areas that include the best quality habitat for these species. Protection of sufficient habitat for these area-sensitive species will also help provide suitable habitat for many other species*." Locating den sites can be very challenging and is usually accomplished opportunistically. If a den site was observed during any other field survey it would have been documented and marked with a GPS point. No den sites were observed during any field surveys.

Mineral licks are found in association with upwelling groundwater and the soil around these seepage areas. It typically occurs in areas of sedimentary and volcanic bedrock. In areas of granitic bedrock, the site is usually overlain with calcareous glacial till. Suitable surface and sub-surface (i.e., soil) conditions were not observed within the LSA that would support a mineral lick.

5.9.5 Birds

Several bird surveys were conducted within the LSA and RSA, including:

- Breeding Bird Surveys (2011 to 2012, 2016);
- Barn Swallow nest searches (2012, 2016);
- Bird Migration Surveys (2011);
- Marshbird and Waterfowl Surveys (2011 to 2012, 2016);
- Bobolink Surveys (2011);
- Whip-poor-will and Common Nighthawk Surveys (2011 to 2012); and
- Stick Nest Surveys (2010 to 2011, 2015).

A total of 100 bird species were encountered across 140 breeding bird surveys stations. Avian species richness was highest in developed areas (76 species) when compared to deciduous (65), coniferous (63), wetland (37), successional (35), and upland habitats (28). The most frequently encountered species were: White-throated Sparrow (*Zonotrichia albicollis*, 177 observations), Red-eyed Vireo (*Vireo olivaceus*, 104), Nashville Warbler (*Oreothlypis ruficapilla*, 97), American Robin (*Turdus migratorius*, 85), Swanson's Thrush (*Catharus ustulatus*, 75), Ruby-crowned Kinglet (*Regulus calendula*, 72), Ovenbird (*Seiurus aurocapilla*, 67), Hermit Thrush (*Catharus guttatus,* 57), Red-breasted Nuthatch (*Sitta canadensis*, 50), and Magnolia Warbler (*Dendroica magnolia*, 49).

No active stick nests were detected within the LSA; however, active nests were detected for several species:

- Common Loon (*Gavia immer*): active nest on Thunder Lake;
- Barn Swallow (Hirundo rustica): active nests on buildings on the grounds of the former tree nursery; and
- Common Grackle (Quiscalus quiscala): nest in the central LSA (grackle nests are not protected by the *Migratory Birds Convention Act*).

Seven avian SAR were encountered within the LSA (Table 5.9.5-1). Generally, the bird communities observed during the environmental baseline surveys are typical of Ontario's boreal forest.

An Information Gathering Form and an Alternatives Assessment Form for Barn Swallow have been submitted to the OMNRF.

Table 5.9.5-1 Summary of Bird SAR observed in the LSA

Species	Scientific Name	SARA/COSEWIC	SARO
Bald Eagle	*Haliaeetus leucocephalus*	Not at Risk	Special Concern
Barn Swallow	*Hirundo rustica*	Threatened	Threatened
Black Tern	*Chlidonias niger*	Not at Risk	Special Concern
Common Nighthawk	*Chordeiles minor*	Threatened	Special Concern
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Special Concern
Peregrine Falcon	*Falco peregrinus*	Special Concern	Special Concern
Rusty Blackbird	*Euphagus carolinus*	Special Concern	—

5.9.6 Amphibians and Reptiles

Several reptile and amphibian field surveys were conducted in the LSA and RSA, including:

- Visual Encounter Surveys (2011); and
- Roadside Call Surveys (2011 and 2012).

Further, passive acoustic monitors were deployed in 2011 to record calls from birds, frogs, and bats (33 recorder location-nights). Six amphibian species have been recorded within the LSA: Spring Peeper (*Pseudacris crucifer*), Boreal Chorus Frog (*Psuedacris maculata*), Grey Treefrog (*Hyla versicolor*), Wood Frog (*Lithobates sylvaticus*), American Toad (*Anaxyrus americanus*), and Blue-spotted Salamander (*Ambystoma jeffersonianum-laterale* “complex”).

Extensive visual encounter surveys specifically targeting Snapping Turtles (*Chelydra serpentine*) were conducted in appropriate habitats (e.g., basking logs, soil banks) throughout the field program. Western Painted Turtle (*Chrysemys picta belli*) and Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) were regularly detected within the LSA, but no reptile or amphibian SAR were encountered.

5.9.7 Invertebrates

Incidental observations gathered during the 2011 field efforts included four butterflies (*Papilo glaucus candensis*, *Colias eurytheme*, *Celastrina ladon*, *Nymphalis antiopa*), two damselflies (*Calopteryx aequabilis*, *Nehalennia irene*) and 16 dragonflies (*Aeshna canadensis*, *Aeshna interrupta*, *Arigomphus cornutus*, *Boyeria grafiana*, *Dorocordulia libera*, *Dromogomphus spinosus*, *Epitheca cynosura*, *Gomphus graslinellus*, *Gomphus lividus*, *Hagenius brevistylus*, *Leucorrhinia hudsonica*, *Libbellula lydia*, *Libellula pulchella*, *Libellula quadrimaculata*, *Macromia illinoiensis*, *Sympetrum danae*).

Only one invertebrate SAR, Monarch (*Danaus plexippus*) is known to occur within the RSA, but was not observed throughout the field program.

5.9.8 Significant Wildlife Habitat

An inventory of significant wildlife habitat, as described in MNRF (2000), was conducted across the LSA in 2010 to 2011 and 2015. Specifically, these habitats include colonial and raptor nest sites, migratory bird staging and stopover areas, ungulate wintering areas and calving/fawning sites, winter deer yards, moose aquatic feeding areas (MAFAs), mineral licks and hibernacula (reptiles and bats). Summaries of Specialized Wildlife Habitat (Table 5.9.8-1) and the Assessment of Seasonal Concentrations of Wildlife (Table 5.9.8-2) in the LSA are presented below.

Table 5.9.8-1: Assessment of Specialized Wildlife Habitat in the LSA

Natural Feature	Likelihood of Occurrence in the LSA	Comments
Habitat for Area Sensitive Species	Yes	Twenty-nine area sensitive species observed in site investigation.
Forest providing high diversity of habitats	Yes	Relatively large, old, and undisturbed forest stands present.
Amphibian Woodland Breeding Pools	Yes	Suitable habitat noted during site investigation. Six amphibian species observed.

Table 5.9.8-2: Assessment of Seasonal Concentrations of Wildlife in the LSA (continued)

Natural Feature	Likelihood of Occurrence in the LSA	Comments
Foraging Areas with Abundant Mast	Possible	No oaks or other nut-bearing trees. Fruit bearing shrubs (blueberries, June berries, pin cherries) common.
Osprey, Bald Eagle nesting habitat	Possible	None documented or observed in site investigation but Bald Eagles observed during nesting season and suitable habitat present.
Turtle Nesting Habitat	Yes	None documented or observed in site investigation but Western painted turtle is present.
Moose aquatic feeding areas	Yes	One Category 4 (High Potential) MAFA was observed in the LSA.
Mink and otter feeding/denning sites	Possible	Dens not observed or documented, but both species present in the LSA.
Marten and fisher denning sites	Possible	Dens not observed or documented, but suitable habitat present and both species present in surrounding area.
Areas of High Diversity (e.g., seeps, springs, cliffs, and caves)	No	None documented or observed in site investigation.

Table 5.9.8-2: Assessment of Seasonal Concentrations of Wildlife in the LSA

Type of Seasonal Concentration	Likelihood of Occurrence in the LSA	Comments
White-tailed deer winter yard	Possible	Not documented or observed in field investigation. Potential habitat present.
Moose late winter habitat	Possible	Not documented or observed in field investigation. Potential habitat present.
Waterfowl stopover and staging areas	Yes	Marshes at Blackwater, Nugget, and Thunder Creek supported significant numbers of migrating waterfowl in October 2011. There are fairly extensive areas of wild rice (important duck food) at these sites.
Waterfowl nesting areas	Yes	Eight waterfowl species observed during the nesting season. Marshes at Blackwater, Nugget, and Thunder Creek may be significant nesting habitat.
Colonial bird nesting sites	Possible	No evidence of heronries or nesting of other colonial species documented or observed in site investigation. Potential habitat present for Great Blue Heron.
Shorebird migratory stopover areas	Possible	No significant numbers of shorebirds observed during site investigation. Stopover of some species may occur in fields and marshes in some years.
Landbird migratory stopover area	No	Not documented. Stopover of some species may occur, but unlikely to be significant at more than the local scale given the absence of large lakes, ravines, and other landforms likely to concentrate migrants.
Raptor wintering areas	Possible	None documented or observed in site investigation. Some potential habitat is present but wintering raptors are generally uncommon in northwestern Ontario.

Table 5.9.8-2: Assessment of Seasonal Concentrations of Wildlife in the LSA (continued)

Type of Seasonal Concentration	Likelihood of Occurrence in the LSA	Comments
Bald Eagle winter, feeding and roosting sites	Possible	Bald Eagles observed in May to October 2011. Wintering not documented. No open water present in most winters, but the dump is a potential source of food.
Wild turkey winter range	No	Wild Turkeys do not occur in the area.
Turkey vulture summer roost	No	None documented or observed in site investigation.
Reptile hibernacula	Possible	None documented or observed in site investigation. Potential habitat present.
Bat hibernacula	No	None documented. No suitable habitat present.
Butterfly migratory stopover areas	No	None documented or observed in site investigation. Suitable habitat present on Wabigoon Lake shoreline, but significant butterfly migration has apparently not been documented in northwestern Ontario.
Bullfrog concentration areas	No	Bullfrogs do not occur in the area.

5.9.9 Traditional Knowledge

Members of the Wabigoon Lake Ojibway Nation identified the following with respect to their traditional knowledge of the terrestrial environment:

- Harvesting plants and trapping in proximity to the Project.
- Gathering activities occur north of Project area and directly south of Tree Nursery harvesting of blueberries and mushrooms (chanterelles and morels).
- Historically trapping for marten occurred within the proposed development area.
- Berries were harvested in Johnsons Beach area.
- Wild rice occurs in the Blackwater Creek mouth area.
- Harvesting wild rice areas near the project.
- Blueberry picking within area of proposed TSF.
- Identified wild rice is important for community economic development and that wild rice grows in Thunder Creek and Blackwater Creek.
- Chanterelles are located throughout the area and have high economic value.
- Historically, and while the tree nursery was in operation, the community used to have open access to the site for land use. During the tree nursery operation access to hunting trails and the rest of the site was available 5 days a week.
- Hunting trails and roads throughout the project area (currently not included in the EIS).
- Project may restrict access to Thunder Lake and areas north of the proposed tailings storage facility.

- Plant harvesting, including blueberries, stump mushrooms, chanterelles, medicinal plants and other berries. Low bush cranberries, snowbush berry, Labrador Tea, low bush hemlock/ground hemlock are known medicines in the area.
- Peat resources in the area are used by the community.
- Cutting wood for subsistence and economic purposes.
- Trapping (Aboriginal community members from Eagle Lake First Nation and Wabigoon Lake Ojibway Nation hold the trapline licenses for the three trapline areas which are directly affected by the Project).
- Members still gather plants, berries, spring water, and exercise their hunting, fishing, and trapping rights and all these activities will be impacted by activities contemplated for exploration and mining operations.
- Thunder Lake used as a pathway to gather rice and other edibles in Rice Lake. Johnsons Beach was used as a stopover location where berries and other gathering activities traditionally occurred.

This community is interested in the assessment of how the project (all phases) will affect their traditional land use. Based on the traditional knowledge shard, access restrictions due to gated roads, changes to the terrestrial environment due to tailings cover/ ponds, and land remediation are important considerations to be considered when assessment potential effects to traditional land use.

Members of the Eagle Lake First Nation identified the following with respect to their traditional knowledge of the terrestrial environment:

- Plant gathering activities north of Project area and directly south of Tree Nursery harvesting of blueberries.
- Wild rice identified as a VC and aspect of historical harvest within ELFN lands, and wild rice continues to be harvested along Wabigoon Lake and the Wabigoon River system.
- Wild rice historically was harvest in regional lakes sich as Rice Lake, Sandy Lake, Table Rock Lake, and Tom Chief Lake.
- Wild rice occurs in the Blackwater Creek mouth area.
- Proposed tailings area is a local feeding area for birds such as robins (feeding on blueberries), and a denning area for foxes.
- Blueberry picking within area of proposed TSF.
- The Great Earth Law is very important. Connections between every aspect of the environment must be recognized. Anishnawbe people want to protect environment, especially water, for future generations. The preservation of land is a key concern.

- The lake down Sioux Lookout highway where Eagle Lake members go rice picking/duck hunting, people from ELFN have brought their families there for 100 years.
- Denning locations for foxes proximal/within Lola lake Nature Reserve (sandy areas).
- Land use south of the tree nursery for gathering berries and other areas.

Members of the Aboriginals Peoples of Wabigoon identified the following with respect to their traditional knowledge of the terrestrial environment:

- Harvesting plants and trapping in proximity to the Project; and
- Harvesting wild rice in vicinity of the Project area.

Members of the Wabauskang First Nation and Whitefish Bay First Nation communities have indicated that plant gathering activities occur in the area. Wabauskang First Nation also identified that moose, rabbit, and partridge are hunted in the area. Wabauskang also indicated that it was their “aboriginal right” to gather plants and berries. Members of this community also harvest plants from the area for medicinal purposes, although the type of plant was not specified.

Whitefish Bay First Nation indicated the following:

- Sacred aspects of the environment in the Project area, including turtles, frogs, rocks and boulders, and that there are sacred sites south of Wabigoon.
- 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.
- Ceremonial sites in the area include stone circles found on residential properties around the project site.
- Wabigoon Lake is the biggest wild rice area in Canada and is used as a spiritual and teaching area.
- A historical interest in the harvest of wild rice from Rice Lake.
- Moose and deer are target species of harvest, low moose numbers around community have forced community members to regional area to harvest.
- Community has indicated that members exercise their harvest rights in the regional area (Ignace).
- Trapping was historically conducted in proximity to the Project.

Members of the Eagle Lake First Nation, Wabigoon Lake Ojibway Nation, and Whitefish Bay (Naotkamegwanning First Nation) all indicated that:

- Owls (barn and long horn), wild turkeys and robins observed in the project area;
- Project area is a fly through area for migratory birds that may be impacted by the Project;
- Migratory bird nesting area located to the north of the site;
- Blueberry areas attract robins and other birds;
- Soils are sandy northeast of Thunder Lake, including the proposed location for the tailings storage facility;
- Blueberries grow in sand areas and are known to move, the entire area should be identified as blueberry habitat;
- Denning habitat for fox in the area of the proposed tailings storage facility;
- Project area includes bear denning habitat. Dens have been identified along first gate to the tree nursery, property line to tree nursery, and the proposed tailings storage facility location; and
- Moose population near Blackwater Creek and up the site.

The Métis Nation of Ontario indicated that:

- Beaver dams are located in area surrounding the project and that the beaver is an important species to the Métis Nation of Ontario that is traditionally hunted and commercially trapped;
- Although berry patches can change from time to time, there are often established areas for gathering which reoccur annually;
- This community harvests berries other than blueberries and that blueberries are located within the Dryden Forest;
- Blueberries, chanterelle mushrooms and wild rice do not constitute the entirety of plant species harvested;
- They do not harvest blueberries from consistent locales and that blueberries can be available at locales for longer than 4-6 years, at times as long as an MNO citizen's lifetime.
- Members of the Métis Nation of Ontario have verbally indicated that members of this Indigenous community come from Atikokan and Fort Frances to fish, harvest, and hunt moose; and
- Preliminary results from the TKLUS have indicated that harvesting activities for large and small game species occurs in proximity of the Project.

Non-disclosed Aboriginal peoples expressed the following this respect to terrestrial resources:

- Vegetation potentially collected within region include: blueberries, raspberries, pin cherries, wild cranberries, and chanterelle mushrooms ;
- Wild rice is a commercial and agricultural venture for the public and First Nation groups within the RSA;
- Game species potentially hunted within the region include: moose, deer, grouse, and waterfowl; and
- Fur bearing species identified within the RSA include: beaver, muskrat, marten, fisher, otter, fox, lynx, and rabbit.

5.10 Migratory Birds

Several bird surveys were conducted within the LSA and RSA, including:

- Breeding Bird Surveys (2011 to 2012, 2016);
- Barn Swallow nest searches (2012, 2016);
- Bird Migration Surveys (2011);
- Marshbird and Waterfowl Surveys (2011 to 2012, 2016);
- Bobolink Surveys (2011);
- Whip-poor-will and Common Nighthawk Surveys (2011 to 2012); and
- Stick Nest Surveys (2010 to 2011, 2015).

A total of 100 bird species were encountered across 140 breeding bird surveys stations. Avian species richness was highest in developed areas (76 species) when compared to deciduous (65), coniferous (63), wetland (37), successional (35), and upland habitats (28). The most frequently encountered species were: White-throated Sparrow (*Zonotrichia albicollis*, 177 observations), Red-eyed Vireo (*Vireo olivaceus*, 104), Nashville Warbler (*Oreothlypis ruficapilla*, 97), American Robin (*Turdus migratorius*, 85), Swanson's Thrush (*Catharus ustulatus*, 75), Ruby-crowned Kinglet (*Regulus calendula*, 72), Ovenbird (*Seiurus aurocapilla*, 67), Hermit Thrush (*Catharus guttatus,* 57), Red-breasted Nuthatch (*Sitta canadensis*, 50), and Magnolia Warbler (*Dendroica magnolia*, 49).

No active stick nests were detected within the LSA; however, active nests were detected for several species:

- Common Loon (*Gavia immer*): active nest on Thunder Lake;
- Barn Swallow (Hirundo rustica): active nests on buildings on the grounds of the former tree nursery; and

- Common Grackle (Quiscalus quiscala): nest in the central LSA (grackle nests are not protected by the *Migratory Birds Convention Act*).

Seven avian SAR were encountered within the LSA (Table 5.9.5-1). Generally, the bird communities observed during the environmental baseline surveys are typical of Ontario's boreal forest.

A migratory bird survey was conducted in 2011, following the *Hawk Migration Association of North America protocol* (HMANA 2011). The survey was intended to identify the potential for migratory route and/or stopover habitat based on known regional bird migration patterns in the LSA. Six survey stations, focusing on shoreline and wetland habitats, were established to describe potential stopover habitats. These stations offered an unimpeded view for at least several hundred meters to the north, east, and/or west to observe birds migrating south. Only migratory birds (i.e., bird species known to migrate and that were purposively flying south or southwest at the time of the survey) were documented during the surveys.

5.10.1 Traditional Knowledge

Members of Eagle Lake First Nation, Wabigoon Lake Ojibway Nation, and Whitefish Bay First Nation (Naotkamegwanning First Nation) shared the following traditional knowledge with respect to birds and migratory birds:

- Owls (barn and long horn), wild turkeys and robins observed in the project area;
- Project area is a fly through area for migratory birds;
- Migratory bird nesting area located to the north of the site;
- Blueberry areas attract robins and other birds; and
- Game species potentially hunted within the region include: moose, deer, grouse, and waterfowl.

Members of the Eagle Lake First Nation Indigenous community identified that Rice Lake, Sandy Lake, Table Rock Lake, and Tom Chief Lake are places where ducks may be abundantly found. Also, members of Eagle Lake First Nation have indicated that they have been harvesting and practicing activities on the lake down Sioux Lookout highway for over 100 years to go rice picking/ duck hunting (Tom Chief Lake). They have also identified denning area in the sandy terrain associated with the Lola Nature Reserve foxes). Eagle Lake First Nation also shared with Treasury Metals information regarding the spirit of water which has no dollar value, and cannot be sold. Water Spirit wants to be preserved and protected, and this community speaks for children, grandchildren, and birds in wanting to protect it.

Additionally, members of Whitefish Bay First Nation stated that the general project area is a flyway for migratory birds.

5.11 Species at Risk

5.11.1 Definition

For the purposes of this EIS, Species at Risk (SAR) are defined as:

- Any species listed as Special Concern, Threatened or Endangered by the Committee on the Status of Species at Risk in Ontario (COSSARO) under the auspices of the provincial *Endangered Species Act*;
- Any plant species identified as provincially rare by the OMNRF Natural Heritage Information Centre (NHIC);
- Any species listed as Special Concern, Threatened or Endangered on Schedule 1 of the federal *Species at Risk Act; and*
- Any species listed as Special Concern, Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

5.11.2 Potential Species at Risk

While the 2012 baseline report identified 20 plant SAR potentially occurring within the LSA or RSA, an updated search of the Natural Heritage Information Centre (NHIC) database in 2016 resulted in occurrence records for only three plant SAR in the Dryden District (Table 5.11.2-1): heart-leaved Alexander (*Zizipa aptera*), Vasey's rush (*Juncus vaseyi*), and western wheat grass (*Pascopyrum smithii*). These occurrences were all located outside of the LSA and the RSA. The other species listed in 2012 occurred in neighboring forest management units, even further from the LSA and RSA. Two additional provincially listed plant species are known to occur within the Kenora region and outside of the RSA: Showy Goldenrod (*Solidago speciosa*) occurs in one single population on an island near Kenora proper, and Western Silvery Aster (*Symphyotrichum sericeum*) has only been identified near Lake of the Woods in prairie habitats.

Table 5.11.2-1: Listed and Locally Rare Vascular Plants with Known or Potential Occurrence within the RSA

Scientific Name	Common Name	Rank/ Status	Data Type/ Source/Location	Observed during Baseline Studies?
Juncus vaseyi	Vasey's Rush	S3	NHIC occurrence records in the Dryden and Wabigoon FMUs	N
Zizia aptera	Heart-leaved Alexanders	S2	NHIC occurrence record in the Dryden FMU	N
Pascopyrum smithii	Western Wheatgrass	S2	NHIC occurrence records in the Dryden FMU	N
Carex parryana	Parry's Sedge	S1	NHIC occurrence records in the Crossroute FMU	N

Table 5.11.2-1: Listed and Locally Rare Vascular Plants with Known or Potential Occurrence within the RSA (continued)

Scientific Name	Common Name	Rank/ Status	Data Type/ Source/Location	Observed during Baseline Studies?
Carex praticola	Northern Meadow Sedge	S2	NHIC occurrence records in the Crossroute FMU	N
Crassula aquatic	Water Pygmyweed	S2	NHIC occurrence records in the English River and Lac Seul FMUs	N
Hudsonia tormentosa	Beach Heather	S3	NHIC occurrence record in the Wabigoon FMU	N
Leucophysalis grandiflora	Large-flowered Ground Cherry	S3	NHIC occurrence records in the Crossroute FMU	N
Limosell aquatic	Northern Mudwort	S2	NHIC occurrence records in the English River FMU	N
Moehringia macrophylla	Large-leaved Sandwort	S2	NHIC occurrence records in the Black Spruce, Dog River-Matawin, and Lakehead FMUs	N
Opuntia fragilis	Brittle Prickly Pear Cactus	S3	NHIC occurrence record	N
Polystichum braunii	Braun's Holly Fern	S3	NHIC occurrence records in the Dog River-Matawin and Lakehead FMUs	N
Potentilla rivalis	Brook Cinquefoil	SH	NHIC occurrence records in the Wabigoon and English River FMUs	N
Schoenoplectus heterochaetus	Slender Bulrush	S3	NHIC occurrence records in the English River and Kenora FMUs	N
Subularia aquatica	Water Awlwort	S3	NHIC occurrence records in the Sapawe FMU	N
Symphotrichum ericodies var. pansum	Prairie White Heath Aster	S2	NHIC occurrence records in the Crossroute and Kenora FMUs	N
Caltha natans	Floating Marsh Marigold	S2	NHIC occurrence records in Crossroute, English River, Lac Seul, Trout Lake, Whiskey Jack, and Kenora FMUs	Identified by KCB during 2011 vegetation baseline field studies (Thunder Creek at Wabigoon Lake)
Solidago speciosa	Showy Goldenrod	S1	Ontario Species at Risk List: Kenora region (known occurrence isolated to one island near Kenora)	N
Symphyotrichum sericeum	Western Silvery Aster	S1	Ontario Species at Risk List: Kenora region (known occurrence in Lake of the Woods area); also present in	N

Table 5.11.2-1: Listed and Locally Rare Vascular Plants with Known or Potential Occurrence within the RSA (continued)

Scientific Name	Common Name	Rank/ Status	Data Type/ Source/Location	Observed during Baseline Studies?
			NHIC database in Crossroute and Kenora FMUs	
Betula alleghaniensis	Yellow Birch	Locally Rare	Dryden Forest Management Plan; species occurs over a range of habitats with some potential to occur within or adjacent to wetlands	N
Quercus macrocarpa	Burr Oak	Locally Rare	Dryden Forest Management Plan; species not typically associated with wetland habitats	N
Ulmus laevis	White Elm	Locally Rare	Dryden Forest Management Plan; species occurs over a range of habitats with some potential to occur within or adjacent to wetlands	N

A further 29 wildlife SAR are known to occur within, or have ranges that overlap the LSA and RSA (Table 5.11.2-2).

Table 5.11.2-2: Wildlife Species at Risk Potentially Occurring or Known to Occur within the LSA and RSA

Species	Scientific Name	Designation		
		SARA	COSEWIC	SARO
Birds				
American White Pelican	*Pelecanus erythrorhynchus*	-	Not at Risk	Threatened
Bald Eagle	*Haliaeetus leucocephalus*	-	Not at Risk	Special Concern
Bank Swallow	*Riparia riparia*	-	Threatened	Threatened
Barn Swallow	*Hirundo rustica*	-	Threatened	Threatened
Black Tern	*Chlidonias niger*	-	Not at Risk	Special Concern
Bobolink	*Dolichonyx oryzivorus*	-	Threatened	Threatened
Canada Warbler	*Cardellina canadensis*	Threatened	Threatened	Special Concern
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	Threatened
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Special Concern
Eastern Loggerhead Shrike	*Lanius ludovicianus*	Endangered	Endangered	Endangered
Eastern Whip-poor-will	*Caprimulgus vociferous*	Threatened	Threatened	Threatened
Eastern Wood Pewee	*Contopus virens*	-	Special Concern	Special Concern
Golden Eagle	*Aquila chrysaetos*	-	Not at Risk	Endangered
Least Bittern	*Ixobrychus exilis*	Threatened	Threatened	Threatened
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	Special Concern

Table 5.11.2-2: Wildlife Species at Risk Potentially Occurring or Known to Occur within the LSA and RSA (continued)

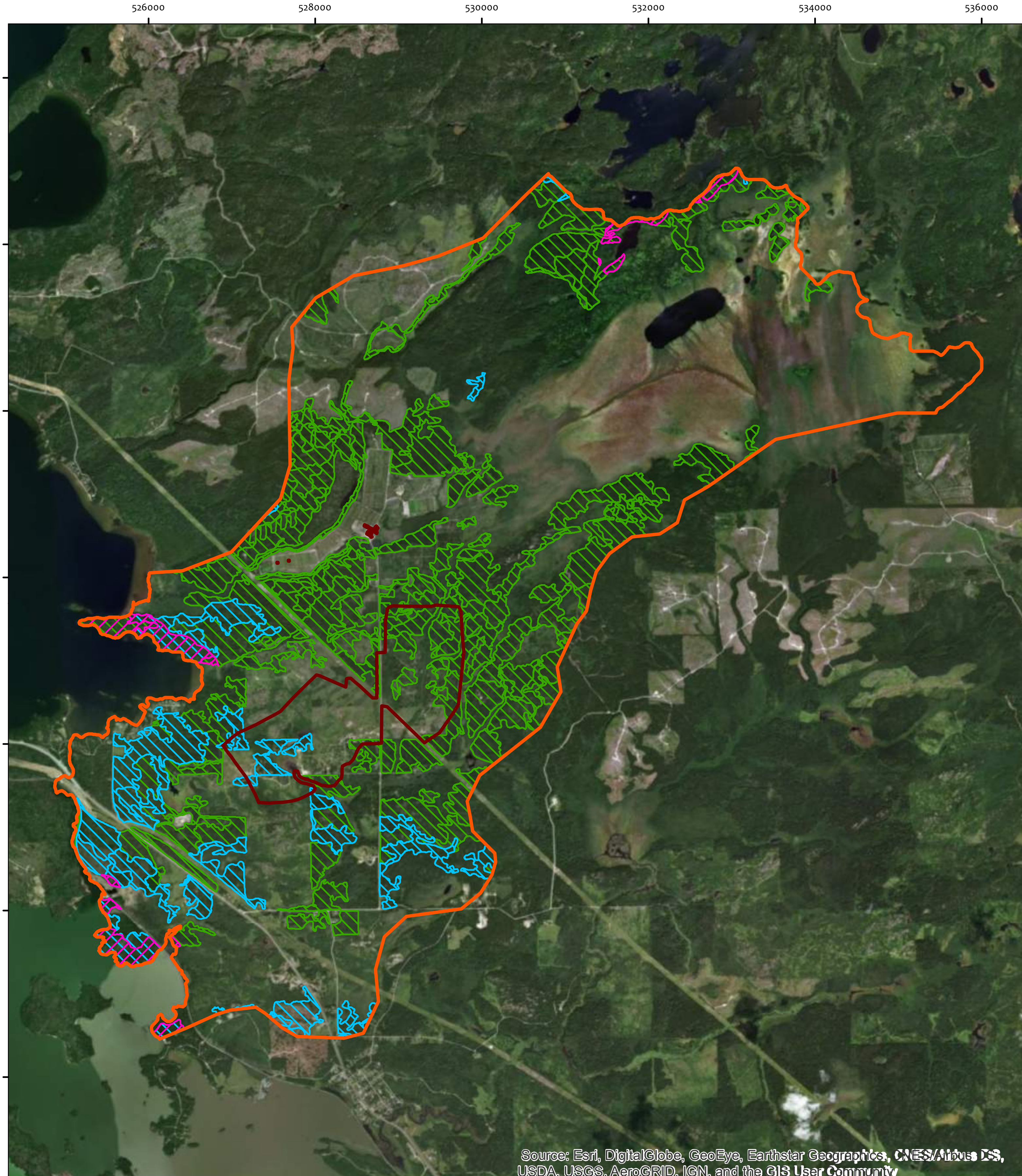
Species	Scientific Name	Designation		
		SARA	COSEWIC	SARO
Peregrine Falcon	*Falco peregrinus*	Special Concern	Special Concern	Special Concern
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Special Concern	-
Short-eared Owl	*Asio flammeus*	Special Concern	Special Concern	Special Concern
Yellow Rail	*Coturnicops noveboracensis*	Special Concern	Special Concern	Special Concern
Wood Thrush	*Hylocichla mustelina*	Threatened	Threatened	Special Concern
Mammals				
American Badger	*Taxidus taxus taxus*	Endangered	Endangered	Endangered
Eastern Cougar	*Puma concolor*	-	-	Endangered
Gray Fox	*Urocyon cinereoargenteus*	Threatened	Threatened	Threatened
Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered
Northern Myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered
Wolverine	*Gulo gulo*	-	Special Concern	Threatened
Woodland Caribou	*Rangifer tarandus caribou*	Threatened	Threatened	Threatened
Invertebrates				
Monarch	*Danaus plexippus*	Special Concern	Special Concern	Special Concern
Skillet Clubtail Dragonfly	*Gomphus ventricosus*	-	Endangered	-

Note: SARA – Federal Species at Risk Act; COSEWIC – Committee on the Status of Endangered Wildlife in Canada; SARO – Species at Risk Ontario

Potential habitat was mapped for the following SAR species:

- Bald Eagle;
- Eastern Wood-Peewee/Wood Thrush;
- Olive -sided Flycatcher;
- Black Tern;
- Yellow Rail/Least Bittern;
- Rusty Blackbird;
- American White Pelican;
- Ground nesting birds (e.g. Whip-poor-will, Common Nighthawk);
- Barn Swallow/Chimney Swift; and
- Snapping Turtle.

Figures depicting the habitat for each of these species can be found Figures 5.11.2-1 to 5.11.2-4.



Legend

- LSA
- Project Footprint
- Potential Bald Eagle Habitat
- Potential Eastern Wood-Pewee/Wood Thrush Habitat
- Potential Olive-sided Flycatcher Habitat

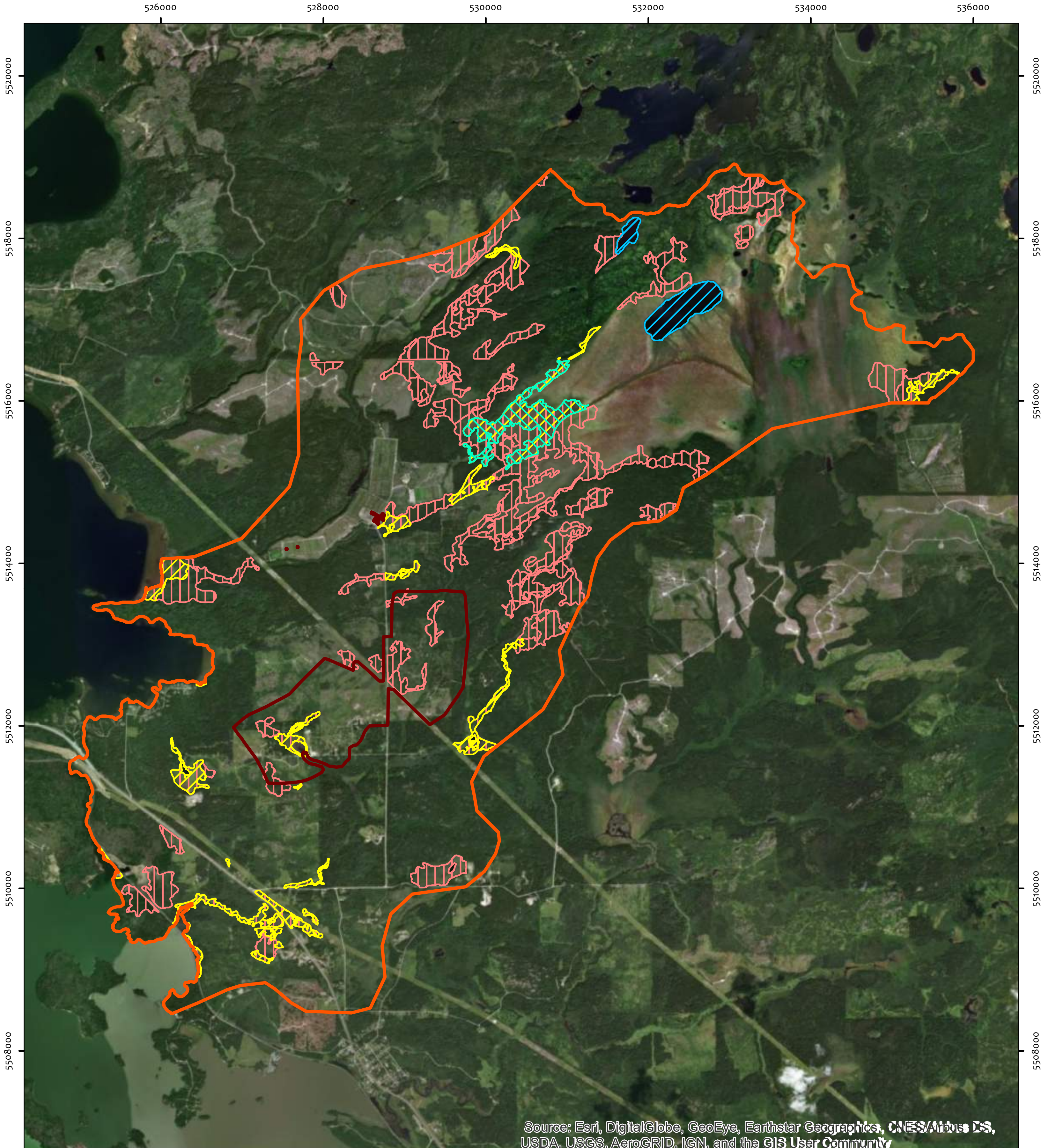
Figure 5.11.2-1. Potential Mature Forest SAR Habitat Within the LSA

0 0.5 1 2 3 4

Km

KBM RESOURCES GROUP

1:59,356
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-02-27



Legend

- LSA
- Project Footprint
- Potential Black Tern Habitat
- Potential Yellow Rail/Least Bittern Habitat
- Potential Rusty Blackbird Habitat
- Potential American White Pelican Habitat

Figure 5.11.2-2. Potential Wetland and Aquatic SAR Habitat Within the LSA

0 0.5 1 2 3 4

Km

KBM RESOURCES GROUP

1:59,356

Projection: NAD 1983 UTM Zone 15N

Date created: 2018-02-27

N S E W

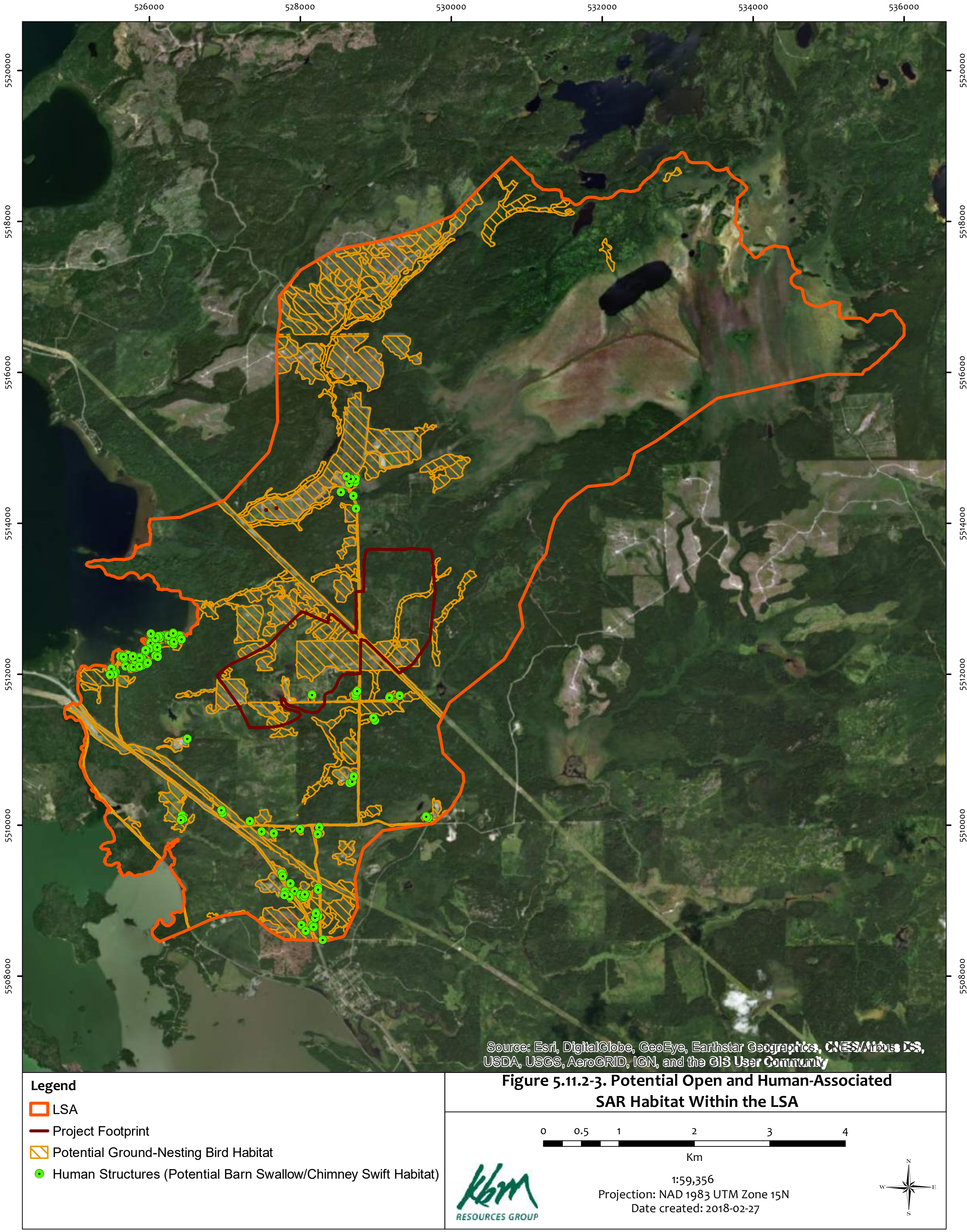


Figure 5.11.2-3. Potential Open and Human-Associated SAR Habitat Within the LSA

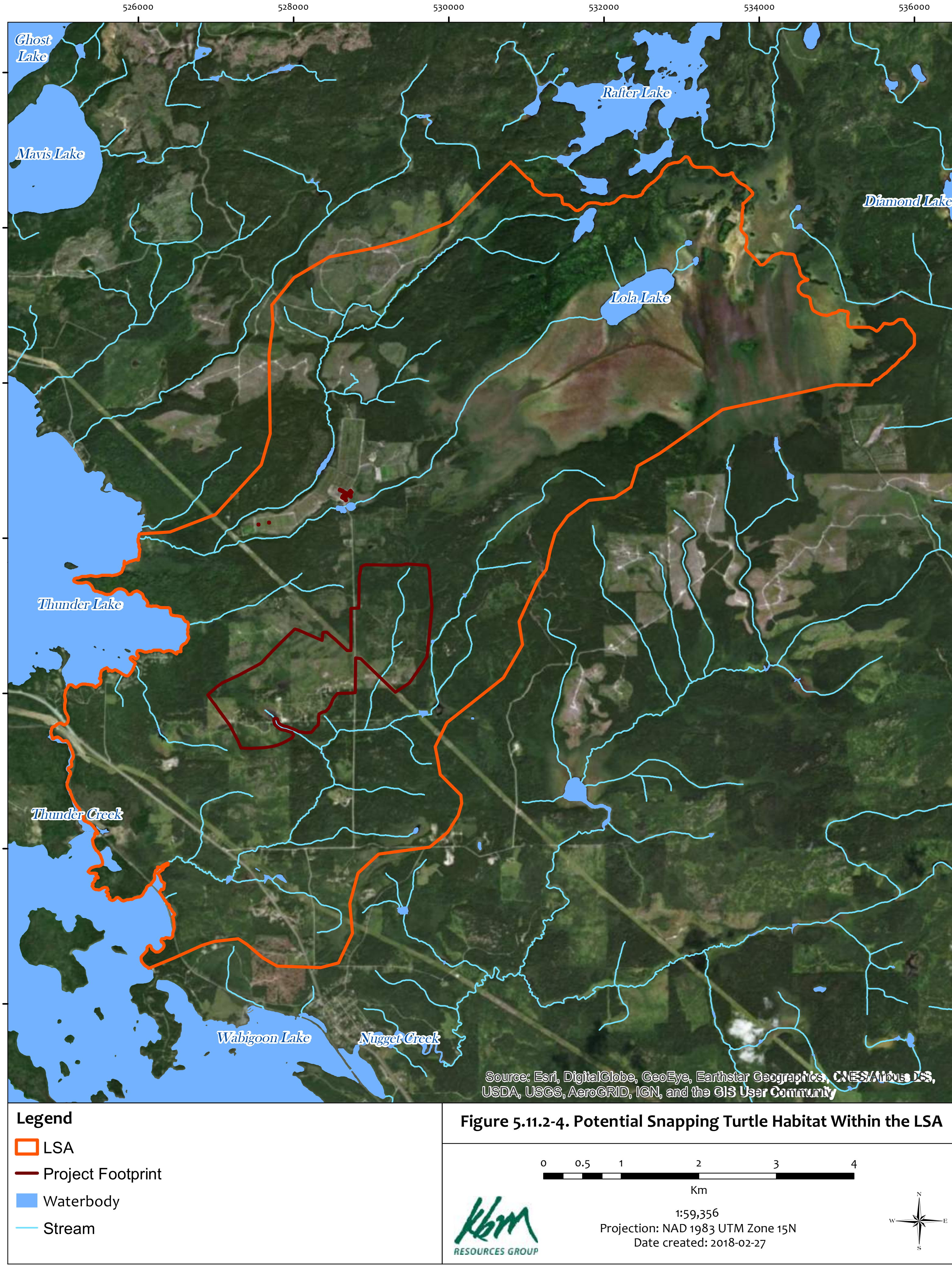


Figure 5.11.2-4. Potential Snapping Turtle Habitat Within the LSA

5.11.3 Observed Species at Risk

5.11.3.1 Plants

The only plant SAR observed within the LSA (during all field work activities) was the floating marsh marigold observed in the Thunder Creek wetland near the mouth of Thunder Creek.

No provincially rare plant communities were documented within the LSA or RSA, nor were any prairie or savannah communities observed. However, both the LSA and RSA contain relatively large stands of old, undisturbed forest.

5.11.3.2 Animals

Two terrestrial mammal SAR were observed within the LSA during field survey efforts: Little Brown Myotis (2011 and 2012) and Northern Myotis (2012). The maternity roost survey (2015) determined that some high quality roosts are present in the Project area, but at very low densities. No bat species were observed using the roosts during an exit survey in 2015, but two bats of unknown species were observed flying over the area.

Eight bird SAR were observed within the LSA during the field survey efforts. Bald Eagle, Barn Swallow, Black Tern, Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, Peregrine Falcon and Rusty Blackbird. Of these, only Barn Swallows are listed as *Threatened*, and are therefore afforded additional protection.

Barn Swallows were observed foraging over ponds, lakes, fields and other open habitat in the LSA and were commonly observed along roads. Active nests were observed on buildings on the former tree nursery grounds in June 2011 and in 2012. No active nests were observed in 2016, as Treasury personnel had made concerted efforts to restrict access to many of the outbuildings on the property.

No reptile or amphibian SAR were observed during the field surveys.

No terrestrial invertebrate SAR were observed during field surveys.

5.11.4 Traditional Knowledge

According to the consolidated comments received from the Agency following the review of the original EIS by members of Eagle Lake First Nation, Wabigoon Lake, Ojibway Nation, and Whitefish Bay First Nation (Naotkamegwanning First Nation), someone shared that a Barn Owl had been observed in the Project area. Barn Owl is an Endangered Species and is protected provincially in Ontario, as well as federally.

In Ontario, Endangered Species and their general habitat are automatically protected under the Endangered Species Act.

According to the Ontario Ministry of Natural Resources and Forestry (MNRF) website reports that there are fewer than five pairs of Barn Owls in Ontario, all of which were observed in southern Ontario in the Windsor-Sarnia corridor, Niagara Region, or Lennox and Addington County. The MNRF reports that The Barn Owl cannot tolerate severe winter temperatures, and southern Ontario is the northern limit of its range. Breeding sites in Ontario seem to be restricted to areas with the moderating effects of the Great Lakes (within 50 kilometres of the lakes).

Therefore, the observation of a Barn Owl in the vicinity of the Project is highly unlikely as northern Ontario does not support a suitable habitat for this particular endangered species. It is possible that the observer may have seen another species of owl that were mistakenly identified as a Barn Owl.

5.12 Human Environment

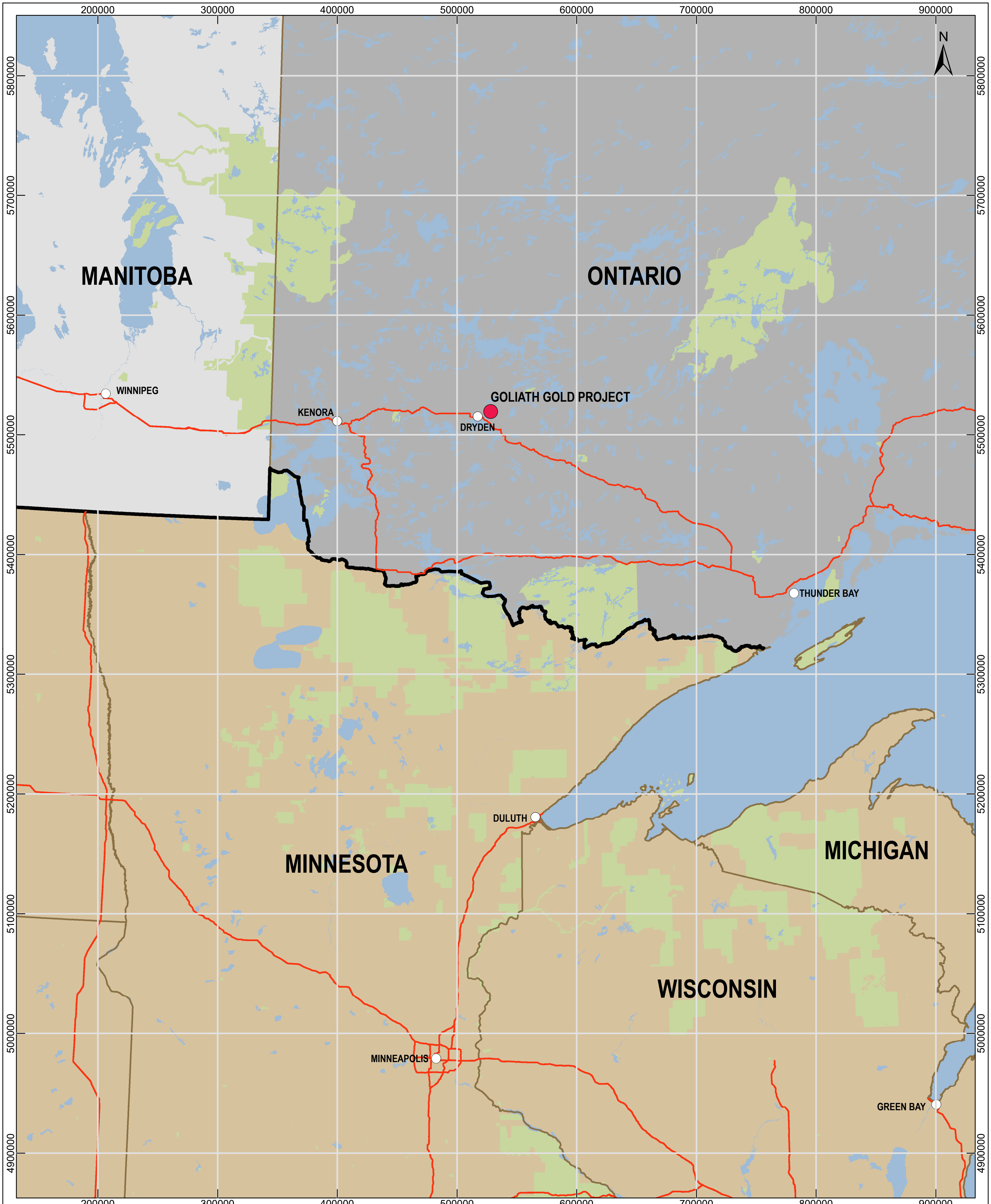
Two baseline studies have been conducted for the Project relevant to the human environment:

- Socioeconomic Baseline Report: Conditions in Northwestern Ontario (GCK Consulting Ltd., May 2014; hereafter GCK 2014).
- Stage One and Two Archaeological and Heritage Assessment (Boreal Heritage Consulting, December 2012; hereafter BHC 2012).

Refer to Appendix T and Appendix U for a detailed treatment of methods and results.

5.12.1 Land Use

The Project is located within with the Kenora District in northwestern Ontario (Figure 5.12.1-1). The Project site is approximately 4 kilometres (km) northwest of the Village of Wabigoon, 20 km east of the town of Dryden and 2 km north of the Trans-Canada Highway 17 and within the Hartman and Zealand townships (Figure 5.12.1-2). Access to the Project property is via existing gravel roads managed through the Local Services Board: Tree Nursery Road, and Anderson Road which originates at Highway 17, west of the village of Wabigoon.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Location of the Goliath Gold Project (Regional Scale)

DESIGN:	MP	31/07/2017
GIS:	MP	31/07/2017
CHECK:	MW	31/07/2017
REVIEW:	DB	31/07/2017

Figure 5.12.1-1 REV.01

Canada | United States | Highway/Interstate
Ontario | Population Center | Provincial/State Line | International Boundary

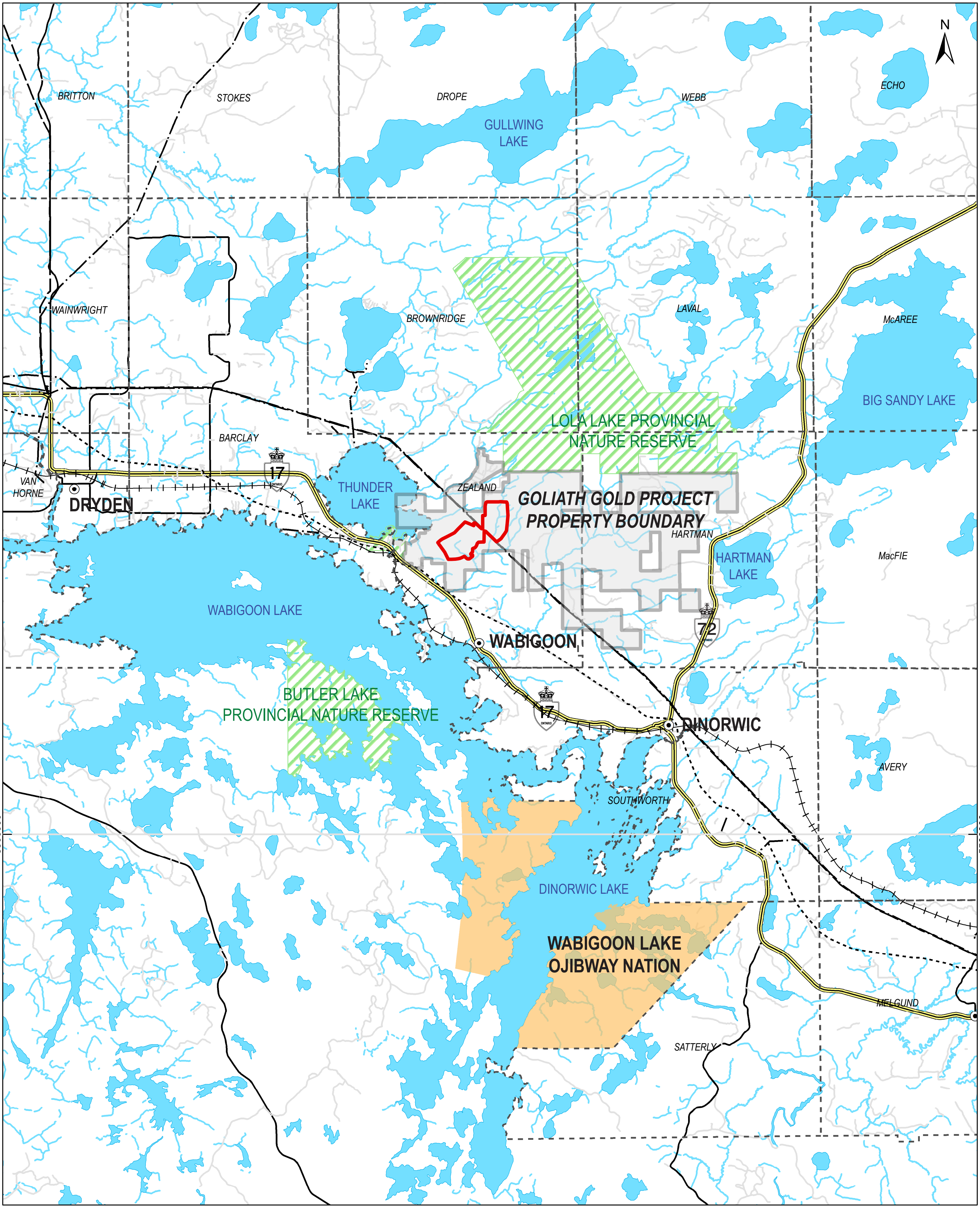
SCALE 1:4,000,000

0 100 200
Kilometers

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

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

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



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	
Location of the Goliath Gold Project (Local Scale)	DESIGN: MP 17/08/2017 GIS: MP 17/08/2017 CHECK: MW 17/08/2017 REVIEW: MW 17/08/2017	
Figure 5.12.1-2	REV.02	

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

SCALE 1:200,000

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

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

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

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

The Project area includes the following towns and communities within the Kenora and Thunder Bay Districts:

First Nations Reserves

- Wabigoon Lake 27, First Nation reserve, Ontario;
- Eagle Lake 27, First Nation reserve, Ontario;
- Wabauskang 21, First Nation reserve, Ontario;
- Lac Seul 28, First Nation reserve, Ontario;
- Whitefish Bay 32A, First Nation, Ontario;
- Whitefish Bay 33A, First Nation, Ontario;
- Whitefish Bay 34A, First Nation, Ontario;
- Lac des Mille Lacs 22A1, First Nation, Ontario;
- Lac des Mille Lacs 22A2, First Nation, Ontario; and
- Grassy Narrows (English River 21), First Nation, Ontario.

Cities, Towns, Municipalities

- Village of Wabigoon, Ontario;
- Eagle Lake & Vermilion Bay (Machin), Municipality, Ontario;
- Sioux Lookout, Municipality, Ontario;
- Atikokan, Town, Ontario;
- Kenora (Township of Ignace), Town, Ontario;
- Rainy River, Town, Ontario;
- Fort Frances, Town, Ontario;
- Dryden, Town, Ontario; and
- Thunder Bay, City, Ontario.

Of local significance is the population proximal to site located on Thunder Lake Road, East Thunder Lake Road, Tree Nursery Road, and Anderson Road.

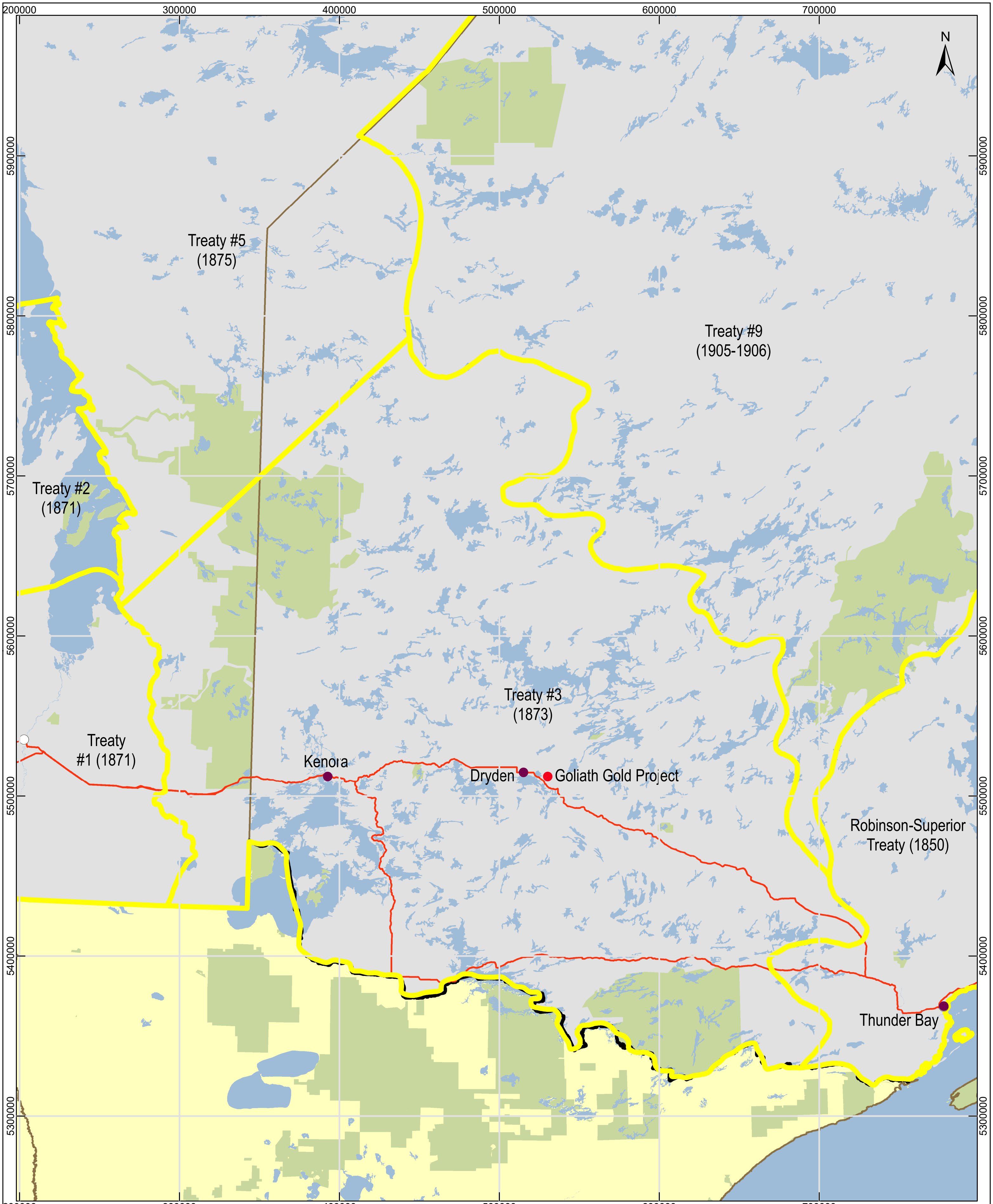
The Project area exhibits rolling terrain, and is drained principally by Blackwater Creek and its associated minor tributaries. The Project site is located in a low density rural area within Hartman and Zealand Townships. There is some limited local agriculture focused on cattle, as well as logging activities in the area. Immediate adjacent areas show mainly second growth poplar-dominated forests and wetlands.

While there are no Federal Parks near the Project site, there are two Provincial Nature Reserves are located proximal to the Project site, Lola Lake Nature Reserve (5 km northwest), and Butler Nature Reserve (10 km southwest). Aaron Provincial Park which is owned by the City of Dryden and operated by Ontario Parks is located adjacent to the Project boundary.

The Project is located within the area covered by Treaty 3. The Treaty 3 area includes approximately 14,245,000 hectares (ha) in Ontario ranging from the vicinity of Upsala in the east, following the Canada-United States border in the south, and extending past the Ontario-Manitoba border in the west (Figure 5.12.1-3). Treaty 3 includes 28 First Nation communities and a number of villages and towns including Wabigoon, Dryden, Eagle Lake, Vermillion Bay, Sioux Lookout, Atikokan, Fort Frances, and Kenora. The relative locations of the closest First Nations communities are shown on Figure 5.12.1-4. The Project is also located within an area identified by the Métis Nation of Ontario as the Treaty 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake traditional harvesting territories, also named Region 1.

Wabigoon Lake Ojibway Nation and Eagle Lake First Nation are the closest indigenous communities to the Project site (see Figure 5.12.1-4). Other Indigenous communities present in the area include: Wabauskang First Nation, Lac Seul First Nation, Whitefish Bay First Nation (Naotkamegwanning First Nation), Grassy Narrows First Nation, and Lacs des Mille Lacs First Nation. The traditional lands of a number of these communities are known to overlap with the Project site and its immediate environs and downstream waters. Traditional activities practiced by members of these communities and by members of the Métis Nation of Ontario in the general region overlapping with and surrounding the Project site include travel, fishing, hunting, trapping, gathering, and other cultural pursuits and activities connected to the land.

A detailed description of baseline conditions with respect to the Indigenous communities is presented in Section 5.13.



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	
Treaty Areas - Regional Scale	DESIGN: MP 18/08/2017 GIS: MP 18/08/2017 CHECK: MW 18/08/2017 REVIEW: MW 18/08/2017	
Figure 5.12.1-3	REV.01	

Treaty Areas — Population Center
Canada — Highways
United States

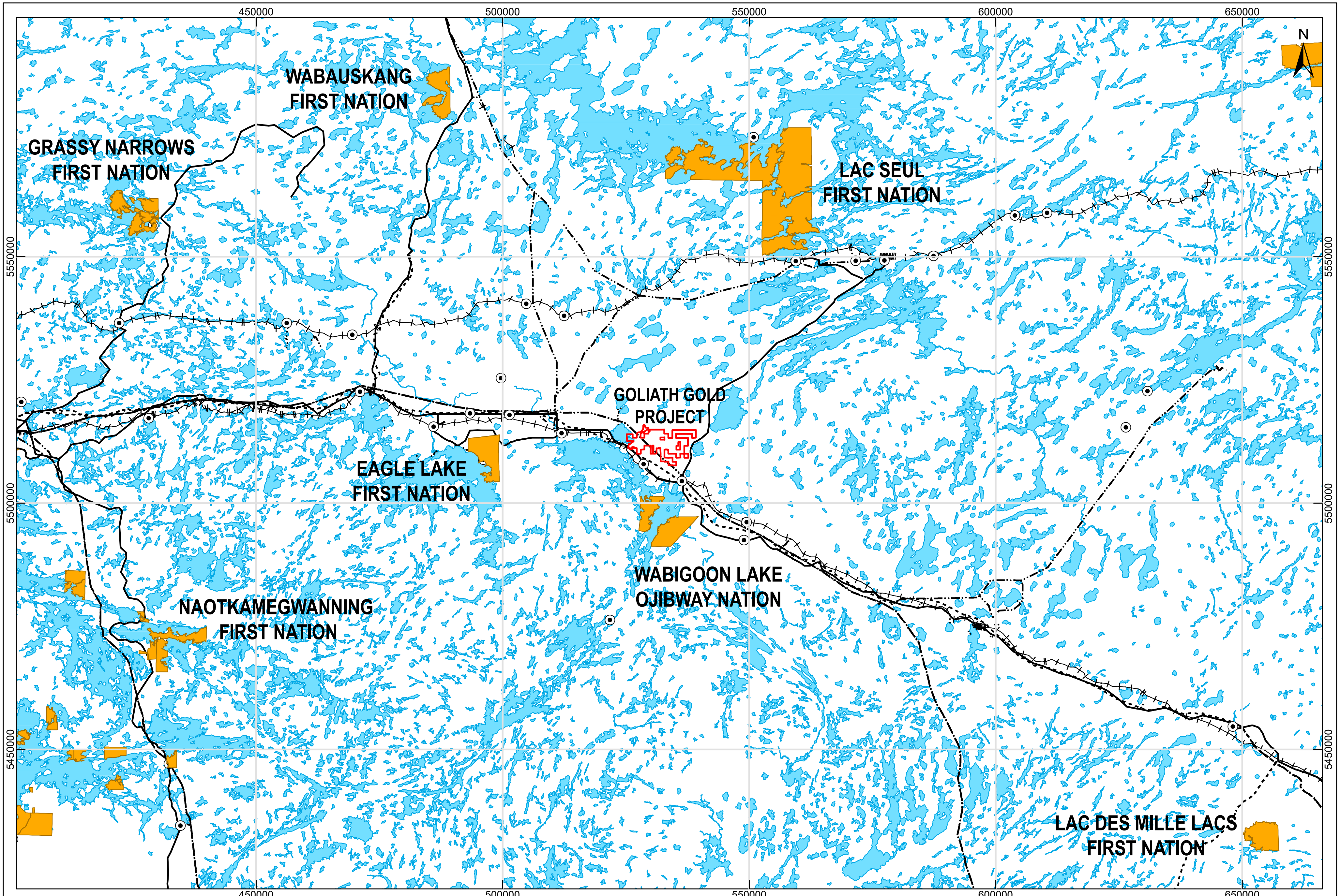
SCALE 1:3,000,000

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

0 — 100
Kilometers

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

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



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

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

SCALE 1:1,000,000

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

0 20 40 60
Kilometers

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

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

Indigenous Communities

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

Figure 5.12.1-4 REV.02

5.12.1.1 Forestry

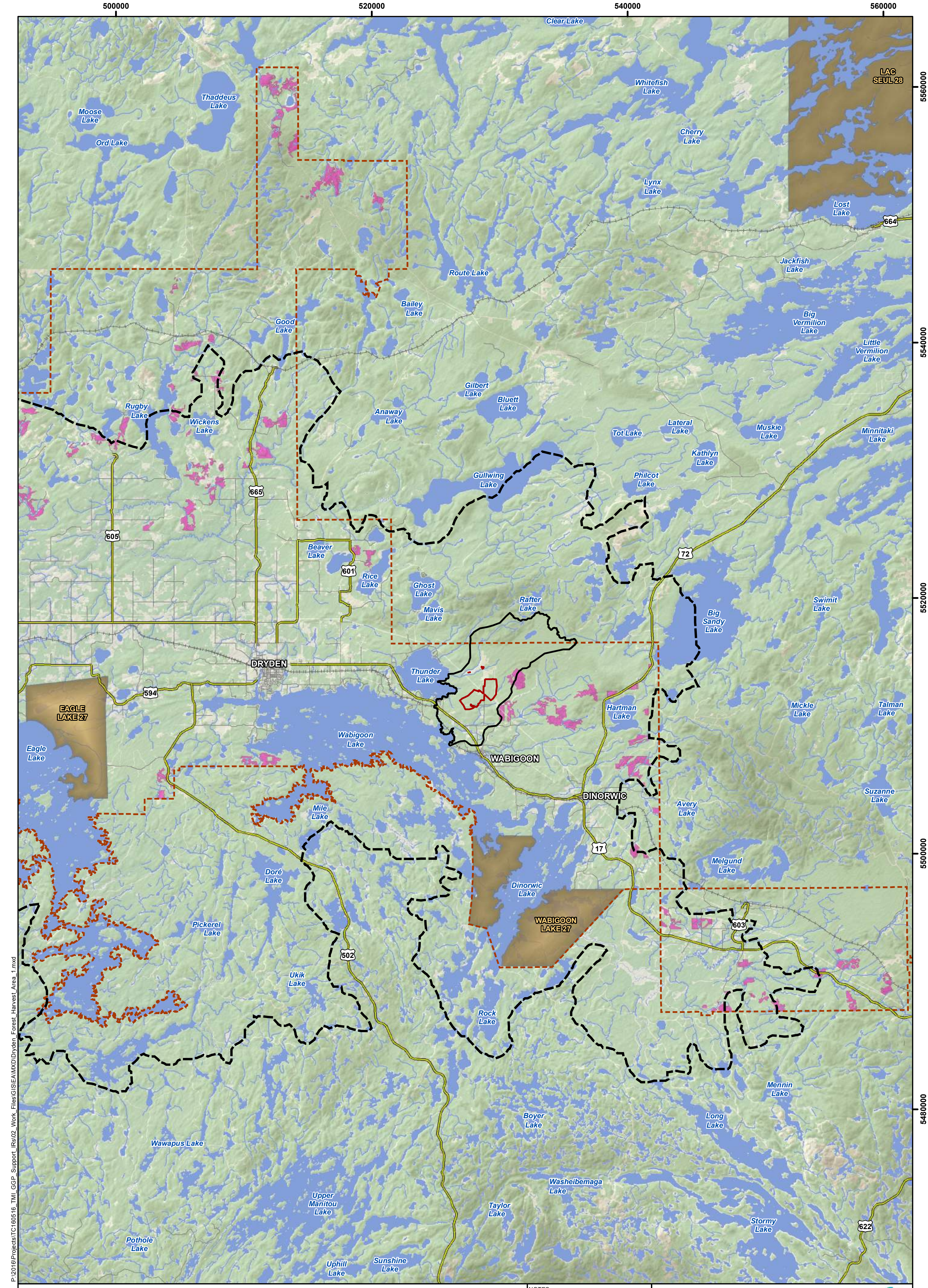
The Project area lies within the Dryden Forest Management Unit (FMU), but a portion of the RSA extends into the adjacent Wabigoon FMU (MNRF 2014). The Dryden Forest Management Plan provides for minor forest harvesting activities (clear-cuts) in the area immediately east of the Project site (see Figure 5.12.1.1-1) during the 2nd five-year term of planned operations for the period of 2016 to 2021 (Dryden Forest Management Company 2016). But there are no planned forest operations within the Project footprint itself. Overall, the Dryden Forest Management Plan provides for the clear-cutting of approximately 5,843 ha in the 2016 to 2021 year period, over the entire plan area. This compares with approximately 6,109 ha harvested for the previous 5-year period. The predominant harvest stand types are hardwood mixed wood, conifer mixed wood and conifer Jack Pine dominant. Forest related industries are the dominant private sector employers in the Dryden area accounting for approximately 712 employment positions including Domtar Inc. (342), Raleigh Falls Ltd. (200) and PRT Group (170+) (City of Dryden 2017).

5.12.1.2 Harvesting of Plant Materials

The harvesting of plant materials in the area includes the gathering of berries and other edible plants, the gathering of wild mushrooms, including chanterelle mushrooms, and the harvesting of wild rice.

A variety of berries are commonly found in northwestern Ontario, include blueberries, raspberries, cloudberries, mountain fly honeysuckle berries, juniper berries and wild cranberries. Blueberries have been identified as a country food that is commonly gathered in the region. Blueberries are common to the boreal forest but not on all sites. Blueberries prefer the sandy or rocky soils associated with jack pine forests but also occasionally can be found on clay rich soils. Blueberries are an early succession species and thrive for a few years following disturbance such as fire or logging, but decline rapidly as the newly regenerating forest reaches crown closure. Generally the period in which blueberry crops proliferate on a site is approximately four to six years. Blueberries are also very dependent on an absence of late spring frost and rely on adequate sunshine and moisture during growing season to allow berries to mature. Consequently, even on ideal sites and at the right stage of forest development, there is no guarantee that blueberries will be available. Disturbance and change within the boreal forest is common and blueberry crops can usually be found at similar sites which are at an earlier stage of forest development. Much of the local area around the Project is suitable or potential blueberry and raspberry habitat (see Figure 5.9.2.3-1).

Chanterelle mushroom picking activity has been documented within the LSA. Chanterelle mushrooms appear in summer and fall either in a solitary or group formation on the ground. Other edible plants found in the region include ostrich fern (fiddleheads), wild chives, black spruce, wild ginger, goldenrod, and Labrador tea (Ontario Nature 2018).



LEGEND

- Operations Area
- Local Study Area for Terrestrial Resources
- Regional Study Area for Terrestrial Resources
- Planned Harvest Areas (2016 - 2021)
- First Nation Reserves
- Dryden Forest Management Unit
- Canadian Pacific Railway
- Highway
- Local Road

0 2.5 5 10 15 20 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

N E S W

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Planned 2016 to 2021 Forest Harvest Areas

PROJECT N°: TC160516	FIGURE: 5.12.1.1-1
SCALE: 1:270,000	DATE: April 2018

Northwestern Ontario is one of the most concentrated areas of naturally remaining wild rice (manomin) growing areas. Several locations of wild rice are documented within the region (see Figure 5.9.3.2-2). Wild rice reseeds itself naturally in areas of circulating mineral-rich water. Water levels vary from one to twelve feet. It will not grow in stagnant or fast moving waters. The best areas for wild rice are the headwaters of major rivers. The naturally occurring stands are found in the undulating channels. The rice bed spreads gradually downstream. Manomin is a sensitive plant and does not tolerate 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. 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.

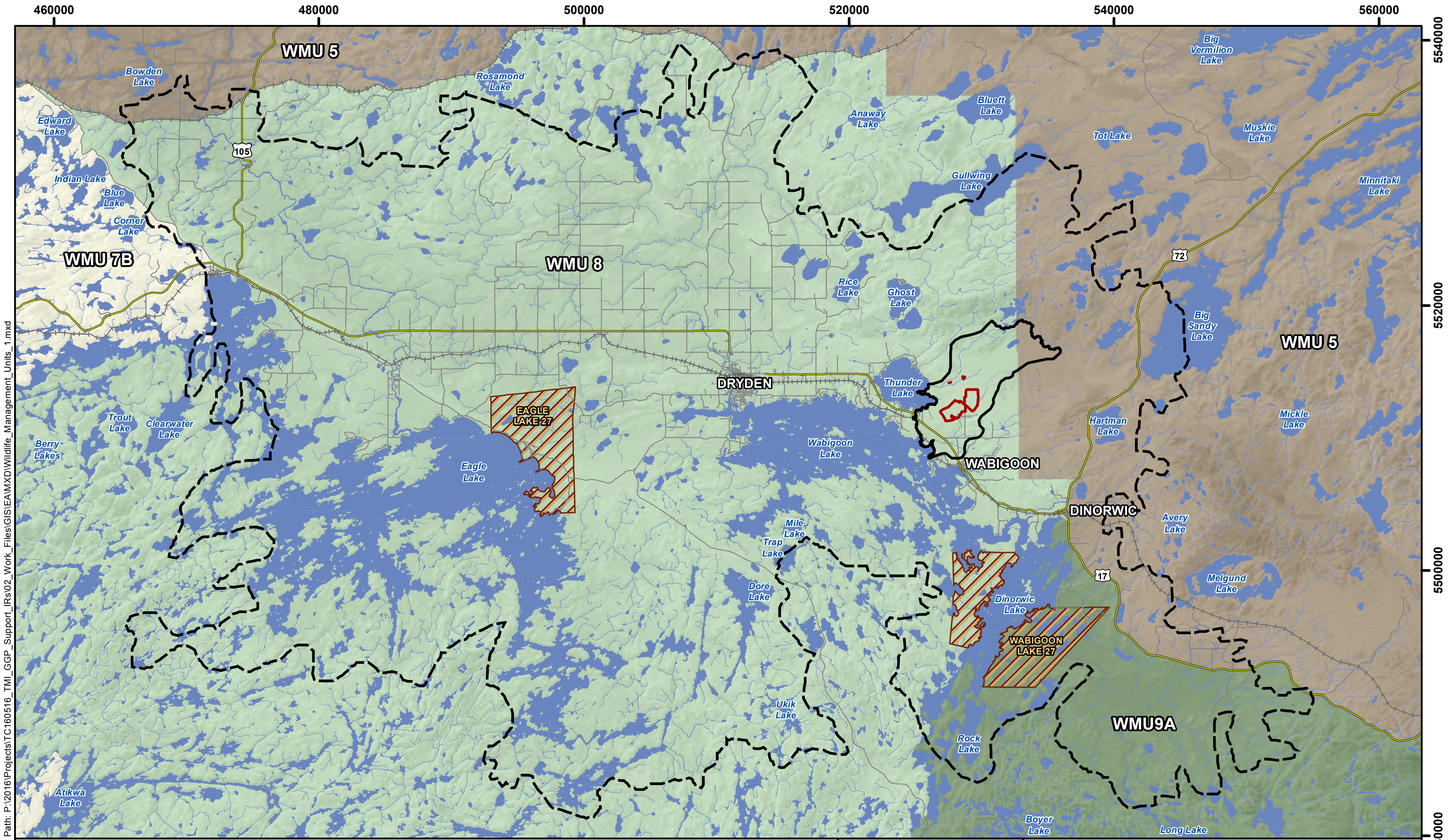
5.12.1.3 Hunting and Trapping

The RSA for terrestrial resources overlaps with a number of wildlife management units (WMU), primarily WMU 8, WMU 5 and WMU 9A, as shown in Figure 5.12.1.3-1. The RSA also includes a number of registered traplines, as illustrated on Figure 5.12.1.3-2. Three of these traplines (DR026, DR027, and DR021) overlap with the local study area (LSA) for terrestrial resources, while the physical footprint of the operations area is located entirely within DR026. Game species that have been identified as valuable to hunting and trapping activities include:

- Moose;
- White-tailed Deer;
- Waterfowl;
- Fur-bearing species (including Beaver); and
- Ruffed Grouse.

Ontario has seen a decline in moose and deer populations in the province and has implemented a series of management actions to address the situation. In Ontario, the management of moose and moose populations, including the harvesting, is done on an ecological basis, and is administered on the basis of the wildlife management units. The stated goal of the moose management policies are to keep moose densities within a range at which the moose can fill their natural role within the ecosystem (MNRF 2014).

Within WMU 8 (MNRF 2014a), in which the Project is situated, the total population of moose is estimated to be 613 moose, with an estimated density of 14 per 100 km². The last two surveys in this management unit (2011 and 2014) indicated that the calf survival rate was below the desired level of 30 calves per 100 cows to ensure maintenance of the population. The annual moose harvest in WMU 8 has dropped off dramatically since the early 2000's, with the average harvest over the last 5 years of 103 moose (96 by residents and 7 by tourists). In 2014 there were a total of 27 tags issues to hunters, and 286 applicants for those tags.



LEGEND

- Operations Area
- Local Study Area for Terrestrial Resources
- Regional Study Area for Terrestrial Resources
- Canadian Pacific Railway
- Highway
- Local Road
- First Nation Reserves

Wildlife Management Unit (Labelled with ID)

- WMU 5
- WMU 7B
- WMU 8
- WMU 9A

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

Datum & Projection:
NAD 1983 UTM Zone 15N

N W E S

0 10 20 30 40 50 Kilometres

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

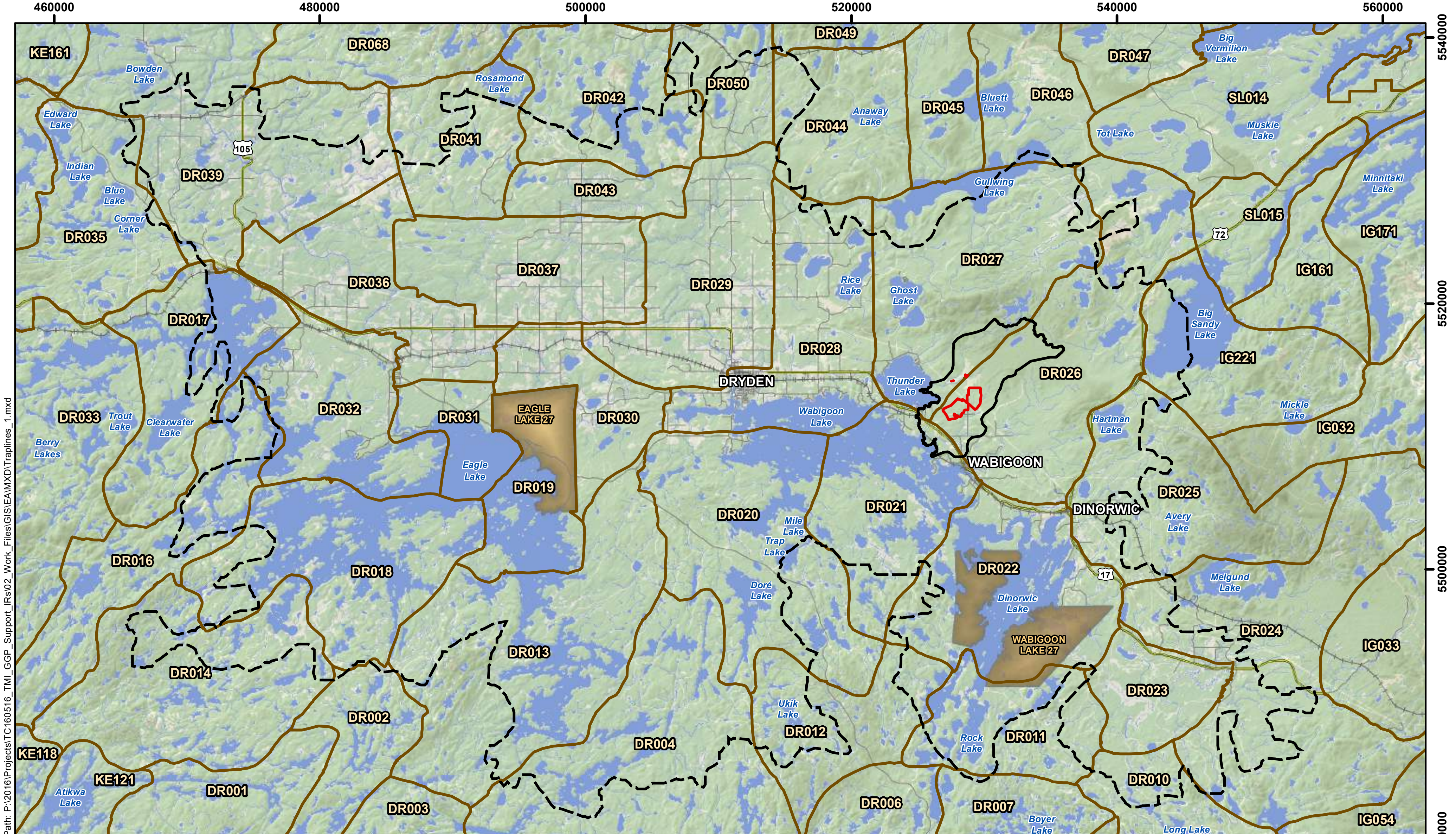
Wildlife Management Units in the Regional Study Area

PROJECT N°: TC160516

FIGURE: 5.12.1.3-1

SCALE: 1:400,000

DATE: April 2018



LEGEND

- Operations Area
- Local Study Area for Terrestrial Resources
- Regional Study Area for Terrestrial Resources
- Trapline Area Boundary (Labelled with ID)
- First Nation Reserves
- Canadian Pacific Railway
- Highway
- Local Road

0 10 20 30 40 50 Kilometres

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

Datum & Projection:
NAD 1983 UTM Zone 15N

N W E S

TREASURY METALS Inc.

amec foster wheeler

GOLIATH GOLD PROJECT

Registered Traplines in the Regional Study Area

PROJECT N°: TC160516	FIGURE: 5.12.1.3-2
SCALE: 1:400,000	DATE: April 2018

To the north of the Project is WMU 5 (MNRF 2014b). The total population of moose is estimated to be 2,633 moose, with an estimated density of 31 per 100 km². In 2014, the calf survival rate was below the desired level of 30 calves per 100 cows to ensure maintenance of the population. The annual moose harvest in WMU 5 has fluctuated since 1985, with the lowest rates occurring over the last 7 years. Over the last 5 years, there was an average of 329 moose (298 by residents and 31 by tourists). In 2014 there were a total of 151 tags issues to hunters, and 1,525 applicants for those tags.

To the southeast of the Project is WMU 9A (MNRF 2014c). The total population of moose is estimated to be 1,180 moose, with an estimated density of 33 per 100 km². For the last three survey periods, the calf survival rate was below the desired level of 30 calves per 100 cows to ensure maintenance of the population. The annual moose harvest in WMU 9A has shown a rapid decline since 2014. The average harvest over the last 5 years was 55 moose (50 by residents and 5 by tourists). In 2014 there were a total of 98 tags issues to hunters, and 735 applicants for

5.12.1.4 Fishing

The Project is located within the Lower English River Section of the Boreal Forest Region, of the Lake Wabigoon Ecoregion (Ecoregion 4S). It is also within the northern limits of the MNRF FMZ 5. Ranging from the Manitoba border east to Quetico Provincial Park and the United States border north to the Wabigoon River Watershed, the total area covers 44,360 km² (KCB 2012, DST 2014).

Aquatic habitat surrounding the Project site is generally of low to moderate value (KCB 2012, DST 2014). Substrates of lakes and streams are primarily dominated by fines (silts and clays), spawning gravels required for some species (i.e., Walleye, White Sucker, Lake Whitefish) are limited. The aquatic vegetation required for Northern Pike and Muskellunge spawning is more abundant. In-stream cover is available mostly in the form of pools, woody debris and vegetation (overhanging, emergent and submergent). Additional areas that have been considered include the spawning areas associated with Thunder Creek, and Nugget Creek. The mouth of Nugget Creek at Wabigoon Lake is designated a Provincial Fish Sanctuary to protect spawning Walleye and fishing is prohibited in this area during the Walleye spawning season; therefore it is seen as a culturally important and relevant to country food harvesters as a valued component.

Additionally the Wabigoon Lake Ojibway Nation and the Naotkamegwanning (Whitefish Bay) First Nation hold commercial fishing licenses on both Thunder and Wabigoon Lakes. Indigenous communities including Eagle Lake First Nation, the Métis Nation of Ontario, and the Aboriginal People of Wabigoon have all expressed an interest in the fishery of Wabigoon Lake.

Thunder Lake and Wabigoon Lake support diverse fish populations that include large predatory fish such as Walleye and Northern Pike; therefore these water bodies must contain suitable spawning and rearing habitat. Assessed streams indicate that suitable habitat is present for small forage fish species (KCB 2012, DST 2014, KBM 2016).

Eating Ontario Fish

Fish represent an important nutritional source in Ontario and this becomes especially true in northern Ontario. Although fish represent a source of high-quality protein, beneficial omega-3 fats, and other nutrients, they also represent a meaningful potential exposure pathway for contaminants including mercury. Based on their size, type, and location, certain fish may be more suitable to eat than others. The Ontario Ministry of the Environment and Climate Change provides a guide each year for eating Ontario fish. The Guide to Eating Ontario Fish provides easy-to-use information to help choose fish caught from Ontario lakes and rivers to minimize exposure to toxins. Consumption advice in the guide is based on guidelines provided by Health Canada.

The guide provides recommendations for both the general population and those considered to be members of a sensitive population. The sensitive population includes women of child-bearing age (women who intend to become pregnant or are pregnant) and children younger than 15 years of age. Women of child-bearing age, including pregnant women and nursing mothers, can affect the health of their baby through a diet elevated in contaminants such as mercury and polychlorinated biphenyls. Young children and developing fetuses are affected by contaminants at lower levels than the general population.

The guide is based on an average meal of 227 grams of a skinless, boneless dorsal fillet (e.g. a fillet of dinner plate length) for an average size adult weighing 154 pounds. If an average size adult is eating substantially more than 227 grams, which is often the case for aboriginal peoples, than fewer fish should be consumed.

To assist those ingesting fish in Ontario, the MOECC provides fish consumption advisory tables for regions where the ingestion of fish may pose risk to human health. In the area directly surrounding the Project, the MOECC provides a fish consumption advisory for the following lakes and species of fish:

- **Wabigoon Lake**: Black Crappie[1], Cisco (Lake Herring)[1], Lake Whitefish[2], Muskellunge[1], Northern Pike[1], Redhorse Sucker[1,] Rock Bass[1], Sauger[1], Smallmouth Bass[1], Walleye[1], White Sucker[1], and Yellow Perch[1]; and
- **Thunder Lake**: Lake Trout[1,2], Northern Pike[1], Smallmouth Bass[1], Walleye[1], and White Sucker[1] .

Superscripts in the consumption tables and in the list above identify the contaminant or group of contaminants that are causing consumption restrictions within a given species/location. In the project area the following two contaminants are considered as part of the consumption advisories:

1. **Mercury:** Mercury, is converted to methylmercury and absorbed by a fish either from water passing over its gills or it is ingested with its diet. Since fish eliminate mercury at a very slow rate, concentrations of this substance gradually increase. Fish at the top of the food web such as Walleye and Pike usually have the highest mercury levels.

2. **Polychlorinated biphenyls (PCBs):** PCBs are a group of chlorinated organic compounds first commercially developed in the late 1920s and banned in the 1970s. They persist for decades in the natural environment and readily accumulate in the aquatic ecosystem.

5.12.2 Social Factors

5.12.2.1 General Population

Population data were collected from the Statistics Canada 2016 census for general population statistics for the regions surrounding the Project site. In Section 5.13 the data are further grouped by the demographics of the population who define themselves as having Aboriginal identify or part of an Indigenous community (i.e., First Nations, Métis, or Inuit).

According to the Statistics Canada 2016 census data the City of Thunder Bay represents the highest concentration of population (107,909), the City of Kenora, the second largest (65,533) followed by the City of Dryden (5,586) and Sioux Lookout (5,272) for the Project. For most regions the median age (mean 44.6, n=9) is over the provincial (41.3) and Canadian national median (41.2). Generally, the population in these regions of north western Ontario are decreasing, whereas the provincial and national population are increasing. This along with a percentage decrease on the 20 to 24 age group in comparison with 2011 points to an outmigration of young adult population. In most cases this pattern is due to the pursuit of school and work opportunities outside of their work communities due to the reduction of employment opportunities in the mining and forest industry sectors.

The 2016 census data indicates that in these regions surrounding the Project site, the percentage of the population identified as being third generation or more Canadian was substantially higher (range: 75% to 85%, n=8) than those observed in Thunder Bay (69%) and the provincial (45%) and national (57%) rates. In addition, these regions have a substantially higher percent of the population who identify as members of an Indigenous communities (range 13% to 51%, n=8) versus the Thunder Bay (12%), provincial (2.7%), and national (4.6%) statistics. The 2016 census placed a large emphasis on immigrations statistics and languages spoken, however the regional demographics in these areas indicate that the areas surrounding the Project have experienced very little immigration, which will be an important determinant for social programs. A detailed discussion of Indigenous communities is provided in Section 5.13.

5.12.2.2 Education

Most education facilities in the Study Area are at the elementary level (Table 5.12.2.2-1). The population of Ontario is highly educated. In Ontario, 24.7% of the population aged 15 years and older has a university degree, higher than any other province or territory in Canada. In addition, 29.2% of its population has obtained College or Trade certification.

Table 5.12.2.2-1: Education Facilities in the Study Area

Community	Elementary School	Middle School	High School	Secondary Institution	Post-Secondary Institution	Private School	Adult Education Institution
Thunder Bay	38	3		8	3	2	1
Kenora	9		2		1		
Dryden	4		1		1		
Ignace	1		1				
Sioux Lookout	1		1		2		
Machin	1						

Approximately 53% of the population in Thunder Bay and 40% of the population in Kenora aged 15 and over has attained education or training at or beyond the high school level (Table 5.12.2.2-2). The highest percentage of individuals with no certificate, diploma, or degree was observed in Wabigoon at 37%. Wabigoon also had the highest percentage of individuals with a high school certificate or equivalent, however no post-secondary education.

Table 5.12.2.2-2: Level of Education in Study Area

Community	Percentage: No certificate, diploma, or degree	Percentage: High School Certificate or Equivalent	Percentage: Postsecondary Certificate: Diploma or Degree
Machin	31	27	42
Wabigoon	37	30	32
Kenora	35	24	40
Atikokan	23	31	46
Rainy River	24	29	47
Fort Frances	22	30	48
Sioux Lookout	24	25	51
Dryden	23	29	48
Thunder Bay	20	27	53
Ontario	18	27	55
Canada	18	26	55

5.12.2.3 Health Services and Programs

The range of health-care services and programs are available in the region, with Table 5.12.2.3-1 providing a listing of the primary care facilities.

Table 5.12.2.3-1: Health Services and Programs in the Region

Community	Primary Health Care Facility	Services Offered
Thunder Bay	Thunder Bay Regional Health Sciences Centre	Thunder Bay Regional Health Sciences Centre (THRHSC) is state-of-the-art acute care facility with 375 acute care beds serving the healthcare needs of people living in Thunder Bay and Northwestern Ontario. The THRHSC Emergency Department has approximately 95,000 annual visits. THRHSC has 12 OR theatres, a 28-bed Post Anesthetic Recovery Unit, and a 40-bed Day Surgery Recovery Area.
Kenora	Lake of the Woods District Hospital	Lake of the Woods District Hospital treats about 30,000 people per year, and is a fully accredited hospital under the national standards of the Canadian Council on Health Services Accreditation. It is the largest hospital in Northwestern Ontario outside of Thunder Bay.
Dryden	Dryden Regional Health Centre	Dryden Regional Health Centre is a fully modern 41 bed acute care hospital. There are thirty-one acute and ten chronic/rehabilitation beds in the hospital. The centre provides a full range of inpatient services, including medical, surgical, obstetrical, chronic and critical care.
Ignace	Mary Berglund Community Health Centre	Health care services are provided by physicians, nurse practitioners and registered nurses. Other services available include physiotherapy, chiropody, lab specimen collection, screening programs for blood sugar and blood pressure.
Sioux Lookout	Meno-Ya-Win Health Centre	The health centre includes a hospital, long term care facility, community services, patient hostel and other related services, and is characterized by its unique blending of mainstream and traditional Aboriginal healing. It has been designated Ontario's Center of Excellence for First Nation Health Care.
Machin	Community Health Centre	Health Services are available through the Machin Family Health Team. Dr. Yvon-Rene Gagnon is the doctor. Further care, as well as home care, may be sought in the nearby City of Dryden.

5.12.2.4 Housing

Total numbers of private dwellings, owned dwellings and rented dwellings are shown in Table 5.12.2.4-1 for area communities. Numbers are shown relative to provincial and national statistics.

Table 5.12.2.4-1: Housing Supply in the Study Area and Comparison to Provincial and National Statistics

Community	Total Private Dwellings	Owned Dwellings	Rented Dwellings	Average Value of Owned Dwelling ($)
Machin	597	360	75	195,064
Wabigoon	189	115	35	164,581
Kenora	31,191	13,640	4,460	251,129
Atikokan	1,477	1,090	220	107,989

Table 5.12.2.4-1: Housing Supply in the Study Area and Comparison to Provincial and National Statistics (continued)

Community	Total Private Dwellings	Owned Dwellings	Rented Dwellings	Average Value of Owned Dwelling ($)
Rainy River	11,217	5,905	1,575	182,320
Fort Frances	3,758	2,480	965	165,673
Sioux Lookout	2,257	1,245	770	261,276
Dryden	2,578	1,635	855	169,183
Thunder Bay	50,388	32,750	14,415	252,159
Ontario	5,598,391	3,557,485	1,554,940	506,409
Canada	15,412,443	9,68,330	4,452,850	443,058

Source: Statistics Canada, 2016 Census Community Profiles

5.12.2.5 Crime and Justice

The Project and surrounding towns and municipalities are policed by The Ontario Provincial Police (OPP) as part of OPP North West Region. There are nine detachments that work collaboratively with First Nation police services and are directly involved in the administration and delivery of policing arrangements under the Ontario First Nations Policing Agreement. Several fly-in remote communities in the region maintain winter ice roads throughout the winter months to aid in their accessibility.

The OPP report that in 2016, with respect to the Highway Traffic Act and other traffic related offences, in 2016, the North West Region accounted for the lowest percentage of federal and provincial statute offices at 5.5% with 30,236 crimes committed in 2016, which was down from 32,511 in 2015 and 33,494 in 2014. There were 103 alcohol-related and 1,454 animal-involved motor-vehicle collisions in 2016 in the North West Region. Violent crime and other “criminal code offences were higher in 2016 than 2015 and 2014. There were 2,441 violent crime, and 2,263 “other” criminal code offence occurrences in the North West Region in 2016. Overall “total” criminal code offenses (7,184 occurrences), property crime offences (2,480 occurrences), and drug crime related offences (419 occurrences) were lower than in previous years.

Most local communities have experienced some increase in criminal activity in recent years (Table 5.12.2.5-1).

Table 5.12.2.5-1: Police Services and Crime in the Study Area

Community	Police Service	Crime
Dryden	Dryden Police Services	From 2010-2012, reported violent crimes in Dryden have increased slightly by 3.73%. Overall major crime activity remained consistent with a significant increase in impaired driving charges. Also notable is the significant decrease in drug-related charges.
Ignace (Kenora)	Ontario Provincial Police	The period from 2010-2012, reported violent crimes in Ignace have increased slightly by 3.73%. Most notably, Ignace has experienced a significant increase in alcohol and drug related crimes, which contribute to impaired driving charges.

Table 5.12.2.5-1: Police Services and Crime in the Study Area (continued)

Community	Police Service	Crime
Sioux Lookout	Ontario Provincial Police	From 2010 to 2012, major crimes in Sioux lookout increased significantly by 10%. In contrast to the increase in major crimes, drug-related offenses have reduced by 30.77% since their height in 2011. This was due to the oxycodone epidemic, which is no longer available in the same format in 2012. The largest contributors to major crimes in the community are attributed to sexual offences and domestic assaults, which constitute 43% of total crimes.
Machin	Ontario Provincial Police	The single most significant threat to public safety within the Machin area remains travelling to and from communities on area roadways. Severe weather patterns and wildlife contribute significantly to motor vehicle collisions in the area; however, the main cause can still be attributed to apparent driver action (speeding, aggressive driving, following too closely, speed too fast for conditions).

5.12.2.6 Poverty and Social Issues

The median household income for the cities, towns and municipalities surrounding the project area (range, $26,432 to $43,173) was generally consistent with the provincial and national averages of $33,539 and $34,204, respectively. The lowest median income was observed in Wabigoon and the maximum in Sioux Lookout.

Several community-based organizations serving low income households (e.g., food banks, second-hand shops, free recovery and counselling programs, temporary shelter and financial assistance programs) operate in the region to serve community needs

5.12.3 Economic Factors

5.12.3.1 Labour Force, Labour Participation and Employment

On the provincial level, Ontario's unemployment rate was 7.4% in 2016 which was slightly lower than the national rate of Canada of 7.7%. Unemployment rates in the Study Area ranged from 6.1% in Sioux Lookout to 16.7% in Wabigoon (Table 5.12.3.1-1).

Table 5.12.3.1-1: Labour Force, Labour Participation and Employment in the Study Area and Comparison to Provincial and National Statistics

Community	Total Labour Force (individuals)	Labour Force Participation (%)	Employment Rate (%)	Unemployment Rate (%)
Machin	350	58.3	50.6	14.3
Wabigoon	150	50	40	16.7
Kenora	19,755	60.7	53.6	11.6
Atikokan	1,030	56	48.7	13.3
Rainy River	6,540	59.7	54.3	9.1
Fort Frances	2,445	61.2	56.9	7.1

Table 5.12.3.1-1: Labour Force, Labour Participation and Employment in the Study Area and Comparison to Provincial and National Statistics (continued)

Community	Total Labour Force (individuals)	Labour Force Participation (%)	Employment Rate (%)	Unemployment Rate (%)
Sioux Lookout	1,195	71.2	66.9	6.1
Dryden	1,780	62.1	57.4	7.9
Thunder Bay	35,250	60.7	56	7.7
Ontario	3,896,765	64.7	59.9	7.4
Canada	9,970,545	65.2	60.2	7.7

Source: Statistics Canada, 2016 Census Community Profiles

Historically, northwestern Ontario's economy has been tied to its landscape and the abundant natural resources contained therein, particularly in forestry and mining as well as tourism. In Thunder Bay the largest amount of labour force participation is in the Sales and Services category. The lowest participation in the labour force is in Natural Resources and Manufacturing occupations.

The main sources of income in Kenora come from different industries that include tourism and tourism-related service businesses, recreation businesses, cottage building and services, value-added forestry, mining and mining services. The two largest private employers in Kenora are the Trus Joist Weyerhaeuser TimberStrand mill and the Canadian Pacific Railway.

5.12.3.2 Income Levels

As per the above, the median household income for the cities, towns and municipalities surrounding the project area (range, $26,432 to $43,173) were generally lower or consistent with the provincial and notational averages of $33,539 and $34,204, respectively.

Lower median household incomes in some communities in the Study Area (Table 5.12.3.2-1) may be attributed to an aging population reaching or entering into retirement. Pension or retirement income is considerably lower than working income, which may partially contribute to lower median incomes.

Government transfers refer to all cash benefits received from federal provincial territorial or municipal governments during the reference period. Government transfers include:

- Old Age Security pension-guaranteed income supplement allowance;
- Retirement, disability and survivor benefits from Canada Pension Plan and Québec Pension Plan;
- Benefits from Employment Insurance and Québec parental insurance plan;
- Child benefits from federal and provincial programs;
- Social assistance benefits;

- Workers' compensation benefits;
- Working income tax benefit;
- Goods and services tax credit and harmonized sales tax credit; and
- Other income from government sources.

Table 5.12.3.2-1: Income Levels in the Study Area Compared to Provincial and National Average

Community	Median total income in 2015 among recipients ($)	Median government transfers in 2015 among recipients ($)
Machin	37,069	10,576
Wabigoon	26,432	9,184
Kenora	31,431	7,072
Atikokan	33,225	10,592
Rainy River	33,928	8,258
Fort Frances	36,703	8,345
Sioux Lookout	43,173	4,256
Dryden	35,879	8,655
Thunder Bay	35,788	7,517
Ontario	33,539	4,206
Canada	34,204	5,453

Source: Statistics Canada, 2016 Census Community Profiles

5.12.3.3 Economic Development

Historically, northwestern Ontario’s economy has been tied to its landscape and the abundant natural resources contained therein, particularly in forestry and mining as well as tourism. Prior to 2006, northwestern Ontario’s primary economic driver was the forestry sector. However, the global recession combined with recent falling lumber prices resulted in devastating impacts on forestry sector. Many local mills were closed or significantly downsized as a result of falling demand. Recently, the forestry sector has seen increased activity, such as the re-opening of the Eacom Forest Products (Ear Falls) and Mckenzie Forest Products (Hudson) sawmills in 2014, but it seems unlikely the industry will return to its previous levels of activity. Many communities are now struggling to diversify their economies to keep dollars circulating locally, meanwhile many workers and families continue to migrate out of the region in search of employment opportunities.

The rich mineral deposits of the Canadian Shield have attracted many mining companies to the region for exploration and extraction. In the wake of the recent recession of the forestry sector, mining activity in the region has received increased attention as a major employer. Speculation regarding the Ring of Fire has also lead to increased political interest in current mining infrastructure and development projects. There are currently six active mines in the region, with many more exploration activities ongoing.

Dryden

Economic development has been a primary focus of City of Dryden staff and leadership for over a decade. As the pulp and paper mill began reducing operations and downsizing its workforce, the City recognized the imperative need to diversify its economic base and attract new industry. The City is currently focusing its industry expansion efforts in the areas of exploration and mining, renewable energy, manufacturing, tourism, agriculture and retail/distribution.

Village of Wabigoon

Inhabitants in the Village of Wabigoon can pursue a number of economic development opportunities mainly concentrating on the tourism and services sectors. Business owners in the community focus on the tourism and retail/service sectors offering hospitality and service employment to residents.

One of the most important economic contributors to the community is the tourism industry and the Village of Wabigoon has a number of businesses to capture the demand for northern adventure.

Township of Ignace (Kenora Census subdivision)

The economy of Ignace is based largely on transportation and tourism, but forestry is recovering and on the rise. The forestry industry has been a major employer in Ignace since the 1940’s. Although there have been significant losses of employment in this sector in the last decade, there is renewed optimism with the announcement of the planned reopening of the Resolute Forest Products Ignace Sawmill, which was idled in 2006.

Municipality of Sioux Lookout

Sioux Lookout has an economic development plan that was approved in 2011 with targeted sectors as follows:

- Health care and service industries;
- Manufacturing, specifically value-added forestry;
- Arts, culture and heritage tourism; and
- First Nation government and economic development.

Sioux Lookout completed over $250 million dollars in capital projects over the last five years. These projects include:

- The Sioux Lookout Meno Ya Win Health Centre;

- An extension of water and sewer infrastructure along Highway 72; and
- New downtown revitalization initiatives.

Sioux Lookout has a great selection of commercial, industrial and residential land with development opportunities in the rural, urban, lakefront and beautiful lake view settings.

Municipality of Machin

Machin boasts a variety of successful businesses. Many of the businesses and economics in Machin depend on seasonal tourism dollars, so they benefit from its location on the TransCanada Highway and its proximity to several excellent fishing lakes. Beyond the current businesses available in Machin, many residents access the businesses and services available in the City of Dryden 45 km east of Vermillion Bay.

5.12.4 Heritage Resources

A Stage 1 and Stage 2 archaeological and cultural heritage assessment was completed for the Project area (Appendix U).

5.12.4.1 Archaeological Context

Several cultural traditions are represented in the prehistory of Northwestern Ontario extending from about 10,000 years ago to the present.

Palaeo-Indian Period (ca. 10.000 B.P. to 7,000 B.P.): Colonization of the northern part of Ontario by vegetation and animals was later than the south due to the northward retreat of the glaciers and subsequent flooding of the glacially depressed landscape by pro- and post-glacial lakes. As a result, it appears that people may have not entered the Thunder Bay area until about 10,000 years ago while archaeological work in the Hudson's Bay Lowland suggests that human occupation maybe limited to about the last 7,000 years.

The first inhabitants of the area most likely arrived by following herds of caribou across the tundra/parkland environment of newly opened lands left by the retreating glaciers. Within a few hundred years succession to a boreal forest environment led to the concentration of peoples along lakes and river systems. Several types of spear points, made of different types of material indicate that different groups of early hunters moved in at various times.

Archaic Period (ca. 7,000 B.P. to 2,500 B.P.): About 7,000 B.P. the environment in the area became warmer and drier which brought about changes in plant and animal communities and in the subsistence patterns of humans. The changes are reflected in the artifact assemblages where the hunting of smaller game resulted in smaller notched projectile points and stone knives replacing large spear points. A new technology involving the production of stone tools by grinding rather that chipping was also utilized.

About 5,000 years ago people started making use of cold-hammered copper to form spear points, knives, and gaff hooks. One of the most complete copper artifact assemblages for Northwestern Ontario was found at a burial site south of Lake Nipigon that dated to about 3,500 years ago. The Lac Seul area has produced an abundance of copper artifacts reflecting many tool types.

Initial Woodland Period (ca. 2,500 B.P. to 900 A.D.): This tradition is marked by the introduction of fired-clay pottery vessels with conical bases made using the coil method. The vessels were smooth with the exception of the neck and rim which were decorated with distinctive toothed or sinuous edged tools. The makers of these vessels are known as the Laurel people who practiced a way of life similar to the region's Archaic people - fishing, hunting, and collecting wild plants on the major waterways. There are two major theories concerning the origin of the Laurel culture in the area. One is that it arose out of an Archaic base differing only by the adoption of pottery. The other is that the people of the Laurel culture moved into the area following the expansion of wild rice into the area about 2,500 B.P.

Terminal Woodland Period (ca.900 A.D. to 1,600 A.D.): Two distinctive cultures, both of which appear to have developed from a Laurel base are present in the Terminal Woodland Period. The Black Duck culture is characterized by globular pottery vessels textured by cord-wrapped paddle and rims decorated with cord wrapped object impressions. Most Archaeologists believe the Black Duck culture to be ancestral to the modem day Ojibway or Anishnabeg Aboriginal Peoples and First Nations.

The Selkirk tradition is found farther north and is characterized by fabric-impressed vessels. These people are thought to be ancestral to the Cree Aboriginal Peoples and First Nations.

Contact Period (ca. 1,650 A.D. to present): This tradition starts with the arrival of Non-Aboriginal Peoples into the area, first the French then English traders bringing with them trade goods such as axes, guns, beads and metal and woolen goods.

5.12.4.2 Historical Context

Zealand Geographic Township has been divided into lots and concessions but is largely undeveloped. A former Ministry of Natural Resources tree nursery was located on the property but is not a historic feature. No historic settlements or historic transportation routes have been identified on or in direct proximity to the property. No historic atlas of the area is available.

5.12.4.3 Description of the Project Area

The Project is located in the Borden block. A site registration database information request made through the Ministry of Tourism, Culture and Sport resulted in no reported archaeological sites within two kilometers of the Project.

Archaeological sites are most often associated with lake and river shoreline environments, and at inland sites with well-drained, sandy soils. Lake and river shoreline environments are outside of potential Project development zones. Relative to inland sites, soils in the vicinity of the Project consist mainly of silt and wet clay over bedrock which suggests low archaeological potential. Site inspection of the local disturbances and access roads with disturbed exposures found no cultural material. The several small areas of elevated topography were observed to have been disturbed by past wood harvesting activities. Therefore, the Project area does not have topological, surface water, or soil characteristics that would indicate any archaeological potential.

5.12.5 Traditional Knowledge

Members of the Wabigoon Lake Ojibway Nation identified the following with respect to their traditional knowledge of the human environment:

- Wabigoon residents use wells for drinking water, and lakeshore residents use Wabigoon Lake and Thunder Lake for drinking water.
- Fishing supports tourism and businesses in the area providing fishing and guiding experiences.
- Medicinal plants such as cedar and white birch are within the local study area.
- The area [wood] collected along roads to heat homes, and supplement incomes.
- Cultural sites of spiritual significance identified proximal to the Project area.
- Mention of old homestead [Becker, presumably Betker] on Project site.
- Potential impacts to tourism, including businesses offering temporary accommodation, guiding, fishing, and hunting outposts. Some local businesses are owned by community members, and many community members guide for hunting and fishing.
- Waterborne contaminants.
- View from Thunder Lake is important.
- Archaeological sites in Thunder Lake and Wabigoon Lake could be underwater.

Members of the Eagle Lake First Nation identified the following with respect to their traditional knowledge of the human environment:

- Mavis and Ghost Lake where there is a sacred site called The Serpent.
- Areas of cultural significance (spirit rocks) on Wabigoon Lake.
- The Great Earth Law is very important. Connections between every aspect of the environment must be recognized. Anishawbe people want to protect environment, especially water, for future generations. The preservation of land is a key concern.
- Should train Eagle Lake people to work at site.

Members of the Whitefish Bay First Nation (Naotkamegwanning First Nation) identified the following with respect to their traditional knowledge of the human environment:

- Cultural sites not identified in Project area.
- Historical travel route through Eagle Lake.
- Rocks and boulders south of the community of Wabigoon [on Wabigoon Lake] are of cultural significance.
- Interest in employment, business and training opportunities expressed by the majority of communities.
- There is a registered fish buyer from Thunder Lake. This community also has a history with Rice Lake where they established base camps in the area, and there overall interests ensuring that the project does not negatively impact their fisheries and that mine drainage does not impact Lac Seul (and presumably other lakes in the area).
- 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.
- Ceremonial sites in the area include stone circles found on residential properties around the project site.
- View of Thunder Lake has cultural importance to the Elders.
- Wabigoon Lake is the biggest wild rice area in Canada and is used as a spiritual and teaching area.
- 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.
- A historical interest in the harvest of wild rice from Rice Lake.
- Spiritual values should be considered its own human environment component.

Members of the Wabauskang First Nation identified the following with respect to their traditional knowledge of the human environment:

- Concern about the grade 12 requirement for employment; and
- Mercury has contaminated waterways.

Members of the Grassy Narrows First Nations identified the following with respect to their traditional knowledge of the human environment:

- Mercury has contaminated waterways.

The Métis Nation of Ontario (MNO) has been working to establish Métis harvesting rights for its members, and have negotiated a harvesting agreement with Ontario (MNRF) to allow MNO to issue an agreed number of Harvester's Cards for the harvesting for food within their traditional territories (MNO 2016). As part of this agreement, the two parties have agreed to share information of harvesting pressures, moose populations to allow those Métis with Harvester's Cards to make voluntary decision to modify their hunting practices. Within the three wildlife management units that overlap the terrestrial RSA for the Project, MNO indicated the following about moose populations (MNO 2016):

- **WMU 8**: Few calves survive in these areas and Métis with Harvester's Cards should consider reducing or avoiding harvesting calves. Moose populations have declined substantially, and Métis with Harvester's Cards should consider reducing or avoiding harvesting moose.
- **WMU 5**: Few calves survive in these areas and Métis with Harvester's Cards should consider reducing or avoiding harvesting calves. Moose populations have declined substantially, and Métis with Harvester's Cards should consider reducing or avoiding harvesting moose.
- **WMU 9A**: Some calves survive in these areas. Moose populations are steady or increasing. Métis with Harvester's Cards should consider harvesting moose in these areas.

5.13 Indigenous Communities

'Indigenous peoples' is a collective name for the original peoples of North America and their descendants. Often, 'Aboriginal peoples' is also used. The Canadian Constitution recognizes three groups of Aboriginal (Indigenous) peoples: First Nations, Inuit, and Métis. These are three distinct peoples with unique histories, languages, cultural practices and spiritual beliefs.

According to the most recent 2016 census, more than 1.67 million people in Canada identify themselves as an Aboriginal person or a member of an Indigenous community. Furthermore, Indigenous and Northern Affairs Canada (INAC) reports that Indigenous communities are:

- The fastest growing population in Canada – grew by 42.5% between 2006 and 2016; and
- The youngest population in Canada – about 44% were under the age of 25 in 2016.

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 purpose of this subsection is to provide an understanding of the current use of lands and resources for traditional purposes by Aboriginal people to specifically 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”. The information presented herein was obtained via meaningful engagement activities with the Indigenous communities defined by the Agency, in accordance with paragraph 4(1)(d) in promoting communication and cooperation with Aboriginal peoples with respect to EAs as one of the purposes of CEAA 2012.

5.13.1 Community Profiles

Participants in the EA process include Indigenous communities, federal, provincial, and municipal governments, project stakeholders, the general public and non-governmental organizations.

Table 5.13.1-1 provides an introductory summary of the various Indigenous communities in the study area. Details regarding Project engagement activities and stakeholder identification are provided in Section 9, and further outlined in Appendices V and DD. Additional details regarding each of these Indigenous communities (see Figure 5.13.1-1) is provided below.

Table 5.13.1-1: Indigenous Community Summary Profile

Indigenous Identity	Indigenous Community	Current Chief/President and Key Contact Information	Indigenous and Northern Affairs Canada Community Profile Summary
First Nation	Wabigoon Lake Ojibway Nation	Esther Pitchenese RR 1, Site 115 PO Box 300 Dryden, Ontario P8N 2Y4 (807) 938-6684	• The Wabigoon Lake Ojibway Nation (WLON) is located 19 km southeast of Dryden. The official title of the reserve is Wabigoon Lake 27 which is 5,209.2 hectares in size. As of February 2018, the total registered population was 738 (192 individuals on the reserve, 546 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council
First Nation	Eagle Lake First Nation	Arnold Gardner PO Box 1001 Migisisahgaigan, Ontario P0V 3H0 (807) 755-5526	• The Eagle Lake First Nation (Number 148) is located 13 km southwest of Dryden. The most populated site is Eagle Lake 27 and the official reserve is 3,592 ha in size. As of February 2018, the total registered population was 623 (358 individuals on the reserve, 253 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council

Table 5.13.1.1-1: Indigenous Community Summary Profile (continued)

Indigenous Identity	Indigenous Community	Current Chief/President and Key Contact Information	Indigenous and Northern Affairs Canada Community Profile Summary
First Nation	Wabauskang First Nation	Martine Petiquan PO Box 339 Ear Falls, Ontario P0V 1T0 (807) 529-3174	• Wabauskang First Nation (Number 156) is located 67 kms northwest of Dryden. The most populated site is Wabauskang 21 which is 3254.5 ha in size. As of February 2018, the total registered population was 336 (136 individuals on the reserve, 196 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council.
First Nation	Lac Seul First Nation	Clifford Bull PO Box 100 Hudson, Ontario P0V 1X0 (807) 582-3503	• Lac Seul First Nation (Number 205) is located 56 kms northeast of Dryden. The most populated site is LAC Seul 28 which is 26,821.50 ha in size. As of February 2018, the total registered population was 3,493 (907 individuals on the reserve, 2,586 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council.
First Nation	Whitefish Bay First Nation (Naotkamegwanning First Nation);	Howard Kabestra 1800 Pawitik Street Pawitik, Ontario P0X 1L0 (807) 226-5411	• The Naotkamegwanning First Nation (Number 158) has four official reserves which include: Agency 30, Sabaskong Bay 32C, and Yellow Girl Bay 32B located 32 kms south east of Kenora and Whitefish Bay 32A located 48 kms southeast of Kenora which are both of particular interest to the Goliath project given their locations. Whitefish Bay 32A is 1954.3 ha and Yellow Girl Bay 32B 1,802.5 ha in size. As of February 2018, the total registered population was 1, 283 (759 individuals on the reserve, 524 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council.
First Nation	Grassy Narrows First Nation	Simon Fobister General Delivery Grassy Narrows, Ontario P0X 1B0 (807) 925-2201	• Grassy Narrows First Nation (Number 149) is located 40 kms northeast of Kenora. The most populated site is English River 21 which is 4,145 ha in size. As of February 2018, the total registered population was 1,588 (969 individuals on the reserve, 619 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council.
First Nation	Lacs des Mille Lacs First Nation	Judith Maunula 328-1100 Memorial Avenue Thunder Bay, Ontario P7B 4A3 (807) 622-9835	• Lacs des Mille Lacs First Nation (Number 189) has two official reserves associated with the First Nation: Lacs des Mille Lacs 22A1 and 22A1 which are 1,518 and 3,430 ha in size, respectively. As of February 2018, the total registered population was 610 (6 individuals on the reserve, 607 off the reserve or on other reserves). • The tribal council affiliated with this First Nation is Brimrose Tribal Council.

Table 5.13.1.1-1: Indigenous Community Summary Profile (continued)

Indigenous Identity	Indigenous Community	Current Chief/President and Key Contact Information	Indigenous and Northern Affairs Canada Community Profile Summary
First Nation	Grand Council Treaty #3 (Anishinaabe Nation of Treaty 3, Anishnaabeg of Naongashiing)	Grand Chief Francis Kavanaugh Grand Council Treaty #3 P.O. Box 1720 Kenora, Ontario P9N 3X7	• Grand Council Treaty #3 represents 28 First Nation communities, with a total population of approximately 25,000. • The mandate of Grand Counicl Treaty #3 is: • At the direction of the leadership, for the benefit/protection of the Citizens, the administrative office of Grand Council Treaty #3 protects, preserves and enhances Treaty and Aboriginal rights. • This is achieved by advancing the exercise of: Inherent jurisdiction, Sovereignty, Nation-building and; Traditional Governance. With the aim to preserve and build the Anishinaabe Nation's goal of self-determination.
Métis	Northwest Métis Council;	Ronald Robinson, President 34B King Street Dryden, Ontario P8N 1B4 (807) 223-8082	NA
Métis	Kenora Métis Council	Joel Henley, President Unit 4, 621 Lakeview Drive Kenora, Ontario P9N 3P6 (807) 465-5619	NA
Métis	Sunset Country Métis Council	Clint Calder, President 714 Armit Avenue Fort Frances, Ontario P9A 2J1 (807) 274-7076	NA
Métis	Atikokan Métis Council	Marlene Davidson, President Box 1630, 33 Birch Road Atikokan ,Ontario P0T1C0 (807) 597-2954 (807) 598-0913 (cell)	NA
	The Aboriginal People of Wabigoon	Mr. Clayton Wetelainen 3 Sherbrook Street Wabigoon, Ontario, CA P0V 2W0 (807) 938-6981	NA

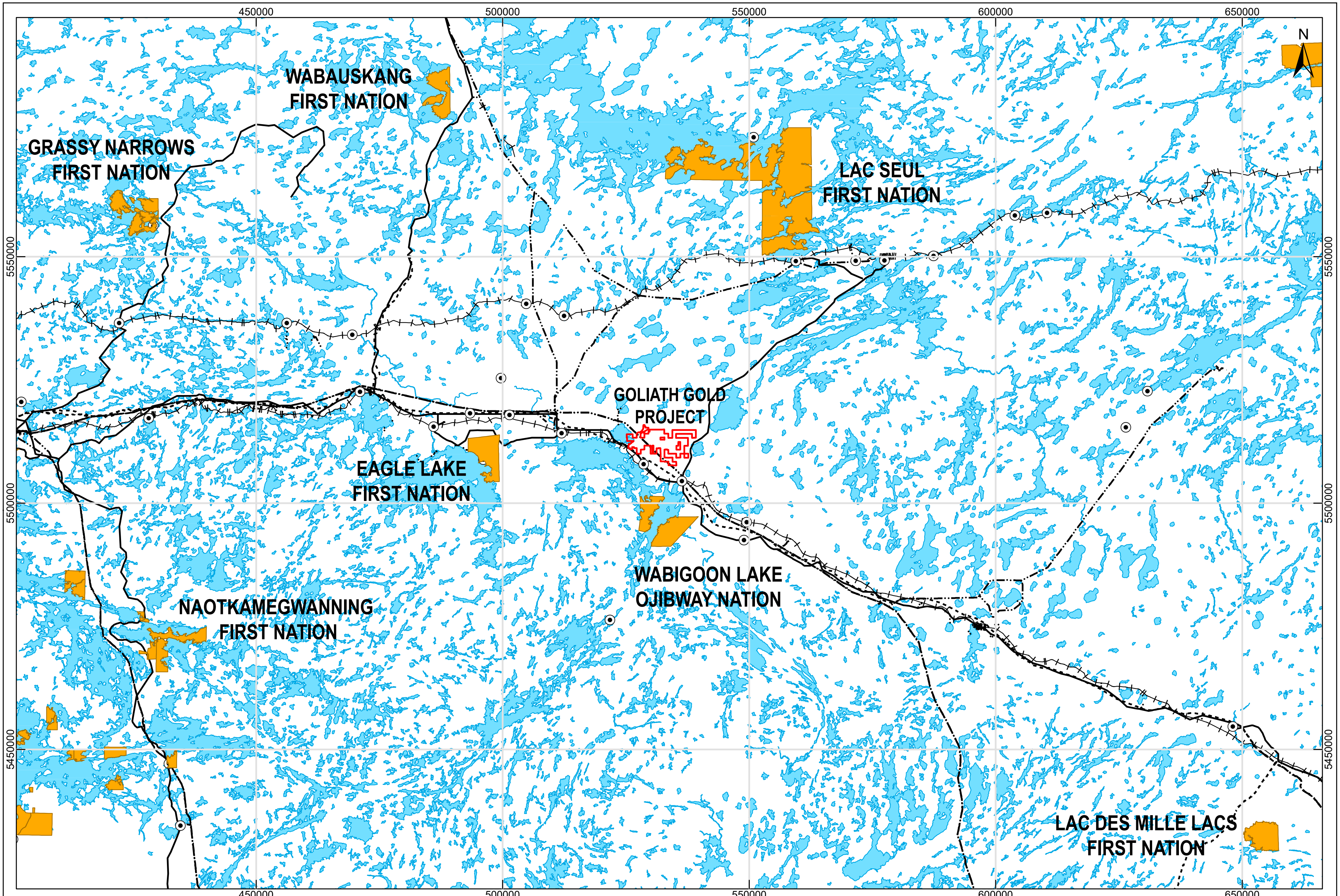
Source

Indigenous and Northern Affairs Canada (INAC) — Aboriginal and Treaty Rights Information System (ATRIS)

NA = Not Available — No Indigenous and Northern Affairs Canada community profile available.

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
    - Grand Council Treaty #3
- Métis Nation of Ontario
    - Northwest Métis Council
    - Kenora Métis Council
    - Sunset Country Métis Council
    - Atikokan Métis Council
- The Aboriginal People of Wabigoon.



GOLIATH GOLD PROJECT
DRYDEN, ONTARIO, CANADA

TREASURY METALS Inc.

Indigenous Communities

Figure 5.13.1-1 REV.02

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

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

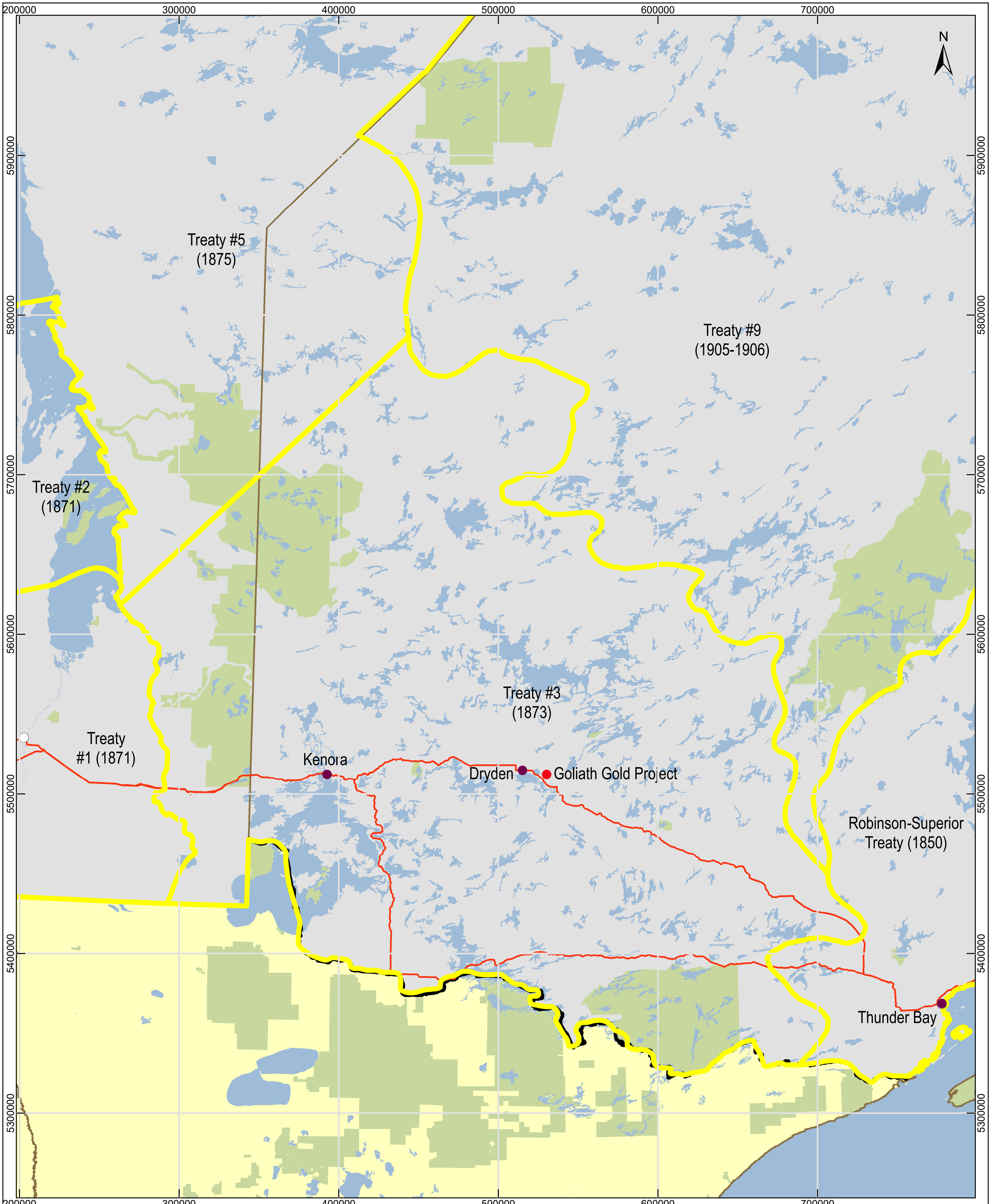
SCALE 1:1,000,000

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

0 20 40 60
Kilometers

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

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



GOLIATH GOLD PROJECT DRYDEN, ONTARIO, CANADA	TREASURY METALS Inc.	Treaty Areas / Population Center / Canada / Highways / United States	SCALE 1:3,000,000 — Coordinate System: NAD 1983 UTM Zone 15N; Projection: Transverse Mercator; Datum: North American 1983 — Base Data: Treasury Metals Inc., LIO Database, KBM Resources Group
Treaty Areas - Regional Scale	DESIGN: MP 18/08/2017 GIS: MP 18/08/2017 CHECK: MW 18/08/2017 REVIEW: MW 18/08/2017		0 — 100 Kilometers — Notes: All details preliminary and subject to change as engineering designs are updated.
Figure 5.13.1-2 — REV.01			

Treasury Metals recognizes that Indigenous people live, work, hunt, fish, trap, collect water, and harvest throughout their lands and rely on them for their individual as well as their communities' 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 identify and culture, inclusive of ceremonial and spiritual recognition. Treasury in respect to this recognizes the importance of assessing any Project-related impacts as these relate to traditional land and resource use activities and practices; and Treasury Metals acknowledges that the Project may impact these activities or practices within the Project area, and is committed to working with all communities to identify, mitigate, and avoid or minimize any such related impacts.

An important component of the federal EIS process is the provision of funding to participants in the process. To date, the Agency has provided $365,933 to assist Indigenous communities to prepare for and participate in consultation activities associated with the federal EA as per Table 5.13.1.1-2. An additional $94,500 was provided to the general public to assist in their participation in the EA process.

Table 5.13.1.1-2: Indigenous Community Summary Profile

Recipients	Total Funding Allocated
Aboriginal People of Wabigoon	$34,872
Eagle Lake First Nation	$55,200
Grassy Narrows First Nation	$44,959
Lac des Mille Lacs First Nation	$10,500
Métis Nation of Ontario	$54,000
Whitefish Bay First Nation (Naotkamegwanning First Nation)	$60,750
Wabauskang First Nation	$60,652
Wabigoon Lake Ojibway Nation	$45,000
Total Funding for Indigenous Communities	**$365,933**
General Public	$94,500
Total Funding	**$460,433**

5.13.2 Demographics of Indigenous Communities

For interpretation of the demographics of indigenous communities, data was collected largely form the 2016 census reported by Statistics Canada in 2017. Statistics Canada provided data on the following nine First Nation communities:

- Wabigoon Lake 27;
- Eagle Lake 27;
- Lac des Mille Lacs 22A1;
- Wabauskang 21;

- Lac Seul 28;
- Whitefish Bay 32A (Naotkamegwanning First Nation);
- Whitefish Bay 33A (Naotkamegwanning First Nation);
- Whitefish Bay 34A (Naotkamegwanning First Nation); and
- Grassy Narrows (English River 21).

The surrounding nine "cities, towns, and municipalities" refer to the following areas referred to by Statistics Canada as census divisions:

- Machin (includes Eagle Lake and Vermilion Bay);
- Wabigoon (the Village of Wabigoon);
- Kenora (Township of Ignace);
- Atikokan;
- Rainy River;
- Fort Frances;
- Sioux Lookout;
- Dryden; and
- Thunder Bay.

5.13.2.1 Population

Population data were collected from the Statistics Canada 2016 census for general population statistics for the regions surrounding the Project sites including nine First Nation Reserves. Although Lac des Mille Lacs 22A1 First Nation was assessed, it appears as though no information was shared to the Government of Canada aside from the area of land, as all other parameters were blank in the 2016 Census Profile for this community.

The 2016 census data indicated the population was declining in six of the nine First Nation Reserves by an average of 5.45%. The exceptions were Lac Seul 28 and Whitefish Bay 33A, which reported a 12% and 22% increase in the population, respectively. The average population size of the First Nations for which Statistics Canada collected data for was 318 individuals, and ranged from Wabauskang First Nation, with 70 individuals listed, to Lac Seul First Nation, with 974 individuals listed. There was no data available for Lac des Mille Lacs First Nation.

The average median age of individuals living on the seven First Nation reserves was 29 years old (± 6.0 years, n=8), compared to the provincial and national averages of 41 years old.

As reported by Statistics Canada and presented in Table 5.13.2.1-1, the 2016 census data indicated that the percentage of the population identifying as a member of an indigenous community (i.e., First Nations, Métis, or Inuk (Inuit)) was substantially higher that the provincial and national average for all towns, cities, municipalities, and official First Nation reserves in the areas surrounding the Project.

Table 5.13.2.1-1: Indigenous Identity for the Population Compared to Provincial and National Average

Community	% Total Indigenous Identity	% First Nations	% Métis	%Inuk (Inuit)	% Non-Aboriginal identity
First Nation Reserve					
Wabigoon Lake 27,	95.24	95.24	0	0	5.95
Eagle Lake 27	98.21	98.21	0	0	4.46
Lac des Mille Lacs 22A1	No data				
Wabauskang 21	100.00	100.00	0	0	0.00
Lac Seul 28	98.05	98.05	0	0	1.54
Whitefish Bay 32A	98.26	98.26	0	0	1.74
Whitefish Bay 33A	98.96	98.96	0	0	0
Whitefish Bay 34A	96.77	96.77	0	0	0
Grassy Narrows (English River 21)	95.61	95.61	0	0	2.35
City, Town, Municipality					
Machin (includes Eagle Lake & Vermilion Bay)	22.66	9.27	13.39	0.00	74.15
Wabigoon	50.94	33.51	17.43	0.00	41.55
Kenora	48.20	42.40	5.75	0.05	50.08
Atikokan	13.98	4.54	9.44	0.00	82.64
Rainy River	26.40	19.19	7.21	0.00	71.41
Fort Frances	23.65	14.15	9.50	0.00	73.46
Sioux Lookout	36.32	31.87	4.27	0.19	61.55
Dryden	19.24	12.08	7.16	0.00	79.04
Thunder Bay	12.27	9.42	2.83	0.03	85.01
Provincial and National					
Ontario	2.69	1.76	0.90	0.03	95.68
Canada	4.64	2.78	1.67	0.18	93.27

Source: Statistics Canada, 2016 Census Community Profiles

For the First Nation Reserves that Statistics Canada collected population data for, the percentage of the total population identifying as First Nation ranged from 95.25% (Wabigoon Lake, 27) to 100% (Wabauskang 21). The 2016 census data indicates that only 2.69% of the total population in Ontario and 4.64% of the total population of Canada identifies as a member of an indigenous group. No data were available on the population of Lac des Mille Lacs.

The closest city, town, or village to the project is Wabigoon, which is also referred to as the Village of Wabigoon. Over half of the population (50.94%) identifies as having indigenous identity which is comprised as 33.51% First Nation and 17.43% Métis.

The data also indicates that a large proportion of the indigenous population resides in larger towns and cities. For example, the population in Sioux Lookout identifies as 31.87% First Nations, 4.27% Métis, and 0.19% Inuk (Inuit); Kenora identifies as 42.40% First Nations, 5.75% Métis, and 0% Inuk (Inuit); and Thunder Bay identifies as 9.42% First Nations, 2.83% Métis, and 00.3% Inuk (Inuit).

5.13.2.2 Education

For all First Nations, and cities, towns, or municipalities surrounding the study area, the percentage of individuals without a certificate, diploma or degree was higher than the provincial and national numbers (Table 5.13.2.2-1).

Table 5.13.2.2-1: Level of Education in Study Area including Indigenous Population Statistics

Community	% Total Indigenous Identity	Percentage: No certificate, diploma, or degree	Percentage: High School Certificate or Equivalent	Percentage: Postsecondary Certificate: Diploma or Degree
First Nation Reserve				
Wabigoon Lake 27,	95	32	18	50
Eagle Lake 27	98	42	28	33
Lac des Mille Lacs 22A1	No data			
Wabauskang 21	100	40	20	40
Lac Seul 28	98	50	24	26
Whitefish Bay 32A	98	42	23	35
Whitefish Bay 33A	99	62	15	15
Whitefish Bay 34A	97	44	19	31
Grassy Narrows (English River 21)	96	64	13	21
City, Town, Municipality				
Machin (Includes Eagle Lake & Vermilion Bay)	23	31	27	42
Wabigoon	51	37	30	32
Kenora	48	35	24	40
Atikokan	14	23	31	46
Rainy River	26	24	29	47
Fort Frances	24	22	30	48
Sioux Lookout	36	24	25	51
Dryden	19	23	29	48
Thunder Bay	12	20	27	53
Provincial and National				
Ontario	3	18	27	55
Canada	5	18	26	55

The average percentage of the population without a certificate, diploma, or degree was on average 47% on First Nations reserves, which was higher than the percentage for populations living in the other cities, towns, and municipalities (24%) Thus, based on the 2016 Census data, there appears to be an inverse relationship between the percentage of the population who identify as members of an Indigenous community, and those who go on to obtain a secondary and post-secondary education.

5.13.2.3 Income and Work Force Status

The median age reported from the First Nations reserves ranged from 25.7 (Whitefish Bay 34A) to 39.2 (Wabigoon Lake, 27). Data with respect to medium income were only available for Lac Seul 28, Whitefish Bay 32A, and Grassy Narrows (English River 21), which reported $17,675, $19,947, and $9,696, respectively, which are all well below the Provincial and National statistics of $33,539 and $34,204, respectively.

Employment data for the First Nation reserves as well as cities, towns and municipalities surrounding the Project are presented in Table 5.13.2.3-1. The average employment rate was lower on average on the seven First Nation reserves relative to the average rate in the towns, cities, and municipalities surrounding the Project site. The average employment rate on the First Nation reserves was 44% compared to 54% in the surrounding cities, towns, and municipalities. These statistics are lower than the Provincial and National averages of 60%.

Table 5.13.1.3-1: Labour Force, Labour Participation and Employment in the Study Area including First Nation Reserves

Community	% Total Population with Indigenous Identity	Total - Population Aged 15 years and over by Labour force status (Individuals)	Participation Rate (%)	Employment Rate (%)	Unemployment Rate (%)
First Nation Reserve					
Wabigoon Lake 27,	95	140	64.3	54	17
Eagle Lake 27	98	185	49	41	11
Lac des Mille Lacs 22A1	No Data				
Wabauskang 21	100	55	72.7	55	25
Lac Seul 28	98	665	59.4	38	37
Whitefish Bay 32A	98	385	59.7	46	22
Whitefish Bay 33A	99	60	61.5	39	50
Whitefish Bay 34A	97	80	62.5	44	20
Grassy Narrows (English River 21)	96	450	46.7	38	19
City, Town, Municipality					
Machin (Includes Eagle Lake and Vermilion Bay)	23	840	58.3	50.6	14.3
Wabigoon	51	300	50.0	40.0	16.7
Kenora	48	50,235	60.7	53.6	11.6
Atikokan	14	2,350	56.0	48.7	13.3
Rainy River	26	16,245	59.7	54.3	9.1
Fort Frances	24	6,320	61.2	56.9	7.1
Sioux Lookout	36	4,165	71.2	66.9	6.1
Dryden	19	4,705	62.1	57.4	7.9

Table 5.13.1.3-1: Labour Force, Labour Participation and Employment in the Study Area including First Nation Reserves

Community	% Total Population with Indigenous Identity	Total - Population Aged 15 years and over by Labour force status (Individuals)	Participation Rate (%)	Employment Rate (%)	Unemployment Rate (%)
Thunder Bay	12	89,665	60.7	56.0	7.7
Provincial and National					
Ontario	2.7	11,038,440	64.7	59.9	7.4
Canada	4.6	28,643,020	65.2	60.2	7.7

Source: Statistics Canada, 2016 Census Community Profiles

5.13.2.4 Crime and Justice

The project and surrounding towns and municipalities are policed by the OPP as part of OPP North West Region. There are nine detachments that work collaboratively with First Nation police services and are directly involved in the administration and delivery of policing arrangements under the Ontario First Nations Policing Agreement.

Crime and Justice statistics for the project area were provided in Section 5.13.2.4 which based on the nature of their collection included Aboriginal and non-Aboriginal peoples (i.e., First Nations, Métis, and Inuit). The First Nations police services do not published detailed records of crime statistics annually in the same manner as the OPP.

Treasury Metals completed a review of available literature to better understand the subject of crime and justice for Indigenous communities.

The Government of Canada reports that research has identified a connection between certain demographic and social factors and an elevated risk of offending and/or victimization for Aboriginal peoples. These factors include being young (Lochner 2004), living in a lone-parent family situation (Stevenson et al. 1998), living common-law (Mihorean 2005), high levels of unemployment (Raphael and Winter-Ebmer 2001), and the consumption of alcohol (Vanderburg et al. 1995). These risk factors have been reported as “highly apparent” in the demographic and social conditions of the Aboriginal population in Canada.

The 2016 Census data indicates that the average median age of individuals living on the eight First Nation reserves (Lac des Mille Lacs could not be assessed due to insufficient data) was 29 ± 6.0 years old (n=8) compared to the provincial and national averages of 41 years old. Thus, from the census data the First Nation population in the project area is much younger than the average age of other Canadians. From the 2016 census data it is not possible to speculate on the average median age of those who identify as Métis.

Additionally, in terms of family composition, indigenous children are more likely than non-Indigenous children to live in lone-parent households, as the 2016 census data indicates that on average 38% (n=8) of the households on the First Nation reserves in the project area reported themselves as "lone-parent households". This is substantially larger than the provincial average of 17% and national average of 16%.

Although Indigenous Canadians have been making important gains in educational achievement, they are still underrepresented in educational attainment. While only 18% of the Canadian population reports not having a high school equivalent, diploma, or degree; the rate is substantial larger, averaging 47% ±11% (n=8) for the First Nation reserves near the Project (Statistics Canada, 2016).

The Indigenous population is also an economically disadvantaged population. The unemployment rate on the First Nation reserves (25% ± 12%) or in the cities, town, and municipalities in the project area (10% ±3.7%) is 3-4 times higher than the overall rate in Ontario (7.4%) and Canada (7.7%) (Section 5.13.2.3). As a correlate, individuals living on the First Nation reserves reported earning between $14,257 – $24,509 less annually than the average Canadian. Data with respect to medium income were only available for Lac Seul 28, Whitefish Bay 32A, and Grassy Narrows (English River 21), which reported $17,675, $19,947, and $9,696, respectively, which are all well below the Provincial and National statistics of $33,539 and $34,204, respectively.

Other factors that may result in higher risk of offending and/or victimization include (but are not limited to): physical or mental health related issues (i.e., disability status) alcohol or drug abuse, and those previously exposed to sexual or physical abuse.

Thus, although specific crime and justice statistics are unavailable that are specific to Aboriginal peoples of First Nation, Métis, or Inuit status in the project area, from the 2016 census data it is evident that the population demographics in the areas surrounding the project indicate that members of these Indigenous communities may be at an elevated risk of offending and/or victimization.

5.13.3 Traditional Land and Resource Use

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.

Treasury Metals is committed to engaging with local Indigenous communities in the local area regarding their traditional knowledge and traditional land and resource use to ensure that the Project does not have a residual adverse effect on these communities. The following subsections provide a summary of the traditional land and resource use information shared with Treasury Metals or obtained by Treasury Metals regarding traditional use of the land. Treasury Metals obtained the traditional land and resource use information via primary sources of information including engagement activities such as community meetings, phone calls, emails and feedback received from Indigenous communities following their review of the original EIS submitted in April 2015. Secondary sources of information were also utilized where appropriate to support information obtained through primary engagement.

Past and present First Nation and Métis land and resource use activities in and around the Project area include harvesting and gathering, hunting, fishing, camping, trapping, use of travel ways and cultural and spiritual uses. The area surrounding the Project is rich in natural resources which support these activities.

5.13.3.1 Wabigoon Lake Ojibway Nation

Wabigoon Lake Ojibway Nation is the Indigenous community in closest proximity to the Goliath Gold Project site. It is located on the shores of Dinorwic Lake approximately 45 km east of Dryden, Ontario and approximately 25 km from the Goliath Gold Project site, via Highway 17 and Wabigoon Lake Ojibway Nation Road. There is unrestricted access between Dinorwic Lake and Wabigoon Lake allowing the residents of Wabigoon Lake Ojibway Nation unrestricted access into Wabigoon Lake for fishing and other traditional Indigenous activities.

As of February 2018, Wabigoon Lake Ojibway Nation had a registered population of 738 with 192 members living on reserve, 3 members living on other reserves, 2 members living on Crown land, and 541 members living off reserve (Reference Table in 5.13.1). The Nation is governed by a Chief and four councillors elected for a two-year term under an electoral governance system.

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.

Information obtained from Wabigoon Lake Ojibway Nation regarding traditional land and resource use is summarized in Table 5.13.3.1-1. 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 for cultural and spiritual purposes.

Table 5.13.3.1-1 Wabigoon Lake Ojibway Nation Traditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Harvesting of Plants	Plants-proximity to the project
	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
	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
	Hunting (moose, deer, rabbit)
	Trapping American Marten within the proposed Project area
Fishing	Fishing of Pike + other species
	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
	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

Based on information available from all sources, a major focus of community activities appears to be on 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.

In addition to traditional land and resource use information obtained through direct community engagement, and information shared through the IR process, traditional land and resource use information relevant to the Wabigoon Lake Ojibway Nation is also available from secondary sources. These sources include:

- 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 compliments, and in some cases expands upon, primary source materials listed in Table 5.13.3.1-1.

Data provided in the English River Forest Management Plan indicate that members of the Wabigoon Lake Ojibway Nation have historically used the English River Forest for business, recreational and cultural activities, and that current primary business uses include wild rice, blueberry and timber harvesting activities (MNR 2009). Wabigoon Lake Ojibway Nation families are also reported to hold five traplines within the Wabigoon Forest Management Unit. Relative to wild rice harvesting, the Wabigoon Lake Ojibway Nation was regarded as being one of the most active of the First Nations in harvesting and processing wild rice. Indigenous traditional land and resource use data collected in association with the Dryden Forest Management Unit are not publically available.

More detailed accounts of wild rice harvesting are provided by Chapeskie (1993), and by the Wabigoon Lake Ojibway Nation web site. Chapeskie (1993), who spent a considerable amount of time on the land with Elders from the Wabigoon Lake Ojibway Nation, provided a detailed historical perspective on wild rice harvesting by the First Nation. According to Chapeskie, the Wabigoon Lake Ojibway Nation harvested wild rice throughout lake systems within upper portions of the Wabigoon River system including Wabigoon Lake, Dinorwic Lake, and Oval Lake. Ricing on Wabigoon Lake was disrupted by the damming of the lake in 1879 with replacement of the dam in 1912. This action increased the water level of the lake by about 3 m, which flooded out much of the originally present rice fields on the lake, although areas of wild rice still exist on Wabagoon Lake. As a result of flooding, the Wabigoon Lake Ojibway Nation people shifted their focus to other areas, particularly to Oval and Dinorwic Lakes, with these efforts including active planting of more favourable areas.

Historical ricing activities on Oval Lake involved communal harvesting by several families, with a portion of the production being traded at the Dinorwic Hudson Bay Company trading post. In 1988 a commercial wild rice processing plant was established on the Wabigoon Lake Ojibway Nation Reserve (the Kagiwiosa Manomin cooperative) (Chapeskie 1993, Kroeker 1998, WLON 2018: *website). According to the community website profile, the processing of wild rice at the* Kagiwiosa Manomin facility is an important success story for the community, with product being shipped to markets worldwide. Data available from DeLisle (2001) indicate that the Wabigoon Lake Ojibway Nation holds the harvesting licence to the Dryden area Unit 10 Registered Wild Rice harvesting Area, which encompasses the area from

A number of other traditional land and resource use activities carried out by the Wabigoon Lake Ojibway Nation peoples are associated with the rice beds. This includes waterfowl harvesting, and the importance of the rice beds as spawning, brooding and feeding habitat for Northern Pike and Muskellunge, as well as trapping for muskrat. According to Chapeskie (1993) the Wabigoon Lake Ojibway Nation peoples used to harvest large numbers of ducks from Oval Lake (and likely other areas) which were smoked and dried for use over the winter months.

Traditionally the Wabigoon Lake Ojibway Nation used timber products for a variety of uses. A natural expansion of these activities was to participate in area commercial forestry operations. As an example, the Noopimiing Anokeewin Inc. forestry operation, is privately owned Indigenous forestry enterprise that is operated on the Wabigoon Lake Ojibway Nation reserve. The company was incorporated in 1992 as a “stump-to-dump” operation that supplies wood directly to the Domtar (formerly Weyerhaeuser) mill in Dryden (Kroeker 1998; WLON 2018: website; Domtar 2008). In this capacity, the community is responsible for the complete system operation, including building and maintaining forest access roads. The community also maintains a tree nursey on the reserve.

Information on regional fishing activities is available from MNR as described in the 2012 Fisheries Management Zone 5 report (MNR 2012). Although not providing specifics relative to individual First Nations, the report states that the majority of commercial fishing licences in Zone 5 are held by First Nations, and these include commercial licences on Wabigoon and Thunder Lakes. Information available from the Naotkamegwanning First Nation (Whitefish Bay First Nation, Whitefish Bay First Nation) (see Section 5.13.3.5 below), indicates that these commercial licences are held by members of the Wabigoon Lake Ojibway Nation and Whitefish Bay First Nation. Within Zone 5, Whitefish, Walleye and Northern Pike are considered the most important species harvested recreationally and commercially. Annual fish consumption rates for area First Nations peoples were estimated at from 18 to 35 kg per person, which is substantial.

5.13.3.2 Eagle Lake First Nation

Eagle Lake First Nation is located on the northeast shore of Eagle Lake, approximately 25 km west southwest of Dryden. Travelling by road (Highway 17/Highway 594/Highway 502) Eagle Lake First Nation is located approximately 50 km from the site of the Project.

As of February 2018, Eagle Lake First Nation had a registered population of 623 with 359 members living on reserve, 12 members living on other reserves, and 252 members living off reserve. The Nation is governed by a Chief and three councillors elected for a two-year term under an electoral governance system.

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, 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.

Information obtained from Eagle Lake First Nation regarding traditional land and resource use is summarized in Table 5.13.3.2-1. 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.

Table 5.13.3.2-1 Eagle Lake First Nation Traditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Harvesting	Plants-proximity to the project
	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
	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
Fishing	Fishing of Pike + other species
	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
	Areas of cultural significance (spirit rocks) on Wabigoon Lake

Eagle Lake First Nation as stated has received Project information and EIS-related materials, and has received additional material as it relates to the revised EIS and engagement activities to date.

In addition to traditional land and resource use information obtained through direct community engagement, and information shared through the IR process, traditional land and resource use information relevant to the Eagle Lake First Nation is also available from secondary sources. These sources include:

- 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 compliments, and in some cases expands upon, primary source materials listed in Table 5.13.3.2-1.

Data from the Domtar 2008 Forest Management Plan (FMP) states that members of the Eagle Lake First Nation are actively engaged in timber harvesting activities, principally through the Eagle Lake Loggers. Eagle Lake First Nation members also reportedly hold rights to five traplines which intersect the Wabigoon Forest Management Unit. Trapiles specifically held by members of the Eagle Lake First Nation are not identified. The Domtar 2008 FMP also states that members of the Eagle Lake First Nation previously held a commercial fishing licence on Eagle Lake, but that this licence lapsed in 1982. Data from MNR show that a commercial fishing licence existed for Eagle Lake as of 2012, but the licence holder is not identified (MNR 2012). Data available from the Energy East Project EA (TransCanada 2016) and from DeLisle (2001) indicate that the Eagle Lake First Nation holds the harvesting licence to the Dryden area Unit 9 Registered Wild Rice harvesting Area. Figure 5.13.3.2-1 illustrates where the various wild rice harvesting areas are in relation to the Project.

5.13.3.3 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. Further to this the Wabauskang First Nation historically held traditional lands located on the Wabigoon River system, proximal to the community of Quibell. Due to the historical issues associated with the pulp and paper facility in Dryden, the people of this area moved north of the Wabigoon River system, to the current location on Wabauskang Lake.

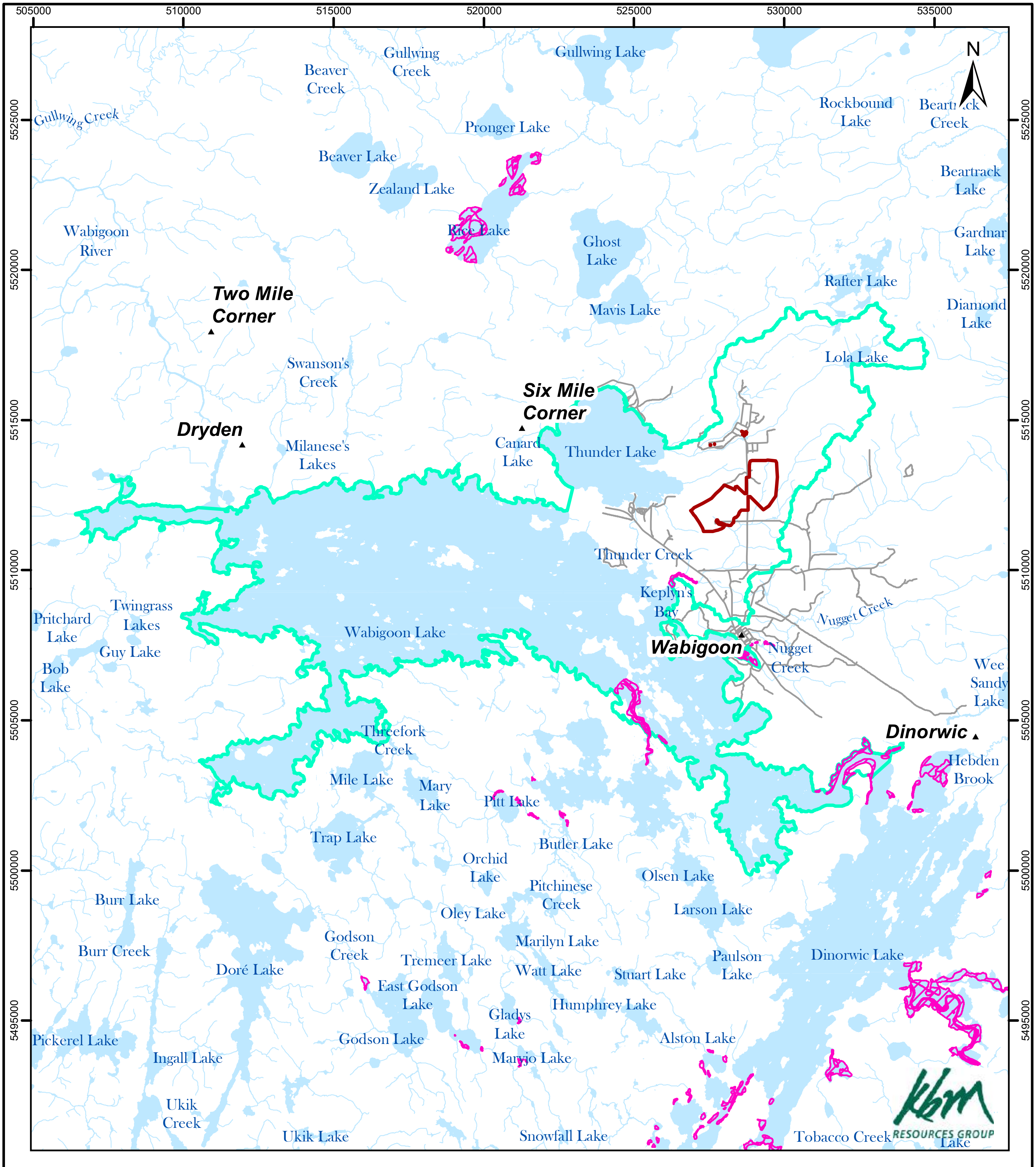


Figure 5.13.3.2-1:
Wild Rice Harvesting Areas

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

As of February 2018, Wabauskang First Nation had a registered population of 336 with 136 members living on reserve, 4 members living on other reserves, and 196 members living off reserve. The Nation is governed by a Chief and three councillors elected for a two-year term under an electoral governance system.

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 has been in ongoing communications with Wabauskang First Nation in regards to presenting the revised material supporting the EIS, and in turn the effects and impacts of the Project. In conjunction to this Treasury has provided a significant amount of documentation to Wabauskang First Nation regarding Project effects and development.

Information obtained from Wabauskang First Nation regarding traditional land and resource use is summarized in Table 5.13.3.3-1. 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

Table 5.13.3.3-1 Wabauskang First NationTraditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access
	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
	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

In addition to traditional land and resource use information obtained through direct community engagement, and information shared through the IR process, traditional land and resource use information relevant to the Wabauskang First Nation is also available from secondary sources. These sources include:

- 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 compliments, and in some cases expands upon, primary source materials listed in Table 5.13.3.3-1.

An historical perspective of life for Wabauskang First Nation peoples is provided in a 2008 Nation Talk session, by Simpson (2008) entitled "*Final Report of the Wabauskang First Nations Indigenous Knowledge and Contaminants Program*". Much of the information from that document is from interviews with Elder Bertha Petiquan. She talks life of the Wabauskang First Nation people starting from early days in the 1900's and how people lived off the land, often in times of hardship. She discusses the gathering of wild rice and berries, and that the people's diet consisted mainly of Northern Pike, Whitefish, Walleye, deer, moose, ducks, beaver and rabbits, occasionally along with bear and porcupine. In the early days moose were not as plentiful and formed a proportionally smaller part of the diet. Fishing and the use of fish was severely impacted by mercury contamination of the English-Wabigoon River system by operation of the Dryden pulp and paper mill, and the people of Wabauskang First Nation suffered from mercury poisoning.

Further details relative to wild rice, are available from the Energy East Project EA (TransCanada 2016), which states that the Wabauskang First Nation does not hold its own rice harvesting area, but is endeavouring to establish such a rice harvesting area. Relative to berry harvesting, and particularly blueberry harvesting, data presented by Chapeskie (1993), again based on interviews with Elder Bertha Petiquan of the Wabauskang First Nation, show that blueberry harvesting is very important to the Wabauskang First Nation. Historically, blue berry harvesting involved the cooperative efforts of many families, with at least a portion of the harvest being sold to non-aboriginal brokers before and after World War II. Elder Petiquan was also instrumental in the establishment of a wild fruit processing facility on the Wabauskang First Nation reserve (Chapeskie 1993).

5.13.3.4 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), it is approximately 105 km from the community of Frenchman's Head on Lac Seul Reserve to the Project site.

As of February 2018, Lac Seul First Nation had a registered population of 3,493 with 906 members living on reserve, 31 members living on other reserves, 24 living on Crown land and 2,532 members living off reserve. The Nation is governed by a Chief and eight councillors elected for a two-year term under an electoral governance system.

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.

Information obtained from Lac Seul First Nation regarding traditional land and resource use is summarized in Table 5.13.3.4-1. Treasury Metals understands that traditional land and resource use activities of the Lac Seul First Nation include harvesting of plants, hunting and trapping of animals, and fishing.

Table 5.13.3.4-1 Lac Seul First Nation Traditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Harvesting	Blueberries- North of Project area and directly south of Tree Nursery (and Tree Nursery itself), area of proposed TSF
	Mushrooms- chanterelles and morels
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access
	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
	Fishing of Walleye + other species
	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint

In addition to traditional land and resource use information obtained through direct community engagement, and information shared through the IR process, traditional land and resource use information relevant to the Lac Seul First Nation is also available from secondary sources. These sources include:

- 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 compliments, and in some cases expands upon, primary source materials listed in Table 5.13.3.2.1.

In relation to the Wataynikaneyap Power Supply Project, hunting, gathering (blueberries and to a lesser extent raspberries), trapping and fishing were the primary traditional land and resource use activities. Hunting is focused on moose, duck, partridge and geese, and to a lesser extent rabbit.

Trapping is focused on beaver, otter, mink, and muskrat as aquatic furbearers; and on marten, lynx, fox and wolf as terrestrial furbearers. Fishing is typically focused on walleye and whitefish. Blueberry harvesting primarily occurs in recently logged areas, as these plants grow best in higher light areas. Red osier dogwood and Labrador tea were identified as medicinal plants used by community members. Both species are common and widespread in suitable habitats.

Four LSFN members / families have licensed traplines within the Wabigoon Forest management Unit (Domtar Pulp and Paper Products Inc. 2008).

5.13.3.5 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 Metals is aware that Whitefish Bay First Nation holds commercial fishing licenses on Thunder Lake and Wabigoon Lake.

As of February 2018, Whitefish Bay First Nation had a registered population of 1,285 with 760 members living on reserve, 24 members living on other reserves, and 501 members living off reserve. The Nation is governed by a Chief and four councillors elected for a two-year term under an electoral governance system.

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.

Information obtained from Whitefish Bay First Nation (Naotkamegwanning First Nation) regarding traditional land and resource use is summarized in Table 5.13.3.5-1. 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.

A search of potential secondary sources did not reveal any other traditional land and resource use information that was applicable to the Project.

Table 5.13.3.5-1: Whitefish Bay First Nation (Naotkamegwanning First Nation) Traditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Hunting and Trapping	Hunting and Trapping within LSA along secondary roads and those used for timber forest access
	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
	Whitefish Bay First Nations holds commercial fishing license on Manitou Lake and Blackwater Creek
Cultural	May be burial sites near Rice Lake
	Overwintering camps on Rice Lake

5.13.3.6 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.

As of February 2018, Grassy Narrows First Nation had a registered population of 1,587 with 969 members living on reserve, 45 members living on other reserves, 1 living on Crown land and 572 members living off reserve. The Nation is governed by a Chief and four councillors elected for a two-year term under an electoral governance system.

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.
- The village of Grassy Narrows First Nation was originally located 8 kms 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 Chemical Company.

5.13.3.7 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). As of February 2018, Lac des Mille Lacs First Nation had a registered population of 616 with 7 members living on reserve, 1 member living on other reserves, 1 living on Crown land and 607 members living off reserve. The Nation is governed by a Chief and five councillors elected for a two-year term under an electoral governance system.

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.

5.13.3.8 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 at 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.

Information obtained from Métis Nation of Ontario regarding traditional land and resource use is summarized in Table 5.13.3.8-1. 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.

Table 5.13.3.8-1 Métis Nation of Ontario Traditional Land and Resource Use Information

Traditional Land and Resource Use	Specific Detail Shared/Collected
Harvesting of Plants	MNO has established places where they gather from berry patches
	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.

Table 5.13.3.8-1 Métis Nation of Ontario Traditional Land and Resource Use Information (continued)

Traditional Land and Resource Use	Specific Detail Shared/Collected
	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.
	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
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
	There is regular harvest in the area by Métis who come from Atikokan and Fort Frances to fish, harvest and hunt moose
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 cultural values indicated within the Project footprint in findings shared as part of the preliminary TKLUS

5.13.3.9 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.

Information obtained from Aboriginal People of Wabigoon regarding traditional land and resource use is summarized in Table 5.13.3.9-1. 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.

Table 5.13.3.9-1 Aboriginal People of Wabigoon Traditional Land and resource use Information

Traditional Land and Resource Use	Specific Detail Shared
Harvesting	Plants-proximity to the project
	Wild Rice
Fishing	Baitfish and minnow trapping conducted within the local area – 2 locations identified within Project area but outside Project footprint

5.13.3.10 Grand Council Treaty #3

The Grand Council Treaty #3 represents 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.

Further to this Grand Council Treaty #3 has indicated that a meeting will occur on September 19, 2017 in Dryden, ON to discuss the information presented in the Impact Footprints and Effect Areas Report, in addition to the revised EIS documentation. Treasury Metals is working cooperatively with Grand Council Treaty #3 to support this endeavor to bring all the Indigenous communities to one coordinated meeting to discuss the Projects technical merit as it relates to traditional land and resource use and activities.

From secondary sources of information, it is Treasury Metals understanding that members of the Grand Council Treaty #3 use the land to harvest fish or wildlife for personal consumption, or for social or ceremonial processes. Other traditional land and resource uses include harvesting or gathering of plants (including wild rice and berries), forestry, and the use of groundwater as potable drinking water.

5.13.4 Traditional Knowledge

All traditional knowledge shared with Treasury Metals by the Indigenous Communities has been summarised by discipline in their respective Subsections in 5.1 through 5.12.