5. Air Quality and Climate

The purpose of **Chapter 5, Air Quality and Climate**, of the Environmental Impact Statement (EIS) is to characterize the existing environment, Project-environment interactions, and potential residual Project and cumulative effects of the Project on air quality and climate. The Project has the potential to cause adverse effects on these components of the atmospheric environment through the release of Project-generated dust and combustion emissions and greenhouse gas (GHG) emissions. Changes in the atmospheric environment can also influence aquatic and terrestrial ecosystems, and the people who use natural resources or ecosystem services (e.g., surface water, fish, plants, wildlife). Therefore, the air quality and climate assessment consequently provide information that is used to support the assessments of other biophysical and socioeconomic Valued Environmental Components (VECs), where applicable.

Additionally, the effects of a changing climate on the Project are assessed in **Chapter 21, Summary of Significance of Residual Effects**.

5.1 Approach to the Effects Assessment

The methods and assessment presented in this chapter were developed in consideration of the requirements under the provincial *Environmental Protection Act*, with specific consideration of the requirements set out in the provincial EIS Guidelines for the Project issued by the Minister of Environment and Climate Change (Government of NL 2024). A table of concordance to the EIS Guidelines is provided in the Executive Summary. The assessment of air quality and climate followed the overall effects assessment approach and methods (**Chapter 4, Environmental Effects Methodology**).

Where possible, comparison to the outcomes of the assessment of air quality and climate completed within the previous EIS has been made to highlight where effects on air quality and climate have been reduced through consideration of environmental design features and mitigation, or where new adverse effects may be introduced and require additional consideration in Project planning.

5.2 Integrating Engagement from Indigenous Groups and Local Stakeholders

Champion has been engaging with potentially affected Indigenous groups and local community stakeholders since the acquisition of the Project in 2021. The overall approach and methods for the incorporation of engagement feedback into the EIS is discussed in detail in **Chapter 22, Engagement**.

Issues and concerns related to air quality and climate raised by Indigenous groups and local stakeholders and how these were addressed through the assessment are summarized in Table 5-1, including cross-references to where comments were considered or addressed in the chapter.

Table 5-1: Summary of Issues and Concerns Related to Air Quality and Climate by Indigenous Groups and Local Stakeholders

Comment Theme	How It Is Addressed in the Assessment	Where It Was Addressed in the Assessment	Indigenous Group or Local Stakeholder	Raised in the Alderon EIS (Yes/No)
Change in air quality (dust)	Potential effects on air quality, including dust, were assessed.	Section 5.5.2	Fermont, Wabush, Labrador City	Yes (Labrador City, Fermont, and Wabush)
Concern regarding the impact of Rose Pit related to dust impacts	Potential effects on air quality, including dust, were assessed.	Section 5.5.2	Fermont	No
Changes to air quality (dust) from mine rock stockpiles	Potential effects on air quality, including dust, were assessed.	Section 5.5.2	Innu Takuaikan Uashat mak Mani-Utenam	Yes by Labrador City, Fermont, Wabush, cabin owners
Changes to greenhouse gas emissions	Potential effects on greenhouse gas emissions were assessed.	Section 5.5.2.5	— Labrador City — Fermont (associated with commuting)	No

Comment Theme	How It Is Addressed in the Assessment	Where It Was Addressed in the Assessment	Indigenous Group or Local Stakeholder	Raised in the Alderon EIS (Yes/No)
Project-related air quality and greenhouse gas conditions and effects	Potential effects on air quality were assessed.	Section 5.5.2 and Section 5.5.2.5	— NL Department of Environment and Climate Change — NL Department of Industry, Energy and Technology — NL Office of Indigenous Affairs and Reconciliation	Agency comments not tracked specifically as part of consultation record
Effectiveness of the mitigation measures to reduce residual effects of dust and air quality	Project-specific mitigation measures and adaptive management related to dust were identified.	Sections 5.5.2.1	Members of the public (Fermont, Labrador City and Wabush) and cabin owners and association, Riordan Lake, specifically regarding the TMF emissions, and Quebec cabin owners.	Yes (Wabush, cabin owners)

EIS = Environmental Impact Statement; NL = Newfoundland and Labrador.

5.3 Assessment Scoping

This section identifies key issues for air quality and climate, defines and provides a rationale for the selection of air quality and climate as VECs, identifies the measurable parameters selected for the assessments, and defines assessment boundaries for the air quality and climate VECs.

5.3.1 Key Issues

Key issues often relate to the potential environmental, social, economic, and health impacts of a proposed project. Key issues identified for the Project reflect the primary concerns raised by regulatory authorities, Indigenous groups, and local stakeholders, including local residents, cabin owners, business owners, and other interested parties.

To identify key issues related to air quality and climate, the following sources were reviewed:

- Section 4.1 of the EIS Guidelines, which summarized key issues from regulatory agencies and feedback received on the Project Registration and draft EIS Guidelines
- the record of engagement (Chapter 22), which captures engagement input received through meetings, phone calls, letters, and interviews
- past experience with mining projects in Labrador
- the key issues identified in the previous EIS

These are the key issues related to air quality and climate:

- air quality
- dust
- cumulative effects on air quality and dust
- GHG emissions

5.3.2 Valued Environmental Components and Measurable Parameters

Air quality was selected as a VEC because it was identified as a key issue in the provincial EIS Guidelines. Emissions to the atmosphere, such as dust emissions from mining activities and emissions from fuel combustion, may occur during the Construction, Operations, and Closure phases of the Project. These atmospheric emissions can affect the environment, land use, and human health if they are present in certain concentrations; therefore, air quality has intrinsic importance to the health and well-being of humans, wildlife, and vegetation.

Measurable parameters are used to characterize changes to attributes of the environment from the Project, other human developments, and natural factors. The changes in measurable parameters are used to assess change and predict overall effects on VECs.

The air quality VEC assessment considered the following contaminants of concern (COCs):

- total particulate matter (TPM)
- particulate matter less than 10 micrometres (PM_{10})
- particulate matter less than 2.5 micrometres ($PM_{2.5}$)
- nitrogen dioxide (NO_2)
- carbon monoxide (CO)
- sulphur dioxide (SO_2)
- metals (arsenic, cadmium, copper, lead, mercury, nickel, vanadium, and zinc)

These COCs have ambient air quality standards in Table 1 of Schedule A of the Government of Newfoundland and Labrador's *Air Pollution Control Regulations, 2022* (O.C. 2022-027) (Government of NL 2022). The emissions of particulates from diesel combustion, referred to as diesel particulate matter, were also assessed. Other contaminants required for the human health risk assessment for the Project were included in the air quality emissions inventory and dispersion modelling assessment. The contaminants include additional metals and polyaromatic hydrocarbons.

Climate, assessed as effects of changes in GHG emissions on climate change, was selected as a VEC because the Project is anticipated to increase the provincial GHG totals. Assessing GHGs is the most effective method for estimating a project's effect on climate change, as GHGs contribute to the greenhouse effect by absorbing infrared radiation in the atmosphere, increasing temperature, and changing weather patterns (Government of Canada 2015).

The climate VEC assessment considered the following GHGs that would be emitted throughout all Project phases:

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)

The federal and provincial governments have committed to reductions in GHG emissions by 2030 and to net zero by 2050. Project GHG emissions will be subject to federal and provincial reporting and are currently subject to carbon pricing regulations. If the Project emits 15,000 tonnes, or more, of carbon dioxide equivalent (tCO_2e) per year within the Project boundary, it will be regulated under s.4 of the Newfoundland and Labrador *Management of Greenhouse Gas Act* (MGGA) and its regulations. Furthermore, if the Project has the potential to emit more than 15,000 tCO_2e, it will be subject to BACT requirements for activities within the Project boundary, as outlined in Section 12.1 of the regulations. A BACT Study Report is included as part of Champion's EIS submission as a Technical Support Document (TSD). The BACT Study (TSD IV) demonstrates that the Project plans to employ the best available control technologies for GHG emissions that have been deemed technically and economically feasible at this stage of the Project.

The air quality and climate VECs, the rationale for selection, and measurable parameters are summarized in Table 5-2. VEC assessments that are supported by the assessment of the air quality and climate VECs is also presented in Table 5-2.

Table 5-2: Valued Environmental Components, Rationale for Selection, and Measurable Parameters

Valued Environmental Component	Rationale for Selection	Measurable Parameters	Linkages to Other Valued Environmental Components
Air quality	— Project is expected to emit dust and air contaminants from fuel combustion and mining activities to the atmospheric environment	Contaminants of concern: — TPM — PM_{10} — $PM_{2.5}$ — NO_2 — CO — SO_2 — metals (arsenic, cadmium, copper, lead, mercury, nickel, vanadium, and zinc)	— Surface Water (Chapter 8) — Fish and Fish Habitat (Chapter 9) — Vegetation and wetland VECs (Chapter 10) — Wildlife VECs (Chapter 11) — Indigenous Land and Resource Use VEC (Chapter 13) — Other land and resource use VEC (Chapter 14) — Community health and well-being VEC (Chapter 17)

Valued Environmental Component	Rationale for Selection	Measurable Parameters	Linkages to Other Valued Environmental Components
Climate	— Project is expected to increase the provincial GHG totals	Greenhouse gases:[a] — CO_2 — CH_4 — N_2O	Not applicable

(a) Additional GHGs were screened as measurable parameters for the Project. The Project is not expected to have sources that produce perfluorocarbons, hydrofluorocarbons, or sulphur hexafluoride (e.g., refrigerants). Although electrical equipment would likely contain sulphur hexafluoride for insulation, this gas would be contained in a sealed system and would not be released to the atmosphere in significant quantities.
CH_4 = methane; CO = carbon monoxide; CO_2 = carbon dioxide; GHG = greenhouse gas; NO_2 = nitrogen dioxide; N_2O = nitrous oxide; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; PM_{10} = particulate matter less than 10 micrometres; SO_2 = sulphur dioxide; TPM = total particulate matter; VEC = Valued Environmental Component.

5.3.3 Assessment Boundaries

Assessment boundaries define the spatial and temporal extents of the assessment for each VEC. The spatial boundaries for air quality are defined in Table 5-3 and shown in Figure 5-1, and consist of the site study area (SSA), a local study area (LSA), and regional study area (RSA).

The SSA includes the proposed infrastructure within the Project footprint, with an additional buffer to reflect existing uncertainty in the final design of the Project, so that adverse effects on VECs are not underestimated (i.e., the SSA area is twice as large as the anticipated Project footprint). The SSA is constrained to avoid certain features, including major lakes, the Québec-Labrador provincial border, and sensitive features like the Wahnahnish Lake Protected Public Water Supply Area. The SSA represents the smallest scale of assessment and an area where the potential direct effects of the anticipated Project can be assessed accurately and precisely.

The LSA is the area within the vicinity of the Project where most of the air quality effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA is a square that extends 20 km from the centre of the mine site infrastructure in the four cardinal directions, for a total area encompassed in 40 km north-south by 40 km east-west. The LSA incorporates the local communities of Wabush, Labrador City, and the Town of Fermont. This LSA size was selected for consistency with the previous EIS (Alderon 2012).

The RSA was selected to represent the area within which cumulative effects from the Project on air quality might occur. The RSA is a square that extends 30 km from the centre of the mine site infrastructure in the four cardinal directions, for a total area encompassed in 60 km north-south by 60 km east-west. The RSA provides an appropriate scale to assess cumulative effects from the Project combined with existing conditions and other reasonably foreseeable development (RFDs).

Table 5-3: Spatial Boundaries for Assessment of the Air Quality Valued Environmental Component

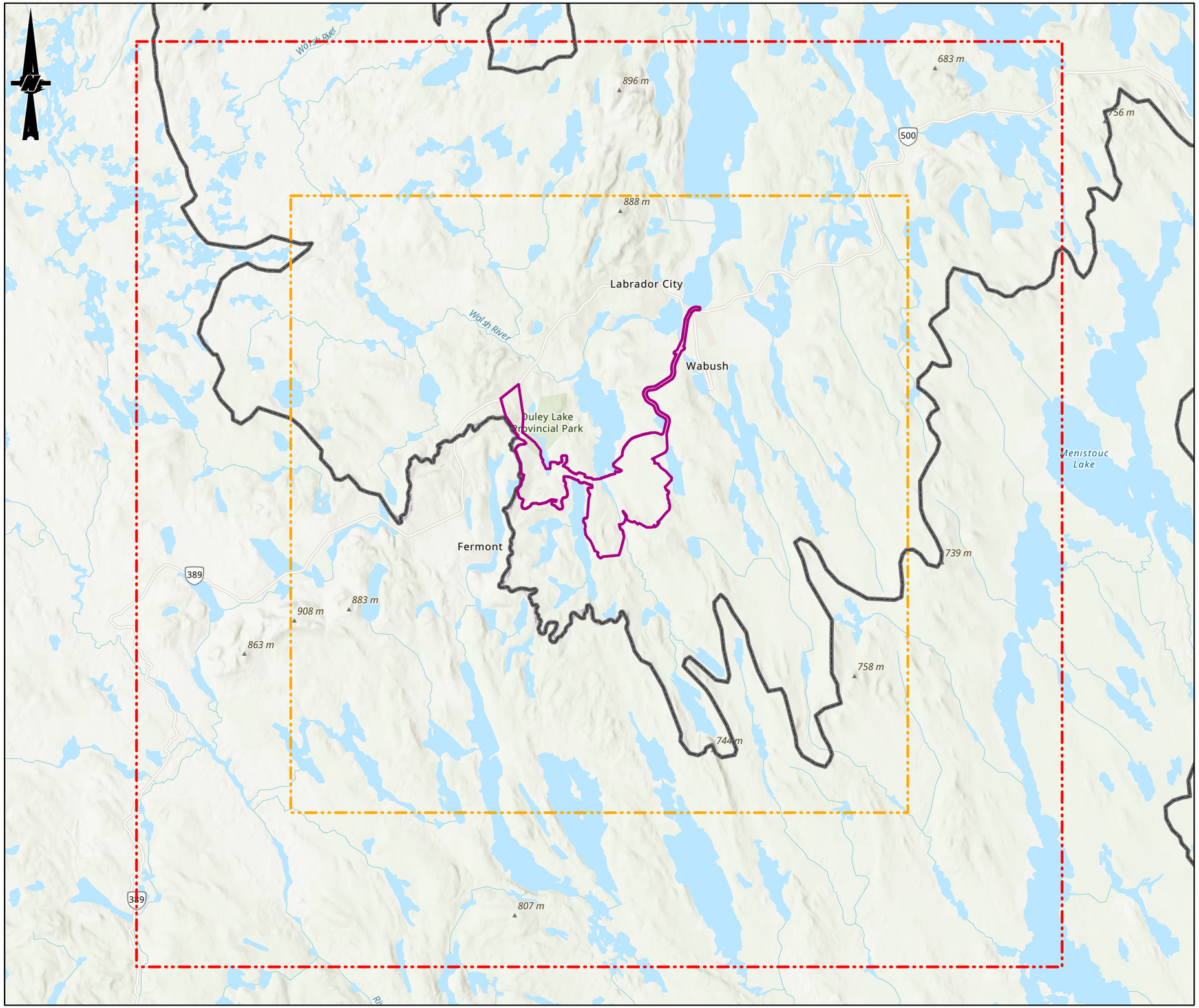
Study Area	Area (hectare)[a]	Description/Rationale
SSA	4,323	Includes the Project footprint plus additional buffered areas to incorporate a level of uncertainty into the Project design so that effects are not underestimated. The SSA was defined using bounding points around the outermost components of the Project footprint.
LSA	160,000	The LSA was defined by a square that extends 20 km from the centre of the mine site infrastructure and includes the towns of Wabush and Labrador City, Labrador and Fermont, Québec. The LSA represents an area where air quality effects can be predicted with a reasonable degree of accuracy and confidence. The LSA is consistent with the LSA defined in the previous EIS (Alderon 2012).
RSA	360,000	The RSA was defined by a square that extends 30 km from the centre of the mine site infrastructure and provides a reasonable scale to consider nearby industrial facilities in the cumulative effects assessment.

(a) 1 hectare = 10,000 m^2.
EIS = Environmental Impact Statement; LSA = local study area; RSA = regional study area; SSA = site study area.

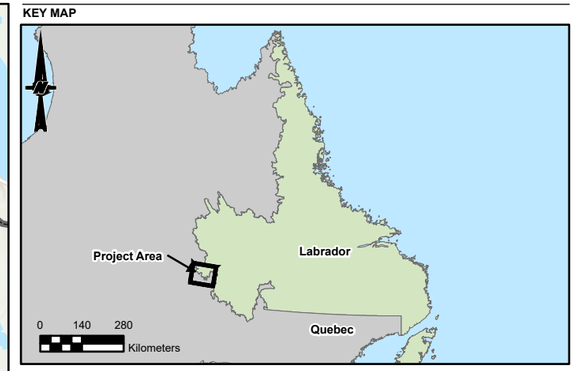
Spatial boundaries are not defined for the climate VEC, as GHG emissions are both regional and global by nature. Boundaries for GHG emissions correlate with the administrative inventory boundaries that currently apply to GHG emissions under the various regulatory GHG emissions reporting programs discussed in this chapter.

The temporal scope of the assessment focuses on the 40-year period from initial construction to the end of decommissioning and rehabilitation (i.e., closure) as defined by the following Project phases:

- **Construction phase (referred to as Construction)**–Includes site preparation, mine, process plant and site infrastructure development, and commissioning the structures, systems, and components. The duration of the Construction phase is expected to be four years.
- **Operations and Maintenance phase (referred to as Operations)**–Includes the mining and milling of iron ore, production and shipment of iron ore concentrate, tailings management, management of mine rock, waste management, water management, release of treated effluent, site maintenance and transportation of staff and materials to and from the site. The Operations phase initiates with one year of pre-development mining (i.e., ramp-up) and concludes when processing is complete and is expected to extend over 26 years.
- **Decommissioning and Rehabilitation phase (referred to as Closure)**–Includes accelerated flooding of the Rose Pit, re-establishment of passive surface water drainage following the pit-flooding period, and recontouring and revegetating disturbed areas. Physical infrastructure that is not required during Post-closure monitoring and for other activities required to achieve the Project's decommissioning criteria, and to return the Project site to a safe and stable condition, will be removed. The active Closure phase is expected to last 10 years.



KEY MAP



SCALE 1:20,000,000

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Labrador/Quebec Boundary

0 4,000 8,000 16,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
WORLD HILLSHADE: ESRI, NASA, NGA, USGS
2. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

AIR QUALITY SPATIAL BOUNDARIES

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	0	5-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PRO\CA0038713.5261_EIS40_PRO\0007 Atmosphere\CA0038713_5261_0007_0000.aprx, PRINTED ON: AT 9:14:46 AM

5.3.4 Regulatory Criteria and Guidelines

The Government of Newfoundland and Labrador lists the Newfoundland Ambient Air Quality Standards (NLAAQS) in Table 1 of Schedule A of the *Air Pollution Control Regulations, 2022* (O.C. 2022-072), under the Newfoundland and Labrador *Environmental Protection Act*. For provincial permitting, facilities are expected to demonstrate compliance with the standards at the facility's administrative boundary.

The Government of Canada has set the Canadian Ambient Air Quality Standards (CAAQS), which are non-regulatory limits that can be used to facilitate air quality management on a regional scale and provide goals for ambient air quality that protect public health, the environment, or aesthetic properties of the environment (CCME 2019). They have been adopted by the Canadian Council of Ministers of the Environment. The CAAQS are not intended to be used for compliance at a facility's administrative boundary. They are intended as a measure of ambient air quality within each of Canada's air zones to determine appropriate air quality management actions. The concentrations predicted by the air dispersion model were compared against the CAAQS to allow discussion of the modelled effects of air emissions on the air zone. The NLAAQS and CAAQS applicable to the Project are summarized in Table 5-4.

Table 5-4: Standards Applicable to the Compounds of Concern Emissions for the Project

Pollutant	Averaging Period	Newfoundland and Labrador Ambient Air Quality Standards[a]	Canadian Ambient Air Quality Standards (CAAQS)[b]
Nitrogen dioxide	1 hour	213 ppb	42 ppb[c,d]
	24 hour	106 ppb	–
	Annual	53 ppb	12 ppb[e,d]
Sulphur dioxide	1 hour	344 ppb	65 ppb[f,d]
	3 hour	229 ppb	–
	24 hour	115 ppb	–
	Annual	23 ppb	4.0 ppb[g,d]
Carbon monoxide	1 hour	30,582 ppb	–
	8 hour	13,107 ppb	–
Total particulate matter	24 hour	120 µg/m³	–
	Annual	60 µg/m³	–
PM_{10}	24 hour	50 µg/m³	–
$PM_{2.5}$	24 hour	25 µg/m³	27 µg/m³ [h]
	Annual	8.8 µg/m³	8.8 µg/m³ [i]
Arsenic	24 hour	0.3 µg/m³	–
Cadmium	24 hour	2 µg/m³	–
Copper	24 hour	50 µg/m³	–
Lead	24 hour	2 µg/m³	–
Mercury	24 hour	2 µg/m³	–
Nickel	24 hour	2 µg/m³	–
Vanadium	24 hour	2 µg/m³	–
Zinc	24 hour	120 µg/m³	–

(a) Government of Newfoundland and Labrador (O.C. 2022-072).
(b) CAAQS published in the Canada Gazette Volume 147, No. 21 – May 25, 2013.
(c) The three-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations of NO_2.
(d) The CAAQS are effective from 2025.
(e) The average over a single calendar year of all one-hour average concentrations of NO_2.
(f) The three-year average of the annual 99th percentile of the SO_2 daily maximum one-hour average concentrations.
(g) The average over a single calendar year of all one-hour average concentrations of SO_2.
(h) The three-year average of the annual 98th percentile of the daily 24-hour average concentrations of $PM_{2.5}$.
(i) The three-year average of the annual average of the daily 24-hour average concentrations of $PM_{2.5}$.
CAAQS = Canadian Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; ppb = parts per billion; SO_2 = sulphur dioxide; µg/m³ = microgram per cubic metre.

The provincial and federal governments have set targets to reduce GHG emissions. The provincial GHG emissions reduction target is a province-wide 30% reduction below 2005 levels by 2030, and to achieve net-zero province-wide by 2050 (Government of NL 2021). The federal 2030 Emissions Reduction Plan aims to reduce total national GHG emissions by 40% to 45% below 2005 levels by 2030 and to achieve net zero GHG emissions Canada-wide by 2050 (ECCC 2024).

The Newfoundland and Labrador MGGA and its regulations came into force in January 2019. Section 4 of the MGGA requires that any industrial facility that emits 15,000 tonnes of GHG emissions is required to report their emissions annually to the provincial Department of Environment and Climate Change, specifically, the Climate Change Branch (Government of NL 2019). Once the threshold of 15,000 tonnes is surpassed, the facility will continue having to report until it ceases operations or emits less than 15,000 tonnes of GHGs in three consecutive years, at which time the facility may apply to the minister for an exemption from this *Act* (Government of NL 2019). Section 5 of the MGGA requires that if a facility emits over 25,000 tonnes of GHG emissions per year, it is required to have its emissions reports verified by an independent third party. In addition to this, if a facility is regulated under section 4 of the MGGA, then Section 5 requires that GHG emissions reduction targets be established for any regulated facility that emits 25,000 tonnes of GHG emissions in any year since the coming into force of the MGGA, and; any regulated facility that emits 15,000 to 25,000 tonnes of GHG emissions in any year since the coming into force of the MGGA and opts to be regulated by the MGGA, This program applies in Newfoundland-Labrador in place of the federal Output-Based Pricing System for industrial emitters. The *Management of Greenhouse Gas Regulations* provides that targets under the MGGA do not apply to an industrial facility during its construction and pre-production stages, do not apply during the facility's first three years of commercial operations, and are phased in from years four to eight of the facility's commercial operations.

The *Management of Greenhouse Gas Regulations* also require that a proponent of an industrial facility that is regulated under section 4 of the MGGA provide information regarding BACT to the minister for approval by the Lieutenant Governor-in-Council. A BACT Study Report is included as part of Champion's EIS submission as a TSD. The BACT Study (TSD IV) demonstrates that the Project plans to employ the best available control technologies for GHG emissions that have been deemed technically and economically feasible at this stage of the Project.

In addition to the provincial MGGA, the Government of Canada Greenhouse Gas Reporting Program (GHGRP) requires annual GHG emissions reporting, specifically targeting industrial GHG emitters in Canada, to satisfy Section 46(1) of the *Canadian Environmental Protection Act*. This program has collected data from facilities every year since 2004. Annual reporting requirements are updated periodically and published as notices in the Canada Gazette. Facilities that meet the requirements in the applicable notice are required to report their GHG emissions by June 1st of the following year. In general, industrial facilities (including mining) that emit 10,000 tCO_2e per year are required to submit a report that contains detailed information on GHG releases, calculated in accordance with the Gazette Notice and applicable guidance documents for the GHGRP. The GHG emission source inventory boundary between the MGGA and GHGRP are functionally the same; however, there may be subtle differences in terms of included or excluded emission source categories.

5.4 Existing Environment

5.4.1 Air Quality

The existing conditions for the air quality VEC generally formed the basis against which the residual Project and cumulative effects were assessed. The existing environment also represents the outcome of historical and current environmental and socioeconomic pressures that have shaped the observed condition of the atmospheric environment. Environmental and socioeconomic pressures or factors were either natural (e.g., weather, wildfire, predation, disease, climate change) or human related (e.g., industrial development, forestry, changing business models, fishing, hunting).

5.4.1.1 Meteorology and Climate Normals

Climate normals for the 1991 to 2020 30-year period were obtained for Wabush, Newfoundland and Labrador, climate station (ECCC 2025). Wabush climate normals are developed as a composite of data from three stations in the Wabush area. These are the nearest Environment and Climate Change Canada meteorological station to the Project. The 1991 to 2020 climate normals for precipitation, air temperature, and wind are presented in Table 5-5.

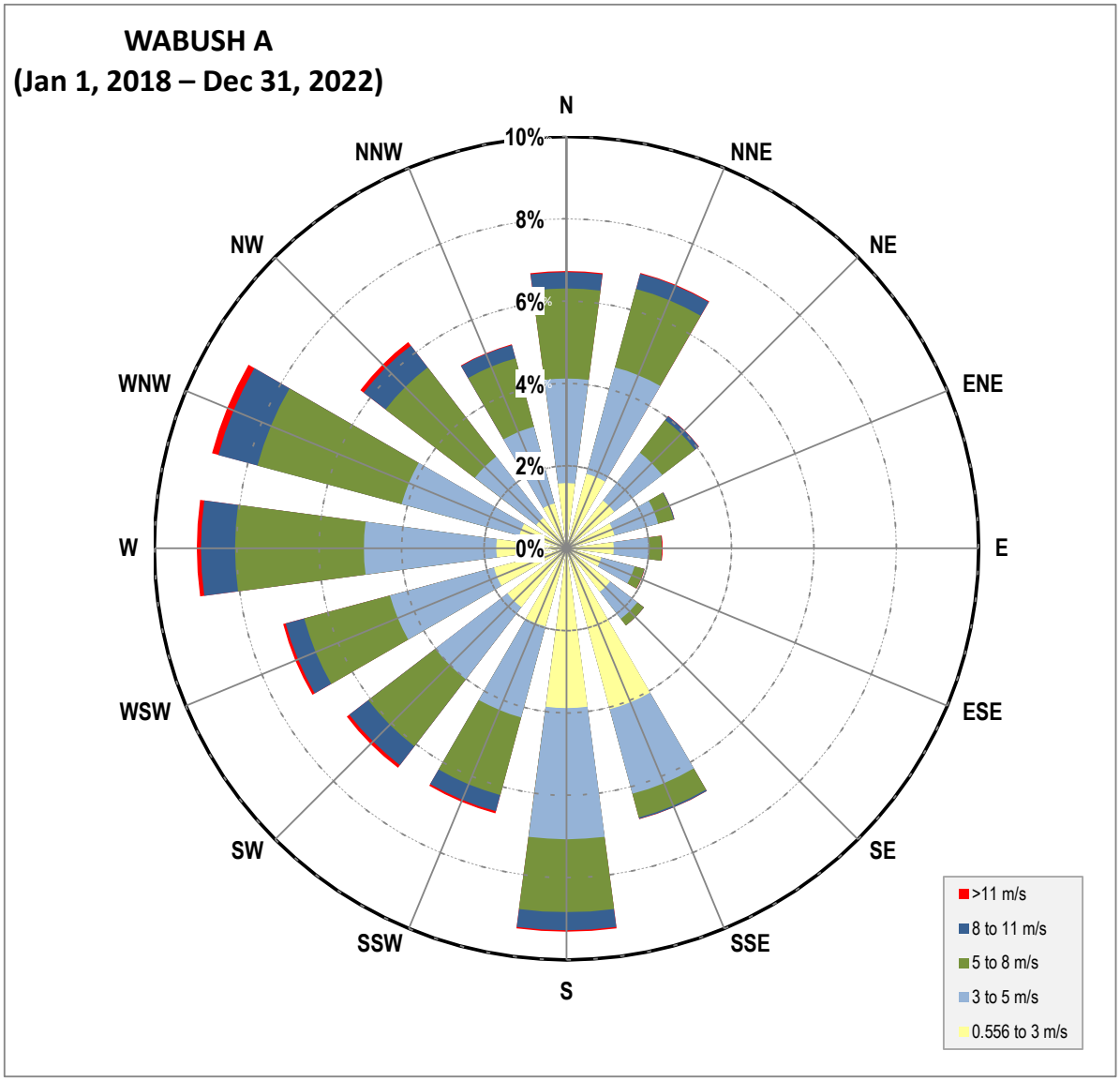
The daily average temperatures in the Wabush area ranged between -21.7°C and 14.1°C, with the lowest average temperatures occurring in January and the highest occurring in July. Extreme daily minimum and maximum temperatures ranged from -46.8°C and 32.6°C, occurring in February and July, respectively.

Total annual average precipitation in the Wabush area was 860.1 mm, with 458.9 cm of snow and 526.8 mm of rain. The monthly average precipitation ranged between 38.1 and 119.9 mm, with the least precipitation in February and the most occurring in August. Extreme daily rainfall was 65.4 mm on August 20, 2010, and the extreme daily snowfall was 45.2 cm on February 15, 2007. The precipitation data from the Wabush area stations were considered in the water balance and water quality model technical data report (Lorax 2025). The mean annual precipitation between 2013 and 2022 at the Wabush Airport 1 and 2 stations is approximately 20% less than the mean annual precipitation over the 1961 to 2012 period (Lorax 2025). This difference is mostly due to known issues with the measurement of solid phase precipitation (i.e., gauge undercatch for solid precipitation can reach 20% to 35%, depending on meteorological conditions, the precipitation gauge, and the wind shield used).

The five-year (2018 to 2022) wind rose for the Wabush Airport station, depicting the wind speed in metres/second (m/s) and wind direction frequency, is provided in Figure 5-2. The prevailing winds were from the west, north, and south. The highest wind speeds occurred most frequently from the southerly and westerly directions, and the lowest wind speeds occur most frequently from easterly directions. As shown in Table 5-4, average monthly wind speeds ranged from 12.4 (July) to 15.2 km/h (April). Extreme wind speeds of more than 60 km/h were recorded in October 2017, blowing from the west or from the southwest.

Table 5-5: 1991 to 2020 Climate Normals for the Environment Canada and Climate Change Wabush Area

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily mean (°C)	-21.7	-20.6	-13.7	-4.5	4.1	10.7	14.1	13.1	7.8	1	-7.5	-15.9	-2.8
Daily maximum (°C)	-16.2	-14.3	-6.8	1.3	9.8	16.7	19.6	18.2	12.4	4.5	-3.7	-11.1	2.5
Daily minimum (°C)	-27.1	-26.9	-20.5	-10.2	-1.6	4.7	8.5	7.9	3.2	-2.4	-11.3	-20.7	-8
Precipitation													
Rainfall (mm)	0.8	1.8	3.1	11.8	42	85.7	112.1	119.6	86.7	45.1	14.7	3.6	526.8
Snowfall (cm)	70.7	56.7	71.4	47.7	13.9	1.2	0	0.3	3.4	38.9	80.2	74.8	458.9
Precipitation (mm)	48.7	38.1	52.3	47.9	55	88.7	113.5	119.9	90.8	80.6	72.2	52.5	860.1
Extreme daily rainfall (mm) and date (yyyy/d)	7.6 (1996/25)	12.6 (1996/25)	9.6 (2011/12)	15.8 (2011/11)	21 (2011/24)	29.2 (1999/14)	38.4 (2004/05)	**65.4 (2010/20)**	33.2 (2010/04)	23.6 (1991/25)	32.2 (2008/16)	11.7 (2000/18)	-
Extreme daily snowfall (cm) and date (yyyy/dd)	34.4 (1995/15)	**45.2 (2007/15)**	36.6 (2008/21)	33 (2010/10)	18 (2006/07)	6.4 (1994/01)	0.2 (1991/01)	6 (2009/27)	7.2 (1991/29)	33.2 (2003/23)	30.2 (2005/07)	30.6 (2010/13)	-
Extreme daily precipitation (mm) and date (yyyy/dd)	31 (1995/15)	28.2 (2007/15)	36.2 (1999/10)	21 (2017/07)	32.4 (2015/30)	29.2 (1996/14)	50.4 (2020/12)	65.4 (2010/20)	38.4 (2020/30)	37 (2017/26)	32.2 (2008/16)	35.8 (2010/13)	-
Wind													
Wind speed (km/h)	13.8	13.7	14.8	15.2	14.0	13.9	12.4	12.5	14.8	14.9	14.5	13.3	14.0
Most frequent wind direction	W	W	N	N	N	S	S	W	W	W	W	W	W
Extreme wind speed (km/h) and date (yyyy/d)	57 (1996/20)	59 (2019/10)	56 (2012/18)	55 (2019/04)	54 (2018/08)	56 (1999/30)	50 (2017/12)	46 (2006/07)	63 (2007/20)	**68** (2017/31)	63 (2015/06)	65 (1991/01)	-
Direction of extreme wind speed	SW	NW	W	NW	W	W	NW	N	W	**SW**	W	W	-



m/s = metre per second.

Figure 5-2: Wind Rose for the Wabush Airport (January 1, 2018, to December 31, 2022)

5.4.1.2 Baseline Air Quality Monitoring

An air quality baseline study was completed in the summer of 2023 to characterize the existing particulate concentrations in the LSA. Baseline data from the Alderon study are over 10 years old, so were not used in the current assessment. As described in the Ambient Air Quality Baseline Report (Annex 1A), the Aeroqual Dust Sentry Profiler's were used at monitoring locations in Fermont, Québec and Wabush, Labrador to measure TPM, PM_{10} and $PM_{2.5}$ continuously over the sampling period of July 26 to September 19, 2023. The monitoring locations were chosen to maintain consistency with the air quality monitoring program completed in 2011 and 2012 (Appendix F, Alderon 2012). The data collected at the Fermont and Wabush monitoring stations underwent validation checks following the quality assurance / quality control procedures outlined in the baseline report (Annex 1A).

The ambient air quality monitoring program measured TPM, PM_{10} and $PM_{2.5}$ continuously between July 26 and September 19, 2023, in Wabush, Labrador, and Fermont, Québec. There were no exceedances of the NLAAQS for TPM, PM_{10} or $PM_{2.5}$ measured during the air quality baseline sampling period. The maximum measured daily average of TPM, PM_{10}, and $PM_{2.5}$ were 28, 25, and 18 micrograms per cubic metre ($\mu g/m^3$), respectively. The samplings results are provided in the Ambient Air Quality Baseline Report in Annex 1A.

5.4.1.3 Ambient Air Quality Reports

In addition to the baseline monitoring program, air quality data from the annual air quality monitoring reports published by the Government of Newfoundland and Labrador, Department of Environment and Climate Change (ECC) were used (reports available at https://www.gov.nl.ca/ecc/publications/env-protection). The annual air quality monitoring reports summarize measurements from the continuous air quality monitoring stations operating in Western Labrador. There are five monitoring locations in Western Labrador: three stations are operated by Rio Tinto Iron Ore Company of Canada (IOC) around Labrador City, and two stations are operated by Tacora Resources in Wabush. The 2022 and 2023 reports provide the most recent available data at the time of preparing this EIS.

The annual air quality monitoring reports for the continuous monitoring stations operating in Western Labrador were used to establish baseline concentrations for NO_2 and SO_2. The most recent published reports at the time of preparing the EIS were for 2022 and 2023 (ECC 2023 and ECC 2024). In 2023, wildfire smoke was evident in the measured particulate concentrations at the air quality monitoring stations in Western Labrador as it was a notably bad year for wildfires across Canada. Smoke from wildfires in Québec contributed to particulate exceedances of the NLAAQS in June and long-range wildfire smoke from northern Alberta and the Northwest Territories contributed to some particulate exceedances of the NLAAQS in September. In addition, the monitoring reports contributed some measured exceedances of the NLAAQS in Western Labrador, to localized fugitive emissions from dust lift-off (ECC 2024).

There were no exceedances of the NO_2 or SO_2 NLAAQS reported at the air quality monitoring stations in Western Labrador in 2022 or 2023.

Carbon monoxide is not measured at the existing monitors in Western Labrador; therefore, measurements from the National Air Pollutant Surveillance stations in Newfoundland and Labrador were considered. There were no exceedances of the CO NLAAQS at the National Air Pollutant Surveillance stations in Newfoundland in 2022 or 2023.

5.4.1.4 Existing Air Emission Sources

There are industrial facilities and anthropogenic sources located within the LSA which contribute emissions of COCs to the airshed of Western Labrador.

A review of the National Pollutant Release Inventory (NPRI) identified four nearby mining operations which meet the requirements to report to the NPRI and reported air emissions of particulate matter, metals, combustion gases including nitrogen oxides, SO_2, and CO, VOCs, polyaromatic hydrocarbons, dioxins and furans (total), hydrochloric acid, sulphuric acid, and quinoline:

- Minerai De Fer Québec Inc. Mine du Lac Bloom, located in Québec
- ArcelorMittal Exploration Minière Canada s.e.n.c. Mine du Mont-Wright, located in Québec
- Iron Ore Company of Canada Carol Project, located in Labrador City
- Tacora Resources Inc. Wabush Mines – Scully, located in Wabush

The local communities of Wabush, Labrador City, and Town of Fermont are located within the LSA. In addition, there are many cabins and recreational use areas within the LSA. The local communities and cabins would contribute COCs from heating, residential wood burning, and transportation.

5.4.1.5 Background Concentrations

The ECC annual published air quality monitoring reports for Hudson Drive in Labrador City, were used to describe the existing environment for the LSA. The baseline air quality monitoring study and discussions with ECC about the ambient air quality in Western Labrador informed this decision. This monitoring station is considered a National Air Pollutant Surveillance equivalent station and is located approximately 12.8 km (straight line distance) from the proposed Rose Pit and 2.3 km (straight line distance) from the eastern access road. The station location is presented in Table 5-6. The Hudson Drive Station monitors TPM, PM_{10}, $PM_{2.5}$, SO_2, NO_2, and ozone.

Table 5-6: Ambient Air Quality Monitoring Station Location

NAPS ID	Station Name	Land Use	Address	UTM Coordinates (Zone 19)	Elevation (masl)
11002	Firehall Labrador City	Residential	317 Hudson Drive, Labrador City	640409 mE, 5868251 mN	558

NAPS = National Air Pollutant Surveillance; UTM = Universal Transverse Mercator; masl = metre above sea level.

Measured concentrations at the Hudson Drive station from 2022 and 2023 were evaluated to establish appropriate baseline concentrations. Because the wildfires were exceptional events in 2023 that resulted in elevated particulate concentrations in 2023, the 2022 measured concentrations were selected to represent baseline concentrations within the LSA.

ECC recommended that the annual average of each contaminant could be used to represent the baseline concentration for all averaging periods of that contaminant. The one exception was the background concentration for 24-hour TPM which was calculated and provided to Champion by ECC. The monitors in Western Labrador do not measure CO; therefore, measurements from a National Air Pollutant Surveillance station in Newfoundland and Labrador were used. The 2022 1-hour maximum CO measurement from St. John's was conservatively chosen to represent background concentration for the Project.

Table 5-7 summarizes the background concentrations that were used in the effects assessment for air quality (Section 5.5.2).

Table 5-7: Background Concentrations Used in the Effects Assessment

Contaminant	Averaging Period	Newfoundland and Labrador Ambient Air Quality Standards (µg/m³) [a]	Background Concentration (µg/m³)
Total particulate matter	Annual	60	10.8
	24 hour	120	24.1[b]
PM_{10}	Annual	–	11.3
	24 hour	50	
$PM_{2.5}$	Annual	8.8	3.6
	24 hour	25	
Nitrogen dioxide	Annual	100	4.9
	1 hour	400	
	24 hour	200	
Sulphur dioxide	Annual	60	0.79
	1 hour	900	
	3 hour	600	
	24 hour	300	
Carbon monoxide	1 hour	35,000	1,495
	8 hour	15,000	

(a) Government of Newfoundland and Labrador (O.C. 2022-072).

(b) Calculated by ECC using the arithmetic mean.

ECC = Government of Newfoundland and Labrador, Department of Environment and Climate Change; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; µg/m³ = microgram per cubic metre.

5.4.2 Climate

The existing conditions for the climate VEC were characterized using the most recent annual dataset from the federal National Inventory Report 1990–2022 (ECCC 2024), which includes GHG emissions information at industry and jurisdictional levels.

Canada's total annual GHG emissions reported for 2022 were 708 million tonnes of carbon dioxide equivalent ($MtCO_2e$). GHG emissions vary across provinces and territories and depend on the population size, energy sources, and types of industries (ECCC 2024). Newfoundland and Labrador's emissions for 2022 were estimated to be 8.6 $MtCO_2e$ (ECCC 2024).

The historical GHG emissions at the provincial and federal level are provided in Table 5-8 in terms of all sectors-total, heavy industry-total and heavy industry-mining Project GHG emissions are expected to contribute to all three of these categories. Baseline information for Newfoundland and Labrador and Canada was obtained from the National Inventory Report. Table 5-9 provides a further breakdown of Newfoundland and Labrador's GHG emissions attributed to mining within the heavy industry economic sector for the 2022 reporting year.

Table 5-8: Historical Greenhouse Gas Emissions (2018 to 2022)

Year	Annual GHG Emissions ($MtCO_2e$)					
	All Sectors – Total		Heavy Industry – Total		Heavy Industry – Mining	
	NL	Canada	NL	Canada	NL	Canada
2018	10.6	753	0.9	80	0.8	11
2019	11.1	752	1.1	79	1.1	11
2020	8.9	686	1.0	74	0.9	10
2021	8.4	698	1.2	78	1.1	11
2022	8.6	708	1.2	78	1.1	11

GHG = greenhouse gas; NL = Newfoundland and Labrador; $MtCO_2e$ = million tonnes of carbon dioxide equivalent.

Table 5-9: Newfoundland and Labrador's Greenhouse Gas Emissions Breakdown by Reporting Mining Facilities in 2022

Facility	Annual GHG Emissions ($MtCO_2e$)	% of Total NL Emissions	% of NL Heavy Industry Emissions	% of Total NL Mining Emissions
Iron Ore Company of Canada[(a)]	0.823	10%	71%	73%
Vale Voisey's Bay Mine Site	0.148	2%	13%	13%
Tacora Resources	0.111	1%	10%	10%
Tata Steel Mineral Canada	0.038	<1%	3%	3%
Canada Fluorspar Inc.	0.003	<1%	<1%	<1%

Source: Government of NL 2024.
(a) Operations include a pellet plant.
GHG = greenhouse gas; NL = Newfoundland and Labrador; $MtCO_2e$ = million tonnes of carbon dioxide equivalent.

5.5 Effects Assessment

The effects assessment for the air quality and climate VECs are presented in the following sections. The methods used to assess effects for each VEC are presented in Section5.5.1. The effect pathway screening, residual Project effect analysis and residual cumulative effect analysis for the air quality VEC is completed in Section 5.5.2 and the climate VEC is completed in Section 5.5.2.5.

5.5.1 Methods

5.5.1.1 Effect Pathway Screening

Interactions between Project components or activities, and the corresponding potential changes to the environment that could result in a potential effect to the air quality VEC were identified by an effect pathway screening. The effect pathway screening was used to inform the residual Project and cumulative effects analyses for the air quality VEC. Each pathway was initially assumed to have an interaction that would results in potential effects.

Potential pathways from Project activities to the air quality and climate VECs were identified using the following:

- review of the Project Description (Chapter 2) and scoping of potential effects by the EIS team for the Project
- input from engagement (Chapter 9)
- scientific knowledge
- review of EIS's for similar mining projects, including the previous EIS (Alderon 2012)
- previous experience with mining projects
- consideration of key issues (Section 5.3.1)

Potential adverse effects of the Project were then identified, and practicable mitigation was applied to avoid and/or minimize effects on air quality. Avoidance and minimization are widely recognized as the most important for biodiversity conservation (BBOP 2015). Avoidance designs and actions integrated into the Project were developed iteratively by the Project's EIS team. The effectiveness of mitigation measures proposed for each effect pathway was assessed to determine whether the mitigation would address the potential Project effect such that the pathway was eliminated or resulted in a negligible adverse effect on air quality, or if residual adverse effects on air quality from the Project remained following the implementation of mitigation measures.

This effect pathway screening was a preliminary assessment that was intended to focus the effects analysis on effect pathways that required a more quantitative or comprehensive assessment of effects on VECs. Using scientific knowledge, feedback from consultation, logic, experience with similar developments, and an understanding of the effectiveness of mitigation (i.e., level of certainty that the proposed mitigation would work), each effect pathway was categorized as one of the following:

- **No effect pathway**–The effect pathway could be removed (i.e., the effect would be avoided) by avoidance measures and/or additional mitigation so that the Project would result in no measurable environmental change relative to existing conditions or guideline values, and, therefore, would have no residual effect on the air quality or climate VECs.
- **Negligible effect pathway**–With the application of mitigation, the effect pathway could result in a measurable but minor environmental change relative to existing conditions or guideline values, but the change is sufficiently small that it would have a negligible residual effect on the air quality or climate VECs (e.g., for the air quality VEC an increase in an air quality parameters that is negligible compared to the existing environment and is well below the NLAAQS for that parameter). Further detailed assessment of the residual effect is not warranted as the effect pathway would not be expected to result in a significant residual Project or cumulative effect on the air quality VEC.
- **Residual effect pathway**–Even with the application of mitigation, the effects pathway is still likely to result in a measurable environmental change relative to existing conditions or guideline values that could cause a greater-than-negligible adverse or positive effect on the air quality or climate VECs and warrants additional assessment.

Project interactions determined as no effect pathway or negligible effect pathways were not carried forward for further assessment (Sections 5.5.2.1 and 5.5.3.1). Residual effect pathways that could result in changes to the environment with one or more associated measurable parameter and have the potential to cause a greater than negligible effect on the air quality or climate VECs, were carried forward to the residual Project effects analysis (Sections 5.5.2.2 and 5.5.3.2) and residual cumulative effects analysis (Section 5.5.2.3).

5.5.1.2 Residual Project Effect Analysis

5.5.1.2.1 Air Quality

The residual Project effects analysis for air quality measures and describes the effects of the Project on air quality relative to existing conditions. The residual Project effects analysis was completed using the temporal snapshot identified for the assessment (Section 5.3.3). The air quality assessment used a dispersion model, as described in the air quality dispersion modelling methods in Appendix 5A (Air Quality Dispersion Modelling Report), to predict the maximum ground-level concentrations of the COCs and deposition rates of particulates from the predicted Project emissions for the Operations phase. The predicted maximum ground-level concentrations of the COCs were compared to the existing environment, applicable regulatory criteria, and were used to describe changes to air quality.

Residual effects are described for each of the measurement indicators for the residual effect pathways identified. The Construction and Closure phases of the Project were assessed qualitatively following the approach taken in the previous EIS (Alderon 2012), while the Operations phase of the Project was assessed using an air dispersion model that allowed for a quantitative assessment.

The residual Project effects analysis used a reasoned narrative to describe anticipated changes to each measurable parameter caused by the Project. The measurable parameters for the Project with regards to air quality, are the and releases of COCs during the Construction, Operations, and Closure phases. This narrative description of anticipated effects is the foundation for the residual effects classification.

Residual effects are classified in tabular form using effects criteria, which is intended to provide structure and comparability across VECs assessed for the Project. The residual effects classification uses nature, magnitude, geographic extent, duration, timing, frequency, reversibility, and probability of occurrence as criteria. The approach to classify each residual effect criterion is provided in Table 5-10. Where possible, the criteria used the same definitions as the Alderon EIS so that residual Project effects assessment conclusions could be compared to the Alderon assessment. Following classification of residual Project effects, the analysis also evaluates the significance of residual Project effects using threshold criteria or standards beyond which a residual effect is considered significant. The definition of a significant effect for air quality is provided in Section 5.5.1.4.

Table 5-10: Definitions Applied to Effects Criteria Classifications for the Assessment of Air Quality

Criterion	Rating	Definition
Nature	Positive	Change in measurable parameter results in net improvement to the air quality.
	Neutral	Change in measurable parameter results in no change to air quality.
	Adverse	Change in measurable parameter results in net degradation of air quality.
Magnitude	Negligible	Maximum predicted concentration of Project emissions is less than 10% of baseline conditions and does not result in exceedances of the corresponding NLAAQS.
	Low	Maximum predicted concentration of Project emissions is greater than 10% of baseline conditions, but less than 50% of the corresponding NLAAQS.
	Moderate	Maximum predicted concentration of Project emissions is between 50% and 100% of the corresponding NLAAQS.
	High	Maximum predicted concentration is above the corresponding NLAAQS.
Geographic extent	Site Study Area	Change in measurable parameter is confined to the SSA.
	Local	Change in measurable parameter extends outside the SSA but within the LSA.
	Regional	Change in measurable parameter extends beyond the LSA but is confined to the RSA.
	Beyond regional	Change in measurable parameter extends beyond the RSA.
Duration	Short term	Effect is limited to the Construction phase or Closure phase of the Project.
	Medium term	Effect occurs in the short term and through the duration of the Project.
	Long term	Residual effect extends beyond the life of the Project.
Timing	Qualitative narrative or numeric quantification	Change in measurable parameter is described with a focus on seasonality (e.g., as applicable with description of how seasonal aspects may affect air quality or not applicable, where seasonal aspects are unlikely to affect air quality).
Frequency	Occasional	Change in measurable parameter is expected to occur infrequently (less than 5% of the time).
	Periodic	Change in measurable parameter is expected to occur consistently at regular intervals (between 5% and 25% of the time) or associated with temporal events (e.g., during hot, dry climatic conditions).
	Continuous	Change in measurable parameter is expected to occur at regular and frequent intervals (greater than 25% of the time).
Reversibility	Reversible	Change in measurable parameter is reversible after closure.
	Irreversible	Change in measurable parameter is predicted to influence the component indefinitely.
Probability of occurrence	Unlikely	Change in measurable parameter is not expected to occur, but not impossible.
	Possible	Change in measurable parameter may occur, but is not likely.
	Probable	Change in measurable parameter is likely to occur, but is uncertain.
	Certain	Change in measurable parameter will occur.
Ecological and socioeconomic context	n/a	Socioeconomic context is considered by predicting concentrations at receptors that could be considered sensitive for air quality, including cabin locations and community receptors. Ecological context is considered qualitatively through the identification of natural factors and anthropogenic sources that contribute to effects on air quality.
	n/a	

LSA = local study area; NLAAQS = Newfoundland Ambient Air Quality Standards; RSA = regional study area; SSA = site study area; n/a = not applicable.

5.5.1.2.2 Climate

The residual Project effects analysis for climate considered the quantity of GHG emissions (i.e., estimated the GHG emissions expected to be generated from the Project). The Project has the potential to emit GHGs throughout all Project phases (i.e., Construction, Operations, and Closure) as a result of the various processes and activities that result in GHG emissions.

For the purposes of accounting and reporting, as defined by *The Greenhouse Gas Reporting Protocol: A Corporate Accounting and Reporting Standard* (WRI and WBCSD 2013), referred to hereafter as the GHG Protocol, GHG emissions are typically classified as direct or indirect GHG emissions, and further categorized into Scope 1, Scope 2, or Scope 3. These three scopes are generally defined as follows:

- **Scope 1: direct GHG emissions**–Emissions occurring from sources that are owned or controlled by a proponent (e.g., haul trucks, generators, vehicles).
- **Scope 2: indirect GHG emissions**–Emissions from the generation of purchased electricity, heating, and cooling consumed by the proponent.
- **Scope 3: other indirect GHG emissions**–Emissions that are a consequence of a proponent's activities but occur from sources not financially or operationally controlled by that proponent (e.g., emissions from waste, the extraction and production of purchased materials, and business travel).

The provincial EIS Guidelines require quantification of a variety of categories of GHG emissions, including Direct (Scope 1) GHG emissions from activities within the Project boundary (i.e., on-site stationary combustion, on-site electricity generation, and mobile transportation), Indirect (Scope 2) GHG emissions from purchased electricity, and some Indirect (Scope 3) GHG emissions from activities from outside the Project boundary. The methods for estimating the various categories of GHG emissions assessed in this report are summarized in the following sub-sections.

5.5.1.2.2.1 Direct Greenhouse Gas Emissions Subject to Regulatory Reporting

This section describes the methodology used to estimate direct Scope 1 Project GHG emissions that would be reportable under the MGGA and GHGRP. For each emission source, emissions are estimated for the measurable parameters of CO_2, CH_4, and N_2O. These emissions are all considered Scope 1 GHG emissions as they result from equipment owned or controlled by the Project. Furthermore, contractor equipment (e.g., for overburden removal) has been included in this category for this assessment.

The GHG emission source categories listed in Schedule D of *Newfoundland and Labrador Regulation 14/17* that are applicable to the Project are listed below.

- general stationary combustion (includes mining explosives)
- mobile equipment
- electricity generation

Estimates of GHG emissions that would be reportable under the MGGA and GHGRP were completed following guidance in the document A Guidance Document for Reporting Greenhouse Gas Emissions for Large Industry in Newfoundland and Labrador published in March 2017 (Government of NL 2017), referred to in this report as the GHG Guideline. Any differences between the GHG Guideline and methodologies prescribed under the federal GHGRP are assumed to be negligible for the purpose of this assessment. Table 5-11 outlines the GHG estimation methodology that was used for each GHG.

Table 5-11: Greenhouse Gas Estimation Methodology

Emission Source Category	GHGs Assessed	GHG Guideline Section Reference	Equation
General stationary fuel combustion	CO_2	6.3.2	Equation 6-4
	CH_4, N_2O	6.4	Equation 6-10
Fuel combustion by mobile equipment at facilities	CO_2	7.3	Equation 7-1
	CH_4, N_2O	7.4	Equation 7-4
On-site electricity generation	CO_2	6.3.2	Equation 6-4
	CH_4, N_2O	6.4	Equation 6-10
Mining explosives	CO_2	10.2	Equation 10-1

GHG = greenhouse gas; CH_4 = methane; CO_2 = carbon dioxide; GHG = greenhouse gas; N_2O = nitrous oxide.

A generalized equation for the GHG estimation methodology is presented below in equation 1.

$$E_{GHG} = Consumption_i \times EF_{GHG} \times UC \quad (1)$$

Where:

- E_{GHG} = estimate of emissions a given GHG (CO_2, CH_4, or N_2O) in tonnes/year
- *Consumption* = consumption of product/yearly (estimated by Champion)
- EF_{GHG} = emission factor of a given GHG (CO_2, CH_4, or N_2O) taken from the GHG Guideline
- *UC* = unit conversion factors

Based on the annual estimates of individual GHGs estimated using equation 1 above, a total GHG release in terms of tonnes of CO_2 equivalents (tCO_2e) was estimated using the equation 2.

$$E_{tCO2e} = E_{CO_2} + E_{CH_4} \times GWP_{CH_4} + E_{N_2O} \times GWP_{N_2O} \quad (2)$$

Where:

- E_{tCO2e} = total annual GHG estimate in tCO_2e
- E_{CO2} = total annual CO_2 emissions estimate from all sources in the assessment
- E_{CH4} = total annual CH_4 emissions estimate from all sources in the assessment
- GWP_{CH4} = global warming potential of CH_4
- E_{N2O} = total annual N_2O emissions estimate from all sources in the assessment
- GWP_{N2O} = global warming potential of N_2O

Emission factors and global warming potentials used for this assessment, along with references to the GHG Guideline are provided in Appendix 5D (Greenhouse Gas Emission Calculations). Based on the mine design, Champion developed annual energy consumption estimates by equipment during the Construction and Operations phases. The annual energy consumption data used to estimate annual GHG emissions are included in Appendix 5D.

With respect to the Construction phase, fuel estimates for years -4 to -1 are currently only available from Champion for mining-related equipment used in the construction years, starting at Year -2. GHG emissions estimates from construction were taken from the previous EIS and added to the estimates for mining-related equipment used during construction. These estimates are understood to include power generation equipment. Since the individual source emissions breakdowns are not available in the previous EIS, the GHG emissions from construction cannot be broken down by category, and only total emissions amounts of CO_2, CH_4, N_2O, and carbon dioxide equivalent (CO_2e) are presented.

Energy consumption during the Closure phase was conservatively assumed to be equivalent to the average of the final two years of the Operations phase, when mining operations begin to reduce and milling of remaining ore stockpile reserves are undertaken.

There are no additional direct GHG emissions anticipated for the Project, other than GHG emissions associated with the loss of carbon sinks, which is outlined in the following section.

5.5.1.2.2.2 Greenhouse Gas Emissions Associated with Loss of Carbon Sink Due to Land Clearing

The draft technical guide related to the strategic assessment of climate change (DTG SACC) (Government of Canada 2021a) provides detailed instructions on the calculation of GHG emissions regarding Scope 1 GHG emissions related to impact on carbon sinks. These calculations are based on the equations presented in of the 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories (IPCC 2006) Volume 4, Chapter 2, Section 2.3 and are presented in Appendix 5D along with the site-specific data sources and assumptions used in the calculations.

Project construction will require land clearing to prepare mine areas, laydowns, buildings, roadways, and other Project features. While the exact location and land area that will be developed is yet to be determined, a maximum disturbance area (MDA), assumed to be a 50 m zone around the Project footprint for a total area of 2,998 ha, was considered. The MDA is composed of approximately 2,206 ha of forest, 71 ha of shrubland, 607 ha of wetland, and 67 ha of water. Only lands categorized by the Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories (IPCC 2006) as being Forest Land or Wetlands are considered as carbon sinks. It is assumed that all land within the MDA will be cleared, to provide a conservative estimate of the impact on carbon sinks.

The DTG SACC describes three possible approaches (tiers) for estimating GHG emission from foregone carbon sequestration, where Tier 1 is a generic approach with default international parameters, Tier 2 uses the same framework but replaces default parameter values with site- or region-specific data, and Tier 3 uses modelling with site-specific data as inputs. Given the size of the MDA, the DTG SACC methodology requires that a Tier 2 approach is used.

In the absence of detailed spatial data, the ecodistrict classification of the site was defined in *Labrador Nature Atlas: Ecozones, Ecoregion and Ecodistricts* (Riley et al. 2013). Each ecodistrict classification is associated with a generalized description, including climate, geology and substrates, land cover and water, which were used to estimate inputs to the carbon stock calculations in the following subsections in lieu of carrying out comprehensive field measurement campaigns. The Project falls under the Wabush Ecodistrict (D-02) and is classified as the McPhayden Plateau Ecoregion in the Taiga Shield Ecozone. The Wabush Ecodistrict is characterized by rocky hills, blanketed with thin glacial drift, supporting lichen-rich spruce dominant woodlands, intersected by wetlands (Riley et al. 2013). Additionally, the Pre-feasibility Study (Champion 2023a) identifies exposed outcrop in the central area of the property, where forest fire incidents are evident. Outside of this area, there is minimal exposed outcrop and tree stands consist of various coniferous and deciduous trees with alder growth over burnt areas.

The impact to carbon sinks quantifies foregone carbon sequestration or how much carbon would have been taken up by the ecosystem in the absence of the Project. Carbon sink impact can be estimated using Equation 3 below.

$$CSI = \sum_{i} ((NatFlux - PostDFlux)_i \cdot T_i \cdot A_i) \quad (3)$$

Where:

- CSI = carbon sink impact.
- $NatFlux$ = natural annual carbon accumulation rate of the land being impacted (tonnes of carbon per hectare per year)
- $PostDFlux$ = post-disturbance flux rate impacted by the Project (tonnes of carbon per hectare per year); assumed annual carbon sequestration capacity of the land to be 0 after it has been converted to a mine
- T_i = is the time interval (years); default value of 100 per the DTG SACC (Government of Canada 2021a)
- A_i = area of soil undergoing disturbance (hectares) for ecosite i.

Where default values are not available, the natural annual carbon accumulation rate (NatFlux) can be calculated using Equation 4 below.

$$NatFlux_{Forest} = \frac{BM_{MCC} - BM_{Curent}}{Age_{MCC} - Age_{Curent}} \quad (4)$$

Where:

- BM_{MCC} = living tree Biomass at maximum carrying capacity (MCC) (tonnes of carbon per hectare)
- $BM_{Current}$ = living tree Biomass at current age of the forest stand (tonnes of carbon per hectare)
- Age_{MCC} = is the age at which the MCC is reached (years)
- $Age_{Current}$ = is current age of forest stand (years)

Table 5-12 presents the data used to quantify the impact on carbon sinks. While site-specific biomass data are not available for the Project, biomass values of the current forest stand was derived based on Canada's National Forest Inventory Photo Plot Data, identifying plot ID833571 as the closest dataset (Government of Canada 2021b). The age of the forest stand was not available in the ground plot data, so current forest stand age was estimated using the Canadian National Forest Inventory, identifying data specific to the leading tree species (black spruce) and the Taiga Shield ecozone (Government of Canada 2023). Default Values of Tree Biomass and Age at Maximum Carrying Capacity were taken from Annex E of the DTG SACC (Government of Canada 2021a) for black spruce with the Taiga Shield ecozone from the Northwest Territories. No default values were available for Newfoundland and Labrador; therefore, the default value from Northwest Territories was considered an adequate proxy.

The NatFlux for the wetlands, classified as fens, was determined using national default values found in Table 32 in the DTG SACC (Government of Canada 2021a). As a result, the fens have been classified as a source of carbon and will therefore be omitted from the assessment.

Table 5-12: Data Inputs for Carbon Sink Impact of the Project

Category	BM_{MCC}: Living Tree Biomass at Maximum Carrying Capacity (t of C/ha)[a]	$BM_{Current}$: Living Tree Biomass at Current Age of the Forest Stand (t of C/ha)[a]	Age_{MCC}: Age at which the Forest Stand is at Maximum Carrying Capacity (yr)	$Age_{Current}$: Current Age of the Forest Stand (yr)	NatFlux: Natural Carbon Flux Rate (t of C/ha/yr)
Forest	58[b]	45[c]	222[2]	112[3]	-0.08
Wetlands (fens)	n/a	n/a	n/a	n/a	0.063[2]

(a) t of C/ha/yr = tonnes of carbon per hectare per year.
(b) Government of Canada 2021a.
(c) Government of Canada 2023.
t of C/ha = tonnes of carbon per hectare; t of C/ha/yr = tonnes of carbon per hectare per year; n/a = not applicable.

5.5.1.2.2.3 Indirect Greenhouse Gas Emissions from Purchased Electricity

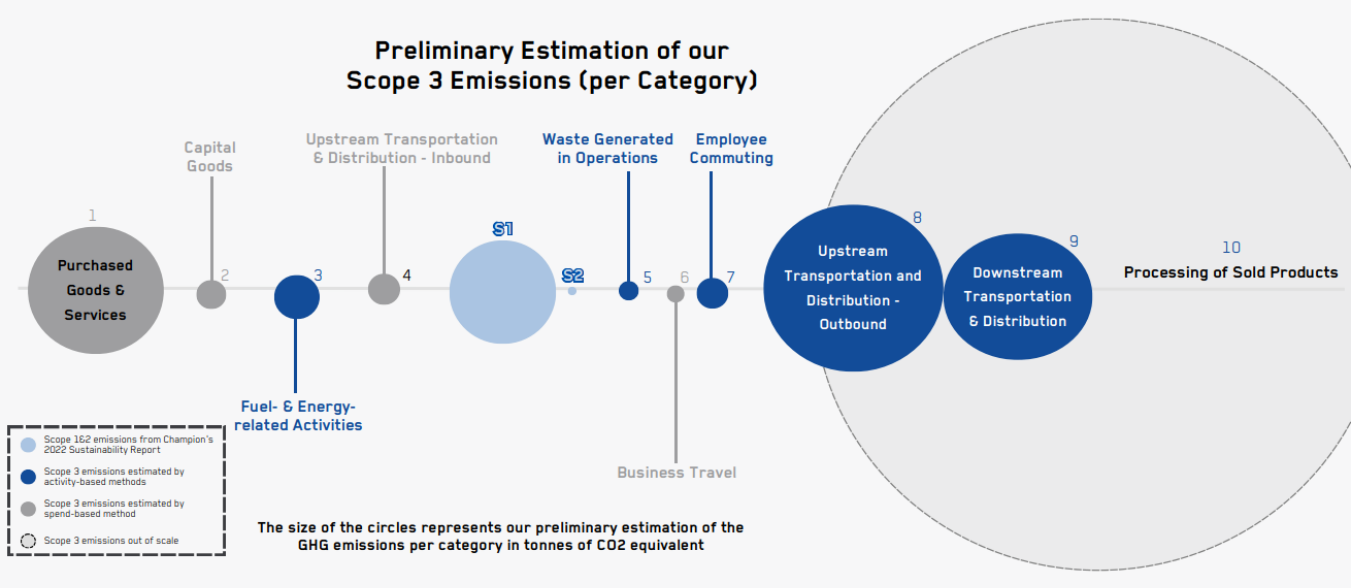
Annual indirect GHG emissions from consumption of purchased electricity (Scope 2) were estimated using annual purchased electricity consumption estimated by Champion by equipment or process, and the current projections of electricity grid intensities from Canada's First Biennial Transparency Report under the Paris Agreement (Government of Canada 2024). These emissions are considered Scope 2 (indirect) emissions and are not regulated under the MGGA. Electricity consumption during the Closure phase was conservatively assumed to be equivalent to the average of the final two years of the Operations phase.

5.5.1.2.2.4 Preliminary Estimates of Indirect Greenhouse Gas Emissions Associated with Various Activities outside the Project Boundary

The provincial EIS guidelines require assessment of "annual GHG emissions by source for activities outside the Project boundary such as on-road, air and marine transportation, solid waste and significant purchased services from providers outside the Project boundary" for the Construction, Operations, and Closure phases of the Project. Following guidance in the GHG Protocol, these GHG emission would be considered Scope 3 GHG emissions. It is important to note that the Scope 3 GHG estimates presented in this report are preliminary, and do not represent a complete Scope 3 inventory for the Project.

At the current stage of the Project, GHG emissions associated with activities outside the Project boundary can be difficult to accurately quantify due to complexities involved when predicting future procurement and the uncertainty surrounding an entire value chain. Champion has completed a preliminary evaluation of the 15 Scope 3 GHG emissions categories outlined in the GHG Protocol document *Corporate Value Chain (Scope 3) Accounting and Reporting Standard* (GHG Protocol 2013), referred to hereafter as the Scope 3 Standard, for Champion's Bloom Lake Mine operations. Bloom Lake mine is an iron ore mine, located within 20 km of the Project, and would share many similarities in terms of upstream and downstream activities, including rail and marine transportation of iron ore concentrate. For the purpose of this preliminary assessment, the Scope 3 Study for the Bloom Lake operations generally forms the basis of the GHG emissions estimates for the activities outside the Project boundary required by the provincial EIS guidelines, as this is currently the best available information on which to base estimates for the Project.

The following figure outlines the results of preliminary estimation of Champion's Scope 3 emissions study for Bloom Lake Mine. The numbering of the Scope 3 emission sources in the figure correspond to the Scope 3 GHG emission source categories in the Scope 3 Standard.



Source: Champion 2024.

Figure 5-3: Champion's Preliminary Estimation of Scope 3 Greenhouse Gas Emissions

The following sections outline how preliminary estimates of Project GHG emission from the Scope 3 categories outlined in the provincial EIS guidelines have been developed based on best available information at this stage of Project development. Refinement to these estimation methods will be possible in the future as more detailed information on the Project becomes available.

On-road

Preliminary estimates have been prepared based on the Scope 3 Study completed by Champion for Bloom Lake Mine described above. On-road GHG emissions for the Bloom Lake Mine are covered under Category 4 (Upstream Transportation & Distribution – Inbound) and Category 7 (Employee Commuting) in Figure 5-3. Based of the proportional GHG emissions as shown in Figure 5-3, on-road GHG emission are estimated to be no more than 25% of the annual Scope 1 emissions.

On-road emissions outside of the Project boundary are assumed to be negligible during Closure phase of the Project in comparison with Construction and Operations phases.

Rail Transportation

During Construction, GHG emissions associated with rail equipment transportation and operation is expected to be less than those estimated for Operations. High-level estimates of GHG emissions are based on GHG emission projections associated with rail construction, provided in the Alderon 2012 EIS.

Based on the Scope 3 Study completed by Champion for Bloom Lake Mine, an emission factor of 10.9 kilotonnes of carbon dioxide equivalent ($ktCO_2e$) per million tonnes of concentrate produced has been estimated for the Operations phase. This emission factor is based on the estimated emissions for rail transport per unit of production for a comparable distance for Bloom Lake Mine. Based on this emission factor, annual rail transport emissions were estimated for the Operations phase based on annual Project production projections.

GHG emissions from rail transportation are expected to be less during the Closure phase of the Project, compared to Operations, based on reduced concentrate production.

Marine Transportation

Similar to rail transport, an emission factor has been developed for marine shipping for the Project, based on the Scope 3 GHG emissions assessment completed by Champion for Bloom Lake Mine. This is based on the expected similarities between the Bloom Lake Mine marine shipping routes and the anticipated Project marine shipping routes. The emission factor developed is 49.8 $ktCO_2e$ per million tonnes of concentrate produced.

GHG emissions from marine transportation during construction are assumed to be negligible for the purpose of the assessment, as there is no concentrate to transport. GHG emissions from marine transportation are expected to be less during the Closure phase of the Project, compared to Operations, based on reduced concentrate production.

Air Travel

Section 21.1.15.1 of the report entitled Pre-feasibility Study for the Kamistiatusset (Kami) Iron Ore Property (Champion Iron 2023) included an estimate of 48,800 contractor round-trip flights to support construction. Distances for these flights are not provided in the pre-feasibility study. Emission factors for air travel taken from United States Environmental Protection Agency have GHG Emission Factor Hub (US EPA 2025) in terms of CO_2e per passenger miles have been used to approximate potential GHG emissions due to air travel during construction. This method is consistent with guidance provided in the Scope 3 Standard. For the purpose of this assessment, a distance of 1,000 miles (approximately 1,600 km) has conservatively been assumed for each one-way flight, as this radius from the Project encompasses major population centres in Newfoundland and Labrador, Québec, and northern and southern Ontario.

Based on Champion's Scope 3 estimates for Bloom Lake, Scope 3 emissions associated with air travel related to the Project during the Operations and Closure phases are assumed to be lower than those estimated for Construction.

Solid Waste

GHG emission estimates for solid waste are based on the proportional relationship as shown in Figure 5-3, from the Scope 3 Study completed by Champion for Bloom Lake Mine, where GHG emissions from waste generated during operations are about 4% of the annual Scope 1 emissions.

Significant Purchased Services from Providers

As outlined in the Scope 3 Standard, Scope 3 Category 1 – Purchased Goods and Services includes all upstream (i.e., cradle to gate) emissions from the production of products purchased or acquired by the reporting company in the reporting year. Products include both goods (tangible products) and services (intangible products). The provincial EIS guidelines request estimates of GHG emissions from "significant purchased services".

As indicated in Section 5.5.1.2.2.1, contractor GHG emissions within the Project boundary are included in that category of GHG emissions. Similarly, delivery of equipment and building materials during the Construction phase is included in the on-road category. Based on the current information for the Project, GHG emissions from "significant purchased services from providers" is assumed to be covered by these estimates and no further assessment of Scope 3 GHG emissions related to purchased services from providers has been completed.

5.5.1.2.2.5 Non-combusted and Industrial Process Greenhouse Gas Emissions

There are no non-combusted or industrial process GHG emission sources anticipated for the Project and, therefore, no quantifications are required for this category.

5.5.1.2.2.6 Carbon Dioxide Sequestration

The Project does not currently include any plan for on-site sequestration of Project carbon dioxide emissions, export of Project carbon dioxide emissions to a separate site for sequestration or purchase and on-site sequestration of non-Project carbon dioxide. As such, no quantifications are required for this category.

5.5.1.2.2.7 Effects of Project on Provincial Greenhouse Gas Emission Levels

GHG emissions for industry, as reported in national and provincial inventory databases, focus on direct emissions (Scope 1), which are considered direct GHG emissions from within the Project boundary. As such, only direct GHG emissions are captured in the assessment on the effects of the Project on provincial GHG emission levels.

5.5.1.2.2.8 Residual Project Effect Characterization

The residual effects analysis measures and describes the effects of the Project on the climate VEC relative to existing conditions. The residual effects analysis was conducted using the temporal snapshot identified for the assessment. Residual effects are described for each of the measurable parameters for the residual effect pathways identified (Section 5.5.1.2.2).

The residual effects analysis considered the quantity of GHG emissions (i.e., measured the quantitative estimates of GHG emissions expected to be generated from the Project). For the climate VEC, most residual effects criteria do not vary due to the long-term to permanent (i.e., duration) and global nature (i.e., beyond regional extent) of GHGs. The effects of GHG releases are invariably adverse, continuous, and irreversible (i.e., lasting well beyond when the contribution of GHGs ceases). Therefore, when considering GHGs, the only applicable residual effects criterion is magnitude. The approach to classify magnitude is provided in Table 5-13.

Table 5-13: Definitions Applied to Effects Criteria Classifications for the Assessment of Climate Valued Environmental Component

Criterion	Rating	Definition
Magnitude	Negligible	Effects that are so small that they are neither detectable nor measurable
	Low	Average annual GHG emissions 0.1% to 1% of the annual provincial emission levels, or 0.01% to 0.1% of the annual federal emission levels
	Moderate	Average annual GHG emissions >1% to <5% of the provincial annual emission levels, or >0.1% to <0.5% of the federal annual emission levels
	High	Average annual GHG emissions >5% of the provincial annual emission levels, or >0.5% of the federal annual emission levels

GHG = greenhouse gas.

5.5.1.3 Residual Cumulative Effect Analysis

The cumulative effects assessment builds on the results of the residual Projects effects assessment and considers the incremental changes that were predicted to likely have a residual adverse effect on air quality. This would include the effects of past and current projects or past climate-related changes (i.e., forest fires), which contribute to existing conditions upon which residual Project effects are assessed. For the EIS, the description of the existing conditions characterizes the environment already affected by past and current projects and activities and applies a background concentration to the air dispersion modelling; therefore, the cumulative effects assessment focused on analyzing the effects of other RFDs in combination with the Project. Although positive residual effects are characterized in the residual Project effects analysis, they are not carried forward to the cumulative effects analysis, as the Project benefits from other past, present and RFDs or activities are unlikely to be known or publicly disclosed (e.g., Benefit Agreements with Indigenous groups or local community stakeholders).

The cumulative effects assessment followed a three-step process:

- Identify RFDs and potential cumulative effects that overlap in time and space with residual effects.
- Identify and describe any additional mitigation measures, if applicable.
- Characterize residual cumulative effects, using the same criteria defined for the residual Project effects analysis (Section 5.5.1.2)

Chapter 4 provides a list of known RFDs and physical activities with potential residual effects that could overlap spatially and temporally with the Project's residual environmental effects. Following the identification of applicable RFDs, cumulative effects on air quality were evaluated. The cumulative effects assessment used publicly availably information (e.g., Project Registrations or EIS reports), to describe the environmental effects of RFDs to air quality. If potential cumulative effects were identified, they were assessed qualitatively because release estimates from each RFD were not publicly available.

A residual cumulative effects assessment was only completed for the air quality VEC, as a residual cumulative effects assessment for the climate VEC is implicitly included in the residual Project effects analysis by nature of the effects of GHG emission. The residual Project effects analysis already considers the cumulative effects of historical, existing, and future projects through comparison to provincial and federal emissions levels and the continued ability for Canada to reach climate change commitments in form of emission reduction targets (Section 5.5.3.2); therefore, the residual cumulative effects analysis is out of scope and is already included in the residual Project effects analysis that provides the necessary information for the provincial government to consider the Project relative to future development. As such, there is no additional information provided for residual cumulative effects for climate above and beyond the analysis completed for the residual Project effects analysis.

Following classification of residual Project and cumulative effects using the criteria defined in Section 5.5.1.2.1 for air quality and Section 5.5.1.2.2 for the climate VEC, the analysis evaluated the significance of residual adverse effects. The definition of a significant Project and cumulative effect for the air quality VEC, and residual Project effect for the climate VEC is provided in Section 5.5.1.4.

5.5.1.4 Significance Determination

The significance of adverse residual Project and cumulative effects on air quality was evaluated by following the approach provided in Chapter 4, Section 4.8 (Significance Determination). The classification of residual effects criteria provided the foundation for determining if the threshold for significance was exceeded.

For the air quality VEC, a significant adverse residual effect was defined as a Project-related environmental effect that degrades the quality of the ambient air such that ground-level concentrations at identified receptors within the vicinity of the Project repeatedly exceeds the respective air quality standard.

The significance of adverse residual effects on the climate VEC was evaluated by defining a significance threshold to determine if the threshold for significance was exceeded. The significance thresholds for the climate VEC are the following:

- contribution of Project GHG emissions to the provincial and federal totals
- continued ability for the Province and Canada to reach climate change commitments in the form of emission reduction targets

Confidence in the significance prediction for the climate VEC was identified and discussed as part of the reasoned narrative.

5.5.2 Air Quality

5.5.2.1 Effect Pathway Screening

The effect pathway screening predicts potential effects pathways that are then evaluated, considering proposed mitigation, to predict whether the effect pathway has the potential to cause residual adverse or positive effects.

The effectiveness of mitigation measures proposed for each effect pathway, was assessed to determine whether the mitigation would address the potential Project effect such that the effect pathway was eliminated or would result in a negligible adverse effect on a VEC. The majority of air emissions related to the Project will consist of fugitive releases of dust from blasting, material handling, and traffic on unpaved roads; therefore, a number of mitigation measures to control the releases of air emissions during the Construction, Operations, and Closure phases of the Project have been proposed. The measures will be described in the Project-specific Environmental Protection Plan (Annex 5D) and will include the following:

- Water and/or dust suppressants may be applied to unpaved roads and disturbed areas of the overburden and mine rock stockpiles during activities or temporal periods that have an increased potential to generate dust.
- Dust suppressants that minimize environmental risk and are government approved will be used.
- Vehicle speed on unpaved roads will be limited to reduce fugitive dust.
- Idling of vehicles and equipment will be limited to the extent practicable.
- Mobile mining equipment and vehicles will be maintained, and the equipment will be operated within the parameters for engine exhaust system design.
- A Project-specific Environmental Effects Monitoring Program that includes ambient air monitoring will be implemented (Annex 5E).
- Exposed dust sources will be revegetated and progressive rehabilitation will be completed whenever appropriate.

The following mitigation measures and environmental design features specific to the Operations phase will be employed:

- use of electric drills and shovels to reduce diesel exhaust emissions from the mining fleet
- use of covered conveyors when required to reduce fugitive releases of dust
- use of pollution control technology at material transfer points
- maintenance of pollution control equipment (dust collectors and bin vents)

The ambient air quality monitoring program will be implemented during each Project phase to verify the model predictions, assess the effectiveness of mitigation measures, and inform if further mitigation measures are required. A preliminary framework for a monitoring program is presented in the Environmental Effect Monitoring Program (Annex 5E). The effectiveness of mitigation measures will be re-assessed through the life of the Project and opportunities for continuous improvement of dust management practices will be investigated, as required. The ambient air quality monitoring program will be in addition to the existing ambient air quality network currently operated by Rio Tino IOC and Tacora in Western Labrador.

The effects pathway screening is summarized in Table 5-14. As described in Section 5.5.1.1, each effect pathway was categorized as one of the following:

- **no effect pathway** (i.e., avoidance measures and/or mitigation results in no residual effect on air quality)
- **negligible effect pathway** (i.e., mitigation results in negligible effect on air quality)
- **residual effect pathway** (i.e., effect that is greater than negligible and carried forward for further assessment)

The subsections following the table provide the rationale used to assign potential effects on the no effect pathway and negligible effect pathway categories and list residual effect pathways. Each Project component/activity identified as a residual effect pathway was carried forward for detailed assessment in Section 5.5.2.2.

Table 5-14: Potential Effects Pathways for the Air Quality Valued Ecosystem Component

Project Components/Activities	Effects Pathway	Project Environmental Design Features, Mitigation or Enhancement Measures	Effect Pathway Screening
Project components/activities that release COCs during Construction, Operations, and Closure include: **Construction** — Site preparation, including vegetation clearing and earthworks — Handling and storage of overburden — Road development, including culverts and bridge installation — Construction of facilities and infrastructure — Construction of tailings management facility starter dam — Handling and storage of mine rock — Drilling and blasting — Power generation — Operating mobile construction equipment — Site traffic, including transportation of personnel and materials to and from site **Operations and Maintenance** — Open pit mining, including blasting and crushing ore and mine rock — Operating mobile mining equipment — Handling and storage of overburden, mine rock and ore — Operation and management of the tailings management facility — Processing iron ore concentrate — Railcar loading and transportation — Site traffic, including transportation of personnel and materials to and from site **Closure** — Removal of infrastructure, restoration and revegetation of facilities and infrastructure — Site traffic, transportation of personnel and materials to and from site	Releases of COCs from Project activities can affect air quality during the Construction, Operations, and Closure phases of the Project.	— Crushed ore material transfers would be covered with dust collection technology to minimize fugitive dust from crushed ore. — Install the transmission line within the first year of construction to minimize consumption of diesel fuel for power. — Use electric drills and shovels to reduce diesel exhaust emissions from the mining fleet. — Minimize areas of vegetation clearing and soil disturbance to reduce the generation of fugitive dust. — Maintain mobile mining equipment and vehicles and operate the equipment within parameters for engine exhaust system design. — Limit idling of vehicles and equipment to the extent practicable. — Conduct regular equipment maintenance to prevent the likelihood of upset conditions. — Apply water and/or dust suppressants to site roads, including the access road, as necessary. — Apply water sprays to stockpiles or areas that have visible dust, as necessary. — Use dust suppressants that minimize environmental risk and are government approved. — Limit vehicle speed on unpaved roads to reduce fugitive dust. — Use the best available pollution control technology at material transfer points. — Implement a cabin owner compensation program. — Implement a Project-specific Environmental Protection Plan that includes mitigation to reduce COC emissions during all Project phases. — Implement a Project-specific Environmental Monitoring Plan that includes ambient air monitoring for COCs.	Residual effect pathway

COC = contaminant of concern.

5.5.2.1.1 No Effect Pathways

There are no Project-environment interactions that result in no effect pathways for air quality.

5.5.2.1.2 Negligible Effect Pathways

There are no Project-environment interactions that result in negligible effect pathways for air quality.

5.5.2.1.3 Residual Effect Pathways

Project interactions that have the potential for a greater than negligible effect on air quality require further consideration and were advanced to the residual effects analysis. Because each Project phase is predicted to release COCs, the Project interactions were predicted to be residual effect pathways to air quality. Indigenous groups and local stakeholders have also expressed concerns related to dust generation and changes to air quality from Project activities. Fugitive dusts are particulates that are emitted the atmosphere from open sources such as a roadway, stockpile, conveyor system, or material transfer activity. There will also be particulate released from point sources at the Project, which are confined flow streams such as an exhaust pipe or stack, which are not classified as fugitive dust (USEPA 1995). Fugitive dust emissions are commonly linked to mechanical disturbances that may result from equipment movement, aggregate handling, the wind, or a combination thereof; therefore, some fugitive dust emissions occur and/or are intensified as a result of equipment use, while others are independent of equipment use (i.e., wind erosion emissions). The main factors affecting the amount of fugitive dust emitted from a source include characteristics of the granular material being disturbed (i.e., particulate size distribution, density and moisture) and intensity and frequency of the mechanical disturbance (i.e., wind conditions and/or equipment use conditions). Precipitation and evaporation conditions can affect the moisture of the granular material being disturbed and, therefore, have an indirect effect on the amount of fugitive dust emitted. Once dust is emitted, its travelling distance from the source is affected by particle size distribution and climatic conditions, such as wind speed, wind direction, precipitation. Higher wind speeds increase the distance dust travels while precipitation can accelerate dust deposition. Finer particulates travel farther before settling.

The residual effects pathway for air quality was defined as:

- Releases of COCs from Project activities may affect air quality during all Project phases.

This effect pathway was advanced for further assessment of residual effects. As part of the proposed approach for the Project, predicted changes to the air quality VEC presented in Section 5.5.2.2 are carried through to the assessments of the following VEC technical chapters:

- Surface Water (Chapter 8)
- Fish and Fish Habitat (Chapter 9)
- Vegetation, Wetlands, and Protected Areas (Chapter 10)
- Wildlife (Chapter 11)
- Indigenous Land and Resource Use (Chapter 13)
- Other Land and Resource Use (Chapter 14)

Predicted changes to air quality were also considered in the human health risk assessment (TSD XI), which informed the assessment of the community health and well-being VEC (Chapter 17).

5.5.2.2 Residual Project Effect Analysis

This section describes the residual Project effects analysis for air quality for the residual effects pathway identified in Section 5.5.2.1.3. Methods for completing the residual Project effects analysis are presented in Section 5.5.1.

The air quality effects assessment focused on the COCs that have ambient air quality standards in Table 1 of Schedule A of the Government of Newfoundland and Labrador *Air Pollution Control Regulations, 2022* (O.C. 2022-027) (Government of NL 2022). The residual effects analysis was completed for each of the temporal boundaries for the Project. During the Closure phase, releases to air are expected to be similar to or less than during Construction and Operations, so the assessment for Closure was completed qualitatively.

Emission rates from Project activities in the Construction and Operations phases were calculated using Project-specific activity and equipment specifications where available. Several assumptions were required to complete the emission estimates, and these assumptions are documented in the Emission Estimates Methods included in Appendix 5B (Air Quality Release Estimates – Operations Phase). Internationally accepted emission factors, most notably emission factors published in the United States Environmental Protection Agency AP-42: Compilation of Air Pollutant Emissions Factors from Stationary Sources (AP-42) (US EPA

1995) were used to estimate emissions. The CALPUFF plume dispersion model is a non-steady state puff dispersion model was used to simulate pollutant transport over complex terrain. CALPUFF can be used to predict ground level concentrations from tens of metres to hundreds of kilometres from a source (Earth Tech Inc. 2000). CALPUFF is the preferred dispersion model for sites located in Newfoundland and Labrador as outlined in the *Guideline for Plume Dispersion Modelling* (Government of NL 2012) published by ECC. The modelling methods, including a discussion of the meteorological data, receptors, model source inputs, and model options are described in detail in Appendix 5A.

5.5.2.2.1 Construction Phase

Construction is expected to occur over a four-year period. During construction, releases of air contaminants may result from site preparation activities including site clearing and grading, which involves various earth moving and excavating equipment. The areas of the Project that require site preparation include the mine rock disposal area, the process plant and infrastructure sites, rail line, site roads, ore stockpile areas, and the Tailings Management Facility (TMF). Releases during construction may also occur from stationary fuel combustion, mobile equipment exhaust, vehicle travel on unpaved roads, cement production, crushing, screening, and blasting. During the construction of site roads and infrastructure, diesel-powered construction equipment will be used such as mobile cranes, boom trucks, generators, and dump trucks.

Releases of particulate matter (TPM, PM_{10}, and $PM_{2.5}$) and combustion gases (CO, NO_2, and SO_2) are predicted from diesel fuel combustion in construction equipment, diesel fuel combustion in power generators, and explosive detonation. Dust (TPM, PM_{10}, and $PM_{2.5}$) is expected from earth moving operations, travel on unpaved roads, and blasting.

Champion is proposing to construct and commission a temporary transmission line during the first year of construction to provide sufficient power to commission Project infrastructure during the last three years of construction; however, as the timing of construction of the transmission line is dependent on the completion of the NL Hydro Labrador West Transmission Study and overall coordination with NL Hydro, it was conservatively assumed that power during all years of construction will be supplied by diesel generators.

The estimated releases were used to predict the change to air quality during construction for Project related COCs. The annual estimated releases to air from Project construction were based on the anticipated construction activities presented in Table 5-14. The release estimates were calculated using published emission factors such as those from the United States Environmental Protection Agency AP-42 (US EPA 1995). Where appropriate, the construction emissions calculated in the Alderon EIS (Alderon 2012, 2013) were used to estimate construction emissions for the Project, because most proposed construction activities have not changed; however, Champion proposed to also include releases for two portable crushers, two portable screeners, two diesel power generators, and blasting. The additional releases were added to Alderon estimates to provide the total annual predicted releases from construction as presented in Table 5-15. The drills will be equipped with dust collectors and are, therefore, considered negligible in relation to the site-wide emissions for construction. Detailed emission estimates are provided in Appendix 5C (Air Quality Release Estimates – Construction Phase).

Table 5-15: Annual Air Quality Release Estimates for Construction Activities

Activity	Total Annual Releases (tonnes/yr)					
	Total Particulate Matter	PM_{10}	$PM_{2.5}$	Nitrogen Oxides[(a)]	Sulphur Dioxide	Carbon Monoxide
Construction emissions (Alderon 2012)						
Transportation of equipment – general	0.06	0.06	0.04	2	0.01	2
Transportation of equipment - rail	0.07	0.07	0.06	2	0.01	5
Transportation of equipment - TMF	0.02	0.02	0.02	1	0.003	0.18
Equipment operation - general	19	19	19	302	10	136
Equipment operation - rail	14	14	13	182	7	90
Equipment operation - TMF	2	2	2	21	1	10
Unpaved roads	1,077	179	2	-	-	-
Fugitive dust (ground clearing)	116	-	-	-	-	-
Concrete batch plant operation	0.11	0.04	-	-	-	-
Additional Construction Activities Anticipated for the Project						
Crushing and screening	50	20	2	-	-	-
Generators	0.43	0.43	0.42	57	0.06	5
Blasting	57	30	2	3	-	37
Total	**1,335**	**264**	**41**	**571**	**18**	**285**

(a) Expressed as nitrogen dioxide.

TMF = Tailings Management Facility; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres.

5.5.2.2.2 Operations Phase

The Operations phase is anticipated to last 26 years, which includes one year of pre-development mining. Changes to air quality resulting from the release of COCs to the atmosphere during operations of the Project were assessed using the CALPUFF air dispersion model.

The maximum emissions for the Operations phase were estimated for the following emission sources:

- open pit mining activities including drilling and blasting
- fugitive dust emissions from material handling activities in the pit and on surface
- emissions from dust collectors from ore crushing processes, material transfer points and concentrate storage
- fugitive emissions from concentrate load-out
- fugitive dust emissions from wind erosion at mine rock and overburden stockpiles and the tailings area
- fugitive dust from unpaved road segments and grading
- diesel exhaust from heavy mobile equipment
- diesel exhaust from the locomotives
- diesel exhaust from periodic generator testing

Emissions of particulate matter (TPM, PM_{10}, and $PM_{2.5}$) and combustion gases (CO, NO_2, and SO_2) from fuel combustion in the mining equipment fleet, fuel combustion in locomotives, fuel combustion in emergency generators, and explosive detonation are expected during the Operations phase. The majority of emissions during operations are fugitive emissions. Emissions of dust (TPM, PM_{10}, $PM_{2.5}$, and metals) from ore, concentrate, and mine rock handling, travel on unpaved roads, drilling and blasting, and wind erosion from overburden stockpile, mine rock stockpile, and the TMF are expected during the Operations phase.

Emissions of the COCs were calculated based on the worst-case material extraction and material handling operating year to document a conservative emissions scenario for the Project. Detailed emission estimates for the Operations phase are provided in Appendix 5B.

5.5.2.2.2.1 Conservative Assumptions in the Air Quality Assessment

The characterization of residual Project effects incorporates a number of conservative assumptions to increase the confidence that the modelled predictions will not underestimate the effects of the Project. The assumptions included in the assessment are:

- The release estimates are based on an operating year that assumes the greatest movement of ore, mine rock, and overburden.
- Unless otherwise noted in Appendix 5B, operations were assumed to be occurring simultaneously 24 hours per day, 365 days per year which is conservative when comparing to an annual standard.
- Except for mobile equipment in the TMF, the mobile fleet was assumed to be operating simultaneously, 24 hours per day, 365 days per year which is conservative when comparing to an annual standard.
- The primary ore crusher and in-pit crusher were assumed to be operating at the maximum throughput 24 hours per day.
- Emissions from the largest blast size were considered for every hour of the meteorological dataset, whereas blasting will be limited to daytime hours and will only be occurring once per day.
- Emission rates for wind erosion from the tailings area and mine rock stockpile were calculated using the maximum exposed surface area from the Project design (which is not expected to occur during the same operating year as the maximum material movement). The model assumes that the emissions from the maximum exposed surface area are occurring over a much smaller area leading to a conservative g/ m^2-s emission rate in the air dispersion model.
- Volume sources were conservatively sized to be smaller than the actual emission source.

5.5.2.2.2.2 Annual Air Quality Release Estimates

The annual air quality emission rates that were used as inputs to the air dispersion model were calculated based upon a conservative emission scenario for the Project, and account for the mitigation measures presented in Section 5.4.2.3.1 to reduce emissions. A summary of the emission rate inputs to the air quality dispersion model for each main emission source is provided in Appendix 5B. The control factors incorporated into the emissions inventory are summarized in Section 4.0 of Appendix 5B. The annual release estimates from the main Project emission sources and activities during operations are summarized in Table 5-16.

Table 5-16: Annual Air Quality Release Estimates for Operations

Source/Activity	Air Quality Release Estimates for Operations (tonnes/year)						
	Total Particulate Matter	PM_{10}	$PM_{2.5}$	Diesel Particulate Matter	Nitrogen Oxides[a]	Sulphur Dioxide	Carbon Monoxide
In-pit blasting	67	35	2	–	4	–	43
Ore handling – pre-crushing	451	165	38	–	–	–	–
Mine rock handling	1,257	518	118	–	–	–	–
Overburden handling	35	17	3	–	–	–	–
Ore crushing and conveying	136	43	8	–	–	–	–
Concentrate handling and load-out	41	20	4	–	–	–	–
Wind erosion from stockpiles	350	175	26	–	–	–	–
Unpaved road dust	3,684	1,010	101	–	–	–	–
Mobile equipment combustion	–	9	9	9	739	2	779
Rail car combustion	–	0.3	0.3	0.3	16	0.01	4
Emergency generator testing	–	0.02	0.02	0.02	3	0.003	0.2
Total	**6,021**	**1,992**	**309**	**9**	**762**	**2**	**826**

(a) Expressed as nitrogen dioxide.
PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; – = not applicable.

5.5.2.2.2.3 National Pollutant Release Inventory

The air quality annual release estimates suggest that the Project will meet the criteria to report to the NPRI. Reporting to the NPRI is required if the reporting or release thresholds outlined in the NPRI are met. Annual release estimates for the Project are based on a preliminary Project design based on an operating scenario with maximum material movement, so it is not reasonable to compare the releases with active projects in Western Labrador where reported releases are based on actual operations.

5.5.2.2.2.4 Air Quality Dispersion Modelling Predictions

The CALPUFF model was used to predict the ground-level concentrations of COCs from the Project. The predicted concentrations correspond to a conservative emission scenario for the Project. The dispersion model methods are described in Appendix 5A. The maximum predicted Project effects of each COC at selected locations outside the SSA and surface lease, is also presented in Appendix 5A.

Meteorological anomalies can lead to model overpredictions. The modelling results were processed to remove the anomalies in accordance with the Government of Newfoundland and Labrador determination of guidance document Determination of Compliance with the Ambient Air Quality Standards (Government of NL 2012a).

The changes to air quality were considered at several receptors within the LSA, which correspond to cabins and the local communities of Wabush and Fermont. The locations were chosen to correspond to locations assessed in the previous EIS (Alderon 2012). The maximum predicted concentrations of COCs at cabins is presented in Table 5-17, and the maximum predicted concentrations of COCs at the corresponding receptor locations are presented in Table 5-18. The maximum concentrations for each contaminant in Table 5-17 do not all occur at the same cabin, but where concentrations at residential cabins are greatest for each COC and respective averaging period. TPM and PM_{10} have predicted modelled concentrations above their respective 24-hour averaging period at cabin and community locations; however, the model predicts that concentrations above the limits at the cabins and community locations are infrequent, occurring between 1 day per year for TPM at Duley Lake South (<1% of the time) and 13 days per year for PM_{10} at a cabin at Riordan Lake (4% of the time), as shown in Table 5-17 and Table 5-18.

The Project effects of individual metals were determined from the maximum predicted 24-hour TPM concentration, assuming the concentrations of metals in the TPM was equal to the 95th percentile of metal concentrations, as shown in Appendix 5A, of the ore and mine rock assays for the Project (Okane Consultants 2024). The predicted concentrations are presented in Table 5-17.The predicted effects are illustrated as a series of isopleths for each of these substances and relevant averaging period in Figures 5-4 to 5-8; the isopleths depict the modelled concentrations graphically as contours of equal concentration based upon the CALPUFF model output for each hour of the four years of meteorological data. The isopleths represent the 1-hour or 24-hour worst-case modelling result at each receptor within the LSA. These results may not occur on the same day or within the same year and account are intended to depict a variety of meteorological conditions over a four-year period. Concentrations are highest closest to the emission source but disperse with distance from the Project and are generally below the respective standards within 4 km of the Project infrastructure.

Table 5-17: Maximum Predicted Change to Air Quality at Cabins

Contaminant	Averaging Period	NLAAQS Criteria (µg/m³)	Background Concentrations (µg/m³)	Maximum Predicted Concentration from Project (µg/m³)	Maximum Predicted plus Background (µg/m³)	Percent of NLAAQS (%)	Frequency Above NLAAQS (%)	Number of Days Above Standard[a]
Total particulate matter	24-hour	120	24.1	***125***[b]	***149***	>100%	<1%	3
	Annual	60	10.8	0.001	11	18%	–	–
PM10	24-hour	50	11.3	***84***	***95***	>100%	4%	13
PM2.5	24-hour	25	3.6	13	16	65%	–	–
	Annual	8.8	3.6	1	5	55%	–	–
Nitrogen dioxide	1-hour	400	4.9	353	358	89%	–	–
	24-hour	200	4.9	97	102	51%	–	–
	Annual	100	4.9	11	15	15%	–	–
Sulphur dioxide	1-hour	900	0.8	0.4	1	<1%	–	–
	3-hour	600	0.8	0.3	1.1	<1%	–	–
	24-hour	300	0.8	0.1	0.9	<1%	–	–
	Annual	60	0.8	0.01	0.8	1%	–	–
Carbon monoxide	1-hour	35,000	1,495	629	2,124	6%	–	–
	8-hour	15,000	1,495	422	1,917	13%	–	–
Arsenic	24-hour	0.3	–	0.002	–	<1%	–	–
Cadmium	24-hour	2	–	0.0004	–	<1%	–	–
Copper	24-hour	50	–	0.02	–	<1%	–	–
Lead	24-hour	2	–	0.004	–	<1%	–	–
Mercury	24-hour	2	–	0.000004	–	<1%	–	–
Nickel	24-hour	2	–	0.01	–	<1%	–	–
Vanadium	24-hour	2	–	0.06	–	3%	–	–
Zinc	24-hour	120	–	0.05	–	<1%	–	–

Notes:
Values are above the NLAAQS criteria.
(a) Out of a possible 365 days in a year.
(b) Predicted concentration from Project includes the 24-hour diesel particulate matter concentration at the maximum TPM receptor.
NLAAQS = Newfoundland Ambient Air Quality Standards (ECC, 2022); TPM = total particulate matter; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; – = no data or not appliable..

Table 5-18: Changes in Air Quality to Local Receptors

Receptor Location	UTM Coordinates (Zone 19)	TPM Concentration			PM_{10} Concentration		$PM_{2.5}$ Concentration		NO_2 Concentration	
		24-Hour ($\mu g/m^3$)	Frequency above NLAAQS (%)	Annual ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)	Frequency above NLAAQS (%)	24-Hour ($\mu g/m^3$)	Annual ($\mu g/m^3$)	1-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)
Wabush North	643662 mE, 5862850 mN	39	–	10.8	21	–	5	4	65	19
Wabush South	644662 mE, 5861350 mN	41	–	10.8	23	–	5	4	71	22
Labrador City South	640162 mE, 5866850 mN	37	–	10.8	20	–	6	4	59	18
Labrador City West	637662 mE, 5866350 mN	39	–	10.8	20	–	5	4	62	20
Duley Lake North	634662 mE, 5861850 mN	58	–	10.8	31	–	7	4	108	41
Duley Lake South	636162 mE, 5857350 mN	***120***	<1% (1 day[(a)])	10.8	***72***	1% (5 days[(a)])	12	5	354	96
Fermont	629662 mE, 5851350 mN	96	–	10.8	***55***	<1% (2 days[(a)])	11	4	147	62
NLAAQS		**120**	**–**	**60**	**50**	**–**	**25**	**8.8**	**400**	**200**

Notes:
Values are above the NLAAQS criteria.
(a) Out of a possible 365 days in a year.
UTM = Universal Transverse Mercator; NLAAQS = Newfoundland Ambient Air Quality Standards; TPM = total particulate matter; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; $\mu g/m^3$ = microgram per cubic metre; – = not applicable.

It is known that fugitive dust from existing mining operations in Western Labrador have resulted in dust episodes which have been observed in the local communities. During a dust episode, the monitoring concentration over a one hour and 24 hour period will be notably higher than the annual average. Predictions about the contribution of the Project during a dust event were considered for southwest winds because under these conditions it is possible for the dust emissions from existing operations to overlap with the Project. The Project infrastructure will be located approximately 10 km from the Hudson Drive station, while the Tacora site is located approximately 5 km from the Hudson Drive station. For reference, the location of the Hudson Drive station is identified on Figures 5-4 and 5-5.

The maximum modelled concentrations during the snow-free period for a modelling receptor located approximately 250 metres from the Hudson Drive station were reviewed. The modelled concentration reflects normal operations when dust control measures are in place. The 24 hour maximum measured PM_{10} and $PM_{2.5}$ concentrations from 2022 at the Hudson Drive air quality monitoring station in Labrador City were considered to represent background concentrations for a dust episode (ECC 2023). Over a 24 hour averaging period, the Project contributed 7.3% of PM_{10} and 10.6% of $PM_{2.5}$ to the maximum modelled plus background concentration which demonstrates that there is potential for the Project to contribute to concentrations of PM_{10} and $PM_{2.5}$ measured in Labrador City during southwest winds.

In addition to understanding the potential contribution of the Project to dust concentrations in Labrador City, it is also important to note the frequency at which the southwest winds occur. Over the four-year modelling period (2018-2021) winds from the southwest have an annual average frequency of 7.3% measured at the Wabush Airport meteorological station and 16.3% from the CALMET grid cell that overlaps with the Hudson Drive station. During the snow-free period (May-October), the frequency of winds from the southwest drops to 9.2% from the CALMET grid cell.

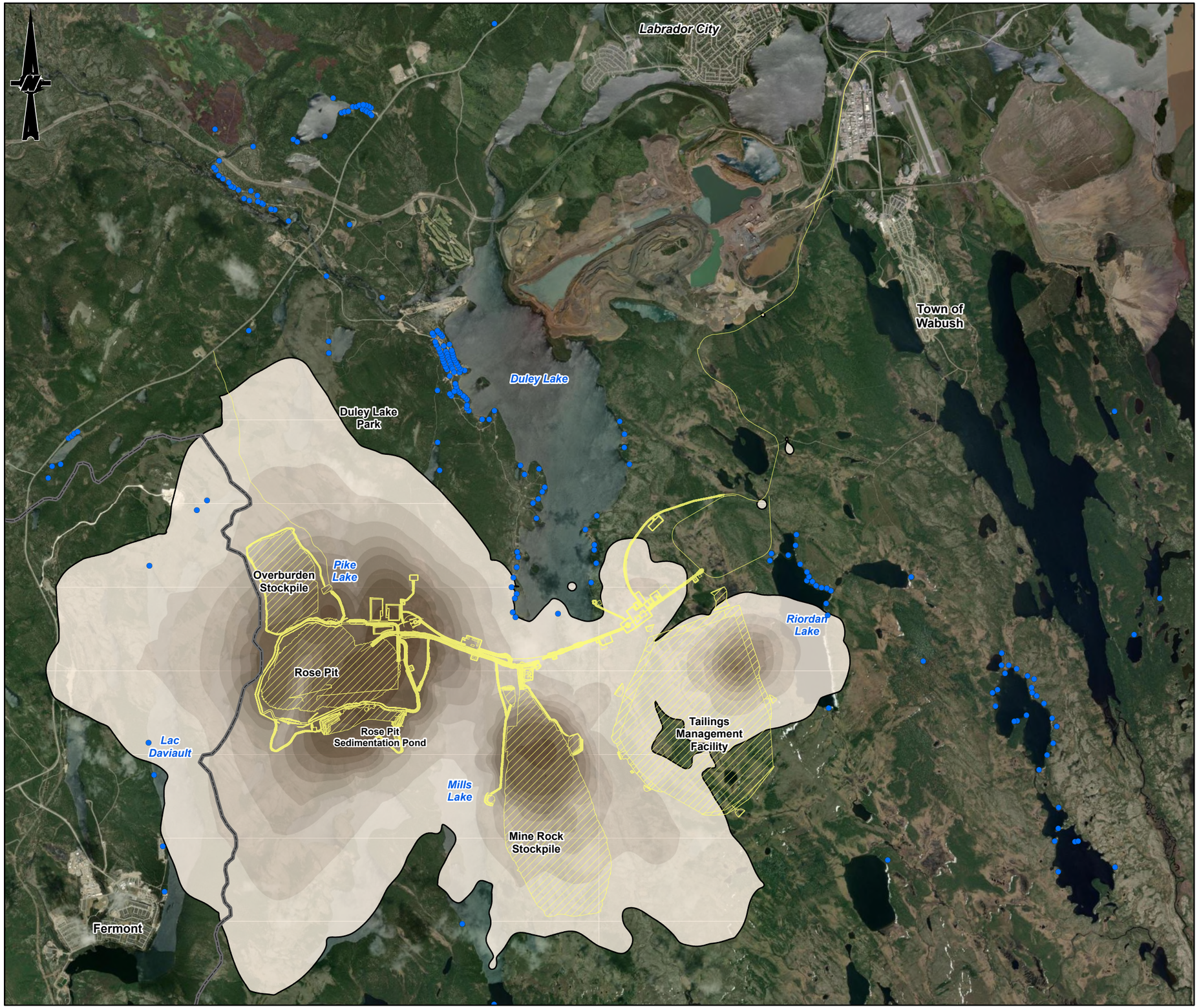
Knowing when the dry-freeze dust episodes are likely to occur can inform dust control measures that can be included in the Environmental Protection Plan. Because the dry-freeze episodes cannot be quantified and modelled, they have not considered in the assessment of residual effects.

The CAAQS are intended as a measure of ambient air quality within each of Canada's air zones to determine appropriate air quality management actions and not for the assessment of specific emission sources or compliance; however, the predicted concentrations from the Project were compared to CAAQS to allow for discussion of the influence of the Project on the air zone. The predicted concentration of 1-hour NO_2 is above the corresponding CAAQS. These comparisons are not a compliance metric and, as such, the CAAQS are not included in the assessment of residual effects.

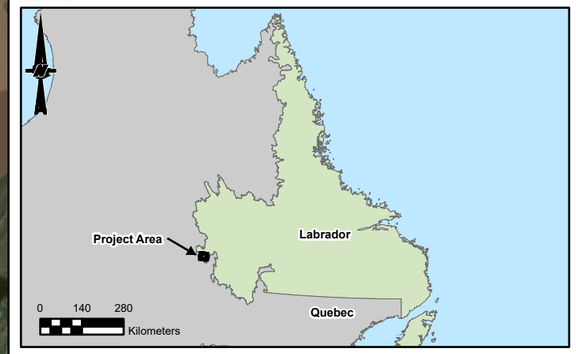
Table 5-19 : Maximum Predicted Change to Air Quality at Cabins

Contaminant	Averaging Period	CAAQS Criteria (µg/m³)	Background Concentrations (µg/m³)	Maximum Predicted Concentration from Project (µg/m³)	Maximum Predicted plus Background (µg/m³)	Percent of CAAQS (%)
$PM_{2.5}$	24 hour	27	3.6	6	10	37%
Nitrogen dioxide	1 hour	79	4.9	***304***[a]	***309***	>100%
	Annual	23	4.9	11[b]	15	67%
Sulphur dioxide	1 hour	170	0.8	0.4[c]	1	<1%
	Annual	10.5	0.8	0.01[2]	0.8	8%

Notes:
Values are above the CAAQS.
(a) 3-year average of annual 98th percentile of the daily maximum one hour average concentration
(b) arithmetic average over a single calendar year of all one-one hour average concentrations
(c) 3-year average of annual 99th percentile of the daily maximum one hour average concentration
CAAQS = Canadian Ambient Air Quality Standards; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; µg/m³ = microgram per cubic metre.



KEY MAP



SCALE 1:20,000,000

Legend

- Labrador/Quebec Boundary
- NL 24-hr standard (120 µg/m³)

PROJECT DATA

- Proposed Project Infrastructure

CABIN OWNERSHIP

- Public Ownership

Total Particulate Matter TPM (120 µg/m³)

- 120 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 800
- 801 - 1,000
- 1,001 - 2,000
- 2,001 - 3,687

0 1,000 2,000 4,000

1:71,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BACKGROUND CONCENTRATION (µg/m³): 24.1
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED 24-HOUR TOTAL PARTICULATE MATTER CONCENTRATIONS, INCLUDING BACKGROUND

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

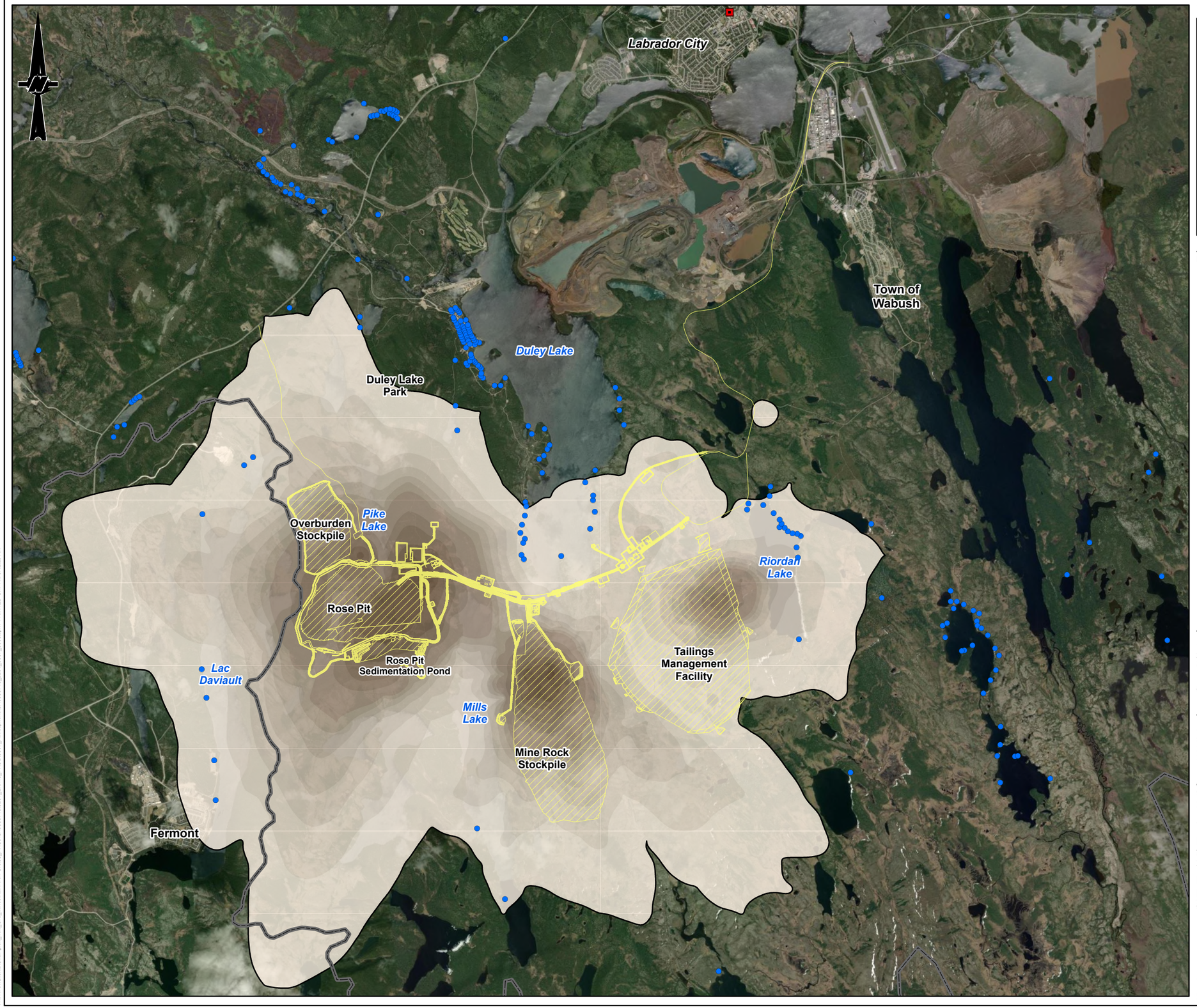
PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	0	5-4

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0007_Atmospheric\CA0038713_5261_0007_0000.aprx PRINTED ON: AT 9:12:55 AM

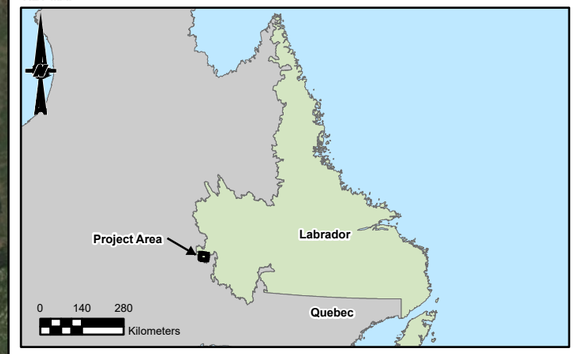
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



KEY MAP



SCALE 1:20,000,000

Legend

- Labrador/Quebec Boundary
- NL 24-hr standard (50 µg/m³)

PROJECT DATA

- Proposed Project Infrastructure

CABIN OWNERSHIP

- Public Ownership

MONITORING STATION

- Hudson Drive Monitoring Station

Particulate Matter under 10 µm (50 µg/m³)

VALUE

- 50 - 75
- 76 - 100
- 101 - 125
- 126 - 150
- 151 - 175
- 176 - 200
- 201 - 300
- 301 - 400
- 401 - 600
- 601 - 800
- 801 - 1,200
- 1,201 - 1,537

0 1,000 2,000 4,000

1:80,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BACKGROUND CONCENTRATION (µg/m³): 11.3
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED 24-HOUR PM10 CONCENTRATIONS, INCLUDING BACKGROUND

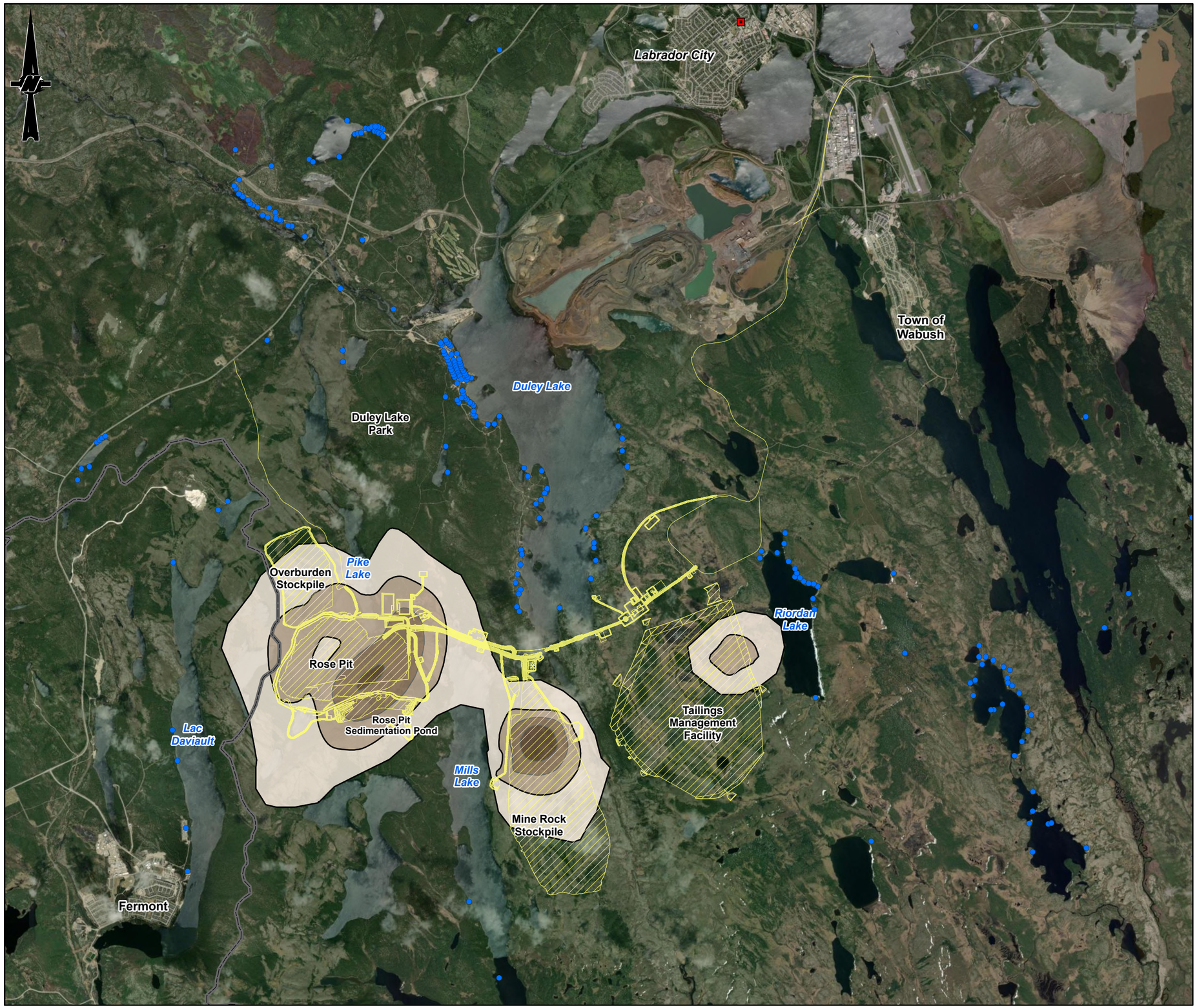
CONSULTANT

Kami

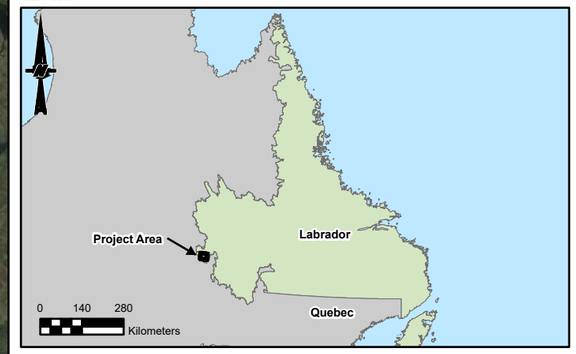
YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0007	0	5-5

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0007_Atmosphere\CA0038713_5261_0007_0000.aprx PRINTED ON: AT 9:12:29 AM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0



KEY MAP



SCALE 1:20,000,000

Legend

- Labrador/Quebec Boundary
- NL 24-hr standard (25 µg/m³)

PROJECT DATA

- Proposed Project Infrastructure

CABIN OWNERSHIP

- Public Ownership

MONITORING STATION

- Hudson Drive Monitoring Station

Particulate Matter under 2.5 µm (25 µg/m³)

- ≤ 50
- 51- 100
- 101 - 150
- > 150

0 1,000 2,000 4,000

1:75,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BACKGROUND CONCENTRATION (µg/m³): 3.6
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED 24-HOUR PM2.5 CONCENTRATIONS, INCLUDING BACKGROUND

CONSULTANT

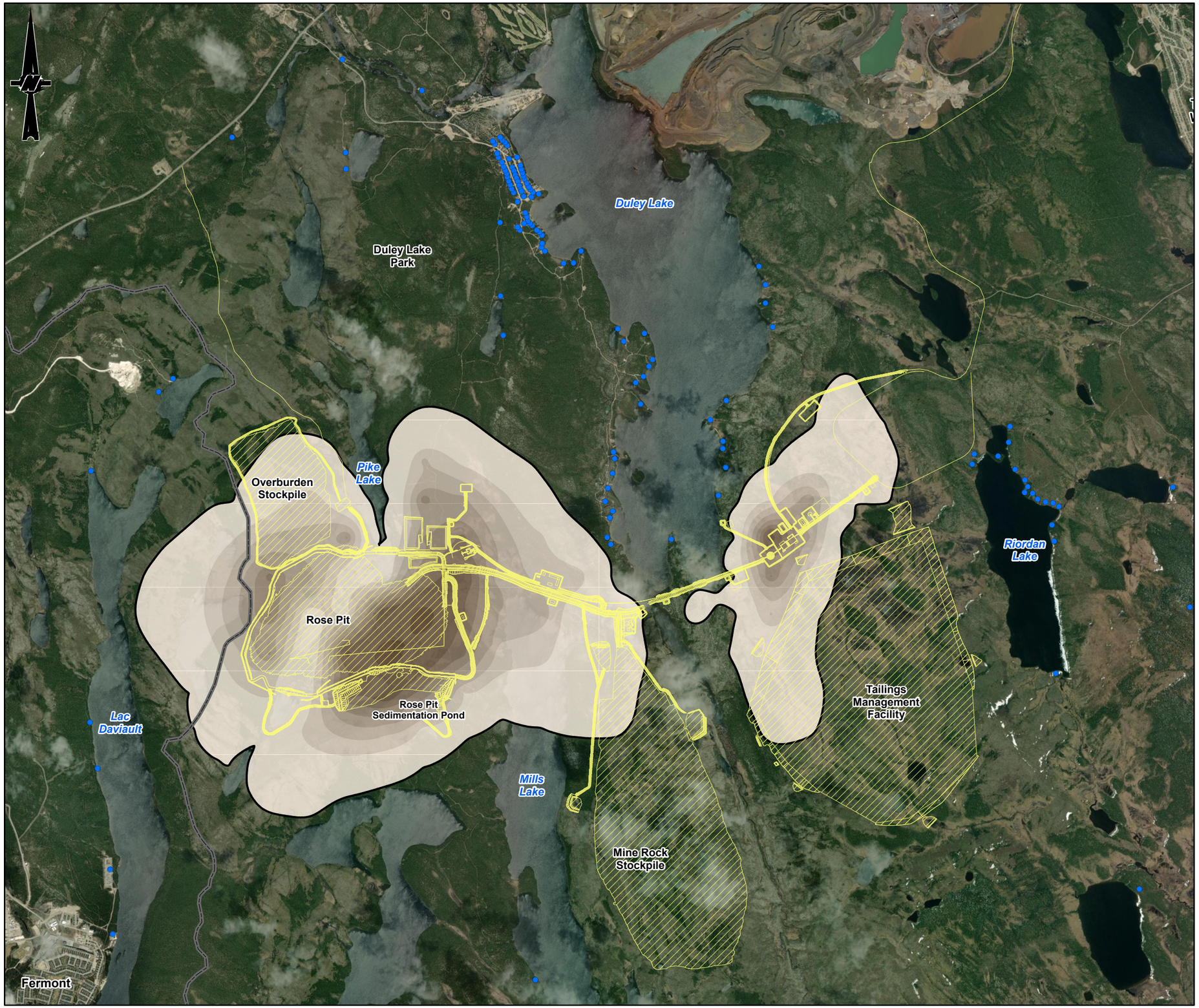
Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

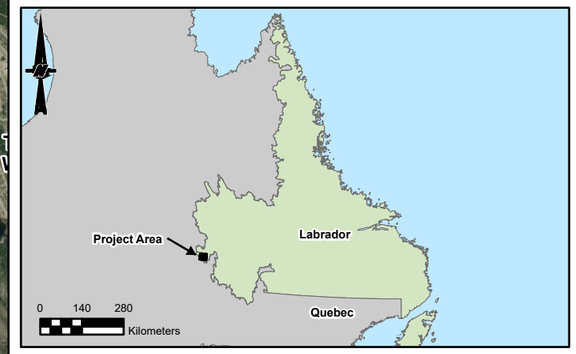
PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0007	0	5-6

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0007_Atmospheric\CA0038713_5261_0007_0000.aprx PRINTED ON: AT: 9:11:40 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm



KEY MAP



SCALE 1:20,000,000

Legend

- Labrador/Quebec Boundary
- NL 1-hr standard (400 µg/m³)

PROJECT DATA

- Proposed Project Infrastructure

CABIN OWNERSHIP

- Public Ownership

NO2 Concentration over 1 Hour (400 µg/m³)

- 50 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1,000
- 1,001 - 1,100
- 1,101 - 1,300
- 1,301 - 1,450

0 750 1,500 3,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BACKGROUND CONCENTRATION (µg/m³): 4.89
3. THE NINTH HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: MAXAR
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED 1-HOUR NITROGEN DIOXIDE CONCENTRATIONS, INCLUDING BACKGROUND

CONSULTANT

Kami

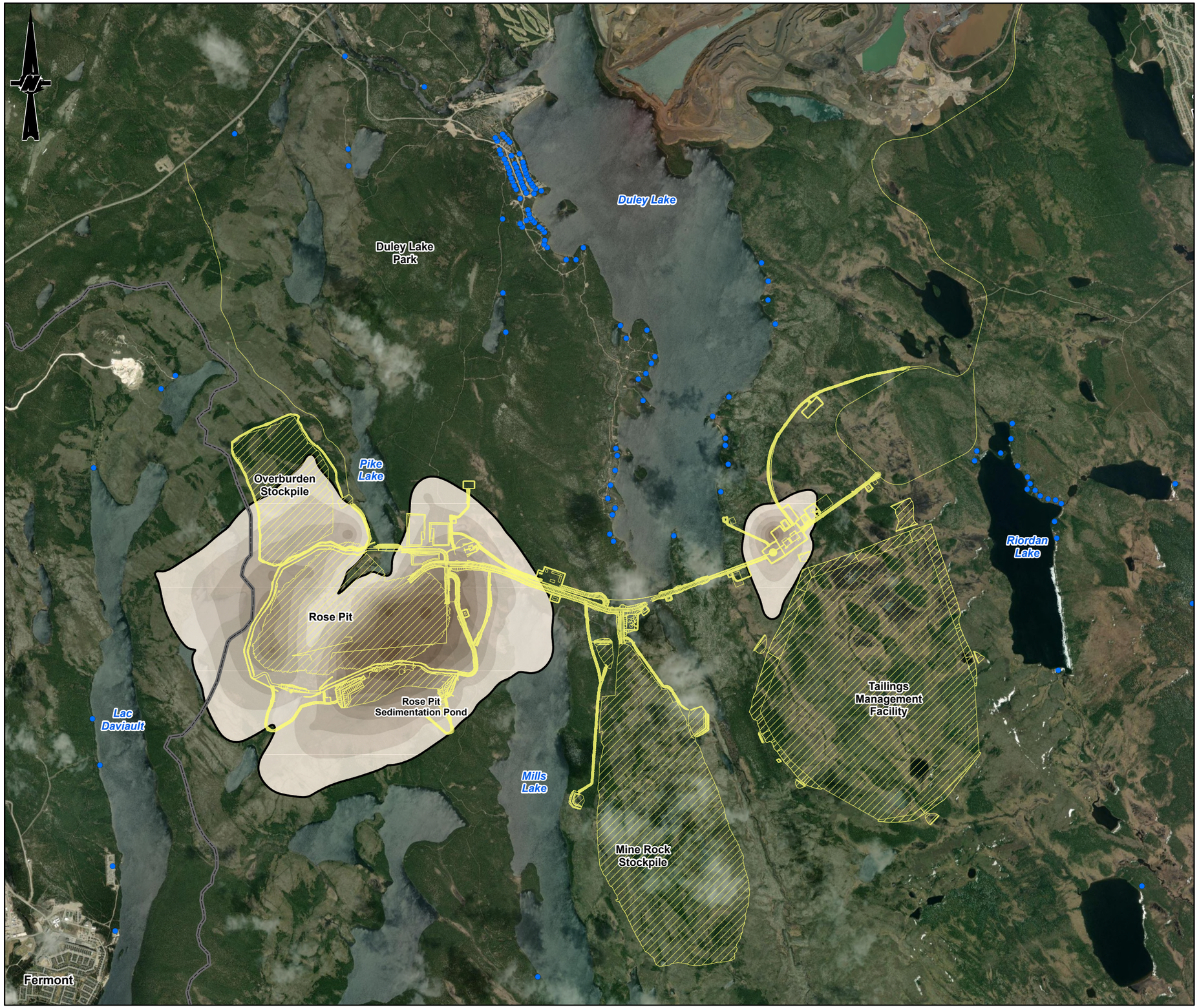
YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	0	5-7

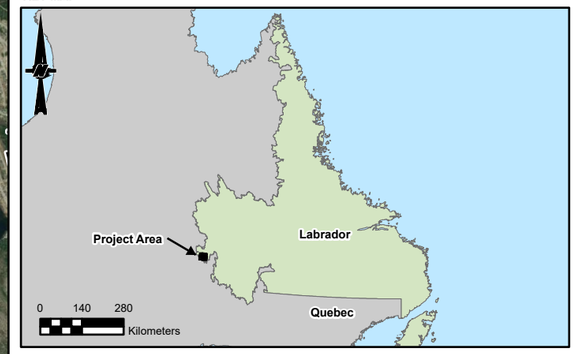
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\D0007_Atmospheric\CA0038713_5261_0007_0000.aprx PRINTED ON: AT 9:11:07 AM



KEY MAP



SCALE 1:20,000,000

Legend

- Labrador/Quebec Boundary
- NL 24-hr standard (200 µg/m³)

PROJECT DATA

- Proposed Project Infrastructure

CABIN OWNERSHIP

- Public Ownership

NO2 Concentration over 24 Hours (200 µg/m³)

- 200 - 250
- 251 - 300
- 301 - 350
- 351 - 400
- 401 - 450
- 451 - 500
- 501 - 600
- 601 - 688

0 750 1,500 3,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BACKGROUND CONCENTRATION (µg/m³): 4.89
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: MAXAR
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED 24-HOUR NITROGEN DIOXIDE CONCENTRATIONS, INCLUDING BACKGROUND

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	0	5-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\6g_PROJ\CA0038713.5261_EISv4\0_PROD\0007_Atmospheric\CA0038713_5261_0007_0000.aprx, PRINTED ON: AT: 9:10:23 AM

5.5.2.2.3 Closure Phase

The Closure phase is expected to last 10 years. Emissions of particulate matter (TPM, PM_{10}, and $PM_{2.5}$) and combustion gases (CO, NO_2, and SO_2) from fuel combustion in construction equipment and emissions of dust (TPM, PM_{10}, and $PM_{2.5}$) from earth moving operations for rehabilitation, travel on unpaved roads are expected during decommissioning and rehabilitation of the Project. During the active Closure phase construction activities will occur, so the releases to air are expected to be similar to, or less than, the releases estimated for Construction and Operations. During the maintenance and monitoring phase of Closure, the releases to air are expected to be lower than during Construction and Operations; therefore, the changes to air quality during Closure were assessed qualitatively, as the Operations phase modelling assessment presents the maximum potential effects of the Project.

5.5.2.2.4 Residual Project Effects Characterization

Residual effects on air quality from release of COCs during all Project phases are summarized in Table 5-20. The table provides information on the effects assessment criteria including direction, magnitude, geographic extent, duration/reversibility, timing, frequency, and probability of occurrence following the methods described in Section 5.5.1.2.

The release of COC emissions from the Project has the potential to cause an adverse effect on air quality during all Project phases because Project activities may increase the ambient concentrations of each measurable parameter COC compared to baseline conditions. The release of COCs during all Project phases are predicted to have a low to high magnitude. High-magnitude effects are COCs with maximum predicted concentration above the corresponding criteria. The 24-hour maximum predicted ground-level concentrations of TPM and PM_{10}, are predicted to be above the corresponding NLAAQS during the Operations phase at identified receptors within the vicinity of the Project and are, therefore, predicted to have a high magnitude. The predicted ground-level concentrations of $PM_{2.5}$, NO_2, CO, SO_2, and metals are predicted to be below corresponding NLAAQS during all phases of the Project and are predicted to have a moderate to low magnitude.

The effect on air quality is predicted to have a local geographic extent because air emissions will be limited to the SSA and LSA. Effects are predicted to be medium term, as it is expected that concentrations will be highest during operations and lower in the Construction and Closure phases. The effect on air quality is anticipated to occur year-round and the effect is anticipated to be reversible, as it is expected that COC concentrations would return to background levels following closure activities.

To consider socioeconomic context, effects were predicted at receptors that could be considered sensitive for air quality (i.e., cabins and communities). At cabins and community locations, the predicted concentrations of 24-hour TPM exceed the NLAAQS at predicted rate of <1% of the year (three days per year at cabins and one day per year at Duley Lake South), while PM_{10} exceeds the NLAAQS at a rate of 4% of the year at a cabin location (13 days of the year), 1% of the year at Duley Lake South (five days of the year), and <1% of the year at Fermont (two days of the year). No exceedances are predicted at the other community locations. Other sources within the air quality VEC spatial boundaries also contribute to the predicted background levels of COCs, including the local communities, cabins, existing mining operations, and natural factors (i.e., fire, precipitation, wind), and therefore the air quality in the area is recognized to be previously disturbed by human development or natural factors.

The residual effects classification takes a conservative approach which is in addition to the conservative release estimates and modelling methods. This conservative approach is intended to follow the precautionary principle to reduce uncertainty in predicted effects. Additional details on how uncertainty is considered in the assessment to improve confidence in the predictions is presented Section 5.6. Conservatism in the residual effects classification includes the following:

- The residual effects classification for air quality measurement indicators was determined from the highest level of effects among the different averaging periods (e.g., one-hour, 24-hour, annual) when applicable.
- Magnitude is applied to the maximum predictions at identified cabin receptors within the vicinity of the Project while at any other cabin location, predictions are expected to result in a smaller change.

Duration considers the lifespan of the Project, even though the exceedances or high magnitude of changes occur for the short term and at low frequency within the worst-case operating year.

Table 5-20: Characterization of Residual Effects on Air Quality Measurable Parameters

Measurable Parameter	Criterion	Rating/Effect Size
Total particulate matter	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	High: The 24-hour maximum predicted ground-level concentration is greater than the NLAAQS.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Expected to exceed NLAAQS infrequently (<1% ,3 days per year at cabins and <1%, 1 day of the year at Duley Lake South). Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.
PM_{10}	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	High: The 24-hour maximum predicted ground-level concentration is greater than the NLAAQS.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Expected to exceed NLAAQS infrequently (4%, 13 days of the year at cabin locations, 1%, 5 days per year at Duley Lake South and <1%, 2 days per year at Fermont. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.
$PM_{2.5}$	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Moderate: The 24-hour and annual maximum predicted ground-level concentrations are below the NLAAQS but greater than 50% of the standard.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	No exceedances at cabins or communities predicted. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.

Measurable Parameter	Criterion	Rating/Effect Size
Nitrogen dioxide	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Moderate: the 1-hour and 24-hour maximum predicted ground-level concentrations of NO_2 are below the NLAAQS but greater than 50% of the standard.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	No exceedances at cabins or communities predicted. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.
Carbon monoxide	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Low
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	No exceedances at cabins or communities predicted. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.
Sulphur dioxide	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Low
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	No exceedances at cabins or communities predicted. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.

Measurable Parameter	Criterion	Rating/Effect Size
Metals	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Low
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	No exceedances at cabins or communities predicted. Local communities, cabins, existing mining operations and natural factors also contribute to the background concentrations.

LSA = local study area; NLAAQS = Newfoundland Ambient Air Quality Standards; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; PM_{10} = particulate matter less than 10 micrometres.

5.5.2.3 Residual Cumulative Effects Analysis

The qualitative assessment of residual cumulative effects on air quality considered the likelihood that the Project's residual effects will overlap with RFDs to result in cumulative effects on air quality.

As described in Section 5.4.1.4, there are a number of existing air emissions sources in the LSA, including mining operations, local communities, cabins, and recreational use areas. The background concentrations used to assess residual effects for the Project account for these existing operations and their contributions to ambient air quality. During the lifespan of the Project, there may be new developments or expansions of existing operations that result in changes to the background air emissions.

A cumulative effect may occur if the projects overlap spatially, overlap temporally, and release contaminants in common as this may lead to increased background concentration and potential exceedances of the NLAAQS. The spatial boundary for the cumulative effects assessment for the air quality VEC was defined as the RSA, which was sized to consider regional effects on air quality and assess potential cumulative effects. Interpretation of the spatial boundary also requires additional consideration of the contaminants emitted from the emission sources. For example, coarse particulates (TPM and PM_{10}) generally settle to the ground within a few kilometres of the emission source, while fine particulates such as $PM_{2.5}$ can travel farther; therefore, an RFD within the RSA does not necessarily indicate that there is a predicted cumulative effect.

The temporal boundary for the air quality residual cumulative effects analysis includes the Project Construction, Operations, and Closure phases. For the purposes of this assessment, it was assumed that construction of the Project is anticipated to begin in 2027, and the Project is expected to extend for 40 years. The final anticipated year of the mine life after decommissioning and rehabilitation is expected to be 2067.

The residual cumulative effects assessment for the air quality VEC considers particulate matter because particulate concentrations have the largest spatial extent of residual effects from the Project. Other COCs have residual effects that extend just beyond the SSA, so spatial overlap with other RFDs is not anticipated. The Operations phase of the Project is expected to have the largest residual effect on air quality, so the extent of particulate emissions from the Operation phase were conservatively used to assess cumulative effects.

5.5.2.3.1 Reasonably Foreseeable Developments and Potential Cumulative Effects

Chapter 4 provides a list of known RFDs and physical activities that have potential to overlap spatially and temporally with the Project's residual environmental effects. Based on this list, RFDs with the potential to overlap spatially and/or temporarily with the Project were assessed in Table 5-21 for possible interactions with the residual Project effects on air quality.

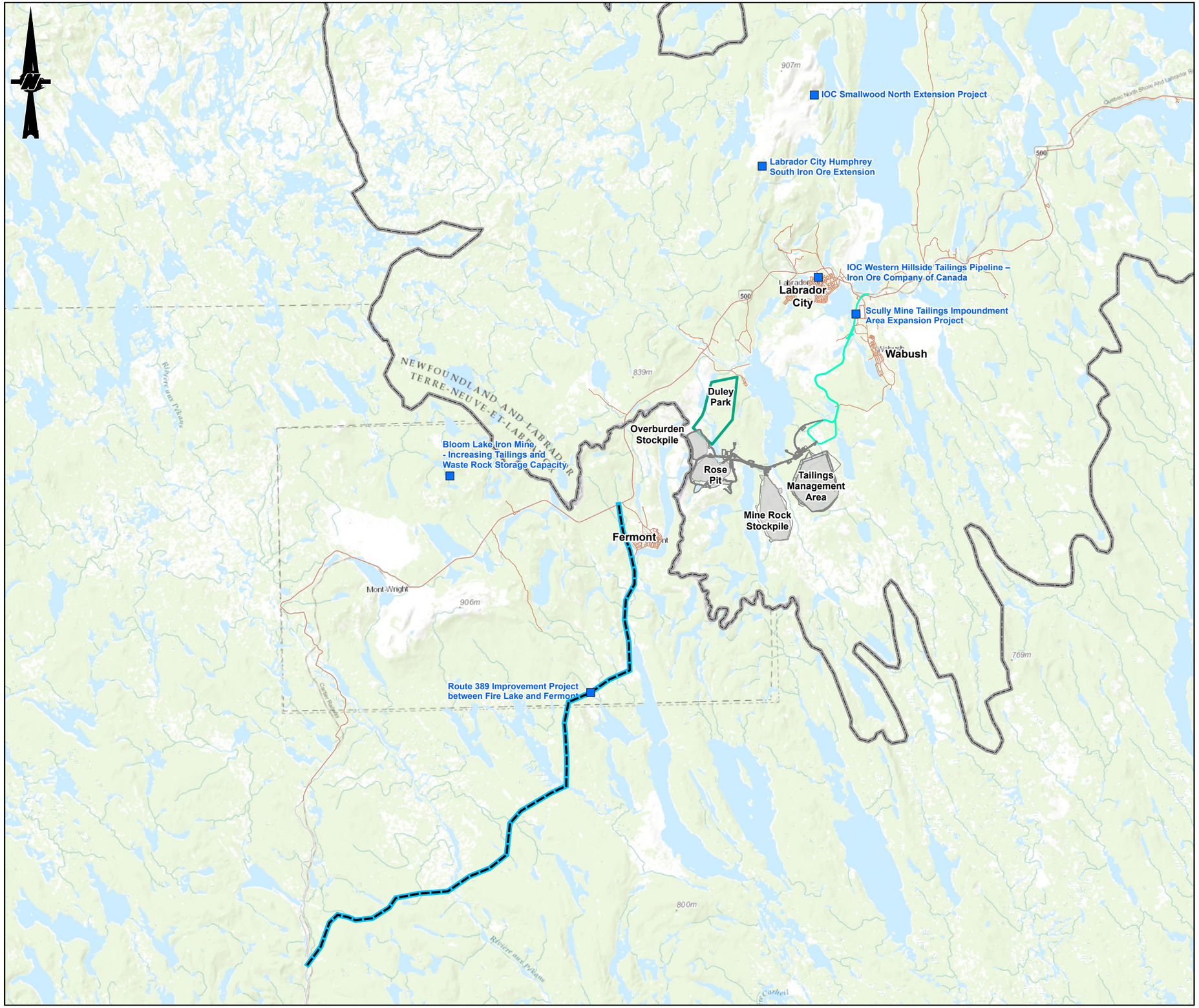
Table 5-21: Reasonably Foreseeable Developments and Activities Considered in the Residual Cumulative Effects Assessment

Project Name or Physical Activity	Description	Distance to Kami Project Site	Status/Timing	Interaction with Residual Effects on Air Quality from Kami Mining Project
Bloom Lake Iron Mine - Increasing Tailings and Mine Rock Storage Capacity	Increasing Tailings and Mine Rock Storage Capacity for Bloom Lake Iron Mine. The objective of the project is to increase the capacity of the accumulation areas to allow annual production of 7.5 Mt of concentrate/year from 2019 to 2021 and 16 Mt of concentrate/year from 2022 to 2040, for an estimated operating life of 21 years.	17 km	2023 to 2040	The Bloom Lake project is predicted to emit contaminants in common with the Project, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the air quality RSA. Increasing the capacity of the tailings area may increase fine dust emissions, and the mine rock pile may generate coarse dust emissions. It is predicted that the dust would deposit within kilometres of the emission sources. As the Bloom Lake project is approximately 17 km away from the western extent of the Kami Mining Project, it is unlikely to overlap with the dust that is predicted to be generated from the Project, and any changes to ambient air quality concentrations of COCs from the interaction of these two projects are likely to be within natural variations of existing baseline conditions; therefore, no potential cumulative effects are anticipated.
Scully Mine Tailings Impoundment Area Expansion Project	Tacora Resources Inc. is proposing to expand the tailings impoundment area of the Scully Mine, an iron ore mine located in Wabush, Newfoundland and Labrador. As proposed, the Scully Mine Tailings Impoundment Area Expansion Project would expand the existing tailings impoundment area by up to 1,411 ha, allowing for the full use of the mine's ore reserves and for operations to continue until 2047. The existing tailings impoundment area is expected to reach full capacity around 2025. The Minister of Environment and Climate change determined that the project does not require an environmental assessment in April 2022.	13 km	Anticipated start in 2025 and expand operations by 22 years	The expanded tailings impoundment area at Scully Mine is predicted to emit contaminants in common with the Project, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the air quality RSA. The expansion is expected to reduce the exposed tailings area so a net increase in fine dust is not expected. Prevailing winds in the region may periodically blow dust from the Project towards Scully Mine and increase the background concentrations on a short time scale (1 hour or 24 hours); therefore, potential for cumulative effects exists.

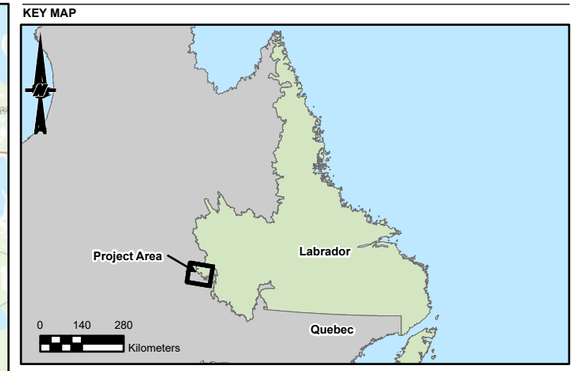
Project Name or Physical Activity	Description	Distance to Kami Project Site	Status/Timing	Interaction with Residual Effects on Air Quality from Kami Mining Project
Rio Tinto IOC Smallwood North Extension Project	Expansion to the boundaries of the existing Smallwood Pit to support ongoing operations in Labrador City. The proposed extension of Smallwood Pit is located within the Rio Tinto IOC's existing mining leases and encompasses approximately 160 ha. The proposed project includes extending the Smallwood North pit to the north, development of a new waste dump, construction of new power lines, construction of new pit dewatering wells and the development of surface water handling systems.	25 km	Construction started in summer 2024 goes into 2030	The Rio Tinto IOC Smallwood North Extension Project is predicted to emit contaminants in common with the Project, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the air quality RSA. Predicted air pollutant concentrations from the Project are not anticipated to contribute notably in terms of a cumulative effect at, or near, the expansion project at a distance of 25 km. It is predicted that the dust would deposit within kilometres of the emission sources, making it unlikely to overlap and interact with the dust predicted to be generated from the Project. In addition, the Rio Tinto IOC mine is not anticipating a net increase in operations or activities resulting from the extension project, so the long-term (annual) background concentrations will show minimal change; therefore, no potential cumulative effects are anticipated.
Route 389 Improvement Project between Fire Lake and Fermont	The Québec Government is improving highway 389 between Fire Lake and Fermont (kilometres 478 to 564) to increase the flow and safety of the road and, in addition, improve the link with Newfoundland and Labrador as well as facilitate access to natural resources. The project is divided into three sections: — Segment 1 – between kilometres 478 and 496: new alignment — Segment 2 – between kilometres 496 and 507: major road rehabilitation — Section 3 – between kilometres 507 and 566: new 45-kilometre route Construction of Section 3 began in late summer 2023 and construction of Segments 1 and 2 in summer 2024. The three sections are scheduled to be complete by 2028.	6 to 93 km	2023 to 2028	The Route 389 Improvement Project is predicted to emit particulate matter during construction. The Project overlaps spatially within the air quality VEC RSA and may overlap temporally during the Project's first two years of construction, assuming the Project starts in 2027. During the Construction phase, the Project is not anticipated to generate particulate matter concentrations that would result in exceedances above the NLAAQS, following the effective implementation of mitigation and monitoring. It is also expected that particulate emissions from the Route 389 Project will be managed, and any course or fine particulates will be limited to the area in the immediate vicinity of the Project; therefore, no potential cumulative effects are anticipated.

Project Name or Physical Activity	Description	Distance to Kami Project Site	Status/Timing	Interaction with Residual Effects on Air Quality from Kami Mining Project
Rio Tinto IOC Western Hillside Tailings Pipeline – Iron Ore Company of Canada	New tailings management plan that would include optimizing available space of the existing Wabush Lake tailings storage facility and utilizing the Western Hillside. The Project would include the development of an access road and pipeline alignment, transmission lines, pumps and pumphouses, and a modified strategy for deposition of tailings into Wabush Lake.	15 km	Construction anticipated to start in 2024 and continue into 2033, operation from 2033 to 2038.	The Rio Tinto IOC Western Hillside Tailings Pipeline construction may overlap temporally during the Project Construction and Operations phases and overlap spatially with the air quality RSA. As tailings will be deposited into Wabush Lake, fine particulate matter emissions from the tailings facility are not anticipated. It is also expected that emissions from construction of the Hillside Tailings Pipeline will be minimal and well managed. Cumulative effects with the Project are not anticipated.
Labrador City Humphrey South Iron Ore Extension	A 370 ha extension to the Humphrey South Pit iron ore deposit that will include development into the White Lake area to support its existing operations in Labrador City. The project includes an extension of the Humphrey South Pit to the east and south, development of a waste dump south of White Lake, extension of the Carol waste dump, power lines, dewatering wells, and surface water-handling systems.	19 km	Construction started in 2024 and operations anticipated by 2026.	Operations at the Rio Tinto IOC Humphrey South extension project is predicted to emit contaminants in common with the Project and may overlap temporally during the Project Construction phase and overlap spatially with the air quality RSA. Air pollutants from the Project are not anticipated to have a cumulative effect at or near the extension project due to the separation distance. It is expected that dust would be in a coarse fraction which would settle close to the emission source. Cumulative effects with the Project are not anticipated.

COC = contaminant of concern; IOC = Iron Ore Company of Canada; NLAAQS = Newfoundland Ambient Air Quality Standards; RSA = regional study area; VEC = Valued Environmental Component; Mt = million tonnes.



KEY MAP



SCALE 1:20,000,000

LEGEND

PROJECT INFRASTRUCTURE

- Proposed Project Infrastructure
- Proposed Project Infrastructure (Linear)
- Proposed Access Road and Railway Corridor
- Reasonably Foreseeable Developments

BASEMAP INFORMATION

- Duley Lake Park
- Labrador/Quebec Boundary
- Existing Road
- Proposed Road 389 Between Fermont and Fire Lake

0 2,500 5,000 10,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, AAFC, NRCAN
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

REASONABLY FORESEEABLE DEVELOPMENTS CONSIDERED IN THE CUMULATIVE EFFECTS ASSESSMENT FOR AIR QUALITY

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	GM
REVIEWED	JT
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	0	5-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\69_PROJ\CA0038713.5261_EIS\40_PROD\0007_Atmospheric\CA0038713_5261_0007_0000.aprx, PRINTED ON: AT: 9:09:56 AM

5.5.2.3.2 Mitigation Measures

It is anticipated that mitigation measures will be implemented to minimize effects on the air quality VEC during the Construction, Operations, and Closure phases of the identified RFDs. A comprehensive list of mitigation measures that will be implemented for the Project are outlined in Table 5-14. Opportunities for continuous improvement of mitigation measures through experience and learning from existing iron ore mining operations, including discussions in meetings with the Labrador West Alliance, will be considered in the development of the Environmental Protection Plan and throughout the life of the Project.

It is expected that Bloom Lake, the Rio Tinto IOC projects, and Scully Mine will be required to comply with any issued permits, including Certificates of Approval from the ECC that would include compliance with the NLAAQS within their administrative boundaries. It is also expected that the identified RFDs in Table 5-21 will be required to implement a project-specific Environmental Protection Plan, similar to the Project, which would include mitigation measures for COCs expected to be released from project activities. It is also expected that Rio Tinto IOC and Tacora will continue to implement their ambient air monitoring programs in Western Labrador to monitor releases of COCs from the projects. The monitoring program would be used to evaluate the effectiveness of the implemented mitigation measures throughout the lifespan of these RFD projects, and mitigation measures would be modified or enhanced as necessary through adaptive management.

Additional mitigation measures are not anticipated to be required for the Project to mitigate potential cumulative effects.

5.5.2.3.3 Residual Cumulative Effects Characterization

There are six RFDs that were identified as having spatial and temporal overlap and the potential to emit contaminants in common with the Project (Table 5-21). Of these six, only one RFD was determined to result in potential cumulative effects with the Project: the Scully Mine Tailings Impoundment Area Project. It is expected that dust from the Project may periodically blow towards Scully Mine Tailings Impoundment Area Expansion Project and increase the background concentrations on a short time scale (1-hour or 24-hours).

As presented in Section 5.5.2.2.4, the 24-hour maximum predicted ground-level concentrations of TPM and PM_{10} are predicted to be above the corresponding NLAAQS during the Operations phase and are predicted to have a high magnitude. Based on the description of the proposed activities, it is anticipated that dust generated from the Scully Mine Tailings Impoundment Area Expansion Project will be fugitive dust that is both fine ($PM_{2.5}$) and coarse (TPM and PM_{10}) and will settle within the local vicinity of the emission sources; however, maximum exceedances of the NLAAQS exist for the maximum predicted ground-level concentrations of TPM and PM_{10} so, the magnitude of residual cumulative effects is also high.

The Project releases of coarse particulates (TPM and PM_{10}), including background concentrations, disperse with the distance from Rose Pit and are generally below their respective NLAAQS within 4 km of the SSA. Fine particulates ($PM_{2.5}$) are generally below their respective NLAAQS within 1 km of the SSA. To this end, concentrations are expected to be below guidelines within the LSA of the Project, and so the geographic extent of the residual cumulative effect is expected to be local. Effects are predicted to be medium term, as it is expected that concentrations will be highest during the Operations and lower in the Construction and Closure phases. The effect is anticipated to be reversible, as it is expected that COC concentrations would return to background levels following closure activities.

Sufficient data are not available to quantitatively assess the predicted cumulative concentrations of COCs at the cabin or community locations. The cabins and community (Duley Lake South, Fermont) located closest to the Kami Project where infrequent exceedances of the NLAAQS are predicted are of sufficient distance (greater than 5 to 10 km) from the Scully Mine Project, and incremental increases to the predicted concentrations of COCs from the Project are not anticipated. Residual cumulative effects on air quality from release of COCs are summarized in Table 5-22.

Table 5-22: Characterization of Residual Effects on Air Quality Measurable Parameters

Measurable Parameter	Criterion	Rating/Effect Size
Total particulate matter	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	High: The 24-hour maximum predicted ground-level concentration is greater than the NLAAQS. The Scully Mine Tailings Impoundment Area Project is predicted to contribute negligible changes to the predicted Project concentrations.
	Geographic extent	Local: Limited to the LSA.
	Timing	Changes to air quality are expected to occur year-round.
	Duration	Medium term
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Similar infrequent exceedances of NLAAQS at cabin and community receptors are expected for the cumulative residual effects as predicted for the residual Project effects.
PM_{10}	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	High: The 24-hour maximum predicted ground-level concentration is greater than the NLAAQS. The Scully Mine Tailings Impoundment Area Project is predicted to contribute negligible changes to the predicted Project concentrations.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Similar infrequent exceedances of NLAAQS at cabin and community receptors are expected for the cumulative residual effects as predicted for the residual Project effects.
$PM_{2.5}$	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Moderate: The Scully Mine Tailings Impoundment Area Project is predicted to contribute negligible changes to the predicted Project concentrations.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Similar infrequent exceedances of NLAAQS at cabin and community receptors are expected for the cumulative residual effects as predicted for the residual Project effects.
Nitrogen dioxide	Nature	Adverse: Increase in ambient air concentration compared to background.
	Magnitude	Moderate: The Scully Mine Tailings Impoundment Area Project is predicted to contribute negligible changes to the predicted Project concentrations.
	Geographic extent	Local: Limited to the LSA.
	Duration	Medium term
	Timing	Changes to air quality are expected to occur year-round.
	Reversibility	Reversible
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Exceedances of NO_2 are not predicted at cabin or community receptors from the Project or cumulatively when considering the Scully Mine Tailings Impoundment Area Project.

LSA = local study area; NLAAQS = Newfoundland Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres.

5.5.2.4 Significance Determination

As described in Section 5.5.1.2, a significant adverse effect on the air quality VEC was defined as a Project-related environmental effect that degrades the quality of the ambient air such that ground-level concentrations at identified receptors within the vicinity of the Project repeatedly exceed the respective air quality standard.

The change to air quality during operations was assessed using the CALPUFF dispersion model which predicted ground-level concentrations of the COCs. The predicted concentrations were added to the background concentrations and the resulting concentrations were compared to the NLAAQS. This determination includes conservative assumptions through the release estimates, dispersion modelling, and residual Project effects pathways.

Effects are anticipated to be greatest during the Project Operations phase. Maximum ground-level concentrations of TPM and PM_{10} at sensitive receptors within the vicinity of the Project are predicted to be above the NLAAQS. These exceedances occur, at the maximum predicted cabin receptor, Duley Lake South, and Fermont. The concentrations above the NLAAQS occur infrequently at the maximum predicted cabin receptor (<1% of the year for TPM and up to 4% of the year for PM_{10}), Duley Lake South (<1% of the year for TPM and 1% of the year for PM_{10}), and Fermont (<1% of the year for PM_{10}) because the coarse particulates disperse with increased distance from the Project. The main contributors to the ground-level concentrations of particulates in the vicinity of the Project are the unpaved haul roads. No exceedances of the NLAAQS are predicted for $PM_{2.5}$, NO_2, SO_2, CO, and metals at the cabin or communities. As predicted effects are anticipated to be infrequently above the NLAAQS, no significant effect is predicted. Potential cumulative effects with identified RFDs, specifically the Scully Lake Tailings Impoundment Project, are unlikely to contribute to the predictions of COCs from the Project; therefore, a significant cumulative effect is not predicted.

5.5.2.5 Climate Change

In addition to human activities, climate change and related effects (e.g., extreme weather, increased frequency and intensity of extreme weather events, and wildfires) may contribute cumulatively to further contribute to declines in air quality. Current climate change projections under a high greenhouse gas emissions model (Shared Socioeconomic Pathway 5-8.5) predict summer temperatures to rise by +1.9°C and winter temperatures to rise by +6.0°C by 2060 in Happy Valley-Goose Bay (roughly 530 km east of the Project area) (Neilsen 2023). A Climate Projections Study (Finnis and Daraio 2018) projects similar changes by mid-century in Wabush where daily mean temperatures are predicted to rise by +2.8°C in the summer and as much as 5.8°C in the winter (Finnis and Daraio 2018). These increases would result in noticeable changes in precipitation, rising ambient temperatures, shorter winters, and permafrost thaw (Neilsen 2023). These climate changes will in turn affect existing air quality.

Changes to climate could also result in an increase in frequency and intensity of extreme weather events. Labrador is subject to severe weather events like heavy rainfall, blizzards, and hurricanes, all of which could affect air quality positively by preventing fugitive dust due to dry conditions. The northwestern Atlantic Ocean, the Labrador Sea, and the Gulf of St. Lawrence are some of the stormiest areas in North America (Savard et al. 2016). Climate projections suggest that substantial changes in wind speed are unlikely to be impacted by climate change but there is likely to be a northward shift in storm tracks that will affect storm frequency and intensity in the East Coast region (Loder et al. 2013). Storms, like hurricanes, can result in substantial habitat loss and alteration. Storms moving up the eastern seaboard or across the continent impact precipitation events in Labrador (Lemmen and Warren 2016).

Changes to climate could also result in an increase in frequency and intensity of wildfires. Labrador is prone to wildfires. The most recent fire to affect air quality LSA occurred in 2024, covering an area of 19,059 ha. An increase in the frequency and intensity of wildfires could result in declines to air quality.

Because of the uncertainty in direction and magnitude, it was conservatively assumed that climate change would have an adverse cumulative effect on air quality.

5.5.3 Climate

5.5.3.1 Effect Pathway Screening

The effect pathway screening predicts potential effects pathways that are then evaluated considering proposed mitigation to predict whether the effect pathway had the potential to cause residual adverse or positive effects. The effectiveness of mitigation measures proposed for each effect pathway was assessed to determine whether the mitigation would address the potential Project effect such that the effect pathway was eliminated or would result in a negligible adverse effect on a VEC. Each effect pathway was categorized as one of the following:

- **no effect pathway** (i.e., avoidance measures and/or mitigation results in no residual effect on climate)
- **negligible effect pathway** (i.e., mitigation results in negligible effect on climate)
- **residual effect pathway** (i.e., effect that is greater than negligible and carried forward for further assessment)

The effects pathway screening is summarized in Table 5-23. All direct (Scope 1) Project GHG emissions were included in the effects pathway screening, and as such, there is only one pathway that was carried forward for detailed assessment, Residual Effects Pathway. Each Project component/activity identified as a residual effect pathway was carried forward for detailed assessment in Section 5.5.3.2.

Table 5-23: Potential Effects Pathways for Climate

Project Components/Activities	Effects Pathway	Environmental Design Features, Mitigation or Enhancement Measures	Effect Pathway Screening
Project components/activities that contribute to GHG emissions during Construction, Operations, and Closure: **Construction** — Site preparation, including vegetation clearing and earthworks — Construction of facilities and infrastructure — Construction of TMF starter dam — Blasting — Power generation — Operating mobile construction equipment — Site traffic, including transportation of personnel and materials to and from site **Operations** — Open pit mining, including blasting — Operating mobile mining equipment — Operation and management of the TMF — Processing iron ore concentrate — Site traffic, including transportation of personnel and materials to and from site **Closure** — Removal of infrastructure, restoration and revegetation of facilities and infrastructure — Site traffic, transportation of personnel and materials to and from site	GHG emissions from Project components and activities contribute to climate change and provincial and national GHG emissions totals	— Install the transmission line within the first year of construction to minimize consumption of diesel fuel for power. — Use electric shovels and production drills in Rose Pit. — Minimize areas of vegetation clearing and soil disturbance — Maintain mobile mining equipment and vehicles and operate the equipment within parameters for engine exhaust system design. — Limit idling of vehicles and equipment to the extent practicable. — Conduct regular equipment maintenance. — Design procurement practices to increase involvement of local businesses within the LSA and RSA including providing information to communities on the size and timing of contracting opportunities. — Use best efforts to provide qualified local residents with a first preference for employment and training opportunities. — Conduct a Best Available Control Technology analysis and implement findings of the most recent version. — Progressive Rehabilitation	Residual effect pathway

GHG = greenhouse gas; LSA = local study area; RSA = regional study area; TMF = tailings management facility.

5.5.3.1.1 No Effect Pathways

There are no Project-environment interactions that result in no pathways for climate.

5.5.3.1.2 Negligible Effect Pathways

There are no Project-environment interactions that result in negligible effect pathways for climate.

5.5.3.1.3 Residual Effect Pathways

Project interactions that were predicted to result in residual effect pathways to climate were advanced for further assessment of residual effects. Because each Project phase is predicted to release GHGs, the Project interactions within all phases were predicted to be residual effect pathways to climate. The residual effects assessment will include Scope 1, 2, and 3 emissions of GHGs, measured in terms of tonnes of CO_2 equivalents (tCO_2e). The residual effects pathway for air quality was defined as:

– GHG emissions from Project components and activities during all Project phases contribute to climate change and provincial and national GHG emissions totals

This effect pathway was advanced for further assessment of residual effects.

5.5.3.2 Residual Project Effects Analysis

5.5.3.2.1 Direct Greenhouse Gas Emissions Subject to Regulatory Reporting

The estimated direct GHG emissions of the Project that are subject to regulatory reporting are presented annually, broken down by MGGA category, for Construction, Operations, and Closure in Table 5-24. A more detailed breakdown for each GHG measurement indicator (CO_2, CH_4, and N_2O) is presented in Appendix 5D.

For Construction, emissions were estimated annually for year -4 to year -1. For Operations, emissions were estimated annually for year 0 to year 25. For the Closure, emissions were estimated annually for year 26 to year 35.

Annual estimates were calculated using MGGA guidance and fuel estimates produced by Champion, as described in Section 5.5.1.2.1.

Table 5-24: Annual Project Greenhouse Gas Emissions Estimates for Emissions Covered by the *Management of Greenhouse Gas Act*

Phase	Project Year	GHG Emissions by Category [tCO_2e/year]				
		General Stationary Combustion	On-site Mobile Equipment	On-Site Electricity Generation	Mining Explosives	Total (Gross)
Construction	Y-4	[1]	[1]	[1]	[1]	11,900
	Y-3	[1]	[1]	[1]	[1]	11,900
	Y-2	[1]	[1]	[1]	937	23,279
	Y-1	[1]	[1]	[1]	3,244	51,879
Operations	Y0	1,216	138,605	156	4,649	144,625
	Y1	1,216	88,429	156	4,643	94,445
	Y2	1,393	88,964	156	4,997	95,510
	Y3	1,393	75,373	156	5,323	82,244
	Y4	1,393	60,514	156	5,815	67,878
	Y5	1,603	47,922	156	5,816	55,497
	Y6	1,602	42,801	156	5,503	50,062
	Y7	1,602	55,040	156	5,528	62,327
	Y8	1,602	53,293	156	5,728	60,779
	Y9	1,603	43,939	156	5,647	51,344
	Y10	1,602	43,936	156	5,821	51,515
	Y11	1,602	42,421	156	5,342	49,521
	Y12	1,602	41,109	156	5,342	48,209
	Y13	1,603	40,305	156	5,366	47,430
	Y14	1,602	42,581	156	6,153	50,493
	Y15	1,602	40,893	156	5,525	48,175

Phase	Project Year	GHG Emissions by Category [tCO_2e/year]				
		General Stationary Combustion	On-site Mobile Equipment	On-Site Electricity Generation	Mining Explosives	Total (Gross)
	Y16	1,602	41,962	156	5,012	48,731
	Y17	1,603	41,170	156	4,528	47,457
	Y18	1,602	40,544	156	3,971	46,273
	Y19	1,602	38,936	156	3,445	44,139
	Y20	1,602	39,306	156	3,184	44,248
	Y21	1,603	40,104	156	2,975	44,838
	Y22	1,602	40,557	156	2,784	45,099
	Y23	1,602	41,346	156	2,626	45,730
	Y24	0	1,411	0	0	1,411
	Y25	0	508	0	0	508
Closure	Y26-35	0	959	0	0	959

Note:
"[1]" denotes breakdown not presented. See Section 5.5.1.2.1and calculations are provided in Appendix 5D.
GHG = greenhouse gas; tCO_2e/year = tonnes of carbon dioxide equivalent per year.

For Construction, Project GHG emissions average 25 $ktCO_2e$ per year, and peak in Year -1 with 52 $ktCO_2e$. During Operations, Project GHG emissions average 59 $ktCO_2e$, and peak in Year 0 at 145 $ktCO_2e$, before steadily decreasing within the first ten years of operations. The relatively higher GHG emissions predicted in the early years reflect increased mobile equipment activity associated with overburden removal and material movement for open pit development. The overburden removal-related activities are predicted to peak in Year 0 and then decrease annually before terminating in Year 10, which is the anticipated end of the overburden contract. For the last two years of the Operations phase and the entire Closure phase, Project GHG emissions are notably lower, reflecting the winding down of mining operations.

Based on these estimates, it is anticipated that the Project would be required to report its emissions under the provincial MGGA, and federal GHGRP. It would also be subject to GHG emission reduction targets under MGGA and required to develop a BACT study, as outlined in s.12.1 of the MGGA. The BACT study is provided in TSD IV. A plan by which net zero GHG emissions may be realized or maximum GHG reductions will be otherwise realized by 2050 will be developed following submission of the EIS, in consultation with ECC. Table 5-25 summarizes the anticipated GHG-related reporting requirements for the Project, based on the annual emissions.

Table 5-25: Summary of Reporting Requirements Associated with Greenhouse Gas Emissions

Regulatory Requirement	Trigger	Anticipated Project Years
Best Available Controls Technology requirements under s.12.1 of MGGA	Projected emissions >15,000 tCO_2e	[1]
Report emissions under provincial MGGA (including verification)	Annual Emissions >15,000 tCO_2e	Y-4 - Y26
Report emissions under federal GHGRP (no verification requirements)	Annual emissions >10,000 tCO_2e	Y-4 - Y26
Project subject to emissions reduction targets under MGGA	Annual emissions >25,000 tCO_2e, following first 3 years of commercial operations	Y4-Y26

Note:
"[1]" denotes required at the Environmental Impact Statement stage.
GHG = greenhouse gas; MGGA = *Management of Greenhouse Gas Act*; GHGRP = Greenhouse Gas Reporting Program; tCO_2e = tonnes of carbon dioxide equivalent.

5.5.3.2.2 Greenhouse Gas Emissions Associated with Loss of Carbon Sink Due to Land Clearing

Loss of carbon sinks due to land clearing were estimated as a loss of the ability of the cleared land to remove carbon from the atmosphere. Based on methods and inputs presented in Section 5.5.1.2.2.2 and in Appendix 5D, it was estimated that the Project will result in the loss of sequestration of 94,600 t of CO_2, assuming a 100-year disturbance period.

The result of this calculation is heavily dependant on certain assumptions such as the time during which carbon sequestration will be interrupted (time interval) and the land area that will be affected. Extending the Project footprint to the MDA (i.e., an area much larger than the anticipated Project footprint) has resulted in a conservative estimate regarding the impact to carbon sinks by the Project. The impact to carbon sinks should decrease when the anticipated Project footprint, which is expected to be smaller than the MDA, is confirmed. Likewise, it has been assumed that all remediation will take place in the mine's Closure phase after mine operation has ended; however, remediation would be applied progressively, prior to the Closure phase, and the period during which carbon uptake is interrupted would be decreased over the remediated areas, leading to a reduction in carbon sink impacts.

5.5.3.2.3 Indirect Greenhouse Gas Emissions from Purchased Electricity

Indirect GHG emissions from purchased electricity (Scope 2) are predicted to be significantly lower than direct Scope 1 GHG emissions, reflecting the low-carbon intensity of the Newfoundland and Labrador electricity grid. Estimates of GHG emissions associated with consumption of purchased electricity are summarized in Table 5-26.

Table 5-26: Summary of Estimates of Scope 2 Greenhouse Gas Emissions from Purchased Electricity

Type	Construction	Operations	Closure
Scope 2 GHG Emissions from Purchased Electricity	2,663 tCO_2e (Year -1)	3,677 - 4,419 tCO_2e/year	<3,677 tCO_2e/year

GHG = greenhouse gas; tCO_2e = tonnes of carbon dioxide equivalent; tCO_2e/year = tonnes of carbon dioxide equivalent per year.

5.5.3.2.4 Preliminary Estimates of Greenhouse Gas Emissions Associated with Various Activities outside the Project Boundary

Preliminary estimates of GHG emissions associated with various activities outside the Project boundary (as required by the provincial EIS Guidelines) are summarized in Table 5-27. As these are considered preliminary estimates of Scope 3 emissions, refinement will be possible in the future as more detailed information on the Project and its supply chain becomes available.

Table 5-27: Summary of Preliminary Estimates of Greenhouse Gas Emissions Associated with Various Activities outside the Project Boundary

Type	Construction	Operations	Closure
On-road	3 to 13 $ktCO_2e$/year	11 to 36 $ktCO_2e$/year	Negligible in comparison with previous phases
Rail transportation	30 $ktCO_2e$	90 to 100 $ktCO_2e$/year	
Marine transportation	–	270 to 450 $ktCO_2e$/year	
Air travel	3 $ktCO_2e$/year	< 3 $ktCO_2e$/year	< 3 $ktCO_2e$/year
Solid waste	<2 $ktCO_2e$/year	2 to 6 $ktCO_2e$/year	< 1 $ktCO_2e$/year

$ktCO_2e$ = kilotonnes of carbon dioxide equivalent; $ktCO_2e$/year = kilotonnes of carbon dioxide equivalent per year.

5.5.3.2.5 Project Greenhouse Gas Emissions Intensity

GHG emissions intensity is a measure of GHG emissions per unit of production. It is a common metric used for comparing similar operations and can be an indictor of efficiency. Annual Project GHG emission intensities have been estimated for Operations, based on total direct Scope 1 GHG emissions per million tonnes of iron ore concentrate produced, and are shown on Table 5-28. Table 5-28 excludes Years 24 and 25 since intensities for those years are not representative of the rest of operations and not suitable for comparison and the findings in the table assumes that the in-pit crusher is operational in Year 0.

Table 5-28: Emission Intensity by Project Year

Year of Operation	Scope 1 GHG Emissions [tCO_2e]	Concentrate (wMt)	Scope 1 GHG Emissions Intensity (tCO_2e/Mt Concentrate)
Y0	144,625	5.4	26,782
Y1	94,445	8.2	11,518
Y2	95,510	8.2	11,648
Y3	82,244	8.2	10,030
Y4	67,878	8.7	7,802
Y5	55,497	8.6	6,453

Year of Operation	Scope 1 GHG Emissions [tCO_2e]	Concentrate (wMt)	Scope 1 GHG Emissions Intensity (tCO_2e/Mt Concentrate)
Y6	50,062	8.5	5,890
Y7	62,327	8.5	7,333
Y8	60,779	8.4	7,236
Y9	51,344	8.5	6,041
Y10	51,515	8.6	5,990
Y11	49,521	8.6	5,758
Y12	48,209	8.6	5,606
Y13	47,430	8.6	5,515
Y14	50,493	8.6	5,871
Y15	48,175	8.6	5,602
Y16	48,731	8.6	5,666
Y17	47,457	8.6	5,518
Y18	46,273	8.6	5,381
Y19	44,139	8.6	5,132
Y20	44,248	8.7	5,086
Y21	44,838	8.6	5,214
Y22	45,099	8.6	5,244
Y23	45,730	8.8	5,197

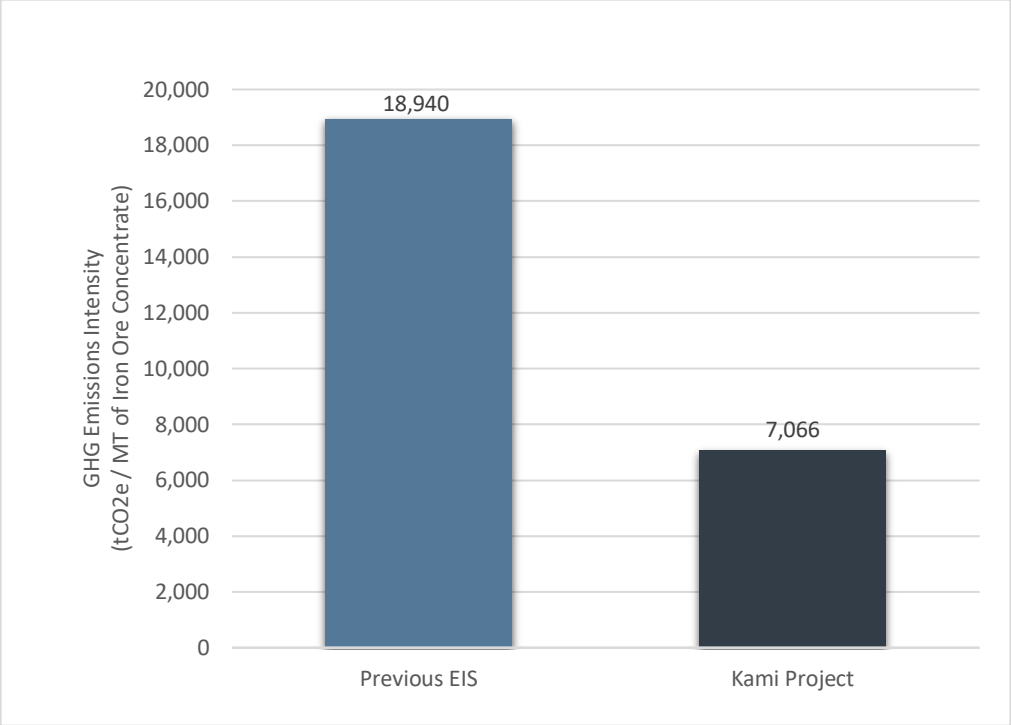
GHG = greenhouse gas; tCO_2e = tonnes of carbon dioxide equivalent; wMt = million tonnes (wet); tCO_2e/Mt concentrate =tonnes of carbon dioxide equivalent per million tonnes concentrate.

The Project GHG emission intensity trend shown in Table 5-29 parallels the Project GHG emissions, where they are initially the highest in Year 0 of Operations at approximately 27 $ktCO_2e$/Mt, before significantly decreasing year over year within the first ten years of operations. GHG emission intensity is more stable in years 11 to 23, stabilizing between 5 and 6 $ktCO_2$/Mt. As discussed in Section 5.5.3.2.1, the relatively high GHG emission intensity in the early years reflect GHG emissions associated with overburden removal and pit development, in addition to hauling.

The nearby Tacora Resources' Scully Mine, an iron ore operation located north of Wabush, reported a GHG emission intensity over 30,000 tCO_2e/Mt of concentrate in 2023 (Tacora 2024). This is between three to six times greater than GHG emission intensity projected for the Project (beyond Year 3). Iron Ore of Canada also operates outside Labrador City; however, this Facility produces iron ore pellets as well as concentrate, and therefore their GHG emission intensity is not directly comparable to the Project.

5.5.3.2.6 Comparison of Greenhouse Gas Emissions to Previous Environmental Impact Statement

The previous EIS provided a single annual Scope 1 GHG emissions estimate for the Operations phase of 303,044 tCO_2e (this excludes the previous EIS's estimate for rail transport, which is not considered Scope 1 in this assessment), and an annual production estimate of 16,000,000 tonnes of iron ore concentrate per year (Alderon 2012). Figure 5-10 compares the Scope 1 GHG emissions intensity for the previous EIS to total Operations Phase Scope 1 GHG emissions intensity of the current Project. This comparison demonstrates that the current Project Scope 1 GHG emissions intensity is significantly lower for the proposed Project when compared to the project proposed in the previous EIS.

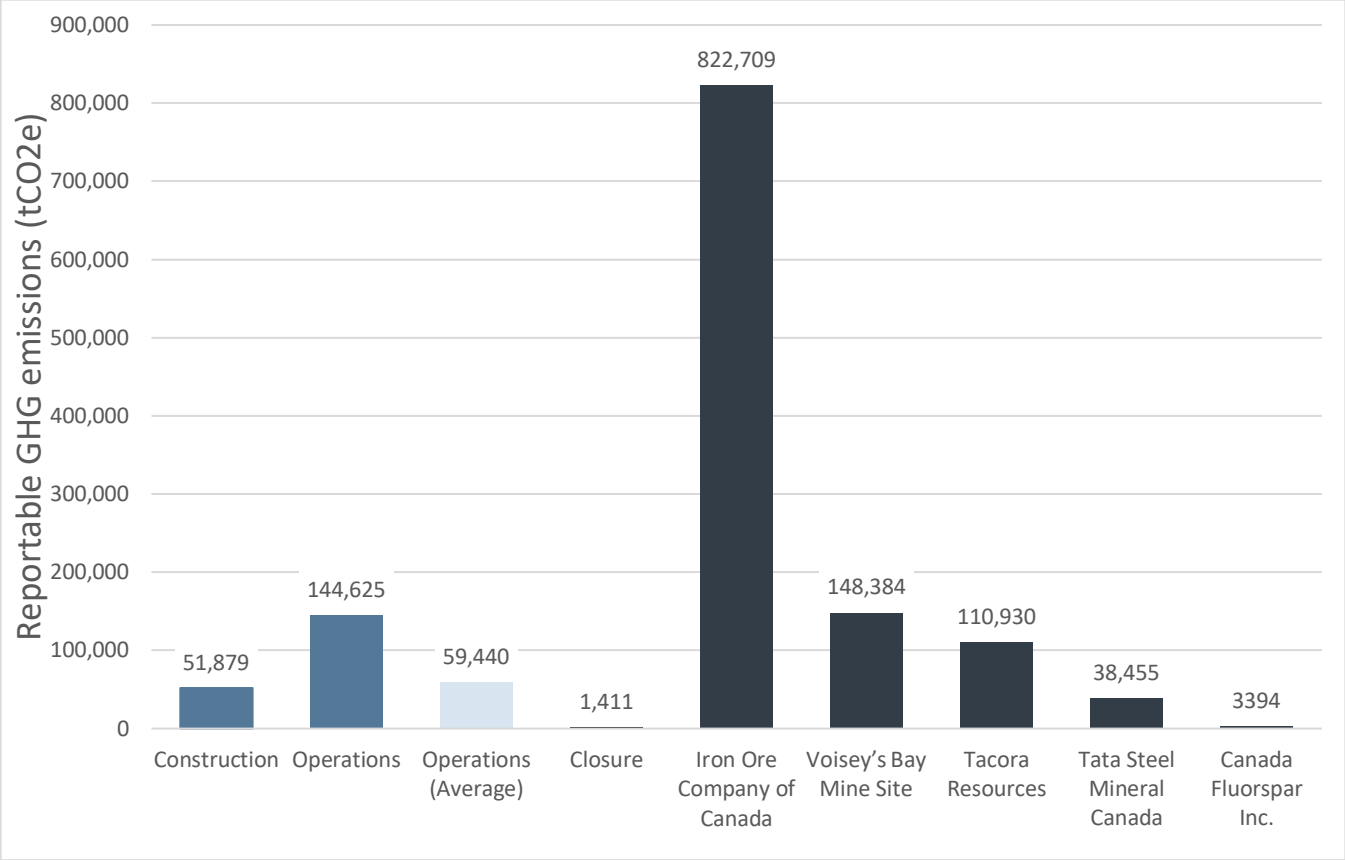


EIS = Environmental Impact Statement; GHG = greenhouse gas; tCO_2e = tonnes of carbon dioxide equivalent; MT = million tonnes.

Figure 5-10: Estimated Scope 1 Greenhouse Emissions Intensity during Operations Phase

5.5.3.2.7 Greenhouse Gas Effects of Project on Provincial Greenhouse Gas Emission Levels

Figure 5-10 provides a comparison of the 2022 GHG emissions from mining facilities operating within Newfoundland and Labrador in red, with Project Construction and Operations GHG emissions in blue. To allow for this comparison, only the direct GHG emissions which are subject to regulatory reporting are included in the Project totals. The figure shows the maximum annual GHG emissions for the Construction, Operations, as well as the representative average GHG emissions for the Operations phase. The Project's predicted peak GHG emissions year during Construction (52 $ktCO_{2e}$) would rank the Project as the fourth-largest emitter in the province among mining operations. For the predicted peak GHG emissions year for Operations (145 $tkCO_{2e}$) the Project would rank as the third-largest emitter amongst the 2022 mining facilities covered under MGGA; however, considering average GHG emission levels projected over the Operations phase (excluding Years 24 and 25, which reflect winding down of operations), the Project would be expected to rank as the fourth-largest emitter for the majority of the Project life. The Project during the Closure Phase would rank as the lowest emitter among the 2022 mining facilities covered under MGGA.



GHG = greenhouse gas; tCO_2e = tonnes of carbon dioxide equivalent.

Figure 5-11: Comparison of Greenhouse Gas Emissions between the Project and 2022 Mining Operations under *Management of Greenhouse Gas Act*

The residual effects of the estimated maximum annual Project GHG emissions from each Project phase on provincial, national sector, and federal levels were assessed through the comparison to the most recent available emission totals for Newfoundland and Labrador and Canada. The annual GHG emissions for Year -1, Year 0, and Year 26 (i.e., representative of the maximum annual GHG emissions for each phase), as well as the operational average GHG emissions, are compared to the 2022 provincial and federal GHG emission inventories in Table 5-29.

Table 5-29: Project Greenhouse Gas Emissions Comparison to 2022 Greenhouse Gas Emission Provincial and Federal Inventories

	GHG Emission Inventory ($MtCO_2e$)	Project GHG Emissions as a Relative Percentage of GHG Emission Inventory			
		Construction Annual Maximum (Year -1)	Operations Annual Maximum (Year 0)	Operations Annual Average	Closure Annual Maximum (Year 26)
NL – all sectors (2022)	8.6	0.6%	1.7%	0.7%	0.02%
NL – heavy industry (2022)	1.2	4.3%	12.1%	5.0%	0.1%
NL – mining (2022)	1.1	4.7%	13.1%	5.4%	0.1%
NL target – all sectors (2030)	7.2	0.7%	2.0%	0.8%	0.02%
Canada (2022)	708	0.01%	0.02%	0.01%	0.00%

Source: ECCC 2024.
NL = Newfoundland and Labrador; GHG = greenhouse gas; $MtCO_2e$ = millions of tonnes of carbon dioxide equivalent.

5.5.3.2.8 Residual Project Effects Characterization

Following the methods described in Section 5.5.1.2.2.8, residual effects on the climate VEC from Project GHG emissions are classified in Table 5-30. As noted in Section 5.5.1.2.2.8, most residual effects criteria do not vary due to the long-term to permanent (i.e., duration) and global nature (i.e., beyond regional extent) of GHGs. The effects of GHG releases are invariably adverse, continuous, and irreversible (i.e., lasting well beyond when the contribution of GHGs ceases); therefore, when considering GHGs, the only applicable residual effects criterion is magnitude. Based on the effects criteria classifications for the assessment, the magnitude of Project GHG emissions is considered low because the average annual Project GHG emissions would be less than 0.7% of the provincial total emissions and less than 0.01% of the federal total emissions.

Table 5-30: Characterization of Residual Effects on Climate for Greenhouse Gas Emissions

Residual Effect	Criterion	Rating/Effect Size
Change in GHG emissions	Magnitude	Low, as annual GHG emissions are between 0.1% and 1% of the annual provincial emission levels (<0.7%), or 0.01% and 0.1% of the annual federal emission levels (<0.01%)

GHG = greenhouse gas.

5.5.3.2.9 Significance Determination

As presented in Section 5.5.1.4, the significance thresholds for the climate VEC are the following:

- contribution of Project GHG emissions to the provincial and federal totals
- continued ability for the province and Canada to reach climate change commitments in the form of emission reduction targets

Average annual Project GHG emissions would be less than 1% of the 2022 provincial annual total GHG emissions and approximately 0.01% of the 2022 federal annual total GHG emissions. Considering the provincial outlook to 2030, where GHG emissions targets are 30% below 2005 levels, the average Project GHG emissions would continue to contribute less than 1% of provincial GHG emissions at the 2030 target. Given the low contribution of the Project to the provincial totals, Newfoundland and Labrador would be expected to be capable of maintaining the ability to reach its climate change commitments through advancing technology to support fuel switching and energy efficiency. This Project also serves as a good example for Newfoundland and Labrador on implementing advanced technology in industry by utilizing electrification for material movement (in-pit crushing and conveyance for mine rock), where the industry standard is to use traditional hauling methods based on fossil fuel combustion. To this end, the residual effects from the Project to the climate VEC are determined to be not significant.

Furthermore, steel is a foundational material for modern infrastructure and industrial development and is estimated to contribute between 8% and 10% of global carbon emissions annually (International Energy Agency, 2023a). In response to global climate objectives such as the Paris Agreement and achieving net-zero GHG emissions by 2050 (United Nations, 2025), the steel industry is increasingly shifting away from the traditional coal-burning, BOF steelmaking and towards decarbonized production pathways such as DRI and electric arc furnace steelmaking (see, for example, Government of Canada 2021c).

The high-grade, low-impurity iron ore concentrate produced by the Project is specifically designed to support an industrial transition to DRI. Whereas traditional BOF methods use coal as a reducing agent in steelmaking, the DRI process uses natural gas or, more efficiently, hydrogen as a reducing agent to considerably reduce carbon emissions (Champion 2023). By contrast, low-grade iron ore concentrate can be used in DRI steelmaking processes if additional costly and energy-intensive beneficiation processes are conducted to remove the ore concentrate's inherent impurities. The Project's concentrate will not require additional downstream processing for use in DRI steelmaking. Thus, by supplying a feedstock that is optimized for low-emissions steelmaking processes (e.g., DRI), the Project aligns with global efforts to reduce reliance on BOF, thereby reducing overall industrial emissions and supporting the long-term sustainability of the steel sector (Champion 2024). It is estimated that the DRI process proposed for the Project emits approximately 50% less carbon emissions than traditional blast furnace processes (i.e., BOF) (Champion 2023b).

5.6 Prediction Confidence and Uncertainty

A key element of a comprehensive environmental assessment is the prediction of future conditions of the environment as a result of the Project from previous and existing projects and activities and RFDs. Given that environments change naturally and continually through time and across space, assessments of effects and predictions about future conditions embody some degree of uncertainty (CEA Agency 2018).

The purpose of the Prediction Confidence and Uncertainty section is to identify the key sources of uncertainty and qualitatively describe how uncertainty was addressed for air quality and climate VECs to increase the level of confidence that effects would not be larger than predicted, including the potential need for monitoring and adaptive management that can reduce uncertainty over time (Section 4.10). Confidence in effects analyses can be related to many elements for air quality and climate VECs.

The main sources of uncertainty associated with the air quality predictions for COCs and GHG predictions are the following:

- Project design (e.g., actual fuel consumption versus proposed fuel consumption) and Project activity levels (e.g., actual operating hours of heavy equipment versus proposed operating hours) associated with the COCs and GHG Scope 1 and 2 emissions
- availability and quality of information on which to base estimates of GHG emissions for activities outside the Project boundary (Scope 3) required by the provincial EIS Guidelines
- variability in local-scale meteorology (e.g., local wind fields and precipitation versus modelled wind fields and precipitation)
- emission source representation (e.g., dimensions of emission sources) in the air dispersion modelling
- availability and accuracy of GHG emission factors for non-traditional emission sources (for example, explosives)
- accuracy of projected GHG emission factors for the Newfoundland Labrador electrical grid
- level of complexity of GHG emissions in terms of who bears the responsibility for the effects GHG emissions are likely to have on climate change
- level of certainty associated with the effectiveness of proposed mitigations, where applicable

The characterization of residual Project effects incorporates a number of conservative assumptions to increase the confidence that the modelled predictions will not underestimate the effects of the Project. The assumptions included in the assessment are:

- The release estimates are based on an operating year that assumes the greatest movement of ore, mine rock, and overburden.
- Unless otherwise noted in Appendix 5B, operations were assumed to be occurring simultaneously 24 hours per day, 365 days per year.
- Except for mobile equipment in the TMF, the mobile fleet was assumed to be operating simultaneously, 24 hours per day, 365 days per year.
- The primary ore crusher and in-pit crusher were assumed to be operating at the maximum throughput 24 hours per day.
- Emissions from the largest blast size were considered for every hour of the meteorological dataset, whereas blasting will be limited to daytime hours and will be occurring only once per day.
- Emission rates for wind erosion from the tailings area and mine rock stockpile were calculated using the maximum exposed surface area from the Project design (which is not expected to occur during the same operating year as the maximum material movement). The model assumes that the emissions from the maximum exposed surface area are occurring over a much smaller area leading to a conservative g/m^2-s emission rate in the air dispersion model.
- Volume sources were conservatively sized to be smaller than the actual emission source.

Uncertainty was also managed by:

- completing quality assurance and quality control of emissions calculations
- using the best available method for calculating emissions from each emission source
- using the best available emission factor data for calculating emissions

To account for the variability of meteorological parameters (e.g., local wind speed and direction), a four-year meteorological dataset was used in the air dispersion modelling to consider plausible meteorological conditions, seasonal variability, and atmospheric stability. Thus, the maximum predictions would represent the concentrations under the worst-case meteorological conditions. The air dispersion model is inherently conservative when configured to predict maximum concentrations, as completed for this assessment. The assessment approach also represents a worst-case emission scenario that is expected to overestimate the ground-level concentrations When combined with the additional conservatism assumed for emissions estimates, there is a high degree of confidence that observed concentrations of COCs and GHG emissions would not exceed the predicted values.

5.7 Monitoring, Follow-Up, and Adaptive Management

This section presents a summary of the identified monitoring and follow-up required to confirm effects predictions and address uncertainty identified in Section 5.5.2.5.

An ambient air quality monitoring program will be implemented during each Project phase to verify the model predictions, assess the effectiveness of mitigation measures, and inform if further mitigation measures are required. The effectiveness of mitigation measures will be re-assessed through the life of the Project and opportunities for continuous improvement of dust management practices will be investigated, as required. The monitors will be in addition to the existing ambient air quality monitors operated by Rio Tinto IOC and Tacora in Western Labrador. The locations of monitors and parameters to be considered at each, will be established in consultation with ECC, and reflected in an updated version of the ambient air quality monitoring program. A framework for a ambient an air quality monitoring program is included in Annex 5E of the EIS.

Where relevant, adaptive management measures to address the uncertainties associated with the effects predictions and mitigation, may be proposed. The process for determining when, how, and where adaptive management would be used will be described in an Environmental Protection Plan. A table of contents for the Environmental Protection Plan that will be prepared for the Construction phase is included in Annex 5D of this EIS.

The Project would result in increased GHG emissions compared to current sector, provincial, and federal totals during all Project phases. Based on the annual estimates of Project GHG emissions, it is anticipated that the Project would be required to report its emissions under the provincial MGGA, and federal GHGRP. The Project would also be subject to GHG emission reduction targets under MGGA, and required to develop a BACT study, as outlined in s.12.1 of the MGGA at the EIS stage. The BACT study is provided in TSD IV of this EIS.

Where relevant, adaptive management measures to address the uncertainties associated with the effects predictions and mitigation, may be proposed. The process for determining when, how, and where adaptive management would be used will be described in an Environmental Protection Plan. A table of contents for the Environmental Protection Plan that will be prepared for the Construction phase is included in Annex 5D of this EIS. As new information verifies environmental effects and the efficacy of mitigation measures, monitoring programs will also be improved accordingly through updates to the Environmental Effects Monitoring Program. Monitoring will be compared to anticipated effects and permit requirements.

5.8 Predicted Future Conditions Should the Project Not Proceed

If the Project were not to proceed, air quality in the LSA would remain at the existing background levels unless any of the other existing mining developments were to substantially increase their operations and emission of COCs or a new Project or operation with large industrial emissions were to be proposed. Based on the RFDs identified in Chapter 4 and presented in Section 5.5.2.3, a substantial increase in emissions that would result in a measurable increase in existing background level is not anticipated.

Both the federal and provincial governments have pledged to cut GHG emissions by 2030 and achieve net-zero emissions by 2050. The federal goal is lower GHG emissions by 30% from 2005 levels by 2030 and to establish a low-carbon economy by 2050 (ECCC 2019). If the Project does not move forward, the current trend of decreasing GHG emissions at the federal and provincial levels would persist due to governmental efforts to meet their targets and mitigate climate change. This trend is expected to continue regardless of the Project's implementation, as its impact on overall GHG emissions would not be significant enough to prevent Canada and Newfoundland and Labrador from meeting their reduction targets.

Globally, steel making is estimated to contribute between 8% and 10% of global carbon emissions annually and not proceeding with the Project would further limit the capacity to produce steel from high-purity iron ore concentrate.

5.9 Key Findings and Conclusions

5.9.1 Air Quality

Potential effects from the Project on air quality were assessed within the LSA by modelling Project emissions and dispersion of COCs during operations and considering the predicted ambient air concentrations. The existing conditions were summarized using measured concentrations from the existing air quality monitoring station in Labrador City. Release estimates for the Project were calculated using published emission factors such as those from the United States Environmental Protection Agency AP-42 (US EPA 1995). COC concentrations were predicted using the accepted air quality dispersion modelling approaches in accordance with the provincial modelling guideline (Government of NL 2012). The predicted air concentrations from the Project were added to the background concentrations to assess residual effects from the Project. The air dispersion model is conservative when configured to predict maximum concentrations as was done in this assessment. When combined with the conservative emission estimates for particulate matter, outlined in Section 5.6, there is a high degree of confidence that the observed conditions will produce lower emissions than what was shown in the modelled predictions.

The previous EIS concluded that residual effects from the Project on air quality were not likely to be significant (Alderon 2012). Although, it was stated that a number of cabins at the southern end of Duley Lake would be affected by particulate matter during operations, mitigation measures would be implemented to reduce significant adverse effects on properties. Operations would increase air pollutants above background levels, but within provincial regulatory limits and federal objectives at the nearest communities and would be restricted to the LSA.

In the current study, the concentrations of 24-hour TPM and PM_{10} have a maximum predicted concentration that exceed the NLAAQS at the predicted worst-case cabin location, Duley Lake South, and Fermont; however, the model predicts a low frequency of the exceedances (Table 5-20 and Table 5-21). For example, the cabin with the highest predicted concentration of TPM, will only exceed the standard 3 days per year and the concentration of PM_{10} in Fermont is predicted to only exceed the standard two days of the year. The release estimates incorporated some mitigation measures, but as discussed in Section 5.7.1, it is acknowledged that more stringent dust control may be required to reduce fugitive dust generation. Champion is also proposing to implement a compensation program for cabin owners which will reduce the magnitude of the predicted effects. A monitoring program for COCs will be developed and implemented prior to Construction, should the Project be approved. Monitoring will be in place during all Project phases to verify modelled concentrations and inform if further mitigation measures are required to reduce emissions from the Project.

A comparison of the residual environmental effects characterization for the Operations phase between the previous EIS (Alderon 2012) and the current study are provided in Table 5-31. There is agreement between the characterizations of residual effects with the exception of magnitude. The magnitude in the current study is determined by the maximum ground level concentrations just outside the SSA and surface leases, while the Alderon magnitude characterization was determined based on modelled concentrations at the community receptors.

Table 5-31: Comparison of the Residual Environmental Effects Characterizations between the Alderon Environmental Impact Statement and Champion Environmental Impact Statement

Residual Environmental Effects Characterization	Alderon EIS	Champion EIS
Direction	Adverse	Adverse
Magnitude	Moderate	High: TPM and PM_{10} Moderate: $PM_{2.5}$ and NO_2 Low: CO, SO_2, and metals
Geographic extent	Local	Local
Duration	Medium term	Medium term
Timing	Not Applicable	Year-round
Frequency	Continuous	Continuous
Reversibility	Reversible	Reversible
Environmental or socioeconomic context	Disturbed	Disturbed

CO = carbon monoxide; EIS = Environmental Impact Statement; NO_2 = nitrogen dioxide; PM_{10} = particulate matter less than 10 micrometres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; SO_2 = sulfur dioxide; TPM = total particulate matter.

Changes to air quality could influence the environment, land use, and human health if they are present in certain concentrations; therefore, air quality has intrinsic importance to the health and well-being of humans, wildlife, and vegetation. Predicted changes to the air quality VEC presented in Section 5.5.2.2 are carried through to the assessments of the following VEC technical chapters:

- surface water (Chapter 8)
- fish and fish habitat (Chapter 9)
- vegetation, wetlands and protected areas (Chapter 10)
- wildlife (Chapter 11)
- Indigenous land and resource use (Chapter 13)
- other land and resource use (Chapter 14)

Predicted changes to air quality were also considered in the human health risk assessment (TSD XI), which informed the assessment of the community health and well-being VEC (Chapter 17).

5.9.2 Climate

Based on the annual estimates of Project GHG emissions, it is anticipated that the Project would be required to report its emissions under the provincial MGGA, and federal GHGRP. The Project would also be subject to GHG emission reduction targets under MGGA, and required to develop a BACT study, as outlined in s.12.1 of the MGGA at the EIS stage. The BACT study is available in TSD IV of this EIS. A plan by which net zero GHG emissions may be realized or maximum GHG reductions will be otherwise realized by 2050 will be developed following submission of the EIS, in consultation with ECC.

The Project GHG estimates demonstrate that the current Project Scope 1 GHG emissions intensity is significantly lower than the proposed project in the previous EIS.

Average annual Project GHG emissions would be lower than 1% of the 2022 provincial annual total GHG emissions and approximately 0.01% of the 2022 federal annual total GHG emissions. Considering the provincial outlook to 2030, where GHG emissions targets are 30% below 2005 levels, the average Project GHG would continue to contribute less than 1% of provincial GHG emissions at the 2030 target. Given the low contribution of the Project to the provincial totals, Newfoundland and Labrador would be expected to be capable of maintaining the ability to reach its climate change commitments through advancing technology to support fuel switching and energy efficiency. This Project also serves as a good example for Newfoundland and Labrador on implementing advanced technology in industry by utilizing electrification for material movement (in-pit crushing and conveyance for waste), where the industry standard is to use traditional hauling methods based on fossil fuel combustion.

Appendix 5A: Air Quality Dispersion Modelling Report

REPORT

Air Quality Dispersion Modelling Report

Kami Iron Ore Mine Project

Submitted to:

Champion Kami Partner Inc.

1155 René-Lévesque Blvd. West
Suite 3300
Montréal, QC H3B 3X7

Submitted by:

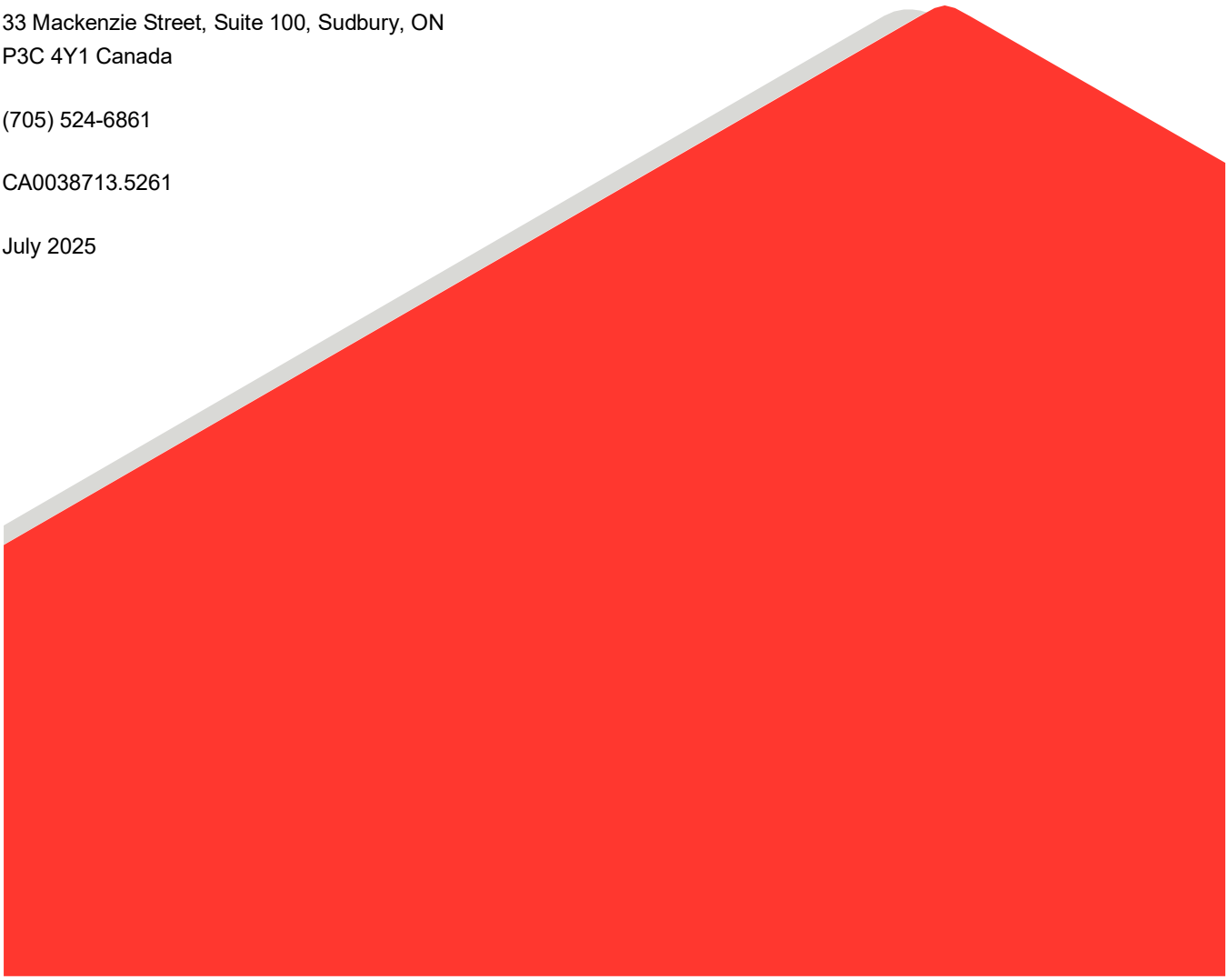
WSP Canada Inc.

33 Mackenzie Street, Suite 100, Sudbury, ON
P3C 4Y1 Canada

(705) 524-6861

CA0038713.5261

July 2025



Distribution List

Champion Kami Partner Inc.

Table of Contents

1.0 INTRODUCTION 1

2.0 ATMOSPHERIC EMISSIONS AND APPLICABLE AIR QUALITY CRITERIA 3

2.1 Compounds of Concern 3

2.2 Regulatory Criteria and Guidelines 3

3.0 ASSESSMENT BOUNDARIES 4

3.1 Spatial Boundaries 4

3.1.1 Site Study Area 4

3.1.2 Local Study Area 4

3.1.3 Regional Study Area 4

3.2 Temporal Boundaries 5

4.0 CALPUFF DISPERSION MODEL 7

4.1 CALMET Meteorological Model 7

4.1.1 CALMET-Predicted Wind Rose 7

4.1.2 Ambient Temperature 8

4.1.3 Mixing Height 9

4.1.4 Atmospheric Stability 10

5.0 DISPERSION MODELLING METHODS 11

5.1 Modelling Domain 11

5.2 Dispersion Modelling Sources 11

5.2.1 Point Sources 12

5.2.2 Area Sources 14

5.2.3 Volume Sources 14

5.3 Building Downwash 16

5.4 Receptors 16

5.5 Particulate Matter Size Distribution and Deposition 19

5.6 Ozone Background Concentrations 19

5.7 Chemical Transformation 20

5.8 Special Modelling Considerations 20
5.8.1 Hourly Emission Files 20
5.8.2 Natural Mitigation 21
5.9 Conservative Modelling Assumptions 21
5.10 CALPUFF Switch Settings 21
6.0 DISPERSION MODELLING RESULTS 22
7.0 CONCLUSIONS 26
8.0 REFERENCES 27

TABLES

Table 2-1: Standards Applicable to the Compounds of Concern Emissions for the Project 3
Table 5-1: Point Source Parameters 12
Table 5-2: List of Area Sources 14
Table 5-3: Volume Source Parameters 14
Table 5-4: Road and Rail Model Source Parameters 16
Table 5-5: Particulate Sizing 19
Table 5-6: Background Ozone Levels for CALPUFF Modelling – Labrador 19
Table 5-7: Background Concentrations of Ammonia and Hydrogen Peroxide 20
Table 5-8: CALPUFF Model Switches 21
Table 6-1: 95th Percentile of Metals in the Ore and Mine Rock Assays for the Project 22
Table 6-2: Maximum Predicted Changes to Air Quality from Project Operations at Model Receptors Outside of the Site Study Area 24
Table 6-3: Maximum Predicted Change to Air Quality at Sensitive Receptors 25

FIGURES

Figure 1-1: Project Location and Site Layout 2
Figure 3-1: Air Quality Assessment Boundaries 6
Figure 4-1: Comparison of Annual Wind Roses Using Regional Observations from the Wabush Airport Meteorological Station and CALMET Data for the Wabush Airport Grid Cell 8
Figure 4-2: Monthly Averages of the Daily Air Temperatures at CALMET Grid Cell, Containing Wabush Airport (January 1, 2018, to December 31, 2021) and Climate Normals at Wabush (1991 to 2020) 9
Figure 4-3: Mixing Height at 10 Metres from the CALMET Grid Cell, Containing Wabush Airport (January 1, 2018, to December 31, 2021) 10

Figure 4-4: Diurnal Variation in Stability Classes from the CALMET Data Representing the Project 11
Figure 5-1: Emission Sources 13
Figure 5-2: Area of Modelling Coverage 17
Figure 5-3: Discrete Receptors.....18

APPENDICES

APPENDIX A
Dispersion Modelling Source Summary Tables

APPENDIX B
Location of Sensitive Receptors

Abbreviations and Units

Abbreviation	Description
BPIP-ISC	Building Profile Input Program
CALPUFF	California Puff
CALMET	Meteorological Model
Champion	Champion Iron Limited
ECC	Government of Newfoundland and Labrador, Department of Environment and Climate Change
EA	Environmental Assessment
EIS	Environmental Impact Statement
H_2O_2	hydrogen peroxide
LSA	local study area
NH_3	ammonia
NO_2	nitrogen dioxide
NO	nitrogen oxide
NOx	nitrogen oxides
TLU	Traditional Land Use
TMF	tailings management facility
UTM	Universal Transverse Mercator
WSP	WSP Canada Inc.

Units	Description
K	Kelvin
km	kilometres
m	metres
m/s	metres per second

1.0 INTRODUCTION

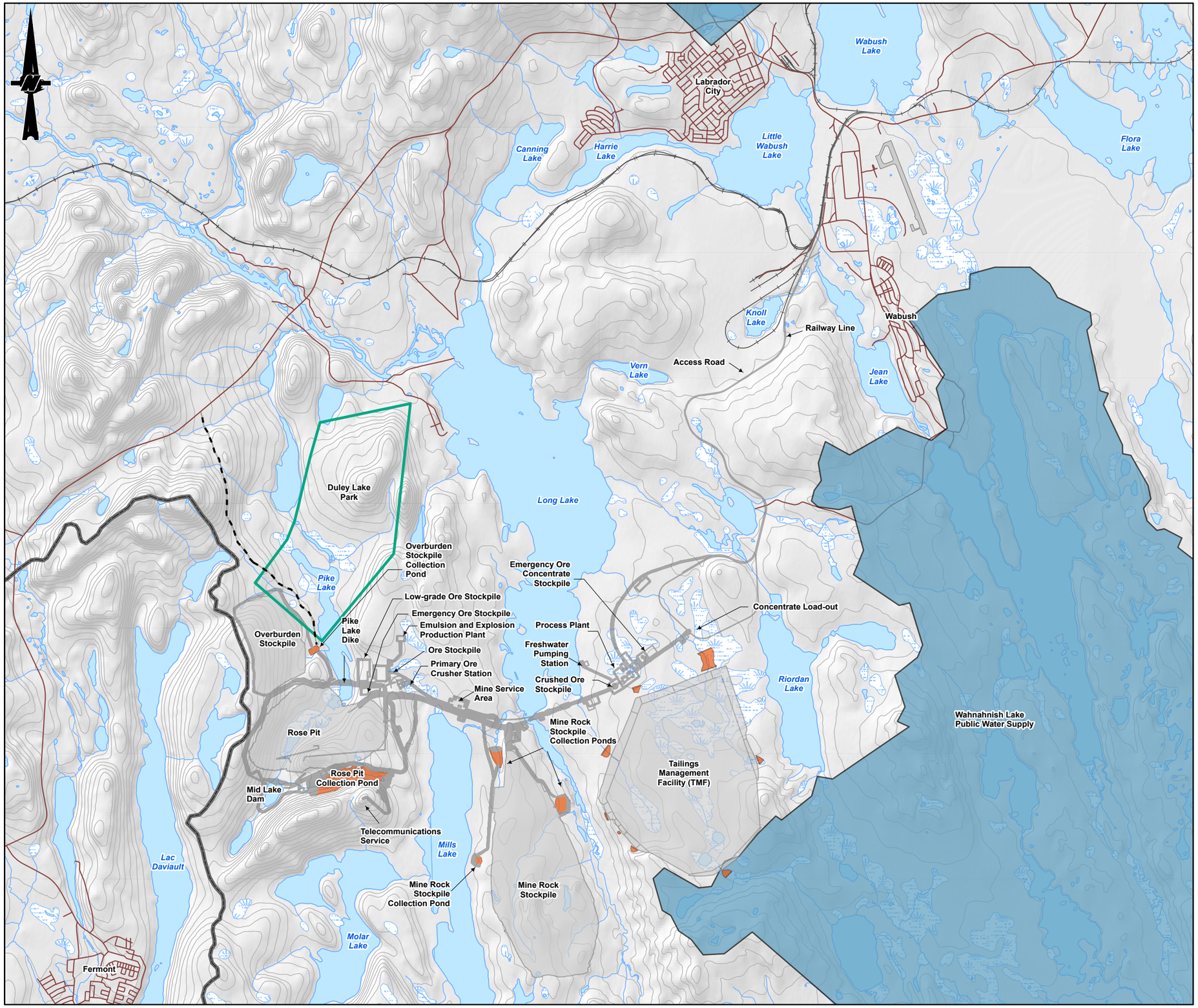
The Kamistiatusset (Kami) Iron Ore Mine Project (the Project) is a proposed iron ore mine in Newfoundland and Labrador. The Project site is located entirely in Labrador, approximately 7 km from the Town of Wabush, 10 km from the Town of Labrador City, and 5 km east of Ville de Fermont, Québec (Figure 1-1).

The Project was originally proposed by the Alderon Iron Ore Corporation (Alderon) and underwent a provincial and federal Environmental Impact Assessment from 2011 to 2013, including a comprehensive baseline program that was completed in 2011 and 2012. The Project was released from the provincial and federal Environmental Assessment (EA) process in 2014. In 2021, Champion Iron Limited (Champion), through its subsidiary, 12364042 Canada Inc., completed the acquisition of the Project from Alderon.

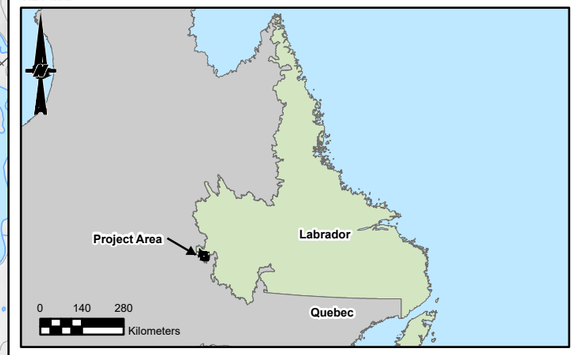
Champion is proposing several changes to the Project design proposed by Alderon through the previous Environmental Impact Statement (EIS). These proposed changes include optimizations to the Project's water management strategy and modernization of the proposed ore handling, conveyance, and processing. Champion's objective for the Project is to produce high-purity (over 69%) iron concentrate, which can be used as direct reduction pellet feed for electric arc furnaces in the green steel supply chain.

Champion submitted a Project Registration document to the Newfoundland and Labrador Environmental Assessment Division of the Department of Environment and Climate Change in April 2024 to restart the EA process for the Project. On June 13, 2024, the Minister issued a Decision Letter to Champion concluding that an EIS would be required for the Project. To support the EIS process, Champion has commissioned the services of WSP Canada Inc. (WSP) to complete air quality dispersion modelling for the Project.

This technical report was prepared as part of the EIS for the Project to describe the dispersion modelling methods and predicted ground-level concentrations for the operation phase of the Project. The air quality release estimates report is provided in Appendix 5B. The report summarizes the emission estimate methods, input parameters, and assumptions that were used to estimate emission rates for the operation phase of the Project. The Project mitigation measures that were factored into the air quality emission estimates are also summarized in Appendix 5B.



KEY MAP



SCALE 1:20,000,000

Legend

PROJECT DATA

- Proposed Project Infrastructure
- Proposed Sediment Pond
- Potential Access Road

BASEMAP INFORMATION

- Road
- Railway
- Watercourse
- Contour
- Duley Lake Park
- Bog/Wetland
- Waterbody
- Labrador/Quebec Boundary
- Public Water Supply

0 1,000 2,000 4,000

1:71,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PROJECT LOCATION AND SITE LAYOUT

CONSULTANT

wsp

YYYY-MM-DD	2025-02-27
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0002_General\CA0038713_5261_0002_V.X.aprx PRINTED ON: AT: 1:57:20 PM

2.0 ATMOSPHERIC EMISSIONS AND APPLICABLE AIR QUALITY CRITERIA

2.1 Compounds of Concern

The air quality effects assessment focused on the Contaminants of Concern (COC) which include total particulate matter (TPM), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), and metals including arsenic, cadmium, copper, lead, mercury, nickel, vanadium, and zinc. TPM was speciated using rock assays for the Project to estimate the concentrations of metals.

2.2 Regulatory Criteria and Guidelines

The Government of Newfoundland and Labrador lists the ambient air quality standards (NLAAQS) in Table I of Schedule A of the *Air Pollution Control Regulations, 2022* (O.C. 2022-072), under the Newfoundland and Labrador *Environmental Protection Act*. For provincial permitting, facilities are expected to demonstrate compliance with the standards at the facility's administrative boundary. The NLAAQS applicable to the Project are summarized in Table 2-1.

Table 2-1: Standards Applicable to the Compounds of Concern Emissions for the Project

Pollutant	Averaging Period	Newfoundland and Labrador Ambient Air Quality Standards[(a)]
Nitrogen dioxide	1 hour	213 ppb
	24 hour	106 ppb
	Annual	53 ppb
Sulphur dioxide	1 hour	344 ppb
	3 hour	229 ppb
	24 hour	115 ppb
	Annual	23 ppb
Carbon monoxide	1 hour	30,582 ppb
	8 hour	13,107 ppb
Total particulate matter	24 hour	120 µg/m³
	Annual	60 µg/m³
PM_{10}	24 hour	50 µg/m³
$PM_{2.5}$	24 hour	25 µg/m³
	Annual	8.8 µg/m³
Arsenic	24 hour	0.3 µg/m³
Cadmium	24 hour	2 µg/m³
Copper	24 hour	50 µg/m³

Table 2-1: Standards Applicable to the Compounds of Concern Emissions for the Project

Pollutant	Averaging Period	Newfoundland and Labrador Ambient Air Quality Standards[(a)]
Lead	24 hour	2 µg/m³
Mercury	24 hour	2 µg/m³
Nickel	24 hour	2 µg/m³
Vanadium	24 hour	2 µg/m³
Zinc	24 hour	120 µg/m³

Notes:

PM_{10} = particulate matter less than 10 micrometers; $PM_{2.5}$ = particulate matter less than 2.5 micrometers

(a) Government of Newfoundland and Labrador (O.C. 2022-072).

3.0 ASSESSMENT BOUNDARIES

3.1 Spatial Boundaries

The spatial boundaries for air quality are shown in Figure 3-1 and defined in Section 3.1.1 through Section 3.1.3.

3.1.1 Site Study Area

The site study area (SSA) includes the proposed infrastructure within the Project footprint, with an additional buffer to reflect existing uncertainty in the final design of the Project, so that adverse effects to Valued Ecosystem Components (VECs) are not underestimated (i.e., the SSA area is twice as large as the anticipated Project footprint). The SSA is constrained to avoid certain features, including major lakes, the Québec–Labrador provincial border, and sensitive features like the Wahnahnish Lake Protected Public Water Supply Area. The SSA represents the smallest scale of assessment and an area where the potential direct effects of the anticipated Project can be assessed with more accurately and precisely.

3.1.2 Local Study Area

The local study area (LSA) is the area within the vicinity of the Project where most of the air quality effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LSA is a square that extends 20 km from the centre of the mine site infrastructure in the four cardinal directions, for a total area encompassed in 40 km north-south by 40 km east-west. The LSA incorporates the local communities of Wabush, Labrador City, and the Town of Fermont. This LSA size was selected for consistency with the previous EIS (Alderon 2012).

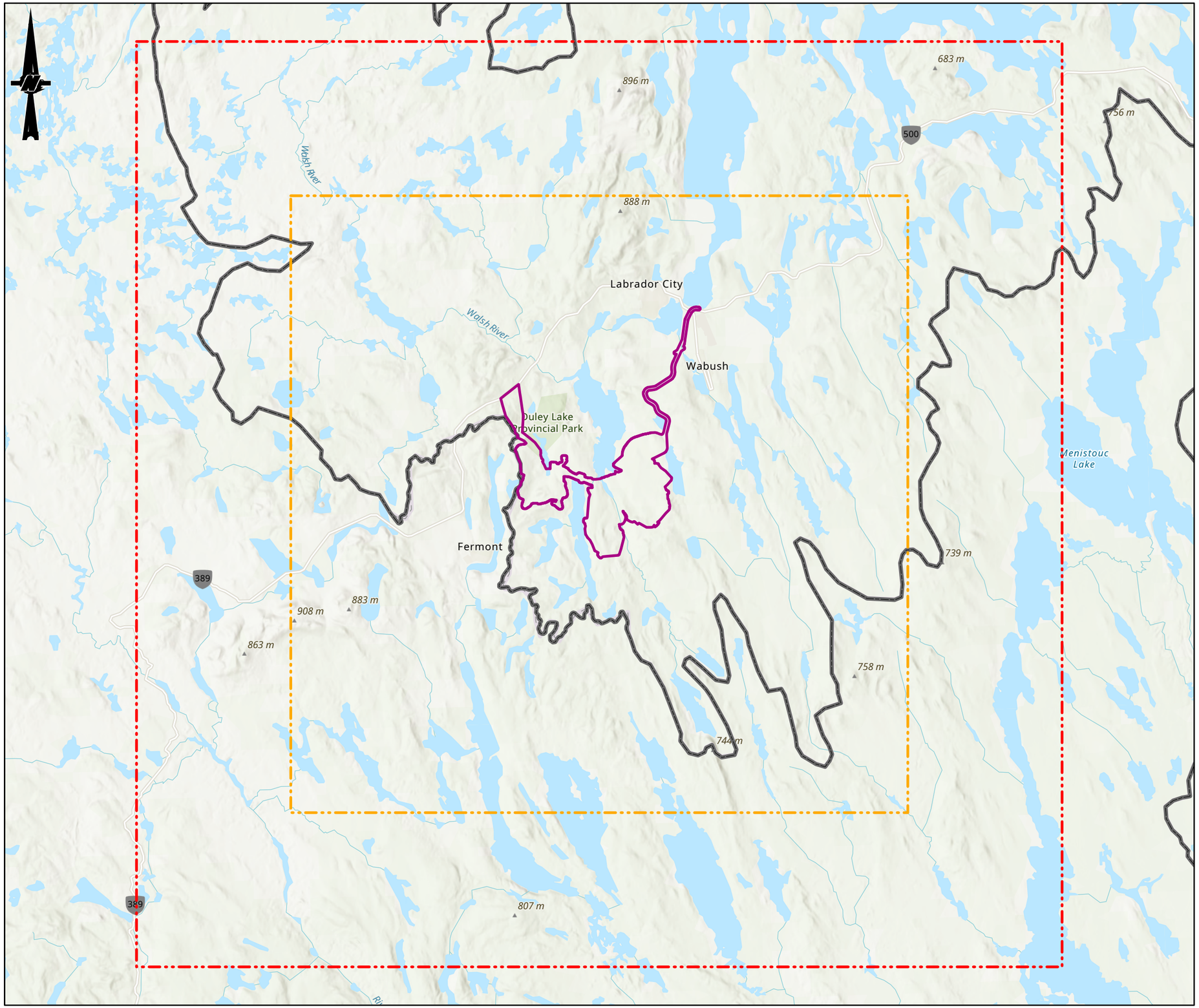
3.1.3 Regional Study Area

The regional study area (RSA) was selected to represent the area within which cumulative effects from the Project on air quality might occur. The RSA is a square that extends 30 km from the centre of the mine site infrastructure in the four cardinal directions, for a total area encompassed in 60 km North-South by 60 km East-West. The RSA provides an appropriate scale to assess cumulative effects from the Project combined with existing conditions and other reasonably foreseeable developments.

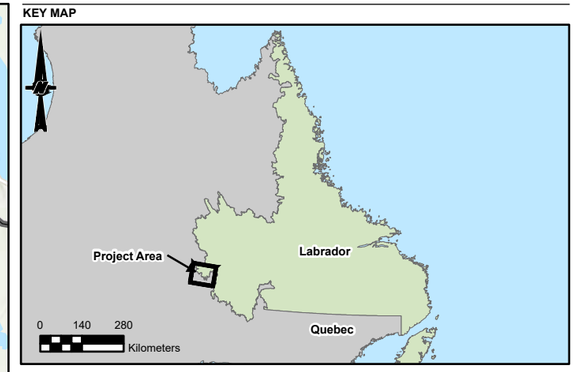
3.2 Temporal Boundaries

The temporal scope of the Project is a 40-year period from initial construction to the end of decommissioning and rehabilitation (i.e., closure). The air quality dispersion modelling assessment focused on the Operations and Maintenance Phase (operations) which includes the mining and milling of iron ore, production and shipment of iron ore concentrate, tailings management, management of mine rock, waste management, water management, release of treated effluent, site maintenance and transportation of staff and materials to and from the site. The Operations Phase initiates with one year of pre-development mining (i.e., ramp-up) and concludes when processing is complete and is expected to extend over 26 years.

The construction and closure phases of the Project were assessed qualitatively in Chapter 5 of the EIS (Champion 2025).



KEY MAP



SCALE 1:20,000,000

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Labrador/Quebec Boundary

0 4,000 8,000 16,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: ESRI CANADA, ESRI, TOMTOM, GARMIN, SAFEGRAPH, METI/NASA, USGS, EPA, USDA, NRCAN, PARKS CANADA
   WORLD HILLSHADE: ESRI, NASA, NGA, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

AIR QUALITY ASSESSMENT BOUNDARIES

CONSULTANT

wsp

YYYY-MM-DD	2025-05-01
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	3-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0008_Noise_Light\CA0038713-5216-0008-RN-0006_EIS.aprx PRINTED ON: AT: 10:53:56 AM

4.0 CALPUFF DISPERSION MODEL

The California Puff (CALPUFF) air quality dispersion model is the preferred dispersion model for Newfoundland and Labrador (Government of NL 2012). CALPUFF is a non-steady state meteorological and air quality modelling system. The three main components of the CALPUFF modelling system are the following:

- the CALMET pre-processor, which generates meteorological files
- the CALPUFF transport and dispersion model, which simulates “puffs” of material emitted from emission sources to calculate hourly concentration and deposition at receptors of interest
- the Post Utility, CALPOST, and CALSUM post-processors, which are used to extract the data of interest from CALPUFF output files

CALPUFF was used to predict the maximum ground level concentrations of contaminants within the LSA shown in Figure 3-1, as well as particulate deposition at discrete receptors. The particulate deposition was considered in the Human Health Risk Assessment Modelling Report (TSD XI; Champion 2025).

4.1 CALMET Meteorological Model

CALMET is a diagnostic meteorological model that produces three-dimensional wind fields based on parameterized treatments of terrain effects, such as slow flows, terrain blocking effects, and kinematic effects. Inputs to the CALMET model include the following:

- gridded terrain
- gridded land use
- land use source characteristics (roughness length, surface albedo, Bowen ratio, soil heat flux, leaf area index, and anthropogenic heat flux)
- surface meteorological data
- mesoscale (regional gridded) meteorological data

A CALMET model is maintained by the Government of Newfoundland and Labrador, Department of Environment and Climate Change (ECC), for Western Labrador to model the regional impacts of industrial emitters. ECC ran the CALMET model for the years 2018 through 2021 and the resulting CALMET files were shared with Champion. The years 2018 through 2021 were agreed upon with ECC based on the availability of information at the time of the CALMET data request. The CALMET grid has a 500 m resolution within a 51 km by 51 km domain.

4.1.1 CALMET-Predicted Wind Rose

Wind roses were used to compare the wind speed and direction from the CALMET data to the observations at the regional Wabush Airport meteorological station. This station is located 14 km north-east of rose pit and is the nearest Environment and Climate Change Canada (ECCC) meteorological station to the Project. Wind roses depict the relative frequency of wind blowing from a particular direction and the frequency of measured wind speed. The rings on the wind rose depict the frequency relative to the total, and the length of each wind rose petal represents the frequency of wind recorded from a given direction within a certain speed range.

The same temporal period was considered for the regional observations and the CALMET data (i.e., for the period of January 1, 2018, to December 31, 2021). As shown in Figure 3-1, the winds measured at Wabush Airport, which is noted as WABUSH A in Figure 4-1, are predominantly from the west, north, and south. Winds from the CALMET cell, which includes Wabush Airport, are also predominantly from the west; however, there is a lower frequency of winds from the north and south. Differences in the modelled and observed data can be attributed to the effects of local terrain.

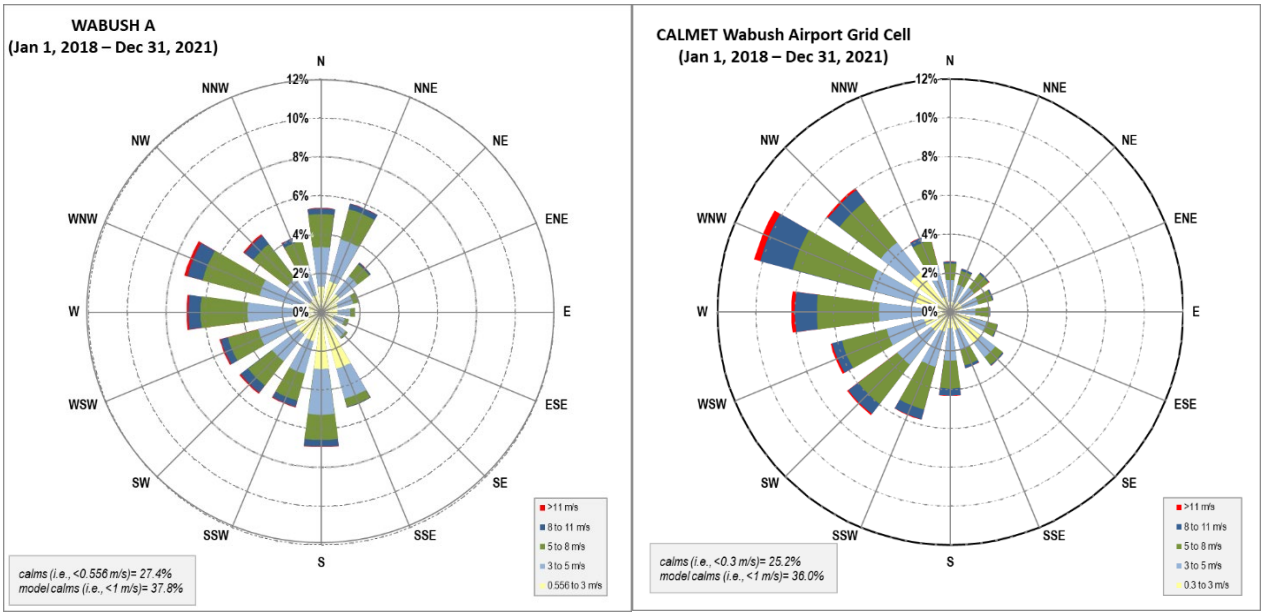


Figure 4-1: Comparison of Annual Wind Roses Using Regional Observations from the Wabush Airport Meteorological Station and CALMET Data for the Wabush Airport Grid Cell

4.1.2 Ambient Temperature

The CALMET-derived temperatures for the Project pertaining to the grid cell that includes Wabush Airport are presented as bars in Figure 4-2. The monthly average of the daily minimum and maximum temperatures at 10 m above ground from January 1, 2018, to December 31, 2021, range from -24.8°C in January to 19.0°C in July. The annual daily average temperature for the CALMET grid cell is -2.6°C.

Climate normals are 30-year statistics published by Environment and Climate Change Canada that are used to describe the climate at a particular location. The closest meteorological stations to the Project with climate normal data are in Wabush, and the normal temperatures from the 1991 to 2020 dataset are summarized here. The daily average temperatures are shown as dotted lines in Figure 4-2 Normal temperatures range from -27.1°C in January to 19.6°C in July. The annual daily average temperature is -2.8°C.

The CALMET-derived monthly averages of the daily minimum, average, and maximum temperatures are similar to the climate normals observed at Wabush.

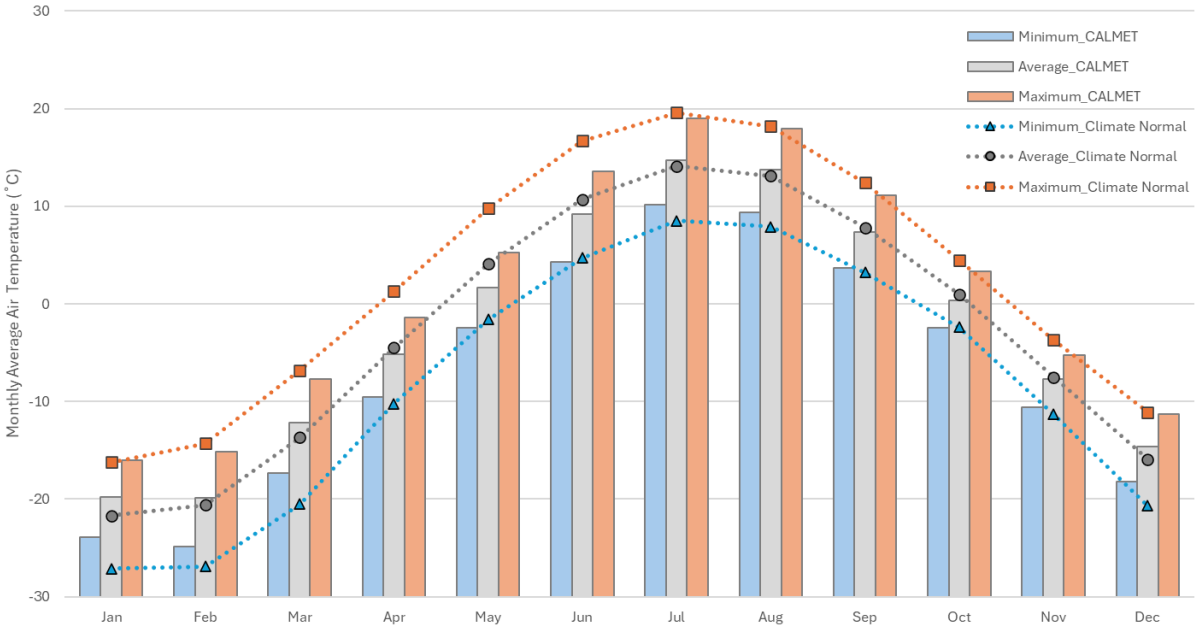


Figure 4-2: Monthly Averages of the Daily Air Temperatures at CALMET Grid Cell, Containing Wabush Airport (January 1, 2018, to December 31, 2021) and Climate Normals at Wabush (1991 to 2020)

4.1.3 Mixing Height

Atmospheric events are driven by the heating and cooling of the earth's surface. The mixing layer is an important part of the dispersion meteorology because this zone of turbulence determines the vertical movement of air and the depth of this layer, referred to as the mixing height, bounds the upper limit of the vertical movement. The depth of the mixed layer is a function of factors such as the heating and cooling of the surface, sinking of cooled air, or surrounding terrain features. One strong driver of mixing height is solar radiation energy. As the sun rises, the land is heated, and warm air rises, causing turbulence in the air. As the day progresses, this continuous heating and the increase in intensity causes even more turbulence, which causes the zone of turbulent air to expand, which also causes the mixing height to increase. The solar radiation energy peaks in the afternoon, but the heat input is still present at a weaker intensity. As the day progresses into evening and night, the atmosphere begins to cool down, and the mixing height decreases. Therefore, the shallowest mixed depth is typically observed in the morning, right before dawn. This mixing height pattern described here matches the CALMET meteorological predictions, shown in Figure 4-3.

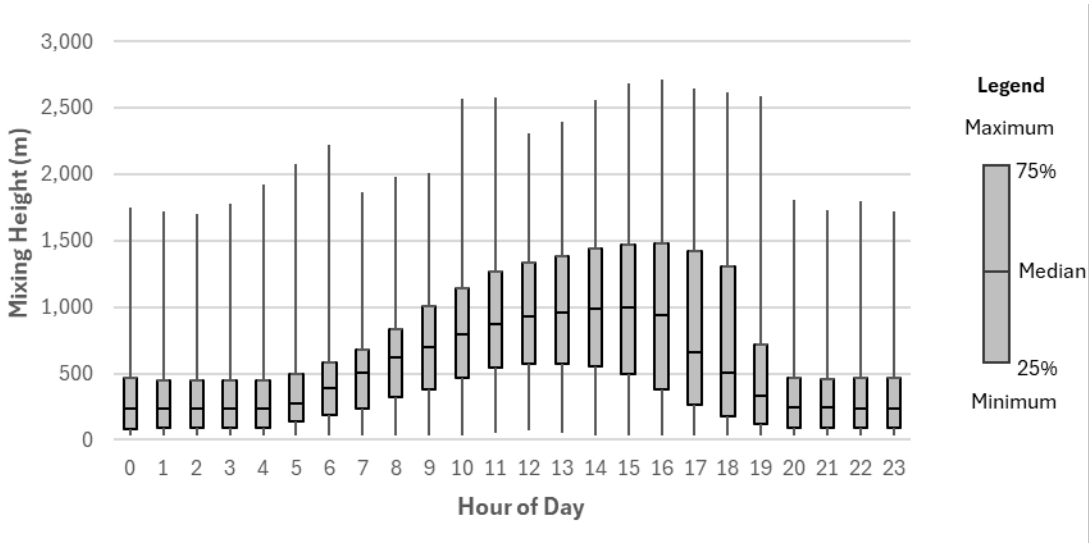


Figure 4-3: Mixing Height at 10 Metres from the CALMET Grid Cell, Containing Wabush Airport (January 1, 2018, to December 31, 2021)

4.1.4 Atmospheric Stability

Atmospheric stability can be viewed as a measure of the atmosphere's capability to disperse emissions. The amount of turbulence plays an important role in the dilution of a plume as it is transported by the wind. Turbulence can be generated by either thermal or mechanical means. Surface heating or cooling by radiation contributes to the generation or suppression of thermal turbulence, while high wind speeds contribute to the generation of mechanical turbulence.

The Pasquill-Gifford (PG) stability classification scheme is one classification of the atmosphere. The classification ranges from very unstable (stability class A), unstable (stability class B), slightly unstable (stability class C), and neutral (stability class D) to slightly stable (stability class E) and stable (stability class F). Unstable conditions are primarily associated with daytime heating conditions, which result in increased turbulence levels that enhance dispersion. Stable conditions are associated primarily with nighttime cooling conditions, which result in suppressed turbulence levels and poorer dispersion. Neutral conditions are primarily associated with higher wind speeds or overcast conditions.

The stability conditions derived by CALMET at the Project are summarized as follows:

- unstable (A, B and C) conditions occur 20% of the time
- neutral (D) conditions occur 49% of the time
- stable (E and F) conditions occur 31% of the time

Figure 4-4 shows the diurnal variation of stability class. The unstable classes follow a bell curve pattern where unstable conditions are more frequent in the afternoon. Unstable conditions are less frequent at dawn because the heating of the surface has just begun to provide the necessary energy for the atmospheric conditions to be unstable. Solar heating peaks in the afternoon, and the warmed air remains unstable. The heating declines in the afternoon to evening, and the atmosphere starts to cool. This in turn changes the stability class from unstable to neutral to stable. At night, no solar radiation input is available, and the atmospheric condition is neutral or stable.

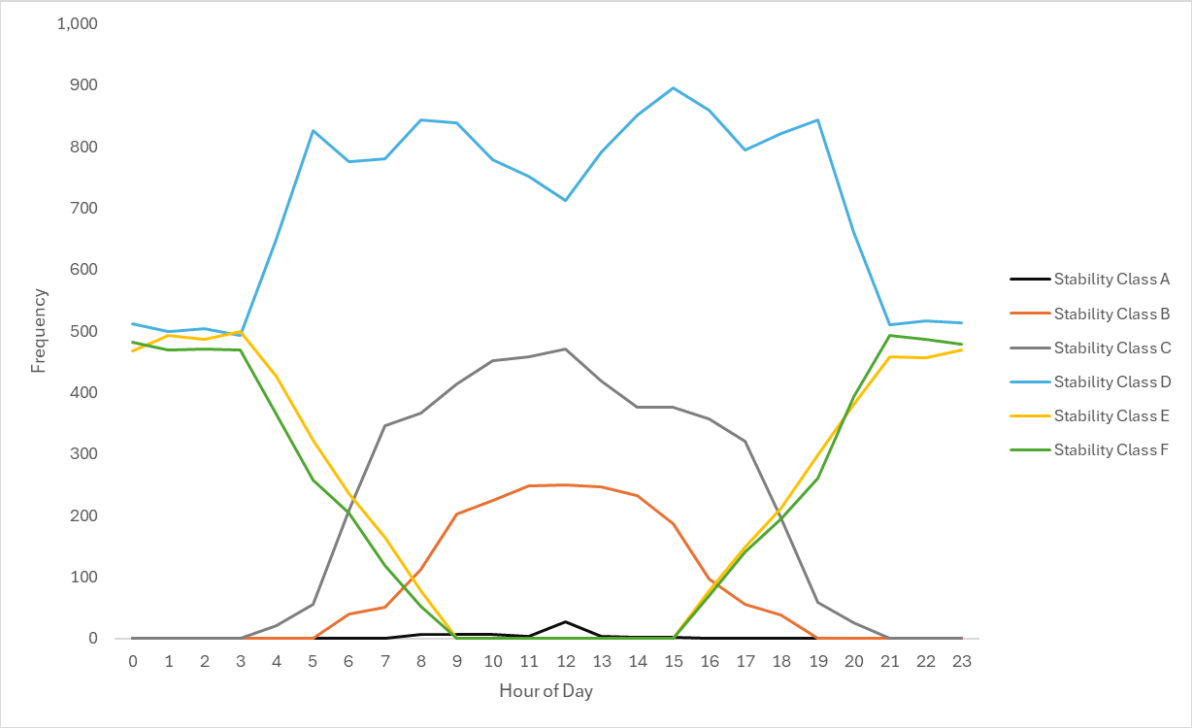


Figure 4-4: Diurnal Variation in Stability Classes from the CALMET Data Representing the Project

5.0 DISPERSION MODELLING METHODS

The latest version of the CALPUFF dispersion model (Version 7.3.2) was used in this assessment.

5.1 Modelling Domain

The modelling domain is the spatial extent over which the dispersion model is executed. The modelling domain for the Project covers an area of 51 by 51 km, which is larger than the LSA shown in Figure 3-1 , to account for edge effects. The modelling domain was centred on a central location of the Project footprint, just north of the mine rock stockpile. The centre coordinate is UTM 636500 m East and 5854500 m North, Zone 19.

5.2 Dispersion Modelling Sources

The emission sources from the Project were characterized as point, area, volume, or road sources, depending on the configuration of the individual sources. Dust collectors were represented by point sources because they have a specific release point. Area sources were used for low-level or ground-level fixed area emission sources with little or no plume rise. The remaining sources, including roads, were categorized as volume sources.

As described in Sections 5.2.1 to 5.2.3 and identified in Figure 5-1, 3 point sources, 6 area sources, 16 volume sources, and 6 road and rail line sources were defined. Where appropriate, multiple emission sources were combined into a single model source where the sources were located over an area or volume that could reasonably be well defined. The site plan was used to identify the locations of the emission sources.

The 1-hour or 24-hour emission rates were modelled to compare the relevant standards for each contaminant. The 1-hour and 24-hr emission rates were also used to provide a conservative predicted maximum ground-level concentration for contaminants with an annual standard.

Dispersion modelling source summary tables are provided in Appendix A.

5.2.1 Point Sources

Point sources are used to model stationary and specific points where contaminants are released into the atmosphere, such as a stack. The source parameters of the point sources of the Project are detailed in Table 5-1, excluding the emission rates.

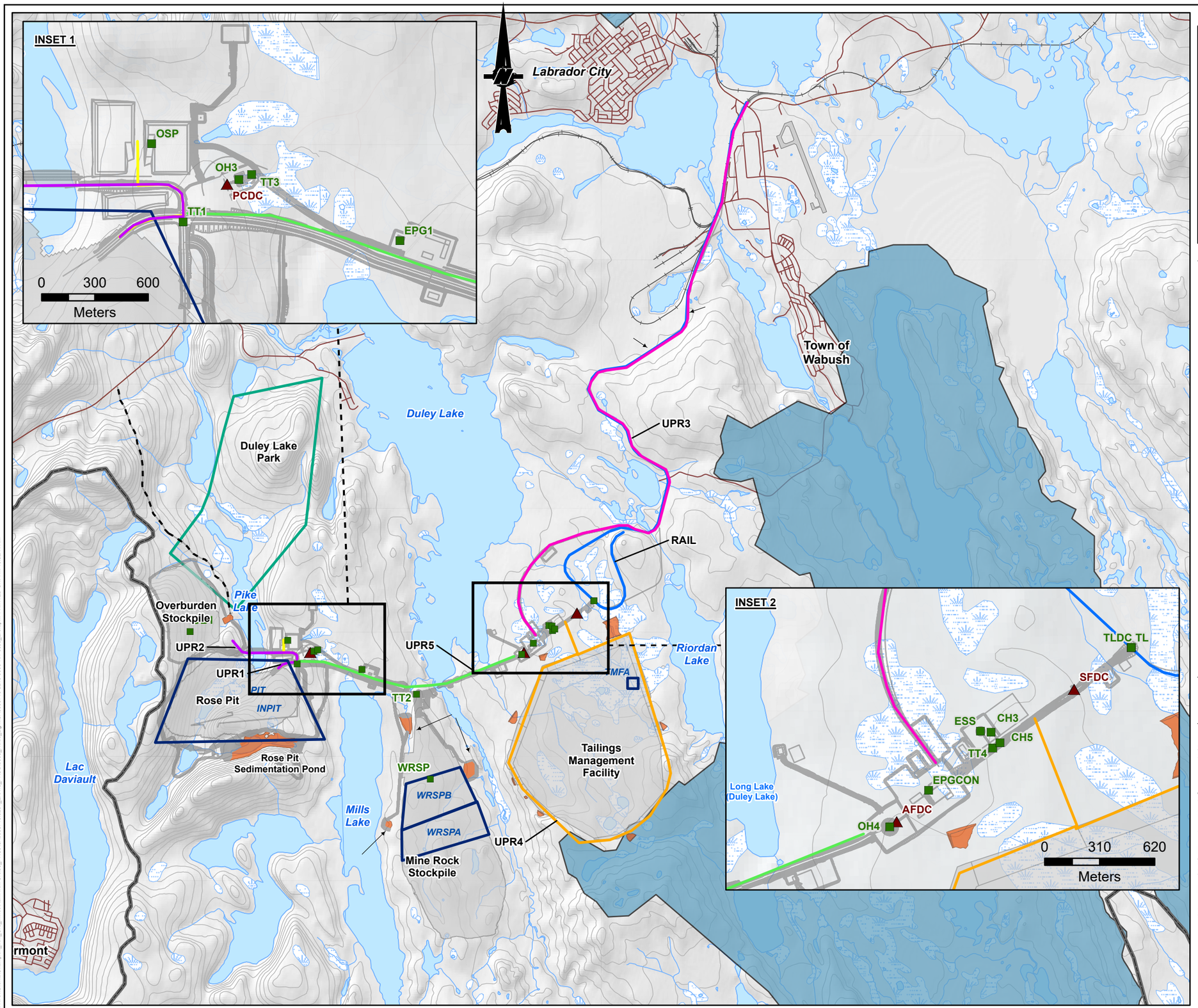
Table 5-1: Point Source Parameters

Point Source ID	Point Source Description	Point Source Locations[(a)]		Release Height (m)	Internal Diameter (m)	Release Temperature (K)	Release Velocity (m/s)	Release Type
		Easting	Northing					
PCDC	Primary crusher dust collector	634178	5856658	8.69	0.91	Ambient	14.7	Vertical
AFDC	Apron feed dust collector	638206	5856656	5.00	0.76	Ambient	15.5	Vertical
SFDC	Silo feed dust collector	639204	5857402	10.00	0.76	Ambient	15.5	Vertical

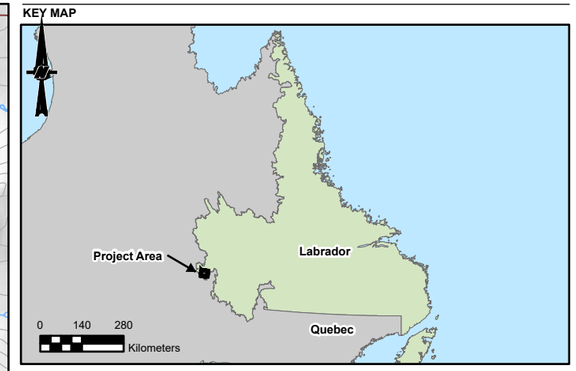
Note:

(a) NAD83, UTM Zone 19.

UTM = Universal Transverse Mercator; K = Kelvin.



KEY MAP



SCALE 1:20,000,000

LEGEND

PROPOSED PROJECT INFRASTRUCTURE
- Project Data
- Proposed Sediment Pond
- Potential Access Road

BASEMAP INFORMATION
- Road
- Railway
- Contour
- Watercourse
- Bog/Wetland
- Waterbody
- Duley Lake Park
- Public Water Supply
- Labrador/Quebec Boundary

EMISSION SOURCES
- Unpaved Roads (UPR) 1-5
- Area Sources
- Volume Sources

Transfer Towers (TT) 1-4
Overburden (OB) 1
Ore Stockpile (OS) 1
Ore Handling (OH) 3-4
Waste Rock Stockpile (WRSP)
Emergency Storage Stockpile (ESS)
Concentrate Handling (CH) 3 & 5

- Point Sources

Primary Crusher Dust Collector (PCDC)
Silo Feed Dust Collector (SFDC)
Apron Feed Dust Collector (AFDC)

0 500 1,000 2,000
1:72,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT
CHAMPION IRON MINES LTD.

PROJECT
KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE
EMISSION SOURCES

CONSULTANT

YYYY-MM-DD	2025-05-01
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	Figure 5-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0008_Notes_Light\CA0038713-5216-0008-RN-0006_EIS.aprx PRINTED ON: AT: 10:52:11 AM

5.2.2 Area Sources

Area sources are used to model low-level or ground releases or emissions to the atmosphere that are distributed over a fixed area. In general, area sources result in higher ground-level concentrations than those of volume or point sources. The CALPUFF model does not have an option for an open pit source type, so the Rose Pit was modelled as a single area source and a pit retention factor of 50% was applied to the emission rates of particulate matter (Long 2011). The effective height and initial dispersion height standard deviation (the initial sigma z), used for each source, are provided in Table 5-2.

The 1-hour and 24-hour emission rates for the tailings management facility (TMF) were modelled over a 40,000 m² area of the TMF in a location that is representative of the early stages of tailings deposition.

Table 5-2: List of Area Sources

Area Source ID	Area Source Description	Effective Height (m)	Area Source Initial Dispersion Height Sigma Z (m)
PIT	Rose Pit	0	0
INPIT	Rose Pit – in pit road	0	0
TMFA	Tailings management facility	10	4.65
WRSPA	Waste rock stockpile Area A	30	13.95
WRSPB	Waste rock stockpile Area B	30	13.95
OBSP	Overburden stockpile	10	4.65

5.2.3 Volume Sources

Volume sources model emissions from a 3D box that represents the evenly mixed emissions of a contaminant from the sources (Ontario Ministry of the Environment and Climate Change 2017). They are commonly used to represent fugitive sources that are not discharged to the atmosphere in a confined flow stream, such as an exhaust pipe or stack (USEPA 1995), and therefore do not take advantage of favourable dispersion characteristics, such as plume buoyance and initial exit velocity of emissions. Table 5-3 provides a summary of the release height, initial lateral dimension, and initial vertical dimension of the volume sources.

Table 5-3: Volume Source Parameters

Volume Source ID	Volume Source Description	Point Source Locations[(a)]		Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)
		Easting	Northing			
OSP	Ore stockpile	633754	5856885	1.50	1.16	1.40
TT1	Conveyor transfer tower for waste rock	633930	5856446	8.20	0.35	7.63
TT2	Conveyor transfer tower 2 for waste rock	636182	5855869	6.29	0.35	5.85
WRSP	Waste rock stockpile	636442	5854271	3.50	1.16	3.26

Table 5-3: Volume Source Parameters

Volume Source ID	Volume Source Description	Point Source Locations[(a)]		Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)
		Easting	Northing			
OB1	Overburden stockpile	631910	5857056	1.50	1.16	1.40
TLDC	Train loadout building dust collector	639527	5857636	13.20	0.35	12.28
OH3	Material transfer via conveyor from primary crusher to ore stockpile	634244	5856684	2.50	0.35	2.33
TT3	Overland conveyor transfer tower (ore)	634316	5856713	8.20	0.35	7.63
OH4	Overland conveyor drop point at dome	638166	5856627	18.00	0.35	16.74
TT4	Emergency stockpile transfer tower	638747	5857071	8.79	0.35	8.18
ESS	Concentrate drop to emergency storage stockpile	638678	5857166	1.50	1.16	1.40
CH3	Emergency storage stockpile – reclaim hopper and conveyor transfer	638737	5857159	2.07	0.47	1.93
CH5	Reclaim conveyor transfer to concentrate conveyor	638788	5857099	6.60	0.35	3.07
TL	Rail car loading	639527	5857636	1.25	0.67	1.16
EPG1	Generator 1 – mine services area	635152	5856340	1.19	0.89	1.10
EPGCON	Generators – concentrator	638386	5856832	1.19	1.74	1.10

Note:
(a) NAD83, UTM Zone 19.
UTM = Universal Transverse Mercator.

The roads and rail line were modelled as a series of volume sources and sources were sized following guidance from the United States Environmental Protection Agency (USEPA 2012). Table 5-4 provides a summary of the model inputs for the roads and rail line. The variable emission profiles used to model roads are described in Section 5.8.2.

Table 5-4: Road and Rail Model Source Parameters

Road Source ID	Source Description	Road Length (km)	Number of Segments	Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)
UPR1	Pit to ore stockpiles	1.02	13	7.45	15.81	5.89
UPR2	Pit to overburden stockpile	1.84	14	7.45	15.81	5.89
UPR3	Access road	14.16	35	3.20	8.37	2.53
UPR4	TMF inspection road	11.48	14	2.00	8.37	1.58
UPR5	Site road	4.24	8	2.00	8.37	1.58
RAIL	Rail line	25.70	91	4.88	1.45	4.88

5.3 Building Downwash

Building wake effects were considered in this assessment using the USEPA's Building Profile Input Program (BPIP-ISC). The inputs into this pre-processor include the coordinates and heights of the buildings and stacks. The output data from BPIP-ISC are used in the building wake effect calculations.

CALPUFF has an option to model building wake effect using a PRIME or ISC algorithm. In most cases, the newer PRIME model is considered to be a more accurate predictor of concentrations within the building wake zone since it takes into account the effect of vertical wind shear and the variation in wind speed deficit with downwind distance. For this assessment, the PRIME algorithm was used. There are two Project buildings that were identified as having point sources within the area of influence of the buldings. The buildings include the geodesic dome, which covers the crushed ore stockpile and the concentrate loadout silo.

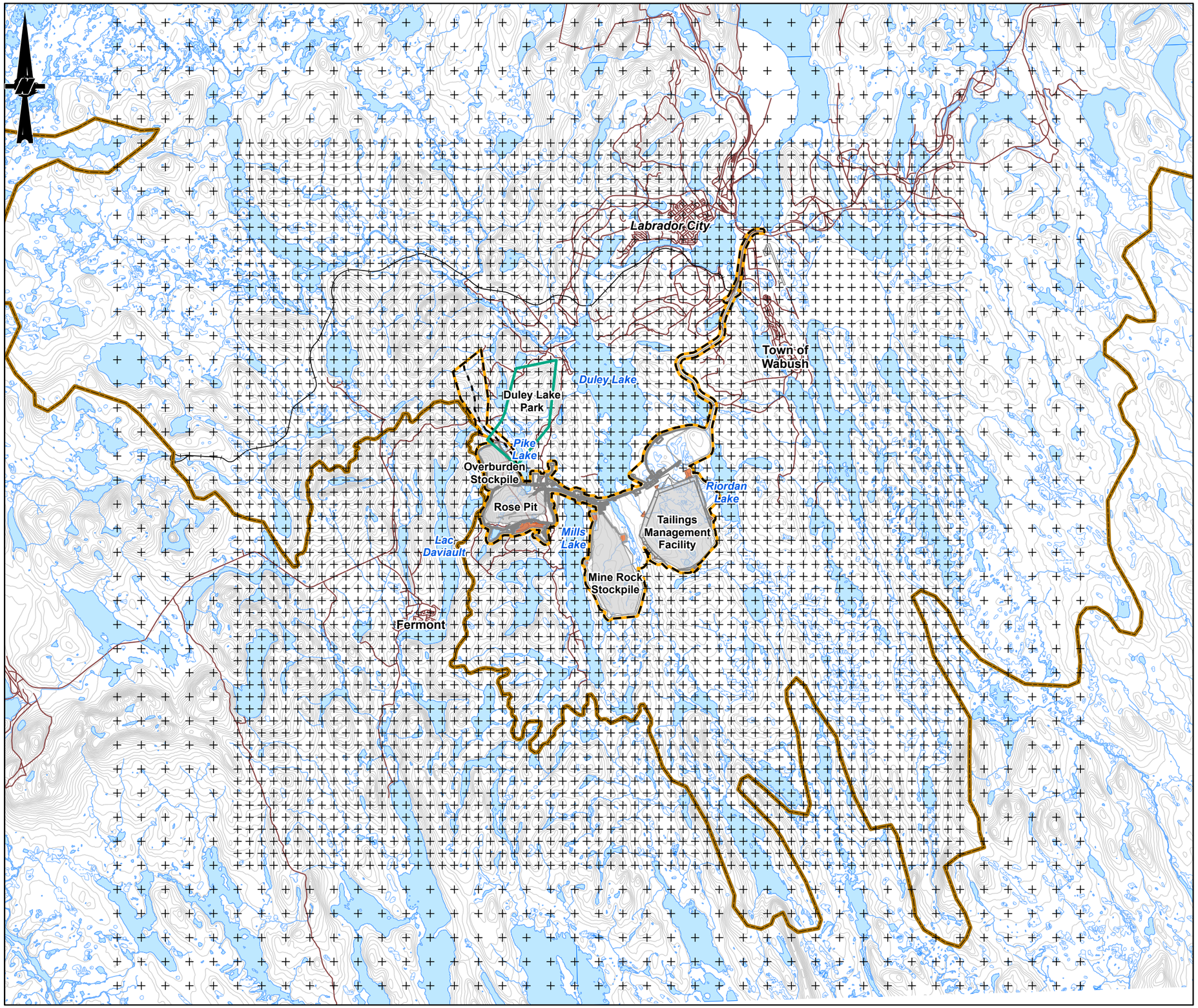
5.4 Receptors

Ambient concentrations resulting from the Project emissions were predicted at receptor locations. Receptors included a nested receptor grid and identified sensitive receptors located within the modelling domain. The nested receptor grid was centred at a central location of the Project, just north of the mine rock stockpile, and receptors were placed as follows:

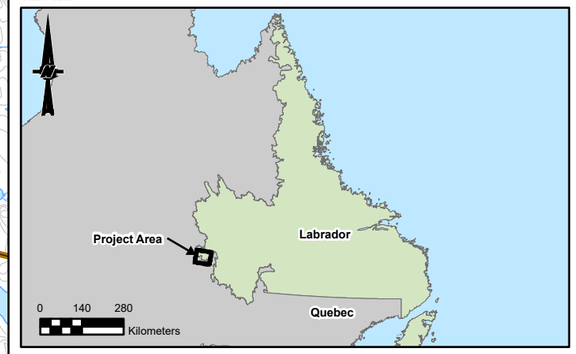
- 500 m spacing, within 15 km of the from a central location of the Project
- 1,000 m spacing, out to 20 km from the area described in the bullet above

The area of modelling coverage is illustrated in Figure 5-2.

A total of 577 discrete sensitive receptors were placed at areas representing cabins, residences, schools, hospitals, and areas for traditional or recreational use (Land Use). The discrete receptors are depicted in Figure 5-3 and a list of discrete receptors is provided in Appendix B.



KEY MAP



SCALE 1:20,000,000

LEGEND

PROPOSED PROJECT INFRASTRUCTURE

- Project Infrastructure
- Potential Access Road

PROJECT DATA

- Gridded Receptor Layout

BASEMAP INFORMATION

- Duley Lake Park
- Existing Railway
- Existing Road
- River/Stream
- Contour
- Bog/Wetland
- Waterbody
- Labrador/Quebec Boundary
- Site Study Area (SSA)

0 1,500 3,000 6,000

1:160,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

AREA OF MODELLING COVERAGE

CONSULTANT

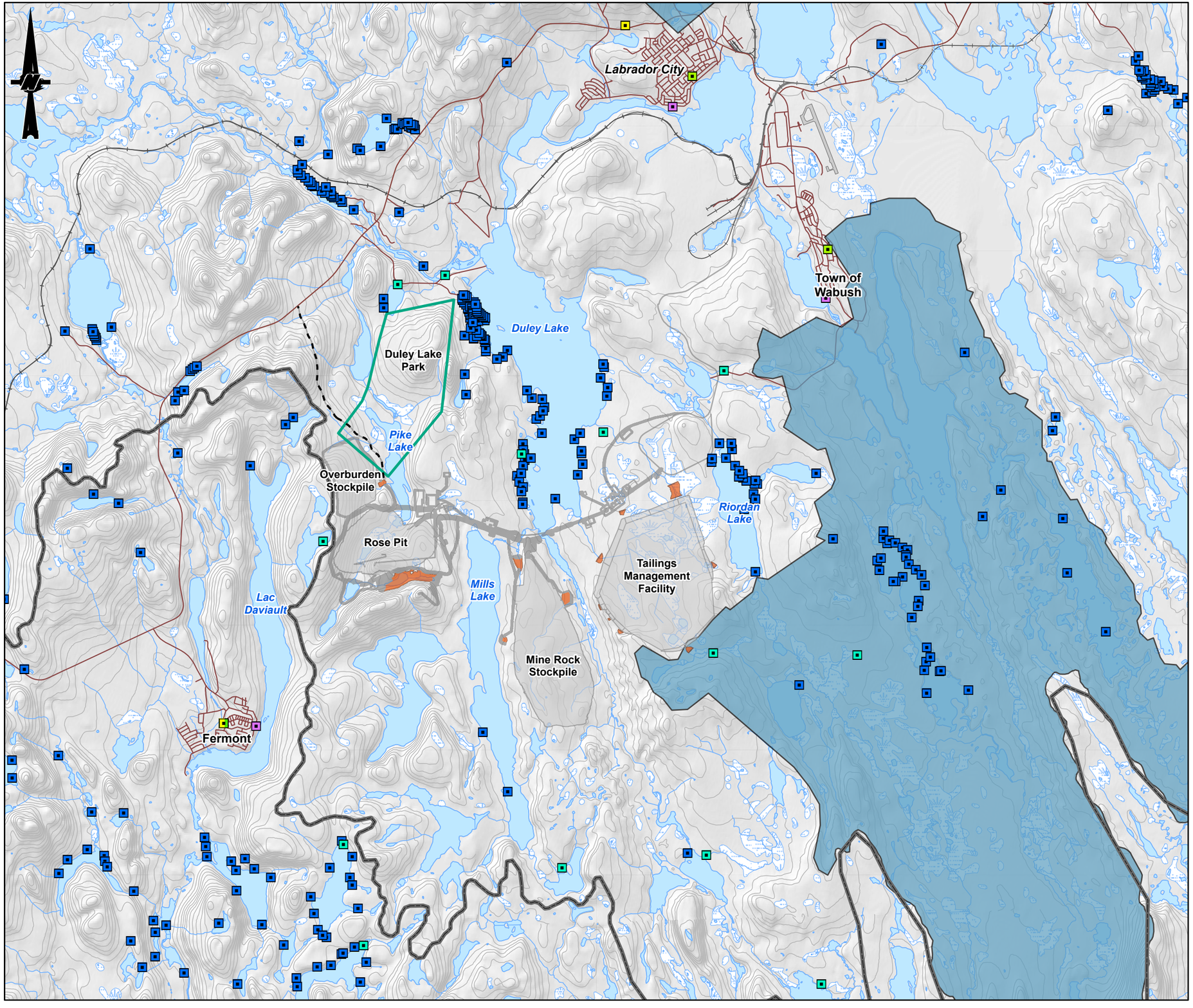
wsp

YYYY-MM-DD	2025-05-01
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

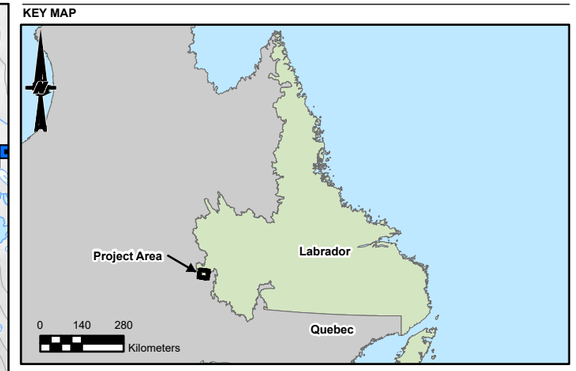
PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	Figure 5-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0008_Noise_Light\CA0038713-5216-0008-RN-0006_EIS.aprx PRINTED ON: AT: 12:22:33 PM



KEY MAP



SCALE 1:20,000,000

Legend

PROJECT DATA

- Proposed Project Infrastructure
- Proposed Sediment Pond
- Potential Access Road

PROJECT DATA

Receptor

- Cabin
- Hospital
- Residence
- School
- Land Use

BASEMAP INFORMATION

- Road
- Railway
- Watercourse
- Contour
- Duley Lake Park
- Bog/Wetland
- Waterbody
- Labrador/Quebec Boundary
- Public Water Supply

0 1,000 2,000 4,000

1:95,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

DISCRETE RECEPTORS

CONSULTANT

wsp

YYYY-MM-DD	2025-05-01
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	Figure 5-3

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\69_PROJ\CA0038713.5261_EISv4_PROD\0008_Noise_Light\CA0038713-5216-0008-RN-0006_EIS.aprx, PRINTED ON: AT 10:53:14 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

5.5 Particulate Matter Size Distribution and Deposition

The CALPUFF model is capable of modelling deposition of particulate matter based upon the particulate sizes and mass fractions. Particulate deposition, also referred to as dust fall, was modelled to support the human health risk assessment completed for the Project (WSP 2025).

The Modelling Guideline provides recommendations on generating particulate matter size distributions. The parameters in Table 5-5 were used to account for plume depletion. Both wet and dry deposition were considered following guidance received from ECC.

Table 5-5: Particulate Sizing

Particle Size Class	Effective Particle Maximum (microns)	Geometric Mass Mean Diameter (microns)	Geometric Standard Deviation (microns)	Particle Size Intervals
P1	2.5	1.25	1.24	5
P2	10	5	1.24	5
P3	40	20	1.24	5

5.6 Ozone Background Concentrations

Ozone is not an indicator compound for the assessment, as the Project does not directly emit ozone nor does it emit precursor compounds in sufficient volumes to result in enhanced ozone formation. However, ozone is important in the conversion of nitric oxide (NO), the major constituent of nitrogen oxide (NOx) emissions, to nitrogen dioxide (NO_2) in the atmosphere.

Revised background ozone levels for Labrador were provided by ECC and are listed in Table 5-6. These revised monthly ozone values were included in the BCKO3 parameter in the CALPUFF model files.

Table 5-6: Background Ozone Levels for CALPUFF Modelling – Labrador

Month	Provided by ECC
January	30
February	31
March	34
April	36
May	28
June	21
July	15
August	17
September	16
October	20
November	27
December	29

ECC = Government of Newfoundland and Labrador, Department of Environment and Climate Change.

5.7 Chemical Transformation

Nitrogen dioxide emissions occur mainly from high-temperature combustion processes. Although most NOx emissions are in the form of NO, these rapidly oxide in the presence of ozone to form NO_2. Hydrogen peroxide is an oxidant that reacts with other pollutants such as sulphur dioxide, contributing to aerosol aqueous sulphate formation.

The background concentrations of ammonia (NH_3) and hydrogen peroxide (H_2O_2) from the Modelling Guideline are provided in Table 5-7.

Table 5-7: Background Concentrations of Ammonia and Hydrogen Peroxide

Month	Ammonia Concentration (ppb)	Hydrogen Peroxide Concentration (ppb)
January	0.5	0.2
February	0.5	0.2
March	0.5	0.2
April	0.5	0.2
May	0.5	0.2
June	0.5	0.2
July	0.5	0.2
August	0.5	0.2
September	0.5	0.2
October	0.5	0.2
November	0.5	0.2
December	0.5	0.2

ppb = parts per billion.

CALPUFF has the capability to account for chemical transformations. For this study, the CALPUFF model used the RIVAD/ISORROPIA chemical transformation module, as advised by ECC. The in-stack NO_2 to NOx ratio of 0.2 from the Modelling Guideline was used to estimate the NO_2 emission rates from each modelling source, with the exception of blasting. An in-stack NO_2 to NOx ratio of 0.05 was used for explosive detonation in the pit (Attalla et al. 2008). The remaining NOx was assumed to be NO.

5.8 Special Modelling Considerations

5.8.1 Hourly Emission Files

Hourly emission rates of particulates were calculated for material handling sources that have emission rates dependent on the hourly wind speed (i.e., emission rates calculated for the transfer of aggregate to a storage pile via a batch or continuous drop operation). Hourly emission rates were calculated using the emission factor equation in Section 13.2.4.3 of the USEPA AP-42 (USEPA 1995) and the CALMET hourly wind speed. Hourly emission rates were included in the CALPUFF model for the following volume sources:

- ESS (concentrate drop to emergency storage stockpile)

- CH3 (emergency stockpile reclaim hopper loading and conveyor transfer)
- TL (rail car loading)
- WRSP (material drop at waste rock stockpile)
- OH2 (ore stockpile)
- OH3 (crushed ore drop to stockpile)

5.8.2 Natural Mitigation

Snow cover is expected from November through April, which will limit the lift-off of particulates from stockpiles and unpaved roads. Emission scaling factors for wind erosion and road dust were included in the CALPUFF file for particulate modelling to account for the natural mitigation from snow cover. Wind erosion was turned off for the months with snow cover and were modelled at 100% for the remaining months. Emissions for roads were set to 5% for the months with snow cover and 100% for the remaining months.

5.9 Conservative Modelling Assumptions

The dispersion model for the Project incorporates several conservative assumptions to increase the confidence that the modelled predictions will not underestimate the effects of the Project. The assumptions included in the assessment are:

- Emissions from the largest blast size were considered for every hour of the meteorological dataset, whereas blasting will be limited to daytime hours and will only be occurring once per day.
- Emission rates for wind erosion from the tailings area and waste rock stockpile were calculated using the maximum exposed surface area from the Project design (which is not expected to occur during the same operating year as the maximum material movement). The model assumes that the emissions from the maximum exposed surface area are occurring over a much smaller area leading to a conservative g/m²-s emission rate in the air dispersion model.

The objective of running the model with conservative assumptions is to identify the sources of emission that require specific monitoring and management practices, and to develop adaptive management strategies during the life of the Project to mitigate those effects efficiently.

5.10 CALPUFF Switch Settings

The CALPUFF model offers various switch options for users to customize model runs that best fit an individual project. Model switch selections were made in consultation with ECC and guidance in the Modelling Guideline. A summary of the CALPUFF switches used in this assessment are provided in Table 5-8.

Table 5-8: CALPUFF Model Switches

Parameter	Parameter Interpretation	CALPUFF Modelling Guideline Default	Values Used in the Modelling	Comment
MBDW	Method used to simulate building downwash	2	2	PRIME method
MSHEAR	Vertical wind shear modelled above stack top	0	0	–
MSPLIT	Puff splitting allowed	1	1	–

Table 5-8: CALPUFF Model Switches

Parameter	Parameter Interpretation	CALPUFF Modelling Guideline Default	Values Used in the Modelling	Comment
MCHEM	Chemical mechanism	6	6	–
MAQCHEM	Aqueous phase transformation	1	1	–
MLWC	Liquid water content	0	0	Water content estimated from cloud cover and presence of precipitation
MWET	Wet removal modelled	1	1	–
MDRY	Dry deposition modelled	1	1	–
MDISP	Method used to compute dispersion coefficients	2	2	Dispersion coefficients from internally calculated sigma V, sigma W using micrometeorological variables (e.g., u*, w*, L)
MPDF	PDF used for dispersion under convective conditions	1	1	–
MREG	Test options specified to see if they conform to regulatory values	0	0	No checks are made
MOZ	Ozone data input option	0	0	Use a monthly background ozone value
MNH3	Ammonia data option	0	0	Not used
MAVGNH3	Ammonia vertical averaging option	1	n/a	Not used
MH2O2	Hydrogen peroxide H_2O_2 data input option	0	0	Use the monthly background H_2O_2 value consistent with the Modelling Guideline

– = default value was used; n/a = not applicable.

6.0 DISPERSION MODELLING RESULTS

The CALPUFF model was used to predict the ground-level concentrations of COCs from the Project based on the emission rates provided in Appendix 5B and the output of the dispersion model. The results describe a conservative emission scenario for the Project. Meteorological anomalies can lead to model overpredictions. The modelling results were, therefore, processed to remove the anomalies in accordance with the Government of Newfoundland and Labrador Determination of guidance documented *Determination of Compliance with the Ambient Air Quality Standards* (Government of NL 2012).

The predicted ground-level concentration of individual metals was determined from the maximum predicted 24-hour TPM concentration, assuming the concentrations of metals in the TPM was equal to the 95th percentile of metal concentrations, as shown in Table 6-1, of the ore and mine rock assays for the Project (Okane Consultants 2024). This assessment conservatively assumes that all particulate matter for the Project will always contain metals at the 95th percentile.

Table 6-1: 95th Percentile of Metals in the Ore and Mine Rock Assays for the Project

Metal	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
95th Percentile	0.0015%	0.0003%	0.015%	0.0034%	0.000003%	0.012%	0.046%	0.044%

The maximum predicted ground-level concentration of the Project effects for each COC outside the administrative boundary (surface lease), is presented in Table 6-2. These predicted ground-level concentrations represent the worst-case Project effect outside the administrative boundary and consider that the surface lease will have controlled access due to their proximity to the mining operations. The background concentrations for each COCs and averaging period and the effects of background concentrations plus the predicted Project effects are also presented in Table 6-2.

The maximum predicted concentrations for TPM, PM_{10}, $PM_{2.5}$, and NO_2, are greater than the respective 24-hour average NLAAQS. The maximum 1-hour predicted modelled concentration of NO_2 is also above the NLAAQS. The frequency above the NLAAQSs of 24-hour $PM_{2.5}$, 1-hour NO_2, and 24-hour NO_2 concentrations are infrequent, occurring 17 days per year (5% of the time), 114 hours per year (1% of the time), and 5 days per year (1% of the time), respectively. The frequency above the NLAAQS of coarse particulates (TPM and PM_{10}) is predicted to occur 122-129 days per year.

The maximum predicted concentrations of particulates (TPM, PM_{10}, and $PM_{2.5}$) and NO_2 occur immediately outside the surface leases to the north and east of Rose pit, where the mining operations and most of the outdoor material handling operations are occurring. The model receptors with the maximum predicted concentrations of particulates or NO_2 is not a sensitive receptor (cabin or community) but these predicted ground-level concentrations represent the worst-case Project effect outside the administrative boundary. The predicted effects are illustrated as a series of isopleths for particulates and NO_2 in Chapter 5 of the EIS, Figures 5-4 to 5-8.

The ore and overburden haul roads run along the boundary of the surface leases north of Rose pit, so the main contributors of particulate matter are the unpaved haul roads, which contribute over 90% to the maximum predicted POI concentrations for TPM and PM_{10}. The Project releases of coarse particulates, including background concentrations, disperse with the distance from Rose pit and are generally below their respective NLAAQS within 4 km of the SSA. There are very few exceedances of NLAAQS for TPM and PM_{10} at sensitive receptors within the vicinity of the Project and there are no exceedances of the NLAAQS predicted for $PM_{2.5}$, NO_2, SO_2, CO, and metals at sensitive receptors (Table 6-3). Champion has committed to reviewing the surface leases and implementing additional controls on the unpaved roads to reduce the predicted effects.

Table 6-2: Maximum Predicted Changes to Air Quality from Project Operations at Model Receptors Outside of the Site Study Area

Contaminant	Averaging Period	Criteria (µg/m³)		Background Concentrations (µg/m³)	Maximum Predicted Concentration from Project (µg/m³)	Maximum Predicted plus Background (µg/m³)	Percent of Criteria (%)	Frequency Above NLAAQS (%)	Number of Hours Above Standard[(a)]	Number of Days Above Standard[(b)]
Total particulate matter	24-hour	120	NLAAQS	24.1	***1,224***[(c)]	***1,247***	>100%	35%	—	129
	Annual	60	NLAAQS	10.8	25	36	60%	—	—	—
PM_{10}	24-hour	50	NLAAQS	11.3	***484***	***495***	>100%	33%	—	122
$PM_{2.5}$	24-hour	25	NLAAQS	3.6	***56***	***60***	>100%	5%	—	17
	Annual	8.8	NLAAQS	3.6	6	***9***	>100%	—	—	—
Nitrogen dioxide	1-hour	400	NLAAQS	4.9	***1,005***	***1,010***	>100%	1%	114	—
	24-hour	200	NLAAQS	4.9	***331***	***336***	>100%	1%	—	5
	Annual	100	NLAAQS	4.9	29	34	76%	—	—	—
Sulphur dioxide	1-hour	900	NLAAQS	0.8	2	3	<1%	—	—	—
	3-hour	600	NLAAQS	0.8	1	2	<1%	—	—	—
	24-hour	300	NLAAQS	0.8	0.41	1.20	<1%	—	—	—
	Annual	60	NLAAQS	0.8	0.04	0.83	2%	—	—	—
Carbon monoxide	1-hour	35,000	NLAAQS	1495	2,487	3,982	18%	—	—	—
	8-hour	15,000	NLAAQS	1,495	1,348	2,843	24%	—	—	—
Arsenic	24-hour	0.3	NLAAQS	—	0.02	—	6%	—	—	—
Cadmium	24-hour	2	NLAAQS	—	0.004	—	<1%	—	—	—
Copper	24-hour	50	NLAAQS	—	0.18	—	<1%	—	—	—
Lead	24-hour	2	NLAAQS	—	0.04	—	2%	—	—	—
Mercury	24-hour	2	NLAAQS	—	0.00004	—	<1%	—	—	—
Nickel	24-hour	2	NLAAQS	—	0.15	—	7%	—	—	—
Vanadium	24-hour	2	NLAAQS	—	0.56	—	28%	—	—	—
Zinc	24-hour	120	NLAAQS	—	0.54	—	<1%	—	—	—

Notes:

Values are above the NLAAQS criteria.

(a) Out of a possible 8,760 hours in a year.

(b) Out of a possible 365 days in a year.

(c) Predicted concentration from Project includes the 24-hour diesel particulate matter concentration at the maximum TPM receptor.

NLAAQS = Newfoundland Ambient Air Quality Standards.

Table 6-3: Maximum Predicted Change to Air Quality at Sensitive Receptors

Contaminant	Averaging Period	NLAAQS Criteria (µg/m³)	Background Concentrations (µg/m³)	Maximum Predicted Concentration from Project (µg/m³)	Maximum Predicted plus Background (µg/m³)	Percent of NLAAQS (%)	Frequency Above NLAAQS (%)	Number of Days Above Standard[(a)]
Total particulate matter	24-hour	120	24.1	***125***[(b)]	***149***	>100%	<1%	3
	Annual	60	10.8	0.001	11	18%	—	—
PM10	24-hour	50	11.3	***84***	***95***	>100%	4%	13
PM2.5	24-hour	25	3.6	13	16	65%	—	—
	Annual	8.8	3.6	1	5	55%	—	—
Nitrogen dioxide	1-hour	400	4.9	353	358	89%	—	—
	24-hour	200	4.9	97	102	51%	—	—
	Annual	100	4.9	11	15	15%	—	—
Sulphur dioxide	1-hour	900	0.8	0.4	1	<1%	—	—
	3-hour	600	0.8	0.3	1.1	<1%	—	—
	24-hour	300	0.8	0.1	0.9	<1%	—	—
	Annual	60	0.8	0.01	0.8	1%	—	—
Carbon monoxide	1-hour	35,000	1,495	629	2,124	6%	—	—
	8-hour	15,000	1,495	422	1,917	13%	—	—
Arsenic	24-hour	0.3	—	0.002	—	<1%	—	—
Cadmium	24-hour	2	—	0.0004	—	<1%	—	—
Copper	24-hour	50	—	0.02	—	<1%	—	—
Lead	24-hour	2	—	0.004	—	<1%	—	—
Mercury	24-hour	2	—	0.000004	—	<1%	—	—
Nickel	24-hour	2	—	0.01	—	<1%	—	—
Vanadium	24-hour	2	—	0.06	—	3%	—	—
Zinc	24-hour	120	—	0.05	—	<1%	—	—

Notes:

Values are above the NLAAQS criteria.

(a) Out of a possible 365 days in a year.

(b) Predicted concentration from Project includes the 24-hour diesel particulate matter concentration at the maximum TPM receptor

NLAAQS = Newfoundland Ambient Air Quality Standards; PM_{10} = particulate matter less than 10 micrometers; $PM_{2.5}$ = particulate matter less than 2.5 micrometers.

7.0 CONCLUSIONS

Potential effects from the Project on air quality were assessed at or beyond the administrative boundary for the Project operations. Release estimates for the Project were calculated using published emission factors such as those from the United States Environmental Protection Agency AP-42 (USEPA 1995) and the existing conditions were summarized using measured concentrations from the existing air quality monitoring station in Labrador City. Contaminants of concern air concentrations were predicted using the accepted air quality dispersion modelling approaches, in accordance with the provincial modelling guideline (Government of NL 2012). The predicted air concentrations from the Project were added to the background concentrations to assess residual effects from the Project.

Short-term concentrations of 24-hour TPM, PM_{10}, $PM_{2.5}$, and NO_2 and 1-hour NO_2 have maximum predicted modelled concentrations above their respective NLAAQS beyond the surface leases. The exceedances are localized to the Project, with the maximum predicted modelled concentrations occurring to the north and east of Rose pit. There is also a predicted annual exceedance of $PM_{2.5}$ adjacent to Rose pit; however, concentrations decrease as contaminants disperse before reaching cabin and community locations so there are no long-term exceedances predicted at sensitive receptors.

The release estimates and dispersion model incorporate some planned and natural mitigation measures however, it is acknowledged that more stringent dust control may be required to reduce fugitive dust generation especially on the unpaved haul roads. The measures will be described in a Environmental Protection Plan included in the Project-specific Environmental Protection Plan. In addition, a blasting plan will be developed to remove some conservatism from the dispersion modelling assessment. An ambient air quality monitoring program will be implemented during each Project phase to verify the model predictions, assess the effectiveness of mitigation measures, and inform if further mitigation measures are required. The effectiveness of mitigation measures will be re-assessed through the life of the Project and opportunities for continuous improvement of dust management practices will be investigated, as required.

8.0 REFERENCES

Alderon (Alderon Iron Ore Corporation). 2012. Kami Iron Ore Project environmental impact statement, volume I, part II. Available at https://www.gov.nl.ca/ecc/files/env-assessment-projects-y2011-1611-kami-eis-volume-1-part-ii.pdf.

Attalla MI, Day SJ, Lange T, Lilley W, Morgan S. 2008. NOx emissions from blasting operations in open-cut coal mining. Atmospheric Environment. 7874–7883.

Government of NL (Government of Newfoundland and Labrador). 2012. Guideline for plume dispersion modelling. Second revision September 18, 2012. Prepared by Lawrence B. 38 p.

Government of NL. 2012. Determination of compliance with the ambient air quality standards. Fourth revision, December 11, 2012. Prepared by Lawrence B. 12 p.

Long ME. 2011. Air quality modeling and impacts on the mining industry: an overview. Presented at Mine Expo. September 26, 2011.

Ontario Ministry of the Environment and Climate Change. 2017. Air dispersion modelling guideline for Ontario [Guideline A-11]. February 2017.

Okane Consultants. 2024. Ore and mine rock assays for the Kami Iron Ore Mine project.

USEPA (United States Environmental Protection Agency). 1995. AP-42 – compilation of air pollutant emission factors – fifth edition. January 1995.

USEPA. 2012. Haul road workgroup final report submission to EPA-OAQPS.

WSP Canada Ltd. (WSP). 2024. Air dispersion modelling plan: Champion Iron Kami ore project. Submitted to Barrie Lawrence at the Department of Environment, Climate Change and Municipalities.

Signature Page

WSP Canada Inc.

Julia Trautmann, M.Sc.
Senior Air Quality Scientist

Linda Lattner, P.Eng.
Principal Air Quality Engineer

JAT/LL/rd

APPENDIX A

Dispersion Modelling Source Summary Tables

Dispersion Modelling Table
Kami Iron Ore Mine Project

POINT SOURCES

Modelling ID	Source Description	Source ID(s)	Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Inner Diameter [m]	Stack Height above Roof [m]	Exhaust Flow Rate [m^3/s]	Stack Exit Gas Temperature [K]	Source Configuration	X Coordinate [m]	Y Coordinate [m]	Contaminant	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	CALPUFF Particle Numbering		
															Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
PCDC	Primary Crushing (ore)	PCDC	8.69	14.674	0.914	—	9.63	Ambient	Vertical	634177.72	5856658.08	TSP	2.49E+00	1.80E+00	P1	4.61E-02	3.33E-02
												PM10	2.49E-01	1.80E-01	P2	2.03E-01	1.46E-01
												PM2.5	4.61E-02	3.33E-02	P3	2.24E+00	1.62E+00
AFDC	Apron Feeder	AFDC	5.00	15.524	0.762	—	7.08	Ambient	Vertical	638205.76	5856656.38	TSP	5.33E-01	3.85E-01	P1	7.54E-02	5.44E-02
												PM10	2.67E-01	1.92E-01	P2	1.91E-01	1.38E-01
												PM2.5	7.54E-02	5.44E-02	P3	2.67E-01	1.92E-01
SFDC	Silo Feed Dust Collector	SFDC	10.00	15.524	0.762	-30.00	7.08	Ambient	Vertical	639204.4	5857401.6	TSP	1.93E-01	1.93E-01	P1	2.73E-02	2.73E-02
												PM10	9.67E-02	9.67E-02	P2	6.93E-02	6.93E-02
												PM2.5	2.73E-02	2.73E-02	P3	9.67E-02	9.67E-02

VOLUME SOURCES

Modelling ID	Source Description	Source ID(s)	Release Height Above Grade [m]	Length of Side [m]	Volume Source Height [m]	Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X Coordinate [m]	Y Coordinate [m]			Contaminant	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	CALPUFF Particle Numbering TSP			CALPUFF Particle Numbering TSP Diesel		
															Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
OSP	Ore Stockpile	OH2 Ore Stockpile_TP	1.5	5.0	3	1.16	1.40	633753.53	5856885.49			TSP	5.86E+00	4.23E+00	P1	4.19E-01	3.03E-01	P1	6.87E-03	6.87E-03
												TSPDiesel	7.08E-03	7.08E-03	P2	2.35E+00	1.70E+00	P2	2.12E-04	2.12E-04
												PM10	2.77E+00	2.00E+00	P3	3.09E+00	2.23E+00	P3	0.00E+00	0.00E+00
												PM2.5	4.19E-01	3.03E-01						
												PM10_D	7.08E-03	7.08E-03						
												PM2.5_D	6.87E-03	6.87E-03						
												NOx	1.30E-01	1.30E-01						
												NO2	2.61E-02	2.61E-02						
												NO	6.80E-02	6.80E-02						
												SO2	1.60E-03	1.60E-03						
												CO	2.52E-01	2.52E-01						
												BaP	3.77E-09	3.77E-09						
												Benz(a)anthracene	6.56E-09	6.56E-09						
												Benzo(b+)+k)fluoranthene	6.04E-09	6.04E-09						
												Benzo(g,h,i)perylene	4.26E-09	4.26E-09						
												Chrysene	7.99E-09	7.99E-09						
												Dibenz(a,h)anthracene	5.38E-10	5.38E-10						
												Indenol(1,2,3-cd)pyrene	3.79E-09	3.79E-09						
												Naphthalene	1.51E-09	1.51E-09						
TT1	Conveyor Transfer Towers for Waste Rock	TT1	8.20	1.5	16.397	0.35	7.63	633930.01	5856446.04			TSP	3.72E-02	2.16E-02	P1	3.85E-03	2.24E-03			
												PM10	1.36E-02	7.93E-03	P2	9.78E-03	5.69E-03			
												PM2.5	3.85E-03	2.24E-03	P3	2.36E-02	1.37E-02			
TT2	Conveyor Transfer Tower 2 for Waste Rock	TT2	6.29	1.5	12.573	0.35	5.85	636182.24	5855868.83			TSP	3.72E-02	2.16E-02	P1	3.85E-03	2.24E-03			
												PM10	1.36E-02	7.93E-03	P2	9.78E-03	5.69E-03			
												PM2.5	3.85E-03	2.24E-03	P3	2.36E-02	1.37E-02			
WRSP	Waste Rock Stockpile	WRH1 WRH2 WRH3 Waste Stockpile_TP	3.5	5.0	7	1.16	3.26	636442.32	5854270.82			TSP	3.50E+01	2.03E+01	P1	2.51E+00	1.46E+00	P1	4.88E-03	4.88E-03
												TSPDiesel	5.03E-03	5.03E-03	P2	1.40E+01	8.17E+00	P2	1.51E-04	1.51E-04
												PM10	1.66E+01	9.62E+00	P3	1.84E+01	1.07E+01	P3	0.00E+00	0.00E+00
												PM2.5	2.51E+00	1.46E+00						
												PM10_D	5.03E-03	5.03E-03						
												PM2.5_D	4.88E-03	4.88E-03						
												NOx	4.36E-01	4.36E-01						
												NO2	8.71E-02	8.71E-02						
												NO	2.27E-01	2.27E-01						
												SO2	8.37E-04	8.37E-04						
												CO	4.36E-01	4.36E-01						
												BaP	3.00E-08	3.00E-08						
												Benz(a)anthracene	3.49E-08	3.49E-08						
												Benzo(b+)+k)fluoranthene	4.81E-08	4.81E-08						
												Benzo(g,h,i)perylene	3.40E-08	3.40E-08						
												Chrysene	5.90E-08	5.90E-08						
												Dibenz(a,h)anthracene	4.30E-09	4.30E-09						
												Indenol(1,2,3-cd)pyrene	3.02E-08	3.02E-08						
												Naphthalene	2.71E-09	2.71E-09						
OB1	Overburden Stockpile	OB1	1.5	5.0	3	1.16	1.40	631910.17	5857055.81			TSP	3.70E-01	3.70E-01	P1	2.65E-02	2.65E-02			
												PM10	1.75E-01	1.75E-01	P2	1.48E-01	1.48E-01			
												PM2.5	2.65E-02	2.65E-02	P3	1.95E-01	1.95E-01			

Dispersion Modelling Table
Kami Iron Ore Mine Project

VOLUME SOURCES

Modelling ID	Source Description	Source ID(s)	Release Height Above Grade [m]	Length of Side [m]	Volume Source Height [m]	Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X Coordinate [m]	Y Coordinate [m]			Contaminant	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	CALPUFF Particle Numbering TSP			CALPUFF Particle Numbering TSP Diesel		
															Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
TLDC	Train Loadout Building Dust Collector	TLDC	13.20	1.5	26.4	0.35	12.28	639526.96	5857636.37			TSP	1.93E-01	1.93E-01	P1	2.73E-02	2.73E-02			
												PM10	9.67E-02	9.67E-02	P2	6.93E-02	6.93E-02			
												PM2.5	2.73E-02	2.73E-02	P3	9.67E-02	9.67E-02			
OH3	Material Transfer Via Conveyor From Primary Crusher to Ore Stockpile	OH3	2.50	1.5	5	0.35	2.33	634243.73	5856683.52			TSP	1.46E+00	1.06E+00	P1	1.05E-01	7.57E-02			
												PM10	6.92E-01	5.00E-01	P2	5.88E-01	4.24E-01			
												PM2.5	1.05E-01	7.57E-02	P3	7.72E-01	5.57E-01			
TT3	Overland Conveyor Transfer Tower (Ore)	TT3	8.20	1.5	16.397	0.35	7.63	634316.43	5856712.84			TSP	1.87E-02	1.35E-02	P1	1.93E-03	1.40E-03			
												PM10	6.84E-03	4.94E-03	P2	4.91E-03	3.54E-03			
												PM2.5	1.93E-03	1.40E-03	P3	1.18E-02	8.53E-03			
OH4	Overland Conveyor Drop Point at Dome	OH4	18.00	1.5	36.00	0.35	16.74	638166.21	5856627.06			TSP	1.46E+00	1.06E+00	P1	1.05E-01	7.57E-02			
												PM10	6.92E-01	5.00E-01	P2	5.88E-01	4.24E-01			
												PM2.5	1.05E-01	7.57E-02	P3	7.72E-01	5.57E-01			
TT4	Emergency Stockpile Transfer Tower	TT4	8.79	1.5	17.589	0.35	8.18	638747.02	5857070.51			TSP	4.83E-03	4.83E-03	P1	5.01E-04	8.23E-06			
												PM10	1.77E-03	1.77E-03	P2	1.27E-03	1.76E-03			
												PM2.5	5.01E-04	8.23E-06	P3	3.06E-03	3.06E-03			
ESS	Concentrate Drop to Emergency Storage Stockpile	CH2 Emergency Concentrate Stockpile_TP	1.5	5.0	3	1.16	1.40	638677.68	5857165.93			TSP	2.67E+00	4.40E-02	P1	1.92E-01	3.15E-03	P1	0.00E+00	0.00E+00
												TSPDiesel	5.34E-04	5.34E-04	P2	1.07E+00	1.76E-02	P2	0.00E+00	0.00E+00
												PM10	1.27E+00	2.08E-02	P3	1.41E+00	2.32E-02	P3	0.00E+00	0.00E+00
												PM2.5	1.92E-01	3.15E-03						
												PM10_D	5.34E-04	5.34E-04						
												PM2.5_D	5.18E-04	5.18E-04						
												NOx	1.60E-02	1.60E-02						
												NO2	3.21E-03	3.21E-03						
												NO	8.37E-03	8.37E-03						
												SO2	2.66E-04	2.66E-04						
												CO	1.39E-01	1.39E-01						
												BaP	2.12E-09	2.12E-09						
												Benz(a)anthracene	3.66E-09	3.66E-09						
												Benzo(b+)+k)fluoranthene	3.39E-09	3.39E-09						
												Benzo(g,h,i)perylene	2.39E-09	2.39E-09						
												Chrysene	4.48E-09	4.48E-09						
												Dibenz(a,h)anthracene	3.02E-10	3.02E-10						
												Indenol(1,2,3-cd)pyrene	2.13E-09	2.13E-09						
												Naphthalene	8.33E-10	8.33E-10						
CH3	Emergency Storage Stockpile - Reclaim Hopper & Conveyor Transfer	CH3 CH4	2.07	2.0	4.146	0.47	1.93	638737.23	5857159.46			TSP	4.61E+00	7.58E-02	P1	3.30E-01	5.43E-03			
												PM10	2.18E+00	3.59E-02	P2	1.85E+00	3.04E-02			
												PM2.5	3.30E-01	5.43E-03	P3	2.43E+00	4.00E-02			
CH5	Reclaim Conveyor Transfer to Concentrate Conveyor	CH5	6.60	1.5	6.6	0.35	3.07	638787.89	5857099.38			TSP	1.04E-01	1.71E-03	P1	1.08E-02	1.77E-04			
												PM10	3.82E-02	6.28E-04	P2	2.74E-02	4.50E-04			
												PM2.5	1.08E-02	1.77E-04	P3	6.60E-02	1.08E-03			

Dispersion Modelling Table
Kami Iron Ore Mine Project

VOLUME SOURCES

Modelling ID	Source Description	Source ID(s)	Release Height Above Grade [m]	Length of Side [m]	Volume Source Height [m]	Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X Coordinate [m]	Y Coordinate [m]			Contaminant	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	CALPUFF Particle Numbering TSP			CALPUFF Particle Numbering TSP Diesel		
															Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]	Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
TL	Rail Car Loading	RCL	1.25	2.900	2.5	0.67	1.16	639526.96	5857636.37			TSP	8.02E-01	8.02E-01	P1	5.75E-02	5.75E-02	P1	0.00E+00	—
												PM10	3.80E-01	3.80E-01	P2	3.22E-01	3.22E-01	P2	0.00E+00	—
												PM2.5	5.75E-02	5.75E-02	P3	4.23E-01	4.23E-01	P3	0.00E+00	—
												TSPDiesel	1.16E-02	1.03E-02						
												PM10_D	1.16E-02	1.03E-02						
												PM2.5_D	1.13E-02	1.00E-02						
												NOx	5.85E-01	5.20E-01						
												NO2	1.17E-01	1.04E-01						
												NO	3.05E-01	2.71E-01						
												SO2	3.68E-04	3.27E-04						
												CO	1.28E-01	1.14E-01						
												BAP	2.62E-08	2.33E-08						
												Benz(a)anthracene	6.35E-08	5.64E-08						
												Benzo(b+)+k)fluoranthene	1.13E-07	1.01E-07						
												Benzo(g,h,i)perylene	5.67E-08	5.04E-08						
												Chrysene	1.56E-07	1.39E-07						
												Dibenz(a,h)anthracene	3.53E-08	3.14E-08						
												Indenol(1,2,3-cd)pyrene	4.22E-08	3.75E-08						
												Naphthalene	1.33E-05	1.18E-05						
EPG1	Generator 1 - Mine Services Area	EPG1	1.19	3.825	2.37	0.88961012	1.10	635151.79	5856340.06			NOX	4.95E+00	2.94E-02				P1	0.00E+00	2.14E-04
												NO2	9.91E-01	5.88E-03				P2	0.00E+00	6.63E-06
												NO	2.59E+00	1.53E-02				P3	0.00E+00	0.00E+00
												CO	3.91E-01	2.32E-03						
												SO2	5.13E-03	3.04E-05						
												TSPDiesel	3.73E-02	2.21E-04						
												PM10_D	3.73E-02	2.21E-04						
												PM2.5_D	3.61E-02	2.14E-04						
												Benz(a)anthracene	6.68E-07	3.96E-09						
												BaP	2.76E-07	1.64E-09						
												Benzo(b+)+k)fluoranthene	1.19E-06	7.07E-09						
												Benzo(g,h,i)perylene	5.97E-07	3.54E-09						
												Chrysene	1.64E-06	9.75E-09						
												Dibenz(a,h)anthracene	3.71E-07	2.20E-09						
												Indenol(1,2,3-cd)pyrene	4.44E-07	2.64E-09						
												Naphthalene	1.40E-04	8.28E-07						
EPGCON	Generators - Concentrator	EPG2 EPG3	1.19	7.499	2.37	1.743906954	1.10	638385.52	5856832.16			NOX	9.91E+00	5.88E-02				P1	1.13E-02	4.29E-04
												NO2	1.98E+00	1.18E-02				P2	3.48E-04	1.33E-05
												NO	5.17E+00	3.07E-02				P3	0.00E+00	0.00E+00
												CO	7.82E-01	4.64E-03						
												SO2	1.03E-02	6.09E-05						
												TSPDiesel	7.45E-02	4.42E-04						
												PM10_D	7.45E-02	4.42E-04						
												PM2.5_D	7.23E-02	4.29E-04						
												Benz(a)anthracene	1.34E-06	7.93E-09						
												BaP	5.52E-07	3.28E-09						
												Benzo(b+)+k)fluoranthene	2.38E-06	1.41E-08						
												Benzo(g,h,i)perylene	1.19E-06	7.09E-09						
												Chrysene	3.28E-06	1.95E-08						
												Dibenz(a,h)anthracene	7.43E-07	4.41E-09						
												Indenol(1,2,3-cd)pyrene	8.89E-07	5.28E-09						
												Naphthalene	2.79E-04	1.66E-06						

Dispersion Modelling Table
Kami Iron Ore Mine Project

PIT RETENTION FACTOR 50%

AREAPOLY SOURCES

Modelling ID	Source Description	Source ID(s)	Area for 1-hr and 24-hr Model [m²]	Area for Annual Model [m²]	Release Height Above Grade [m]	Number of Vertices	Initial Vertical Dimension of Plume	X Coordinate	Y Coordinate	X Vertices	Y Vertices	Contaminant	Emission Rates						Emissions Rates INCLUDING Pit Retention (FOR PIT MODEL SOURCE)						CALPUFF PARTICLE NUMBERING TSP						
													1-hr		24-hr		Annual		1-hr		24-hr		Annual			1-hr		24-hr		Annual	
													AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	Particle #	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]	AREAPOLY Source Emission Rate [g/s]	AREAPOLY Source Emission Rate as Inputted into CALPUFF [g/m²-s]
PIT	Rose Pit	IPO1A	3,891,037	3,891,037	0	4	0	633748.63	5856505.31	633748.63	5856505.31	TSP	1.58E+02	4.07E-05	4.16E+01	1.07E-05	2.95E+01	7.58E-06	7.91E+01	**2.03E-05**	2.08E+01	**5.35E-06**	1.47E+01	**3.79E-06**	**P1**	3.92E+00	1.01E-06	2.09E+00	5.36E-07	1.50E+00	3.86E-07
		IPO2								631866.35	5856539.85	PM10	7.66E+01	1.97E-05	1.67E+01	4.28E-06	1.09E+01	2.79E-06	3.83E+01	**9.84E-06**	8.33E+00	**2.14E-06**	5.43E+00	**1.40E-06**	**P2**	3.44E+01	8.83E-06	6.25E+00	1.61E-06	3.93E+00	1.01E-06
		IPO3								631253.31	5854999.76	PM2.5	7.85E+00	2.02E-06	4.17E+00	1.07E-05	3.00E+00	7.71E-07	3.92E+00	**1.01E-06**	2.09E+00	**5.36E-07**	1.50E+00	**3.86E-07**	**P3**	4.08E+01	1.05E-05	1.25E+01	3.21E-06	9.31E+00	2.39E-06
		IPO4								634448.01	5855020.2	CO	9.45E+01	**2.43E-05**	2.05E+01	**5.28E-06**	1.87E+01	**4.81E-06**	9.45E+01	**2.43E-05**	2.05E+01	**5.28E-06**	1.87E+01	**4.81E-06**								
		IPO5										NOX	2.38E+01	**6.11E-06**	1.73E+01	**4.46E-06**	1.72E+01	**4.42E-06**	2.38E+01	**6.11E-06**	1.73E+01	**4.46E-06**	1.72E+01	**4.42E-06**								
		IPO6										NO2	3.75E+00	**9.63E-07**	3.43E+00	**8.81E-07**	3.42E+00	**8.78E-07**	3.75E+00	**9.63E-07**	3.43E+00	**8.81E-07**	3.42E+00	**8.78E-07**								
		IPO7										NO	1.31E+01	**5.15E-06**	9.08E+00	**3.58E-06**	8.98E+00	**3.54E-06**	1.31E+01	**5.15E-06**	9.08E+00	**3.58E-06**	8.98E+00	**3.54E-06**								
		IPO9										SO2	3.33E-02	**8.55E-09**	3.33E-02	**8.55E-09**	3.33E-02	**8.55E-09**	3.33E-02	**8.55E-09**	3.33E-02	**8.55E-09**	3.33E-02	**8.55E-09**								
		In Pit_TP										TSPDiesel	1.98E-01	5.08E-08	1.98E-01	5.08E-08	1.98E-01	5.08E-08	9.88E-02	**2.54E-08**	9.88E-02	**2.54E-08**	9.88E-02	**2.54E-08**	**P1**	9.58E-02	2.46E-08	9.58E-02	2.46E-08	9.58E-02	2.46E-08
												PM10_D	1.98E-01	5.08E-08	1.98E-01	5.08E-08	1.98E-01	5.08E-08	9.88E-02	**2.54E-08**	9.88E-02	**2.54E-08**	9.88E-02	**2.54E-08**	**P2**	2.96E-03	7.62E-10	2.96E-03	7.62E-10	2.96E-03	7.62E-10
												PM2.5_D	1.92E-01	4.93E-08	1.92E-01	4.93E-08	1.92E-01	4.93E-08	9.58E-02	**2.46E-08**	9.58E-02	**2.46E-08**	9.58E-02	**2.46E-08**	**P3**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
												BaP	1.08E-06	**2.77E-13**	1.08E-06	**2.77E-13**	1.08E-06	**2.77E-13**	1.08E-06	**2.77E-13**	1.08E-06	**2.77E-13**	1.08E-06	**2.77E-13**								
												Benz(a)anthracene	1.26E-06	**3.25E-13**	1.26E-06	**3.25E-13**	1.26E-06	**3.25E-13**	1.26E-06	**3.25E-13**	1.26E-06	**3.25E-13**	1.26E-06	**3.25E-13**								
												Benzo(b+j+k)fluoranthene	1.72E-06	**4.44E-13**	1.72E-06	**4.44E-13**	1.72E-06	**4.44E-13**	1.72E-06	**4.44E-13**	1.72E-06	**4.44E-13**	1.72E-06	**4.44E-13**								
												Benzo(g,h,i)perylene	1.22E-06	**3.13E-13**	1.22E-06	**3.13E-13**	1.22E-06	**3.13E-13**	1.22E-06	**3.13E-13**	1.22E-06	**3.13E-13**	1.22E-06	**3.13E-13**								
												Chrysene	2.13E-06	**5.48E-13**	2.13E-06	**5.48E-13**	2.13E-06	**5.48E-13**	2.13E-06	**5.48E-13**	2.13E-06	**5.48E-13**	2.13E-06	**5.48E-13**								
												Dibenz(a,h)anthracene	1.59E-07	**4.09E-14**	1.59E-07	**4.09E-14**	1.59E-07	**4.09E-14**	1.59E-07	**4.09E-14**	1.59E-07	**4.09E-14**	1.59E-07	**4.09E-14**								
												Indeno(1,2,3-cd)pyrene	1.09E-06	**2.79E-13**	1.09E-06	**2.79E-13**	1.09E-06	**2.79E-13**	1.09E-06	**2.79E-13**	1.09E-06	**2.79E-13**	1.09E-06	**2.79E-13**								
												Naphthalene	1.09E-07	**2.80E-14**	1.09E-07	**2.80E-14**	1.09E-07	**2.80E-14**	1.09E-07	**2.80E-14**	1.09E-07	**2.80E-14**	1.09E-07	**2.80E-14**								
INPIT	Rose Pit - In Pit Road	INPIT	3,891,037	3,891,037	0	4	0	633748.63	5856505.31	633748.63	5856505.31	TSP	1.23E+02	**3.15E-05**	1.23E+02	**3.15E-05**	1.23E+02	**3.15E-05**	6.13E+01	**1.57E-05**	6.13E+01	**1.57E-05**	6.13E+01	**1.57E-05**	**P1**	1.62E+00	4.17E-07	1.62E+00	4.17E-07	1.62E+00	4.17E-07
										631866.35	5856539.85	PM10	3.24E+01	**8.33E-06**	3.24E+01	**8.33E-06**	3.24E+01	**8.33E-06**	1.62E+01	**4.17E-06**	1.62E+01	**4.17E-06**	1.62E+01	**4.17E-06**	**P2**	1.46E+01	3.75E-06	1.46E+01	3.75E-06	1.46E+01	3.75E-06
										631253.31	5854959.76	PM2.5	3.24E+00	**8.33E-07**	3.24E+00	**8.33E-07**	3.24E+00	**8.33E-07**	1.62E+00	**4.17E-07**	1.62E+00	**4.17E-07**	1.62E+00	**4.17E-07**	**P3**	4.52E+01	1.16E-05	4.52E+01	1.16E-05	4.52E+01	1.16E-05
										634448.01	5855020.2																					
TMFA	Tailings Management Facility	TMF	40,000	5,158,731	10	4	4.651162791	640360.05	5,856,178	640360.05	5856177.67	TSP	1.16E+01	**2.89E-04**	1.16E+01	**2.89E-04**	8.12E+00	**1.57E-06**	1.16E+01	**2.89E-04**	1.16E+01	**2.89E-04**	8.12E+00	**1.57E-06**	**P1**	8.67E-01	2.17E-05	8.67E-01	2.17E-05	6.09E-01	1.18E-07
		TMF_TP								640159.97	5856178.06	PM10	5.78E+00	**1.44E-04**	5.78E+00	**1.44E-04**	4.06E+00	**7.87E-07**	5.78E+00	**1.44E-04**	5.78E+00	**1.44E-04**	4.06E+00	**7.87E-07**	**P2**	4.91E+00	1.23E-04	4.91E+00	1.23E-04	3.45E+00	6.69E-07
										640159.9	5855977.95	PM2.5	8.67E-01	**2.17E-05**	8.67E-01	**2.17E-05**	6.09E-01	**1.18E-07**	8.67E-01	**2.17E-05**	8.67E-01	**2.17E-05**	6.09E-01	**1.18E-07**	**P3**	5.78E+00	1.44E-04	5.78E+00	1.44E-04	4.06E+00	7.87E-07
										640359.66	5855977.52	NOx	5.66E-01	**1.42E-05**	5.66E-01	**1.42E-05**	2.00E-01	**3.87E-08**	5.66E-01	**1.42E-05**	5.66E-01	**1.42E-05**	2.00E-01	**3.87E-08**								
												NO2	1.13E-01	**2.83E-06**	1.13E-01	**2.83E-06**	3.99E-02	**7.74E-09**	1.13E-01	**2.83E-06**	1.13E-01	**2.83E-06**	3.99E-02	**7.74E-09**								
												NO	2.95E-01	**1.13E-05**	2.95E-01	**1.13E-05**	1.04E-01	**3.10E-08**	2.95E-01	**1.13E-05**	2.95E-01	**1.13E-05**	1.04E-01	**3.10E-08**								
												SO2	1.52E-03	**3.79E-08**	1.52E-03	**3.79E-08**	5.42E-04	**1.05E-10**	1.52E-03	**3.79E-08**	1.52E-03	**3.79E-08**	5.42E-04	**1.05E-10**								
												CO	8.41E-01	**2.10E-05**	8.41E-01	**2.10E-05**	3.02E-01	**5.85E-08**	8.41E-01	**2.10E-05**	8.41E-01	**2.10E-05**	3.02E-01	**5.85E-08**								
												TSPDiesel	1.16E-02	**2.91E-07**	1.16E-02	**2.91E-07**	4.12E-03	**7.98E-10**	1.16E-02	**2.91E-07**	1.16E-02	**2.91E-07**	4.12E-03	**7.98E-10**	**P1**	1.13E-02	2.82E-07	1.13E-02	2.82E-07	3.99E-03	7.74E-10
												PM10_D	1.16E-02	**2.91E-07**	1.16E-02	**2.91E-07**	4.12E-03	**7.98E-10**	1.16E-02	**2.91E-07**	1.16E-02	**2.91E-07**	4.12E-03	**7.98E-10**	**P2**	3.49E-04	8.73E-09	3.49E-04	8.73E-09	1.23E-04	2.39E-11
												PM2.5_D	1.13E-02	**2.82E-07**	1.13E-02	**2.82E-07**	3.99E-03	**7.74E-10**	1.13E-02	**2.82E-07**	1.13E-02	**2.82E-07**	3.99E-03	**7.74E-10**	**P3**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
												BaP	3.58E-08	**8.96E-13**	3.58E-08	**8.96E-13**	1.27E-08	**2.46E-15**	3.58E-08	**8.96E-13**	3.58E-08	**8.96E-13**	1.27E-08	**2.46E-15**								
												Benz(a)anthracene	4.53E-08	**1.13E-12**	4.53E-08	**1.13E-12**	1.61E-08	**3.11E-15**	4.53E-08	**1.13E-12**	4.53E-08	**1.13E-12**	1.61E-08	**3.11E-15**								
												Benzo(b+j+k)fluoranthene	5.75E-08	**1.44E-12**	5.75E-08	**1.44E-12**	2.03E-08	**3.94E-15**	5.75E-08	**1.44E-12**	5.75E-08	**1.44E-12**	2.03E-08	**3.94E-15**								
												Benzo(g,h,i)perylene	4.05E-08	**1.01E-12**	4.05E-08	**1.01E-12**	1.44E-08	**2.78E-15**	4.05E-08	**1.01E-12**	4.05E-08	**1.01E-12**	1.44E-08	**2.78E-15**								
												Chrysene	7.14E-08	**1.79E-12**	7.14E-08	**1.79E-12**	2.53E-08	**4.90E-15**	7.14E-08	**1.79E-12**	7.14E-08	**1.79E-12**	2.53E-08	**4.90E-15**								
												Dibenz(a,h)anthracene	5.13E-09	**1.28E-13**	5.13E-09	**1.28E-13**	1.82E-09	**3.52E-16**	5.13E-09	**1.28E-13**	5.13E-09	**1.28E-13**	1.82E-09	**3.52E-16**								
												Indeno(1,2,3-cd)pyrene	3.61E-08	**9.02E-13**	3.61E-08	**9.02E-13**	1.28E-08	**2.48E-15**	3.61E-08	**9.02E-13**	3.61E-08	**9.02E-13**	1.28E-08	**2.48E-15**								
												Naphthalene	5.17E-09	**1.29E-13**	5.17E-09	**1.29E-13**	1.85E-09	**3.60E-16**	5.17E-09	**1.29E-13**	5.17E-09	**1.29E-13**	1.85E-09	**3.60E-16**								
WRSPA	Waste Rock Stockpile Wind Erosion A	WRSP	961,235	961,235	30.00	4	13.95348837	635900.97	5853308.06	635900.97	5853308.06	TSP	4.16E+00	**4.33E-06**	4.16E+00	**4.33E-06**	4.16E+00	**4.33E-06**	4.16E+00	**4.33E-06**	4.16E+00	**4.33E-06**	4.16E+00	**4.33E-06**	**P1**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**
										637547.92	5853229	PM10	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	**P2**	1.77E+00	**1.84E-06**	1.77E+00	**1.84E-06**	1.77E+00	**1.84E-06**
										637311.71	5853836.21	PM2.5	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	3.12E-01	**3.24E-07**	**P3**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**	2.08E+00	**2.16E-06**
WRSPB	Waste Rock Stockpile Wind Erosion B	WRSP	973,381	973,381	30.00	4	13.95348837	635982.15	5854183.17	635982.15	5854183.17	TSP	4.21E+00	**4.33E-06**	4.21E+00	**4.33E-06**	4.21E+00	**4.33E-06**	4.21E+00	**4.33E-06**	4.21E+00	**4.33E-06**	4.21E+00	**4.33E-06**	**P1**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**
				1,558,610						637323.37	5853846.87	PM10	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	**P2**	1.79E+00	**1.84E-06**	1.79E+00	**1.84E-06**	1.79E+00	**1.84E-06**
										635902.12	5853220.56	PM2.5	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	3.16E-01	**3.24E-07**	**P3**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**	2.11E+00	**2.16E-06**
OBSP	Overburden Stockpile	OBSP	1,499,509	1,499,509	10	4	4.651162791	631770.17	5858415.6	631770.17	5858415.6	TSP	2.31E+00	**1.54E-06**	2.31E+00	**1.54E-06**	2.31E+00	**1.54E-06**	2.31E+00	**1.54E-06**	2.31E+00	**1.54E-06**	2.31E+00	**1.54E-06**	**P1**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**
				1503988						631037.63	5858058.41	PM10	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	**P2**	9.84E-01	**6.56E-07**	9.84E-01	**6.56E-07**	9.84E-01	**6.56E-07**
										631618.82	5856508.56	PM2.5	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	1.74E-01	**1.16E-07**	**P3**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**	1.16E+00	**7.72E-07**
										632531.91	5857071.59																					

Dispersion Modelling Table
Kami Iron Ore Mine Project

ROAD SOURCES

Modelling ID	Source Description	Source ID(s)	Road Length [km]	Road Width [m]	Vehicle Height [m]	Release Height Above Grade [m]	Plume Width [m] (Road Width + 6 m)	Volume Source Height [m] (Top of Plume Height) [m]	Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X, Y Coordinates [m]	Contaminant	1 and 24 hr Emission Rate [g/s/m]	Annual Emission Rate [g/s/m]	CALPUFF Particle Numbering			CALPUFF Particle Numbering TSP Diesel		
															Particle #	1 and 24 hr Emission Rate [g/s/m]	Annual Emission Rate [g/s/m]	Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
UPR1	Pit to Ore Stockpiles	UPR1	1.020	28	7	6	34	13	16	5.89	see model input files	TSP	2.51E-02	2.51E-02	P1	7.12E-04	7.12E-04	P1	3.22E-05	3.22E-05
												PM10	7.12E-03	7.12E-03	P2	6.41E-03	6.41E-03	P2	9.95E-07	9.95E-07
												PM2.5	7.12E-04	7.12E-04	P3	1.79E-02	1.79E-02	P3	0.00E+00	0.00E+00
												TSPDiesel	3.32E-05	3.32E-05						
												PM10_D	3.32E-05	3.32E-05						
												PM2.5_D	3.22E-05	3.22E-05						
												NOx	2.87E-03	2.87E-03						
												NO2	5.75E-04	5.75E-04						
												NO	1.50E-03	1.50E-03						
												SO2	5.52E-06	5.52E-06						
												CO	2.87E-03	2.87E-03						
												BaP	1.68E-10	1.68E-10						
												Benz(a)anthracene	1.95E-10	1.95E-10						
												Benzo(b+)+k)fluoranthene	2.69E-10	2.69E-10						
												Benzo(g,h,i)perylene	1.90E-10	1.90E-10						
												Chrysene	3.29E-10	3.29E-10						
												Dibenz(a,h)anthracene	2.39E-11	2.39E-11						
												Indenol(1,2,3-cd)pyrene	1.69E-10	1.69E-10						
												Naphthalene	1.82E-11	1.82E-11						
UPR2	Pit to Overburden Stockpile	UPR2	1.840	28	7	6	34	13	16	5.89	see model input files	TSP	3.81E-02	3.81E-02	P1	1.08E-03	1.08E-03	P1	7.84E-06	7.84E-06
												PM10	1.08E-02	1.08E-02	P2	9.74E-03	9.74E-03	P2	2.42E-07	2.42E-07
												PM2.5	1.08E-03	1.08E-03	P3	2.72E-02	2.72E-02	P3	0.00E+00	0.00E+00
												TSPDiesel	8.08E-06	8.08E-06						
												PM10_D	8.08E-06	8.08E-06						
												PM2.5_D	7.84E-06	7.84E-06						
												NOx	7.00E-04	7.00E-04						
												NO2	1.40E-04	1.40E-04						
												NO	3.65E-04	3.65E-04						
												SO2	1.34E-06	1.34E-06						
												CO	7.00E-04	7.00E-04						
												BaP	4.08E-11	4.08E-11						
												Benz(a)anthracene	4.75E-11	4.75E-11						
												Benzo(b+)+k)fluoranthene	6.55E-11	6.55E-11						
												Benzo(g,h,i)perylene	4.62E-11	4.62E-11						
												Chrysene	8.01E-11	8.01E-11						
												Dibenz(a,h)anthracene	5.82E-12	5.82E-12						
												Indenol(1,2,3-cd)pyrene	4.11E-11	4.11E-11						
												Naphthalene	4.42E-12	4.42E-12						
UPR3	Access Road	UPR3	14.158	12	3.2	2.72	18	5.44	8.37	2.53	see model input files	TSP	9.28E-04	9.28E-04	P1	2.63E-05	2.63E-05			
												PM10	2.64E-04	2.64E-04	P2	2.38E-04	2.38E-04			
												PM2.5	2.63E-05	2.63E-05	P3	6.64E-04	6.64E-04			
UPR4	TMF Inspection Road	UPR4	11.478	12	2	1.70	18	3.40	8.37	1.58	see model input files	TSP	7.34E-06	7.34E-06	P1	2.11E-07	2.11E-07			
												PM10	2.28E-06	2.28E-06	P2	2.07E-06	2.07E-06			
												PM2.5	2.11E-07	2.11E-07	P3	5.06E-06	5.06E-06			
UPR5	Site Road	UPR5 General Site_TP	4.240	12	2	1.70	18	3.40	8.37	1.58	see model input files	TSP	7.23E-04	7.23E-04	P1	2.06E-05	2.06E-05	P1	5.77E-06	5.77E-06
												PM10	2.06E-04	2.06E-04	P2	1.85E-04	1.85E-04	P2	1.78E-07	1.78E-07
												PM2.5	2.06E-05	2.06E-05	P3	5.17E-04	5.17E-04	P3	0.00E+00	0.00E+00
												NOx	3.01E-04	3.01E-04						
												NO2	6.03E-05	6.03E-05						
												NO	1.57E-04	1.57E-04						
												SO2	8.64E-07	8.64E-07						
												CO	4.50E-04	4.50E-04						
												TSPDiesel	5.95E-06	5.95E-06						
												PM10_D	5.95E-06	5.95E-06						
												PM2.5_D	5.77E-06	5.77E-06						
												BaP	1.71E-11	1.71E-11						
												Benz(a)anthracene	2.17E-11	2.17E-11						
												Benzo(b+)+k)fluoranthene	2.74E-11	2.74E-11						
												Benzo(g,h,i)perylene	1.93E-11	1.93E-11						
												Chrysene	3.40E-11	3.40E-11						
												Dibenz(a,h)anthracene	2.44E-12	2.44E-12						
												Indenol(1,2,3-cd)pyrene	1.72E-11	1.72E-11						
												Naphthalene	2.80E-12	2.80E-12						

Dispersion Modelling Table
Kami Iron Ore Mine Project

RAIL SOURCES

Modelling ID	Source Description	Source ID(s)	Rail Length [km]	Engine Width [m]	Engine Height [m]	Release Height Above Grade [m]			Initial Lateral Dimension of Volume [m]	Initial Vertical Dimension of Volume [m]	X, Y Coordinates [m]	Contaminant	24 hr Emission Rate [g/s/m]	Annual Emission Rate [g/s/m]	CALPUFF Particle Numbering			CALPUFF Particle Numbering TSP Diesel		
															Particle #	1 and 24 hr Emission Rate [g/s/m]	Annual Emission Rate [g/s/m]	Particle #	1 and 24 hr Emission Rate [g/s]	Annual Emission Rate [g/s]
RAIL	Rail Line	SMT	25.698	3.11	4.8768	4.8768	—	—	1.45	4.88	see model input files	TSPDiesel	4.37E-07	4.01E-07				P1	4.24E-07	3.89E-07
												PM10_D	4.37E-07	4.01E-07				P2	1.31E-08	1.20E-08
												PM2.5_D	4.24E-07	3.89E-07				P3	0.00E+00	0.00E+00
												NOx	2.20E-05	2.02E-05						
												NO2	4.41E-06	4.04E-06						
												NO	1.15E-05	1.06E-05						
												SO2	1.39E-08	1.27E-08						
												CO	4.84E-06	4.44E-06						
												BAP	9.88E-13	9.07E-13						
												Benz(a)anthracene	2.39E-12	2.19E-12						
												Benzo(b+)+k)fluoranthene	4.27E-12	3.92E-12						
												Benzo(g,h,i)perylene	2.14E-12	1.96E-12						
												Chrysene	5.88E-12	5.40E-12						
												Dibenz(a,h)anthracene	1.33E-12	1.22E-12						
												Indenol(1,2,3-cd)pyrene	1.59E-12	1.46E-12						
												Naphthalene	5.00E-10	4.59E-10						

APPENDIX B

Location of Sensitive Receptors

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
603	Land Use	632162	5845850
1212	Land Use	631662	5848350
1831	Land Use	631162	5855850
4450	Previous receptor from Alderon study	635960	5857470
4451	Previous receptor from Alderon study	641590	5856650
4452	Residence	643605	5861877
4453	Residence	639817	5866611
4454	Residence	629503	5851281
4455	School	643660	5863076
4456	School	640302	5867360
4457	School/Hospital	628698	5851349
4458	Hospital	638645	5868618
4459	Land Use	641084	5860082
4460	Land Use	640822	5853090
4461	Land Use	644385	5853040
4462	Land Use	634182	5862441
4463	Land Use	633008	5862216
4464	Land Use	638099	5858558
4465	Land Use	637075	5847769
4466	Land Use	640649	5848093
4467	Land Use	643498	5844896
4468	Land Use	642596	5841626
4469	Land Use	636075	5858013
4470	Cabin	634534	5855508
4471	Cabin	634622	5855519
4472	Cabin	634650	5855395
4473	Cabin	633180	5850615
4474	Cabin	634768	5851652
4475	Cabin	635153	5851045
4476	Cabin	634691	5853207
4477	Cabin	635565	5850010
4478	Cabin	635730	5849660
4479	Cabin	636064	5849777
4480	Cabin	636577	5858531
4481	Cabin	636140	5858010
4482	Cabin	636150	5857870
4483	Cabin	636111	5857722
4484	Cabin	636065	5857541
4485	Cabin	636018	5857320
4486	Cabin	636115	5857198

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4487	Cabin	636071	5857082
4488	Cabin	636105	5856822
4489	Cabin	636098	5856774
4490	Cabin	636324	5856546
4491	Cabin	636330	5856310
4492	Cabin	636907	5856912
4493	Cabin	637535	5856849
4494	Cabin	637468	5857501
4495	Cabin	637586	5857769
4496	Cabin	637560	5858030
4497	Cabin	637559	5858097
4498	Cabin	637382	5858386
4499	Cabin	636439	5858885
4500	Cabin	636532	5858957
4501	Cabin	636641	5859177
4502	Cabin	636587	5859379
4503	Cabin	636606	5859082
4504	Cabin	636333	5859399
4505	Cabin	636210	5859591
4506	Cabin	637527	5858533
4507	Cabin	638152	5859197
4508	Cabin	638188	5859443
4509	Cabin	638031	5859903
4510	Cabin	638118	5860164
4511	Cabin	638095	5860244
4512	Cabin	635722	5860584
4513	Cabin	635612	5860422
4514	Cabin	635465	5860365
4515	Cabin	635190	5860555
4516	Cabin	635188	5860635
4517	Cabin	635168	5860784
4518	Cabin	635180	5860827
4519	Cabin	635148	5860858
4520	Cabin	637494	5854699
4521	Cabin	637585	5853997
4522	Cabin	640778	5857817
4523	Cabin	640792	5857909
4524	Cabin	641137	5857912
4525	Cabin	641364	5857724
4526	Cabin	641817	5857027

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4527	Cabin	641845	5856814
4528	Cabin	641912	5857277
4529	Cabin	641840	5857280
4530	Cabin	641870	5857362
4531	Cabin	641637	5857344
4532	Cabin	641560	5857425
4533	Cabin	641454	5857454
4534	Cabin	641550	5857525
4535	Cabin	641466	5857605
4536	Cabin	643367	5857532
4537	Cabin	641285	5858131
4538	Cabin	641270	5858280
4539	Cabin	645508	5854969
4540	Cabin	645337	5854863
4541	Cabin	645280	5854855
4542	Cabin	644937	5855135
4543	Cabin	644879	5855382
4544	Cabin	644973	5855439
4545	Cabin	645128	5855810
4546	Cabin	645033	5855930
4547	Cabin	645036	5856102
4548	Cabin	645180	5855879
4549	Cabin	645330	5855813
4550	Cabin	645506	5855705
4551	Cabin	645632	5855644
4552	Cabin	645590	5855518
4553	Cabin	645598	5855459
4554	Cabin	645662	5855285
4555	Cabin	645835	5855153
4556	Cabin	645976	5855021
4557	Cabin	646064	5854762
4558	Cabin	645907	5854389
4559	Cabin	645885	5854241
4560	Cabin	645737	5853966
4561	Cabin	646109	5853232
4562	Cabin	646092	5852876
4563	Cabin	646044	5852659
4564	Cabin	646428	5852634
4565	Cabin	646459	5852650
4566	Cabin	647491	5856467

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4567	Cabin	647943	5857120
4568	Cabin	650541	5853615
4569	Cabin	649585	5855075
4570	Cabin	649478	5856415
4571	Cabin	647046	5860524
4572	Cabin	649298	5858933
4573	Cabin	649221	5858590
4574	Cabin	655939	5864862
4575	Cabin	653216	5864965
4576	Cabin	650592	5866521
4577	Cabin	654383	5868123
4578	Cabin	652330	5866689
4579	Cabin	652553	5866833
4580	Cabin	651537	5866940
4581	Cabin	651680	5866972
4582	Cabin	652221	5867025
4583	Cabin	652077	5867051
4584	Cabin	651961	5867112
4585	Cabin	651905	5867244
4586	Cabin	651748	5867032
4587	Cabin	651696	5867089
4588	Cabin	651770	5867105
4589	Cabin	651729	5867176
4590	Cabin	651644	5867146
4591	Cabin	651661	5867206
4592	Cabin	651724	5867265
4593	Cabin	651643	5867292
4594	Cabin	651530	5867284
4595	Cabin	651454	5867325
4596	Cabin	651429	5867372
4597	Cabin	651534	5867399
4598	Cabin	651493	5867515
4599	Cabin	651408	5867478
4600	Cabin	651364	5867523
4601	Cabin	651278	5867741
4602	Cabin	651350	5867872
4603	Cabin	644982	5868163
4604	Cabin	645736	5872547
4605	Cabin	647298	5871616
4606	Cabin	647380	5872093

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4607	Cabin	647567	5872814
4608	Cabin	648994	5873410
4609	Cabin	648810	5872842
4610	Cabin	649250	5872924
4611	Cabin	649691	5872830
4612	Cabin	649454	5872485
4613	Cabin	648506	5871448
4614	Cabin	648477	5871383
4615	Cabin	648480	5871299
4616	Cabin	649256	5871272
4617	Cabin	649219	5871153
4618	Cabin	649040	5870830
4619	Cabin	648373	5871124
4620	Cabin	648315	5870871
4621	Cabin	647828	5870049
4622	Cabin	647878	5869444
4623	Cabin	648314	5870737
4624	Cabin	648272	5870692
4625	Cabin	648269	5870647
4626	Cabin	648258	5870593
4627	Cabin	648264	5870553
4628	Cabin	648270	5870506
4629	Cabin	648272	5870457
4630	Cabin	648265	5870408
4631	Cabin	648284	5870335
4632	Cabin	648252	5870308
4633	Cabin	649181	5870379
4634	Cabin	648970	5869837
4635	Cabin	648958	5869792
4636	Cabin	648936	5869727
4637	Cabin	648920	5869645
4638	Cabin	648852	5870348
4639	Cabin	648843	5870252
4640	Cabin	648898	5870384
4641	Cabin	648951	5870402
4642	Cabin	649025	5870558
4643	Cabin	648631	5869827
4644	Cabin	648642	5869878
4645	Cabin	648651	5869929
4646	Cabin	648642	5870001

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4647	Cabin	648638	5870052
4648	Cabin	648632	5870101
4649	Cabin	648640	5870159
4650	Cabin	648630	5870277
4651	Cabin	648618	5870215
4652	Cabin	648594	5870174
4653	Cabin	648572	5870134
4654	Cabin	648562	5870092
4655	Cabin	648563	5870003
4656	Cabin	648562	5869932
4657	Cabin	648542	5869870
4658	Cabin	648509	5869939
4659	Cabin	648495	5869805
4660	Cabin	648497	5869710
4661	Cabin	648450	5869787
4662	Cabin	648394	5869828
4663	Cabin	648333	5869844
4664	Cabin	648183	5869654
4665	Cabin	648163	5869722
4666	Cabin	648128	5869767
4667	Cabin	648100	5869844
4668	Cabin	648110	5869905
4669	Cabin	648153	5869931
4670	Cabin	648059	5869943
4671	Cabin	648034	5869997
4672	Cabin	648094	5869999
4673	Cabin	648089	5870034
4674	Cabin	648087	5870094
4675	Cabin	648099	5870137
4676	Cabin	648165	5870012
4677	Cabin	648175	5870058
4678	Cabin	648198	5870102
4679	Cabin	648206	5870039
4680	Cabin	648201	5869958
4681	Cabin	648259	5870043
4682	Cabin	648249	5869959
4683	Cabin	648277	5869976
4684	Cabin	648280	5869924
4685	Cabin	651945	5870270
4686	Cabin	651677	5870154

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4687	Cabin	651358	5870320
4688	Cabin	651367	5870392
4689	Cabin	651356	5870439
4690	Cabin	651157	5870970
4691	Cabin	651172	5870888
4692	Cabin	651287	5870886
4693	Cabin	651278	5870756
4694	Cabin	651334	5870666
4695	Cabin	651541	5870880
4696	Cabin	651555	5870970
4697	Cabin	651664	5872078
4698	Cabin	651168	5872216
4699	Cabin	651309	5872615
4700	Cabin	651406	5872686
4701	Cabin	651702	5872787
4702	Cabin	652123	5872653
4703	Cabin	652137	5872385
4704	Cabin	651902	5872256
4705	Cabin	652139	5871371
4706	Cabin	652202	5871433
4707	Cabin	652479	5871780
4708	Cabin	652688	5871967
4709	Cabin	653634	5871447
4710	Cabin	654237	5871709
4711	Cabin	654126	5871774
4712	Cabin	654058	5871822
4713	Cabin	653897	5872230
4714	Cabin	653958	5872375
4715	Cabin	653813	5872763
4716	Cabin	654316	5873211
4717	Cabin	654464	5873390
4718	Cabin	654568	5873147
4719	Cabin	654435	5873112
4720	Cabin	654502	5873072
4721	Cabin	654560	5873036
4722	Cabin	654417	5873017
4723	Cabin	654533	5872975
4724	Cabin	654475	5872843
4725	Cabin	654527	5872823
4726	Cabin	654585	5872884

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4727	Cabin	654712	5872759
4728	Cabin	654603	5872652
4729	Cabin	654615	5872494
4730	Cabin	654701	5872346
4731	Cabin	654827	5872301
4732	Cabin	654883	5872207
4733	Cabin	654891	5872150
4734	Cabin	654759	5872177
4735	Cabin	654788	5872127
4736	Cabin	655144	5871117
4737	Cabin	648102	5875979
4738	Cabin	651945	5874720
4739	Cabin	652653	5874099
4740	Cabin	653035	5874384
4741	Cabin	653048	5874439
4742	Cabin	653058	5874488
4743	Cabin	653088	5874540
4744	Cabin	653119	5874586
4745	Cabin	653053	5874684
4746	Cabin	653419	5874770
4747	Cabin	653624	5874866
4748	Cabin	653740	5875312
4749	Cabin	653331	5875587
4750	Cabin	653431	5876073
4751	Cabin	652687	5876590
4752	Cabin	653006	5877663
4753	Cabin	652913	5878002
4754	Cabin	654087	5876771
4755	Cabin	654390	5876812
4756	Cabin	654516	5876861
4757	Cabin	654613	5877129
4758	Cabin	654712	5877344
4759	Cabin	655194	5877509
4760	Cabin	655948	5877716
4761	Cabin	655845	5877808
4762	Cabin	655662	5878267
4763	Cabin	655612	5878362
4764	Cabin	655714	5878551
4765	Cabin	655750	5879081
4766	Cabin	655705	5879176

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4767	Cabin	655698	5879229
4768	Cabin	655692	5879276
4769	Cabin	655687	5879312
4770	Cabin	655663	5879335
4771	Cabin	655586	5879389
4772	Cabin	655568	5879450
4773	Cabin	655536	5879531
4774	Cabin	655510	5879565
4775	Cabin	655522	5879635
4776	Cabin	655470	5879666
4777	Cabin	655759	5879805
4778	Cabin	655849	5879886
4779	Cabin	655904	5879873
4780	Cabin	655920	5879832
4781	Cabin	655937	5879787
4782	Cabin	655959	5879742
4783	Cabin	655981	5879336
4784	Cabin	656134	5879093
4785	Cabin	656122	5879036
4786	Cabin	656200	5878849
4787	Cabin	656222	5878810
4788	Cabin	656264	5878773
4789	Cabin	656283	5878749
4790	Cabin	656569	5878718
4791	Cabin	656610	5878723
4792	Cabin	656672	5878657
4793	Cabin	656727	5878686
4794	Cabin	657116	5878637
4795	Cabin	657218	5878746
4796	Cabin	656827	5878816
4797	Cabin	656811	5878856
4798	Cabin	656761	5878871
4799	Cabin	656749	5878923
4800	Cabin	656727	5878962
4801	Cabin	656706	5879002
4802	Cabin	656675	5879035
4803	Cabin	656652	5879085
4804	Cabin	656636	5879131
4805	Cabin	656387	5879799
4806	Cabin	656370	5879850

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4807	Cabin	656353	5879895
4816	Cabin	653229	5878711
4817	Cabin	659194	5877695
4818	Cabin	659742	5879641
4819	Cabin	659782	5879683
4820	Cabin	659872	5879695
4821	Cabin	660349	5879906
4822	Cabin	660518	5879947
4823	Cabin	661421	5879718
4824	Cabin	661493	5879728
4829	Cabin	646105	5852101
4830	Cabin	647139	5852170
4831	Cabin	643788	5855911
4832	Cabin	641867	5855099
4833	Cabin	642951	5852301
4834	Cabin	640185	5848135
4835	Cabin	643735	5844087
4836	Cabin	643567	5839358
4837	Cabin	634702	5859483
4838	Cabin	634666	5859994
4839	Cabin	634659	5860950
4840	Cabin	632662	5861640
4841	Cabin	632659	5861856
4842	Cabin	633647	5862663
4843	Cabin	634888	5860864
4844	Cabin	634890	5860887
4845	Cabin	635091	5860936
4846	Cabin	635065	5860944
4847	Cabin	635052	5860975
4848	Cabin	634970	5860935
4849	Cabin	635023	5861008
4850	Cabin	634957	5861080
4851	Cabin	634815	5861127
4852	Cabin	635036	5861316
4853	Cabin	635162	5861325
4854	Cabin	634845	5861353
4855	Cabin	634799	5861381
4856	Cabin	634807	5861446
4857	Cabin	634799	5861486
4858	Cabin	634775	5861536

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4859	Cabin	634754	5861592
4860	Cabin	634742	5861621
4861	Cabin	634700	5861717
4862	Cabin	634648	5861759
4863	Cabin	634612	5861829
4864	Cabin	634602	5861866
4865	Cabin	634794	5861747
4866	Cabin	634894	5861777
4867	Cabin	634797	5861656
4868	Cabin	634842	5861618
4869	Cabin	634856	5861562
4870	Cabin	634874	5861521
4871	Cabin	634872	5861484
4872	Cabin	634889	5861407
4873	Cabin	634927	5861378
4874	Cabin	634931	5861325
4875	Cabin	635001	5861306
4876	Cabin	635178	5861388
4877	Cabin	635129	5861414
4878	Cabin	635078	5861447
4879	Cabin	635041	5861481
4880	Cabin	635007	5861512
4881	Cabin	634975	5861552
4882	Cabin	634966	5861604
4883	Cabin	634965	5861650
4884	Cabin	634933	5861729
4885	Cabin	634720	5861903
4886	Cabin	634674	5861939
4887	Cabin	634633	5861947
4888	Cabin	631918	5864060
4889	Cabin	631635	5864244
4890	Cabin	631596	5864309
4891	Cabin	631426	5864364
4892	Cabin	631376	5864401
4893	Cabin	631353	5864438
4894	Cabin	631356	5864521
4895	Cabin	631202	5864477
4896	Cabin	631123	5864530
4897	Cabin	631228	5864629
4898	Cabin	630947	5864637

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4899	Cabin	630884	5864669
4900	Cabin	630852	5864739
4901	Cabin	630795	5864782
4902	Cabin	630714	5864850
4903	Cabin	630606	5864912
4904	Cabin	630537	5864985
4905	Cabin	630525	5865055
4906	Cabin	630640	5865177
4907	Cabin	630567	5865762
4908	Cabin	631282	5865426
4909	Cabin	632004	5865577
4910	Cabin	632080	5865528
4911	Cabin	632587	5865628
4912	Cabin	632732	5866318
4913	Cabin	632922	5866041
4914	Cabin	632958	5866076
4915	Cabin	633002	5866061
4916	Cabin	633121	5866205
4917	Cabin	633171	5866177
4918	Cabin	633224	5866191
4919	Cabin	633281	5866124
4920	Cabin	633337	5866100
4921	Cabin	633366	5866082
4922	Cabin	633424	5866069
4923	Cabin	633441	5866043
4924	Cabin	633416	5866143
4925	Cabin	633382	5866155
4926	Cabin	633337	5866176
4927	Cabin	633263	5866222
4928	Cabin	633042	5864004
4929	Cabin	635709	5867705
4930	Cabin	625388	5863092
4931	Cabin	625920	5861156
4932	Cabin	625442	5861111
4933	Cabin	625549	5860832
4934	Cabin	625534	5860894
4935	Cabin	625503	5860934
4936	Cabin	625491	5860984
4937	Cabin	625463	5861044
4938	Cabin	627494	5859339

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4939	Cabin	627568	5859552
4940	Cabin	627722	5859592
4941	Cabin	627868	5860070
4942	Cabin	627927	5860110
4943	Cabin	627972	5860154
4944	Cabin	628037	5860189
4945	Cabin	624767	5861052
4946	Cabin	636109	5858268
4947	Cabin	636117	5858111
4948	Cabin	636305	5857910
4949	Cabin	623261	5854416
4950	Cabin	622652	5855437
4951	Cabin	622708	5855456
4952	Cabin	624826	5857667
4953	Cabin	634870	5861276
4954	Cabin	636371	5856493
4955	Cabin	636578	5855888
4956	Cabin	638207	5859661
4957	Cabin	640974	5858284
4958	Cabin	641865	5856903
4959	Cabin	636813	5855952
4960	Cabin	636896	5855892
4961	Cabin	636974	5855802
4962	Cabin	637481	5854721
4963	Cabin	635118	5851124
4964	Cabin	635057	5848930
4965	Cabin	634306	5848285
4966	Cabin	633397	5852627
4967	Cabin	646196	5852986
4968	Cabin	634710	5855758
4969	Cabin (Québec)	625475	5857021
4970	Cabin (Québec)	626098	5856799
4971	Cabin (Québec)	627564	5858038
4972	Cabin (Québec)	629357	5857726
4973	Cabin (Québec)	630419	5858921
4974	Cabin (Québec)	630862	5856082
4975	Cabin (Québec)	626642	5855575
4976	Cabin (Québec)	630232	5858749
4977	Cabin (Québec)	623764	5852692
4978	Cabin (Québec)	623459	5850432

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
4979	Cabin (Québec)	623460	5849999
4980	Cabin (Québec)	624604	5850547
4981	Cabin (Québec)	624617	5847632
4982	Cabin (Québec)	624830	5847970
4983	Cabin (Québec)	625323	5848229
4984	Cabin (Québec)	625741	5848074
4985	Cabin (Québec)	625759	5847941
4986	Cabin (Québec)	625815	5847803
4987	Cabin (Québec)	626223	5849126
4988	Cabin (Québec)	625431	5849151
4989	Cabin (Québec)	626474	5847197
4990	Cabin (Québec)	626396	5845965
4991	Cabin (Québec)	626683	5845314
4992	Cabin (Québec)	626999	5845576
4993	Cabin (Québec)	627003	5846178
4994	Cabin (Québec)	626961	5846463
4995	Cabin (Québec)	627273	5846354
4996	Cabin (Québec)	627718	5845172
4997	Cabin (Québec)	628038	5844372
4998	Cabin (Québec)	628284	5848046
4999	Cabin (Québec)	628253	5848298
5000	Cabin (Québec)	628223	5848529
5001	Cabin (Québec)	628578	5846400
5002	Cabin (Québec)	629041	5844898
5003	Cabin (Québec)	629002	5847705
5004	Cabin (Québec)	628885	5847933
5005	Cabin (Québec)	629224	5847999
5006	Cabin (Québec)	629015	5847202
5007	Cabin (Québec)	629458	5847745
5008	Cabin (Québec)	629868	5847536
5009	Cabin (Québec)	629643	5846371
5010	Cabin (Québec)	631620	5848434
5011	Cabin (Québec)	631326	5847777
5012	Cabin (Québec)	631880	5848045
5013	Cabin (Québec)	631823	5847529
5014	Cabin (Québec)	631882	5847344
5015	Cabin (Québec)	632025	5846765
5016	Cabin (Québec)	630856	5847059
5017	Cabin (Québec)	630937	5846639
5018	Cabin (Québec)	631031	5846240

Table B-1: Discrete Sensitive Receptor Locations

Receptor ID	Description	Easting	Northing
5019	Cabin (Québec)	631246	5846056
5020	Cabin (Québec)	631149	5846103
5021	Cabin (Québec)	630186	5845857
5022	Cabin (Québec)	630521	5844826
5023	Cabin (Québec)	630500	5845040
5024	Cabin (Québec)	631014	5845317
5025	Cabin (Québec)	631354	5845361
5026	Cabin (Québec)	632084	5844943
5027	Cabin (Québec)	632227	5845440
5028	Cabin (Québec)	631938	5845808
5029	Cabin (Québec)	631611	5845632
5030	Cabin (Québec)	631655	5845663
5031	Cabin (Québec)	628692	5842474
5032	Cabin (Québec)	628547	5842770
5033	Cabin (Québec)	628397	5843140
5034	Cabin (Québec)	627634	5843239
5035	Cabin (Québec)	628194	5841853

wsp.com

Appendix 5B: Air Quality Release Estimates – Operations Phase

REPORT

Air Quality Release Estimates

Operation Phase

Submitted to:

Champion Kami Partner Inc.

Submitted by:

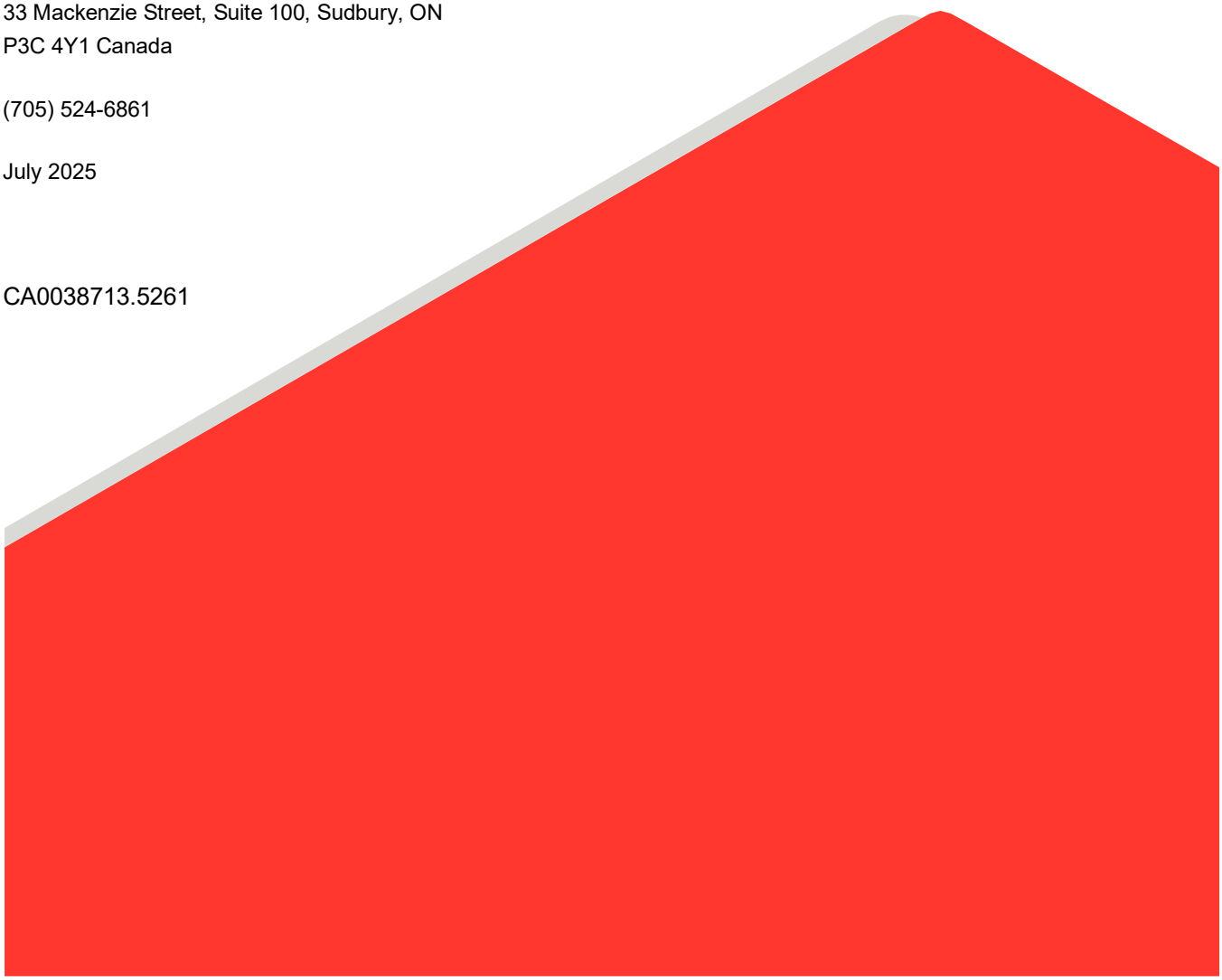
WSP Canada Inc.

33 Mackenzie Street, Suite 100, Sudbury, ON
P3C 4Y1 Canada

(705) 524-6861

July 2025

CA0038713.5261



Distribution List

Champion Kami Partner Inc.

Acronyms

Summary of Units

Acronym	Description
bhp	brake horsepower
g	gram
gal	gallon
hp	horsepower
hr	hour
kg	kilogram
kW	kilowatt
L	litre
m	metre
mg	milligram
Mg	metric tonne
s	second
tpd	tonnes per day
VKT	vehicle kilometre travelled

Summary of Acronyms

Acronym	Description
CO	carbon monoxide
COC	contaminant of concern
DPM	diesel particulate matter
EF	emission factor
ER	emission rate
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
PAH	polycyclic aromatic hydrocarbon
PM_{10}	particulate matter (less than 10 microns)
$PM_{2.5}$	particulate matter (less than 2.5 microns)
SO_2	sulphur dioxide
TSP	total suspended particulate matter

Table of Contents

1.0 INTRODUCTION 1

2.0 ASSESSMENT OF COMPOUNDS AND ACTIVITIES 3

2.1 Emission Source Summary 3

2.2 Compounds and Activities Excluded from the Assessment 5

3.0 EMISSION RATE CALCULATIONS AND ASSUMPTIONS 6

3.1 Open Pit Extraction 6

3.1.1 Blasting (Fugitive Dust) 6

3.1.2 Blasting (Combustion Gases) 7

3.1.3 Ore Material Handling (Bulldozing) 8

3.1.4 Material Handling (Ore Drop into Haul Trucks) 9

3.1.5 Waste Rock Material Handling (Bulldozing) 10

3.1.6 In Pit Crushing (Waste Rock) 10

3.1.7 In Pit Conveyor Loading (Waste Rock) 10

3.1.8 Overburden Material Handling 11

3.2 Surface Material Handling 11

3.2.1 Ore Drop to Stockpiles 11

3.2.2 Primary Crushing (Ore) 12

3.2.3 Conveyor to Crushed Ore Stockpile 13

3.2.4 Conveyor Transfer Towers (Ore, Waste Rock and Concentrate) 14

3.2.5 Overland Conveyor Drop at Geodesic Dome 15

3.2.6 Apron Feeder Under Geodesic Dome 15

3.2.7 Concentrate Drop at Emergency Storage Stockpile and Reclaim System 16

3.2.8 Reclaim Conveyor Transfer Point 16

3.2.9 Silo Feed and Train Loadout Building Dust Collector 17

3.2.10 Rail Car Loading 17
3.2.11 Waste Rock Drops at Stockpile 17
3.2.12 Overburden Drop to Stockpile....18
3.3 Wind Erosion....19
3.4 On-site Roadway and Vehicle Emissions....20
3.4.1 Fugitive Dust from Ore and Mine Rock Hauling....20
3.4.2 Fugitive Dust from Pit Maintenance (Grading)....22
3.4.3 Mobile Equipment Exhaust....23
3.5 Rail Cars....23
3.6 Emergency Power Generators....25
4.0 EMISSION CONTROL FACTORS 26
5.0 EMISSION RATES SUMMARY 27
6.0 REFERENCES 33

TABLES

Table 2-1: Emission Source Summary Table for the Operation Phase of the Project....3
Table 2-2: Emissions Excluded from the Site-Wide Emissions Inventory for the Project....5
Table 3-1: Open Pit Extraction Emission Calculation Parameters 6
Table 3-2: Open Pit Blasting Emission Calculation Parameters 7
Table 3-3 In Pit Bulldozing Parameters 8
Table 3-4: Ore Material Handling Parameters....9
Table 3-5: Waste Rock Crushing Calculation Parameters....10
Table 3-6: Overburden Material Handling Calculation Parameters....11
Table 3-7: Primary Crushing Calculation Parameters 12
Table 3-8: Conveyor Transfer Calculation Parameters 13
Table 3-9: Calculation Parameters for Transfer Towers....14
Table 3-10: Apron Feeder Dust Collector Calculation Parameters 15
Table 3-11: Concentrate Material Handling Calculation Parameters 16
Table 3-12: Calculation Parameters for Concentrate Conveyor Transfer Point....16
Table 3-13: Calculation Parameters for Concentrate Storage 17
Table 3-14: Calculation Parameters for Rail Car Loading 17

Table 3-15: Overburden Material Handling Parameters 18
Table 3-16: Calculation Parameters for Wind Erosion.....19
Table 3-17: Unpaved Road Emission Factor Calculation Parameters 21
Table 3-18: Calculation Parameters for Grading Unpaved Roads 22
Table 3-19: Calculation Parameters for Rail Car Emissions 24
Table 3-20: Emergency Generator Power Rating 25
Table 4-1: Emission Control Factors for the Operation Phase of the Project. 26
Table 5-1: Project Emission Summary.....28

FIGURES

Figure 1-1: Project Location and Site Layout 2

APPENDICES

APPENDIX A
Emission Rate Estimates for the Operation Phase of the Project

1.0 INTRODUCTION

The Kamistiatusset (Kami) Iron Ore Mine Project (the Project) is a proposed iron ore mine in Newfoundland and Labrador. The Project site is located entirely in Labrador, approximately 7 km from the Town of Wabush, 10 km from the Town of Labrador City, and 5 km east of Ville de Fermont, Québec (Figure 1-1).

The Project was originally proposed by the Alderon Iron Ore Corporation (Alderon) and underwent a provincial and federal Environmental Impact Assessment from 2011 to 2013, including a comprehensive baseline program that was completed in 2011 and 2012. The Project was released from the provincial and federal Environmental Assessment (EA) process in 2014. In 2021, Champion Iron Limited (Champion), through its subsidiary, 12364042 Canada Inc., completed the acquisition of the Project from Alderon.

Champion is proposing several changes to the Project design proposed by Alderon through the previous Environmental Impact Statement (EIS). These proposed changes include optimizations to the Project's water management strategy and modernization of the proposed ore handling, conveyance, and processing. Champion's objective for the Project is to produce high-purity (over 69%) iron concentrate, which can be used as direct reduction pellet feed for electric arc furnaces in the green steel supply chain.

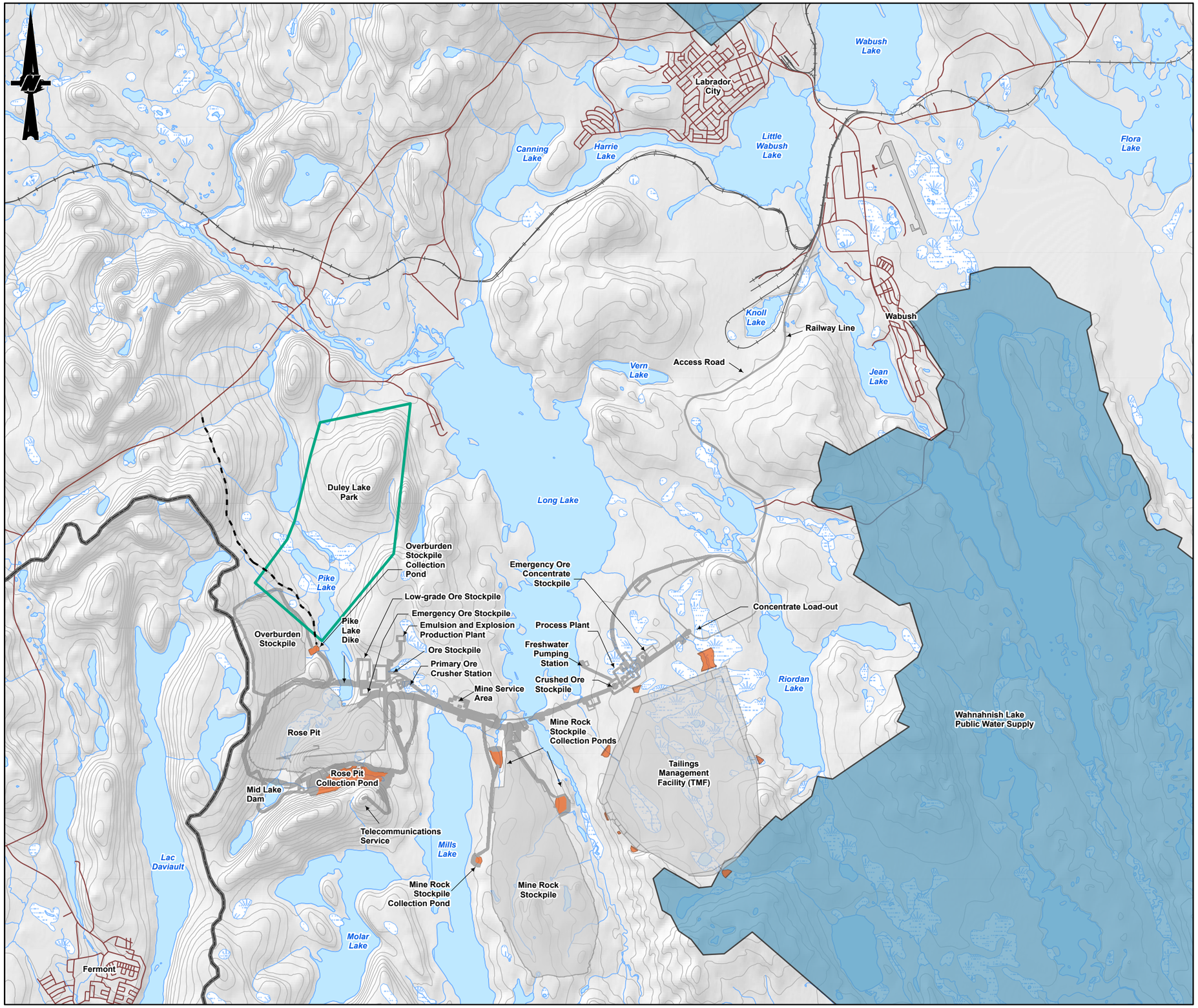
Champion submitted a Project Registration document to the Newfoundland and Labrador Environmental Assessment Division of the Department of Environment and Climate Change in April 2024 to restart the EA process for the Project. On June 13, 2024, the Minister issued a Decision Letter to Champion concluding that an EIS would be required for the Project. To support the EIS process, Champion has commissioned the services of WSP Canada Inc. (WSP) to complete air quality dispersion modelling for the Project.

The Air Quality Release Estimates report was prepared as part of the EIS for the Project, through Champion's subsidiary 12364042 Canada Inc. The report summarizes the methods, input parameters, and assumptions that were used to estimate emission rates for the operation phase of the Project.

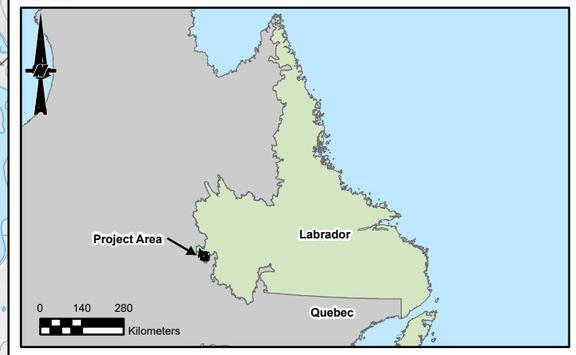
The following sources of air emission associated with the Project were identified:

- Open pit mining emissions including drilling and blasting;
- Fugitive dust emissions from material handling activities in the pit and on surface;
- Emissions from dust collectors from ore crushing processes, material transfer points and concentrate storage;
- Fugitive emissions from concentrate loadout;
- Fugitive dust emissions from wind erosion at waste rock and overburden stockpiles and the tailings area;
- Fugitive dust from unpaved road segments and grading;
- Diesel exhaust from heavy mobile equipment;
- Diesel exhaust from the locomotives; and
- Diesel exhaust for periodic generator testing.

The emission rates were used as inputs for dispersion modelling which provided estimates of maximum ground-level concentrations resulting from the Project. Emissions were calculated based on a worst-case material extraction and material handling scenario to document a conservative operating scenario for the Project.



KEY MAP



SCALE 1:20,000,000

Legend

PROJECT DATA

- Proposed Project Infrastructure
- Proposed Sediment Pond
- Potential Access Road

BASEMAP INFORMATION

- Road
- Railway
- Watercourse
- Contour
- Duley Lake Park
- Bog/Wetland
- Waterbody
- Labrador/Quebec Boundary
- Public Water Supply

0 1,000 2,000 4,000

1:71,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS:
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PROJECT LOCATION AND SITE LAYOUT

CONSULTANT

wsp

YYYY-MM-DD	2025-02-27
DESIGNED	----
PREPARED	GM
REVIEWED	AF
APPROVED	--

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0001	B	1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0002_General\CA0038713_5261_0002_V.X.aprx PRINTED ON: AT: 1:57:20 PM

The modelling methods are described in the Air Quality Dispersion Modelling Report provided in Appendix 5A. The emission estimation methods described herein follow generally accepted practices for similar mining operations.

The results of the air quality dispersion modelling assessment are presented Chapter 5 of the EIS (Champion 2025) and Appendix 5A (WSP 2025).

2.0 ASSESSMENT OF COMPOUNDS AND ACTIVITIES

The air quality effects assessment focused on the Contaminants of Concern (COC) which include total particulate matter (TSP), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), and metals including arsenic, cadmium, copper, lead, mercury, nickel, vanadium, and zinc. TSP was speciated using rock assays for the Project to estimate the concentrations of metals. These COCs have ambient air quality standards in Table 1 of Schedule A of the Government of Newfoundland and Labrador *Air Pollution Control Regulations, 2022* (O.C. 2022-027) (Government of Newfoundland and Labrador, 2022). The emissions inventory estimates the releases of calculate nitrogen oxides (NOx). Although most NOx emissions are in the form of NO, these rapidly oxide in the presence of ozone to form NO_2. Prior to inputting the release estimates into the air quality dispersion model, the in-stack ratio of NO_2 to NOx was used to estimate NO_2 releases as described in Section 5.7 of Appendix 5A. Other contaminants included in the air quality emissions inventory are additional metals and polyaromatic hydrocarbons (PAH), as they were required for the human health risk assessment.

Emission rates were calculated using activity and equipment specifications from the prefeasibility study and additional information available at the current design stage of the Project. A number of assumptions were required to complete the emission estimates, and these assumptions are documented in Section 3.0 and the emission rate calculation sheets provided in Appendix A. Internationally accepted emission factors, most notably emission factors published in the United States Environmental Protection Agency AP-42: Compilation of Air Pollutant Emissions Factors from Stationary Sources (AP-42) (U.S. EPA 1995) were used.

2.1 Emission Source Summary

The emission sources that were assessed for the operation phase of the Project and the expected contaminants emitted from each source are presented in Table 2-1.

Table 2-1: Emission Source Summary Table for the Operation Phase of the Project

Source ID for Emissions Inventory	Source Description	Expected Contaminants
IPO1A	Blasting (fugitive dust)	TSP, metals, PM_{10}, $PM_{2.5}$
IPO2	Blasting (combustion gases)	CO, NOx
IP03	In Pit Bulldozing (ore)	TSP, metals, PM_{10}, $PM_{2.5}$
IPO4	In-Pit Truck Loading (ore)	TSP, metals, PM_{10}, $PM_{2.5}$
OH2	Ore Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
IP05	In Pit Bulldozing (waste rock)	TSP, metals, PM_{10}, $PM_{2.5}$
IPO6	In Pit Crusher (waste rock)	TSP, metals, PM_{10}, $PM_{2.5}$
IPO7	Crushed waste rock drop to conveyor (in-pit)	TSP, metals, PM_{10}, $PM_{2.5}$
TT1	Conveyor Transfer Towers for Waste Rock	TSP, metals, PM_{10}, $PM_{2.5}$

Table 2-1: Emission Source Summary Table for the Operation Phase of the Project

Source ID for Emissions Inventory	Source Description	Expected Contaminants
TT2	Conveyor Transfer Tower 2 for Waste Rock	TSP, metals, PM_{10}, $PM_{2.5}$
WRH1	Crushed waste rock drop from last conveyor to Waste Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
WRH2	Crushed Waste Material Transfer to Spreader System	TSP, metals, PM_{10}, $PM_{2.5}$
WRH3	Crushed Waste Spreader System Drop to Pile	TSP, metals, PM_{10}, $PM_{2.5}$
IPO9	In-Pit Truck Loading (overburden)	TSP, PM_{10}, $PM_{2.5}$
OB1	Material Drop to Overburden Stockpile	TSP, PM_{10}, $PM_{2.5}$
PCDC	Primary Crushing (ore)	TSP, metals, PM_{10}, $PM_{2.5}$
AFDC	Apron Feeder	TSP, metals, PM_{10}, $PM_{2.5}$
SFDC	Silo Feed Dust Collector	TSP, metals, PM_{10}, $PM_{2.5}$
TLDC	Train Loadout Building Dust Collector	TSP, metals, PM_{10}, $PM_{2.5}$
OH3	Material Transfer Via Conveyor From Primary Crusher to Ore Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
TT3	Overland Conveyor Transfer Tower (ore)	TSP, metals, PM_{10}, $PM_{2.5}$
OH4	Overland Conveyor Drop Point at Dome	TSP, metals, PM_{10}, $PM_{2.5}$
TT4	Emergency Stockpile Transfer Tower	TSP, metals, PM_{10}, $PM_{2.5}$
CH2	Concentrate Drop to Emergency Storage Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
CH3	Emergency Storage Stockpile - Reclaim Hopper	TSP, metals, PM_{10}, $PM_{2.5}$
CH4	Emergency Storage Stockpile - Reclaim Hopper to Conveyor	TSP, metals, PM_{10}, $PM_{2.5}$
CH5	Reclaim Conveyor Transfer to Concentrate Conveyor	TSP, metals, PM_{10}, $PM_{2.5}$
TMF	Fugitive Dust from Tailings Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
WRSP	Fugitive Dust from Waste Rock Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
OBSP	Fugitive Dust from Overburden Stockpile	TSP, PM_{10}, $PM_{2.5}$
In Pit_TP	In Pit Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
Ore Stockpile_TP	Ore Stockpile Haulage Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
Waste Stockpile_TP	Waste Stockpile Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
Emergency Concentrate Stockpile_TP	Emergency Concentrate Stockpile Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
TMF_TP	Tailings Management Facility Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
General Site_TP	Site Road Tailpipe Emissions	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, PAH
INPIT	In Pit Road	TSP, metals, PM_{10}, $PM_{2.5}$

Table 2-1: Emission Source Summary Table for the Operation Phase of the Project

Source ID for Emissions Inventory	Source Description	Expected Contaminants
UPR1	Pit to Ore Stockpiles	TSP, metals, PM_{10}, $PM_{2.5}$
UPR2	Pit to Overburden Stockpile	TSP, metals, PM_{10}, $PM_{2.5}$
UPR3	Access Road	TSP, metals, PM_{10}, $PM_{2.5}$
UPR4	TMF Inspection Road	TSP, metals, PM_{10}, $PM_{2.5}$
UPR5	Site Road	TSP, metals, PM_{10}, $PM_{2.5}$
EPG1	Generator 1 - Mine Services Area	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO
EPG2	Generator 2 - Concentrator	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO
EPG3	Generator 3 - Concentrator	$TSP_{(diesel)}$, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO

2.2 Compounds and Activities Excluded from the Assessment

There may be general ventilation from some buildings related to the Project that discharge uncontaminated air from the workspaces or air from the workspaces that may include compounds that come from commercial office supplies, building maintenance products or supplies and activities. These types of ventilation sources are considered negligible and were not identified as sources for the Project. General ventilation located in the process area that does not vent process emissions is also considered to be negligible and are, therefore, not included in this analysis.

A number of sources were considered negligible in relation to the overall site-wide emissions from the Project. The rational for these exclusions is provided in Table 2-2.

Table 2-2: Emissions Excluded from the Site-Wide Emissions Inventory for the Project

Activity	Rationale for Excluding from the Assessment
In-pit drilling	The drill is equipped with a dust collector to control emissions. Drilling and blasting cannot occur simultaneously so the source with the higher emissions (blasting) was carried forward into the dispersion modelling.
Tailpipe exhaust from passenger vehicles	Tailpipe emission rates from passenger vehicles are small in comparison to the haul truck fleet and other heavy mobile equipment. In addition, the passenger vehicles do not operate continuously.
Grinding circuit in the concentrator	The griding circuit is a wet process so no particulate emissions are expected.
Operational support activities, such as maintenance welding, light towers, small water pumps, and small generators (6-60 kW).	The emission rates for the activities are insignificant relative to the overall emission rates from the Project.

3.0 EMISSION RATE CALCULATIONS AND ASSUMPTIONS

Data used in developing the emission estimates for the operation phase of the Project emission are summarized in Sections 3.1–3.6.

3.1 Open Pit Extraction

3.1.1 Blasting (Fugitive Dust)

An equation from Table 11.9-2 of the U.S. EPA AP-42 Chapter 11.9 "*Western Surface Coal Mining*" dated October, 1998 was used to calculate the fugitive dust emissions associated with blasting activities:

$$EF = 0.00022 \times \mathrm{A}^{1.5}$$

where: EF = SPM emission factor (kg/blast)

A = horizontal area (m²)

The inputs used to calculate fugitive dust emission rates from blasting in the open pit are listed in Table 3-1.

Table 3-1: Open Pit Extraction Emission Calculation Parameters

Activity	Input	Value	Notes
Blasting	Blast per day	1	It is assumed that the emissions from blasting will disperse within 1 hour. Blasting occurs 3 days per week (Provided by Champion).
	Horizontal blast area	15,611 m²	Maximum blast area provided by Champion.

The TSP predictive emission factor for the blast area was calculated as follows:

$$EF_{TSP} = 0.00022 \times (15{,}611)^{1.5}$$

$$EF_{TSP} = 429\ kg/blast$$

The 24-hour average TSP emission rate was calculated as follows:

$$ER = EF\ \times Daily\ Number\ of\ Blasts \times \frac{1{,}000\ g}{kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSP} = \frac{4.29E+02\ kg}{blast} \times \frac{1\ blast}{day} \times \frac{1{,}000\ g}{kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSP} = 4.97\ g/s$$

3.1.2 Blasting (Combustion Gases)

Emission factors from Australian Government Department of Sustainability, Environment, Water, Population and Communities "*National Pollutant Inventory Explosives Detonation and Firing Ranges 3.1*" dated August, 2016 were used to calculate the nitrogen oxides (NO_X) and CO emission rates associated with blasting activities. The emission rate was calculated as follows:

$$ER = EF \times usage$$

where: EF = emission factor (kg)

usage = amount of explosive usage per blast (Mg)

The inputs used to calculate combustion gas emission rates from blasting in the open pit are listed in Table 3-2.

Table 3-2: Open Pit Blasting Emission Calculation Parameters

Activity	Input	Value	Notes
Blasting	Type of explosive	Emulsion	Provided by Champion
	Amount of explosives	121 tonnes/blast	Provided by Champion

Assuming the emissions from each blast are dissipating within one hour of the blast, the following is the 24-hour average emission rate for CO from blasting in the pit.

$$ER = EF \times usage \times \frac{1{,}000g}{kg} \times \frac{1hr}{3{,}600s}$$

$$ER_{CO} = \frac{2.3\ kg}{Mg} x\ \frac{121\ Mg}{hr} \times \frac{1{,}000g}{kg} \times \frac{1\ hr}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{CO} = 3.21\ g/s$$

The NO_X emission rate was calculated using the same method and source of emission factor.

3.1.3 Ore Material Handling (Bulldozing)

An equation from U.S. EPA AP-42 Chapter 11.9 "*Western Surface Coal Mining*" dated October, 1998 was used to calculate the fugitive dust emission factors associated with bulldozing activities in the pit.

The emission factor equation for TSP is as follows:

$$EF = 2.6 \times \frac{s^{1.2}}{M^{1.3}}$$

where: EF = particulate emission factor (kg/hr)
s = silt content of material (%)
M =moisture content of material (%)

The inputs used to calculate the emission rate for bulldozing in the open pit are listed in Table 3-3.

Table 3-3 In Pit Bulldozing Parameters

Activity	Input	Value	Notes
In Pit Bulldozing	Surface Silt Content	5.8%	Assumption from AP-42 Table 13.2.2-1 for "Taconite mining haul road"
	Surface Moisture Content	1.5%	Provided by Champion
	Number of Units	2	Provided by Champion
	Operating time	20 hours/day	Provided by Champion

$$EF = 2.6 \times \frac{5.80^{1.2}}{1.5^{1.3}}$$

$$EF = 12.7\ kg/hr$$

The 24-hour average TSP emission rate was calculated as follows:

$$ER = EF \times \frac{1\ hr}{3{,}600\ s} \times \frac{1{,}000\ g}{kg}$$

$$ER_{TSP} = 12.7 \frac{kg}{hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{1{,}000\ g}{kg} \times \frac{20\ hr}{24\ hr} \times\ 2\ units$$

$$ER_{TSP} = 5.86\ g/s$$

3.1.4 Material Handling (Ore Drop into Haul Trucks)

The material handling emission rates associated with ore and mine rock handling in the pit were estimated using the emission factors from Section 13.24 "*Aggregate Handling and Storage Piles*" of the U.S. EPA AP-42 document revised November, 2006. Material handling emission rates are estimated when the ore and mine rock are dropped into haul trucks. The emission factor incorporates the moisture content of the material and the mean wind speed.

The calculation parameters for ore material handling are presented in Table 3-4.

Table 3-4: Ore Material Handling Parameters

Activity	Input	Value	Notes
Material Handling	Surface Moisture Content	1.5%	Provided by Champion
	Mean Wind Speed	4.66 m/s	CALMET meteorological data (2018-2021)
	Ore Throughput	107,502 tonnes/day	Provided by Champion

The k value for TSP, particles less than 30 micrometres, was obtained from the U.S. EPA Section 13.24 document dated November, 2006. The emission factor was calculated as follows:

$$EF_{TSP} = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{\mathrm{M}}{2}\right)^{1.4}}$$

$$EF_{TSP} = 0.74 \times 0.0016 \times \frac{\left(\frac{4.66}{2.2}\right)^{1.3}}{\left(\frac{1.5}{2}\right)^{1.4}}$$

$$EF_{TSP} = 0.00471 \frac{\mathrm{kg}}{tonne}$$

The 24-hour average TSP emission rate was calculated as follows:

$$ER_{TSP} = EF_{TSP} \times DT \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSP} = \frac{0.00471\ \mathrm{kg}}{tonne} \times \frac{107{,}502\ tonnes}{day} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSP} = 5.86 \frac{g}{s}$$

3.1.5 Waste Rock Material Handling (Bulldozing)

The material handling emission rates associated with bulldozing waste rock in the pit were estimated using the same parameters and methods described in Section 3.1.3.

3.1.6 In Pit Crushing (Waste Rock)

Emission rates associated with crushing waste rock in the pit were estimated using the emission factor from the U.S. EPA AP-42 Section 11.19-1 "*Crushed Stone Processing and Pulverised Mineral Processing*" dated August, 2004 for tertiary crushing since no data was available for primary crushing. The calculation parameters for waste rock crushing are presented in Table 3-5.

Table 3-5: Waste Rock Crushing Calculation Parameters

Activity	Input	Value	Notes
In Pit Crushing	Waste Rock Throughput	214,200 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum

The 24-hour average emission rate was calculated as follows:

$$ER = EF \times tonnage \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

where: EF = emission factor (kg/Mg)

tonnage = amount of material being moved (Mg/day)

$$ER_{TSP} = 0.0027 \frac{\text{kg}}{tonne} \times \frac{214{,}200\ tonnes}{day} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSP} = 6.69 \frac{g}{s}$$

3.1.7 In Pit Conveyor Loading (Waste Rock)

The emission rates for conveyor loading were calculated in a similar manner to the ore loading to the haul trucks as described in Section 3.1.4; however, the daily throughput of waste rock is 214,200 tonnes per day.

3.1.8 Overburden Material Handling

The emission rates for overburden truck loading were calculated using similar methods to ore loading to the haul trucks as described in Section 3.1.4. The parameters used to calculate the emission factor and emission rate for overburden handling are provided in Table 3-6.

Table 3-6: Overburden Material Handling Calculation Parameters

Activity	Input	Value	Notes
Overburden Handling	Overburden Throughput	69,159 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Moisture Content	4.8%	A moisture content of 7.9% was provided by Champion, however the maximum applicability for the equation in Section 13.24 "*Aggregate Handling and Storage Piles*" of the AP-42 document 4.8%.

3.2 Surface Material Handling

3.2.1 Ore Drop to Stockpiles

The ore handling emission rates at the ore stockpiles were estimated using the emission factors from the U.S. EPA AP-42 Section 13.24 "*Aggregate Handling and Storage Piles*" revised November, 2006. Emission rates were calculated in the same manner as described in Section 3.1.4.

3.2.2 Primary Crushing (Ore)

The primary crusher is equipped with a dust collector. The dust collector specifications were not available at the prefeasibility stage of the Project, so the emission rates for primary crushing were estimated using the emission factors from the U.S. EPA AP-42 Section 11.24 "*Metallic Mineral Processing*" dated August, 1982 and a control factor was applied to the emission estimates to account for the dust collector control efficiency. The calculation parameters are provided in Table 3-7.

Table 3-7: Primary Crushing Calculation Parameters

Activity	Input	Value	Notes
Primary crushing	Ore Throughput	107,520 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	U.S. EPA, 2003 – Air Pollution Control Technology, Fabric Filter Pulse Jet Cleaned

The 24-hour average emission rate was calculated as follows:

$$ER = EF \times tonnage \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times control\ efficiency$$

where: EF = emission factor (kg/Mg)

tonnage = amount of material being moved (Mg/day)

$$ER_{TSP} = \frac{0.2\ \text{kg}}{tonne} \times \frac{107{,}520\ tonnes}{day} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{(100-99)}{100}$$

$$ER_{TSP} = 2.49\frac{g}{s}$$

3.2.3 Conveyor to Crushed Ore Stockpile

Crushed ore is conveyed from the primary crusher to the crushed ore stockpile, which is covered by a partial enclosure. Emission rates were estimated using the emission factors from the U.S. EPA AP-42 Section 13.24 "*Aggregate Handling and Storage Piles*" document revised November, 2006. A control factor was applied to account for the partial enclosure at the drop point. The calculation parameters are provided in Table 3-8.

Table 3-8: Conveyor Transfer Calculation Parameters

Activity	Input	Value	Notes
Conveyor Drop to crushed ore stockpile	Ore Throughput	107,520 tonnes/day	Provided by Champion
	Wind Speed	4.66 m/s	CALMET meteorological data (2018-2021)
	Moisture Content	1.5%	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	75%	Three-walled enclosure (WRAP, 2006).

The k value for TSP, particles less than 30 micrometres, was obtained from the U.S. EPA Section 13.24 document dated November, 2006. The emission factor was calculated as follows:

$$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{\mathrm{M}}{2}\right)^{1.4}}$$

$$EF_{TSP} = 0.74 \times 0.0016 \times \frac{\left(\frac{4.66}{2.2}\right)^{1.3}}{\left(\frac{1.5}{2}\right)^{1.4}}$$

$$EF_{TSP} = 0.00471 \frac{\mathrm{kg}}{tonne}$$

The 24-hour average emission rate was calculated as follows:

$$ER = EF_{TSP} \times tonnage \times \frac{1{,}000g}{1\,kg} \times \frac{1\,day}{24\,hr} \times \frac{1\,hr}{3{,}600\,s} \times control\ factor$$

$$ER_{TSP} = \frac{0.00471\ \mathrm{kg}}{tonne} \times \frac{107{,}502\ tonnes}{day} \times \frac{1{,}000g}{1\,kg} \times \frac{1\,day}{24\,hr} \times \frac{1\,hr}{3{,}600\,s} \times \frac{(100-75)}{100}$$

$$ER_{TSP} = 1.46 \frac{g}{s}$$

3.2.4 Conveyor Transfer Towers (Ore, Waste Rock and Concentrate)

Emission rates at the conveyor transfer points were estimated using the emission factors from the U.S. EPA AP-42 Section 11.19-1 "*Crushed Stone Processing and Pulverised Mineral Processing*" document dated August, 2004 for uncontrolled conveyor transfer points. The conveyor transfer points are occurring in the transfer tower which is equipped with a dust collector to control fugitive emissions. A control factor has been applied to account for the use of a fabric filter dust collector at the transfer points. The calculation parameters are provided in Table 3-9.

Table 3-9: Calculation Parameters for Transfer Towers

Activity	Input	Value	Notes
Overland Conveyor Transfers (Ore)	Ore Throughput	107,520 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	Enclosure around the conveyor transfer point and use of a fabric filter (DSEWPC, 2012 - Table 4).
Conveyor Transfers to Waste Pile	Waste Rock Throughput	214,200 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	Enclosure around the conveyor transfer point and use of a fabric filter (DSEWPC, 2012 - Table 4).
Concentrate Transfer at Transfer Tower	Concentrate Throughput	27,840 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	Enclosure around the conveyor transfer point and use of a fabric filter (DSEWPC, 2012 - Table 4).

The 24-hour average emission rate was calculated as follows:

$$ER = EF_{TSP} \times tonnage \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times control\ factor$$

where: EF = emission factor (kg/Mg)

tonnage = amount of material being moved (Mg/day)

$$ER_{TSP} = \frac{0.0015\ \text{kg}}{tonne} \times \frac{214{,}200\ tonnes}{day} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{(100-99)}{100}$$

$$ER_{TSP} = 0.0372 \frac{g}{s}$$

3.2.5 Overland Conveyor Drop at Geodesic Dome

Emission estimates for the ore drop at the geodesic dome were estimated following the same methods and calculation parameters outlined in Section 3.2.3. A 75% control factor was applied to account for the partial enclosure at the drop point (WRAP, 2006).

3.2.6 Apron Feeder Under Geodesic Dome

Fugitive dust emissions from the apron feeder are controlled by a dust collector. The dust collector specifications were not available at the prefeasibility stage of the Project, so the emission rates for primary crushing were estimated using the emission factors from the U.S. EPA AP-42 Section 11.24 "*Metallic Mineral Processing*" dated August, 1982 and a control factor was applied to the emission estimates to account for the dust collector control efficiency. The calculation parameters are provided in Table 3-10.

Table 3-10: Apron Feeder Dust Collector Calculation Parameters

Activity	Input	Value	Notes
Apron Feeder	Ore Throughput	76,800 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	Reference: U.S. EPA, 2003 – Air Pollution Control Technology, Fabric Filter Pulse Jet Cleaned

The 24-hour average emission rate was calculated as follows:

$$ER = EF \times tonnage \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times control\ factor$$

where: EF = emission factor (kg/Mg)

tonnage = amount of material being moved (Mg/day)

$$ER_{TSP} = \frac{0.06\ \text{kg}}{tonne} \times \frac{76{,}800\ tonnes}{day} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{(100-99)}{100}$$

$$ER_{TSP} = 0.533\frac{g}{s}$$

3.2.7 Concentrate Drop at Emergency Storage Stockpile and Reclaim System

The fugitive dust generated from the drop of concentrate to the emergency storage stockpile, reclaim hopper loading, and reclaim hopper conveyor transfer were estimated using the emission factors from the U.S. EPA AP-42 Section 13.24 "*Aggregate Handling and Storage Piles*" document revised November, 2006. Emission rates were estimated using the same calculation methods described in Section 3.1.4 and the calculation parameters listed in Table 3-11.

Table 3-11: Concentrate Material Handling Calculation Parameters

Activity	Input	Value	Notes
Concentrate Drop to Emergency Storage Stockpile	Concentrate Throughput	27,840 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Wind Speed	4.66 m/s	CALMET meteorological data (2018-2021)
	Moisture Content	1%	The lowest moisture content provided by Champion was conservatively used.
Reclaim Concentrate	Concentrate Throughput	24,000 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Wind Speed	4.66 m/s	CALMET meteorological data (2018-2021)
	Moisture Content	1%	The lowest moisture content provided by Champion was conservatively used.

3.2.8 Reclaim Conveyor Transfer Point

The concentrate transfer from the reclaim conveyor to the main conveyor line was calculated using the emission factors from the U.S. EPA AP-42 Section 11.19-1 "*Crushed Stone Processing and Pulverised Mineral Processing*" document dated August, 2004 for uncontrolled conveyor transfer points. The conveyor is covered so a control factor was applied to account for the partial enclosure. Emission rates were estimated using the same methods described in Section 3.2.4 with the calculation parameters provided in Table 3-12.

Table 3-12: Calculation Parameters for Concentrate Conveyor Transfer Point

Activity	Input	Value	Notes
Concentrate Transfer at Transfer Tower	Concentrate Throughput	24,000 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	75%	Three-walled enclosure (WRAP 2006).

3.2.9 Silo Feed and Train Loadout Building Dust Collector

Emissions for concentrate transfer to the storage silo and train loadout building are controlled. Emission rates were calculated using the methods outlined in Section 3.2.6 and the calculation parameters in Table 3-13.

Table 3-13: Calculation Parameters for Concentrate Storage

Activity	Input	Value	Notes
Concentrate Transfer to Storage Silo	Concentrate Throughput	27,840 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	DSEWPC, 2012 - Table 4 (enclosure around conveyor transfer point and use of fabric filters)
Concentrate Transfer to Train Loadout Building	Concentrate Throughput	27,840 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	99%	U.S. EPA, 2003 – Air Pollution Control Technology, Fabric Filter Pulse Jet Cleaned

3.2.10 Rail Car Loading

The emission rates from concentrate loading to the rail cars were estimated using the emission factors from the U.S. EPA AP-42 Section 13.24 "*Aggregate Handling and Storage Piles*" document revised November, 2006. Emission rates were calculated using the same methods described in Section 3.1.4 with the calculation parameters described in Table 3-14.

Table 3-14: Calculation Parameters for Rail Car Loading

Activity	Input	Value	Notes
Rail Car Loading	Concentrate Throughput	27,840 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Control	70%	DSEWPC, 2012 – Table 4 (Loading to trains partial enclosure)

3.2.11 Waste Rock Drops at Stockpile

The emission rates from waste rock handling at the surface waste pile were estimated using the emission factors from the U.S. EPA AP-42 Section 13.24 "*Aggregate Handling and Storage Piles*" document revised November, 2006. Emission rates were calculated in the same manner as described in Section 3.1.4; however, the daily throughput of waste rock is 214,200 tonnes/day. The material is dropped to the pile at the final conveyor and moved at the pile using a spreader system.

3.2.12 Overburden Drop to Stockpile

The overburden handling emission rates at the surface stockpile were estimated using the emission factors from the U.S. EPA AP42 Section 13.24 "*Aggregate Handling and Storage Piles*" document revised November, 2006. Emission rates were calculated using the methods described in Section 3.1.4 with the calculation parameters described in Table 3-15.

Table 3-15: Overburden Material Handling Parameters

Activity	Input	Value	Notes
Overburden Handling	Overburden Throughput	69,159 tonnes/day	Provided by Champion
	Operating Hours	24 hours/day	Conservative maximum
	Moisture Content	4.8%	A moisture content of 7.9% was provided by Champion, however the maximum applicability for the equation in Section 13.24 "*Aggregate Handling and Storage Piles*" of the AP-42 document is 4.8%.

3.3 Wind Erosion

Fugitive dust from wind erosion on the exposed areas of the stockpile was estimated following the calculation method from the "*National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1* published by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC, 2012). This approach assumes an average value for wind erosion so as not to overestimate the disturbed area susceptible to wind erosion. The calculation parameters are provided in Table 3-16.

Table 3-16: Calculation Parameters for Wind Erosion

Activity	Input	Value	Notes
Tailings Area	Surface Area	7,489,600 m²	Provided by Champion
	Control	50%	Water sprays (DSEWPC 2012 – Table 4)
Waste Stockpile	Surface Area	5,422,400 m²	Provided by Champion
	Control	50%	Water sprays (DSEWPC 2012 – Table 4)
Overburden Stockpile	Surface Area	1,500,000 m²	Provided by Champion
	Control	50%	Water sprays (DSEWPC 2012 – Table 4)

The 24-hour average emission rate from the tailings area was calculated as follows:

$$EF_{TSP} = \frac{0.4\ kg}{ha - hr} \times \frac{1{,}000g}{1\ kg} \times \frac{1\ ha}{10{,}000\ m^2} \times \frac{1\ hr}{3{,}600\ s}$$

$$EF_{TSP} = 0.000011\ \mathrm{g/m^2/s}$$

$$ER = EF_{TSP} \times surface\ area \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times control\ factor$$

$$ER = 0.000011\ \frac{\mathrm{g}}{\mathrm{m^2 - s}} \times 7{,}489{,}600\ m^2 \times \frac{1{,}000g}{1\ kg} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{(100 - 50)}{100}$$

$$ER_{TSP} = 11.6\frac{g}{s}$$

3.4 On-site Roadway and Vehicle Emissions

3.4.1 Fugitive Dust from Ore and Mine Rock Hauling

The predictive equation in U.S. EPA AP-42 Section 13.2.2 "*Unpaved Roads*" dated November, 2006 was used to calculate the fugitive dust emissions from the unpaved roadways. The equation, including unit conversions and a control factor for fugitive dust best management practices is as follows:

$$EF = k\left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b} \times 281.9 \times \text{Control Factor}$$

where: *EF = particulate emission factor (g/VKT)*
k = empirical constant for particle size range (pounds per vehicle mile travelled) (Table 4-1), 4.9 for TSP
s = road surface silt content (%)
W = average weight (tons) of the vehicles traveling the road
a= empirical constant for particle size range (dimensionless) (Table 4-1), 0.7 for TSP
b= empirical constant for particle size range (dimensionless) (Table 4-1), 0.45 for TSP
281.9 = conversion from pounds per vehicle miles travelled to grams per vehicle kilometres travelled
Control Factor = reduction of fugitive dust emissions due to best management practices to control fugitive dust

Unpaved road dust emission rates were calculated without an adjustment for natural mitigation. A control factor for natural mitigation was applied in the dispersion model as described in Appendix 5-1.

The calculation parameters in Table 3-17 were used to estimate the emission factor for the unpaved road segment used for hauling ore from the pit to the ore stockpile.

Table 3-17: Unpaved Road Emission Factor Calculation Parameters

Parameter	Value	Comment
Silt content (%)	8.3	Assumption
Average weight of vehicles (tons)(a)	407.65	Calculated
Length of road segment (km)	1.02	From site plan
Number of one-way vehicle passes per day	371	Based on maximum material movement
Control Factor (%)	70	WRAP, 2006 Watering on unpaved roads

(a) Average weight assumes a full truck weighs 567 tons and an empty truck weighs 248 tons and the truck drives there and back in one trip.

$$EF = 4.9\left(\frac{8.3}{12}\right)^{0.7} \times \left(\frac{407.65}{3}\right)^{0.45} \times 281.9 \times (1 - 70\%)$$

$$EF = 2{,}919\ g/VKT$$

The controlled 24-hour average TSP emission rate was calculated as follows:

$$ER = EF \times Daily\ Vehicle\ Kilometres\ Travelled \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3600\ s}$$

$$ER = \frac{2{,}919\ \text{g}}{VKT} \times \frac{742\ \text{vehicle passes}}{24\ \text{hours}} \times \frac{1.02\ \text{km}}{\text{pass}} \times \frac{1\ hr}{3600\ s}$$

$$ER = 25.57\ g/s$$

3.4.2 Fugitive Dust from Pit Maintenance (Grading)

An equation from the U.S. EPA AP-42 Chapter 11.9 "*Western Surface Coal Mining*" dated October, 1998 was used to calculate the fugitive dust emission factors from unpaved road grading activities. The equation for TSP is as follows:

$$EF = 0.0034 \times S^{2.5} \times \text{Control Factor}$$

where: *EF = particulate emission factor (kg/km)*
S = vehicle speed (km/hr)
Control Factor = reduction of fugitive dust emissions due to best management practices to control fugitive dust

The calculation parameters for emission rates generated by grading the unpaved road from the pit to the primary crusher are provided in Table 3-18.

Table 3-18: Calculation Parameters for Grading Unpaved Roads

Parameter	Value	Comment
Vehicle speed (km/hr)	5	Provided by Champion
Number of passes/day	2	Provided by Champion
Vehicle Kilometers Travelled (VKT) (km/day)	2.04	Calculated
Control Factor (%)	70	(WRAP, 2006) Watering on unpaved roads

$$EF = 0.0034 \times 5^{2.5} \times (1 - 70\%)$$

$$EF = 0.057\ kg/VKT$$

The 24-hour average TSP emission rate was calculated as follows:

$$ER = EF \times Daily\ Vehicle\ Kilometres\ Travelled \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{1{,}000\ g}{kg}$$

$$ER = \frac{0.057\ kg}{VKT} \times \frac{2.04\ VKT}{day} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s} \times \frac{1{,}000\ g}{kg}$$

$$ER = 0.00135\ g/s$$

3.4.3 Mobile Equipment Exhaust

Emission rates from the operation of heavy mobile equipment were estimated using the U.S. EPA "*Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition NR-009d"* document dated July, 2010. The load factors were obtained from the U.S. EPA "*Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, Report No. NR-005d*" document (dated July 2010). The engine output power was estimated based on the specification sheets for the equipment. A sample calculation for 24-hour average diesel particulate matter TSP_{diesel} from the Komatsu 930E haul trucks is as follows:

$$ER = EF \times horsepower \times load\ factor \times number\ of\ vehicles \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

where: EF = g/hp-hr

$$ER_{TSPdiesel} = \frac{0.03\ g}{hp - hr} \times 3500\ hp \times 0.58 \times 7 \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSPdiesel} = 0.118\ g/s$$

The equipment operating at the tailings management facility operates 50% of the year, while the remaining equipment was conservatively assessed as operating 24 hours per day, 365 days per year. The sulphur content by weight of the diesel fuel is assumed to be the maximum allowable sulphur content in diesel fuel produced, imported or sold for use in small stationary engines in Canada (15 mg/kg or 0.0015%). A detailed emission rate calculation is provided in Appendix A - Emission Calculations for the Operation Phase of the Project.

3.5 Rail Cars

The calculation parameters in Table 3-19 and the following publications were used to estimate emission rates of NO_2, PM, CO and SO_2:

- Rail Association of Canada 2022 Locomotive Emissions Monitoring Program Report
- Rail Association of Canada 2016 Locomotive Emissions Monitoring Program Report
- U.S. Environmental Protection Agency 2024 Federal Railroad Administration Locomotive Emissions Comparison Tool (LECT): Emissions Data Documentation
- U.S. EPA Locomotive Emission Standards: Regulatory Support Document dated April, 1998

Table 3-19: Calculation Parameters for Rail Car Emissions

Activity	Input	Value	Notes
Rail Cars	Number of Locomotives/train	3	Provided by Champion
	Number of Trips / day (summer)	3.32	Provided by Champion
	Hours/Trip	7.00	Provided by Champion
	Hours/Day	23.24	Calculated
	Small Class (II/III) Line-haul	18.20 bhp-hr/gal	U.S. EPA, 2024 Federal Railroad Administration Locomotive Emissions Comparison Tool (LECT): Emissions Data Documentation (page 4)
	Notch 5 / Fraction of Trip	1461 hp / 0.13	Horsepower's taken from U.S. EPA Locomotive Emission Standards: Regulatory Support Document (April 1998), Appendix B (Locomotive Emission Data by Throttle Notch for EMD 16-645E3)
	Notch 3 / Fraction of Trip	686 hp / 0.11	
	Notch 1 / Fraction of Trip	105 hp / 0.5	
	Idle / Fraction of Trip	17 hp / 0.26	

The fuel consumption was calculated as follows:

$$Fuel\ Consumption\ (Notch5) = 1{,}461\ \text{hp}\ \div (18.20\ \frac{\text{bhp} - \text{hr}}{\text{gal}}\ \div\ 3.785\ \frac{\text{gal}}{\text{L}})$$

$$Fuel\ Consumption\ (Notch5) = 303.9\ \text{L/hr}$$

It was assumed that diesel particulate will be less than PM_{10} so the PM_{10} emission factor was used to estimate the $TSP_{(diesel)}$ emission rates.

$EF_{PM10} = 0.63\ \frac{\text{g}}{\text{L}}$, Rail Association of Canada, 2016 Locomotive Emissions Monitoring Program Report, Table 10: CAC Emission Factors for Diesel Locomotives (g/L) for Line Haul Freight.

The $TSP_{(diesel)}$ emission rate for rail cars travelling at Notch 5 was calculated as follows:

$$ER = EF_{PM10} \times Fuel\ Consumption \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSPdiesel} = 0.63\frac{g}{L} \times 303.9\ L/hr \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{TSPdiesel} = 9.66E-03\ g/s$$

The calculation was repeated for each notch level and the sum of the TSP_{diesel} emission rates was included in the dispersion model.

3.6 Emergency Power Generators

The emission factors in the U.S. EPA AP-42 Section 3.4 "*Large Stationary Diesel and all Stationary Dual Fuel Engines*" dated October, 1996 were used to calculate the emission rates from the emergency diesel powered generators. Because the generators are used in emergencies only, the daily and annual emission rate reflects generator testing for one hour per week. The generator engine power is provided in Table 3-20.

Table 3-20: Emergency Generator Power Rating

Activity	Input	Value	Notes
Emergency Generators	Power rating	2,500 kW	Provided by Champion
		3,353 hp	

The NOx emission rate was calculated as follows:

$$ER = EF_{NOx} \times power\ rating \times \frac{1\ hr}{3{,}600\ s}$$

$$ER = 5.32 \frac{g}{hp-hr} \times 3{,}353\ hp \times \frac{1\ hr}{3{,}600\ s}$$

$$ER_{NOx} = 4.95 \frac{g}{s}$$

4.0 EMISSION CONTROL FACTORS

Table 4-1 provides a summary of the fugitive dust controls incorporated into the emission estimates for the operation phase for the Project.

Table 4-1: Emission Control Factors for the Operation Phase of the Project.

Source	Source ID	Control	Control Factor (%)	Reference
In Pit Drilling	IPO1B	Drills equipped with dust collectors	99	DSEWPC, 2012
Overburden Stockpile	OB1	Water truck when needed	50	WRAP, 2006 DSEWPC, 2012
	OBSP			
Waste Stockpile	WRSP	Water truck when needed.	50	DSEWPC, 2012
Tailings Management Facility	TMF	Wet loose tailings when needed.	50	DSEWPC, 2012
Conveyor Transfer Towers for Waste Rock	TT1	Dust collector in transfer towers	99	DSEWPC, 2012
Conveyor Transfer Tower 2 for Waste Rock	TT2			
Overland Conveyor Transfer Tower (Ore)	TT3			
Emergency Stockpile Transfer Tower	TT4			
Crushed ore transfer to crushed ore stockpile (Prior to overland conveyors)	OH3	Three walled enclosure	75	WRAP, 2006
Overland Conveyor Drop Point at Dome	OH4	Three walled enclosure	75	WRAP, 2006
Primary Crushing (ore)	PCDC	Dust Collectors	99	U.S. EPA, 2003 Air Pollution Control Technology Fact Sheet
Apron Feeder	AFDC			
Train Loadout Building Dust Collector	TLDC			
Reclaim Conveyor transfer to Concentrate Conveyor (From emergency storage pile to concentrate conveyor)	CH5	Partial enclosure	75	WRAP, 2006
Silo Feed Dust Collector	SFDC	Bin vents	99	DSEWPC, 2012
Site Roads	Roads	Watering more than twice a day (not applicable during freezing conditions)	70	WRAP, 2006
In Pit Road	INPIT	Watering more than twice a day (not applicable during freezing conditions)	70	WRAP, 2006
		Limit vehicle speed to 25 mph	44	WRAP, 2006
		Combination of watering and speed limit	83	Calculated using the watering and speed limit control factors
Rail Load Out	RC	Partial enclosure	70	DSEWPC, 2012

5.0 EMISSION RATES SUMMARY

The air quality environmental effects assessment has been carried out in accordance with the EIS Guidelines. Emission rates, in g/s were calculated as described in Section 3.0 to represent the significant emissions sources from the Project. The emission estimates are based on a conservative emission scenario so as not to underestimate the effects of the Project on the existing environment.

Table 5-1 provides a source summary table for the Project. The contaminant “PAH” represents the species requested for the human health risk assessment and include benzo(a)pyrene, benz(a)anthracene, benzo(b+)+k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indenol (1,2,3-cd)pyrene, and naphthalene.

Emission Source Summary Table
Operations Phase

Source ID	Source Description	Contaminant	1 - hr		24 - hr		Annual	
			Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution
IPO1A	Blasting (Fugitive Dust)	TSP	1.19E+02	25%	4.97E+00	1%	2.12E+00	<1%
		PM10	6.20E+01	35%	2.58E+00	2%	1.10E+00	1%
		PM2.5	3.58E+00	18%	1.49E-01	<1%	6.37E-02	<1%
IPO2	Blasting (Combustion Gases)	CO	7.72E+01	74%	3.21E+00	11%	1.37E+00	5%
		NOX	6.71E+00	15%	2.80E-01	1%	1.19E-01	<1%
IP03	In Pit Bulldozing (Ore)	TSP	7.03E+00	1%	5.86E+00	2%	5.86E+00	2%
		PM10	1.48E+00	<1%	1.24E+00	1%	1.24E+00	1%
		PM2.5	7.38E-01	4%	6.15E-01	4%	6.15E-01	5%
IPO4	In-Pit Truck Loading (ore)	TSP	5.86E+00	1%	5.86E+00	2%	4.23E+00	1%
		PM10	2.77E+00	2%	2.77E+00	2%	2.00E+00	2%
		PM2.5	4.19E-01	2%	4.19E-01	3%	3.03E-01	2%
OH2	Ore Stockpile	TSP	5.86E+00	1%	5.86E+00	2%	4.23E+00	1%
		PM10	2.77E+00	2%	2.77E+00	2%	2.00E+00	2%
		PM2.5	4.19E-01	2%	4.19E-01	3%	3.03E-01	2%
IP05	In Pit Bulldozing (Waste Rock)	TSP	7.03E+00	1%	5.86E+00	2%	5.86E+00	2%
		PM10	1.48E+00	<1%	1.24E+00	1%	1.24E+00	1%
		PM2.5	7.38E-01	4%	6.15E-01	4%	6.15E-01	5%
IPO6	In Pit Crusher (waste rock)	TSP	6.69E+00	1%	6.69E+00	2%	3.89E+00	1%
		PM10	2.98E+00	2%	2.98E+00	3%	1.73E+00	2%
		PM2.5	1.49E+00	7%	1.49E+00	9%	8.65E-01	6%
IPO7	Crushed waste rock drop to conveyor (in-pit)	TSP	1.17E+01	2%	1.17E+01	3%	6.78E+00	2%
		PM10	5.52E+00	3%	5.52E+00	5%	3.21E+00	3%
		PM2.5	8.36E-01	4%	8.36E-01	5%	4.86E-01	4%
TT1	Conveyor Transfer Towers for Waste Rock	TSP	3.72E-02	<1%	3.72E-02	<1%	2.16E-02	<1%
		PM10	1.36E-02	<1%	1.36E-02	<1%	7.93E-03	<1%
		PM2.5	3.85E-03	<1%	3.85E-03	<1%	2.24E-03	<1%
TT2	Conveyor Transfer Tower 2 for Waste Rock	TSP	3.72E-02	<1%	3.72E-02	<1%	2.16E-02	<1%
		PM10	1.36E-02	<1%	1.36E-02	<1%	7.93E-03	<1%
		PM2.5	3.85E-03	<1%	3.85E-03	<1%	2.24E-03	<1%
WRH1	Crushed waste rock drop from last conveyor to Waste Stockpile	TSP	1.17E+01	2%	1.17E+01	3%	6.78E+00	2%
		PM10	5.52E+00	3%	5.52E+00	5%	3.21E+00	3%
		PM2.5	8.36E-01	4%	8.36E-01	5%	4.86E-01	4%
WRH2	Crushed Waste Material Transfer to Spreader System	TSP	1.17E+01	2%	1.17E+01	3%	6.78E+00	2%
		PM10	5.52E+00	3%	5.52E+00	5%	3.21E+00	3%
		PM2.5	8.36E-01	4%	8.36E-01	5%	4.86E-01	4%
WRH3	Crushed Waste Spreader System Drop to Pile	TSP	1.17E+01	2%	1.17E+01	3%	6.78E+00	2%
		PM10	5.52E+00	3%	5.52E+00	5%	3.21E+00	3%
		PM2.5	8.36E-01	4%	8.36E-01	5%	4.86E-01	4%
IPO9	In-Pit Truck Loading (overburden)	TSP	7.39E-01	<1%	7.39E-01	<1%	7.39E-01	<1%
		PM10	3.50E-01	<1%	3.50E-01	<1%	3.50E-01	<1%
		PM2.5	5.29E-02	<1%	5.29E-02	<1%	5.29E-02	<1%

Source ID	Source Description	Contaminant	1 - hr		24 - hr		Annual	
			Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution
OB1	Material Drop to Overburden Stockpile	TSP	3.70E-01	<1%	3.70E-01	<1%	3.70E-01	<1%
		PM10	1.75E-01	<1%	1.75E-01	<1%	1.75E-01	<1%
		PM2.5	2.65E-02	<1%	2.65E-02	<1%	2.65E-02	<1%
PCDC	Primary Crushing (ore)	TSP	2.49E+00	<1%	2.49E+00	<1%	1.80E+00	<1%
		PM10	2.49E-01	<1%	2.49E-01	<1%	1.80E-01	<1%
		PM2.5	4.61E-02	<1%	4.61E-02	<1%	3.33E-02	<1%
AFDC	Apron Feeder	TSP	5.33E-01	<1%	5.33E-01	<1%	3.85E-01	<1%
		PM10	2.67E-01	<1%	2.67E-01	<1%	1.92E-01	<1%
		PM2.5	7.54E-02	<1%	7.54E-02	<1%	5.44E-02	<1%
SFDC	Silo Feed Dust Collector	TSP	1.93E-01	<1%	1.93E-01	<1%	1.93E-01	<1%
		PM10	9.67E-02	<1%	9.67E-02	<1%	9.67E-02	<1%
		PM2.5	2.73E-02	<1%	2.73E-02	<1%	2.73E-02	<1%
TLDC	Train Loadout Building Dust Collector	TSP	1.93E-01	<1%	1.93E-01	<1%	1.93E-01	<1%
		PM10	9.67E-02	<1%	9.67E-02	<1%	9.67E-02	<1%
		PM2.5	2.73E-02	<1%	2.73E-02	<1%	2.73E-02	<1%
OH3	Material Transfer Via Conveyor From Primary Crusher to Ore Stockpile	TSP	1.46E+00	<1%	1.46E+00	<1%	1.06E+00	<1%
		PM10	6.92E-01	<1%	6.92E-01	<1%	5.00E-01	<1%
		PM2.5	1.05E-01	<1%	1.05E-01	<1%	7.57E-02	<1%
TT3	Overland Conveyor Transfer Tower (Ore)	TSP	1.87E-02	<1%	1.87E-02	<1%	1.35E-02	<1%
		PM10	6.84E-03	<1%	6.84E-03	<1%	4.94E-03	<1%
		PM2.5	1.93E-03	<1%	1.93E-03	<1%	1.40E-03	<1%
OH4	Overland Conveyor Drop Point at Dome	TSP	1.46E+00	<1%	1.46E+00	<1%	1.06E+00	<1%
		PM10	6.92E-01	<1%	6.92E-01	<1%	5.00E-01	<1%
		PM2.5	1.05E-01	<1%	1.05E-01	<1%	7.57E-02	<1%
TT4	Emergency Stockpile Transfer Tower	TSP	4.83E-03	<1%	4.83E-03	<1%	4.83E-03	<1%
		PM10	1.77E-03	<1%	1.77E-03	<1%	1.77E-03	<1%
		PM2.5	5.01E-04	<1%	5.01E-04	<1%	8.23E-06	<1%
CH2	Concentrate Drop to Emergency Storage Stockpile	TSP	2.67E+00	<1%	2.67E+00	<1%	4.40E-02	<1%
		PM10	1.27E+00	<1%	1.27E+00	1%	2.08E-02	<1%
		PM2.5	1.92E-01	<1%	1.92E-01	1%	3.15E-03	<1%
CH3	Emergency Storage Stockpile - Reclaim Hopper	TSP	2.31E+00	<1%	2.31E+00	<1%	3.79E-02	<1%
		PM10	1.09E+00	<1%	1.09E+00	<1%	1.79E-02	<1%
		PM2.5	1.65E-01	<1%	1.65E-01	1%	2.71E-03	<1%
CH4	Emergency Storage Stockpile - Reclaim Hopper to Conveyor	TSP	2.31E+00	<1%	2.31E+00	<1%	3.79E-02	<1%
		PM10	1.09E+00	<1%	1.09E+00	<1%	1.79E-02	<1%
		PM2.5	1.65E-01	<1%	1.65E-01	1%	2.71E-03	<1%
CH5	Reclaim Conveyor Transfer to Concentrate Conveyor	TSP	1.04E-01	<1%	1.04E-01	<1%	1.71E-03	<1%
		PM10	3.82E-02	<1%	3.82E-02	<1%	6.28E-04	<1%
		PM2.5	1.08E-02	<1%	1.08E-02	<1%	1.77E-04	<1%

Source ID	Source Description	Contaminant	1 - hr		24 - hr		Annual	
			Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution
RCL	Rail Car Loading	TSP	8.02E-01	<1%	8.02E-01	<1%	8.02E-01	<1%
		PM10	3.80E-01	<1%	3.80E-01	<1%	3.80E-01	<1%
		PM2.5	5.75E-02	<1%	5.75E-02	<1%	5.75E-02	<1%
SMT	Slow Moving Train	TSPDiesel	1.16E-02	3%	1.12E-02	4%	1.03E-02	3%
		PM10	1.16E-02	<1%	1.12E-02	<1%	1.03E-02	<1%
		PM2.5	1.13E-02	<1%	1.09E-02	<1%	1.00E-02	<1%
		NOx	5.85E-01	1%	5.66E-01	2%	5.20E-01	2%
		SO2	3.68E-04	<1%	3.57E-04	<1%	3.27E-04	<1%
		CO	1.28E-01	<1%	1.24E-01	<1%	1.14E-01	<1%
		PAH (selected species)	1.38E-05	3%	1.33E-05	31%	1.22E-05	46%
TMF	Fugitive Dust from Tailings Stockpile	TSP	1.16E+01	2%	1.16E+01	3%	1.16E+01	4%
		PM10	5.78E+00	3%	5.78E+00	5%	5.78E+00	6%
		PM2.5	8.67E-01	4%	8.67E-01	5%	8.67E-01	6%
WRSP	Fugitive Dust from Waste Rock Stockpile	TSP	8.37E+00	2%	8.37E+00	2%	8.37E+00	3%
		PM10	4.18E+00	2%	4.18E+00	4%	4.18E+00	4%
		PM2.5	6.28E-01	3%	6.28E-01	4%	6.28E-01	5%
OBSP	Fugitive Dust from Overburden Stockpile	TSP	2.31E+00	<1%	2.31E+00	<1%	2.31E+00	<1%
		PM10	1.16E+00	<1%	1.16E+00	<1%	1.16E+00	1%
		PM2.5	1.74E-01	<1%	1.74E-01	1%	1.74E-01	1%
In Pit_TP	In Pit Tailpipe Emissions	TSPDiesel	1.98E-01	47%	1.98E-01	63%	1.98E-01	66%
		PM10	1.98E-01	<1%	1.98E-01	<1%	1.98E-01	<1%
		PM2.5	1.92E-01	<1%	1.92E-01	1%	1.92E-01	1%
		NOx	1.71E+01	37%	1.71E+01	68%	1.71E+01	71%
		SO2	3.33E-02	51%	3.33E-02	66%	3.33E-02	68%
		CO	1.73E+01	17%	1.73E+01	61%	1.73E+01	66%
		PAH (selected species)	8.78E-06	2%	8.78E-06	20%	8.78E-06	33%
Ore Stockpile_TP	Ore Stockpile Haulage Tailpipe Emissions	TSPDiesel	7.08E-03	2%	7.08E-03	2%	7.08E-03	2%
		PM10	7.08E-03	<1%	7.08E-03	<1%	7.08E-03	<1%
		PM2.5	6.87E-03	<1%	6.87E-03	<1%	6.87E-03	<1%
		NOx	1.30E-01	<1%	1.30E-01	<1%	1.30E-01	<1%
		SO2	1.60E-03	2%	1.60E-03	3%	1.60E-03	3%
		CO	2.52E-01	<1%	2.52E-01	<1%	2.52E-01	<1%
		PAH (selected species)	3.45E-08	<1%	3.45E-08	<1%	3.45E-08	<1%
Waste Stockpile_TP	Waste Stockpile Tailpipe Emissions	TSPDiesel	5.03E-03	1%	5.03E-03	2%	5.03E-03	2%
		PM10	5.03E-03	<1%	5.03E-03	<1%	5.03E-03	<1%
		PM2.5	4.88E-03	<1%	4.88E-03	<1%	4.88E-03	<1%
		NOx	4.36E-01	<1%	4.36E-01	2%	4.36E-01	2%
		SO2	8.37E-04	1%	8.37E-04	2%	8.37E-04	2%
		CO	4.36E-01	<1%	4.36E-01	2%	4.36E-01	2%
		PAH (selected species)	2.43E-07	<1%	2.43E-07	<1%	2.43E-07	<1%

Source ID	Source Description	Contaminant	1 - hr		24 - hr		Annual	
			Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution
Emergency Concentrate Stockpile_TP	Emergency Concentrate Stockpile Tailpipe Emissions	TSPDiesel	5.34E-04	<1%	5.34E-04	<1%	5.34E-04	<1%
		PM10	5.34E-04	<1%	5.34E-04	<1%	5.34E-04	<1%
		PM2.5	5.18E-04	<1%	5.18E-04	<1%	5.18E-04	<1%
		NOx	1.60E-02	<1%	1.60E-02	<1%	1.60E-02	<1%
		SO2	2.66E-04	<1%	2.66E-04	<1%	2.66E-04	<1%
		CO	1.39E-01	<1%	1.39E-01	<1%	1.39E-01	<1%
		PAH (selected species)	1.85E-08	<1%	1.85E-08	<1%	1.85E-08	<1%
TMF_TP	Tailings Management Facility Tailpipe Emissions	TSPDiesel	1.16E-02	3%	1.16E-02	4%	5.86E-03	2%
		PM10	1.16E-02	<1%	1.16E-02	<1%	5.86E-03	<1%
		PM2.5	1.13E-02	<1%	1.13E-02	<1%	5.68E-03	<1%
		NOx	5.66E-01	1%	5.66E-01	2%	2.84E-01	1%
		SO2	1.52E-03	2%	1.52E-03	3%	7.72E-04	2%
		CO	8.41E-01	<1%	8.41E-01	3%	4.30E-01	2%
		PAH (selected species)	2.97E-07	<1%	2.97E-07	<1%	1.50E-07	<1%
General Site_TP		TSPDiesel	2.52E-02	6%	2.52E-02	8%	2.52E-02	8%
		PM10	2.52E-02	<1%	2.52E-02	<1%	2.52E-02	<1%
		PM2.5	2.45E-02	<1%	2.45E-02	<1%	2.45E-02	<1%
		NOx	1.28E+00	3%	1.28E+00	5%	1.28E+00	5%
		SO2	3.66E-03	6%	3.66E-03	7%	3.66E-03	7%
		CO	1.91E+00	2%	1.91E+00	7%	1.91E+00	7%
		PAH (selected species)	6.02E-07	<1%	6.02E-07	1%	6.02E-07	2%
INPIT	In Pit Road	TSP	1.23E+02	26%	1.23E+02	35%	1.23E+02	39%
		PM10	3.24E+01	18%	3.24E+01	28%	3.24E+01	32%
		PM2.5	3.24E+00	16%	3.24E+00	20%	3.24E+00	24%
UPR1	Pit to Ore Stockpiles	TSP	2.56E+01	5%	2.56E+01	7%	2.56E+01	8%
		PM10	7.27E+00	4%	7.27E+00	6%	7.27E+00	7%
		PM2.5	7.27E-01	4%	7.27E-01	4%	7.27E-01	5%
UPR1_TP	Pit to Ore Stockpiles	TSPDiesel	3.38E-02	8%	3.38E-02	11%	3.38E-02	11%
		PM10	3.38E-02	<1%	3.38E-02	<1%	3.38E-02	<1%
		PM2.5	3.28E-02	<1%	3.28E-02	<1%	3.28E-02	<1%
		NOx	2.93E+00	6%	2.93E+00	12%	2.93E+00	12%
		SO2	5.63E-03	9%	5.63E-03	11%	5.63E-03	12%
		CO	2.93E+00	3%	2.93E+00	10%	2.93E+00	11%
		PAH (selected species)	1.39E-06	<1%	1.39E-06	3%	1.39E-06	5%
UPR2	Pit to Overburden Stockpile	TSP	7.00E+01	15%	7.00E+01	20%	7.00E+01	22%
		PM10	1.99E+01	11%	1.99E+01	17%	1.99E+01	20%
		PM2.5	1.99E+00	10%	1.99E+00	12%	1.99E+00	15%

Source ID	Source Description	Contaminant	1 - hr		24 - hr		Annual	
			Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution	Emission Rate [g/s]	% Contribution
UPR2_TP	Pit to Overburden Stockpile	TSPDiesel	1.49E-02	4%	1.49E-02	5%	1.49E-02	5%
		PM10	1.49E-02	<1%	1.49E-02	<1%	1.49E-02	<1%
		PM2.5	1.44E-02	<1%	1.44E-02	<1%	1.44E-02	<1%
		NOx	1.29E+00	3%	1.29E+00	5%	1.29E+00	5%
		SO2	2.47E-03	4%	2.47E-03	5%	2.47E-03	5%
		CO	1.29E+00	1%	1.29E+00	5%	1.29E+00	5%
		PAH (selected species)	6.10E-07	<1%	6.10E-07	1%	6.10E-07	2%
UPR3	Access Road	TSP	1.31E+01	3%	1.31E+01	4%	1.31E+01	4%
		PM10	3.74E+00	2%	3.74E+00	3%	3.74E+00	4%
		PM2.5	3.73E-01	2%	3.73E-01	2%	3.73E-01	3%
UPR4	TMF Inspection Road	TSP	8.42E-02	<1%	8.42E-02	<1%	8.42E-02	<1%
		PM10	2.62E-02	<1%	2.62E-02	<1%	2.62E-02	<1%
		PM2.5	2.42E-03	<1%	2.42E-03	<1%	2.42E-03	<1%
UPR5	Site Road	TSP	3.07E+00	<1%	3.07E+00	<1%	3.07E+00	<1%
		PM10	8.73E-01	<1%	8.73E-01	<1%	8.73E-01	<1%
		PM2.5	8.72E-02	<1%	8.72E-02	<1%	8.72E-02	<1%
EPG1	Generator 1 - Mine Services Area	NOX	4.95E+00	11%	2.06E-01	<1%	2.94E-02	<1%
		CO	3.91E-01	<1%	1.63E-02	<1%	2.32E-03	<1%
		SO2	5.13E-03	8%	2.14E-04	<1%	3.04E-05	<1%
		TSPDiesel	3.73E-02	9%	1.55E-03	<1%	2.21E-04	<1%
		PM10	3.73E-02	<1%	1.55E-03	<1%	2.21E-04	<1%
		PM2.5	3.61E-02	<1%	1.51E-03	<1%	2.14E-04	<1%
		PAH (selected species)	1.45E-04	31%	6.03E-06	14%	8.59E-07	3%
EPG2	Generator 2 - Concentrator	NOX	4.95E+00	11%	2.06E-01	<1%	2.94E-02	<1%
		CO	3.91E-01	<1%	1.63E-02	<1%	2.32E-03	<1%
		SO2	5.13E-03	8%	2.14E-04	<1%	3.04E-05	<1%
		TSPDiesel	3.73E-02	9%	1.55E-03	<1%	2.21E-04	<1%
		PM10	3.73E-02	<1%	1.55E-03	<1%	2.21E-04	<1%
		PM2.5	3.61E-02	<1%	1.51E-03	<1%	2.14E-04	<1%
		PAH (selected species)	1.45E-04	31%	6.03E-06	14%	8.59E-07	3%
EPG3	Generator 3 - Concentrator	NOX	4.95E+00	11%	2.06E-01	<1%	2.94E-02	<1%
		CO	3.91E-01	<1%	1.63E-02	<1%	2.32E-03	<1%
		SO2	5.13E-03	8%	2.14E-04	<1%	3.04E-05	<1%
		TSPDiesel	3.73E-02	9%	1.55E-03	<1%	2.21E-04	<1%
		PM10	3.73E-02	<1%	1.55E-03	<1%	2.21E-04	<1%
		PM2.5	3.61E-02	<1%	1.51E-03	<1%	2.14E-04	<1%
		PAH (selected species)	1.45E-04	31%	6.03E-06	14%	8.59E-07	3%

Notes:

PAH (selected species) includes benzo(a)pyrene, benz(a)anthracene, benzo(b+)+k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indenol (1,2,3-cd)pyrene, and naphthalene.

ER = Emission Rate

% Contribution of the contaminant emission rate to the total Project emissions for that contaminant

6.0 REFERENCES

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2012. *National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1).*

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2016. *National Pollutant Inventory Explosives Detonation and Firing Ranges (Version 3.1).*

Government of Newfoundland and Labrador. 2022. Regulation 11/22 *Air Pollution Control Regulations, 2022 under the Environmental Protection Act* (O.C. 2022-072).

Railway Association of Canada. No date. *Locomotive Emissions Monitoring Program Report, 2016*.

Railway Association of Canada 2023. *Locomotive Emissions Monitoring Report, 2022.*

U.S. EPA AP-42. 1982. *11.24 Metallic Mineral Processing.*

U.S. EPA AP-42. 1995. *Emission Factors*

U.S. EPA AP-42. 1996. *3.4 Large Stationary Diesel and all Stationary Dual Fuel Engines.*

U.S. EPA AP-42. 1998. *11.9 Western Surface Coal Mining.*

U.S. EPA AP-42. 2004. *11.19.2 Crushed Stone Processing and Pulverized Mineral Processing.*

U.S. EPA AP-42. 2006. *13.2.2 Unpaved Roads*.

U.S. EPA AP-42. 2006. *13.2.4 Aggregate Handling and Storage Piles.*

U.S. EPA. 2003. *Air Pollution Control Technology Fact Sheet: Fabric Filter – Pulse-Jet Cleaned Type.*

U.S. EPA. 2010. *Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition NR-009R.*

U.S. EPA. 2010. *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, Report No. NR-005d*.

U.S. EPA 1998. *Locomotive Emission Standards, Regulatory Support Document.*

U.S. EPA 2024. *Federal Railroad Administration Locomotive Emissions Comparison Tool*.

Western Governors' Association (WRAP). 2006. *WRAP Fugitive Dust Handbook.*

Signature Page

WSP Canada Inc.

Julia Trautmann, M.Sc.
Senior Air Quality Scientist

Linda Lattner, P.Eng.
Principal Air Quality Engineer

JT/LL/rd

https://wsponlinecan.sharepoint.com/sites/ca-kamieaca00030925894/shared documents/04_issued to client/02_eis/01_eis chapters/05_chapter 5/appendix 5b emission estimates/kami tsd - air quality release estimates_clean.docx

APPENDIX A

Emission Rate Estimates for the Operation Phase of the Project

In-Pit Blasting

The TSP, PM_{10} and $PM_{2.5}$ emission factors for fugitive dust for in-pit blasting were obtained from U.S. EPA AP-42 Table 11.9-2 .

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

Each blast consists of 100% emulsion. The Carbon Monoxide and Nitrogen Oxide emission factors for the blasting using emulsion explosives [water based gel (>150 mm)] were obtained from the Australian NPI "Emission estimation technique manual for Explosives detonation and firing ranges" Version 3.1 August 2016.

Scaling Tables

Scaling Table	Blasting (Fugitive Dust)	Scaling Table	Blasting (Combustion Gases)
Source ID	IPO1A	**Source ID**	IPO2
Hours per Day	1	Hours per Day	1
Days per Year	156	Days per Year	156
Blasts per day	1	Blasts per day	1
Horizontal Area [m^2]	15,611	Tonnes of Explosives Per Blast	121
		Daily Throughput [tonnes/day]	121
		Hourly Throughput [tonnes/hour]	121
		Percent ANFO per blast	0.0%
		Percent Emulsion per blast	100.0%

ACTIVITY SUMMARY TABLE

Contaminant	Open Blasting Fugitive Emission Rates (g/s)			Open Blasting Fugitive Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	1.19E+02	4.97E+00	2.12E+00	66.94
PM_{10}	6.20E+01	2.58E+00	1.10E+00	34.81
$PM_{2.5}$	3.58E+00	1.49E-01	6.37E-02	2.01
CO	7.72E+01	3.21E+00	1.37E+00	43.33
NOX	6.71E+00	2.80E-01	1.19E-01	3.77

EMISSION FACTORS/ACTIVITIES

Blasting

Reference: *US EPA AP-42 - 11.9 Western Surface Coal Mining (7/98)*

Contaminant	Emission Factor [kg/blast]	Table Reference	Notes
TSP	4.29E+02	11.9-2	—
PM_{10}	2.23E+02	11.9-2	—
$PM_{2.5}$	1.29E+01	11.9-2	—

EMISSION RATE CALCULATIONS

Source ID: IPO1A

Blasting (Fugitive Dust)

Compound	EF [kg/Blast]	Base [BPH]	Conversion	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.29E+02	1	0.278	1.19E+02	4.97E+00	2.12E+00
PM_{10}	2.23E+02	1	0.278	6.20E+01	2.58E+00	1.10E+00
$PM_{2.5}$	1.29E+01	1	0.278	3.58E+00	1.49E-01	6.37E-02

Sample Calculation for TSP ER for IPO1A for 1-hr Emissions

ER TSP= Blasting EF x Hourly Throughput x Conversion

$$\text{ER TSP} = \frac{4.29\text{E+02}\ \text{kg}}{\text{blast}} \times \frac{1\ \text{blast}}{\text{hr}} \times \frac{1\ \text{hr}}{3600\ \text{s}} \times \frac{1000\ \text{g}}{1\ \text{kg}}$$

ER TSP= 1.19E+02 g/s

In-Pit Blasting Continued

Explosives

Reference: *Australia NPI Explosives Detonation and Firing Ranges 3.0, January 2012*

Contaminant	Emulsion Emission Factor [kg/Mg]	Australian NPI Table Reference for Emission Factors	Notes
CO	2.3	7	Each blast consists 100% emulsion
NOX	0.2	7	

Source ID: IPO2

Blasting (Combustion Gases)

Compound	Emulsion EF [kg/Mg]	Base [Mg/hr]	Conversion	1- hour Emulsion Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
CO	2.3	121	0.278	7.72E+01	3.21E+00	1.37E+00
NOX	0.2	121	0.278	6.71E+00	2.80E-01	1.19E-01

Sample Calculation for CO ER for IPO2 for 1-hr Emissions

ER CO= Emulsion EF x Hourly Throughput x Conversion

$$\text{ER CO} = \frac{2.3\ \text{kg}}{\text{tonne}} \times \frac{121\ \text{tonnes}}{\text{hr}} \times \frac{1000\ \text{g}}{\text{kg}} \times \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{ER CO} = 7.72\text{E+01}\ \frac{\text{g}}{\text{s}}$$

In-Pit Drilling

The TSP emission factor for fugitive dust for in-pit drilling were obtained from U.S. EPA AP-42 Table 11.9-4 . The emission factor for PM10 was estimated based on the ratio between TSP and PM10 emission factors for tertiary crushing (uncontrolled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (US EPA 2004)/ Table 11.19.2.1. The emission factor for PM2.5 was estimated based on the ratio between TSP and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (US EPA 2004)/ Table 11.19.2.1.

The drills are at all times equipped with dust collectors containing fabric filters. Therefore a 99% control efficiency is applied to the emissions as per Table 4 of the NPI Emissions Estimation Technique Manual for Mining Version 3.1 dated January 2012.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

Because blasting and drilling will not occur at the same time, the maximum emission rates between the two activities is considered in the dispersion model. Blasting has been carried forward into the dispersion modelling assessment.

Scaling Tables

Scaling Table	Drilling (Fugitive Dust)
Source ID	IPO1B
Number of holes drilled per day	112
Days per Year	365
Control Factor	99%

EMISSION FACTORS/ACTIVITIES

Drilling

Reference: *US EPA AP-42 - 11.9 Western Surface Coal Mining (7/98)*

Contaminant	Emission Factor [kg/hole]	Table Reference	Notes
TSP	0.59	11.9-4	—
PM_{10}	0.26	11.9-4/11.19.2.1	—
$PM_{2.5}$	0.049	11.9-4/11.19.2.1	—

ACTIVITY SUMMARY TABLE

Contaminant	Open Pit Extraction Fugitive Emission Rates (g/s)			Open Pit Extraction Fugitive Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	7.65E-05	7.65E-05	7.65E-05	2.41E-03
PM_{10}	3.40E-05	3.40E-05	3.40E-05	1.07E-03
$PM_{2.5}$	6.37E-06	6.37E-06	6.37E-06	2.01E-04

EMISSION RATE CALCULATIONS

Source ID: IPO1B

Drilling (Fugitive Dust)

Compound	EF [kg/Blast]	Base [BPH]	Number of Holes Drilled / Day	Conversion	% Emissions After Control Factor	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.59	1	112	0.012	0.01%	7.65E-05	7.65E-05	7.65E-05
PM_{10}	0.26	1	112	0.012	0.01%	3.40E-05	3.40E-05	3.40E-05
$PM_{2.5}$	0.05	1	112	0.012	0.01%	6.37E-06	6.37E-06	6.37E-06

Sample Calculation for TSP ER for IPO1B for 1-hr Emissions

$$ER_{TSP} = \frac{0.59\ kg}{hole} \times \frac{112\ holes}{24\ hours} \times \frac{1000\ g}{1\ kg} \times \frac{1\ hour}{3600\ s} \times (1 - 0.99)\ \%$$

ER_{TSP} = 7.65E-05 g/s

Ore Handling (Pre-Crushing)

TSP, PM_{10} and $PM_{2.5}$ emissions from bulldozing activities in the pit were calculated using the emission factor equations from Table 11.9-2 of the U.S. EPA AP-42 document for bulldozing of overburden.

Ore handling operations occur in the pit when ore is dropped into haul trucks and at the ore stockpile when ore is dropped from the haul trucks onto the pile. The maximum emission scenario considers that all ore hauled from the pit is dropped at the ore stockpile therefore the material handling rate at the low grade ore stockpile has been set to zero (0). TSP, PM_{10} and $PM_{2.5}$ emissions from material handling of ore were calculated using equation 1 from Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document dated November 2006.

Emission rates have been obtained based on the average annual windspeed from the CALMET meteorological data set. The annual emission rate is calculated based on the maximum annual ore movement.

A loader will pick up the ore from the stockpile and drop it into the primary crusher. The emission factor for primary crushing includes the drop of material into the crusher, so the loader has not been added as a source of emissions.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

SCALING TABLES

Scaling Table	In Pit Bulldozing (Ore)	**Scaling Table**	In-Pit Truck Loading (ore)	Low Grade Ore Stockpile	Ore Stockpile
Source ID	IP03	**Source ID**	IPO4	OH1	OH2
Hours per Day	20	Hours per Day	24	24	24
Days per Year	365	Throughput [tpy]	28,329,000	0	28,329,000
hour per hour	1	Throughput [tpd]	107,520	0	107,520
Number of Units	2	Throughput [tph]	4,480	0	4,480

ACTIVITY SUMMARY TABLE

Contaminant	**Ore Handling (pre-crush) ER [g/s]**			**Ore Handling (pre-crush) Emission Rates (tonnes/yr)**
	1-hour	**24-hour**	**Annual**	**Annual**
TSP	1.87E+01	1.76E+01	1.43E+01	451.33
PM_{10}	7.02E+00	6.78E+00	5.24E+00	165.11
$PM_{2.5}$	1.58E+00	1.45E+00	1.22E+00	38.49

EMISSION FACTORS/ACTIVITIES

Bulldozing

Reference: *USEPA AP-42 11.9 Western Surface Coal Mining (7/98) overburden*

Compound	**Equation**	**Surface Silt Content (s) [%]**	**Surface Moisture Content (M) [%]**	**EF [kg/hr]**	**Reference**
TSP	$= 2.6 \times S^{1.2}/M^{1.3}$	5.80	1.5	1.27E+01	Table 11.9-2
PM_{15}	$= 0.45 \times S^{1.5}/M^{1.4}$	5.80	1.5	3.56E+00	Table 11.9-2
PM_{10}	$= EF_{PM15} \times 0.75$	—	—	2.67E+00	Table 11.9-2
$PM_{2.5}$	$= EF_{TSP} \times 0.105$	—	—	1.33E+00	Table 11.9-2

EMISSION RATE CALCULATIONS

In Pit Bulldozing (Ore)

Source ID: **IP03**

Compound	**EF [kg/hr]**	**Base [hr/hr]**	**Conversion**	**Number of Units**	**1- hour Emission Rate [g/s]**	**24- hour Emission Rate [g/s]**	**Annual Emission Rate [g/s]**
TSP	1.27E+01	1	0.278	2	7.03E+00	5.86E+00	5.86E+00
PM10	2.67E+00	1	0.278	2	1.48E+00	1.24E+00	1.24E+00
PM2.5	1.33E+00	1	0.278	2	7.38E-01	6.15E-01	6.15E-01

Ore Handling (Pre-Crushing) Continued

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document instead of Section 11.24 Metallic Minerals Processing to account for the high moisture content of the material.

$$EF\ (kg/Mg) = \frac{k\ (0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30µm	<10µm	<2.5µm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s — Mean windspeed from from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 1.5 % — Moisture Content in recently blasted material as provided by Champion Iron

Parameter	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Reference
TSP	4.71E-03	4.71E-03	AP-42 / 13.2.4
PM_{10}	2.23E-03	2.23E-03	AP-42 / 13.2.4
$PM_{2.5}$	3.37E-04	3.37E-04	AP-42 / 13.2.4

Sample Calculation for TSP EF (kg/Mg) Drop for IPO4 for 1-hr and 24-hr Emissions

$$EF = \frac{0.74 \times 0.0016 \times 4.66^{1.3} \times 2^{1.4}}{2.2^{1.3} \times 1.5^{1.4}}$$

$$EF = 4.71E\text{-}03\ \frac{kg}{Mg}$$

Sample Calculation for TSP ER for IPO4 for 1-hr and 24-hr Emissions

$$ER = \frac{4.71E\text{-}03\ kg}{Mg} \times \frac{4{,}480\ Mg}{hr} \times \frac{1000\ g}{kg} \times \frac{1\ hr}{3600\ s}$$

$$ER = 5.86E+00\ \frac{g}{s}$$

In-Pit Truck Loading (ore)

Source ID: IPO4

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	4,480	28,329,000	0.278	0.000032	5.86E+00	5.86E+00	4.23E+00
PM10	2.23E-03	2.23E-03	4,480	28,329,000	0.278	0.000032	2.77E+00	2.77E+00	2.00E+00
PM2.5	3.37E-04	3.37E-04	4,480	28,329,000	0.278	0.000032	4.19E-01	4.19E-01	3.03E-01

Low Grade Ore Stockpile

Source ID: OH1

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	0	0	0.278	0.000032	0.00E+00	0.00E+00	0.00E+00
PM10	2.23E-03	2.23E-03	0	0	0.278	0.000032	0.00E+00	0.00E+00	0.00E+00
PM2.5	3.37E-04	3.37E-04	0	0	0.278	0.000032	0.00E+00	0.00E+00	0.00E+00

Ore Stockpile

Source ID: OH2

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	4,480	28,329,000	0.278	0.000032	5.86E+00	5.86E+00	4.23E+00
PM10	2.23E-03	2.23E-03	4,480	28,329,000	0.278	0.000032	2.77E+00	2.77E+00	2.00E+00
PM2.5	3.37E-04	3.37E-04	4,480	28,329,000	0.278	0.000032	4.19E-01	4.19E-01	3.03E-01

Waste Rock Management

TSP, PM10 and PM2.5 emissions from bulldozing activities in the pit and at the waste stockpile were calculated using the emission factor equations from Table 11.9-2 of the U.S. EPA AP-42 document for bulldozing of overburden.

Waste rock is crushed in the pit before being loaded onto the in-pit conveyors. TSP and PM10 emissions from crushing were estimated in accordance with the emission factors in Table 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004) for tertiary crushing, since no data is available for primary crushing.

Waste rock handling operations occur in the pit when waste rock is dropped onto conveyors, and at various transfer points along the overland conveyor line. The crushed rock is transported to the waste rock stockpile. TSP, PM10 and PM2.5 emissions from outdoor material handling of waste rock were calculated using equation 1 from Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document dated November 2006. Emission rates have been obtained based on the average annual windspeed from the CALMET meteorological data set.

TSP, PM10 and PM2.5 emissions from conveyor transfer points at the transfer towers were calculated using the AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004) in the absence of emission factors for metallic minerals. A 99% control was applied to the transfer tower to account for the enclosure around the conveyor transfer point and the use of a fabric filter dust collector (Australian NPI Emission Estimation Technique Manual for Mining Version 3.1, Table 4, January 2012).

The annual emission rate is calculated based on the maximum mining rate.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

SCALING TABLES

Scaling Table	In Pit Bulldozing (Waste Rock)	Bulldozer at Waste Stockpile	Scaling Table	In Pit Crusher (waste rock)	Crushed waste rock drop to conveyor (in-pit)	Conveyor Transfer Towers for Waste Rock	Conveyor Transfer Tower 2 for Waste Rock	Crushed waste rock drop from last conveyor to Waste Stockpile	Crushed Waste Material Transfer to Spreader System	Crushed Waste Spreader System Drop to Pile
Source ID	IP05	BD1	**Source ID**	IPO6	IPO7	TT1	TT2	WRH1	WRH2	WRH3
Hours per Day	20	24	Hours per Day	24	24	24	24	24	24	24
Days per Year	365	365	Throughput [tpy]	45,461,000	45,461,000	45,461,000	45,461,000	45,461,000	45,461,000	45,461,000
hour per hour	1	1	Throughput [tpd]	214,200	214,200	214,200	214,200	214,200	214,200	214,200
Number of Units	2	1	Throughput [tph]	8,925	8,925	8,925	8,925	8,925	8,925	8,925
			Control Factor [%]	0	0	99	99	0	0	0

EMISSION FACTORS/ACTIVITIES

Bulldozing

Reference: *USEPA AP-42 11.9 Western Surface Coal Mining (7/98) overburden*

Compound	Equation	Surface Silt Content (s) [%]	Surface Moisture Content (M) [%]	EF [kg/hr]	Reference
TSP	$= 2.6 \times S^{1.2}/M^{1.3}$	5.80	1.5	1.27E+01	Table 11.9-2
TSPmetals	$= 2.6 \times S^{1.2}/M^{1.4}$	5.80	1.5	1.27E+01	Table 11.9-2
PM_{15}	$= 0.45 \times S^{1.5}/M^{1.4}$	5.80	1.5	3.56E+00	Table 11.9-2
PM_{10}	$= EF_{PM15} \times 0.75$	—	—	2.67E+00	Table 11.9-2
$PM_{2.5}$	$= EF_{TSP} \times 0.105$	—	—	1.33E+00	Table 11.9-2

Crushing and Material Transfers

Reference: *US. EPA AP-42 11.19.2-1 Crushed Stone Processing and Pulverized Mineral Processing, dated 8/04)*

Source	Unit	TSP	PM_{10}	$PM_{2.5}$
Primary Crushing	kg/Mg	0.0027	0.0012	No Data
	% of TSP	100%	44%	
Conveyor Transfer Point (uncontrolled)	kg/Mg	0.00150	5.50E-04	1.55E-04
	% of TSP	100%	37%	10%

Sample Calculation for TSP EF (kg/Mg) Drop for IPO6 for 1-hr Emissions

$$ER = \frac{0.0027\ kg}{Mg} \times \frac{8{,}925\ Mg}{hr} \times \frac{1000\ g}{kg} \times \frac{1\ hr}{3600\ s}$$

ER = 6.69E+00 g/s

ACTIVITY SUMMARY TABLE

Contaminant	Waste Rock Handling ER [g/s]			Waste Rock Handling Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	6.40E+01	6.22E+01	3.99E+01	1256.85
PM_{10}	2.73E+01	2.69E+01	1.64E+01	518.28
$PM_{2.5}$	5.94E+00	5.76E+00	3.74E+00	117.80

EMISSION RATE CALCULATIONS

In Pit Bulldozing (Waste Rock)

Source ID: IP05

Compound	EF [kg/hr]	Operating Time [hr/hr]	Conversion	Number of Units	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	1.27E+01	1	0.278	2	7.03E+00	5.86E+00	5.86E+00
PM10	2.67E+00	1	0.278	2	1.48E+00	1.24E+00	1.24E+00
PM2.5	1.33E+00	1	0.278	2	7.38E-01	6.15E-01	6.15E-01

Bulldozer at Waste Stockpile

Source ID: BD1

Compound	EF [kg/hr]	Operating Time [hr/hr]	Conversion	Number of Units	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	1.27E+01	1	0.278	1	3.51E+00	2.93E+00	2.93E+00
PM10	2.67E+00	1	0.278	1	7.42E-01	6.19E-01	6.19E-01
PM2.5	1.33E+00	1	0.278	1	3.69E-01	3.08E-01	3.08E-01

In Pit Crusher (waste rock)

Source ID: IPO6

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.0027	8,925	45,461,000	0.278	0.000032	0	6.69E+00	6.69E+00	3.89E+00
PM10	0.0012	8,925	45,461,000	0.278	0.000032	0	2.98E+00	2.98E+00	1.73E+00
PM2.5	0.0006	8,925	45,461,000	0.278	0.000032	0	1.49E+00	1.49E+00	8.65E-01

Waste Rock Management Continued

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document instead of Section 11.24 Metallic Minerals Processing to account for the high moisture content of the material.

$$EF\ (kg/Mg) = \frac{k\,(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30µm	<10µm	<2.5µm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s Mean windspeed from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 1.5 % Moisture Content in recently blasted material as provided by Champion Iron

Parameter	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Reference
TSP	4.71E-03	4.71E-03	AP-42 / 13.2.4
PM_{10}	2.23E-03	2.23E-03	AP-42 / 13.2.4
$PM_{2.5}$	3.37E-04	3.37E-04	AP-42 / 13.2.4

Sample Calculation for TSP EF (kg/Mg) Drop for IPO6

$$EF = \frac{0.740 \times 0.0016 \times \frac{4.66^{1.3}}{2.2^{1.3}} \times \frac{2.0^{1.4}}{1.5^{1.4}}}{}$$

$$EF = 4.71E\text{-}03\ \frac{kg}{Mg}$$

Sample Calculation for TSP ER for IPO6 for 1-hr and 24-hr Emissions

$$ER = \frac{4.71E\text{-}03\ kg}{Mg} \times \frac{8{,}925\ Mg}{hr} \times \frac{1000\ g}{kg} \times \frac{1\ hr}{3600\ s}$$

$$ER = 1.17E+01\ \frac{g}{s}$$

Sample Calculation for TSP ER for WRH1 Annual Emissions

$$ER = \frac{4.71E\text{-}03\ kg}{Mg} \times \frac{45{,}461{,}000\ Mg}{yr} \times \frac{1000\ g}{kg} \times \frac{1\ hr}{31536000\ s}$$

$$ER = 6.78E+00\ \frac{g}{s}$$

Crushed waste rock drop to conveyor (in-pit)

Source ID: IPO7

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	8,925	45,461,000	0.278	0.000032	1.17E+01	1.17E+01	6.78E+00
PM10	2.23E-03	2.23E-03	8,925	45,461,000	0.278	0.000032	5.52E+00	5.52E+00	3.21E+00
PM2.5	3.37E-04	3.37E-04	8,925	45,461,000	0.278	0.000032	8.36E-01	8.36E-01	4.86E-01

Conveyor Transfer Towers for Waste Rock

Source ID: TT1

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.00150	8,925	45,461,000	0.278	0.000032	99	3.72E-02	3.72E-02	2.16E-02
PM10	5.50E-04	8,925	45,461,000	0.278	0.000032	99	1.36E-02	1.36E-02	7.93E-03
PM2.5	1.55E-04	8,925	45,461,000	0.278	0.000032	99	3.85E-03	3.85E-03	2.24E-03

Conveyor Transfer Tower 2 for Waste Rock

Source ID: TT2

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.00150	8,925	45,461,000	0.278	0.000032	99	3.72E-02	3.72E-02	2.16E-02
PM10	5.50E-04	8,925	45,461,000	0.278	0.000032	99	1.36E-02	1.36E-02	7.93E-03
PM2.5	1.55E-04	8,925	45,461,000	0.278	0.000032	99	3.85E-03	3.85E-03	2.24E-03

Crushed waste rock drop from last conveyor to Waste Stockpile

Source ID: WRH1

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	8,925	45,461,000	0.278	0.000032	1.17E+01	1.17E+01	6.78E+00
PM10	2.23E-03	2.23E-03	8,925	45,461,000	0.278	0.000032	5.52E+00	5.52E+00	3.21E+00
PM2.5	3.37E-04	3.37E-04	8,925	45,461,000	0.278	0.000032	8.36E-01	8.36E-01	4.86E-01

Crushed Waste Material Transfer to Spreader System

Source ID: WRH2

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	8,925	45,461,000	0.278	0.000032	1.17E+01	1.17E+01	6.78E+00
PM10	2.23E-03	2.23E-03	8,925	45,461,000	0.278	0.000032	5.52E+00	5.52E+00	3.21E+00
PM2.5	3.37E-04	3.37E-04	8,925	45,461,000	0.278	0.000032	8.36E-01	8.36E-01	4.86E-01

Crushed Waste Spreader System Drop to Pile

Source ID: WRH3

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	8,925	45,461,000	0.278	0.000032	1.17E+01	1.17E+01	6.78E+00
PM10	2.23E-03	2.23E-03	8,925	45,461,000	0.278	0.000032	5.52E+00	5.52E+00	3.21E+00
PM2.5	3.37E-04	3.37E-04	8,925	45,461,000	0.278	0.000032	8.36E-01	8.36E-01	4.86E-01

Overburden Handling

Overburden handling operations occur in the pit when overburden is loaded into haul trucks. The overburden is trucked and unloaded at the overburden stockpile. TSP, PM_{10} and $PM_{2.5}$ emissions from material handling of overburden were calculated using equation 1 from Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document dated November 2006.

Emission rates for 1-hr and 24-hr averaging times have been obtained based on the maximum daily average windspeed from the CALMET meteorological data set. An emission rate for the annual averaging time has been obtained based on the average annual windspeed from the CALMET meteorological data set.

The annual emission rates were estimated assuming the projected overburden generated during the first year of production, which is the year with the projected maximum material mined. A 50% control was applied to the drop to the stockpile to account for wet suppression control measures.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

SCALING TABLES

Scaling Table	In-Pit Truck Loading (overburden)	Material Drop to Overburden Stockpile
Source ID	IPO9	OB1
Hours per Day	24	24
Throughput [tpy]	25,243,000	25,243,000
Throughput [tpd]	69,159	69,159
Throughput [tph]	2,882	2,882
Control Factor [%]	0	50

ACTIVITY SUMMARY TABLE

Contaminant	Overburden Handling ER [g/s]			Waste Rock Handling Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	1.11E+00	1.11E+00	1.11E+00	34.96
PM_{10}	5.24E-01	5.24E-01	5.24E-01	16.54
$PM_{2.5}$	7.94E-02	7.94E-02	7.94E-02	2.50

EMISSION FACTORS/ACTIVITIES

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document instead of Section 11.24 Metallic Minerals Processing to account for the high moisture content of the material.

$$EF\ (kg/Mg) = \frac{k\,(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30μm	<10μm	<2.5μm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s Mean windspeed from from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 4.8 % Moisture Content in recently blasted material as provided by Champion Iron is 7.9%, maximum applicability for equation is 4.8%

Parameter	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Reference
TSP	9.23E-04	9.23E-04	AP-42 / 13.2.4
PM_{10}	4.37E-04	4.37E-04	AP-42 / 13.2.4
$PM_{2.5}$	6.61E-05	6.61E-05	AP-42 / 13.2.4

Overburden Handling Continued

Sample Calculation for TSP EF (kg/Mg) Drop for IPO9

$$EF = \frac{0.740 \quad 0.0016 \quad 4.66^{1.3} \quad 2^{1.4}}{2.2^{1.3} \quad 4.8^{1.4}}$$

$$EF = 9.23E\text{-}04\ \frac{kg}{Mg}$$

Sample Calculation for TSP ER for IPO9 for 1-hr and 24-hr Emissions

$$ER = \frac{9.23E\text{-}04\ kg}{Mg} \quad \frac{2{,}882\ Mg}{hr} \quad \frac{1000\ g}{kg} \quad \frac{1\ hr}{3600\ s}$$

$$ER = 7.39E\text{-}01\ \frac{g}{s}$$

Sample Calculation for TSP ER for IPO9 for Annual Emissions

$$ER = \frac{9.23E\text{-}04\ kg}{Mg} \quad \frac{25{,}243{,}000\ Mg}{yr} \quad \frac{1000\ g}{kg} \quad \frac{1\ hr}{31{,}536{,}000\ s}$$

$$ER = 7.39E\text{-}01\ \frac{g}{s}$$

EMISSION RATE CALCULATIONS

In-Pit Truck Loading (overburden)

Source ID: IPO9

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	9.23E-04	9.23E-04	2,882	25,243,000	0.278	0.000032	7.39E-01	7.39E-01	7.39E-01
PM10	4.37E-04	4.37E-04	2,882	25,243,000	0.278	0.000032	3.50E-01	3.50E-01	3.50E-01
PM2.5	6.61E-05	6.61E-05	2,882	25,243,000	0.278	0.000032	5.29E-02	5.29E-02	5.29E-02

Material Drop to Overburden Stockpile

Source ID: OB1

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	9.23E-04	9.23E-04	2,882	25,243,000	0.278	0.000032	50	3.70E-01	3.70E-01	3.70E-01
PM10	4.37E-04	4.37E-04	2,882	25,243,000	0.278	0.000032	50	1.75E-01	1.75E-01	1.75E-01
PM2.5	6.61E-05	6.61E-05	2,882	25,243,000	0.278	0.000032	50	2.65E-02	2.65E-02	2.65E-02

Crusher Area Ore Handling

The crushed ore from the primary crusher is conveyed to the crushed ore stockpile via the take away belt conveyor. The crushed ore transfers to the sacrificial belt conveyor through the apron feeder which is located under the stockpile. The apron feeder is located underground. The crushed ore transfers from the sacrificial belt conveyor to the overland conveyor at the transfer tower. The transfer tower is enclosed with the exception of the openings for the conveyors and is equipped with a dust collector. The overland conveyor carries the ore to the dome enclosure where it is stockpiled as feed for the mill.

The primary crusher is controlled by a dust collector. TSP and PM10 emissions from primary crushing low moisture ore were estimated using the AP-42 CH 11.24 Emission Factors for Metallic Minerals Processing - Table 11.24-1 (August 1982). The emission factor for PM2.5 is not available so it was estimated using the fraction of PM2.5 and PM10 from tertiary crushing (controlled) from AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004). A 99% control was applied to account for the dust collector efficiency as per the US EPA Control Device - Capture/Disposal fact sheet for Fabric Filter - Pulse-Jet Cleaned Type dust collectors (EPA-452/F-03-025).

TSP, PM10 and PM2.5 emissions from the material drop to the apron feeder were estimated using the material handling and transfer - all material except bauxite emission factor for low moisture ore from the AP-42 CH 11.24 Emission Factors for Metallic Minerals Processing - Table 11.24-1 (August 1982). The emission factor for PM2.5 is not available so it was estimated using the fraction of PM2.5 and PM10 from the Conveyor Transfer Point (Controlled) from the AP-42 Ch 11.19.2 (August 2004). A 99% control was applied to account for the dust collector efficiency as per the US EPA Control Device - Capture/Disposal fact sheet for Fabric Filter - Pulse-Jet Cleaned Type dust collectors (EPA-452/F-03-025).

TSP, PM10 and PM2.5 emissions from conveyor transfer points were calculated using the AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004) in the absence of emission factors for metallic minerals. The emission factor for PM2.5 is not available so it was estimated using the fraction of PM2.5 and PM10 from the Conveyor Transfer Point (Controlled). A 99% control was applied to the transfer tower to account for the enclosure around the conveyor transfer point and the use of a fabric filter dust collector (Australian NPI Emission Estimation Technique Manual for Mining Version 3.1, Table 4, January 2012).

TSP, PM_{10} and $PM_{2.5}$ emissions from the conveyor drop to the crushed ore stockpile and stockpile located in the dome are calculated using the AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document dated November 2006. A 75% control is applied to the conveyor transfer to the stockpile in the dome to account for the enclosure around the stockpile (WRAP Fugitive Dust Handbook, September 2006).

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

SCALING TABLE

Scaling Table	Primary Crushing (ore)	Material Transfer Via Conveyor From Primary Crusher to Ore Stockpile	Overland Conveyor Transfer Tower (Ore)	Overland Conveyor Drop Point at Dome	Apron Feeder
Source ID	PCDC	OH3	TT3	OH4	AFDC
Annual Throughput [tonnes]	28,329,000	28,329,000	28,329,000	28,329,000	20,235,000
Hourly Throughput [tonnes]	4,480	4,480	4,480	4,480	3,200
Hours per Day	24	24	24	24	24
Days per Year	365	365	365	365	365
Control Factor	99	75	99	75	99

ACTIVITY SUMMARY TABLE (ore handling)

Contaminant	Emission Rates (g/s)			Crushed Ore Handling Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	5.97E+00	5.97E+00	4.31E+00	1.36E+02
PM_{10}	1.91E+00	1.91E+00	1.38E+00	4.34E+01
$PM_{2.5}$	3.33E-01	3.33E-01	2.40E-01	7.58E+00

EMISSION FACTORS/ACTIVITIES

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document instead of Section 11.24 Metallic Minerals Processing to account for the high moisture content of the material.

$$EF\ (kg/Mg) = \frac{k\,(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30µm	<10µm	<2.5µm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s — Mean windspeed from from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 1.5 % — Moisture Content in recently blasted material as provided by Champion Iron

Parameter	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Reference
TSP	4.71E-03	4.71E-03	AP-42 / 13.2.4
PM_{10}	2.23E-03	2.23E-03	AP-42 / 13.2.4
$PM_{2.5}$	3.37E-04	3.37E-04	AP-42 / 13.2.4

EMISSION RATE CALCULATIONS

Primary Crushing (ore)

Source ID: PCDC

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.2	4,480	28,329,000	0.278	0.000032	99	2.49E+00	2.49E+00	1.80E+00
PM10	0.02	4,480	28,329,000	0.278	0.000032	99	2.49E-01	2.49E-01	1.80E-01
PM2.5	3.70E-03	4,480	28,329,000	0.278	0.000032	99	4.61E-02	4.61E-02	3.33E-02

Material Transfer Via Conveyor From Primary Crusher to Ore Stockpile

Source ID: OH3

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	4,480	28,329,000	0.278	0.000032	75	1.46E+00	1.46E+00	1.06E+00
PM10	2.23E-03	2.23E-03	4,480	28,329,000	0.278	0.000032	75	6.92E-01	6.92E-01	5.00E-01
PM2.5	3.37E-04	3.37E-04	4,480	28,329,000	0.278	0.000032	75	1.05E-01	1.05E-01	7.57E-02

Crusher Area Ore Handling Continued

Material Handling Emission Factors

Source	Unit	TSP	PM_{10}	$PM_{2.5}$	Reference
Primary Crushing (Low Moisture Ore)	kg/Mg	0.2	2.00E-02	3.70E-03	AP-42 Ch 11.24 Emission Factors for Primary Crushing Low Moisture Ore - Table 11.24-1 (August 1982)
	% of TSP	100%	10%	2%	
Material Handling and Transfer (Low Moisture Ore)	kg/Mg	0.06	3.00E-02	8.48E-03	AP-42 Ch 11.24 Emission Factors for Material Handling and Transfer - All Material Except bauxite - \ Low Moisture Ore - Table 11.24-1 (August 1982)
	% of TSP	100%	50%	14%	
Conveyor Transfer Point (uncontrolled)	kg/Mg	0.0015	5.50E-04	1.55E-04	AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004)
	% of TSP	100%	37%	10%	

Overland Conveyor Transfer Tower (Ore)

Source ID: TT3

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.0015	4,480	28,329,000	0.278	0.000032	99	1.87E-02	1.87E-02	1.35E-02
PM10	5.50E-04	4,480	28,329,000	0.278	0.000032	99	6.84E-03	6.84E-03	4.94E-03
PM2.5	1.55E-04	4,480	28,329,000	0.278	0.000032	99	1.93E-03	1.93E-03	1.40E-03

Overland Conveyor Drop Point at Dome

Source ID: OH4

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	4.71E-03	4.71E-03	4,480	28,329,000	0.278	0.000032	75	1.46E+00	1.46E+00	1.06E+00
PM10	2.23E-03	2.23E-03	4,480	28,329,000	0.278	0.000032	75	6.92E-01	6.92E-01	5.00E-01
PM2.5	3.37E-04	3.37E-04	4,480	28,329,000	0.278	0.000032	75	1.05E-01	1.05E-01	7.57E-02

Reference Apron Feeder

Source ID: AFDC

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Maximum Annual Processing Rate [Mg/yr]	Conversion kg/hr to g/s	Conversion kg/yr to g/s	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.06	3,200	20,235,000	0.278	0.000032	99	5.33E-01	5.33E-01	3.85E-01
PM10	0.03	3,200	20,235,000	0.278	0.000032	99	2.67E-01	2.67E-01	1.92E-01
PM2.5	8.48E-03	3,200	20,235,000	0.278	0.000032	99	7.54E-02	7.54E-02	5.44E-02

Concentrate Handling

The concentrate is transferred to a conveyor for transport to the concentrate storage silo. A transfer tower may move some of the concentrate to an emergency stockpile for temporary storage. A loader operating at the emergency stockpile moves material to the reclaim hopper which then unloads to a conveyor for transfer to the concentrate storage silo. Dust generated from the transfer of the concentrate into the storage silo is controlled by bin vents located on the top of the silo.

TSP and PM10 emissions from the concentrate transfer to the conveyor at the concentrator were estimated using the AP-42 Ch 11.24 Emission Factors for Metallic Mineral Processing - Table 11.24-1 (August 1982). The emission factor for PM2.5 is not available so it was estimated using the fraction of PM2.5 and PM10 from the Conveyor Transfer Point (Controlled) from the AP-42 Ch 11.19.2 (August 2004). A 75% control is applied to the concentrate conveyor loading to account for the enclosure around the transfer point (WRAP Fugitive Dust Handbook, September 2006).

TSP, PM10 and PM2.5 emissions from conveyor transfer point at the transfer tower were calculated using the AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004) in the absence of emission factors for metallic minerals. A 70% control was applied to the transfer tower to account for the enclosure around the conveyor transfer point (Australian NPI Emission Estimation Technique Manual for Mining Version 3.1, Table 4, January 2012).

TSP, PM_{10} and $PM_{2.5}$ emissions from loading the reclaim hopper conveyor, conveyor drop to the stockpile, and concentrate drop to the hopper are calculated using the AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document dated November 2006.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

SCALING TABLE

Scaling Table	Emergency Stockpile Transfer Tower	Concentrate Drop to Emergency Storage Stockpile	Emergency Storage Stockpile - Reclaim Hopper	Emergency Storage Stockpile - Reclaim Hopper to Conveyor	Reclaim Conveyor Transfer to Concentrate Conveyor	Silo Feed Dust Collector	Train Loadout Building Dust Collector	Rail Car Loading
Source ID	TT4	CH2	CH3	CH4	CH5	SFDC	TLDC	RCL
Hourly Throughput [tonnes]	1,160	1,160	1,000	1,000	1,000	1,160	1,160	1,160
Hours per Day	24	24	24	24	24	24	24	24
Days per Year	365	6	6	6	6	365	365	365
Control Factor	99	0	0	0	75	99	99	70

ACTIVITY SUMMARY TABLE (concentrate handling)

Contaminant	Emission Rates (g/s)			Concentrate Handling Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	8.58E+00	8.58E+00	1.32E+00	41.48
PM_{10}	4.06E+00	4.06E+00	6.32E-01	19.93
$PM_{2.5}$	6.45E-01	6.45E-01	1.21E-01	3.81

EMISSION FACTORS/ACTIVITIES

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document.

$$EF\ (kg/Mg) = \frac{k\,(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30µm	<10µm	<2.5µm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s Mean windspeed from from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 1.0 % Moisture content ranges from 1-6% as provided by Champion

Parameter	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Reference
TSP	8.30E-03	8.30E-03	AP-42 / 13.2.4
PM_{10}	3.93E-03	3.93E-03	AP-42 / 13.2.4
$PM_{2.5}$	5.95E-04	5.95E-04	AP-42 / 13.2.4

EMISSION RATE CALCULATIONS

Emergency Stockpile Transfer Tower

Source ID: TT4

Compound	EF [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.0015	1,160	0.278	99	4.83E-03	4.83E-03	4.83E-03
PM10	5.50E-04	1,160	0.278	99	1.77E-03	1.77E-03	1.77E-03
PM2.5	1.55E-04	1,160	0.278	99	5.01E-04	5.01E-04	8.23E-06

Concentrate Drop to Emergency Storage Stockpile

Source ID: CH2

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	8.30E-03	8.30E-03	1,160	0.278	0	2.67E+00	2.67E+00	4.40E-02
PM10	3.93E-03	3.93E-03	1,160	0.278	0	1.27E+00	1.27E+00	2.08E-02
PM2.5	5.95E-04	5.95E-04	1,160	0.278	0	1.92E-01	1.92E-01	3.15E-03

Concentrate Handling Continued

Material Handling Emission Factors

Reference:

US. EPA AP-42 11.24-1 Metallic Mineral Processing, dated 11/95) & US. EPA AP-42 11.19.2-1 Crushed Stone Processing and Pulverized Mineral Processing, dated 8/04)

Source	Unit	TSP	PM_{10}	$PM_{2.5}$	Reference
Material Handling and Transfer (low moisture ore)	kg/Mg	0.06	0.03	8.48E-03	AP-42 Ch 11.24 Emission Factors for Metallic Mineral Processing 8/82
	% of TSP	100%	50%	14%	
Conveyor Transfer Point (uncontrolled)	kg/Mg	0.0015	5.50E-04	1.55E-04	AP-42 Ch 11.19.2 Emission Factors for Crushed Stone Processing Operations - Table 11.19.2-1 (August 2004)
	% of TSP	100%	37%	10%	

Emergency Storage Stockpile - Reclaim Hopper

Source ID: CH3

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	8.30E-03	8.30E-03	1,000	0.278	0	2.31E+00	2.31E+00	3.79E-02
PM10	3.93E-03	3.93E-03	1,000	0.278	0	1.09E+00	1.09E+00	1.79E-02
PM2.5	5.95E-04	5.95E-04	1,000	0.278	0	1.65E-01	1.65E-01	2.71E-03

Emergency Storage Stockpile - Reclaim Hopper to Conveyor

Source ID: CH4

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	8.30E-03	8.30E-03	1,000	0.278	0	2.31E+00	2.31E+00	3.79E-02
PM10	3.93E-03	3.93E-03	1,000	0.278	0	1.09E+00	1.09E+00	1.79E-02
PM2.5	5.95E-04	5.95E-04	1,000	0.278	0	1.65E-01	1.65E-01	2.71E-03

Reclaim Conveyor Transfer to Concentrate Conveyor

Source ID: CH5

Compound	EF [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.0015	1,000	0.278	75	1.04E-01	1.04E-01	1.71E-03
PM10	5.50E-04	1,000	0.278	75	3.82E-02	3.82E-02	6.28E-04
PM2.5	1.55E-04	1,000	0.278	75	1.08E-02	1.08E-02	1.77E-04

Silo Feed Dust Collector

Source ID: SFDC

Compound	EF [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.06	1,160	0.278	99	1.93E-01	1.93E-01	1.93E-01
PM10	0.03	1,160	0.278	99	9.67E-02	9.67E-02	9.67E-02
PM2.5	0.008	1,160	0.278	99	2.73E-02	2.73E-02	2.73E-02

Train Loadout Building Dust Collector

Source ID: TLDC

Compound	EF [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	0.06	1,160	0.278	99	1.93E-01	1.93E-01	1.93E-01
PM10	0.03	1,160	0.278	99	9.67E-02	9.67E-02	9.67E-02
PM2.5	0.008	1,160	0.278	99	2.73E-02	2.73E-02	2.73E-02

Rail Car Loading

Source ID: RCL

Compound	EF for 1-hr and 24-hr Emissions [kg/Mg]	EF for Annual Emissions [kg/Mg]	Base [Mg/hr]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	8.30E-03	8.30E-03	1,160	0.278	70	8.02E-01	8.02E-01	8.02E-01
PM10	3.93E-03	3.93E-03	1,160	0.278	70	3.80E-01	3.80E-01	3.80E-01
PM2.5	5.95E-04	5.95E-04	1,160	0.278	70	5.75E-02	5.75E-02	5.75E-02

Wind Erosion - Stockpiles

An average value for wind erosion from open areas and stockpiles was recommended by Australian NPI Australia 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. The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

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.

An emission factor for PM2.5 was not available in the Australian NPI (2012) emission estimation technique manual for mining, so it was estimated by multiplying the TSP emission factor by the fraction of the PM2.5 and TSP particle size multipliers from the US EPA-42 Chapter 13.2.5 Emission Factor guidance document for Industrial Wind Erosion, dated November, 2006.

The annual emission rates in tonnes per year assume that there will be snow on the ground or precipitation levels greater than 0.254 mm per day for 182 days per year.

SCALING TABLE

Scaling Table	Fugitive Dust from Tailings Stockpile	Fugitive Dust from Waste Rock Stockpile	Fugitive Dust from Overburden Stockpile
Source ID	TMF	WRSP	OBSP
Surface Area [m²]	7,489,600	5,422,400	1,500,000
Surface Area [ha]	749	542	150
Hours per Day	24	24	24
Day per Year	365	365	365
Control Factor	50	50	50

EMISSION FACTORS/ACTIVITIES

Reference: *Australian NPI Mining, Version 3.1 (Table 2)*

Emission Factors

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	0.03	1.11E-05	5.56E-06	8.33E-07

Sample Calculation for EF Unit Conversion for TSP:

$$EF = \frac{0.4\ kg}{ha\text{-}hr} \times \frac{1{,}000\ g}{kg} \times \frac{1\ ha}{10{,}000\ m^2} \times \frac{1\ hr}{3{,}600\ s}$$

EF = 1.11E-05 g/m²/s

ACTIVITY SUMMARY TABLE

Contaminant	Emission Rates (g/s)			Wind Erosion Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
TSP	2.22E+01	2.22E+01	2.22E+01	3.50E+02
PM_{10}	1.11E+01	1.11E+01	1.11E+01	1.75E+02
$PM_{2.5}$	1.67E+00	1.67E+00	1.67E+00	2.62E+01

EMISSION RATE CALCULATIONS

Fugitive Dust from Tailings Stockpile

Source ID: TMF

Compound	EF [g/m²/s]	Surface Area [m²]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	1.11E-05	7.49E+06	0.278	50	1.16E+01	1.16E+01	1.16E+01
PM10	5.56E-06	7.49E+06	0.278	50	5.78E+00	5.78E+00	5.78E+00
PM2.5	8.33E-07	7.49E+06	0.278	50	8.67E-01	8.67E-01	8.67E-01

Fugitive Dust from Waste Rock Stockpile

Source ID: WRSP

Compound	EF [g/m²/s]	Surface Area [m²]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	1.11E-05	5.42E+06	0.278	50	8.37E+00	8.37E+00	8.37E+00
PM10	5.56E-06	5.42E+06	0.278	50	4.18E+00	4.18E+00	4.18E+00
PM2.5	8.33E-07	5.42E+06	0.278	50	6.28E-01	6.28E-01	6.28E-01

Fugitive Dust from Overburden Stockpile

Source ID: OBSP

Compound	EF [g/m²/s]	Surface Area [m²]	Conversion	Control Factor [%]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
TSP	1.11E-05	1.50E+06	0.278	50	2.31E+00	2.31E+00	2.31E+00
PM10	5.56E-06	1.50E+06	0.278	50	1.16E+00	1.16E+00	1.16E+00
PM2.5	8.33E-07	1.50E+06	0.278	50	1.74E-01	1.74E-01	1.74E-01

Non-Road Emission Calculation

Source	**Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition NR-009d (July 2010)** Assessment and Standards Division of the Office of Transportation and Air Quality United States Environmental Protection Agency EPA 420-R-10-018
Reference	Compression Ignition Load Factors -- Median Life, Annual Activity, and Load Factor Values for Nonroad engine Emissions Modeling – Report No. NR-005D, Table 9: pg.14

Emission Calculations

Mine Fleet (Non-Road)

Vehicle Type	Type	Equipment Model	Location	Number of Vehicles	Engine Size [hp]	Fuel per Vehicle [L/hr]	U.S. EPA Emission Standard	Load Factor	Daily Operating Hours Per Vehicle	Annual Operating Hours per Vehicle
Shovel	Loader	Komatsu PC5500	In Pit	2				**Electric**		
Production Drill	Drill Rig	Epiroc PV271	In Pit	6				**Electric**		
Auxiliary Pre-split Drill (4.5-8")	Drill Rig	EPIROC-SmartRoc D65	In Pit	1	540	45.7	Tier 4	0.43	24	8760
Haul Truck	Off-Highway Truck	Komatsu 930E	In Pit	7	3500	399.9	Tier 4	0.58	24	8760
Wheel Loader	Loader	Komatsu WE-1850	In Pit	2	2000	189.1	Tier 4	0.48	24	8760
Wheel Dozer	Wheel Dozer	Caterpillar 844	In Pit	2	766	87.5	Tier 4	0.58	24	8760
Track Dozer	Track Dozer	Komatsu DA475-8	In Pit	2	1040	118.8	Tier_4	0.58	24	8760
Stemming Loader	Loader	Komatsu-WA380-8	In Pit	2	191	18.1	Tier_4	0.48	24	8760
Haul Truck (100t)	Off-Highway Truck	CAT 777	In Pit	9	1025	117.1	Tier_4	0.58	24	8760
Excavator	Excavator	Komatsu PC 490	Ore Stockpile	1	362	37.8	Tier_4	0.53	24	8760
Wheel Loader	Wheel Dozer	—	Ore Stockpile	1	271	31.0	Tier 3	0.58	24	8760
Track Dozer	Track Dozer	Komatsu DA475-8	Waste Stockpile	1	1040	118.8	Tier_4	0.58	24	8760
Excavator	Excavator	Komatsu PC 490	Emergency Concentrate Stockpile	1	363	37.9	Tier_4	0.53	24	8760
Excavator	Excavator	Komatsu PC800	TMF	1	496	51.8	Tier_4	0.53	24	4818
Track Dozer	Track Dozer	Komatsu DA475-8	TMF	1	1040	118.8	Tier_4	0.58	24	4380
Motor Grader (18ft)	Grader	Caterpillar 16M	TMF	1	290	33.1	Tier 4	0.58	24	4380
Wheel Loader 271HP	Loader	—	TMF	1	271	25.6	Tier 3	0.48	24	4380
Haul Truck	Off-Highway Truck	Komatsu 930E	UPR1	2	3500	399.9	Tier 4	0.58	24	8760
Haul Truck (100t)	Off-Highway Truck	CAT 777	UPR2	3	1025	117.1	Tier 4	0.58	24	8760
Motor Grader (18ft)	Grader	Caterpillar 16M	General Site	3	290	33.1	Tier 4	0.58	24	8760
Water/Sand Truck (76kL tank)	Off-Highway Truck	Komatsu-HD785-8	General Site	2	1200	137.1	Tier 4	0.58	24	8760
Fuel & Lube truck 10Wheel	Off-Highway Truck	—	General Site	1	450	51.4	Tier 3	0.58	24	8760
Pipelayer Dozer	Track Dozer	Komatsu-D155CX-8	General Site	1	354	40.4	Tier 4	0.58	24	8760
Cable Handling Wheel Loader 271HP	Loader	Komatsu-WA475-10	General Site	2	290	27.4	Tier 4	0.48	24	8760

PM Emissions

Engine	Number of Vehicles	Location	Hp	U.S. EPA Emission Standard [Tier]	Compound	Non-Road Emission Standard [g/hp-hr]	Load Factor	Daily Operating Hours	Daily Emission Rate [g/s]	Annual Operating Hours per Vehicle	Annual Emission Rate [g/s]
Auxiliary Pre-split Drill (4.5-8")	1	In Pit	540	Tier 4	PM	0.01	0.43	24	6.45E-04	8760	6.45E-04
Haul Truck	7	In Pit	3500	Tier 4	PM	0.03	0.58	24	1.18E-01	8760	1.18E-01
Wheel Loader	2	In Pit	2000	Tier 4	PM	0.03	0.48	24	1.60E-02	8760	1.60E-02
Wheel Dozer	2	In Pit	766	Tier 4	PM	0.03	0.58	24	7.40E-03	8760	7.40E-03
Track Dozer	2	In Pit	1040	Tier_4	PM	0.03	0.58	24	1.01E-02	8760	1.01E-02
Stemming Loader	2	In Pit	191	Tier_4	PM	0.01	0.48	24	5.09E-04	8760	5.09E-04
Haul Truck (100t)	9	In Pit	1025	Tier_4	PM	0.03	0.58	24	4.46E-02	8760	4.46E-02
Excavator	1	Ore Stockpile	362	Tier_4	PM	0.01	0.53	24	5.33E-04	8760	5.33E-04
Wheel Loader	1	Ore Stockpile	271	Tier 3	PM	0.15	0.58	24	6.55E-03	8760	6.55E-03
Track Dozer	1	Waste Stockpile	1040	Tier_4	PM	0.03	0.58	24	5.03E-03	8760	5.03E-03
Excavator	1	Emergency Concentrate Stockpile	363	Tier_4	PM	0.01	0.53	24	5.34E-04	8760	5.34E-04
Excavator	1	TMF	496	Tier_4	PM	0.01	0.53	24	7.30E-04	4818	4.02E-04
Track Dozer	1	TMF	1040	Tier_4	PM	0.03	0.58	24	5.03E-03	4380	2.51E-03
Motor Grader (18ft)	1	TMF	290	Tier 4	PM	0.01	0.58	24	4.67E-04	4380	2.34E-04
Wheel Loader 271HP	1	TMF	271	Tier 3	PM	0.15	0.48	24	5.42E-03	4380	2.71E-03
Haul Truck	2	UPR1	3500	Tier 4	PM	0.03	0.58	24	3.38E-02	8760	3.38E-02
Haul Truck (100t)	3	UPR2	1025	Tier 4	PM	0.03	0.58	24	1.49E-02	8760	1.49E-02
Motor Grader (18ft)	3	General Site	290	Tier 4	PM	0.01	0.58	24	1.40E-03	8760	1.40E-03
Water/Sand Truck (76kL tank)	2	General Site	1200	Tier 4	PM	0.03	0.58	24	1.16E-02	8760	1.16E-02
Fuel & Lube truck 10Wheel	1	General Site	450	Tier 3	PM	0.15	0.58	24	1.09E-02	8760	1.09E-02
Pipelayer Dozer	1	General Site	354	Tier 4	PM	0.01	0.58	24	5.70E-04	8760	5.70E-04
Cable Handling Wheel Loader 271HP	2	General Site	290	Tier 4	PM	0.01	0.48	24	7.73E-04	8760	7.73E-04
								PM	**2.96E-01**	**—**	**2.90E-01**

Non-Road Emission Calculation Continued

NOx Emissions

Engine	Number of Vehicles	Location	Hp	Tier	Compound	Non-Road Emission Standard [g/hp-hr]	Load Factor	Daily Operating Hours	Daily Emission Rate [g/s]	Annual Operating Hours per Vehicle	Annual Emission Rate [g/s]
Auxiliary Pre-split Drill (4.5-8")	1	In Pit	540	Tier 4	NOx	0.30	0.43	24	1.94E-02	8760	1.94E-02
Haul Truck	7	In Pit	3500	Tier 4	NOx	2.60	0.58	24	1.03E+01	8760	1.03E+01
Wheel Loader	2	In Pit	2000	Tier 4	NOx	2.60	0.48	24	1.39E+00	8760	1.39E+00
Wheel Dozer	2	In Pit	766	Tier 4	NOx	2.60	0.58	24	6.42E-01	8760	6.42E-01
Track Dozer	2	In Pit	1040	Tier_4	NOx	2.60	0.58	24	8.71E-01	8760	8.71E-01
Stemming Loader	2	In Pit	191	Tier_4	NOx	0.30	0.48	24	1.53E-02	8760	1.53E-02
Haul Truck (100t)	9	In Pit	1025	Tier_4	NOx	2.60	0.58	24	3.86E+00	8760	3.86E+00
Excavator	1	Ore Stockpile	362	Tier_4	NOx	0.30	0.53	24	1.60E-02	8760	1.60E-02
Wheel Loader	1	Ore Stockpile	271	Tier 3	NOx	2.62	0.58	24	1.14E-01	8760	1.14E-01
Track Dozer	1	Waste Stockpile	1040	Tier_4	NOx	2.60	0.58	24	4.36E-01	8760	4.36E-01
Excavator	1	Emergency Concentrate Stockpile	363	Tier_4	NOx	0.30	0.53	24	1.60E-02	8760	1.60E-02
Excavator	1	TMF	496	Tier_4	NOx	0.30	0.53	24	2.19E-02	4818	1.20E-02
Track Dozer	1	TMF	1040	Tier_4	NOx	2.60	0.58	24	4.36E-01	4380	2.18E-01
Motor Grader (18ft)	1	TMF	290	Tier 4	NOx	0.30	0.58	24	1.40E-02	4380	7.01E-03
Wheel Loader 271HP	1	TMF	271	Tier 3	NOx	2.62	0.48	24	9.47E-02	4380	4.73E-02
Haul Truck	2	UPR1	3500	Tier 4	NOx	2.60	0.58	24	2.93E+00	8760	2.93E+00
Haul Truck (100t)	3	UPR2	1025	Tier 4	NOx	2.60	0.58	24	1.29E+00	8760	1.29E+00
Motor Grader (18ft)	3	General Site	290	Tier 4	NOx	0.30	0.58	24	4.21E-02	8760	4.21E-02
Water/Sand Truck (76kL tank)	2	General Site	1200	Tier 4	NOx	2.60	0.58	24	1.01E+00	8760	1.01E+00
Fuel & Lube truck 10Wheel	1	General Site	450	Tier 3	NOx	2.62	0.58	24	1.90E-01	8760	1.90E-01
Pipelayer Dozer	1	General Site	354	Tier 4	NOx	0.30	0.58	24	1.71E-02	8760	1.71E-02
Cable Handling Wheel Loader 271HP	2	General Site	290	Tier 4	NOx	0.30	0.48	24	2.32E-02	8760	2.32E-02
								NOx	**2.37E+01**	—	**2.34E+01**

SO2 Emissions | Sulphur Content (ppm) | *15* | *Density of Diesel (g/l)* | *845*

Engine	Number of Vehicles	Location	Hp	Tier	Compound	Fuel Consumption per Vehicle [L/hr]	Emission Factor [g/L]	Daily Operating Hours	Daily Emission Rate [g/s]	Annual Operating Hours per Vehicle	Annual Emission Rate [g/s]
Auxiliary Pre-split Drill (4.5-8")	1	In Pit	540	Tier 4	SO2	45.74	2.54E-02	24	3.22E-04	8760	3.22E-04
Haul Truck	7	In Pit	3500	Tier 4	SO2	399.92	2.54E-02	24	1.97E-02	8760	1.97E-02
Wheel Loader	2	In Pit	2000	Tier 4	SO2	189.12	2.54E-02	24	2.66E-03	8760	2.66E-03
Wheel Dozer	2	In Pit	766	Tier 4	SO2	87.52	2.54E-02	24	1.23E-03	8760	1.23E-03
Track Dozer	2	In Pit	1040	Tier_4	SO2	118.83	2.54E-02	24	1.67E-03	8760	1.67E-03
Stemming Loader	2	In Pit	191	Tier_4	SO2	18.06	2.54E-02	24	2.54E-04	8760	2.54E-04
Haul Truck (100t)	9	In Pit	1025	Tier_4	SO2	117.12	2.54E-02	24	7.42E-03	8760	7.42E-03
Excavator	1	Ore Stockpile	362	Tier_4	SO2	37.80	2.54E-02	24	2.66E-04	8760	2.66E-04
Wheel Loader	1	Ore Stockpile	271	Tier 3	SO2	189.12	2.54E-02	24	1.33E-03	8760	1.33E-03
Track Dozer	1	Waste Stockpile	1040	Tier_4	SO2	118.83	2.54E-02	24	8.37E-04	8760	8.37E-04
Excavator	1	Emergency Concentrate Stockpile	363	Tier_4	SO2	37.80	2.54E-02	24	2.66E-04	8760	2.66E-04
Excavator	1	TMF	496	Tier_4	SO2	37.80	2.54E-02	24	2.66E-04	4818	1.46E-04
Track Dozer	1	TMF	1040	Tier_4	SO2	118.83	2.54E-02	24	8.37E-04	4380	4.18E-04
Motor Grader (18ft)	1	TMF	290	Tier 4	SO2	33.14	2.54E-02	24	2.33E-04	4380	1.17E-04
Wheel Loader 271HP	1	TMF	271	Tier 3	SO2	25.63	2.54E-02	24	1.80E-04	4380	9.02E-05
Haul Truck	2	UPR1	3500	Tier 4	SO2	399.92	2.54E-02	24	5.63E-03	8760	5.63E-03
Haul Truck (100t)	3	UPR2	1025	Tier 4	SO2	117.12	2.54E-02	24	2.47E-03	8760	2.47E-03
Motor Grader (18ft)	3	General Site	290	Tier 4	SO2	33.14	2.54E-02	24	7.00E-04	8760	7.00E-04
Water/Sand Truck (76kL tank)	2	General Site	1200	Tier 4	SO2	137.11	2.54E-02	24	1.93E-03	8760	1.93E-03
Fuel & Lube truck 10Wheel	1	General Site	450	Tier 3	SO2	51.42	2.54E-02	24	3.62E-04	8760	3.62E-04
Pipelayer Dozer	1	General Site	354	Tier 4	SO2	40.45	2.54E-02	24	2.85E-04	8760	2.85E-04
Cable Handling Wheel Loader 271HP	2	General Site	290	Tier 4	SO2	27.42	2.54E-02	24	3.86E-04	8760	3.86E-04
								SO2	**4.93E-02**	—	**4.85E-02**

CO Emissions

Engine	Number of Vehicles	Location	Hp	Tier	Compound	Non-Road Emission Standard [g/hp-hr]	Load Factor	Daily Operating Hours	Daily Emission Rate [g/s]	Annual Operating Hours per Vehicle	Annual Emission Rate [g/s]
Auxiliary Pre-split Drill (4.5-8")	1	In Pit	540	Tier 4	CO	2.6	0.43	24	1.68E-01	8760	1.68E-01
Haul Truck	7	In Pit	3500	Tier 4	CO	2.6	0.58	24	1.03E+01	8760	1.03E+01
Wheel Loader	2	In Pit	2000	Tier 4	CO	2.6	0.48	24	1.39E+00	8760	1.39E+00
Wheel Dozer	2	In Pit	766	Tier 4	CO	2.6	0.58	24	6.42E-01	8760	6.42E-01
Track Dozer	2	In Pit	1040	Tier_4	CO	2.6	0.58	24	8.71E-01	8760	8.71E-01
Stemming Loader	2	In Pit	191	Tier_4	CO	2.6	0.48	24	1.32E-01	8760	1.32E-01
Haul Truck (100t)	9	In Pit	1025	Tier_4	CO	2.6	0.58	24	3.86E+00	8760	3.86E+00
Excavator	1	Ore Stockpile	362	Tier_4	CO	2.6	0.53	24	1.39E-01	8760	1.39E-01
Wheel Loader	1	Ore Stockpile	271	Tier 3	CO	2.6	0.58	24	1.14E-01	8760	1.14E-01
Track Dozer	1	Waste Stockpile	1040	Tier_4	CO	2.6	0.58	24	4.36E-01	8760	4.36E-01
Excavator	1	Emergency Concentrate Stockpile	363	Tier_4	CO	2.6	0.53	24	1.39E-01	8760	1.39E-01
Excavator	1	TMF	496	Tier_4	CO	2.6	0.53	24	1.90E-01	4818	1.04E-01
Track Dozer	1	TMF	1040	Tier_4	CO	2.6	0.58	24	4.36E-01	4380	2.18E-01
Motor Grader (18ft)	1	TMF	290	Tier 4	CO	2.6	0.58	24	1.21E-01	4380	6.07E-02
Wheel Loader 271HP	1	TMF	271	Tier 3	CO	2.6	0.48	24	9.39E-02	4380	4.70E-02
Haul Truck	2	UPR1	3500	Tier 4	CO	2.6	0.58	24	2.93E+00	8760	2.93E+00
Haul Truck (100t)	3	UPR2	1025	Tier 4	CO	2.6	0.58	24	1.29E+00	8760	1.29E+00
Motor Grader (18ft)	3	General Site	290	Tier 4	CO	2.6	0.58	24	3.64E-01	8760	3.64E-01
Water/Sand Truck (76kL tank)	2	General Site	1200	Tier 4	CO	2.6	0.58	24	1.01E+00	8760	1.01E+00
Fuel & Lube truck 10Wheel	1	General Site	450	Tier 3	CO	2.6	0.58	24	1.89E-01	8760	1.89E-01
Pipelayer Dozer	1	General Site	354	Tier 4	CO	2.6	0.58	24	1.48E-01	8760	1.48E-01
Cable Handling Wheel Loader 271HP	2	General Site	290	Tier 4	CO	2.6	0.48	24	2.01E-01	8760	2.01E-01
								CO	**2.51E+01**	—	**2.47E+01**

Non-Road Emission Calculation Continued

MOVES Emission Factors and PAH Emissions

Equipment	MOVES Equipment Category	Engine (HP)	Emission Factors (g/hp-hr)							
			BaP	Benz(a)anthracene	Benzo(b+)+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Indenol(1,2,3-cd)pyrene	Naphthalene
Auxiliary Pre-split Drill (4.5-8")	Bore/Drill Rigs	755	3.27E-07	4.44E-07	4.93E-07	3.48E-07	7.62E-07	9.65E-08	3.23E-07	1.15E-08
Haul Truck	Off-highway trucks	3500	1.52E-07	1.76E-07	2.43E-07	1.72E-07	2.98E-07	2.16E-08	1.53E-07	1.64E-08
Wheel Loader	Rubber Tire Loaders	2000	2.25E-07	2.64E-07	3.60E-07	2.54E-07	4.47E-07	3.34E-08	2.26E-07	1.57E-08
Wheel Dozer	Crawler Tractor/Dozer	766	1.79E-07	2.09E-07	2.87E-07	2.03E-07	3.52E-07	2.57E-08	1.80E-07	1.62E-08
Track Dozer	Crawler Tractor/Dozer	1040	1.79E-07	2.09E-07	2.87E-07	2.03E-07	3.52E-07	2.57E-08	1.80E-07	1.62E-08
Stemming Loader	Rubber Tire Loaders	191	3.79E-08	6.66E-08	6.09E-08	4.29E-08	8.07E-08	5.42E-09	3.82E-08	1.57E-08
Haul Truck (100t)	Off-highway trucks	1025	1.52E-07	1.76E-07	2.43E-07	1.72E-07	2.98E-07	2.16E-08	1.53E-07	1.64E-08
Excavator	Excavators	362	3.96E-08	6.84E-08	6.35E-08	4.48E-08	8.39E-08	5.65E-09	3.99E-08	1.56E-08
Wheel Loader	Rubber Tire Loaders	271	3.79E-08	6.66E-08	6.09E-08	4.29E-08	8.07E-08	5.42E-09	3.82E-08	1.57E-08
Track Dozer	Crawler Tractor/Dozer	1040	1.79E-07	2.09E-07	2.87E-07	2.03E-07	3.52E-07	2.57E-08	1.80E-07	1.62E-08
Excavator	Excavators	363	3.96E-08	6.84E-08	6.35E-08	4.48E-08	8.39E-08	5.65E-09	3.99E-08	1.56E-08
Excavator	Excavators	496	3.96E-08	6.84E-08	6.35E-08	4.48E-08	8.39E-08	5.65E-09	3.99E-08	1.56E-08
Track Dozer	Crawler Tractor/Dozer	1040	1.79E-07	2.09E-07	2.87E-07	2.03E-07	3.52E-07	2.57E-08	1.80E-07	1.62E-08
Motor Grader (18ft)	Graders	290	3.33E-08	6.21E-08	5.35E-08	3.77E-08	7.18E-08	4.76E-09	3.36E-08	1.62E-08
Wheel Loader 271HP	Rubber Tire Loaders	271	3.79E-08	6.66E-08	6.09E-08	4.29E-08	8.07E-08	5.42E-09	3.82E-08	1.57E-08
Haul Truck	Off-highway trucks	3500	1.52E-07	1.76E-07	2.43E-07	1.72E-07	2.98E-07	2.16E-08	1.53E-07	1.64E-08
Haul Truck (100t)	Off-highway trucks	1025	1.52E-07	1.76E-07	2.43E-07	1.72E-07	2.98E-07	2.16E-08	1.53E-07	1.64E-08
Motor Grader (18ft)	Graders	290	3.33E-08	6.21E-08	5.35E-08	3.77E-08	7.18E-08	4.76E-09	3.36E-08	1.62E-08
Water/Sand Truck (76kL tank)	Off-highway trucks	1200	1.52E-07	1.76E-07	2.43E-07	1.72E-07	2.98E-07	2.16E-08	1.53E-07	1.64E-08
Fuel & Lube truck 10Wheel	Off-highway trucks	450	3.25E-08	6.11E-08	5.22E-08	3.68E-08	7.03E-08	4.64E-09	3.28E-08	1.62E-08
Pipelayer Dozer	Crawler Tractor/Dozer	354	6.62E-08	9.92E-08	1.06E-07	7.49E-08	1.36E-07	9.45E-09	6.67E-08	1.55E-08
Cable Handling Wheel Loader 271HP	Rubber Tire Loaders	290	3.79E-08	6.66E-08	6.09E-08	4.29E-08	8.07E-08	5.42E-09	3.82E-08	1.57E-08

Equipment	MOVES Equipment Category	Engine (HP)	Load Factor	Number of Vehicles	Location	1 hour and 24 hour Emission Rates [g/s]							
						BaP	Benz(a)anthracene	Benzo(b+)+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Indenol(1,2,3-cd)pyrene	Naphthalene
Auxiliary Pre-split Drill (4.5-8")	Bore/Drill Rigs	755	0.43	1	In Pit	2.95E-08	4.00E-08	4.44E-08	3.14E-08	6.87E-08	8.70E-09	2.91E-08	1.04E-09
Haul Truck	Off-highway trucks	3500	0.58	7	In Pit	5.98E-07	6.96E-07	9.60E-07	6.77E-07	1.17E-06	8.54E-08	6.03E-07	6.48E-08
Wheel Loader	Rubber Tire Loaders	2000	0.48	2	In Pit	1.20E-07	1.41E-07	1.92E-07	1.35E-07	2.38E-07	1.78E-08	1.21E-07	8.35E-09
Wheel Dozer	Crawler Tractor/Dozer	766	0.58	2	In Pit	4.42E-08	5.15E-08	7.09E-08	5.00E-08	8.69E-08	6.34E-09	4.45E-08	3.99E-09
Track Dozer	Crawler Tractor/Dozer	1040	0.58	2	In Pit	6.00E-08	6.99E-08	9.63E-08	6.79E-08	1.18E-07	8.61E-09	6.05E-08	5.41E-09
Stemming Loader	Rubber Tire Loaders	191	0.48	2	In Pit	1.93E-09	3.39E-09	3.10E-09	2.19E-09	4.11E-09	2.76E-10	1.95E-09	7.97E-10
Haul Truck (100t)	Off-highway trucks	1025	0.58	9	In Pit	2.25E-07	2.62E-07	3.61E-07	2.55E-07	4.42E-07	3.21E-08	2.27E-07	2.44E-08
Excavator	Excavators	362	0.53	1	Ore Stockpile	2.11E-09	3.65E-09	3.38E-09	2.39E-09	4.47E-09	3.01E-10	2.12E-09	8.30E-10
Wheel Loader	Rubber Tire Loaders	271	0.58	1	Ore Stockpile	1.66E-09	2.91E-09	2.66E-09	1.88E-09	3.52E-09	2.37E-10	1.67E-09	6.84E-10
Track Dozer	Crawler Tractor/Dozer	1040	0.58	1	Waste Stockpile	3.00E-08	3.49E-08	4.81E-08	3.40E-08	5.90E-08	4.30E-09	3.02E-08	2.71E-09
Excavator	Excavators	363	0.53	1	Emergency Concentrate Stockpile	2.12E-09	3.66E-09	3.39E-09	2.39E-09	4.48E-09	3.02E-10	2.13E-09	8.33E-10
Excavator	Excavators	496	0.53	1	TMF	2.89E-09	5.00E-09	4.64E-09	3.27E-09	6.12E-09	4.13E-10	2.91E-09	1.14E-09
Track Dozer	Crawler Tractor/Dozer	1040	0.58	1	TMF	3.00E-08	3.49E-08	4.81E-08	3.40E-08	5.90E-08	4.30E-09	3.02E-08	2.71E-09
Motor Grader (18ft)	Graders	290	0.58	1	TMF	1.56E-09	2.90E-09	2.50E-09	1.76E-09	3.36E-09	2.22E-10	1.57E-09	7.57E-10
Wheel Loader 271HP	Rubber Tire Loaders	271	0.48	1	TMF	1.37E-09	2.41E-09	2.20E-09	1.55E-09	2.92E-09	1.96E-10	1.38E-09	5.66E-10
Haul Truck	Off-highway trucks	3500	0.58	2	UPR1	1.71E-07	1.99E-07	2.74E-07	1.93E-07	3.36E-07	2.44E-08	1.72E-07	1.85E-08
Haul Truck (100t)	Off-highway trucks	1025	0.58	3	UPR2	7.51E-08	8.73E-08	1.20E-07	8.50E-08	1.47E-07	1.07E-08	7.56E-08	8.13E-09
Motor Grader (18ft)	Graders	290	0.58	3	General Site	4.67E-09	8.70E-09	7.49E-09	5.29E-09	1.01E-08	6.67E-10	4.71E-09	2.27E-09
Water/Sand Truck (76kL tank)	Off-highway trucks	1200	0.58	2	General Site	5.86E-08	6.82E-08	9.40E-08	6.63E-08	1.15E-07	8.36E-09	5.90E-08	6.35E-09
Fuel & Lube truck 10Wheel	Off-highway trucks	450	0.58	1	General Site	2.36E-09	4.43E-09	3.78E-09	2.67E-09	5.09E-09	3.37E-10	2.38E-09	1.18E-09
Pipelayer Dozer	Crawler Tractor/Dozer	354	0.58	1	General Site	3.77E-09	5.66E-09	6.05E-09	4.27E-09	7.76E-09	5.39E-10	3.80E-09	8.83E-10
Cable Handling Wheel Loader 271HP	Rubber Tire Loaders	290	0.48	2	General Site	2.93E-09	5.15E-09	4.71E-09	3.32E-09	6.24E-09	4.19E-10	2.96E-09	1.21E-09

PAHs/VOCs Emissions

Engine	Number of Vehicles	Location	Annual Operating Hours per Vehicle	Annual Emission Rate [g/s]							
				BaP	Benz(a)anthracene	Benzo(b+)+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Indenol(1,2,3-cd)pyrene	Naphthalene
Auxiliary Pre-split Drill (4.5-8")	1	In Pit	8760	2.95E-08	4.00E-08	4.44E-08	3.14E-08	6.87E-08	8.70E-09	2.91E-08	1.04E-09
Haul Truck	7	In Pit	8760	5.98E-07	6.96E-07	9.60E-07	6.77E-07	1.17E-06	8.54E-08	6.03E-07	6.48E-08
Wheel Loader	2	In Pit	8760	1.20E-07	1.41E-07	1.92E-07	1.35E-07	2.38E-07	1.78E-08	1.21E-07	8.35E-09
Wheel Dozer	2	In Pit	8760	4.42E-08	5.15E-08	7.09E-08	5.00E-08	8.69E-08	6.34E-09	4.45E-08	3.99E-09
Track Dozer	2	In Pit	8760	6.00E-08	6.99E-08	9.63E-08	6.79E-08	1.18E-07	8.61E-09	6.05E-08	5.41E-09
Stemming Loader	2	In Pit	8760	1.93E-09	3.39E-09	3.10E-09	2.19E-09	4.11E-09	2.76E-10	1.95E-09	7.97E-10
Haul Truck (100t)	9	In Pit	8760	2.25E-07	2.62E-07	3.61E-07	2.55E-07	4.42E-07	3.21E-08	2.27E-07	2.44E-08
Excavator	1	Ore Stockpile	8760	2.11E-09	3.65E-09	3.38E-09	2.39E-09	4.47E-09	3.01E-10	2.12E-09	8.30E-10
Wheel Loader	1	Ore Stockpile	8760	1.66E-09	2.91E-09	2.66E-09	1.88E-09	3.52E-09	2.37E-10	1.67E-09	6.84E-10
Track Dozer	1	Waste Stockpile	8760	3.00E-08	3.49E-08	4.81E-08	3.40E-08	5.90E-08	4.30E-09	3.02E-08	2.71E-09
Excavator	1	Emergency Concentrate Stockpile	8760	2.12E-09	3.66E-09	3.39E-09	2.39E-09	4.48E-09	3.02E-10	2.13E-09	8.33E-10
Excavator	1	TMF	4818	1.59E-09	2.75E-09	2.55E-09	1.80E-09	3.37E-09	2.27E-10	1.60E-09	6.26E-10
Track Dozer	1	TMF	4380	1.50E-08	1.75E-08	2.41E-08	1.70E-08	2.95E-08	2.15E-09	1.51E-08	1.35E-09
Motor Grader (18ft)	1	TMF	4380	7.79E-10	1.45E-09	1.25E-09	8.81E-10	1.68E-09	1.11E-10	7.84E-10	3.78E-10
Wheel Loader 271HP	1	TMF	4380	6.86E-10	1.20E-09	1.10E-09	7.76E-10	1.46E-09	9.79E-11	6.91E-10	2.83E-10
Haul Truck	2	UPR1	8760	1.71E-07	1.99E-07	2.74E-07	1.93E-07	3.36E-07	2.44E-08	1.72E-07	1.85E-08
Haul Truck (100t)	3	UPR2	8760	7.51E-08	8.73E-08	1.20E-07	8.50E-08	1.47E-07	1.07E-08	7.56E-08	8.13E-09
Motor Grader (18ft)	3	General Site	8760	4.67E-09	8.70E-09	7.49E-09	5.29E-09	1.01E-08	6.67E-10	4.71E-09	2.27E-09
Water/Sand Truck (76kL tank)	2	General Site	8760	5.86E-08	6.82E-08	9.40E-08	6.63E-08	1.15E-07	8.36E-09	5.90E-08	6.35E-09
Fuel & Lube truck 10Wheel	1	General Site	8760	2.36E-09	4.43E-09	3.78E-09	2.67E-09	5.09E-09	3.37E-10	2.38E-09	1.18E-09
Pipelayer Dozer	1	General Site	8760	3.77E-09	5.66E-09	6.05E-09	4.27E-09	7.76E-09	5.39E-10	3.80E-09	8.83E-10
Cable Handling Wheel Loader 271HP	2	General Site	8760	2.93E-09	5.15E-09	4.71E-09	3.32E-09	6.24E-09	4.19E-10	2.96E-09	1.21E-09

Non-Road Emission Calculation Continued

All Mobile Emissions by Location	1 hour and 24 hour Emission Rates						Annual Emission Rates					
Emission Location	**TSPDiesel**	**PM10**	**PM2.5**	**NOx**	**SO_2**	**CO**	**TSPDiesel**	**PM10**	**PM2.5**	**NOx**	**SO_2**	**CO**
	[g/s]	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**	**[g/s]**
In Pit	1.98E-01	1.98E-01	1.92E-01	1.71E+01	3.33E-02	1.73E+01	1.98E-01	1.98E-01	1.92E-01	1.71E+01	3.33E-02	1.73E+01
Ore Stockpile	7.08E-03	7.08E-03	6.87E-03	1.30E-01	1.60E-03	2.52E-01	7.08E-03	7.08E-03	6.87E-03	1.30E-01	1.60E-03	2.52E-01
Waste Stockpile	5.03E-03	5.03E-03	4.88E-03	4.36E-01	8.37E-04	4.36E-01	5.03E-03	5.03E-03	4.88E-03	4.36E-01	8.37E-04	4.36E-01
Emergency Concentrate Stockpile	5.34E-04	5.34E-04	5.18E-04	1.60E-02	2.66E-04	1.39E-01	5.34E-04	5.34E-04	5.18E-04	1.60E-02	2.66E-04	1.39E-01
TMF	1.16E-02	1.16E-02	1.13E-02	5.66E-01	1.52E-03	8.41E-01	5.86E-03	5.86E-03	5.68E-03	2.84E-01	7.72E-04	4.30E-01
UPR1	3.38E-02	3.38E-02	3.28E-02	2.93E+00	5.63E-03	2.93E+00	3.38E-02	3.38E-02	3.28E-02	2.93E+00	5.63E-03	2.93E+00
UPR2	1.49E-02	1.49E-02	1.44E-02	1.29E+00	2.47E-03	1.29E+00	1.49E-02	1.49E-02	1.44E-02	1.29E+00	2.47E-03	1.29E+00
General Site	2.52E-02	2.52E-02	2.45E-02	1.28E+00	3.66E-03	1.91E+00	2.52E-02	2.52E-02	2.45E-02	1.28E+00	3.66E-03	1.91E+00
Total	**2.96E-01**	**2.96E-01**	**2.87E-01**	**2.37E+01**	**4.93E-02**	**2.51E+01**	**2.90E-01**	**2.90E-01**	**2.81E-01**	**2.34E+01**	**4.85E-02**	**2.47E+01**

Emission Location	1 hour and 24 hour Emission Rates [g/s]							
	BaP	**Benz(a)anthracene**	**Benzo(b+)+k)fluoranthene**	**Benzo(g,h,i)perylene**	**Chrysene**	**Dibenz(a,h)anthracene**	**Indenol(1,2,3-cd)pyrene**	**Naphthalene**
In Pit	1.08E-06	1.26E-06	1.73E-06	1.22E-06	2.13E-06	1.59E-07	1.09E-06	1.09E-07
Ore Stockpile	3.77E-09	6.56E-09	6.04E-09	4.26E-09	7.99E-09	5.38E-10	3.79E-09	1.51E-09
Waste Stockpile	3.00E-08	3.49E-08	4.81E-08	3.40E-08	5.90E-08	4.30E-09	3.02E-08	2.71E-09
Emergency Concentrate Stockpile	2.12E-09	3.66E-09	3.39E-09	2.39E-09	4.48E-09	3.02E-10	2.13E-09	8.33E-10
TMF	3.58E-08	4.53E-08	5.75E-08	4.05E-08	7.14E-08	5.13E-09	3.61E-08	5.17E-09
UPR1	1.71E-07	1.99E-07	2.74E-07	1.93E-07	3.36E-07	2.44E-08	1.72E-07	1.85E-08
UPR2	7.51E-08	8.73E-08	1.20E-07	8.50E-08	1.47E-07	1.07E-08	7.56E-08	8.13E-09
General Site	7.23E-08	9.21E-08	1.16E-07	8.19E-08	1.44E-07	1.03E-08	7.29E-08	1.19E-08
Total	**1.47E-06**	**1.73E-06**	**2.35E-06**	**1.66E-06**	**2.90E-06**	**2.15E-07**	**1.48E-06**	**1.58E-07**

Emission Location	Annual Emission Rates [g/s]							
	BaP	**Benz(a)anthracene**	**Benzo(b+)+k)fluoranthene**	**Benzo(g,h,i)perylene**	**Chrysene**	**Dibenz(a,h)anthracene**	**Indenol(1,2,3-cd)pyrene**	**Naphthalene**
In Pit	1.08E-06	1.26E-06	1.73E-06	1.22E-06	2.13E-06	1.59E-07	1.09E-06	1.09E-07
Ore Stockpile	3.77E-09	6.56E-09	6.04E-09	4.26E-09	7.99E-09	5.38E-10	3.79E-09	1.51E-09
Waste Stockpile	3.00E-08	3.49E-08	4.81E-08	3.40E-08	5.90E-08	4.30E-09	3.02E-08	2.71E-09
Emergency Concentrate Stockpile	2.12E-09	3.66E-09	3.39E-09	2.39E-09	4.48E-09	3.02E-10	2.13E-09	8.33E-10
TMF	1.81E-08	2.29E-08	2.90E-08	2.04E-08	3.60E-08	2.59E-09	1.82E-08	2.64E-09
UPR1	1.71E-07	1.99E-07	2.74E-07	1.93E-07	3.36E-07	2.44E-08	1.72E-07	1.85E-08
UPR2	7.51E-08	8.73E-08	1.20E-07	8.50E-08	1.47E-07	1.07E-08	7.56E-08	8.13E-09
General Site	7.23E-08	9.21E-08	1.16E-07	8.19E-08	1.44E-07	1.03E-08	7.29E-08	1.19E-08
Total	**1.45E-06**	**1.71E-06**	**2.32E-06**	**1.64E-06**	**2.87E-06**	**2.12E-07**	**1.46E-06**	**1.55E-07**

Emergency Power Generators

There are two emergency generators located at the concentrator and one located at the mine services area.

SCALING TABLE

Assuming 1-hr testing once per week.

Scaling Table	
Hours per Day	1
Days per Year	52

EMISSION FACTORS/ACTIVITIES

Diesel Generators > 600 hp

Reference: *Cat 3516 C Generator Spec Sheet; US. EPA AP-42 Ch.3.4 Large Stationary Diesel and all Stationary Dual Fuel Engines (10/96)*

Compound	Uncontrolled EF [g/hp-hr]	Reference	Rating
NOX	5.32	Cat 3516C Spec Sheet	B
CO	0.42	Cat 3516C Spec Sheet	C
SO2	0.006	Table 3.4-1, converted to [g/hp-hr]	B
TSPDiesel	0.04	Cat 3516C Spec Sheet	B

Assume all SOx is SO2 with a sulphur content of 15ppm sulphur, the maximum allowable concentration in Canada

Assume all TSP is PM10, PM2.5 is 0.97 PM10

ACTIVITY SUMMARY TABLE

Contaminant	Generator Emission Rates (g/s)			Stationary Diesel Combustion Emission Rates (tonnes/yr)
	1-hour	24-hour	Annual	Annual
CO	1.17E+00	4.89E-02	6.97E-03	2.20E-01
NOX	1.49E+01	6.19E-01	8.82E-02	2.78E+00
TSPDiesel	1.12E-01	4.66E-03	6.63E-04	2.09E-02
PM10	1.12E-01	4.66E-03	6.63E-04	2.09E-02
PM2.5	1.08E-01	4.52E-03	6.43E-04	2.03E-02
SO2	1.54E-02	6.41E-04	9.13E-05	2.88E-03

EMISSION RATE CALCULATIONS

Generator 1 - Mine Services Area

Source ID: EPG1

Generator ID	Generator Capacity [kW]	Generator Capacity [hp]	Compound	Uncontrolled EF [g/hp-hr]	Emission Rate [g/hr]	Conversion	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
1	2500	3353	NOX	5.32E+00	1.78E+04	0.0003	4.95E+00	2.06E-01	2.94E-02
			CO	4.20E-01	1.41E+03	0.0003	3.91E-01	1.63E-02	2.32E-03
			SO2	5.50E-03	1.85E+01	0.0003	5.13E-03	2.14E-04	3.04E-05
			TSPDiesel	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM10	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM2.5	3.88E-02	1.30E+02	0.0003	3.61E-02	1.51E-03	2.14E-04

Generator 2 - Concentrator

Source ID: EPG2

Generator ID	Generator Capacity [kW]	Generator Capacity [hp]	Compound	Uncontrolled EF [g/hp-hr]	Emission Rate [g/hr]	Conversion	1- hour Emission Rate	24- hour Emission Rate	Annual Emission Rate
2	2500	3353	NOX	5.32E+00	1.78E+04	0.0003	4.95E+00	2.06E-01	2.94E-02
			CO	4.20E-01	1.41E+03	0.0003	3.91E-01	1.63E-02	2.32E-03
			SO2	5.50E-03	1.85E+01	0.0003	5.13E-03	2.14E-04	3.04E-05
			TSPDiesel	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM10	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM2.5	3.88E-02	1.30E+02	0.0003	3.61E-02	1.51E-03	2.14E-04

Emergency Power Generators Continued

Generator 3 - Concentrator

Source ID: EPG3

Generator ID	Generator Capacity [kW]	Generator Capacity [hp]	Compound	Uncontrolled EF [g/hp-hr]	Emission Rate [g/hr]	Conversion	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
3	2500	3353	NOX	5.32E+00	1.78E+04	0.0003	4.95E+00	2.06E-01	2.94E-02
			CO	4.20E-01	1.41E+03	0.0003	3.91E-01	1.63E-02	2.32E-03
			SO2	5.50E-03	1.85E+01	0.0003	5.13E-03	2.14E-04	3.04E-05
			TSPDiesel	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM10	4.00E-02	1.34E+02	0.0003	3.73E-02	1.55E-03	2.21E-04
			PM2.5	3.88E-02	1.30E+02	0.0003	3.61E-02	1.51E-03	2.14E-04

Generator 1-3

Source ID: EPG1-3

Generator ID	Generator Capacity [kW]	Generator Capacity [hp]	Compound	EF [lb/MMBtu]	EF Conversion	EF [g/bhp-hr]	1- hour Emission Rate [g/s]	24- hour Emission Rate [g/s]	Annual Emission Rate [g/s]
1-3	2500	3353	Benz(a)anthracene	6.22E-07	1.15	7.17E-07	6.68E-07	2.78E-08	3.96E-09
			BaP	2.57E-07	1.15	2.96E-07	2.76E-07	1.15E-08	1.64E-09
			Benzo(b+)+k)fluoranthene	1.11E-06	1.15	1.28E-06	1.19E-06	4.96E-08	7.07E-09
			Benzo(g,h,i)perylene	5.56E-07	1.15	6.41E-07	5.97E-07	2.49E-08	3.54E-09
			Chrysene	1.53E-06	1.15	1.76E-06	1.64E-06	6.84E-08	9.75E-09
			Dibenz(a,h)anthracene	3.46E-07	1.15	3.99E-07	3.71E-07	1.55E-08	2.20E-09
			Indenol(1,2,3-cd)pyrene	4.14E-07	1.15	4.77E-07	4.44E-07	1.85E-08	2.64E-09
			Naphthalene	1.30E-04	1.15	1.50E-04	1.40E-04	5.81E-06	8.28E-07

Concentrate Handling

.

Concentrate is transferred to railcars at the train loadout and transported off-site for shipment.

Emission factors from the Canadian Rail Association 2022 Locomotive Emissions Monitoring Program Report were used to estimate emissions of NOx, PM, CO and SO2. Emissions of PAH species were obtained from the US EPA Chapter 3.4 Large Uncontrolled Stationary Diesel Engines (10/96) emission factor document.

SCALING TABLE

Scaling Table	Slow Moving Train	
Source ID	SMT	
Number of Locomotives/train	3	
Number of Trips / day (summer)	3.32	from PFS
Hours/Trip	7.00	
Hours/Day	23.24	
Number of Trips / day (prorated for summer/winter)	3.05	from PFS
Hours/Day (prorated for summer/winter)	21.33	
Days/year	365	

EMISSION FACTORS/ACTIVITIES

Reference: *US EPA Federal Railroad Administration Locomotive Emissions Comparison Tool (LECT): Emissions Data Documentation (page 4)*

Engine Type	Conversion Factors	
Small Class (II/III) Line-Haul	18.20	bhp-hr/gal
	4.81	bhp-hr/L

1 L = 3.78541 gal

Equipment Specifications

Reference: Horsepowers taken from US EPA Locomotive Emission Standards: Regulatory Support Document (April 1998), Appendix B (locomotive Emission Data by Throttle Notch for EMD 16-645E3)

Train Activity	Horsepower (hp)	Duration (fraction of trip)[1]	Fuel Consumption (L/hr)	Engine Count	Load Factors
Notch 8	3159	0	657.04	3	1.00
Notch 5	1461	0.13	303.87	3	0.46
Notch 3	686	0.11	142.68	3	0.22
Notch 1	105	0.50	21.84	3	0.03
Idle	17	0.26	3.54	3	0.01

[1]**Assumed based on similar operations - going to request from Champion**

Reference: Canadian Rail Association 2016 Locomotive Emissions Monitoring Program Report, Table 10: CAC Emission Factors for Diesel Locomotives (g/L) for Line Haul Freight

Year	NOx (g/L)	PM10 (g/L)	CO (g/L)	HC (g/L)	SO2 (g/L)
2022	31.76	0.63	6.98	1.21	0.02

Reference: USEPA AP-42 3.4 Large Stationary Diesel and all Stationary Dual-fuel Engines (10/96)

Compound	EF [lb/MMBTU]	Conversion	EF [g/bhp-hr]
BAP	2.57E-07	1.15	2.96E-07
Benz(a)anthracene	6.22E-07	1.15	7.17E-07
Benzo(b+)+k)fluoranthene	1.11E-06	1.15	1.28E-06
Benzo(g,h,i)perylene	5.56E-07	1.15	6.41E-07
Chrysene	1.53E-06	1.15	1.76E-06
Dibenz(a,h)anthracene	3.46E-07	1.15	3.99E-07
Indenol(1,2,3-cd)pyrene	4.14E-07	1.15	4.77E-07
Naphthalene	1.30E-04	1.15	1.50E-04

EMISSION RATE CALCULATIONS

Slow Moving Train			
Source ID:	SMT		
Compound	1- hour Emission Rate [g/s]	24-hr Emission Rate [g/s]	Annual Emission Rate [g/s]
TSPDiesel	1.16E-02	1.12E-02	1.03E-02
PM10	1.16E-02	1.12E-02	1.03E-02
PM2.5	1.13E-02	1.09E-02	1.00E-02
NOx	5.85E-01	5.66E-01	5.20E-01
SO2	3.68E-04	3.57E-04	3.27E-04
CO	1.28E-01	1.24E-01	1.14E-01
BAP	2.62E-08	2.54E-08	2.33E-08
Benz(a)anthracene	6.35E-08	6.14E-08	5.64E-08
Benzo(b+)+k)fluoranthene	1.13E-07	1.10E-07	1.01E-07
Benzo(g,h,i)perylene	5.67E-08	5.49E-08	5.04E-08
Chrysene	1.56E-07	1.51E-07	1.39E-07
Dibenz(a,h)anthracene	3.53E-08	3.42E-08	3.14E-08
Indenol(1,2,3-cd)pyrene	4.22E-08	4.09E-08	3.75E-08
Naphthalene	1.33E-05	1.28E-05	1.18E-05

EMISSION RATE CALCULATIONS

Train Activity	NOx (g/hr)	TSP (g/hr)	PM10 (g/hr)	PM2.5 (g/hr)	SO2 (g/hr)	CO (g/hr)	BAP (g/hr)	Benz(a)anthracene (g/hr)	Benzo(b+)+k)fluoranthene (g/hr)	Benzo(g,h,i)perylene (g/hr)	Chrysene (g/hr)	Dibenz(a,h)anthracene (g/hr)	Indenol(1,2,3-cd)pyrene (g/hr)	Naphthalene
Notch 5	9,651.00	191.44	191.44	185.70	6.08	2,121.03	4.33E-04	1.05E-03	1.87E-03	9.36E-04	2.58E-03	5.83E-04	6.97E-04	2.19E-01
Notch 3	4,531.54	89.89	89.89	87.19	2.85	995.91	2.03E-04	4.92E-04	8.78E-04	4.40E-04	1.21E-03	2.74E-04	3.27E-04	1.03E-01
Notch 1	693.60	13.76	13.76	13.35	0.44	152.44	3.11E-05	7.53E-05	1.34E-04	6.73E-05	1.85E-04	4.19E-05	5.01E-05	1.57E-02
Idle	112.30	2.23	2.23	2.16	0.07	24.68	5.04E-06	1.22E-05	2.17E-05	1.09E-05	3.00E-05	6.78E-06	8.11E-06	2.55E-03

one hour emission estimates

Train Activity	NOx (g/s)	TSP (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	CO (g/s)	BAP (g/s)	Benz(a)anthracene (g/s)	Benzo(b+)+k)fluoranthene (g/s)	Benzo(g,h,i)perylene (g/s)	Chrysene (g/s)	Dibenz(a,h)anthracene (g/s)	Indenol(1,2,3-cd)pyrene (g/s)	Naphthalene
Notch 5	4.87E-01	9.66E-03	9.66E-03	9.37E-03	3.07E-04	1.07E-01	2.18E-08	5.29E-08	9.43E-08	4.73E-08	1.30E-07	2.94E-08	3.52E-08	1.10E-05
Notch 3	8.79E-02	1.74E-03	1.74E-03	1.69E-03	5.53E-05	1.93E-02	3.94E-09	9.54E-09	1.70E-08	8.52E-09	2.35E-08	5.30E-09	6.35E-09	1.99E-06
Notch 1	9.61E-03	1.91E-04	1.91E-04	1.85E-04	6.05E-06	2.11E-03	4.31E-10	1.04E-09	1.86E-09	9.32E-10	2.56E-09	5.80E-10	6.94E-10	2.18E-07
Idle	1.32E-04	2.62E-06	2.62E-06	2.54E-06	8.31E-08	2.90E-05	5.91E-12	1.43E-11	2.55E-11	1.28E-11	3.52E-11	7.96E-12	9.53E-12	2.99E-09

Fugitive Dust from Unpaved Roadways

TSP, PM10 and PM2.5 emissions from roadways were estimated using the method described in the US EPA AP-42 Chapter 13.2.2 "Unpaved Roads" (11/06). Vehicle travel was identified on the ore haul roads,overburden haul road, access road, site road, and in-pit unpaved roadway. Fugitive dust emissions from grading were estimated using the emission factor equations from US EPA AP-42 - 11.9 Western Surface Coal Mining (7/98). TSP, PM10 and PM2.5 emissions from grading were allotted to each unpaved roadway segment. A control factor was applied to represent dust control measures to mitigate fugitive dust.

The 95th percentile metal concentrations from the mine rock and overburden assays have been conservatively used to scale the TSP emission rates and Point of Impingement concentrations for each metal.

The annual emission rates in tonnes per year assume that there will be snow on the ground or precipitation levels greater than 0.254 mm per day for 182 days per year.

SCALING TABLE

Source ID	Source Description	Silt Content [%]**	Daily Passenger Vehicles [Passes/24 hrs]	Daily Industrial Vehicles [Passes/24 hrs]	Daily Full 100t Haul Trucks [Passes/24 hrs]	Daily Empty 100t Haul Trucks [Passes/24 hrs]	Daily Full 320t Haul Trucks [Passes/24 hrs]	Daily Empty 320t Haul Trucks [Passes/24 hrs]	Prorated Mean Vehicle Weight [tons]	Length/Pass [km]
INPIT*	In Pit Road	5.80	0	0	755	755	371	371	276.82	4.400
UPR1	Pit to Ore Stockpiles	8.30	0	0	0	0	371	371	407.65	1.020
UPR2	Pit to Overburden Stockpile	8.30	0	0	755	755	0	0	212.55	1.840
UPR3	Access Road	8.30	0	125	0	0	0	0	14.00	14.158
UPR4	TMF Inspection Road	8.00	2	0	0	0	0	0	2.00	11.478
UPR5	Site Road	8.30	68	60	0	0	0	0	7.63	4.240

[*] This source is accounted for in the open pit emissions

Calculation of prorated fleet weight assumes:

Passenger vehicles weigh =	2	tons
Industrial vehicles weigh =	14	tons
Full industrial (100t haul trucks) vehicles weigh =	263.05	tons
Empty industrial (100t haul trucks) vehicles weigh =	162.05	tons
Full industrial (320t haul trucks) vehicles weigh =	567	tons
Empty industrial (320t haul trucks) vehicles weigh =	248	tons
Control Factor =	70	%

EMISSION FACTORS

Dust Emissions from Unpaved Roads

Reference: *US. EPA AP-42 13.2.2 Unpaved Roads , dated 11/06*

Industrial site equation:

$$EF = k\,(s/12)^{a}(W/3)^{b}$$

Where:

EF = Emission factor: grams particulate emitted per vehicle kilometre travelled [lb/VMT]

a, b, k = empirical constants

s = Surface material silt content [%]

W = Average vehicle weight [tons]

Parameter	k	a	b	Reference
TSP	4.9	0.7	0.45	AP-42 / 13.2.2 - Table 13.2.2-2
PM_{10}	1.5	0.9	0.45	AP-42 / 13.2.2 - Table 13.2.2-2
$PM_{2.5}$	0.15	0.9	0.45	AP-42 / 13.2.2 - Table 13.2.2-2

EMISSION RATE CALCULATIONS

INPIT — **In Pit Road**

Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control [%]	Controlled Emission Rate [g/s]
TSP	2.26E+01	[lb/VMT]	7.29E+02	1.90E-01	2	kg/VKT	1.94E-02	83	1.23E+02
PM10	5.97E+00	[lb/VMT]	1.93E+02	8.40E-02	2	kg/VKT	8.66E-03	83	3.24E+01
PM2.5	5.97E-01	[lb/VMT]	1.93E+01	5.89E-03	2	kg/VKT	6.00E-04	83	3.24E+00

UPR1 — **Pit to Ore Stockpiles**

Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control [%]	Controlled Emission Rate [g/s]
TSP	3.45E+01	[lb/VMT]	8.52E+01	1.90E-01	2	kg/VKT	4.49E-03	70	2.56E+01
PM10	9.82E+00	[lb/VMT]	2.42E+01	8.40E-02	2	kg/VKT	1.98E-03	70	7.27E+00
PM2.5	9.82E-01	[lb/VMT]	2.42E+00	5.89E-03	2	kg/VKT	1.39E-04	70	7.27E-01

UPR2 — **Pit to Overburden Stockpile**

Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control [%]	Controlled Emission Rate [g/s]
TSP	2.57E+01	[lb/VMT]	2.33E+02	1.90E-01	2	kg/VKT	8.10E-03	70	7.00E+01
PM10	7.32E+00	[lb/VMT]	6.64E+01	8.40E-02	2	kg/VKT	3.58E-03	70	1.99E+01
PM2.5	7.32E-01	[lb/VMT]	6.64E+00	5.89E-03	2	kg/VKT	2.51E-04	70	1.99E+00

UPR3 — **Access Road**

Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control [%]	Controlled Emission Rate [g/s]
TSP	7.57E+00	[lb/VMT]	4.37E+01	1.90E-01	2	kg/VKT	6.23E-02	70	1.31E+01
PM10	2.15E+00	[lb/VMT]	1.24E+01	8.40E-02	2	kg/VKT	2.75E-02	70	3.74E+00
PM2.5	2.15E-01	[lb/VMT]	1.24E+00	5.89E-03	2	kg/VKT	0.00E+00	70	3.73E-01

UPR4 — **TMF Inspection Road**

Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control [%]	Controlled Emission Rate [g/s]
TSP	3.07E+00	[lb/VMT]	2.30E-01	1.90E-01	2	kg/VKT	5.05E-02	70	8.42E-02
PM10	8.68E-01	[lb/VMT]	6.50E-02	8.40E-02	2	kg/VKT	2.23E-02	70	2.62E-02
PM2.5	8.68E-02	[lb/VMT]	6.50E-03	5.89E-03	2	kg/VKT	1.57E-03	70	2.42E-03

Fugitive Dust from Unpaved Roadways Continued

Grading

Reference: *USEPA AP-42 11.9 Western Surface Coal Mining* *AP-42 Ch. 11.9 Dated 10/98*

It is assumed that grading occurs once every 24-hrs on each unpaved roadway and that graders travel at 5 km/hr

Compound	Equation	Mean Vehicle Speed (S) [km/hr]	EF [kg/VKT]	Reference
TSP	= 0.0034 x $S^{2.5}$	5	1.90E-01	Table 11.9-2
PM_{10}	= 0.0056 x S^{2}	5	1.40E-01	Table 11.9-2
PM_{10}	= EF_{PM10} x 0.6	5	8.40E-02	Table 11.9-2
$PM_{2.5}$	= EF_{TSP} x 0.031	5	5.89E-03	Table 11.9-2

SAMPLE CALCULATION

Sample Calculation for dust emissions from hauling ore on UPR1

The following parameters were used to calculate emission rates of TSP (suspended particulate):

k = 4.9 (Table 13.2.2-2)

a = 0.7 (Table 13.2.2-2)

b = 0.45 (Table 13.2.2-2)

s = 8.30 (US EPA AP-42 Table 13.2.2-1 Haul Road to/from pit)

W = 407.65 tons

Emission Factor for TSP

$$EF = \frac{4.9 \text{ lb}}{\text{VMT}} \left| \frac{8.3^{0.7}}{12^{0.7}} \right| \frac{407.65^{0.45}}{3^{0.45}}$$

EF = 3.45E+01 lb/VMT

Uncontrolled Emission Rate

Total length of road = 1.020 km

$$ER_{TSP} = \frac{3.45E+01 \text{ lb}}{\text{VMT}} \left| \frac{742 \text{ passes}}{24 \text{ hr}} \right| \frac{1.02 \text{ km}}{\text{pass}} \left| \frac{1 \text{ hr}}{3600 \text{ s}} \right| \frac{281.9 \text{ gVKT}}{\text{lb/VMT}}$$

ER_{TSP} = 8.52E+01 g/s

Sample Calculation for grading on UPR1

Emission Factor for TSP

$EF = 0.0034 \times S^{2.5}$

$EF = 0.0034 \left| S^{2.5} \right.$

EF = 1.90E-01 kg/VKT

Uncontrolled Emission Rate

Total length of road = 1.020

Number of passes / day = 2

$$ER_{TSP} = \frac{0.19 \text{ kg}}{\text{VKT}} \left| \frac{1.020 \text{ km}}{\text{pass}} \right| \frac{1 \text{ hr}}{3600 \text{ s}} \left| \frac{1000 \text{ g}}{1 \text{ kg}} \right| \frac{2 \text{ passes}}{24 \text{ hrs}}$$

ER_{TSP} = 4.49E-03 g/s

Sample Calculation for Total Controlled emission rate on UPR1

Controlled Emission Rate

ER_{TSP} = (Uncontrolled Emission Rate from Ore Hauling + Uncontrolled Emission Rate from Grading) x Control Factor

ER_{TSP} = (8.52E+01 g/s + 4.49E-03 g/s) x (100 - 70) / 100

ER_{TSP} = 2.56E+01 g/s

UPR5	Site Road								
Compound	Fugitive Dust from Vehicle Traffic			Fugitive Dust from Grading				Controlled Emission Rate [g/s]	
	EF	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	EF	Number of Passes/day	EF Unit	Uncontrolled Emission Rate for Entire Segment [g/s]	Dust Control (%)	Controlled Emission Rate [g/s]
TSP	5.76E+00	[lb/VMT]	1.02E+01	1.90E-01	2	kg/VKT	1.87E-02	70	3.07E+00
PM10	1.64E+00	[lb/VMT]	2.90E+00	8.40E-02	2	kg/VKT	8.24E-03	70	8.73E-01
PM2.5	1.64E-01	[lb/VMT]	2.90E-01	5.89E-03	2	kg/VKT	5.78E-04	70	8.72E-02

ACTIVITY SUMMARY TABLE

Contaminant	Emission Rates (g/s)	Unpaved Road Emission Rate (tonnes/yr)
	24-hour	Annual
TSP	2.34E+02	3.68E+03
PM_{10}	6.42E+01	1.01E+03
$PM_{2.5}$	6.42E+00	1.01E+02

wsp.com

Appendix 5C: Air Quality Release Estimates – Construction Phase

Construction Emissions Inventory

The following emission factor reference documents were used to estimate construction releases in the Alderon Environmental Impact Statement (Alderon 2013).

Alderon Emission Sources	Emission Factor Reference from Alderon EIS	Alderon EIS Reference
Transportation of equipment - general	U.S. EPA Non-road Program and U.S. EPA AP-42 Chapter 3.3	Amendment to the Environmental Impact Statement Volume 3 Information Request Responses dated February 2013 (Alderon 2013)
Transportation of equipment - rail		
Transportation of equipment - TMF		
Equipment operation - general	Transport Canada's Urban Transportation Emission Calculator (UTEC)	
Equipment operation - rail		
Equipment operation - TMF		
Unpaved roads	U.S. EPA AP-42 Chapter 13.2.3	
Fugitive dust (ground clearing)	U.S. EPA AP-42 Chapter 13.2.2	
Cement plant operation	U.S. EPA AP-42 Chapter 11.12	

Notes:
Emission estimates for PM_{10} and $PM_{2.5}$ from "Equipment Operation" were added to the Alderon estimates by assuming that all of TSP will be in the PM_{10} fraction, and 0.97 of PM_{10} will be $PM_{2.5}$.

Crushing and Screening

Site prepration activities may require rock to be crushed or screened before being used for construction. One drop point to a temporary stockpile was assumed for each crushing and screening unit.

SCALING TABLE

Scaling Table	Primary Crushers	Screeners	Material Drop to Stockpile
Source ID	PC	SC	DROP
Number of Units	2	2	4
Hourly Throughput [tonnes]	500	500	500
Hours per Year	2,016	2,016	2,016

ACTIVITY SUMMARY TABLE

Contaminant	Crushing Screening Emission Rates (tonnes/yr)
	Annual
TSP	4.96E+01
PM_{10}	2.01E+01
$PM_{2.5}$	2.39E+00

EMISSION FACTORS/ACTIVITIES

Drop Operations

Reference: *US. EPA AP-42 13.2.4*

Emissions from material handling operations were calculated using Section 13.2.4 Aggregate Handling and Storage Piles of the U.S. EPA AP-42 document instead of Section 11.24 Metallic Minerals Processing to account for the high moisture content of the material.

$$EF\ (kg/Mg) = \frac{k\ (0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where k=particle size multiplier (dimensionless)

U= mean wind speed (m/s)

M= material moisture content (%)

Aerodynamic Particle Size Multiplier (k)

Particle Size	<30µm	<10µm	<2.5µm
Multiplier	0.74	0.35	0.05

*See chart

U= 4.66 m/s — Mean windspeed from from CALMET meteorological data (2018-2021) provided by the Government of Newfoundland.

M= 1.5 % — Moisture Content in recently blasted material as provided by Champion Iron

Parameter	EF for Annual Emissions [kg/Mg]	Reference
TSP	0.0047	AP-42 / 13.2.4
PM_{10}	0.0022	AP-42 / 13.2.4
$PM_{2.5}$	0.0003	AP-42 / 13.2.4

Material Handling Emission Factors

Source	Unit	TSP	PM_{10}	$PM_{2.5}$	Reference
Primary Crushing	kg/Mg	0.0027	0.0012	0.0002	AP-42 Ch 11.19 Emission Factors for Crushed Stone Processing and Pulverized Mineral Processing - Tertiary Crushing
	% of TSP	100%	44%	8%	
Screening	kg/Mg	0.0125	0.0043	0.0003	AP-42 Ch 11.19 Emission Factors for Crushed Stone Processing and Pulverized Mineral Processing - Screening
	% of TSP	100%	34%	2%	

EMISSION RATE CALCULATIONS

Primary Crushers

Source ID: PC

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Operating hours [hr/yr]	Conversion kg/yr to Mg/yr	Number of Units	Annual Emission Rate [Mg/yr]
TSP	0.0027	500	2,016	0.001	2	5.44E+00
PM10	0.0012	500	2,016	0.001	2	2.42E+00
PM2.5	0.0002	500	2,016	0.001	2	4.48E-01

Screeners

Source ID: SC

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Operating hours [hr/yr]	Conversion kg/yr to Mg/yr	Number of Units	Annual Emission Rate [Mg/yr]
TSP	0.0125	500	2,016	0.001	2	2.52E+01
PM10	0.0043	500	2,016	0.001	2	8.67E+00
PM2.5	0.0003	500	2,016	0.001	2	5.86E-01

Reference **Material Drop to Stockpile**

Source ID: DROP

Compound	EF [kg/Mg]	Maximum Processing Rate [Mg/hr]	Operating hours [hr/yr]	Conversion kg/yr to Mg/yr	Number of Units	Annual Emission Rate [Mg/yr]
TSP	0.0047	500	2,016	0.001	4	1.90E+01
PM10	0.0022	500	2,016	0.001	4	8.97E+00
PM2.5	0.0003	500	2,016	0.001	4	1.36E+00

Diesel Generators

Diesel generators may be used to supply power for construction. Emission factors were taken from the US EPA AP-42 Chapter 3.4 *Large Stationary Diesel and all Stationary Dual Fuel Engines* for engines ≥600 hp. Sulphur content by weight of diesel fuel is assumed to be the maximum allowable sulphur content in diesel fuel produced, imported or sold for use in small stationary engines in Canada (15 mg/kg or 0.0015%).

Equipment List

Equipment	Location	Number of Units	Horsepower (hp)	Operating Hours Per Unit (hr/year)
Diesel Generator	General	2	2,680	2,016

ACTIVITY SUMMARY TABLE

Contaminant	Annual Emissions (Tonnes/yr)
TSP	4.32E-01
PM_{10}	4.32E-01
$PM_{2.5}$	4.19E-01
NOX	5.75E+01
CO	4.54E+00
SO_2	5.95E-02

Assume all TSP is PM_{10}, $PM_{2.5}$ is 0.97 PM_{10}

EMISSION FACTORS/ACTIVITIES

Diesel Generators > 600 hp

Reference: *Cat 3516 C Generator Spec Sheet; US. EPA AP-42 Ch.3.4 Large Stationary Diesel and all Stationary Dual Fuel Engines (10/96)*

Compound	Uncontrolled EF [g/hp-hr]
NOX	5.32
CO	0.42
SO_2	0.0055
TSP	0.04

Assume all SOx is SO2 with a sulphur content of 15ppm sulphur, the maximum allowable concentration in Canada

EMISSION RATE CALCULATIONS

Equipment	Location	Number of Units	Horsepower (hp)	Contaminant	EF (g/hp-hr)	Operating Hours Per Unit (hr/year)	Conversion (g to tonne)	Emission Rate (tonnes/yr)
Diesel Generator	General	2	2680	TSP	0.04	2,016	0.000001	4.32E-01
				NOX	5.32	2,016	0.000001	5.75E+01
				CO	0.42	2,016	0.000001	4.54E+00
				SO_2	0.0055	2,016	0.000001	5.95E-02

Drilling

The TSP emission factor for fugitive dust for drilling were obtained from U.S. EPA AP-42 Table 11.9-4 . The emission factor for PM10 was estimated based on the ratio between TSP and PM10 emission factors for tertiary crushing (uncontrolled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (US EPA 2004)/ Table 11.19.2.1. The emission factor for PM2.5 was estimated based on the ratio between TSP and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (US EPA 2004)/ Table 11.19.2.1.

The drills are at all times equipped with dust collectors containing fabric filters. Therefore a 99% control efficiency is applied to the emissions as per Table 4 of the NPI Emissions Estimation Technique Manual for Mining Version 3.1 dated January 2012.

The number of days drilling will occur during construction was estimated using the predicted number of blasts per year during construction.

Scaling Tables

Scaling Table	Drilling (Fugitive Dust)
Number of holes drilled per day	112
Days per Year	310
Number of holes drilled per year	34,748
Control Factor	99%

ACTIVITY SUMMARY TABLE

Contaminant	Annual Emissions (Tonnes/yr)
TSP	0.0021
PM_{10}	0.0009
$PM_{2.5}$	0.0002

EMISSION FACTORS/ACTIVITIES

Drilling

Reference: *US EPA AP-42 - 11.9 Western Surface Coal Mining (7/98)*

Contaminant	Emission Factor [kg/hole]	Table Reference	Notes
TSP	0.59	11.9-4	—
TSPmetals	0.59	11.9-4	—
PM_{10}	0.26	11.9-4/11.19.2.1	—
$PM_{2.5}$	0.049	11.9-4/11.19.2.1	—

EMISSION RATE CALCULATIONS

Drilling (Fugitive Dust)

Compound	EF [kg/Blast]	Number of Holes Drilled / Year	Conversion	% Emissions After Control Factor	Emission Rate (tonnes/yr)
TSP	0.59	34,748	0.001	0.01%	2.05E-03
PM_{10}	0.26	34,748	0.001	0.01%	9.11E-04
$PM_{2.5}$	0.05	34,748	0.001	0.01%	1.71E-04

Sample Calculation for TSP from drilling

$$ER_{TSP} = \frac{0.59 \text{ kg}}{\text{hole}} \times \frac{34{,}748 \text{ holes}}{\text{year}} \times \frac{1 \text{ tonne}}{1000 \text{ kg}} \times (1 - 0.99)\,\%$$

ER_{TSP} = 2.05E-03 tonnes/year

Blasting

The TSP, PM_{10} and $PM_{2.5}$ emission factors for fugitive dust for blasting were obtained from U.S. EPA AP-42 Table 11.9-2 .

Each blast consists of 100% emulsion. The Carbon Monoxide and Nitrogen Oxide emission factors for the blasting using emulsion explosives [water based gel (>150 mm)] were obtained from the Australian NPI "Emission estimation technique manual for Explosives detonation and firing ranges" Version 3.0 January 2012.

The number of blasts per year were estimated based on the total explosives usage per year for construction and the tonnes of explosive per blast used in operations. The same blast area as operations was assumed.

Scaling Tables

Scaling Table	Blasting (Fugitive Dust)	Scaling Table	Blasting (Combustion Gases)
Blasts per Year	133	Blasts per Year	133
Horizontal Area [m^2]	15,611	Tonnes of Explosives Per Year	16,096
		Tonnes of Explosives Per Blast	121
		Percent ANFO per blast	0.0%
		Percent Emulsion per blast	100.0%

ACTIVITY SUMMARY TABLE

Contaminant	Annual Emissions (Tonnes/yr)
TSP	57.20
PM_{10}	29.74
$PM_{2.5}$	1.72
CO	37.02
NOX	3.22

EMISSION FACTORS/ACTIVITIES

Blasting

Reference: *US EPA AP-42 - 11.9 Western Surface Coal Mining (7/98)*

Contaminant	Emission Factor [kg/blast]	Table Reference	Notes
TSP	4.29E+02	11.9-2	—
PM_{10}	2.23E+02	11.9-2	—
$PM_{2.5}$	1.29E+01	11.9-2	—

Sample Calculation for TSP From Blasting

ER TSP= Blasting EF x Annual Throughput x Conversion

$$ER\ TSP = \frac{4.29E+02\ kg}{blast} \times \frac{133\ blasts}{yr} \times \frac{1\ tonne}{1000\ kg}$$

ER TSP= 57.20 tonnes/yr

Explosives

Reference: *Australia NPI Explosives Detonation and Firing Ranges 3.0, January 2012*

Contaminant	Emulsion Emission Factor [kg/Mg]	Australian NPI Table Reference for Emission Factors	Notes
CO	2.3	7	Each blast consists 100% emulsion
NOX	0.2	7	

Sample Calculation for CO From Blasting

ER CO= Emulsion EF x Annual Throughput x Conversion

$$ER\ CO = \frac{2.3\ kg}{tonne} \times \frac{16,096\ tonnes}{year} \times \frac{1\ tonne}{1000\ kg}$$

ER CO= 3.70E+01 $\frac{tonnes}{year}$

EMISSION RATE CALCULATIONS

Blasting (Fugitive Dust)

Compound	EF [kg/Blast]	Base [BPY]	Conversion	Emission Rate (tonnes/yr)
TSP	4.29E+02	133	0.001	5.72E+01
PM_{10}	2.23E+02	133	0.001	2.97E+01
$PM_{2.5}$	1.29E+01	133	0.001	1.72E+00

Blasting (Combustion Gases)

Compound	Emulsion EF [kg/Mg]	Base [Mg/yr]	Conversion	Emission Rate (tonnes/yr)
CO	2.3	16,096	0.001	3.70E+01
NOX	0.2	16,096	0.001	3.22E+00

Appendix 5D: Greenhouse Gas Emission Calculations

Indirect Greenhouse Gas Emissions from Purchased Electricity

Emission Factors

Activity	Emission Factor Units	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Purchased Electricity (NL Grid)	t CO_2 eq/GWh	9.1	4.0	4.0	3.9	3.7	3.6	3.7	3.7	3.8	3.9	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Emission Factor Reference	ECCC Current Projections of Electricity Grid Intensities, December 2024. from Canada's First Biennial Transparency Report under the Paris Agreement.																									Assumed to be the same as 2040, no further predictions available for Newfoundland-Labrador at this time				

Summary: GHG Emissions from Purchased Electricity (t CO_2e)

Electricity	Units	TOTAL	Annual GHG Emissions from Purchased Electricity [tCO2e]																											
			Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Total CO_{2e}	t CO_2e	112,563	0	2,663	4,376	4,268	4,056	3,955	4,076	4,083	4,278	4,392	4,172	4,214	4,217	4,204	4,204	4,403	4,419	4,403	4,390	4,379	4,363	4,350	4,343	4,339	4,333	4,329	3,677	3,677	3,677

Total: Annual Energy Consumption (MWh)

Electricity	Units	TOTAL	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Electricity	MWh	29,645,127	3	665,698	1,093,921	1,094,269	1,096,287	1,098,644	1,101,674	1,103,561	1,125,920	1,126,046	1,127,507	1,108,937	1,109,673	1,106,348	1,106,348	1,158,572	1,162,785	1,158,770	1,155,148	1,152,438	1,148,209	1,144,820	1,142,977	1,141,928	1,140,210	1,139,202	967,617	967,617	967,617

Electric Equipment: Annual Energy Consumption (MWh)

Mining Equipment

Equipment / Vehicle Category	Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Energy Consumption (MWh)																										
					Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mining Equipment Fleet	Production Drill (8.5-12")	EPIROC-PV271 Electric	Electric	6	3	11	15	16	17	18	20	20	19	19	20	20	21	19	19	19	22	20	18	16	14	12	11	11	10	9	0	0	0
	Electric Hydraulic Shovel (29 m³)	Komatsu-PC5500-11 FSE	Electric	4	0	20,609	29,329	29,410	31,693	34,049	37,077	38,698	36,578	36,703	38,163	36,865	37,885	34,562	34,562	34,787	39,425	35,411	31,791	28,656	24,856	21,469	19,627	18,152	16,861	15,854	0	0	0
Primary Crusher - Mining - In Pit Crushing of waste and transport	Waste Primary Crusher (In-Pit)	—	Electric	1	0	0	7,821	7,843	7,821	7,821	7,821	7,843	7,821	7,821	7,821	7,843	7,821	7,821	7,821	7,843	7,821	7,821	7,821	7,843	7,821	7,821	7,821	7,843	7,821	7,821	0	0	0
	Waste Conveyor Line 1	—	Electric	1	0	0	19,458	19,512	19,458	19,458	19,458	19,512	19,458	19,458	19,458	19,512	19,458	19,458	19,458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waste Conveyor Line 2	—	Electric	1	0	0	7,447	7,468	7,447	7,447	7,447	7,468	7,447	7,447	7,447	7,468	7,447	7,447	7,447	7,468	7,447	7,447	7,447	7,468	7,447	7,447	7,447	7,468	7,447	7,447	0	0	0
	Waste Conveyor Line 3	—	Electric	1	0	0	8,361	8,384	8,361	8,361	8,361	8,384	8,361	8,361	8,361	8,384	8,361	8,361	8,361	8,384	8,361	8,361	8,361	8,384	8,361	8,361	8,361	8,384	8,361	8,361	0	0	0
	Waste Conveyor Line 4	—	Electric	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20,447	20,391	20,391	20,391	20,447	20,391	20,391	20,391	20,447	20,391	20,391	0	0	0
	Waste Conveyor Line 5	—	Electric	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,242	3,233	3,233	3,233	3,242	3,233	3,233	3,233	3,242	3,233	3,233	0	0	0
	Waste Conveyor Line 6	—	Electric	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47,537	47,407	47,407	47,407	47,537	47,407	47,407	47,407	47,537	47,407	47,407	0	0	0
Waste Stockpile - Mining Spreader	Spreader System Conveyor Line 1	—	Electric	1	0	0	17,557	17,605	17,557	17,557	17,557	17,605	17,557	17,557	17,557	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Spreader System Conveyor Line 2	—	Electric	1	0	0	0	0	0	0	0	0	24,746	24,746	24,746	24,814	24,746	24,746	24,746	24,814	24,746	24,746	24,746	24,814	24,746	24,746	24,746	24,814	24,746	24,746	0	0	0
	Spreader System Conveyor Line 3	—	Electric	1	0	0	17,544	17,592	17,544	17,544	17,544	17,592	17,544	17,544	17,544	17,592	17,544	17,544	17,544	17,592	17,544	17,544	17,544	17,592	17,544	17,544	17,544	17,592	17,544	17,544	0	0	0
	Waste Spreader System	—	Electric	1	0	0	5,582	5,598	5,582	5,582	5,582	5,598	5,582	5,582	5,582	5,598	5,582	5,582	5,582	5,598	5,582	5,582	5,582	5,598	5,582	5,582	5,582	5,598	5,582	5,582	0	0	0
	Waste Tripper Cars (Spreader)	—	Electric	1	0	0	13,189	13,225	13,189	13,189	13,189	13,225	13,189	13,189	13,189	13,225	13,189	13,189	13,189	13,225	13,189	13,189	13,189	13,225	13,189	13,189	13,189	13,225	13,189	13,189	0	0	0

Processing Equipment

Equipment	Annual Electricity Consumption (MWh)																														
	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35		
Concentrator – Boilers	0	81,667	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500	122,500
Concentrator – AG Mill	0	87,528	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292
Concentrator – Ball Mill	0	87,528	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292	131,292
Concentrator – Other loads	0	211,568	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352	317,352
Mine – Pumping stations	0	77,672	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508	116,508
Primary Crusher – Overland Conveyor (1/3)	0	6,216	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324	9,324
Mine garage	0	26,280	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420	39,420
Overland conveyor (2/3)	0	12,544	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
Waste stockpile – Waste pumping stations	0	13,432	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148	20,148
Tailings – Lifting stations	0	2,800	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200
Worker's camp	0	29,200	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800	43,800
Other site loads – Fresh water pumphouse, Gate house, Emergency stockpile, Silo, Train loadout	0	8,643	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965	12,965

Preliminary Estimates of Indiret GHG Emissions Associated with Various Activities Outside the Project Boundary

On-Road

Construction, Operations and Closure

On-road GHG emissions outside the Project boundary estimated to be 25% of total direct Project emissions, based on Scope 3 study completed for Champion Bloom Lake Mine

Parameter	Units	Annual On-Road Emissions Estimates																																
		Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Total Project Scope 1 GHG Estimates	$ktCO_2e$ / yr	12	12	23	52	145	94	96	82	68	55	50	62	61	51	52	50	48	47	50	48	49	47	46	44	44	45	45	46	1	1	1
Estimated On-road GHG Emissions Outside Project Boundary	$ktCO_2e$ / yr	**3**	**3**	**6**	**13**	**36**	**24**	**24**	**21**	**17**	**14**	**13**	**16**	**15**	**13**	**13**	**12**	**12**	**12**	**13**	**12**	**12**	**12**	**12**	**11**	**11**	**11**	**11**	**11**	**0**	**0**	**0**

Rail and Marine Transportation

Operations

tonnes of concentrate (used to estimate emissions based on respective Scope 3 emission factors for rail and marine transport as outlined below)

Material	Units	Annual Production																											
		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Concentrate	Mt/yr concentrate	5.4	8.2	8.2	8.2	8.7	8.6	8.5	8.5	8.4	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.7	8.6	8.6	8.8	9.0	0.8	0

Rail GHG Estimates

Estimates are based on Scope 3 study completed for Champion Bloom Lake Mine, as communicated by Champion to WSP. Emission factor details as follows:

10.9 ktCO2eq/Mt of concentrate

Parameter	Units	Preliminary Annual Rail Transportation Emissions Estimates																										
		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
GHG emissions from rail transport	$ktCO_2e$ / yr	59	90	90	90	95	94	93	93	92	93	94	94	94	94	94	94	94	94	94	94	95	94	94	96	98	9	0

Marine GHG Estimates

Estimates are based on Scope 3 study completed for Champion Bloom Lake Mine, as communicated by Champion to WSP. Emission factor details as follows:

49.8 ktCO2eq/Mt of concentrate

Parameter	Units	Preliminary Annual Marine Transportation Emissions Estimates																										
		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
GHG emissions from marine transport	$ktCO_2e$ / yr	269	408	408	408	433	428	423	423	418	423	428	428	428	428	428	428	428	428	428	428	433	428	428	438	448	40	0

Air Travel

Construction (whole period)

Input data:

Input Parameter	Value	Note
Passenger flights during construction	48,800	Pre-feasibility Study s.21.1.15.1 - page 21-18
Trip distance (one way)	1,000	Conservative Assumption - radius that encompasses major population centers in Newfoundland Labrador, Quebec as well as Northern and Southern Ontario
Miles per trip	2,000	Accounts for Return Trip
Total Passenger Miles	97,600,000	Miles per return trip x # of return trips

Calculation of CO_2 Emissions

GWP Values	CO_2
	1

Source		Step 1 - Quantities		Step 2 - CO_2 Emission Factor			Step 3	Step 4
		A	B	C	D	E	F	G
		Passenger Miles	Units for A	CO_2 emission factor	Units for C	Unit conversion factor to tonne	CO_2 emissions in metric tonnes	CO_2 emissions (t CO_2e)
							F = A x C x E	G = F x GWP
1	Air travel during construction	97,600,000	passenger-miles	0.129	kg CO_2/passenger mile	1.00E-03	12,590	12,590

Calculation of CH_4 and N_2O Emissions

GWP Values	CH_4	N_2O
	28	265

Source		Step 5 - CH_4 and N_2O Emission Factors					Step 6			
		H	I	J	K	L	M	N	O	P
		CH_4 emission factor	Units for H	N_2O emission factor	Units for J	Unit conversion factor to tonne	CH_4 emissions (t)	N_2O emissions (t)	CH_4 emissions (t CO_2e)	N_2O emissions (t CO_2e)
							M = Passenger Miles x H x L	N = Passenger Miles x J x L	O = M x GWP	P = N x GWP
1	Air travel during construction	6.00E-07	kg CH_4 / passenger mile	4.10E-06	kg N_2O / passenger mile	1.00E-03	0.059	0.400	2	106

Calculation of total emissions in $ktCO_2e$

Source		Step 7
		Q
		Total Emissions ($ktCO_2e$)
		Q = (G + O + P) / 1000
1	Air travel during construction	**13**

Above estimate of air travel-related emissions are for the entire construction period.

Solid Waste

Construction, Operations and Closure

Solid Waste-related GHG emissions outside the Project boundary estimated to be 4% of total direct Project emissions, based on Scope 3 study completed for Champion Bloom Lake Mine

Parameter	Units	Annual On-Road Emissions Estimates																																
		Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Total Project Scope 1 GHG Estimates	$ktCO_2e$ / yr	12	12	23	52	145	94	96	82	68	55	50	62	61	51	52	50	48	47	50	48	49	47	46	44	44	45	45	46	1	1	1
Estimated Solid Waste-related GHG Emissions Outside Project Boundary	$ktCO_2e$ / yr	**0.5**	**0.5**	**1**	**2**	**6**	**4**	**4**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**0**	**0**	**0**

Greenhouse Gas Emissions - Emission Factors

Fuel Combustion Emission Factors

Activity	Fuel Type	CO_2 Emission Factor		CH_4 Emission Factor		N_2O Emission Factor		tCO_2e Emission Factor	tCO_2e Emission Factor Unit
		CO_2 Emission Factor	CO_2 Emission Factor Unit	CH_4 Emission Factor	CH_4 Emission Factor Unit	N_2O Emission Factor	N_2O Emission Factor Unit		
Stationary Fuel Combustion	Diesel	2,663	kg CO_2/ kL	0.133	kg CH_4/ kL	0.4	kg N_2O/ kL	2,773	kg CO_2/ kL
On-Site Transportation	Diesel	2,663	kg CO_2/ kL	0.133	kg CH_4/ kL	0.4	kg N_2O/ kL	2,773	kg CO_2/ kL
On-Site Transportation	Gasoline	2,289	kg CO_2/ kL	2.7	kg CH_4/ kL	0.05	kg N_2O/ kL	2,378	kg CO_2/ kL

Note: All emission factors in the above table are taken from Table 5-2 of the NL document "A Guidance Document for Reporting Greenhouse Gas Emissions for Large Industry in Newfoundland and Labrador" (March 2017)

Purchased Electricity Emission Factors

Activity	Emission Factor Units	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Purchased Electricity (NL Grid)	t CO_2 eq/GWh	9.1	4.0	4.0	3.9	3.7	3.6	3.7	3.7	3.8	3.9	3.7	3.8	3.8
Emission Factor Reference		ECCC Current Projections of Electricity Grid Intensities, December 2024. from Canada's First Biennial Transparency Report under the Paris Agreement.												

Activity	Emission Factor Units	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Purchased Electricity (NL Grid)	t CO_2 eq/GWh	3.8	3.9	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Emission Factor Reference		ECCC Current Projections of Electricity Grid Intensities, December 2024. from Canada's First Biennial Transparency Report under the Paris Agreement.											Assumed to be the same as 2050, no further predictions available for Newfoundland-Labrador at this time			

Global Warming Potentials (GWP)

Greenhouse Gas	GWP	Reference
Carbon Dioxide	1	Newfoundland Labrador Regulation 14/17 Schedule C
Methane	28	
Nitrous Oxide	265	

Note: emission factors used for preliminary estimates of indirect GHG emissions associated with various activities outside the project boundary are provided on the calculation sheet for those estimates

Direct Greenhouse Gas Emissions - Consumption Data

1.1 Annual Diesel Consumption

Summary: Annual Fuel Usage

Fuel Type	Unit	TOTAL	Annual Fuel Usage																														
			Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Diesel	kL	475,919	ND	ND	3,707	12,953	49,892	31,795	32,053	27,151	21,792	17,325	15,479	19,894	19,263	15,888	15,889	15,342	14,869	14,578	15,400	14,791	15,177	14,890	14,665	14,085	14,219	14,505	14,670	14,955	509	183	346

Mobile Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Fuel Usage (L)																													
				Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	ND	ND	0	204,464	225,021	191,074	126,698	92,965	198,088	161,539	123,008	117,778	106,303	93,439	107,526	101,227	83,149	68,642	99,382	90,599	94,360	106,287	67,728	63,392	59,863	80,657	53,052	104,655	0	0	0
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	ND	ND	849,945	439,778	542,456	598,726	633,934	854,861	991,340	1,030,667	632,134	590,385	654,354	911,288	978,930	880,758	653,180	692,127	1,161,546	912,481	917,281	593,927	719,024	463,730	279,936	293,518	289,849	118,079	0	0	0
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	ND	ND	1,552,525	4,426,649	5,879,593	6,174,215	6,776,237	6,734,504	6,661,840	6,611,569	7,641,403	7,966,953	7,568,959	7,058,351	7,742,321	7,512,592	7,383,634	7,281,756	7,578,284	6,757,911	7,383,797	7,390,145	7,415,909	6,971,372	7,546,796	7,968,940	8,168,729	8,573,702	0	0	0
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	ND	ND	310,827	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	1,243,307	1,246,713	1,243,307	1,243,307	0	0	0
Motor Grader (18ft)	CAT-18M	Diesel	3	ND	ND	69,523	417,139	417,139	418,282	417,139	417,139	417,139	418,282	417,139	417,139	417,139	418,282	417,139	417,139	417,139	417,139	417,139	417,139	418,282	417,139	417,139	417,139	417,139	418,282	417,139	417,139	0	0	0
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	ND	ND	447,845	447,845	895,691	898,145	895,691	895,691	895,691	898,145	895,691	895,691	895,691	898,145	895,691	895,691	895,691	898,145	895,691	895,691	895,691	898,145	895,691	895,691	895,691	898,145	895,691	895,691	0	0	0
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	ND	ND	0	330,235	660,470	662,280	660,470	660,470	660,470	662,280	660,470	660,470	660,470	662,280	660,470	660,470	660,470	662,280	660,470	660,470	660,470	662,280	660,470	660,470	660,470	662,280	660,470	660,470	0	0	0
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	ND	ND	96,789	193,579	193,579	194,109	193,579	193,579	193,579	194,109	193,579	193,579	193,579	194,109	193,579	193,579	193,579	194,109	193,579	193,579	193,579	194,109	193,579	193,579	193,579	194,109	193,579	193,579	0	0	0
Stemming Loader	Komatsu-WA380-8	Diesel	2	ND	ND	35,781	71,563	143,125	143,517	143,125	143,125	143,125	143,517	143,125	143,125	143,125	143,517	143,125	143,125	143,125	143,517	143,125	143,125	143,125	143,517	143,125	143,125	143,125	143,517	143,125	143,125	0	0	0
Excavator (90t)	Komatsu-PC800	Diesel	1	ND	ND	146,893	146,893	146,893	147,295	146,893	146,893	146,893	147,295	146,893	146,893	146,893	147,295	146,893	146,893	146,893	147,295	146,893	146,893	146,893	147,295	146,893	146,893	146,893	147,295	146,893	146,893	0	0	0
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	ND	ND	0	111,816	111,816	112,123	111,816	111,816	111,816	112,123	111,816	111,816	111,816	112,123	111,816	111,816	111,816	112,123	111,816	111,816	111,816	112,123	111,816	111,816	111,816	112,123	111,816	111,816	0	0	0
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	ND	ND	0	18,424	36,848	36,949	36,848	36,848	36,848	36,949	36,848	36,848	36,848	36,949	36,848	36,848	36,848	36,949	36,848	36,848	36,848	36,949	36,848	36,848	36,848	36,949	36,848	36,848	0	0	0
Rehandling	—	Diesel	1	ND	ND	0	20	5	26	6	98	201	403	43	5	28	147	218	228	0	21	267	105	285	44	318	145	51	136	181	29	0	0	0
Mining Contract	—	Diesel	1	ND	ND	3,094	21,393	10,641	10,401	7,485	4,186	1,520	104	2,707	2,569	740	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topo Drilling Contract	—	Diesel	1	ND	ND	153	178	273	194	195	214	179	142	133	99	94	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boom Truck 28t	Manitex-2892C	Diesel	2	ND	ND	59,616	59,616	59,616	59,779	59,616	59,616	59,616	59,779	59,616	59,616	59,616	59,779	59,616	59,616	59,616	59,779	59,616	59,616	59,616	59,779	59,616	59,616	59,616	59,779	59,616	59,616	0	0	0
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	ND	ND	0	26,923	53,846	53,994	53,846	53,846	53,846	53,994	53,846	53,846	53,846	53,994	53,846	53,846	53,846	53,994	53,846	53,846	53,846	53,994	53,846	53,846	53,846	53,994	53,846	53,846	0	0	0
Snow Blower	Vohl-Vohl-350	Diesel	2	ND	ND	0	31,085	62,171	62,341	62,171	62,171	62,171	62,341	62,171	62,171	62,171	62,341	62,171	62,171	62,171	62,341	62,171	62,171	62,171	62,341	62,171	62,171	62,171	62,341	62,171	62,171	0	0	0
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	ND	ND	0	30,735	61,470	61,639	61,470	61,470	61,470	61,639	61,470	61,470	61,470	61,639	61,470	61,470	61,470	61,639	61,470	61,470	61,470	61,639	61,470	61,470	61,470	61,639	61,470	61,470	0	0	0
Pit Bus	Ford-Nordik	Diesel	1	ND	ND	0	17,033	34,066	34,159	34,066	34,066	34,066	34,159	34,066	34,066	34,066	34,159	34,066	34,066	34,066	34,159	34,066	34,066	34,066	34,159	34,066	34,066	34,066	34,159	34,066	34,066	0	0	0
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	ND	ND	95,716	95,716	191,433	191,957	191,433	191,433	191,433	191,957	191,433	191,433	191,433	191,957	191,433	191,433	191,433	191,957	191,433	191,433	191,433	191,957	191,433	191,433	191,433	191,957	191,433	191,433	0	0	0
Mechanic Service Truck	International-International CV515	Diesel	3	ND	ND	38,640	115,920	231,839	232,474	231,839	231,839	231,839	232,474	231,839	231,839	231,839	232,474	231,839	231,839	231,839	232,474	231,839	231,839	231,839	232,474	231,839	231,839	231,839	232,474	231,839	231,839	0	0	0
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	ND	ND	0	140,001	280,001	280,768	280,001	280,001	280,001	280,768	280,001	280,001	280,001	280,768	280,001	280,001	280,001	280,768	280,001	280,001	280,001	280,768	280,001	280,001	280,001	280,768	280,001	280,001	0	0	0
Wheel Loader	Komatsu WE-1850	Diesel	2	ND	ND	0	849,945	634,785	933,222	989,492	1,024,700	1,245,627	1,382,105	1,421,430	1,022,900	981,151	1,045,120	1,302,054	1,369,692	1,271,518	1,043,946	1,082,893	1,552,302	1,303,247	1,308,040	984,693	1,108,967	854,496	670,702	680,490	680,483	508,844	183,238	346,041
Haul Truck (100 t)	CAT 777	Diesel	12	ND	ND	0	2,294,954	15,868,505	7,893,581	7,715,343	5,552,299	3,105,125	1,127,336	77,001	2,008,070	1,905,425	548,704	119,235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rest of overburden contract	Miscellaneous	Diesel	N/A	ND	ND	0	798,901	21,392,523	10,641,432	10,401,146	7,485,121	4,186,056	1,519,775	103,807	2,707,104	2,568,726	739,714	160,742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TOTAL:		ND	ND	**3,707,347**	**12,534,112**	**49,377,112**	**31,279,396**	**31,473,847**	**26,572,258**	**21,213,284**	**16,670,165**	**14,824,977**	**19,239,174**	**18,609,091**	**15,233,534**	**15,234,335**	**14,687,807**	**14,214,793**	**13,923,017**	**14,745,684**	**14,136,709**	**14,522,280**	**14,234,967**	**14,010,982**	**13,430,917**	**13,564,453**	**13,850,479**	**14,015,610**	**14,300,259**	**508,844**	**183,238**	**346,041**

Electricity Generation

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Fuel Usage (L)																													
				Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Genset 6kW	Multiquip-DAC7000SSA3	Diesel	3	ND	ND	0	0	7,086	7,105	7,086	7,086	7,086	7,105	7,086	7,086	7,086	7,105	7,086	7,086	7,086	7,105	7,086	7,086	7,086	7,105	7,086	7,086	7,086	7,105	7,086	7,086	0	0	0
Genset 60kW	Multiquip-DCA70SSIU4F	Diesel	2	ND	ND	0	0	49,055	49,190	49,055	49,055	49,055	49,190	49,055	49,055	49,055	49,190	49,055	49,055	49,055	49,190	49,055	49,055	49,055	49,190	49,055	49,055	49,055	49,190	49,055	49,055	0	0	0
		TOTAL:		ND	ND	**0**	**0**	**56,141**	**56,295**	**56,141**	**56,141**	**56,141**	**56,295**	**56,141**	**56,141**	**56,141**	**56,295**	**56,141**	**56,141**	**56,141**	**56,295**	**56,141**	**56,141**	**56,141**	**56,295**	**56,141**	**56,141**	**56,141**	**56,295**	**56,141**	**56,141**	**0**	**0**	**0**

General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Fuel Usage (L)																													
				Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	ND	ND	0	5,425	10,851	10,880	10,851	10,851	10,851	10,880	10,851	10,851	10,851	10,880	10,851	10,851	10,851	10,880	10,851	10,851	10,851	10,880	10,851	10,851	10,851	10,880	10,851	10,851	0	0	0
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	ND	ND	0	4,731	9,463	9,489	9,463	9,463	9,463	9,489	9,463	9,463	9,463	9,489	9,463	9,463	9,463	9,489	9,463	9,463	9,463	9,489	9,463	9,463	9,463	9,489	9,463	9,463	0	0	0
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	ND	ND	0	379,485	379,485	379,485	443,191	443,191	443,191	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	518,842	0	0	0
Light Plant	Generac-MLT6SKDS	Diesel	10	ND	ND	0	29,524	59,048	59,210	59,048	59,048	59,048	59,210	59,048	59,048	59,048	59,210	59,048	59,048	59,048	59,210	59,048	59,048	59,048	59,210	59,048	59,048	59,048	59,210	59,048	59,048	0	0	0
		TOTAL:		ND	ND	**0**	**409,009**	**438,533**	**438,694**	**502,239**	**502,239**	**502,239**	**578,052**	**577,890**	**577,890**	**577,890**	**578,052**	**577,890**	**577,890**	**577,890**	**578,052**	**577,890**	**577,890**	**577,890**	**578,052**	**577,890**	**577,890**	**577,890**	**578,052**	**577,890**	**577,890**	**0**	**0**	**0**

1.2 Annual Gasoline Consumption

Summary: Annual Fuel Usage

Fuel Type	Units	TOTAL	Annual Fuel Usage																														
			Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Gasoline	kL	17,550	ND	ND	68	357	713	715	713	713	713	715	713	713	713	715	713	713	713	715	713	713	713	715	713	713	713	715	713	713	0	0	0

Total Fleet: Annual Fuel Usage

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Fuel Usage (L)																													
				Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	ND	ND	28	84	84	85	84	84	84	85	84	84	84	85	84	84	84	85	84	84	84	85	84	84	84	85	84	84	0	0	0
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	ND	ND	68,194	356,483	712,967	714,920	712,967	712,967	712,967	714,920	712,967	712,967	712,967	714,920	712,967	712,967	712,967	714,920	712,967	712,967	712,967	714,920	712,967	712,967	712,967	714,920	712,967	712,967	0	0	0

1.3 Mining Explosives

tonnes of emulsion

Explosive type	Unit	Annual Usage(tonnes)																															
		Y-4	Y-3	Y-2	Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Emulsion	tonnes of emulsion	ND	ND	4,651	16,096	23,071	23,040	24,799	26,415	28,857	28,862	27,307	27,433	28,424	28,021	28,885	26,508	26,508	26,628	30,535	27,416	24,869	22,471	19,704	17,096	15,802	14,765	13,817	13,031	0	0	0

ND = No data estimate available - see Construction GHG estimations sheets for details on GHG estimates for years Y-4 to Y-1.

Direct Greenhouse Gas Emissions - Construction - CO_2 Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	ND	ND	0	544
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	ND	ND	2,263	1,171
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	ND	ND	4,134	11,788
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	ND	ND	828	3,311
Motor Grader (18ft)	CAT-18M	Diesel	3	ND	ND	185	1,111
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	ND	ND	1,193	1,193
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	ND	ND	0	879
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	ND	ND	258	515
Stemming Loader	Komatsu-WA380-8	Diesel	2	ND	ND	95	191
Excavator (90t)	Komatsu-PC800	Diesel	1	ND	ND	391	391
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	ND	ND	0	298
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	ND	ND	0	49
Rehandling	—	Diesel	1	ND	ND	0	0
Mining Contract	—	Diesel	1	ND	ND	8	57
Topo Drilling Contract	—	Diesel	1	ND	ND	0	0
Boom Truck 28t	Manitex-2892C	Diesel	2	ND	ND	159	159
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	ND	ND	0	72
Snow Blower	Vohl-Vohl-350	Diesel	2	ND	ND	0	83
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	ND	ND	0	82
Pit Bus	Ford-Nordik	Diesel	1	ND	ND	0	45
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	ND	ND	255	255
Mechanic Service Truck	International-International CV515	Diesel	3	ND	ND	103	309
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	ND	ND	0	373
Wheel Loader	Komatsu WE-1850	Diesel	2	ND	ND	0	2,263
Haul Truck (100 t)	CAT 777	Diesel	12	ND	ND	0	6,111
Rest of overburden contract	Miscellaneous	Diesel	N/A	ND	ND	0	2,127
			TOTAL:	ND	ND	**9,873**	**33,378**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	ND	ND	0	14
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	ND	ND	0	13
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	ND	ND	0	1,011
Light Plant	Generac-MLT6SKDS	Diesel	10	ND	ND	0	79
			TOTAL:	ND	ND	**0**	**1,089**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	ND	ND	0	0
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	ND	ND	156	816
			TOTAL:	ND	ND	**156**	**816**

CO2 from Mining Explosives

Explosive type	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Emulsion	tonnes of emulsion	ND	ND	937	3,244

Construction GHG Estimates from Alderon EIS (Alderon, 2012)

Activity	Total Emissions (tonnes)	Approximate Emissions Per Year (tonnes)
Equipment Operation - general	43,533	10,883
Equipment Operation - TMF	4,066	1,017
Total	**47,599**	**11,900**

Total Annual GHG Emissions Estimates

Parameter	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Total Annual Emissions	tCO_2	11,900	11,900	22,866	50,427

ND = No data estimate available

Direct Greenhouse Gas Emissions - Construction - CH_4 Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	ND	ND	0.00E+00	2.72E-02
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	ND	ND	1.13E-01	5.85E-02
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	ND	ND	2.06E-01	5.89E-01
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	ND	ND	4.13E-02	1.65E-01
Motor Grader (18ft)	CAT-18M	Diesel	3	ND	ND	9.25E-03	5.55E-02
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	ND	ND	5.96E-02	5.96E-02
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	ND	ND	0.00E+00	4.39E-02
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	ND	ND	1.29E-02	2.57E-02
Stemming Loader	Komatsu-WA380-8	Diesel	2	ND	ND	4.76E-03	9.52E-03
Excavator (90t)	Komatsu-PC800	Diesel	1	ND	ND	1.95E-02	1.95E-02
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	ND	ND	0.00E+00	1.49E-02
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	ND	ND	0.00E+00	2.45E-03
Rehandling	—	Diesel	1	ND	ND	0.00E+00	2.72E-06
Mining Contract	—	Diesel	1	ND	ND	4.11E-04	2.85E-03
Topo Drilling Contract	—	Diesel	1	ND	ND	2.03E-05	2.36E-05
Boom Truck 28t	Manitex-2892C	Diesel	2	ND	ND	7.93E-03	7.93E-03
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	ND	ND	0.00E+00	3.58E-03
Snow Blower	Vohl-Vohl-350	Diesel	2	ND	ND	0.00E+00	4.13E-03
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	ND	ND	0.00E+00	4.09E-03
Pit Bus	Ford-Nordik	Diesel	1	ND	ND	0.00E+00	2.27E-03
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	ND	ND	1.27E-02	1.27E-02
Mechanic Service Truck	International-International CV515	Diesel	3	ND	ND	5.14E-03	1.54E-02
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	ND	ND	0.00E+00	1.86E-02
Wheel Loader	Komatsu WE-1850	Diesel	2	ND	ND	0.00E+00	1.13E-01
Haul Truck (100 t)	CAT 777	Diesel	12	ND	ND	0.00E+00	3.05E-01
Rest of overburden contract	Miscellaneous	Diesel	N/A	ND	ND	0.00E+00	1.06E-01
			TOTAL:	ND	ND	**0.49**	**1.67**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	ND	ND	0.00E+00	7.22E-04
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	ND	ND	0.00E+00	6.29E-04
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	ND	ND	0.00E+00	5.05E-02
Light Plant	Generac-MLT6SKDS	Diesel	10	ND	ND	0.00E+00	3.93E-03
			TOTAL:	ND	ND	**0.00**	**0.05**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	ND	ND	7.60E-05	2.28E-04
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	ND	ND	1.84E-01	9.63E-01
			TOTAL:	ND	ND	**0.2**	**1.0**

Construction GHG Estimates from Alderon

Activity	Total GHG Emissions (tonnes)	Approximate GHG Emissions Per Year (tonnes)
Equipment Operation - general	ND	ND
Equipment Operation - TMF	ND	ND
Total	**ND**	**ND**

Total Annual GHG Emissions Estimates

Parameter	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Total Annual Emissions	tCH_4	0.0	0.0	0.7	2.7

ND = No data estimate available

Direct Greenhouse Gas Emissions - Construction - N_2O Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	ND	ND	0.00E+00	8.18E-02
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	ND	ND	3.40E-01	1.76E-01
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	ND	ND	6.21E-01	1.77E+00
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	ND	ND	1.24E-01	4.97E-01
Motor Grader (18ft)	CAT-18M	Diesel	3	ND	ND	2.78E-02	1.67E-01
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	ND	ND	1.79E-01	1.79E-01
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	ND	ND	0.00E+00	1.32E-01
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	ND	ND	3.87E-02	7.74E-02
Stemming Loader	Komatsu-WA380-8	Diesel	2	ND	ND	1.43E-02	2.86E-02
Excavator (90t)	Komatsu-PC800	Diesel	1	ND	ND	5.88E-02	5.88E-02
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	ND	ND	0.00E+00	4.47E-02
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	ND	ND	0.00E+00	7.37E-03
Rehandling	—	Diesel	1	ND	ND	0.00E+00	8.18E-06
Mining Contract	—	Diesel	1	ND	ND	1.24E-03	8.56E-03
Topo Drilling Contract	—	Diesel	1	ND	ND	6.12E-05	7.10E-05
Boom Truck 28t	Manitex-2892C	Diesel	2	ND	ND	2.38E-02	2.38E-02
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	ND	ND	0.00E+00	1.08E-02
Snow Blower	Vohl-Vohl-350	Diesel	2	ND	ND	0.00E+00	1.24E-02
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	ND	ND	0.00E+00	1.23E-02
Pit Bus	Ford-Nordik	Diesel	1	ND	ND	0.00E+00	6.81E-03
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	ND	ND	3.83E-02	3.83E-02
Mechanic Service Truck	International-International CV515	Diesel	3	ND	ND	1.55E-02	4.64E-02
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	ND	ND	0.00E+00	5.60E-02
Wheel Loader	Komatsu WE-1850	Diesel	2	ND	ND	0.00E+00	3.40E-01
Haul Truck (100 t)	CAT 777	Diesel	12	ND	ND	0.00E+00	9.18E-01
Rest of overburden contract	Miscellaneous	Diesel	N/A	ND	ND	0.00E+00	3.20E-01
			TOTAL:	ND	ND	**1.48**	**5.01**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	ND	ND	0.00E+00	2.17E-03
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	ND	ND	0.00E+00	1.89E-03
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	ND	ND	0.00E+00	1.52E-01
Light Plant	Generac-MLT6SKDS	Diesel	10	ND	ND	0.00E+00	1.18E-02
			TOTAL:	ND	ND	**0.00**	**0.16**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	ND	ND	1.41E-06	4.22E-06
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	ND	ND	3.41E-03	1.78E-02
			TOTAL:	ND	ND	**0.00**	**0.02**

Construction GHG Estimates from Alderon

Activity	Total GHG Emissions (tonnes)	Approximate GHG Emissions Per Year (tonnes)
Equipment Operation - general	ND	ND
Equipment Operation - TMF	ND	ND
Total	**ND**	**ND**

Total Annual GHG Emissions Estimates

Parameter	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Total Annual Emissions	tN_2O	ND	ND	1.5	5.2

ND = No data estimate available

Direct Greenhouse Gas Emissions - Construction - tCO_2e Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	ND	ND	0	567
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	ND	ND	2,357	1,219
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	ND	ND	4,305	12,274
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	ND	ND	862	3,447
Motor Grader (18ft)	CAT-18M	Diesel	3	ND	ND	193	1,157
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	ND	ND	1,242	1,242
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	ND	ND	0	916
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	ND	ND	268	537
Stemming Loader	Komatsu-WA380-8	Diesel	2	ND	ND	99	198
Excavator (90t)	Komatsu-PC800	Diesel	1	ND	ND	407	407
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	ND	ND	0	310
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	ND	ND	0	51
Rehandling	—	Diesel	1	ND	ND	0	0
Mining Contract	—	Diesel	1	ND	ND	9	59
Topo Drilling Contract	—	Diesel	1	ND	ND	0	0
Boom Truck 28t	Manitex-2892C	Diesel	2	ND	ND	165	165
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	ND	ND	0	75
Snow Blower	Vohl-Vohl-350	Diesel	2	ND	ND	0	86
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	ND	ND	0	85
Pit Bus	Ford-Nordik	Diesel	1	ND	ND	0	47
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	ND	ND	265	265
Mechanic Service Truck	International-International CV515	Diesel	3	ND	ND	107	321
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	ND	ND	0	388
Wheel Loader	Komatsu WE-1850	Diesel	2	ND	ND	0	2,357
Haul Truck (100 t)	CAT 777	Diesel	12	ND	ND	0	6,363
Rest of overburden contract	Miscellaneous	Diesel	N/A	ND	ND	0	2,215
			TOTAL:	ND	ND	**10,279**	**34,754**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	ND	ND	0	15
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	ND	ND	0	13
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	ND	ND	0	1,052
Light Plant	Generac-MLT6SKDS	Diesel	10	ND	ND	0	82
			TOTAL:	ND	ND	**0**	**1,134**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Emissions (tonnes)			
				Y-4	Y-3	Y-2	Y-1
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	ND	ND	0	0
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	ND	ND	162	848
			TOTAL:	ND	ND	**162**	**848**

CO2 from Mining Explosives

Explosive type	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Emulsion	tonnes of emulsion	ND	ND	937	3,244

Construction GHG Estimates from Alderon EIS (Alderon, 2012)

Activity	Total Emissions (tonnes)	Approximate Emissions Per Year (tonnes)
Equipment Operation - general	43,533	10,883
Equipment Operation - TMF	4,066	1,017
Total	**47,599**	**11,900**

Total Annual GHG Emissions Estimates

Parameter	Unit	Emissions (tonnes)			
		Y-4	Y-3	Y-2	Y-1
Total Annual Emissions	tCO_2e	11,900	11,900	23,279	51,879

ND = No data estimate available

Direct Greenhouse Gas Emissions - Operations and Closure - CO_2 Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																										
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	599	509	337	248	528	430	328	314	283	249	286	270	221	183	265	241	251	283	180	169	159	215	141	279	0	0	0
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	1,445	1,594	1,688	2,276	2,640	2,745	1,683	1,572	1,743	2,427	2,607	2,345	1,739	1,843	3,093	2,430	2,443	1,582	1,915	1,235	745	782	772	314	0	0	0
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	15,657	16,442	18,045	17,934	17,740	17,607	20,349	21,216	20,156	18,796	20,618	20,006	19,663	19,391	20,181	17,996	19,663	19,680	19,749	18,565	20,097	21,221	21,753	22,832	0	0	0
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	3,311	3,320	3,311	3,311	3,311	3,320	3,311	3,311	3,311	3,320	3,311	3,311	3,311	3,320	3,311	3,311	3,311	3,320	3,311	3,311	3,311	3,320	3,311	3,311	0	0	0
Motor Grader (18ft)	CAT-18M	Diesel	3	1,111	1,114	1,111	1,111	1,111	1,114	1,111	1,111	1,111	1,114	1,111	1,111	1,111	1,114	1,111	1,111	1,111	1,114	1,111	1,111	1,111	1,114	1,111	1,111	0	0	0
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	2,385	2,392	2,385	2,385	2,385	2,392	2,385	2,385	2,385	2,392	2,385	2,385	2,385	2,392	2,385	2,385	2,385	2,392	2,385	2,385	2,385	2,392	2,385	2,385	0	0	0
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	1,759	1,764	1,759	1,759	1,759	1,764	1,759	1,759	1,759	1,764	1,759	1,759	1,759	1,764	1,759	1,759	1,759	1,764	1,759	1,759	1,759	1,764	1,759	1,759	0	0	0
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	515	517	515	515	515	517	515	515	515	517	515	515	515	517	515	515	515	517	515	515	515	517	515	515	0	0	0
Stemming Loader	Komatsu-WA380-8	Diesel	2	381	382	381	381	381	382	381	381	381	382	381	381	381	382	381	381	381	382	381	381	381	382	381	381	0	0	0
Excavator (90t)	Komatsu-PC800	Diesel	1	391	392	391	391	391	392	391	391	391	392	391	391	391	392	391	391	391	392	391	391	391	392	391	391	0	0	0
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	298	299	298	298	298	299	298	298	298	299	298	298	298	299	298	298	298	299	298	298	298	299	298	298	0	0	0
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0
Rehandling	—	Diesel	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Mining Contract	—	Diesel	1	28	28	20	11	4	0	7	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topo Drilling Contract	—	Diesel	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boom Truck 28t	Manitex-2892C	Diesel	2	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	159	0	0	0
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	143	144	143	143	143	144	143	143	143	144	143	143	143	144	143	143	143	144	143	143	143	144	143	143	0	0	0
Snow Blower	Vohl-Vohl-350	Diesel	2	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	0	0	0
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	0	0	0
Pit Bus	Ford-Nordik	Diesel	1	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	0	0	0
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	510	511	510	510	510	511	510	510	510	511	510	510	510	511	510	510	510	511	510	510	510	511	510	510	0	0	0
Mechanic Service Truck	International-International CV515	Diesel	3	617	619	617	617	617	619	617	617	617	619	617	617	617	619	617	617	617	619	617	617	617	619	617	617	0	0	0
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	746	748	746	746	746	748	746	746	746	748	746	746	746	748	746	746	746	748	746	746	746	748	746	746	0	0	0
Wheel Loader	Komatsu WE-1850	Diesel	2	1,690	2,485	2,635	2,729	3,317	3,681	3,785	2,724	2,613	2,783	3,467	3,647	3,386	2,780	2,884	4,134	3,471	3,483	2,622	2,953	2,276	1,786	1,812	1,812	1,355	488	922
Haul Truck (100 t)	CAT 777	Diesel	12	42,258	21,021	20,546	14,786	8,269	3,002	205	5,347	5,074	1,461	318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rest of overburden contract	Miscellaneous	Diesel	N/A	56,968	28,338	27,698	19,933	11,147	4,047	276	7,209	6,841	1,970	428	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			TOTAL:	**131,491**	**83,297**	**83,815**	**70,762**	**56,491**	**44,393**	**39,479**	**51,234**	**49,556**	**40,567**	**40,569**	**39,114**	**37,854**	**37,077**	**39,268**	**37,646**	**38,673**	**37,908**	**37,311**	**35,767**	**36,122**	**36,884**	**37,324**	**38,082**	**1,355**	**488**	**922**

Diesel Electricity Generation

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																										
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Genset 6kW	Multiquip-DAC7000SSA3	Diesel	3	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	0	0	0
Genset 60kW	Multiquip-DCA70SSIU4F	Diesel	2	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	0	0	0
			TOTAL:	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**0**	**0**	**0**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																										
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	0	0	0
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	0	0	0
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	1,011	1,011	1,180	1,180	1,180	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	1,382	0	0	0
Light Plant	Generac-MLT6SKDS	Diesel	10	157	158	157	157	157	158	157	157	157	158	157	157	157	158	157	157	157	158	157	157	157	158	157	157	0	0	0
			TOTAL:	**1,168**	**1,168**	**1,337**	**1,337**	**1,337**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**1,539**	**0**	**0**	**0**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																										
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	1,632	1,636	1,632	1,632	1,632	1,636	1,632	1,632	1,632	1,636	1,632	1,632	1,632	1,636	1,632	1,632	1,632	1,636	1,632	1,632	1,632	1,636	1,632	1,632	0	0	0
			TOTAL:	**1,632**	**1,637**	**1,632**	**1,632**	**1,632**	**1,637**	**1,632**	**1,632**	**1,632**	**1,637**	**1,632**	**1,632**	**1,632**	**1,637**	**1,632**	**1,632**	**1,632**	**1,637**	**1,632**	**1,632**	**1,632**	**1,637**	**1,632**	**1,632**	**0**	**0**	**0**

CO2 from Mining Explosives

Explosive type	Unit	Annual Emissions (tonnes)																												
		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Emulsion	tonnes of emulsion	4,649	4,643	4,997	5,323	5,815	5,816	5,503	5,528	5,728	5,647	5,821	5,342	5,342	5,366	6,153	5,525	5,012	4,528	3,971	3,445	3,184	2,975	2,784	2,626	0	0	0

Direct Greenhouse Gas Emissions - Operations and Closure - CH_4 Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	2.99E-02	2.54E-02	1.69E-02	1.24E-02	2.63E-02	2.15E-02	1.64E-02	1.57E-02	1.41E-02	1.24E-02	1.43E-02	1.35E-02	1.11E-02	9.13E-03	1.32E-02	1.20E-02	1.25E-02	1.41E-02	9.01E-03	8.43E-03	7.96E-03	1.07E-02	7.06E-03	1.39E-02	0.00E+00	0.00E+00	0.00E+00
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	7.21E-02	7.96E-02	8.43E-02	1.14E-01	1.32E-01	1.37E-01	8.41E-02	7.85E-02	8.70E-02	1.21E-01	1.30E-01	1.17E-01	8.69E-02	9.21E-02	1.54E-01	1.21E-01	1.22E-01	7.90E-02	9.56E-02	6.17E-02	3.72E-02	3.90E-02	3.85E-02	1.57E-02	0.00E+00	0.00E+00	0.00E+00
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	7.82E-01	8.21E-01	9.01E-01	8.96E-01	8.86E-01	8.79E-01	1.02E+00	1.06E+00	1.01E+00	9.39E-01	1.03E+00	9.99E-01	9.82E-01	9.68E-01	1.01E+00	8.99E-01	9.82E-01	9.83E-01	9.86E-01	9.27E-01	1.00E+00	1.06E+00	1.09E+00	1.14E+00	0.00E+00	0.00E+00	0.00E+00
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	1.65E-01	1.66E-01	1.65E-01	1.65E-01	1.65E-01	1.66E-01	1.65E-01	1.65E-01	1.65E-01	1.66E-01	1.65E-01	1.65E-01	1.65E-01	1.66E-01	1.65E-01	1.65E-01	1.65E-01	1.66E-01	1.65E-01	1.65E-01	1.65E-01	1.66E-01	1.65E-01	1.65E-01	0.00E+00	0.00E+00	0.00E+00
Motor Grader (18ft)	CAT-18M	Diesel	3	5.55E-02	5.56E-02	5.55E-02	5.55E-02	5.55E-02	5.56E-02	5.55E-02	5.55E-02	5.55E-02	5.56E-02	5.55E-02	5.55E-02	5.55E-02	5.56E-02	5.55E-02	5.55E-02	5.55E-02	5.56E-02	5.55E-02	5.55E-02	5.55E-02	5.56E-02	5.55E-02	5.55E-02	0.00E+00	0.00E+00	0.00E+00
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	1.19E-01	0.00E+00	0.00E+00	0.00E+00
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	8.78E-02	8.81E-02	8.78E-02	8.78E-02	8.78E-02	8.81E-02	8.78E-02	8.78E-02	8.78E-02	8.81E-02	8.78E-02	8.78E-02	8.78E-02	8.81E-02	8.78E-02	8.78E-02	8.78E-02	8.81E-02	8.78E-02	8.78E-02	8.78E-02	8.81E-02	8.78E-02	8.78E-02	0.00E+00	0.00E+00	0.00E+00
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	2.57E-02	2.58E-02	2.57E-02	2.57E-02	2.57E-02	2.58E-02	2.57E-02	2.57E-02	2.57E-02	2.58E-02	2.57E-02	2.57E-02	2.57E-02	2.58E-02	2.57E-02	2.57E-02	2.57E-02	2.58E-02	2.57E-02	2.57E-02	2.57E-02	2.58E-02	2.57E-02	2.57E-02	0.00E+00	0.00E+00	0.00E+00
Stemming Loader	Komatsu-WA380-8	Diesel	2	1.90E-02	1.91E-02	1.90E-02	1.90E-02	1.90E-02	1.91E-02	1.90E-02	1.90E-02	1.90E-02	1.91E-02	1.90E-02	1.90E-02	1.90E-02	1.91E-02	1.90E-02	1.90E-02	1.90E-02	1.91E-02	1.90E-02	1.90E-02	1.90E-02	1.91E-02	1.90E-02	1.90E-02	0.00E+00	0.00E+00	0.00E+00
Excavator (90t)	Komatsu-PC800	Diesel	1	1.95E-02	1.96E-02	1.95E-02	1.95E-02	1.95E-02	1.96E-02	1.95E-02	1.95E-02	1.95E-02	1.96E-02	1.95E-02	1.95E-02	1.95E-02	1.96E-02	1.95E-02	1.95E-02	1.95E-02	1.96E-02	1.95E-02	1.95E-02	1.95E-02	1.96E-02	1.95E-02	1.95E-02	0.00E+00	0.00E+00	0.00E+00
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	0.00E+00	0.00E+00	0.00E+00
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	4.90E-03	4.91E-03	4.90E-03	4.90E-03	4.90E-03	4.91E-03	4.90E-03	4.90E-03	4.90E-03	4.91E-03	4.90E-03	4.90E-03	4.90E-03	4.91E-03	4.90E-03	4.90E-03	4.90E-03	4.91E-03	4.90E-03	4.90E-03	4.90E-03	4.91E-03	4.90E-03	4.90E-03	0.00E+00	0.00E+00	0.00E+00
Rehandling	—	Diesel	1	6.46E-07	3.42E-06	7.66E-07	1.30E-05	2.67E-05	5.36E-05	5.78E-06	6.91E-07	3.76E-06	1.96E-05	2.89E-05	3.03E-05	3.68E-08	2.79E-06	3.55E-05	1.40E-05	3.79E-05	5.79E-06	4.23E-05	1.93E-05	6.77E-06	1.81E-05	2.40E-05	3.92E-06	0.00E+00	0.00E+00	0.00E+00
Mining Contract	—	Diesel	1	1.42E-03	1.38E-03	9.96E-04	5.57E-04	2.02E-04	1.38E-05	3.60E-04	3.42E-04	9.84E-05	2.14E-05	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
Topo Drilling Contract	—	Diesel	1	3.63E-05	2.58E-05	2.59E-05	2.84E-05	2.38E-05	1.89E-05	1.77E-05	1.32E-05	1.25E-05	1.12E-05	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
Boom Truck 28t	Manitex-2892C	Diesel	2	7.93E-03	7.95E-03	7.93E-03	7.93E-03	7.93E-03	7.95E-03	7.93E-03	7.93E-03	7.93E-03	7.95E-03	7.93E-03	7.93E-03	7.93E-03	7.95E-03	7.93E-03	7.93E-03	7.93E-03	7.95E-03	7.93E-03	7.93E-03	7.93E-03	7.95E-03	7.93E-03	7.93E-03	0.00E+00	0.00E+00	0.00E+00
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	7.16E-03	7.18E-03	7.16E-03	7.16E-03	7.16E-03	7.18E-03	7.16E-03	7.16E-03	7.16E-03	7.18E-03	7.16E-03	7.16E-03	7.16E-03	7.18E-03	7.16E-03	7.16E-03	7.16E-03	7.18E-03	7.16E-03	7.16E-03	7.16E-03	7.18E-03	7.16E-03	7.16E-03	0.00E+00	0.00E+00	0.00E+00
Snow Blower	Vohl-Vohl-350	Diesel	2	8.27E-03	8.29E-03	8.27E-03	8.27E-03	8.27E-03	8.29E-03	8.27E-03	8.27E-03	8.27E-03	8.29E-03	8.27E-03	8.27E-03	8.27E-03	8.29E-03	8.27E-03	8.27E-03	8.27E-03	8.29E-03	8.27E-03	8.27E-03	8.27E-03	8.29E-03	8.27E-03	8.27E-03	0.00E+00	0.00E+00	0.00E+00
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	8.18E-03	8.20E-03	8.18E-03	8.18E-03	8.18E-03	8.20E-03	8.18E-03	8.18E-03	8.18E-03	8.20E-03	8.18E-03	8.18E-03	8.18E-03	8.20E-03	8.18E-03	8.18E-03	8.18E-03	8.20E-03	8.18E-03	8.18E-03	8.18E-03	8.20E-03	8.18E-03	8.18E-03	0.00E+00	0.00E+00	0.00E+00
Pit Bus	Ford-Nordik	Diesel	1	4.53E-03	4.54E-03	4.53E-03	4.53E-03	4.53E-03	4.54E-03	4.53E-03	4.53E-03	4.53E-03	4.54E-03	4.53E-03	4.53E-03	4.53E-03	4.54E-03	4.53E-03	4.53E-03	4.53E-03	4.54E-03	4.53E-03	4.53E-03	4.53E-03	4.54E-03	4.53E-03	4.53E-03	0.00E+00	0.00E+00	0.00E+00
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	0.00E+00	0.00E+00	0.00E+00
Mechanic Service Truck	International-International CV515	Diesel	3	3.08E-02	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.09E-02	3.08E-02	3.08E-02	0.00E+00	0.00E+00	0.00E+00
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	3.72E-02	3.73E-02	3.72E-02	3.72E-02	3.72E-02	3.73E-02	3.72E-02	3.72E-02	3.72E-02	3.73E-02	3.72E-02	3.72E-02	3.72E-02	3.73E-02	3.72E-02	3.72E-02	3.72E-02	3.73E-02	3.72E-02	3.72E-02	3.72E-02	3.73E-02	3.72E-02	3.72E-02	0.00E+00	0.00E+00	0.00E+00
Wheel Loader	Komatsu WE-1850	Diesel	2	8.44E-02	1.24E-01	1.32E-01	1.36E-01	1.66E-01	1.84E-01	1.89E-01	1.36E-01	1.30E-01	1.39E-01	1.73E-01	1.82E-01	1.69E-01	1.39E-01	1.44E-01	2.06E-01	1.73E-01	1.74E-01	1.31E-01	1.47E-01	1.14E-01	8.92E-02	9.05E-02	9.05E-02	6.77E-02	2.44E-02	4.60E-02
Haul Truck (100 t)	CAT 777	Diesel	12	2.11E+00	1.05E+00	1.03E+00	7.38E-01	4.13E-01	1.50E-01	1.02E-02	2.67E-01	2.53E-01	7.30E-02	1.59E-02	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
Rest of overburden contract	Miscellaneous	Diesel	N/A	2.85E+00	1.42E+00	1.38E+00	9.96E-01	5.57E-01	2.02E-01	1.38E-02	3.60E-01	3.42E-01	9.84E-02	2.14E-02	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
		TOTAL:		**6.6**	**4.2**	**4.2**	**3.5**	**2.8**	**2.2**	**2.0**	**2.6**	**2.5**	**2.0**	**2.0**	**2.0**	**1.9**	**1.9**	**2.0**	**1.9**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.8**	**1.9**	**1.9**	**0.1**	**0.02**	**0.05**

Diesel Electricity Generation

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Genset 6kW	Multiquip-DAC7000SSA3	Diesel	3	9.42E-04	9.45E-04	9.42E-04	9.42E-04	9.42E-04	9.45E-04	9.42E-04	9.42E-04	9.42E-04	9.45E-04	9.42E-04	9.42E-04	9.42E-04	9.45E-04	9.42E-04	9.42E-04	9.42E-04	9.45E-04	9.42E-04	9.42E-04	9.42E-04	9.45E-04	9.42E-04	9.42E-04	0.00E+00	0.00E+00	0.00E+00
Genset 60kW	Multiquip-DCA70SSIU4F	Diesel	2	6.52E-03	6.54E-03	6.52E-03	6.52E-03	6.52E-03	6.54E-03	6.52E-03	6.52E-03	6.52E-03	6.54E-03	6.52E-03	6.52E-03	6.52E-03	6.54E-03	6.52E-03	6.52E-03	6.52E-03	6.54E-03	6.52E-03	6.52E-03	6.52E-03	6.54E-03	6.52E-03	6.52E-03	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	1.44E-03	1.45E-03	1.44E-03	1.44E-03	1.44E-03	1.45E-03	1.44E-03	1.44E-03	1.44E-03	1.45E-03	1.44E-03	1.44E-03	1.44E-03	1.45E-03	1.44E-03	1.44E-03	1.44E-03	1.45E-03	1.44E-03	1.44E-03	1.44E-03	1.45E-03	1.44E-03	1.44E-03	0.00E+00	0.00E+00	0.00E+00
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	0.00E+00	0.00E+00	0.00E+00
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	5.05E-02	5.05E-02	5.89E-02	5.89E-02	5.89E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	6.90E-02	0.00E+00	0.00E+00	0.00E+00
Light Plant	Generac-MLT6SKDS	Diesel	10	7.85E-03	7.87E-03	7.85E-03	7.85E-03	7.85E-03	7.87E-03	7.85E-03	7.85E-03	7.85E-03	7.87E-03	7.85E-03	7.85E-03	7.85E-03	7.87E-03	7.85E-03	7.85E-03	7.85E-03	7.87E-03	7.85E-03	7.85E-03	7.85E-03	7.87E-03	7.85E-03	7.85E-03	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**0.06**	**0.06**	**0.07**	**0.07**	**0.07**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.00**	**0.00**	**0.00**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	2.28E-04	2.29E-04	2.28E-04	2.28E-04	2.28E-04	2.29E-04	2.28E-04	2.28E-04	2.28E-04	2.29E-04	2.28E-04	2.28E-04	2.28E-04	2.29E-04	2.28E-04	2.28E-04	2.28E-04	2.29E-04	2.28E-04	2.28E-04	2.28E-04	2.29E-04	2.28E-04	2.28E-04	0.00E+00	0.00E+00	0.00E+00
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	1.93E+00	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**1.93**	**0.00**	**0.00**	**0.00**

Direct Greenhouse Gas Emissions - Operations and Closure - N_2O Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	9.00E-02	7.64E-02	5.07E-02	3.72E-02	7.92E-02	6.46E-02	4.92E-02	4.71E-02	4.25E-02	3.74E-02	4.30E-02	4.05E-02	3.33E-02	2.75E-02	3.98E-02	3.62E-02	3.77E-02	4.25E-02	2.71E-02	2.54E-02	2.39E-02	3.23E-02	2.12E-02	4.19E-02	0.00E+00	0.00E+00	0.00E+00
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	2.17E-01	2.39E-01	2.54E-01	3.42E-01	3.97E-01	4.12E-01	2.53E-01	2.36E-01	2.62E-01	3.65E-01	3.92E-01	3.52E-01	2.61E-01	2.77E-01	4.65E-01	3.65E-01	3.67E-01	2.38E-01	2.88E-01	1.85E-01	1.12E-01	1.17E-01	1.16E-01	4.72E-02	0.00E+00	0.00E+00	0.00E+00
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	2.35E+00	2.47E+00	2.71E+00	2.69E+00	2.66E+00	2.64E+00	3.06E+00	3.19E+00	3.03E+00	2.82E+00	3.10E+00	3.01E+00	2.95E+00	2.91E+00	3.03E+00	2.70E+00	2.95E+00	2.96E+00	2.97E+00	2.79E+00	3.02E+00	3.19E+00	3.27E+00	3.43E+00	0.00E+00	0.00E+00	0.00E+00
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	4.97E-01	4.99E-01	4.97E-01	4.97E-01	4.97E-01	4.99E-01	4.97E-01	4.97E-01	4.97E-01	4.99E-01	4.97E-01	4.97E-01	4.97E-01	4.99E-01	4.97E-01	4.97E-01	4.97E-01	4.99E-01	4.97E-01	4.97E-01	4.97E-01	4.99E-01	4.97E-01	4.97E-01	0.00E+00	0.00E+00	0.00E+00
Motor Grader (18ft)	CAT-18M	Diesel	3	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01	0.00E+00	0.00E+00	0.00E+00
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	3.58E-01	3.59E-01	3.58E-01	3.58E-01	3.58E-01	3.59E-01	3.58E-01	3.58E-01	3.58E-01	3.59E-01	3.58E-01	3.58E-01	3.58E-01	3.59E-01	3.58E-01	3.58E-01	3.58E-01	3.59E-01	3.58E-01	3.58E-01	3.58E-01	3.59E-01	3.58E-01	3.58E-01	0.00E+00	0.00E+00	0.00E+00
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	2.64E-01	2.65E-01	2.64E-01	2.64E-01	2.64E-01	2.65E-01	2.64E-01	2.64E-01	2.64E-01	2.65E-01	2.64E-01	2.64E-01	2.64E-01	2.65E-01	2.64E-01	2.64E-01	2.64E-01	2.65E-01	2.64E-01	2.64E-01	2.64E-01	2.65E-01	2.64E-01	2.64E-01	0.00E+00	0.00E+00	0.00E+00
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	7.74E-02	7.76E-02	7.74E-02	7.74E-02	7.74E-02	7.76E-02	7.74E-02	7.74E-02	7.74E-02	7.76E-02	7.74E-02	7.74E-02	7.74E-02	7.76E-02	7.74E-02	7.74E-02	7.74E-02	7.76E-02	7.74E-02	7.74E-02	7.74E-02	7.76E-02	7.74E-02	7.74E-02	0.00E+00	0.00E+00	0.00E+00
Stemming Loader	Komatsu-WA380-8	Diesel	2	5.73E-02	5.74E-02	5.73E-02	5.73E-02	5.73E-02	5.74E-02	5.73E-02	5.73E-02	5.73E-02	5.74E-02	5.73E-02	5.73E-02	5.73E-02	5.74E-02	5.73E-02	5.73E-02	5.73E-02	5.74E-02	5.73E-02	5.73E-02	5.73E-02	5.74E-02	5.73E-02	5.73E-02	0.00E+00	0.00E+00	0.00E+00
Excavator (90t)	Komatsu-PC800	Diesel	1	5.88E-02	5.89E-02	5.88E-02	5.88E-02	5.88E-02	5.89E-02	5.88E-02	5.88E-02	5.88E-02	5.89E-02	5.88E-02	5.88E-02	5.88E-02	5.89E-02	5.88E-02	5.88E-02	5.88E-02	5.89E-02	5.88E-02	5.88E-02	5.88E-02	5.89E-02	5.88E-02	5.88E-02	0.00E+00	0.00E+00	0.00E+00
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	4.47E-02	4.48E-02	4.47E-02	4.47E-02	4.47E-02	4.48E-02	4.47E-02	4.47E-02	4.47E-02	4.48E-02	4.47E-02	4.47E-02	4.47E-02	4.48E-02	4.47E-02	4.47E-02	4.47E-02	4.48E-02	4.47E-02	4.47E-02	4.47E-02	4.48E-02	4.47E-02	4.47E-02	0.00E+00	0.00E+00	0.00E+00
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	1.47E-02	1.48E-02	1.47E-02	1.47E-02	1.47E-02	1.48E-02	1.47E-02	1.47E-02	1.47E-02	1.48E-02	1.47E-02	1.47E-02	1.47E-02	1.48E-02	1.47E-02	1.47E-02	1.47E-02	1.48E-02	1.47E-02	1.47E-02	1.47E-02	1.48E-02	1.47E-02	1.47E-02	0.00E+00	0.00E+00	0.00E+00
Rehandling	—	Diesel	1	1.94E-06	1.03E-05	2.30E-06	3.91E-05	8.03E-05	1.61E-04	1.74E-05	2.08E-06	1.13E-05	5.89E-05	8.70E-05	9.12E-05	1.11E-07	8.40E-06	1.07E-04	4.20E-05	1.14E-04	1.74E-05	1.27E-04	5.81E-05	2.04E-05	5.46E-05	7.22E-05	1.18E-05	0.00E+00	0.00E+00	0.00E+00
Mining Contract	—	Diesel	1	4.26E-03	4.16E-03	2.99E-03	1.67E-03	6.08E-04	4.15E-05	1.08E-03	1.03E-03	2.96E-04	6.43E-05	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
Topo Drilling Contract	—	Diesel	1	1.09E-04	7.77E-05	7.80E-05	8.55E-05	7.14E-05	5.67E-05	5.32E-05	3.97E-05	3.77E-05	3.36E-05	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
Boom Truck 28t	Manitex-2892C	Diesel	2	2.38E-02	2.39E-02	2.38E-02	2.38E-02	2.38E-02	2.39E-02	2.38E-02	2.38E-02	2.38E-02	2.39E-02	2.38E-02	2.38E-02	2.38E-02	2.39E-02	2.38E-02	2.38E-02	2.38E-02	2.39E-02	2.38E-02	2.38E-02	2.38E-02	2.39E-02	2.38E-02	2.38E-02	0.00E+00	0.00E+00	0.00E+00
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	2.15E-02	2.16E-02	2.15E-02	2.15E-02	2.15E-02	2.16E-02	2.15E-02	2.15E-02	2.15E-02	2.16E-02	2.15E-02	2.15E-02	2.15E-02	2.16E-02	2.15E-02	2.15E-02	2.15E-02	2.16E-02	2.15E-02	2.15E-02	2.15E-02	2.16E-02	2.15E-02	2.15E-02	0.00E+00	0.00E+00	0.00E+00
Snow Blower	Vohl-Vohl-350	Diesel	2	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	2.49E-02	0.00E+00	0.00E+00	0.00E+00
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	2.46E-02	2.47E-02	2.46E-02	2.46E-02	2.46E-02	2.47E-02	2.46E-02	2.46E-02	2.46E-02	2.47E-02	2.46E-02	2.46E-02	2.46E-02	2.47E-02	2.46E-02	2.46E-02	2.46E-02	2.47E-02	2.46E-02	2.46E-02	2.46E-02	2.47E-02	2.46E-02	2.46E-02	0.00E+00	0.00E+00	0.00E+00
Pit Bus	Ford-Nordik	Diesel	1	1.36E-02	1.37E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	1.36E-02	1.36E-02	0.00E+00	0.00E+00	0.00E+00
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	7.66E-02	7.68E-02	7.66E-02	7.66E-02	7.66E-02	7.68E-02	7.66E-02	7.66E-02	7.66E-02	7.68E-02	7.66E-02	7.66E-02	7.66E-02	7.68E-02	7.66E-02	7.66E-02	7.66E-02	7.68E-02	7.66E-02	7.66E-02	7.66E-02	7.68E-02	7.66E-02	7.66E-02	0.00E+00	0.00E+00	0.00E+00
Mechanic Service Truck	International-International CV515	Diesel	3	9.27E-02	9.30E-02	9.27E-02	9.27E-02	9.27E-02	9.30E-02	9.27E-02	9.27E-02	9.27E-02	9.30E-02	9.27E-02	9.27E-02	9.27E-02	9.30E-02	9.27E-02	9.27E-02	9.27E-02	9.30E-02	9.27E-02	9.27E-02	9.27E-02	9.30E-02	9.27E-02	9.27E-02	0.00E+00	0.00E+00	0.00E+00
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	1.12E-01	0.00E+00	0.00E+00	0.00E+00
Wheel Loader	Komatsu WE-1850	Diesel	2	2.54E-01	3.73E-01	3.96E-01	4.10E-01	4.98E-01	5.53E-01	5.69E-01	4.09E-01	3.92E-01	4.18E-01	5.21E-01	5.48E-01	5.09E-01	4.18E-01	4.33E-01	6.21E-01	5.21E-01	5.23E-01	3.94E-01	4.44E-01	3.42E-01	2.68E-01	2.72E-01	2.72E-01	2.04E-01	7.33E-02	1.38E-01
Haul Truck (100 t)	CAT 777	Diesel	12	6.35E+00	3.16E+00	3.09E+00	2.22E+00	1.24E+00	4.51E-01	3.08E-02	8.03E-01	7.62E-01	2.19E-01	4.77E-02	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
Rest of overburden contract	Miscellaneous	Diesel	N/A	8.56E+00	4.26E+00	4.16E+00	2.99E+00	1.67E+00	6.08E-01	4.15E-02	1.08E+00	1.03E+00	2.96E-01	6.43E-02	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
		TOTAL:		**19.8**	**12.5**	**12.6**	**10.6**	**8.5**	**6.7**	**5.9**	**7.7**	**7.4**	**6.1**	**6.1**	**5.9**	**5.7**	**5.6**	**5.9**	**5.7**	**5.8**	**5.7**	**5.6**	**5.4**	**5.4**	**5.5**	**5.6**	**5.7**	**0.2**	**0.1**	**0.1**

Diesel Electricity Generation

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Genset 6kW	Multiquip-DAC7000SSA3	Diesel	3	2.83E-03	2.84E-03	2.83E-03	2.83E-03	2.83E-03	2.84E-03	2.83E-03	2.83E-03	2.83E-03	2.84E-03	2.83E-03	2.83E-03	2.83E-03	2.84E-03	2.83E-03	2.83E-03	2.83E-03	2.84E-03	2.83E-03	2.83E-03	2.83E-03	2.84E-03	2.83E-03	2.83E-03	0.00E+00	0.00E+00	0.00E+00
Genset 60kW	Multiquip-DCA70SSIU4F	Diesel	2	1.96E-02	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.96E-02	1.96E-02	1.96E-02	1.97E-02	1.96E-02	1.96E-02	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.00**	**0.00**	**0.00**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	4.34E-03	4.35E-03	4.34E-03	4.34E-03	4.34E-03	4.35E-03	4.34E-03	4.34E-03	4.34E-03	4.35E-03	4.34E-03	4.34E-03	4.34E-03	4.35E-03	4.34E-03	4.34E-03	4.34E-03	4.35E-03	4.34E-03	4.34E-03	4.34E-03	4.35E-03	4.34E-03	4.34E-03	0.00E+00	0.00E+00	0.00E+00
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	3.79E-03	3.80E-03	3.79E-03	3.79E-03	3.79E-03	3.80E-03	3.79E-03	3.79E-03	3.79E-03	3.80E-03	3.79E-03	3.79E-03	3.79E-03	3.80E-03	3.79E-03	3.79E-03	3.79E-03	3.80E-03	3.79E-03	3.79E-03	3.79E-03	3.80E-03	3.79E-03	3.79E-03	0.00E+00	0.00E+00	0.00E+00
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	1.52E-01	1.52E-01	1.77E-01	1.77E-01	1.77E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	2.08E-01	0.00E+00	0.00E+00	0.00E+00
Light Plant	Generac-MLT6SKDS	Diesel	10	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**0.18**	**0.18**	**0.20**	**0.20**	**0.20**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.00**	**0.00**	**0.00**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	4.22E-06	4.24E-06	4.22E-06	4.22E-06	4.22E-06	4.24E-06	4.22E-06	4.22E-06	4.22E-06	4.24E-06	4.22E-06	4.22E-06	4.22E-06	4.24E-06	4.22E-06	4.22E-06	4.22E-06	4.24E-06	4.22E-06	4.22E-06	4.22E-06	4.24E-06	4.22E-06	4.22E-06	0.00E+00	0.00E+00	0.00E+00
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	3.56E-02	3.57E-02	3.56E-02	3.56E-02	3.56E-02	3.57E-02	3.56E-02	3.56E-02	3.56E-02	3.57E-02	3.56E-02	3.56E-02	3.56E-02	3.57E-02	3.56E-02	3.56E-02	3.56E-02	3.57E-02	3.56E-02	3.56E-02	3.56E-02	3.57E-02	3.56E-02	3.56E-02	0.00E+00	0.00E+00	0.00E+00
		TOTAL:		**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.00**	**0.00**	**0.00**

Direct Greenhouse Gas Emissions - Operations and Closure - tCO_2e Emissions

Mobile Diesel Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Auxiliary Pre-split Drill (4.5-8")	EPIROC-SmartRoc D65	Diesel	1	624	530	351	258	549	448	341	327	295	259	298	281	231	190	276	251	262	295	188	176	166	224	147	290	0	0	0
Wheel Loader (30 m³)	Letourneau-L1850	Diesel	1	1,504	1,660	1,758	2,370	2,749	2,858	1,753	1,637	1,814	2,527	2,714	2,442	1,811	1,919	3,221	2,530	2,543	1,647	1,994	1,286	776	814	804	327	0	0	0
Mining Haul Truck (320t)	Komatsu-HD 930E-4SE	Diesel	8	16,302	17,119	18,789	18,673	18,471	18,332	21,188	22,090	20,987	19,571	21,467	20,830	20,473	20,190	21,012	18,738	20,473	20,491	20,562	19,330	20,925	22,096	22,650	23,773	0	0	0
Track Dozer (850 HP)	Komatsu-D475A-8	Diesel	2	3,447	3,457	3,447	3,447	3,447	3,457	3,447	3,447	3,447	3,457	3,447	3,447	3,447	3,457	3,447	3,447	3,447	3,457	3,447	3,447	3,447	3,457	3,447	3,447	0	0	0
Motor Grader (18ft)	CAT-18M	Diesel	3	1,157	1,160	1,157	1,157	1,157	1,160	1,157	1,157	1,157	1,160	1,157	1,157	1,157	1,160	1,157	1,157	1,157	1,160	1,157	1,157	1,157	1,160	1,157	1,157	0	0	0
Water/Sand Truck (76kL tank)	Komatsu-HD785-8 w/ GF20kGal w/rockspreader	Diesel	2	2,484	2,490	2,484	2,484	2,484	2,490	2,484	2,484	2,484	2,490	2,484	2,484	2,484	2,490	2,484	2,484	2,484	2,490	2,484	2,484	2,484	2,490	2,484	2,484	0	0	0
Wheel Dozer (752 HP)	CAT-844K	Diesel	2	1,831	1,836	1,831	1,831	1,831	1,836	1,831	1,831	1,831	1,836	1,831	1,831	1,831	1,836	1,831	1,831	1,831	1,836	1,831	1,831	1,831	1,836	1,831	1,831	0	0	0
Excavator (49t)	Komatsu-PC490LC-11	Diesel	2	537	538	537	537	537	538	537	537	537	538	537	537	537	538	537	537	537	538	537	537	537	538	537	537	0	0	0
Stemming Loader	Komatsu-WA380-8	Diesel	2	397	398	397	397	397	398	397	397	397	398	397	397	397	398	397	397	397	398	397	397	397	398	397	397	0	0	0
Excavator (90t)	Komatsu-PC800	Diesel	1	407	408	407	407	407	408	407	407	407	408	407	407	407	408	407	407	407	408	407	407	407	408	407	407	0	0	0
Cable Handling Wheel Loader 271HP	Komatsu-WA475-10	Diesel	2	310	311	310	310	310	311	310	310	310	311	310	310	310	311	310	310	310	311	310	310	310	311	310	310	0	0	0
Pipelayer Dozer	Komatsu-D155CX-8	Diesel	1	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	0	0	0
Rehandling	—	Diesel	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0
Mining Contract	—	Diesel	1	30	29	21	12	4	0	8	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topo Drilling Contract	—	Diesel	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boom Truck 28t	Manitex-2892C	Diesel	2	165	166	165	165	165	166	165	165	165	166	165	165	165	166	165	165	165	166	165	165	165	166	165	165	0	0	0
Tire Handler Loader	CAT-988 for Tire Handler	Diesel	1	149	150	149	149	149	150	149	149	149	150	149	149	149	150	149	149	149	150	149	149	149	150	149	149	0	0	0
Snow Blower	Vohl-Vohl-350	Diesel	2	172	173	172	172	172	173	172	172	172	173	172	172	172	173	172	172	172	173	172	172	172	173	172	172	0	0	0
Diesel Powered Air Heaters	Flagro-FVO400	Diesel	4	170	171	170	170	170	171	170	170	170	171	170	170	170	171	170	170	170	171	170	170	170	171	170	170	0	0	0
Pit Bus	Ford-Nordik	Diesel	1	94	95	94	94	94	95	94	94	94	95	94	94	94	95	94	94	94	95	94	94	94	95	94	94	0	0	0
Fuel & Lube truck 10Wheel	Halrai-Custom Body	Diesel	1	531	532	531	531	531	532	531	531	531	532	531	531	531	532	531	531	531	532	531	531	531	532	531	531	0	0	0
Mechanic Service Truck	International-International CV515	Diesel	3	643	645	643	643	643	645	643	643	643	645	643	643	643	645	643	643	643	645	643	643	643	645	643	643	0	0	0
TowHaul Truck 150t	Komatsu-HD1500	Diesel	1	776	778	776	776	776	778	776	776	776	778	776	776	776	778	776	776	776	778	776	776	776	778	776	776	0	0	0
Wheel Loader	Komatsu WE-1850	Diesel	2	1,760	2,588	2,744	2,841	3,454	3,832	3,941	2,836	2,720	2,898	3,610	3,798	3,526	2,895	3,003	4,304	3,614	3,627	2,730	3,075	2,369	1,860	1,887	1,887	1,411	508	959
Haul Truck (100 t)	CAT 777	Diesel	12	43,999	21,887	21,393	15,395	8,610	3,126	214	5,568	5,283	1,521	331	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rest of overburden contract	Miscellaneous	Diesel	N/A	59,316	29,506	28,840	20,754	11,607	4,214	288	7,506	7,122	2,051	446	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			TOTAL:	**136,909**	**86,729**	**87,268**	**73,678**	**58,819**	**46,222**	**41,106**	**53,345**	**51,598**	**42,238**	**42,241**	**40,725**	**39,414**	**38,605**	**40,886**	**39,197**	**40,266**	**39,470**	**38,849**	**37,240**	**37,610**	**38,404**	**38,861**	**39,651**	**1,411**	**508**	**959**

Diesel Electricity Generation

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Genset 6kW	Multiquip-DAC7000SSA3	Diesel	3	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	0
Genset 60kW	Multiquip-DCA70SSIU4F	Diesel	2	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	0	0	0
			TOTAL:	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**0**	**0**	**0**

Diesel General Stationary Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Mobile Air Compressor 185CFM	Kaesar-M55PE	Diesel	1	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	0
Welding Machine Diesel 400A	Miller-Big Blue 400 Pro Accreach	Diesel	2	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	0	0	0
Water Pump 6in - Diesel	Godwin-HL160M	Diesel	1	1,052	1,052	1,229	1,229	1,229	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439	0	0	0
Light Plant	Generac-MLT6SKDS	Diesel	10	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	164	0	0	0
			TOTAL:	**1,216**	**1,216**	**1,393**	**1,393**	**1,393**	**1,603**	**1,602**	**1,602**	**1,602**	**1,603**	**1,602**	**1,602**	**1,602**	**1,603**	**1,602**	**1,602**	**1,602**	**1,603**	**1,602**	**1,602**	**1,602**	**1,603**	**1,602**	**1,602**	**0**	**0**	**0**

Mobile Gasoline Combustion

Equipment	Equipment Model	Fuel Type	Fleet Size	Annual Emissions (tonnes)																									
				Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Pick Up (Blasting Crew)	Chevrolet-Silverado 5500	Gasoline	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pick Up	Chevrolet-Silverado 1500	Gasoline	17	1,695	1,700	1,695	1,695	1,695	1,700	1,695	1,695	1,695	1,700	1,695	1,695	1,695	1,700	1,695	1,695	1,695	1,700	1,695	1,695	1,695	1,700	1,695	1,695	0	0	0
			TOTAL:	**1,696**	**1,700**	**1,696**	**1,696**	**1,696**	**1,700**	**1,696**	**1,696**	**1,696**	**1,700**	**1,696**	**1,696**	**1,696**	**1,700**	**1,696**	**1,696**	**1,696**	**1,700**	**1,696**	**1,696**	**1,696**	**1,700**	**1,696**	**1,696**	**0**	**0**	**0**

CO2 from Mining Explosives

Explosive type	Unit	Annual Emissions (tonnes)																											
		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26-35
Emulsion	tonnes of emulsion	4,649	4,643	4,997	5,323	5,815	5,816	5,503	5,528	5,728	5,647	5,821	5,342	5,342	5,366	6,153	5,525	5,012	4,528	3,971	3,445	3,184	2,975	2,784	2,626	0	0	0

Direct Greenhouse Gas Emissions Associated with Loss of Carbon Sink Due to Land Clearing

Summary: Impact to Carbon Sinks

Ecozone	Impact to Carbon Sinks	Unit	Annual Impact to Carbon Sinks																											
			Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Forest	Impact to Carbon Sinks (CSI)	tonnes C y^{-1}	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258	-258
	Total	tonnes CO_2 y^{-1}	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946	-946

Note - negative results represent the amount of carbon that would have been sequestered were disturbance not to occur.

Parameters

Category	Parameters		Comments
Forest	Area (ha)	2,206	Provided by Champion
Shrubland	Area (ha)	71	Provided by Champion
Wetland	Area (ha)	607	Provided by Champion

Note - negative results represent a loss of carbon from land use change which equals a 'direct' emission of carbon

Assumptions

This site falls under "Tier 2" methodology requirements as per the SACC Draft Technical Guide. Where site/country specific data was not available, Tier 1 defaults were selected based on best available knowledge.

Impact to Carbon Sinks

Annex D of the SACC Draft Technical Guide provides "*Further guidance on the methodology used to quantify the impact to carbon sinks*". For the purpose of quantifying a project's impact to carbon sinks under the SACC, only lands categorized by the IPCC guidelines (IPCC 2006) as being Forest Land or Wetlands are considered as carbon sinks.

In the calculation for forested land, Equations 5 and 6 were used to quantify the Carbon Sink Impact.

The wetlands calculation was done using "*Approach 2) sum of annual CO_2 and CH_4 flux approach*". Fens have been calculated as a source of C rather than a sink, and as such the land area covered in fens has been omitted in the calculation of total CSI.

Equation 5: Estimated carbon sink impact

$$CSI = \sum_{IJ}((NatFlux - PostDFlux)_{IJ} \bullet T_{IJ} \bullet A_{IJ})$$

Where:

CSI is the estimated carbon sink impact (t C)
NatFlux is the natural annual carbon accumulation rate of the land being impacted (t C ha^{-1} y^{-1})
PostDFlux is the post-disturbance (i.e. post conversion) flux rate impacted by the project (t C ha^{-1} y^{-1})
T is the time interval (years)
A is the land area (ha)
I is the land-use class
J is the disturbance activity for each phase of the project (construction, operation, decommission including, for instance, site restoration or reclamation).

Equation 6: Natural annual carbon accumulation rate of a forest

$$NATFLUX_{FOREST} = \frac{BM_{@CC} - BM_{Current}}{Age_{@CC} - Age_{Current}}$$

Where:

$NatFlux_{Forest}$ is the natural annual carbon accumulation rate of a forest (t C ha^{-1} y^{-1})
$BM_{@CC}$ is the living tree biomass at MCC (t C ha^{-1})
$BM_{Current}$ is the living tree biomass at the forest stand's current age (t C ha^{-1})
$Age_{@CC}$ is the age at which MCC is reached (years)
$Age_{Current}$ is the current age of the forest (years)

Ecozone	Parameters		Unit	Source
Forest	Living Tree Biomass at Maximum Carrying Capacity ($BM_{@CC}$)	58.00	tonne C ha^{-1}	Annex E, SACC Draft Technical Guide. Table 34. *Default Values of Tree Biomass and Age at Maximum Carrying Capacity.* NT, TSW, Black Spruce (no spruce value available for Newfoundland or Labrador)
	Living Tree Biomass at current age ($BM_{Current}$)	45.120	tonne C ha^{-1}	Calculated using Canadian National Forest Inventory Biomass values.
	Age at which MCC is reached ($Age_{@CC}$)	222.00	years	Annex E, SACC Draft Technical Guide. Table 34. *Default Values of Tree Biomass and Age at Maximum Carrying Capacity.* NT, TSW, Black Spruce (no spruce value available for Newfoundland or Labrador)
	Current age ($Age_{Current}$)	111.86	years	Calculated using Canadian National Forest Inventory. Weighted average age for all trees across Taiga Shield Ecozone, using median values of 20 year age classes.
	Natural Annual Carbon Accumulation (NatFlux)	-0.12	tonne C ha^{-1} yr^{-1}	Equation 6, SACC Draft Technical Guide Annex D
	Post-Conversion flux rate (PostDFlux)	0	tonne C ha^{-1} yr^{-1}	Assumed to be 0 as per SACC Draft Technical Guide Annex D, Step 3.
	Time (T)	100	years	Default value of 100 as per SACC Draft Technical Guide.
	CSI	**-25,798**	tonne C	Equation 5, SACC Draft Technical Guide Annex D
Wetland	CO2 Accumulation	0.00	tonne CO_2-C ha^{-1} yr^{-1}	Annex E, SACC Draft Technical Guide. Table 32. National defaults provided for natural carbon accumulation rate (NatFlux) for the 'sum of annual CO_2 and CH_4 flux approach'. Fen
	CH4 Accumulation	0.06	tonne CO_2-C ha^{-1} yr^{-1}	Annex E, SACC Draft Technical Guide. Table 32. National defaults provided for natural carbon accumulation rate (NatFlux) for the 'sum of annual CO_2 and CH_4 flux approach'. Fen
	Natural Annual Carbon Accumulation (NatFlux)	0.06	tonne C ha^{-1} yr^{-1}	Calculated using method described in Annex E, SACC Draft Technical Guide, Section 2. Approach 2, *'sum of annual CO_2 and CH_4 flux approach'*
	Post-Conversion flux rate (PostDFlux)	0	tonne C ha^{-1} yr^{-1}	Assumed to be 0 as per SACC Draft Technical Guide Annex D, Step 3.
	Time (T)	100	years	Default value of 100 as per SACC Draft Technical Guide.
	CSI[1]	**3,824**	tonne C	Equation 5, SACC Draft Technical Guide Annex D

[1] Fens have been calculated as a source of C rather than a sink. and as such the land area covered in fens has been omitted in the calculation of total CSI.

Kami
Kamistiatusset
Mining
Project

6. Noise, Vibration, and Light Chapter

The purpose of **Chapter 6, Noise, Vibration and Light**, of the Environmental Impact Statement (EIS) is to characterize the existing environment, Project-environment interactions and potential residual Project and cumulative effects of the Project on noise, vibration and light. The Project has the potential to cause adverse effects on these components of the atmospheric environment through the release of Project generated noise, vibration and light. Changes in the atmospheric environment can also influence aquatic and terrestrial ecosystems, and the people that use natural resources or ecosystem services (e.g., fish and wildlife). Therefore, the noise, vibration and light assessment consequently provides information that is used to support the assessments of other biophysical and socioeconomic valued environmental components (VECs), where applicable.

6.1 Approach to the Effects Assessment

The methods and assessment presented in this chapter were developed in consideration of the requirements under the provincial *Environmental Protection Act*, with specific consideration of the requirements set out in the provincial Environmental Impact Statement Guidelines (EIS Guidelines) for the Project issued by the Minister of Environment and Climate Change (Government of Newfoundland and Labrador 2024). A table of concordance to the EIS Guidelines is provided in the Executive Summary. The assessment of noise, vibration and light followed the overall effects assessment approach and methods (**Chapter 4, Environmental Effects Methodology**).

Where possible, comparison to the outcomes of the assessment of noise, vibration and light completed within the previous EIS have been made to highlight where effects have been reduced through consideration of environmental design features and mitigation or where new adverse effects may be introduced and require additional consideration in Project planning.

6.2 Integrating Engagement from Indigenous Groups and Local Stakeholders

Engagement activities on the Project with Indigenous groups and local stakeholders have been ongoing since 2011 when Alderon Iron Ore Corp. (Alderon) engaged on the Project as part of the previous environmental assessment (EA) process.

Champion has been engaging with potentially effected Indigenous groups and local community stakeholders since the acquisition of the Project in 2021. The overall approach and methods for the incorporation of engagement feedback into the EIS is discussed in detail in **Chapter 22, Engagement**.

Issues and concerns related to noise, vibration and light raised by Indigenous groups and local stakeholders and how they were addressed through the assessment are summarized in Table 6-1, including cross references to where comments were considered or addressed in the chapter.

Table 6-1: Summary of Issues and Concerns Related to Noise, Vibration, and Light by Indigenous Groups and Local Stakeholders

Comment Theme	How It Is Addressed in the Assessment	Where It Was Addressed in the Assessment	Indigenous Group or Local Stakeholder	Raised in Alderon EIS (Yes/No)
Noise effects from the project	Potential noise effects of the project are addressed in Chapter 6, Section 6.5.3, and 6.7.1	Chapter 6: Noise, Vibration and Light	Fermont and Quebec cabin owners During previous EIS also identified by: Cabin Owners, Wabush and Labrador City	Yes
Vibration effects from the project	Potential vibration effects of the project are addressed in Chapter 6, Section 6.5.4, and 6.7.2	Chapter 6: Noise, Vibration and Light	Fermont During the previous EIS was also identified by: NNK, Cabin Owners, Wabush, Labrador City	Yes
Concern regarding light pollution from the project	Potential light pollution was assessed in Chapter 6, Section 6.5.5 and 6.7.3	Chapter 6: Noise, Vibration and Light	Fermont	Yes

NNK = Naskapi Nation of Kawawachikamach.

6.3 Assessment Scoping

This section identifies key issues for noise, vibration and light, defines and provides a rationale for the selection of noise, vibration and light as VECs, identifies the measurable parameters selected for the assessment, and defines assessment boundaries for noise, vibration and light VECs.

6.3.1 Key Issues

Key issues often relate to the potential environmental, social, economic, and health effects of a proposed project. Key issues identified for the Project reflect the primary concerns raised by regulatory authorities, Indigenous groups, and local stakeholders, including local residents, cabin owners, business owners, and other interested parties.

To identify key issues related to noise, vibration and light, the following sources were reviewed:

- Section 4.1 of the EIS Guidelines, which summarized key issues from regulatory agencies and feedback received on the Project Registration and draft EIS Guidelines
- the record of engagement (Chapter 22), which captures engagement input received through meetings, phone calls, letters, and interviews
- past experience with mining projects in Labrador
- the key issues identified in the previous EIS

Key issues related to noise, vibration and light include the following:

- potential noise effects on noise sensitive human receptors
- potential vibration effects on vibration sensitive human receptors and fisheries habitat
- potential light effects on light sensitive human receptors
- cumulative effects on noise, vibration and light

6.3.2 Valued Environmental Components and Measurable Parameters

Emissions from the Project due to noise, vibration and light may occur during the Construction, Operation, and Closure phases of the Project.

Noise was selected as a VEC as there are potential environment effects of the Project on potential noise-sensitive human receptors. Vibration was selected as a VEC as Project activities may affect nearby vibration sensitive fisheries, humans and land use. Light was selected as a VEC to understand the effects of the Project on potential sensitive human receptors by considering the light emissions from the Project.

Measurable parameters are used to characterize changes to attributes of the environment from the Project, other human developments, and natural factors. The changes in measurable parameters are used to assess change and predict overall effects on VECs.

Noise

As discussed in Section 6.3.4.1, various guidelines were utilized to support the noise assessment; therefore, the noise VEC assessment considered the following measurable parameters to support the methodology and criteria presented within them:

- nighttime maximum sound level (Lmax) (presented in A-weighted Decibels [dBA])
- day-night sound level (Ldn) (presented in dBA)
- daytime sound level (Ld) (presented in dBA)
- nighttime sound level (Ln) (presented in dBA)
- %HA

Potential effects of the Project on the acoustic environment, specifically, environmental effects relevant to human noise receptors are assessed. The assessment of the effects of the Project on wildlife, socioeconomics and human health, as related to sensory disturbance from noise are carried out in their respective sections.

Vibration

As discussed in Section 6.3.4.1.3, various guidelines were considered to support the vibration assessment; therefore, the vibration VEC assessment considered the following measurable parameters to support the methodology and criteria presented within them:

- peak particle velocity (PPV) ground vibration level velocity (presented in millimetres per second [mm/s])
- root-mean square (RMS) ground vibration velocity (presented in mm/s)
- peak sound pressure level (PSPL) peak air overpressure (presented in dB Linear [dBL])
- water overpressure (presented in kilopascals [kPa])

Potential effects of the Project on the vibration environment, specifically, environmental effects relevant to human vibration receptors are assessed. The assessment of the effects of the Project on fisheries, socioeconomics and human health, as related to physical and/or sensory disturbance from vibration are carried out in their respective sections.

Light

As discussed in Section 6.3.4.3, various guidelines were considered to support the light assessment; therefore, the light VEC assessment considered the following measurable parameters to support the methodology and criteria presented within them:

- light trespass, which refers to the effect of light or illuminance (measured in lumens per square metre or lux) that strays from its intended purpose onto neighbouring areas, illuminating areas where lighting may be undesirable
- sky glow, which refers to stray light being scattered in the atmosphere due to a project, resulting in a brightening of the natural sky background level and reduction in star visibility

Potential effects of the Project on the light environment, specifically, environmental effects relevant to human receptors are assessed. The assessment of the effects of the Project on wildlife, socioeconomics and human health, as related to sensory disturbance from light are carried out in their respective sections.

The noise, vibration and light VECs, the rationale for selection, and measurable parameters are summarized in Table 6-2. VEC assessments that are supported by the assessment of the noise, vibration and light VECs are also presented in Table 6-2.

Table 6-2: Valued Environmental Components, Rationale for Selection, and Measurable Parameters

Valued Environmental Component	Rationale for Selection	Measurable Parameters	Linkages to Other Valued Environmental Components
Noise	– May affect nearby noise sensitive wildlife, human occupancy and land use	– Nighttime maximum sound level (Lmax) – Day-night sound level (Ldn) – Daytime sound level (Ld) – Nighttime sound level (Ln) – Percent highly annoyed (%HA)	– Wildlife (Chapter 11) – Indigenous Land and Resource Use (Chapter 13) – Other Land and Resource Use (Chapter 14) – Services and Infrastructure (Chapter 16) – Community Health and Well-Being (Chapter 17)
Vibration	– May affect nearby vibration sensitive wildlife, human occupancy and land use	– Peak particle ground vibration velocity – Root-mean square ground vibration velocity – Air overpressure – Water overpressure	– Fish and Fish Habitat (Chapter 9) – Wildlife (Chapter 11) – Heritage and Historical Resources (Chapter 12) – Indigenous Land and Resource Use (Chapter 13) – Other Land and Resource Use (Chapter 14) – Services and Infrastructure (Chapter 16) – Community Health and Well-Being (Chapter 17)
Light	– Light was selected as a VEC to understand the effects of the Project on potential sensitive human and wildlife receptors by considering the light emissions from the Project.	– Light trespass – Sky glow	– Wildlife (Chapter 11) – Indigenous Land and Resource Use (Chapter 13) – Other Land and Resource Use (Chapter 14) – Community Health and Well-Being (Chapter 17)

Ld = daytime noise level (7 a.m. to 10 p.m.); Ldn = day–night noise level; Ln = nighttime noise level (10 p.m. to 7 a.m.); Lmax = maximum sound level; %HA = percent highly annoyed.

6.3.3 Assessment Boundaries

Assessment boundaries define the spatial and temporal extents of the assessment for each VEC. The spatial boundaries for noise, vibration and light are defined in Table 6-3 and shown in Figure 6-1, Figure 6-2 and Figure 6-3 and consist of the site study area (SSA), a local study area (LSA), and a larger regional study area (RSA).

The SSA includes the proposed infrastructure within the Project footprint, with an additional buffer to reflect existing uncertainty in the final design of the Project, so that adverse effects on VECs are not underestimated (i.e., the SSA area is twice as large as the anticipated Project footprint). The SSA is constrained to avoid certain features, including major lakes, the Québec–Labrador provincial border, and sensitive features like the Wahnahnish Lake Protected Public Water Supply Area. The SSA represents the smallest scale of assessment and an area where the potential direct effects of the anticipated Project can be assessed accurately and precisely.

The LSA is the area within the vicinity of the Project which represents where most or all direct effects on noise, vibration and light from the Project are anticipated. Each of the VECs, noise, vibration and light have their own LSA defined as follows:

- **Noise**–5 km buffer from the SSA
- **Vibration**–1 km buffer from the SSA
- **Light**–8 km buffer from the SSA

The LSAs for noise, vibration and light defined above are smaller than the atmospheric environment LSA in the previous EIS (Alderon 2012). The consideration of different LSAs compared to the previous EIS was based on professional judgment and experience on mining projects. In the previous EIS, noise, vibration and light were defined as part of the atmospheric environment, with atmospheric environment LSA defined as an area that is 40 km (east-west) by 40 km (north-south), extending from the centre of the Project-related activities and incorporating the towns of Labrador City and Wabush, Newfoundland and Labrador (NL), and Fermont, Québec.

The RSA for this assessment was selected to represent the area within which cumulative effects from the Project on noise, vibration and light might occur. Each of the VECs, noise, vibration and light have their own RSA defined as follows:

- **Noise**–10 km buffer from the SSA
- **Vibration**–5 km buffer from the SSA
- **Light**–15 km buffer from the SSA

The RSA provides an appropriate scale to identify and assess potential cumulative effects from the Project combined with existing conditions and other reasonably foreseeable developments (RFDs). The RSAs for noise, vibration and light defined above are smaller than the RSA in the previous EIS (Alderon 2012). The consideration of different RSAs compared to the previous EIS was based on professional judgment and experience on mining projects. In the previous EIS, noise, vibration, and light were defined as part of the atmospheric environment, with noise, vibration and light RSA defined as an area that is approximately 360 km (east–west) by 480 km (north–south), extending from the centre of the Project-related activities and incorporating other sites such as Wabush Mines, Iron Ore Company of Canada's operations, Bloom Lake Mine and Rail Spur, Schefferville Iron Ore Mine, and the Direct Shipping Ore Iron Ore Project.

Table 6-3: Spatial Boundaries for Assessment of Noise, Vibration, and Light Valued Environmental Components

Study Area	Area (ha)	Description/Rationale
SSA	4,323	Includes the Project footprint plus additional buffered areas to incorporate a level of uncertainty into the Project design so that effects are not underestimated. The SSA was defined using bounding points around the outermost components of the Project footprint.
Noise		
LSA	41,637	Defined as a 5 km buffer from the SSA
RSA	89,679	Defined as a 10 km buffer from the SSA
Vibration		
LSA	11,592	Defined as a 1 km buffer from the SSA
RSA	41,637	Defined as a 5 km buffer from the SSA

Study Area	Area (ha)	Description/Rationale
Light		
LSA	68,768	Defined as an 8 km buffer from the SSA
RSA	152,590	Defined as a 15 km buffer from the SSA

LSA = local study area; RSA = regional study area; SSA = site study area.

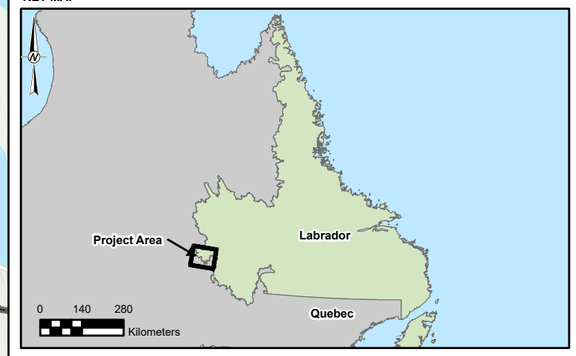
The temporal scope of the assessment focuses on the 40-year period from initial construction to the end of decommissioning and rehabilitation (i.e., closure) as defined by the following Project phases:

- **Construction phase (referred to as Construction)**–includes site preparation, mine, process plant and site infrastructure development, and commissioning the structures, systems, and components. The duration of Construction is expected to be four years.
- **Operations and Maintenance phase (referred to as Operations)**–includes the mining and milling of iron ore, production and shipment of iron ore concentrate, tailings management, management of mine rock, waste management, water management, release of treated effluent, site maintenance and transportation of staff and materials to and from the site. The Operations phase initiates with one year of pre-development mining (i.e., ramp-up) and concludes when processing is complete and is expected to be over 26 years.
- **Decommissioning and Rehabilitation phase (referred to as Closure)**–includes accelerated flooding of the Rose Pit, re-establishment of passive surface water drainage following the pit-flooding period, and recontouring and revegetating disturbed areas. Physical infrastructure that is not required during post-closure monitoring and for other activities required to achieve the Project's decommissioning criteria and to return the Project site to a safe and stable condition will be removed. The active Closure phase is expected to 10 years in length.

The assessment of potential Project effects on noise, vibration and light considers effects that occur during both the Construction and Operations phases. It is expected these periods are sufficient to capture the effects of the Project. Potential effects and mitigation measures to be identified for the Construction of the Project will likely equally apply to the Closure phase. Therefore, the Construction scenario assessed as part of the EIS is considered bounding when compared to the Closure phase and potential effects and mitigation measures for Closure are not identified separately in this EIS.

814 m
Walsh River
896 m
683 m
756 m
500
888 m
Labrador City
Walsh River
Wabush
Duley Lake Provincial Park
Menistouc Lake
Fermont
739 m
389
908 m
883 m
863 m
758 m
744 m
389
807 m

KEY MAP



SCALE 1:20,000,000

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Labrador/Quebec Boundary

0 3,000 6,000 12,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
WORLD HILLSHADE: ESRI, NASA, NGA, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

NOISE ASSESSMENT SPATIAL BOUNDARY

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-1

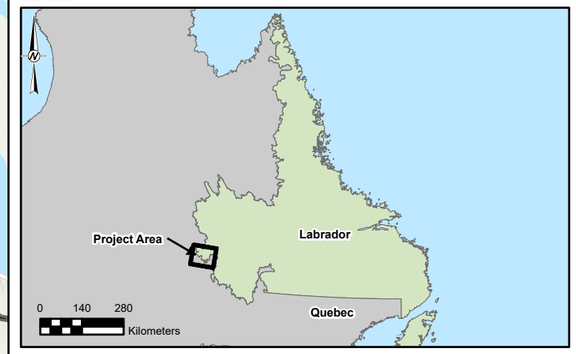
PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_Noise\Vibration\Light\0019_NoiseVibrationLight.aprx PRINTED ON: AT: 2:09:13 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

814 m
Walsh River
896 m
683 m
756 m
500
888 m
Labrador City
Walsh River
Wabush
Dulley Lake Provincial Park
Menistouc Lake
Fermont
739 m
389
908 m
883 m
863 m
758 m
744 m
389
807 m

KEY MAP



SCALE 1:20,000,000

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Labrador/Quebec Boundary

0 3,000 6,000 12,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
WORLD HILLSHADE: ESRI, CGIAR, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

VIBRATION ASSESSMENT SPATIAL BOUNDARIES

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-2

PATH: S:\Clients\Champion_Iron_Ore_Mine\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_NoiseVibration\Light\0019_NoiseVibrationLight.aprx, PRINTED ON: AT: 2:09:48 PM

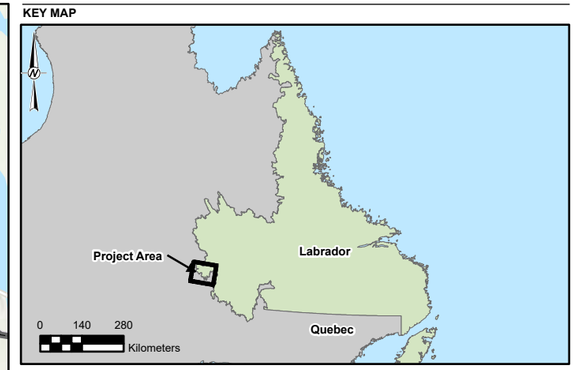
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

814 m
Walsh River
896 m
683 m
756 m
500
888 m
Labrador City
Walsh River
Wabush
Duley Lake
Provincial Park
Menistouc
Lake
Fermont
739 m
389
908 m
883 m
863 m
758 m
744 m
807 m
389

KEY MAP



SCALE 1:20,000,000

Legend

- Site Study Area
- Local Study Area
- Regional Study Area
- Labrador/Quebec Boundary

0 3,000 6,000 12,000

1:250,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
WORLD HILLSHADE: ESRI, NASA, NGA, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

LIGHT ASSESSMENT SPATIAL BOUNDARIES

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-3

PATH: S:\Clients\Champion_Iron_Ore_Mine\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_NoiseVibrationLight\0019_NoiseVibrationLight.aprx, PRINTED ON: AT: 2:11:12 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

6.3.4 Regulatory Criteria and Guidelines

6.3.4.1 Noise

The Province of Newfoundland and Labrador does not have regulations or guidelines for the assessment of environmental noise from industrial and/or mining facilities. The Project is located in the Labrador West Region, which consists of the Town of Labrador City and the Town of Wabush. Noise regulations exist for the Town of Labrador City, *Town of Labrador City Noise Abatement Regulations 2017* dated June 2017 (*Labrador City Noise Abatement Regulations*) (Town of Labrador City 2017) and for the Town of Wabush, *Noise and Nuisance Regulations 2023* dated July 2023 (*Wabush Noise and Nuisance Regulations*) (Town of Wabush 2023). The EIS Guidelines did not specify any regulations or guidelines for the assessment of environmental noise. Federal guidance for noise is considered applicable for mining projects, in particular Health Canada's *Guidance for Evaluating Human Health Effects in Impact Assessment: Noise* dated December 2023 (Health Canada Noise Guideline; Health Canada 2023). Noise assessments for industrial facilities in the Province of Québec often utilize the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) Note d'instructions sur le bruit 98-01 (Québec Noise Guideline; MDDELCC 2006). As the study areas described in Section 6.3.3 extend into the Province of Québec and the Town of Fermont includes noise sensitive receptors, the Québec Noise Guideline was also considered in the assessment of environmental noise.

The following describes aspects of each of these documents considered relevant for the purposes of the noise assessment of the Project.

6.3.4.1.1 Health Canada Noise Guideline

The noise effects due to Project Construction and Operations activities were assessed using the Health Canada Noise Guideline. Although Health Canada does not have enforceable noise thresholds or standards, the Health Canada Noise Guideline is a guidance document for the assessment of environmental noise. It provides general information on predicting potential effects related to noise in federal EAs of major resources and infrastructure projects.

The Health Canada Noise Guideline assesses potential noise effects due to a project using numerous acoustical descriptors, or indicators. In assessing the long-term (i.e., lasting longer than one year) noise effects from projects, the calculated change in percent highly annoyed (%HA) is one widely accepted indicator that provides information on how an average community responds to a change in noise level. This indicator represents the change in the percentage of highly annoyed people within the community due to the change in noise levels as a result of a project. The %HA is calculated based on the day-night energy equivalent sound level (L_{dn}) using the following formula:

$$\%\mathrm{HA} = \frac{100}{1+e^{(10.4-0.132\times L_{dn})}},$$

where L_{dn} is defined in the formula below based on the 15-hour (7 a.m. to 10 p.m.) daytime equivalent energy sound level (L_d) and 9-hour (10 p.m. to 7 p.m.) nighttime equivalent energy sound level (L_n):

$$L_{dn} = 10\log_{10}\left(\frac{15\times10^{L_d/10}+9\times10^{(L_n+10)/10}}{24}\right).$$

Health Canada suggests that an increase in %HA of 6.5% due to a project should result in the consideration of noise mitigation to decrease the overall noise emissions and associated effects from a project. Due to the expected heightened sensitivity to noise in quiet rural areas, existing and project noise levels in quiet rural areas are adjusted by adding 10 dB for use in the equation for %HA above, which results in a greater calculated change in %HA.

Health Canada considers the guidelines and recommendations of the World Health Organization regarding sleep disturbance, in particular for quiet rural areas and susceptible populations such as those in hospitals, or convalescent or senior homes (Health Canada 2023). Health Canada recommends an annual average nighttime period (i.e., L_n) limit of 40 dBA for long-term exposure (i.e., operations phase) and suggests a less restrictive limit of 45 dBA for shorter-term exposure (i.e., construction phase). Health Canada also recommends that outdoor noise levels should not exceed 60 dBA nighttime maximum sound level (Lmax) more than 10 to 15 times per night, which considers an indoor limit of 45 dBA with a 15 dB outdoor-to-indoor transmission loss with windows partially open.

The recommended sound levels to maintain good speech comprehension are defined with respect to indoors and outdoors. Based on reviews of relevant studies, Health Canada recommends that the daytime noise levels due to project activities when measured indoors should be maintained below 40 dBA to sustain adequate speech comprehension, and below 55 dBA when measured outdoors for outdoor speech comprehension (Health Canada 2023).

Table 6-4 summarizes all Health Canada Noise Guideline criteria and how these may correlate to impacts on human receptors as considered in support of the assessment of environmental noise due to the Project.

Table 6-4: Health Canada Noise Guideline Assessment Descriptors and Criteria

Activity	Noise Descriptor(s)	Health Canada Guide Limit	Noise Impact Correlation
Project Operations /Construction ≥1 year	Outdoor L_d	55 dBA	Threshold for sustaining good outdoor speech comprehension
	%HA	Increase in %HA ≤6.5%	Threshold for noise-induced human health effects
	Outdoor L_n - Operations	40 dBA (annual average)	Threshold for adverse health effects due to sleep disturbance during the nighttime
	Outdoor Ln - Construction	45 dBA (Nighttime period for short-term and long-term construction)	Threshold for potential effects due to sleep disturbance during the nighttime
	Outdoor nighttime Lmax	60 dBA, 10 to 15 events per night	Threshold for sleep disturbance due to individual nighttime noise events

dB = decibel; dBA = A-weighted decibels; Ld = daytime noise level (7 a.m. to 10 p.m.); Ln = nighttime noise level (10 p.m. to 7 a.m.); Ldn = day-night noise level; Lmax = maximum noise level; %HA = percent highly annoyed.

6.3.4.1.2 Québec Noise Guideline

The Québec Noise Guideline describes its purpose and the role of the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques in relation to Section 94 of the *Environment Quality Act*, specifically with respect to stationary noise sources. A stationary source is defined as an industry, a factory, a power plant, a high-voltage power line, an electrical transformer station, a landfill, a firing range or any company that operates a process. A stationary source may consist of one or more elements (i.e., equipment such as fans and motors with an associated noise level) located within its property, with the sum of all the elements' noise levels forming the overall noise contribution from the stationary source to the environment. The Québec Noise Guideline presents the methods and criteria expected to be carried out based on either measurement or predictions of the stationary noise source, such that the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques can issue a Certificate of Authorization for the stationary noise source confirming the stationary source complies with applicable criteria. The Québec Noise Guideline may be considered as guidance for noise complaint investigations as well.

The Québec Noise Guideline presents stationary noise source sound level criteria at noise points of reception (PORs), expressed with a reference interval time of 1 hour, that is the higher of the ambient noise level or the maximum noise levels allowed according to the zoning category of the POR and time of day, as described in Table 6-5 below. The following is a description of each of the zoning categories:

- **Zone I**–Land intended for single-family dwellings, detached or semi-detached, schools, hospitals or other educational, health establishments. An existing dwelling in an agricultural zone is included.
- **Zone II**–Multi-dwelling units, mobile home parks, institutions or campgrounds.
- **Zone III**–Commercial uses or recreational parks. Note, the noise level limit during the nighttime only applies within the property lines of residential uses. Otherwise, the daytime noise level limit also applies at night.
- **Zone IV**–Industrial or agricultural purposes. However, on the land of an existing dwelling in an industrial zone and established in accordance with the municipal by-laws in force at the time of its construction, the criteria are 50 dBA at night and 55 dBA during the day.

Table 6-5: Québec Noise Guideline Noise Limits

Zoning	Nighttime Noise Limit (dBA) (19:00 to 7:00)	Daytime Noise Limit (dBA) (7:00 to 19:00)
I	40	45
II	45	50
III	50	55
IV	70	50

dBA = A-weighted decibels.

The Québec Noise Guideline was considered to support the assessment of environmental noise due to the Project for PORs located in Québec.

6.3.4.1.3 Labrador West Region – Town of Labrador City and Town of Wabush

The *Labrador City Noise Abatement Regulations* includes sound level limits for residential, commercial and industrial zones and general duties and obligations. The lowest sound level limit is 45 dBA during the nighttime period and applies to a POR in a residential zone when the sound is made within a residential zone. A sound level limit of 50 dBA during the nighttime period is applied to a POR in a residential zone when the sound is made within an industrial zone. Industrial zones are defined as a zone as established in the *Town of Labrador City Land Use Development Regulations* in which General & Light Industrial Uses are permitted uses. In addition, it states the *Labrador City Noise Abatement Regulations* shall apply to all residential and commercial property and lands contained within the municipal boundaries of the Town of Labrador City, which includes portions of the Project.

The *Wabush Noise and Nuisance Regulations* includes noise restrictions and the process to obtain an exemption. It does not include any sound level limits. However, one noise restriction includes any noise made by industry, business, trade or vocation that in the opinion of the Enforcement Authority disturbs or may disturb the peace and tranquility of any Person residing in the vicinity of a POR.

With the Health Canada Noise Guideline criteria during the nighttime period being lower than that of the *Labrador City Noise Abatement Regulations*, the noise assessment addressed the sound level limit requirements of the *Labrador City Noise Abatement Regulations* and the *Wabush Noise and Nuisance Regulations* with the Health Canada Noise Guideline criteria (i.e., annual average L_n limit of 40 dBA for operations and 45 dBA for construction, which is expected to be limited to a shorter duration). Other aspects of these regulations considered applicable to the Project are discussed in the following relevant sections.

6.3.4.2 Vibration

The Province of Newfoundland and Labrador does not have regulations or guidelines for the assessment of environmental vibration from industrial and/or mining facilities. The Project is located in the Labrador West Region, which consists of the Town of Labrador City and the Town of Wabush. Vibration requirements, specifically related to blasting, exist within the *Town of Labrador City Development Regulations* dated April 2018 (*Labrador City Development Regulations*) (Town of Labrador City 2018). In addition, the EIS Guidelines did not specify any regulations or guidelines for the assessment of environmental vibration.

Federal, provincial and municipal regulations and/or guidance for vibration from other regions is considered applicable for mining projects. Québec's Directive 019-Sur L'industrie Minière, Mars 2025 (Directive 019) is considered applicable for the assessment of mine blasting projects. Therefore, Directive 019 was considered to support the assessment of ground vibration and air overpressure induced by the mine on the Project during operations. Québec's Cahiers des Charges et Devis Généraux (2018) is applicable for the assessment of the ground vibration from construction blasting operations and was considered to support the assessment of vibrations from construction blasting. The Department of Fisheries and Oceans Canada (DFO) guidelines for the use of explosives in or near Canadian fisheries waters (Wright and Hopky 1998) is applicable for the assessment of the construction and operations blasting and was considered to support the assessment of vibrations and water overpressure from blasting near fisheries habitat from the Project. The Health Canada Noise Guideline is applicable for the assessment of human annoyance from construction and operations blasting and was considered to support the vibration assessment. The vibration guidelines presented in the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* (FTA Manual, FTA 2018) and the general vibration guidelines presented are appropriate to assess potential building damage and potential human annoyance due to non-blasting activities during operations and general construction. As such, these were considered in the assessment of non-blasting vibrations from the Projects.

6.3.4.2.1 Overview

Vibration is an oscillatory motion and can be described in terms of the displacement, velocity and acceleration. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is often used to monitor blasting and vibrations related to structural damages. However, human response to vibration is assessed for an average vibration as opposed to PPV. The parameter used is the RMS velocity.

Both PPV and RMS vibration are described in mm/second but can also be described in decibel notation. When described in decibel the reference velocity of $5x10^{-8}$ m/second is typically used. Rumbling sound caused by the vibration of room surfaces is called ground-borne noise.

There are no federal or provincial guidelines that provide ground vibration and air overpressure limits for Project Operations or general non-blasting construction activities at locations where human activity is expected to occur.

The vibration criteria limits, which are further discussed below, are considered appropriate at this stage of the Project and are applicable where human activity is expected to occur and do not necessarily apply to locations where human activity is not expected to occur such as a heritage structure and/or utility infrastructure. At the time of preparing this assessment, the location of heritage structures and/or utility infrastructure was not readily available. The Project is currently at the EA stage; therefore, it is recommended that, prior to commencing preliminary and detailed design, discussions with the various stakeholders (i.e., residential dwellings, heritage structures, utility infrastructure) be carried out to confirm the guidance documents considered in this vibration assessment and their respective criteria continue to be applicable to the Project. Further vibration assessments may be carried out for specific locations where required, to determine potential vibration effects once more detailed design and supporting information is available (e.g., locations where blasting is expected to be required).

6.3.4.2.2 Blast Vibrations

Mine Blasting

As discussed above, due to the lack of vibration guidelines at a provincial or federal level and considering the proximity to the Québec border and the fact that guidelines exist in Québec, Québec's Directive 019 was considered. Directive 019 provides a maximum ground vibration and air overpressure (PSPL)—from mine blasting operations measured at the nearest sensitive receptor:

- PPV – 12.7 mm/s
- PSPL – 128 linear decibels (dBL)

Construction Blasting

Québec's CCDG states that vibration from construction blasting operations is limited to 25 mm/s. That is, the PPV from the blasting is limited to 25 mm/s.

Fisheries and Oceans Canada

Pressure changes and vibrations caused by blasting during construction or operations have the potential to cause injury or mortality of fish in nearby waterbodies. Post detonation compression shock waves (i.e., overpressures) caused by detonations of explosives in or near water can cause internal damage to the swim bladder and other soft organs of fish and can cause changes to fish behaviour (Wright 1982; Wright and Hopky 1998; Godard et al. 2008). For the purposes of this assessment, water Overpressure is measured in kilopascals (kPa). Fish eggs incubating in spawning beds near blasting zones can also be damaged by movement of the substrate in which eggs are embedded, causing mortality or disrupting development (Wright 1982; Faulkner et al. 2008). PPVs can increase mortality of incubating eggs close to blasting zones (Wright 1982).

DFO provides guidelines for operations that involve the use of confined or unconfined explosives in or near Canadian fisheries waters as well as suggested methods and practices for the conservation and protection of fish, marine mammals, and fish habitat from impacts arising from blasting (Wright and Hopky 1998). Subsequent work by Cott and Hanna (2005), also of the DFO, suggested that a more appropriate limit for fisheries habitat in northern waters is 50 kPa (rather than the 100 kPa limit suggested by Wright and Hopky [1998]). The DFO has confirmed that 50 kPa is an appropriate limit for fisheries habitat in northern Canadian waters. Two key fisheries guidelines are:

- **Overpressure**—Explosives are not to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous water pressure change (i.e., overpressure) greater than 50 kPa (7.25 pounds per square inch [psi]) where fish are present.
- **Vibration**—Explosives are not to be detonated that produce, or are likely to produce, a PPV greater than 13 mm/s in a spawning bed during the period of egg incubation.

Health Canada

The Health Canada Noise Guideline presents a method to determine criteria for air overpressure, a blasting Mitigation Noise Level, which is expected to result in little or no public annoyance (i.e., human annoyance), based on the number of daily blasts for short-term construction (i.e., less than one year). The approach is based on the US Environmental Protection Agency 1974 criterion for sonic booms and that, according to the findings of Schomer et al. (1997), blasts and sonic booms create similar levels of annoyance for equal peaks. The Mitigation Noise Level is calculated using the formula Mitigation Noise Level = 125 – 10logN in Linear Decibels (dBL), where N is the number of daytime blasts per day. Table 6-6 is a recreation of Table 6.4 in the Health Canada Noise Guideline, which summarizes the number of daytime blasts and the corresponding blasting Mitigation Noise Level (dBL).

Table 6-6: Health Canada Air Overpressure Criteria – Mitigation Noise Levels Related to Number of Blasts

Number of Daytime Blasts (N)	Blasting Mitigation Noise Level (125-10logN) (dBL)
1	125
2	122
5	118
10	115
20	112

dB = decibel; dBL = linear decibels; N = number of daytime blasts per day.

The Project air overpressure effects due to the construction blasting activities (i.e., non-mining related) were assessed using the Health Canada Noise Guideline. It is expected blasting activities at any one location will be completed in less than one year. Therefore, the Health Canada Noise Guideline (Health Canada 2023) blasting Mitigation Noise Level approach for air overpressure was considered to support the Project Construction vibration assessment of human annoyance due to blasting activities.

6.3.4.2.3 Non-blast Vibrations

The Project ground vibration levels due to operations and general non-blasting construction activities were assessed for potential building damage and potential human annoyance. Potential building damage was assessed using a vibration zone of influence that is non-frequency dependent. Potential human annoyance was assessed in accordance with the FTA Manual (FTA 2018). Table 6-7 summarizes the corresponding ground vibration criteria for the zone of influence. Note, the use of the limits shown in Table 6-7 and FTA Manual is typically considered appropriate for similar projects in the absence of local guidance on potential building damage and potential human annoyance due to ground vibration levels. As other local or federal guidance for vibration does not exist for non-blasting activities, the above referenced guidelines were used.

Table 6-7: Vibration Assessment Descriptors and Criteria – Project Operation and General Non-blasting Construction Activities Zone of Influence

Activity	Vibration Descriptor	Criteria Limit	Vibration Impact Correlation
Operations	PPV	5 mm/s	Screening threshold for vibration-related building damage due to operational activities
	RMS	0.1 mm/s[(a)]	Criteria limit for vibration effects on sleep (i.e., human annoyance) for frequent events due to operational activities
General non-blasting construction	PPV	5 mm/s	Screening threshold for vibration-related building damage due to Project construction activities
	RMS	0.1 mm/s[(a)]	Criteria limit for vibration effects on sleep (i.e., human annoyance) for frequent events due to Project construction activities

(a) Converted from the FTA Manual's RMS velocity limit of 72 VdB (re 1 micro-inch/s) based on criteria for frequent events for the land use category: Category 2: Residences and buildings where people normally sleep.
PPV= peak particle velocity; RMS = root mean square; VdB = vibration velocity level in decibels.

Note, according to the FTA Manual, ground vibration levels are a concern almost exclusively inside buildings. It indicates that a vibration source such as a train, which typically produces higher vibration levels than vehicular traffic with rubber tires, may be perceptible to people who are outdoors but it is very rare for outdoor vibration to be a cause for complaints. Without the shaking of a building or noise that accompanies building vibration, the motion of the ground that may be perceived outdoors typically does not provoke the same adverse human reaction. Therefore, the vibration criteria limits related to human annoyance in the *Transit Noise and Vibration Impact Assessment* are for the purposes of indoor vibration levels, when the indoor space is occupied. For the purposes of this EIS, the vibration criteria further discussed below were conservatively selected to address both indoor and outdoor receptor locations.

In addition, the human response differs for vibration velocity level based on frequency. For receptor locations that may be located within the vibration zone of influence, additional frequency-dependent criteria for potential building damage were considered using the construction vibration limits, as shown in Table 6-8. For buildings where people sleep, frequency-dependent vibration criteria limits for potential human annoyance are the same as those provided in Table 6-7 (0.1 mm/s), limited to frequencies between 8 Hz and 80 Hz, as described in the FTA Manual. Table 6-8 summarizes the corresponding vibration criteria within the vibration zone of influence.

Table 6-8: Vibration Assessment Criteria Within Vibration Zone of Influence

Activity	Vibration Descriptor	Frequency of Vibration (Hz)	Criteria Limit	Vibration Impact Correlation
General non-blasting construction	PPV	<4	8 mm/s	Criteria limit for vibration-related building damage due to Project construction activities
		4 to 10	15 mm/s	
		>10	25 mm/s	
	RMS	8 to 80	0.1 mm/s[(a)]	Criteria limit for vibration effects on sleep (i.e., human annoyance) for frequent events due to Project construction activities
General non-blasting operations	PPV	< 4	8 mm/s	Criteria limit for vibration-related building damage due to Project operational activities
		4 to 10	15 mm/s	
		>10	25 mm/s	
	RMS	8 to 80	0.1 mm/s[(a)]	Criteria limit for vibration effects on sleep (i.e., human annoyance) for frequent events due to Project Operations

(a) Converted from FTA Manual root-mean-square velocity limit of 72 VdB (re 1 micro-inch/s) based on criteria for frequent events for the land use category: Category 2: Residences and buildings where people normally sleep.
Hz = hertz; PPV= peak particle velocity; RMS = root mean square; VdB = vibration velocity level.

6.3.4.3 Light

The Province of Newfoundland and Labrador and the municipalities within the vicinity of the Project do not have regulations or guidelines for the assessment of environmental light from industrial and/or mining facilities. In addition, the EIS Guidelines did not specify any regulations or guidelines for the assessment of environmental light. The quantification of light impacts is based on the Commission Internationale de l'Éclairage (CIE) Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Installations (CIE 2017), Illuminating Engineering Society of North America Light Trespass: Research, Results and Recommendations (IESNA 2000), and Institution of Lighting Professionals Guidance Note for the Reduction of Obtrusive Light (ILP 2021).

The quantification of light impacts is based on the CIE environmental lighting zones (CIE 2017), as described in Table 6-9. The CIE light classification system consists of a set of illuminance zones, identified as E0 to E4, ranging from intrinsically dark landscapes to areas of high ambient brightness. As described in Section 6.4.3, areas surrounding the Project range from E1 (natural) to E3 (suburban).

Table 6-9: Environmental Lighting Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Intrinsically dark	UNESCO Starlight Reserves, International Dark-Sky Association Dark Sky Parks, major optical observatories
E1	Natural	Dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, International Dark-Sky Association buffer zones
E2	Rural	Low district brightness	Sparsely inhabited rural areas, village, or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well-inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town and city centres and other commercial areas

Source: CIE 2017; ILP 2021.
UNESCO = United Nations Educational, Scientific and Cultural Organization.

Recommended light trespass limits may be determined based on the CIE environmental lighting zone identified for the area. The recommended light trespass limits (measured in lux) for each CIE environmental lighting zone are provided in Table 6-10.

Table 6-10: Maximum Values of Vertical Illuminance

Environmental Zone	Recommended Light Trespass Limit (lux)
E0	0
E1	0.1
E2	1
E3	2
E4	5

Source: CIE 2017.
lux = lumens per square metre.

Sky glow limits have been established for each environmental lighting zone based on sky quality recommendations from the Institution of Lighting Professionals (ILP 2021). The sky glow limit in terms of sky glow and sky quality for each environmental lighting zone is defined in Table 6-11.

Table 6-11: Suggestions for the Limitation of Sky Glow

Environmental Zones	Sky Glow (% brightness above natural dark sky)	Sky Quality (mag/arcsec^2)
E0	<175%	>20.5
E1	175% to 337%	20 to 20.5
E2	337% to 43,553%	15 to 20
E3	>43,553%	<15
E4		

Source: ILP 2021.
mag/arcsec^2 = magnitude per square arc second.

Note that the Bureau de normalisation du Québec has a standard BNQ 4930-100 Exterior Lighting – Control of Light Pollution (BNQ 2023) which provides requirements for facilities to consider during lighting design to minimize light pollution, including the quantity and direction of light emitted, the spectral composition and its duration of use. While not considered in this assessment, it is recommended that it is considered during detailed design of the Project lighting.

6.4 Existing Environment

The existing environment for noise, vibration and light generally formed the basis against which the residual Project and cumulative effects were assessed. The existing environment also represents the outcome of historical and current environmental and socioeconomic pressures that have shaped the observed condition of noise, vibration and light. Environmental and socioeconomic pressures or factors were either natural (e.g., weather, wildfire, predation, disease, climate change) or human related (e.g., industrial development, forestry, changing business models, fishing, hunting).

Baseline field studies were conducted to support the characterization of the noise and light existing environment. The field studies measured existing noise and light levels in areas where human activity is expected to occur within the vicinity of the Project. During the noise field study, both unattended long-term continuous noise monitoring and attended short-term spot-check noise measurements were carried out. The light study comprised of measuring light trespass and sky glow during the nighttime period. The noise and light baseline field studies are further described in the following sections and in Annex 1B and Annex 1C, respectively.

6.4.1 Noise

6.4.1.1 Methods

The objective of the noise baseline program was to establish the existing conditions for noise where human activity is expected to occur within the vicinity of the Project. According to the EIS Guidelines for the Project, which were finalized on December 19, 2024, the EIS shall describe the existing environment prior to the implementation of the Project, including ambient noise levels.

A baseline data collection program was completed between 2011 and 2012 for the Kami Mining Project; however, since the data are more than 10 years old, it was determined that additional data would be required to describe the existing ambient noise levels within the LSA and to validate whether existing ambient noise levels have changed when compared to those measured in 2011 and 2012. A baseline program was completed in 2024. The 2024 baseline field program focused on supporting the desktop review of identifying potential PORs located within the identified LSA (i.e., 5 km from SSA) and collecting existing noise data to characterize the existing ambient noise levels based on the existing noise sources present at the time of the noise baseline program.

A potential POR refers to any location on a noise sensitive land use where human activity is expected and noise from a source could be received. Potential PORs were identified in general accordance with the Health Canada Noise Guideline and Québec Noise Guideline. For the purposes of this assessment, a potential POR for either guideline was considered an existing sensitive land use with human activity, including dwellings, campsites or campgrounds, sensitive institutional uses (e.g., educational, nursery, hospital, healthcare, community centre, place of worship, or detention centre), or sensitive commercial uses (e.g., hotel or motel). Upon review of the *Town of Labrador City Development Regulations* dated April 2018 (*Labrador City Development Regulations*) and the *Town of Wabush Development Regulations* dated September 2018 (*Wabush Development Regulations*), which describes the different permitted use zones and includes a zoning map for the Town of Labrador City, it is assumed the existing potential PORs identified through the desktop analysis further discussed below, reasonably addresses any future potential PORs.

The desktop level analysis considered orthoimagery, publicly readily available imagery and publicly available ownership information. The potential noise sensitive land uses identified within the LSA were permanent cabins, recreational cabins, recreational vehicle campsites and low-density residential dwellings. The desktop level analysis of the potential PORs was supplemented with site observations from the noise baseline program. The noise assessment did not consider receptors located within the SSA. It considers properties that are expected to be used for noise-sensitive purposes in the future. It is understood that a worker camp will be developed to support the Project. It is expected the Project and associated worker camp will be designed to be protective of workers when off-shift. Accordingly, the worker camp was not explicitly considered in the noise assessment.

The measurement locations consisted of both unattended long-term continuous monitoring and attended short-term spot-check measurements carried out in the vicinity of potential PORs. The short-term measurements were completed during the daytime period to supplement the long-term monitoring to characterize existing noise levels within larger spatial extent to provide more context related to the typical noise sources present in the area and document noise sources contributing to the acoustical environment. For the purposes of the noise baseline program, long term is defined as approximately 24 hours in duration that includes both weekend and weekday periods when applicable, while short term is approximately 5 to 20 minutes in duration (assuming constant noise levels), during periods of favourable weather. A program of this duration is considered adequate for locations in rural and/or remote areas where day-to-day variability is expected to be minimal due to limited human activity.

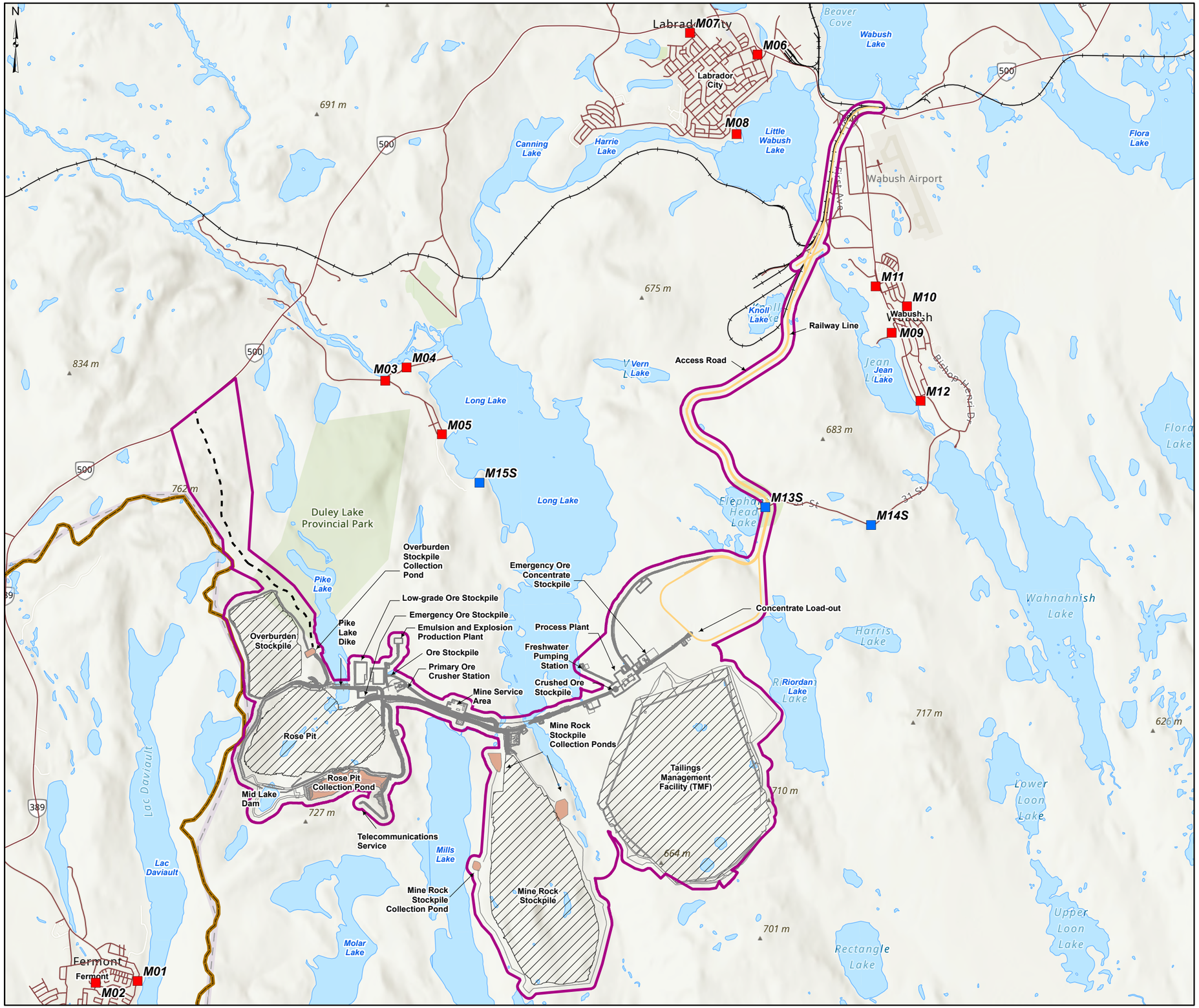
6.4.1.2 Representative Potential Points of Reception

Potential PORs were identified during the noise baseline assessment and then updated in February 2025 using available information. The identified potential noise sensitive land uses considered readily available public information and are expected to be used for noise, vibration and light-sensitive use into the future. Any existing noise, vibration or light-sensitive receptors within the SSA were not carried forward through the assessment. A total of 20 potential Representative PORs (RPORs) were selected from the identified potential PORs to represent noise sensitive PORs surrounding the SSA in all cardinal directions. The assessment location for all RPORs associated with a building is assumed to be at the plane of window, 4.5 metres (m) above ground to represent a potential second storey, which is considered a conservative assessment based on the large distance between the Project and the RPORs. The complete list of RPORs and their UTM coordinates are provided in Table 6-12. The identified potential PORs and RPORs are presented in Figure 6-4.

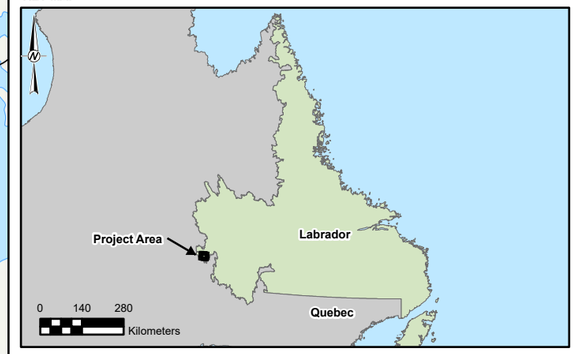
Table 6-12: Representative Potential Points of Reception

Point of Reception ID	Description	Assessment Location Height (m)	UTM Coordinates (NAD 83; Zone 15N)	
			Easting (m)	Northing (m)
RPOR01	Cabin west of Project – Lac Daviault Lake	4.5	626662	5855575
RPOR02	Cabin southwest of Project – camp site in Fermont	4.5	629641	5852708
RPOR03	Cabin southwest of Project – southeast of Fermont	4.5	631620	5848434
RPOR04	Cabin south of Project – south of Mills Lake	4.5	635730	5849660
RPOR05	Cabin south of Project – north of Swanson Lake	4.5	640185	5848135
RPOR06	Cabin south of Project – northeast of Rectangle Lake	4.5	642951	5852301
RPOR07	Cabin east of Project – south of Riordan Lake	4.5	641867	5855099
RPOR08	Cabin east of Project – North Riordan Lake	4.5	640778	5857817
RPOR09	Cabin east of Project – South Wabush and south of Jean Lake	4.5	643599	5861887
RPOR10	Cabin east of Project – North Wabush and north of Jean Lake	4.5	642976	5864508
RPOR11	Cabin northeast of Project – east of Labrador City and north of Wabush	4.5	644982	5868163
RPOR12	Cabin north of Project – Labrador City	4.5	640811	5867632
RPOR13	Cabin north of Project – Labrador City	4.5	638191	5866822
RPOR14	Cabin north of Project – Duley Lake Park	4.5	634795	5862322
RPOR15	Cabin north of Project – Duley Lake	4.5	638188	5859443
RPOR16	Cabin north of Project – Duley Lake	4.5	637468	5857501
RPOR17	Cabin north of Project – Duley Lake	4.5	636907	5856912
RPOR18	Cabin north of Project – Duley Lake	4.5	636098	5856774
RPOR19	Cabin north of Project – west of Duley Lake	4.5	634702	5859483
RPOR20	Cabin northwest of Project – north of Lac Daviault Lake	4.5	630232	5858749

UTM = Universal Transverse Mercator.



KEY MAP



SCALE 1:20,000,000

LEGEND

- Existing Railway
- Existing Road
- Proposed Access Road and Railway Corridor
- Potential Access Road
- Summer Light Measurement Location
- Winter/Summer Light Measurement Location
- Proposed Sedimentation Pond
- Proposed Infrastructure
- Site Study Area
- Labrador/Quebec Boundary
- Waterbody
- Project Infrastructure

0 2 4

1:70,000 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY WORLD HILLSHADE: ESRI, NASA, NGA, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

BASELINE LIGHT MEASUREMENT LOCATIONS

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-4

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_Notext\VibrationLight\0019_NotextVibrationLight.aprx, PRINTED ON: AT 2:11:45 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

6.4.1.3 Existing Noise Levels

The noise baseline program included long-term (ranging from approximately 72 to 96 hours) monitoring and short-term (up to 5 minutes) measurements of existing ambient noise levels in the vicinity of the Project. Long-term monitoring locations were identified based on the location of potential PORs and the ability and permission to access the different locations. Four long-term monitoring locations were selected, one in each general cardinal direction within the LSA, in line-of-sight to the Project, specifically near Fermont, Duley Lake, Riordan Lake and Wabush. A total of 10 short-term locations were used to collect data to supplement the long-term monitoring data collected.

The results of the noise baseline program indicate that the existing noise levels within the Project area are primarily dominated by nature-based ambient sources including wind-induced noise due to vegetation, wildlife, and insects, and to a lesser degree by anthropogenic sources (such as local industrial activity and traffic along Highway 389/500/503).

Table 6-13 summarizes the average day and night sound levels for the previous baseline data collection programs completed between 2011 and 2012 and the 2024 programs. Overall, in 2024 sound levels were measured to be slightly lower than levels measured in 2011 and 2012. Upon a comparison of the two sets of programs, generally the differences included the length of the monitoring program, monitoring locations and the uncertainty of whether the previous program followed a similar criterion applied to the collected data to what was applied in the 2024 program. Based on a review of 2011 and 2012 data and collected data in 2024, from the perspective of existing noise levels, the area in the vicinity of the Project can be considered as rural within the towns of Wabush and Fermont to remote in the Duley Lake and Riordan Lake areas. Overall, when considering the data collected, sufficient data exists to support the characterization of existing sound levels and assessment of anticipated effects on the acoustic environment from the Project. Additional details of the noise baseline program are provided in Annex 1B.

Table 6-13: Summary of Previous and Current Baseline Noise Monitoring Results

Monitor Location	Monitoring Station	Average Day Sound Levels (Ld)	Average Night Sound Levels (Ln)
Fermont	Site 1 – 2011 Summer Program	43	40
	Site 1 – 2012 Winter Program[(a)]	41/47	35/39
	ML1 – Fermont Campsite 2024 Summer Program	37	35
Duley Lake	Site 2 – 2011 Summer Program	42	40
	ML2 – Duley Lake 2024 Summer Program	32	25
Riordan Lake	ML3 – Riordan Lake 2024 Summer Program	38	37
Wabush	Site 3 – 2011 Summer Program	53	43
	Site 3 – 2011 Winter Program[(a,b)]	46/44	38/33
	Site 4 – 2012 Winter Program[(a,b)]	45	35
	ML4 – Wabush 2024 Summer Program	39	36

(a) The winter 2012 baseline program summarized measurements on the weekday and weekend and have been presented as weekday/weekend.
(b) The above table presents data from Table 14.18 and Table 14.20 of the previous EIS (Alderon 2012). In the previous EIS, it is noted that Site 2 was not measured in the winter of 2012 and instead Site 4 was measured to reflect noise levels in Wabush. However, there is a discrepancy in Table 14.20 that summarizes the results for Site 2, instead of Site 4. It has been interpreted that the results summarized for Site 2 in Table 14.20 are for Site 3, and the results for Site 3 are actually for Site 4.

Ld = daytime noise level (7 a.m. to 10 p.m.); Ln = nighttime noise level (10 p.m. to 7 a.m.).

The levels established through the 2024 program were based on the removal of data captured during periods with inclement weather. This approach is a common industry practice typically known to result in a conservative approach in establishing baseline conditions. It is expected the approach taken in establishing baseline conditions is conservative (i.e., established lower baseline conditions) when compared to the annual average levels when considering all meteorological conditions. Using these baseline levels is expected to result in a conservative assessment.

6.4.2 Vibration

Other than the existing rail line, there are no known vibration generation sources identified near the proposed rail line or other areas within the proposed Project site. Most of the normal industrial vibration sources are attenuated below perception within the first 100 m from the source. Due to the absence of major anthropogenic activities in the vicinity of the Project site and rail line, ambient vibration is expected to be below average human perception including in the vicinity of existing rail activities, with the exception of the blasting operations at existing mines.

6.4.3 Light

To assess the change in light due to the Project, it is necessary to characterize baseline light conditions (i.e., sky quality and light trespass). Existing data were reviewed for the RSA and LSA. Light measurement data were obtained from the previous EIS (Alderon 2012), for which baseline sky quality measurements were carried out in Wabush, Labrador City, Duley Lake, and Fermont.

As the baseline sky quality data were over 10 years old and the previous field program did not include the measurement of light trespass, baseline light field programs were carried out in 2024 to update the previous baseline and confirm current baseline conditions.

Measurements of the two indicators for light were carried out: light trespass and sky glow. Data were collected during field programs under wintertime conditions in April 2024 and under summertime conditions in August/September 2024 for the purpose of characterizing the existing light environment.

Available information was collected from mapping of the area surrounding the Project. Based on analysis of available information, 12 locations for the wintertime field program and 15 locations for the summertime field program were selected as monitoring locations representative of sensitive locations in the vicinity of the Project.

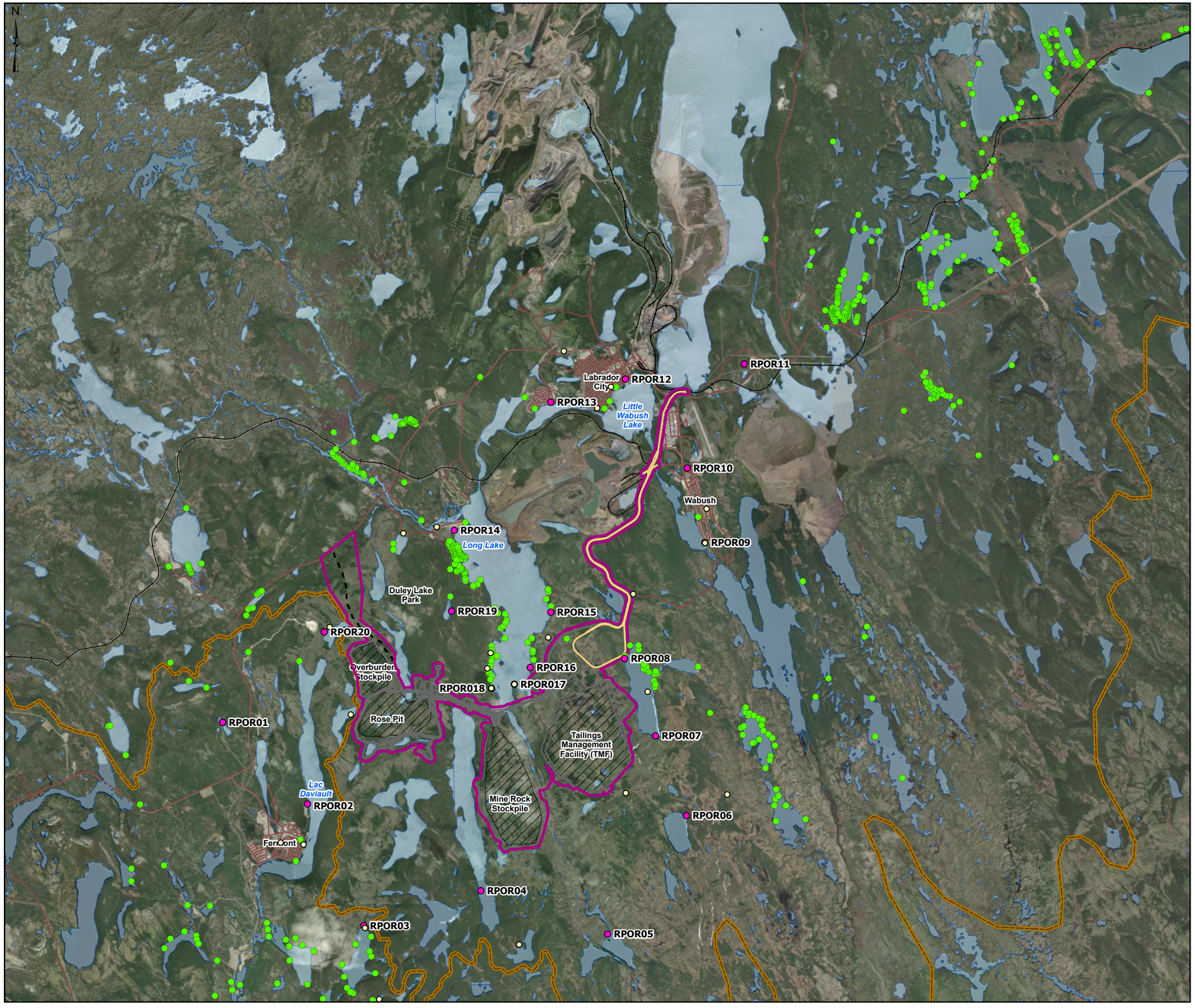
Sky quality and light trespass measurements were undertaken during both clear and cloudy skies, after astronomical twilight and while the moon was set so there was no effect on light levels from the sun or the moon.

The light trespass measurements were carried out using a Solar Light PMA2100 photometer and a PMA2131 scotopic detector and a Unihedron Sky Quality Meter was used to gather information on existing sky glow levels. The measurements were made at each identified measurement location following best practices as per the Illuminating Engineering Society of North America and CIE guidelines (CIE 2017; IESNA 2000).

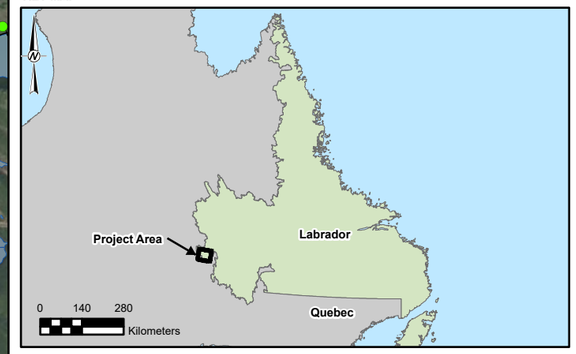
Table 6-14 summarizes the measured illuminance levels and sky quality at the measurement locations, which are shown in Figure 6-5.

Measured illuminance levels met the applicable CIE zone light trespass limit at most measurement locations except for M06, M07, and M11, which were associated with commercial land uses and were lit up by parking and commercial lights. The sky quality measured at most locations met the applicable CIE zone sky quality limit except for M06 and M07. Light trespass and sky quality were generally impacted by street and commercial lighting and lighting from nearby residences.

The sky quality measurement results from the 2024 baseline program were generally lower than those presented in the previous EIS, expected to be due to a general increase in human activities over the past decade, except for in Duley Lake Provincial Park. The lower sky quality indicates higher sky glow caused by reflection from the atmosphere of human-made lighting. Comparing data under similar weather conditions (i.e., clear skies during summertime), the sky quality results collected at the Duley Lake Provincial Park are very similar in both assessments. Additional details are provided in Annex 1C.



KEY MAP



SCALE 1:20,000,000

LEGEND

- Potential Points Reception (POR)
- Human Health Risk Assessment Receptors (HHRA)
- Representative Potential Points of Reception (RPOR)
- Existing Railway
- Existing Road
- Proposed Access Road and Railway Corridor
- Proposed Infrastructure
- Potential Access Road
- Proposed Infrastructure
- Site Study Area
- Labrador/Quebec Boundary
- Waterbody

0 2.5 5

1:135,000 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.
2. AQ STANDARD IS 50 MG/M³
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS.
4. TPM AIR QUALITY STANDARD IS 120 MG/M³

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

POTENTIAL POINTS OF RECEPTION

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD/MS
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-5

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_Noise\Vibration\Light\0019_NoiseVibrationLight.aprx PRINTED ON: AT: 2:12:10 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

Table 6-14: Existing Light Trespass and Sky Quality at Measurement Locations

Measurement Location ID	Measurement Location Description	Key Light Sources	Illuminance (lux)			Sky Quality (mag/arcsec^2)			CIE Zone Classification
			Winter	Summer (Night 1)	Summer (Night 2)	Winter	Summer (Night 1)	Summer (Night 2)	
M01	Residences, Fermont QC	Residential lights	0.004	0.154	0.548	20.01	18.43	16.96	E3 – suburban centres
M02	Horizon-Blanc High School, Fermont QC	Internal/External school lights	0.424	1.258	1.135	18.61	17.02	16.83	E3 – suburban centres
M03	Duley Lake Provincial Park entrance, Labrador City NL	None	0.007	0.006	0.006	20.73	20.32	20.97	E1 – natural
M04	Duley Lake Provincial Park, Labrador City NL	None	0.007	0.014	0.005	20.72	19.96	20.81	E1 – natural
M05	Residences south of Duley Lake Provincial Park, Labrador City NL	None	0.003	0.010	0.008	20.31	20.17	20.66	E2 – rural
M06	Drake Ave and Avalon Dr. intersection, Labrador City NL	Commercial lights	6.835	12.475	13.158	16.04	14.42	14.52	E3 – suburban centres
M07	Labrador Mall Parking Lot, Labrador City NL	Commercial streetlights	19.503	20.139	18.098	12.32	12.46	11.86	E3 – suburban centres
M08	Dog Park, Labrador City NL	Residential lights	0.220	0.026	0.025	18.16	19.47	19.01	E3 – suburban centres
M09	Open space near Jean Lake, Wabush NL	Streetlights	0.034	0.235	0.268	20.02	19.55	17.61	E3 – suburban centres
M10	Reid St. and Whiteway Dr. intersection, Wabush NL	Streetlights	1.056	0.531	0.549	16.88	17.08	17.34	E3 – suburban centres
M11	1 Grenfell Dr., Wabush NL	Commercial lights	2.744	1.441	1.898	15.68	16.49	15.27	E3 – suburban centres
M12	South end of Snow's Dr., Wabush NL	Streetlights	0.103	0.835	0.350	19.76	16.82	18.36	E3 – suburban centres
M13 (summer only)	Elephant Head Lake, Wabush NL	None	N/D	0.006	0.028	n/d	20.38	20.62	E1 – natural
M14 (summer only)	Riordan Lake, NL	None	N/D	0.005	0.028	n/d	20.08	20.25	E1 – natural
M15 (summer only)	Duley Lake, NL	None	N/D	0.005	n/d	n/d	20.40	N/D	E1 – natural

CIE = Commission Internationale de l'Éclairage; lux = lumens per square metre; mag/arcsec^2 = magnitude per square arc second; n/d = no data collected; NL = Newfoundland and Labrador; QC = Québec.

6.5 Effects Assessment

The effects assessment for the noise, vibration and light VECs are presented in the following sections. The methods to assessing effects for each VEC are presented in Section 6.5.1. The effect pathway screening is presented in Section 6.5.2, the residual Project effect analysis for the noise, vibration and light VECs are presented in Sections 6.5.3, 6.5.4 and 6.5.5, respectively, and the residual cumulative effect analysis for the noise, vibration and light VECs is presented in Section 6.5.6.

6.5.1 Methods

6.5.1.1 Effect Pathway Screening

Interactions between Project components or activities and the corresponding potential changes to the environment that could result in potential effects to the noise, light and vibration VECs were identified by an effect pathway screening. The effect pathway screening was used to inform the residual Project and cumulative effect analyses for the noise, light and vibration VECs. The first part of the analysis was to identify the potential effects pathways for each phase of the Project. Each pathway was initially assumed to have an interaction that would result in potential effects on noise, vibration and light VECs.

Potential pathways from Project activities to noise, vibration and light VECs were identified using the following:

- review of the **Project Description** (**Chapter 2**) and scoping of potential effects by the EIS team for the Project
- input from Engagement (Chapter 22)
- scientific knowledge
- review of EISs for similar mining projects, including the previous EIS (Alderon 2012)
- previous experience with mining projects
- consideration of key issues (Section 6.3.1)

Potential adverse effects of the Project were then identified, and practicable mitigation was applied to avoid and/or minimize effects on noise, vibration, and light VECs. Avoidance designs and actions integrated into the Project were developed iteratively by the Project's EIS team. The effectiveness of mitigation measures proposed for each effect pathway was assessed to determine whether the mitigation would address the potential Project effect such that the pathway was eliminated or resulted in a negligible adverse effect on noise, vibration or light or if residual adverse effects on noise, vibration, or light from the Project remained following the implementation of mitigation measures.

This effect pathway screening was a preliminary assessment that was intended to focus the effects analysis on effect pathways that required a more quantitative or comprehensive assessment of effects on VECs. Using scientific knowledge, feedback from consultation, logic, experience with similar developments, and an understanding of the effectiveness of mitigation (i.e., level of certainty that the proposed mitigation would work), each effect pathway was categorized as one of the following:

- **No effect pathway**–The effect pathway could be removed (i.e., the effect would be avoided) by avoidance measures and/or additional mitigation so that the Project would result in no measurable environmental change relative to existing conditions or guideline values; therefore, it would have no residual effect on noise, vibration or light VECs.
- **Negligible effect pathway**–With the application of mitigation, the effect pathway could result in a measurable but minor environmental change relative to existing conditions or guideline values, but the change is sufficiently small that it would have a negligible residual effect on noise, vibration or light VECs (e.g., for the noise VEC, a negligible increase in noise level which could be measurable, but likely not perceptible (i.e., a change of less than 3 dB). Therefore, further detailed assessment of the residual effect is not warranted as the effect pathway would not be expected to result in a significant residual Project or cumulative effect on noise, vibration or light VECs.
- **Residual effect pathway**–Even with the application of mitigation, the effects pathway is still likely to result in a measurable environmental change relative to existing conditions or guideline values that could cause a greater-than-negligible adverse or positive effect on noise, vibration or light VECs and warrants additional assessment.

Project interactions determined as no effect pathway or negligible effect pathways were not carried forward for further assessment (Section 6.5.2). Residual effect pathways that could result in changes to the environment with one or more associated measurable parameter and have the potential to cause a greater than negligible effect on the noise, vibration and light VECs were carried forward to the residual Project effects analysis (Sections 6.5.3, 6.5.4 and 6.5.5) and residual cumulative effects analysis (Section 6.5.6).

6.5.1.2 Residual Project Effect Analysis

The residual effects analysis for noise, vibration and light measures and describes the effects of the Project on noise, vibration and light relative to existing conditions or against applicable guideline values. The residual Project effects analysis was conducted using the temporal snapshot identified for the assessment (Sections 6.5.3, 6.5.4, and 6.5.5). Residual effects are described for each of the measurement indicators for the residual effect pathways identified.

The residual Project effects analysis used a reasoned narrative to describe anticipated changes to each measurable parameter caused by the Project. This narrative description of anticipated effects is the foundation for the residual effects classification.

Residual effects are classified in tabular form using effects criteria, which is intended to provide structure and comparability across VECs assessed for the Project. The residual effects classification uses nature, magnitude, geographic extent, duration, frequency, reversibility, and probability of occurrence as criteria.

The following sections provide the methods used to predict changes in measurable parameters for noise, vibration and light and present the approach to classify each residual effect criterion for each VEC. Where possible, the criteria used the same definitions as the Alderon EIS so that residual Project effects assessment conclusions could be compared to the Alderon assessment.

Following classification of residual Project effects, the analysis also evaluates the significance of residual Project effects using threshold criteria or standards beyond which a residual effect is considered significant. The definition of a significant effect for noise, vibration and light is provided in Section 6.5.1.4.

6.5.1.2.1 Noise

The following summarizes the methods of the residual Project effects analysis for the noise VEC if the results of the Effect Pathway Screening identify it is required. This includes the methods used to predict changes in measurable parameters and the approach to classify each residual effect criterion for noise.

The assessment of potential Project effects on noise considers effects that occur during both the Construction and Operations phases. It is expected that these periods are sufficient to capture the effects of the Project and reflect when the greatest effects are expected as they relate to noise. As previously mentioned, potential effects and mitigation measures to be identified for the Construction of the Project will likely apply to the Closure phase. Therefore, assessing the Construction scenario is considered bounding between these two phases. A quantitative noise assessment of the potential effects due to noise during the Project's Construction and Operation phases was carried out.

Noise levels due to the Construction and Operations phases were predicted in accordance with International Organization for Standardization (ISO) Standard 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, dated December 1996 (ISO 9613-2:1996), implemented in the CadnaA noise prediction modelling software, Version 2023 MR2, developed by DataKustik GmbH. This modelling method is currently accepted by numerous regulators across Canada and has been used for projects assessed against the Health Canada Noise Guideline. Noise sources were characterized by entering the sound power octave band spectrum associated with each source. Other parameters including building dimensions, source height, frequency of use and hours of operation also defined the nature of noise emissions. The ISO 9613 prediction method is considered to be conservative as it assumes that all PORs are downwind from the noise source or that a moderate ground-based temperature inversion exists. In addition, ground cover, terrain and atmospheric absorption were included as they related specifically to the Project. In selecting the CadnaA software, consideration was given to the capabilities of CadnaA in dealing with Geographic Information System data and complex topography and the ability to generate noise contours. Noise contours provide a visual representation of the acoustical environment associated with the noise sources in the vicinity of, and within, the Project site and are therefore useful in identifying potential noise concerns.

The assessment of the Construction and Operations phases each focused on a single scenario that represents when predictable worst-case sound levels are expected to occur during each phase, specifically when the greatest amount of material is planned to be extracted and/or maximum quantities of key noise sources are operating.

The following are key assumptions and modelling inputs that were considered in the development of the noise prediction modelling, both general to the entire noise assessment and specific to the Construction and Operations phases.

General

- The site layout dated October 2024, as presented in Figure 6-6, was considered. The following are the key noise-generating areas and/or activities expected during the Construction and Operations phases:
  - Rose Pit
  - overburden stockpile
  - ore handling
  - primary ore crushing
  - mine service area
  - mine rock stockpile
  - process plant
  - silo
  - conveyors
  - truck traffic along various roadways
  - fresh water pumping station
  - diesel generators
  - emergency diesel generator
  - transformers
  - fire protection system
  - tailings management facility (TMF)
  - railroad
  - railway concentrate load-out
- The RPOR layout assessed considers land use and ownership as of February 2025, as described in Section 6.4.1.2. A single assessment location was selected at a height of 4.5 m (i.e., represents a 2nd storey window) for each RPOR.
- Potential attenuation from existing offsite buildings or foliage between the Project and a given RPOR were conservatively not included in the model.
- Equipment was conservatively located on the existing terrain (i.e., at grade); therefore, potential attenuation from a working face in the pit and/or stockpile was not considered.
- Key noise sources and on-site structures (i.e., buildings and other structures acting as barriers) were primarily located as per the Navisworks file dated February 23, 2024.
- When appropriate, the minimum potential distance between a noise source and RPOR was considered.
- During the Construction and Operations phases, all key noise sources, except for the railway operations to transfer concentrate, were modelled as operating 24 hours per day, 7 days per week, without any variation between daytime, nighttime, and hourly periods.
- The key on site noise sources were considered operating at either a discreet location, along a defined alignment or within a general area. The railway operations are further discussed below.
- The types of key noise sources were identified based on information provided by the Project team, including the previous EIS (Alderon 2012). The list of key noise sources is considered to be representative of the types of equipment and associated activities for the Project. Respective maximum noise emissions for each source were assumed, primarily considering Project design details, WSP's database of similar noise sources, manufacturer's specifications, and publicly readily available information. Key noise source emissions were assumed to be no greater than those assessed.
- A berm/barrier near the railway activities in the vicinity of the PORs near Riordan Lake that are in close proximity to the rail loop was considered. Currently, a conceptual 700 m long, 6 m high barrier near the rail loop is required.
- A ground absorption coefficient of 0.7 was used to represent a combination of acoustically soft (1.0) and hard (0.0) ground for the entire LSA with the exception of a ground absorption coefficient of 0.0 considered for large waterbodies and a ground absorption coefficient of 0.2 to represent the mine site removed of natural vegetation.
- The use of backup beepers was not quantitively assessed. A back-up beeper's primary purpose is for health and safety however they may result in nuisance noise complaints due to their sound characteristic. It is expected the Project will investigate options to minimize any potential noise nuisance complaints, including the use of "broadband" alarms (i.e., multiple frequencies) and other technologies that are permitted by the regulating authorities.

Construction Phase

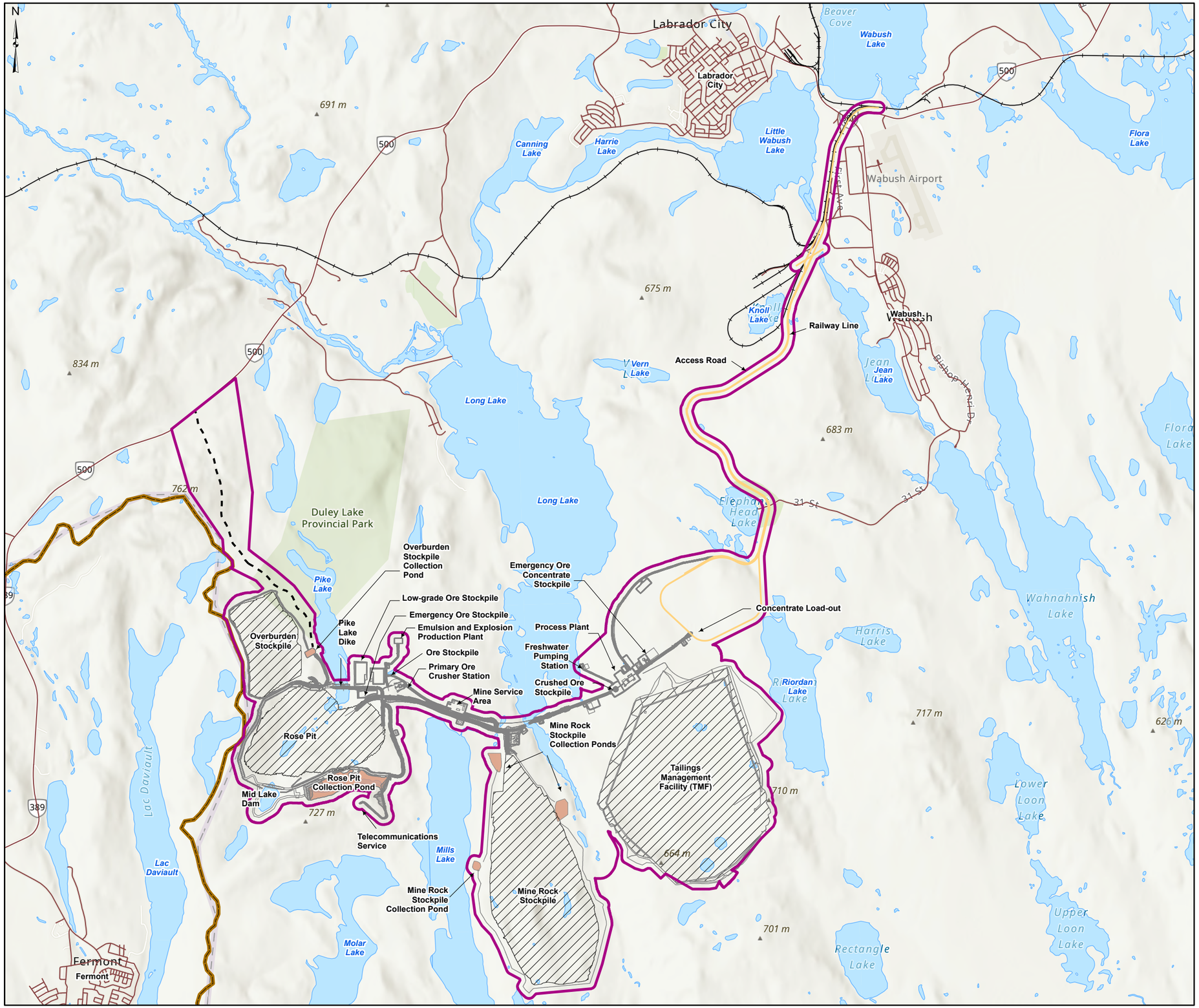
- During the Construction phase, the predictable worst-case scenario considers the maximum quantities of key noise sources in any one of the four years of construction.
- Detailed construction information, such as a list of planned equipment and schedule, was not available at the time of this noise assessment. The previous EIS (Alderon 2012) formed the basis of a list of potential construction equipment to be considered as representative of what is expected to be used for the Project as well as assumptions on their use for major construction activities. Additional construction equipment, proposed operating scenario and respective operating locations, assumed based on WSP's past similar project experience, were included in the noise assessment.

- For the purposes of the EA, it was assumed construction will be carried out within the following specific areas of the SSA sequentially in two stages:
  - stage 1
    - general site clearing and preparation of the entire Project site
  - stage 2
    - Rose Pit
    - conveyors
    - railway
    - TMF
    - building assembly
    - roadway construction
    - bridges
    - transportation – general site
    - transportation – TMF
    - transportation – railway
- Table 6-15 summarizes the quantity, utilization factor, and estimated noise emissions (i.e., sound power levels) of the representative major construction equipment within each of the areas defined above. It is assumed the construction equipment could be operating anywhere within their specific area.

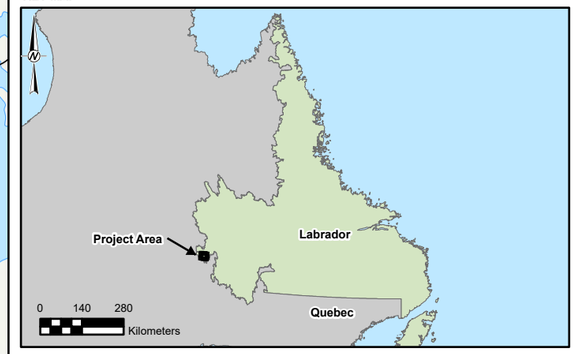
Operations

- During the Operations phase, the predictable worst-case scenario considers when the greatest amount of material is extracted, which is expected to occur in Year 2 (i.e., the year following pre-production).
- Table 6-16 summarizes the quantity, utilization factor, and estimated noise emissions (i.e., sound power levels) of the key noise sources during the Operations phase.
- As noted above, the list of significant noise sources is considered to be representative of the types of equipment and associated activities for the Project. Respective maximum noise emissions for each source were assumed, primarily considering; Project design details, WSP's database of similar noise sources, manufacturer's specifications, and publicly readily available information. Significant noise source emissions were assumed to be no greater than those assessed and operating 100% of the time at their maximum sound power levels with the exception of the sources associated with the railway operations as further discussed below.
- The following are maximum noise emissions (i.e., sound power levels) required for specific key noise sources to minimize potential noise effects which will need to be verified during the detailed design and commissioning stages:
  - all production drills – 112 dBA (i.e., approximately 90 dBA at 15 m)
  - all loaders – 112 dBA (i.e., approximately 80 dBA at 15 m)
  - all dozers – 107 dBA (i.e., approximately 75 dBA at 15 m)
  - all excavators – 102 dBA (i.e., approximately 70 dBA at 15 m)
  - all graders – 107 dBA (i.e., approximately 75 dBA at 15 m)
  - all shovels – 112 dBA (i.e., approximately 80 dBA at 15 m)
  - all pumps – 92 dBA (i.e., approximately 60 dBA at 15 m)
  - all conveyors – 57 dBA/m (i.e., approximately 40 dBA at 15 m)
  - all haul trucks (both 100 ton and 320 ton) – 112 dBA (i.e., approximately 80 dBA at 15 m)
  - dust collectors – 96 dBA (i.e., approximately 64 dBA at 15 m)
  - snow blowers – 98 dBA (i.e., approximately 66 dBA at 15 m)
  - train loading (i.e., the conveyor loading the train and the material drop) – 93 dBA (i.e., approximately 61 dBA at 15 m)
  - transformers – 91 dBA (i.e., approximately 59 dBA at 15 m)
  - concentration building (i.e., acoustically designed) – 51 dBA/m^2
  - impulsive coupling train noise – 123 dBA (i.e., approximately 91 dBA at 15 m)
  - all medium trucks – 96 dBA (i.e., approximately 63 dBA at 15 m)
  - primary crusher – 112 (i.e., approximately 80 dBA at 15 m)

- Railway operations were based on information provided by the Project team, considering guidance from the Canadian Transportation Agency on typical railway sources and assumptions. The typical railway sources include:
  - train pass-by noise
  - idling locomotive noise
  - railway crossover
  - wheel squeal on curved tracks
  - locomotive whistle noise
  - rail cars classification/shunting impulsive noise
- Railway source noise levels were estimated using the Project design details, Canadian Transportation Agency's Railway Noise Measurement and Reporting Methodology (Canadian Transportation Agency Guide; CTA 2011), WSP's database of similar noise sources and/or readily available public information. Railway source predictions were carried out using ISO 9613.
- The potential noise due to the railway crossing safety devices, specifically train horns (i.e., whistles) and crossing signals in the vicinity of at grade crossings, were not quantitatively included in the noise assessment. It is expected that directly mitigating noise due to these railway safety devices will compromise the purpose of the safety device (i.e., designing a barrier to mitigate a safety device's audible signal). Notwithstanding, it is possible a noise barrier in the vicinity of a railway crossing that would be used to address other railway noise sources may indirectly reduce the noise levels due to a railway safety device. Note that Canadian Transportation Agency or Transport Canada does not have publicly readily available guidance related to assessing railway safety devices when mitigating noise due to train operations. It is not uncommon for train horns to be a source of noise complaints and can possibly be mitigated through a train whistle exemption requested by the local government or wayside horns as confirmed through detailed design.
- The potential noise emissions due to wheel squeal were not quantitatively included in the operations noise assessment. Wheel squeal can be a source if the Project infrastructure is not designed appropriately. Wheel squeal is the result of multiple factors but is likely to occur along curved sections of a railway. The minimum track curve radius at various locations along the proposed railway is approximately 300 m or less and, based on the FTA Manual (FTA 2018) (i.e., Table 4-33), the generation of wheel squeal noise is possible when the track curve radius is less than 300 m. It is expected the railway infrastructure and operations will be designed with the consideration of environmental noise emissions that could include at-source mitigation (e.g., greater turn curve radius, rail lubrication, resilient or damped wheels) and/or at-receptor mitigation (e.g., acoustical barriers, berms, acquiring additional lands) to avoid potential noise effects from wheel squeal at potential PORs and will be implemented prior to commissioning the railway operations.
- The following is a summary of the railway operations:
  - railway operations 24 hours per day, 7 days per week
  - number of locomotives per train: 3
  - number of cars per train: 247
  - duration to load a train: approximately 4 hours
  - duration to travel between the site and port: approximately 1 hour
  - number of daytime pass-bys on the main line (one direction): 4
  - number of nighttime pass-bys on the main line (one direction): 2
  - train speed during loading: 0.5 miles per hour (1 km/h)
  - train speed when travelling: 30 miles per hour (48 km/h)
  - reference rail car length: 12 m
  - reference locomotive length: 20 m
  - duration of train coupling impulse: 0.5 s
  - total # of train coupling occurrences per loading period: 2
  - total # of train coupling sources: 239 per occurrence (i.e., total of 478)
  - total locomotive idling daytime period: 10 min
  - total locomotive idling nighttime period: 5 min
  - total length of train: 2,904 m
  - total length of proposed railway: 16.4 km
  - total distance of the loop section within proposed railway: 5.3 km
- Emergency diesel stand-by generators will provide emergency power during the Operations phase.



KEY MAP



SCALE 1:20,000,000

LEGEND

- Existing Railway
- Existing Road
- Proposed Access Road and Railway Corridor
- Potential Access Road
- Proposed Sedimentation Pond
- Proposed Infrastructure
- Site Study Area
- Labrador/Quebec Boundary
- Waterbody
- Project Infrastructure

0 2 4

1:70,000 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY WORLD HILLSHADE: ESRI, NASA, NGA, USGS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

SITE LAYOUT

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-6

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\99_PROJ\CA0038713.5261_EIS\40_PROD\0019_Notext\VibrationLight\0019_NotextVibrationLight.aprx, PRINTED ON: AT: 2:12:31 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

Table 6-15: Construction Scenarios and Corresponding Noise Sources

Area of Construction	Noise Source	Quantity	Duty Cycle	Overall Sound Power Level (dBA)[a]
General site clearing and preparation	Mobile crane	3	15%	109
	Boom truck	20	15%	
	Construction – earth moving equipment	35	15%	
	Dump truck	5	15%	
	Diesel generator	5	15%	
	Concrete plant	1	15%	
	Cement mixer	2	15%	
Rose Pit	Mobile crane	1	25%	121
	Construction – earth moving equipment	20	50%	
	Dump truck	2	50%	
	Diesel generator	1	25%	
	Concrete plant	1	50%	
	Cement mixer	1	50%	
Conveyors	Mobile crane	1	20%	110
	Boom truck	5	20%	
	Construction – earth moving equipment	5	10%	
	Dump truck	1	20%	
	Diesel generator	1	20%	
Railway	Blasting drill rig	2	15%	123
	Dump truck	15	25%	
	Dozer	6	25%	
	Excavator	8	25%	
	Grader	2	25%	
	Roller compactor	3	25%	
	Front end wheel loader	5	20%	
	Diesel generator	2	25%	
	Boom crane	2	15%	
	Boom truck	2	15%	
	Rail locomotive	1	15%	
	Tractor backhoe/loader	5	20%	
	Earth moving equipment	2	20%	
TMF	Excavator	1	50%	123
	Earth moving equipment	4	50%	
	Drill	6	25%	
	Tractor backhoe/loader	1	50%	
	Dozer	2	50%	
	Vibratory roller	3	50%	
	Dump truck	2	50%	
	Boom truck	5	25%	
	Diesel generator	1	25%	

Area of Construction	Noise Source	Quantity	Duty Cycle	Overall Sound Power Level (dBA)[a]
Building assembly	Dump truck	1	10%	105
	Cement mixer	1	10%	
	Mobile crane	1	15%	
	Earth moving equipment	2	6%	
	Boom truck	5	15%	
Roadway construction	Excavator	2	20%	113
	Grader	2	20%	
	Roller compactor	2	20%	
	Dump truck	2	20%	
	Boom truck	5	20%	
	Earth moving equipment	2	20%	
	Diesel generator	1	20%	
	Cement mixer	2	20%	
Bridges	Excavator	1	15%	108
	Front end wheel loader	1	15%	
	Mobile crane	1	15%	
	Boom crane	1	15%	
	Earth moving equipment	2	15%	
	Dump truck	1	15%	
	Diesel generator	1	15%	
	Mobile crane	1	15%	
Transportation – general site	Medium duty trucks (water truck, fuel truck)	15	50%	104
	Tanker	2	50%	99
Transportation – TMF	Haul truck	5	50%	112
Transportation – railway	Medium duty trucks (water truck, fuel truck)	19	50%	104
	Medium duty trucks (concrete/aggregate truck)	2	50%	104

(a) This is the sum of all the sound power levels of the sources included in this group. Sound power levels based on WSP's database of similar noise sources, manufacturer's specifications, and publicly readily available data.
dBA = A-weighted decibel; TMF = tailings management facility.

Table 6-16: Operations Scenario and Assessed Noise Sources

Source Description	Maximum Sound Power Levels (dBA)	Quantity
Electric hydraulic shovel	112	4
Wheel loader	112	4
Production drill	112	6
Auxiliary pre-split drill (4.5–8")	112	1
Wheel dozer	107	2
Track dozer	107	4
Stemming loader	112	2
Waste primary crusher	117	1
Excavator (90ft)	102	1
Excavator (49ft)	102	1
Motor grader (18ft)	107	1
Primary crushing	117	1
Primary crushing dust collector	96	1
Spreader system conveyor	77	1
Concentration building	61	1
Cooling condenser	96	5
Load-out to concentrate conveyor	113	1
Silo feed dust collector	96	1
Train load-out building conveyor transfer	93	1
Train load-out dust collector	96	1
Train load-out building – train loading	93	1
Rose Pit sump pump	92	4
Rose Pit collection pond	92	3
Rose Pit mining diesel pump	92	1
Overburden stockpile pump	92	1
Downstream of Pike Lake dike pump	92	1
Mid Lake pump	92	3
General site pump	92	2
Mine rock stockpile west collection pond pump	92	9
Fresh water pump station	92	3
North waste stockpile booster pumps	92	3
TMF sump pump	92	8
Mobile air compressor 185CFM	97	1
Snow blower	99	2
Pit to waste stockpile conveyors	77	1
Ore transportation conveyors	77	1
Transformer[a]	91	3
In pit road (320T haul trucks) Pit to ore stockpile (320T haul trucks)	112	9
Pit to overburden stockpile road (100T haul trucks)	112	12
Site road (medium trucks)	97	5
Access site road east (medium trucks)	96	5
Railway coupling impulsive noise[b]	123	478
Idling locomotive	112	2
Railway crossover	98	1

(a) Penalty of 6 dB for a tonal source added to this sound power level (ISO 2016).
(b) Penalty of 12 dB for a highly impulsive source added to this sound power level (ISO 2016).
(CFM = cubic feet per minute; dBA = A-weighted decibel; TMF = tailings management facility.

The approach to classify each residual effect criterion for noise is provided in Table 6-17.

Table 6-17: Definitions Applied to Effects Criteria Classifications for the Assessment of Noise

Criterion	Rating	Definition
Nature	Positive	Change in measurable parameter results in net improvement or benefit to the noise VEC
	Neutral	Change in measurable parameter results in no change to the noise VEC
	Adverse	Change in measurable parameter results in net degradation to the noise VEC
Magnitude	Negligible	Less than or equal to 3 dB change in ambient noise levels and meets Health Canada/Québec Guideline criteria
	Low	3 to 5 dB change in ambient noise levels and meets Health Canada/Québec Guideline criteria
	Moderate	Greater than 5 dB change in ambient noise levels and meets Health Canada/Québec Guideline criteria
	High	Exceeds Health Canada/Québec Guideline criteria
Geographic extent	SSA	Change in measurable parameter is confined to the SSA
	Local	Change in measurable parameter extends outside the SSA but within the LSA
	Regional	Change in measurable parameter extends beyond the LSA but is confined to the RSA
	Beyond regional	Change in measurable parameter extends beyond the RSA
Duration	Short term	Effect is limited to the Construction phase or Closure phase of the Project
	Medium term	Effect occurs in the short term and through the duration of the Project
	Long term	Residual effect extends beyond the life of the Project
Timing	Qualitative narrative or numeric quantification	Change in measurable parameter is described with a focus on seasonality (Project effects on noise are relatively insensitive to seasonality)
Frequency	Occasional	Change in measurable parameter is expected to occur rarely (e.g., once or a few times)
	Periodic	Change in measurable parameter is expected to occur consistently at regular intervals or associated with temporal events (e.g., during hot, dry climatic conditions)
	Continuous	Change in measurable parameter is expected to occur all the time
Reversibility	Reversible	Change in measurable parameter is reversible after closure
	Irreversible	Change in measurable parameter is predicted to influence the component indefinitely
Probability of occurrence	Unlikely	Change in measurable parameter is not expected to occur, but not impossible
	Possible	Change in measurable parameter may occur, but is not likely
	Probable	Change in measurable parameter is likely to occur, but is uncertain
	Certain	Change in measurable parameter will occur
Ecological and socioeconomic context	Undisturbed	Effect takes place within an area that is relatively or not adversely affected by human activity
	Disturbed	Effect takes place within an area with human activity. Area has been previously disturbed by human development or human development is still present

LSA = local study area; RSA = regional study area; SSA = site study area; VEC = valued environmental component.

6.5.1.2.2 Vibration

Project vibration levels were assessed using the Bureau of Mines prediction formula provided in the International Society of Explosives Engineers (ISEE) Blaster's Handbook (ISEE 2016) for blasting, and general assessment formulae provided in the FTA Manual (FTA 2018) for general construction activities and operations and rail traffic. The approach for the prediction of water overpressure levels induced by blasting and which was recommended by the DFO and followed for this assessment is described by the Wright and Hopky (1998). Where vibration source parameters were not available (e.g., vibration emissions), the assessment incorporated data from industry standard reference publications (e.g., FTA Manual) or data collected from similar equipment for other projects

The highest source of vibration will be from the blasting activities during Construction and Operations activities. However, the separation distance between the construction equipment and the nearest sensitive receptor (see Figure 6-4) may be significantly smaller than that for the blasting activities during the Construction and Operations activities. As such, the vibrations induced by construction equipment were also assessed.

Vibration emissions from the Project could increase the existing vibration levels within the vibration LSA.

6.5.1.2.2.1 Ground Vibration

Ground Vibration from Blasting

Ground vibration due to blasting was assessed. Both ground and air vibration levels lose energy and dissipate with increasing distance from the blast source. The rate at which these effects attenuate or dissipate from a particular site are dependent on geologic and environmental conditions, topography, and the particulars of the blast design. The intensity of ground and air vibration effects from any surface blasting operation are primarily governed by the distance between the POR and the blast, and the maximum weight of explosive detonated per delay period within the blast.

Where no site-specific data are available, the model factors can be estimated based on literature derived models or models based on applicable experience. Since blasting for the Project will occur over a large area and no previous blasting for the area is known, attenuation characteristics were estimated based on a literature review.

The rate ground vibrations attenuate from a blast site is dependent on a number of variables. These include the characteristics of the blast (delay timing, type of explosive), topography of the site, as well as the characteristics of the bedrock and/or soil materials. The rate ground vibrations decay or attenuate from a blast site can be expressed by the Scaled Distance presented in the ISEE Blaster's Handbook (ISEE 2016) and defined as:

$$Scaled\ Distance\ (SD) = \left(\frac{D}{\sqrt{W}}\right)$$

where D = the distance (m) between the blast and receptor

W = the maximum weight of explosive (kg) detonated per delay period

The ground vibration level is given by:

$$PPV = K(SD)^{-e}$$

Where PPV = Peak Particle Velocity (mm/s)

SD = Scaled Distance ($m/kg^{1/2}$) as defined above

K, e = Site factors typically derived from monitoring

The ISEE provided a simplified prediction model for the evaluation of vibration impact severity (ISEE 2016). This model is shown below.

$$PPV = 1140\left(\frac{D}{\sqrt{W}}\right)^{-1.60}$$

Where D = the distance (m) between the blast and receptor

W = the maximum weight of explosive (kg) detonated per delay period

The purpose of this equation is not so much to predict what a given vibration level would be at a particular location for a given blast, but to indicate that the peak vibration would fall below the level indicated by the equation for a given distance and maximum explosive weight. The equation is therefore a useful blast design tool in establishing maximum charge weights for various distances from a blast site for a given maximum ground vibration level. It is important to note that the blast vibration model proposed above would need to be calibrated with site-specific data collected during the initial blasts carried out at the Project and refined as the blasting continues.

The minimum SD required for the blast vibrations to remain complaint with the vibration limits is shown in Table 6-18. By maintaining the SD above those shown in Table 6-18, the vibration levels are expected to remain below the vibration level for that receptor type.

Table 6-18: Minimum Scaled Distance to Remain Compliant with the Vibration Limits at Identified Receptor Types

Phase	Receptor Type	Vibration Limit (mm/s)	Minimum Scaled Distance ($m/kg^{½}$)
Construction	Residential structures	25.0	10.88
	Fisheries during egg incubation	13.0	16.38
Operations	Residential structures	12.7	16.62
	Fisheries during egg incubation	13.0	16.38

$m/kg^{½}$ = metres per square root of explosive weight (in kg).

Ground Vibration from Trains

The operation of railway trains will introduce vibrations to the nearby communities. It is expected the vibration of the trains are far lower than those induced by blasting and dissipates to very low levels within tens of metres of the railway track. The actual train vibration level will depend on a number of factors including speed of the train, geological conditions, condition of the tracks and coupling of the residential structures to the ground.

Ground Vibration During General Construction Activities

To assess vibration due to general construction activities, a preliminary zone of influence was predicted. The preliminary zone of influence defines an area that may be potentially affected by vibrations at any frequency due to construction and is typically based on levels less than respective vibration limits, therefore resulting in a potential larger area of investigation. If receptor locations were located within the preliminary vibration zone of influence, a frequency-dependent assessment was carried out.

A list of construction equipment was provided by the Project team that was considered to be representative of the types of equipment and associated activities for the Project (see Table 6-15). Sources of construction vibrations generate waves that transmit vibrations through the ground medium. The waves travel outward from the construction source and attenuate as a result of geometrical spreading and material damping.

The FTA Manual presents the following Equation 7-2 as the vibration attenuation model for construction equipment when assessing potential building damage:

$$\mathbf{PPV}_{\boldsymbol{equip}} = \boldsymbol{PPV}_{\boldsymbol{ref}} \left(\frac{\mathbf{25}}{\boldsymbol{D}}\right)^{\mathbf{1.5}}$$

Where:

PPV_{equip} = the peak particle velocity of the equipment adjusted for distance, in/s

PPV_{ref} = the source vibration level at 25 ft, in/s

D = distance from the equipment to the receiver, ft

The FTA Manual Equation 7.2 can also be represented as follows:

$$\mathbf{PPV}_{\boldsymbol{equip}} = \boldsymbol{PPV}_{\boldsymbol{ref}} \left(\frac{\boldsymbol{D}_{\boldsymbol{ref}}}{\boldsymbol{D}}\right)^{\mathbf{n}}$$

Where:

PPV_{equip} = the peak particle velocity of the equipment adjusted for distance, mm/s

PPV_{ref} = the source vibration level at reference distance, mm/s

D = distance from the equipment to the receiver, m

D_{ref} = reference distance for PPV_{ref}, m

n = is a value related to the vibration attenuation rate through ground, also referred to as soil class designation.

The value of "n" based on site-specific soil conditions can be used for an estimation of vibration amplitude. According to Caltrans Transportation and Construction Vibration Guidance Manual (Caltrans 2020), the value of "n" can range from 1.0 for bedrock to 1.5 for weak or soft soils. According to the Caltrans Transportation and Construction Vibration Guidance Manual, the use of values greater than 1.1 would likely result in overestimation of amplitudes at distances closer than 25 ft and would be slightly conservative at distances beyond 25 ft. For the purposes of this assessment, the FTA Manual vibration attenuation model was applied as presented, with a "n" value of 1.5.

The FTA Manual presents the following Equation 7.3 to assess human annoyance for each piece of equipment individually in RMS velocity levels, expressed in vibration velocity level (VdB).

$$L_{v.distance} = L_{vref} - 30\log\left(\frac{D}{25}\right)$$

Where:

$L_{v.distance}$ = the RMS velocity level adjusted for distance, VdB

L_{vref} = the source reference vibration level at 25 ft, VdB

D = distance from the equipment to the receiver, ft

6.5.1.2.2.2 Air Overpressure

Air overpressure attenuates from a blast site as the distance to the POR increases (Siskind 2005). Air vibrations attenuate from a blast site at a slower rate than ground vibrations. The distribution of air vibration energy from a blast is strongly influenced by the prevailing weather conditions during the blast. For example, wind can increase downwind levels by 10 to 15 linear decibels (dBL) above what would otherwise be measured (Dowding 1985). Low cloud ceilings and temperature inversions also contribute to air vibrations propagating farther than would typically be the case. Other factors influencing air vibration distribution from a blast include orientation of the blast face, local topography and vegetation, length of collar and type of stemming material, differences in explosive types and variations in burden distance. Generally, the air overpressure is expected to be lower behind the free face. However, in an operating mine, the air overpressure wave may travel out from the face and may be reflected from an adjacent pit wall, resulting in an almost similar level behind the blast as in front of the blast.

The blasting operation will generally progress toward the extraction perimeter with the nearest sensitive receptors located behind the blast face. However, as the mine is developed, there will likely be situations where quarry faces will not be oriented this way (e.g., open corners). As such, the overpressure model used for this study considers the PSPL expected in front of the free face.

The rate air vibrations decay or attenuate from a blast site can be expressed by the Scaled Distance presented in ISEE's Blaster's Handbook (ISEE 2016) and defined as:

$$Scaled\ Distance\ (SD) = \left(\frac{D}{\sqrt[3]{W}}\right)$$

where D = the distance (m) between the blast and receptor

W = the maximum weight of explosive (kg) detonated per delay period.

The air overpressure level is given by:

$$PSPL = K\left(\frac{D}{\sqrt[3]{W}}\right)^{-e}$$

where PSPL = Peak Sound Pressure Level (kilopascal [kPa])

D = distance (m) between the blast and receptor

W = maximum weight of explosive (kg) detonated per delay period

K, e = site factors typically derived from monitoring

Where no site-specific data are available, the model factors can be estimated based on literature derived models or models based on applicable experience. The air overpressure model assumed for this study is based on the ISEE (2016) model. When expressed in term of linear decibels and scaled distance, this model is shown below:

$$PSPL_{dBL} = 157.44 - 17.66\ln(SD)$$

where PSPL = Peak Sound Pressure Level (dBL)

SD = Scaled Distance ($m/kg^{1/3}$) as defined above

The calculated SD for an air overpressure level of 128 dBL would be equal to the 45.45 $m/kg^{1/3}$.

6.5.1.2.2.3 Fisheries Habitat

The maximum explosive weight detonated per delay period within a blast and the distance between the blast and the receptor influence the intensity of blast vibrations and amount of water overpressure. The DFO provides guidelines for operations that involve the use of confined or unconfined explosives in or near Canadian fisheries waters as well as suggested methods and practices for the conservation and protection of fish, marine mammals, and fish habitat from impacts arising from blasting (Wright and Hopky 1998). The methodology for the assessing the ground vibration is similar that shown above. The approach to estimating the water overpressure discussed in Wright and Hopky (1998) was followed.

The assessment of Project effects on vibration considered two modelling scenarios, each with their own sources, when the greatest effects are expected:

- Construction
- Operations

The approach to classify each residual effect criterion for vibration is provided in Table 6-19.

Table 6-19: Definitions Applied to Effects Criteria Classifications for the Assessment of Vibration

Criterion	Rating	Definition
Nature	Positive	Change in measurable parameter results in net improvement or benefit to the vibration VEC
	Neutral	Change in measurable parameter results in no change to the vibration VEC
	Adverse	Change in measurable parameter results in net degradation to the vibration VEC
Magnitude	Negligible	No perceptible change in vibration levels
	Low	Perceptible change in vibration level (i.e., >0.3 mm/s) that is within normal levels (<2.5 mm/s)
	Moderate	Perceptible change in vibration level that is above low and within limits outlined for the receptor type. The effect would cause an increase over baseline but is within regulatory limits.
	High	Vibration levels above limits for the receptor type
Geographic extent	SSA	Change in measurable parameter is confined to the SSA
	Local	Change in measurable parameter extends outside the SSA but within the LSA
	Regional	Change in measurable parameter extends beyond the LSA but is confined to the RSA
	Beyond regional	Change in measurable parameter extends beyond the RSA
Duration	Short term	Effect is limited to the Construction phase or Closure phase of the Project
	Medium term	Effect occurs in the short term and through the duration of the Project
	Long term	Residual effect extends beyond the life of the Project
Timing	Qualitative narrative or numeric quantification	Change in measurable parameter is described with a focus on seasonality (Project effects on vibration are relatively insensitive to seasonality)
Frequency	Occasional	Change in measurable parameter is expected to occur rarely (e.g., once or a few times)
	Periodic	Change in measurable parameter is expected to occur consistently at regular intervals or associated with temporal events (e.g., during hot, dry climatic conditions)
	Continuous	Change in measurable parameter is expected to occur all the time
Reversibility	Reversible	Change in measurable parameter is reversible after closure
	Irreversible	Change in measurable parameter is predicted to influence the component indefinitely
Probability of occurrence	Unlikely	Change in measurable parameter is not expected to occur, but not impossible
	Possible	Change in measurable parameter may occur, but is not likely
	Probable	Change in measurable parameter is likely to occur, but is uncertain
	Certain	Change in measurable parameter will occur
Ecological and socioeconomic context	Undisturbed	Effect takes place within an area that is relatively or not adversely affected by human activity
	Disturbed	Effect takes place within an area with human activity. Area has been previously disturbed by human development or human development is still present

LSA = local study area; RSA = regional study area; SSA = site study area; VEC = valued environmental component.

6.5.1.2.3 Light

The potential effect of the Project on existing light trespass and sky glow was assessed qualitatively. Light from the Project will be emitted by mobile and fixed onsite lighting established for health and safety and/or navigational purposes. A review of the Project was carried out to assess lighting from the Project during the nighttime period during both Project Construction and Operations. Lighting was assessed against the criteria for sky glow and light trespass for CIE environmental lighting zones that are outlined in Section 6.3.4.3.

The approach to classify each residual effect criterion for light is provided in Table 6-20.

Table 6-20: Definitions Applied to Effects Criteria Classifications for the Assessment of Light

Criterion	Rating	Definition
Nature	Positive	Change in measurable parameter results in net improvement or benefit to the light VEC
	Neutral	Change in measurable parameter results in no change to the light VEC
	Adverse	Change in measurable parameter results in net degradation to the light VEC
Magnitude	Negligible	No perceptible change in light levels
	Low	Perceptible change in light levels that is within normal variability of baseline conditions
	Moderate	Perceptible change in light trespass and/or sky glow while applicable CIE Zone limits are met
	High	Light trespass or sky glow above applicable CIE Zone limits
Geographic extent	SSA	Change in measurable parameter is confined to the SSA
	Local	Change in measurable parameter extends outside the SSA but within the LSA
	Regional	Change in measurable parameter extends beyond the LSA but is confined to the RSA
	Beyond regional	Change in measurable parameter extends beyond the RSA
Duration	Short term	Effect is limited to the Construction phase or Closure phase of the Project
	Medium term	Effect occurs in the short term and through the duration of the Project
	Long term	Residual effect extends beyond the life of the Project
Timing	Qualitative narrative or numeric quantification	Change in measurable parameter is described with a focus on seasonality (Project effects on light are relatively insensitive to seasonality)
Frequency	Occasional	Change in measurable parameter is expected to occur rarely (e.g., once or a few times)
	Periodic	Change in measurable parameter is expected to occur consistently at regular intervals or associated with temporal events (e.g., during hot, dry climatic conditions)
	Continuous	Change in measurable parameter is expected to occur all the time
Reversibility	Reversible	Change in measurable parameter is reversible after closure
	Irreversible	Change in measurable parameter is predicted to influence the component indefinitely
Probability of occurrence	Unlikely	Change in measurable parameter is not expected to occur, but not impossible
	Possible	Change in measurable parameter may occur, but is not likely
	Probable	Change in measurable parameter is likely to occur, but is uncertain
	Certain	Change in measurable parameter will occur
Ecological and socioeconomic context	Undisturbed	Effect takes place within an area that is relatively or not adversely affected by human activity
	Disturbed	Effect takes place within an area with human activity. Area has been previously disturbed by human development or human development is still present

CIE = Commission Internationale de l'Éclairage; LSA = local study area; RSA = regional study area; SSA = site study area; VEC = valued environmental component.

6.5.1.3 Residual Cumulative Effect Analysis

The cumulative effects assessment builds on the results of the residual Projects effects assessment and considers the incremental changes that were predicted to have a likely residual adverse effect on noise, vibration and light. This would include the effects of past and current projects, which contribute to existing conditions upon which residual Project effects are assessed. For the EIS, the description of the existing environment characterizes the environment already affected by past and current projects and activities; therefore, the cumulative effects assessment focused on analyzing the effects of other RFDs in combination with the Project through a qualitative assessment.

The cumulative effects assessment followed a three-step process:

- Identify RFDs and potential cumulative effects that overlap in time and space with residual effects.
- Identify and describe any additional mitigation measures, if applicable.
- Characterize residual cumulative effects, using the same criteria defined for the residual Project effects analysis (Section 6.5.1.2)

Chapter 4 provides a list of known RFDs and physical activities with potential residual effects that could overlap spatially and temporally with the Project's residual environmental effects. This list was considered in the identification of RFDs for the assessment of cumulative effects on noise, vibration and light. Following the identification of applicable RFDs, residual Project effects on noise, vibration and light were evaluated for temporal and spatial overlap with the effects of RFDs to identify potential cumulative effects. The evaluation was completed qualitatively based on publicly available information (e.g., Project Registrations or EIS reports) describing the environmental effects of RFDs. If effects from these RFDs overlapped spatially or temporally with the residual Project effects on noise, vibration and light, then potential cumulative effects were identified. If no spatial or temporal overlap existed for the residual Project effects and RFDs identified in Chapter 4, then a cumulative effects assessment was not required.

Based on the assessment of potential cumulative effects, an assessment was made regarding whether additional mitigation measures, beyond those proposed for the Project, were required to address potential cumulative effects. Where applicable, additional mitigation measures were identified.

Residual cumulative effects were characterized using the same criteria assessed for residual Project effects (Section 6.5.1.2).

Following classification of residual cumulative effects, the analysis also evaluated the significance of residual Project effects using threshold criteria or standards beyond which a residual environmental effect was considered significant. The definition of a significant effect for noise, vibration and light is provided in Section 6.5.1.4.

6.5.1.4 Significance Determination

The significance of adverse residual Project and cumulative effects on noise, vibration and light was evaluated by following the approach provided in Chapter 4, Section 4.8 (Significance Determination). The classification of residual effects criteria provided the foundation for determining if the threshold for significance was exceeded. A significant adverse residual effect on noise, vibration and light is defined as one that is:

- high magnitude
- medium or long term in duration
- frequent or continuous in frequency

6.5.2 Effect Pathway Screening

The effect pathway screening predicts potential effects pathways that are then evaluated considering proposed mitigation to predict whether the effect pathway had the potential to cause residual adverse or positive effects. The effectiveness of mitigation measures proposed for each effect pathway was assessed to determine whether the mitigation would address the potential Project effect such that the effect pathway was eliminated or would result in a negligible adverse effect on a VEC. As described in Section 6.5.1.1, each effect pathway was categorized as one of the following:

- **no effect pathway** (i.e., avoidance measures and/or mitigation results in no residual effect on noise, vibration and light)
- **negligible effect pathway** (i.e., mitigation results in negligible effect of noise, vibration and light)
- **residual effect pathway** (i.e., effect that is greater than negligible and carried forward for further assessment)

The effects pathway screening is summarized in Table 6-21. The subsections following the table provide rationale used to assign potential effects on the no effect pathway and negligible effect pathway categories and list residual effect pathways. Each Project component/activity identified as a residual effect pathway was carried forward for detailed assessment in Section 6.5.3, Section 6.5.4 and Section 6.5.5.

Table 6-21: Potential Effects Pathways for Noise, Vibration, and Light

VEC	Project Components/Activities	Effects Pathway	Environmental Design Features, Mitigation or Enhancement Measures	Effect Pathway Screening
Noise	Project components/activities that may change noise, vibration or light during the Project are the following: **Construction** – site preparation, including vegetation clearing and earthworks – handling and storage of overburden – road development, including culverts and bridge installation – construction of facilities and infrastructure – construction of TMF starter dam – handling and storage of mine rock – construction of water management infrastructure – dewatering activities – power generation – operating mobile mining equipment – site traffic, including transportation of rationale and materials to and from site **Operation** – open pit mining, including blasting and crushing ore and mine rock – operating mobile mining equipment – handling and storage of overburden, mine rock and ore – operation and management of the TMF – processing iron ore concentrate – pit dewatering and site water management – progressive reclamation – railcar loading and transportation	Project activities can change noise levels during Construction and Operations.	***Construction Noise*** As potential construction noise effects are expected at some of the PORs in the vicinity of the Project, the following are some general recommendations to assist in minimizing potential noise effects due to the Project's construction activities: – Champion, with its contractor(s), will prepare and implement an EPP with noise measures prior to Construction. – Comply with *Labrador City Noise Abatement Regulations*, *Wabush Noise and Nuisance Regulations*, Health Canada Noise Guideline, and Québec Noise Guideline. – Maintain road surfaces such that rough surface, ruts, or pothole conditions are avoided or repaired. – Maintain equipment to minimize noise emissions. – Design access roads to minimize reversing, which is expected to minimize use of backup beepers, where possible. – Notify Indigenous communities, landowners, and relevant stakeholders through the Kami Working Group of the planned construction schedule before the start of construction and prior to specific noisy activities. – Minimize equipment idling. – Operate vehicles and equipment such that impulsive noise is minimized, where possible. – Investigate noise concerns as they arise through a complaint resolution mechanism whereby persons can contact Champion if there are perceived noise issues. ***Operations Noise*** As potential operations noise effects are expected at some of the PORs in the vicinity of the Project, the following are some general recommendations to assist in minimizing noise effects due to the Project's operations activities: – Comply with *Labrador City Noise Abatement Regulations, Wabush Noise and Nuisance Regulations*, Health Canada Noise Guideline and Québec Noise Guideline. – Champion, with its contractor(s), will prepare and implement an EPP and Noise Mitigation and Monitoring Plan prior to Operations. – Conduct noise monitoring and measurements. – Maintain road surfaces such that rough surface, ruts or pothole conditions are avoided or repaired. – Maintain equipment to minimize noise emissions. – Minimize equipment idling. – Investigate noise concerns as they arise through a complaint resolution mechanism whereby persons can contact Champion if there are perceived noise issues.	Residual effect pathway

VEC	Project Components/Activities	Effects Pathway	Environmental Design Features, Mitigation or Enhancement Measures	Effect Pathway Screening

Vibration	– site traffic, including transportation of rationale and materials to and from site
	– camp, mine services area, and office operation
	
	Closure
	– accelerated pit flooding
	– removal of infrastructure, restoration and revegetation of facilities and infrastructure
	– site traffic, transportation of personnel and materials to and from the site
		Project blasting and the use of heavy equipment can affect vibration during Construction and Operations.	***Construction Vibration***
			As potential construction vibration effects are expected at some of the PORs in the vicinity of the Project, some general recommendations to assist in minimizing vibration effects due to the Project's construction activities follow.
			– Champion, with its contractor(s), will prepare and implement an EPP, including vibration management measures prior to Construction.
			– Investigate vibration concerns as they arise through a complaint resolution mechanism whereby persons can contact the Project team if there are perceived vibration issues.
			– Comply with *Labrador City Noise Abatement Regulations*, *Wabush Noise and Nuisance Regulations*, Health Canada Noise Guideline, and Québec Noise Guideline.
			– Maintain road surfaces such that rough surface, ruts or pothole conditions are avoided.
			– Avoid operating equipment that is expected to generate significant vibrations at the same time. Operating them separately may reduce overall vibration levels.
			– Carry out construction blasting in compliance with Québec's Transport Ministry Guideline for construction blasting and the DFO's guideline for the use of explosives in or near fisheries waters. All blasts which might impact local structures, disrupt humans or impact local fisheries will be monitored for ground and air vibrations.
			– Blasting detonator timing and blast mats will be used, as appropriate, to control vibration and fly rock as required.
			Operations Vibration
			As potential operations blasting induced vibration effects are expected at some of the PORs in the vicinity of the Project, some general recommendations to assist in minimizing vibration effects due to the Project's operation blasting activities follow:
			– Champion, with its contractor(s), will prepare and implement an EPP, including vibration management measures prior to Operations.
			– Monitor vibrations, air overpressure and water overpressure at the nearest receptor where impact may occur for that source (i.e., when predicted levels are expected to be more than 20% of the limit for that receptor).
			– Use the results of the monitoring program to refine the attenuation models presented in this report.
			– Should the vibration source (during construction or operations) reach 80% of the limits outlined in the report, mitigative measures should be engaged as part of the adaptive management.
			– Any one or combination of the following blast design modifications would reduce the maximum explosive charge weight and reduce the vibrations, air overpressure and/or water overpressure induced at the nearest sensitive receptor:
			  – Reduce the borehole diameter with a corresponding reduction in the drill pattern parameters.
			  – Introduce additional decked charges within each borehole. Decking is a method of loading blastholes in which the explosive charges, called decks, are separated by stemming. Essentially, each hole contains multiple smaller charges.
			  – Reduce the borehole length (depth) by reducing the bench height.
			  – Consider the use of electronic detonators as indicated in the pre-feasibility study (Champion 2024).
			– Investigate vibration concerns as they arise through a complaint resolution mechanism whereby persons can contact Champion if there are perceived vibration issues.
				Residual effect pathway

Light		Project lighting can change light levels during Construction and Operations.	– Investigate light concerns as they arise through a complaint resolution mechanism whereby persons can contact the Project team if there are perceived light issues. – Design and install lighting systems for worker safety, security, and navigation to meet industry-recommended minimum lighting levels, while minimizing light spill offsite and non-essential lighting. – Use full horizontal cutoff light fixtures for fixed lighting. – Leave tree cover in place, where feasible, to reduce the visibility of mobile equipment lighting at PORs.	Residual effect pathway

DFO = Fisheries and Oceans Canada; EPP = Environmental Protection Plan; POR = point of reception; TMF = tailings management facility; VEC = valued environmental component.

6.5.2.1 No Effect Pathways

There are no Project-environment interactions that result in no effect pathways for noise, vibration or light.

6.5.2.2 Negligible Effect Pathways

There are no Project-environment interactions that result in negligible effect pathways for noise, vibration or light.

6.5.2.3 Residual Effect Pathways

Project interactions that have the potential for a greater than negligible effect on noise, vibration and light require further consideration and were advanced to the residual effects analysis. Because the Project interactions during both the Construction and Operations phases were predicted to be residual effect pathways to noise, vibration and light, Project Construction and Operations were carried forward to the residual effect analysis. Indigenous groups and local stakeholders have also expressed concerns related to noise, vibration and light from Project activities.

The residual effects pathways for noise, vibration and light were defined as:

- Project activities can change noise levels during Construction and Operations.
- Project blasting and the use of heavy equipment can affect vibration during Construction and Operations.
- Project lighting can change light levels during Construction and Operations.

This effect pathway was advanced for further assessment of residual effects. As part of the proposed approach for the Project, predicted changes to the noise, vibration and light VECs are carried through to the assessments of the following VEC technical chapters:

- **Fish and Fish Habitat (Chapter 9)**
- **Wildlife (Chapter 11)**
- **Heritage and Historical Resources (Chapter 12)**
- **Indigenous Land and Resource Use (Chapter 13)**
- **Other Land and Resource Use (Chapter 14)**
- **Community Health and Well-Being (Chapter 17)**

6.5.3 Noise

6.5.3.1 Residual Project Effect Analysis

This section provides results of the residual Project effects analysis for noise for the residual effects pathways identified in Section 6.5.2.3.

Methods for completing the residual Project effects analysis for noise is presented in Section 6.5.1.2.

6.5.3.1.1 Construction Phase

Noise levels can be expected to increase, on occasion, due to construction activities at the identified potential PORs, but construction noise will be temporary in nature and localized within the LSA. The range in increased noise levels associated with construction activities will depend primarily on the number and type of noise sources and their proximity to the RPORs (i.e., the Project noise levels in the environment decrease as the distance between the PORs and construction activities increases).

Table 6-22 presents the predicted noise levels from Project Construction considering the methods described in Section 6.5.1.2.1. The predicted noise levels evaluated the Stage 2 scenario described in Section 6.5.1.2.1 as it results in the greatest number of key noise sources. As presented in Section 6.5.1.2.1, the list of key noise sources is considered to be representative of the types of equipment and associated activities for the Project and assumptions were made. Consequently, the predicted noise levels in Table 6-22 are estimates and should be regarded as indicative, as actual noise levels may fluctuate due to variations in construction activities.

The results in Table 6-22 indicate that during Project construction, noise levels are within Health Canada's nighttime criteria for sleep disturbance (i.e., 45 dBA), daytime criteria for speech comprehension (i.e., 55 dBA), and change in %HA criteria at the RPORs.

6.5.3.1.2 Operations Phase

Noise levels can be expected to increase due to Operations at the RPORs. Table 6-22 and Figure 6-7 present the predicted noise levels from Project Operations at the RPORs.

The results in Table 6-23 and Figure 6-7 indicate that during Project Operations, noise levels are expected to be at or below Health Canada's nighttime criteria for sleep disturbance (i.e., 40 dBA) and daytime criteria for speech comprehension (i.e., 55 dBA) at the RPORs. It also indicates that Health Canada's change in %HA is expected to be at or below the criteria at the RPORs within the LSA. The results in Table 6-23 indicate that during Project Operations, noise levels are expected to be at or below Québec's Noise Guideline criteria (i.e., 40 dBA).

Table 6-22: Predicted Noise Levels at Points of Reception During Project Construction

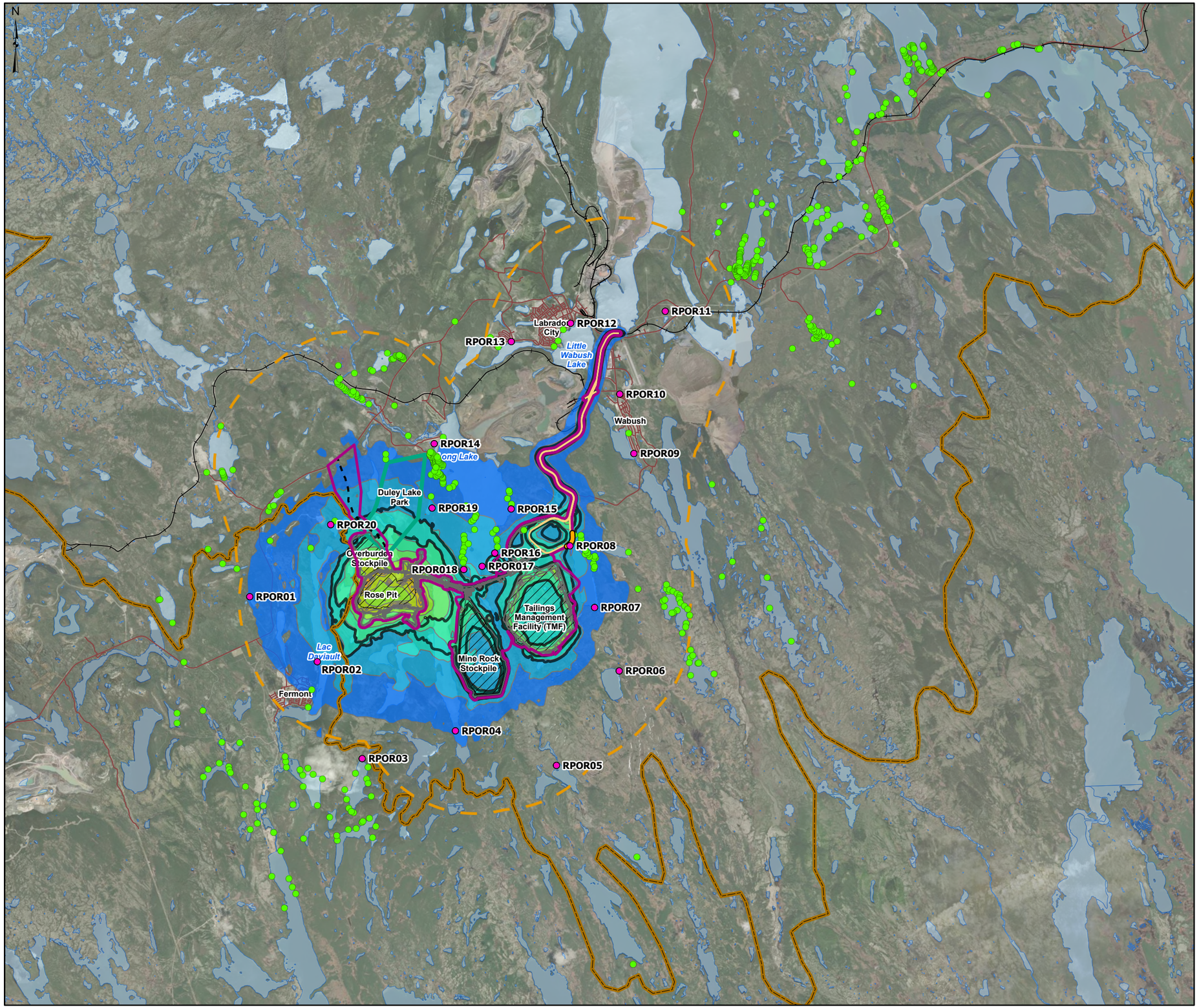
Point of Reception	Existing Noise Level				Project Contribution		Future Noise Level				Change in Noise Level (Ldn -dB)	Change in %HA (%)	Comply with Health Canada Speech Interference (55 dBA)	Comply with Health Canada Sleep Disturbance (45 dBA)	Comply with Health Canada %HA (Δ 6.5%)
	Ld (dBA)	Ln (dBA)	Ldn (dBA)	%HA (%)	Ld (dBA)	Ln (dBA)	Ld (dBA)	Ln (dBA)	Ldn (dBA)	%HA (%)					
RPOR01	39	36	43	3.2	23	23	39	36	43	3.3	0.2	0.1	Yes	Yes	Yes
RPOR02	37	35	42	0.7	27	27	37	36	42	0.8	0.6	0.1	Yes	Yes	Yes
RPOR03	37	35	42	2.7	20	20	37	35	42	2.8	0.1	0.0	Yes	Yes	Yes
RPOR04	32	25	33	0.9	25	25	33	28	35	1.2	2.0	0.3	Yes	Yes	Yes
RPOR05	32	25	33	0.9	22	22	32	27	35	1.1	1.1	0.1	Yes	Yes	Yes
RPOR06	32	25	33	0.9	27	27	33	29	36	1.4	3.1	0.5	Yes	Yes	Yes
RPOR07	32	25	33	0.9	36	36	38	37	43	3.3	9.9	2.4	Yes	Yes	Yes
RPOR08	32	25	33	0.9	42	42	42	42	48	6.2	14.9	5.3	Yes	Yes	Yes
RPOR09	39	36	43	0.9	29	29	39	37	44	1.0	0.6	0.1	Yes	Yes	Yes
RPOR10	39	36	43	0.9	35	35	41	39	45	1.2	2.4	0.3	Yes	Yes	Yes
RPOR11	39	36	43	0.9	21	21	39	36	43	0.9	0.1	0.0	Yes	Yes	Yes
RPOR12	39	36	43	0.9	26	26	39	36	43	0.9	0.4	0.0	Yes	Yes	Yes
RPOR13	39	36	43	0.9	23	23	39	36	43	0.9	0.2	0.0	Yes	Yes	Yes
RPOR14	39	36	43	0.9	26	26	39	36	43	0.9	0.4	0.0	Yes	Yes	Yes
RPOR15	32	25	33	0.9	35	35	37	35	42	2.8	8.5	1.9	Yes	Yes	Yes
RPOR16	32	25	33	0.9	41	41	42	41	48	5.7	14.2	4.8	Yes	Yes	Yes
RPOR17	32	25	33	0.9	43	43	43	43	49	7.1	15.9	6.2	Yes	Yes	Yes
RPOR18	32	25	33	0.9	38	38	39	43	49	7.2	16.1	6.3	Yes	Yes	Yes
RPOR19	32	25	33	0.9	30	30	34	31	38	1.7	4.6	0.8	Yes	Yes	Yes
RPOR20	32	25	33	0.9	34	34	36	34	41	2.5	7.7	1.6	Yes	Yes	Yes

dBA = A-weighted decibels; Ld = daytime noise level (7 a.m. to 10 p.m.); Ln = nighttime noise level (10 p.m. to 7 a.m.); Ldn = day-night noise level; Lmax = maximum noise level; %HA = percent highly annoyed; Δ = change.

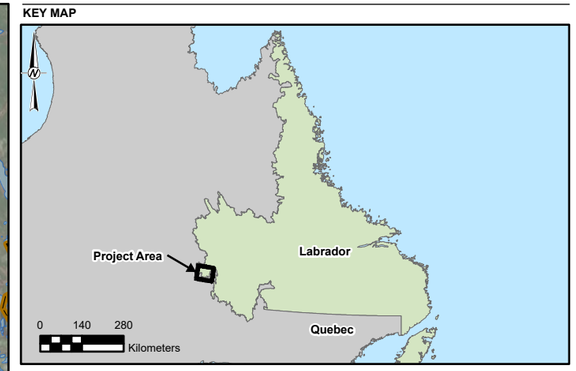
Table 6-23: Predicted Noise Levels at Points of Reception During Project Operations

Point of Reception	Existing Noise Level				Project Contribution		Future Noise Level				Change in Noise Level (Ldn - dB)	Change in %HA (%)	Comply with Health Canada Speech Interference (55 dBA)	Comply with Health Canada Sleep Disturbance (40 dBA)	Comply with Health Canada %HA (Δ 6.5%)	Comply with Quebec Guidelines (40 dBA)
	Ld (dBA)	Ln (dBA)	Ldn (dBA)	%HA (%)	Ld (dBA)	Ln (dBA)	Ld (dBA)	Ln (dBA)	Ldn (dBA)	%HA (%)						
RPOR01	39	36	43	3.2	30	30	40	37	44	3.6	0.9	0.4	Yes	Yes	Yes	-
RPOR02	37	35	42	0.7	34	34	39	38	44	1.0	2.5	0.3	Yes	Yes	Yes	Yes [(a)]
RPOR03	37	35	42	2.7	26	26	37	36	42	2.9	0.5	0.2	Yes	Yes	Yes	-
RPOR04	32	25	33	0.9	32	32	35	32	39	2.0	5.8	1.1	Yes	Yes	Yes	-
RPOR05	32	25	33	0.9	24	24	33	28	35	1.2	1.8	0.2	Yes	Yes	Yes	-
RPOR06	32	25	33	0.9	26	26	33	29	36	1.3	2.6	0.4	Yes	Yes	Yes	-
RPOR07	32	25	33	0.9	32	32	35	33	40	2.1	6.4	1.2	Yes	Yes	Yes	-
RPOR08	32	25	33	0.9	35	36	37	36	42	3.0	9.0	2.1	Yes	Yes	Yes	-
RPOR09	39	25	38	0.5	23	23	39	27	39	0.5	0.6	0.0	Yes	Yes	Yes	-
RPOR10	39	36	43	0.9	24	25	46	36	46	1.3	3.1	0.4	Yes	Yes	Yes	-
RPOR11	39	36	43	0.9	10	11	39	36	43	0.9	0.0	0.0	Yes	Yes	Yes	-
RPOR12	39	36	43	0.9	21	22	39	36	43	0.9	0.2	0.0	Yes	Yes	Yes	-
RPOR13	39	36	43	0.9	22	22	39	36	43	0.9	0.1	0.0	Yes	Yes	Yes	-
RPOR14	39	36	43	0.9	29	29	39	37	44	1.0	0.7	0.1	Yes	Yes	Yes	-
RPOR15	32	25	33	0.9	33	33	36	34	41	2.3	7.1	1.4	Yes	Yes	Yes	-
RPOR16	32	25	33	0.9	38	38	39	38	45	4.1	11.5	3.2	Yes	Yes	Yes	-
RPOR17	32	25	33	0.9	39	39	40	39	46	4.6	12.5	3.7	Yes	Yes	Yes	-
RPOR18	32	25	33	0.9	38	38	39	38	45	4.1	11.5	3.2	Yes	Yes	Yes	-
RPOR19	32	25	33	0.9	36	36	37	36	43	3.0	9.2	2.1	Yes	Yes	Yes	-
RPOR20	32	25	33	0.9	37	37	38	37	44	3.6	10.5	2.7	Yes	Yes	Yes	-

Notes:
'-' represents Not Applicable
(a) RPOR2 is the only representative POR located in the province of Québec
dBA = A-weighted decibels; Ld = daytime noise level (7 a.m. to 10 p.m.); Ln = nighttime noise level (10 p.m. to 7 a.m.); Ldn = day-night noise level; Lmax = maximum noise level; %HA = percent highly annoyed; Δ = change.



KEY MAP



SCALE 1:20,000,000

LEGEND

- Potential Points Reception (POR)
- Representative Potential Points of Reception (RPOR)
- Noise Barrier
- Existing Railway
- Existing Road
- Proposed Access Road and Railway Corridor
- Proposed Infrastructure
- Potential Access Road
- Proposed Infrastructure
- Local Study Area
- Site Study Area
- Duley Lake Park
- Labrador/Quebec Boundary
- Waterbody
- Health Canada – Noise-Induced Sleep Disturbance (40 dBA)

Predicted Noise Levels @ 4.5 m(dBA)

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80

0 2.5 5

1:170,000 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.
2. AQ STANDARD IS 50 MG/M³
3. THE SECOND HIGHEST PREDICTED CONCENTRATION IS SHOWN TO REMOVE METEOROLOGICAL ANOMALIES AS PER NEWFOUNDLAND AND LABRADOR DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT, DETERMINATION OF COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS.
4. TPM AIR QUALITY STANDARD IS 120 MG/M³

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED OPERATION NOISE RESULTS

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD/MS
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: S:\Clients\Champion_Iron_Ore_Mines\Kami Iron Ore\69_PROJ\CA0038713.5261_EIS\40_PROD\0019_Noise\Vibration\Light\0019_NoiseVibrationLight.aprx PRINTED ON: AT: 2:15:31 PM

6.5.3.2 Residual Project Effects Characterization

6.5.3.2.1 Construction Phase

Taking into account the implementation of the mitigation measures in Table 6-21 and the methods described in Section 6.5.1.2.1, the magnitude of the residual effects from the increased noise during Construction has the potential to range from low to moderate, depending on the distance between the identified potential PORs and the construction activities. Therefore, for a conservative assessment, the residual effects were assessed to be moderate. The residual effects were assessed to be local in geographic extent as the effects are limited to the LSA and will be short term as the effects occur within the Construction phase. The effects are reversible as they will cease when the Project ceases, periodic as they are expected to be intermittent, and probable as they are likely to occur. Local communities, cabins, and existing mining operations contribute to the existing noise environment; therefore, the ecological and socioeconomic context is considered to be disturbed. A summary of the characterization of the residual effects on noise due to the Construction phase is provided in Table 6-24.

6.5.3.2.2 Operations Phase

Taking into account the implementation of the mitigation measures in Table 6-21 and the methods described in Section 6.5.1.2.1, the magnitude of the residual effects from noise during Project Operations is predicted to be moderate, because perceptible changes in noise levels (i.e., change in ambient noise levels that could reach 5 dB) due to the Project may occur, but Health Canada and Québec Noise Guideline criteria are expected to be met. The residual effects were assessed to be local in geographic extent as the effects are limited to the LSA and the medium term as the effects occurs in the short term and through the duration of the Project. The effects are reversible as they will cease when the Project ceases, continuous as they are expected to occur all the time, and certain as they are likely to occur. Local communities, cabins, and existing mining operations contribute to the existing noise environment; therefore, the ecological and socioeconomic context is considered to be disturbed. A summary of the characterization of the residual effects on noise due to the Operations phase is provided in Table 6-24.

Table 6-24: Characterization of Residual Effects on Noise

Residual Effect	Criterion	Rating/Effect Size
Change in noise level during Construction	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Short term
	Reversibility	Reversible
	Timing	Year-round
	Frequency	Periodic
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Disturbed – local communities, cabins and existing mining operations contribute to the existing noise environment
Change in noise level during Operations	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Medium term
	Reversibility	Reversible
	Timing	Year-round
	Frequency	Continuous
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Disturbed – local communities, cabins and existing mining operations contribute to the existing noise environment

6.5.3.3 Significance Determination

As described in Section 6.5.1.4, a significant adverse residual effect is defined as one that is high in magnitude, medium or long term in duration and frequent or continuous. For the Construction phase, as the magnitude of the residual effect on noise was assessed to be moderate, the duration to be short-term and the frequency of the effect was assessed to be periodic, the residual effect is predicted to be not significant during Project Construction based on this noise assessment. For the Operations phase, as the magnitude of the residual effect on noise was assessed to be moderate, the duration to be medium-term and the frequency of the effect was assessed to be continuous, the residual effect is predicted to be not significant during Project Operations based on this noise assessment.

6.5.4 Vibration

6.5.4.1 Residual Project Effect Analysis

This section provides results of the residual Project effects analysis for vibration for the residual effects pathways identified in Section 6.5.2.3.

Methods for completing the residual project effects analysis for vibration is presented in Section 6.5.1.2.2.

6.5.4.1.1 Increase in Vibration Level during Construction

6.5.4.1.1.1 Construction Vibration Assumptions

Blasting

Currently, there is no blasting being carried out on the site. However, it is expected aggregates used for construction will be from blasting used for the development of the open pit. As such, the vibration levels from those activities will be considered in the Operations phase. Construction blasts will be for site preparation. Blasting procedures would be carried out by the contractor(s) using typical construction blasting techniques and parameters. For the purposes of this assessment, hypothetical blast design details are provided for the proposed construction blasting, based on those from other blasting operations that the author of this assessment has been involved with, and are summarized in Table 6-25.

Table 6-25: Hypothetical Blast Design Details – During Construction

Parameter	Construction Blasting Details
Hole diameter	89 mm
Bench height	Up to 6 m
Sub-drill	0.7 m
Depth of hole	Up to 6.7 m
Blast pattern (burden x spacing)	2.4 x 2.4 m
Stemming length	1.7 m
Stemming type	Clear crushed stone
Explosive type	Emulsion explosives
Explosive density	1.15 g/cm^3
Explosive weight per delay	Up to 36 kg
Powder factor	1.09 kg/m^3, 0.41 kg/t[(b)]

(a) Assuming one hole detonated per delay period.
(b) Based on a rock density of 2.7 g/cm^3.

If the blasting contractor implements blast designs which differ significantly from those proposed in Table 6-25, the results from this study may need to be reassessed.

General Construction Activities

To assess vibration due to general construction activities, a preliminary zone of influence was initially predicted. The preliminary zone of influence defines an area that may be potentially affected by vibrations at any frequency due to construction and is typically based on levels less than respective vibration limits, which therefore results in a potential larger area of investigation. If receptor locations were located within the preliminary vibration zone of influence, a frequency-dependent assessment was carried out.

As discussed in Section 6.5.1.2, a list of construction equipment was provided by the Project team that was considered to be representative of the types of equipment and associated activities for the Project. Sources of construction vibrations generate waves that transmit vibrations through the ground medium. The waves travel outward from the construction source and attenuate as a result of geometrical spreading and material damping.

The FTA Manual provides PPV_{ref} and L_{vref} estimated average source levels for various types of construction equipment for a wide range of soil conditions. Table 6-26 is a reproduction of the estimates.

Table 6-26: Federal Transit Administration Manual-Suggested PPV_{ref} and L_{vref} for Various Equipment Types

Equipment	PPV_{ref} at 7.62 m, mm/s	Approximate L_v (RMS) at 7.62 m, dB[(a)]
Pile driver (impact) – upper range	38.56	112
Pile driver (impact) – typical	16.36	104
Pile driver (sonic) – upper range	18.64	105
Pile driver (sonic) – typical	4.32	93
Clam shovel drop (slurry wall)	5.13	94
Hydromill (slurry wall) in soil	0.20	66
Hydromill (slurry wall) in rock	0.43	75
Vibratory roller	5.33	94
Hoe ram	2.26	87
Large bulldozer	2.26	87
Caisson drilling	2.26	87
Loaded trucks	1.93	86
Jackhammer	0.89	79
Small bulldozer	0.077	58

(a) The approximate RMS vibration velocity levels were calculated from the PPV limits using a crest factor of 4, representing a PPV-RMS difference of 12 dB.
L_v = velocity level; L_{vref} = reference velocity level; PPV = peak particle velocity; PPV_{ref} = PPV reference value; RMS = root-mean square.

6.5.4.1.1.2 Estimated Increase in Vibration Level During Construction

Vibration levels can be expected to increase, on occasion, due to construction activities at the potential PORs, but construction vibration will be temporary in nature and localized within the vibration LSA. The range in increased vibration levels associated with construction activities will depend primarily on the type of vibration source and its proximity to the PORs (i.e., the Project vibration levels in the environment decrease as the distance between the PORs and construction activities increases). Potential effects on vibration levels during blasting for the Construction phase are expected to be greatest during when construction blasting is required near an existing POR.

Construction Blasting

A semi-quantitative assessment of the potential blasting during the Project's Construction phase was carried out using the Québec Transport Ministry limit of 25.0 mm/s (CCDG 2018) vibration attenuation model described in Section 6.5.1.2.2.1 and the blast parameters described in Table 6-25. It is assumed the blasting activities will occur near where aggregate materials are required and / or where the local bedrock profile require construction blasts to achieve the proper elevations. As the exact locations for the required blasting are not currently known, the results are presented as distance between the blast and the nearest sensitive receptor. Table 6-27 presents the predicted vibration levels from Project construction. The table also indicates where vibration levels are expected to exceed the Transport Ministry limit of 25.0 mm/s limit in bold / underlined.

Table 6-27: Estimated Ground Vibrations for the Construction Blast Design at a Range of Distances

Distance[a] (m)	Peak Particle Velocity[b] (mm/s)
50	**38.3**
100	12.6
200	4.2
300	2.2
400	1.4
500	1.0
600	0.7
700	0.6
800	0.5
900	0.4
1,000	0.3

Bold and underlined text means vibration levels exceed the Transport Ministry limit of 25.0 mm/s.

(a) Distance between the blast and the sensitive receptor.
(b) Assuming a single hole per delay.

Assuming a single hole per delay, the Québec Transport Ministry limit of 25.0 mm/s (CCDG 2018) may be complied with for all blasting beyond the estimated standoff distance of 65 m from adjacent receptor locations. Note, the SSA includes a 100-m buffer on Project facilities with a 50-m buffer on either side of the road/rail right-of-way. As such, potential ground vibration levels due to construction blasting surrounding the Project facility are predicted to be at or below the 25 mm/s criteria within the SSA, and surrounding the road/rail right-of-way the levels are predicted to exceed the 25 mm/s criteria to 65 m from the construction blasts (i.e., 15 m from the 50-m buffer).

Assuming a single hole per delay, the DFO limit of 13.0 mm/s may be complied with for all blasting beyond the estimated standoff distances of 99 m from an active spawning bed during egg incubation. As well, the DFO limit of 50 kPa may be complied with for all blasting beyond the estimated standoff distances of 51 m from the nearest fisheries habitat.

As potential vibration effects may occur during Project Construction at PORs within 65 m of construction blasting, a detailed vibration assessment, including a mitigation assessment as required and a monitoring program, is recommended to be carried out during detailed design.

General Construction Activities

Existing vibration levels can be expected to increase, on occasion, due to the general construction activities at nearby PORs, but general construction vibration is expected to be temporary in nature, occur only during specific activities, and limited to the vicinity of the Project footprint within the Study Area. The range in increased vibration levels associated with general construction activities will depend primarily on the number and type of vibration sources and their proximity to the PORs (i.e., the Project vibration levels in the environment generally decrease as the distance between the POR and construction activities increase). Potential effects on vibration levels during the Construction phase will vary based on type of general construction activities, but for the Project, vibration effects are expected to be greatest during impact pile driving.

The assessment of the Project's general construction activities was carried out using the FTA Manual vibration attenuation model. Select pieces of construction equipment presented in Section 6.5.4.1.1.1 were selected to present a range in potential vibration levels due to the Project general construction activities. It is assumed the general construction activities will occur anywhere within the Project footprint outside of the Rose Pit.

The preliminary zone of influence criteria (i.e., 5 mm/s) for building damage are unlikely to exist for some general construction equipment, which are expected to be the greatest source of vibrations. They are estimated to exceed 5 mm/s within the following estimated standoff distances:

- impact pile driving–30 m from impact pile driving location
- vibratory roller–8 m from the use of the vibratory roller

– rock drills–5 m from the use of the rock drill

Based on the above, the general construction activities are expected to comply with the 5 mm/s zone of influence criteria beyond 30 m from the source. The SSA includes a 100-metre buffer on Project facilities with a 50-metre buffer on either side of the road/rail right-of-way. As such, potential effects due to general construction activities surrounding the Project facility are predicted to be at or below the 5 mm/s zone of influence criteria within the SSA.

Based on the results of the vibration attenuation model, the predicted preliminary zone of influence (i.e., 5 mm/s) for building damage is within 30 m of general construction activities. Therefore, for the purposes of this assessment, a frequency-dependent analysis was not carried out for building damage.

The FTA Manual guideline limit of 0.1 mm/s for human annoyance may be complied with for some general construction equipment, which are expected to be the greatest source of vibration, beyond the following estimated standoff distances:

– impact pile driving–175 m from impact pile driving location
– vibratory roller–50 m from the use of the vibratory roller
– rock drills–25 m from the use of the rock drill

Based on the above, only impact pile driving is expected to exceed the 0.1 mm/s criteria for human annoyance for sensitive receptors within 175 m of the piling activities. Due to the short-term intermittent nature of the construction building damage criteria are considered for compliance, while human annoyance is not

6.5.4.1.1.3 Predicted Residual Effects

Vibration during Construction may result in perceptible changes in vibration level however is unlikely to result in exceedances of applicable criteria at potential PORs after the implementation of mitigation measures. This potential effect is therefore carried through for further assessment in the following sections, including an assessment of significance.

6.5.4.1.2 Increase in Vibration Level During Operations

6.5.4.1.2.1 Operations Vibration Assumptions

Operations Blasting

The greatest source of vibrations during operations will be from open pit blasts. The parameters for the proposed open pit blasts were described in the pre-feasibility study (Champion 2024). For the purposes of this assessment, blast design details presented in the pre-feasibility study are summarized in Table 6-28.

Table 6-28: Hypothetical Blast Design Details – During Operations

Parameter	Open Pit Blast Details
Hole diameter	251 mm
Bench height	10.00 m
Sub-drill	1.50 m
Depth of hole	11.50 m
Blast pattern (burden x spacing)	Ore 5.50 x 6.25 m Waste 6.50 x 7.50 m
Stemming length	4.00 m
Stemming type	Clear crushed stone
Explosive type	High energy bulk emulsion
Explosive density	1.25 g/cm^3
Explosive weight per delay	Up to 464 kg[(a)]
Powder factor[(b)]	Ore 0.40 kg/t Waste 0.34 kg/t

(a) Calculated assuming one hole detonated per delay period.
(b) Based on a rock density of 3.40 g/cm^3 for ore and 2.83 g/cm^3 for waste.

If the blasting contractor implements blast designs which differ significantly from those proposed in Table 6-28, the results from this study may need to be reassessed.

General Operations Activities

It is expected the vibration levels from general equipment use during the Operations phase will be similar to, but lower than those assessed for general construction activities as described in Section 6.5.4.1.1.2. Accordingly, the vibration levels from general operations activities were not further assessed.

6.5.4.1.2.2 Estimated Increase in Vibration Level During Operations

Vibration levels can be expected to increase, on occasion, due to operation activities at the potential PORs, but operation vibration will be temporary in nature and localized within the vibration LSA. The range in increased vibration levels associated with operation activities will depend primarily on the type of vibration source and its proximity to the PORs (i.e., the Project vibration levels in the environment decrease as the distance between the PORs and operation activities increases) and the energy of the vibration source (i.e., for blasting maximum explosive charge weight detonated at a given instance [i.e., delay period]).

Table 6-29 presents the predicted vibration levels from Project operations. The tables indicates where vibration levels exceed the Directive 019 limits of 12.7 mm/s and 128 dBL in bold/underline.

Table 6-29: Estimated Ground Vibrations for the Operations Blast Design at a Range of Distances

Distance[(a)] (m)	Peak Particle Velocity (mm/s)	Air Overpressure (dBL)
100	**97.8**	**139.6**
200	**32.2**	**133.2**
300	**16.9**	**129.4**
400	10.6	126.8
500	7.4	124.7
600	5.6	123.0
700	4.3	121.6
800	3.5	120.4
900	2.9	119.3
1,000	2.5	118.3

Notes:

Bold and underlined text means vibration levels exceed the Directive 019 limits of 12.7 mm/s and 128 dBL.

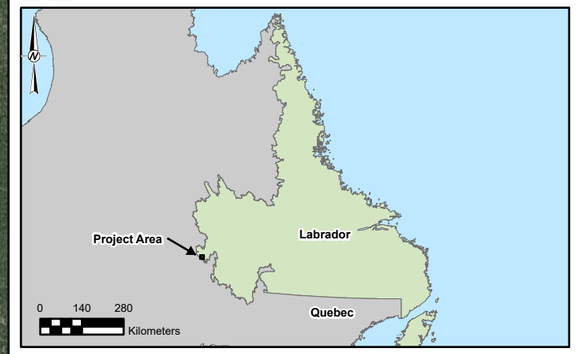
(a) Distance between the blast and the sensitive receptor

; dBL = linear decibel.

Assuming a single hole per delay, Québec's Directive 019 vibration limit of 12.7 mm/s may be complied with for all blasting beyond the estimated standoff distances of 358 m from adjacent POR locations. Additionally, Directive 019's air overpressure limit of dBL may be complied with for all blasting beyond the estimated standoff distances of 350 m from adjacent residential POR locations. The estimated offsets required to remain compliant with the Operations ground vibrations and air overpressure limits are shown in Figure 6-8.

Assuming a single hole per delay, the DFO limit of 13.0 mm/s may be complied with for all blasting beyond the estimated standoff distances of 353 m from an active spawning bed during egg incubation. As well, the DFO limit of 50 kPa may be complied with for all blasting beyond the estimated standoff distances of 182 m from the nearest fisheries habitat.

KEY MAP



SCALE 1:20,000,000

Legend

- EXISTING RAILWAY
- EXISTING ROAD
- Proposed Infrastructure
- PSPL 128 dBL - OPERATIONS BLASTING
- PPV 12.7 mm - OPERATIONS BLASTING
- WATERBODY

0 175 350 700

1:15,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. BASED ON AN OPERATIONS MAXIMUM EXPLOSIVE WEIGHT PER DELAY OF 464 KG

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
2. IMAGERY CREDITS: WORLD IMAGERY: MAXAR
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 19N

CLIENT

CHAMPION IRON MINES LTD.

PROJECT

KAMI IRON ORE MINE PROJECT (KAMI PROJECT)
WABUSH, NL

TITLE

PREDICTED OFFSETS TO COMPLY WITH OPERATIONS PPV & PSPL LIMITS

CONSULTANT

Kami

YYYY-MM-DD	2025-06-27
DESIGNED	----
PREPARED	RRD
REVIEWED	GE
APPROVED	SC

PROJECT NO.	CONTROL	REV.	FIGURE
CA0038713.5261	0019	0	6-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: S:\Clients\Champion Iron_Ore_Mines\Kami Iron Ore\09_PROJ\CA0038713.5261 EIS\40_PROD\0019 Noise\Vibration\Light\0019_NoiseVibrationLight.aprx PRINTED ON: AT: 2:16:04 PM

6.5.4.1.2.3 Predicted Residual Effects

Vibration during operations from pit blasting may result in a potential effect because it is predicted that, after the implementation of impact management measures, exceedances of applicable criteria at potential PORs may occur. This potential effect is therefore carried through for further assessment in the following sections, including an assessment of significance.

6.5.4.2 Residual Project Effects Characterization

Table 6-30: Characterization of Residual Effects on Vibration

Residual Effect	Criterion	Rating/Effect Size
Change in vibration level during Construction	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Short term
	Reversibility	Reversible
	Timing	Year-round
	Frequency	Periodic
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Undisturbed – the existing vibration environment has been assessed as near-null.
Change in vibration level during Operations	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Medium term
	Timing	Year-round
	Reversibility	Reversible
	Frequency	Periodic
	Probability of occurrence	Certain
	Ecological and socioeconomic context	Undisturbed – the existing vibration environment has been assessed as near-null.

6.5.4.3 Significance Determination

As described in Section 6.5.1.4, a significant adverse residual effect is defined as one that is high in magnitude, medium or long term in duration and frequent or continuous. As the magnitude of the residual effect on vibration was assessed to be moderate and the frequency is periodic, the residual effect is predicted to be not significant.

6.5.5 Light

6.5.5.1 Residual Project Effect Analysis

Project activities may occur for up to 24 hours per day, which will require lighting related to evening or nighttime activities. Light emissions during nighttime construction and operations will be based on mobile and fixed onsite lighting established for health and safety and/or navigational purposes. Lighting systems for worker safety, security, and navigation would be designed and installed to meet industry-recommended minimum lighting levels.

Change in Light Level During Construction

Lighting effects during Project Construction would be intermittent in multiple localized areas throughout the Project site as the construction work progresses. Construction activities including site preparation and the construction of roads, facilities and infrastructure are expected to result in light emissions from mobile equipment and portable light plants. These activities will be short in duration and intermittent. A change in light levels may be perceptible but applicable light trespass and sky glow CIE zone criteria are expected to be met for Project Construction.

Change in Light Level During Operations

During Project operations, light emissions will be generated from open pit mining, mobile mining equipment, handling and storage of overburden, mine rock and ore, operation of the TMF, ore processing, railcar loading and transportation, site traffic, and operation of the camp, mine services area and office. The Project will use full horizontal cutoff lighting for fixed lighting that will direct light towards work areas and away from PORs as required, which will result in negligible changes in light trespass and sky glow at PORs. The majority of on-site haul routes will be shielded from PORs by topography and vegetation along their length, but lighting from individual vehicles may be visible at PORs at times. Tree cover will be left in place, where feasible, to reduce the visibility of mobile equipment lighting at the PORs.

Applicable light trespass and sky glow CIE zone criteria are expected to be met for Project Operations.

6.5.5.2 Residual Project Effects Characterization

Change in Light Level During Construction

Taking into account the implementation of the mitigation measures in Table 6-21, the magnitude of the residual effects from Project Construction lighting is predicted to be moderate, because perceptible changes in light levels due to the Project may occur but CIE zone criteria are expected to be met. The residual effects were assessed to be local in geographic extent, as the effects are limited to the LSA, and will be short term, as the effects occur within the Construction phase. The effects are reversible, as they will cease when the Project ceases; periodic, as they are expected to be intermittent; and probable, as they are likely to occur. Local communities, cabins, and existing mining operations contribute to the existing lighting environment; therefore, the ecological and socioeconomic context is considered to be disturbed.

Change in Light Level During Operations

Taking into account the implementation of the mitigation measures in Table 6-21, the magnitude of the residual effects from lighting during Project Operations is predicted to be moderate, because perceptible changes in light levels due to the Project may occur but CIE zone criteria are expected to be met. The residual effects were assessed to be local in geographic extent as the effects are limited to the LSA and the medium term as the effects occur within the Operations phase. The effects are reversible as they will cease when the Project ceases, periodic as they are expected to be intermittent, and probable as they are likely to occur. Local communities, cabins, and existing mining operations contribute to the existing lighting environment; therefore, the ecological and socioeconomic context is considered to be disturbed.

A summary of the characterization of the residual effects on light is provided in Table 6-31.

Table 6-31: Characterization of Residual Effects on Light

Residual Effect	Criterion	Rating/Effect Size
Change in light level during Construction	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Short term
	Reversibility	Reversible
	Timing	Year-round
	Frequency	Periodic
	Probability of occurrence	Probable
	Ecological and socioeconomic context	Disturbed – local communities, cabins and existing mining operations contribute to the existing lighting environment.
Change in light level during Operations	Nature	Adverse
	Magnitude	Moderate
	Geographic extent	Local
	Duration	Medium term
	Reversibility	Reversible
	Timing	Year-round
	Frequency	Periodic
	Probability of occurrence	Probable
	Ecological and socioeconomic context	Disturbed – local communities, cabins and existing mining operations contribute to the existing lighting environment.

6.5.5.3 Significance Determination

As described in Section 6.5.1.4, a significant adverse residual effect is defined as one that is high in magnitude, medium or long term in duration and frequent or continuous. As the magnitude of the residual effect on light was assessed to be moderate and the frequency of the effect was assessed to be periodic during Project Construction and Operations, the residual effect is predicted to be not significant.

6.5.6 Residual Cumulative Effects Analysis

The qualitative assessment of residual cumulative effects on noise, vibration, and light considered the likelihood that the Project's residual effects will overlap with RFDs to result in cumulative effects on noise, vibration, and light.

A cumulative effect may occur if an RFD overlaps spatially, overlaps temporally, and results in emissions of noise, vibration or light. The spatial boundaries for the cumulative effects assessment for the noise, vibration and light VECs was defined as each VEC's RSA, which was sized to consider regional effects on noise, vibration, and light and assess potential cumulative effects.

The temporal boundary for the noise, vibration and light residual cumulative effects analysis includes the Project Construction, Operations, and Closure phases. For the purposes of this assessment, it was assumed that construction of the Project is anticipated to begin in 2027, and the Project is expected to extend for 40 years. The final anticipated year of the mine life after decommissioning and rehabilitation is expected to be 2067.

6.5.6.1 Reasonably Foreseeable Developments and Potential Cumulative Effects

Chapter 4 provides a list of known RFDs and physical activities that have potential to overlap spatially and temporally with the Project's residual environmental effects. Chapter 4, Figure 4-4 presents the location of identified RFDs. Based on this list, RFDs with the potential to overlap spatially and/or temporarily with the Project were assessed in Table 6-32 for possible interactions with the residual Project effects on noise, vibration, and light.

Table 6-32: Other Projects and Activities Considered in the Cumulative Effects Assessment

Project Name or Physical Activity	Description of Project Effects	Approximate Direct Distance to Kami Mining Project Site	Status/Timing	Interaction with Residual Effects on Noise, Vibration, and Light from Kami Mining Project
Bloom Lake Iron Mine – Increasing Tailings and Waste Rock Storage Capacity	Increasing tailings and waste rock storage capacity for Bloom Lake Iron Mine. The objective of the project is to double the iron ore concentrate production of the Bloom Lake mining complex, increasing the existing nameplate capacity of 7.5 Mtpa (Phase I) to 15 Mtpa, with operations continuing until 2040.	17 km	2023 to 2040	The Bloom Lake project is predicted to emit noise, vibration and light, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the light RSA. Increasing the capacity is unlikely to substantially change the light produced by the Bloom Lake Iron Mine compared to existing conditions. As the Project is approximately 17 km away from the western extent of the Kami Mining Project, it is unlikely to overlap with the light that is predicted to be generated from the Project. Therefore, no potential cumulative effects are anticipated.

Project Name or Physical Activity	Description of Project Effects	Approximate Direct Distance to Kami Mining Project Site	Status/Timing	Interaction with Residual Effects on Noise, Vibration, and Light from Kami Mining Project
Scully Mine Tailings Impoundment Area Expansion Project	Tacora Resources Inc. is proposing to expand the tailings impoundment area of the Scully Mine, an iron ore mine located in Wabush, NL. As proposed, the Scully Mine Tailings Impoundment Area Expansion project would expand the existing tailings impoundment area by up to 1,411 ha, allowing for the full use of the mine's ore reserves and for operations to continue until 2047. The existing tailings impoundment area is expected to reach full capacity around 2025. The Minister of Environment and Climate Change determined that the project does not require an EA in April 2022.	13 km	Anticipated start in 2025 and expand operations by 22 years	The expanded tailings impoundment area at Scully Mine is predicted to emit noise, vibration and light, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the noise, vibration and light RSAs. Increasing the capacity of tailings in the tailings area is not expected to substantially increase the noise, vibration and light compared to existing conditions. Therefore, no potential cumulative effects are anticipated.
IOC Smallwood North Extension Project	Expansion to the boundaries of the existing Smallwood Pit to support ongoing operations in Labrador City. The proposed extension of Smallwood Pit is located within IOC's existing mining leases and encompasses approximately 160 ha. The proposed project includes extending the Smallwood North pit to the north, development of a new waste dump, construction of new power lines, construction of new pit dewatering wells and the development of surface water handling systems.	25 km	Construction starts in summer 2024 into 2030	The IOC Smallwood North Extension project is predicted to emit noise, vibration and light, overlap temporally during the Project Construction and Operations phases, and overlap spatially with the light RSA. IOC is not anticipating a net increase in operations or activities resulting from the extension project; therefore, light is not expected to substantially change compared to existing conditions. As the Project is approximately 25 km away from the Kami Mining Project, it is unlikely to overlap with the light that is predicted to be generated from the Project. Therefore, no potential cumulative effects are anticipated.

Project Name or Physical Activity	Description of Project Effects	Approximate Direct Distance to Kami Mining Project Site	Status/Timing	Interaction with Residual Effects on Noise, Vibration, and Light from Kami Mining Project
Route 389 Improvement Project between Fire Lake and Fermont	The Québec Government is improving Route 389 between Fire Lake and Fermont (kilometres 478 to 564) to increase the flow and safety of the road and, in addition, improve the link with NL as well as facilitate access to natural resources. The project is divided into three sections: – Segment 1–between kilometres 478 and 496: new alignment – Segment 2–between kilometres 496 and 507: major road rehabilitation – Section 3–between kilometres 507 and 566: new 45-km route Construction of Section 3 began in late summer 2023 and construction of Segments 1 and 2 in summer 2024. The three sections are scheduled to be complete by 2028.	6 to 93 km	2023 to 2028	The Route 389 Improvement project is predicted to emit noise, vibration and light. The Project overlaps spatially within the noise, vibration and light RSAs and may overlap temporally during the Project's first two years of construction, assuming the Project starts in 2027. It is expected that noise, vibration, and light from the Route 389 project will be managed following similar mitigations to the Kami Mining Project, and any noise, vibration and light will be limited to the area in the immediate vicinity of the Project. Therefore, no potential cumulative effects are anticipated.
IOC Western Hillside Tailings Pipeline – Iron Ore Company of Canada	New tailings management plan that would include optimizing available space of the existing Wabush Lake tailings storage facility and utilizing the Western Hillside. The project would include the development of an access road and pipeline alignment, transmission lines, pumps and pumphouses, and a modified strategy for deposition of tailings into Wabush Lake.	15 km	Construction anticipated to start in 2024 and continue into 2033; operation from 2033 to 2038	The IOC Western Hillside Tailings Pipeline construction is expected to emit noise, vibration and light, may overlap temporally during the Project Construction and Operations phases and overlap spatially with the noise, vibration and light RSAs. It is expected that noise, vibration and light from the IOC Western Hillside Tailings Pipeline project will be managed following similar mitigations to the Kami Mining Project, and any noise, vibration, and light will be limited to the area in the immediate vicinity of the Project. Cumulative effects with the Project are not anticipated.
Labrador City Humphrey South Iron Ore Extension	A 370 ha extension to the Humphrey South Pit iron ore deposit that will include development into the White Lake area to support its existing operations in Labrador City. The project includes an extension of the Humphrey South Pit to the east and south, development of a waste dump south of White Lake, extension of the Carol waste dump, power lines, dewatering wells, and surface water-handling systems.	20 km	Construction to start in 2024 and operations anticipated by 2026	Operations at the IOC Humphrey South extension project is predicted to emit noise, vibration and light, may overlap temporally during the Project Construction phase and overlap spatially with the noise, vibration, and light RSAs. The extension is unlikely to substantially change the noise, vibration, and light produced by the Humphrey South Pit compared to existing conditions. As the project is approximately 20 km away from the Kami Mining Project, it is unlikely to overlap with the noise, vibration, and light that is predicted to be generated from the Project. Therefore, no potential cumulative effects are anticipated.

IOC = Iron Ore Company of Canada; Mtpa = million tonnes per annum; RSA = regional study area.

It is highly unlikely that there are any noise, vibration, and light cumulative effects with the RFDs listed in Table 6-32 if the distances that were identified in the residual effects assessment and the distance of the RFD projects are considered. That is, there should be no overlap between the potential cumulative effects and the RFDs.

6.6 Prediction Confidence and Uncertainty

A key element of a comprehensive EA is the prediction of future conditions of the environment as a result of the Project from previous and existing projects and activities and RFDs. Given that environments change naturally and continually through time and across space, assessments of effects and predictions about future conditions embody some degree of uncertainty (CEA Agency 2018).

The purpose of the Prediction Confidence and Uncertainty section is to identify the key sources of uncertainty and qualitatively describe how uncertainty was addressed for noise, vibration and light to increase the level of confidence that effects would not be larger than predicted, including the potential need for monitoring and adaptive management that can reduce uncertainty over time (Section 4.10).

The main sources of uncertainty associated with the noise, vibration, and light assessments are:

- existing environment characterization (i.e., identifying potential receptors and collecting existing levels) represents the conditions at the time of carrying out this assessment and may differ throughout the life of the Project
- project activity levels (e.g., actual versus proposed operating hours of equipment) associated with key sources
- availability and quality of information on which to base source emission levels and respective locations
- assumptions, conditions, and constraints of quantitative model inputs resulting in potential variability in the predicted results
- prediction tolerances within the modelling being utilized resulting in potential variability in the predicted results
- level of uncertainty associated with vibration attenuation models with distance from the source
- level of uncertainty associated with the blast design parameters implemented during Construction and Operations
- conducting a qualitative assessment of light from the Project
- level of certainty associated with the effectiveness of proposed mitigations, where applicable

The characterization of residual Project effects incorporated a number of conservative assumptions to increase the confidence that the modelled noise and vibration predictions will not underestimate the effects of the Project. The assumptions included in the assessment were:

- Predictable worst-case scenarios were considered (i.e., maximum quantities of significant noise sources or movement of extracted material).
- Noise sources (except sources associated with the rail line) were assumed to all operate 100% of the time at their maximum sound power levels.
- Potential attenuation from existing off-site buildings or foliage or from a working face in the pit and/or stockpile were conservatively not included in the model.
- The results of follow-up noise monitoring and/or measurements will inform changes in the Project design as it relates to noise, if required, and will allow the Project noise levels to remain compliant with the applicable criteria.
- Vibration attenuation models presented in the report conservatively represent the level of vibration with the source parameter (e.g., explosive charge weight per delay period) and the distance from the source.
- The blast design parameters presented in the Pre-feasibility Study (Champion 2024) conservatively represent the blasting that will be carried out during the Operations phase.
- The results of follow-up vibration monitoring will inform changes in the blast designs and construction equipment that will allow the induced vibration levels to remain compliant with the appropriate vibration limits.

Uncertainty was considered to be moderate, as the Project-related effects are mostly understood. There is a level of uncertainty associated with the emission levels and effectiveness of proposed mitigations; however, conservative assumptions were applied.

6.7 Monitoring, Follow-Up, and Adaptive Management

This section presents a summary of the identified monitoring and follow-up required to confirm effects predictions and address uncertainty identified in Section 6.6.

Specifically, follow up and monitoring programs will be used as follows:

- Evaluate the effectiveness of mitigation actions and modify or enhance as necessary through monitoring and developing updated mitigation measures (if needed).
- Identify unanticipated negative effects, including possible accidents and malfunctions.

As noted in Table 6-21, a complaints-based process for noise, vibration and light will be established for the Project whereby persons can contact the Project team if there are perceived noise, vibration or light issues. Complaints will be investigated and, if justified, the noise, vibration or light source that caused the complaint will be minimized or eliminated where possible. Investigations can include noise, vibration or light monitoring as required.

6.7.1 Noise Monitoring and/or Measurements

Noise monitoring and/or measurements are recommended during the Construction and Operations phases to minimize overall adverse environmental effects potentially associated with activities associated with the Construction and Operations phases of the Project.

As noted above, the list of key noise sources assessed for the Project during the Construction and Operations phases are considered to be representative of the types of equipment and associated activities, including the mitigation measures summarized above in Section 6.5.1.2.1 and Table 6-21, which are intended to limit effects on noise level. Therefore, noise monitoring and/or measurements are recommended to support the Project's adaptive management approach and Environmental Protection Plan and confirm the findings presented in the EIS as the Project progresses.

In addition, it is expected Champion will prepare the Noise Monitoring and/or Measurement Plan for both the Construction and Operations phases, with support from the selected contractor to address the requirements for the Construction and Operations phases. Note, noise monitoring reflects unattended longer-term noise data collection while noise measurements reflect intermittent attended short-term noise data collection. The Noise Monitoring and/or Measurement Plan should be continuously reviewed and if required updated, as the Project progresses.

The following summarizes a high-level approach recommended when developing the Noise Monitoring and/or Measurement Plan:

- review of applicable regulations, guidelines and/or policies
- identification of applicable indicators, criteria and limits
- characterization of the existing environment to identify potential noise sensitive receptors and potential monitoring and/or measurement locations
- selection of appropriate monitoring and/or measurement equipment
- development of appropriate frequency and schedule
- development of proposed remediation actions
- development of procedure in-case of the receipt of complaints
- proposed reporting requirements

In addition, the following are recommended to be taken into consideration when developing a Noise Monitoring and/or Measurement Plan:

- The Project is currently at the EA stage; therefore, it is recommended that, prior to commencing detailed design and construction, discussions with the various stakeholders (i.e., regulators) be carried out to confirm the guidance documents considered in this noise assessment and their respective criteria continue to be applicable to the Project.
- Depending on the construction activity and type of receptor, noise monitoring and/or measurement locations may be aligned with the vibration monitoring locations.
- In addition, it is expected any noise monitoring and/or measurement locations will require authorization from the landowner to permit noise data to be collected on their property. Therefore, it is recommended that multiple potential locations be identified.

Additional options include, but are not limited to, locations considered acoustically similar with respect to distance to the activities being assessed, topography and existing noise levels, but are located on public lands.

- Prior to the start of Construction, when detailed construction information becomes readily available, the existing conditions in the vicinity of the Project will need to be reviewed and updated accordingly, including identifying potential sensitive PORs and characterizing the existing noise levels (i.e., baseline noise levels). It is recommended that actual baseline noise levels be measured at each monitoring and/or measurement location prior to the start of construction. Existing noise levels should align with the selected indicators, criteria and/or limits for the Project and be in accordance with the applicable regulations, guidelines and/or limits. At a minimum, monitoring and/measurements should be in general accordance with ISO 1996-2.
- The noise assessment for the Project was completed using a change in the percentage of highly annoyed people (%HA) as an indicator for Project construction and operation noise that could potentially result in a public response that would require the implementation of noise mitigation. The change in %HA resulting from the Project Construction and Operations phases was calculated at each identified receptor based on the pre-Project baseline noise level and the predicted Project contributions. As there is a degree of variability in the baseline noise levels across the receptors, for the purposes of the construction noise monitoring, it will not be possible to establish a single noise limit applicable across the entire Project area. Instead, a receptor-specific noise limit (i.e., the construction noise level resulting in the change in %HA not exceeding a value of 6.5%, which is identified by Health Canada as the trigger for the consideration of mitigation) will need to be established for each monitoring and/or measurement location once current applicable baseline levels are available (i.e., measured) at the commencement of the Project.
- Noise monitoring locations should be reviewed periodically and confirmed whether they are an appropriate location. The most sensitive location at the POR will need to be identified, which may need to comply with the selected regulation, guideline and/or policies and is not necessarily the location where the highest noise levels are expected since there may be multiple areas of concern at one location.

6.7.2 Vibration Monitoring

6.7.2.1 Construction Vibration Monitoring

Vibration monitoring is expected to be required for general construction blasting activities to align with Québec's CCDG (2018) requirements and general industry practices. Based on typical blasts, monitoring would be recommended for construction blasting within 200 m of receptors verified to be vibration sensitive. Modification of blast designs is recommended where the measured level is 80% of the 25 mm/s limit.

All blasting within 250 m of an active spawning bed during egg incubation should be monitored for ground vibration to confirm compliance with the DFO's 13 mm/s limit. As well, all blasting within 75 m of the nearest fisheries habitat should be monitored for underwater overpressure to confirm compliance with the DFO's 50 kPa limit. Modification of blast designs is recommended where the measured level is 80% of the DFO's limit.

General construction activities should be monitored where the estimated vibration at the nearest sensitive receptor is estimated to be 5 mm/s or greater. Where the measured vibration level exceeds the 5 mm/s zone of influence, mitigation measures are proposed to maintain compliance with the limits described in Section 6.3.4.2.

Note, the Project is currently at the EA stage; therefore, it is recommended that, prior to commencing detailed design, discussions with the various stakeholders (i.e., utility infrastructure owners/operators) be carried out to confirm the guidance documents considered in this vibration assessment and their respective criteria continue to be applicable to the Project.

6.7.2.2 Operations Vibration Monitoring

Table 6-33 summarizes the operations vibration monitoring proposed to support the Project's adaptive management approach and confirm the findings presented in the EIS. The table describes what will be monitored, the method for completing the monitoring and the frequency proposed for the monitoring.

Table 6-33: Vibration Monitoring During Operations Phase

Parameter	Method	Frequency
Ground and air vibration level monitoring from blasting operations to develop site-specific vibration attenuation.	Establishing a series of seismographs at varying distances from blasts and keeping a detailed record of the loading parameters.	Monitoring campaign: from a minimum 12 blasts at 6 sites during each blast, set up at distances varying from about 300 m to 1,000 m from the blast.
Blast ground and air vibrations at nearest receptor locations.	Establishing instrumentation at nearest receptor locations. During spawning season, also establish instrumentation for blasts with 525 m of the nearest active spawning bed.	Instrumentation to record ground and air vibration intensities on a continuous basis. Data would be compared to known blast times to assess peak ground and air vibration intensities produced.
Blast-induced water overpressure level at nearest active fishery.	Establishing instrumentation at nearest active fishery location for blasts within 275 m of the watercourse. This will include a hydrophone and data acquisition unit.	Instrumentation to record water overpressure intensities during the initial blasts. Based on the data recorded, a decision will be made on subsequent monitoring. Periodic monitoring should be conducted as the blasts approach the nearest fishery.

The results of the monitoring will be used to establish that proper mitigation is implemented as part of the adaptive management program throughout the Project.

6.7.3 Light Monitoring

No further light monitoring is recommended for the Project.

6.8 Predicted Future Conditions Should the Project Not Proceed

If the Project were not to proceed, noise, vibration and light in the LSA would remain at the existing background levels unless any of the other existing mining developments were to substantially increase their operations and emission of noise, vibration and/or light, or a new Project or operation with large emissions of noise, vibration and/or light were to be proposed. Based on the RFDs identified in Chapter 4 and presented in Table 6-32, a substantial increase in noise, vibration and/or light that would result in a measurable increase in existing background level is not anticipated.

6.9 Key Findings and Conclusions

6.9.1 Noise

Potential effects from the Project on noise were assessed within the LSA. The existing conditions were established through a combination of a desktop study that identified potential PORs and a baseline data collection program consisting of both unattended long-term continuous monitoring and attended short-term spot-check measurements carried out in the vicinity of the identified potential PORs. The potential noise sensitive land uses identified within the LSA included permanent cabins, recreational cabins, recreational vehicle campsites and low-density residential dwellings. In addition, there are several lands with dwellings located in the SSA which were not included in the noise assessment as potential PORs and assessment locations. The assessment considered receptors that are expected to be used for noise-sensitive uses in the future. The results of the noise baseline program indicate that the existing noise levels within the Project area are primarily dominated by nature-based ambient sources including wind-induced noise due to vegetation, wildlife, and insects, and to a lesser degree by anthropogenic sources (such as local industrial activity and traffic along Highway 389/500/503).

The assessment of potential Project effects on noise considered the potential effects that could occur during both the Construction and Operations phases. It is expected that the assessment of these phases was adequate to capture the potential effects of the Project and reflect when the greatest effects are expected as they relate to noise. A quantitative noise assessment of the potential effects due to noise during the Project's Construction and Operations phases was carried out. The results in Table 6-22 indicate that during the Project Construction phase, noise levels are within Health Canada's nighttime criteria for sleep disturbance (i.e., 40 dBA), daytime criteria for speech comprehension (i.e., 55 dBA) and change in %HA criteria at the RPORs. The results in Table 6-23 and Figure 6-7 indicate that during the Project Operations phase, noise levels are expected to be at or below Health Canada's nighttime criteria for sleep disturbance (i.e., 40 dBA) at the RPORs. It also indicates that Health Canada's change in %HA is expected to be at or below the criteria at the RPORs within the LSA.

A comparison of the residual environmental effects characterization for the Construction and Operations phases between the previous EIS (Alderon 2012) and the current study are provided in Table 6-34. There is agreement between the characterizations of residual effects.

Table 6-34: Comparison of the Residual Environmental Effects Characterizations Between the Alderon Environmental Impact Statement and Champion Environmental Impact Statement

Residual Effect	Residual Environmental Effects Characterization	Alderon EIS	Champion EIS
Change in noise level during Construction	Direction	Adverse	Adverse
	Magnitude	Moderate	Moderate
	Geographic extent	Local	Local
	Duration	Short term	Short term
	Frequency	Regular	Periodic
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed
Change in noise level during Operations	Direction	Adverse	Adverse
	Magnitude	Moderate	Moderate
	Geographic extent	Local	Local
	Duration	Medium term	Medium term
	Frequency	Continuous	Continuous
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed

EIS = Environmental Impact Statement.

6.9.2 Vibration

Potential effects from the Project on vibration were assessed within the vibration LSA. Vibration estimates for the Project were calculated using published vibration attenuation models such as those from the ISEE (2016), the United States FTA (FTA 2018), and the DFO (Wright and Hopky 1998). Ground vibration levels as well as air and water overpressure were predicted using those models. As the Province of Newfoundland and Labrador does not have regulations or guidelines for the assessment of environmental vibration from industrial and/or mining facilities, federal, provincial and municipal regulations and/or guidance for vibration from other regions was considered applicable for mining projects. The limits provide within these regulations and/or guidance were compared with the vibration levels calculated using the attenuation models described within this study

A comparison of the residual environmental effects characterization for the Construction and Operations phases between the previous EIS (Alderon 2012) and the current study are provided in Table 6-35. There is agreement between the characterizations of residual effects with the exception of magnitude during Construction. The magnitude during construction in the current study was conservatively determined to be moderate based on the available information and the proposed mitigation measures. The vibration levels are expected to increase the most during blasting activities. The magnitude of the residual effects from Project Construction vibration is predicted to be moderate, because the vibration levels are expected to cause an increase over baseline but remain below the limits described within this assessment.

Table 6-35: Comparison of the Residual Vibration Effects Characterizations Between the Alderon Environmental Impact Statement and Champion Environmental Impact Statement

Residual Effect	Residual Environmental Effects Characterization	Alderon EIS	Champion EIS
Change in vibration level during Construction	Direction	Adverse	Adverse
	Magnitude	Low	Moderate
	Geographic extent	Local	Local
	Duration	Short term	Short term
	Frequency	Sporadic	Periodic
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed

Residual Effect	Residual Environmental Effects Characterization	Alderon EIS	Champion EIS
Change in vibration level during Operations	Direction	Adverse	Adverse
	Magnitude	Moderate	Moderate
	Geographic extent	Local	Local
	Duration	Medium term	Medium term
	Frequency	Sporadic	Periodic
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed

EIS = Environmental Impact Statement.

6.9.3 Light

Potential effects from the Project on light were assessed qualitatively within the LSA. The existing conditions were established using light trespass and sky glow measured at locations representative of sensitive locations in the vicinity of the Project. Lighting from the Project, including from mobile equipment and fixed lighting, were compared to the baseline values to assess residual effects from the Project. A change in light levels may be perceptible at times at PORs but applicable light trespass and sky glow CIE zone criteria are expected to be met for Project Construction and Operations.

A comparison of the residual environmental effects characterization for the Construction and Operations phases between the previous EIS (Alderon 2012) and the current study are provided in Table 6-36. There is agreement between the characterizations of residual effects with the exception of magnitude. The magnitude in the current study was determined to be moderate based on the available information and the proposed mitigation measures, which are less restrictive than those proposed for the Alderon EIS.

Table 6-36: Comparison of the Residual Light Effects Characterizations Between the Alderon Environmental Impact Statement and Champion Environmental Impact Statement

Residual Effect	Residual Environmental Effects Characterization	Alderon EIS	Champion EIS
Change in light level during Construction	Direction	Adverse	Adverse
	Magnitude	Low	Moderate
	Geographic extent	Local	Local
	Duration	Short term	Short term
	Frequency	Sporadic	Periodic
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed
Change in light level during Operations	Direction	Adverse	Adverse
	Magnitude	Low	Moderate
	Geographic extent	Local	Local
	Duration	Medium term	Medium term
	Frequency	Regular	Periodic
	Reversibility	Reversible	Reversible
	Environmental or socioeconomic context	Disturbed	Disturbed

EIS = Environmental Impact Statement.

Kami
Kamistiatusset
Mining
Project