APPENDIX G

AIR QUALITY TECHNICAL SUPPORT DOCUMENTS

G-1 Air Quality Baseline Report

G-2 Air Quality Assessment Report

Air Quality Assessment

Springpole Gold Project

First Mining Gold Corp.

ONS2104

Prepared by:
WSP Canada Inc.

October 2024

Air Quality Assessment
Springpole Gold Project

Red Lake District, Northwest Ontario
Project #ONS2104

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EXECUTIVE SUMMARY

First Mining Gold Corp. (FMG) proposes to develop, operate and eventually decommission / close an open pit gold and silver mine and ore process plant with supporting facilities known as the Springpole Gold Project (Project). The Project is located in a remote area of northwestern Ontario, approximately 110 kilometres (km) northeast of the Municipality of Red Lake and 145 km north of the Municipality of Sioux Lookout (Figure 1-1).

An environmental assessment (EA) pursuant to the Canadian Environmental Assessment Act, 2012 (SC 2012, c. 19, s. 52) and the Ontario Environmental Assessment Act (RSO 1990, c. E.18) is required to be completed for the Project. This report is one of a series of Technical Support Documents prepared by WSP Canada Inc. (WSP) on behalf of FMG to describe the predicted environmental effects of the Project.

This Air Quality Assessment Report has been prepared to support the assessment of potential effects from the construction, operation, and closure phases of the Project on air quality. The assessment considers the modelled effects of the Project on ambient air concentrations for each parameter, as well as the cumulative concentrations resulting from the Project and the existing baseline air concentrations established for the Project.

The notable findings of the air quality assessment are as follows:

- The Project is subject to the Ontario *Environmental Protection Act* Section 9 requirement and will require approval from the Ministry of the Environment, Conservation and Parks (MECP) to construct and operate. It was determined that the Project met the requirements of O. Reg. 419/05 and there were no modelled exceedances of the Air Quality Standards or other Air Contaminants Benchmarks, which demonstrates that the Project meets the air quality requirements for obtaining the required provincial Environmental Compliance Approval (ECA) for air.
- For all phases, predicted concentrations of parameters except for benzo(a)pyrene (b(a)p) were below the respective Ontario Ambient Air Quality Criteria (AAQC) for all averaging times, even with consideration of both Project emissions and the existing baseline concentrations.
    - The combustion of fuels results in trace emissions of polycyclic aromatic hydrocarbons to the air, for which b(a)p is used as a surrogate in air quality assessments. The predicted b(a)p concentrations resulting from these Project emissions are below the AAQC for both the 24-hour and the annual averaging times. However, the baseline b(a)p concentration of 0.000018 micrograms per cubic metre (µg/m^3) for the annual averaging time is greater than the AAQC, and the baseline concentration of 0.000036 µg/m^3 for the 24-hour averaging time is at 72 percent (%) of the respective AAQC. As a result, there are modelled exceedances along the northern extent of the leased lands when cumulative concentrations are considered for the operations phase. The modelled Project concentrations have been carried forward into the Human and Ecological Health Risk Assessment (Section 6.24 of the Environmental Impact Statement / Environmental Assessment) to assess the incremental lifetime risk as a result of the Project.
- Air quality effects associated with the mine infrastructure construction were evaluated with emissions from equipment tailpipe and construction activities considered. Air quality effects were limited to the Project site and there were no predicted exceedances of the AAQC at or beyond the Project boundary with the exception of b(a)p due to the elevated annual baseline concentrations that are already exceeding the AAQC (note that the modelled Project effects of b(a)p only account for 3% of the AAQC).

- Air quality concentrations associated with the mine access road and transmission line construction were evaluated, with emissions from equipment tailpipe and construction activities considered. Air quality effects were limited to the construction footprint and there were no predicted exceedances of the AAQC.
- The Canadian Ambient Air Quality Standards (CAAQS) were included as air quality criteria for the assessment; these CAAQS were not developed as facility level regulatory standards. Rather, they are intended for use by the provinces and territories to guide air zone management actions as an indicator of good air quality (CCME 2019). For nitrogen dioxide, the Ontario AAQC over the same averaging time is over four times greater than the CAAQS and is protective against effects on health and the environment (MECP 2020). However, Project effects were compared to the CAAQS for discussion which indicated that predicted exceedances may occur for nitrogen dioxide for the one-hour averaging time for the operations phase, construction of the mine infrastructure, and construction of the mine access road.

To minimize air quality effects, the Project includes the following mitigation and operational controls:

- A dust management plan will be prepared prior to the construction and operations phases that will be subject to MECP review and approval as part of the provincial ECA application process. The plan will identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation and detail the inspection and record keeping to demonstrate that fugitive dusts are being effectively managed. The proposed dust control measures will be based on current international best management practices that are predictably effective and are not prone to failure. The dust management plan will utilize adaptive management, in which the intensity of the control measures may need to be adjusted based on site inspections and monitoring.
- A blasting plan to control the emissions of particulate matter and nitrogen oxides and to restrict blasting to specific hours of the day, where the meteorological conditions are favourable and atmospheric dispersion is optimized.
- A preventive maintenance program will be employed that encompasses all pollution control equipment, diesel-fired engines (vehicle, equipment, and standby power generating), and all processes with the potential for meaningful environmental effects.
- An ambient air quality monitoring program will be established in consultation with the MECP as part of the ECA approvals process.
- Vehicle speed will be limited.
- Revegetation and progressive reclamation of exposed dust sources will be conducted wherever appropriate.
- A net-zero plan will be implemented to reduce the net greenhouse gas emissions to zero over the life of the Project. The Net-Zero Plan (Appendix I-2 of the Environmental Impact Statement / Environmental Assessment) developed to achieve this target includes the use of technologies and practices to reduce fossil fuel use and carbon offsets to balance greenhouse gas emissions that cannot be eliminated. Benefits of this plan are expected to also be reductions in non-greenhouse gas air parameter emissions.

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LIST OF ABBREVIATIONS

%	percent
AAQC	Ontario Ambient Air Quality Criteria
AAV	Annual Assessment Value
ACB	Air Contaminants Benchmark
ADMGO	Guideline A-11: Air Dispersion Modelling Guideline for Ontario, v3.0
AERMOD	US EPA AERMOD version 22112, an MECP-approved air quality dispersion model
As	arsenic
b(a)p	benzo(a)pyrene
CAAQS	Canadian Ambient Air Quality Standards
CAP	Criteria Air Parameter
CaO	calcium oxide
CDF	co-disposal facility
CO	carbon monoxide
Cr	chromium
$CuSO_4$	copper sulphate
DAV	Daily Assessment Value
DPM	diesel particulate matter
EA	Environmental Assessment
ECA	Ontario Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
Fe	iron
FMG	First Mining Gold Corp.
g/cm^3	grams per cubic metre
g/s	grams per second
HCN	hydrogen cyanide
Hg	mercury
km	kilometre
kV	kilovolt
L/s	litres per second
m	metre
MECP	Ministry of the Environment, Conservation and Parks
Mg	magnesium
Mn	manganese
NAD	North American Dataum
NAPS	National Air Pollution Surveillance Program
Ni	nickel
NH_3	ammonia
NO	nitric oxide
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
O_3	ozone
O.Reg.	Ontario Regulation
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PDA	Project Development Area
$PM_{2.5}$	particles less than 2.5 µm in diameter
PM_{10}	particles less than 10 µm in diameter
POI	point of impingement
POR	point of reception

ppb	parts per billion
ppm	parts per million
Project	Springpole Gold Project
SiO_2	silicon dioxide (respirable silica)
SO_2	sulphur dioxide
SO_3	sulphur trioxide
SOx	sulphur oxides
SPM	suspended particulate matter (particulate matter less than 44 micrometers in diameter)
Ti	titanium
tpd	metric tonnes per day
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VOC	volatile organic compound
WSP	WSP Canada Inc.
Zn	zinc
°C	degrees Celsius
µm	micrometre, micron
µg/g	micrograms per gram
$\mu g/m^3$	micrograms per cubic metre

1.0 INTRODUCTION AND PROJECT OVERVIEW

First Mining Gold Corp. (FMG) proposes to develop, operate and eventually decommission / close an open pit gold and silver mine and ore process plant with supporting facilities known as the Springpole Gold Project (Project). The Project is located in a remote area of northwestern Ontario, approximately 110 kilometres (km) northeast of the Municipality of Red Lake and 145 km north of the Municipality of Sioux Lookout (Figure 1-1).

An environmental assessment (EA) pursuant to the Canadian Environmental Assessment Act, 2012 (SC 2012, c. 19, s. 52) and the Ontario Environmental Assessment Act (RSO 1990, c. E.18) is required to be completed for the Project. This report is one of a series of Technical Support Documents prepared by WSP Canada Inc. (WSP) on behalf of FMG to describe the predicted environmental effects of the Project.

During the consultation process, Project-specific input from regulatory agencies and Indigenous communities was considered at key milestones of the EA process including baseline studies, alternatives, assessment approach, mitigation and monitoring where appropriate. An overview of the consultation input that was considered during the assessment in relation to this assessment will be summarized in the Environmental Impact Statement / Environmental Assessment (EIS/EA). The updated air quality assessment includes additional simulations, outputs, and discussion based on the additional field data / information collected since the preparation of the draft EIS/EA.

1.1 Air Quality Assessment Objectives

This Air Quality Assessment Report has been prepared to assess the potential effects of the construction, operation, and closure and decommissioning phases of the Project on air quality, and fulfils the requirements of Section 7.1.1. of the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 Springpole Gold Project* (CEAA 2018), the approved Amended Terms of Reference for the provincial EA (Appendix B-3 of the EIS/EA), and Health Canada's (2016a) *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality* as they pertain to air quality.

The objectives of the Air Quality Assessment are as follows:

- Identify the air parameters that are expected to be emitted in notable quantities during the construction, operations, and closure and decommissioning phases.
- Prepare estimates of the air emission rates of these parameters from Project stationary and mobile sources for each of the phases, as applicable.
- Complete air dispersion modelling to predict the resultant air quality effects on ambient air.
- Identify mitigative measures, if required, to reduce parameter emission rates such that resultant offsite air quality effects do not result in exceedances of the Ontario Ambient Air Quality Criteria (AAQC) or of the Canadian Ambient Air Quality Standards (CAAQS).
- Demonstrate compliance with the regulatory standards of Ontario Regulation (O. Reg.) 419/05 – Local Air Quality, as required to obtain an air Environmental Compliance Approval (ECA).
- Propose appropriate air quality monitoring so that mining activities are managed in a manner that is protective of air quality and the respective ambient air quality standards and criteria.
- Provide air quality data to other EA disciplines to support their assessments, such as Human and Ecological Health Risk Assessment.

1.2 Project Overview

The Project is proposed to be mined as an open pit. To allow the development and safe operation of the open pit mine, dikes will be established to facilitate controlled dewatering of the mining area. Ore from the open pit will be processed in an onsite process plant at approximately 30,000 tonnes per day (tpd). Tailings resulting from the processing of ore will be stored in a co-disposal facility (CDF).

The main components of the Project (Figure 1-2) include:

- Open pit;
- Dikes (west dike and east dike);
- CDF for mine rock and tailings (north cell and south cell);
- Surficial soils stockpile;
- Ore stockpiles;
- Process plant or process plant complex;
- Buildings and supporting infrastructure;
- Water management and treatment facilities;
- Fish habitat development area;
- Accommodations complex;
- Aggregate operation(s);
- Transmission line; and
- Mine access road and co-located airstrip.

The expected duration of Project phases:

- Construction phase (Years -3 to -1: three years in length);
- Operations phase (Years 1 to 10: ten years in length);
- Decommissioning and closure phase (Years 11 to 15: five years in length); and
- Post-closure phase (Years 16+).

After decommissioning and closure of the site will follow a period of environmental monitoring. The Project including mine access road and transmission line are shown in Figure 3-1 in Section 3.

1.3 Regional Setting

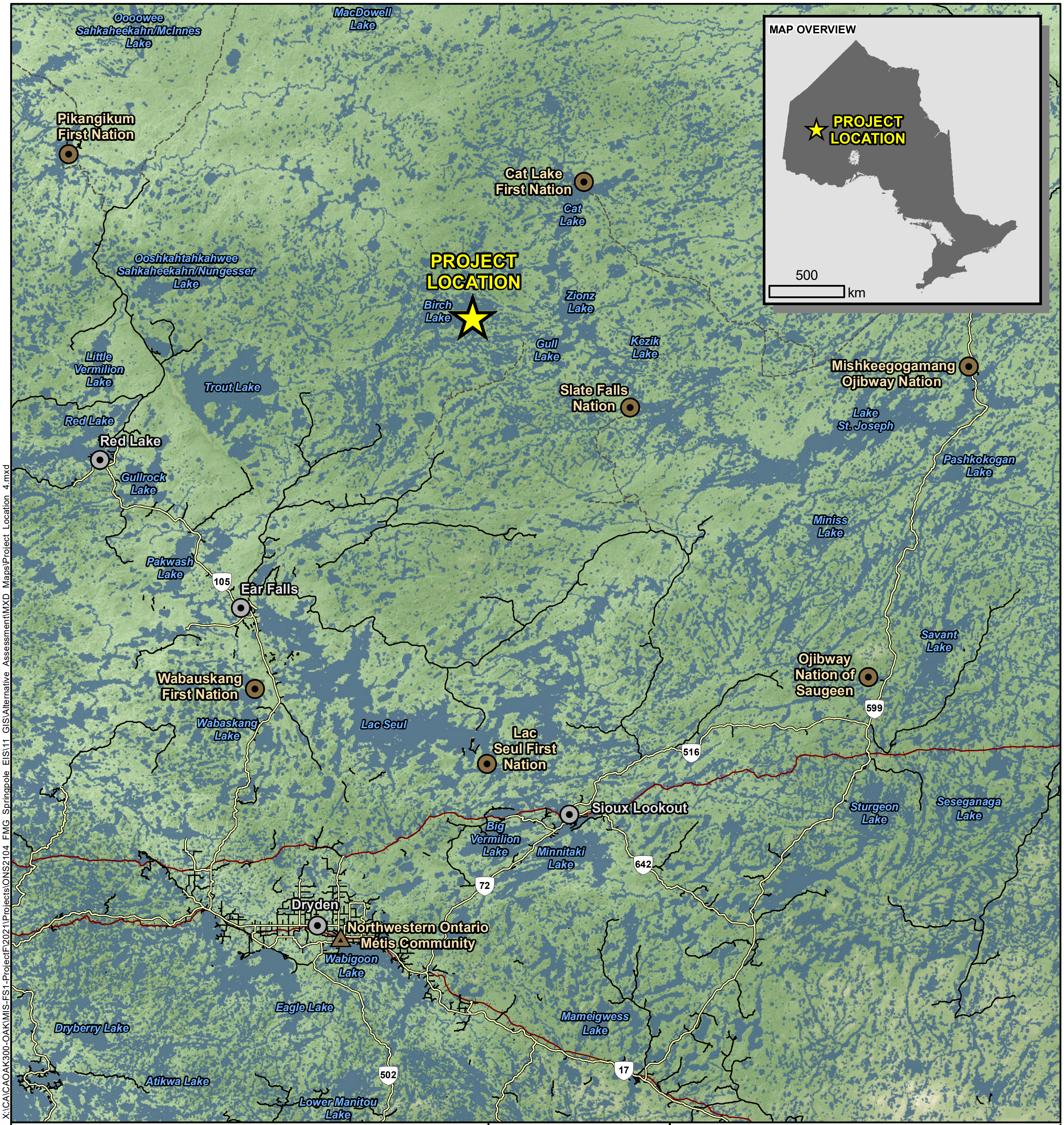
The Project is located in a remote area of northwestern Ontario with no notable anthropogenic sources of air emissions nearby though subject to forestry and exploration activities. The Project is currently accessible only by float plane, helicopter, or by ice road during the winter months.

Indigenous communities in the Region include:

- Cat Lake First Nation;
- Lac Seul First Nation;
- Mishkeegogamang Ojibway Nation;
- Ojibway Nation of Saugeen;

- Pikangikum First Nation;
- Slate Falls Nation;
- Wabauskang First Nation; and
- Northwestern Ontario Métis Community.

The nearest municipality is the Municipality of Red Lake, located approximately 110 km southwest of the Project.



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LEGEND

- Project Location
- Town
- First Nation Reserve
- Northwestern Ontario Métis Community
- Highway
- Secondary Road
- Resource / Winter Road
- Railway

0 12.5 25 50 75 100 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

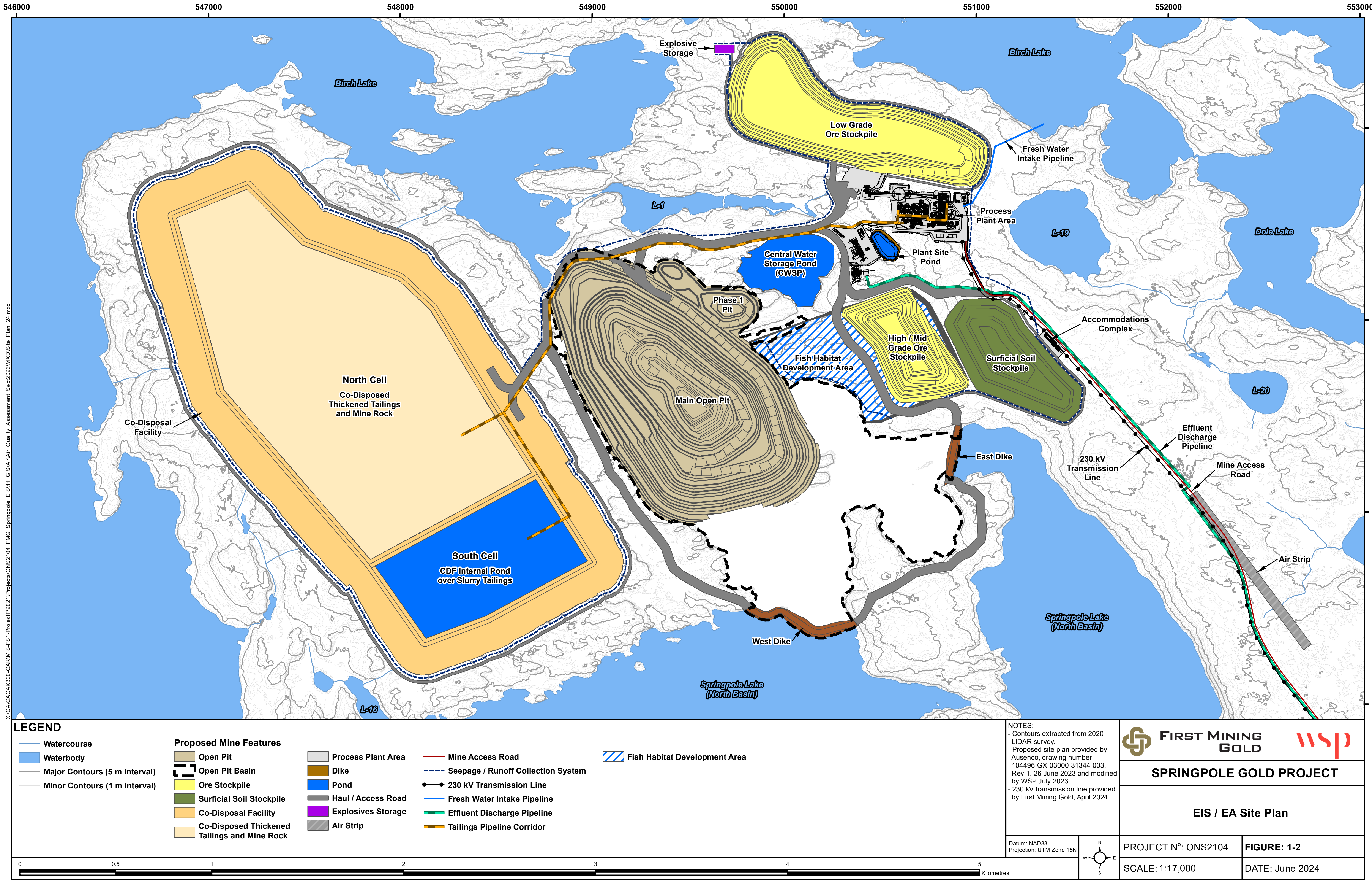
FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

Project Location

PROJECT Nº: ONS2104	**FIGURE: 1-1**
SCALE: 1:1,500,000	DATE: September 2024



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Birch Lake
Birch Lake
Explosive Storage
Low Grade Ore Stockpile
Fresh Water Intake Pipeline
Process Plant Area
L-1
L-19
Dole Lake
Central Water Storage Pond (CWSP)
Plant Site Pond
Phase 1 Pit
High / Mid Grade Ore Stockpile
Surficial Soil Stockpile
Accommodations Complex
Fish Habitat Development Area
North Cell
Co-Disposed Thickened Tailings and Mine Rock
Co-Disposal Facility
Main Open Pit
L-20
Effluent Discharge Pipeline
East Dike
230 kV Transmission Line
Mine Access Road
Air Strip
South Cell
CDF Internal Pond over Slurry Tailings
West Dike
Springpole Lake (North Basin)
Springpole Lake (North Basin)
L-16
LEGEND
Watercourse
Waterbody
Major Contours (5 m interval)
Minor Contours (1 m interval)
Proposed Mine Features
Open Pit
Open Pit Basin
Ore Stockpile
Surficial Soil Stockpile
Co-Disposal Facility
Co-Disposed Thickened Tailings and Mine Rock
Process Plant Area
Dike
Pond
Haul / Access Road
Explosives Storage
Air Strip
Mine Access Road
Seepage / Runoff Collection System
230 kV Transmission Line
Fresh Water Intake Pipeline
Effluent Discharge Pipeline
Tailings Pipeline Corridor
Fish Habitat Development Area
NOTES:
- Contours extracted from 2020 LiDAR survey.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.
Datum: NAD83
Projection: UTM Zone 15N
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3
4
5
Kilometres
FIRST MINING GOLD
wsp
SPRINGPOLE GOLD PROJECT
EIS / EA Site Plan
PROJECT Nº: ONS2104
FIGURE: 1-2
SCALE: 1:17,000
DATE: June 2024

2.0 ATMOSPHERIC EMISSIONS AND APPLICABLE AIR QUALITY CRITERIA

The air quality effects prediction study requires comparing the results of the air dispersion modelling to applicable air quality criteria in order to assess the potential for effects on the environment and human health from air emissions of key parameters associated with the Project.

Greenhouse gases, including carbon dioxide, methane and nitrous oxide, are considered in a separate document.

2.1 Air Parameters

Key air parameters anticipated from the Project are presented in Table 2-1.

The release of these key air parameters to the atmosphere from the open pit, stationary and mobile sources (such as tailpipe emissions from haul trucks), and road dust particulate were considered in the assessment; mobile sources were excluded for the O.Reg. 419/05 assessment per O.Reg. 419/05 and *Guideline A-11: Air Dispersion Modelling Guideline for Ontario* (ADMGO), Version 3.0 (MECP 2017). Trace metals released with the fugitive dust were considered in both assessments.

2.1.1 Nitrogen Oxides

There are three oxides of nitrogen found in appreciable concentrations in the atmosphere: nitrogen dioxide (NO_2), nitric oxide (NO) and nitrous oxide (N_2O). Collectively they are known as nitrogen oxides (NO_X) and are often expressed as the equivalent mass concentration of nitrogen dioxide. Nitrogen dioxide is a red-brown gas with associated health effects and contributes to the formation of tropospheric ozone (photochemical smog) and acid rain, nitric oxid is a precursor for nitrogen dioxide, and nitrogen dioxide is a greenhouse gas and ozone depleter. Sources of nitrogen oxides for the Project include blasting and fuel combustion.

Since nitrogen dioxide has adverse effects at much lower concentrations than nitric oxide, and nitric oxide converts to nitrogen dioxide in ambient air, the standards and AAQC for nitrogen oxides are based on the health effects of nitrogen dioxide. In the assessment of ambient air quality where effects are compared against the AAQCs, nitrogen dioxide is the reference parameter.

The Ministry of the Environment, Conservation and Parks (MECP) has set standards for nitrogen dioxide concentrations, however there are no standards for nitric oxide or nitrous oxide. The O. Reg. 419/05 standards are based upon potential health effects of exposure to nitrogen dioxide, but conservatively set for total nitrogen oxides under the regulation; this takes into consideration that the amount of nitrogen dioxide formation from nitric oxide conversion between the point of release and the receptor is not accurately known.

As of 2024, there are CAAQS for nitrogen dioxide which will become more stringent in 2025.

2.1.2 Carbon Monoxide

Carbon monoxide (CO) is a colourless and odourless gas which is produced primarily through the combustion of fossil fuels as a result of incomplete combustion. Releases associated with explosive detonation are also considered in the assessment. Carbon monoxide is generally not considered to be a key pollutant for open pit mining operations; it is more important for underground mines.

The O. Reg. 419/05 carbon monoxide standard is for the one half-hour averaging time. AAQCs exist for the one-hour and eight-hour averaging times. The O. Reg. 419/05 standards and AAQC for carbon monoxide are all based upon potential health effects.

2.1.3 Sulphur Oxides

Sulphur oxides, or SOx, comprise sulphur dioxide (SO_2), sulphur trioxide (SO_3) and solid sulphate forms. Sulphur dioxide is a non-flammable, non-explosive colourless gas. In connection with fuel burning, where the majority is in the form of sulphur dioxide, sulphur oxides is normally expressed in terms of the equivalent mass concentration of sulphur dioxide.

The combustion of fuels is a source of sulphur dioxide due to the presence of sulphur in the fuel, though in very low concentrations. Explosive detonation is also a source of sulphur dioxide, again due to the presence of sulphur in the fuel. Sulphur dioxide is used in the cyanide destruction process, however the delivery and process tanks are operated as closed-loop with no releases to atmosphere.

Effective July 1, 2023, new O. Reg. 419/05 air quality standards for sulphur dioxide were introduced for the 1-hour and annual averaging times (there is no longer a 24-hour standard), with equivalent AAQCs. In addition, Ontario has a 10-minute AAQC for sulphur dioxide. The standards and AAQC are based upon potential health effects of sulphur dioxide, as well as potential effects on vegetation.

As of 2024, there are also CAAQS for sulphur dioxide which will become more stringent in 2025.

2.1.4 Particulate Matter

Suspended particulate matter (SPM), which consists primarily of fugitive dusts, is generated from a variety of activities at mine sites, including crushing, screening, and material handling activities. Airborne particles are categorized as primary (being emitted directly from the source into the atmosphere) and secondary (being formed in part by chemical and physical transformations). Particles can be chemically inert or active. Even if inert, they may adsorb chemically active compounds or they may combine to form chemically active species.

Historically, standards were developed based upon visibility effects for all particle sizes that remain airborne for appreciable distances as they are small enough that gravitational settling does not prevent dispersion, referred to as SPM. As the scientific data evolved, it was found that the correlation between health effects and particulate was stronger at smaller particle sizes. Air quality criteria were then developed for particles with diameters of less than 10 micron (µm) and, more recently, those criteria have been superseded by standards for particles less than 2.5 µm in diameter.

SPM is defined by the MECP, in O. Reg. 419/05, as having a particle size less than 44 µm in aerodynamic diameter. SPM will be discussed in terms of 44 µm noting that the measured quantities may include a small contribution from larger particle sizes. The AAQC for SPM is based on visibility.

SPM includes the smaller particle size fractions PM_{10} and $PM_{2.5}$ (particles less than 10 µm in diameter and particles less than 2.5 µm in diameter); it is emphasized that these particle size fractions are not separate compounds, nor are they additive. The smaller particle sizes are a subset of the large particulate matter size fractions.

The PM_{10} size fraction is generally associated with dusts generated by mechanical activities and road dust. The MECP has not set an AAQC for PM_{10}. In the AAQC listing (MECP 2020), the MECP suggests a value for PM_{10} of 50 micrograms per cubic metre (µg/m^3) for the 24-hour averaging time and identified it as an "interim" AAQC.

Respirable particle $PM_{2.5}$, with particles sizes less than 2.5 µm in diameter, are produced during the combustion of fuels for power generation and equipment operation. The CAAQS for $PM_{2.5}$ are set at 27 µg/m^3 for the 24-hour averaging time, and 8.8 µg/m^3 for the annual averaging time, which have been adopted as the AAQCs in Ontario.

2.1.4.1 Respirable Silica

Respirable silica (or silicon dioxide, SiO_2) is present as a constituent of PM_{10}. The quartz content of the deposit is similar to that observed for common granitic rocks, which have quartz contents that range from 20 percent (%) to 60%. These types of granitic rocks are a considerable component of the rock found throughout northern Ontario.

The secondary minerals in granites (feldspar and phyllosilicates) are less resistant to physical abrasion and weathering than quartz and would be preferentially liberated from the rock matrix by physical comminution/abrasion in comparison to quartz. As a result, the fine particulate emitted from handling and processing of the mine rock and ore would be composed of a disproportionately higher content of secondary minerals compared to silica, and the respirable silica would be appreciably less than the bulk material quartz content. A silica concentration of 7.5% of the PM_{10} was determined in an extensive Ministry of Labour study of mines in northern Ontario (Verma et al. 2014).

2.1.4.2 Diesel Particulate Matter

Diesel particulate matter (DPM) consists of fine and ultrafine particulate matter released directly from fuel combustion in diesel engines or is formed by secondary particulates in the exhaust. $PM_{2.5}$ from combustion processes (including blasting) were considered in the air dispersion modelling as a surrogate for DPM and were compared against chronic and short-term exposure guidance values for diesel exhaust particulate matter published by Health Canada (2016b).

2.1.5 Metals

Several metal species are present in the mine rock and processed ore and may be subsequently emitted as trace constituents of the particulate matter (i.e., particle-bound).

The following list of metals were included in the assessment due to their potential presence in appreciable concentrations in the ore and mine rock as determined by the geochemistry of samples collected at the Project site, the existance of an AAQC to compare modelled effects against, and the general interest of these metals for mining projects:

- Arsenic (As);
- Chromium (Cr);
- Copper (Cu), including the copper fraction in copper sulphate ($CuSO_4$);
- Iron (Fe);
- Mercury (Hg);
- Magnesium (Mg);
- Manganese (Mn);
- Nickel (Ni);
- Lead (Pb);
- Titanium (Ti); and
- Zinc (Zn).

These metals all have O. Reg. 419/05 standards based upon potential health effects. As well, a number of these metals have AAQC values based on different particle size fractions (i.e., the metal content in $PM_{2.5}$ or PM_{10}). The screening of the available geochemistry data to identify the metals and metalloids to include in the air dispersion modelling is detailed in Attachment C.

There are other metals likely to be present in trace quantities on the dust emitted from the Project, including beryllium, bismuth, gallium, gold, lanthanum, scandium, and thorium. The Human and Ecological Health Risk Assessment will consider Project effects of these metals.

Mercury, including methyl mercury, will not be used in the mining or ore processing, and therefore no associated processing releases to the air will occur. Mercury that may be present in the mine rock and ore is considered, and the potential effects have been modelled for comparison against the AAQC and O. Reg. 419/05 standard for mercury.

Silica, a metalloid with properties of both metals and non-metals, is naturally occurring in the overburden, mine rock, and ore; the assessment of silica effects is described in Section 5 as a constituent of respirable particulate matter.

2.1.6 Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons

There are a number of volatile organic compound (VOCs) and polycyclic aromatic hydrocarbon (PAHs) that are emitted as a by-product of fuel combustion by generators, onsite equipment, and vehicles, and from fuel storage and dispensing activities. VOCs and PAHs are both groups of parameters, and surrogate species were selected to represent each grouping for the assessement.

Benzo(a)pyrene (b(a)p) was used as the surrogate for all PAHs, as recommended by the MECP.

For mobile combustion sources, relevant VOCs include 1,3,-butadiene, acetaldehyde, acrolein, benzene, and formaldehyde (MTO 2020). Additionally the VOCs toluene, ethylbenzene, and xylene were monitored on site as common VOCs in petroleum products. Considering those VOCs with the most stringent criteria, and where data were available, 1,3,-butadiene, acetaldehyde, benzene, and formaldehyde were selected as appropriate surrogates for the VOCs.

2.1.7 Other Parameters Associated with Ore Mining and Processing

A number of other parameters have been considered in the air quality effects prediction study that may be released from the mining and ore processing phase of the Project. These parameters include hydrogen cyanide (HCN), calcium oxide (CaO) and copper sulphate ($CuSO_4$). As these parameters are associated with mining and ore processing, assessment during the construction phase was not required.

Ore processing will be carried out using a conventional whole ore cyanidation for gold recovery, which involves the use of sodium cyanide. In-plant cyanide destruction using the sulphur dioxide / air treatment process will be used, minimizing cyanide releases in tailings. Cyanide, in the form of HCN, is emitted from the leach tanks as a process fugitive. The O. Reg. 419/05 standard for HCN is based upon the potential for both acute and chronic health effects.

Calcium oxide and copper sulphate were also considered for this assessment as there is bulk handling of these reagents at the process plant.

Ammonia (NH_3) is known to be released during explosive detonation, however the quantities discharged during each blast are not substantial; in the absence of other ammonia sources, the expected effects from ammonia are not appreciable and it was not chosen as an air quality indicator for this assessment.

Ozone (O_3) is monitored and regulated as an indicator of air quality in Canada. The air quality assessment does not include ozone as an indicator. There are no sources of ozone associated with the Project. While the Project emits compounds that could be considered precursors for ozone (i.e., nitrogen oxides and small quantities of VOCs that react in the presence of heat and sunlight to form ozone), there is no expectation that the amounts emitted will cause an increase in ozone on either a local or regional scale. Ozone concentrations measured in northwestern Ontario are also similar across the region, suggesting that ozone is a regional air quality issue rather than a local issue. However, ozone is important in the conversion of nitric oxide, the major constituent of nitrogen oxide emissions, to nitrogen dioxide in the atmosphere; the ozone concentrations measured at Pickle Lake were used in the air quality assessment to quantify the extent of this atmospheric conversion using the Ozone Limiting Method, as described in Section 3.

2.2 Air Quality Standards and Criteria

Various regulatory agencies set specific target criteria to be protective of human health and the environment. Criteria and standards can have different averaging times depending on the type of effect the compound may have. The averaging time is the duration of exposure to the air parameter, and ranges from 10-minute averaging time for odour-based criteria to evaluate acute effects, to annual averaging time for long-term exposure effects (chronic). It is noted that air quality criteria are reported in both units of parts per million (ppm), parts per billion (ppb), and µg/m^3. To present consistent values for comparison, any parts per million or parts per billion values will be converted to micrograms per cubic metre using a reference temperature and pressure of 25°C and 760 mm mercury, respectively (Environment Canada 2004) where not otherwise provided.

The MECP has established AAQC for various parameters, including most of the target parameters identified for this air quality assessment. The AAQCs are set to determine a target concentration for a location, inclusive of all sources and baseline. The AAQC levels are not compliance standards but set to provide guidance for decision-making regarding what is an acceptable ambient air concentration.

In contrast, the O. Reg. 419/05 standards are used for the assessment of stationary sources for the purposes of permitting or to establish compliance with the regulation. There is no consideration of deposition or plume depletion, and assuming that all nitrogen oxides is converted to nitrogen dioxide immediately, as described in Section 2.4.4. This assessment is also conducted in accordance with specific requirements of O. Reg. 419/05, *Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling Report* (MECP 2018a) and ADMGO (MECP 2017). The standards, as well as other Air Contaminants Benchmarks (ACBs) (MECP 2023) are used for permitting and compliance purposes; the ACBs include standards, guidelines and jurisdictional screening levels for more than 5,000 parameters. In many cases, the AAQC and the ACBs are numerically the same.

The ACB list also includes provincial Annual Assessment Values (AAVs) and Daily Assessment Values (DAVs) for parameters that have ACBs based on effects of long-term exposure (i.e., ACBs with annual averaging times); the DAV reflects the short-term risk associated with the parameters. The AAV represents the maximum annual average concentration associated with sustained, peak operations over the entire year.

For this assessment, it was appropriate to compare the modelled effects to the respective AAQC with consideration of baseline air concentrations. In addition, the Project was assessed in accordance with O. Reg. 419/05 and the noted MECP guidelines to establish whether the provincial requirements for obtaining an ECA can be met.

In addition to the provincial criteria, federal CAAQS for $PM_{2.5}$, nitrogen dioxide, and sulphur dioxide have been adopted by the Canadian Council of Ministers of the Environment and were considered in this assessment. These CAAQS are intended as targets for air quality to determine appropriate air quality management actions for action within an air zone and not for local assessment or enforcement. The CAAQS are not intended for the assessment of specific emission sources but rather to characterize air quality within a broader air zone. The CAAQS are not directly comparable to individual concentrations but rather to the three-year average of the 98^{th} percentile of $PM_{2.5}$ and nitrogen dioxide data, and the 99^{th} percentile for sulphur dioxide. For this assessment, the concentrations predicted by the air dispersion model were compared against the CAAQS to allow for discussion of the modelled effects of air emissions on the air zone.

There is no AAQC for DPM; in order to assess the modelled effects, the Health Canada's chronic and short-term exposure guidance values were used (Health Canada 2016b). Copper sulphate has an ACB under O. Reg. 419/05 but no AAQC. Where the AAQCs are used, the copper fraction of copper sulphate was compared to the copper AAQC.

A summary of the applicable AAQCs, ACBs and CAAQS is provided in Table 2-2.

Table 2-1: Key Parameters Considered by Project Phase

Parameter	Phase (1)	
	Construction	Operations
Oxides of nitrogen (NO_X), reported as nitrogen dioxide (NO_2)	✓	✓
Carbon monoxide (CO)	✓	✓
Suspended particulate matter (SPM)	✓	✓
Fine particulate matter less than 10 µm in diameter (PM_{10})	✓	✓
Fine particulate matter less than 2.5 µm in diameter ($PM_{2.5}$)	✓	✓
Diesel particulate matter (DPM);	✓	✓
Volatile organic compounds (VOCs) (3)	✓	✓
Polycyclic aromatic hydrocarbons (PAHs) (4)	✓	✓
Hydrogen cyanide (HCN)	✓	✓
Sulphur dioxide (SO_2)	✓(2)	✓
Metals (particle-bound)	✓(5)	✓
Respirable silica (SiO_2);	✓(5)	✓
Hydrogen cyanide (HCN);	×	✓
Calcium oxide (CaO);	×	✓
Copper sulphate ($CuSO_4$);	×	✓

Notes:

(1) The closure and decommissioning phase would have parameters in common with the construction phase but at a reduced fleet and activity level.

(2) SO_2 was not assessed for construction of the transmission line or mine access road as blasting is the main source of SO_2 emissions.

(3) 1,3,-butadiene, acetaldehyde, benzene, and formaldehyde were used as surrogates for all VOCs.

(4) Benzo(a)pyrene was used as a surrogate for all PAHs.

(5) Metals and silica were assessed for construction and operations of the mine site infrastructure.

✓ = parameter considered; × = parameter not considered.

Table 2-2: Air Quality Standards and Criteria

Parameter	Averagin Time	O. Reg. 419/05 Standards and Air Contaminants Benchmark (ACB)	Ambeint Air Quality Criterion (AAQC)	Canadian Ambient Air Quality Standard [5] (CAAQS)
		Unit of Measure: µg/m³		
Suspended particulate matter (SPM)	24-hour	120	120	—
	Annual	—	60	—
Inhalable particulate (PM_{10})	24-hour	—	50 (Interim)	—
Respirable particulate ($PM_{2.5}$)	24-hour	—	27 [2]	27
	Annual	—	8.8 [2]	8.8
Diesel particulate matter (DPM)	24-hour	—	10 [4]	—
	Annual	—	5 [4]	—
Respirable silica (<10 µm)	24-hour	5	5	—
Nitrogen dioxide (NO_2)	1-hour	400 [1]	400	79
	24-hour	200 [1]	200	—
	Annual	—	—	23
Carbon monoxide (CO)	0.5-hour	6,000	—	—
	1-hour	—	36,200	—
	8-hour	—	15,700	—
Sulphur dioxide (SO_2)	10-min	—	175	—
	1-hour	100	105	170
	Annual	10	10	10
Hydrogen cyanide (HCN)	24-hour	8	8	—
Calcium oxide (CaO)	24-hour	10	10	—
Copper sulphate ($CuSO_4$)	24-hour	0.5	— [3]	—
Arsenic (As)	24-hour	0.3	0.3	—
Chromium (Cr)	24-hour	0.5	0.5	—
Copper (Cu)	24-hour	50	50 [3]	—
Iron (Fe)	24-hour	25 [6]	25	—
Lead (Pb)	24-hour	0.5	0.5	—
	30-day	0.2	0.2	—
Magnesium (Mg)	24-hour	72	120 [7]	—
Manganese (Mn)	24-hour	0.4	0.4 in SPM	—
		—	0.2 in PM_{10}	—
		—	0.1 in $PM_{2.5}$	—
Mercury (Hg)	24-hour	2	2	—
Nickel (Ni)	24-hour	—	0.2 in SPM	—
		—	0.1 in PM_{10}	—
	Annual	0.04	0.04 in SPM	—
		—	0.02 in PM_{10}	—
	AAV	0.4	—	—
	DAV	2	—	—
Titanium (Ti)	24-hour	120	120	—
Zinc (Zn)	24-hour	120	120	—
Benzene	Annual	0.45	0.45	—
	24-hour	—	2.3	—
	AAV	4.5	—	—
	DAV	100	—	—
Toluene	24-hour	2,000	2,000	—

Table 2-2: Air Quality Standards and Criteria

Parameter	Averagin Time	O. Reg. 419/05 Standards and Air Contaminants Benchmark (ACB)	Ambeint Air Quality Criterion (AAQC)	Canadian Ambient Air Quality Standard [(5)] (CAAQS)
		Unit of Measure: µg/m³		
Xylene	10-min	3,000	—	—
	24-hour	730	730	—
Ethylbenzene	10-min	1,900	1,900	—
	24-hour	1,000	1,000	—
1,3-Butadiene	24-hour	10	10	—
	Annual	2	2	—
	AAV	20	—	—
	DAV	300	—	—
Formaldehyde	24-hour	65	65	—
Acetaldehyde	0.5-hour	500	500	—
	24-hour	500	500	—
Benzo(a)pyrene [(8)]	24-hour	—	0.00005	—
	Annual	0.00001	0.00001	—
	AAV	0.0001	—	—
	DAV	0.005	—	—

Notes:

(1) NO_X expressed as NO_2.

(2) MECP references the CAAQS for assessment of $PM_{2.5}$ effects.

(3) The copper fraction of copper sulphate was compared to the copper AAQC.

(4) Acute and chronic exposure guidance values for DPM (Health Canada 2016b).

(5) 2025 CAAQS for NO_2 and SO_2. Note that the CAAQS are based on specific statistical forms and not for direct comparison of the maximum modelled effects.

(6) Ferric oxide as surrogate.

(7) Magnesium oxide as surrogate.

(8) Benzo(a)pyrene, as a surrogate of total PAHs.

— = no criterion or standard for the respective parameter and/or averaging times; AAV = Annual Assessment Value; DAV = Daily Assessment Value.

3.0 METHODS

3.1 Spatial Boundaries

There is a Project Development Area (PDA) which encompasses the anticipated footprint of the Project within the care and control of FMG and includes the mine site area, the mine site access road corridor and the transmission line corridor. For this assessment, the PDA is not used as a spatial boundary, but the study areas are based on setbacks from the PDA.

3.1.1 Property Boundary

This boundary represents the nearest extent to where effects are predicted and is the extent of the mining claims to be brought to lease.

For the mine access road and transmission line construction, the modelling boundary used a 140 m wide area, where the majority of the activity is expected to occur. This width includes a 50 m wide buffer on each side of the 40 m wide corridor that accounts for the low release heights of the emission sources proximate to the receptors.

3.1.2 Local Study Area

The Local Study Area for air quality corresponds to the area in the vicinity of the Project where most of the air quality effects of the Project are expected to occur and can be predicted or measured with a reasonable degree of accuracy; this is a square that extends 10 km from the centre of the the mine infrastructure and encompassess the property boundary. Along the transmission line and mine access road, the local study area extends 3 km from the PDA For the air quality assessment, the Local Study Area is presented in Figure 3-1.

3.1.3 Regional Study Area

The Regional Study Area for air quality encompasses both the property boundary and the Local Study Area, as illustrated in Figure 3-1, and is defined as an area that extends approximately 20 km from the PDA.

Air quality effects of the Project would not be measurable beyond the regional study area.

3.2 Temporal Boundaries

The temporal boundaries of the air quality assessment correspond to those of the EA, and will span all phases of the Project:

- Construction;
- Operations; and
- Decommissioning and closure.

3.3 Points of Reception

For the purposes of the air quality assessment, the term "point of reception" (POR) is defined as a location with human activity, which includes traditional land and resources uses. It is recognized that the term "receptor" in air quality commonly refers to all computer-generated points where the modelling software predicts concentrations of parameters, independent of land use; this is distinct from a POR.

The PORs consist of residences, Indigenous points of interest identified through traditional land and resource use studies and engagement, and potential sensitive recreational, cabin, lodge, and camp sites identified through a review of the Ministry of Natural Resources and Forestry Land Information Ontario geographic datasets. In some cases where a land use covered large areas, representative points were selected. Locations of all selected PORs are provided in Figure 3-1 and Attachment D.

3.4 Selection of Assessment Indicators for Air Quality

Ambient air quality may be affected by one or more of the Project components, and the assessment indicators selected are the predicted ground level air concentrations for each of the compounds deemed relevant, in terms of the aggregate site-wide emission rate and the resultant predicted concentration being appreciable when compared with the applicable criteria within the Local Study Area.

The selection of assessment indicators for air quality considered those parameters identified in the *Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012 Springpole Gold Project* (CEAA 2018), the approved Amended Terms of Reference for the provincial EA (Appendix B-3 of the EIS/EA), and those identified during the review of the draft EIS/EA.

The key potential parameters include particulate matter as fugitive dust and released from point sources, and parameters associated with the combustion of fossil fuels that include Criteria Air Parameters (CAPs), PAHs and VOCs. Also included are select air parameters associated with the mining and ore processing activities such as particulate-bound metals and HCN, as examples. The assessment indicators are further defined in Section 2 of this report.

3.5 Modelling Setup

WSP has completed an assessment of the potential air quality effects of the proposed Project in accordance with standard air quality assessment practice.

The prediction of effects involved the following steps:

- Identify stationary and mobile emissions sources associated with each phase of the Project.
- Identify the key parameters emitted to the atmosphere from the identified sources.
- Summarize the baseline ambient air quality conditions in the absence of the Project for each of the key parameters emitted (see Section 4.0 Existing Environmental Conditions)
- Estimate the air emission rates for each of the key parameters using appropriate estimation methods and established data sources.
- Prepare a source summary table that identifies sources at the Project site which may release one or more of the key parameters emitted to the atmosphere in appreciable quantities and the corresponding parameters and emission rates.
- Perform air dispersion modelling using the United States Environmental Protection Agency (US EPA) AERMOD version 22112, the current regulatory air dispersion model used in Ontario.

- Compare the dispersion modelling output to the assessment criteria, comparing predicted offsite concentrations with the corresponding air quality standard or criterion.
- Provide a quantitative or qualitative discussion of effects for each Project phase, as applicable.

3.5.1 Emission Sources and Emission Rate Quantification

Due to the nature of open pit mining, the sources of emissions during construction are often similar to those used in pit development and mining during the operations phase.

A list of emission sources identified by phase for the Project and included in the air dispersion modelling is outlined in Table 3-1.

The emission estimates from the different phases of the Project have been presented in the form of source summary tables and emission summary tables (Attachment B), which include data on all emission sources that may discharge one or more of the target parameters, data quality, source of the emission data and percent of total emissions for each source, for each parameter. The locations of the emission sources at for each phase of the Project site are shown in Figure 3-2.

A summary of the emission calculation methods, emission factors used, and the associated calculations, are provided in Attachment C. Calculations are shown for all emission source type, including open pit blasting, material handling and hauling, crushing, fuel combustion, and ore processing.

3.5.1.1 Stationary Fuel Combustion

Manufacturer's test data were used to quantify emission rates from the diesel generators, with the exception of sulphur dioxide; to quantify sulphur dioxide emissions, the US EPA (2023c) AP-42 Section 3.4 factors for large stationary diesel and all stationary dual-fuel engines, assumed sulphur content in the fuel and engine horsepower were used.

For propane combustion sources, the US EPA (2023c) AP-42 Section 1.5 factors for liquefied petroleum gas combustion were used with projected propane usage rates to estimate nitrogen oxide emissions.

3.5.1.2 Mobile Fuel Combustion

For the construction phase scenarios, a construction fleet was developed for each major construction activity with typical engine size and utilization factors (US DOT 2017) applied. Tier 4 emission standards were applied to estimate emission rates. While not all equipment may meet Tier 4 standard, the Project is expected to employ a modern fleet with a high percentage of Tier 4 engines.

3.5.1.3 Drilling

Emission factors for drilling published in US EPA (2023c) AP-42 Section 11.9 Western Surface Coal Mining were used with an estimate of the number of holes drilled per hour. A control efficiency of 50% was used to account for dust control at the drills. This is below the recommended reduction of 70% indicated in the Ontario Mining Association's Emission Inventory Guidance Document and is therefore considered conservative.

3.5.1.4 Blasting

The emissions expected from blasting are particulate matter and by-products of combustion from ammonium nitrate fuel oil emulsion or emulsion blend explosives. Particulate emissions from blasting were calculated using factors published in US EPA (2023c) AP-42 Section 11.9 Western Surface Coal Mining and the projected emulsion usage. Manufacturer's data were used to calculate sulphur dioxide, nitrogen oxides and carbon monoxide emissions.

3.5.1.5 Material Handling

Fugitive emissions during loading and unloading at material transfer points were estimated using emission factors published in US EPA (2023c) AP-42 Section 11.24 Factors for Metallic Mineral Processing for high moisture ore (above 4%). The material loaded onto haul trucks within the pit is very coarse (minimal fines) as it is transported uncrushed from the pit to the primary crusher; particulate emissions associated with this very coarse ore would be notably lower than emissions associated with fine aggregate which has been crushed and screened, or sand and gravel operations where the raw material already contains fines. A control efficiency of 80% was used to account for naturally wet material and the reduced particulate emissions that would be associated with handling of very coarse material. This is supported by the US EPA AP-42 Table 11.24-1 emission factors where a 90% efficiency is assumed for wet material handling and transfers.

3.5.1.6 Baghouse Dust Collectors and Wet Scrubbers

Several baghouse dust collection systems are located on site to control emissions from various processes. Per Table C-2 of the MECP (2018a) Guideline A-10, an outlet concentration of 20 milligrams per cubic metre (mg/m^3) was used for the two largest dust collectors, in conjunction with exhaust flow rates to estimate particulate emissions. An outlet concentration of 15 mg/m^3 was used for the remaining dust collectors.

Particulate emissions from wet scrubbers were estimated assuming an outlet concentration of 20 mg/m^3.

3.5.1.7 Cyanide Process Tanks

HCN emissions from process leach tanks and process were calculated using the equation published in the Australian National Pollutant Inventory *Emission Estimation Technique Manual for Gold Ore Processing*, Version 2.0, Section 6.2.1 (Australian Government Department of the Environment and Heritage 2006). The solution in tanks is kept alkaline at a minimum pH of 10.5 to minimize HCN volatilization and emissions.

3.5.1.8 Cyanide Destruction

Excess sulphur dioxide is used in the cyanide destruction process to ensure a complete stoichiometric reaction, however there are no emissions to the air as the process is operated as a closed-circuit with excess sulphur dioxide returned to the cyanide destruction tanks.

3.5.1.9 Ore Stockpiles and Co-disposal Facility

Emissions from bulldozing at stockpiles were estimated using the published US EPA (2023c) AP-42 Section 11.9 Western Surface Coal Mining equations for this activity. The calculated emission factor is dependent on the aggregate silt content, which was assumed to be similar to taconite mining; a 3.9% silt was assessed. A control efficiency of 75% was applied to account for regular watering to control fugitive emissions.

3.5.1.10 Road Dust

Fugitive road dust emissions for SPM, PM_{10}, and $PM_{2.5}$, were estimated using the method detailed in US EPA (2023c) AP-42 Chapter 13.2.2 Unpaved Roads. A lower range 3.9% silt was assessed and a dust control efficiency of 95% was assessed to account for watering, vehicle speed, low silt content, and dust suppressant use as applicable for operations; for the construction phase assessments a dust control of 85% was applied in recognition that controls, road maintenance programs, and other fugitive dust best management practices would not yet be fully established. In response to comments received on the draft EIS/EA, Section 6.2.1 presents an assessment including a silt content of 5.8% and dust control of 85% to demonstrate how differing silt content and dust control affect the predicted concentrations.

3.5.1.11 Wind Erosion

An average value for wind erosion from open areas and stockpiles is recommended by Environment Australia in their Emission Estimation Technique Manual for Mining (Version 3.1). This approach was used to avoid overestimating the disturbed areas that would be susceptible to wind erosion.

This estimated average value is more conservative in nature than the estimated wind erosion of overburden or graded areas at surface coal mine (US EPA 2023c, AP-42 Section 11.9), which estimates that the annual losses from wind erosion are 0.85 tonnes per hectare per year (t/ha/yr, or 0.097 kilograms per hectare per hour [kg/ha/h]).

Per unit area emission rates for the different particulate size fractions were multiplied by the respective footprints of the stockpiles and CDF beach being assessed to obtain emission rates. A dust control of 80% was applied to account for watering in the stockpiles and CDF.

3.5.1.12 Metals in Fugitive Dust

Metals will be present in the particulate matter that is generated as fugitive dust on the site and dispersed offsite. The dust is assumed to have the same metals composition as the mine rock used in road construction and the unprocessed ore. Trace metals are also likely to be released from various ore processing activities such as crushing, conveying, and ore handling. The measures that are designed to control fugitive dust releases and effects will also serve to control the emission and deposition of metals that are a component of the dust.

The predicted air concentrations for each of the speciated metals was determined by assuming a conservative particulate matter composition that considers each metal present in the particulate matter at a concentration equal to the 90^{th} percentile concentration measured in the mine rock. Project effects from metals are expected to be conservative as the worst-case operating scenarios were paired with 90^{th} percentile metals' concentrations from the geochemistry.

3.5.1.13 Respirable Silica in Fugitive Dust

Silica is present in fugitive dusts generated by the disturbance of both ore and mine rock. The predicted air concentrations of respirable silica as a constituent of respirable dust (PM_{10}) were quantified assuming the modelled PM_{10} concentrations are composed of 7.5% silica (Verma et al. 2014); this has been accepted by the MECP for a number of ECAs for other mining projects in northern Ontario, and has therefore been used as a default value in the absence of site-specific data.

3.5.1.14 Concrete Batch Plant

Particulate matter emissions from the onsite concrete batch plant were estimated using the emission factors published in US EPA (2023c) AP-42 Section 11.12 Concrete Batching. The controlled emission factors were used to account for dust management practices that will be employed.

3.5.1.15 Fuel Storage

During fuel storage filling, VOC-saturated headspace can be displaced as an emission to atmosphere proportional to the tank filling rate. Headspace VOCs were estimated based on typical headspace profiles and an emission rate of 3.15 litres per second (L/s). The emissions were not assessed to be material (Attachment C, C14).

3.5.2 Air Dispersion Model Selection

AERMOD, an industry-standard Gaussian air dispersion model, was determined to be the most appropriate model for this assessment as it is capable of handling multiple sources of varying types such as point, area, and linear sources. The dispersion model was used to predict the offsite concentrations (in micrograms per cubic metre) of the air parameters identified in Section 2 at each receptor beyond the Project lease area (i.e., property boundary in the model) and beyond the transmission line and mine access road alignments for those models. The model also predicts particle deposition (in grams per square metre). The location of the maximum modelled offsite concentration for a given parameter is termed the maximum point of impingement (POI).

The input data required for AERMOD includes five years of local, hourly meteorological data and the characteristics of the buildings, structures, open pit, roads and emission sources at the Project.

Although the immediate area surrounding the Project does not have major topographical features such as mountains, valleys, or canyons, local topography was considered in the AERMOD modelling. Canadian Digital Elevation Data were publicly available as GeoTIFF files for the modelling domain.

3.5.2.1 Plume Depletion

Where particulate matter was modelled, the plume depletion option was used to account for particle mass being removed from the plume via gravitational settling and precipitation scavenging, with the particles deposited on the ground.

The particle size distribution and characterization used in this assessment were derived from the US EPA (2023c) AP-42 Air Emission Factors and Quantification guidance documents, such as those for mining and ore processing. As an example for the wind erosion sources, the deposition parameters, including the particle size distribution, the equivalent diameter, and the particle density, are summarized in Table 3-2.

3.5.2.2 Atmospheric Conversion of Nitrogen Oxide to Nitrogen Dioxide

Where air dispersion modelling was used to assess predicted air concentrations against the AAQCs and CAAQS, Ozone Limiting Method nitrogen oxides conversion was used to account for atmospheric reactions that convert nitric oxide emissions to nitrogen dioxide. This method is widely accepted as being a reasonable approach that recognizes the most important mechanism for nitrogen oxides conversion, namely reactions with ozone, and is a preferred method in other Canadian provinces (such as Alberta, British Columbia and Newfoundland) when chemical transformation is required (Government of Saskatchewan 2012; Government of Alberta 2021). Other conversion options are either typically less accurate or recommended only for isolated sources.

Baseline ozone concentrations measured at the Environment and Climate Change Canada (ECCC) Pickle Lake station between 2017 and 2019 were used as representative ozone concentrations at the Project, specifically the monthly 90th-percentile ozone values were used (Section 4.1.2); the 90th percentile is a conservative statistical measure where 90% of values (i.e., measured ozone concentrations) are less than, and 10% of values are greater than the value.

An in-stack value ratio 0.1 nitrogen dioxide / nitrogen oxides was used in the model and this value was obtained from the US EPA (2023a) In-Stack-Ratio (ISR) database, for all nitrogen oxides conversion sources in this assessment, as they were all internal diesel combustion engines. For blasting, full nitrogen oxides conversation was assumed.

3.5.3 Meteorological Data for Air Dispersion Modelling

The site-specific meteorological data used for the AERMOD modelling consisted of five years of surface meteorological data and upper air data processed by the MECP; the dataset prepared by the MECP was for 2013 to 2017. Precipitation data were acquired from Lakes Environmental as a Weather Research Forecast dataset, which was incorporated into the dataset provided by the MECP.

The meteorological data included hourly wind speed, wind direction, temperature and barometric pressure. The surrounding land use was used in processing the AERMET (version 22112) file to establish appropriate surface roughness, albedo and Bowen ratio values for the modelling domain. These data allow the determination of the mixing height and other parameters that influence air dispersion of emissions from sources at the Project.

Wind is a critical parameter in the dispersion of parameters. The wind direction determines the primary direction of dispersion. At low wind speeds (or calm conditions), concentrations tend to be higher due to poor mixing and dispersion. Increasing wind speed has the effect of decreasing air concentrations of parameters through enhanced dispersion and mixing. For particulates, this enhanced dispersion can be offset by increased emissions of particulates due to wind erosion and reduced settling.

The wind data from the site-specific dataset are presented for the entire five-year period (2013 to 2017) and for the summer months only, as wind roses in Figure 3-3 and Figure 3-4, respectively. A wind rose is a useful frequency distribution plot that shows the wind speed and direction data in one plot. Each colour in the plot represents a wind speed range, and each segment extending out from the centre represents the frequency that wind is blowing from that direction. This is the wind speed and direction data used for the air dispersion modelling. It is noted that MECP modifies the wind speed data in the dataset to replace all calm conditions with low wind speeds. As such, the wind rose does not show any calm conditions.

The wind roses do not indicate any wind direction as prevalent, however winds from the east and northeast were least common. The average wind speed for the dataset was 3.4 metres per second (m/s).

Precipitation data (2013 to 2017) are used in the air dispersion model to incorporate plume depletion; the average, minimum, and maximum monthly rainfall data are presented in Figure 3-5. Precipitation is also a natural dust suppressant, and on days where there is appreciable rainfall or snowfall, the emission rate estimates used in the air dispersion model that assume dry conditions will be even more conservative.

The method outlined in the ADMGO was used to address the potential for meteorological anomalies to overly influence the results of air dispersion modelling (MECP 2017).

3.5.4 Air Dispersion Modelling for Permitting in Ontario

In order to demonstrate compliance with the air standards of O. Reg. 419/05 (Section 5) that a project is eligible for an ECA (Air), air dispersion was conducted in accordance with the ADMGO. The ADMGO modelling does not incorporate plume depletion or nitrogen oxides conversion, and only operations phase stationary sources of air emission were modelled (mobile sources are excluded from assessment per O.Reg. 419/05) for particulate matter and CAPs, and fugitive dusts were modelled only to assess the POI concentrations for the metals with standards based upon health effects.

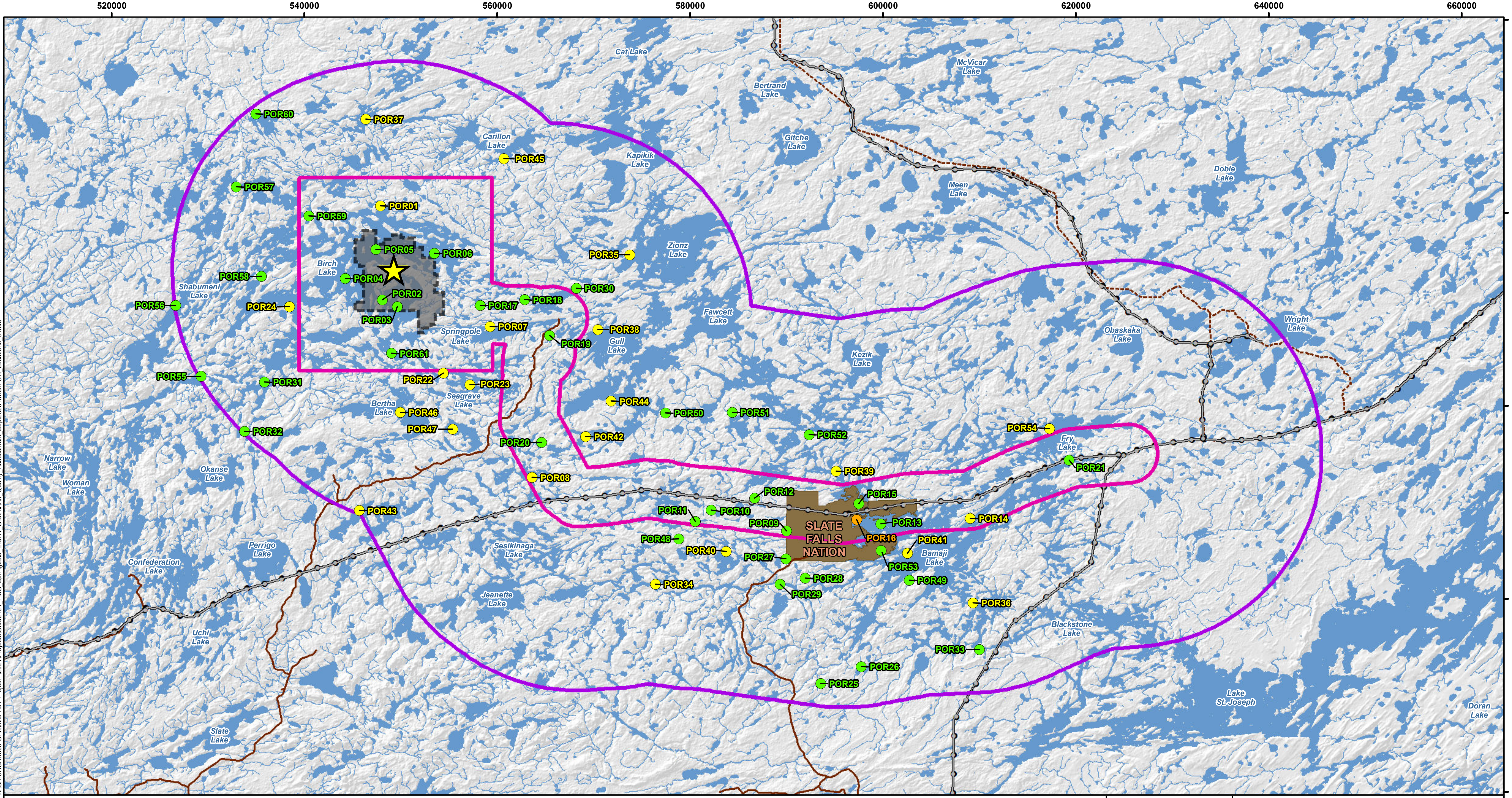
Table 3-1: Sources Considered by Project Phase

Source	Phase (1)	
	Construction	Operations
Portable crushing of non-acid generating mine rock	✓	×
Material handling at offsite aggregate pits along the mine access road	✓	×
Ground-level helicopters	✓	×
Wind erosion at ore stockpiles and the CDF	×	✓
Fuel combustion for heating	×	✓
Ore processing at the process plant	×	✓
Material handling at the plant	×	✓
Material handling and crushing of ore and mine rock	×	✓
Material handling at ore stockpiles and the CDF	✓	✓
Concrete batch plant	✓	✓
Exhaust from backup power generation and other diesel equipment	✓	✓
Road dust emissions (re-entrained dust)	✓	✓
Open pit emissions from drilling, blasting, material handling, in-pit road dust, and mobile equipment	✓	✓

Notes:
(1) The closure and decommissioning phase would have parameters in common with the construction phase but at a reduced fleet and activity level.
✓ = parameter considered for this phase; × = parameter not considered for this phase.

Table 3-2: Particular Size Distribution and Density Used for Wind Erosion Plume Depletion and Deposition

Parameter	Equivalent Particulate Diameter (µm)	Mass Fraction (0 to 1)	Particulate Density (g/cm^3)
SPM	1.6	0.20	2.6
	6.9	0.30	2.6
	30.2	0.50	2.6
PM_{10}	1.6	0.40	2.6
	6.9	0.60	2.6
$PM_{2.5}$	1.6	1.00	2.6



LEGEND

- Project Location
- Property Boundary
- Local Study Area for Air Quality
- Regional Study Area for Air Quality
- First Nation Reserve
- Existing Road
- Existing Winter Road
- Existing Transmission Line
- Watercourse
- Waterbody

Potential Points of Reception

- Cabin/Lodge/Camp
- TLRU
- Residential

0 5 10 20 30 40 50 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

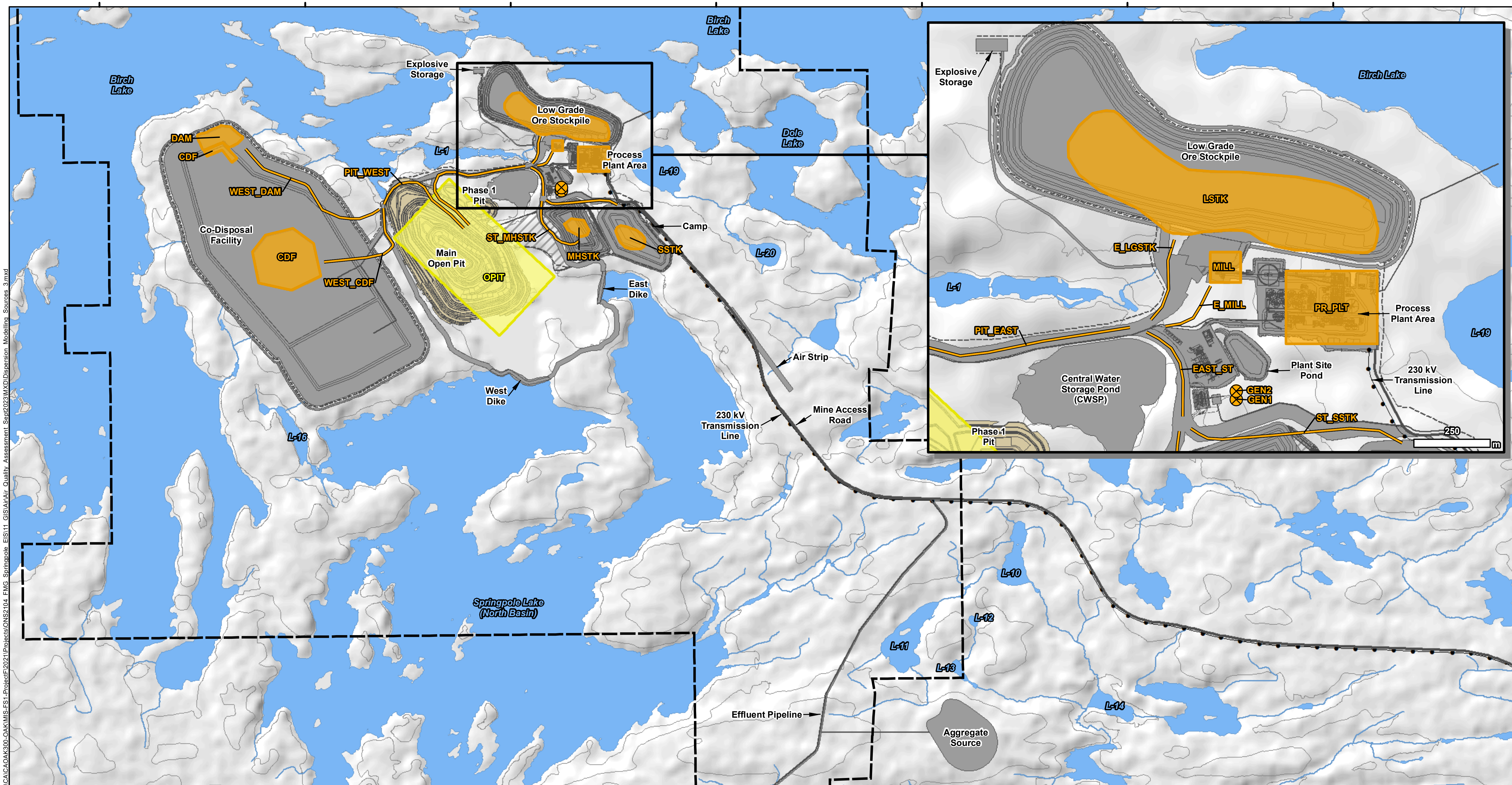
FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

Spatial Boundaries and Points of Reception

PROJECT Nº: ONS2104	FIGURE: 3-1
SCALE: 1:375,000	DATE: June 2024



LEGEND

- Air Quality Modelling Boundary (Gold Canyon Resources Patents and Leases)
- Point Sources
- Line Sources
- Area Sources
- Open Pit Sources
- Watercourse
- Waterbody
- Contour (10 m intervals)

Proposed Project Features

- Open Pit
- Other Project Feature
- 230 kV Transmission Line
- Pipeline
- Fish Habitat Development Area

0 0.5 1 2 3 4 5 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

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SPRINGPOLE GOLD PROJECT

Dispersion Modelling Air Emission Sources

PROJECT N°: ONS2104	FIGURE: 3-2
SCALE: 1:35,500	DATE: June 2024

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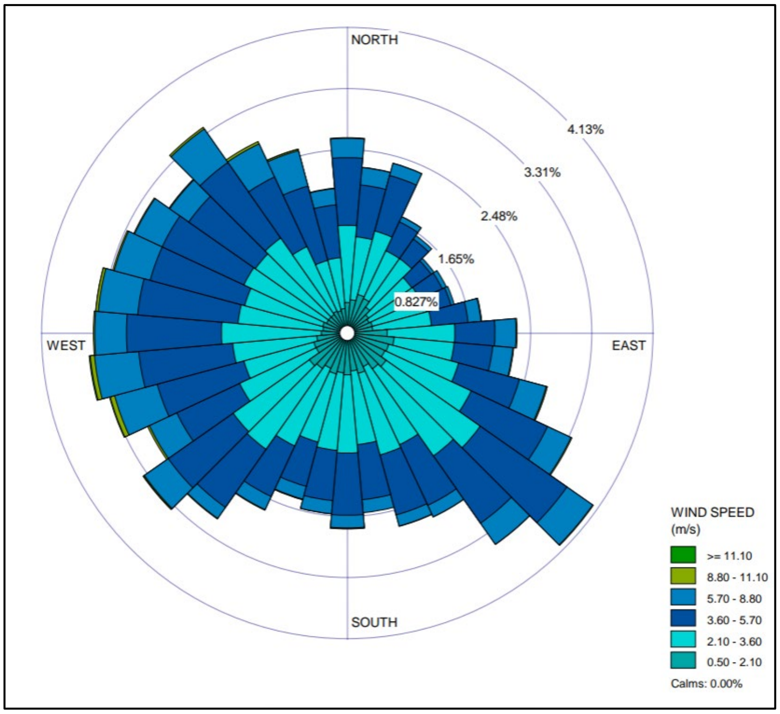


Figure 3-3: Wind Rose (2013 to 2017)

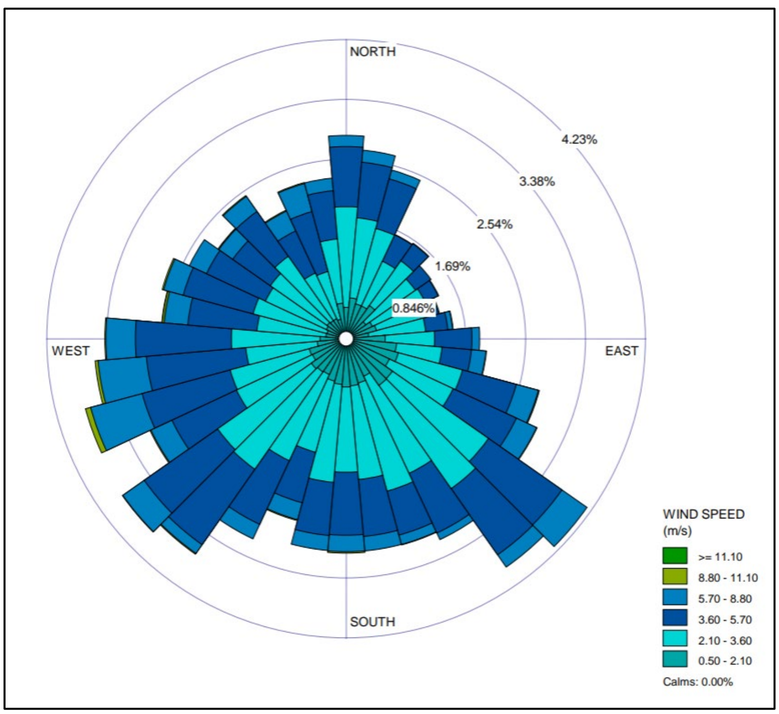


Figure 3-4: Wind Rose (June to September 2013 to 2017)

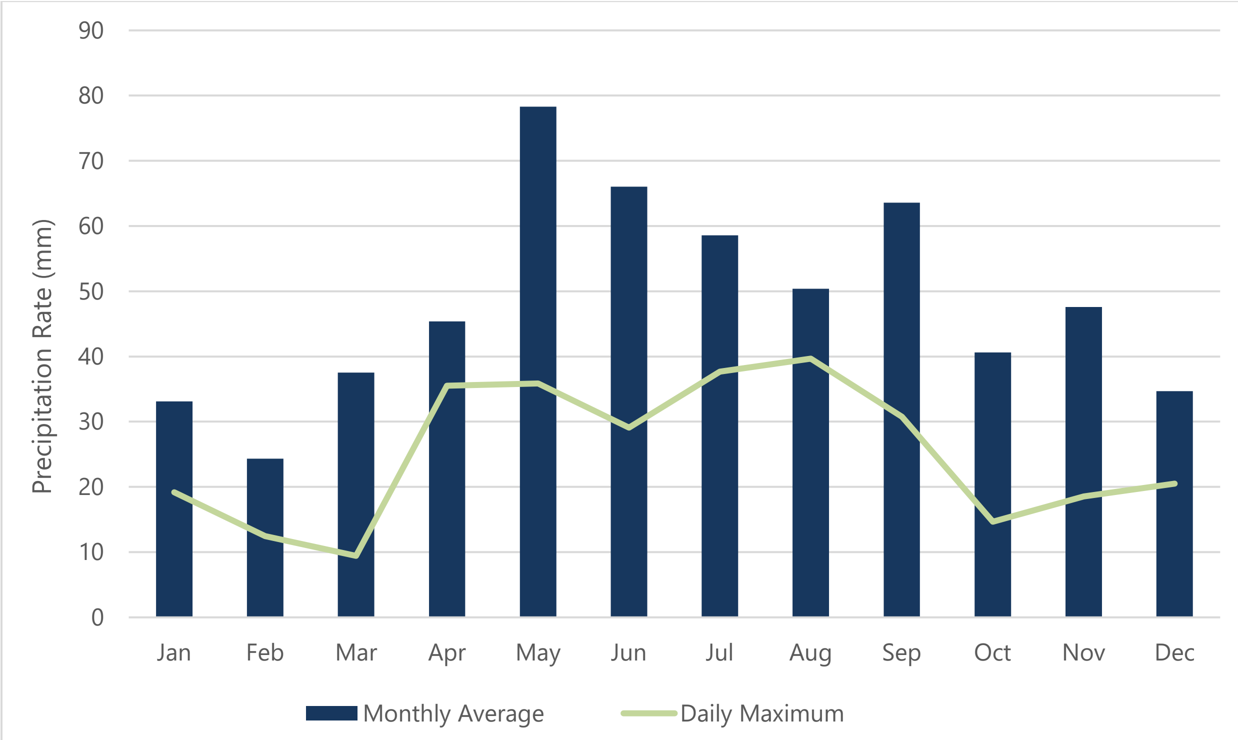


Figure 3-5: Monthly Precipitation (Red Lake, 2013 to 2017)

4.0 EXISTING ENVIRONMENTAL CONDITIONS

4.1 Baseline Air Quality

The Project is located in a remote area, absent of nearby large urban centres and industrial sources. Local sources of emissions may include road dust, exploration and forrestry activities, comfort heating, operation of small gensets, and recreational vehicles. Baseline air quality at the Project is influenced by longer range transport of air parameters as well as by natural sources, such as wildfires and VOC emissions from forest vegetation.

An onsite baseline air monitoring program was initiated in 2020 to measure SPM, PM_{10}, $PM_{2.5}$, metals, nitrogen dioxide, sulphur dioxide, and VOCs at the proposed Project site to establish existing conditions in the local study area, with an expansion of the program in mid-2021 to collect additional data. The data have confirmed that air concentrations are well below respective AAQCs. As an example, the 24-hour 90th percentile SPM concentration for the program was 12% of its AAQC and the highest metal of interest was manganese at 2% of its 24-hour AAQC.

Where data could be collected on site in a robust and representative manner, these data were preferentially used to establish baseline concentrations; other data collected on site were used to qualify the use of regional data. In some cases, multiple concurrent monitoring methods were employed for a single parameter for redundancy given the logistical challenges at the site. Side-by-side comparisons of the onsite methods and ECCC National Air Pollution Surveillance (NAPS) data for each parameter are provided in the Baseline Air Quality Monitoring Data Summary Report (Appendix G-1).

Regional data summarized in the baseline report were collected by regulatory agencies at Thunder Bay, Winnipeg (Ellen Station), Pickle Lake, and at the Experimental Farm (Simcoe); the regional stations are part of the NAPS network. Although Thunder Bay is located approximately 430 km from the Project, and Winnipeg approximately 300 km, these stations are still representative of the regional air quality experienced in northwestern Ontario. These urban stations will overestimate air concentrations at the Project as they are influenced by urban sources (e.g., traffic, industry, residential heating) and are considered to be a conservative baseline; this is particularly true where the 90th percentile of a measured dataset are used.

The location of each regional station in Universal Transverse Mercator (UTM) coordinates is provided in Table 4-1, and in Figure 4-1.

The data collected for the determination of existing concentrations in the Project area are provided in the Baseline Air Quality Monitoring Data Summary Report (Appendix G-1) and the baseline concentration used in the assessment of air quality effects for each parameter is shown in Table 4-2.

4.1.1 Particulate and Metals

For SPM, two methods were used for onsite sampling: high volume air sampling and low volume air sampling using Airmetrics MiniVol^{TM} portable air samplers (MiniVols). The SPM measured by high-volume sampling was used to establish baseline concentrations as 1) a robust dataset of 55 samples was collected with seasonal variability and 2) high volume air sampling is the MECP's approved reference method for SPM. The high volume air sampling was also used to establish baseline concentrations for the trace metals identified as key parameters.

For PM_{10}, three methods were used for onsite sampling: PQ200 low volume sampling, MiniVol TAS low volume sampling, and continuous monitoring using an Aeroqual Dust Sentry Pro instrument. PQ200 results were used to establish baseline concentrations as a robust dataset (47 samples) was collected with seasonal variability and this is an MECP reference method.

For $PM_{2.5}$, two methods were used for onsite sampling: MiniVol low volume sampling and an Aeroqual Dust Sentry Pro instrument. Both methods measured the same 90th concentration for $PM_{2.5}$ as was measured for PM_{10} via the PQ200 indicating all PM_{10} is $PM_{2.5}$.

It is estimated that 90% of DPM is of the ultrafine particle fraction of less than 0.1 micron in diameter ($PM_{0.1}$, US EPA 2023b). Therefore, the use of the regional average baseline of 1.8 µg/m^3 for the DPM is a conservative baseline concentration, as this is average background $PM_{2.5}$ concentration in Canada as recommended by Health Canada (2021).

4.1.2 Criteria Air Parameters (nitrogen dioxide, sulphur dioxide, carbon monoxide and ozone)

The baseline concentrations for nitrogen dioxide, sulphur dioxide, carbon monoxide and ozone were determined using regional data measured at the Thunder Bay, Winnipeg, and Pickle Lake NAPS stations. For the annual averaging time, where onsite data were not available, the highest annual average for the 2018 to 2021 period was used as baseline. For 24-hour and 1-hour averaging times, the 90th percentile of the measured concentrations was used. The baseline concentrations determined at these sites are comparable or conservative, particularly at the 90th percentile, as both are from stations located in a more urban environment in comparison to the remote location of the Project.

For nitrogen dioxide, baseline concentrations for shorter averaging times were established using the NAPS data from the Winnipeg station. The annual baseline was established using the onsite passive monitoring. The onsite monitoring indicated that the long-term average is approximately 0.6 µg/m^3, which is notably lower than the 18 µg/m^3 regional baseline. Use of regional data is also expected to overestimate short-term concentrations on site due to the greater variety and intensity of nitrogen dioxide sources in an urban environment.

For sulphur dioxide, short-term baseline concentrations were established using Winnipeg data, and the annual baseline was established using the onsite passive monitoring. Onsite monitoring indicated the long-term average is approximately 0.3 µg/m^3 which is consistent with the Winnipeg NAPS data. Regional data are also expected to overestimate short-term concentrations. The annual baseline was established using the onsite passive monitoring.

For carbon monoxide, baseline concentrations were established using Winnipeg data for the relevant averaging times.

For ozone, baseline concentrations were established using NAPS data for Pickle Lake; ozone was not quantitatively assessed for effects but was an input in the air dispersion models for nitrogen oxides.

4.1.3 Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons

The NAPS Experimental Farm station located in southwestern Ontario is Ontario's only regional baseline station that measures VOCs and PAHs. Because of prevailing southwesterly airflows, it is expected that measurements at this station are more influenced by transboundary contributors such as the Ohio Valley (MECP 2022) than the Project would be and use of this data for baseline at the Project location is conservative.

Of the VOCs commonly associated with diesel fuel combustion (i.e., vehicle and equipment tailpipe emissions), only benzene and 1,3-butadiene were measured at concentrations greater than 5% of their respective AAQCs at the Experimental Farm NAPS station. Onsite measurements of VOCs were all below the detection limit with the exception of toluene and benzene; toluene was well below its AAQC and the detectable measurements of benzene were determined to have been biased high due to use of the ice road in the winter.

The Experimental Farm data for VOCs and b(a)p were, therefore, used to establish the Project baseline concentrations for these parameters; the 90th percentile of measured concentrations were used for averaging times of less than one year, and the average of measured values was used as baseline for the annual averaging time.

4.1.4 Other Parameters (hydrogen cyanide, calcium oxide)

Existing concentrations for HCN were assumed to be negligible, and for calcium oxide a baseline concentration was established based on the baseline air concentrations of particulate and a calcium content assumed to be consistent with that of the ore and mine rock.

Table 4-1: Regional Air Monitoring Station Locations

Station	Station ID	UTM Cooridnates (NAD83)			Distance from Site (km)	Relevant Parameters Measured
		Northing (m)	Easting (m)	Zone		
Pickle Lake	064001	5 703 329	693 315	15U	145	Ozone
Thunder Bay	060809	5 360 993	330 430	16U	399	NO_2, $PM_{2.5}$
Winnipeg Ellen Station	070119	5 528 926	663 112	14U	381	CO, NO_2, SO_2, $PM_{2.5}$
Simcoe Experimental Farm	062601	4 745 177	559 668	17T	1,310	PAHs, VOCs

Table 4-2: Baseline Concentrations

Parameter	CAS Number	Averaging Time	Baseline Concentration (μg/m^3) (1)	Reference for Baseline Concentration
Suspended particulate matter (SPM)	N/A	24-hour	14.1	90th percentile and geometric mean of onsite high-volume sampling, respectively.
		Annual	5.3	
Inhalable particulate (PM_{10})	N/A	24-hour	9.1	90th percentile of onsite PQ200 sampling.
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	9.1	90th percentile of MiniVol sampling
		Annual	4.2	Mean of the onsite MiniVol sampling
Diesel particulate matter (DPM)	N/A	24-hour	1.8	Health Canada $PM_{2.5}$ average (Judek, 2004)
		Annual		
Respirable silica (SiO_2, <10 μm)	Various	24-hour	—	No appreciable baseline concentration.
Nitrogen dioxide (NO_2)	10102-44-0	1 hour	30	90th percentile of the regional monitoring data (Winnipeg and Thunder Bay). Onsite monitoring indicates long-term average is approximately 0.6 μg/m^3 and regional data are expected to overestimate short-term concentrations.
		24-hour	28	
		Annual	0.6	Mean of onsite passive monitoring.
Carbon monoxide (CO)	630-08-0	1 hour	114	90th percentile of the regional monitoring data (Winnipeg)
		8-hour	114	90th percentile of regional monitoring data (Winnipeg)
Sulphur dioxide (SO_2)	7446-09-5	10-minute	1.7	90th percentile of the regional monitoring data (Winnipeg). Onsite monitoring indicates long-term average is approximately 0.3 μg/m^3 and regional data are expected to overestimate short-term concentrations. 10-minute average determined from 1-hour average per the MECP's Guideline A-10.
		1-hour	1.0	
		Annual	0.3	Mean of onsite passive monitoring.
Hydrogen cyanide (HCN)	74-90-8	24-hour	—	No appreciable baseline concentration.
Calcium oxide (CaO)	1305-78-8	24-hour	0.12 (as Ca)	The baseline concentrations of CaO were estimated assuming the particulate is of the same composition of ore and mine rock.
Arsenic (As)	7440-38-2	24-hour	0.0010	90th percentile and mean, respectively, of onsite SPM high-volume sampling.
Chromium (Cr)	7440-47-3	24-hour	0.0012	

Table 4-2: Baseline Concentrations

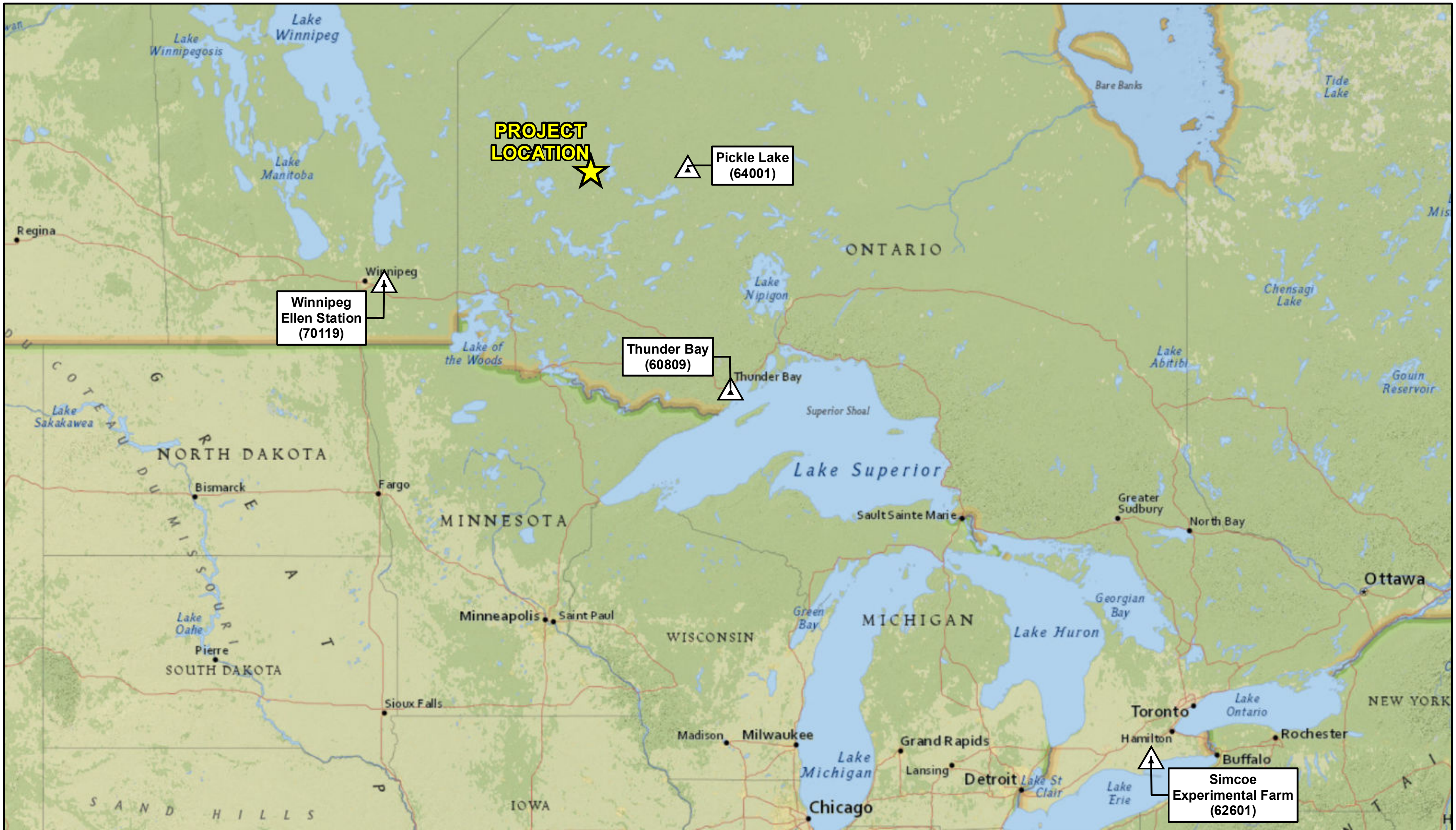
Parameter	CAS Number	Averaging Time	Baseline Concentration (µg/m³) (1)	Reference for Baseline Concentration
Copper (Cu) (2)	7440-50-8	24-hour	0.14	
Iron (Fe)	7439-89-6	24-hour	0.14	
Lead (Pb)	10099-74-8	24-hour	0.0012	
		30-day	0.0012	
Magnesium (Mg)	1309-48-4	24-hour	0.13	
Manganese (Mn) in SPM	7439-96-5	24-hour	0.0082	
Manganese (Mn) in PM_{10}		24-hour	0.0082	
Manganese (Mn) in $PM_{2.5}$		24-hour	0.0082	
Mercury (Hg)	7439-97-6	24-hour	0.000012	
Nickel (Ni) in SPM	7440-02-0	24-hour	0.0015	
		Annual	0.00089	
Nickel (Ni) in PM_{10}		24-hour	0.0015	90th percentile and mean, respectively, of onsite SPM high-volume sampling.
		Annual	0.00089	
Titanium (Ti)	7440-32-6	24-hour	0.0061	
Zinc (Zn)	7440-66-6	24-hour	0.010	
Benzene	71-43-2	24-hour	0.49	90th percentile and mean, respectively, of the regional monitoring data (Experimental Farm).
		Annual	0.30	
1,3-Butadiene	106-99-0	24-hour	0.24	90th percentile and mean respectively of the regional monitoring data (Experimental Farm). Onsite monitoring indicates the long-term mean is approximately 3.0 µg/m³.
		Annual	0.26	
Formaldehyde	50-00-0	24-hour	1.5	90th percentile and mean respectively of the regional monitoring data (Experimental Farm).
Acetaldehyde	75-07-0	0.5-hour	7.0	90th percentile of the regional monitoring data (Experimental Farm).
		24-hour		
Benzo(a)pyrene	50-32-8	24-hour	0.000036	90th percentile and mean of the regional monitoring data (Experimental Farm).
		Annual	0.000018	

Notes:

(1) NAPS data are reported in ppb was converted to µg/m³ using a reference temperature and pressure of 25°C and 760 mm mercury respectively (Environment Canada 2004) where a conversion was not otherwise provided.

(2) $CuSO_4$ baseline concentration was assumed conservatively to equal the copper baseline.

CAS = Chemical Abstracts Service; N/A = not applicable; — = no appreciable baseline concentration.



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LEGEND

- ☆ Project Location
- △ National Air Pollution Surveillance Station (Labelled with Station Name and NAPS ID)

0 100 200 400 600 800 1,000 Kilometres

NOTES:
- Background image extracted from ESRI Basemaps online.

Datum: WGS 1984
Projection: Web Mercator Auxiliary Sphere

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SPRINGPOLE GOLD PROJECT

Regional Ambient Air Monitoring Stations

PROJECT N°: ONS2104	**FIGURE: 4-1**
SCALE: 1:13,000,000	DATE: June 2024

5.0 PREDICTIVE AIR QUALITY ASSESSMENT

An assessment of predicted concentrations was undertaken for each Project phase to understand the cumulative concentrations predicted from the Project emissions and the existing air concentrations for the key parameters.

5.1 Scenarios and Emission Rate Estimates

5.1.1 Construction Phase – Mine Infrastructure

The construction phase of the Project's mine infrastructure is expected to take place over a three-year period.

Construction activities are expected to include:

- Early works such as clearing and grubbing for road building and infrastructure pad preparations;
- Development and use of an onsite quarry area (future mid / high grade ore stockpile and fish habitat development area);
- Dike construction and dewatering;
- Open pit preparation such of removal of overburden;
- Use of non-acid generating mine rock from the open pit as construction material;
- Process plant and site infrastructure construction;
- Preparation of stockpile pads;
- CDF clearing, grubbing and overburden removal; and
- CDF preparation and dam construction.

The prediction of effects encompasses the sources of air emissions that are associated with this construction phase of the Project. The effects assessed cease upon completion of this construction phase. Equipment, activity levels, emissions sources, and key parameters associated with the construction phase are similar to those of the operations phase, but at a generally smaller scale and of shorter duration.

An airstrip is proposed to be constructed on site to support up to two flights per week starting during the construction phase of the Project. Emissions associated with the operation of this airstrip were qualitatively assessed. Emissions (infrequent flights and limited runway idling) are of short-duration, and are not expected to be material relative to the equipment fleets used during the Project.

A maximum emission scenario was developed for the construction phase which considered variability in the construction schedule and in the location of construction phase activities. The scenario combined the most intensive period of earthworks construction (i.e., Year -2) with other activities that while not necessarily concurrent were spatially offset. In some cases, modelling non-concurrent tasks together meant that emissions associated with certain construction equipment or activities were double-counted leading to conservatism in the estimates and predictions. The two offsite aggregate pits were also considered.

All sources were considered in the air dispersion modelling to assess effects on air quality concentrations for comparison against AAQCs and CAAQS.

5.1.2 Construction Phase – Mine Access Road and 230 kV Transmission Line Corridor

A two-lane all weather mine access road is proposed that will extend approximately 18 km from the mine site to the existing end of the existing Wenasaga Road. A 230-kilovolt (kV) transmission line will be constructed to connect the Project site to the regional electrical grid. The 40 m wide and 89 km long transmission line corridor will not be grubbed, and the vegetative root mass will be retained.

The potential air quality effects associated with construction of the mine access road and 230 kV transmission line were assessed assuming the respective construction fleets worked in 5 km segments at a time and the entire alignment of each was modelled.

All sources were considered in the air dispersion modelling to assess effects on air quality concentrations for comparison against AAQCs and CAAQS.

Generally, these acitivities are expected to be limited in geographic area and duration. Fugitive dusts and tailpipe emissions will be mitigated as detailed in Section 7.0 to reduce the air emissions. A dust control of 85% was assumed during construction modelling to reflect that dust management programs may not be fully developed at the time of construction.

The alignment for the mine access road to the Project and the 230 kV transmission line are shown in Figure 3-1.

5.1.3 Operations Phase

An overview of the Project's operations phase is provided in Section 1.2. For the operations phase, it was conservatively assumed that the Project will be operating under the maximum emission scenario, which included two backup diesel generators, crushing and screening, ore processing, vehicular traffic, and open pit mining all operating at maximum activity rates. A conservative approach was also taken to capture potential variation in material movement. The emissions scenario for material movement considered the maximum movements for each activity (i.e., ore from pit, mine rock from pit, stockpile management) over the life of the Project. The scenario modelled was a hybrid of Year 3 and Year 4 (Table 5-1), where Year 3 accounts for the maximum ore extracted and Year 4 the maximum mine rock extracted. Therefore, a hybrid of these two years provides a conservative scenario to how material will be moved during the mine operation.

The modelled results are expected to over-predict the emissions and air quality effects for material handling operations and haul truck movements. The material movement projections for the Project, that were used to quantify the air emission rates are provided in Attachment C. Note that the Project underwent optimizations since issuance of the draft EIS/EA, including changing from dry to thickened tailings, which reduced haul road traffic.

An airstrip is proposed to be constructed on site to support up to 2 flights per week during the operations phase of the Project. Emissions associated with the operation of this airstrip were qualitatively assessed. Emissions (infrequent flights and limited runway idling) are of short-duration, and are not expected to be material relative to the equipment fleets used during the Project.

All sources were considered in the air dispersion modelling to assess effects on air quality concentrations for comparison against AAQCs and CAAQS; certain sources were intentionally excluded from the modelling where O. Reg. 419/05 requirements were followed to allow for appropriate comparisons against the standards set out in O. Reg. 419/05 and the ACBs applicable to facility operations as described in Section 2.2.

5.1.4 Closure and Decommissioning Phase and Post-Closure

The closure and decommissioning period is expected to be five years in length with post-closure following that. Activities in the closure and decommissioning phase are similar to those that occur during the operations and construction phases, and use similar mining and construction equipment, but on a generally smaller scale and timeframe. The fugitive dust management plan will include practices to minimize dust emissions during the closure phase (e.g., watering, travel area surface management). Accordingly, no specific closure and decommissioning phase air quality assessment was completed.

The post-closure phase will not have notable sources of air parameter emissions that would warrant the assessment of effects.

5.2 Air Quality Assessment Results

Air dispersion modelling was used to predict the offsite air concentrations of the key parameters identified in Section 2.1 beyond the extent of the mine lease. With respect to the mine access road and transmission line, the potential for air quality effects beyond the immediate Project footprint was assessed. The modelled air quality offsite effects for the operations phase were compared against the AAQCs (with, and without, inclusion of baseline concentrations) as presented in Table 5-2 and Table 5-3.

Table 5-2 presents the maximum modelled POI concentration for each key parameter and relevant averaging time, taking into account the removal of meteorological anomalies using the method described in the ADMGO (MECP 2017).

The potential effects at the sensitive receptors were also determined. The maximum modelled air concentrations at these sensitive receptors are presented in Table 5-3; this table has not had meteorological anomolies removed. So, it may be that for a given parameter, a sensitive receptor shows a higher concentration than the maximum point of impingment value.

Tables 5-2 and 5-3 include the modelled concentrations, the baseline for each parameter, and their combined, cumulative concentration.

The figures in Section 5.0 depict the predicted, worst-case, extent of each phase's air quality effects as isopleths, or lines of equal concentration, as predicted by the air dispersion model. For consistancy, the same parameters presented in draft EIS/EA via isopleths are presented here.

Figure 5-1, Figure 5-2, Figure 5-3, Figure 5-4, Figure 5-5, Figure 5-6,Figure 5-7, Figure 5-8, Figure 5-9, Figure 5-10 and Figure 5-11 do not have concentration isopleths shown, which indicates that predicted air quality effects do not extend beyond the property boundary (patent and lease area) or the respective mine access road and transmission line footprints.

A sensitivity analysis of PM_{10} concentrations using reduced road dust controls and higher silt content is provided in Section 6.0.

The isopleths map out the maximum concentration predicted for each averaging time at each receptor, and therefore present the worst-case scenario. The shapes of the isopleths indicate the location of effects, which vary with direction and distance, as a result of source locations, meteorological conditions, and receptor elevation. These isopleths do not necessarily occur during the same hour or time period, as it is the maximum modelled effect at each receptor that is shown and is not a snapshot in time. For the longer averaging times, the isopleths are affected by the frequency a given point of assessment is downwind of the Project. The isopleths show how ground level concentrations decrease with distance from the Project, due to the ground level and open pit release height of the emissions for all phases.

Similar to Table 5-3 which presents the worst-case modelled effects at the sensitive receptors, the isopleths are not adjusted in the same manner that the maximum POI concentrations are because the anomalies do not affect all receptors. The isopleths shown may suggest an exceedance which is the result of these meteorological anomalies, but which cannot be removed from the concentration plot; concentrations in the tables rather than the concentration plots should be taken as the absolute value of each maximum predicted concentration.

5.2.1 Construction Phase

5.2.1.1 Mine Infrastructure

For the construction of the mine infrastructure, the predicted cumulative concentrations for all parameters were below their respective AAQC with the exception of b(a)p for the annual averaging time. However, for the Project the baseline b(a)p concentration of 0.000018 μg/m^3 for the annual averaging time is greater than the AAQC, and the baseline concentration of 0.000036 μg/m^3 for the 24-hour averaging time is at 72% of the respective AAQC. As a result, there are modelled exceedances along the Project boundary when cumulative concentrations are considered. The predicted air concentrations for the Project during the construction phase were less than 3% of the AAQC for each averaging time. The modelled Project concentrations have been carried forward into the Human and Ecological Health Risk Assessment (Section 6.24) to assess the incremental lifetime risk as a result of the Project.

There were no predicted exceedances of an AAQC at any of the receptors listed in Attachment D as a result of the construction phase activities.

For the two offsite aggregate pits west of the mine access road, cumulative concentrations were predicted to be limited for the key parameters with the exception of the annual b(a)p AAQC where the baseline without the Project already exceeds the AAQC. The predicted 24-hour b(a)p concentration was highest at 76% of the AAQC at 400 m from an aggregate pit (only 4% of which was Project emissions).

As previously noted, the CAAQS were not developed as project-level regulatory standards. Rather, they are used by provinces and territories to guide air zone management actions and represent an indicator of good air quality (CCME 2019). For nitrogen dioxide, the Ontario AAQC over the same averaging time is over four times greater than the CAAQS and is also not a regulatory value but is protective against effects on health and the environment (MECP 2020). The CAAQS consist of a numerical standard and the statistical form, intended to minimize the influence of variable meteorological conditions on compliance with the CAAQS.

A comparison of construction effects against the CAAQS identified the potential for the maximum nitrogen dioxide concentrations modelled to exceed the one-hour CAAQS noting that background nitrogen dioxide accounted for 38% of the standard. The construction phase predicted concentrations are presented in Attachment A, Table A-2.

If direct comparisons of the maximum predicted concentrations are made without use of the appropriate statistical form, there were also predicted exceedances of the one-hour nitrogen dioxide CAAQS.

Results are presented in Attachment A, Tables A-1 and A-2.

5.2.1.2 Mine Access Road and 230 kV Transmission Line Corridor

For the construction of the transmission line and mine access road, modelled air concentrations were predicted to decrease with distance from the work areas.

For the construction of the mine access road and the transmission line, the predicted cumulative concentrations for all parameters were below their respective AAQC with the exception of b(a)p for the annual averaging time, consistent with the findings of the operations phase assessment. The exceedances were the result of elevated baseline concentrations and not Project effects; the baseline b(a)p concentration of 0.000018 µg/m³ for the annual averaging time is already greater than the AAQC, and the baseline concentration of 0.000036 µg/m³ for the 24-hour averaging time is at 72% of the respective AAQC.

For both the transmission line and mine access road construction, there were no modelled exceedances of an AAQC at any of the receptors listed in Attachment D as a result of these construction phase activities.

For the CAAQS, the air dispersion modelling of transmission line construction activities did not predict exceedances of the CAAQS beyond the immediate work area.

The mine access road construction modelling identified the potential for exceedances of the one-hour nitrogen dioxide CAAQS at a distance of 1200 m from the construction area or 350 m when considering the Project effects alone (i.e., without baseline).

If direct comparisons of the maximum predicted concentrations are made without use of the appropriate statistical form, there were also predicted exceedances of the one-hour nitrogen dioxide CAAQ.

See Section 5.2.1.1 for qualifiers around comparisons of Project effects to the CAAQS.

Results are presented in Attachment A, Tables A-3 through A-6.

5.2.2 Operations Phase

5.2.2.1 Particulate Matter

The modelled effects were compared against the AAQC for each of the three particulate size fractions. As described in Section 2.2, the AAQC are set as air quality targets, or desirable air quality, and consider all Project sources for the phase as well as baseline air quality.

The modelling identified fugitive dusts, primarily from haul road fugitive emissions, as having the highest potential for contributing to offsite concentrations, and effective dust mitigation is necessary to prevent, or minimize, these contributions.

These predicted concentrations for particulate matter should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological conditions over five years of meteorological data). The modelled concentrations for particulate are at a level that is also typical of many mining projects in Ontario.

As summarized in Table 5-2, the modelling predicts concentrations for all particulate fractions below their respective AAQCs.

The results of the air dispersion modelling for SPM, PM_{10} and $PM_{2.5}$ are also presented as isopleths in Figure 5-1 to Figure 5-5.

Respirable silica and DPM are other particulates identified as key air parameters associated with mining activities with air emissions quantified and the effects on air quality predicted using air dispersion modelling. For both respirable silica and DPM, the predicted concentrations were below the respective criteria.

5.2.2.2 Nitrogen Dioxide and Sulphur Dioxide

These CAPs are by-products of fuel combustion, and the air quality effects for the one-hour averaging time are overwhelmingly influenced by in-pit blast emissions when compared with all other fuel combustion sources (tailpipe emissions, heating, testing of the emergency diesel generators).

The predicted maximum concentrations for nitrogen dioxide and sulphur dioxide at the extent of the Project leased lands were below their respective AAQC when the site adhered to a specific blast schedule that avoided blasting during unfavourable meteorological conditions; the blast schedule is a mitigation measure identified in Section 6.0 for the construction and operations phases.

The results of the air dispersion modelling for nitrogen dioxide and sulphur dioxide is depicted in Figure 5-6 to Figure 5-10.

5.2.2.3 Polycyclic Aromatic Hydrocarbons

The combustion of fuels results in trace emissions of PAHs to the air, for which b(a)p is used as a surrogate in air quality assessments. The predicted b(a)p concentrations resulting from these Project emissions are below the AAQC for both the 24-hour and the annual averaging times. However, for the Project the baseline b(a)p concentration of 0.000018 µg/m^3 for the annual averaging time is greater than the AAQC, and the baseline concentration of 0.000036 µg/m^3 for the 24-hour averaging time is at 72% of the respective AAQC. As a result, modelled exceedances are shown along the Project boundary for the annual averaging time when cumulative concentrations are considered for the operations phase.

See Section 5.2.1.1 for qualifiers around comparisons of Project effects to the CAAQS.

5.2.2.4 Other Parameters

The predicted maximum concentrations of all other compounds at the extent of the mine leased area, and beyond, were below their respective AAQC even when baseline concentrations were added to the modelled concentrations as a cumulative air quality effect. The results at the receptors, with baseline levels included, were also less than the AAQCs.

For the metals identified in Section 2.1.5, namely arsenic, chromium, copper, iron, mercury, magnesium, manganese, nickel, titanium, lead and zinc, the maximum offsite effects were estimated through speciation of the modelled particulate matter concentrations, assuming that the dust is of the same composition as that of the samples of ore and mine rock at the Project site. There were no exceedances of the AAQCs for the metals.

An isopleth figure for manganese is provided in Figure 5-11 as manganese was the metal with the highest modelled concentrations relative to its AAQC.

5.2.2.5 Ozone Formation

There are no sources of ozone associated with the Project. Nitrogen oxides and VOCs will however be released, are known ozone precursors, and react in the presence of heat and sunlight to form ozone.

Given these requirements, ozone formation is most likely from May to September, between noon and the early evening (MECP 2024).

In 2021, Ontario measured ozone at 47 stations where the 90th percentile of one-hour values ranged from 36 to 47 ppb. The health-based AAQC for ozone is 80 ppb and given the range of ozone concentrations from remote to urban locations only varied by 11 ppb, ozone is a regional air quality issue rather than a local issue with no appreciable effects from the Project on the ozone concentrations in the local or regional study areas.

5.2.2.6 Ontario Regulation 419/05 Compliance

O. Reg. 419/05 air quality standards are used to assess emissions from all stationary sources associated with the Project; by regulatory requirement and guidance, baseline concentrations, non-Project emissions sources, construction activities, and mobile sources are excluded and the total nitrogen oxides is compared against the ACB. The modelled Project effects were assessed against the O. Reg. 419/05 standards and other applicable ACBs.

The Emissions Summary Table (Table 5-4) summarizes the site-wide emission rates for all stationary sources and the modelled predictions for all compounds compared to the respective standards or ACBs. The Emissions Summary Table demonstrates that the modelled concentrations for all compounds are below the respective O. Reg. 419/05 standards or ACB, including at the receptors and, as such, the Project is considered to be permittable in Ontario.

A complete Emission Summary and Dispersion Modelling Report will be prepared as part of an application for an ECA (Air and Noise) for the Project.

5.2.2.7 Canadian Air Quality Standards

The CAAQS were not developed as project-level regulatory standards. Rather, they are used by provinces and territories to guide air zone management actions and represent an indicator of good air quality (CCME 2019). For nitrogen dioxide, the Ontario AAQC over the same averaging time is over four times greater than the CAAQS and is also not a regulatory value but is protective against effects on health and the environment (MECP 2020).

The CAAQS consist of a numerical standard and the statistical form, intended to minimize the influence of variable meteorological conditions on compliance with the CAAQS. When the appropriate statistical form is considered, all of the CAPs were below the respective CAAQS with one exception: the nitrogen dioxide concentrations were predicted to exceed the CAAQS for the one-hour averaging time, as shown in Table 5-5. The nitrogen dioxide exceedances are the result of blasting in the open pit and will be managed according to a Blasting Plan.

If direct comparisons of the maximum predicted concentrations are made without use of the appropriate statistical form, there were also predicted exceedances of the 24-hour $PM_{2.5}$ CAAQS in addition to those of the one-hour nitrogen dioxide CAAQS.

As the $PM_{2.5}$ CAAQS is numerically equivalent to its AAQC, the discussions around the AAQC apply equivalently to the CAAQS.

These predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological conditions over five years of meteorological data).

Table 5-1: Construction and Operations Phase Material Movements

	Construction Phase (Year -1)	Maximum Annual Operations Phase (Year 4)	Maximum Emissions Scenario for Air Dispersion Modelling (Hybrid of Year 3/4) (1)
Material Movements (Tonnes)			
Ore	3,224,094	9,372,386	16,873,480
Overburden	3,450,702	5,321,071	3,404,235
Mine rock	13,329,204	45,306,543	37,222,286
Total material movements	20,004,000	60,000,000	57,500,000

Note:

(1) This scenario uses the average ore and mine rock moved from Year 3 (peak ore extraction) and Year 4 (peak mine rock extraction).

Table 5-2: Operations Phase - Emissions Summary Table with Comparison of Maximum Modelled Concentrations to the Ambient Air Quality Criteria

Parameter	CAS Number	Averaging Time	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	20.7	29.7	14.1	43.8	120	37
		Annual		2.4	5.3	7.7	60	13
Inhalable particulate (PM_{10})	N/A	24-hour	8.46	29.7	9.1	38.8	50	78
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	3.12	17.2	9.1	27.0	27	97
		Annual		1.07	4.2	5.27	8.8	60
Diesel particulate matter (DPM)	N/A	24-hour	0.48	2.55	1.8	4.35	10	44
		Annual		0.24	1.8	2.04	5	41
Respirable silica (SiO_2 <10 µm)	Various	24-hour	0.63	2.23	–	2.71	5	54
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	99	148	30	178	400	44
		24-hour	33.8	57	28	85	200	42
Carbon monoxide (CO)	630-08-0	1-hour	363	2150	114	2,264	36,200	6.3
		8-hour	49.22	419	114	533	15,700	3.4
Sulphur dioxide (SO_2)	7446-09-5	10-minute	4.26	44.5	1.7	46.2	178	26
		1-hour	4.26	26.9	1.0	27.9	100	28
		Annual	0.23	0.04	0.30	0.34	10	3.4
Hydrogen cyanide (HCN)	74-90-8	24-hour	0.42	4.22	–	4.22	8	53
Calcium oxide (CaO)	1305-78-8	24-hour	0.13	1.08	0.12	1.20	10	12
Arsenic (As)	7440-38-2	24-hour	0.0035	0.005	0.0010	0.006	0.3	2.0
Chromium (Cr)	7440-47-3	24-hour	0.0023	0.003	0.0012	0.0046	0.5	0.9
Copper (Cu)	7440-50-8	24-hour	0.0027	0.004	0.14	0.14	50	0.3
Iron (Fe)	7439-89-6	24-hour	1.54	2.26	0.14	2.40	25	10
Lead (Pb)	7439-92-1	30-day	0.0025	0.0037	0.0012	0.0049	0.5	1.0
		24-hour	0.0025	0.0037	0.0012	0.0049	0.2	2.4
Magnesium (Mg)	1309-48-4	24-hour	0.60	0.89	0.13	1.02	120	0.8
Manganese (Mn) in $PM_{2.5}$	7439-96-5	24-hour	0.0031	0.033	0.0082	0.041	0.1	41
Manganese (Mn) in PM_{10}		24-hour	0.0085	0.056	0.0082	0.065	0.2	32
Manganese (Mn) in SPM		24-hour	0.038	0.056	0.0082	0.06	0.4	16
Mercury (Hg)	7439-97-6	24-hour	0.000006	0.0000094	0.000012	0.000021	2	0.001

Table 5-2: Operations Phase - Emissions Summary Table with Comparison of Maximum Modelled Concentrations to the Ambient Air Quality Criteria

Parameter	CAS Number	Averaging Time	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Nickel (Ni) in SPM	7440-02-0	24-hour	0.0018	0.0026	0.0015	0.0041	0.2	2.1
		Annual		0.0002	0.00089	0.0011	0.04	2.7
Nickel (Ni) in PM_{10}		24-hour	0.0007	0.0026	0.0015	0.0041	0.1	4.1
		Annual		0.00019	0.00089	0.0011	0.02	5.4
Titanium (Ti)	7440-32-6	24-hour	0.039	0.06	0.0061	0.06	120	0.1
Zinc (Zn)	7440-66-6	24-hour	0.0053	0.008	0.010	0.018	120	0.01
Benzene	71-43-2	24-hour	0.80	0.42	0.49	0.91	2.3	40
		Annual		0.03	0.30	0.33	0.45	74
1,3-Butadiene	106-99-0	24-hour	0.033	0.019	0.24	0.26	10	2.6
		Annual		0.014	0.26	0.27	2	13.7
Formaldehyde	50-00-0	24-hour	1.6	1.94	1.50	3.44	65	5.3
Acetaldehyde	75-07-0	0.5-hour	0.82	4.78	7	11.78	500	2.4
		24-hour		0.72	7	7.72	500	1.5
Benzo(a)pyrene	50-32-8	24-hour	0.0000043	0.00001	0.000036	0.00005	0.00005	95
		Annual		0.000001	0.000018	0.00002	0.00001	**190**

Notes:

Bolded text indicates that the modelled + baseline concentration are higher than the AAQC.

CAS = Chemical Abstracts Service; N/A = not applicable; – = no value for the respective parameter and/or averaging time.

Table 5-3: Operations Phase - Emission Summary Table with Maximum Concentration at a Point of Reception

Parameter	CAS Number	Averaging Time	Receptor ID	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	POR03	20.7	21.0	14.1	35.1	120	29
		Annual	POR05		2.1	5.3	7.4	60	12
Inhalable particulate (PM_{10})	N/A	24-hour	POR03	8.46	21.0	9.1	30.1	50	60
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	POR03	3.12	9.9	9.1	19.0	27	70
		Annual	POR05		0.6	4.2	4.8	8.8	55
Diesel particulate matter (DPM)	N/A	24-hour	POR02	0.48	2.5	1.8	4.31	10	43
		Annual	POR02		0.2	1.8	2.04	5	41
Respirable silica (SiO_2 <10 µm)	Various	24-hour	POR03	0.63	1.58	–	1.58	5	32
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	POR03	99	273.2	30.0	303.2	400	76
		24-hour	POR02	33.8	56.5	28.0	84.5	200	42
Carbon monoxide (CO)	630-08-0	1-hour	POR03	363	8,458.5	114	8,572	36,200	24
		8-hour	POR03	49.22	1,093.0	114	1,207	15,700	7.7
Sulphur dioxide (SO_2)	7446-09-5	10-minute	POR05	4.26	8.4	1.70	10.1	178	5.7
		1-hour	POR05	4.26	5.1	1.00	6.1	100	6.1
		Annual	POR02	0.23	0.04	0.30	0.34	10	3.4
Hydrogen cyanide (HCN)	74-90-8	24-hour	POR03	0.42	1.8	–	1.80	8	22
Calcium oxide (CaO)	1305-78-8	24-hour	POR03	0.13	1.52	0.12	1.64	10	16
Arsenic (As)	7440-38-2	24-hour	POR03	0.0035	0.0036	0.0010	0.0046	0.3	1.5
Chromium (Cr)	7440-47-3	24-hour	POR03	0.0023	0.0024	0.0012	0.0036	0.5	0.7
Copper (Cu)	7440-50-8	24-hour	POR03	0.003	0.0028	0.14	0.14	50	0.3
Iron (Fe)	7439-89-6	24-hour	POR03	1.54	1.6015	0.14	1.74	25	7.0
Lead (Pb)	7439-92-1	24-hour	POR03	0.0025	0.0026	0.0012	0.0038	0.5	0.8
		30-day	POR03	0.0025	0.0026	0.0012	0.0038	0.2	1.9
Magnesium (Mg)	1309-48-4	24-hour	POR03	0.60	0.63	0.13	0.76	120	0.6
Manganese - in $PM_{2.5}$	7439-96-5	24-hour	POR03	0.0031	0.019	0.0082	0.027	0.1	27

Table 5-3: Operations Phase - Emission Summary Table with Maximum Concentration at a Point of Reception

Parameter	CAS Number	Averaging Time	Receptor ID	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Manganese - in PM_{10}		24-hour	POR03	0.008	0.040	0.0082	0.048	0.2	24
Manganese - in SPM		24-hour	POR03	0.038	0.040	0.0082	0.048	0.4	12
Mercury	7439-97-6	24-hour	POR03	0.000006	0.0000067	0.000012	0.000019	2	0.001
Nickel - in SPM	7440-02-0	24-hour	POR03	0.0018	0.0019	0.0015	0.0034	0.2	1.7
		Annual	POR05		0.00019	0.00089	0.0011	0.04	2.7
Nickel - in PM_{10}		24-hour	POR03	0.0007	0.0019	0.0015	0.0034	0.1	3.4
		Annual	POR05		0.00016	0.00089	0.0011	0.02	5.3
Titanium (Ti)	7440-32-6	24-hour	POR03	0.039	0.04	0.0061	0.0462	120	0.04
Zinc (Zn)	7440-66-6	24-hour	POR03	0.0053	0.0055	0.0100	0.015	120	0.01
Benzene	71-43-2	24-hour	POR02	0.80	0.32	0.49	0.811	2.3	35
		Annual	POR02		0.03	0.30	0.330	0.45	73
1,3-Butadiene	106-99-0	24-hour	POR02	0.033	0.01	0.24	0.25	10	2.5
		Annual	POR02		0.0013	0.26	0.26	2	13
Formaldehyde	50-00-0	24-hour	POR02	1.6	2.05	1.50	3.55	65	5.5
Acetaldehyde	75-07-0	0.5-hour	POR03	0.82	4.62	7	11.6	500	2.3
		24-hour	POR02		0.73	7	7.73	500	1.5
Benzo(a)pyrene	50-32-8	24-hour	POR02	0.0000043	0.000013	0.00004	0.00005	0.00005	97
		Annual	POR02		0.0000010	0.00002	0.00002	0.00001	**190**

Notes:

Bolded text indicates that the modelled + baseline concentration are higher than the AAQC.

CAS = Chemical Abstracts Service; N/A = not applicable; – = no value for the respective parameter and or averaging time.

Table 5-4: Operations Phase - Emission Summary Table with Comparison to Ontario Regulation 419/05 Standards and Guidelines

Parameter	CAS Number	Averaging Time	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Ontario Regulation 419/05 Standard or ACB (µg/m³)	ACB B1/B2	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	20.7	66	120	B1	55
Respirable silica (<10µm)	Various	24-hour	0.63	2.78	5	B1	56
Nitrogen oxides (NO_x, reported as NO_2)	10102-44-0	1-hour	99	307	400	B1	77
		24-hour	33.8	61	200	B1	30
Carbon monoxide (CO)	630-08-0	0.5-hour	363	1,704	6,000	B1	28
Sulphur dioxide (SO_2)	7446-09-5	1-hour	4.26	22.0	100	B1	22
		Annual	0.001	0.011	10	B1	0.1
Hydrogen cyanide (HCN)	74-90-8	24-hour	0.42	4.22	8	B1	53
Calcium oxide (CaO)	1305-78-8	24-hour	0.13	1.08	10	B1	11
Copper sulphate ($CuSO_4$)	7758-99-8	24-hour	0.040	0.34	0.5	B2	68
Arsenic (As)	7440-38-2	24-hour	0.0035	0.011	0.3	B1	3.7
Chromium (Cr)	7440-47-3	24-hour	0.0023	0.007	0.5	B1	1.5
Copper (Cu)	7440-50-8	24-hour	0.0027	0.009	50	B1	0.02
Iron (Fe)	7439-89-6	24-hour	1.54	5.01	25	B2	20.1
Lead (Pb)	7439-92-1	24-hour	0.0025	0.008	0.5	B1	1.6
		30-day	0.000007	0.008	0.2	B2	4.1
Magnesium (Mg)	1309-48-4	24-hour	0.60	1.96	72	B1	2.7
Manganese (Mn)	7439-96-5	24-hour	0.038	0.12	0.4	B1	31
Mercury (Hg)	7439-97-6	24-hour	0.000006	0.000021	2	B1	0.001
Nickel (Ni)	7440-02-0	24-hour	0.0018	0.0058	2	DAV	0.3
		Annual		0.00025	0.4	AAV	0.1
		Annual		0.00025	0.04	B1	0.6
Zinc (Zn)	7440-66-6	24-hour	0.0053	0.017	120	B1	0.01

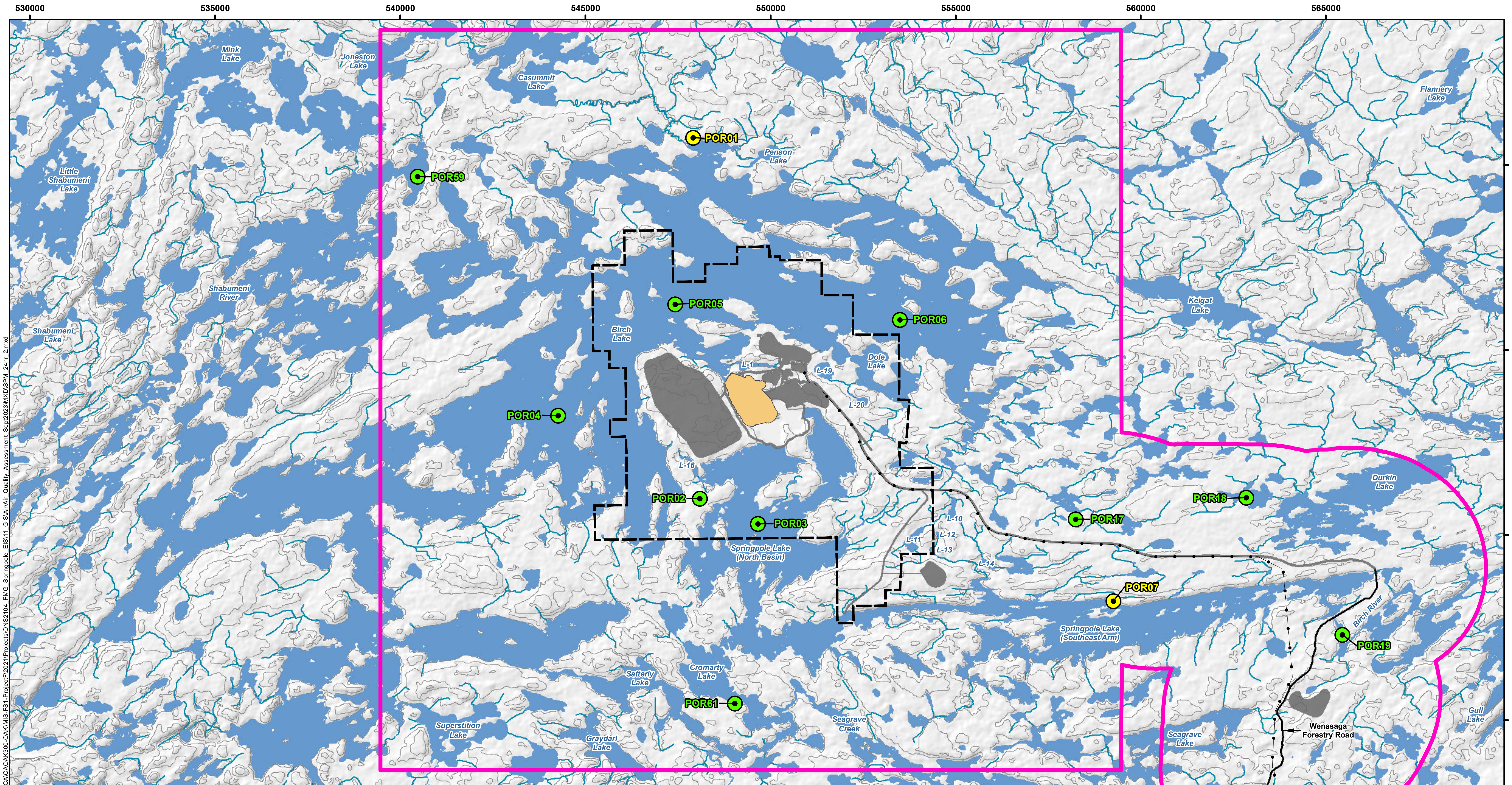
Note:

CAS = Chemical Abstracts Service; AAV = Annual Assessment Value; DAV = Daily Assessment Value; N/A = not applicable.

Table 5-5: Operations Phase - Emission Summary Table with Comparison to Canadian Ambient Air Quality Standards

Parameter	CAS Number	Averaging Time (HR - Unless Noted Otherwise)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	Canadian Ambient Air Quality Standard - 2025 (µg/m³)	% of CAAQS
Fine particulate matter ($PM_{2.5}$)	N/A	24	4.80	9.1	13.9	27	51
		Annual	0.98	4.2	5.2	8.8	59
Nitrogen oxides (as NO_2)	10102-44-0	1	107	30	137	79	**Exceeding CAAQS**
		Annual	3.40	0.6	4.00	23	17
Sulphur dioxide (SO_2)	7446-09-5	1	1.38	1.0	2.38	170	1
		Annual	0.04	0.3	0.45	10	3

Note:
CAS = Chemical Abstracts Service; N/A = not applicable.



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

- Predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological condition over five years of meteorological data).
- Isopleths map out the maximum concentration predicted for each averaging time at each receptor, and therefore present the worst-case scenario. The isopleths are not adjusted in the same manner that the maximum POI concentrations (tabular results) are because the anomalies do not affect all receptors. The isopleths shown may suggest an exceedance which is the result of these meteorological anomalies, but which cannot be removed from the concentration plot; concentrations in the tables rather than the concentration plots should be taken as the absolute value of each maximum predicted concentration.

NOTES:

- Topographic information extracted from LIO, MNRF.
- Receptor locations provided by First Mining Gold, July 2021.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

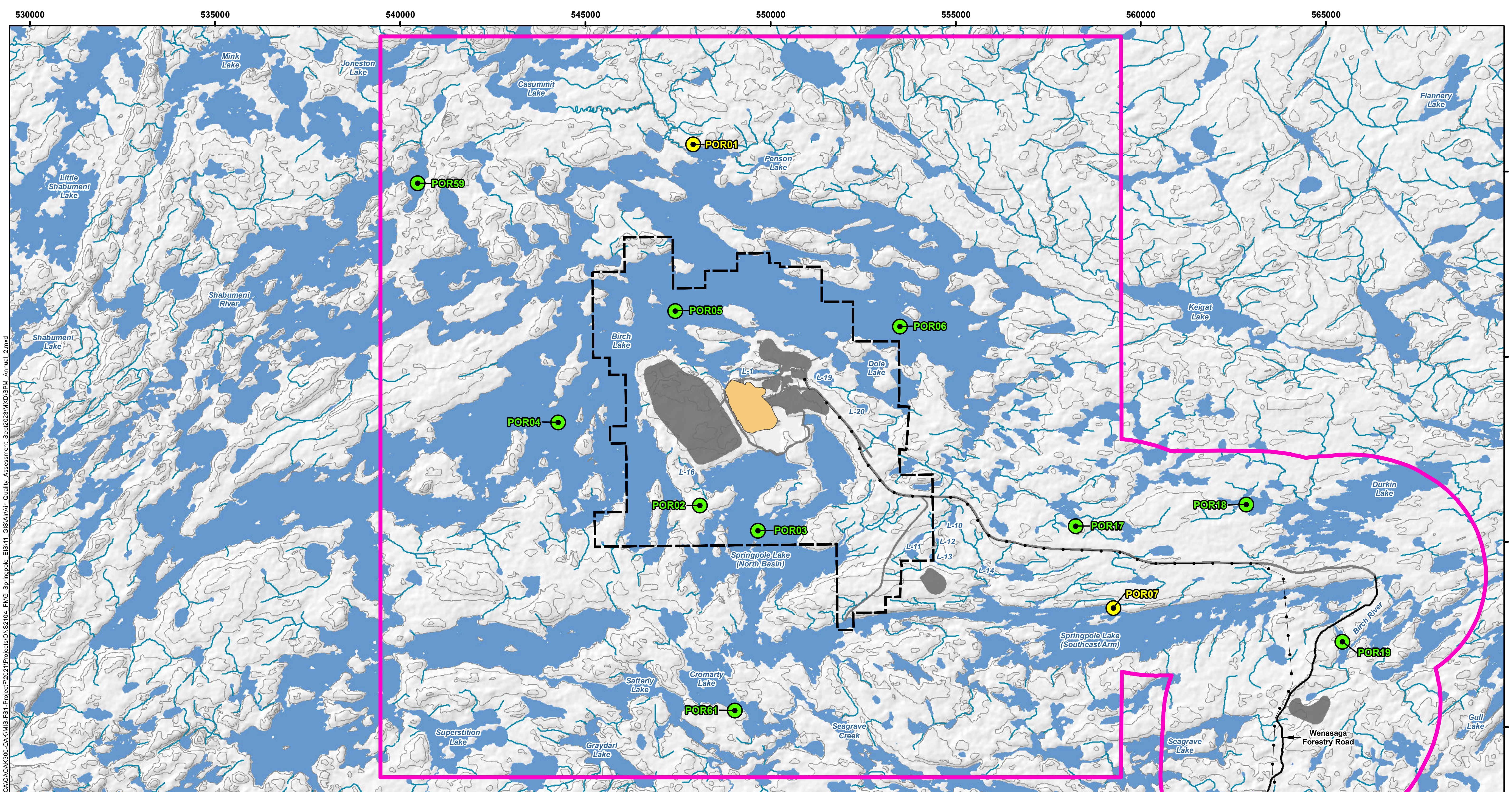
FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

SPM Concentration Isopleth (24-Hour Averaging Time)

PROJECT Nº: ONS2104	FIGURE: 5-1
SCALE: 1:97,000	DATE: June 2024



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LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

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0 2.5 5 10 15 20 Kilometres

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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

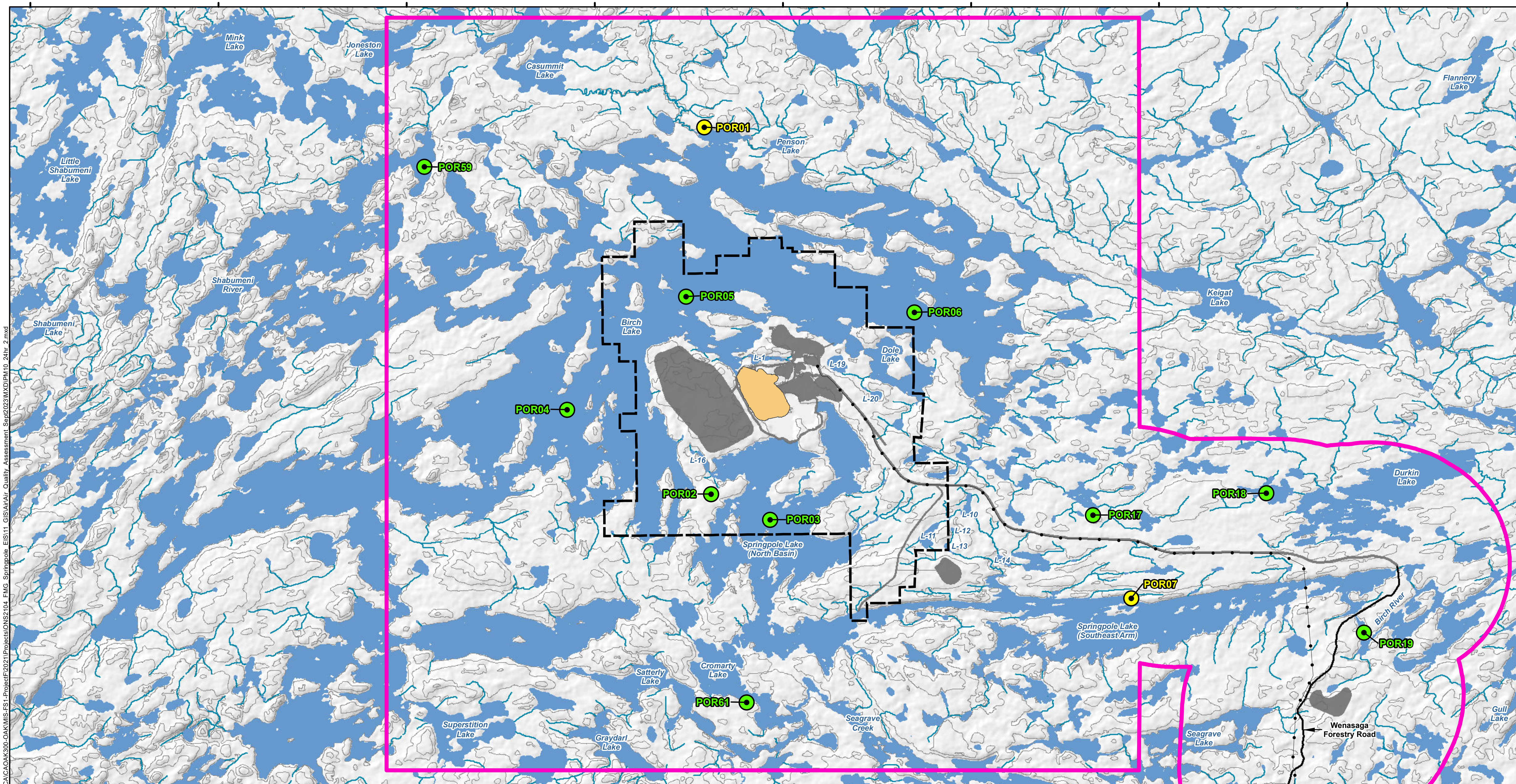
FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

SPM Concentration Isopleth (Annual Averaging Time)

PROJECT N°: ONS2104	**FIGURE: 5-2**
SCALE: 1:97,000	DATE: June 2024



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LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

- Predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological condition over five years of meteorological data).
- Isopleths map out the maximum concentration predicted for each averaging time at each receptor, and therefore present the worst-case scenario. The isopleths are not adjusted in the same manner that the maximum POI concentrations (tabular results) are because the anomalies do not affect all receptors. The isopleths shown may suggest an exceedance which is the result of these meteorological anomalies, but which cannot be removed from the concentration plot; concentrations in the tables rather than the concentration plots should be taken as the absolute value of each maximum predicted concentration.

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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

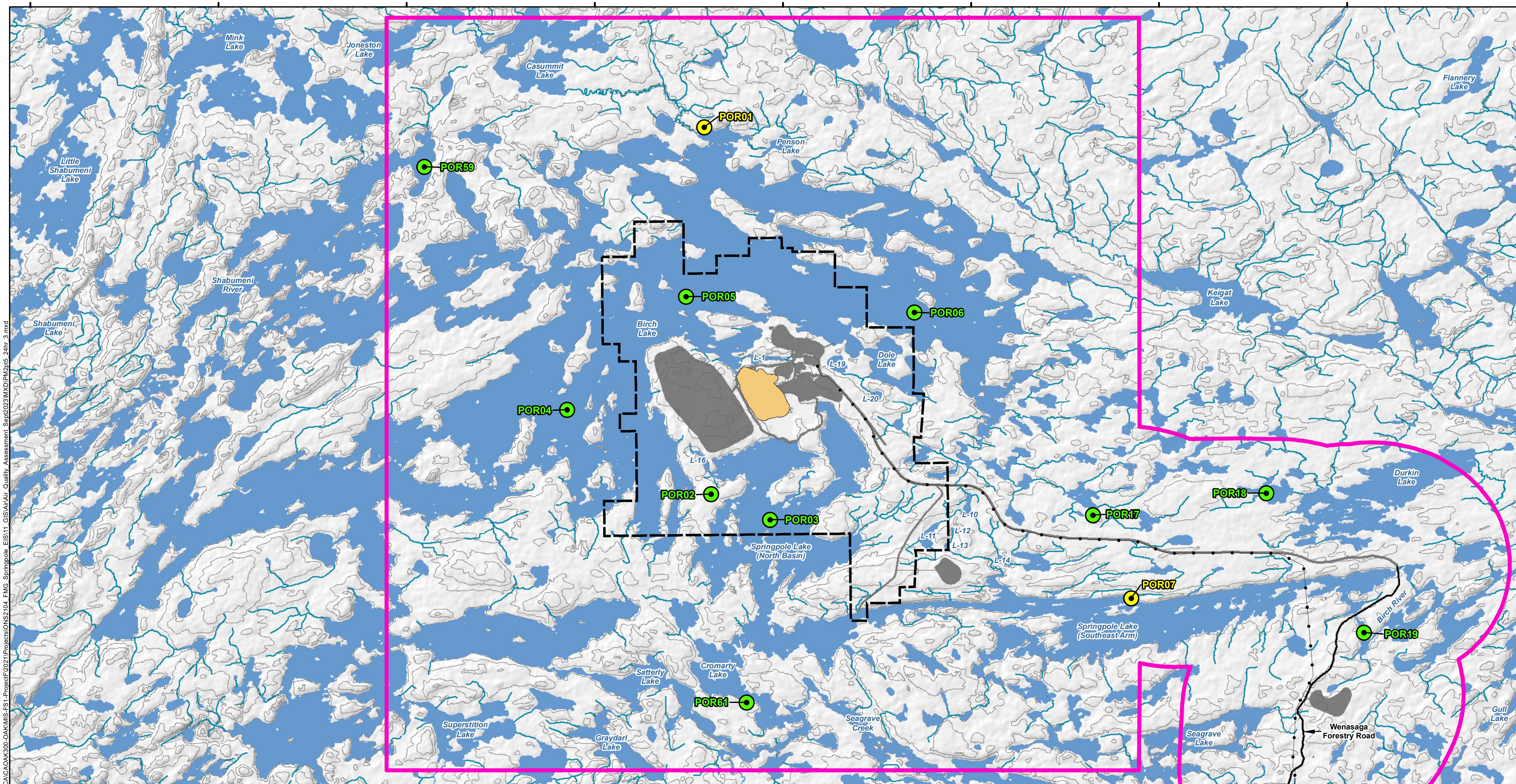
FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

PM_{10} Concentration Isopleth (24-Hour Averaging Time)

PROJECT N°: ONS2104	FIGURE: 5-3
SCALE: 1:97,000	DATE: June 2024



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LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

- Predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological condition over five years of meteorological data).
- Isopleths map out the maximum concentration predicted for each averaging time at each receptor, and therefore present the worst-case scenario. The isopleths are not adjusted in the same manner that the maximum POI concentrations (tabular results) are because the anomalies do not affect all receptors. The isopleths shown may suggest an exceedance which is the result of these meteorological anomalies, but which cannot be removed from the concentration plot; concentrations in the tables rather than the concentration plots should be taken as the absolute value of each maximum predicted concentration.

NOTES:

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- Receptor locations provided by First Mining Gold, July 2021.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

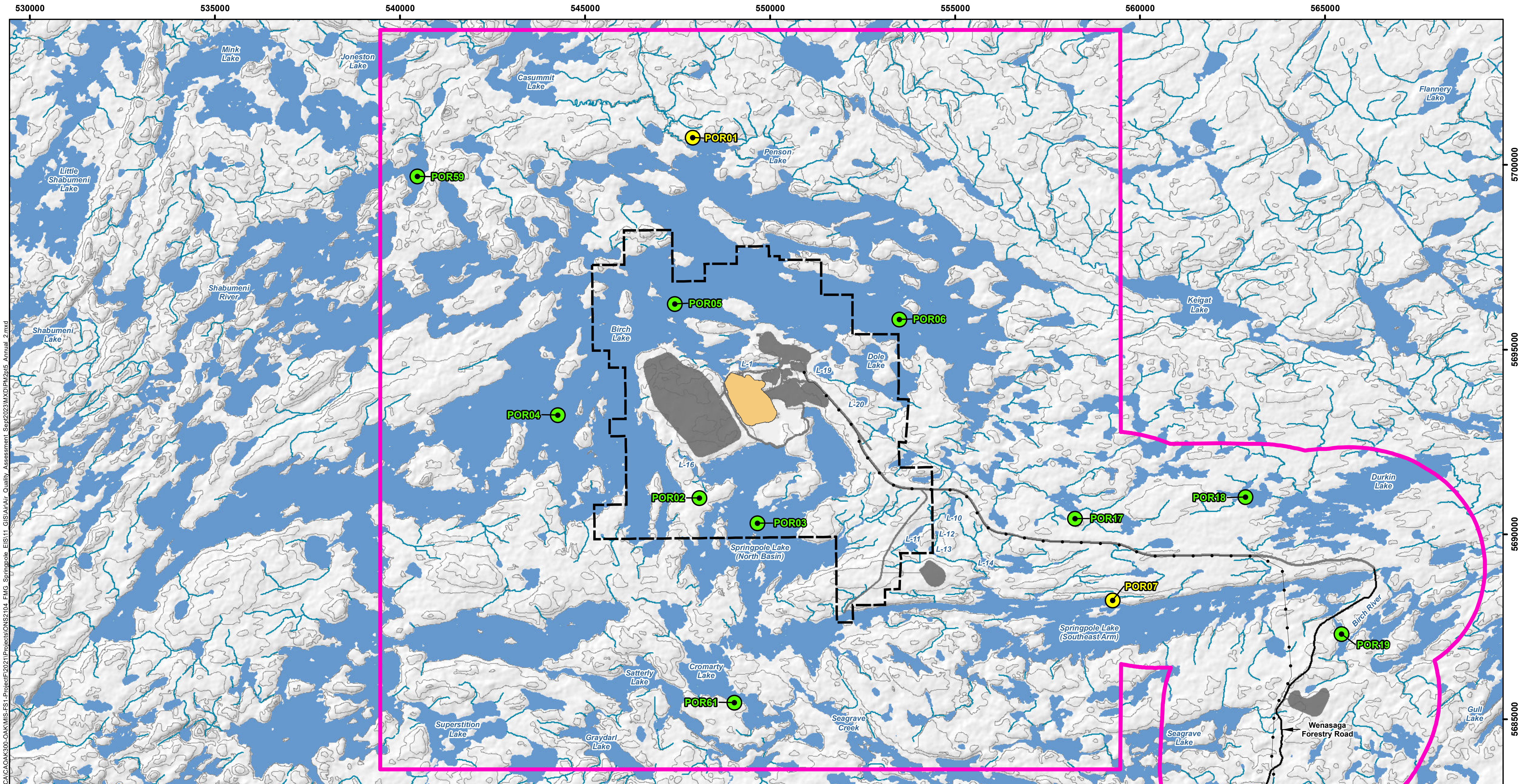
0 2.5 5 10 15 20 Kilometres

FIRST MINING GOLD | wsp

SPRINGPOLE GOLD PROJECT

$PM_{2.5}$ Concentration Isopleth (24-Hour Averaging Time)

PROJECT Nº: ONS2104	FIGURE: 5-4
SCALE: 1:97,000	DATE: August 2024



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

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0 2.5 5 10 15 20 Kilometres

NOTES:

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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

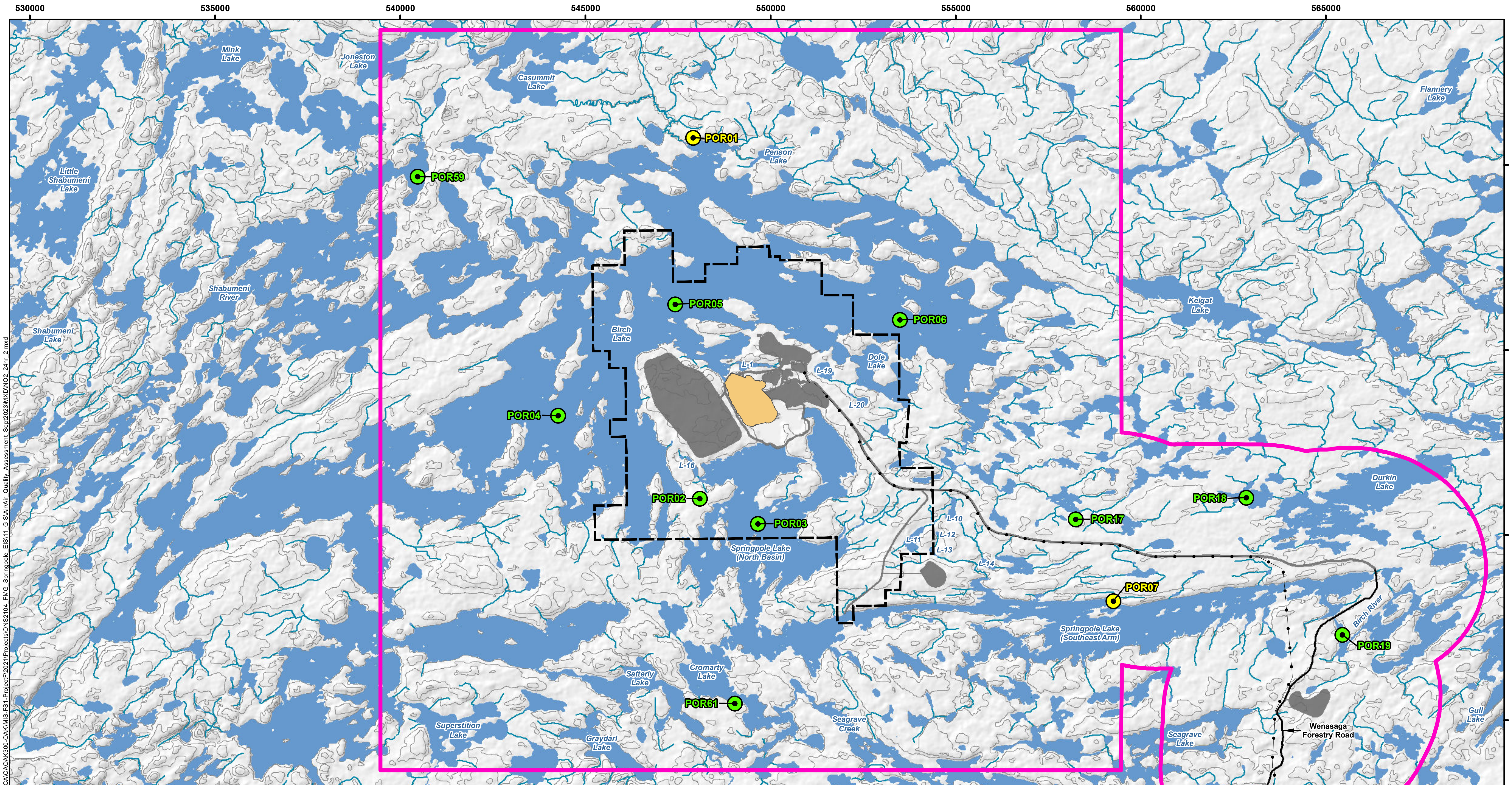
FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

$PM_{2.5}$ Concentration Isopleth (Annual Averaging Time)

PROJECT Nº: ONS2104	FIGURE: 5-5
SCALE: 1:97,000	DATE: June 2024



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

- Predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological condition over five years of meteorological data).
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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

FIRST MINING GOLD

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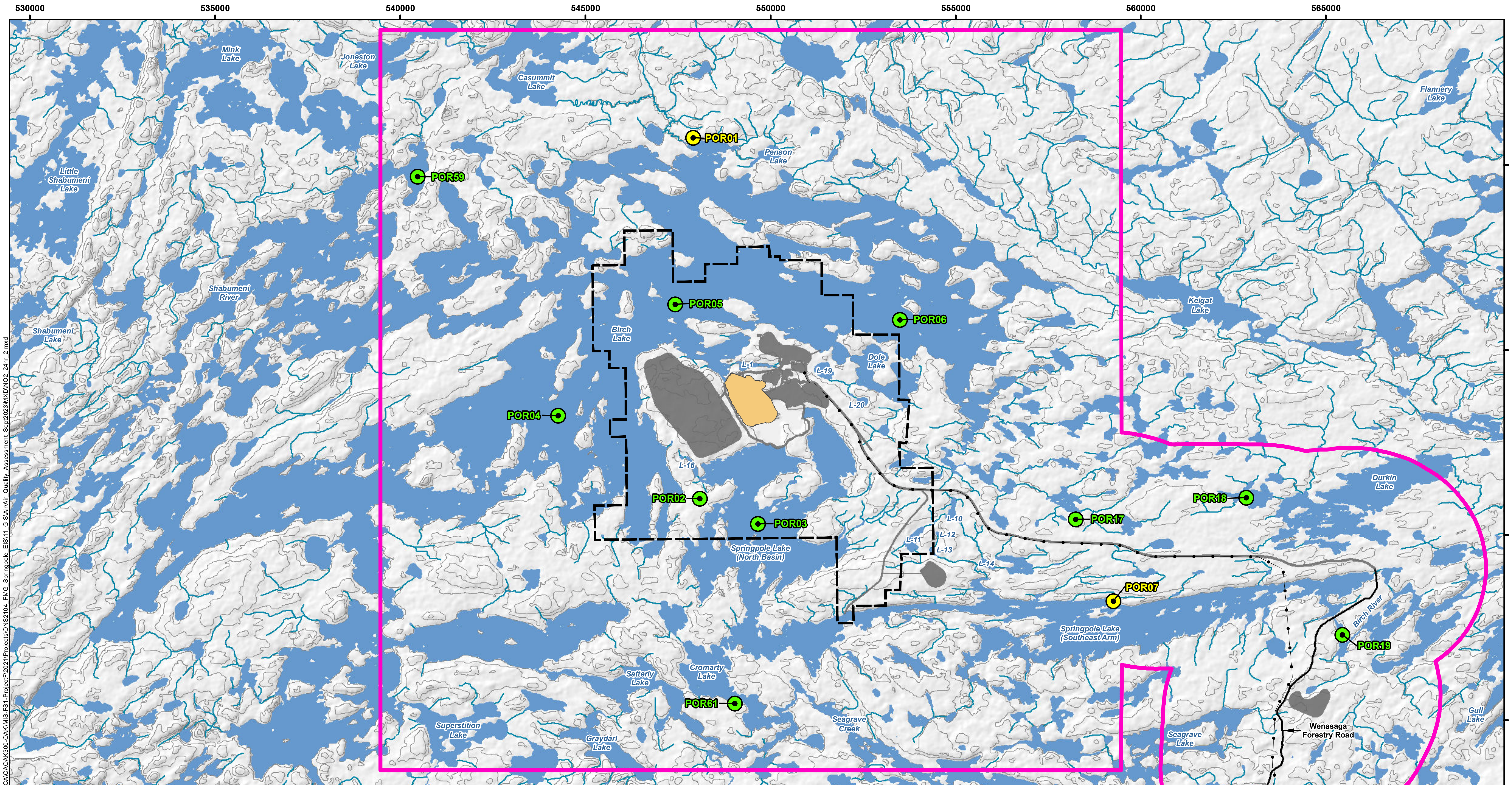
SPRINGPOLE GOLD PROJECT

NO_2 Concentration Isopleth (1-Hour Averaging Time)

PROJECT Nº: ONS2104	FIGURE: 5-6
SCALE: 1:97,000	DATE: June 2024



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

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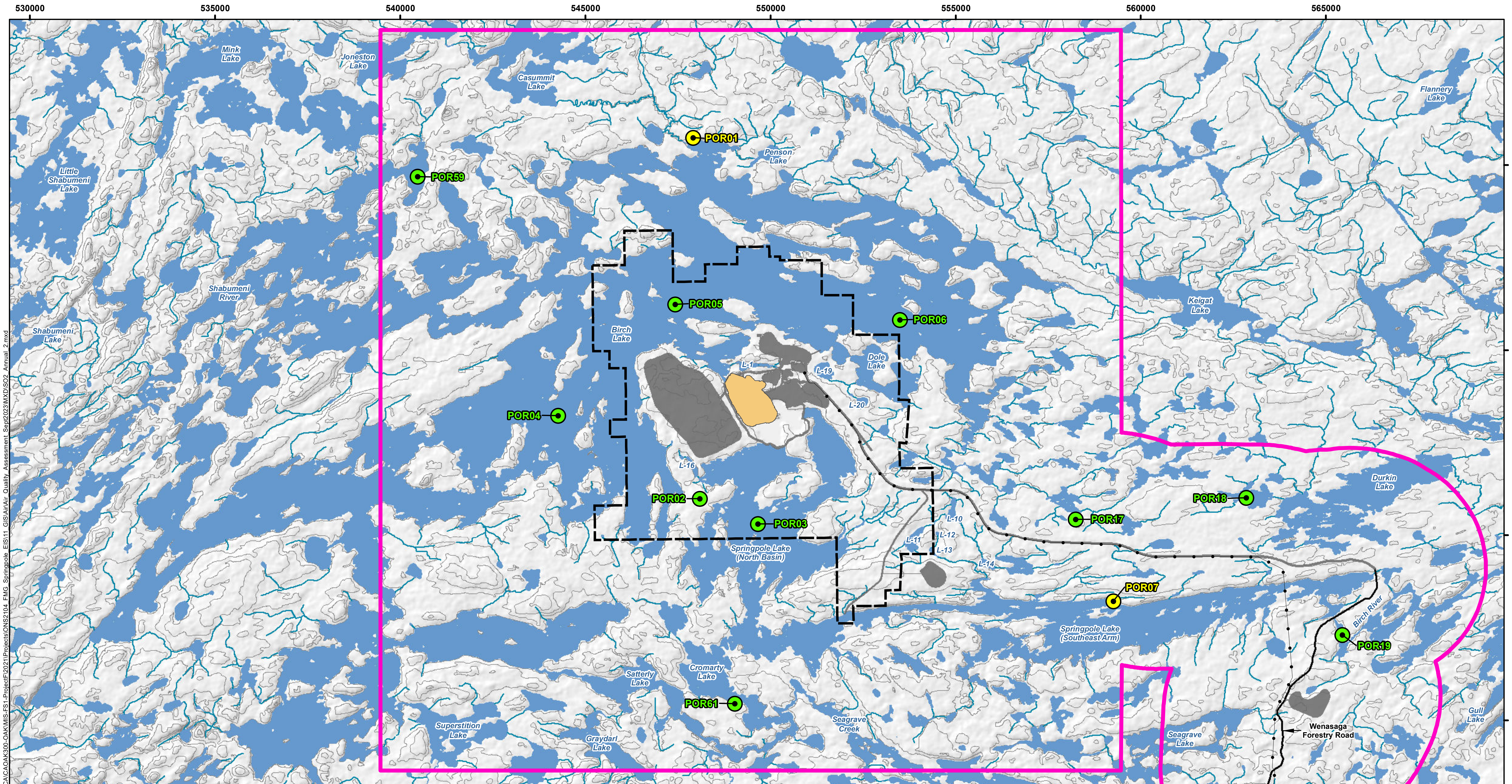
SPRINGPOLE GOLD PROJECT

NO_2 Concentration Isopleth (24-Hour Averaging Time)

PROJECT N°: ONS2104	FIGURE: 5-7
SCALE: 1:97,000	DATE: June 2024



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LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

- Predicted concentrations should be considered in the context of the conservative nature of the emission rate estimates (all sources active at maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological condition over five years of meteorological data).
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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

FIRST MINING GOLD

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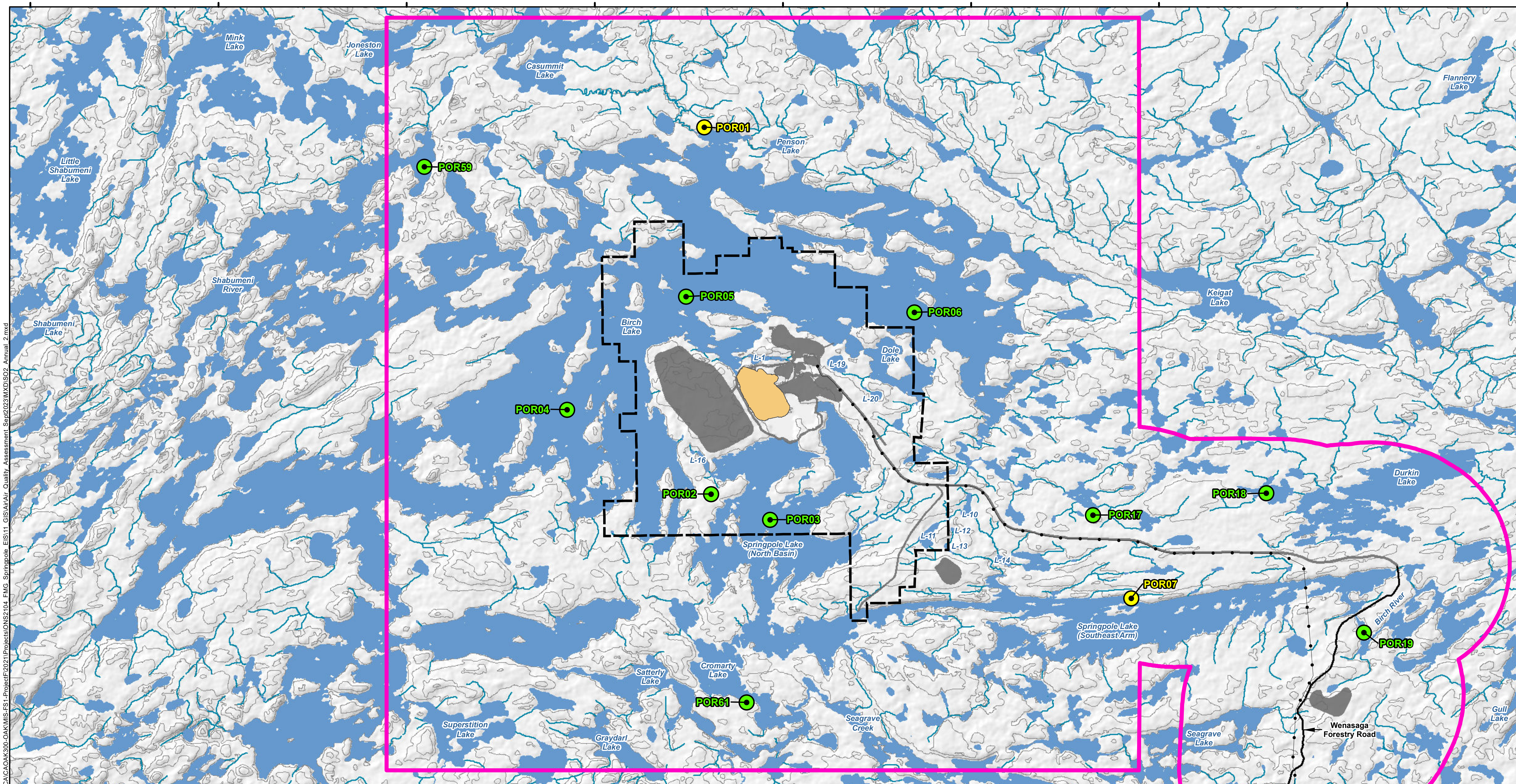
SPRINGPOLE GOLD PROJECT

SO_2 Concentration Isopleth (10-Minute Averaging Time)

PROJECT N°: ONS2104	FIGURE: 5-8
SCALE: 1:97,000	DATE: June 2024



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LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

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0 2.5 5 10 15 20 Kilometres

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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

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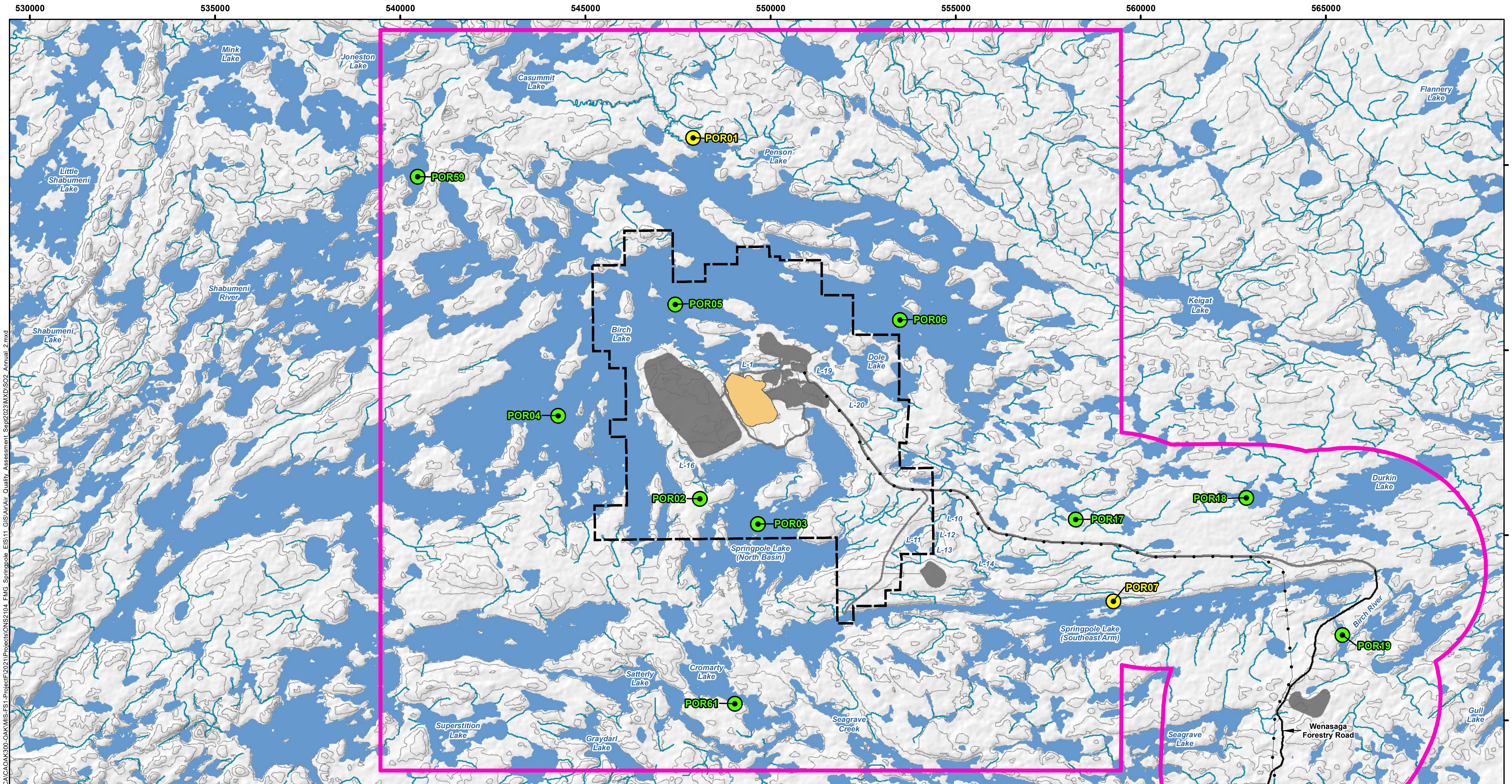
SPRINGPOLE GOLD PROJECT

SO_2 Concentration Isopleth (1-hour Averaging Time)

PROJECT N°: ONS2104	FIGURE: 5-9
SCALE: 1:97,000	DATE: June 2024



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Disclaimers:

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0 2.5 5 10 15 20 Kilometres

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Datum: NAD83
Projection: UTM Zone 15N

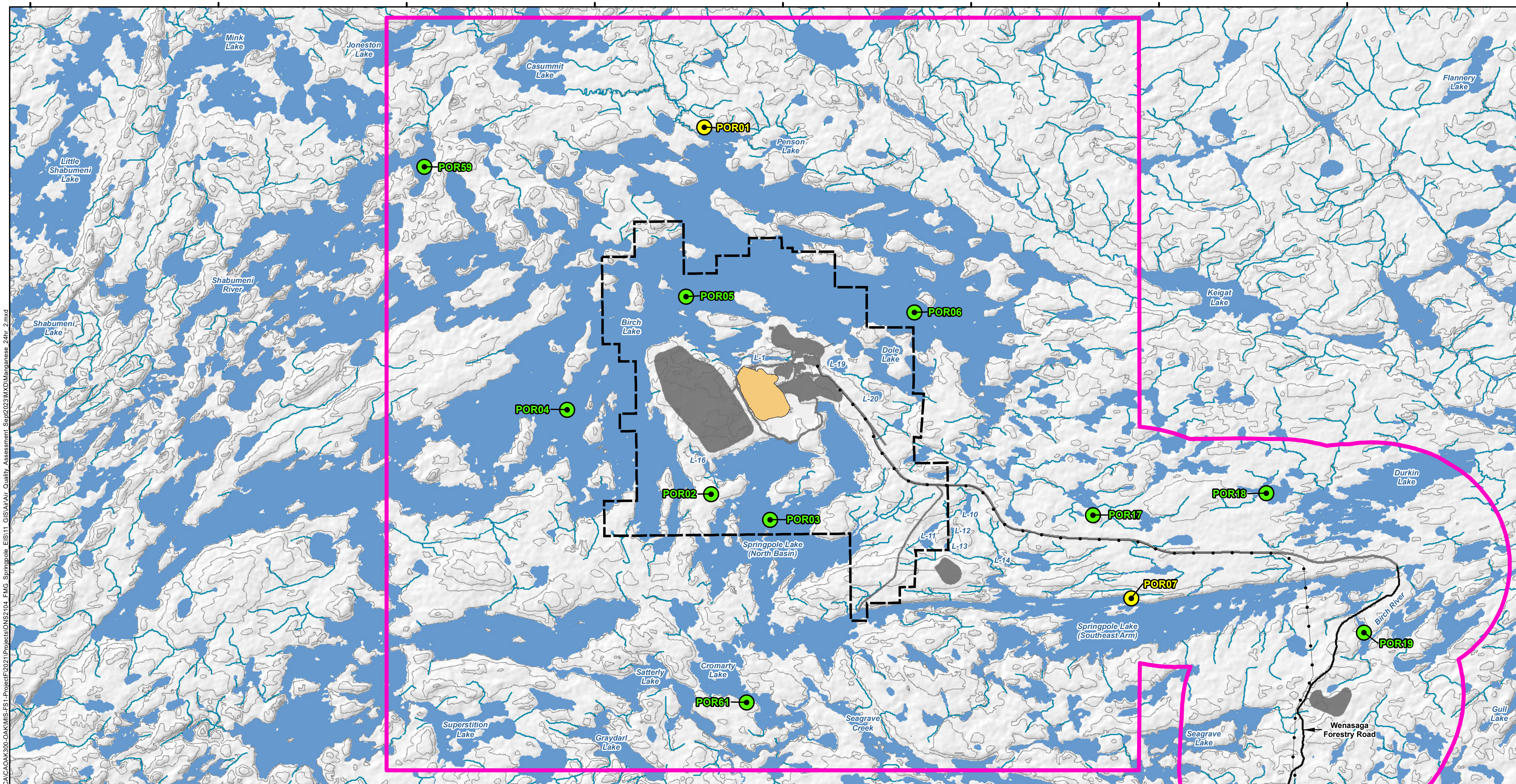
FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

SO_2 Concentration Isopleth (Annual Averaging Time)

PROJECT N°: ONS2104	**FIGURE: 5-10**
SCALE: 1:97,000	DATE: June 2024



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

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0 2.5 5 10 15 20 Kilometres

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Datum: NAD83
Projection: UTM Zone 15N

FIRST MINING GOLD

wsp

SPRINGPOLE GOLD PROJECT

Manganese in $PM_{2.5}$ Concentration Isopleth (24-Hour Averaging Time)

PROJECT Nº: ONS2104	**FIGURE: 5-11**
SCALE: 1:97,000	DATE: June 2024

6.0 PARAMETER SENSITIVITY

6.1 Model

AERMOD is Ontario's approved air dispersion model for evaluating air quality effects within 50 km of a Project, and where there are no notable terrain features or major waterbodies.

The model uses source input parameters (e.g., location, flows, emissions rates), terrain inputs, and a five-year meteorological dataset to predict the maximum air parameter concentrations for the given inputs. An assumption of the method is that all sources are operating at maximum activity levels concurrently to create a maximum emissions scenario for modelling. This assumption results in conservatism build into the modelled results (i.e., predicted concentrations). In addition to considering the magnitude of the maximum predicted air quality concentration, a frequency assessment allows for the determination of the likelihood of such an event taking place.

6.2 Use of Regional Monitoring Data to Establish Baseline Concentrations

Where data could be collected on site in a robust and representative manner, these data were preferentially used to establish the baseline concentrations used and otherwise were used to qualify the use of regional data.

In some cases, the assessment used three to five years of data from the referenced NAPS monitoring stations, so that a robust, long-term monitoring dataset was used to establish baseline concentrations.

Although the selected NAPS locations are influenced by local urban sources, they are broadly reflective of regional air quality, and from an EA perspective they are expected to overestimate parameters relative to the Project site. This lends itself to a conservative approach when assessing the effects on air quality from the Project.

The sensitivity of the assessment to baseline concentration accuracy depends on the parameter concentration relative to its criteria. In this context, the air quality effects predictions for VOCs and PAHs are sensitive to uncertainty in the baseline concentrations that are elevated in relation to the respective AAQCs. In particular, the annual average baseline concentration for benzene is 67% of the AAQC, and for b(a)p the baseline concentrations are at 72% of the 24-hour AAQC and 180% of the annual AAQC, respectively.

Tailpipe emissions from equipment contribute to increased level of volatiles such as benzene and b(a)p, which given the elevated baseline concentrations can contribute to exceedances of AAQCs. This type of finding is typical of air quality assessments in Ontario where baseline benzene and b(a)p concentrations, attributed to a variety of sources including industry and transportation, are high relative to the stringent criteria.

In summary, the uncertainty created by using regional data was mitigated by using sources in areas of higher air parameter concentrations (e.g., southern Ontario) and using the data from the years that give the highest statistical values for a conservative assessment.

6.2.1 Silt Content and Dust Control Efficiency for Unpaved Roads

Empirical calculations to estimate emission factors according to the method outlined in the US EPA (2023c) AP-42 emission factor compilation Section 13.2.2 Unpaved Roads requires site-specific inputs including the road surface silt content.

The US EPA's AP-42 Chapter 13.2.2 provides a silt content range of 3.9% to 9.7% with a mean of 5.8% for Taconite (lean iron ore) mining and processing haul roads to/from the pit based on studies in the 1970s. Keeping an unpaved road surface's silt level on the lower end of what was typical in the 1970s was considered feasible using modern practices. Considering the proximity of the planned haul road to the property line, it was assumed that highly effective road surface design and maintenance (including a robust fugitive dust management plan and monitoring program) would be required. Further, the onsite crushing and screening plant will be able to provide coarse aggregate product to an engineered specification with less than 3.9% silt for use as road surface.

To provide additional conservatism around silt content, particulate was assessed using both 3.9% and 5.8% silt content to demonstrate the variability of results and the importance of the Project having highly effective road surface design and maintenance.

Dust control efficacy on unpaved haul roads is also an important consideration for most operations with haul roads as it is difficult to accurately quantify. Control efficiencies of 85% to 95% reflect well-managed sites with effective dust management programs.

Control efficiencies are multiplicative, meaning that an overall control efficiency may be estimated considering the expected efficiency of individual control measures as follows:

Where CE = Control Efficiency,

$CE_{Total} = 1 - (1\text{-}CE_1)\times(1\text{-}CE_2)\times\ldots(1\text{-}CE_N)$

Considering the following individual CEs, an overall CE of more than 95% is justified where an effective dust management and monitoring plan is implemented:

- Watering: 70% to 75%;
- Chemical dust suppression: 80% to 84%; and
- Limit vehicle speeds: 44%.

To provide additional conservatism around dust control, modelling of the roads considering both 85% and 95% dust control efficiency was done to demonstrate the variability of results and the importance of the Project having highly effective dust control measures.

Practically, dust controls efficacy can be difficult to measure. A robust fugitive dust management plan and monitoring program with continuous particulate monitoring to allow a feedback loop will be key tools in helping the Project minimize offsite effects.

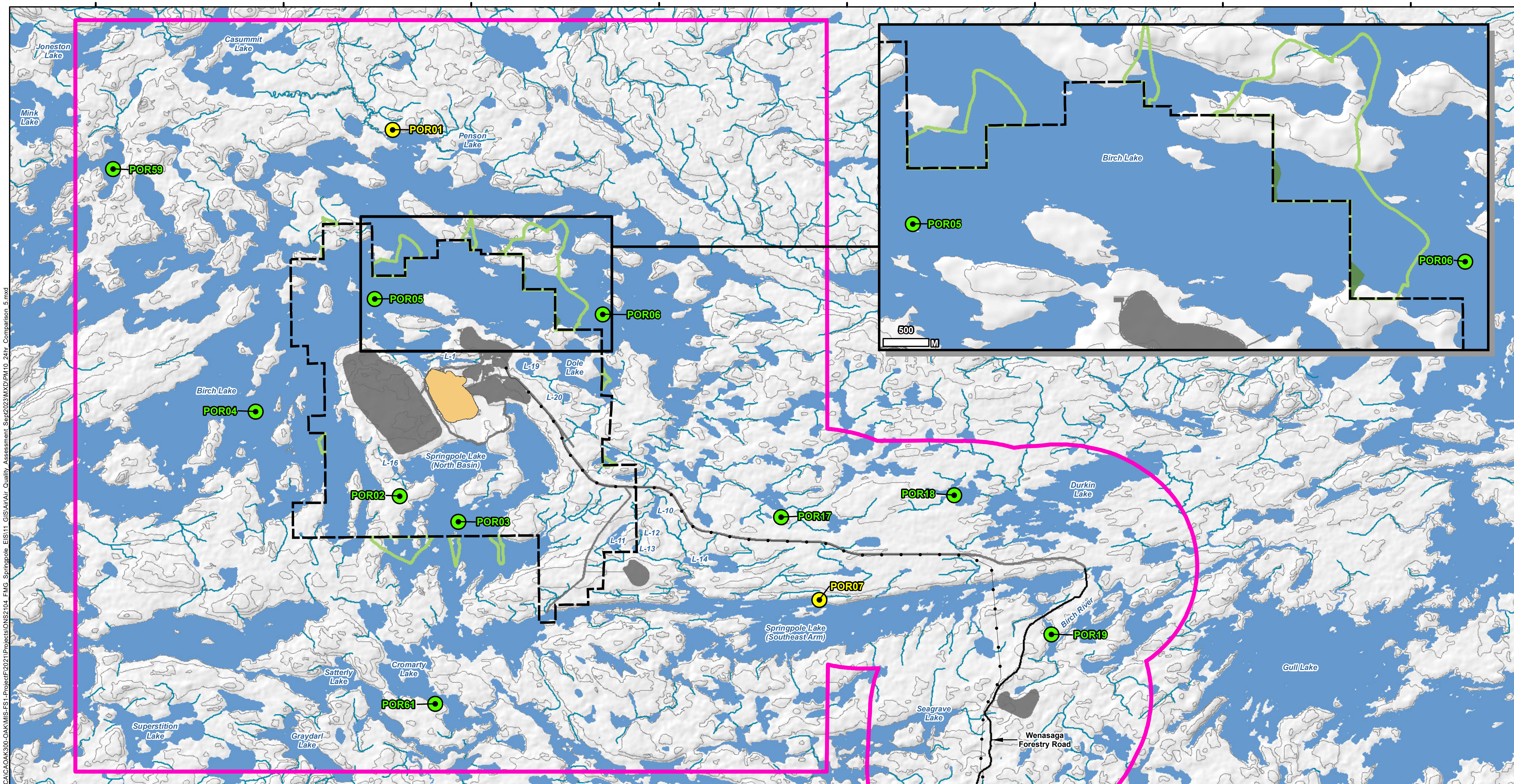
A comparison of the different silt contents and dust control efficiencies is presented in Table 6-1. This table demonstrates that road silt content is far less important in the assessment of effects than dust control efficiency and that the focus of efforts for the Project should be on having a robust fugitive dust management program.

The extent of effects (i.e., 100% of the AAQC) between the scenarios (see Figure 6-1) is comparable with the exception of POR05, having predicted exceedances for the low dust control / higher silt scenario for PM_{10}; note the isopleths have not had meteorological anomalies removed and tabular values (Table 6-1) should be taken as final. Note, Figure 6-1 also provides an isopleth of where concentrations reach 75% of the AAQC for reference. A frequency plot for POR05 (POR with the highest predicted concentration) is provided as Figure 6-2 which shows that exceedances of the PM_{10} AAQC at this receptor are predicted 0.1% of the time (two days) in a five-year period; all exceedances are predicted in November and December during generally frozen conditions when use is not expected and no exceedances are predicted for $PM_{2.5}$.

Table 6-1: Comparison of Operations Phase Particulate Maximum Point of Reception Results with Varying Silt Content and Dust Control Efficacy

Parameter	CAS Number	Averaging Time	Receptor ID	AAQC ($\mu g/m^3$)	Modelled + Baseline Concentration ($\mu g/m^3$)		% of AAQC	
					3.9% Silt / 95% Dust Control	5.8% Silt / 85% Dust Control	3.9% Silt / 95% Dust Control	5.8% Silt / 85% Dust Control
Suspended particulate matter (SPM)	N/A	24-hour	POR05	120	33.3(1)	64.8	28(1)	54
		Annual	POR05	60	7.4	10.5	12	17
PM_{10}	N/A	24-hour	POR05	50	28.3(2)	59.3	57(2)	**Exceeding AAQC**
$PM_{2.5}$	N/A	24-hour	POR03	27	19.0	20.2(3)	70	75(3)
		Annual	POR05	8.8	4.8	5.3	55	61

Notes:
(1) POR03 had the highest concentration for the SPM 24-hour averaging time, under the 3.9% silt and 95% control scenario (29% of its AAQC). However, for the purpose of comparison with other silt content and dust control scenarios POR05 is shown in the table above.
(2) POR03 had the highest concentration for the PM_{10} 24-hour averaging time, under the 3.9 % silt and 95% control scenario (60% of its AAQC). However, for the purpose of comparison with other silt content and dust control scenarios POR05 is shown in the table above.
(3) POR02 had the highest concentration for the $PM_{2.5}$ 24-hour averaging time, under the 5.8% silt and 85% control scenario (81% of its AAQC). However, for the purpose of comparison with other silt content and dust control scenarios POR03 is shown in the table above.
CAS = Chemical Abstracts Service; N/A= not applicable.



LEGEND

- Air Quality Modelling Boundary (First Mining Gold Patents and Leases)
- Air Quality Local Study Area
- Proposed Open Pit
- Proposed 230 kV Transmission Line
- Other Proposed Mine Feature
- Existing Road
- Watercourse
- Waterbody
- Contour (10 m intervals)

Receptors within the Air Quality Local Study Area

- Cabin/Lodge/Camp
- TLRU

Project and Baseline Effects

- Project and Baseline Concentrations at 100% of the AAQC
- Project and Baseline Concentrations at 75% of the AAQC

Disclaimers:

- Predicted effects should be considered in the context of the conservative nature of the emission rate estimates (all sources active ay the maximum all the time, activity levels for all years at the maximum year of operations) and the conservative modelling (worst-case meteorological conditions over five years of meteorological data.
- For the low dust control and higher silt, only POR05 predicts exceedances and only 0.1% of the time (2 days) in a 5-year period. All exceedances for POR05 were predicted in November and December during generally frozen conditions when use is not expected.

NOTES:

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- Receptor locations provided by First Mining Gold, July 2021.
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- 230 kV transmission line provided by First Mining Gold, April 2024.

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 Kilometres

FIRST MINING GOLD

WSP

SPRINGPOLE GOLD PROJECT

PM10 Concentration Isopleth (24-Hour Averaging Time) for 95% Dust Control and 3.9% Silt (Top) and 85% Dust Control and 5.8% Silt (Bottom)

PROJECT N°: ONS2104	FIGURE: 6-1
SCALE: 1:97,000	DATE: October 2024

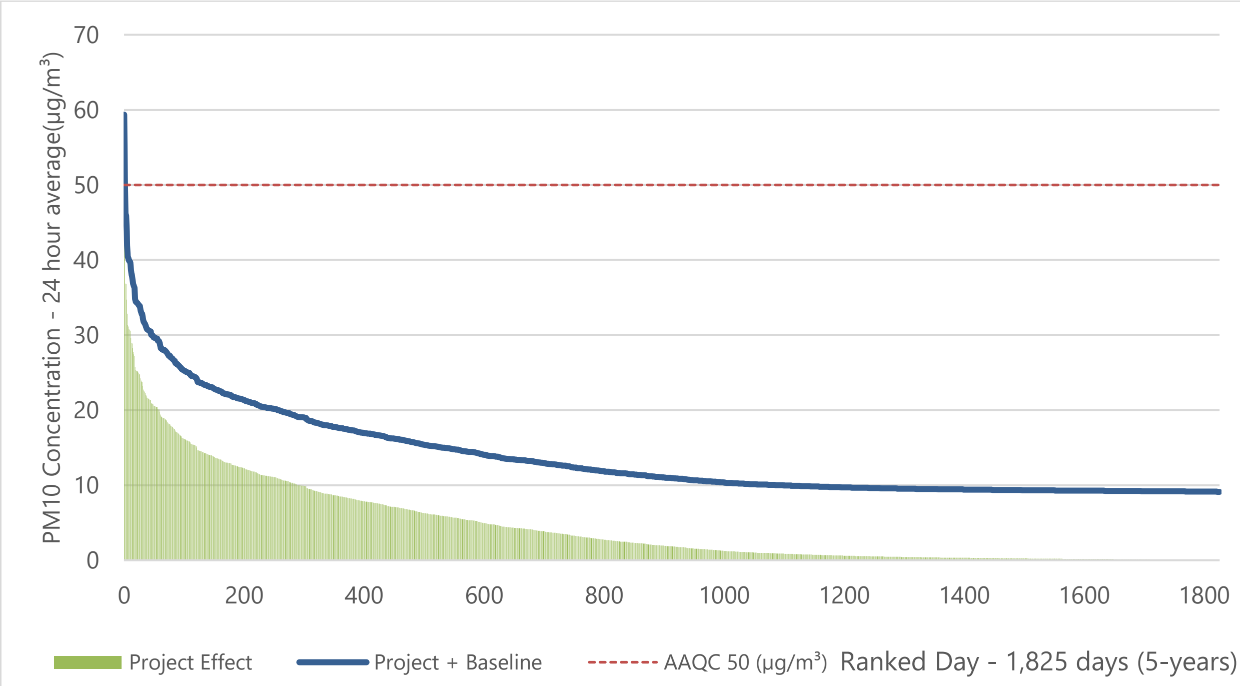

Figure 6-2: Frequency Plot of PM_{10} Concentrations at POR5 with 85% Dust Control and 5.8% Road Silt Content

7.0 MITIGATION MEASURES

The key air parameters emitted from the Project are particulate matter (fugitive dust), criteria air parameters and other by-products of fuel combustion parameters, and metals present on the fugitive dust (i.e., particle-bound). The emissions are mainly attributed to the following sources:

- Construction equipment tailpipe emissions;
- Road dust associated with haul trucks transporting mine rock and ore from the open pit;
- Dust from mining activities within the open pit (drilling, blasting, and loading of haul trucks);
- Dust from material handling at the overburden, ore and CDF;
- Dust from ore crushing; and
- Dust from the exposed area of the CDF.

In areas where there are sensitive receptors or traditional land use areas within 250 m of the transmission line construction footprint, emphasis will be placed on comprehensive implementation of impact management measures such as dust suppression activities. When feasible, equipment will be turned off and will be regularly inspected and maintained.

A dust management plan will be prepared prior to the construction and operations phase to identify all potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation, and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed. The proposed dust control measures will be based on current international best management practices, are predictably effective and are not prone to failure. The dust management plan will include opportunities for adaptive management, in which the intensity of the control measures would be increased if site inspections and monitoring indicate that current measures are insufficient to prevent offsite dust effects.

Dust emissions from roads and mineral stockpiles will be controlled through the application of water spray. If required, chemical suppressants will also be used to control dust, particularly on roads, provided that such applications are acceptable to the MECP; magnesium chloride and calcium chloride are common suppressants used at mining projects. All site roadways will be constructed using coarse aggregate and will be maintained in good condition with regular inspections and timely maintenance completed to minimize the silt loading on the roads.

The process plant emission sources will be designed to allow for good atmospheric dispersion, and dust control equipment such as dust collectors and water sprays will be utilized together with best management practices, where necessary, to reduce emissions.

Blasting also results in appreciable emissions for particulate and nitrogen oxides, and a blasting plan will be developed that will include measures to minimize these air parameter emissions. Nitrogen oxides generated from the blast can be minimized by reducing the water penetration of the set charges, and the blasting plan will include a procedure to minimize the length of time the blasting material is allowed to sit in a drill hole before blasting. As well, blasting will be limited to a set time on any specific blast day with a blast schedule developed to ensure optimal air dispersion and minimize effects on air quality.

Air emissions from diesel consumption associated with mobile heavy equipment operations will be controlled through strategic mine scheduling to minimize the total distance travelled by haul trucks. Other measures to reduce tailpipe air parameter emissions will include:

- Use of low sulphur diesel fuel;
- Implementation of an anti-idling policy;
- Equipment meeting ECCC's vehicle emission requirements; and
- Effective preventive and responsive equipment maintenance.

A preventive maintenance program will be employed that encompasses all pollution control equipment, diesel-fired engines (vehicle, equipment, and standby power generating), and all processes with the potential for meaningful environmental effects.

At closure, exposed dust sources will be vegetated, and progressive reclamation will be used wherever practicable to better control dust emissions from the CDF. A summary of mitigation measures for each of the construction, operations, and closure phases is provided as Table 7-1.

Table 7-1: Summary of Mitigation Measures

Project Phase	Potential Interaction	Mitigation Measure	Description / Commitment	Standard
Construction	Fugitive Dust Emissions	Dust Management Plan	The dust management plan will outline effective fugitive dust management to mitigate potential offsite effects of the particulate matter and trace metals present on the particulate. The dust management plan will detail the following measures: watering frequency, visual monitoring, inspection, record keeping, responsibility, training, complaint response, and corrective actions. The site will have water trucks; if required, other acceptable suppressants (such as magnesium chloride or calcium chloride) will be used following MECP notification and authorization. Travel surfaces will be maintained to minimize silt (fine material). Onsite speed limits will be enforced.	Maintain air quality below O. Reg. 419/05 SPM and metals at offsite receptors.
Construction	Blasting emissions Poor dispersion during specific hours Increased emissions due to specific operational conditions	Blasting schedule will prevent blasting during unfavourable weather conditions. Manufacturer's recommended guidelines regarding water infiltration and time of explosives usage	Mitigation measures identified to reduce offsite effects of particulate, metals and NO_X to meet standards. Meteorological conditions leading to poor air dispersion have been identified; a blasting plan will include a schedule to avoid blasting during unfavourable conditions. Nitrogen oxides (NO_X) emissions may increase if emulsion is left in boreholes for extended period of time due to infiltration of water.	Maintain air quality below O. Reg. 419/05 air quality standards for NO_X, SPM, and metals at offsite receptors.
Construction	Exhaust from generators, trucks, and mobile equipment	Engine Maintenance Program	A preventive maintenance program will be employed that encompasses all pollution control equipment and diesel-fired engines.	Maintain air quality below Ontario's AAQC for NO_2, SO_2, CO, and SPM at offsite receptors.
Construction	Exhaust from trucks and off-road mobile equipment	Equipment compliant with ECCC vehicle emission requirements	Emission reductions achieved through the use of equipment that complies with ECCC's off-road engine emission criteria.	Off-road Compression-Ignition and Large Spark-Ignition Engine Emission Regulations (SOR/2020-258)

Table 7-1: Summary of Mitigation Measures

Project Phase	Potential Interaction	Mitigation Measure	Description / Commitment	Standard
Construction	Sulphur dioxide (SO_2) emissions from diesel fuel use	Use of low sulphur fuel (15 ppm sulphur)	Low sulphur fuels will be used in off-road diesel engines; this will reduce the sulphur dioxide emissions from all sources and the resultant offsite air concentrations.	ECCC Sulphur in Diesel Fuel Regulations (SOR/2002-254) limiting fuel sulphur content to less than 15 ppm for off-road engines
Operations	Fugitive Dust Emissions	Dust Management Plan	The dust management plan will outline effective fugitive dust management to mitigate potential offsite effects of the particulate matter and trace metals present on the particulate and will incorporate adaptive management. The dust management plan will detail the following measures: watering frequency, visual monitoring, inspection, record keeping, responsibility, training, complaint response, and corrective actions. The site will have water trucks; if required, other acceptable suppressants (such as magnesium chloride or calcium chloride) will be used following MECP notification and authorization. Travel surfaces will be maintained to minimize silt (fine material). Onsite speed limits will be enforced.	Maintain air quality below O. Reg. 419/05 standards for SPM and metals at offsite receptors Dust management plan will be part of the MECP ECA
Operations	Exhaust from generators, trucks, and mobile equipment	Engine Maintenance Program	A preventive maintenance program will be employed that encompasses all pollution control equipment and diesel-fired engines.	Maintain air quality below the Ontario AAQC for NO_2, SO_2, CO and particulate matter at offsite receptors
Operations	Exhaust from trucks and off-road mobile equipment	Equipment compliant with ECCC vehicle emission requirements	Emission reductions achieved through the use of equipment that complies with ECCC off-road engine emission criteria.	Off-road Compression-Ignition and Large Spark-Ignition Engine Emission Regulations (SOR/2020-258)
Operations	SO_2 emissions from diesel fuel use	Use of low sulphur fuel (15 ppm sulphur)	Low sulphur fuels will be used in off-road diesel engines; this will reduce the sulphur dioxide emissions from all sources and the resultant offsite air concentrations.	ECCC Sulphur in Diesel Fuel Regulations (SOR/2002-254) limiting fuel sulphur content to less than 15 ppm for off-road engines

Table 7-1: Summary of Mitigation Measures

Project Phase	Potential Interaction	Mitigation Measure	Description / Commitment	Standard
Operations	Particulate emissions from drilling	Control measures provided by equipment supplier	Mitigation measures are required to prevent offsite effects of particulate and metals through the use of equipment with dust control and implementation of the Dust Management Plan.	Compliance with O. Reg. 419/05 standards for SPM and metals at offsite receptors.
Operations	Blasting emissions Poor dispersion during specific hours Increased emissions due to specific operational conditions	Blasting schedule will prevent blasting during unfavourable weather conditions. Manufacturer's recommended guidelines regarding water infiltration and time of explosives usage.	Mitigation measures required to prevent offsite effects of particulate, metals, and NO_X. Meteorological conditions leading to poor air dispersion have been identified; a blasting plan will include a schedule to avoid blasting during unfavourable conditions. Nitrogen oxides (NO_X) emissions may increase if emulsion is left in boreholes for extended period of time due to infiltration of water.	Compliance with O. Reg. 419/05 air quality standards for NO_X, SPM and metals at offsite receptors.
Operations	Hydrogen cyanide (HCN) emissions	HCN destruction at the mill	HCN emissions eliminated, as sulphur dioxide will be used to destroy HCN at the mill before mine rock and tailings are placed in the CDF.	Compliance with O. Reg. 419/05 air quality standard for HCN at offsite receptors
Operations	Material handling at the process plant	Baghouses	Mitigation measures to control dust emissions from crushing (primary and secondary) and reclaim from feed stockpiles are required to prevent offsite effects of particulate and metals. All crushing and reclaim from stockpiles for crushed materials are to be controlled by baghouses. A maintenance plan will ensure baghouses are functioning properly.	Compliance with O. Reg. 419/05 air quality standards for SPM at offsite receptors.
Operations	Particulate emissions from lime silo	Dust collector	Mitigation measures are required to control dust during lime delivery to the silos to prevent offsite effects of particulate. Lime silo vents are to be controlled by a dust collector. A maintenance plan will ensure dust collectors are functioning properly.	Compliance with O. Reg. 419/05 air quality standards for SPM at offsite receptors

Table 7-1: Summary of Mitigation Measures

Project Phase	Potential Interaction	Mitigation Measure	Description / Commitment	Standard
Operations	Emissions from lime slaker	Dust control equipment	Mitigation measures are required to control emissions from the lime slaker to prevent offsite effects of particulate. A maintenance plan will ensure dust control equipment is functioning properly.	Compliance with O. Reg. 419/05 air quality standard for SPM at offsite receptors
Operations	Particulate from dry material handling at the process plant (flocculants, copper sulphate)	Dust collectors	Mitigation measures are required to control emissions from handling and mixing of dry chemicals. Mixing and handling areas are to be controlled by dust collectors. A maintenance plan will ensure dust collectors are functioning properly.	Compliance with O. Reg. 419/05 air quality standard for SPM at offsite receptors
Operations	Emissions from induction furnace	Dust control equipment	Emissions from the furnace are to be controlled. A maintenance plan will ensure dust control equipment is functioning properly.	Compliance with O. Reg. 419/05 air quality standard for SPM at offsite receptors
Operations	SO_2 emissions from HCN destruction	Closed loop delivery and cyanide destruction process	To control emissions during delivery, SO_2 is to be delivered to the site as a pressurized liquid with a return line from the tank to the truck used to prevent filling losses; SO_2 gases displaced from the tank will be captured in the truck. The process tanks for cyanide destruction also operate as closed loop to prevent SO_2 releases to the air.	Compliance with O. Reg. 419/05 air quality standard for SO_2 at offsite receptors
Operations	Emissions from onsite emergency generators	Testing of units one at a time during daytime hours	Mitigation measures are required to control NO_X and particulate emissions from the generators. Testing one unit at a time will reduce short-term emissions, and testing will be conducted during the day when meteorological conditions promote better air dispersion.	Maintain air quality below O. Reg. 419/05 air quality standards for SPM and NO_X at offsite receptors

Table 7-1: Summary of Mitigation Measures

Project Phase	Potential Interaction	Mitigation Measure	Description / Commitment	Standard
Closure	Fugitive Dust Emissions	Dust Management Plan	The dust management plan will outline effective fugitive dust management to mitigate potential offsite effects of the particulate matter and trace metals present on the particulate. The dust management plan will detail the following measures: watering frequency, visual monitoring, inspection, record keeping, responsibility, training, complaint response, and corrective actions. The site will have water trucks; if required, other acceptable suppressants (such as magnesium chloride or calcium chloride) will be used following MECP notification and authorization. Travel surfaces will be maintained to minimize silt (fine material). Onsite speed limits will be enforced.	Maintain air quality at property line below O. Reg. 419/05 standards for SPM and metals at offsite receptors
Closure	Exhaust from generators, trucks, and mobile equipment	Engine Maintenance Program	A preventive maintenance program will be employed that encompasses all pollution control equipment and diesel-fired engines.	Maintain air quality below Ontario's AAQC AAQC for NO_2, SO_2, CO, and particulate matter at offsite receptors
Closure	Exhaust from trucks and off-road mobile equipment.	Equipment compliant with ECCC vehicle emission requirements	Emission reductions achieved through the use of equipment that complies with ECCC's off-road engine emission criteria.	Off-road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations (SOR/2020-258)

8.0 RECOMMENDED MONITORING

An Ambient Air Monitoring Plan will be prepared in accordance with the MECP (2018b) *Operations Manual for Air Quality Monitoring in Ontario*. The Ambient Air Monitoring Plan will be submitted to the MECP for review and approval prior to the construction phase as a component of the application for an ECA (Air and Noise).

Generally, this process includes a review of EA results and discussion on items including:

- Target air parameters for monitoring;
- Sampling duration and frequency;
- Sampling methods and instruments; and
- Reporting requirements.

The Ambient Air Monitoring Plan will include the following:

- Purpose or objectives of the monitoring program;
- Expected duration of the monitoring program;
- Identified air emission source(s);
- Identified receptors;
- Number and location of monitoring sites (including meteorological sites);
- Air quality parameters to be monitored and the monitoring frequency;
- Monitoring methods / instruments to be used;
- Analytical methods / procedures;
- Laboratory services support to be used;
- Dispersion model to be used (if applicable);
- Quality assurance / quality control plan; and
- Data reporting procedures.

Details of the recommended monitoring, based on the findings of the assessment are provided in Table 8-1.

Table 8-1: Recommended Monitoring

Parameter	Criterion
Suspended particulate matter (SPM)	Based upon the AAQCs for SPM (24-hour and annual averaging times).
Metals	Ambient air quality criteria for metals. The metals to be monitored will be identified in the Air Quality Monitoring Plan that will be submitted to the MECP prior to initiating the monitoring program.
PM_{10}	Ambient air quality criteria (24-hour averaging time).
$PM_{2.5}$	Ambient air quality criteria (24-hour and annual averaging times).
Dustfall	Ambient air quality criteria for dustfall (30-day and annual averaging times).
Respirable silica	Ambient air quality criteria (24-hour averaging time).
NO_2	Ambient air quality criteria (1-hour and 24-hour averaging times).
SO_2	Ambient air quality criteria (10-min, 1-hour, and annual averaging times).

9.0 CONCLUSIONS

This Air Quality Assessment Report has been prepared to assess the potential effects of the construction, operation, and closure phases of the Project on air quality. The assessment considers the modelled effects of the Project on ambient air concentrations for each parameter, as well as the cumulative effect of the Project emissions and the existing baseline air concentrations established for the Project.

The notable findings of the air quality assessment were as follows:

- The Project is subject to the Ontario *Environmental Protection Act* Section 9 requirement and will require approval from the MECP to construct and operate. It was determined that the Project met the requirements of O. Reg. 419/05 and there were no modelled exceedances of the Air Quality Standards or other ACBs, which demonstrates that the Project meets the air quality requirements for obtaining the required ECA for air.
- For all phases, predicted concentrations of parameters except for b(a)p were below the respective AAQC for all averaging times, even with consideration of both Project emissions and the existing baseline concentrations.
  - The combustion of fuels results in trace emissions of polycyclic aromatic hydrocarbons to the air, for which b(a)p is used as a surrogate in air quality assessments. The predicted b(a)p concentrations resulting from these Project emissions are below the AAQC for both the 24-hour and the annual averaging times. However, the baseline b(a)p concentration of 0.000018 µg/m^3 for the annual averaging time is greater than the AAQC, and the baseline concentration of 0.000036 µg/m^3 for the 24-hour averaging time is at 72% of the respective AAQC. As a result, there are modelled exceedances along the northern extent of the leased lands when cumulative concentrations are considered for the operations phase.
- Air quality effects associated with the mine infrastructure construction were evaluated with emissions from equipment tailpipe and construction activities considered. Air quality effects were limited to the Project site and there were no predicted exceedances of the AAQC at or beyond the Project boundary with the exception of b(a)p due to the elevated annual baseline concentrations that are already exceeding the AAQC (note that the modelled Project effects of b(a)p only account for 3% of the AAQC).
- Air quality concentrations associated with the mine access road and transmission line construction were evaluated, with emissions from equipment tailpipe and construction activities considered. Air quality effects were limited to the construction footprint and there were no predicted exceedances of the AAQC.
- The CAAQS were included as air quality criteria for the assessment; these CAAQS were not developed as facility level regulatory standards. Rather, they are intended for use by the provinces and territories to guide air zone management actions as an indicator of good air quality (CCME 2019). For nitrogen dioxide, the Ontario AAQC over the same averaging time is over four times greater than the CAAQS and is protective against effects on health and the environment (MECP 2020). However, Project effects were compared to the CAAQS for discussion which indicated that predicted exceedances may occur for nitrogen dioxide for the one-hour averaging time for the operations phase, construction of the mine infrastructure, and construction of the mine access road.

To minimize air quality effects, the Project includes the following mitigation and operational controls:

- A dust management plan will be prepared prior to the construction and operations phases that will be subject to MECP review and approval as part of the provincial ECA application process. The plan will identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation, and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed. The proposed dust control measures will be based on current international best management practices that are predictably effective and are not prone to failure. The dust management plan will utilize adaptive management, in which the intensity of the control measures may need to be adjusted based on site inspections and monitoring.
- A blasting plan to control the emissions of particulate matter and nitrogen oxides and to restrict blasting to specific hours of the day, where the meteorological conditions are favourable and atmospheric dispersion is optimized.
- A preventive maintenance program will be employed that encompasses all pollution control equipment, diesel-fired engines (vehicle, equipment, and standby power generating), and all processes with the potential for meaningful environmental effects.
- An ambient air quality monitoring program will be established in consultation with the MECP as part of the ECA approvals process.
- Vehicle speed will be limited.
- Revegetation and progressive reclamation of exposed dust sources will be conducted wherever appropriate.
- A net-zero plan will be implemented to reduce the net greenhouse gas emissions to zero over the life of the Project. The Net-Zero Plan (Appendix I-2 of the EIS/EA) developed to achieve this target includes the use of technologies and practices to reduce fossil fuel use and carbon offsets to balance greenhouse gas emissions that cannot be eliminated. Benefits of this plan are expected to also be reductions in non-greenhouse gas air parameter emissions.

10.0 CLOSING

This Air Quality Assessment Report was prepared for FMG by WSP. The quality of information, conclusions and scheduling estimates contained here is consistent with the level of effort involved in WSP's services and based on 1) information available at the time of preparation; 2) data supplied by outside sources; and 3) the assumptions, conditions and qualifications set forth in this report.

Yours truly,

WSP Canada Inc.

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Attachment A
Construction Results Summary

Table A-1: Construction Phase – Mine Infrastructure - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m^3)	Baseline Concentration (µg/m^3)	Modelled + Baseline Concentration (µg/m^3)	AAQC (µg/m^3)	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	5.9	7.3	14.1	21.4	120	18
		Annual		0.4	5.3	5.7	60	9
Inhalable particulate (PM_{10})	N/A	24-hour	2.08	7.1	9.1	16.2	50	32
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	1.25	5.1	9.1	14.2	27	53
		Annual		0.19	4.2	4.39	8.8	50
Diesel particulate matter (DPM)	N/A	24-hour	0.46	0.60	1.8	2.40	10	24
		Annual		0.03	1.8	1.83	5	37
Respirable silica (SiO_2 <10 µm)	Various	24-hour	0.16	0.53	–	0.53	5	11
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	8	139	30	169	400	42
		24-hour	7	40	28	68	200	34
Carbon monoxide (CO)	630-08-0	1-hour	3	78	114	192	36,200	0.5
		8-hour	3.34	15	114	129	15,700	0.8
Sulphur dioxide (SO_2)	7446-09-5	10-minute	0.39	21.5	1.7	23.2	178	13
		1-hour	0.39	13.0	1.00	14.0	100	14
		Annual	0.39	0.05	0.30	0.35	10	3.5
Arsenic (As)	7440-38-2	24-hour	0.0010	0.001	0.0010	0.002	0.3	0.8
Chromium (Cr)	7440-47-3	24-hour	0.0007	0.001	0.0012	0.0020	0.5	0.4
Copper (Cu)	7440-50-8	24-hour	0.0008	0.001	0.14	0.14	50	0.3
Iron (Fe)	7439-89-6	24-hour	0.45	0.560	0.14	0.70	25	2.8
Lead (Pb)	7439-92-1	30-day	0.0007	0.0009	0.0012	0.0021	0.5	0.4
		24-hour	0.0007	0.0009	0.0012	0.0021	0.2	1.1
Magnesium (Mg)	1309-48-4	24-hour	0.1760	0.22	0.13	0.35	120	0.3
Manganese (Mn) in $PM_{2.5}$	7439-96-5	24-hour	0.0024	0.010	0.0082	0.018	0.1	18
Manganese (Mn) in PM_{10}		24-hour	0.0039	0.013	0.0082	0.02	0.2	11
Manganese (Mn) in SPM		24-hour	0.0112	0.01	0.0082	0.02	0.4	5.5
Mercury (Hg)	7439-97-6	24-hour	0.0000019	0.0000023	0.000012	0.000014	2	0.001

Table A-1: Construction Phase – Mine Infrastructure - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Nickel (Ni) in SPM	7440-02-0	24-hour	0.0005	0.0006	0.0015	0.0021	0.2	1.1
		Annual		0.00003	0.00089	0.0009	0.04	2.3
Nickel (Ni) in PM_{10}		24-hour	0.0002	0.0006	0.0015	0.0021	0.1	2.1
		Annual		0.00003	0.00089	0.0009	0.02	4.6
Titanium (Ti)	7440-32-6	24-hour	0.0113	0.01	0.0061	0.02	120	0.02
Zinc (Zn)	7440-66-6	24-hour	0.0015	0.002	0.010	0.012	120	0.01
Benzene	71-43-2	24-hour	0.016	0.07	0.49	0.56	2.3	25
		Annual		0.002	0.30	0.30	0.45	67
1,3-Butadiene	106-99-0	24-hour	0.0001	0.00040	0.24	0.24	10	2.4
		Annual		0.00002	0.26	0.26	2	13.0
Formaldehyde	50-00-0	24-hour	0.01	0.03	1.50	1.53	65	2.4
Acetaldehyde	75-07-0	0.5-hour	0.005	0.24	7.0	7.24	500	1.4
		24-hour		0.02	7.0	7.02	500	1.4
Benzo(a)pyrene	50-32-8	24-hour	0.0000005	0.000001	0.000036	0.00004	0.00005	75
		Annual		0.0000001	0.000018	0.00002	0.00001	**181**

Note:
CAS = Chemical Abstracts Service; N/A = not applicable; - = no value, assume zero.

Table A-2: Construction Phase – Mine Infrastructure - Emission Summary Table with Comparison to Canadian Ambient Air Quality Standards (CAAQS)

Parameter	CAS Number	Averaging Time (HR - Unless Noted Otherwise)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	Canadian Ambient Air Quality Standard - 2025 (µg/m³)	% of CAAQS
Respirable particulate ($PM_{2.5}$)	N/A	24	5.1	9.1	14.2	27	53
		Annual	0.52	4.2	4.7	8.8	54
Nitrogen oxides (as NO_2)	10102-44-0	1	128	30	158	79	**Exceeding CAAQS**
		Annual	3.4	0.6	4.0	23	17
Sulphur dioxide (SO_2)	7446-09-5	1	10.7	1.0	11.7	170	1
		Annual	0.06	0.3	0.4	10	3

Note:
CAS = Chemical Abstracts Service; N/A = not applicable.

Table A-3: Construction Phase – Mine Access Road - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (μg/m³)	Baseline Concentration (μg/m³)	Modelled + Baseline Concentration (μg/m³)	AAQC (μg/m³)	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	0.3	28.1	14.1	42.2	120	35
		Annual		5.4	5.3	10.7	60	18
Inhalable particulate (PM_{10})	N/A	24-hour	0.11	9.9	9.1	19.0	50	38
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	0.08	6.9	9.1	16.0	27	59
		Annual		1.3	4.2	5.53	8.8	63
Diesel particulate matter (DPM)	N/A	24-hour	0.07	6.1	1.8	7.91	10	79
		Annual		1.2	1.8	2.97	5	59
Respirable silica (SiO_2 <10 μm)	Various	24-hour	0.01	0.74	–	0.74	5	15
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	2	129	30	159	400	40
		24-hour	1.1	55	28	83	200	42
Carbon monoxide (CO)	630-08-0	1-hour	0.9	360	114	474	36200	1.3
		8-hour	0.9	129	114	243	15700	1.5
Arsenic (As)	7440-38-2	24-hour	0.0001	0.005	0.0010	0.006	0.3	1.9
Chromium (Cr)	7440-47-3	24-hour	0.00004	0.003	0.0012	0.0044	0.5	0.9
Copper (Cu)	7440-47-3	24-hour	0.00004	0.004	0.14	0.14	50	0.3
Iron (Fe)	7439-89-6	24-hour	0.02	2.144	0.14	2.28	25	9
Lead (Pb)	7439-92-1	24-hour	0.00004	0.0035	0.0012	0.0047	0.5	0.9
		30-day	0.00004	0.0035	0.0012	0.0047	0.2	2.3
Magnesium (Mg)	1309-48-4	24-hour	0.0096	0.84	0.13	0.97	120	0.8
Manganese (Mn) in $PM_{2.5}$	7439-96-5	24-hour	0.0002	0.013	0.0082	0.021	0.1	21
Manganese (Mn) in PM_{10}		24-hour	0.0002	0.019	0.0082	0.03	0.2	14
Manganese (Mn) in SPM		24-hour	0.0006	0.05	0.0082	0.06	0.4	15
Mercury (Hg)	7439-97-6	24-hour	0.0000001	0.0000089	0.000012	0.000021	2	0.001
Nickel (Ni) in SPM	7440-02-0	24-hour	0.00003	0.0025	0.0015	0.0040	0.2	2.0
		Annual		0.0005	0.00089	0.0014	0.04	3.4
Nickel (Ni) in PM_{10}		24-hour	0.00001	0.0009	0.0015	0.0024	0.1	2.4
		Annual		0.00009	0.00089	0.0010	0.02	4.9

Table A-3: Construction Phase – Mine Access Road - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Titanium (Ti)	7440-32-6	24-hour	0.0006	0.05	0.0061	0.06	120	0.05
Zinc (Zn)	7440-66-6	24-hour	0.0001	0.007	0.010	0.017	120	0.01
Benzene	71-43-2	24-hour	0.003	0.26	0.49	0.75	2.3	33
		Annual	0.003	0.05	0.30	0.35	0.45	78
1,3-Butadiene	106-99-0	24-hour	0.0001	0.011	0.24	0.25	10	2.5
		Annual	0.0001	0.0022	0.26	0.26	2	13.1
Formaldehyde	50-00-0	24-hour	0.02	1.62	1.50	3.12	65	4.8
Acetaldehyde	75-07-0	0.5-hour	0.013	3.30	7	10.30	500	2.1
		24-hour	0.013	0.58	7	7.58	500	1.5
Benzo(a)pyrene	50-32-8	24-hour	0.0000004	0.000002	0.000036	0.00004	0.00005	75
		Annual	0.0000004	0.00000011	0.000018	0.00002	0.00001	**181**

Note:
CAS = Chemical Abstracts Service; N/A = not applicable; - = no value, assume zero.

Table A-4: Construction Phase – Mine Access Road - Emission Summary Table with Comparison to Canadian Ambient Air Quality Standards (CAAQS)

Parameter	CAS Number	Averaging Time (HR - Unless Noted Otherwise)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	Canadian Ambient Air Quality Standard - 2025 (µg/m³)	% of CAAQS
Respirable particulate ($PM_{2.5}$)	N/A	24	6.9	9.1	16.0	27	59
		Annual	1.3	4.2	5.5	8.8	63
Nitrogen oxides (as NO_2)	10102-44-0	1	129	30	159	79	**Exceeding CAAQS**
		Annual	15.2	0.6	15.8	23	69

Note:
CAS = Chemical Abstracts Service; N/A = not applicable.

Table A-5: Construction Phase – Transmission Line - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m³)	Baseline Concentration (µg/m³)	Modelled + Baseline Concentration (µg/m³)	AAQC (µg/m³)	% of Criterion
Suspended particulate matter (SPM)	N/A	24-hour	0.12	5.4	14.1	19.5	120	16
		Annual		0.5	5.3	5.8	60	10
Inhalable particulate (PM_{10})	N/A	24-hour	0.10	4.4	9.1	13.5	50	27
Respirable particulate ($PM_{2.5}$)	N/A	24-hour	0.09	4.2	9.1	13.3	27	49
		Annual		0.42	4.2	4.62	8.8	52
Diesel particulate matter (DPM)	N/A	24-hour	0.09	4.11	1.8	5.91	10	59
		annual		0.41	1.8	2.21	5	44
Respirable silica (SiO_2 <10 µm)	Various	24-hour	0.01	0.33	–	0.33	5	7
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	3	38	30	68	400	17
		24-hour	1.3	7	28	35	200	17
Carbon monoxide (CO)	630-08-0	1-hour	1.2	344	114	458	36200	1.3
		8-hour	0.86	65	114	179	15700	1.1
Arsenic (As)	7440-38-2	24-hour	0.00002	0.001	0.0010	0.002	0.3	0.6
Chromium (Cr)	7440-47-3	24-hour	0.00001	0.001	0.0012	0.0018	0.5	0.4
Copper (Cu)	7440-47-3	24-hour	0.00002	0.001	0.14	0.14	50	0.3
Iron (Fe)	7439-89-6	24-hour	0.01	0.41	0.14	0.55	25	2
Lead (Pb)	7439-92-1	24-hour	0.00001	0.0007	0.0012	0.0019	0.5	0.4
		30-day	0.00001	0.0007	0.0012	0.0019	0.2	0.9
Magnesium (Mg)	1309-48-4	24-hour	0.0035	0.16	0.13	0.29	120	0.2
Manganese (Mn) in $PM_{2.5}$	7439-96-5	24-hour	0.0002	0.008	0.0082	0.016	0.1	16
Manganese (Mn) in PM_{10}		24-hour	0.0002	0.008	0.0082	0.02	0.2	8.3
Manganese (Mn) in SPM		24-hour	0.0002	0.01	0.0082	0.02	0.4	4.6
Mercury (Hg)	7439-97-6	24-hour	0.00000004	0.0000017	0.000012	0.000014	2	0.001

Table A-5: Construction Phase – Transmission Line - Point of Impingement Emission Summary Table with Comparison to the Ambient Air Quality Criteria (AAQCs)

Parameter	CAS Number	Averaging Time (HR – unless otherwise noted)	Project Emission Rate (g/s)	Modelled POI Concentration (µg/m^3)	Baseline Concentration (µg/m^3)	Modelled + Baseline Concentration (µg/m^3)	AAQC (µg/m^3)	% of Criterion
Nickel (Ni) in SPM	7440-02-0	24-hour	0.00001	0.0005	0.0015	0.0020	0.2	1.0
		Annual		0.0000	0.00089	0.0009	0.04	2.3
Nickel (Ni) in PM_{10}		24-hour	0.00001	0.0004	0.0015	0.0019	0.1	1.9
		Annual		0.00004	0.00089	0.0009	0.02	4.6
Titanium (Ti)	7440-32-6	24-hour	0.0002	0.01	0.0061	0.02	120	0.01
Zinc (Zn)	7440-66-6	24-hour	0.0000	0.001	0.010	0.011	120	0.01
Benzene	71-43-2	24-hour	0.004	0.16	0.49	0.65	2.3	28
		Annual	0.0002	0.016	0.30	0.32	0.45	70
1,3-Butadiene	106-99-0	24-hour	0.0002	0.008	0.24	0.25	10	2.5
		Annual	0.004	0.0008	0.26	0.26	2	13.0
Formaldehyde	50-00-0	24-hour	0.03	1.22	1.50	2.72	65	4.2
Acetaldehyde	75-07-0	0.5-hour	0.016	5.64	7.0	12.64	500	2.5
		24-hour	0.016	0.75	7.0	7.75	500	1.5
Benzo(a)pyrene	50-32-8	24-hour	0.0000004	0.000001	0.000036	0.00004	0.00005	74
		Annual	0.0000004	0.0000001	0.000018	0.00002	0.00001	**181**

Note:
CAS = Chemical Abstracts Service; N/A = not applicable; - = no value, assume zero.

Table A-6: Construction Phase – Transmission Line - Emission Summary Table with Comparison to Canadian Ambient Air Quality Standards (CAAQS)

Parameter	CAS Number	Averaging Time (HR - Unless Noted Otherwise)	Modelled POI Concentration (µg/m^3)	Baseline Concentration (µg/m^3)	Modelled + Baseline Concentration (µg/m^3)	Canadian Ambient Air Quality Standard - 2025 (µg/m^3)	% of CAAQS
Respirable particulate ($PM_{2.5}$)	N/A	24	4.2	9.1	13.3	27	49
		Annual	0.42	4.2	4.6	8.8	52
Nitrogen oxides(as NO_2)	10102-44-0	1	38.0	30	68.0	79	86
		Annual	0.80	0.6	1.4	23	6

Note:
CAS = Chemical Abstracts Service; N/A = not applicable.

Attachment B

Source and Emission Rate Tables

Table B-1: Operations Phase - Source Summary

Source	Source ID	Description	Model ID	Emissions (g/s)														
				TPM	PM10	PM2.5	NOx		CO		SO_2		NH3		HCN	$CuSO_4$	CaO	Si
				24-hr	24-hr	24-hr	1-hr	24-hr	1-hr	8-hr	1-hr	24-hr	1-hr	24-hr	24-hr	24-hr	24-hr	24-hr
TOTAL				20.71	8.46	3.12	98.80	33.75	363.13	49.22	4.26	0.23	21.73	0.91	0.42	0.04	0.13	0.63
Drill	PIT	Open Pit Mining - Drilling	OPIT_D	0.51	0.27	0.27												0.020
Blast	PIT	Open Pit Mining - Blasting	OPIT	1.599	0.83	0.048	58.74	2.45	326	13.6	4.2	0.17	21.73	0.91				0.062
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	OPIT_D	1.82	0.7	0.206												0.055
In Pit Road	PIT Roads - Dust	Edge of Pit to Centre (In pit road)	OPIT_D	1.9	0.5	0.046												0.034
In Pit Road	PIT Roads - Tailpipe	Edge of Pit to Centre (In pit road)	OPIT_T	0.009	0.009	0.009	0.77	0.74	0.77	0.74	0.0012	0.0012						0.001
Exiting Pit Road to West	PIT Roads - Dust	Pit to Main Road West	PIT_WEST_D	2.24	0.55	0.055												0.041
Exiting Pit Road to West	PIT Roads - Tailpipe	Pit to Main Road West	PIT_WEST_T	0.026	0.026	0.026	2.31	2.21	2.31	2.21	0.0037	0.0036						0.002
Exiting Pit Road East	PIT Roads - Dust	Pit to Main Road East	PIT_EAST_D	3.08	0.752	0.075												0.056
Exiting Pit Road East	PIT Roads - Tailpipe	Pit to Main Road East	PIT_EAST_T	0.035	0.035	0.035	3.07	2.95	3.07	2.95	0.0050	0.0047						0.003
Haul Roads	Roads (various) - Dust	West Road to CDF	WEST_CDF_D	1.843	0.450	0.045												0.034
Haul Roads	Roads (various) - Tailpipe	West Road to CDF	WEST_CDF_T	0.035	0.035	0.035	3.07	2.95	3.07	2.95	0.0050	0.005						0.003
Haul Roads	Roads (various) - Dust	West Road to Dam	WEST_DAM_D	1.019	0.249	0.0249												0.019
Haul Roads	Roads (various) - Tailpipe	West Road to Dam	WEST_DAM_T	0.026	0.026	0.026	2.305	2.21	2.305	2.21	0.0037	0.00						0.002
Haul Roads	Roads (various) - Dust	Mill Feed Road	E_MILL_D	0.274	0.067	0.007												0.005
Haul Roads	Roads (various) - Tailpipe	Mill Feed Road	E_MILL_T	0.009	0.009	0.009	0.77	0.74	0.77	0.74	0.0012	0.001						0.001
Haul Roads	Roads (various) - Dust	LG Stockpile Access Road	E_LGSTK_D	0.058	0.014	0.0014												0.001
Haul Roads	Roads (various) - Tailpipe	LG Stockpile Access Road	E_LGSTK_T	0.009	0.009	0.009	0.77	0.74	0.77	0.74	0.0012	0.001						0.001
Haul Roads	Roads (various) - Dust	East Road to South	EAST_ST_D	0.187	0.046	0.005												0.003
Haul Roads	Roads (various) - Tailpipe	East Road to South	EAST_ST_T	0.009	0.009	0.009	0.768	0.74	0.768	0.74	0.0012	0.00						0.001
Haul Roads	Roads (various) - Dust	South Road to Mid/High Grade Ore Stockpile	ST_MHSTK_D	0.214	0.052	0.0052												0.004
Haul Roads	Roads (various) - Tailpipe	South Road to Mid/High Grade Ore Stockpile	ST_MHSTK_T	0.018	0.018	0.018	1.537	1.47	1.537	1.47	0.0025	0.002						0.001
Haul Roads	Roads (various) - Dust	South Road to Surficial Stockpile	ST_SSTK_D	0.175	0.043	0.0043												0.003
Haul Roads	Roads (various) - Tailpipe	South Road to Surficial Stockpile	ST_SSTK_T	0.018	0.018	0.018	1.537	1.47	1.537	1.47	0.0025	0.002						0.001
Equipment in pit	PIT Equip - Dust	Equipment in pit	OPIT_D	0.3	0.2	0.03												0.017
Equipment in pit	PIT Equip - Tailpipe	Equipment in pit	OPIT_T	0.135	0.135	0.14	11.16	10.69	12.67	12.67	0.0216	0.02						0.010
Concrete	BATCH	Batch Plant	CBP	0.792	0.351	0.057												0.026
UnloadMILL	MILL	Drop at Mill	MILL_DZ_D	0.56	0.23	0.06												0.017
DozerMill	MILL	Dozer at Mill	MILL_MH_D	0.15	0.11	0.02												0.009
UnloadCDF	Co-Disposal Facility Area	Drop at CDF	CDF_MH_D	0.51	0.20	0.06												0.015
DozerCDF	Co-Disposal Facility Area Dust	Dozer at CDF	CDF_DZ_D	0.15	0.11	0.02												0.009
UnloadOreLG	ORELG	LG Ore stockpile unloading	LGORE_MH_D	0.09	0.04	0.01												0.003
DozerOreLG	OREDoz Dust LG	Dozer at LG Ore stockpile	LGORE_DZ_D	0.15	0.11	0.02												0.009
UnloadOreMG/HG	ORE MG/HG	MG Ore stockpile unloading	MGORE_MH_D	0.14	0.06	0.02												0.004
DozerOreMG/HG	OREDoz Dust MG/HG	MG Dozer at Ore stockpile	MGORE_DZ_D	0.15	0.11	0.02												0.009
Unload OVB	OVB Dust	Unloading OVB at SSTK	SSTK_MH_D	0.11	0.04	0.01												0.003
Dozer OVB	OVB Doz	Dozer at SSTK	SSTK_DZ_D	0.15	0.11	0.02												0.009
UnloadDam	Dam Dust	Unloading at Dam	DAM_MH_D	0.41	0.16	0.046												0.012
Dozer Dam	Dam Doz	Dozer at Dam	DAM_DZ_D	0.15	0.11	0.016												0.009
EquipCDF	Co-Disposal Facility Tailpipe	Equipment at CDF	CDF_EQ_T	0.011	0.011	0.011	0.75	0.75	1.23	1.23	0.00204	0.002						0.001
EquipOre LG	OREEoz Tailpipe LG	Equipment at LG Ore stockpile	LGORE_EQ_T	0.011	0.011	0.011	0.747	0.747	1.23	1.23	0.00204	0.002						0.001
EquipOre MGHG	OREEoz Tailpipe MG HG	Equipment at MG Ore stockpile	MGORE_EQ_T	0.011	0.011	0.011	0.747	0.747	1.23	1.23	0.00204	0.002						0.001
EquipProc	Processing Plant area	Equipment at Processing Plant	ORE_EQ_T	0.011	0.011	0.011	0.747	0.747	1.23	1.23	0.00204	0.002						0.001
EquipSST	Surficial Stockpile Area	Equipment at Surficial Stockpile	SSTK_EQ_T	0.011	0.011	0.011	0.747	0.747	1.23	1.23	0.00204	0.002						0.001
EquipDAM	Dam construction Area	Equipment at Dam	DAM_EQ_T	0.003	0.003	0.003	0.062	0.062	0.54	0.54	0.00093	0.001						0.000
WindErosion LG	LGSTK	Wind Erosion at LG Ore Stockpile	LGSTKE_WE	0.011	0.0056	0.0022												0.000
WindErosion M/HG	MHGSTK	Wind Erosion at MGHG Ore Stockpile	MHGSTK_WE	0.011	0.0056	0.0022												0.000
WindErosion CDF	CDFWind	Wind Erosion at CDF	CDF_WE	0.044	0.022	0.009												0.002
BagHouse1	BH1 PCRUSH	baghouse for crusher	PR_PLANT	0.19	0.19	0.19												0.014
BagHouse2	BH2 - under crushed ore pile	Baghouse for conveyor drop under stockpile feed conveyor	PR_PLANT	0.28	0.28	0.28												0.021
Baghouse3	BH3 2ndCrush	baghouse for secondary crusher	PR_PLANT	0.19	0.19	0.19												0.014
Baghouse4	BH4 - under crushed 2nd ore pile	baghouse for conveyor drop under stockpile feed conveyor	PR_PLANT	0.42	0.42	0.42												0.032
Leach	LEACH	Leach Tanks - LT1 to LT8	LEACH1, LEACH2												0.425			
SpaceHeat	SPACEHEAT	space heating in process building	HEAT				0.28	0.28										
Induction Furances	IND1	scrubber to control emissions	PR_PLANT	0.19	0.19	0.19												0.014
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	PR_PLANT	0.047	0.047	0.047											0.047	0.004
Scrubber lime slaker	LS	scrubber for lime slaker	PR_PLANT	0.080	0.080	0.080											0.08	0.006
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	PR_PLANT	0.047	0.047	0.047												0.004
CuSO4 filter	EF11CuSO4	CuSO4 dust filter	PR_PLANT	0.040	0.040	0.040										0.040		0.003
CN-Dest	HCND1	CN Destruction Tank	PR_PLANT															
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	EGEN1	0.0240	0.0240	0.0240	3.9604	0.1650	0.2400	0.0300	0.0044	0.0002						0.002
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	EGEN2	0.0240	0.0240	0.0240	3.9604	0.1650	0.2400	0.0300	0.0044	0.0002						0.002

Table B-1: Operations Phase - Source Summary

Source	Source ID	Description	Model ID	Emissions (g/s)																
				BaP	Benzene	1,3-Butadien	Formaldehyde	Acetaldehyde	As	Cr	Cu	Fe	Hg	Mg	Mn	Ni	Pb	Ti	Zn
				24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr
TOTAL				4.19E-06	0.798	0.03	1.59	0.82	0.00	0.00	0.00	1.54	0.00	0.60	0.04	0.00	0.00	0.04	0.01
Drill	PIT	Open Pit Mining - Drilling	OPIT_D						8.76E-05	5.84E-05	6.77E-05	3.90E-02	1.62E-07	1.53E-02	9.72E-04	4.52E-05	6.34E-05	9.78E-04	1.33E-04
Blast	PIT	Open Pit Mining - Blasting	OPIT						2.73E-04	1.82E-04	2.11E-04	1.22E-01	5.07E-07	4.76E-02	3.03E-03	1.41E-04	1.98E-04	3.05E-03	4.15E-04
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	OPIT_D						3.12E-04	2.08E-04	2.41E-04	1.39E-01	5.78E-07	5.43E-02	3.46E-03	1.61E-04	2.26E-04	3.48E-03	4.74E-04
In Pit Road	PIT Roads - Dust	Edge of Pit to Centre (In pit road)	OPIT_D						3.18E-04	2.12E-04	2.46E-04	1.42E-01	5.90E-07	5.55E-02	3.53E-03	1.65E-04	2.31E-04	3.55E-03	4.84E-04
In Pit Road	PIT Roads - Tailpipe	Edge of Pit to Centre (In pit road)	OPIT_T	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03											
Exiting Pit Road to West	PIT Roads - Dust	Pit to Main Road West	PIT_WEST_D						3.83E-04	2.55E-04	2.96E-04	1.71E-01	7.10E-07	6.67E-02	4.25E-03	1.98E-04	2.77E-04	4.28E-03	5.82E-04
Exiting Pit Road to West	PIT Roads - Tailpipe	Pit to Main Road West	PIT_WEST_T	2.06E-07	1.09E-02	3.97E-04	6.09E-02	2.17E-02											
Exiting Pit Road East	PIT Roads - Dust	Pit to Main Road East	PIT_EAST_D						5.26E-04	3.51E-04	4.06E-04	2.34E-01	9.75E-07	9.17E-02	5.84E-03	2.72E-04	3.81E-04	5.87E-03	7.99E-04
Exiting Pit Road East	PIT Roads - Tailpipe	Pit to Main Road East	PIT_EAST_T	2.74E-07	1.45E-02	5.29E-04	8.12E-02	2.89E-02											
Haul Roads	Roads (various) - Dust	West Road to CDF	WEST_CDF_D						3.15E-04	2.10E-04	2.44E-04	1.40E-01	5.84E-07	5.49E-02	3.50E-03	1.63E-04	2.28E-04	3.52E-03	4.78E-04
Haul Roads	Roads (various) - Tailpipe	West Road to CDF	WEST_CDF_T	2.74E-07	1.45E-02	5.29E-04	8.12E-02	2.89E-02											
Haul Roads	Roads (various) - Dust	West Road to Dam	WEST_DAM_D						1.74E-04	1.16E-04	1.35E-04	7.77E-02	3.23E-07	3.04E-02	1.94E-03	9.01E-05	1.26E-04	1.95E-03	2.65E-04
Haul Roads	Roads (various) - Tailpipe	West Road to Dam	WEST_DAM_T	2.06E-07	1.09E-02	3.97E-04	6.09E-02	2.17E-02											
Haul Roads	Roads (various) - Dust	Mill Feed Road	E_MILL_D						4.69E-05	3.13E-05	3.63E-05	2.09E-02	8.69E-08	8.18E-03	5.21E-04	2.42E-05	3.40E-05	5.24E-04	7.12E-05
Haul Roads	Roads (various) - Tailpipe	Mill Feed Road	E_MILL_T	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03											
Haul Roads	Roads (various) - Dust	LG Stockpile Access Road	E_LGSTK_D						9.89E-06	6.59E-06	7.64E-06	4.41E-03	1.83E-08	1.72E-03	1.10E-04	5.11E-06	7.16E-06	1.10E-04	1.50E-05
Haul Roads	Roads (various) - Tailpipe	LG Stockpile Access Road	E_LGSTK_T	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03											
Haul Roads	Roads (various) - Dust	East Road to South	EAST_ST_D						3.19E-05	2.13E-05	2.47E-05	1.42E-02	5.92E-08	5.57E-03	3.55E-04	1.65E-05	2.31E-05	3.57E-04	4.85E-05
Haul Roads	Roads (various) - Tailpipe	East Road to South	EAST_ST_T	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03											
Haul Roads	Roads (various) - Dust	South Road to Mid/High Grade Ore Stockpile	ST_MHSTK_D						3.66E-05	2.44E-05	2.83E-05	1.63E-02	6.79E-08	6.38E-03	4.07E-04	1.89E-05	2.65E-05	4.09E-04	5.56E-05
Haul Roads	Roads (various) - Tailpipe	South Road to Mid/High Grade Ore Stockpile	ST_MHSTK_T	1.37E-07	7.27E-03	2.65E-04	4.06E-02	1.44E-02											
Haul Roads	Roads (various) - Dust	South Road to Surficial Stockpile	ST_SSTK_D						3.00E-05	2.00E-05	2.32E-05	1.34E-02	5.56E-08	5.23E-03	3.33E-04	1.55E-05	2.17E-05	3.35E-04	4.56E-05
Haul Roads	Roads (various) - Tailpipe	South Road to Surficial Stockpile	ST_SSTK_T	1.37E-07	7.27E-03	2.65E-04	4.06E-02	1.44E-02											
Equipment in pit	PIT Equip - Dust	Equipment in pit	OPIT_D						5.21E-05	3.48E-05	4.03E-05	2.32E-02	9.66E-08	9.09E-03	5.79E-04	2.69E-05	3.78E-05	5.82E-04	7.92E-05
Equipment in pit	PIT Equip - Tailpipe	Equipment in pit	OPIT_T	1.48E-06	3.23E-02	1.79E-03	2.34E-01	8.35E-02											
Concrete	BATCH	Batch Plant	CBP						1.35E-04	9.03E-05	1.05E-04	6.04E-02	2.51E-07	2.36E-02	1.50E-03	7.00E-05	9.81E-05	1.51E-03	2.06E-04
UnloadMILL	MILL	Drop at Mill	MILL_DZ_D						9.62E-05	6.42E-05	7.44E-05	4.29E-02	1.78E-07	1.68E-02	1.07E-03	4.97E-05	6.97E-05	1.07E-03	1.46E-04
DozerMill	MILL	Dozer at Mill	MILL_MH_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
UnloadCDF	Co-Disposal Facility Area	Drop at CDF	CDF_MH_D						8.75E-05	5.83E-05	6.76E-05	3.90E-02	1.62E-07	1.53E-02	9.72E-04	4.52E-05	6.34E-05	9.77E-04	1.33E-04
DozerCDF	Co-Disposal Facility Area Dust	Dozer at CDF	CDF_DZ_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
UnloadOreLG	ORELG	LG Ore stockpile unloading	LGORE_MH_D						1.54E-05	1.03E-05	1.19E-05	6.86E-03	2.85E-08	2.68E-03	1.71E-04	7.96E-06	1.12E-05	1.72E-04	2.34E-05
DozerOreLG	OREDoz Dust LG	Dozer at LG Ore stockpile	LGORE_DZ_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
UnloadOreMG/HG	ORE MG/HG	MG Ore stockpile unloading	MGORE_MH_D						2.42E-05	1.61E-05	1.87E-05	1.08E-02	4.48E-08	4.21E-03	2.68E-04	1.25E-05	1.75E-05	2.70E-04	3.67E-05
DozerOreMG/HG	OREDoz Dust MG/HG	MG Dozer at Ore stockpile	MGORE_DZ_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
Unload OVB	OVB Dust	Unloading OVB at SSTK	SSTK_MH_D						1.85E-05	1.23E-05	1.43E-05	8.23E-03	3.42E-08	3.22E-03	2.05E-04	9.54E-06	1.34E-05	2.06E-04	2.80E-05
Dozer OVB	OVB Doz	Dozer at SSTK	SSTK_DZ_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
UnloadDam	Dam Dust	Unloading at Dam	DAM_MH_D						7.00E-05	4.67E-05	5.41E-05	3.12E-02	1.30E-07	1.22E-02	7.77E-04	3.62E-05	5.07E-05	7.82E-04	1.06E-04
Dozer Dam	Dam Doz	Dozer at Dam	DAM_DZ_D						2.61E-05	1.74E-05	2.02E-05	1.16E-02	4.83E-08	4.54E-03	2.89E-04	1.35E-05	1.89E-05	2.91E-04	3.96E-05
EquipCDF	Co-Disposal Facility Tailpipe	Equipment at CDF	CDF_EQ_T	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03											
EquipOre LG	OREEoz Tailpipe LG	Equipment at LG Ore stockpile	LGORE_EQ_T	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03											
EquipOre MGHG	OREEoz Tailpipe MG HG	Equipment at MG Ore stockpile	MGORE_EQ_T	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03											
EquipProc	Processing Plant area	Equipment at Processing Plant	ORE_EQ_T	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03											
EquipSST	Surficial Stockpile Area	Equipment at Surficial Stockpile	SSTK_EQ_T	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03											
EquipDAM	Dam construction Area	Equipment at Dam	DAM_EQ_T																
WindErosion LG	LGSTK	Wind Erosion at LG Ore Stockpile	LGSTKE_WE						1.90E-06	1.27E-06	1.47E-06	8.47E-04	3.52E-09	3.31E-04	2.11E-05	9.82E-07	1.38E-06	2.12E-05	2.89E-06
WindErosion M/HG	MHGSTK	Wind Erosion at MGHG Ore Stockpile	MHGSTK_WE						1.90E-06	1.27E-06	1.47E-06	8.47E-04	3.52E-09	3.31E-04	2.11E-05	9.82E-07	1.38E-06	2.12E-05	2.89E-06
WindErosion CDF	CDFWind	Wind Erosion at CDF	CDF_WE						7.60E-06	5.07E-06	5.87E-06	3.39E-03	1.41E-08	1.32E-03	8.44E-05	3.93E-06	5.51E-06	8.48E-05	1.15E-05
BagHouse1	BH1 PCRUSH	baghouse for crusher	PR_PLANT						3.23E-05	2.15E-05	2.49E-05	1.44E-02	5.98E-08	5.63E-03	3.58E-04	1.67E-05	2.34E-05	3.60E-04	4.90E-05
BagHouse2	BH2 - under crushed ore pile	Baghouse for conveyor drop under stockpile feed conveyor	PR_PLANT						4.84E-05	3.23E-05	3.74E-05	2.16E-02	8.97E-08	8.44E-03	5.38E-04	2.50E-05	3.51E-05	5.41E-04	7.35E-05
Baghouse3	BH3 2ndCrush	baghouse for secondary crusher	PR_PLANT						3.23E-05	2.15E-05	2.49E-05	1.44E-02	5.98E-08	5.63E-03	3.58E-04	1.67E-05	2.34E-05	3.60E-04	4.90E-05
Baghouse4	BH4 - under crushed 2nd ore pile	baghouse for conveyor drop under stockpile feed conveyor	PR_PLANT						7.26E-05	4.84E-05	5.61E-05	3.24E-02	1.35E-07	1.27E-02	8.06E-04	3.75E-05	5.26E-05	8.11E-04	1.10E-04
Leach	LEACH	Leach Tanks - LT1 to LT8	LEACH1, LEACH2						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SpaceHeat	SPACEHEAT	space heating in process building	HEAT						0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Induction Furances	IND1	scrubber to control emissions	PR_PLANT						3.23E-05	2.15E-05	2.49E-05	1.44E-02	5.98E-08	5.63E-03	3.58E-04	1.67E-05	2.34E-05	3.60E-04	4.90E-05
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	PR_PLANT						8.07E-06	5.38E-06	6.24E-06	3.60E-03	1.50E-08	1.41E-03	8.96E-05	4.17E-06	5.85E-06	9.01E-05	1.23E-05
Scrubber lime slaker	LS	scrubber for lime slaker	PR_PLANT						1.37E-05	9.12E-06	1.06E-05	6.10E-03	2.54E-08	2.38E-03	1.52E-04	7.07E-06	9.91E-06	1.53E-04	2.08E-05
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	PR_PLANT						8.07E-06	5.38E-06	6.24E-06	3.60E-03	1.50E-08	1.41E-03	8.96E-05	4.17E-06	5.85E-06	9.01E-05	1.23E-05
CuSO4 filter	EF11CuSO4	CuSO4 dust filter	PR_PLANT						6.84E-06	4.56E-06	5.29E-06	3.05E-03	1.27E-08	1.19E-03	7.59E-05	3.53E-06	4.95E-06	7.64E-05	1.04E-05
CN-Dest	HCND1	CN Destruction Tank	PR_PLANT																
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	EGEN1	4.78E-07	3.39E-01	1.42E-02	4.28E-01	2.78E-01											
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	EGEN2	4.78E-07	3.39E-01	1.42E-02	4.28E-01	2.78E-01											

Table B-2: Operations Phase - Source Summary - Percent by Source

Source	Source ID	Description	% of Emissions by Source and Contaminant															
			TPM	PM10	PM2.5	NOx		CO		SO2		NH3		HCN	CuSO4	CaO	Si	BaP
			24-hr	24-hr	24-hr	1-hr	24-hr	1-hr	8-hr	1-hr	24-hr	1-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr
Drill	PIT	Open Pit Mining - Drilling	2.47	3.18	8.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.18	0.00
Blast	PIT	Open Pit Mining - Blasting	7.72	9.83	1.54	59.45	7.25	89.88	27.63	98.39	74.99	100.00	100.00	0.00	0.00	0.00	9.83	0.00
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	8.81	8.62	6.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.62	0.00
In Pit Road	PIT Roads - Dust	Edge of Pit to Centre (In pit road)	8.99	5.38	1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.38	0.00
In Pit Road	PIT Roads - Tailpipe	Edge of Pit to Centre (In pit road)	0.04	0.10	0.28	0.78	2.18	0.21	1.50	0.03	0.51	0.00	0.00	0.00	0.00	0.00	0.10	1.64
Exiting Pit Road to West	PIT Roads - Dust	Pit to Main Road West	10.82	6.47	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.47	0.00
Exiting Pit Road to West	PIT Roads - Tailpipe	Pit to Main Road West	0.13	0.31	0.85	2.33	6.55	0.63	4.49	0.09	1.53	0.00	0.00	0.00	0.00	0.00	0.31	4.91
Exiting Pit Road East	PIT Roads - Dust	Pit to Main Road East	14.85	8.89	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.89	0.00
Exiting Pit Road East	PIT Roads - Tailpipe	Pit to Main Road East	0.17	0.42	1.13	3.11	8.73	0.85	5.98	0.12	2.04	0.00	0.00	0.00	0.00	0.00	0.42	6.55
Haul Roads	Roads (various) - Dust	West Road to CDF	8.90	5.33	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.33	0.00
Haul Roads	Roads (various) - Tailpipe	West Road to CDF	0.17	0.42	1.13	3.11	8.73	0.85	5.98	0.12	2.04	0.00	0.00	0.00	0.00	0.00	0.42	6.55
Haul Roads	Roads (various) - Dust	West Road to Dam	4.92	2.95	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95	0.00
Haul Roads	Roads (various) - Tailpipe	West Road to Dam	0.13	0.31	0.85	2.33	6.55	0.63	4.49	0.09	1.53	0.00	0.00	0.00	0.00	0.00	0.31	4.91
Haul Roads	Roads (various) - Dust	Mill Feed Road	1.32	0.79	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00
Haul Roads	Roads (various) - Tailpipe	Mill Feed Road	0.04	0.10	0.28	0.78	2.18	0.21	1.50	0.03	0.51	0.00	0.00	0.00	0.00	0.00	0.10	1.64
Haul Roads	Roads (various) - Dust	LG Stockpile Access Road	0.28	0.17	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00
Haul Roads	Roads (various) - Tailpipe	LG Stockpile Access Road	0.04	0.10	0.28	0.78	2.18	0.21	1.50	0.03	0.51	0.00	0.00	0.00	0.00	0.00	0.10	1.64
Haul Roads	Roads (various) - Dust	East Road to South	0.90	0.54	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00
Haul Roads	Roads (various) - Tailpipe	East Road to South	0.04	0.10	0.28	0.78	2.18	0.21	1.50	0.03	0.51	0.00	0.00	0.00	0.00	0.00	0.10	1.64
Haul Roads	Roads (various) - Dust	South Road to Mid/High Grade Ore Stockpile	1.03	0.62	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00
Haul Roads	Roads (various) - Tailpipe	South Road to Mid/High Grade Ore Stockpile	0.08	0.21	0.56	1.56	4.36	0.42	2.99	0.06	1.02	0.00	0.00	0.00	0.00	0.00	0.21	3.27
Haul Roads	Roads (various) - Dust	South Road to Surficial Stockpile	0.85	0.51	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00
Haul Roads	Roads (various) - Tailpipe	South Road to Surficial Stockpile	0.08	0.21	0.56	1.56	4.36	0.42	2.99	0.06	1.02	0.00	0.00	0.00	0.00	0.00	0.21	3.27
Equipment in pit	PIT Equip - Dust	Equipment in pit	1.47	2.70	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.70	0.00
Equipment in pit	PIT Equip - Tailpipe	Equipment in pit	0.65	1.60	4.33	11.29	31.68	3.49	25.75	0.51	8.89	0.00	0.00	0.00	0.00	0.00	1.60	35.29
Concrete	BATCH	Batch Plant	3.83	4.15	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.15	0.00
UnloadMILL	MILL	Drop at Mill	2.72	2.66	2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.66	0.00
DozerMill	MILL	Dozer at Mill	0.74	1.35	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
UnloadCDF	Co-Disposal Facility Area	Drop at CDF	2.47	2.42	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	0.00
DozerCDF	Co-Disposal Facility Area Dust	Dozer at CDF	0.74	1.35	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
UnloadOreLG	ORELG	LG Ore stockpile unloading	0.43	0.43	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00
DozerOreLG	OREDoz Dust LG	Dozer at LG Ore stockpile	0.74	1.35	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
UnloadOreMG/HG	ORE MG/HG	MG Ore stockpile unloading	0.68	0.67	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00
DozerOreMG/HG	OREDoz Dust MG/HG	MG Dozer at Ore stockpile	0.74	1.35	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
Unload OVB	OVB Dust	Unloading OVB at SSTK	0.52	0.51	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00
Dozer OVB	OVB Doz	Dozer at SSTK	0.74	1.35	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
UnloadDam	Dam Dust	Unloading at Dam	1.98	1.94	1.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.00
EquipProc	Processing Plant area	Equipment at Processing Plant	0.05	0.13	0.35	0.76	2.21	0.34	2.50	0.05	0.87	0.00	0.00	0.00	0.00	0.00	0.13	1.18
EquipSST	Surficial Stockpile Area	Equipment at Surficial Stockpile	0.05	0.13	0.35	0.76	2.21	0.34	2.50	0.05	0.87	0.00	0.00	0.00	0.00	0.00	0.13	1.18
EquipDAM	Dam construction Area	Equipment at Dam	0.02	0.04	0.10	0.06	0.18	0.15	1.11	0.02	0.40	0.00	0.00	0.00	0.00	0.00	0.04	0.00
WindErosion LG	LGSTK	Wind Erosion at LG Ore Stockpile	0.05	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
WindErosion M/HG	MHGSTK	Wind Erosion at MGHG Ore Stockpile	0.05	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
WindErosion CDF	CDFWind	Wind Erosion at CDF	0.21	0.26	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
BagHouse1	BH1 PCRUSH	baghouse for crusher	0.91	2.23	6.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23	0.00
BagHouse2	BH2 - under crushed ore pile	Baghouse for conveyor drop under stockpile feed conveyor	1.37	3.35	9.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.35	0.00
Baghouse3	BH3 2ndCrush	baghouse for secondary crusher	0.91	2.23	6.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23	0.00
Baghouse4	BH4 - under crushed 2nd ore pile	baghouse for conveyor drop under stockpile feed conveyor	2.05	5.02	13.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.02	0.00
Leach	LEACH	Leach Tanks - LT1 to LT8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
SpaceHeat	SPACEHEAT	space heating in process building	0.00	0.00	0.00	0.29	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Induction Furances	IND1	scrubber to control emissions	0.91	2.23	6.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23	0.00
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	0.23	0.56	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.10	0.56	0.00
Scrubber lime slaker	LS	scrubber for lime slaker	0.39	0.95	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.90	0.95	0.00
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	0.23	0.56	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00
CuSO4 filter	EF11CuSO4	CuSO4 dust filter	0.19	0.47	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.47	0.00
CN-Dest	HCND1	CN Destruction Tank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	0.12	0.28	0.77	4.01	0.49	0.07	0.06	0.10	0.08	0.00	0.00	0.00	0.00	0.00	0.28	11.40
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	0.12	0.28	0.77	4.01	0.49	0.07	0.06	0.10	0.08	0.00	0.00	0.00	0.00	0.00	0.28	11.40
TOTALS			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table B-2: Operations Phase - Source Summary - Percent by Source

Source	Source ID	Description	% of Emissions by Source and Contaminant														
			Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	As	Cr	Cu	Fe	Hg	Mg	Mn	Ni	Pb	Ti	Zn
			24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr	24-hr
Drill	PIT	Open Pit Mining - Drilling	0.00	0.00	0.00	0.00	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
Blast	PIT	Open Pit Mining - Blasting	0.00	0.00	0.00	0.00	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89
Load	PIT	Open Pit Mining - Load Haul Truck (Shovel)	0.00	0.00	0.00	0.00	8.99	8.99	8.99	8.99	8.99	8.99	8.99	8.99	8.99	8.99	8.99
In Pit Road	PIT Roads - Dust	Edge of Pit to Centre (In pit road)	0.00	0.00	0.00	0.00	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18
In Pit Road	PIT Roads - Tailpipe	Edge of Pit to Centre (In pit road)	0.46	0.40	1.28	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exiting Pit Road to West	PIT Roads - Dust	Pit to Main Road West	0.00	0.00	0.00	0.00	11.05	11.05	11.05	11.05	11.05	11.05	11.05	11.05	11.05	11.05	11.05
Exiting Pit Road to West	PIT Roads - Tailpipe	Pit to Main Road West	1.37	1.19	3.84	2.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exiting Pit Road East	PIT Roads - Dust	Pit to Main Road East	0.00	0.00	0.00	0.00	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17
Exiting Pit Road East	PIT Roads - Tailpipe	Pit to Main Road East	1.82	1.58	5.12	3.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	West Road to CDF	0.00	0.00	0.00	0.00	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Haul Roads	Roads (various) - Tailpipe	West Road to CDF	1.82	1.58	5.12	3.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	West Road to Dam	0.00	0.00	0.00	0.00	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03
Haul Roads	Roads (various) - Tailpipe	West Road to Dam	1.37	1.19	3.84	2.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	Mill Feed Road	0.00	0.00	0.00	0.00	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
Haul Roads	Roads (various) - Tailpipe	Mill Feed Road	0.46	0.40	1.28	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	LG Stockpile Access Road	0.00	0.00	0.00	0.00	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Haul Roads	Roads (various) - Tailpipe	LG Stockpile Access Road	0.46	0.40	1.28	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	East Road to South	0.00	0.00	0.00	0.00	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Haul Roads	Roads (various) - Tailpipe	East Road to South	0.46	0.40	1.28	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	South Road to Mid/High Grade Ore Stockpile	0.00	0.00	0.00	0.00	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Haul Roads	Roads (various) - Tailpipe	South Road to Mid/High Grade Ore Stockpile	0.91	0.79	2.56	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haul Roads	Roads (various) - Dust	South Road to Surficial Stockpile	0.00	0.00	0.00	0.00	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Haul Roads	Roads (various) - Tailpipe	South Road to Surficial Stockpile	0.91	0.79	2.56	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equipment in pit	PIT Equip - Dust	Equipment in pit	0.00	0.00	0.00	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Equipment in pit	PIT Equip - Tailpipe	Equipment in pit	4.04	5.35	14.75	10.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete	BATCH	Batch Plant	0.00	0.00	0.00	0.00	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91
UnloadMILL	MILL	Drop at Mill	0.00	0.00	0.00	0.00	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
DozerMill	MILL	Dozer at Mill	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
UnloadCDF	Co-Disposal Facility Area	Drop at CDF	0.00	0.00	0.00	0.00	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52
DozerCDF	Co-Disposal Facility Area Dust	Dozer at CDF	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
UnloadOreLG	ORELG	LG Ore stockpile unloading	0.00	0.00	0.00	0.00	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
DozerOreLG	OREDoz Dust LG	Dozer at LG Ore stockpile	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
UnloadOreMG/HG	ORE MG/HG	MG Ore stockpile unloading	0.00	0.00	0.00	0.00	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
DozerOreMG/HG	OREDoz Dust MG/HG	MG Dozer at Ore stockpile	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Unload OVB	OVB Dust	Unloading OVB at SSTK	0.00	0.00	0.00	0.00	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Dozer OVB	OVB Doz	Dozer at SSTK	0.00	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
UnloadDam	Dam Dust	Unloading at Dam	0.00	0.00	0.00	0.00	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
EquipProc	Processing Plant area	Equipment at Processing Plant	0.22	0.19	0.63	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EquipSST	Surficial Stockpile Area	Equipment at Surficial Stockpile	0.22	0.19	0.63	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EquipDAM	Dam construction Area	Equipment at Dam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WindErosion LG	LGSTK	Wind Erosion at LG Ore Stockpile	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
WindErosion M/HG	MHGSTK	Wind Erosion at MGHG Ore Stockpile	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
WindErosion CDF	CDFWind	Wind Erosion at CDF	0.00	0.00	0.00	0.00	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
BagHouse1	BH1 PCRUSH	baghouse for crusher	0.00	0.00	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
BagHouse2	BH2 - under crushed ore pile	Baghouse for conveyor drop under stockpile feed conveyor	0.00	0.00	0.00	0.00	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Baghouse3	BH3 2ndCrush	baghouse for secondary crusher	0.00	0.00	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Baghouse4	BH4 - under crushed 2nd ore pile	baghouse for conveyor drop under stockpile feed conveyor	0.00	0.00	0.00	0.00	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Leach	LEACH	Leach Tanks - LT1 to LT8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SpaceHeat	SPACEHEAT	space heating in process building	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Induction Furances	IND1	scrubber to control emissions	0.00	0.00	0.00	0.00	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Lime Baghouse	BH11 Lime	exhaust for lime bin dust collector	0.00	0.00	0.00	0.00	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Scrubber lime slaker	LS	scrubber for lime slaker	0.00	0.00	0.00	0.00	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Flocculant Dust collector	FLOC1	flocculant handling cartridge filter	0.00	0.00	0.00	0.00	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
CuSO4 filter	EF11CuSO4	CuSO4 dust filter	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
CN-Dest	HCND1	CN Destruction Tank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emerg Gen 1	EGEN1	Emergency Diesel Generator 1	42.42	42.48	26.99	34.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emerg Gen 2	EGEN2	Emergency Diesel Generator 2	42.42	42.48	26.99	34.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table B-3: Operations Phase - List of Primary Emissions Control Equipment

Source ID	Source Description	Make & Model	Flowrate (acfm)	Flowrate (m^3/s)
Dust Collectors				
BH1 PCRUSH	Primary Crusher Dust Control Equipment	Not yet identified. Will be consistent with specifications	20000	9.4
BH2 - under crushed ore pile	Baghouse at under feed from stockpile (2)	Not yet identified. Will be consistent with specifications	40000	18.9
BH3 2ndCrush	Secondary Crusher	Not yet identified. Will be consistent with specifications	20000	9.4
BH4 - under crushed 2nd ore pile	Baghouse at under feed from stockpile (2)	Not yet identified. Will be consistent with specifications	60000	28.3
BH11 Lime	Lime silo dust collection	Not yet identified. Will be consistent with specifications	5000	2.4
EF11CuSO4	CuSO4	Not yet identified. Will be consistent with specifications	5000	2.4
FLOC1	Flocculant Dust collector	Not yet identified. Will be consistent with specifications	5000	2.4
Wet Scrubbers				
LS	Lime Slaking	Not yet identified. Will be consistent with specifications	5000	2.4
IND1	Furnace Exhaust	Not yet identified. Will be consistent with specifications	10000	4.7

Table B-4: Construction Phase – Mine Infrastructure - Source Summary

Construction Area	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	NO_X	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	SPM	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	Acetaldehyde	Acrolein	Formaldehyde
				24-Hour Averaging									1-Hour Averaging								
Main Open Pit	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9	1.30E-01	2.29E-02	8.78E-03								1.84E-01	3.86E-02	1.61E-02						
	Generators	US EPA AP-42																			
	Crusher	US EPA AP-42	8.76E-01	3.27E-01	3.27E-01																
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	1.76E-03	1.76E-03	1.71E-03	3.52E-02	8.79E-09	1.76E-03	3.60E-06	5.08E-04	1.82E-04	4.14E-05	3.53E-03	3.53E-03	3.42E-03	2.23E-02	7.03E-02	1.54E-04	3.65E-04	8.28E-05	1.02E-03
Total Emission Rate			1.01E+00	3.52E-01	3.38E-01	3.52E-02	8.79E-09	1.76E-03	3.60E-06	5.08E-04	1.82E-04	4.14E-05	1.88E-01	4.21E-02	1.95E-02	2.23E-02	7.03E-02	1.54E-04	3.65E-04	8.28E-05	1.02E-03
Lake Dewatering	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9																			
	Generators	US EPA AP-42	2.50E-01	2.50E-01	2.50E-01	3.53E+00	1.50E-07	7.43E-04	3.12E-05	9.40E-04	6.11E-04	7.37E-05	2.50E-01	2.50E-01	2.50E-01	7.60E-01	3.53E+00	2.33E-01	6.11E-04	7.37E-05	9.40E-04
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	2.60E-04	2.60E-04	2.52E-04	3.95E-03	1.35E-09	2.60E-04	5.17E-07	7.58E-05	2.72E-05	5.75E-06	5.20E-04	5.20E-04	5.04E-04	3.55E-03	7.90E-03	2.03E-05	5.44E-05	1.15E-05	1.52E-04
Total Emission Rate			2.51E-01	2.51E-01	2.51E-01	3.53E+00	1.51E-07	1.00E-03	3.17E-05	1.02E-03	6.38E-04	7.94E-05	2.51E-01	2.51E-01	2.51E-01	7.64E-01	3.54E+00	2.33E-01	6.65E-04	8.52E-05	1.09E-03
SITE PREP & EARTHWORKS	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9	1.94E-01	7.56E-02	1.90E-02									1.51E-01	3.79E-02						
	Generators	US EPA AP-42																			
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	1.75E-03	1.75E-03	1.69E-03	2.76E-02	1.07E-08	1.75E-03	5.15E-06	8.01E-04	2.86E-04	5.19E-05	3.49E-03	3.49E-03	3.39E-03	2.45E-02	5.52E-02	1.41E-04	5.72E-04	1.04E-04	1.60E-03
Total Emission Rate			1.96E-01	7.73E-02	2.06E-02	2.76E-02	1.07E-08	1.75E-03	5.15E-06	8.01E-04	2.86E-04	5.19E-05	2.54E-01	1.55E-01	4.13E-02	2.45E-02	5.52E-02	1.41E-04	5.72E-04	1.04E-04	1.60E-03
Concrete	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9	1.70E-01	5.82E-02	1.78E-02								3.40E-01	1.16E-01	3.57E-02						
	Generators	US EPA AP-42	1.50E-02	1.50E-02	1.50E-02	2.11E-01	8.95E-09	4.44E-05	1.86E-06	5.62E-05	3.65E-05	4.41E-06	1.50E-02	1.50E-02	1.50E-02	4.54E-02	2.11E-01	1.39E-02	3.65E-05	4.41E-06	5.62E-05
	Crusher	US EPA AP-42	8.76E-01	3.27E-01	3.27E-01																
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	1.60E-03	1.60E-03	1.55E-03	1.88E-02	7.87E-09	1.60E-03	4.74E-06	6.88E-04	2.46E-04	5.38E-05	3.20E-03	3.20E-03	3.10E-03	2.23E-02	3.75E-02	8.95E-05	4.92E-04	1.08E-04	1.38E-03
Total Emission Rate			1.06E+00	4.02E-01	3.62E-01	2.30E-01	1.68E-08	1.64E-03	6.61E-06	7.44E-04	2.83E-04	5.82E-05	3.58E-01	1.35E-01	5.38E-02	6.77E-02	2.48E-01	1.40E-02	5.29E-04	1.12E-04	1.43E-03
SMP	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9																			
	Generators	US EPA AP-42	6.64E-02	6.64E-02	6.64E-02	9.36E-01	3.97E-08	1.97E-04	8.27E-06	2.49E-04	1.62E-04	1.96E-05	6.64E-02	6.64E-02	6.64E-02	2.02E-01	9.36E-01	6.19E-02	1.62E-04	1.96E-05	2.49E-04
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	5.45E-03	5.45E-03	5.29E-03	8.13E-02	2.67E-08	5.45E-03	1.38E-05	1.97E-03	7.04E-04	1.57E-04	1.09E-02	1.09E-02	1.06E-02	7.41E-02	1.63E-01	2.49E-04	1.41E-03	3.15E-04	3.95E-03
Total Emission Rate			7.19E-02	7.19E-02	7.17E-02	1.02E+00	6.64E-08	5.65E-03	2.20E-05	2.22E-03	8.66E-04	1.77E-04	7.74E-02	7.74E-02	7.70E-02	2.76E-01	1.10E+00	6.22E-02	1.57E-03	3.34E-04	4.20E-03

Table B-4: Construction Phase – Mine Infrastructure - Source Summary

Construction Area	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	NO_X	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	SPM	PM_{10}	$PM_{2.5}$	CO	NO_X	SO_2	Acetaldehyde	Acrolein	Formaldehyde
				24-Hour Averaging									1-Hour Averaging								
General	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9																			
	Generators	US EPA AP-42																			
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	1.04E-04	1.04E-04	1.00E-04	1.68E-03	6.52E-10	1.04E-04	1.49E-07	2.37E-05	8.61E-06	1.52E-06	2.07E-04	2.07E-04	2.01E-04	1.26E-03	3.36E-03	1.49E-05	1.72E-05	3.05E-06	4.74E-05
Total Emission Rate			1.04E-04	1.04E-04	1.00E-04	1.68E-03	6.52E-10	1.04E-04	1.49E-07	2.37E-05	8.61E-06	1.52E-06	2.07E-04	2.07E-04	2.01E-04	1.26E-03	3.36E-03	1.49E-05	1.72E-05	3.05E-06	4.74E-05
E&I	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9																			
	Generators	US EPA AP-42	8.54E-02	8.54E-02	8.54E-02	1.20E+00	5.11E-08	2.54E-04	1.06E-05	3.21E-04	2.08E-04	2.51E-05	8.54E-02	8.54E-02	8.54E-02	2.59E-01	1.20E+00	7.96E-02	2.08E-04	2.51E-05	3.21E-04
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	4.67E-04	4.67E-04	4.53E-04	8.45E-03	2.55E-09	4.67E-04	1.04E-06	1.57E-04	5.57E-05	1.06E-05	9.34E-04	9.34E-04	9.06E-04	7.11E-03	1.69E-02	2.44E-05	1.11E-04	2.12E-05	3.13E-04
Total Emission Rate			8.59E-02	8.59E-02	8.59E-02	1.21E+00	5.37E-08	7.21E-04	1.17E-05	4.77E-04	2.64E-04	3.58E-05	8.64E-02	8.64E-02	8.63E-02	2.67E-01	1.22E+00	7.96E-02	3.20E-04	4.64E-05	6.34E-04
East & West Dykes	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9	1.17E-01	3.74E-02	8.98E-03								1.76E-01	6.67E-02	1.69E-02						
	Generators	US EPA AP-42																			
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	8.70E-04	8.70E-04	8.44E-04	1.53E-02	4.28E-09	8.70E-04	1.73E-06	2.39E-04	8.57E-05	2.10E-05	1.74E-03	1.74E-03	1.69E-03	9.74E-03	3.06E-02	6.14E-05	1.71E-04	4.20E-05	4.78E-04
Total Emission Rate			1.17E-01	3.83E-02	9.82E-03	1.53E-02	4.28E-09	8.70E-04	1.73E-06	2.39E-04	8.57E-05	2.10E-05	1.78E-01	6.84E-02	1.86E-02	9.74E-03	3.06E-02	6.14E-05	1.71E-04	4.20E-05	4.78E-04
Co-Dispodal Facility	Materials Handling (Bulldozer, Grader, Loader, Compators)	US EPA AP-42 Sections 11.9	1.49E-01	5.30E-02	1.57E-02								2.99E-01	1.06E-01	3.14E-02						
	Generators	US EPA AP-42																			
	Vehicular Tailpipe Emissions (site preparation)	US EPA MOVES software Version 2014b (considering vehicle utilization)	9.22E-04	9.22E-04	8.94E-04	1.22E-02	5.19E-09	9.22E-04	1.59E-06	2.35E-04	8.47E-05	1.72E-05	1.84E-03	1.84E-03	1.79E-03	1.05E-02	2.45E-02	8.53E-05	1.69E-04	3.43E-05	4.71E-04
Total Emission Rate			1.50E-01	5.39E-02	1.66E-02	1.22E-02	5.19E-09	9.22E-04	1.59E-06	2.35E-04	8.47E-05	1.72E-05	3.01E-01	1.08E-01	3.32E-02	1.05E-02	2.45E-02	8.53E-05	1.69E-04	3.43E-05	4.71E-04
Pit road to East	Road Dust	US EPA AP-42	1.79E+00	4.38E-01	4.38E-02								3.58E+00	8.76E-01	8.76E-02						
	Tailpipe	US EPA AP-42	1.81E-02	1.81E-02	1.81E-02	6.34E-01	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11	3.62E-02	3.62E-02	3.62E-02	6.34E-01	1.27E+00	2.04E-03	8.63E-05	9.07E-11	
Pit road to West	Road Dust	US EPA AP-42	1.15E+00	2.80E-01	2.80E-02								5.73E-01	1.40E-01	1.40E-02						
	Tailpipe	US EPA AP-42	9.05E-03	9.05E-03	9.05E-03	3.17E-01	5.24E-08	3.80E-04	1.38E-05	3.42E-06	2.16E-05	2.27E-11	1.81E-02	1.81E-02	1.81E-02	1.27E+00	6.34E-01	1.02E-03	4.32E-05	4.54E-11	
Total Emission Rate			2.96E+00	7.45E-01	9.90E-02	9.51E-01	1.57E-07	1.14E-03	4.15E-05	1.03E-05	6.47E-05	6.81E-11	4.21E+00	1.07E+00	1.56E-01	1.90E+00	1.90E+00	3.06E-03	1.29E-04	1.36E-10	0.00E+00
Project Total Emission Rate			5.91E+00	2.08E+00	1.25E+00	7.03E+00	4.75E-07	1.56E-02	1.26E-04	6.28E-03	2.76E-03	4.83E-04	5.90E+00	1.99E+00	7.37E-01	3.34E+00	8.19E+00	3.93E-01	4.51E-03	8.44E-04	1.10E-02

All emission rates are in the unit of grams per second (g/s).

Table B-5: Construction Phase – Access Road - Source Summary

Category	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	DPM	NO_X	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
			24-Hour Averaging									
Materials Handling	Bulldozer activity	US EPA AP-42 Sections 11.9	2.52E-02	4.00E-03	2.64E-03							
	Grader activity		1.58E-02	7.08E-03	4.91E-04							
	Loader activity		1.83E-01	2.63E-02	3.49E-03							
	Soil compaction		2.52E-02	4.00E-03	2.64E-03							
Vehicular Tailpipe Emissions (site preparation)	Dump Truck / Truck&Trailer	US EPA MOVES software Version 2014b (considering vehicle utilization)	3.29E-03	3.29E-03	3.19E-03	3.19E-03	5.34E-02	2.07E-08	1.36E-04	4.75E-06	7.53E-04	2.74E-04
	Loader		7.58E-03	7.58E-03	7.35E-03	7.35E-03	1.12E-01	3.84E-08	2.90E-04	1.29E-05	1.82E-03	6.52E-04
	Grader		3.72E-04	3.72E-04	3.61E-04	3.61E-04	5.55E-03	2.24E-09	1.84E-05	6.65E-07	1.03E-04	3.73E-05
	Compactors / Packers		4.02E-03	4.02E-03	3.90E-03	3.90E-03	9.96E-02	2.31E-08	2.72E-04	9.96E-06	1.54E-03	5.46E-04
	D8 Dozer		8.43E-03	8.43E-03	8.18E-03	8.18E-03	1.14E-01	4.90E-08	3.31E-04	1.26E-05	1.91E-03	6.82E-04
	Excavator		2.25E-03	2.25E-03	2.18E-03	2.18E-03	2.96E-02	1.37E-08	9.17E-05	3.30E-06	5.11E-04	1.84E-04
	Mobile Crane		1.09E-03	1.09E-03	1.06E-03	1.06E-03	2.06E-02	6.16E-09	7.50E-05	2.83E-06	4.30E-04	1.54E-04
	Pile Driver		2.00E-03	2.00E-03	1.94E-03	1.94E-03	2.52E-02	7.53E-09	8.28E-05	4.47E-06	5.89E-04	2.10E-04
	Ligth Duty Pickup Truck		5.85E-03	5.85E-03	5.67E-03	5.67E-03	9.49E-02	3.69E-08	2.42E-04	8.44E-06	1.34E-03	4.86E-04
	Flat Bed or Haul Truck		2.92E-03	2.92E-03	2.84E-03	2.84E-03	4.75E-02	1.84E-08	1.21E-04	4.22E-06	6.70E-04	2.43E-04
	Skid Steer		4.76E-03	4.76E-03	4.62E-03	4.62E-03	2.46E-02	1.23E-08	1.64E-04	1.22E-05	1.46E-03	5.22E-04
	Water Truck		1.83E-03	1.83E-03	1.77E-03	1.77E-03	2.97E-02	1.15E-08	7.55E-05	2.64E-06	4.19E-04	1.52E-04
	Light Duty Service Truck		5.85E-04	5.85E-04	5.67E-04	5.67E-04	9.49E-03	3.69E-09	2.42E-05	8.44E-07	1.34E-04	4.86E-05
	Gravel Truck		7.70E-03	7.70E-03	7.47E-03	7.47E-03	1.25E-01	4.80E-08	3.14E-04	1.10E-05	1.74E-03	6.33E-04
	Packer		1.17E-03	1.17E-03	1.13E-03	1.13E-03	1.18E-02	7.01E-09	4.58E-05	1.70E-06	2.59E-04	9.24E-05
	Reed Drill 3500		3.60E-03	3.60E-03	3.49E-03	3.49E-03	5.75E-02	9.74E-09	1.20E-04	8.47E-06	1.03E-03	3.68E-04
	Reed Drill 345		3.60E-03	3.60E-03	3.49E-03	3.49E-03	5.75E-02	9.74E-09	1.20E-04	8.47E-06	1.03E-03	3.68E-04
	Rock Crusher		4.94E-03	4.94E-03	4.79E-03	4.79E-03	1.04E-01	2.16E-08	2.50E-04	1.21E-05	1.66E-03	5.93E-04
	Personnel transport		5.99E-03	5.99E-03	5.81E-03	5.81E-03	7.47E-02	3.81E-08	2.08E-04	7.16E-06	1.14E-03	4.15E-04
Total Emission Rate			3.22E-01	1.13E-01	7.91E-02	6.98E-02	1.10E+00	3.78E-07	2.98E-03	1.29E-04	1.85E-02	6.66E-03

All emission rates are in the unit of grams per second (g/s).

Table B-5: Construction Phase – Access Road - Source Summary

Category	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	CO	NO_X	Acetaldehyde	Acrolein	Formaldehyde	SO2
			1-Hour Averaging								
Materials Handling	Bulldozer activity	US EPA AP-42 Sections 11.9	5.04E-02	8.00E-03	5.29E-03						
	Grader activity		3.17E-02	1.42E-02	9.82E-04						
	Loader activity		9.17E-02	1.31E-02	1.74E-03						
	Soil compaction		5.04E-02	8.00E-03	5.29E-03						
Vehicular Tailpipe Emissions (site preparation)	Dump Truck / Truck&Trailer	US EPA MOVES software Version 2014b (considering vehicle utilization)	6.58E-03	6.58E-03	6.38E-03	4.02E-02	1.07E-01	5.47E-04	9.68E-05	1.51E-03	4.75E-04
	Loader		1.52E-02	1.52E-02	1.47E-02	1.03E-01	2.25E-01	1.30E-03	2.89E-04	3.65E-03	3.94E-04
	Grader		7.45E-04	7.45E-04	7.22E-04	3.91E-03	1.11E-02	7.46E-05	1.34E-05	2.06E-04	4.70E-05
	Compactors / Packers		8.05E-03	8.05E-03	7.81E-03	6.08E-02	1.99E-01	1.09E-03	1.98E-04	3.07E-03	2.93E-04
	D8 Dozer		1.69E-02	1.69E-02	1.64E-02	1.05E-01	2.29E-01	1.36E-03	2.58E-04	3.82E-03	5.03E-04
	Excavator		4.49E-03	4.49E-03	4.36E-03	2.70E-02	5.91E-02	3.68E-04	6.61E-05	1.02E-03	1.81E-04
	Mobile Crane		2.18E-03	2.18E-03	2.11E-03	1.07E-02	4.12E-02	3.08E-04	5.60E-05	8.60E-04	1.22E-04
	Pile Driver		8.00E-04	8.00E-04	7.76E-04	4.09E-03	5.03E-02	8.41E-05	2.30E-05	2.35E-04	5.45E-05
	Ligth Duty Pickup Truck		1.17E-02	1.17E-02	1.13E-02	7.14E-02	1.90E-01	9.73E-04	1.72E-04	2.68E-03	8.44E-04
	Flat Bed or Haul Truck		5.85E-03	5.85E-03	5.67E-03	3.57E-02	9.49E-02	4.86E-04	8.60E-05	1.34E-03	4.22E-04
	Skid Steer		9.52E-03	9.52E-03	9.23E-03	5.97E-02	4.92E-02	1.04E-03	3.52E-04	2.91E-03	5.26E-05
	Water Truck		3.66E-03	3.66E-03	3.55E-03	2.23E-02	5.93E-02	3.04E-04	5.38E-05	8.37E-04	2.64E-04
	Light Duty Service Truck		1.17E-03	1.17E-03	1.13E-03	7.14E-03	1.90E-02	9.73E-05	1.72E-05	2.68E-04	8.44E-05
	Gravel Truck		1.54E-02	1.54E-02	1.49E-02	1.39E-01	2.51E-01	1.27E-03	2.24E-04	3.49E-03	1.11E-03
	Packer		2.34E-03	2.34E-03	2.27E-03	9.71E-03	2.35E-02	1.85E-04	3.36E-05	5.18E-04	6.75E-05
	Reed Drill 3500		7.20E-03	7.20E-03	6.99E-03	3.51E-02	1.15E-01	7.37E-04	2.24E-04	2.06E-03	1.25E-04
	Reed Drill 345		7.20E-03	7.20E-03	6.99E-03	3.51E-02	1.15E-01	7.37E-04	2.24E-04	2.06E-03	1.25E-04
	Rock Crusher		9.88E-03	9.88E-03	9.58E-03	6.35E-02	2.08E-01	1.19E-03	2.87E-04	3.31E-03	3.39E-04
	Personnel transport		1.20E-02	1.20E-02	1.16E-02	5.16E-02	1.49E-01	8.30E-04	1.46E-04	2.27E-03	9.01E-04
Total Emission Rate			3.65E-01	1.84E-01	1.50E-01	8.84E-01	2.19E+00	1.30E-02	2.82E-03	3.61E-02	6.40E-03

All emission rates are in the unit of grams per second (g/s).

Table B-6: Construction Phase – Transmission Line - Source Summary

Category	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	DPM	NO_X	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
			24-Hour Averaging									
Materials Handling	Bulldozer activity	US EPA AP-42 Sections 11.9	2.52E-02	4.00E-03	2.64E-03							
Vehicular Tailpipe Emissions	D8 Dozer	US EPA MOVES software Version 2014b (considering vehicle utilization)	5.62E-03	5.62E-03	5.45E-03	5.45E-03	7.63E-02	3.27E-08	2.21E-04	8.43E-06	1.27E-03	4.55E-04
	330 CAT Excavator (Clearing)		1.55E-02	1.55E-02	1.50E-02	1.50E-02	2.19E-01	9.49E-08	6.63E-04	2.38E-05	3.70E-03	1.33E-03
	Digger Derrick with Bucket		4.15E-03	4.15E-03	4.03E-03	4.03E-03	7.31E-02	1.08E-08	1.33E-04	9.93E-06	1.18E-03	4.24E-04
	Line Truck		4.22E-03	4.22E-03	4.09E-03	4.09E-03	6.64E-02	2.65E-08	1.79E-04	6.22E-06	9.91E-04	3.63E-04
	Concrete Mixers		6.19E-03	6.19E-03	6.01E-03	6.01E-03	1.23E-01	1.62E-08	2.23E-04	1.66E-05	1.98E-03	7.11E-04
	Gravel Truck		2.19E-03	2.19E-03	2.13E-03	2.13E-03	3.56E-02	1.38E-08	9.07E-05	3.16E-06	5.02E-04	1.82E-04
	Flat Bed or Haul Truck		7.03E-03	7.03E-03	6.82E-03	6.82E-03	1.14E-01	4.40E-08	2.89E-04	1.01E-05	1.60E-03	5.81E-04
	ROW Clearing		3.01E-02	3.01E-02	2.92E-02	2.92E-02	4.06E-01	1.11E-07	8.89E-04	5.12E-05	6.60E-03	2.37E-03
	Rubber Tire Backhoe		7.93E-03	7.93E-03	7.69E-03	7.69E-03	5.60E-02	2.87E-08	3.49E-04	1.97E-05	2.56E-03	9.15E-04
	Light Duty Service Truck		1.17E-03	1.17E-03	1.13E-03	1.13E-03	1.90E-02	7.37E-09	4.83E-05	1.69E-06	2.68E-04	9.73E-05
	Mobile Crane		1.63E-03	1.63E-03	1.59E-03	1.59E-03	3.09E-02	9.23E-09	1.12E-04	4.25E-06	6.45E-04	2.31E-04
	Tracked Excavator		9.31E-04	9.31E-04	9.03E-04	9.03E-04	1.50E-02	5.74E-09	4.34E-05	1.55E-06	2.43E-04	8.79E-05
	Ligth Duty Pickup Truck		5.85E-04	5.85E-04	5.67E-04	5.67E-04	9.49E-03	3.69E-09	2.42E-05	8.44E-07	1.34E-04	4.86E-05
	Personnel transport		5.99E-03	5.99E-03	5.81E-03	5.81E-03	7.47E-02	3.81E-08	2.08E-04	7.16E-06	1.14E-03	4.15E-04
	Super Puma Helicopter		2.06E-04	2.06E-04	2.06E-04	2.06E-04	8.23E-03	5.60E-11	3.72E-05	1.51E-06	2.67E-03	4.30E-06
	Bell 407 Helicopter		7.80E-05	7.80E-05	7.80E-05	7.80E-05	4.63E-03	1.22E-10	8.07E-05	3.36E-06	1.50E-03	9.33E-06
Total Emission Rate			**1.19E-01**	**9.75E-02**	**9.34E-02**	**9.07E-02**	**1.33E+00**	**4.43E-07**	**3.59E-03**	**1.70E-04**	**2.70E-02**	**8.22E-03**

All emission rates are in the unit of grams per second (g/s).

Table B-6: Construction Phase – Transmission Line - Source Summary

Category	Emission Source / Activity	Emission Estimation Methodology	SPM	PM_{10}	$PM_{2.5}$	CO	NO_X	Acetaldehyde	Acrolein	Formaldehyde	SO2
			1-Hour Averaging								
Materials Handling	Bulldozer activity	US EPA AP-42 Sections 11.9	5.04E-02	8.00E-03	5.29E-03						
Vehicular Tailpipe Emissions	D8 Dozer	US EPA MOVES software Version 2014b (considering vehicle utilization)	1.12E-02	1.12E-02	1.09E-02	6.98E-02	1.53E-01	9.10E-04	1.72E-04	2.54E-03	3.35E-04
	330 CAT Excavator (Clearing)		3.09E-02	3.09E-02	3.00E-02	1.79E-01	4.39E-01	2.67E-03	4.78E-04	7.40E-03	1.58E-03
	Digger Derrick with Bucket		8.30E-03	8.30E-03	8.06E-03	5.04E-02	1.46E-01	8.48E-04	2.83E-04	2.36E-03	1.41E-04
	Line Truck		8.44E-03	8.44E-03	8.19E-03	4.82E-02	1.33E-01	7.27E-04	1.28E-04	1.98E-03	7.47E-04
	Concrete Mixers		1.24E-02	1.24E-02	1.20E-02	8.18E-02	2.46E-01	1.42E-03	4.74E-04	3.96E-03	2.40E-04
	Gravel Truck		4.39E-03	4.39E-03	4.26E-03	2.68E-02	7.12E-02	3.65E-04	6.45E-05	1.00E-03	3.16E-04
	Flat Bed or Haul Truck		1.41E-02	1.41E-02	1.36E-02	1.06E-01	2.28E-01	1.16E-03	2.06E-04	3.20E-03	1.01E-03
	ROW Clearing		6.02E-02	6.02E-02	5.84E-02	4.50E-01	8.12E-01	4.73E-03	1.32E-03	1.32E-02	1.18E-03
	Rubber Tire Backhoe		1.59E-02	1.59E-02	1.54E-02	1.02E-01	1.12E-01	1.83E-03	4.92E-04	5.13E-03	1.51E-04
	Light Duty Service Truck		2.34E-03	2.34E-03	2.27E-03	1.43E-02	3.80E-02	1.95E-04	3.44E-05	5.36E-04	1.69E-04
	Mobile Crane		3.27E-03	3.27E-03	3.17E-03	1.61E-02	6.19E-02	4.63E-04	8.40E-05	1.29E-03	1.82E-04
	Tracked Excavator		1.86E-03	1.86E-03	1.81E-03	1.00E-02	3.00E-02	1.76E-04	3.13E-05	4.85E-04	1.32E-04
	Ligth Duty Pickup Truck		1.17E-03	1.17E-03	1.13E-03	7.14E-03	1.90E-02	9.73E-05	1.72E-05	2.68E-04	8.44E-05
	Personnel transport		1.20E-02	1.20E-02	1.16E-02	5.16E-02	1.49E-01	8.30E-04	1.46E-04	2.27E-03	9.01E-04
	Super Puma Helicopter		4.13E-04	4.13E-04	4.13E-04	1.46E-03	1.65E-02	8.60E-06	9.11E-08	5.35E-03	0.00E+00
	Bell 407 Helicopter		1.56E-04	1.56E-04	1.56E-04	3.25E-03	9.26E-03	1.87E-05	2.03E-07	3.01E-03	0.00E+00
Total Emission Rate			**2.37E-01**	**1.95E-01**	**1.87E-01**	**1.22E+00**	**2.66E+00**	**1.64E-02**	**3.93E-03**	**5.40E-02**	**7.17E-03**

All emission rates are in the unit of grams per second (g/s).

Attachment C
Emission Rate Calculations

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
Construction	year	3		Project Description
Mine Life	year	12	last 3 years are stockpile reclaim	Project Description
Ore Production				
Mill throughput	tonnes/day	30,000	design	Table 17-1, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
Mill throughput	tonnes/hr	1,250	based on 24 hour operation	
Crushing Plant Availability	%	75		Table 17-1, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
Mill Availability	%	92		Table 17-1, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
Days of Operation per year	days	365		
Truck Shift per day	hours	22	assume 2 hours for shift change over	Assumed
Drilling				**Values for production**
# drills	#	3	251mm - electric	Table 21-9, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
shift drill time	hours	22	2 hours for shift change over	Assumed
drill horsepower	hp			
# holes	#	74.4	holes per shift	Calculated
hole diameter	inches	-		Table 21-22, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
hole diameter	m	0.251		Table 21-22, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
hole depth	m	13.3		Table 21-22, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
penetration rate	min	0.50		Table 21-22, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
drill time per hole	m/min	26.60		Table 21-22, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
Blasting				
average density	tonne/m^3	2.60	(Ore 2.68, Mine Rock 2.57)	Updated value from AGP
hole depth (average)	m	12.0	depth of bench	Project Description
explosive (bulk emulsion)	kg/tonne	0.3		Project Description 16-48
Phase 1				
frequency	#	5	per week	
maximum daily volume moved	m3	6,144	Mine Rock and Ore (annual maximum/number days)	
maximum daily tonnage moved	tonnes	15,973	Mine Rock and Ore (annual maximum/number days)	Updated value from AGP
rock mass	tonnes	22,363	total tonne per blast (ore and waste in pit)	
volume blasted	m^3	8,601	per blast	
area blasted	m^2	717		
mass blasted (volume x density)	tonnes	22,363		
explosive (bulk emulsion)	kg/blast	6,709	Calculated	
Phase 2				
frequency	#	5	per week	
maximum daily volume moved	m3	52,675	Mine Rock and Ore (annual maximum/number days)	
maximum daily tonnage moved	tonnes	136,955	Mine Rock and Ore (annual maximum/number days)	Updated value from AGP
rock mass	tonnes	191,737	total tonne per blast (ore and waste in pit)	
volume blasted	m^3	73,745	per blast	
area blasted	m^2	6,145		
mass blasted (volume x density)	tonnes	191,737		
explosive (bulk emulsion)	kg/blast	57,521	Calculated	
Phase 2C				
frequency	#	5	per week	
maximum daily volume moved	m^3	62,849	Mine Rock and Ore (annual maximum/number days)	
maximum daily tonnage moved	tonnes	163,408	Mine Rock and Ore (annual maximum/number days)	
rock mass	tonnes	228,771	total tonne per blast (ore and waste in pit)	
volume blasted	m^3	87,989	per blast	
area blasted	m^2	7,332		
mass blasted (volume x density)	tonnes	228,771		
explosive (bulk emulsion)	kg/blast	68,631	Calculated	
Crushing and Milling				
Primary Crusher	tonnes/day	36,000	design plus 20% for max day	
single train	tonnes/year	13,140,000		
	tonnes/hour	1,500	assume 24 hour operation	
Crushed Ore Storage				
description		Single, covered conical	single, covered conical	Ausenco recommendation, standard procedures or in-house data
- residence time	hours	12		Ausenco recommendation, standard procedures or in-house data
- live capacity	tonnes	16,304		Ausenco recommendation, standard procedures or in-house data
Cement Batch Plants				
cement production per hour, plant 1	m^3/hr	120	Assumed based on previous projects with 50safety factor	
	cu.yards	157.0		
cement density	pounds per yard	4,024		
coarse aggregate	pounds per yard	1,865		
sand	pounds per yard	1,428		
cement	pounds per yard	491		
cement supplement	pounds per yard	73		
water	pounds per yard	167		

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
Ore Processing Reagents				
Tails Circuit				
Flotation Tails Thickener		1		Mechanical Equipment List (Mar 2023)
Thickener Tank Quantity	#	41		Mechanical Equipment List (Mar 2023)
Thickener Tank Diameter	m	**3.2**		Mechanical Equipment List (Mar 2023)
Thickener Tank Height	m			
Flotation Tails Leaching		4		Leach, Adsorption and Elution Sizing (2023)
Tank Quantity	#	6,200		Leach, Adsorption and Elution Sizing (2023)
Tank Volume	m³	15.6		Leach, Adsorption and Elution Sizing (2023)
Tank Residence Time	hours			
Tails CIP		6		Leach, Adsorption and Elution Sizing (2023)
Tank Quantity	#	1,600		Leach, Adsorption and Elution Sizing (2023)
Tank Volume	m³	6.1		Leach, Adsorption and Elution Sizing (2023)
Tank Residence Time	hours			
Potassium Amyl Xanthate (PAX)		100		Process Design Criteria (2023)
Consumption	g/t feed			
Methyl Isobutyl Carbinol (MIBC)		14		Process Design Criteria (2023)
Consumption	g/t feed			
Flocculant Plant 1		0.02		Process Design Criteria (2023)
Consumption	kg/t ore feed	480		
Consumption	kg/day	175		
Consumption	tonnes/year	20.0		
Consumption	kg/hr			
Coagulant		0.03		Process Design Criteria (2023)
Consumption	kg/t ore feed	0		
Consumption	kg/day			
Pebble Lime		1.41		Process Design Criteria (2023)
Consumption	kg/t ore feed	42,300		
Consumption	kg/day	15,440		
Consumption	tonnes/year	1,763		
Consumption	kg/hr	300		Process Design Criteria (2023)
Silo Capacity	tonne	0.90		Process Design Criteria (2023)
Density	t/m^3	20	Granules in Bulk Tanker	Process Design Criteria (2023)
Truck Delivery	tonne per truck			
Sodium Cyanide Addition Rate		0.42		Reagent Consumption and Storage Area (2023)
Tails Leach Consumption	kg/t ore feed	12,429	Feed Flow of 1,233 m^3/hr	
	kg/day	4,536		
	tonnes/year	518		
	kg/hr	200		Reagent Consumption and Storage Area (2023)
Residual Cyanide in Solution	ppm	0.17	Feed Flow of 1,093 m^3/hr	
Residual Cyanide in Soln Consumption	kg/t ore feed	5,248		
	kg/day	1,916		
	tonnes/year	219		
	kg/hr	737		
Total Cyanide Addition	kg/hr			
Copper Sulphate		0.08		Reagent Consumption and Storage Area (2023)
Consumption	kg/t ore feed	2,400		
Consumption	kg/day	876		
Consumption	tonnes/year	100.0		
Consumption	kg/hr	1200.0	Blue Crystal Powder in Bulk Bags	Reagent Consumption and Storage Area (2023)
Package Delivery	kg net weight	98.0		Reagent Consumption and Storage Area (2023)
Purity	%wt/w	20.0		Reagent Consumption and Storage Area (2023)
Mixture Strength	%wt/w			
Activated Carbon		0.04		Reagent Consumption and Storage Area (2023)
Consumption	kg/t ore feed	1.09		
Consumption	kg/day	0.40		
Consumption	tonnes/year	0.05		
Consumption	kg/hr	500	Granules in Bulk Bag	Reagent Consumption and Storage Area (2023)
Package Delivery	kg net weight			
Zinc Powder		0.02		Reagent Consumption and Storage Area (2023)
Consumption	kg/t ore feed	552		
Consumption	kg/day	201		
Consumption	tonnes/year	23.0		
Consumption	kg/hr	7.1		Reagent Consumption and Storage Area (2023)
Solids SG	t/m^3	250	Powder in Drum	Reagent Consumption and Storage Area (2023)
Package Delivery	kg net weight			
Diatomaceous Earth		0.02		Reagent Consumption and Storage Area (2023)
Consumption	kg/t ore feed	552		
Consumption	kg/day	201		
Consumption	tonnes/year	23.0		
Consumption	kg/hr	2.25		Reagent Consumption and Storage Area (2023)
Solids SG	t/m^3	3		
Mixing Strength	% w/w	1,000	Fine Solid in Bulk Bags	Reagent Consumption and Storage Area (2023)
Package Delivery	kg net weight			

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
Ore Processing Reagents				
Flotation Circuit				
- potassium amyl xanthate (PAX)	g/t feed	80		
- methyl isobutyl carbinol (MIBC)	g/t feed	40		
Thickener (flocculent)	kg/t ore feed	0.03		Project Description 17-7, Oct 2020 trade off studies
	kg/day	900		
	tonnes/year	329		
	kg/hr	37.5		
Coagulant	kg/t ore feed	0.03		
	kg/day	900		
# thickener tanks	#	1		
tank diameter	m	54		
tank height	m	**3.2**		
Lime Usage	kg/t ore feed	1.5	(0.8 kg/t float plus 0.7 kg/t leach)	Project Description 17-8; 1.1 kg/t ROM feed
(90% pure)	kg/day	45,000		
	tonnes/year	16,425		
	kg/hr	1,875		Oct 2020 trade off studies
silo capacity	tonne	300		Oct 2020 trade off studies
density	t/m^3	0.90		Oct 2020 trade off studies
truck delivery	tonne per truck	20	solid pellet in ISO container	Project Description 17-8; 1.2 kg/t ROM feed (trade off study)
Concentration Leaching (NaCN)	kg/t ore feed	0.68	alkaline leaching	
	pH	11.0		
	mg/L NaCN	1,000		
	kg/day	20,400		
	tonnes/year	7,446		
	kg/hr	850		
leach circuit design capacity	t/d	16,816.8		no specific data found
leach circuit design capacity	t/h	700.7		no specific data found
# leach tanks	#	3.0		no specific data found
total residence time (Leach + CIP)	hours	30.0		no specific data found
leach tank diameter	m	17.0		no specific data found
leach tank height	m	17.63		no specific data found
Sodium Cyanide Usage	kg/t ore feed	2.36	solid pellet in ISO container	
	pH	11	alkaline leaching	
	mg/L NaCN	1000		
	kg/day	70,800		
	tonnes/year	25,842		
	kg/hr	2950		
Tails Leaching NaCN addition rate design	kg/t	1.12		
Tails Leaching NaCN consumption rate opex	kg/t	0.49		
leach circuit design capacity	t/d	30000		
leach circuit design capacity	t/h	1359		
# leach tanks	#	5		
retention	hours	21		
leach tank diameter	m	19.1	9.55	
leach tank height	m	20.2		
CIP Tanks - Concentrate				
# CIP tanks	#	7		
tank volume	m^3	1,000		
CIP Tanks - Tails				
# CIP tanks	#	7		Project Description 17-7; Oct 2020 trade off studies
tank volume	m^3	2,000		
Hydrochloric Acid	kg/t ore feed	0.111	average: range 0.06 to 0.12	
	kg/day	3,330		
	tonnes/year	1,215		
	kg/hr	138.8		
	%w/v	3.0		
storage tank volume	m^3	52.0		
truck delivery	tonne per truck	30.0		
purity	%wt/w	33.0		
Caustic Soda (NaOH)	kg/t ore feed	0.349		From Project Description
	kg/day	10,470		
	tonnes/year	3,822		
	kg/hr	436.3		
storage tank volume	m^3	40.0		
truck delivery	tonne per truck	34.0		
purity	%wt/w	50.0		
Copper Sulphate	kg/t ore feed	0.11		
	kg/day	3,300		
	tonnes/year	1,205		
	kg/hr	137.5		
blue crystal powder bulk bags	kg net weight	1200.0		
purity	%wt/w	98.0		
mixture strength	%wt/w	20.0		
SO_2 Use for CN destruction	kg/tonne	0.54	Assumed based on previous projects with 20% saftey factor	
	t/h	1,359		
	gSO2/g CNWAD	6.0		
	gCU/gCNWAD	0.1		
	gCaO/gCNWAD	2.6		
	kg/day	16,200		
	tonnes/year	5,913		
	kg/hr	675		
truck Delivery	tonnes per truck			
storage Tank	tonnes			
	% excess	3%		

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
Sodium Metabisulphite				
bulk bags (net weight)	kg	1250		
purity	%wt/w	97.5%		
mixture strength	%wt/w	20%		
Flux	tonnes/year	2.12		
	kg/hr	0.24		
silica	kg/100kg concentrate	30		
borax	kg/100kg concentrate	60		
sodium nitrate	kg/100kg concentrate	5		
sodium carbonate	kg/100kg concentrate	5		
Electrical Load				
- installed	kW	63,612		32 kWh/ton processed, $0.08/kWh
- in use	kW	60,939		
- load (operating)	kW	55,057		
- load (operating)	kVA	61,578		
- load (operating)	kVAr	26,417		
Propane, Gasoline, and Road Taxed Diesel Fuel Usage				
Propane	L/day	24,163	average	Updated - Propane Claculation (June 2023)
- plant (elution heaters, carbon regeneration kilns)	L/year	5,732,654	65% of total average	From Project Description
- plant	L/hour	654	65% of total average	From Project Description
- camp	L/year	3,086,814	35% of total average	From Project Description
- camp	L/hour	705	based on 35% of average daily x 2 for cold day	From Project Description
Gasoline	L/year	102024	refer to annnual data forecasts	
Road Taxed Diesel	L/year	264692	refer to annnual data forecasts	
	L/day	1,500	maximum daily use, 1200L reuseable totes	
Diesel Fuel Consumption				
annual usage (minimum)	L	10,950,000		
annual usage (maximum)	L	18,250,000		
annual usage (average)	L/year	14,600,000		
daily usage (average)	L/day	40,000		
diesel generators (power supply)	MW		<5MW assumed	
diesel generators (back-up power)	MW	2	Diesel Generator Set, output rating: 4.16 kV, 3 phase, 60 Hertz, 2000 kW, 0.8 power factor, Standby Duty	Identify where onsite these will be
diesel generators (back-up power)	MW	2	Diesel Generator Set, output rating: 4.16 kV, 3 phase, 60 Hertz, 2000 kW, 0.8 power factor, Standby Duty	Identify where onsite these will be
backup generator fuel consumption	gal/hr		for generator testing purposes	no data provided - can make assumption if not available
	lb/hr	0	7.0 lb/gal	
	MMBTU/hour	0	18390 BTU/lb fuel from CAT spec sheet	
Diesel Fuel Storage				
	# tanks	2	mine tank farm	
maximum tank size	L/tank	175000	capacity (nominal)	
total fuel storage (min)	L	150,000		Table 18-3, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
capacity (7 days)	L	250,000		Table 18-3, NI 43-101 Technical Report and PFS on the SGP (Feb 2021)
tanker truck loads (B-train	L	50,000		Preliminary Logistics Overview (Dec 2020)
daily DEF ULS Diesel (max)	L	1,500	1200L reuseable totes	Preliminary Logistics Overview (Dec 2020)
Gasoline Storage				
	# tanks	1	mine tank farm	
maximum tank size	L/tank		capacity (nominal)	
total fuel storage (minimum)	L			
capacity (7 days)	L			
tanker truck loads (B-train	L			
daily DEF ULS Diesel (max)	L		1200L reuseable totes	

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
MATERIAL HAULING SUMMARY				
Hours of Operation				
Ore Hauling	hours / year	8,760	365 days per year --- 24 hours per day	
Waste Rock Hauling	hours / year	8,760	365 days per year --- 24 hours per day	
Tailings Hauling	hours / year	8,760	365 days per year --- 24 hours per day	
Process Plant	hours / year	8,760	365 days per year --- 24 hours per day	
Haul Routes				
double lane	width (m)	35.4		project description
single lane	width (m)	27.1		project description
ore and waste	length (m)	*see table F5*		
Haul Details				
Open Pit Truck Loads (Ore to crush)	#/hour	5	calculated based upon mill throughput	
	tonnes/trip	240		
	tonnes/hour	1,250		
	tonnes/day	30,000		
	tonnes/year	10,950,000	maximum year	
Truck Loads (Ore to LGstockpile)	#/hour	3.97	loads per hour calculated from annual data forecasts	
	tonnes/trip	240		
	tonnes/hour	953	to be calculated	
	tonnes/day	22,877		
	tonnes/year	8,350,000		8,350,000
Truck Loads (Ore to H/MGstockpile)	#/hour	3.97	loads per hour calculated from annual data forecasts	
	tonnes/trip	240		
	tonnes/hour	1,250	to be calculated	
	tonnes/day	30,000		
	tonnes/year	10,950,000		
Truck Loads (overburden)	#/hour	10	loads per hour calculated from annual data forecasts	
	tonnes/trip	240	check smaller truck capacity during construction	
	tonnes/hour	2,386	calculated	
	tonnes/day	57,260	calculated	
	tonnes/year	20,900,000	calculated	
Truck Loads (Mine Rock)	#/hour	20	loads per hour calculated from annual data forecasts	
	tonnes/trip	240		
	tonnes/hour	4,783	calculated	
	tonnes/day	114,795	calculated	
	tonnes/year	41,900,000	calculated	
Truck Loads (Tailings to WMF)	#/hour	6	calculated	
	tonnes/trip	217		assumed same size as haul truck
	tonnes/hour	1,495	calculated	
	tonnes/day	35,890	calculated	
	tonnes/year	13,100,000	based on 7,616,279 m3 x 1.72 t/m3	WST Trade-Off Tech Memo - August 19, 2020 page 5

Table C-1: Operations Phase - Key Data

Source	Units	Quantity	Comment	Basis
Open Pit Haul Trucks				
240mT Haul Trucks	#	17	Consider larger for calculation (19 total)	
unladen weight	tonnes	210	from specs. Max weight of body (122.3 chasis + 47.6 body)	
load weight	tonnes	240	CAT 793F	
width	m	7.605	Road width - 35.4m	2021 AGP Technical Report / PFS, page 16-13:
height	m	6.603		
length	m	13.702		
91mT Haul Trucks	#	2		
unladen weight	tonnes	0		
load weight	tonnes	91		
width	m	0		
height	m	0		
length	m	0		
Shovel (Ore/Waste)	#	2	36 m3	
Production Loader	#	1	23 m3	
Crusher Loader	#	1		
Excavator (Production/Support)	#	1	construction	
Wheel Dozer	#	0		
Track Dozer	#	5		
Motor Grader	#	1		
Water Trucks	#	1	2019 PEA	
Density of Waste Rock	t/m^3	2.74	PFS Table 14.7: Bulk Density of Un-estimated Blocks in the Model	
Density of Overburden	t/m^3	1.9		
Estimated Average Depth of Overburden	m	0		
Ore Density	t/m^3	2.62	average	
Pit Design				
Pit Design - Phase 1 Small Satellite Pit to Northeast - Used for Consturction				
Grade at Edge of Pit	mASL	388		
Maximum Depth	mASL	328	2021 Technical Report and PFS - DRAFT	
Maximum Depth	m	60		
Area	m2	58,905	Determined from site plans - Elipse shape approx. (r1=250m, r2=300m)	
Width	m	0		
Length	m	0		
Estimated Average Depth of Overburden	m	0.00		
Maximum Pit Volume	m^3	3,534,292		
Effective Depth of pit	m	30.0		
Pit Design - Phase 2 Upper and Northern Portion of Deposit				
Minimum Depth	mASL	136	2021 Technical Report and PFS - DRAFT	
Maximum Depth	m	252		
Area	m^2	716,120	Determined from site plans - Elipse shape approx. (r1=645.01m, r2=1413.61m)	
Width	m	0		
Length	m	0		
Maximum Pit Volume	m^3	180,462,296		
Effective Depth of pit	m	126		
Pit Design - Phase 3 Southwest				
Minimum Depth	mASL	52	2021 Technical Report and PFS - DRAFT	
Maximum Depth	m	336.0		
Area	m^2	1,100,432	Determined from site plans - Elipse shape approx. (r1=1682.15m, r2=832.93 m)	
Width	m	0		
Length	m	0		
Maximum Pit Volume	m^3	369,745,062		
Effective Depth of pit	m	168		

Indicates calculated values

Table C-2: Metal Content of Mine Rock and Ore

Crustal Abundance															
	Hg	**Ag**	**Al**	**As**	**Ba**	**Be**	**Bi**	**Ca**	**Cd**	**Co**	**Cr**	**Cu**	**Fe**	**K**	**Li**
Unit	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
Average Cristal Abundance*	0.085	0.075	--	1.8	425	3	0.0085	--	0.15	25	102	60	--	--	20
Ten Times Average Cristal Abundance*	0.85	0.75	--	18	4250	30	0.085	--	1.5	250	1020	600	--	--	200
Method Detection Limit															

*Based on cristal abundance values presented by Price (1997), excluding major elements.

All Rock Samples Summary	Hg	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li
Number of Samples	442	442	442	442	442	442	442	442	442	442	442	442	442	442	442
Min	0.005	0.020	2000	2.00	10.0	0.05	0.010	300	0.010	1.20	1	4.2	5300	400	1.7
Max	12.92	57.4	50100	865	594	7.6	4.4	195500	51.3	95	1303	988	124600	56600	1936
Average	0.202	2.10	14645	70.0	85	0.7	0.29	28701	0.86	27	70	73	50967	8951	55
Median	0.054	0.51	12200	42.7	53	0.5	0.090	29400	0.17	28.0	48	59	53950	7100	25
Standard Deviation	0.825	5.10	10002	87.8	89	0.64	0.50	26091	3.21	13	111	75	22101	7479	123.5
10th Percentile	0.011	0.080	4010	9.02	19	0.22	0.020	1300	0.050	8.0	22	19	16630	1600	6.1
90th Percentile	0.32	5.09	31290	171.0	187	1.1	0.74	55590	1.60	41	114	132	76200	18990	101

Screening

Compound	Hg	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li
average	6.00E-06	6.24E-05	4.35E-01	2.08E-03	2.51E-03	1.93E-05	8.69E-06	8.52E-01	2.55E-05	7.91E-04	2.09E-03	2.18E-03	1.51E+00	2.66E-01	1.62E-03
90%ile	9.41E-06	1.51E-04	9.29E-01	5.08E-03	5.55E-03	3.34E-05	2.18E-05	1.65E+00	4.75E-05	1.22E-03	3.39E-03	3.93E-03	2.26E+00	5.64E-01	3.00E-03
Maximum concentration (24h)	2.80E-10	6.82E-08	4.19E-04	2.29E-06	2.50E-06	1.51E-08	9.84E-09	7.45E-04	2.14E-08	5.49E-07	1.53E-06	1.77E-06	1.02E-03	2.54E-04	1.35E-06
Maximum concentration (Annual)	7.49E-10	1.20E-08	7.39E-05	4.04E-07	4.41E-07	2.66E-09	1.74E-09	1.31E-04	3.78E-09	9.69E-08	2.69E-07	3.12E-07	1.80E-04	4.49E-05	2.38E-07
if > 1	9.41E-05	1.51E-03	9.29E+00	5.08E-02	5.55E-02	3.34E-04	2.18E-04	1.65E+01	4.75E-04	1.22E-02	3.39E-02	3.93E-02	2.26E+01	5.64E+00	3.00E-02
ACB	2	1	120	0.3	10	0.01	2.5	10	0.025	0.1	0.5	50	25	10	20
%of ACB	0%	0%	1%	2%	0%	0.3%	0%	17%	0%	1%	1%	0%	9%	6%	0%

if % of ACB > 5, then above "insignficant" value and carreid forward
Exception for Caclcium and Potassium

Table C-2: Metal Content of Mine Rock and Ore

Crustal Abundance															
	Mg	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**Sn**	**Sr**	**Ti**	**Tl**	**U**	**V**	**Y**	**Zn**
Unit	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**
Average Cristal Abundance*	--	950	1.2	84	14	0.20	0.05	2.3	370	--	0.85	2.7	120	33	70
Ten Times Average Cristal Abundance*	--	9500	12	840	140	2.0	0.5	23	3700	--	8.5	27	1200	330	700
Method Detection Limit															

*Based on cristal abundance values presented by Pri

All Rock Samples Summary	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**Sn**	**Sr**	**Ti**	**Tl**	**U**	**V**	**Y**	**Zn**
Number of Samples	442	442	442	442	442	442	442	442	442	442	442	442	442	442	442
Min	200	13	0.17	2.0	0.80	0.10	0.20	0.20	9	50	0.040	0.050	2.0	3.0	5.0
Max	76200	9407	1228	527	3324	107.9	26.4	3.0	4181	4220	14.95	21.5	294	28	6830
Average	16364	1097	36.7	43	73.2	2.37	1.35	0.2	205	855	1.90	2.7	52	10	188
Median	14850	1001	7.66	33.5	15.5	1.38	0.40	0.2	149	590	1.520	1.2	45	9	105
Standard Deviation	10572	972	97.5	40	246.3	6.035	2.35	0.2	259	780	1.755	3.29	40	3	446
10th Percentile	4710	84	1.04	10.2	3.4	0.44	0.20	0.20	41	110	0.210	0.26	9.0	6	46.0
90th Percentile	29800	1898	84.2	88	123.9	3.84	3.79	0.4	428	1909	4.02	6.8	105	14	260

Screening

Compound	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**Sn**	**Sr**	**Ti**	**Tl**	**U**	**V**	**Y**	**Zn**
average	4.86E-01	3.26E-02	1.09E-03	1.29E-03	2.17E-03	7.05E-05	4.00E-05	7.36E-06	6.10E-03	2.54E-02	5.65E-05	7.91E-05	1.56E-03	2.95E-04	5.58E-03
90%ile	8.85E-01	5.64E-02	2.50E-03	2.62E-03	3.68E-03	1.14E-04	1.13E-04	1.19E-05	1.27E-02	5.67E-02	1.19E-04	2.01E-04	3.12E-03	4.02E-04	7.71E-03
Maximum concentration (24h)	3.99E-04	2.54E-05	1.13E-06	1.18E-06	1.66E-06	5.14E-08	5.08E-08	5.36E-09	5.73E-06	2.56E-05	5.38E-08	9.07E-08	1.41E-06	1.81E-07	3.48E-06
Maximum concentration (Annual)	7.04E-05	4.49E-06	1.99E-07	2.09E-07	2.93E-07	9.06E-09	8.96E-09	9.45E-10	1.01E-06	4.51E-06	9.49E-09	1.60E-08	2.48E-07	3.20E-08	6.14E-07
if > 1	8.85E+00	5.64E-01	2.50E-02	2.62E-02	3.68E-02	1.14E-03	1.13E-03	1.19E-04	1.27E-01	5.67E-01	1.19E-03	2.01E-03	3.12E-02	4.02E-03	7.71E-02
ACB	72	0.4	120	0.2	0.5	25	10	10	120	120	0.5	0.03	2	5	120
%of ACB	1%	14%	0%	1%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%

if % of ACB > 5, then above "insignficant" value and carreid forward

Exception for Caclcium and Potassium

Table C-3: Material Movement by Year

2023 Update	Maximum Year	Maximum Daily	Maximum Hourly	Maximum Hourly Y3/4	Total	Pre Production	Year 1	Year 2	Year 3	Year 4	Year 5
OPEN-PIT (OP)											
Total Ore Mined	24 374 573	66 780	2 782	1 926	101 912 358	3 224 094	11 370 616	18 485 429	24 374 573	9 372 386	1 871 795
Ore Mine to Mill tonnes	10 950 000	30 000	1 250	1 094	64 047 728		6 262 293	10 512 764	10 950 000	8 208 326	1 274 951
Ore Mine to Ore Stockpile	13 424 573	36 780	1 532	833	37 864 630	3 224 094	5 108 323	7 972 665	13 424 573	1 164 060	596 844
LG + tonnes	5 936 800	16 265	678	324	23 167 288	1 345 297	3 533 152	5 936 800	5 441 277	238 365	374 209
MG + tonnes	1 886 137	5 167	215	113	4 484 538	459 801	1 035 387	872 538	1 886 137	87 295	67 499
HG + tonnes	6 097 159	16 705	696	396	10 212 803	1 418 996	539 784	1 163 327	6 097 159	838 401	155 135
Mine Rock tonnes	50 627 614	138 706	5 779	4 638	312 687 579	16 779 906	38 592 558	31 514 571	30 625 427	50 627 614	48 379 642
Overburden tonnes	8 199 239	22 464	936	389	20 361 983	3 450 702	8 199 239	1 028 795	1 487 398	5 321 071	874 778
NAG to Const	3 900 000	10 685	445		3 900 000	3 900 000					
NAG to CDF (Dam Const)	18 610 576	50 988	2 124	1 474	97 883 436	454 747	10 634 928	10 721 356	7 374 645	18 452 427	18 610 576
NAG to Mill (Thickend	8 565 095	23 466	978	678	45 048 627	209 287	4 894 484	4 934 260	3 394 013	8 492 310	8 565 095
PAG to CDF	20 983 549	57 489	2 395	1 842	127 857 953	7 702 726	13 062 221	13 032 564	16 142 779	16 136 132	17 865 048
PAG to Mill	2 894 283	7 930	330	254	17 635 580	1 062 445	1 801 686	1 797 595	2 226 590	2 225 673	2 464 145
Total From Pit	60 000 000	164 384	6 849	6 564	414 599 937	20 004 000	49 963 174	50 000 000	55 000 000	60 000 000	50 251 437
based SP data Aug 27, 2020											
Reclaim											
Mill	9 675 049	26 507	1 104	156	37 864 630		3 489 207	437 236		2 741 674	9 675 049
Stockpile											
LG - tonnes	8 431 199	23 099	962	156	23 167 288		878 449			2 741 674	2 077 645
MG - tonnes	3 251 943	8 909	371		4 484 538		651 978	437 236			3 251 943
HG - tonnes	4 345 461	11 905	496		10 212 803		1 958 780				4 345 461
Total Material Movement											
Ore + MR + Reclaim	91 030 790	249 399	10 392	6 720	452 464 567	20 004 000	53 452 381	50 437 236	55 000 000	62 741 674	59 926 485
Total tonnes mined by phase											
Ph1	1 175 005	3 219	134		2 229 929	1 054 924	1 175 005				
Ph2	24 364 997	66 753	2 781		64 101 337	2 169 170	10 194 739	18 485 417	24 364 997	8 887 013	
Ph2c	14 874 635	40 752	1 698		35 581 092		871	13	9 576	485 373	1 871 795
Total	24 374 573	66 780	2 782		101 912 358	3 224 094	11 370 615	18 485 430	24 374 573	9 372 386	1 871 795

Table C-3: Material Movement by Year

2023 Update	Maximum Year	Maximum Daily	Maximum Hourly	Maximum Hourly Y3/4	Total	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
OPEN-PIT (OP)												
Total Ore Mined	24 374 573	66 780	2 782	1 926	101 912 358	4 334 117	14 874 635	11 211 679	2 793 033			
Ore Mine to Mill tonnes	10 950 000	30 000	1 250	1 094	64 047 728	2 496 475	10 950 000	10 950 000	2 442 919			
Ore Mine to Ore Stockpile	13 424 573	36 780	1 532	833	37 864 630	1 837 642	3 924 635	261 679	350 115			
LG + tonnes	5 936 800	16 265	678	324	23 167 288	1 837 642	3 877 249	233 184	350 115			
MG + tonnes	1 886 137	5 167	215	113	4 484 538		47 386	28 496				
HG + tonnes	6 097 159	16 705	696	396	10 212 803							
Mine Rock tonnes	50 627 614	138 706	5 779	4 638	312 687 579	40 665 883	44 769 363	10 104 367	628 250			
Overburden tonnes	8 199 239	22 464	936	389	20 361 983							
NAG to Const	3 900 000	10 685	445		3 900 000							
NAG to CDF (Dam Const)	18 610 576	50 988	2 124	1 474	97 883 436	15 447 082	14 307 041	1 846 825	33 809			
NAG to Mill (Thickend	8 565 095	23 466	978	678	45 048 627	7 109 168	6 584 491	849 959	15 560			
PAG to CDF	20 983 549	57 489	2 395	1 842	127 857 953	15 914 526	20 983 549	6 509 693	508 714			
PAG to Mill	2 894 283	7 930	330	254	17 635 580	2 195 107	2 894 283	897 889	70 167			
Total From Pit	60 000 000	164 384	6 849	6 564	414 599 937	45 000 000	59 643 998	21 316 046	3 421 283			
based SP data Aug 27, 2020												
Reclaim												
Mill	9 675 049	26 507	1 104	156	37 864 630	8 453 525			8 507 081	4 560 858		
Stockpile												
LG - tonnes	8 431 199	23 099	962	156	23 167 288	4 477 463			8 431 199	4 560 858		
MG - tonnes	3 251 943	8 909	371		4 484 538	67 499			75 882			
HG - tonnes	4 345 461	11 905	496		10 212 803	3 908 562						
Total Material Movement												
Ore + MR + Reclaim	91 030 790	249 399	10 392	6 720	452 464 567	53 453 525	59 643 998	21 316 046	11 928 364	4 560 858		
Total tonnes mined by phase												
Ph1	1 175 005	3 219	134		2 229 929							
Ph2	24 364 997	66 753	2 781		64 101 337							
Ph2c	14 874 635	40 752	1 698		35 581 092	4 334 117	14 874 635	11 211 679	2 793 033			
Total	24 374 573	66 780	2 782		101 912 358	4 334 117	14 874 635	11 211 679	2 793 033			

Table C-4: Generator Sets (Emergency Generators for Operations Phase) and Fire Pump

Gen Sets (2)	2 x 2 MW	**Source ID: Gen1 and Gen 2**	**Generator model: Cat 3516C - 2500 kW**
Emission data taken from Specification Sheets			
Fuel Type:	15	sulphur content (mg/kg)	
Fuel Use:	157	gallons per hour	
	7	lbs/US gallon (CAT Spec sheet)	
	1,096	lbs/hour	
	18,390	BTU/lb fuel (CAT spec sheet)	
	20	MMBTU/hour	
	7,000	BTU/hp-hour (from U.S EPA AP-42)	
Hp per unit	2,880	hp (~ 2.15 MW)	

	U.S. EPA AP42 Table 3.4-1	From CAT spec sheet			U.S. EPA AP42 Table 3.3-2					
	SO_x	NO_x	PM	CO	BaP	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein
Emission Factor (lb/MMBtu)	—	—	—	—	1.88E-07	—	—	—	—	—
Emission Factor (lb/hp-h)	0.000012	—	—	—	1.32E-09	9.33E-04	3.91E-05	1.18E-03	7.67E-04	9.25E-05
Emission Factor (g/hp-h)	0.0055	4.95	0.030	0.30	5.97E-07	4.23E-01	1.77E-02	5.35E-01	3.48E-01	4.20E-02
Emission Rate (g/s):	**0.0044**	**3.96**	**0.024**	**0.24**	**4.78E-07**	**3.39E-01**	**1.42E-02**	**4.28E-01**	**2.78E-01**	**3.36E-02**
Dimensions (m)	W	L	H							
	7.0	2.8	3.0	From CAT Specs Sheet						

Note: For combustion sources $PM_{2.5}$ = PM_{10} = TSP

Sample Calculation

Step 1: Determine the Generator Energy output (MMBtu/hour)

EnergyOutput = fuel usage (gallons/hour) fuel conversion (lbs/gallon) x energy output conversion (BTU/lbs)

= 157 (gallons/h) x 7 (lbs/gallon) x 18,390 (Btu/lbs) = 20,000,000 Btu/h

Step 2: convert energy output to horse power

EnergyOutput = 20 MMBtu/h x 7,000 BTU/hp-hour = 2,880 hp

Step 3: Caculate emission rate based on individual compounds emission factor (NOx as an example).

Emission Rate (g/s) = NOx Emission Factor (g/hp-h) x EnergyOutput (hp)

Emission Rate (g/s) = 4.95 (g/hp-h) x 2,880 (hp) / 3600 (h/s) = 3.96 grams/second

Table C-5: Drilling and Blasting

Blasting Emissions (In Pit)				
Reference: US EPA AP-42 Section 11.9 Western Surface Coal Mining Table 11.9-2				
US EPA Emission Factor Rating: C		Data Quality: Average		
Emission Factor (kg/blast) = 0.00022 x $A^{1.5}$				
A (blast area)	7,332	m^2	from design	
D (blast hole depth)	12	m	from design	
Moisture	4	%		
Emissions	138.13	kg/blast		
TSP emission rate (g/s)	**1.599**	assume 1 blast per day, average over 24 hours		
PM_{10} emission rate (g/s)	**0.831**	US EPA Table 11.9-2, PM10=0.52*TSP		
$PM_{2.5}$ emission rate (g/s)	**0.0480**	US EPA Table 11.9-2, PM2.5 = 0.03*TSP		

Drilling Emissions					
	75	holes per shift			
	2	Shifts			
Emission Factors					
	TPM	PM_{10}	$PM_{2.5}$		
uncontrolled	0.59	0.31	0.31	kg/hole	AP-42, Table 11.9-4, C-rating
control level assumed	50	50	50	%	$PM_{10/2.5}$: NPRI based on Mojave Desert report
Emission Rate (g/s)	**0.512**	**0.269**	**0.269**		

Sample Calculation
Step 1: Determine the total drilled holes per day
Drilled Holes = Holes per Shift x Shifts per Day
= 75 x 2 = 150 holes/day
Step 2: Claculate the emission rate based no the emission factor and total number of holes (TPM as example)
Emission Rate (g/s) = Emission Factor (kg/hole) x Control Level (%) x Drilled Holes per Day
= 0.59 (kg/day) x 50% x 150 (holes/day) x 1000 (g/kg) / 24 (h/day) / 3600 (s/h) = 0.512

Table C-5: Drilling and Blasting

Blasting Particulate - Estimates Based Upon US EAP AP-42 Factors

Reference: US EPA AP-42 Section 11.9 Western Surface Coal Mining Table 11.9-2□

One blast per day, therefore emissions averaged over 24 hours.

EF(kg/blast) = $0.00022\ A^{1.5}$ C-Rating

Phase 1						
A (blast area)	717	m^2	**Emission Rate**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Emission Rate =	4.2	kg/blast	**24 hour average (g/s)**	**0.049**	**0.025**	**0.0015**
	4.2	kg/day	**1 hour average (g/s)**	**1.17**	**0.61**	**0.035**
Phase 2						
A (blast area)	6,145	m^2	**Emission Rate**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Emission Rate =	106.0	kg/blast	**24 hour average (g/s)**	**1.23**	**0.64**	**0.037**
	106.0	kg/day	**1 hour average (g/s)**	**29.4**	**15.3**	**0.88**
Phase 2C						
A (blast area)	7,332	m^2	**Emission Rate**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Emission Rate =	138.1	kg/blast	**24 hour average (g/s)**	**1.60**	**0.83**	**0.05**
	138.1	kg/day	**1 hour average (g/s)**	**38.37**	**19.95**	**1.15**

$PM_{2.5}$ Emission = 0.03 x TSP emission rate (ECCC NPRI / US EPA Table 11.9-2)

PM_{10} Emission = 0.52 x TSP emission rate (ECCC NPRI / US EPA Table 11.9-2)

Blasting NO_x, CO, and SO_2 - Estimates Based Upon Supplier Emission Factors

Reference: Data provided by Supplier.

Phase 1 Pit					
Emulsion per blast	6,709	kg	from Key Data sheet		
	NO_x	CO	SO_2	NH_3	
Rating	NA	NA	D	NA	
Emission factor	3.08	17.12	0.22	1.14	g/kg (emulsion)
Emission per blast	20,670	114,854	1,476	7,648	g/blast
Emisison rate (one hour average)	**5.7**	**31.9**	**0.4**	**2.1**	g/s
Emission rate (24-hour average)	**0.24**	**1.3**	**0.02**	**0.09**	g/s
Phase 2 Pit					
Emulsion per blast	57,521	kg	from Key Data sheet		
	NO_x	CO	SO_2	NH_3	
Rating	NA	NA	D	NA	
Emission factor	3.08	17.12	0.22	1.14	g/kg (emulsion)
Emission per blast	177,224	984,763	12,655	65,574	g/blast
Emisison rate (one hour average)	**49.2**	**273.5**	**3.5**	**18.2**	g/s
Emission rate (24-hour average)	**2.1**	**11.4**	**0.15**	**0.76**	g/s
Phase 2C Pit					
Emulsion per blast	68,631	kg	from Key Data sheet		
	NO_x	CO	SO_2	NH_3	
Rating	NA	NA	D	NA	
Emission factor	3.08	17.12	0.22	1.14	g/kg (emulsion)
Emission per blast	211,455	1,174,970	15,099	78,240	g/blast
Emisison rate (one hour average)	**58.7**	**326.4**	**4.2**	**21.7**	g/s
Emission rate (24-hour average)	**2.4**	**13.6**	**0.175**	**0.9**	g/s

Note: NO_x, CO and SO_2 emission factors are provied by the manufacturer - Orica

Table C-5: Drilling and Blasting

Manufacturer's Emission Factors - Dyno Nobel

Det within	NO_x l/kg	NO_x g/kg	NO_x lb/ton	NO_2 l/kg	NO_2 g/kg	NO_2 lb/ton
Steel pipe	1.50	3.08	6.16	0.50	1.03	2.05
sheet metal	2.50	5.14	10.27	0.90	1.85	3.70
sheet metal	3.00	6.16	12.32	1.30	2.67	5.34
AVERAGE			9.59			3.70

Det within	CO l/kg	CO g/kg	CO lb/ton
Steel pipe	13.00	16.26	32.51
sheet metal	14.00	17.51	35.01
sheet metal	21.00	26.26	52.52
AVERAGE			40.01

Emission Factors from Blasting - Orica

Species	**g/kg**
NO_x	3.08
CO	17.1
NH_3	1.1
SO_2	0.22

Table C-6: Material Handling

Crushing and Screening

Reference:	ESDM Procedure Document Table C-1 (March 2009)					
	Emission Factor kg/Mg (kg/tonne)					
	SCC	**TSP**	**EPA Rating**	**PM_{10}**	**EPA Rating**	**$PM_{2.5}$**
Primary Crusher	3-03-024-01	0.01	C	0.004	C	–
Secondary Crusher	3-03-024-01	0.03	C	0.012	C	–
Crushing Capacity	1,500	tonnes/hour				

	Flowrate (m^3/s)	**Concentration (mg/m^3)**	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**Unit**
Primary Crusher Emissions	9.4	20	0.19	0.19	0.19	g/s
Primary Under Pile	18.9	15	0.28	0.28	0.28	g/s
Secondary Crusher Emissions	9.4	20	0.19	0.19	0.19	g/s
Secondary Under Pile	28.3	15	0.42	0.42	0.42	g/s

Material Loading and Unloading, and Drops at Stockpiles

Reference: AP 42 - Section 11.24 (based on high moisture > 4%)		Quantity	Unit	Destination
Activity Data:	Material Handling	1,094	tonnes/hour	Ore to Mill
		933	tonnes/hour	Waste Rock to Mill
		1,842	tonnes/hour	Waste Rock to CDF
		1,474	tonnes/hour	Waste Rock to Dam
		389	tonnes/hour	Overburden
		324	tonnes/hour	Ore to LG stockpile
		509	tonnes/hour	Ore to MG/HG stockpile

Emission Factors:		**Uncontrolled**			**Control Efficiency (water spray or enclosed drop)**	**Controlled kg/Mg**
	SCC	**kg/Mg (kg/tonne)**	**Size Fraction**	**EPA Rating**		
Material Transfer:	3-03-024-08	0.005	TSP	C	80%	0.001
		0.002	PM_{10}	C	80%	0.0004
		0.00057	$PM_{2.5}$	NA	80%	0.00011

The material transfer is used for all conveyor drops, stock pile drops, ore dumps and other locations where material is allowed to fall freely, as per AP42 - Section 11.24

	Emission Rate (g/s)		
	TSP	*PM_{10}*	*$PM_{2.5}$*
Total Material Out of Pit	1.82	0.73	0.21
Mill Feed	0.56	0.23	0.06
Co-Disposal Facility Area	0.51	0.20	0.06
Overburden	0.11	0.04	0.01
LG Ore stockpile unloading	0.09	0.04	0.01
MG/HG Ore stockpile unloading	0.14	0.06	0.02
Dam Construction unloading	0.41	0.16	0.05

Table C-7: HCN Emissions

HCN Emissions from Leaching Process

Based on Australian NPI (version 2) Dec. 2006

HCN emission from page 28

E (kg of CN) = (0.013 * aqueous concentration of NaCN in tank +0.46) * area of tank * time * 0.96/1000 (equation 1)

aqueous concentration of HCN = concentration as mg/L of NaCN in tank * 10 ^ (9.2 - pH) (equation 2)

The leach process will be operated at a pH of 10.5 to 11, and the target NaCN concentration is 1000 ppm.

The HCN emissions for the scenario with 1000 ppm NaCN in solution was used to ensure estimates are conservative.

	Concentrate Leach			**Source of Data**
pH = pH in the leach/adsorption tank	> 10.5	> 10.5	> 10.5	Process Design
[NaCN] = Concentration (as mg/l) of NaCN in the leach/adsorption tank	1000	350	250	Estimated
[HCN(aq)] = [NaCN] x $10^{(9.2 - pH)}$	50.12	17.54	12.53	calculated from equation (2)
A = Surface area (m2) of the leach/adsorption tank	287	287	287	Process Design
T = Period of emissions (hours)	24	24	24	Process Design
E = Emission of CN (kg) per tank per day	7.34	4.54	4.11	calculated from equation (1)
E = emission of CN g/s per tank	**0.085**	**0.053**	**0.048**	= kg*1000/24/60/60
Total Emissions for Leach circuit overall (g/s)	0.42	0.263	0.24	Total = E (g/s per tank) x number of tanks

6.2.1 Cyanide emissions from the ore processing area

Based on research performed by CSIRO on investigating HCN emissions from process tanks, it was estimated that approximately **1%** of the total cyanide added to the circuit is lost through HCN volatilisation across all tanks (Heath *et al.*, 1998). A figure of 1% of total cyanide added to the leach circuit may therefore be used as a default value for loss of cyanide as HCN from the leach/adsorption train.

Alternatively, a site specific figure for emissions may be calculated using the equation below. The equation estimates the HCN emissions from an individual process tank and is derived from the work reported by Heath et al.

$$\mathbf{E = ([0.013 \times [HCN_{(aq)}] + 0.46\} \times A \times T \times 0.96/10^3)}$$

Where:

E	=	Emission of CN (kg)
$[HCN_{(aq)}]$	=	[NaCN] x $10^{(9.2 - pH)}$
[NaCN]	=	Concentration (as mg/l) of NaCN in the leach/adsorption tank
pH	=	pH in the leach/adsorption tank
A	=	Surface area (m^2) of the leach/adsorption tank
T	=	Period of emissions (hours)

Table C-8: Road Dust Emissions (Haul Roads)

Table 1: Particulate Emission Coefficients for Truck Traffic on Unpaved Industrial Roads from AP42 (Chapter 13.2 - Unpaved Roads; Nov 2006)

Constant	Expressed Units	PM_{30} (TPM)[3]	PM_{10}	$PM_{2.5}$	US EPA Data
k	lb/VMT [(1)]	4.9	1.5	0.15	B
a	-	0.7	0.9	0.9	B
b	-	0.45	0.45	0.45	B
Conversion	lb/VMT to g/VKT	281.9	281.9	281.9	–

Notes:

1. "lb/VMT" means pounds pre vehicle mile travelled.
2. "g/VKT" means grams per vehicle kilometre
3. TPM means total particulate matter

Table 2: Fixed Haul Road Segments

Road Source ID Segment	Route or Area Description	Road Dimensions		Total VKT per hour per segment	Uncontrolled kg/hour			Uncontrolled (g/s)			Controlled (g/s)		
		Distance (km)	Length (Round Trip) (m)		TPM Emission Rate	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate
Pit to Main Road West													
PIT_WEST		1.07	2143	29.61	161.3	39.4	3.9	44.79	10.95	1.10	2.240	0.548	0.055
Pit to Main Road East													
PIT_EAST		1.50	3005	40.66	221.4	54.1	5.4	61.51	15.04	1.50	3.076	0.752	0.075
West Road to CDF													
West_CDF		1.59	3173	24.36	132.7	32.4	3.2	36.85	9.01	0.90	1.843	0.450	0.045
West Road to DAM													
West_DAM		1.10	2194	13.48	73.4	17.9	1.8	20.39	4.99	0.50	1.019	0.249	0.025
Mill Feed													
E_Mill		0.21	430	3.63	19.8	4.8	0.5	5.49	1.34	0.13	0.274	0.067	0.007
Low Grade Stockpile													
East_LGSTK		0.28	566	0.76	4.2	1.0	0.1	1.16	0.28	0.03	0.058	0.014	0.0014
East Road to South													
East_ST		0.33	661	2.47	13.5	3.3	0.3	3.74	0.91	0.09	0.187	0.046	0.005
Mid/High Grade Stockpile													
ST_MHSTK		0.67	1336	2.83	15.4	3.8	0.4	4.28	1.05	0.10	0.214	0.052	0.005
Surficial Soil Stockpile													
ST_SSS		0.72	1432	2.32	12.6	3.1	0.3	3.51	0.86	0.09	0.175	0.043	0.004
Edge of Pit to Centre (In pit road)													
OPIT		0.45	900	24.61	134.1	32.8	3.3	37.24	9.10	0.91	1.862	0.455	0.046

Particle Size	TPM	PM10	PM2.5
Total	**10.95**	**2.68**	**0.27**
Total (in-pit)	**4.10**	**1.00**	**0.10**
Total (outside pit)	**6.85**	**1.67**	**0.17**

Table C-8: Road Dust Emissions (Haul Roads)

Table 3: Truck Details

	Tonnes per hour	Load per Truck (tonnes)	Round Trips per hour	Vehicle Weight Empty (tonnes)	Vehicle Weight Loaded (tonnes)	Mean Vehicle Weight (tonnes)	TPM Emission Factor lb/VKT	PM_{10} Emission Factor lb/VKT	$PM_{2.5}$ Emission Factor lb/VKT	TPM Emission Factor kg/VKT	PM_{10} Emission Factor kg/VKT	$PM_{2.5}$ Emission Factor kg/VKT
Total Material from PIT	6,564	240	27	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Material from PIT to West	3,317	240	14	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Material from PIT to East	3,247	240	14	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
West Road to CDF	1,842	240	8	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
West Road to DAM	1,474	240	6	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Mill Feed	2,026	240	8	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Low Grade Stockpile Access	324	240	1	210	450	330.0				5.45	1.33	0.13
Iimperial units						363.4	19.3	4.7	0.5			
East Road to South	897	240	4	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Mid/High Grade Ore Stockpile	509	240	2	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Surficial Soil Stockpile	389	240	2	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			
Tailings to CDF	933	240	4	210	450	330.0				5.45	1.33	0.13
Imperial units						363.4	19.3	4.7	0.5			

Road Emission Assumptions (needed for AP42)					
Mean Silt Content	3.9	%	based on AP42 Chapter 13.2 for taconite mining		
Assumed average speed of trucks	50	km/hour	31.1	miles/hour	(not used in calculations)
Assumed Control Efficiency	95	%	based on watering, vehicle speed, lack of silt, dust suppressant		

Table C-8: Road Dust Emissions (Haul Roads)

Sample Calculation:

Step 1: Caculation of lb/VKT (from AP42 - Chapter 13.2.2)
E (lb/vkt) (for TSP) = k x (silt %/12)^a x (mean weight/3)^b (see values for k, a, b above)
= 4.9 x (5.8/12) ^ 0.7 x (317/3) ^ 0.45 = 24 lb/VKT (in Table 3)
Step 2: convert to kg/VKT
E (kg/VKT) = 281.9 g/VKT x 24 lb/vkt /1000 g/kg = 6.76 kg/VKT (this is shown in Table 3)
Step 3: total VKT is obtained from distance travelled x number of round trips per hour.
Total VKT - 3117 m x 40 trips per hour/ 1000 m/km = 125 VK T travelled in an hour. (Table 2)
note: trips per hour is calculed from total tonnes per hour divided by load per truck
Step 4: Total emission rate (kg/hour) = 125 VKT/hour x 6.76 kg/VKT = 847 kg/hour (Table 2)
Step 5: Uncontrolled emission rate (g/s) = 847 kg/hour x 1000 g/kg / 3600 s/hour = 235 g/s (Table 2)
Step 6: Controlled emission rate (g/s) = 235 g/s x (1 - efficiency) = 235 X (1- 0.85) = 35.3g/s

Table C-9: Concrete Batching

Reference: US EPA AP-42 Chapter 11.12 Concrete Batching	Rating ranges from E to B			
Activity Data:				
	Concrete Processing Rate			
	m^3/hr	**cubic yard per hour**		
Batch Plant 1	80	157		
Emission Factors:	**Uncontrolled**		**Controlled**	
	PM (lb/yd^3)	**PM_{10} (lb/yd^3)**	**PM (lb/yd^3)**	**PM_{10} (lb/yd^3)**
Aggregate delivery to ground storage (3-05-011-21)	0.0064	0.0031	0.0064	0.0031
Sand delivery to ground storage (3-05-011-22)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to conveyor (3-05-011-23)	0.0064	0.0031	0.0064	0.0031
Sand transfer to conveyor (3-05-011-24)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to elevated storage (3-05-011-04)	0.0064	0.0031	0.0064	0.0031
Sand transfer to elevated storage (3-05-011-05)	0.0015	0.0007	0.0015	0.0007
Cement delivery to Silo (3-05-011-07 controlled)	0.0002	0.0001	0.0002	0.0001
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.0003	0.0002	0.0003	0.0002
Weigh hopper loading (3-05-011-08)	0.0079	0.0038	0.0079	0.0038
Truck mix loading (3-05-011-10)	0.1393	0.03892	0.007952	0.00224
Emission Rates:	**Batch Plant 1 - Controlled Emissions**			
	PM	PM_{10}	$PM_{2.5}$	
Aggregate delivery to ground storage (3-05-011-21)	0.127	0.061	0.010	
Sand delivery to ground storage (3-05-011-22)	0.030	0.014	0.002	
Aggregate transfer to conveyor (3-05-011-23)	0.127	0.061	0.010	
Sand transfer to conveyor (3-05-011-24)	0.030	0.014	0.002	
Aggregate transfer to elevated storage (3-05-011-04)	0.127	0.061	0.010	
Sand transfer to elevated storage (3-05-011-05)	0.030	0.014	0.002	
Cement delivery to Silo (3-05-011-07 controlled)	0.004	0.002	0.0003	
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.006	0.004	0.0006	
Weigh hopper loading (3-05-011-08)	0.156	0.075	0.012	
Truck mix loading (3-05-011-10)	0.157	0.044	0.007	
Total:	**0.792**	**0.351**	**0.057**	

*PM2.5 not specifically calculated in AP42: Table 11.12-3 ratio of PM10/PM2.5 used to estimate emission

Table C-10: Mill Process and Misc Sources

CN Destruction			
Excess SO_2 from CN Destruction			
Use of SO_2	675	kg/hour	(see Key Data sheet)
Percent Excess	1	%	excess assumed to ensure reaction complete
Emission Rate	**1.88**	**g/s**	Closed loop, so no emissions.

Lime Bin Baghouse				
Reference:	ESDM Procedure Document Table C-1 (March 2009)			
Controlled by baghouse.	Data Quality "AA"			
Flowrate	5000	acfm		
	2.36	am^3/s		
PM Concentration	20	mg/m^3		
Emission Rate	**PM (g/s)**	**PM_{10}**	**$PM_{2.5}$**	
	0.0472	**0.0472**	**0.0472**	**g/s**

Induction Furnace			
Furnaces controlled with wet scrubber - emission based on engineering estimate			
Assumed concentration	20	mg/m^3	(estimated maximum)
Flowrate from scrubber	4.72	am^3/s	
Emission Rate (per furnace)	0.09		
Emission Rate (total)	**0.19**	**g/s**	assumed same for PM_{10} and $PM_{2.5}$

Lime Slaker			
Slaker controlled by wet scrubber --- emission based on engineering estimate			
Assumed concentration	20	mg/m^3	(estimated maximum)
Flowrate from scrubber	2.00	am^3/s	(assumed 4000 cfm)
Emission Rate (per slaker)	0.04		
Emission Rate (total)	**0.08**	**g/s**	assumed same for PM_{10} and $PM_{2.5}$

CuSO4 Scrubber			
Reference:	ESDM Procedure Document Table C-1 (March 2009)		
Controlled by baghouse.	Data Quality "AA"		
$CuSO_4$ mixing controlled baghouse			
Assumed concentration	20.00	mg/m^3	
Flowrate from scrubber	2.00	am^3/s	
Emission Rate	**0.040**	**g/s**	assumed same for PM_{10} and $PM_{2.5}$

Flocculant			
Reference:	ESDM Procedure Document Table C-1 (March 2009)		
Controlled by baghouse.	Data Quality "AA"		
Flowrate	5000	acfm	
	2.36	am^3/s	
PM Concentration	20	mg/m^3	
Emission Rate	**PM (g/s)**		
	0.0472	**g/s**	assumed same for PM_{10} and $PM_{2.5}$

Propane Heating in Process building				
Maximum propane use	654	L/hour		
	48.3	MMBTU/hour	All propane assumed to be used	
	In process building as per ESDM guidance only Nox is considered from NG or propane combustion			
Emission Factors		NO_x	AP42	e-rating
lb/1000 gallon		13		
Emission Rate:	=L/hour x 0.264 gallon/L x EF x 454 g/lb / 1000 /3600 sec/hour			
g/s		**0.28**		

Table C-11: Ore / Rock Handling at Stockpiles (Dozers)

Bulldozers at Rock / Ore Stockpiles					
Reference:	US EPA AP-42 Table 11.9-2				
Equation: EF(kg/hour) = k*2.6*silt^1.2*moisture^-1.3, k = 1 for TSP					
Silt	3.9	assumed	AP42 Taconite mining		
Moisture	4	assumed			
Emission Factor (kg/hour)	2.20		EPA Rating		
TSP	Emmission Rate (g/s)	0.61	B		
Control Efficiency	75	%	assumed based on watering and BMP		
	0.75	scaling factor for PM10			
	0.105	scaling factor for PM2.5			
Number of Dozers					
	Co-Disposal Facility	1	key data	split between areas	
	Overburden	1	key data		
	Ore Processing Area	1	key data		
	LG Ore Stock Pile	1	key data		
	MG/HG Ore Stock Pile	1	key data		
	Dam Construction Area	1	key data		
	In Pit	2	key data		
Dust Dozers Emissions		**TSP**	**PM_{10}**	**$PM_{2.5}$**	**Unit**
Emissions:	Co-Disposal Facility	0.15	0.11	0.02	g/s
	Overburden	0.15	0.11	0.02	g/s
	Ore Processing Area	0.15	0.11	0.02	g/s
	LG Ore Stock Pile	0.15	0.11	0.02	g/s
	MG/HG Ore Stock Pile	0.15	0.11	0.02	g/s
	Dam Construction Area	0.15	0.11	0.02	g/s
	In Pit	0.30	0.23	0.03	g/s

Table C-12: Road Emissions (Tailpipe)

Mining Equipment - Tailpipe

Equipment Description	kW	Equipment Distribution							NO_x Emission Rate (g/s)							CO Emission Rate (g/s)						
		Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam
Diesel drive Shovels (Hitachi EX8000)	2900	2							5.639							5.639						
Blast Hole Drill - CAT 6420	597	3							1.741							1.741						
Wheel Loader (L-1850)	1491	2							2.899							2.899						
Track Dozer (CAT D10T)	560	2	1	1	1	1	1	1	0.124	0.062	0.062	0.062	0.062	0.062	0.062	1.089	0.544	0.544	0.544	0.544	0.544	0.544
Motor Grader (CAT 16M)	248	1							0.028							0.241						
Water Truck / Sand Truck (CAT 777)	704	1	1	1	1	1	1		0.684	0.684	0.684	0.684	0.684	0.684		0.684	0.684	0.684	0.684	0.684	0.684	
Excavator (CAT 390)	390	1							0.043							0.379						
								Totals	11.159	0.747	0.747	0.747	0.747	0.747	0.062	12.673	1.229	1.229	1.229	1.229	1.229	0.544

	SO_2 Emission Rate (g/s)							PM Emission Rate (g/s)							BaP Emission Rate (g/s)						
	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam
	0.010							0.064							4.68E-07						
	0.003							0.020							1.65E-07						
	0.005							0.033							7.24E-07						
	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.006	0.003	0.003	0.003	0.003	0.003	0.003	8.17E-08	4.08E-08	4.08E-08	4.08E-08	4.08E-08	4.08E-08	4.08E-08
	0.000							0.001							1.09E-08						
	0.001	0.001	0.001	0.001	0.001	0.001		0.008	0.008	0.008	0.008	0.008	0.008		8.72E-09	8.72E-09	8.72E-09	8.72E-09	8.72E-09	8.72E-09	
	0.001							0.002							1.96E-08						
Totals	0.022	0.002	0.002	0.002	0.002	0.002	0.001	0.135	0.011	0.011	0.011	0.011	0.011	0.003	1.48E-06	4.96E-08	4.96E-08	4.96E-08	4.96E-08	4.96E-08	4.08E-08

	Benzene Emission Rate (g/s)							1-3, Butadiene Emission Rate (g/s)							Formaldehyde Emission Rate (g/s)						
	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam
	1.22E-02							5.45E-04							7.74E-02						
	7.35E-03							5.88E-04							6.84E-02						
	8.66E-03							5.04E-04							6.51E-02						
	2.37E-03	1.18E-03	1.18E-03	1.18E-03	1.18E-03	1.18E-03	1.18E-03	9.04E-05	4.52E-05	4.52E-05	4.52E-05	4.52E-05	4.52E-05	4.52E-05	1.36E-02	6.82E-03	6.82E-03	6.82E-03	6.82E-03	6.82E-03	6.82E-03
	5.10E-04							1.92E-05							2.91E-03						
	5.65E-04	5.65E-04	5.65E-04	5.65E-04	5.65E-04	5.65E-04		1.98E-05	1.98E-05	1.98E-05	1.98E-05	1.98E-05	1.98E-05		3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	
	5.99E-04							2.16E-05							3.34E-03						
Totals	3.23E-02	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.18E-03	1.79E-03	6.50E-05	6.50E-05	6.50E-05	6.50E-05	6.50E-05	4.52E-05	2.34E-01	9.96E-03	9.96E-03	9.96E-03	9.96E-03	9.96E-03	6.82E-03

	Acetaldehyde Emission Rate (g/s)							Acrolein Emission Rate (g/s)						
	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam	Pit	CDF	SSTK	PLANT	LG STK	H/M STK	Dam
	2.75E-02							5.49E-03						
	2.46E-02							8.95E-03						
	2.32E-02							5.93E-03						
	4.88E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03	9.22E-04	4.61E-04	4.61E-04	4.61E-04	4.61E-04	4.61E-04	4.61E-04
	1.04E-03							1.94E-04						
	1.14E-03	1.14E-03	1.14E-03	1.14E-03	1.14E-03	1.14E-03		2.02E-04	2.02E-04	2.02E-04	2.02E-04	2.02E-04	2.02E-04	
	1.20E-03							2.16E-04						
Totals	8.35E-02	3.58E-03	3.58E-03	3.58E-03	3.58E-03	3.58E-03	2.44E-03	2.19E-02	6.63E-04	6.63E-04	6.63E-04	6.63E-04	6.63E-04	4.61E-04

Table C-12: Road Emissions (Tailpipe)

Haul Trucks

Haul Truck Engine kW (CAT 793)	1976
Total # Trucks	19
Load Factor	40%

Road Segment	ID	Length	# Trucks	NO_x (g/s)	CO (g/s)	SO_2 (g/s)	PM (g/s)	BaP (g/s)	Benzene (g/s)	1,3-Butadiene (g/s)	Formaldehyde (g/s)	Acetaldehyde (g/s)	Acrolein (g/s)
Pit to Main Road West	PIT_WEST	2142.600	3	2.305	2.305	0.00371	0.026	2.06E-07	1.09E-02	3.97E-04	6.09E-02	2.17E-02	3.94E-03
Pit to Main Road East	PIT_EAST	3005.000	4	3.074	3.074	0.00495	0.035	2.74E-07	1.45E-02	5.29E-04	8.12E-02	2.89E-02	5.25E-03
West Road to CDF	West_CDF	3173.000	4	3.074	3.074	0.0050	0.035	2.74E-07	1.45E-02	5.29E-04	8.12E-02	2.89E-02	5.25E-03
West Road to DAM	West_DAM	2194.200	3	2.305	2.305	0.0037	0.026	2.06E-07	1.09E-02	3.97E-04	6.09E-02	2.17E-02	3.94E-03
Mill Feed	E_Mill	429.600	1	0.768	0.768	0.00124	0.009	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03
Low Grade Stockpile	East_LGSTK	566.000	1	0.768	0.768	0.00124	0.009	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03
East Road to South	East_ST	660.800	1	0.768	0.768	0.0012	0.009	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03
Mid/High Grade Stockpile	ST_MHSTK	1336.200	2	1.537	1.537	0.00248	0.018	1.37E-07	7.27E-03	2.65E-04	4.06E-02	1.44E-02	2.62E-03
Surficial Soil Stockpile	ST_SSS	1432.200	2	1.537	1.537	0.0025	0.018	1.37E-07	7.27E-03	2.65E-04	4.06E-02	1.44E-02	2.62E-03
Edge of Pit to Centre (In pit road)	OPIT	900.000	1	0.768	0.768	0.00124	0.009	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03

Summary

Description	Model ID	NO_x (g/s)	CO (g/s)	SO_2 (g/s)	PM (g/s)	BaP (g/s)	Benzene (g/s)	1,3-Butadiene (g/s)	Formaldehyde (g/s)	Acetaldehyde (g/s)	Acrolein (g/s)
Total Haul Roads (In Pit)	OPIT	0.768	0.768	0.0012	0.0088	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03
Total Equipment (In Pit)	PITD	11.159	12.673	0.0216	0.1351	1.48E-06	3.23E-02	1.79E-03	2.34E-01	8.35E-02	2.19E-02
Total Haul Roads (Outside Pit)	PIT_WEST, PIT_EAST, West_CDF, West_DAM,, E_Mill, East_LGSTK, East_ST, ST_MHSTK, ST_SSS	16.137	16.137	0.026	0.184	1.44E-06	7.63E-02	2.78E-03	4.26E-01	1.52E-01	2.75E-02
Co-Disposal Facility	CDF	0.747	1.229	0.0020	0.0109	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03	6.63E-04
Ore Processing Area	OREPR	0.747	1.229	0.0020	0.0109	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03	6.63E-04
Surficial Stockpile	SSTK	0.747	1.229	0.0020	0.0109	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03	6.63E-04
Low Grade Stockpile	LGSTKE	0.747	1.229	0.0020	0.0109	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03	6.63E-04
Mid/High Grade Stockpile	MHGSTK	0.747	1.229	0.0020	0.0109	4.96E-08	1.75E-03	6.50E-05	9.96E-03	3.58E-03	6.63E-04
Dam Construction	DAM	0.062	0.544	0.0009	0.0031	4.08E-08	1.18E-03	4.52E-05	6.82E-03	2.44E-03	4.61E-04
	Total	31.86	36.27	0.060	0.386	0.000	0.122	0.005	0.737	0.263	0.055

Table C-12: Road Emissions (Tailpipe)

Table 1: Tier 4 emission standards—Engines up to 560 kW, g/kWh (g/bhp-hr)

Emission Standards: USA: Nonroad Diesel Engines (dieselnet.com)

Engine Power	Year	CO	NMHC	NOx	PM (2.5)
kW < 8	2008	8.0	-	-	0.4[a]
8 ≤ kW < 19	2008	6.6	-	-	0.40
19 ≤ kW < 37	2008	5.5	-	-	0.30
	2013	5.5	-	-	0.03
37 ≤ kW < 56	2008	5.0	-	-	0.3[b]
	2013	5.0	-	-	0.03
56 ≤ kW < 130	2012-2014c	5.0	0.19	0.40	0.020
130 ≤ kW ≤ 560	2011-2014d	3.5	0.19	0.40	0.020

a - hand-startable, air-cooled, DI engines may be certified to Tier 2 standards through 2009 and to an optional PM standard of 0.6 g/kWh starting in 2010

b - 0.4 g/kWh (Tier 2) if manufacturer complies with the 0.03 g/kWh standard from 2012

c - PM/CO: full compliance from 2012; NOx/HC: Option 1 (if banked Tier 2 credits used)—50% engines must comply in 2012-2013; Option 2 (if no Tier 2 credits claimed)—25% engines must comply in 2012-2014, with full compliance from 2014.12.31

d - PM/CO: full compliance from 2011; NOx/HC: 50% engines must comply in 2011-2013

Table 2: Tier 4 emission standards—Engines above 560 kW, g/kWh (g/bhp-hr)

Emission Standards: USA: Nonroad Diesel Engines (dieselnet.com)

Category	Year	CO	NMHC	NOx	PM (2.5)
All engines except gensets > 900 kW	2011	3.5	0.4	3.5	0.10
All engines except gensets	2015	3.5	0.19	3.5	0.04

Table 3: MOVES Emissio Factors for PAHs and VOCs (g/hp-hr)

Equipment	Engine (HP)	Emission Factors (g/hp-h)						Load Factors (%)	Emission Rate (g/s)					
		BaP	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein		BaP	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein
Diesel drive Shovels (Hitachi EX8000)	3889	3.33E-07	5.65E-03	2.52E-04	3.58E-02	1.27E-02	2.54E-03	65	2.34E-07	6.10E-03	2.73E-04	3.87E-02	1.37E-02	2.74E-03
Blast Hole Drill - CAT 6420	801	4.13E-07	1.10E-02	8.81E-04	1.03E-01	3.69E-02	1.34E-02	60	5.51E-08	2.45E-03	1.96E-04	2.28E-02	8.20E-03	2.98E-03
Wheel Loader (L-1850)	1999	1.09E-06	7.80E-03	4.54E-04	5.86E-02	2.09E-02	5.34E-03	60	3.62E-07	4.33E-03	2.52E-04	3.26E-02	1.16E-02	2.97E-03
Track Dozer (CAT D10T)	751	3.26E-07	5.68E-03	2.17E-04	3.27E-02	1.17E-02	2.21E-03	60	4.08E-08	1.18E-03	4.52E-05	6.82E-03	2.44E-03	4.61E-04
Motor Grader (CAT 16M)	333	2.96E-07	5.52E-03	2.07E-04	3.15E-02	1.13E-02	2.09E-03	40	1.09E-08	5.10E-04	1.92E-05	2.91E-03	1.04E-03	1.94E-04
Water Truck / Sand Truck (CAT 777)	944	2.66E-07	2.15E-03	7.55E-05	1.20E-02	4.34E-03	7.69E-04	50	3.49E-08	5.65E-04	1.98E-05	3.14E-03	1.14E-03	2.02E-04
Excavator (CAT 390)	523	2.70E-07	4.13E-03	1.49E-04	2.30E-02	8.28E-03	1.49E-03	50	1.96E-08	5.99E-04	2.16E-05	3.34E-03	1.20E-03	2.16E-04
Haul Trucks	2650	2.66E-07	4.94E-03	1.80E-04	2.76E-02	9.81E-03	1.78E-03	35	6.86E-08	3.63E-03	1.32E-04	2.03E-02	7.22E-03	1.31E-03

Table C-13: Open Face Wind Erosion

An average value for wind erosion from open areas and stockpiles was recommended by Australian NPI Australlia DSEWPC. 2012. National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1), Table 2). This approach was used to avoid overestimating the disturbed areas that would be susceptible to wind erosion.
This estimated average value is more conservative in nature than the estimated wind erosion of overburden or graded areas at surface coal mine (AP-42 Section 11.9), which estimates that the annual losses from wind erosion are 0.85 Mg/ha/year (or 0.097 kg/ha/h).

Average Wind Erosion from Exposed Areas (kg/ha/hr)			**Average Wind Erosion from Exposed Areas ($g/m^2/s$)**		
TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
0.40	0.20	0.08	0.0000111	0.0000056	0.0000022

Site Activity per day	24	Control Efficiency %	80

Location	**Total Area (m^2)**	**Total Area (ha)**	**Emissions (kg/h)**		
			TSP	**PM_{10}**	**$PM_{2.5}$**
Material stockpile LG	5,000	0.50	0.20	0.10	0.04
Material stockpile HMG	5,000	0.50	0.20	0.10	0.04
Co-Disposal Facility Beach	20,000	2.00	0.80	0.40	0.16

Location	**Uncontrolled Emission Rate (g/s)**					
	24-Hour Averaging Emissions			**1-Hour Averaging Emissions**		
Material stockpile LG	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Material stockpile HMG	0.06	0.03	0.01	0.06	0.03	0.01
Co-Disposal Facility Beach	0.22	0.11	0.04	0.22	0.11	0.04

Location	**Controlled Emission Rate (g/s)**					
	24-Hour Averaging Emissions			**1-Hour Averaging Emissions**		
Material stockpile LG	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Material stockpile HMG	0.011	0.0056	0.0022	0.011	0.006	0.002
Co-Disposal Facility Beach	0.044	0.022	0.009	0.044	0.022	0.009

It should be noted that the particulate emissions from disturbed, or active, stockpiles, may be significantly higher during periods of high winds. However the emission rate during such events decreases quickly as the particulate matter on the surface that is susceptible to the wind is finite. Such episodes or events are best managed by on-site practices such as water application and modified activity at stockpiles during high wind events.

The use of the current emission factors for wind erosion in the U.S. EPA's AP-42 document would require hourly input of emission values. In addition, that factor only applies to a limited number of hours above a high wind speed threshold. For these reasons, a more practical approach was used to avoid modelling a different emission value for each hour of meteorological data. An average value based on the emission factor for coal mines was used. Since this factor would lead to higher wind erosion because coal dust related wind erosion is more likely to occur than asphalt, limestone, or overburden type soil related wind erosion, that approach is considered conservative. In addition, wind erosion is only expected to significantly occur when the wind speed exceeds 10 m/s. The wind erosion was therefore modelled using a variable emission rate, assuming 0 g/s if the wind speed is less than 8.24 m/s, and as calculated for wind speeds greater than this threshold.

Table C-14: Construction Phase – Mine Infrastructure - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
Access Road Length	17	km
Construction Phase Duration (17km)	12	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction.

Representative Construction Fleet (these data should include both activities within the Access Road construction footprint as well as transport of aggregate from the mine site to the construction site)

Source ID	Source Description	Engine Type	Engine Size/Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
Main Open Pit	Dozer	Diesel >=19kW, Tier 1–3	D8	354	1	50%	3,003
Main Open Pit	Haul Truck	Diesel >=19kW, Tier 4	T264 (240 Mt)	2,700	6	82%	5,218
Main Open Pit	Primary Drill	Electric	140mm SmartRoc D65	540	1	20%	5,693
Main Open Pit	Ore Control Drill	Diesel >=19kW, Tier 1–3	Explorac E100	110	1	20%	4,338
Main Open Pit	Drill	Electric	Komatsu 77XR - 251mm	1,000	1	85%	5,319
Main Open Pit	Hydraulic Excavator	Electric	R9600 36m^3 (240t +)	3,400	1	64%	4,164
Main Open Pit	Production Loader	Diesel >=19kW, Tier 4	L-1350 (23m3)	1,676	1	44%	2,628
Main Open Pit	Production Backhoe	Diesel >=19kW, Tier 4	PC1250 (6.7m3)	785	1	44%	543
Main Open Pit	Haul Truck	Diesel >=19kW, Tier 4	HD785	1,178	2	50%	2,300
Main Open Pit	Dump Truck	Diesel >=19kW, Tier 4	20ton	400	2	13%	1,074
Main Open Pit	Track Dozer	Diesel >=19kW, Tier 4	D375A-6R	609	4	43%	1,957
Main Open Pit	Grader	Diesel >=19kW, Tier 4	GD655-7	218	2	53%	2,348
Main Open Pit	Transfer Loader	Diesel >=19kW, Tier 4	WA900	899	1	40%	1,358
Main Open Pit	Snow Plow/Water Truck	Diesel >=19kW, Tier 4	T880	400	2	9%	1,409
Main Open Pit	Support Backhoe + Rock Hammer	Diesel >=19kW, Tier 4	PC490LC-11	359	1	13%	1,074
Main Open Pit	Road Maintenance Loader	Diesel >=19kW, Tier 4	WA600-3	529	1	13%	1,074
Main Open Pit	Tire Manipulator	Diesel >=19kW, Tier 4	WA-500-7	353	1	8%	716
Main Open Pit	Lube/Fuel Truck	Diesel >=19kW, Tier 4		500	1	25%	2,148
Main Open Pit	Mechanics Truck	Diesel >=19kW, Tier 4		350	1	50%	4,296
Main Open Pit	Welding Truck	Diesel >=19kW, Tier 4		350	1	33%	2,864
Main Open Pit	Blasting Loader	Diesel >=19kW, Tier 4	CAT 262	75	1	33%	2,864
Main Open Pit	Blasters Truck	Diesel >=19kW, Tier 4	F350	400	1	33%	2,864
Main Open Pit	Pump Truck	Diesel >=19kW, Tier 4		500	1	33%	2,864
Main Open Pit	Integrated Tool Carrier	Diesel >=19kW, Tier 4	WA200-7	126	1	17%	1,432
Main Open Pit	Compactor	Diesel >=19kW, Tier 4	Hamm 16i P	128	1	8%	716
Main Open Pit	Lighting Plants	Solar			6	50%	4,296
Main Open Pit	Manbus	Electric			1	21%	3,580
Main Open Pit	Pickup Trucks	Diesel >=19kW, Tier 4		300	15	42%	3,580
Main Open Pit	Ambulance	Diesel >=19kW, Tier 4		400	1	40%	
Main Open Pit	Fire Truck	Diesel >=19kW, Tier 4		400	1	40%	
Main Open Pit	Rough Terrain Crane	Diesel >=19kW, Tier 4	50ton	350	1	2%	179
Main Open Pit	Lowboy and Tractor	Diesel >=19kW, Tier 1–3	75ton - 100ton	500	1	1%	90
Main Open Pit	Rock Crusher	Electric	Sandvik UD211	276	1	50%	2,551

Table C-14: Construction Phase – Mine Infrastructure - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
Access Road Length	17	km
Construction Phase Duration (17km)	12	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction.

Representative Construction Fleet (these data should include both activities within the Access Road construction footprint as well as transport of aggregate from the mine site to the construction site)

Source ID	Source Description	Engine Type	Engine Size/Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
Lake Dewatering	Diesel Pump	Diesel >=19kW, Tier 4	HL250M	440	2	100%	13,080
Lake Dewatering	Submersible Pump	Electric	J604	94	2	100%	13,080
Lake Dewatering	Fusion Machine	Diesel < 19kW	24" HDPE	13	1	20%	2,927
Lake Dewatering (Winterization)	Heat Trace Unit	Electric		328	3		
Lake Dewatering	GenSet 415kVA	Diesel >=19kW, Tier 4	Diesel Pump	445	2	100%	2,928
Lake Dewatering	GenSet 90kVA	Electric	Submersible Pump	97	2	100%	2,928
Lake Dewatering	GenSet 15kVA	Diesel >=19kW, Tier 4	Fusion Machine	16	1		
Lake Dewatering	Pick Up Truck	Diesel >=19kW, Tier 4	F150	250	2	33%	2,300
Lake Dewatering	Excavator	Diesel >=19kW, Tier 4	PC490LC-11	359	2	13%	2,708
Lake Dewatering	Pump Truck	Diesel >=19kW, Tier 4		500	3	33%	2,300
SITE PREP & EARTHWORKS	40T Articuating Truck	HDDV (Moderate Control)		370	10	75%	3003
SITE PREP & EARTHWORKS	35 Ton Excavator	Diesel >=19kW, Tier 1–3		300	8	75%	3003
SITE PREP & EARTHWORKS	120 Ton Excavator	Diesel >=19kW, Tier 1–3		560	2	75%	3003
SITE PREP & EARTHWORKS	D5 Dozer	Diesel >=19kW, Tier 1–3		170	2	75%	3003
SITE PREP & EARTHWORKS	D8 Dozer	Diesel >=19kW, Tier 1–3		350	3	35%	3003
SITE PREP & EARTHWORKS	16' Grader	Diesel >=19kW, Tier 1–3		290	4	75%	3003
SITE PREP & EARTHWORKS	Crane 80T	Diesel >=19kW, Tier 1–3		390	2	75%	3003
SITE PREP & EARTHWORKS	Drum Roller	Diesel >=19kW, Tier 1–3		130	4	75%	3003
SITE PREP & EARTHWORKS	Compactor 1000lb	Diesel < 19kW		6	4	75%	3003
SITE PREP & EARTHWORKS	Compressor	Diesel < 19kW		36	4	50%	2002
SITE PREP & EARTHWORKS	Generator Set 10KVA	Diesel < 19kW		11	6	70%	2803
SITE PREP & EARTHWORKS	Zoom Boom	Diesel >=19kW, Tier 1–3		99	4	75%	3003
SITE PREP & EARTHWORKS	Tadem Water Trucks 2500 gls	HDDV (Moderate Control)		420	4	75%	3003
SITE PREP & EARTHWORKS	Pick up truck	LDDV (Moderate Control)		180	6	30%	1201
Concrete	Rock Crusher	Electric	Sandvik UD211	276	1	50%	2551
Concrete	Batch Plant	Diesel >=19kW, Tier 1–3		711	1	80%	1980
Concrete	80T RT Crane	HDDV (Moderate Control)		390	2	75%	1980
Concrete	35 Ton Excavator	Diesel >=19kW, Tier 1–3		300	4	75%	1980
Concrete	40T Articuating Truck	HDDV (Moderate Control)		370	4	75%	1980
Concrete	D5 Dozer	Diesel >=19kW, Tier 1–3		170	4	75%	1980
Concrete	66" Drum Roller	HDDV (Moderate Control)		130	2	75%	1980
Concrete	2500 Gal Tandem Water Truck	HDDV (Moderate Control)		420	2	40%	1980
Concrete	Compactor Plate 1000 lb	Diesel < 19kW		5	6	40%	1980
Concrete	Flat Bed	HDDV (Moderate Control)		470	4	30%	1980
Concrete	Generators 13kVA	Diesel < 19kW		15	6	60%	1320
Concrete	Pick Up Truck	LDDV (Moderate Control)		180	6	40%	1848
Concrete	Skidsteer	LDDV (Moderate Control)		80	2	60%	1980
Concrete	Genie 4 ton Ext boom FORKLIFT	Diesel >=19kW, Tier 1–3		99	2	60%	1980

Table C-14: Construction Phase – Mine Infrastructure - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
Access Road Length	17	km
Construction Phase Duration (17km)	12	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction.

Representative Construction Fleet (these data should include both activities within the Access Road construction footprint as well as transport of aggregate from the mine site to the construction site)

Source ID	Source Description	Engine Type	Engine Size/Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
SMP	GenSet 13KVA	Diesel < 19kW		15	6	70%	792
SMP	GenSet 100KVA	Diesel >=19kW, Tier 1–3		125	2	70%	2310
SMP	COMPRESOR DOOSAN XP-375	Diesel >=19kW, Tier 1–3		36	6	70%	2310
SMP	COMPRESOR DOOSAN XP-375	Diesel >=19kW, Tier 1–3		36	1	70%	2310
SMP	12,000lb Telehandler	Diesel >=19kW, Tier 1–3		130	2	60%	1980
SMP	JLG - 125'	Diesel >=19kW, Tier 1–3		75	2	60%	1980
General	Welding Truck	HDDV (Moderate Control)		66	8	50%	1980
SMP	Welding machine, Diesel	Diesel >=19kW, Tier 1–3		66	3	60%	1980
SMP	Genie 4 ton Ext boom FORKLIFT	Diesel >=19kW, Tier 1–3		99	6	60%	1980
SMP	Light Tower	Diesel >=19kW, Tier 1–3		27	40	40%	1320
SMP	Tadem Water Trucks 2500 gls	HDDV (Moderate Control)		420	4	40%	1320
SMP	Fusing Machine 2" - 8"	Diesel < 19kW		4	3	50%	1650
SMP	Heater - Indirect Fire 350000 BTU	Diesel >=19kW, Tier 1–3		145	1	50%	1650
SMP	Manlift Articulating 60'	Diesel >=19kW, Tier 1–3		74	6	70%	2310
SMP	Manlift Scissor Lift 32'	Diesel >=19kW, Tier 1–3		30	6	70%	2310
SMP	SkidSteer	LDDV (Moderate Control)		80	6	70%	2310
SMP	Frana Crane 30T	Diesel >=19kW, Tier 1–3		300	5	40%	1320
SMP	160T RT	Diesel >=19kW, Tier 1–3		282	5	40%	1320
SMP	88T Telescopic Crawler	Diesel >=19kW, Tier 1–3		250	1	40%	1320
SMP	350T Crawler	Diesel >=19kW, Tier 1–3		365	1	70%	924
E&I	80T RT	HDDV (Moderate Control)		60	1	40%	660
E&I	JLG - 125'	HDDV (Moderate Control)		75	2	60%	990
E&I	GenSet 13KVA	Diesel < 19kW		15	6	90%	1485
E&I	GenSet 100KVA	Diesel >=19kW, Tier 1–3		125	2	90%	1485
E&I	COMPRESOR DOOSAN XP-375	Diesel >=19kW, Tier 1–3		36	6	90%	1485
GENERAL	WAREHOUSE	Diesel >=19kW, Tier 1–3		140	1	90%	3861
GENERAL	STEEL YARD	Diesel >=19kW, Tier 1–3		71	1	80%	2112
GENERAL	PREASEMBLY YARD	Diesel >=19kW, Tier 1–3		140	1	80%	3432
GENERAL	CONSTRUCTION CAMP (1000pp)	Diesel >=19kW, Tier 1–3		237	2	90%	7722
GENERAL	MESS BUILDING	Diesel >=19kW, Tier 1–3		237	1	50%	4290
GENERAL	GATEHOUSE	Diesel >=19kW, Tier 1–3		12	1	90%	4455
GENERAL	ADMIN BUILDING	Diesel >=19kW, Tier 1–3		178	1	70%	6006
GENERAL	CHANGE HOUSE	Diesel >=19kW, Tier 1–3		119	1	30%	2574
GENERAL	HOSPITAL	Diesel >=19kW, Tier 1–3		119	1	30%	1485
GENERAL	GYM	Diesel >=19kW, Tier 1–3		140	1	30%	1287
GENERAL	LAUNDRY	Diesel >=19kW, Tier 1–3		119	1	30%	1485

Table C-14: Construction Phase – Mine Infrastructure - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
Access Road Length	17	km
Construction Phase Duration (17km)	12	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction.

Representative Construction Fleet (these data should include both activities within the Access Road construction footprint as well as transport of aggregate from the mine site to the construction site)

Source ID	Source Description	Engine Type	Engine Size/Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
East & West Dykes	Dozer	Diesel >=19kW, Tier 1–3	D8	354	2	50%	3003
East & West Dykes	CAT 740 EJ Articulated Trucks	Diesel >=19kW, Tier 4		496	4	50%	2002
East & West Dykes	Tandem Truck	HDDV (Moderate Control)		500	5	50%	2002
East & West Dykes	CAT 950 Loader	Diesel, Tier 4		249	1	50%	2002
East & West Dykes	CAT CS64B Compactor	Diesel		131	3	50%	2002
East & West Dykes	336 CAT Excavator	Diesel >=19kW, Tier 1–3		300	1	30%	1201
East & West Dykes	340 CAT Excavator	Diesel >=19kW, Tier 1–3		346	1	50%	2002
East & West Dykes	Ligth Duty Pickup Truck	LDDV (Moderate Control)		400	2	90%	3604
East & West Dykes	CG630E Grout Plant	Compressed Air			2	50%	2002
East & West Dykes	Sullair 375H Compressor	Diesel		122	2	50%	2002
East & West Dykes	Sheet Piling Rig	Diesel >=19kW, Tier 4		1,006	1	50%	2002
East & West Dykes	Soil Mixing Machine	Diesel >=19kW, Tier 4		172	1	50%	2002
East & West Dykes	Haul Truck	Diesel >=19kW, Tier 4	HD785	1,178	4	50%	2300
East & West Dykes	Production Backhoe	Diesel >=19kW, Tier 4	PC1250	785	1	44%	1476
East & West Dykes	Drill	Electric	SmartRoc D65	540	1	50%	4,338
Co-Dispodal Facility	D6 EX Dozer	Diesel >=19kW, Tier 4		215	2	50%	2002
Co-Dispodal Facility	D8 Dozer	Diesel >=19kW, Tier 1–3	D8	354	2	75%	3003
Co-Dispodal Facility	336 CAT Excavator	Diesel >=19kW, Tier 1–3		300	6	90%	3604
Co-Dispodal Facility	Tandem Truck	HDDV (Moderate Control)		500	10	50%	2002
Co-Dispodal Facility	CAT 740 EJ Articulated Trucks	Diesel >=19kW, Tier 4		496	8	50%	3604
Co-Dispodal Facility	CAT CS64B Compactor	Diesel		131	3	75%	3003
Co-Dispodal Facility	JD 640L Skidder	Diesel		237	2	25%	1001
Co-Dispodal Facility	Flat Bed or Boom Truck	Diesel >=19kW, Tier 1–3		600	1	30%	1201
Co-Dispodal Facility	Ligth Duty Pickup Truck	LDDV (Moderate Control)		400	3	90%	3604
GENERAL	WAREHOUSE	Diesel >=19kW, Tier 1–3		140	1	90%	3861
GENERAL	STEEL YARD	Diesel >=19kW, Tier 1–3		71	1	80%	2112
GENERAL	PREASEMBLY YARD	Diesel >=19kW, Tier 1–3		140	1	80%	3432
GENERAL	CONSTRUCTION CAMP (1000pp)	Diesel >=19kW, Tier 1–3		237	2	90%	7722
GENERAL	MESS BUILDING	Diesel >=19kW, Tier 1–3		237	1	50%	4290
GENERAL	GATEHOUSE	Diesel >=19kW, Tier 1–3		12	1	90%	4455
GENERAL	ADMIN BUILDING	Diesel >=19kW, Tier 1–3		178	1	70%	6006
GENERAL	CHANGE HOUSE	Diesel >=19kW, Tier 1–3		119	1	30%	2574
GENERAL	HOSPITAL	Diesel >=19kW, Tier 1–3		119	1	30%	1485
GENERAL	GYM	Diesel >=19kW, Tier 1–3		140	1	30%	1287
GENERAL	LAUNDRY	Diesel >=19kW, Tier 1–3		119	1	30%	1485

*Equipment Utilization factors are retrieved from: U.S. Department of Transportation

Table C-15: Construction Phase – Mine Infrastructure - Bulldozer Activity

Particulate matter emissions from the movement of bulldozers was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-2, Bulldozing on Material other than Coal (Overburden).

$$TSP\ EF\left(\frac{kg}{hr}\right) = 2.6 \times \left(\frac{(s)^{1.2}}{(M)^{1.3}}\right)$$

$$PM_{10}\ EF\left(\frac{kg}{hr}\right) = 0.34 \times \left(\frac{(s)^{1.5}}{(M)^{1.4}}\right)$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.105 \times TSP$$

s = silt content (%)
M = moisture content (%)

SiltContent(%)
3.9
MoistureContent(%)
7.9

Table 1: Bulldozer Distribution per Construction Site

Construction Site	Quantity	Utilization Factor (%)	Operating Hours (h/day)	Control Efficiency %	Emission Rate								
					SPM			PM_{10}			PM_{25}		
					per Dozer (kg/h)	total (kg/h)	total (g/s)	per Dozer (kg/h)	total (kg/h)	total (g/s)	per Dozer (kg/h)	total (kg/h)	total (g/s)
Main Open Pit	1	50%	12	75	0.91	0.91	0.25	0.14	0.14	0.04	0.10	0.10	0.03
Main Open Pit	4	43%	12	75	0.91	3.63	1.01	0.14	0.58	0.16	0.10	0.38	0.11
SITE PREP & EARTHWORKS	2	75%	12	75	0.91	1.81	0.50	0.14	0.29	0.08	0.10	0.19	0.05
SITE PREP & EARTHWORKS	3	35%	12	75	0.91	2.72	0.76	0.14	0.43	0.12	0.10	0.29	0.08
Concrete	4	75%	12	75	0.91	3.63	1.01	0.14	0.58	0.16	0.10	0.38	0.11
East & West Dykes	2	50%	12	75	0.91	1.81	0.50	0.14	0.29	0.08	0.10	0.19	0.05
Co-Dispodal Facility	2	50%	12	75	0.91	1.81	0.50	0.14	0.29	0.08	0.10	0.19	0.05
Co-Dispodal Facility	2	75%	12	75	0.91	1.81	0.50	0.14	0.29	0.08	0.10	0.19	0.05

Table C-15: Construction Phase – Mine Infrastructure - Bulldozer Activity

Table 2: Particulate Emissions from Bulldozers Activity

Scenario	Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
		24-hr Average	1-hr Average	24-hr Average	1-hr Average
Main Open Pit	TSP	2.79E-01	5.59E-01	6.99E-02	1.40E-01
	PM_{10}	4.44E-02	8.88E-02	1.11E-02	2.22E-02
	$PM_{2.5}$	2.93E-02	5.87E-02	7.34E-03	1.47E-02
SITE PREP & EARTHWORKS	TSP	3.21E-01	6.42E-01	8.03E-02	1.61E-01
	PM_{10}	5.10E-02	1.02E-01	1.27E-02	2.55E-02
	$PM_{2.5}$	3.37E-02	6.74E-02	8.43E-03	1.69E-02
Concrete	TSP	3.78E-01	7.55E-01	9.44E-02	1.89E-01
	PM_{10}	6.00E-02	1.20E-01	1.50E-02	3.00E-02
	$PM_{2.5}$	3.97E-02	7.93E-02	9.91E-03	1.98E-02
East & West Dykes	TSP	1.26E-01	2.52E-01	3.15E-02	6.29E-02
	PM_{10}	2.00E-02	4.00E-02	5.00E-03	1.00E-02
	$PM_{2.5}$	1.32E-02	2.64E-02	3.30E-03	6.61E-03
Co-Dispodal Facility	TSP	3.15E-01	6.29E-01	7.87E-02	1.57E-01
	PM_{10}	5.00E-02	1.00E-01	1.25E-02	2.50E-02
	$PM_{2.5}$	3.30E-02	6.61E-02	8.26E-03	1.65E-02

Table C-16: Construction Phase – Mine Infrastructure - Grader Activity

Particulate matter emissions from the movement of grader was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-3.

$$TSP\ EF\left(\frac{kg}{hr}\right) = 0.0034 \times (S^{2.5})$$

$$PM_{10}\ \ EF\left(\frac{kg}{hr}\right) = 0.0034 \times (S^{2.0})$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.031 \times TSP$$

S = mean vehicle speed

Table 1: Particulate Emissions from Grader Activity

Scenario	Particle Size	Number of Grader or Equivalent	Mean Vehicle Speed (km/hr)	Emission Rate per Grader (kg/h)	Emission Rate total (kg/h)	Emission Rate total (g/s)	Utilization Factor %	Hours per Day	Control Efficiency %
Main Open Pit	TSP	2	5.00	0.19	0.38	0.11	53	12	75
	PM_{10}			0.09	0.17	0.05			
	$PM_{2.5}$			0.01	0.01	0.003			
SITE PREP & EARTHWORKS	TSP	4	5.00	0.19	0.76	0.21	75	12	75
	PM_{10}			0.09	0.34	0.09			
	$PM_{2.5}$			0.01	0.02	0.007			

	Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
		24-hr Average	1-hr Average	24-hr Average	1-hr Average
Main Open Pit	TSP	2.80E-02	5.60E-02	7.00E-03	1.40E-02
	PM_{10}	1.25E-02	2.50E-02	3.13E-03	6.26E-03
	$PM_{2.5}$	8.67E-04	1.73E-03	2.17E-04	4.34E-04
SITE PREP & EARTHWORKS	TSP	7.92E-02	1.58E-01	1.98E-02	3.96E-02
	PM_{10}	3.54E-02	7.08E-02	8.85E-03	1.77E-02
	$PM_{2.5}$	2.46E-03	4.91E-03	6.14E-04	1.23E-03

Table C-17: Construction Phase – Mine Infrastructure - Loader Activity

Particulate matter emissions from the movement of grader was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9.2 (Truck Loading).

$$TSP\ EF\left(\frac{kg}{Mg}\right) = \frac{0.580}{M^{1.2}}$$

$$PM_{10}\ EF\left(\frac{kg}{Mg}\right) = 0.75 \times \frac{0.0596}{M^{0.9}}$$

$$PM_{2.5}\ EF\left(\frac{kg}{Mg}\right) = 0.019 \times TSP$$

M = material moisture content

moisture content (%)

7.9

Table 1: Particulate Emissions from Loading Activity

Scenario	Number of Loader or Equivalent	Material Handling (tonnes / hour)	Utilization Factor %	Hours per Day	Control Efficiency %	Emission Rate (kg/tonne)		
						SPM	PM_{10}	PM_{25}
Main Open Pit	1	17	44	12	75	4.86E-02	6.96E-03	9.23E-04
Main Open Pit	1	17	40	12	75	4.86E-02	6.96E-03	9.23E-04
Main Open Pit	1	17	13	12	75	4.86E-02	6.96E-03	9.23E-04
Main Open Pit	1	17	33	12	75	4.86E-02	6.96E-03	9.23E-04
East & West Dykes	1	17	50	12	75	4.86E-02	6.96E-03	9.23E-04

Scenario	Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
		24-hr Average	1-hr Average	24-hr Average	1-hr Average
Main Open Pit	TSP	5.96E-01	2.98E-01	5.04E-02	2.52E-02
	PM_{10}	8.54E-02	4.27E-02	7.23E-03	3.61E-03
	$PM_{2.5}$	1.13E-02	5.66E-03	9.59E-04	4.79E-04
East & West Dykes	TSP	2.29E-01	1.15E-01	3.78E-02	1.89E-02
	PM_{10}	3.29E-02	1.64E-02	5.42E-03	2.71E-03
	$PM_{2.5}$	4.36E-03	2.18E-03	7.19E-04	3.59E-04

Vehicle Weight	Tri-Axle Dump Truck
Payload	18.7 tons
Operating Weight (Empty)	13.8 tons
Operating Weight (with Load)	32.5 tons
Payload	17.0 tonnes
Operating Weight (Empty)	12.5 tonnes
Operating Weight (with Load)	29.5 tonnes

Table C-18: Construction Phase – Mine Infrastructure - Haulage Activity

Table 1: Particulate Emission Coefficients for Truck Traffic on Unpaved Industrial Roads from AP42 (Chapter 13.2 - Unpaved Roads; Nov 2006)

Constant	Expressed Units	PM_{30} (TPM)[3]	PM_{10}	$PM_{2.5}$	US EPA Data Quality
k	lb/VMT [(1)]	4.9	1.5	0.15	B
a	-	0.7	0.9	0.9	B
b	-	0.45	0.45	0.45	B
Conversion	lb/VMT to g/VKT	281.9	281.9	281.9	–

Notes:

1. "lb/VMT" means pounds pre vehicle mile travelled.
2. "g/VKT" means grams per vehicle kilometre
3. TPM means total particulate matter

Table 2: Fixed Haul Road Segments

Road Source ID Segment	Route or Area Description	Road Dimensions		Total VKT per hour per segment	Uncontrolled kg/hour			Uncontrolled (g/s)			Controlled (g/s)		
		Distance (km)	Length (Round Trip) (m)		TPM Emission Rate	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate	TPM Emission per segment	PM_{10} Emission Rate	$PM_{2.5}$ Emission Rate
Pit to Main Road West													
PIT_WEST		1.07	2143	11.72	55.0	13.4	1.3	15.27	3.73	0.37	2.291	0.560	0.056
Pit to Main Road East													
PIT_EAST		1.50	3005	18.32	86.0	21.0	2.1	23.89	5.84	0.58	3.583	0.876	0.088
West Road to CDF													
West_CDF		1.59	3173	14.13	66.3	16.2	1.6	18.42	4.50	0.45	2.763	0.676	0.068
West Road to DAM													
West_DAM		1.10	2194	0.58	2.7	0.7	0.1	0.75	0.18	0.02	0.113	0.028	0.003
Mill Feed													
E_Mill		0.21	430	0.32	1.5	0.4	0.0	0.41	0.10	0.01	0.062	0.015	0.002
Low Grade Stockpile													
East_LGSTK		0.28	566	0.44	2.1	0.5	0.1	0.57	0.14	0.01	0.086	0.021	0.0021
East Road to South													
East_ST		0.33	661	2.04	9.6	2.3	0.2	2.65	0.65	0.06	0.398	0.097	0.010
Mid/High Grade Stockpile													
ST_MHSTK		0.67	1336	1.45	6.8	1.7	0.2	1.89	0.46	0.05	0.284	0.069	0.007
Surficial Soil Stockpile													
ST_SSS		0.72	1432	2.86	13.4	3.3	0.3	3.72	0.91	0.09	0.559	0.137	0.014
Edge of Pit to Centre (In pit road)													
OPIT		0.45	900	10.41	48.8	11.9	1.2	13.57	3.32	0.33	2.035	0.498	0.050

Particle Size	TPM	PM10	PM2.5
Total	12.17	2.98	0.30
Total (in-pit)	4.33	1.06	0.11
Total (outside pit)	7.85	1.92	0.19

Table C-18: Construction Phase – Mine Infrastructure - Haulage Activity

Table 3: Truck Details

	Tonnes per hour	Load per Truck (tonnes)	Round Trips per hour	Vehicle Weight Empty (tonnes)	Vehicle Weight Loaded (tonnes)	Mean Vehicle Weight (tonnes)	TPM Emission Factor lb/VKT	PM_{10} Emission Factor lb/VKT	$PM_{2.5}$ Emission Factor lb/VKT	TPM Emission Factor kg/VKT	PM_{10} Emission Factor kg/VKT	$PM_{2.5}$ Emission Factor kg/VKT
Total Material from PIT	2,284	197	12	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Material from PIT to West	1,080	197	5	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Material from PIT to East	1,204	197	6	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
West Road to CDF	879	197	4	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
West Road to DAM	52	197	0	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Mill Feed	145	197	1	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Low Grade Stockpile Access	154	197	1	138	336	237.0				4.69	1.15	0.11
Iimperial units						261.0	16.6	4.1	0.4			
East Road to South	608	197	3	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Mid/High Grade Ore Stockpile	214	197	1	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Surficial Soil Stockpile	394	197	2	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			
Tailings to CDF		197	0	138	336	237.0				4.69	1.15	0.11
Imperial units						261.0	16.6	4.1	0.4			

Road Emission Assumptions (needed for AP42)					
Mean Silt Content	3.9	%	based on AP42 Chapter 13.2 for taconite mining		
Assumed average speed of trucks	50	km/hour	31.1	miles/hour	(not used in calculations)
Assumed Control Efficiency	85	%	based on watering, vehicle speed, lack of silt, dust suppressant		

Sample Calculation Segment PIT1-HR:
Step 1: Caculation of lb/VKT (from AP42 - Chapter 13.2.2)
E (lb/vkt) (for TSP) = k x (silt %/12)^a x (mean weight/3)^b (see values for k, a, b above) = 4.9 x (5.8/12) ^ 0.7 x (317/3) ^ 0.45 = 24 lb/VKT (in Table 3)
Step 2: convert to kg/VKT
E (kg/VKT) = 281.9 g/VKT x 24 lb/vkt /1000 g/kg = 6.76 kg/VKT (this is shown in Table 3)
Step 3: total VKT is obtained from distance travelled x number of round trips per hour.
Total VKT - 3117 m x 40 trips per hour/ 1000 m/km = 125 VK T travelled in an hour. (Table 2)
note: trips per hour is calculed from total tonnes per hour divided by load per truck
Step 4: Total emission rate (kg/hour) = 125 VKT/hour x 6.76 kg/VKT = 847 kg/hour (Table 2)
Step 5: Uncontrolled emission rate (g/s) = 847 kg/hour x 1000 g/kg / 3600 s/hour = 235 g/s (Table 2)

Table C-18: Construction Phase – Mine Infrastructure - Haulage Activity

Table 4: Vehicle Weights

Vehicle Class	Quantity	Weight (tonnes)			Power	
		No Load	Loaded	Load	HP	kW
240 mt	5	164	404	240	2650	1976
91 mt	2	74	164	91	1025	764
Weighted Average	7	138	335	197	2186	1630

Haul Trucks

Average kW	1630
Average HP	2186
Total # Trucks	7
Load Factor	40%

Road Segment	ID	Length	# Trucks	NO_x (g/s)	CO (g/s)	SO_2 (g/s)	PM (g/s)	BaP (g/s)	Benzene (g/s)	1,3-Butadiene (g/s)	Formaldehyde (g/s)	Acetaldehyde (g/s)	Acrolein (g/s)
Pit to Main Road West	PIT_WEST	1.071	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Pit to Main Road East	PIT_EAST	1.503	2.00	1.268	1.268	0.00204	0.036	2.10E-07	1.52E-03	5.53E-05	1.37E-05	8.63E-05	9.07E-11
West Road to CDF	West_CDF	1.587	2.00	1.268	1.268	0.00204	0.036	2.10E-07	1.52E-03	5.53E-05	1.37E-05	8.63E-05	9.07E-11
West Road to DAM	West_DAM	1.097	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Mill Feed	E_Mill	0.215	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Low Grade Stockpile	East_LGSTK	0.283	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
East Road to South	East_ST	0.330	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Mid/High Grade Stockpile	ST_MHSTK	0.668	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Surficial Soil Stockpile	ST_SSS	0.716	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11
Edge of Pit to Centre (In pit road)	OPIT	0.450	1.00	0.634	0.634	0.00102	0.018	1.05E-07	7.60E-04	2.77E-05	6.84E-06	4.32E-05	4.54E-11

Table C-18: Construction Phase – Mine Infrastructure - Haulage Activity

Table 5: Tier 4 emission standards—Engines up to 560 kW, g/kWh (g/bhp-hr)

Emission Standards: USA: Nonroad Diesel Engines (dieselnet.com)

Engine Power	Year	CO	NMHC	NOx	PM (2.5)
kW < 8	2008	8.0	-	-	0.4[a]
8 ≤ kW < 19	2008	6.6	-	-	0.40
19 ≤ kW < 37	2008	5.5	-	-	0.30
	2013	5.5	-	-	0.03
37 ≤ kW < 56	2008	5.0	-	-	0.3[b]
	2013	5.0	-	-	0.03
56 ≤ kW < 130	2012-2014c	5.0	0.19	0.40	0.020
130 ≤ kW ≤ 560	2011-2014d	3.5	0.19	0.40	0.020

a - hand-startable, air-cooled, DI engines may be certified to Tier 2 standards through 2009 and to an optional PM standard of 0.6 g/kWh starting in 2010

b - 0.4 g/kWh (Tier 2) if manufacturer complies with the 0.03 g/kWh standard from 2012

c - PM/CO: full compliance from 2012; NOx/HC: Option 1 (if banked Tier 2 credits used)—50% engines must comply in 2012-2013; Option 2 (if no Tier 2 credits claimed)—25% engines must comply in 2012-2014, with full compliance from 2014.12.31

d - PM/CO: full compliance from 2011; NOx/HC: 50% engines must comply in 2011-2013

Table 6: Tier 4 emission standards—Engines above 560 kW, g/kWh (g/bhp-hr)

Emission Standards: USA: Nonroad Diesel Engines (dieselnet.com)

Category	Year	CO	NMHC	NOx	PM (2.5)
All engines except gensets > 900 kW	2011	3.5	0.4	3.5	0.10
All engines except gensets	2015	3.5	0.19	3.5	0.04

Table 7: MOVES Emissio Factors for PAHs and VOCs (g/hp-hr)

Equipment	Emission Factors (g/hp-h)					
	BaP	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein
Haul Trucks	4.32E-07	4.94E-03	1.80E-04	2.76E-02	9.81E-03	1.78E-03

Table C-19: Construction Phase – Mine Infrastructure - Tailpipe Emission

Construction Area	Equipment List	Number of Units Used Concurrently	Hours per day	Emission Rate 1-hr (g/s)											Emission Rate 24-hr (g/s)										
				NOx	SO2	CO	PM10	PM2.5	Acetaldehyde	Acrolein	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	NOx	CO	SO2	B(a)P	TPM	PM10	PM2.5	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
Main Open Pit	Dozer	1	12	9.64E-04	2.12E-06	4.41E-04	7.11E-05	6.90E-05	5.75E-06	1.09E-06	4.13E-10	2.79E-06	1.07E-07	1.61E-05	4.82E-04	2.21E-04	1.06E-06	2.07E-10	3.55E-05	3.55E-05	3.45E-05	1.40E-06	5.33E-08	8.04E-06	2.87E-06
Main Open Pit	Haul Truck	8	12	1.09E-02	1.55E-05	1.83E-03	2.82E-04	2.73E-04	3.86E-05	7.01E-06	1.70E-09	1.94E-05	7.07E-07	1.08E-04	5.47E-03	9.14E-04	7.77E-06	8.49E-10	1.41E-04	1.41E-04	1.37E-04	9.71E-06	3.53E-07	5.42E-05	1.93E-05
Main Open Pit	Primary Drill	1	12	2.31E-03	2.23E-06	7.96E-04	1.31E-04	1.27E-04	1.34E-05	4.47E-06	3.40E-10	4.20E-06	3.14E-07	3.74E-05	1.15E-03	3.98E-04	1.12E-06	1.70E-10	6.56E-05	6.56E-05	6.37E-05	2.10E-06	1.57E-07	1.87E-05	6.70E-06
Main Open Pit	Ore Control Drill	1	12	2.21E-03	2.21E-06	7.08E-04	1.46E-04	1.41E-04	1.50E-05	4.62E-06	4.22E-10	5.04E-06	3.43E-07	4.20E-05	1.10E-03	3.54E-04	1.10E-06	2.11E-10	7.28E-05	7.28E-05	7.06E-05	2.52E-06	1.72E-07	2.10E-05	7.52E-06
Main Open Pit	Drill	1	12	6.19E-03	4.50E-06	1.93E-03	3.18E-04	3.08E-04	3.62E-05	1.32E-05	7.66E-10	1.08E-05	8.67E-07	1.01E-04	3.09E-03	9.65E-04	2.25E-06	3.83E-10	1.59E-04	1.59E-04	1.54E-04	5.42E-06	4.33E-07	5.04E-05	1.81E-05
Main Open Pit	Hydraulic Excavator	1	12	1.62E-03	2.05E-06	3.32E-04	5.21E-05	5.05E-05	6.25E-06	1.25E-06	2.47E-10	2.78E-06	1.24E-07	1.76E-05	8.10E-04	1.66E-04	1.03E-06	1.23E-10	2.60E-05	2.60E-05	2.53E-05	1.39E-06	6.20E-08	8.81E-06	3.13E-06
Main Open Pit	Production Loader	1	12	2.12E-03	2.21E-06	6.35E-04	9.30E-05	9.02E-05	1.03E-05	2.63E-06	3.26E-10	3.83E-06	2.23E-07	2.88E-05	1.06E-03	3.18E-04	1.10E-06	1.63E-10	4.65E-05	4.65E-05	4.51E-05	1.92E-06	1.12E-07	1.44E-05	5.13E-06
Main Open Pit	Production Backhoe	1	12	2.24E-03	2.18E-06	4.41E-04	7.46E-05	7.23E-05	1.03E-05	2.74E-06	2.55E-10	3.81E-06	2.26E-07	2.90E-05	1.12E-03	2.21E-04	1.09E-06	1.27E-10	3.73E-05	3.73E-05	3.62E-05	1.91E-06	1.13E-07	1.45E-05	5.16E-06
Main Open Pit	Haul Truck	8	12	1.09E-02	1.55E-05	1.83E-03	2.82E-04	2.73E-04	3.86E-05	7.01E-06	1.70E-09	1.94E-05	7.07E-07	1.08E-04	5.47E-03	9.14E-04	7.77E-06	8.49E-10	1.41E-04	1.41E-04	1.37E-04	9.71E-06	3.53E-07	5.42E-05	1.93E-05
Main Open Pit	Dump Truck	2	12	8.40E-04	3.73E-06	3.16E-04	5.18E-05	5.02E-05	4.30E-06	7.61E-07	3.26E-10	2.14E-06	7.47E-08	1.19E-05	4.20E-04	1.58E-04	1.87E-06	1.63E-10	2.59E-05	2.59E-05	2.51E-05	1.07E-06	3.73E-08	5.93E-06	2.15E-06
Main Open Pit	Track Dozer	4	12	3.89E-03	8.48E-06	2.57E-03	2.89E-04	2.80E-04	2.22E-05	4.19E-06	1.63E-09	1.08E-05	4.10E-07	6.20E-05	1.94E-03	1.29E-03	4.24E-06	8.14E-10	1.44E-04	1.44E-04	1.40E-04	5.39E-06	2.05E-07	3.10E-05	1.11E-05
Main Open Pit	Grader	2	12	8.94E-04	3.78E-06	3.15E-04	5.99E-05	5.81E-05	6.00E-06	1.08E-06	3.61E-10	2.95E-06	1.07E-07	1.66E-05	4.47E-04	1.57E-04	1.89E-06	1.80E-10	3.00E-05	3.00E-05	2.91E-05	1.48E-06	5.35E-08	8.30E-06	3.00E-06
Main Open Pit	Transfer Loader	1	12	2.12E-03	2.21E-06	6.35E-04	9.30E-05	9.02E-05	1.03E-05	2.63E-06	3.26E-10	3.83E-06	2.23E-07	2.88E-05	1.06E-03	3.18E-04	1.10E-06	1.63E-10	4.65E-05	4.65E-05	4.51E-05	1.92E-06	1.12E-07	1.44E-05	5.13E-06
Main Open Pit	Snow Plow/Water Truck	2	12	8.40E-04	3.73E-06	3.16E-04	5.18E-05	5.02E-05	4.30E-06	7.61E-07	3.26E-10	2.14E-06	7.47E-08	1.19E-05	4.20E-04	1.58E-04	1.87E-06	1.63E-10	2.59E-05	2.59E-05	2.51E-05	1.07E-06	3.73E-08	5.93E-06	2.15E-06
Main Open Pit	Support Backhoe + Rock Hammer	1	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Main Open Pit	Road Maintenance Loader	1	12	1.24E-03	2.18E-06	5.67E-04	8.38E-05	8.13E-05	7.21E-06	1.60E-06	4.24E-10	3.21E-06	1.42E-07	2.02E-05	6.22E-04	2.84E-04	1.09E-06	2.12E-10	4.19E-05	4.19E-05	4.06E-05	1.60E-06	7.11E-08	1.01E-05	3.61E-06
Main Open Pit	Tire Manipulator	1	12	1.50E-03	2.18E-06	7.53E-04	1.10E-04	1.07E-04	8.94E-06	2.48E-06	4.11E-10	3.36E-06	1.93E-07	2.50E-05	7.48E-04	3.77E-04	1.09E-06	2.06E-10	5.49E-05	5.49E-05	5.33E-05	1.68E-06	9.67E-08	1.25E-05	4.47E-06
Main Open Pit	Lube/Fuel Truck	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Mechanics Truck	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Welding Truck	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Blasting Loader	1	12	2.58E-03	4.44E-06	1.33E-03	1.72E-04	1.66E-04	1.50E-05	2.75E-06	9.34E-10	7.18E-06	2.81E-07	4.22E-05	1.29E-03	6.65E-04	2.22E-06	4.67E-10	8.58E-05	8.58E-05	8.32E-05	3.59E-06	1.41E-07	2.11E-05	7.49E-06
Main Open Pit	Blasters Truck	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Pump Truck	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Integrated Tool Carrier	1	12	1.85E-03	2.54E-06	1.19E-03	2.22E-04	2.16E-04	2.70E-05	7.10E-06	8.64E-10	1.05E-05	5.78E-07	7.57E-05	9.25E-04	5.97E-04	1.27E-06	4.32E-10	1.11E-04	1.11E-04	1.08E-04	5.23E-06	2.89E-07	3.78E-05	1.35E-05
Main Open Pit	Compactor	1	12	6.95E-04	1.99E-06	2.86E-04	6.89E-05	6.69E-05	5.45E-06	9.91E-07	4.14E-10	2.70E-06	1.00E-07	1.53E-05	3.47E-04	1.43E-04	9.96E-07	2.07E-10	3.45E-05	3.45E-05	3.34E-05	1.35E-06	5.01E-08	7.64E-06	2.73E-06
Main Open Pit	Pickup Trucks	15	12	9.79E-03	5.51E-05	3.55E-03	6.23E-04	6.04E-04	5.36E-05	9.42E-06	3.91E-09	2.64E-05	9.18E-07	1.46E-04	4.89E-03	1.78E-03	2.76E-05	1.96E-09	3.11E-04	3.11E-04	3.02E-04	1.32E-05	4.59E-07	7.31E-05	2.68E-05
Main Open Pit	Rough Terrain Crane	1	12	1.29E-03	2.15E-06	3.85E-04	5.99E-05	5.81E-05	7.32E-06	1.70E-06	2.76E-10	3.17E-06	1.47E-07	2.05E-05	6.45E-04	1.92E-04	1.07E-06	1.38E-10	2.99E-05	2.99E-05	2.90E-05	1.58E-06	7.34E-08	1.02E-05	3.66E-06
Main Open Pit	Lowboy and Tractor	1	12	4.20E-04	1.87E-06	1.58E-04	2.59E-05	2.51E-05	2.15E-06	3.81E-07	1.63E-10	1.07E-06	3.73E-08	5.93E-06	2.10E-04	7.90E-05	9.34E-07	8.15E-11	1.29E-05	1.29E-05	1.26E-05	5.35E-07	1.87E-08	2.96E-06	1.08E-06
Main Open Pit	Rock Crusher	1	12	7.67E-04	2.03E-06	1.99E-04	4.06E-05	3.93E-05	5.65E-06	1.03E-06	2.26E-10	2.73E-06	1.05E-07	1.58E-05	3.84E-04	9.94E-05	1.01E-06	1.13E-10	2.03E-05	2.03E-05	1.97E-05	1.37E-06	5.23E-08	7.90E-06	2.83E-06
Lake Dewatering	Diesel Pump	2	12	2.99E-03	4.36E-06	1.51E-03	2.20E-04	2.13E-04	1.79E-05	4.95E-06	8.23E-10	6.71E-06	3.87E-07	4.99E-05	1.50E-03	7.53E-04	2.18E-06	4.11E-10	1.10E-04	1.10E-04	1.07E-04	3.36E-06	1.93E-07	2.50E-05	8.94E-06
Lake Dewatering	Fusion Machine	1	12	1.87E-03	2.69E-06	8.10E-04	9.18E-05	8.91E-05	1.91E-05	3.44E-06	5.92E-10	9.91E-06	3.42E-07	5.36E-05	9.36E-04	4.05E-04	1.34E-06	2.96E-10	4.59E-05	4.59E-05	4.45E-05	4.96E-06	1.71E-07	2.68E-05	9.54E-06
Lake Dewatering	Pick Up Truck	2	12	4.65E-04	3.61E-06	1.58E-04	3.12E-05	3.03E-05	2.84E-06	4.95E-07	1.95E-10	1.38E-06	4.77E-08	7.64E-06	2.32E-04	7.89E-05	1.81E-06	9.77E-11	1.56E-05	1.56E-05	1.52E-05	6.92E-07	2.39E-08	3.82E-06	1.42E-06
Lake Dewatering	Excavator	2	12	1.31E-03	4.01E-06	5.97E-04	9.94E-05	9.65E-05	8.14E-06	1.46E-06	6.08E-10	4.06E-06	1.46E-07	2.26E-05	6.54E-04	2.99E-04	2.01E-06	3.04E-10	4.97E-05	4.97E-05	4.82E-05	2.03E-06	7.30E-08	1.13E-05	4.07E-06
Lake Dewatering	Pump Truck	3	12	1.26E-03	5.60E-06	4.74E-04	7.76E-05	7.53E-05	6.46E-06	1.14E-06	4.89E-10	3.21E-06	1.12E-07	1.78E-05	6.30E-04	2.37E-04	2.80E-06	2.45E-10	3.88E-05	3.88E-05	3.77E-05	1.60E-06	5.60E-08	8.89E-06	3.23E-06
SITE PREP & EARTHWORKS	40T Articuating Truck	10	12	4.20E-03	1.87E-05	1.58E-03	2.59E-04	2.51E-04	2.15E-05	3.81E-06	1.63E-09	1.07E-05	3.73E-07	5.93E-05	2.10E-03	7.90E-04	9.34E-06	8.15E-10	1.29E-04	1.29E-04	1.26E-04	5.35E-06	1.87E-07	2.96E-05	1.08E-05
SITE PREP & EARTHWORKS	35 Ton Excavator	8	12	8.63E-03	3.10E-05	3.52E-03	6.09E-04	5.90E-04	5.25E-05	9.40E-06	3.73E-09	2.61E-05	9.35E-07	1.45E-04	4.31E-03	1.76E-03	1.55E-05	1.87E-09	3.04E-04	3.04E-04	2.95E-04	1.30E-05	4.67E-07	7.27E-05	2.62E-05
SITE PREP & EARTHWORKS	120 Ton Excavator	2	12	1.31E-03	4.01E-06	5.97E-04	9.94E-05	9.65E-05	8.14E-06	1.46E-06	6.08E-10	4.06E-06	1.46E-07	2.26E-05	6.54E-04	2.99E-04	2.01E-06	3.04E-10	4.97E-05	4.97E-05	4.82E-05	2.03E-06	7.30E-08	1.13E-05	4.07E-06
SITE PREP & EARTHWORKS	D5 Dozer	2	12	1.24E-03	3.86E-06	4.39E-04	1.04E-04	1.01E-04	7.95E-06	1.44E-06	6.40E-10	4.00E-06	1.44E-07	2.22E-05	6.19E-04	2.20E-04	1.93E-06	3.20E-10	5.18E-05	5.18E-05	5.03E-05	2.00E-06	7.20E-08	1.11E-05	3.97E-06
SITE PREP & EARTHWORKS	D8 Dozer	3	12	2.89E-03	6.36E-06	1.32E-03	2.13E-04	2.07E-04	1.72E-05	3.26E-06	1.24E-09	8.37E-06	3.20E-07	4.82E-05	1.45E-03	6.62E-04	3.18E-06	6.20E-10	1.07E-04	1.07E-04	1.03E-04	4.19E-06	1.60E-07	2.41E-05	8.62E-06
SITE PREP & EARTHWORKS	16' Grader	4	12	1.79E-03	7.57E-06	6.29E-04	1.20E-04	1.16E-04	1.20E-05	2.15E-06	7.21E-10	5.91E-06	2.14E-07	3.32E-05	8.94E-04	3.15E-04	3.78E-06	3.61E-10	5.99E-05	5.99E-05	5.81E-05	2.95E-06	1.07E-07	1.66E-05	6.00E-06
SITE PREP & EARTHWORKS	Crane 80T	2	12	2.58E-03	4.30E-06	7.69E-04	1.20E-04	1.16E-04	1.46E-05	3.40E-06	5.52E-10	6.34E-06	2.93E-07	4.09E-05	1.29E-03	3.85E-04	2.15E-06	2.76E-10	5.99E-05	5.99E-05	5.81E-05	3.17E-06	1.47E-07	2.05E-05	7.32E-06
SITE PREP & EARTHWORKS	Drum Roller	4	12	2.78E-03	7.97E-06	1.15E-03	2.76E-04	2.67E-04	2.18E-05	3.96E-06	1.66E-09	1.08E-05	4.01E-07	6.11E-05	1.39E-03	5.73E-04	3.98E-06	8.28E-10	1.38E-04	1.38E-04	1.34E-04	5.40E-06	2.00E-07	3.06E-05	1.09E-05
SITE PREP & EARTHWORKS	Compactor 1000lb	4	12	1.64E-02	2.15E-05	9.95E-03	9.73E-04	9.44E-04	3.38E-04	6.07E-05	6.30E-09	1.76E-04	6.04E-06	9.48E-04	8.21E-03	4.97E-03	1.07E-05	3.15E-09	4.87E-04	4.87E-04	4.72E-04	8.78E-05	3.02E-06	4.74E-04	1.69E-04
SITE PREP & EARTHWORKS	Compressor	4	12	5.67E-03	8.38E-06	1.29E-03	1.95E-04	1.90E-04	3.18E-05	5.70E-06	1.26E-09	1.64E-05	5.66E-07	8.94E-05	2.84E-03	6.47E-04	4.19E-06	6.31E-10	9.77E-05	9.77E-05	9.48E-05	8.19E-06	2.83E-07	4.47E-05	1.59E-05
SITE PREP & EARTHWORKS	Zoom Boom	4	12	4.62E-03	8.86E-06	2.18E-03	3.29E-04	3.19E-04	3.00E-05	5.60E-06	1.78E-09	1.42E-05	5.70E-07	8.43E-05	2.31E-03	1.09E-03	4.43E-06	8.90E-10	1.64E-04	1.64E-04	1.59E-04	7.10E-06	2.85E-07	4.22E-05	1.50E-05
SITE PREP & EARTHWORKS	Tadem Water Trucks 2500 gls	4	12	1.68E-03	7.47E-06	6.32E-04	1.04E-04	1.00E-04	8.61E-06	1.52E-06	6.52E-10	4.28E-06	1.49E-07	2.37E-05	8.40E-04	3.16E-04	3.73E-06	3.26E-10	5.18E-05	5.18E-05	5.02E-05	2.14E-06	7.47E-08	1.19E-05	4.30E-06
SITE PREP & EARTHWORKS	Pick up truck	6	12	1.39E-03	1.08E-05	4.74E-04	9.37E-05	9.09E-05	8.53E-06	1.48E-06	5.86E-10	4.15E-06	1.43E-07	2.29E-05	6.97E-04	2.37E-04	5.42E-06	2.93E-10	4.69E-05	4.69E-05	4.55E-05	2.08E-06	7.16E-08	1.15E-05	4.27E-06
Concrete	Rock Crusher	1	12	7.67E-04	2.03E-06	1.99E-04	4.06E-05	3.93E-05	5.65E-06	1.03E-06	2.26E-10	2.73E-06	1.05E-07	1.58E-05	3.84E-04	9.94E-05	1.01E-06	1.13E-10	2.03E-05	2.03E-05	1.97E-05	1.37E-06	5.23E-08	7.90E-06	2.83E-06
Concrete	80T RT Crane	2	12	2.58E-03	4.30E-06	7.69E-04	1.20E-04	1.16E-04	1.46E-05	3.40E-06	5.52E-10	6.34E-06	2.93E-07	4.09E-05	1.29E-03	3.85E-04	2.15E-06	2.76E-10	5.99E-05	5.99E-05	5.81E-05	3.17E-06	1.47E-07	2.05E-05	7.32E-06
Concrete	35 Ton Excavator	4	12	4.31E-03	1.55E-05	1.76E-03	3.04E-04	2.95E-04	2.62E-05	4.70E-06	1.87E-09	1.30E-05	4.67E-07	7.27E-05	2.16E-03	8.81E-04	7.75E-06	9.33E-10	1.52E-04	1.52E-04	1.48E-04	6.52E-06	2.34E-07	3.64E-05	1.31E-05
Concrete	40T Articuating Truck	4	12	1.68E-03	7.47E-06	6.32E-04	1.04E-04	1.00E-04	8.61E-06	1.52E-06	6.52E-10	4.28E-06	1.49E-07	2.37E-05	8.40E-04	3.16E-04	3.73E-06	3.26E-10	5.18E-05	5.18E-05	5.02E-05	2.14E-06	7.47E-08	1.19E-05	4.30E-06
Concrete	D5 Dozer	4	12	2.48E-03	7.71E-06	8.79E-04	2.07E-04	2.01E-04	1.59E-05	2.87E-06	1.28E-09	7.99E-06	2.88E-07	4.45E-05	1.24E-03	4.39E-04	3.86E-06	6.40E-10	1.04E-04	1.04E-04	1.01E-04	4.00E-06	1.44E-07	2.22E-05	7.95E-06
Concrete	66" Drum Roller	2	12	1.39E-03	3.98E-06	5.73E-04	1.38E-04	1.34E-04	1.09E-05	1.98E-06	8.28E-10	5.40E-06	2.00E-07	3.06E-05	6.95E-04	2.86E-04	1.99E-06	4.14E-10	6.89E-05	6.89E-05	6.69E-05	2.70E-06	1.00E-07	1.53E-05	5.45E-06
Concrete	2500 Gal Tandem Water Truck	2	12	8.40E-04	3.73E-06	3.16E-04	5.18E-05	5.02E-05	4.30E-06	7.61E-07	3.26E-10	2.14E-06	7.47E-08	1.19E-05	4.20E-04	1.58E-04	1.87E-06	1.63E-10	2.59E-05	2.59E-05	2.51E-05	1.07E-06	3.73E-08	5.93E-06	2.15E-06

Table C-19: Construction Phase – Mine Infrastructure - Tailpipe Emission

Construction Area	Equipment List	Number of Units Used Concurrently	Hours per day	Emission Rate 1-hr (g/s)											Emission Rate 24-hr (g/s)											
				NOx	SO2	CO	PM10	PM2.5	Acetaldehyde	Acrolein	B(a)P	Benzene	1,3-Butadiene	Formaldehyde	NOx	CO	SO2	B(a)P	TPM	PM10	PM2.5	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
Concrete	Compactor Plate 1000 lb	6	12	1.23E-02	1.61E-05	7.46E-03	7.30E-04	7.08E-04	2.53E-04	4.55E-05	4.72E-09	1.32E-04	4.53E-06	7.11E-04	6.16E-03	3.73E-03	8.05E-06	2.36E-09	3.65E-04	3.65E-04	3.54E-04	6.59E-05	2.26E-06	3.55E-04	1.27E-04
Concrete	Flat Bed	4	12	1.68E-03	7.47E-06	6.32E-04	1.04E-04	1.00E-04	8.61E-06	1.52E-06	6.52E-10	4.28E-06	1.49E-07	2.37E-05	8.40E-04	3.16E-04	3.73E-06	3.26E-10	5.18E-05	5.18E-05	5.02E-05	2.14E-06	7.47E-08	1.19E-05	4.30E-06
Concrete	Pick Up Truck	6	12	1.39E-03	1.08E-05	4.74E-04	9.37E-05	9.09E-05	8.53E-06	1.48E-06	5.86E-10	4.15E-06	1.43E-07	2.29E-05	6.97E-04	2.37E-04	5.42E-06	2.93E-10	4.69E-05	4.69E-05	4.55E-05	2.08E-06	7.16E-08	1.15E-05	4.27E-06
Concrete	Skidsteer	2	12	5.44E-03	5.82E-06	6.60E-03	1.05E-03	1.02E-03	1.15E-04	3.90E-05	2.71E-09	3.63E-05	2.71E-06	3.22E-04	2.72E-03	3.30E-03	2.91E-06	1.36E-09	5.26E-04	5.26E-04	5.11E-04	1.82E-05	1.35E-06	1.61E-04	5.77E-05
Concrete	Genie 4 ton Ext boom FORKLIFT	2	12	2.63E-03	4.59E-06	1.96E-03	2.53E-04	2.45E-04	2.01E-05	3.90E-06	1.33E-09	9.37E-06	3.85E-07	5.64E-05	1.31E-03	9.82E-04	2.30E-06	6.64E-10	1.26E-04	1.26E-04	1.23E-04	4.69E-06	1.93E-07	2.82E-05	1.00E-05
SMP	COMPRESOR DOOSAN XP-375	7	12	9.93E-03	1.47E-05	2.26E-03	3.42E-04	3.32E-04	5.56E-05	9.97E-06	2.21E-09	2.87E-05	9.90E-07	1.56E-04	4.96E-03	1.13E-03	7.33E-06	1.10E-09	1.71E-04	1.71E-04	1.66E-04	1.43E-05	4.95E-07	7.82E-05	2.78E-05
SMP	COMPRESOR DOOSAN XP-375	7	12	9.93E-03	1.47E-05	2.26E-03	3.42E-04	3.32E-04	5.56E-05	9.97E-06	2.21E-09	2.87E-05	9.90E-07	1.56E-04	4.96E-03	1.13E-03	7.33E-06	1.10E-09	1.71E-04	1.71E-04	1.66E-04	1.43E-05	4.95E-07	7.82E-05	2.78E-05
SMP	12,000lb Telehandler	2	12	1.52E-03	3.98E-06	4.15E-04	1.05E-04	1.02E-04	1.14E-05	2.08E-06	6.18E-10	5.61E-06	2.11E-07	3.20E-05	7.61E-04	2.07E-04	1.99E-06	3.09E-10	5.27E-05	5.27E-05	5.11E-05	2.81E-06	1.06E-07	1.60E-05	5.71E-06
SMP	JLG - 125'	2	12	6.79E-03	9.64E-06	4.69E-03	5.74E-04	5.56E-04	5.48E-05	1.10E-05	2.86E-09	2.54E-05	1.06E-06	1.54E-04	3.40E-03	2.35E-03	4.82E-06	1.43E-09	2.87E-04	2.87E-04	2.78E-04	1.27E-05	5.29E-07	7.70E-05	2.74E-05
General	Welding Truck	8	12	3.36E-03	1.49E-05	1.26E-03	2.07E-04	2.01E-04	1.72E-05	3.05E-06	1.30E-09	8.56E-06	2.99E-07	4.74E-05	1.68E-03	6.32E-04	7.47E-06	6.52E-10	1.04E-04	1.04E-04	1.00E-04	4.28E-06	1.49E-07	2.37E-05	8.61E-06
SMP	Welding machine, Diesel	3	12	5.54E-03	7.33E-06	3.42E-03	4.06E-04	3.94E-04	4.34E-05	8.68E-06	1.99E-09	2.02E-05	8.35E-07	1.22E-04	2.77E-03	1.71E-03	3.66E-06	9.94E-10	2.03E-04	2.03E-04	1.97E-04	1.01E-05	4.17E-07	6.10E-05	2.17E-05
SMP	Genie 4 ton Ext boom FORKLIFT	6	12	7.88E-03	1.38E-05	5.89E-03	7.58E-04	7.35E-04	6.02E-05	1.17E-05	3.99E-09	2.81E-05	1.16E-06	1.69E-04	3.94E-03	2.95E-03	6.89E-06	1.99E-09	3.79E-04	3.79E-04	3.68E-04	1.41E-05	5.78E-07	8.46E-05	3.01E-05
SMP	Light Tower	40	12	6.03E-02	8.72E-05	1.66E-02	2.65E-03	2.57E-03	3.92E-04	7.03E-05	1.71E-08	2.03E-04	6.98E-06	1.10E-03	3.02E-02	8.32E-03	4.36E-05	8.56E-09	1.33E-03	1.33E-03	1.29E-03	1.01E-04	3.49E-06	5.51E-04	1.96E-04
SMP	Tadem Water Trucks 2500 gls	4	12	1.68E-03	7.47E-06	6.32E-04	1.04E-04	1.00E-04	8.61E-06	1.52E-06	6.52E-10	4.28E-06	1.49E-07	2.37E-05	8.40E-04	3.16E-04	3.73E-06	3.26E-10	5.18E-05	5.18E-05	5.02E-05	2.14E-06	7.47E-08	1.19E-05	4.30E-06
SMP	Fusing Machine 2" - 8"	3	12	6.16E-03	8.05E-06	4.00E-03	4.01E-04	3.89E-04	1.25E-04	2.26E-05	2.59E-09	6.51E-05	2.24E-06	3.52E-04	3.08E-03	2.00E-03	4.03E-06	1.29E-09	2.00E-04	2.00E-04	1.94E-04	3.26E-05	1.12E-06	1.76E-04	6.26E-05
SMP	Heater - Indirect Fire 350000 BTU	1	12	1.20E-03	2.14E-06	4.65E-04	1.04E-04	1.00E-04	9.53E-06	1.85E-06	5.72E-10	4.53E-06	1.81E-07	2.68E-05	6.01E-04	2.32E-04	1.07E-06	2.86E-10	5.18E-05	5.18E-05	5.02E-05	2.27E-06	9.05E-08	1.34E-05	4.76E-06
SMP	Manlift Articulating 60'	6	12	1.11E-02	1.47E-05	6.85E-03	8.12E-04	7.88E-04	8.68E-05	1.74E-05	3.98E-09	4.05E-05	1.67E-06	2.44E-04	5.54E-03	3.42E-03	7.33E-06	1.99E-09	4.06E-04	4.06E-04	3.94E-04	2.02E-05	8.35E-07	1.22E-04	4.34E-05
SMP	Manlift Scissor Lift 32'	6	12	9.05E-03	1.31E-05	2.50E-03	3.98E-04	3.86E-04	5.88E-05	1.05E-05	2.57E-09	3.04E-05	1.05E-06	1.65E-04	4.53E-03	1.25E-03	6.54E-06	1.28E-09	1.99E-04	1.99E-04	1.93E-04	1.52E-05	5.24E-07	8.26E-05	2.94E-05
SMP	SkidSteer	6	12	1.63E-02	1.74E-05	1.98E-02	3.16E-03	3.06E-03	3.46E-04	1.17E-04	8.14E-09	1.09E-04	8.12E-06	9.66E-04	8.17E-03	9.90E-03	8.72E-06	4.07E-09	1.58E-03	1.58E-03	1.53E-03	5.45E-05	4.06E-06	4.83E-04	1.73E-04
SMP	Frana Crane 30T	5	12	9.83E-03	2.07E-05	2.80E-03	4.78E-04	4.64E-04	6.19E-05	1.31E-05	2.39E-09	2.81E-05	1.20E-06	1.73E-04	4.91E-03	1.40E-03	1.04E-05	1.19E-09	2.39E-04	2.39E-04	2.32E-04	1.41E-05	5.99E-07	8.64E-05	3.09E-05
SMP	160T RT	5	12	3.38E-03	9.96E-06	8.81E-04	1.79E-04	1.73E-04	2.53E-05	4.59E-06	1.01E-09	1.23E-05	4.64E-07	7.05E-05	1.69E-03	4.40E-04	4.98E-06	5.04E-10	8.93E-05	8.93E-05	8.66E-05	6.14E-06	2.32E-07	3.52E-05	1.26E-05
SMP	88T Telescopic Crawler	1	12	6.76E-04	1.99E-06	1.76E-04	3.57E-05	3.46E-05	5.06E-06	9.18E-07	2.02E-10	2.46E-06	9.28E-08	1.41E-05	3.38E-04	8.81E-05	9.96E-07	1.01E-10	1.79E-05	1.79E-05	1.73E-05	1.23E-06	4.64E-08	7.05E-06	2.53E-06
SMP	350T Crawler	1	12	1.29E-03	2.15E-06	3.85E-04	5.99E-05	5.81E-05	7.32E-06	1.70E-06	2.76E-10	3.17E-06	1.47E-07	2.05E-05	6.45E-04	1.92E-04	1.07E-06	1.38E-10	2.99E-05	2.99E-05	2.90E-05	1.58E-06	7.34E-08	1.02E-05	3.66E-06
E&I	80T RT	1	12	1.60E-03	2.24E-06	4.74E-04	6.77E-05	6.57E-05	8.85E-06	1.64E-06	3.54E-10	4.23E-06	1.66E-07	2.49E-05	7.99E-04	2.37E-04	1.12E-06	1.77E-10	3.38E-05	3.38E-05	3.28E-05	2.11E-06	8.32E-08	1.25E-05	4.42E-06
E&I	JLG - 125'	2	12	6.79E-03	9.64E-06	4.69E-03	5.74E-04	5.56E-04	5.48E-05	1.10E-05	2.86E-09	2.54E-05	1.06E-06	1.54E-04	3.40E-03	2.35E-03	4.82E-06	1.43E-09	2.87E-04	2.87E-04	2.78E-04	1.27E-05	5.29E-07	7.70E-05	2.74E-05
E&I	COMPRESOR DOOSAN XP-375	6	12	8.51E-03	1.26E-05	1.94E-03	2.93E-04	2.84E-04	4.77E-05	8.55E-06	1.89E-09	2.46E-05	8.48E-07	1.34E-04	4.25E-03	9.70E-04	6.28E-06	9.46E-10	1.47E-04	1.47E-04	1.42E-04	1.23E-05	4.24E-07	6.71E-05	2.38E-05
East & West Dykes	Dozer	2	12	1.93E-03	4.24E-06	8.82E-04	1.42E-04	1.38E-04	1.15E-05	2.17E-06	8.26E-10	5.58E-06	2.13E-07	3.22E-05	9.64E-04	4.41E-04	2.12E-06	4.13E-10	7.11E-05	7.11E-05	6.90E-05	2.79E-06	1.07E-07	1.61E-05	5.75E-06
East & West Dykes	CAT 740 EJ Articulated Trucks	4	12	1.68E-03	7.47E-06	6.32E-04	1.04E-04	1.00E-04	8.61E-06	1.52E-06	6.52E-10	4.28E-06	1.49E-07	2.37E-05	8.40E-04	3.16E-04	3.73E-06	3.26E-10	5.18E-05	5.18E-05	5.02E-05	2.14E-06	7.47E-08	1.19E-05	4.30E-06
East & West Dykes	Tandem Truck	5	12	2.10E-03	9.34E-06	7.90E-04	1.29E-04	1.26E-04	1.08E-05	1.90E-06	8.15E-10	5.35E-06	1.87E-07	2.96E-05	1.05E-03	3.95E-04	4.67E-06	4.08E-10	6.47E-05	6.47E-05	6.28E-05	2.67E-06	9.34E-08	1.48E-05	5.38E-06
East & West Dykes	CAT 950 Loader	1	12	6.09E-04	1.99E-06	2.37E-04	4.78E-05	4.63E-05	4.75E-06	8.60E-07	2.79E-10	2.32E-06	8.66E-08	1.32E-05	3.04E-04	1.18E-04	9.93E-07	1.39E-10	2.39E-05	2.39E-05	2.32E-05	1.16E-06	4.33E-08	6.61E-06	2.37E-06
East & West Dykes	CAT CS64B Compactor	3	12	2.08E-03	5.97E-06	8.59E-04	2.07E-04	2.01E-04	1.64E-05	2.97E-06	1.24E-09	8.10E-06	3.01E-07	4.58E-05	1.04E-03	4.30E-04	2.99E-06	6.21E-10	1.03E-04	1.03E-04	1.00E-04	4.05E-06	1.50E-07	2.29E-05	8.18E-06
East & West Dykes	336 CAT Excavator	1	12	1.08E-03	3.87E-06	4.41E-04	7.61E-05	7.38E-05	6.56E-06	1.17E-06	4.66E-10	3.26E-06	1.17E-07	1.82E-05	5.39E-04	2.20E-04	1.94E-06	2.33E-10	3.80E-05	3.80E-05	3.69E-05	1.63E-06	5.84E-08	9.09E-06	3.28E-06
East & West Dykes	340 CAT Excavator	1	12	6.54E-04	2.01E-06	2.99E-04	4.97E-05	4.82E-05	4.07E-06	7.32E-07	3.04E-10	2.03E-06	7.30E-08	1.13E-05	3.27E-04	1.49E-04	1.00E-06	1.52E-10	2.49E-05	2.49E-05	2.41E-05	1.01E-06	3.65E-08	5.65E-06	2.03E-06
East & West Dykes	Ligth Duty Pickup Truck	2	12	8.40E-04	3.73E-06	3.16E-04	5.18E-05	5.02E-05	4.30E-06	7.61E-07	3.26E-10	2.14E-06	7.47E-08	1.19E-05	4.20E-04	1.58E-04	1.87E-06	1.63E-10	2.59E-05	2.59E-05	2.51E-05	1.07E-06	3.73E-08	5.93E-06	2.15E-06
East & West Dykes	Sullair 375H Compressor	2	12	1.39E-03	3.98E-06	5.73E-04	1.38E-04	1.34E-04	1.09E-05	1.98E-06	8.28E-10	5.40E-06	2.00E-07	3.06E-05	6.95E-04	2.86E-04	1.99E-06	4.14E-10	6.89E-05	6.89E-05	6.69E-05	2.70E-06	1.00E-07	1.53E-05	5.45E-06
East & West Dykes	Sheet Piling Rig	1	12	3.09E-03	2.25E-06	9.65E-04	1.59E-04	1.54E-04	1.81E-05	6.60E-06	3.83E-10	5.42E-06	4.33E-07	5.04E-05	1.55E-03	4.82E-04	1.12E-06	1.91E-10	7.94E-05	7.94E-05	7.70E-05	2.71E-06	2.17E-07	2.52E-05	9.06E-06
East & West Dykes	Soil Mixing Machine	1	12	1.20E-03	2.14E-06	4.65E-04	1.04E-04	1.00E-04	9.53E-06	1.85E-06	5.72E-10	4.53E-06	1.81E-07	2.68E-05	6.01E-04	2.32E-04	1.07E-06	2.86E-10	5.18E-05	5.18E-05	5.02E-05	2.27E-06	9.05E-08	1.34E-05	4.76E-06
East & West Dykes	Haul Truck	4	12	5.47E-03	7.77E-06	9.14E-04	1.41E-04	1.37E-04	1.93E-05	3.50E-06	8.49E-10	9.71E-06	3.53E-07	5.42E-05	2.73E-03	4.57E-04	3.89E-06	4.24E-10	7.05E-05	7.05E-05	6.84E-05	4.85E-06	1.77E-07	2.71E-05	9.65E-06
East & West Dykes	Production Backhoe	1	12	2.24E-03	2.18E-06	4.41E-04	7.46E-05	7.23E-05	1.03E-05	2.74E-06	2.55E-10	3.81E-06	2.26E-07	2.90E-05	1.12E-03	2.21E-04	1.09E-06	1.27E-10	3.73E-05	3.73E-05	3.62E-05	1.91E-06	1.13E-07	1.45E-05	5.16E-06
East & West Dykes	Drill	1	12	6.19E-03	4.50E-06	1.93E-03	3.18E-04	3.08E-04	3.62E-05	1.32E-05	7.66E-10	1.08E-05	8.67E-07	1.01E-04	3.09E-03	9.65E-04	2.25E-06	3.83E-10	1.59E-04	1.59E-04	1.54E-04	5.42E-06	4.33E-07	5.04E-05	1.81E-05
Co-Dispodal Facility	D6 EX Dozer	2	12	9.16E-04	3.80E-06	3.25E-04	6.22E-05	6.03E-05	6.28E-06	1.13E-06	3.73E-10	3.09E-06	1.12E-07	1.74E-05	4.58E-04	1.63E-04	1.90E-06	1.86E-10	3.11E-05	3.11E-05	3.02E-05	1.54E-06	5.61E-08	8.69E-06	3.14E-06
Co-Dispodal Facility	D8 Dozer	2	12	1.93E-03	4.24E-06	8.82E-04	1.42E-04	1.38E-04	1.15E-05	2.17E-06	8.26E-10	5.58E-06	2.13E-07	3.22E-05	9.64E-04	4.41E-04	2.12E-06	4.13E-10	7.11E-05	7.11E-05	6.90E-05	2.79E-06	1.07E-07	1.61E-05	5.75E-06
Co-Dispodal Facility	336 CAT Excavator	6	12	6.47E-03	2.32E-05	2.64E-03	4.57E-04	4.43E-04	3.93E-05	7.05E-06	2.80E-09	1.96E-05	7.01E-07	1.09E-04	3.23E-03	1.32E-03	1.16E-05	1.40E-09	2.28E-04	2.28E-04	2.21E-04	9.78E-06	3.50E-07	5.45E-05	1.97E-05
Co-Dispodal Facility	Tandem Truck	10	12	4.20E-03	1.87E-05	1.58E-03	2.59E-04	2.51E-04	2.15E-05	3.81E-06	1.63E-09	1.07E-05	3.73E-07	5.93E-05	2.10E-03	7.90E-04	9.34E-06	8.15E-10	1.29E-04	1.29E-04	1.26E-04	5.35E-06	1.87E-07	2.96E-05	1.08E-05
Co-Dispodal Facility	CAT 740 EJ Articulated Trucks	8	12	3.36E-03	1.49E-05	1.26E-03	2.07E-04	2.01E-04	1.72E-05	3.05E-06	1.30E-09	8.56E-06	2.99E-07	4.74E-05	1.68E-03	6.32E-04	7.47E-06	6.52E-10	1.04E-04	1.04E-04	1.00E-04	4.28E-06	1.49E-07	2.37E-05	8.61E-06
Co-Dispodal Facility	CAT CS64B Compactor	3	12	2.08E-03	5.97E-06	8.59E-04	2.07E-04	2.01E-04	1.64E-05	2.97E-06	1.24E-09	8.10E-06	3.01E-07	4.58E-05	1.04E-03	4.30E-04	2.99E-06	6.21E-10	1.03E-04	1.03E-04	1.00E-04	4.05E-06	1.50E-07	2.29E-05	8.18E-06
Co-Dispodal Facility	JD 640L Skidder	2	12	3.40E-03	5.08E-06	2.10E-03	3.81E-04	3.69E-04	4.64E-05	1.23E-05	1.40E-09	1.75E-05	1.00E-06	1.30E-04	1.70E-03	1.05E-03	2.54E-06	6.99E-10	1.90E-04	1.90E-04	1.85E-04	8.76E-06	5.01E-07	6.50E-05	2.32E-05
Co-Dispodal Facility	Flat Bed or Boom Truck	1	12	8.42E-04	3.73E-06	3.92E-04	5.19E-05	5.03E-05	4.29E-06	7.59E-07	3.25E-10	2.13E-06	7.45E-08	1.18E-05	4.21E-04	1.96E-04	1.87E-06	1.62E-10	2.59E-05	2.59E-05	2.52E-05	1.06E-06	3.72E-08	5.90E-06	2.14E-06
Co-Dispodal Facility	Ligth Duty Pickup Truck	3	12	1.26E-03	5.60E-06	4.74E-04	7.76E-05	7.53E-05	6.46E-06	1.14E-06	4.89E-10	3.21E-06	1.12E-07	1.78E-05	6.30E-04	2.37E-04	2.80E-06	2.45E-10	3.88E-05	3.88E-05	3.77E-05	1.60E-06	5.60E-08	8.89E-06	3.23E-06

Table C-20: Construction Phase – Mine Infrastructure - Compactor Activity

Particulate matter emissions from the movement of comactors was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-2, Bulldozing on Material other than Coal (Overburden). This is recommended by the USEPA AP-42, Section 13.2.3 Heavy Construction Operations, Table 13.2.3-1.

$$TSP\ EF\left(\frac{kg}{hr}\right) = 2.6 \times \left(\frac{(s)^{1.2}}{(M)^{1.3}}\right)$$

$$PM_{10}\ EF\left(\frac{kg}{hr}\right) = 0.34 \times \left(\frac{(s)^{1.5}}{(M)^{1.4}}\right)$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.105 \times TSP$$

s = silt content (%)
M = moisture content (%)

Table B5: Particulate Emissions from Compaction Activity

Scenario	Particle Size	Number of Bulldozers or Equivalent	Silt Content (%)	Moisture Content (%)	Emission Rate per Compactor (kg/h)	Emission Rate total (g/s)	Utilization Factor %	Hours per Day	Control Efficiency %
Main Open Pit	TSP	1	3.9	7.9	0.91	0.25	8.0	12	75
	PM_{10}				0.14	0.14			
	$PM_{2.5}$				0.10	0.03			
SITE PREP & EARTHWORKS	TSP	4	3.9	7.9	0.91	1.01	75.0	12	75
	PM_{10}				0.14	0.58			
	$PM_{2.5}$				0.10	0.11			
Concrete	TSP	6	3.9	7.9	0.91	1.51	40.0	12	75
	PM_{10}				0.14	0.86			
	$PM_{2.5}$				0.10	0.16			
East & West Dykes	TSP	3	3.9	7.9	0.91	0.76	50.0	12	75
	PM_{10}				0.14	0.43			
	$PM_{2.5}$				0.10	0.08			
Co-Dispodal Facility	TSP	3	3.9	7.9	0.91	0.76	75.0	12	75
	PM_{10}				0.14	0.43			
	$PM_{2.5}$				0.10	0.08			

	Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
		24-hr Average	1-hr Average	24-hr Average	1-hr Average
Main Open Pit	TSP	1.01E-02	2.01E-02	2.52E-03	5.04E-03
	PM_{10}	5.76E-03	1.15E-02	1.44E-03	2.88E-03
	$PM_{2.5}$	1.06E-03	2.12E-03	2.64E-04	5.29E-04
SITE PREP & EARTHWORKS	TSP	3.78E-01	7.55E-01	9.44E-02	1.89E-01
	PM_{10}	2.16E-01	4.32E-01	5.40E-02	1.08E-01
	$PM_{2.5}$	3.97E-02	7.93E-02	9.91E-03	1.98E-02
Concrete	TSP	3.02E-01	6.04E-01	7.55E-02	1.51E-01
	PM_{10}	1.73E-01	3.45E-01	4.32E-02	8.64E-02
	$PM_{2.5}$	3.17E-02	6.35E-02	7.93E-03	1.59E-02
East & West Dykes	TSP	1.89E-01	3.78E-01	4.72E-02	9.44E-02
	PM_{10}	1.08E-01	2.16E-01	2.70E-02	5.40E-02
	$PM_{2.5}$	1.98E-02	3.97E-02	4.96E-03	9.91E-03
Co-Dispodal Facility	TSP	2.83E-01	5.67E-01	7.08E-02	1.42E-01
	PM_{10}	1.62E-01	3.24E-01	4.05E-02	8.10E-02
	$PM_{2.5}$	2.97E-02	5.95E-02	7.44E-03	1.49E-02

Table C-21: Construction Phase – Mine Infrastructure - Portable Crushers

Emission Factors Reference: Emission Factors Reference: US EPA AP-42, Table 11.19.2-1

Portable crushing operations located west of the polishing pond where the MGO and LGO stockpiles meet.

Crusher Processing Rate	3600 tonnes/day
	2.69 t/m3
	150 tph

Activity	SCC	SPM Emission Factor kg/Mg	SPM Emission Factor g/s	EPA Rating	Final Rating*	Notes
Drop to Crusher	3-05-020-31	0.000016	0.001	E	F	factor only for PM10.TPM assumed to be 2x
Primary Crushing	3-05-020-03	0.0027	0.113	E	F	no factor given, tertiary crushing factor used
Secondary Crushing	3-05-020-03	0.0027	0.113	E	F	no factor given, tertiary crushing factor used
Screening	3-05-020-02	0.0125	0.521	E	E	1 screener
Conveyor Transfer Point	3-05-020-06	0.003	0.125	E	E	2x Transfer Point
Load Out from Crusher	3-05-020-32	0.00010	0.004	E	F	factor only for PM10.TPM assumed to be 2x
	Total Crushing Emission Rate per location			0.88		

* EPA rating downgraded one level where factor not specific

Activity	SCC	PM_{10} Emission Factor kg/Mg	PM_{10} Emission Factor g/s	EPA Rating	Final Rating*	Notes
Drop to Crusher	3-05-020-31	0.000008	0.000	E	F	
Primary Crushing	3-05-020-03	0.0012	0.050	E	F	no factor given, tertiary crushing factor used
Secondary Crushing	3-05-020-03	0.0012	0.050	E	F	no factor given, tertiary crushing factor used
Screening	3-05-020-02	0.0043	0.179	E	E	1 screener
Conveyor Transfer Point	3-05-020-06	0.0011	0.046	E	E	2x Transfer Point
Load Out from Crusher	3-05-020-32	0.00005	0.002	E	F	
	Total Crushing Emission Rate per location			0.33		

* EPA rating downgraded one level where factor not specific

Activity	SCC	$PM_{2.5}$ Emission Factor kg/Mg	$PM_{2.5}$ Emission Factor g/s	EPA Rating	Final Rating*	Notes
Drop to Crusher	3-05-020-31	0.000008	0.000	E	F	factor only for PM10. PM25 assumed to be same
Primary Crushing	3-05-020-03	0.0012	0.050	E	F	factor only for PM10. PM25 assumed to be same
Secondary Crushing	3-05-020-03	0.0012	0.050	E	F	factor only for PM10. PM25 assumed to be same
Screening	3-05-020-02	0.0043	0.179	E	E	1 screeners
Conveyor Transfer Point	3-05-020-06	0.0011	0.046	E	E	2x Transfer Point
Load Out from Crusher	3-05-020-32	0.00005	0.002	E	F	factor only for PM10. PM25 assumed to be same
	Total Crushing Emission Rate per location			0.33		

* EPA rating downgraded one level where factor not specific

Table C-22: Construction Phase – Access Road - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
Access Road Length	18	km
Construction Phase Duration (17km)	12	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction.

Representative Construction Fleet (includes both activities within the Access Road construction footprint as well as transport of aggregate from the mine site to the construction site)

Source ID	Source Description	Engine Type	Engine Size/Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
Access Road Construction	Dump Truck / Truck&Trailer	HDDV (Moderate Control)	3 Axle 19 yd CAT	375	3	40%	3024
Access Road Construction	Loader	Diesel >=19kW, Tier 1–3	CAT 980H	400	2	40%	2016
Access Road Construction	Grader	Diesel >=19kW, Tier 1–3	CAT 14M	275	1	40%	1008
Access Road Construction	Compactors / Packers	Diesel >=19kW, Tier 1–3	Vibratory / Walk Behind	50	6	20%	6048
Access Road Construction	D8 Dozer	Diesel >=19kW, Tier 1–3		350	3	40%	3024
Access Road Construction	Excavator	Diesel >=19kW, Tier 1–3	Cat 330C / 345DL	400	2	40%	2016
Access Road Construction	Mobile Crane	Diesel >=19kW, Tier 1–3	Crawler Crane	270	1	16%	1008
Access Road Construction	Pile Driver	Diesel >=19kW, Tier 1–3	CAT Vermeer	50	1	20%	1008
Access Road Construction	Ligth Duty Pickup Truck	LDDV (Moderate Control)		400	4	40%	4032
Access Road Construction	Flat Bed or Haul Truck	HDDV (Moderate Control)		500	2	50%	2016
Access Road Construction	Skid Steer	LDDV (Moderate Control)	Cat 262B Skid Steer	80	2	40%	2016
Access Road Construction	Water Truck	HDDV (Moderate Control)		500	1	40%	1008
Access Road Construction	Light Duty Service Truck	LDDV (Moderate Control)		400	1	40%	1008
Access Road Construction	Gravel Truck	HDDV (Moderate Control)		700	3	40%	3024
Access Road Construction	Packer	Diesel >=19kW, Tier 1–3	Cat CS563 Packer	150	2	20%	2016
Access Road Construction	Reed Drill 3500	Diesel >=19kW, Tier 1–3	Hydraulic 3500 Reed Drill	250	2	20%	2016
Access Road Construction	Reed Drill 345	Diesel >=19kW, Tier 1–3	Hydraulic 345 Reed Drill	250	2	20%	2016
Access Road Construction	Rock Crusher	Diesel >=19kW, Tier 1–3		350	2	50%	2016
Access Road Construction	Personnel transport	LDDV (Moderate Control)		175	5	40%	5040

*Equipment Utilization factors are retrieved from: U.S. Department of Transportation

Table C-23: Construction Phase – Access Road - Bulldozer Activity

Particulate matter emissions from the movement of bulldozers was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-2, Bulldozing on Material other than Coal (Overburden).

$$TSP\ EF\left(\frac{kg}{hr}\right) = 2.6 \times \left(\frac{(s)^{1.2}}{(M)^{1.3}}\right)$$

$$PM_{10}\ \ EF\left(\frac{kg}{hr}\right) = 0.34 \times \left(\frac{(s)^{1.5}}{(M)^{1.4}}\right)$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.105 \times TSP$$

s = silt content (%)
M = moisture content (%)

Table 1: Particulate Emissions from Bulldozers Activity

Scenario	Particle Size	Number of Bulldozers or Equivalent	Silt Content (%)	Moisture Content (%)	Emission Rate per Dozer (kg/h)	Emission Rate total (kg/h)	Emission Rate total (g/s)	Utilization Factor %	Hours per Day	Control Efficiency %
Maximum	TSP	2	3.9	7.9	0.91	1.81	0.50	40	12	75
	PM_{10}				0.14	0.29	0.08			
	$PM_{2.5}$				0.10	0.19	0.05			

Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
	24-hr Average	1-hr Average	24-hr Average	1-hr Average
TSP	1.01E-01	2.01E-01	2.52E-02	5.04E-02
PM_{10}	1.60E-02	3.20E-02	4.00E-03	8.00E-03
$PM_{2.5}$	1.06E-02	2.12E-02	2.64E-03	5.29E-03

Table C-24: Construction Phase – Access Road - Grader Activity

Particulate matter emissions from the movement of grader was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-3.

$$TSP\ EF\left(\frac{kg}{hr}\right) = 0.0034 \times (S^{2.5})$$

$$PM_{10}\ EF\left(\frac{kg}{hr}\right) = 0.0034 \times (S^{2.0})$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.031 \times TSP$$

S = mean vehicle speed

Table 1: Particulate Emissions from Grader Activity

Scenario	Particle Size	Number of Grader or Equivalent	Mean Vehicle Speed (km/hr)	Emission Rate			Utilization Factor %	Hours per Day	Control Efficiency %
				per Grader (kg/h)	total (kg/h)	total (g/s)			
Maximum	TSP	6	5.00	0.19	1.14	0.32	40	12	75
	PM_{10}			0.09	0.51	0.14			
	$PM_{2.5}$			0.01	0.04	0.010			

Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
	24-hr Average	1-hr Average	24-hr Average	1-hr Average
TSP	6.34E-02	1.27E-01	1.58E-02	3.17E-02
PM_{10}	2.83E-02	5.67E-02	7.08E-03	1.42E-02
$PM_{2.5}$	1.96E-03	3.93E-03	4.91E-04	9.82E-04

Table C-25: Construction Phase – Access Road - Loader Activity

Particulate matter emissions from the movement of grader was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9.2 (Truck Loading).

$$TSP\ EF\left(\frac{kg}{Mg}\right) = \frac{0.580}{M^{1.2}}$$

M = material moisture content

$$PM_{10}\ EF\left(\frac{kg}{Mg}\right) = 0.75 \times \frac{0.0596}{M^{0.9}}$$

$$PM_{2.5}\ EF\left(\frac{kg}{Mg}\right) = 0.019 \times TSP$$

Table 1: Particulate Emissions from Loading Activity

Scenario	Particle Size	Number of Loader or Equivalent	Moisture Content (%)	Emission Rate per Loader (kg/tonne)	Material Handling (tonnes / hour)	Utilization Factor %	Hours per Day	Control Efficiency %
Maximum	TSP	4	7.9	1.94E-01	17	40	12	75
	PM_{10}			2.78E-02				
	$PM_{2.5}$			3.69E-03				

Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
	24-hr Average	1-hr Average	24-hr Average	1-hr Average
TSP	7.34E-01	3.67E-01	1.83E-01	9.17E-02
PM_{10}	1.05E-01	5.26E-02	2.63E-02	1.31E-02
$PM_{2.5}$	1.39E-02	6.97E-03	3.49E-03	1.74E-03

Vehicle Weight	Tri-Axle Dump Truck
Payload	18.7 tons
Operating Weight (Empty)	13.8 tons
Operating Weight (with Load)	32.5 tons
Payload	17.0 tonnes
Operating Weight (Empty)	12.5 tonnes
Operating Weight (with Load)	29.5 tonnes

Table C-26: Construction Phase – Access Road - Compactor Activity

Particulate matter emissions from the movement of comactors was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-2, Bulldozing on Material other than Coal (Overburden). This is recommended by the USEPA AP-42, Section 13.2.3 Heavy Construction Operations, Table 13.2.3-1.

$$TSP\ EF\left(\frac{kg}{hr}\right) = 2.6 \times \left(\frac{(s)^{1.2}}{(M)^{1.3}}\right)$$

$$PM_{10}\ EF\left(\frac{kg}{hr}\right) = 0.34 \times \left(\frac{(s)^{1.5}}{(M)^{1.4}}\right)$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.105 \times TSP$$

s = silt content (%)
M = moisture content (%)

Table 1: Particulate Emissions from Compaction Activity

Scenario	Particle Size	Number of Bulldozers or Equivalent	Silt Content (%)	Moisture Content (%)	Emission Rate			Utilization Factor %	Hours per Day	Control Efficiency %
					per Compactor (kg/h)	total (kg/h)	total (g/s)			
Maximum	TSP	2	3.9	7.9	0.91	1.81	0.50	40	12	75
	PM_{10}				0.14	0.29	0.08			
	$PM_{2.5}$				0.10	0.19	0.05			

Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
	24-hr Average	1-hr Average	24-hr Average	1-hr Average
TSP	1.01E-01	2.01E-01	2.52E-02	5.04E-02
PM_{10}	1.60E-02	3.20E-02	4.00E-03	8.00E-03
$PM_{2.5}$	1.06E-02	2.12E-02	2.64E-03	5.29E-03

Table C-27: Construction Phase – Access Road - Tailpipe Emission

Equipment List	Number of Units Used Concurrently	Hours per day	Emission Rate 1-hr (g/s)										
			NOx	CO	PM10	PM2.5	Acetaldehyde	B(a)P	Benzene	1,3-Butadiene	SO2	NOx	CO
Dump Truck / Truck&Trailer	3	12	1.07E-01	4.02E-02	6.58E-03	6.38E-03	5.47E-04	4.15E-08	2.72E-04	9.49E-06	4.75E-04	5.34E-02	2.01E-02
Loader	2	12	2.25E-01	1.03E-01	1.52E-02	1.47E-02	1.30E-03	7.67E-08	5.80E-04	2.57E-05	3.94E-04	1.12E-01	5.13E-02
Grader	1	12	1.11E-02	3.91E-03	7.45E-04	7.22E-04	7.46E-05	4.48E-09	3.67E-05	1.33E-06	4.70E-05	5.55E-03	1.96E-03
Compactors / Packers	6	12	1.99E-01	6.08E-02	8.05E-03	7.81E-03	1.09E-03	4.61E-08	5.43E-04	1.99E-05	2.93E-04	9.96E-02	3.04E-02
D8 Dozer	3	12	2.29E-01	1.05E-01	1.69E-02	1.64E-02	1.36E-03	9.81E-08	6.62E-04	2.53E-05	5.03E-04	1.14E-01	5.23E-02
Excavator	2	12	5.91E-02	2.70E-02	4.49E-03	4.36E-03	3.68E-04	2.75E-08	1.83E-04	6.60E-06	1.81E-04	2.96E-02	1.35E-02
Mobile Crane	1	12	4.12E-02	1.07E-02	2.18E-03	2.11E-03	3.08E-04	1.23E-08	1.50E-04	5.66E-06	1.22E-04	2.06E-02	5.37E-03
Pile Driver	1	12	5.03E-02	4.09E-03	8.00E-04	7.76E-04	8.41E-05	3.01E-09	3.31E-05	1.79E-06	5.45E-05	2.52E-02	1.02E-02
Ligth Duty Pickup Truck	4	12	1.90E-01	7.14E-02	1.17E-02	1.13E-02	9.73E-04	7.37E-08	4.83E-04	1.69E-05	8.44E-04	9.49E-02	3.57E-02
Flat Bed or Haul Truck	2	12	9.49E-02	3.57E-02	5.85E-03	5.67E-03	4.86E-04	3.69E-08	2.42E-04	8.44E-06	4.22E-04	4.75E-02	1.79E-02
Skid Steer	2	12	4.92E-02	5.97E-02	9.52E-03	9.23E-03	1.04E-03	2.45E-08	3.28E-04	2.45E-05	5.26E-05	2.46E-02	2.98E-02
Water Truck	1	12	5.93E-02	2.23E-02	3.66E-03	3.55E-03	3.04E-04	2.30E-08	1.51E-04	5.27E-06	2.64E-04	2.97E-02	1.12E-02
Light Duty Service Truck	1	12	1.90E-02	7.14E-03	1.17E-03	1.13E-03	9.73E-05	7.37E-09	4.83E-05	1.69E-06	8.44E-05	9.49E-03	3.57E-03
Gravel Truck	3	12	2.51E-01	1.39E-01	1.54E-02	1.49E-02	1.27E-03	9.60E-08	6.28E-04	2.20E-05	1.11E-03	1.25E-01	6.94E-02
Packer	2	12	2.35E-02	9.71E-03	2.34E-03	2.27E-03	1.85E-04	1.40E-08	9.15E-05	3.40E-06	6.75E-05	1.18E-02	4.86E-03
Reed Drill 3500	2	12	1.15E-01	3.51E-02	7.20E-03	6.99E-03	7.37E-04	1.95E-08	2.40E-04	1.69E-05	1.25E-04	5.75E-02	1.75E-02
Reed Drill 345	2	12	1.15E-01	3.51E-02	7.20E-03	6.99E-03	7.37E-04	1.95E-08	2.40E-04	1.69E-05	1.25E-04	5.75E-02	1.75E-02
Rock Crusher	2	12	2.08E-01	6.35E-02	9.88E-03	9.58E-03	1.19E-03	4.31E-08	5.00E-04	2.42E-05	3.39E-04	1.04E-01	3.17E-02
Personnel transport	5	12	1.49E-01	5.16E-02	1.20E-02	1.16E-02	8.30E-04	7.63E-08	4.15E-04	1.43E-05	9.01E-04	7.47E-02	2.58E-02
TOTAL	45	-	2.19E+00	8.84E-01	1.41E-01	1.37E-01	1.30E-02	7.44E-07	5.83E-03	2.50E-04	6.40E-03	1.10E+00	4.50E-01

Table C-27: Construction Phase – Access Road - Tailpipe Emiss

Equipment List	Number of Units Used Concurrently	Hours per day	Emission Rate 24-hr (g/s)								
			SO2	B(a)P	TPM	PM10	PM2.5	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
Dump Truck / Truck&Trailer	3	12	2.37E-04	2.07E-08	3.29E-03	3.29E-03	3.19E-03	1.36E-04	4.75E-06	7.53E-04	2.74E-04
Loader	2	12	1.97E-04	3.84E-08	7.58E-03	7.58E-03	7.35E-03	2.90E-04	1.29E-05	1.82E-03	6.52E-04
Grader	1	12	2.35E-05	2.24E-09	3.72E-04	3.72E-04	3.61E-04	1.84E-05	6.65E-07	1.03E-04	3.73E-05
Compactors / Packers	6	12	1.46E-04	2.31E-08	4.02E-03	4.02E-03	3.90E-03	2.72E-04	9.96E-06	1.54E-03	5.46E-04
D8 Dozer	3	12	2.51E-04	4.90E-08	8.43E-03	8.43E-03	8.18E-03	3.31E-04	1.26E-05	1.91E-03	6.82E-04
Excavator	2	12	9.07E-05	1.37E-08	2.25E-03	2.25E-03	2.18E-03	9.17E-05	3.30E-06	5.11E-04	1.84E-04
Mobile Crane	1	12	6.08E-05	6.16E-09	1.09E-03	1.09E-03	1.06E-03	7.50E-05	2.83E-06	4.30E-04	1.54E-04
Pile Driver	1	12	2.73E-05	7.53E-09	2.00E-03	2.00E-03	1.94E-03	8.28E-05	4.47E-06	5.89E-04	2.10E-04
Ligth Duty Pickup Truck	4	12	4.22E-04	3.69E-08	5.85E-03	5.85E-03	5.67E-03	2.42E-04	8.44E-06	1.34E-03	4.86E-04
Flat Bed or Haul Truck	2	12	2.11E-04	1.84E-08	2.92E-03	2.92E-03	2.84E-03	1.21E-04	4.22E-06	6.70E-04	2.43E-04
Skid Steer	2	12	2.63E-05	1.23E-08	4.76E-03	4.76E-03	4.62E-03	1.64E-04	1.22E-05	1.46E-03	5.22E-04
Water Truck	1	12	1.32E-04	1.15E-08	1.83E-03	1.83E-03	1.77E-03	7.55E-05	2.64E-06	4.19E-04	1.52E-04
Light Duty Service Truck	1	12	4.22E-05	3.69E-09	5.85E-04	5.85E-04	5.67E-04	2.42E-05	8.44E-07	1.34E-04	4.86E-05
Gravel Truck	3	12	5.54E-04	4.80E-08	7.70E-03	7.70E-03	7.47E-03	3.14E-04	1.10E-05	1.74E-03	6.33E-04
Packer	2	12	3.38E-05	7.01E-09	1.17E-03	1.17E-03	1.13E-03	4.58E-05	1.70E-06	2.59E-04	9.24E-05
Reed Drill 3500	2	12	6.25E-05	9.74E-09	3.60E-03	3.60E-03	3.49E-03	1.20E-04	8.47E-06	1.03E-03	3.68E-04
Reed Drill 345	2	12	6.25E-05	9.74E-09	3.60E-03	3.60E-03	3.49E-03	1.20E-04	8.47E-06	1.03E-03	3.68E-04
Rock Crusher	2	12	1.70E-04	2.16E-08	4.94E-03	4.94E-03	4.79E-03	2.50E-04	1.21E-05	1.66E-03	5.93E-04
Personnel transport	5	12	4.51E-04	3.81E-08	5.99E-03	5.99E-03	5.81E-03	2.08E-04	7.16E-06	1.14E-03	4.15E-04
TOTAL	45	-	3.20E-03	3.78E-07	7.20E-02	7.20E-02	6.98E-02	2.98E-03	1.29E-04	1.85E-02	6.66E-03

Table C-28: Construction Phase – Transmission Line - Key Data

Construction Schedule	12	hours/day of construction
	7	day/week of construction
TL Length	89	km
Construction Phase Duration (100km)	24	months

Note: # of Equipment should represent the typical active fleet over the duration of the construction

Representative Construction Fleet
(includes both activities within the T-line construction footprint as well as transport of construction materials (aggregate, concrete, etc.) from the mine site to construction site)

Source ID	Source Description	Engine Type	Engine Size / Description	Engine Output (HP)	# of Equipment	Utilization Factor (%)*	Total Operating Hours per piece of equipment (if available)
Transmission Line Construction	D8 Dozer	Diesel >=19kW, Tier 1–3		350	2	40%	800
Transmission Line Construction	330 CAT Excavator (Clearing)	Diesel >=19kW, Tier 1–3		300	6	40%	1600
Transmission Line Construction	Digger Derrick with Bucket	HDDV (Moderate Control)		350	2	40%	2000
Transmission Line Construction	Line Truck	HDDV (Moderate Control)		300	3	40%	3000
Transmission Line Construction	Concrete Mixers	HDDV (Moderate Control)		475	1	40%	3000
Transmission Line Construction	Gravel Truck	HDDV (Moderate Control)		500	3	40%	1200
Transmission Line Construction	Flat Bed or Haul Truck	Diesel >=19kW, Tier 1–3		600	2	50%	1500
Transmission Line Construction	ROW Clearing	Various - FB/Sk/Ch		600	2	20%	3000
Transmission Line Construction	Rubber Tire Backhoe	HDDV (Moderate Control)		100	1	40%	3000
Transmission Line Construction	Light Duty Service Truck	LDDV (Moderate Control)		400	1	40%	3000
Transmission Line Construction	Mobile Crane	Diesel >=19kW, Tier 1–3	Crawler Crane	270	3	16%	3000
Transmission Line Construction	Tracked Excavator	Diesel >=19kW, Tier 1–3	Small Excavator	250	1	40%	2000
Transmission Line Construction	Ligth Duty Pickup Truck	LDDV (Moderate Control)		400	1	40%	3000
Transmission Line Construction	Personnel transport	LDDV (Moderate Control)		175	5	40%	3000
Transmission Line Construction	Super Puma Helicopter	Jet Fuel		3700	1	10%	1000
Transmission Line Construction	Bell 407 Helicopter	Jet Fuel		865	1	10%	1000

Table C-29: Construction Phase – Transmission Line - Bulldozer Activity

Particulate matter emissions from the movement of bulldozers was estimated using the methodology outlined in US EPA Section 11.9, Table 11.9-2, Bulldozing on Material other than Coal (Overburden).

$$TSP\ EF\left(\frac{kg}{hr}\right) = 2.6 \times \left(\frac{(s)^{1.2}}{(M)^{1.3}}\right)$$

$$PM_{10}\ EF\left(\frac{kg}{hr}\right) = 0.34 \times \left(\frac{(s)^{1.5}}{(M)^{1.4}}\right)$$

$$PM_{2.5}\ EF\left(\frac{kg}{hr}\right) = 0.105 \times TSP$$

s = silt content (%)
M = moisture content (%)

Table 1: Particulate Emissions from Bulldozers Activity

Scenario	Particle Size	Number of Bulldozers or Equivalent	Silt Content (%)	Moisture Content (%)	Emission Rate			Utilization Factor %	Hours per Day	Control Efficiency %
					per Dozer (kg/h)	total (kg/h)	total (g/s)			
Maximum	TSP	2	3.9	7.9	0.91	1.81	0.50	40	12	75
	PM_{10}				0.14	0.29	0.08			
	$PM_{2.5}$				0.10	0.19	0.05			

Particle Size	Uncontrolled Emission rate (g/s)		Controlled Emission rate (g/s)	
	24-hr Average	1-hr Average	24-hr Average	1-hr Average
TSP	1.01E-01	2.01E-01	2.52E-02	5.04E-02
PM_{10}	1.60E-02	3.20E-02	4.00E-03	8.00E-03
$PM_{2.5}$	1.06E-02	2.12E-02	2.64E-03	5.29E-03

Table C-30: Construction Phase – Transmission Line - Tailpipe Emission

Equipment List	Number of Units Used Concurrently	Hours per day	Emission Rate 1-hr (g/s)						Emission Rate 24-hr (g/s)										
			NOx	CO	PM10	PM2.5	Acetaldehyde	SO2	NOx	CO	SO2	B(a)P	TPM	PM10	PM2.5	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde
D8 Dozer	2	12	1.53E-01	6.98E-02	1.12E-02	1.09E-02	9.10E-04	3.35E-04	7.63E-02	3.49E-02	1.68E-04	3.27E-08	5.62E-03	5.62E-03	5.45E-03	2.21E-04	8.43E-06	1.27E-03	4.55E-04
330 CAT Excavator (Clearing)	6	12	4.39E-01	1.79E-01	3.09E-02	3.00E-02	2.67E-03	1.58E-03	2.19E-01	8.96E-02	7.88E-04	9.49E-08	1.55E-02	1.55E-02	1.50E-02	6.63E-04	2.38E-05	3.70E-03	1.33E-03
Digger Derrick with Bucket	2	12	1.46E-01	5.04E-02	8.30E-03	8.06E-03	8.48E-04	1.41E-04	7.31E-02	2.52E-02	7.06E-05	1.08E-08	4.15E-03	4.15E-03	4.03E-03	1.33E-04	9.93E-06	1.18E-03	4.24E-04
Line Truck	3	12	1.33E-01	4.82E-02	8.44E-03	8.19E-03	7.27E-04	7.47E-04	6.64E-02	2.41E-02	3.74E-04	2.65E-08	4.22E-03	4.22E-03	4.09E-03	1.79E-04	6.22E-06	9.91E-04	3.63E-04
Concrete Mixers	1	12	2.46E-01	8.18E-02	1.24E-02	1.20E-02	1.42E-03	2.40E-04	1.23E-01	4.09E-02	1.20E-04	1.62E-08	6.19E-03	6.19E-03	6.01E-03	2.23E-04	1.66E-05	1.98E-03	7.11E-04
Gravel Truck	3	12	7.12E-02	2.68E-02	4.39E-03	4.26E-03	3.65E-04	3.16E-04	3.56E-02	1.34E-02	1.58E-04	1.38E-08	2.19E-03	2.19E-03	2.13E-03	9.07E-05	3.16E-06	5.02E-04	1.82E-04
Flat Bed or Haul Truck	2	12	2.28E-01	1.06E-01	1.41E-02	1.36E-02	1.16E-03	1.01E-03	1.14E-01	5.31E-02	5.06E-04	4.40E-08	7.03E-03	7.03E-03	6.82E-03	2.89E-04	1.01E-05	1.60E-03	5.81E-04
ROW Clearing	2	12	8.12E-01	4.50E-01	6.02E-02	5.84E-02	4.73E-03	1.18E-03	4.06E-01	2.25E-01	5.91E-04	1.11E-07	3.01E-02	3.01E-02	2.92E-02	8.89E-04	5.12E-05	6.60E-03	2.37E-03
Rubber Tire Backhoe	1	12	1.12E-01	1.02E-01	1.59E-02	1.54E-02	1.83E-03	1.51E-04	5.60E-02	5.09E-02	7.57E-05	2.87E-08	7.93E-03	7.93E-03	7.69E-03	3.49E-04	1.97E-05	2.56E-03	9.15E-04
Light Duty Service Truck	1	12	3.80E-02	1.43E-02	2.34E-03	2.27E-03	1.95E-04	1.69E-04	1.90E-02	7.14E-03	8.44E-05	7.37E-09	1.17E-03	1.17E-03	1.13E-03	4.83E-05	1.69E-06	2.68E-04	9.73E-05
Mobile Crane	3	12	6.19E-02	1.61E-02	3.27E-03	3.17E-03	4.63E-04	1.82E-04	3.09E-02	8.06E-03	9.12E-05	9.23E-09	1.63E-03	1.63E-03	1.59E-03	1.12E-04	4.25E-06	6.45E-04	2.31E-04
Tracked Excavator	1	12	3.00E-02	1.00E-02	1.86E-03	1.81E-03	1.76E-04	1.32E-04	1.50E-02	5.01E-03	6.60E-05	5.74E-09	9.31E-04	9.31E-04	9.03E-04	4.34E-05	1.55E-06	2.43E-04	8.79E-05
Ligth Duty Pickup Truck	1	12	1.90E-02	7.14E-03	1.17E-03	1.13E-03	9.73E-05	8.44E-05	9.49E-03	3.57E-03	4.22E-05	3.69E-09	5.85E-04	5.85E-04	5.67E-04	2.42E-05	8.44E-07	1.34E-04	4.86E-05
Personnel transport	5	12	1.49E-01	5.16E-02	1.20E-02	1.16E-02	8.30E-04	9.01E-04	7.47E-02	2.58E-02	4.51E-04	3.81E-08	5.99E-03	5.99E-03	5.81E-03	2.08E-04	7.16E-06	1.14E-03	4.15E-04
Super Puma Helicopter	1	12	1.65E-02	1.46E-03	4.13E-04	4.13E-04	8.60E-06	0.00E+00	8.23E-03	7.31E-04	0.00E+00	5.60E-11	2.06E-04	2.06E-04	2.06E-04	3.72E-05	1.51E-06	2.67E-03	4.30E-06
Bell 407 Helicopter	1	12	9.26E-03	3.25E-03	1.56E-04	1.56E-04	1.87E-05	0.00E+00	4.63E-03	1.63E-03	0.00E+00	1.22E-10	7.80E-05	7.80E-05	7.80E-05	8.07E-05	3.36E-06	1.50E-03	9.33E-06
TOTAL	35	-	2.66E+00	1.22E+00	1.87E-01	1.81E-01	1.64E-02	7.17E-03	1.33E+00	6.09E-01	3.59E-03	4.43E-07	9.35E-02	9.35E-02	9.07E-02	3.59E-03	1.70E-04	2.70E-02	8.22E-03

Attachment D
Points of Reception

Table D-1: Sensitive Receptors (including TKLUs)

Receptor ID	Type	Easting (m)	Northing (m)	Proxy POR Land use Identification
POR01	Cabin	547 907	5 700 737	Cabin
POR02	Wabauskang/ Heritage	548 092	5 690 987	TLRU
POR03	Wabauskang	549 656	5 690 307	TLRU
POR04	Metis Nation of Ontario	544 260	5 693 233	TLRU
POR05	Metis Nation of Ontario	547 428	5 696 234	TLRU
POR06	Metis Nation of Ontario	553 496	5 695 821	TLRU
POR07	Cabin	559 261	5 688 223	Cabin
POR08	Outpost Camp	563 621	5 672 599	Cabin
POR09	Metis Nation of Ontario	590 007	5 667 054	TLRU
POR10	Mishkeegogamang First Nation	582 183	5 669 202	TLRU
POR11	Mishkeegogamang First Nation	580 530	5 668 044	TLRU
POR12	Mishkeegogamang First Nation	586 716	5 670 462	TLRU
POR13	Metis Nation of Ontario	599 770	5 667 769	TLRU
POR14	Outpost Camp	609 062	5 668 361	Cabin
POR15	Mishkeegogamang First Nation	597 511	5 669 880	TLRU
POR16	Mishkeegogamang First Nation	597 265	5 668 219	Residential
POR17	Cat Lake	558 246	5 690 430	TLRU
POR18	Cat Lake	562 850	5 691 012	TLRU
POR19	Cat Lake	565 443	5 687 308	TLRU
POR20	Cat Lake	564 596	5 676 227	TLRU
POR21	Cat Lake	619 312	5 674 375	TLRU
POR22	Cabin	554 399	5 683 394	Cabin
POR23	Cabin	557 166	5 682 203	Cabin
POR24	Cabin	538 464	5 690 301	Cabin
POR25	Mishkeegogamang First Nation	593 556	5 651 233	TLRU
POR26	Mishkeegogamang First Nation	597 756	5 652 986	TLRU
POR27	Mishkeegogamang First Nation	589 944	5 664 165	TLRU
POR28	Mishkeegogamang First Nation	591 955	5 662 154	TLRU
POR29	Mishkeegogamang First Nation	589 353	5 661 522	TLRU
POR30	Metis Nation of Ontario	568 218	5 692 198	TLRU
POR31	Metis Nation of Ontario	535 868	5 682 483	TLRU
POR32	Metis Nation of Ontario	533 810	5 677 373	TLRU
POR33	Metis Nation of Ontario	610 010	5 654 751	TLRU
POR34	Recreational Point	576 426	5 661 532	Camp
POR35	Outpost Camp	573 745	5 695 672	Camp
POR36	Outpost Camp	609 347	5 659 593	Camp
POR37	Outpost Camp	546 367	5 709 714	Camp
POR38	Outpost Camp	570 436	5 687 920	Lodge
POR39	Outpost Camp	595 155	5 673 252	Camp
POR40	Outpost Camp	583 751	5 664 927	Camp
POR41	Main Base Lodge	602 540	5 664 729	Camp
POR42	Outpost Camp	569 188	5 676 840	Camp
POR43	Main Base Lodge	545 709	5 669 169	Lodge
POR44	Outpost Camp	571 827	5 680 506	Camp
POR45	Outpost Camp	560 707	5 705 624	Camp
POR46	Outpost Camp	549 951	5 679 342	Camp
POR47	Outpost Camp	555 391	5 677 581	Camp
POR48	Mishkeegogamang First Nation	578 843	5 666 225	TLRU
POR49	Mishkeegogamang First Nation	602 736	5 661 948	TLRU
POR50	Mishkeegogamang First Nation	577 476	5 679 284	TLRU
POR51	Mishkeegogamang First Nation	584 379	5 679 357	TLRU
POR52	Mishkeegogamang First Nation	592 350	5 677 036	TLRU
POR53	Mishkeegogamang First Nation	599 807	5 665 023	TLRU
POR54	Outpost Camp	617 291	5 677 674	Camp
POR55	Cat Lake	529 284	5 683 104	TLRU
POR56	Cat Lake	526 655	5 690 430	TLRU
POR57	Cat Lake	532 952	5 702 707	TLRU
POR58	Cat Lake	535 545	5 693 446	TLRU
POR59	Cat Lake	540 466	5 699 690	TLRU
POR60	Cat Lake	534 963	5 710 274	TLRU
POR61	Cat Lake	549 039	5 685 456	TLRU