# Appendix S

## Final Atmospheric Environment Technical Support Document



MARTEN FALLS FIRST NATION
COMMUNITY ACCESS ROAD

# Air Quality and Greenhouse Gas Technical Support Document: Existing Conditions & Impact Assessment

*February 2026*

## Volume 1 – Air Quality

# Disclaimer: Dillon Consulting Limited

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# Executive Summary

Marten Falls First Nation, a First Nation community in northern Ontario, has proposed a Community Access Road that will connect Marten Falls First Nation to Ontario's provincial highway network (Highway 463) to the south via the existing Painter Lake Road.

Located at the junction of the Albany and Ogoki rivers, approximately 430 km from Thunder Bay, Ontario, Marten Falls First Nation is a remote community surrounded by natural landscapes and resources. Currently, Marten Falls First Nation is accessible by land only in the winter via an ice road (i.e., winter access road). The proposed Community Access Road would allow year-round access to Marten Falls First Nation, providing greater connectivity for residents and visitors.

This document outlines existing conditions and impact assessment results for the Air Quality study. Volume 2 of this report will provide results for the Greenhouse Gas study.

Existing conditions were characterized by a year-long ambient air monitoring program which was conducted in Marten Falls First Nation. The impact assessment was prepared through a dispersion modelling evaluation of both Project construction and operation phases.

Through the ambient monitoring program, it was found that the majority of indicator compounds have concentrations below their respective air quality criteria. Air quality criteria is defined by the Ontario Ministry of the Environment, Conservation and Parks Ambient Air Quality Criteria as well as the Canadian Council of Ministers of the Environment Canadian Ambient Air Quality Standards. It should be noted that the Canadian Ambient Air Quality Standards are stringent, aspirational regional air quality targets and not Project-specific air quality criteria.

The maximum observed ambient concentrations for particulate matter were shown to exceed the Ambient Air Quality Criteria and Canadian Ambient Air Quality Standards, however, the 90$^{th}$ percentile concentrations were demonstrated to be below their respective criteria. This may be due to isolated events such as forest fires influencing ambient air quality. Community wood burning or fugitive dust from vehicular traffic on unpaved roads may also contribute to elevated particulate levels.

A residual effect are the effects remaining after the application of mitigation measures. Residual effects were generally considered to be significant if the residual effect was assessed at a high magnitude with potential residual impacts occurring at sensitive receptors, at either a frequent occurrence or in long term duration with irreversible effects.

Potential effects of the construction phase of Community Access Road were determined through emission calculations and dispersion modelling. The United States Environmental

Protection Agency AERMOD dispersion model was used to estimate maximum ground level concentrations of indictor compounds resulting from construction-related activities. This model was developed for a representative segment of the roadway and results were extrapolated across the Construction Disturbance Area. In addition, a community-based model was also developed to provide a more refined assessment of potential effects within the location of the Marten Falls Community.

The impact assessment for the construction phase indicates that significant residual effects are not anticipated through the development of Community Access Road. This finding was largely driven by the reversibility of air quality effects from construction activities. It is expected that periods of elevated ambient levels of indicator compounds will occur during construction and generally are highest in close proximity to construction activities. As road development and construction activities advance along the roadway, potential impacts to receptors will decrease the further receptors are from emission generating activities. Short term impacts can be reduced through the implementation of best management construction practices as well as standard construction mitigation measures.

Potential effects resulting from the operations phase of Community Access Road were determined through emission rate calculations and dispersion modelling. The United States Environmental Protection Agency CAL3QHCR dispersion model was used to estimate maximum ground level concentrations of indicator compounds from the operation of the road. The model developed for two representative road segments. A model was developed for the north-south road segment, and another was developed for the segment of roadway closest to the Marten Falls Community. Projected traffic volumes as well as vehicle classification distribution were incorporated in both models.

As the operations phase of Community Access Road is expected to be continuous, the residual effects associated with this phase are considered irreversible. Residual effects from the operations phase that were classified to have a high magnitude were determined to be significant. Through dispersion modelling a high magnitude of particulate matter concentrations are predicted driven by fugitive road dust generated from vehicular travel on the unpaved road resulting in the potential for a significant residual effect. It should be noted that anticipated impacts are based on the maximum vehicular traffic volume on the Community access road occurring in 2046.

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# 1. Introduction

This Report presents the existing conditions and impact assessment for the Air Quality and Greenhouse Gas Discipline and is being prepared in support of the Marten Falls Community Access Road Environmental Assessment / Impact Statement Report. This Report (Volume 1) is specific to the Air Quality; Volume 2 is specific to the Greenhouse Gases.

Marten Falls First Nation is a remote First Nation community in northern Ontario, approximately 430 km from Thunder Bay, Ontario, located at the junction of the Albany and Ogoki rivers. Marten Falls First Nation is proposing a multi-purpose all-season Community Access Road (the Project) that will connect the community to the Ontario provincial highway network. The Project includes the construction and operation of the Community Access Road with the following key characteristics:

- Approximately 184 km of two-lane gravel all-season road on a new right-of-way;
- Approximately 100 m wide right-of-way cleared to a width of 60 m; and
- Proposed designated speed limit of 80 km per hour.

Marten Falls First Nation is currently accessible year-round by air transportation out of Thunder Bay, Ontario and Nakina, Ontario, and by a winter access road constructed on an annual basis, if winter conditions permit. Since the 1990s, Marten Falls First Nation has received provincial funding to maintain the 140 km of winter road to the community.

## 1.1 Project Overview

The Project consists of a Community Access Road from Painter Lake Road located approximately 57 km north of Nakina, Ontario to the Community of Marten Falls First Nation. The Community Access Road will serve community access and industrial supply needs for both Marten Falls First Nation (e.g., fuel, construction supplies, water treatment supplies) and industrial proponents (e.g., mining, forestry), thereby minimizing infrastructure corridors in the Far North. Therefore, Community Access Road will be for a multi-purpose road built to meet industrial use specifications.

In April 2018, Marten Falls First Nation signed an agreement with the Ministry of the Environment, Conservation and Parks to prepare an environmental assessment under the *Ontario Environmental Assessment Act*, 1990 to support the development of the Community Access Road. A study under the *Ontario Environmental Assessment Act* was formally initiated by Marten Falls First Nation in March 2019 when the Notice of Commencement for a Terms of Reference for Community Access Road was published.

All-season public roads that require 75 kilometres or more of new right-of-way, as per Schedule 1 (51) of the Physical Activities Regulations under the *Impact Assessment Act*, may be subject to the Act (Government of Canada, 2019b). After considering the detailed Project Description, the Agency determined that a federal impact assessment is required for the Community Access Road, and an Impact Statement needs to be submitted to the Agency for review and approval. The Agency prepared and released the Marten Falls Community Access Road Project: Tailored Impact Statement Guidelines in February 2020 (Impact Assessment Agency of Canada, 2020a) to outline the information and studies necessary to conduct the impact assessment.

The Federal and provincial governments are cooperating on the assessment of the Community Access Road, in accordance with the Co-operation Plan (Impact Assessment Agency of Canada, 2020b). The Co-operation Plan allows Marten Falls First Nation to prepare one single Environmental Assessment / Impact Statement submission to satisfy both the federal and provincial processes (Government of Canada).

## 1.2 Qualifications of Individuals

A list of names and qualifications of the authors and technical reviewers of this Report is presented in **Table 1-1**.

**Table 1-1: Qualifications of Individuals**

| Name | Title / Role | Years of Experience | Qualifications |
|---|---|---|---|
| **David Diemer** | Senior Environmental Engineer / Senior Review | 31 | P.Eng. |
| **Robert Morgan** | Senior Environmental Engineer / Senior Review | 12 | P.Eng. |
| **Doug Gay** | Environmental Engineer / Technical Discipline Lead | 10 | P.Eng. |
| **Ryan Chen** | Environmental Engineer / Technical Support | 10 | P.Eng. |

# 2. Project Description

Community Access Road will be executed in three main phases:

- Planning and design, which includes the preparation of the Environmental Assessment / Impact Statement Report, obtaining regulatory approvals and detailed engineering design;
- Construction, which is anticipated to last between three and ten years; and
- Operations, for a permanent road.

## 2.1 Project Components

### 2.1.1 Roads

The Project consists of an approximately 184 km all-season road within a 100 m wide right-of-way, 60 m of which will be cleared of vegetation. Additional temporary clearing occurring in certain locations to accommodate construction activities, access, pits and quarries, aggregate source areas, quarry sites, and temporary infrastructure such as staging areas, camps and debris, and / or timber stockpiles will be required. It has a roadway approximately 11 m in width to accommodate a two-lane gravel road with culverts and two-lane bridges at water crossing locations. Traffic levels for Community Access Road have been estimated at 700 vehicles per day for the north-south section and 100 vehicles a day for the east-west section of the Community Access Road. These volumes are reflective of the anticipated peak traffic in 2046.

The predominant building materials will be, blasted rockfill and composite excavation material capped with granular surface material. The majority of blasted rockfill will be obtained from rock outcrops within and / or adjacent to the right-of-way. Building materials will be primarily obtained through the pits and quarries developed specifically to support construction of Community Access Road.

Early investigations on permafrost have shown Community Access Road is located within a sporadic discontinuous permafrost zone, with known locations documented and monitored. At the time of drafting no areas of known permafrost have been found within the Construction Disturbance Area. Excavation within identified permafrost areas will be avoided, whenever possible, as cutting into surface vegetation can disturb the permafrost regime resulting in thaw and unstable ground. As a precaution, the design will primarily use fill to minimize any permafrost degradation and will follow the recommendations outlined in a Permafrost Management Plan.

### 2.1.2 Bridges and Culverts

Bridges will be required over the various waterways to provide grade separation with sizes ranging from single span to multi-span bridges to carry two lanes of traffic with appropriate shoulder widths. The foundation support for the bridge abutments are expected to consist of driven steel piles, drilled concrete piles or concrete spread footings.

Equalization culverts will be installed at locations where it is determined that spring-melt or storm runoff needs to pass from one side of Community Access Road to the other to prevent flooding and / or erosion. The purpose of equalization culverts is to maintain the existing surface water drainage patterns in the area. Culverts will be put in place as construction progresses along Community Access Road.

### 2.1.3 Quarries, Pits and Aggregate Source Areas

Quarries, pits and quarries, and aggregate source areas will be developed to provide crushed rock and granular materials for the construction of Community Access Road and temporary access roads. These sites have been identified and considered in this Environmental Assessment / Impact Assessment. Most of the rock required for construction is expected to come from quarry sites in the vicinity of the Community Access Road route. Temporary access roads will be established to connect the various Project components as required and will be limited in length to the extent feasible. All materials will be subject to a geotechnical verification process in order to ensure they possess the desired physical properties for use in construction. The development and operation of all pits and quarries will be subject to the aggregate permitting process under the *Aggregate Resources Act* (Aggregate Resources of Ontario: Site Plan (2020) Standards and Technical Reports and Information (2023)). Permitted pits and quarries will follow the progressive and final rehabilitation requirements outlined in the approved site plans under the Act.

Only material that has been cleared through a geochemical verification process will be utilized for the road surface to avoid acid rock drainage or metal leaching. Monitoring of runoff will be conducted from an erosion and sediment control perspective; further details about this specific type of monitoring will be available in the Erosion and Sediment Control Plan.

### 2.1.4 Temporary Infrastructure for Construction

Temporary access roads may be required to access the right-of-way during construction. The purpose of the temporary access roads is to facilitate emergency access, equipment and personnel access, and to provide access to and from quarries, borrow sites, and

aggregate source areas. The temporary access roads will be cleared, but not grubbed, to approximately 10 m wide to accommodate equipment movement.

Upon completion of construction, sand and gravel pits, including temporary access roads leading to the pits will be rehabilitated (progressive and final rehabilitation) and surrendered in accordance with the *Aggregate Resources Act*.

Temporary construction camps, staging areas, and stockpile areas are anticipated to be established at various locations along the right-of-way and / or near other Project components. These components are proposed to support crews, store equipment, vehicles, materials, and supplies.

# 3. Information Shared by Indigenous Peoples & Other Interested Persons Which Informed This Report

In the course of completing the description of existing conditions and impact assessment for this report, information provided by Indigenous knowledge holders, Indigenous community members, regulators, and public stakeholders was used to develop the approach and assessment conducted for this study. This information and how it informed the development of this report are described below. This section does not detail all the information, comments, or questions received related to Community Access Road and is limited to only the information which informed this Report. For a full description of all consultation and engagement related to the Community Access Road refer to the Record of Consultation and Engagement for the Environmental Assessment / Impact Statement Report. Information related to the Indigenous Knowledge Program can be found in the Marten Falls Community Access Road: Aboriginal and / or Treaty Rights and Interests Draft Report (Dillon, 2024).

## 3.1 Indigenous Knowledge

Indigenous Knowledge refers to Indigenous systems of knowledge as well as cultural practices related to the production of knowledge based on traditional belief systems, relationships to the environment, and community practices. It is the accumulated and living knowledge built upon the historic experiences of Peoples living on the land and adapting to social, economic, environmental, spiritual, and political change (Chiefs of Ontario, n.d.) It includes knowledge about the natural environment (e.g., locations of caribou seasonal use and calving areas), the relationships between environmental changes and species or ecosystems, and how potential effects to the environment can be avoided or reduced.

Indigenous Land and Resource Use refers to specific areas and resources used for traditional purposes when Indigenous peoples learn and practice their Indigenous Knowledge (Garvin & Northern Forestry Centre (Canada), 2001). This includes the areas and sites used for hunting, trapping, fishing, and gathering and the resources harvested, as well as cultural sites, features and practices—sometimes referred to as Traditional Land Use.

In 2019, the Community Access Road Project Team launched a program to collect Indigenous Knowledge. The Indigenous Knowledge Program is a critical component of the information base upon which the assessments will rely. The information generated through the Indigenous Knowledge Program has been woven with scientific approaches, and both

knowledge systems will be given equal consideration in forming the foundation for existing conditions, predicting potential Project effects, and determining appropriate mitigation and monitoring methods.

The Indigenous Knowledge Program occurs in two concurrent phases:

1. Collecting existing Indigenous Knowledge and information on Indigenous land and resource use to help inform the early stages of the assessments; and
2. Completing Project-specific Indigenous Knowledge and Lands and Resource Use studies.

The protection and confidentiality of Indigenous Knowledge and information on Indigenous land and resource use is of the utmost importance to Community Access Road Team. To honour and respect this important information, Indigenous Knowledge Sharing Agreements were established with interested communities prior to the use of community information. The Sharing Agreement outlines how confidential and sensitive information will be woven into Community Access Road's environmental / impact and design processes.

All Indigenous communities and groups identified by the Ministry of the Environment, Conservation and Parks and the Impact Assessment Agency of Canada (the Agency) through the Indigenous Engagement and Partnership Plan have had the opportunity to participate in the Indigenous Knowledge Program. The Indigenous Knowledge Program provides interested Indigenous communities an opportunity to: share existing Indigenous Knowledge and information on Indigenous land and resource use and cultural values that may be relevant to Community Access Road, and / or complete Project-specific studies to collect and share Indigenous Knowledge and information on Indigenous land and resource use and cultural values. The Indigenous Knowledge Program included opportunities for Indigenous communities and groups to meet with the Proponent to discuss the program, ask questions, and share concerns and interests.

The Proponent strove to respectfully collaborate with Indigenous communities on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values were considered in reporting, and how potential effects to Aboriginal and Treaty Rights and Interests were assessed. Measures to support this included but were not limited to: engaging Indigenous communities to solicit information on Indigenous Knowledge and Indigenous land and resource use and cultural values; to inform existing conditions, providing Indigenous communities with draft sections of the Environmental Assessment / Impact Statement Report; to illustrate how Indigenous Knowledge and information on Indigenous land and resource use and cultural values has been integrated, and to confirm it has been presented appropriately. The Proponent aims to complete collaborative working sessions with Indigenous communities to inform the impact

assessment on Aboriginal and Treaty Rights and Interests. Further information on how potential effects on Indigenous rights were assessed is provided in the Aboriginal and Treaty Rights and Interests Study Plan (Dillon, 2021).

Information provided by Indigenous knowledge holders, recognized as such by their Indigenous community, has been, obtained through literature review and shared directly by Indigenous nations in support of this Project through face-to-face meetings or receipt of Indigenous knowledge reports. The information, some of which is confidential, that has been used to inform this reporting is described in **Table 3-1** below.

## Table 3-1: Indigenous Knowledge

| Valued Component | Indigenous Community | Details | Section Reference |
|---|---|---|---|
| ■ **Air Quality** | ■ Marten Falls First Nation | ■ The location of sensitive receptor types (e.g., dwellings, protected areas, and areas where human activity is likely to occur such as recreation activities). Further discussion on the inclusion of sensitive receptors is described in **Section 4.4.3**. **Figure 7-1** provides a summary of Sensitive Receptor Locations. | ■ Informed multiple sections of this Air Quality study. |

## 3.2 Regulator and Public Stakeholder Input

The Proponent engaged with Regulators and Public Stakeholders with technical knowledge related to the Valued Components in order to inform aspects of this report. The information and how it informed the development of this report are described in **Table 3-2** below.

**Table 3-2: Public, Agency, and Other Input**

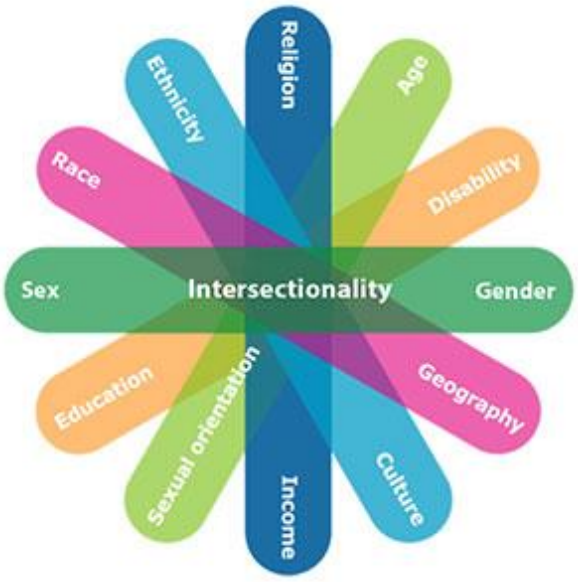
| Valued Component | Provided By | Details | Section Reference |
|---|---|---|---|
| ■ **Air Quality** | ■ Ministry of the Environment, Conservation and Parks;<br>■ Impact Assessment Agency of Canada;<br>■ Health Canada;<br>■ Environment and Climate Change Canada;<br>■ Marten Falls First Nation Community Access Road Project Team;<br>■ The Northern Development and Mines; and<br>■ Natural Resources Canada. | ■ Types of monitoring equipment to be used for monitoring program;<br>■ Compounds to be monitored;<br>■ Approach to estimating existing conditions for compounds that cannot be monitored;<br>■ Location of monitoring equipment in the Marten Falls First Nation community;<br>■ Technical discussion with the Ministry of the Environment, Conservation and Parks regarding general approach of monitoring plan and conformance to the Ministry of the Environment, Conservation and Parks Operations Manual for Air Quality Monitoring (MECP, 2019);<br>■ Discuss comments submitted by the Federal Review Team on the Air Quality study plan;<br>■ Receptor selection;<br>■ Establishment of representative background concentrations;<br>■ Model inputs / model design within the study plan;<br>■ Relevant assessment standards and guidelines;<br>■ Technical challenges with monitoring for polycyclic aromatic hydrocarbons;<br>■ Changes to equipment to be used based on emerging technical (equipment) limitations and cellular network access within the Marten Falls First Nation community; and<br>■ Revised equipment and compounds to be monitored. | ■ **Section 0: Existing Conditions Study Design and Methods; and**<br>■ **Section 4.4: Impact Assessment Methodology.** |

## 3.3 Gender-Based Analysis Plus

The *Impact Assessment Act* of Canada (Government of Canada, 2019) requires Gender-Based Analysis Plus to be applied to Impact Assessments in Canada. Gender-Based Analysis Plus is not a specific set of methods for Impact Assessments, but rather an approach that is adapted to Community Access Road and the communities potentially impacted and / or being engaged.

Gender-Based Analysis Plus is an approach to assessing inequalities and impacts of policies, programs, Projects on diverse groups and identities. These identities could include (but are not limited to): gender, sexual orientation, age, race, ethnicity, class, religion, and mental or physical disability (Women and Gender Equality Canada, 2022). These identities can also intersect or overlap; for example, where an individual identifies as being both Indigenous and an Elder or youth.

**Figure 3-1: Gender-Based Analysis Plus Intersecting Identity Factors**




Source: (Canadian institutes of Health Research, 2022)

The Gender-Based Analysis Plus approach involves understanding how certain vulnerable groups such as Indigenous peoples, women, Elders, youth, and could Two-Spirit, Lesbian, Gay, Bisexual, Transgender, Queer, Questioning, Intersex, and Asexual persons experience, and could be disproportionately impacted by a Project. Understanding how these groups could be affected by Projects allow for more targeted, sensitive, and appropriate enhancement measures, mitigations, monitoring, and follow-up (Impact Assessment Agency of Canada, 2021).

It is important to understand that vulnerability in impact assessment is understood primarily, but not solely, as a structural vulnerability. This means that in many cases it is the systems and power structures that make certain groups more vulnerable (Impact Assessment Agency of Canada, 2021). For Indigenous peoples this includes historic and ongoing colonialism, loss of lands and culture, intergenerational trauma, and the residential school system that have resulted in significant social, economic, health and well-being disparities relative to the non-Indigenous Canadian population (Kim, 2019). Exceptions to this are where vulnerability may be associated with biological sex, pregnancy, or age in relation to environmental determinants of health and exposure to contaminants, for example.

For each discipline of the Impact Assessment, a Gender-Based Analysis Plus approach was employed. This approach and extent of its application also varied, however, depending on the type of study, and the relevance of Gender-Based Analysis Plus to that study. The details of the approach for the discipline are outlined below.

### 3.3.1 Air Quality Gender-Based Analysis Plus Approach

The Gender-Based Analysis Plus approach for the Air Quality study involved a more limited, but still important application of Gender-Based Analysis Plus. This approach varied from the Gender-Based Analysis Plus approach in other disciplines, for example, within the socio-economic disciplines, in that it primarily involved identifying how vulnerable groups that could be disproportionately impacted by Community Access Road informed the study which included:

- Weaving Project specific Indigenous Knowledge from Indigenous Elders that has been provided, verified, and made available through the Indigenous Knowledge program into the Air Quality Assessment (see **Section 3.1**); and
- Identifying and including interests and concerns specific to this study through the Consultation and Engagement program from groups who could be more vulnerable to, and disproportionately impacted by Community Access Road which include Indigenous communities (see **Section 3.3**).

# 4. Study Methods and Assessment Scope

This section contains excerpts from the Draft Community Access Road: Air Quality and Greenhouse Gas Study Plan (Dillon, 2021) prepared for the Impact Assessment Agency of Canada at the outset of this Project. The original Draft Study Plan and Workplan, including comments from regulators can be found in **Attachment A**. In some instances, the approach to this study deviated from what was described in the original Draft Study Plan, these deviations are outlined in **Section 4.6 – Table 4-19**. General changes such as changes to section headings, organization of sections and subsections and, changes to phrasing and tense have been made throughout. These administrative changes have not been documented in **Table 4-19**.

## 4.1 Study and Work Plan Purpose and Objectives

As required by the *Impact Assessment Act* (Government of Canada, 2019) and referenced in the *Tailored Impact Statement Guidelines* (Impact Assessment Agency of Canada, 2020), Study Plans and Work Plans were developed for disciplines as required. The purpose of the Study Plan is to explain:

- An Existing Conditions study methodology that will result in a comprehensive description of the existing environment potentially impacted by Community Access Road;
- The process for ensuring efficient and transparent data management and analysis was completed; and
- Developing the discipline specific Impact Assessment methodology.

Work Plans included details on how to action the study plans; containing information such as location of sampling sites, scheduling, and sequencing.

As noted above the Draft Community Access Road: Air Quality and Greenhouse Gas Study Plan (Dillon, 2021) can be found in **Attachment A**.

## 4.2 Study Scoping

### 4.2.1 Temporal Boundaries

Project phases, which are temporal boundaries, are developed to establish the timeframes within which potential effects of Community Access Road will be considered. Community Access Road is planned to occur in three phases, which are briefly described below.

- **Construction Phase:** The time from start of construction, including site preparation activities, to the start of operations of the Marten Falls First Nation Community Access Road. Decommissioning of construction works is included in the construction phase. The construction phase is anticipated to take approximately three to ten years to complete;
- **Operations Phase:** The operations phase starts once construction activities are complete and lasts for the life of Community Access Road. The operations phase of Community Access Road is considered to be permanent based on the expected timeline for when major refurbishment of road components (e.g., bridges), is anticipated; and
- **Decommissioning Phase:** There are currently no plans to decommission the Marten Falls First Nation Community Access Road as there is no expected / known end date for its need. Therefore, future suspension, decommissioning, and eventual abandonment will not be considered in this report. It will be considered if and when a decommissioning or abandonment application is made for the road.

### 4.2.2 Valued Components and Indicators

The Agency describes **Valued Components** as the environmental, health, social, economic, or additional elements or conditions of the natural and human environment that may be impacted by a proposed Project and area of concern or value to the public, Indigenous peoples, federal authorities and interested parties (Impact Assessment Agency of Canada, 2021).

**Indicators** represent the resource, feature, or issue related to the Valued Component that, if changed, may demonstrate an effect on the environment. Indicators may be characterized quantitatively or qualitatively. For example, effects from changes to the availability and distribution of Valued Components are often expressed through quantitative assessment of direct vegetation removals as well as predicted indirect effects on retained vegetation.

The Draft Study Plan presented indicators and rationale for selection known to the Proponent at the time of drafting. The draft table and the factors that influenced it can be found in Section 9.2 of the Draft Community Access Road: Air Quality and Greenhouse Gas Study Plan (Dillon, 2021) in **Attachment A**.

An updated list of Air Quality Assessment Indicators can be found in **Table 4-1** below.

**Table 4-1: Air Quality Indicators**

| Valued Component | Indicators | Rationale for Selection | Measures of Change |
|---|---|---|---|
| **Air Quality** | Change in concentration of Air Contaminants:<br>■ $NO_2$;<br>■ CO;<br>■ $SO_2$;<br>■ Total Suspended Particulate;<br>■ $PM_{10}$;<br>■ $PM_{2.5}$;<br>■ Selected Volatile Organic Compounds (acrolein, acetaldehyde, benzene, formaldehyde, 1,3-butadiene, toluene, ethylbenzene, and xylene); and<br>■ Polycyclic aromatic hydrocarbons (benzo(a)pyrene). | The contaminants chosen for the indicators are based on those commonly associated with transportation and construction activities, as prescribed by the Ontario Ministry of Transportation (MTO, 2020). | Predicted air quality concentrations |

## 4.2.3 Spatial Boundaries

### Project Study Areas

Study areas identify the geographic extents within which potential effects of Community Access Road are likely to occur and will be considered in the Environmental Assessment / Impact Statement Report. General Project boundaries were established for the scoping of field programs, and to delineate study areas for discipline specific surveys. These general Project boundaries are described in **Table 4-2** below:

**Table 4-2: Project Study Areas Definition and Description**

| Study Area | Definition | Description |
|---|---|---|
| **Construction Disturbance Area** | ■ Area of expected direct disturbance | ■ 100 m wide Community Access Road right-of-way, temporary construction access roads, work areas, worker camps, and pits, quarries and associated access roads. |
| **Project Study Area** | ■ The area where most of the direct effects of Community Access Road are likely to occur | ■ The area within 2.5 km (total of 5 km) of the centreline of the route alternatives. |

## Air Quality Study Areas

Discipline-specific Local Study Areas and Regional Study Areas have been defined for Community Access Road. In defining these areas, the following was considered:

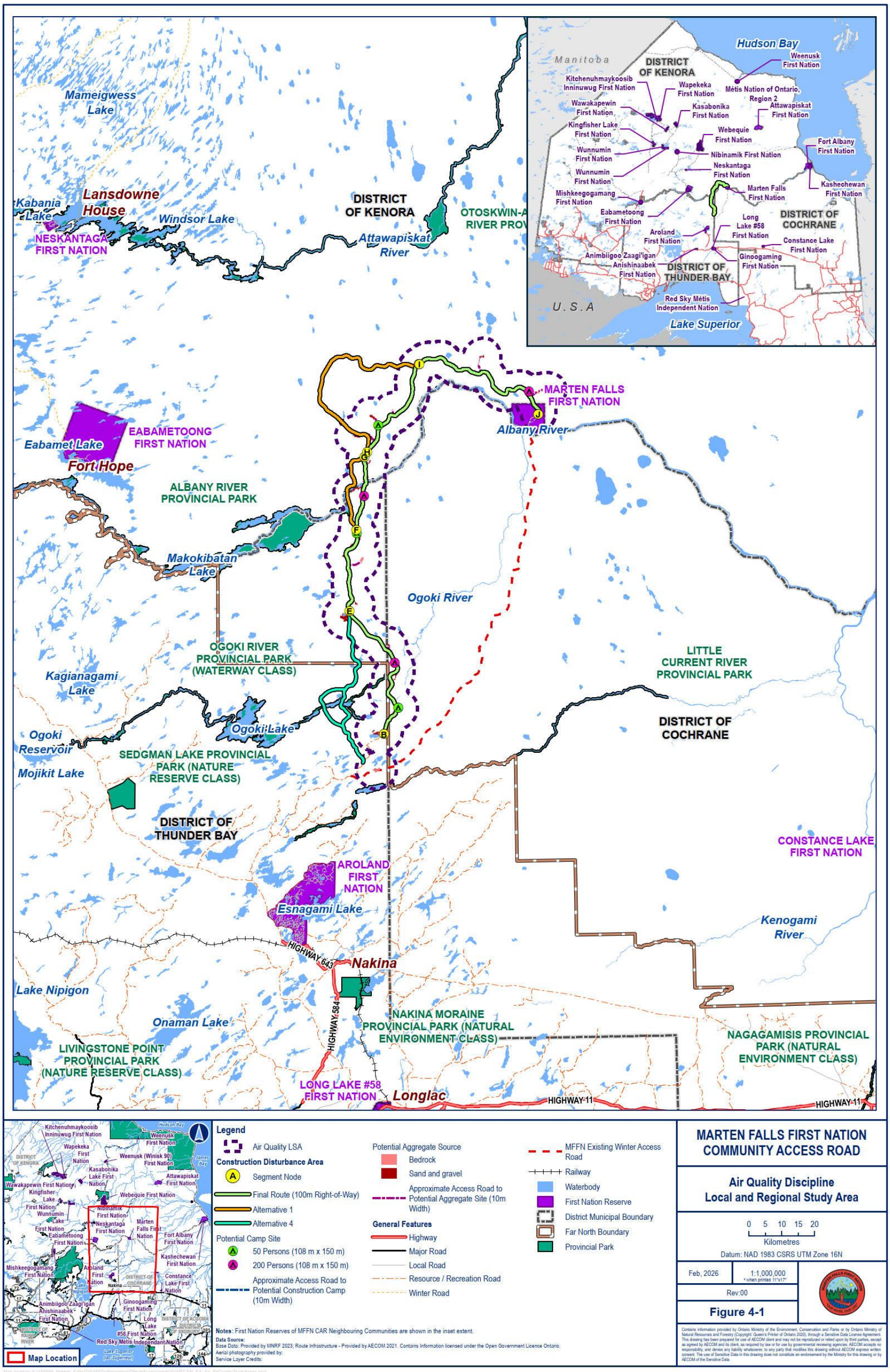
- Location and other characteristics of the discipline relative to Community Access Road;
- The anticipated extent of the potential Project effects;
- Federal, provincial, regional, and local government administrative boundaries;
- Input from Indigenous Communities;
- Community knowledge and Indigenous Knowledge;
- Current or traditional land and resource use by Indigenous communities;
- Exercise of Aboriginal and Treaty Rights of Indigenous peoples, including cultural and spiritual practices; and
- Physical, ecological, technical, social, health, economic, and cultural considerations.

The Local and Regional Study Areas for this Air Quality study and the rationale for their selection are described in **Table 4-3** and shown in **Figure 4-1**.

### Table 4-3: Discipline Specific Study Areas Description and Rationale

| Study Area | Geographic Extent | Rationale |
|---|---|---|
| **Local Study Area** | ■ Air Quality: Construction Disturbance Area plus a 5 km buffer that extends from the perimeter of the Construction Disturbance Area | ■ Air Quality: A local study area has been selected to align with the Ontario Ministry of the Environment, Conservation and Parks recommendations for local dispersion modelling, which is that effects be assessed up to 5 km from a source (MECP, 2019). |
| **Regional Study Area** | ■ Air Quality: Not applicable | ■ Air Quality: Not Applicable as effects are not expected beyond the Local Study Area. |

## Figure 4-1: Discipline Local and Regional Study Area



The study areas included in this document cover the extent to which readily available information suggests Community Access Road may have noticeable effects on the environment. The size, nature, and location of past, present, and reasonably foreseeable Projects will be taken into consideration in the development of the cumulative effects assessment study area(s) and are further discussed in **Section 8**.

### 4.2.4 Tailored Impact Statement Guidelines Requirements Mitigation and Enhancement Measures and Terms of Reference Requirements

The Tailored Impact Statement Guidelines (Impact Assessment Agency of Canada, 2020) Section 20 requirements and Terms of Reference Requirements (AECOM Canada ULC, 2020) for the Air Quality study are provided below. The applicability of these requirements has been evaluated and will be adapted to the needs of the site, environment, and Project activities.

**Table 4-4: Tailored Impact Statement Guidelines Section 20 Requirements and Terms of Reference Requirements**

| TISG Requirement Section 20 Requirement | Section Addressed In |
|---|---|
| ■ **Describe mitigation measures that are specific to each environmental, health, social, or economic effect identified.** | ■ **Section 7.1.2** and **Section 7.2.2** |
| **Terms of Reference Requirement** | **Section Addressed In** |
| ■ **The Project will undertake an atmospheric environment field program to better understand the existing local and regional air quality.** | ■ **Section 5** |

## 4.3 Existing Conditions Study Design and Methods

### 4.3.1 Desktop Assessment Methodology

A desktop review of existing information sources was completed to identify information gaps that needed to be addressed through further study. A preliminary list of applicable information sources including federal and provincial guidance was reviewed in development of this approach.

### 4.3.2 Field Investigations Methodology

To characterize existing Air Quality within the Local Study Area a field monitoring program was deployed. One year of ambient air quality data (May 2021 to May 2022) was collected within the Community to characterize existing air quality.

A detailed Ambient Air Monitoring Plan (the Monitoring Plan) was submitted to the Ontario Ministry of the Environment, Conservation and Parks which contained specific details related to the program's deployment. The Monitoring Plan is included within **Attachment A** of this Report. The Monitoring Plan was developed with consideration of the Ontario Ministry of the Environment, Conservation and Parks Operations Manual for Air Quality Monitoring in Ontario (Ontario Ministry of the Environment, Conservation and Parks Manual) as well as the data requirements of the air quality study to be completed.

Within the Local Study Area, the Community of Marten Falls First Nation is the primary area of human settlement and is the only location with sufficient power and serviceability access to support air quality monitoring equipment.

Concentrations within Marten Falls First Nation are expected to be elevated in comparison with the remainder of the Local Study Area due to the presence of sustained human activity (e.g., power generation, Ogoki Post Airport). Therefore, using background data collected from within Marten Falls First Nation is expected to result in a conservative characterization of existing conditions across the Local Study Area.

The intention of the air quality assessment is to provide a reasonable worst-case estimate of the changes in air quality as a result of Community Access Road. The air quality assessment will add background concentrations to the predicted Project emissions to determine air quality within the Local Study Area to provide a conservative air quality assessment.Ambient air quality monitoring equipment was deployed in the Community of Marten Falls First Nation to monitor particulate matter ($PM_{2.5}$), ozone, nitrogen oxides ($NO_2$), sulphur dioxide ($SO_2$), and benzene, toluene, ethylbenzene, and xylene as well as meteorological parameters (wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation). Some of these indicator compounds were monitored non-continuously (i.e., not on an hourly basis), based on equipment limitations. Meteorological parameters that are not utilized in dispersion modelling (e.g., pan evaporation, extreme weather events) were not monitored. The ambient air quality monitoring equipment was deployed for up to one year to address seasonal variations in existing concentration.

Total Suspended Particulate was determined from the measured $PM_{2.5}$ and $PM_{10}$ data. As $PM_{2.5}$ is a size fraction subset of $PM_{10}$, and $PM_{10}$ is a size fraction subset of Total Suspended Particulate, the $PM_{10}$ and Total Suspended Particulate background

concentrations can be estimated based on a ratio of the measured $PM_{2.5}$. A literature review has been completed to gather representative particulate ratios that are reflective of the study area. This literature review included an analysis of historical data collected at representative monitoring stations such as those included within the Environment and Climate Change Canada National Air Pollution Surveillance Program, and a review of United States Environmental Protection Agency studies and supporting documentation.

$PM_{2.5}$ was also used as surrogates for aromatic hydrocarbons and diesel particulate matter which cannot be sampled due to equipment limitations coupled with serviceability challenges given the remote location of the Community.

Concentrations of acetaldehyde, formaldehyde, 1,3-butadiene, and acrolein will be estimated based on monitored benzene, toluene, ethylbenzene, and xylenes concentrations and published emission factors, such as the United States Environmental Protection Agency's AP-42 emissions database.

Diesel Particulate Matter emissions from Community Access Road will be included for discussion in the air quality assessment. Due to the technical limitations of measuring Diesel Particulate Matter in the Community, background concentrations were conservatively estimated. Ambient concentrations of Diesel Particulate Matter were estimated to be 8% of ambient $PM_{2.5}$ concentrations (i.e., assumed that 8% of monitored particulate matter is Diesel Particulate Matter). This assumption is based on the California Air Resource Board's Overview of Diesel Exhaust & Health (CARB, 2026) which states that California's statewide average DPM comprises about 8% of outdoor $PM_{2.5}$. It is expected given the remote location of Community Access Road and current absence of sources of Diesel Particulate Matter this estimation method is conservative and likely overestimating actual ambient Diesel Particulate Matter levels.

Carbon monoxide sensors were not included in the monitoring trailer setup. As such background carbon monoxide ambient monitoring data was collected from remote Environment and Climate Change Canada's National Air Pollution Surveillance data sets.

### Field Survey Site Selection

An enclosed trailer equipped with air monitoring and meteorological equipment was installed within Marten Falls First Nation behind the Community's nursing station (geographic coordinates: 51.638645°, -85.929023°).

The ambient air quality monitoring equipment was located near the Community's nursing station. Attempts were made to adhere to station and probe siting criteria documented in the Ministry of the Environment, Conservation and Parks' Operations Manual for Air Quality Monitoring in Ontario (Ministry of the Environment, Conservation and Parks, 2023) (hereafter referred to as the Ministry of the Environment, Conservation and Parks Manual),

however due to the location of Community Access Road, and limited power supply options, it was not possible to meet all the criteria. Specifically, the Ministry of the Environment, Conservation and Parks Manual indicates that meteorological parameters are recommended to be taken from a height of 10 m. The monitoring station was installed at a maximum feasible tower height of 4.8 m to minimize wind interference from nearby trees and buildings. The satellite image below shows the size of land cleared surrounding the station. **Figure 4-2** shows the location of the monitoring station.

The results were statistically summarized based on the averaging period of the applicable standards and criteria. The Canadian Council of Ministers of the Environment Canadian Ambient Air Quality Standards (Canadian Council of Ministers of the Environment, 2023) and Ministry of the Environment, Conservation and Parks Ambient Air Quality Criteria (Ministry of the Environment, Conservation and Parks, 2023) were considered in this assessment.

**Figure 4-2: Air Monitoring Station Location**



### Existing Sources

The major existing operations within the Local Study Area which influence the existing air quality include the Marten Falls diesel generating station, the Ogoki Post Airport, and Community uses. The Marten Falls diesel generating station is located approximately 75 m to the southwest of the monitoring station, as shown in **Figure 4-2**. Due to the close proximity of the diesel generating station to the monitoring station there is potential that the monitoring program may be influenced by the operation of the station. As previously discussed, this location was selected due to technical limitations and requirements of the monitoring equipment. The average annual diesel consumptions between 2019 and 2021 at the generating station was about 787,000 Litres. Fuel combustions at the above existing sources are expected to generate air contaminants such as particulates (including Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$, and Diesel Particulate Matter), oxides of nitrogen, carbon monoxide, benzene, toluene, ethylbenzene, and xylenes, and polycyclic aromatic hydrocarbons.

The Marten Falls Community residential area is located 200 m to the south of the monitoring station. Human activities within Marten Falls First Nation such as wood burning, residential heating, and vehicle use are expected to impact existing air quality conditions. In addition, the Marten Falls First Nation Ogoki Post Airport is located approximately 2.5 km to the northeast of the monitoring station. The emissions from fuel combustions due to aircraft landing and takeoff operations would be expected to impact existing air quality measured at the monitoring station.

The concentrations measured at the monitoring station are expected to be elevated in comparison with the remainder of the Local Study Area due to the presence of the existing sources as described above. Therefore, using the monitoring data collected from the station is anticipated to result in a conservative characterization of existing air quality conditions.

### Monitoring Instrument

The air monitoring station contains multiple analyzer units and modules. **Table 4-5** provides a summary of the methods and instruments used to analyze each compound:

**Table 4-5: Analyzer Summary**

| Compound | Monitoring instrument or Method | Sample Frequency |
|---|---|---|
| **Particulate Matter ($PM_{2.5}$ and $PM_{10}$)[1]** | Nephelometry | Continuous |
| **Ozone ($O_3$)** | UV absorption (EN 14625) | Continuous |

| Compound | Monitoring instrument or Method | Sample Frequency |
|---|---|---|
| **Nitrogen Oxides ($NO_2$)** | Chemiluminescence (EN14211) | Continuous |
| **Sulphur Dioxide ($SO_2$)** | UV fluorescence (EN14212) | Continuous |
| **BTEX (benzene, toluene, ethylbenzene, and xylene)** | Canister Method TO-15, GC/MS | Discrete Sample (six-day frequency) |

**Notes:**

[1] The air monitoring station is equipped with a $PM_{2.5}$ and $PM_{10}$ sensor, other particulate matter size fractions (i.e., Total Suspended Particulate) have been calculated from $PM_{2.5}$ and $PM_{10}$ results.

### Processing of Monitoring Results

Following the monitoring program, a desktop analysis of the collected data was completed to characterize existing ambient air quality. Monitoring data was summarized based on averaging periods and statistical methods specific to each indicator compounds as indicated in Ministry of the Environment, Conservation and Parks guidelines and criteria. Data was also statistically processed following the Canadian Council of Ministers of the Environment Standards where applicable. In the cases where monitoring data was not collected (i.e., Total Suspended Particulate / $PM_{10}$, select Volatile Organic Compounds, polycyclic aromatic hydrocarbons, Diesel Particulate Matter, and Carbon Monoxide) monitored data was scaled to develop existing values. The following sections provide an overview of methods used to develop background ambient data for these indicator compounds.

Particulate Matter

As the monitoring equipment deployed did not include a sensor for Total Suspended Particulate, existing Total Suspended Particulate concentrations were estimated based on $PM_{2.5}$ results. $PM_{2.5}$ is a size fraction subset of Total Suspended Particulate, and as such, existing concentrations of Total Suspended Particulate were estimated by applying a $PM_{2.5}$ / Total Suspended Particulate ratio of 0.3 as shown below (Lall, et al, 2024):

$$PM_{2.5\text{concentration}} / 0.3 = TSP_{\text{ concentration}}$$

Volatile Organic Compounds, Polycyclic Aromatic Hydrocarbons, and Diesel Particulate Matter

Select volatile organic compounds, polycyclic aromatic hydrocarbons, and diesel particulate matter were not sampled due to equipment limitations coupled with serviceability challenges given the remote location of Marten Falls First Nation. Monitored

benzene, toluene, ethylbenzene, and xylene concentrations were used to estimate concentrations of other relevant volatile organic compounds including acetaldehyde, formaldehyde, 1,3- butadiene, and acrolein.

Emission ratios presented in the United States Environmental Protection Agency Speciate database were considered in these estimates. Hydrocarbon to benzene, toluene, ethylbenzene, and xylene ratios were developed by taking the average ratio for each specific compound from the United States Environmental Protection Agency Speciate emission profiles listed in **Table 4-6**. The following emission profiles were selected as they represent typical activities and fuel sources found within the Community:

- Residential oil boilers;
- Diesel exhaust – light duty truck operated at 0.50C (composite);
- Gasoline exhaust – E-10 gasoline at 10C, US06 cycle; and
- Aircraft landing / takeoff (LTO) – commercial.

**Table 4-6: SPECIATE Profile Ratios**

| Volatile Organic Compounds | Ratio to Benzene | Ratio to Toluene | Ratio to Ethylbenzene |
|---|---|---|---|
| **Acetaldehyde** | 1.64 | 4.50 | 15.87 |
| **Formaldehyde** | 5.36 | 15.25 | 49.11 |
| **1,3-Butadiene** | 0.35 | 1.26 | 3.83 |
| **Acrolein** | 0.53 | 1.73 | 5.61 |

To develop existing concentrations for volatile organic compounds not measured during the monitoring program, the calculated ratios presented in **Table 4-6** were multiplied by the measured concentration of the benzene, toluene, and ethylbenzene compound which resulted in the highest overall concentration. Ethylbenzene ratios resulted in the highest calculated existing concentrations of each volatile organic compound, as such the average ratios for ethylbenzene from the four profiles listed in **Table 4-6** were selected to estimate existing concentrations of acetaldehyde, formaldehyde, 1,3- butadiene, and acrolein. A sample calculation for 1,3-butadiene is provided below:

$$1{,}3-butadiene\ (24hr\ concentration) = [Ethylbenzene\ (24hr\ concentration)\ x\ Ratio\ to\ Ethylbenzene]$$

$= [0.65\ \mu g/m^3\ x\ 3.8] = 2.5\ \mu g/m^3$ .

Polycyclic aromatic hydrocarbons were considered as part of the Air Quality Assessment. Benzo(a)pyrene was selected as a surrogate for polycyclic aromatic hydrocarbons. Due to the technical limitations of measuring benzo(a)pyrene, monitoring was not included within

the existing monitoring. A review of stations monitoring benzo(a)pyrene was completed of the Environment and Climate Change Canada's National Air Pollution Surveillance datasets (Environment and Climate Change Canada, 2023). Preference was given to rural and suburban stations, which are less affected by urban sources (e.g., industries and heavy road traffic) and would therefore be more representative of the study area. Data from the following station was used to represent benzo(a)pyrene air quality levels within the LSA:

- Simcoe – Ontario (National Air Pollution Surveillance Station ID: 62601).

Due to technical limitations of measuring diesel particulate matter within the Marten Falls First Nation community, background diesel particulate matter was not monitored during the existing program. As nearly all diesel particulates (> 90%) have sizes of significantly less than 1 µm (California Air Resources Board, 2023), it is appropriate to assume the $PM_{2.5}$ from diesel engine combustion equals diesel particulate matter. Diesel Particulate Matter is ultrafine particulate matter that results from the combustion of diesel. Diesel Particulate Matter is primarily made up of soot particles, carbon, ash, polycyclic aromatic hydrocarbons, metallic abrasion particles, sulfates, and silicates[1]. Diesel Particulate Matter emissions are expected to be released during both construction and operations phases of Community Access Road. The majority of heavy construction equipment or heavy mobile equipment is powered by diesel fuel. To estimate Diesel Particulate Matter emissions for both construction and operations scenarios tailpipe emissions of $PM_{2.5}$ were used to represent Diesel Particulate Matter. This methodology provides a conservative emission rate estimate.

It should also be noted that diesel particulate matter is not an indicator compound for the Air Quality Impact assessment. An assessment of diesel particulate matter was included for the purpose of informing the Community Well-Being Technical Support Document: Existing Conditions & Effects Assessment (Appendix T of the Marten Falls Environmental Assessment / Impact Statement) (Community Well-Being Assessment).

Carbon Monoxide

Carbon monoxide sensors were not included in the monitoring trailer setup. As such background carbon monoxide ambient monitoring data was collected from remote Environment and Climate Change Canada's National Air Pollution Surveillance data sets. The following stations were selected as they were considered most representative of the Marten Falls First Nation Community location:

[1] Canadian Centre for Occupational Heath and Safety. 2024. https://www.ccohs.ca/oshanswers/chemicals/diesel_exhaust.html

- Fort Smith – Northwest Territories (National Air Pollution Surveillance Station ID: 129601); and
- Inuvik – Northwest Territories (National Air Pollution Surveillance Station ID: 129203).

The maximum 1-hour and 8-hour averages were selected to represent a conservative carbon monoxide existing ambient air quality condition.

Ozone

Ozone ($O_3$) is not a primary contaminant related to Community Access Road and therefore the data is not presented or used for a cumulative assessment. Ground-level ozone is typically formed many kilometres downwind of the source of its precursors and concentrations are usually depressed around highways since nitrogen oxide emissions react relatively rapidly to convert ozone into oxygen gas (Ontario Ministry of Transportation, 2020). Considering Community Access Roaded roadway volumes for Community Access Road, (i.e., Annual Average Daily Traffic amount of up to 1,000), ozone formation is expected to be negligible.

### Ambient Air Quality Standards

**Table 4-7** identifies the ambient air quality criteria considered for the Local Study Area. The Ontario Ambient Air Quality Criteria developed by the ministry (Ministry of the Environment, Conservation and Parks, 2020) are the applicable criteria to characterize ambient air quality. Federally, the Canadian Council of Ministers of the Environment has set Canadian Ambient Air Quality Standards that were developed as ambient air quality targets. The applicable Ambient Air Quality Criteria and Canadian Ambient Air Quality Standards are provided in **Table 4-7**.The most stringent criteria, standards, or guidelines for each averaging period are used throughout the assessment.

## Table 4-7: Ambient Air Quality Standards

| Indicator Compound | CAS # | Averaging Period (hour) | Criteria (µg/m$^3$) | Guideline |
|---|---|---|---|---|
| **$NO_2$** | 10102-44-0 | 1 hr | 400 | Ontario AAQC |
| | | | *79* | CAAQS (2025) |
| | | 24 hr | 200 | Ontario AAQC |
| | | Annual | *22.6* | CAAQS (2025) |
| **$PM_{2.5}$** | – | 24 hr | 27 | Ontario AAQC |
| | | Annual | 8.8 | CAAQS (2020) |
| | | | 8.8 | Ontario AAQC |
| **$PM_{10}$** | – | 24 hr | 50 | Ontario AAQC |
| **Total Suspended Particulate** | – | 24 hr | 120 | Ontario AAQC |
| | | Annual | 60 | Ontario AAQC |
| **$SO_2$** | 7446-09-05 | 10min | 178 | Ontario AAQC |
| | | 1 hr | 100 | Ontario AAQC |
| | | | *170* | CAAQS (2025) |
| | | Annual | 10 | Ontario AAQC |
| | | | *10* | CAAQS (2025) |
| **CO** | 630-08-0 | 1 hr | 36,200 | Ontario AAQC |
| | | 8 hr | 15,700 | Ontario AAQC |
| **Acrolein** | 107-02-8 | 1 hr | 4.5 | Ontario AAQC |
| | | 24 hr | 0.4 | Ontario AAQC |
| **Acetaldehyde** | 75-07-0 | 0.5 hr | 500 | Ontario AAQC |
| | | 24 hr | 500 | Ontario AAQC |
| **Benzene** | 71-43-2 | 24 hr | 2.3 | Ontario AAQC |
| | | Annual | 0.45 | Ontario AAQC |
| **Formaldehyde** | 50-00-0 | 24 hr | 65 | Ontario AAQC |
| **1,3 Butadiene** | 106-99-0 | 24 hr | 10 | Ontario AAQC |
| | | Annual | 2 | Ontario AAQC |
| **Toluene** | 108-88-3 | 24 hr | 2,000 | Ontario AAQC |
| **Ethylbenzene** | 100-41-4 | 10 min | 1,900 | Ontario AAQC |
| | | 24 hr | 1,000 | Ontario AAQC |
| **Xylene** | 1330-20-7 | 24 hr | 730 | Ontario AAQC |
| **Benzo(a)pyrene** | 50-32-8 | 24 hr | 0.00005 | Ontario AAQC |
| | | Annual | 0.00001 | Ontario AAQC |

1. $NO_2$ Canadian Ambient Air Quality Standards 1-hour averaging based on a 3-year average of the annual 98$^{th}$ percentile of the daily maximum 1-hour average concentrations
2. $PM_{2.5}$ Canadian Ambient Air Quality Standards 24-hour averaging based on the 24-hour 98$^{th}$ percentile ambient measurement annually, averaged over 3 consecutive years
3. $PM_{2.5}$ Canadian Ambient Air Quality Standards annual averaging based on a 3-year average of the annual 98$^{th}$ percentile of the daily 24-hour average concentrations
4. $SO_2$ Canadian Ambient Air Quality Standards 1-hour averaging based on a 3-year average of the annual 99$^{th}$ percentile of the $SO_2$ daily maximum 1-hour average concentrations
5. CO values based on the maximum 90$^{th}$ percentile of data obtained from the following Environment Canada National Air Pollution Surveillance stations (Hope Airport, Fort Smith, Inuvik)
6. Acrolein, Acetaldehyde, Formaldehyde and 1,3 Butadiene values are based on an Ethylbenzene ratio of United States Environmental Protection Agency Speciate Emission Profiles
7. 1,3 Butadiene annual value is based on a ratio of Benzene from the United States Environmental Protection Agency SPECIATE Emission Profile
8. Italic values indicate that guideline values were reported in ppb/ppm values were converted to µg/m3 for comparison purposes
9. Ontario AAQC = Ontario Ambient Air Quality Criteria
10. CAAQS = Canadian Ambient Air Quality Standards

## 4.4 Impact Assessment Methodology

The following is a high-level overview of the approach for the identification, assessment, and evaluation of the potential effects:

- Review construction and operations activities to identify potential interaction(s) that could result in environmental effects;
- Characterize the existing environment for both route alternatives;
- Identify potential environmental effects of the Preferred Route and recommend mitigation measures to avoid or minimize identified effects, as well as identify opportunities to enhance benefits to the environment;
- Predict and assess potential environmental effects remaining after taking into consideration the recommended mitigation measures (i.e., residual effects) using direction, magnitude, geographic extent, duration, frequency, reversibility, and likelihood;
- Predict cumulative effects that may result from a combination of the residual effects of the Preferred Route with the effects of other past, present, and reasonably foreseeable Projects; and
- Identify a follow-up program for the Preferred Route that includes monitoring to verify the prediction of the impact assessment and effectiveness of the mitigation measures, and a requirement for monitoring of the commitments made in the Terms of Reference and Environmental Assessment / Impact Statement Report.

The following sections provide discipline-specific input and considerations as they pertain to the methodology for impact assessment. For detailed descriptions of the methodology used to inform this study refer to the Environmental Assessment / Impact Statement Report. Refer to **Section 6** for details related to the Preferred Route, including revised Study Areas which have been used in the Impact Assessment.

### 4.4.1 Project-Environment-Interactions

Community Access Road activities that may result in changes to the environment are described within the identified temporal and spatial boundaries (**Section 4.2**). This includes identification of both direct and indirect changes to the environment by comparing the existing condition to the effects anticipated to occur as a result of Community Access Road. The likely Project-environment interactions were identified based on professional judgment, activities planned to occur, as described in the Marten Falls Community Access Road Project Tailored Impact Statement Guidelines (Impact Assessment Agency of Canada, 2020) as well as Projects of similar magnitude and / or location.

An analysis of Project-environment interactions for Air Quality that are likely to have a potential effect is provided in **Table 4-8**.

**Table 4-8: Project – Environment Interactions**

| Project Phases | Project Activities | Air Quality |
|---|---|---|
| **Construction Phase** | Mobilization of Equipment and Supplies | X |
| | Temporary Construction Staging Areas | X |
| | Temporary Access Roads and Trails | X |
| | Temporary Construction Camps | X |
| | Right-of-Way Clearing and Grubbing | X |
| | Brush and Timber Disposal | X |
| | Pits and Quarries | X |
| | Temporary Concrete Batch Plants | X |
| | Drilling / Blasting / Aggregate Production | X |
| | Road Construction (stripping, subgrade excavation, embankment fill placement, grading, ditching) | X |
| | Bridge and Culvert Installation (approach embankments, foundations, substructures, superstructures, traffic protection, erosion controls) | X |
| | Construction Site Restoration | X |
| **Construction Phase: Decommissioning** | Pits and Quarries | X |
| | Temporary Camps, Roads / Trails, and Staging Areas | X |
| **Operations Phase** | Road Usage | X |
| | Maintenance | X |

## 4.4.2 Potential Effects

Following the identification of Community Access Road-Environment Interactions noted in **Table 4-8** above, a comparative analysis of the existing conditions for the Preferred Route has been conducted to determine the potential effects of Community Access Road. The potential effects are described as either direct or indirect. Following the identification of direct and indirect effects, residual effects are described. Residual effects were then carried forward into the Cumulative Impact Assessment, which is described in **Section 8**.

A **direct effect** is an immediate change to an environmental component caused by a project activity at the same time and place as the activity.

An **indirect effect** occurs when a change resulting from a project activity leads to subsequent changes in other environmental component, which may occur later in time or at a different location but are reasonably foreseeable. **Table 4-9** provides a preliminary

identification of how changes to Air Quality may result in indirect effects to other environmental disciplines.

**Residual effects** are the effects that remain after the application of mitigation measures. These effects are described in **Section 7** and include descriptions in detail of the potential adverse and positive residual effects in relation to each temporal phase of Community Access Road as outlined in **Section 4.2.3**.

Changes occurring in the following disciplines may result in a change to the Atmospheric Environment: Vegetation, Social, and Land and Resource Use. Details are provided below that provide some examples of potential changes that may occur.

### Social

- Changes in housing and accommodation types may result in changes in fuel consumption (heating fuel, wood burning), this can result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases;
- Changes in community services and infrastructure may result in changes in energy input method and consumption (switch from heating fuel to electricity), this can result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases;
- Changes in transportation mode (vehicle type) and volume (traffic loading) will result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases; and
- Changes in population and demographics can result in either an increase or decrease in fuel usage for transportation, heating, and community services. This change in fuel usage may result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases.

### Land and Resource Use

- Changes in land use compatibility, parks and protected areas, local industries, and linear infrastructure may have an effect on emission sources and quantities that may result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases;
- Changes to linear infrastructure may result in changes in fuel type and usage quantities that may result in either an increase or decrease in community emissions of indicator compounds and greenhouse gases; and
- Changes in recreation and tourism quantities can affect traffic loading and energy consumption within the Marten Falls First Nation community and may result in either an

increase or decrease in community emissions of indicator compounds and greenhouse gases.

## Table 4-9: Potential Discipline In-Direct Interactions

| Valued Component - Effect | Aboriginal Treaty Rights and Interests | Atmospheric Environment | Climate Change Adaptation | Acoustic Environment | Physiology, Terrain and Soils | Surface Water | Groundwater | Vegetation | Wildlife | Fish and Fish Habitat | Social | Economy | Land and Resource Use | Human Health and Community Safety | Visual Aesthetics | Archaeological and Cultural Heritage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atmospheric Environment**<br>■ **Air Quality** | - | | - | - | - | x | - | x | x | - | - | - | - | x | - | - |

## 4.4.3 Methods for Predicting Future Conditions

With respect to quantitative models and predictions, the Environmental Assessment / Impact Statement Report must detail the model assumptions, parameters, the quality of the data, and the degree of certainty of the predictions obtained.

The following subsections describe the methods which were used to predict future conditions associated with the indicators for Community Access Road. In general, the assessment involved quantifying emissions of selected contaminants from Project activities, dispersion modelling to predict effects within the Local Study Area, recommendation of mitigation measures to avoid or minimize identified effects, as well as identifying opportunities to enhance benefits to the environment, and the prediction and assessment of potential environmental effects remaining after taking into consideration the recommended mitigation measures (i.e., residual effects).

### Air Quality Emissions – Construction Phase

Emissions were estimated for the construction phase based on Community Access Roaded types of activity and duration. Anticipated construction activities, such as land clearing, blasting, aggregate extraction, material hauling, road construction, and equipment and vehicle operation were included in the estimate of emissions. Emissions were estimated based on published emission factors, such as those found in the United States Environmental Protection Agency's AP-42 (United States Environmental Protection Agency, 2021), those generated in the most current version of the United States Environmental Protection Agency Motor Vehicle Emissions Simulator (MOVES3) (United States Environmental Protection Agency, 2020), or engineering principles, as applicable. Further details on methods used to generate emission factors using Motor Vehicle Emissions Simulator are described in **Section 4.4.3 – Methods for Predicting Future Conditions**. Specific model inputs used within the Motor Vehicle Emissions Simulator model are provided in **Attachment E – Supporting Information for Calculations – Operations**. Fugitive emissions such as wind erosion from uncovered soil or stockpiles will be estimated based on the size of Community Access Roaded working area. A bounding scenario for construction activities was developed
(i.e., a scenario describing the maximum simultaneous construction activities) and used for the emission calculations.

#### Sources of Emissions

A quantitative assessment of emission rate estimates was performed to identify the worst-case operations scenario based on each indicator compound's specific Ministry of the Environment, Conservation and Parks criteria averaging periods (e.g., 1-hour, 8-hour,

24-hour, annual, etc.). Emissions associated with the construction of the road as well as activities supporting the quarry operations were included.

The following sections describe the sources of emissions and their respective emission rate estimate methodologies.

**Tables A1, A2, and A3 – Source Summary Tables** are included in **Attachment B** and include a list of sources as well as calculated emission rates for all sources used within modelling construction phases of Community Access Road. Emissions rates were calculated for each indicator compound's criteria specific averaging periods.

Tailpipe / Mobile Emissions

Mobile emissions including tailpipe, tire wear, and brake wear were calculated using the United States Environmental Protection Agency Motor Vehicle Emission Simulator. Project specific inputs including meteorology, source types, road type, vehicle type, age distribution, vehicle speeds, and fuel consumption were used in the Motor Vehicle Emission Simulator model. Emission rates for select indicator compounds were generated and used to inform source emissions. A summary of Motor Vehicle Emission Simulator inputs and emission rate outputs is included in **Attachment D – Construction Emission Calculations** for Sources C-1-Q, C-1-R, C-1-B, and C-1-A.

Emissions from this source include: $NO_2$, CO, $SO_2$, Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$), volatile organic compounds, benzene, toluene, ethylbenzene, and xylenes, Diesel Particulate Matter, and polycyclic aromatic hydrocarbons.

Drilling

Blast hole drilling operations occur at both the quarries and roadway. Drilling is required in advance of blasting operations to allow explosives to be loaded into aggregate material for grading and aggregate extraction purposes. Assumptions as well as specific parameters used in the emission calculations are described in **Attachment D – Construction Emission Calculations** for Source IDs C-2-Q and C-2-R. Please note that drilling operation emission estimates differ between the quarry and the right-of-way due to their specific blasting requirements.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Blasting

All quarries located within the Construction Disturbance Area will include blasting and explosive detonations during each year of road development. Blasting operations also

occur on the right-of-way. Emission calculations and assumptions for blasting are described in **Attachment D – Construction Emission Calculations** for Source IDs C-3-Q and C-3-R. Please note that emission estimates for blasting operations differ between the quarry and the right-of-way due to their specific blasting requirements.

Emissions from this source include: $NO_2$, CO, $SO_2$, and Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Crushing

Crushing of aggregate material occurs at the right-of-way. Emission rates were based on information provided by Community Access Road engineering team. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source ID C-4-R.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Bulldozing

Bulldozing of aggregate and surface material is expected to occur at the right-of-way. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source ID C-5-R.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Material Handling

Material handling includes the loading and unloading of material at both the quarry and right-of-way. Following blasting operations aggregate is loading into dump trucks and transported to the active working area of the right-of-way. Fugitive dust emissions are expected from material handing operations. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source IDs C-6-Q and C-6-R.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Stockpile Wind Erosion

Stockpiling of aggregate material will occur at the quarry locations. An assessment was completed to determine the potential for fugitive dust from stockpile wind erosion. Meteorological data was collected from both the ambient air monitoring station at the

Marten Falls First Nation Community as well as the Ogoki Post Airport. Windspeeds recorded did not exceed the calculated threshold friction velocity required for stockpile wind erosion. Therefore, emissions associated with wind erosion were not assessed further in the detailed air dispersion modelling. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source ID C-7-Q.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Grading

Grading involves the removal or leveling of loose road material (on unpaved roads) by scraping and planing. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source ID C-8-R.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Fugitive Road Dust

Fugitive road dust is expected due to vehicular traffic on unpaved roads such as gravel surfaced roads. Fugitive road dust emissions will occur on both the right-of-way as well as the quarry and quarry access roads. Emission are dependant on vehicle traffic volumes as well as vehicle specifics such as speed and mean vehicle weight. Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment D – Construction Emission Calculations** for Source IDs C-9-A and C-9-R.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

Chipping and Burning

As the right-of-way is cleared, trees are either burned or chipped. Some trees will be salvaged for lumber sales however this quantity is unknown. As such, a conservative assessment was completed where it was assumed that 50% of biomass cleared within the right-of-way was chipped and the remaining 50% was burned. Total biomass of material removed as a result of clearing was estimated based on average tree tonnage per acre in northern Ontario from Natural Resources Canada's 2006 Forest Inventory Report (NRC, 2006). Tree species and vegetation type was informed from site specific vegetation surveys. Assumptions as well as specific parameters used to inform emission calculations

are described in **Attachment D – Construction Emission Calculations** for Source IDs C-10-R and C-11-R.

Emissions from this source include: $NO_2$, CO, Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$), volatile organic compounds, benzene, toluene, ethylbenzene, and xylenes, and polycyclic aromatic hydrocarbons.

Temporary Worker Camps

During the construction phase of Community Access Road, temporary work camps will be established to house and support workers on-site. Emissions associated with activity at the temporary work camps have not been included within the assessment boundary as supporting information is not readily available.

The sources of emissions associated with activity at the temporary work camps may include, but are not limited to: truck traffic, generators, comfort heating, etc. As the construction emissions developed for this assessment represent a conservative worst-case scenario, it is likely that the overall impact of the temporary work camps will be insignificant when compared to the total emissions profile. Upon final design of Community Access Road, if additional information becomes available that indicates temporary worker camps may represent a significant source of emission, a revaluation of modelling and impact assessment may be recommended.

### Construction Air Quality Model Development

Dispersion modelling was conducted to assess Community Access Road's effect on air quality. Modelling was conducted following published guidance, as applicable, such as the Ministry of the Environment, Conservation and Parks' Guideline A-11 Air Dispersion Modelling Guideline for Ontario (Ministry of the Environment, Conservation and Parks, 2017).

Models utilized within this assessment include:

- United States Environmental Protection Agency AERMOD version 22112 (United States Environmental Protection Agency, 2019); and
- United States Environmental Protection Agency Motor Vehicle Emissions Simulator (United States Environmental Protection Agency, 2020).

AERMOD was used to predict ground level concentrations of indicator compounds while Motor Vehicle Emissions Simulator was used to develop emission rates for mobile equipment.

Due to the spatial size of the Construction Disturbance Area (>190 km) modelling limitations were present. Modelling the full Project Construction Disturbance Area within one domain would cause technical limitations in respect to processing model runs. Due to the transient nature of construction activities modelling considerations were required to account for the potential of plume overlap from adjacent sources of emissions.

Dispersion modelling was performed for a representative construction segment (physical size and level of activity). The representative segment was selected based on a review of the construction program for the entire Community Access Road and identification of activities that represent a maximum operations condition. Modelling results from the representative segment can be extrapolated along Community Access Road area to predict the effects at sensitive receptors within the Local Study Area. Additionally, a model representative of the worst-case activity in proximity to the Marten Falls First Nation community was developed to assess Community Access Road effects within the Marten Falls First Nation Community. This model will include the Marten Falls First Nation Community Access Road segments closest to Marten Falls First Nation, and receptors specific to the Marten Falls First Nation community.

The following sections describe the dispersion modelling approach for Community Access Road construction phase in detail. Project specific modelling considerations are also discussed in further detail.

Dispersion Modelling Inputs

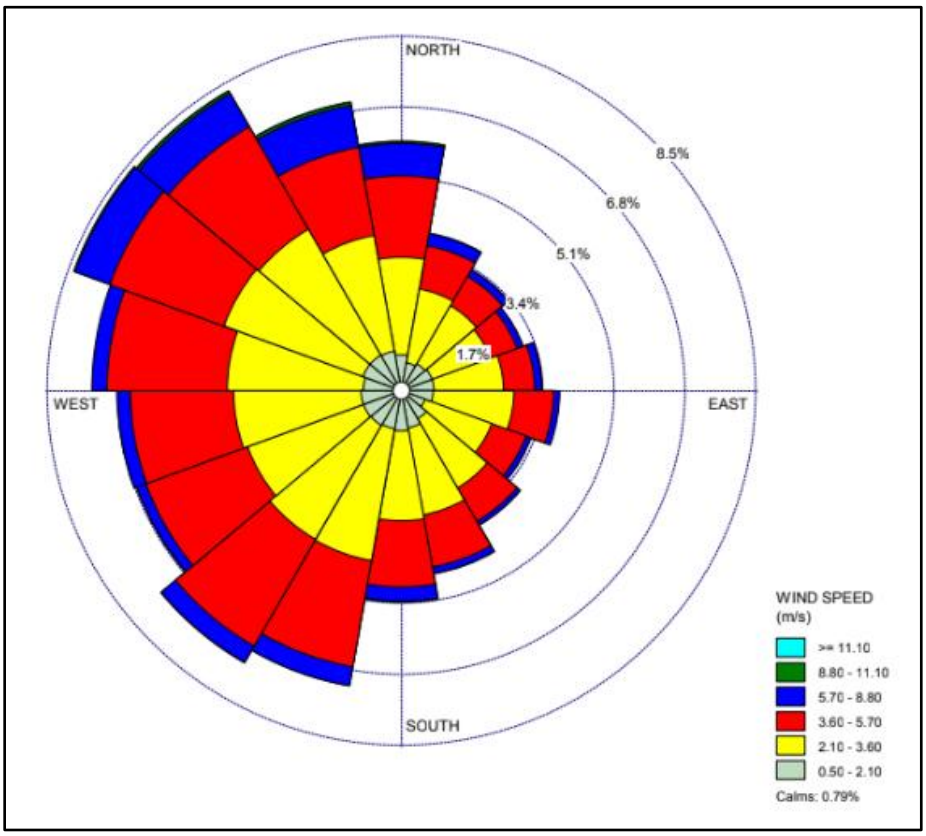
The AERMOD modelling system has been identified by the Ministry of the Environment, Conservation and Parks as one of the approved dispersion models under O.Reg. 419/05. The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. AERMOD version 22112 was used for the assessment of the construction scenario.

Meteorology

A 5-year AERMOD-ready Weather Research and Forecasting (WRF) prognostic dataset, from January 1, 2019, to December 31, 2023, was used for the modelling assessment. The WRF dataset was prepared by LAKES Environmental Software, centred on the Marten Falls community (Latitude 51.63313N, Longitude 85.92712 W).

The following windrose in Figure 4-3 displays the predominate wind direction and wind speeds of the meteorological data set used as part the dispersion model. The wind rose demonstrate the predominant wind direction is blowing from the west.

**Figure 4-3: Lakes Environmental Meteorological Data Windrose 2019-2023**




Terrain

Terrain data was incorporated into the model using web based digital elevation data downloaded using the Lakes Environmental AERMOD View program. The following CDEM files in USGS DEM / CDED format was used in the dispersion model for UTM Zone 16: 042m02_0200_deme.dem and 042m07_0200_demw.dem. These terrain data files are a 23m resolution.

Receptors

A tiered receptor grid was utilized within modelling and extended outward from the selected Construction Disturbance Area modelled. Receptor spacing was as follows: 50 m spacing from 0 to 500 m, 100 m spacing from 500 m to 1,000 m, 200 m spacing from 1,000 m to 2,000 m, and 500 m spacing from 2,000 m to 5,000 m. Spacing of this tiered grid was selected to provide reasonable coverage of the extended Project area and to allow for the development of predicted concentration contour maps (isopleths).

For the Marten Falls First Nation community specific model, two uniform cartesian grid networks were incorporated within modelling. One grid with a 250 m by 250 m spacing

was placed in the area of roadway construction and another grid with 100 m by 100 m spacing was placed over the Marten Falls First Nation community to assess potential impacts from construction on the Marten Falls First Nation community.

Please note that sensitive receptor locations were provided by other disciplines as well as through Indigenous Knowledge data collection. Due to the wide variety of receptor types, receptors shapes (discrete points, large polygonal areas, etc.), and locations (e.g., overlapping with the Construction Disturbance Area), it was determined that the receptor data would not be the most applicable to provide a meaningful dispersion modelling result. A representative impact assessment was selected using a tiered receptor grid extending from the perimeter of the Construction Disturbance Area. The Construction Disturbance Area includes both the roadway as well as supporting quarry and quarry access roads as part of its footprint. This receptor grid allowed for indicator compound ground level concentrations to be represented in terms of distance from representative segment and could be extrapolated along the entire Construction Disturbance Area. Potential air quality impacts on receptors can be related to the receptor distance from sources. In the event that a receptor represents a large geographic area (i.e., waterbody or caribou habitat) maximum ground level concentrations can be inferred based on distance from construction activity.

Averaging Time and Conversions

The shortest time scale that AERMOD predicts is a 1-hour average value. Models were developed for indicator compounds based on their respective criteria averaging periods. These included 1-hour, 8-hour, 24-hour, and annual averaging times. In the cases where specific indicator compounds have criteria with averaging periods less than 1-hr (i.e. $SO_2$ 10-min) model results were scaled followed guidance from the MECP Guideline A-11 Section 4.4 Averaging Periods (Conversion Factor). For example, 1-hr results were converted to 10-min results by multiplying results by the recommended 1.65 conversion factor.

Meteorological anomalies were not removed as part of the presentation of results from the dispersion modelling assessment. Therefore, the results included within the impact assessment represent maximum modelled results. This provides additional conservatism to model results.

Dispersion Modelling Options

The regulatory default options for AERMOD were used for this assessment. Some of the options used are summarized in **Table 4-10** below:

## Table 4-10: AERMOD Options

| Modelling Parameter | Description | Used in the Assessment? |
|---|---|---|
| **DFAULT** | Specifies the regulatory default options will be used | Yes (Except for $NO_x$ to $NO_2$ conversion as discussed below) |
| **CONC** | Specifies that concentration values will be calculated | Yes |
| **NODRYDPLT** | Specifies that no dry deposition will be calculated | Dry deposition was considered(1) |
| **NOWETDPLT** | Specifies that no wet deposition will be calculated | Wet deposition was not considered |
| **FLAT** | Specifies that the non-default option of assuming flat terrain will be used | No – elevated terrain used |
| **NOSTD** | Specifies that the non-default option of no-stack tip downwash will be used | No |
| **AVERTIME** | Averaging periods used | 1-hour, 8-hour, 24-hour, and annual |
| **URBANOPT** | Specifies that the urban dispersion coefficients will be used | No |
| **URBANROUGHNESS** | Specifies the urban roughness (m) if URBANOPT is used | No |
| **FLAGPOLE** | Specifies that receptor heights above local ground level is allowed on the receptors | No |

**Notes:**

AERMOD non-default dry deposition option was selected as part of the assessment of particulate matter. Justification for the use of dry depletion option parameters is provided in the 'Particle Deposition' section below. No consultation with the MECP was coordinated prior to this assessment.

### $NO_x$ to $NO_2$ Conversion

Default regulatory settings were used with the exception of the $NO_x$ to $NO_2$ conversion. $NO_2$ is primarily emitted from combustion activities. Emission estimates were based on published emission factors from sources such as AP-42, which are typically provided as total nitrogen oxides ($NO_x$). The most conservative method of estimating $NO_2$ concentration is to assume a full (100%) conversion of $NO_x$ to $NO_2$. When representative NO and $NO_2$ ambient monitoring data is available, a more accurate estimate can be made when implementing the Ozone Limiting Method.

When background $O_3$ concentrations are greater than the amount of $NO_X$, a full conversion to $NO_2$ is assumed. If the $NO_X$ concentration is greater than the background $O_3$ concentrations the formation of $NO_2$ will be limited by the background $O_3$ concentrations.

The following Ozone Limiting Method options were selected in AERMOD:

- Equilibrium $NO_2$ / $NO_x$ Ratio = 0.9; and
- Default in stack $NO_2$ / $NO_x$ Ratio = 0.1.

The equilibrium ratio of 0.9 was selected as it is the United States Environmental Protection Agency default value. As blasting emissions account for greater than 55% of $NO_x$ emissions on a 1-hour basis, the in-stack $NO_2$ / $NO_x$ value was adjusted from 0.5 to 0.1. This adjustment was based on a literature review which indicated $NO_2$ / $NO_x$ ratios in blasting emissions equal to 0.04 (Attala et al, 2007)[2]. A value of 0.1 was selected to be conservative and also more reflective of $NO_2$ / $NO_x$ ratios within tailpipe emissions.

Ambient Ozone ($O_3$) concentrations were measured in the Marten Falls First Nation community as part of the 2021 to 2022 monitoring program. The 90$^{th}$ percentile $O_3$ concentrations were used to calculate average hourly concentrations on a seasonal basis (i.e. 90$^{th}$ percentile values from January, February and December were averaged to calculate an average hourly winter value). These values were calculated and inputted into AERMOD to be utilized for Ozone Limiting Method calculations. **Table 4-11** provides a summary of hourly average $O_3$ concentrations by season.

**Table 4-11: $O_3$ Concentrations for OLM Method**

| Average $O_3$ Concentrations (µg/m$^3$) | | | | |
|---|---|---|---|---|
| **Hour** | Winter | Spring | Summer | Fall |
| **00:00** | 68.12 | 84.02 | 62.43 | 53.53 |
| **01:00** | 67.27 | 82.65 | 60.47 | 54.58 |
| **02:00** | 66.23 | 81.28 | 59.09 | 55.23 |
| **03:00** | 66.88 | 80.03 | 55.04 | 52.09 |
| **04:00** | 66.75 | 79.31 | 54.45 | 49.93 |
| **05:00** | 67.34 | 78.72 | 55.49 | 49.93 |
| **06:00** | 67.21 | 79.05 | 55.69 | 48.43 |
| **07:00** | 67.34 | 78.79 | 54.25 | 51.11 |
| **08:00** | 66.23 | 79.18 | 55.17 | 48.95 |
| **09:00** | 66.68 | 79.84 | 54.97 | 50.91 |

[2] Attalla, M, et al. NOx Emissions from Blasting in Open Cut Coal Mining in the Hunter Valley, Australian Coal Industry Research Program Project C14054, 2007

| Average $O_3$ Concentrations ($\mu g/m^3$) | | | | |
|---|---|---|---|---|
| **10:00** | 68.25 | 81.15 | 54.51 | 52.68 |
| **11:00** | 69.37 | 82.39 | 59.81 | 58.31 |
| **12:00** | 69.17 | 83.70 | 68.97 | 58.77 |
| **13:00** | 70.81 | 84.94 | 72.64 | 60.34 |
| **14:00** | 71.26 | 85.40 | 74.34 | 63.54 |
| **15:00** | 72.57 | 86.25 | 75.26 | 63.61 |
| **16:00** | 71.98 | 87.17 | 76.56 | 64.00 |
| **17:00** | 71.85 | 88.67 | 80.23 | 64.00 |
| **18:00** | 70.74 | 89.52 | 79.90 | 63.61 |
| **19:00** | 70.61 | 89.13 | 78.20 | 60.60 |
| **20:00** | 69.30 | 87.69 | 70.87 | 61.84 |
| **21:00** | 69.82 | 86.90 | 70.87 | 58.57 |
| **22:00** | 69.89 | 87.49 | 72.05 | 56.87 |
| **23:00** | 69.43 | 85.66 | 66.81 | 56.08 |

Representative Segment for Modelling

As the total length of the roadway extends over a large boundary (>190 km), the following technical limitations were present with respect to developing a dispersion model for the road construction phase of Community Access Road:

- Transient nature of construction operations;
- Receptor identification;
- Emission source parameters; and
- Model run time.

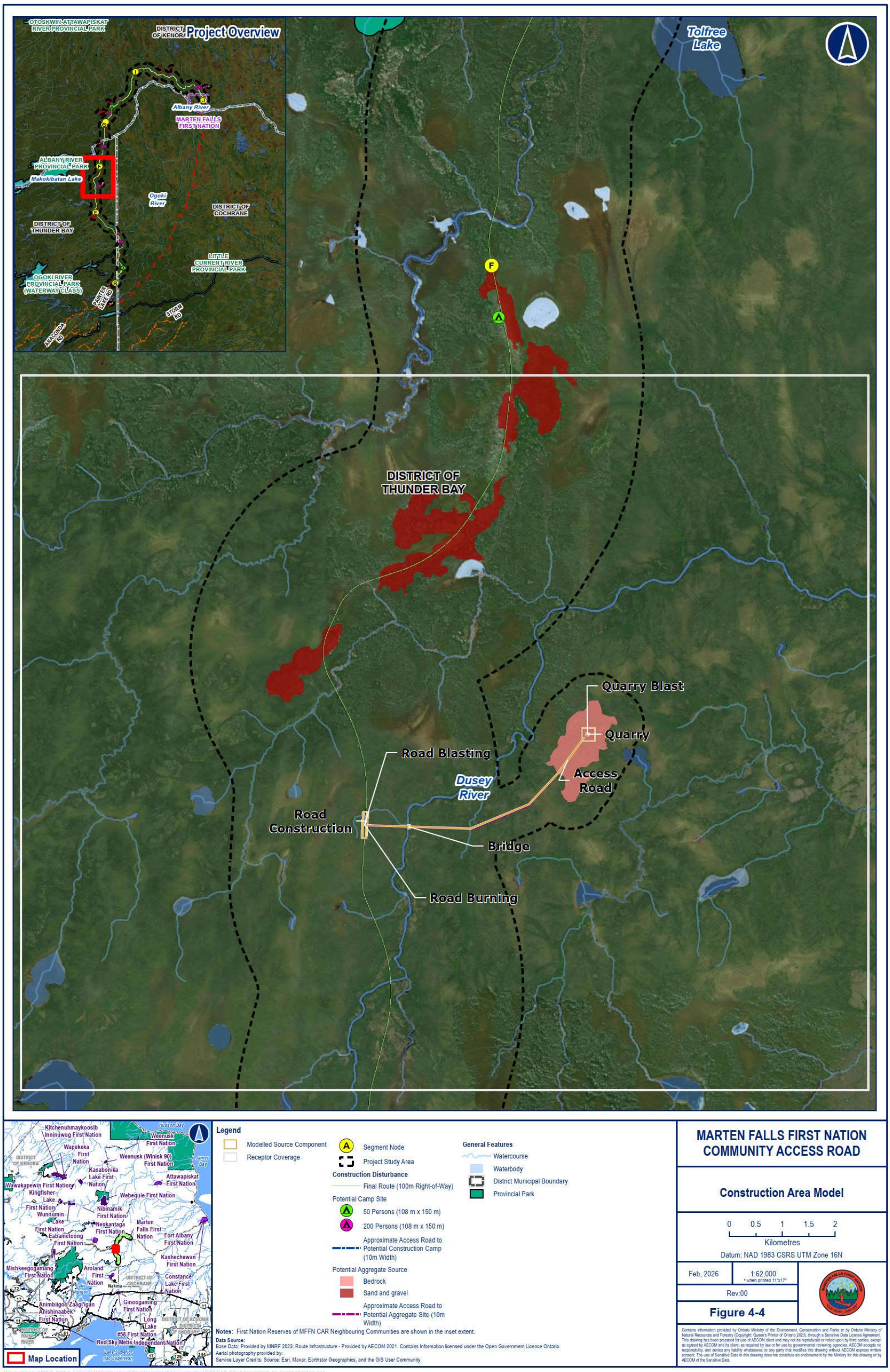
To overcome the limitations, a scaled down, representative segment of the roadway was developed. This segment is referred to as the North/South (N/S) segment as it is located along the N/S corridor. Selection of this representative segment was based on a location that included all aspects of road construction activity (e.g., quarries, bridges, road construction, etc.) in close proximity. By selecting a segment where all the major road construction activities would be occurring in close proximity to each other, including supporting quarry operations a high conservative scenario could be developed which would evaluate all operations occurring simultaneously in close proximity to each other.

Results from modelling the representative segment were used to estimate potential air quality impacts within the entire study area in terms of distance from roadway to specific air quality criteria or thresholds. The location of the construction activity representative segment is presented in **Figure 4-4**.

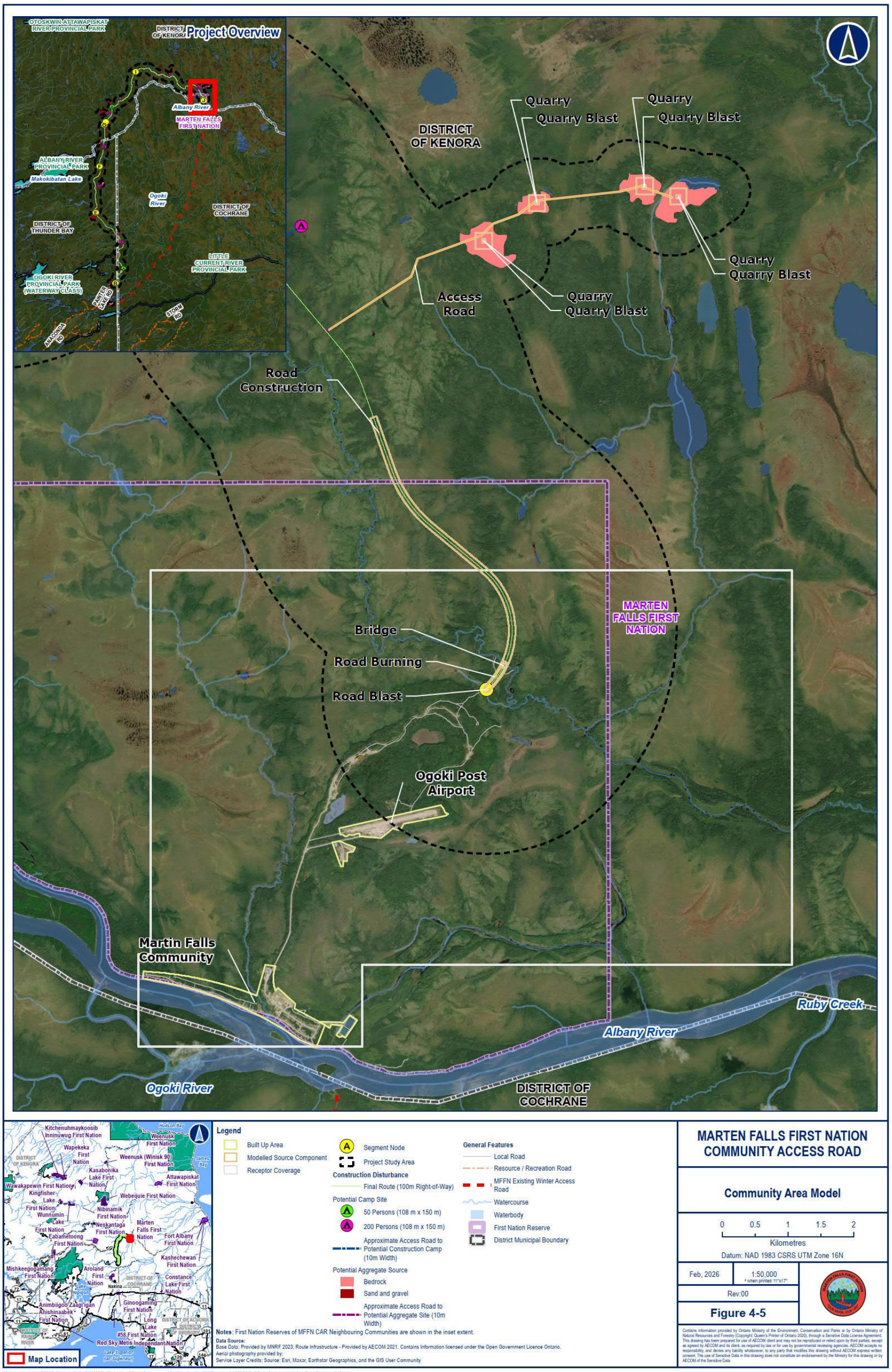
An additional representative segment was developed to estimate the potential air quality impacts from road construction on the Marten Falls First Nation Community. Results from modelling the Marten Falls First Nation Community representative segment were used to evaluate potential maximum ground level concentrations at the Marten Falls First Nation community for comparison to relevant air quality criteria. The location of this Marten Falls First Nation Community representative segment is presented in **Figure 4-5**. This section of road was selected as it is closest to the Marten Falls First Nation Community and would allow for a determination of potential effects at the community instead of extrapolating results from the N/S road segment.

These two representative segments of the roadway were included in the modelling assessment to provide results to characterize predicted effects along the corridor from the construction and operations phases of Community Access Road.

## Figure 4-4: Construction Model Area – North South Representative Segment



## Figure 4-5: Construction Model Area – E/W Representative Segment -Marten Falls First Nation Community Representative Segment



For conservatism in the modelling, the emission rate estimates were developed using maximum operations activity. Due to the nature of construction operations, different operations scenarios can occur throughout Community Access Road duration which will use a variety of equipment (e.g., clearing, aggregate, burning, chipping, bridge building, etc.). Emission rates for each construction scenario were calculated for the individual indicator compounds and the maximum emission rate was used for each indicator compound's specific model.

**Tables A1, A2, and A3 – Source Summary Tables** included in **Attachment B**, provides a summary of each activities indicator compound's emission rates. **Table A4 – Source Parameters** included in **Attachment B** provides specific source parameter details used within modelling.

As the construction equipment will not be static, an average daily working area was determined based on input provided by the engineering design team. It was determined that a daily working area of 500 m would be probable during the construction period. To represent this working area and associated construction activities a combination of line volume sources and volume sources were used in the AERMOD dispersion model to represent construction-related emission sources on the Construction Disturbance Area. Quarry activities including blasting, material handing and access road vehicular traffic were also incorporated within modelling.

All quarry operations along the Construction Disturbance Area were assumed to remain constant throughout the duration of construction. This is a conservative approach as operations are expected to vary from quarry to quarry as construction progresses. All access roads leading from the main Construction Disturbance Area to each quarry were also assumed to be in operation at all times of the year. **Table 4A – Source Parameters** included in **Attachment B – Tables** provides a summary of source parameters used to represent each construction activity.

### Acid Deposition

Acid deposition occurs when emission activities release compounds containing sulphur and nitrogen to the atmosphere and transform into secondary pollutants. Examples of such pollutants are sulphuric acid, ammonium nitrate, and nitric acid. Acid deposition may result in adverse environmental impacts and ecological changes. Acid deposition may negatively impact waterbodies, vegetation, and cause soil nutrient imbalances. Depending on existing sources of emissions within a particular airshed (i.e., heavy industry sources) the buffering capacity of the ecosystem or vulnerability to acid deposition may change. The Community Access Road Project is occurring in what is considered a pristine environment where heavy anthropogenic sources of emissions are not present. Both the Ontario Ministry of

Transportation and Ministry of the Environment, Conservation and Parks do not have guidelines or methodologies for assessing acid deposition for transportation Projects within Ontario. The Alberta Environment and Parks (Alberta Environment) has adopted a framework developed by the Clean Air Strategic Alliance for managing effects in Alberta. The Alberta Environment and Parks (Alberta Environment) 2022 Alberta Acid Deposition Management Framework (AADMF, 2022) was referenced to establish a method to determine the Community Access Road Project's potential to contribute to acid deposition.

Alberta Environment recommends that a total acidifying emission threshold of 0.175 tonnes / day be used to assess if acid deposition modelling is required. To calculate total acidifying emissions of Community Access Road ($H^+$) the following equation is used:

$$H^+ \, equivalent \, \left(\frac{t}{day} H^+\right) = \left[\frac{2x\left(SO_2 \frac{t}{day}\right)}{64}\right] + \left[\frac{1x\left(NO_x \frac{t}{day}\right)}{46}\right] + \left[\frac{1x\left(\frac{NH_3 t}{day}\right)}{17}\right]$$

$SO_2$ and $NO_x$ emissions are expected as a result of this Project from construction related activities as well traffic during the final operation. As per the Ontario Ministry of Transportation Air Quality & Greenhouse Gas Guide, ammonia ($NH_3$) emissions are not typically associated with transportation related pollutants.

Total $H^+$ equivalents were calculated for the construction phase of Community Access Road by taking the sum of Community Access Road's 24-hour $SO_2$ and $NO_x$ emissions. A total daily $H^+$ equivalent was calculated to be equal to 0.004 tonnes / day of H+ equivalent. This is well below the 0.175 tonnes / day threshold recommended in the Alberta Acid Deposition Management Framework. As the calculated daily acidification is approximately 2% of the recommended threshold limit, modelling was not completed as part of this assessment, acid deposition was also not considered as an indicator for this Project. It should also be noted that emission scenarios used to calculate the worst-case Project emissions represent a worst-case operations condition which included the maximum number of equipment operations simultaneously at their maximum duration. $SO_2$ and $NO_x$ emissions resulting from blasting were calculated on a worst-case number and size of blasts per a day. Actual emissions of both $SO_2$ and $NO_x$ are anticipated to be lower than Projected. Through the use of construction best management practices (i.e., anti-idling policies, strategic works planning…etc.) further reductions in both $SO_2$ and $NO_x$ emissions can be expected.

### Particulate Deposition

AERMOD has two methods for handling particulate depositions. The default Method 1 is used when the particle size distribution is reasonably well known and a majority (>10%) of the particulate are larger than 10 microns in diameter. Method 2 is used when the particle

size distribution is not well known, and the majority of the particulate is less than 10 microns in diameter. As the majority of Project's particulate emission sources (e.g., road dust and quarry material handling) generate mainly coarse-size particles (i.e., larger than 10 µm), the default deposition Method 1 was used.

Method 1 requires particle size distribution (i.e., mean particulate diameter and mass fraction for each defined particle size range) and particle densities. A particle density of 2.65 g / $cm^3$ is commonly used for dust associated with aggregate operations as most natural aggregates have particle densities of between 2.4 g / $cm^3$ and 2.9 g / $cm^3$ (Kosmatka, et.al. 2002). An analysis of particle size distribution was conducted for particulate emission generating sources from the community access road construction.

In the absence of available particle size distribution data, the United States Environmental Protection Agency AP-42 size-specific emission factors for particulates were used to develop cumulative mass fractions for each specified particle size category range. These mass fractions were used in the modelling of particulate deposition. Detailed information including particle size distribution calculations are included in **Attachment F – Supporting Information Particulate Deposition**.

## Air Quality Emissions – Operations Phase

Emissions from the operation phase included vehicle tailpipe emissions as well as fugitive roadway emissions of re-suspended particulate matter from vehicle travel.

Routine road maintenance activities such as snow clearing are expected to be captured in the roadway vehicle data (traffic volumes and vehicle types). Minor roadway maintenance activities, such as re-grading, are expected to have an insignificant impact.

Emissions were estimated based on published emission factors, such as those found in the United States Environmental Protection Agency's AP-42 (United States Environmental Protection Agency, 2021), those generated in the most current version of the United States Environmental Protection Agency Motor Vehicle Emissions Simulator (United States Environmental Protection Agency, 2020), or engineering principles, as applicable.

Re-suspended road dust was estimated based on emission factors included in the United States Environmental Protection Agency's AP-42 (United States Environmental Protection Agency, 2021) emission factor database.

### Sources of Emissions

Emissions from the operation phase consist of vehicle tailpipe emissions as well as fugitive roadway emissions of re-suspended particulate matter from vehicle travel. Vehicle tailpipe emissions from the Marten Falls First Nation community access road were estimated

based on Projected traffic volumes and the MOVES3. Road dust emissions were estimated based on United States Environmental Protection Agency AP-42 emission factors. A summary of emission sources is included in **Attachment E – Supporting Information for Calculations – Operations**.

Tailpipe / Mobile Emissions

Mobile emissions including tailpipe, tire wear, and brake wear were calculated using MOVES3. Project specific inputs including meteorology, source types, road type, vehicle type, age distribution, vehicle speeds, and fuel consumption were used in MOVES3.

The MOVES3 model included meteorological and fuel composition data reflective of the study area. Fleet data sets included within MOVES3 only include those of counties in the United States. As such, the Niagara County was selected as it borders Canada, and while geographically it may vary from the MFFN location it is anticipated to be representative. MOVES was run in "Emission Rate" mode, therefore the county selection only affects the default fuel input (i.e., fuel formulation). Fuel formulation in Ontario and Niagara are expected to be similar due to Clean Fuel Regulations in Canada and the United States. Other county-default inputs, such as VMT and average speed distribution, were not used in the emission rate run as these parameters were based on site specific data.

Emission rates for select indicator compounds were generated and used to inform source emissions. A summary of Motor Vehicle Emission Simulator inputs and emission rate outputs is included in **Attachment E – Supporting Information for Calculations – Operations**.

Emissions from this source include: $NO_2$, CO, $SO_2$, Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$), volatile organic compounds, benzene, toluene, ethylbenzene, and xylenes, Diesel Particulate Matter, and polycyclic aromatic hydrocarbons.

Fugitive Road Dust

The emissions of re-suspended dust particulates, including Total Suspended Particulate, $PM_{10}$, and $PM_{2.5}$, due to vehicular traffic on both the north-south and east-west road segments were estimated following the methodology presented in United States Environmental Protection Agency AP-42 Section 13.2.2 – Unpaved Roads. Specifics of road dust emission calculations are included in **Attachment E – Supporting Information for Calculations – Operation**.

Emission rate estimates do not account for the addition of mitigation techniques, other than natural mitigation from precipitation, which is only included in annual emission rate estimates. As per United States Environmental Protection Agency methodology, an adjustment factor of annual precipitation (days with >0.254 mm of precipitation or snow

cover) was included in annual averaging period calculations. Methodology is documented within Attachment **E – Supporting Information for Calculations – Operation**.

Assumptions as well as specific parameters used to inform emission calculations are described in **Attachment E – Supporting Information for Calculations – Operations**.

Emissions from this source include: Particulate Matter (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$).

### Operations Air Quality Model Development

The predicted impact of traffic emissions was assessed through CALRoads View, a Lakes Environmental Consultants Inc. modelling package. CALRoads is an interface for the three United States Environmental Protection Agency air dispersion models including CALINE4, CAL3QHC, and CAL3QHCR, and has been commonly used for predicting pollutant concentrations by motor sources at or near roadways. In this assessment, the CAL3QHCR dispersion model was used to predict air quality impacts from roadways using vehicle emissions, traffic data, and site-specific meteorological data.

#### Dispersion Modelling Inputs

Vehicle emissions of indicator compounds were estimated using the MOVES3 model using the “emission rates” mode to obtain appropriate rate-per-distance emission factors of relevant contaminants. For this assessment, emission factors were developed for auto traffic, medium trucks, and heavy trucks. **Table 4-12** below summarizes key MOVES3 parameters for the “emission rates” run for the operation phase.

**Table 4-12: Motor Vehicle Emission Simulator Model Parameters**

| Key Motor Vehicle Emission Simulator Parameters | Motor Vehicle Emission Simulator Emission Rate Run |
|---|---|
| **Geography** | A surrogate county (Niagara) was selected. |
| **Time Span** | 2035 Year-Anticipated Road built year.<br>January and July weekdays as the worst-case. |
| **Meteorology** | Average temperature and humidity for selected months from the nearest weather station (ID 6075786 OGOKI POST Airport):<br>January: Avg Temp 9.3 °F, humidity 96%<br>July: Avg Temp 63.8 °F, humidity 67% |
| **Source types** | Selected vehicle types as below:<br>Passenger car (source type =21) to represent auto traffic;<br>Light Commercial Trucks (source type=32) to represent median trucks;<br>Combination Long-haul Trucks (source type=62) to represent heavy trucks. |

| Key Motor Vehicle Emission Simulator Parameters | Motor Vehicle Emission Simulator Emission Rate Run |
|---|---|
| **Road types** | Rural unrestricted access (road type =3) |
| **Pollutants** | NOx, CO, SO2, PM10, PM2.5 and VOCs including Acrolein, Acetaldehyde, Benzene, Formaldehyde, 1,3-Butadiene, Toluene, Ethylbenzene, Xylene, and Benzo(a)pyrene (BaP).<br>GHGs (CO2e) including CO2, CH4, and N2O. |
| **Vehicle Type VMT** | County default hour VMT Fraction. |
| **Age Distribution** | County default age group |
| **Average Speed Distribution** | Heavy trucks: 30 km / hr<br>Auto traffic and median trucks: 80 km / hr |
| **Fuel** | County default fuel formulation<br>Auto traffic vehicles use gasoline<br>All heavy and median trucks use diesel |

A summary of vehicle emission factors for the operation phase is provided in **Table 4-13**. **Attachment E – Supporting Information for Calculations – Operations** provides further details on emission factors.

### Table 4-13: Operations Phase – MOVES Emission Factor Summary

| Indicator Compound | Emission Factors (g/VKT) | | |
|---|---|---|---|
| | Heavy Trucks | Median Trucks | Auto Traffic |
| **Oxides of Nitrogen (NOx)** | 4.3E+00 | 1.4E-01 | 6.6E-03 |
| **Carbon Monoxide (CO)** | 2.4E+00 | 3.4E-01 | 5.9E-01 |
| **Sulfur Dioxide (SO2)** | 3.7E-03 | 7.7E-04 | 8.1E-04 |
| **Primary Exhaust PM10 – Total** | 3.3E-02 | 4.5E-03 | 7.5E-04 |
| **Primary PM10 – Brake wear Particulate** | 2.6E-01 | 9.9E-03 | 6.6E-03 |
| **Primary PM10 – Tire wear Particulate** | 3.0E-02 | 6.7E-03 | 5.1E-03 |
| **Primary Exhaust PM2.5 – Total** | 3.0E-02 | 4.1E-03 | 6.7E-04 |
| **Primary PM2.5 – Brake wear Particulate** | 3.2E-02 | 1.2E-03 | 8.2E-04 |
| **Primary PM2.5 – Tire wear Particulate** | 4.4E-03 | 1.0E-03 | 7.6E-04 |
| **Benzo(a)pyrene particle** | 1.6E-07 | 1.8E-07 | 1.6E-07 |
| **Benzo(a)pyrene gas** | 0.0E+00 | 0.0E+00 | 1.2E-09 |
| **Acrolein** | 2.7E-04 | 7.5E-05 | 3.0E-06 |
| **Acetaldehyde** | 3.0E-03 | 4.9E-04 | 2.7E-05 |

| Indicator Compound | Emission Factors (g/VKT) | | |
|---|---|---|---|
| | Heavy Trucks | Median Trucks | Auto Traffic |
| **Benzene** | 2.2E-05 | 7.4E-05 | 2.0E-04 |
| **Formaldehyde** | 2.1E-03 | 8.6E-04 | 6.2E-05 |
| **1,3-Butadiene** | 6.0E-06 | 2.6E-05 | 0.0E+00 |
| **Toluene** | 1.3E-03 | 1.1E-04 | 3.0E-04 |
| **Ethyl Benzene** | 7.9E-04 | 6.6E-05 | 6.6E-05 |
| **Xylene** | 5.9E-03 | 3.5E-04 | 2.4E-04 |
| **Atmospheric CO2** | 1.1E+03 | 2.3E+02 | 1.2E+02 |
| **Methane (CH4)** | 1.8E-02 | 2.0E-03 | 2.1E-03 |
| **Nitrous Oxide (N2O)** | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| **CO2 Equivalent** | 1.1E+03 | 2.3E+02 | 1.2E+02 |
| **Total PM2.5 (Exhaust + Brake wear + tire wear)** | 6.7E-02 | 6.4E-03 | 2.3E-03 |
| **Total PM10 (Exhaust + Brake wear + tire wear)** | 3.2E-01 | 2.1E-02 | 1.2E-02 |
| **Total TSP (Exhaust + Brake wear + tire wear)** | 3.2E-01 | 2.1E-02 | 1.2E-02 |
| **Total BaP (Particulate and Gas)** | 1.6E-07 | 1.8E-07 | 1.6E-07 |

Traffic Data

For the assessment of potential air quality impact from the operation phase, modelling using CAL3QHCR was completed. The operation emission assessment used the Tier II approach in the CAL3QHCR which requires more detailed emission and traffic data for each hour of a week. In the absence of hourly traffic data Projections for the road segments, the United States Environmental Protection Agency default traffic distribution for a rural roadway during weekdays was used to estimate traffic volume by hour of the day for both road sections. In general hour traffic volumes were less during early morning hours 01:00-05:00 and gradually increase throughout the day slowly stabilizing between 10:00-15:00 followed by another gradual increase in traffic volumes between 15:00 and 17:00 and then a decline in traffic during the following nighttime hours. Specific details are included in **Attachment E – Supporting Information for Calculations – Operations**. The estimated hourly traffic volume was used as input for the CAL3QHCR model for the assessment of traffic emissions.

It is recognized that in the absence of site-specific hourly traffic data uncertainty may exist within model results. The following demonstrates conservative assumptions and methods included with respect to traffic volume and distribution. The maximum traffic activity along

the roadway was used within emission calculations and model development (700 AADT for the N/S and 100 AADT for the E/W).

Details specific to this additional sensitivity testing are documented in **Appendix G – Operations Phase Supporting Documentation.**

In addition to the traffic volume estimates, the CAL3QHCR model requires contaminant emission factors (in grams per vehicle mile travelled) in each hour of the day. The contaminant emission factors vary slightly by hour of the day due to differences in vehicle compositions in each hour for both road sections. The calculated contaminant hourly emission factors are presented in **Attachment E – Supporting Information for Calculations – Operation**.

**Table 4-14** presents the maximum vehicular traffic volume on community access road segments, which is anticipated to occur in the year 2046. The north-south road segment is estimated to have seven times higher traffic volume than the east-west segment. The majority of traffic on the north-south segment is heavy trucks and the majority of traffic on the east-west segment to Marten Fall community is auto traffic. Detailed traffic data is included in **Attachment E – Supporting Information for Calculations – Operations**.

**Table 4-14: Traffic Data for Road Segments**

| | Vehicle Types | Annual Average Daily Traffic (AADT)[1] | Vehicle Type Percentages (%)[1] |
|---|---|---|---|
| **North-South Segment (to ROF)[4]** | Heavy Trucks[2] | 448 | 64% |
| | Medium Trucks[3] | 49 | 7% |
| | Auto Traffic | 203 | 29% |
| | **Total** | **700** | **100%** |
| **East-West Segment (to Marten Falls First Nation)[5]** | Heavy Trucks | 3 | 3% |
| | Medium Trucks | 20 | 20% |
| | Auto Traffic | 77 | 77% |
| | **Total** | **100** | **100%** |

**Notes:**

1. Annual Average Daily Traffic and vehicle type percentage estimates are provided by AECOM CANADA ULC for the year 2046 which is predicted to have the highest vehicular traffic on the Community Access Road.

2. Heavy trucks: all vehicles with three or more axles designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 12,000 kg. Intercity buses are also included in this category. The heavy trucks on the Community Access Road are mainly mine trucks which have an average load of 36 tonne as per the Eagle's Nest Access Road Traffic Study prepared by Hatch in August 2022.

3. Medium trucks: all vehicles with two axles and six wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 4,500 kg but less than 12,000 kg. City buses are also included in this category.

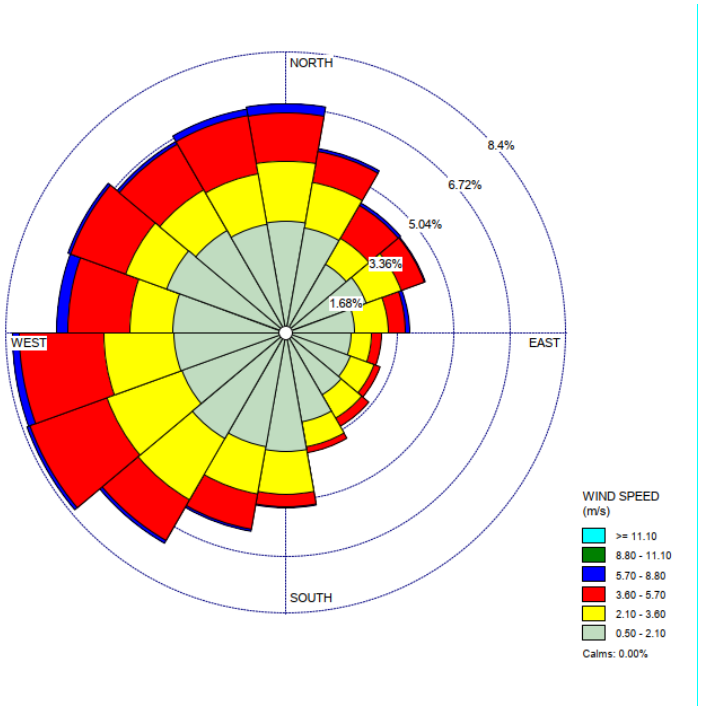
4. The North-south segment between the Northern Road Link and Aroland will be a public road serving traffic heading to and from Webequie, Marten Falls, and the Ring of Fire.

5. The East-west segment between the Northern Road Link and Marten Falls will serve local traffic heading to and from Marten Falls.

## Meteorology

Five years of CAL3QHCR meteorological datasets were generated using the meteorological preprocessor for the CAL3QHCR model – PCRAMMET. The generated meteorological dataset contains the surface meteorological data extracted from the Weather Research & Forecasting Model prognostic model for the Marten Falls area, which was also used for modelling of the construction phase. In advance of the operations phase modelling, a sensitivity assessment of the five years of meteorological data was completed to determine the worst-case year to carry forward in the modelling assessment. The sensitivity assessment was completed for the E/W roadway which was closest in proximity to the MFFN community. When completing this sensitivity analysis, $NO_2$ was used as a representative pollutant to determine the worst-case year. The meteorological year 2023 was identified as the worst-case year and was carried forward to represent a conservative approach to the modelling assessment. The windrose for the 2023 year is provided below in **Figure 4-6**.

## Figure 4-6: Lakes (WRF) Wind Rose (2023)




Meteorological anomalies were not removed as part of the presentation of results from the dispersion modelling assessment. Therefore, the results included within the impact assessment represent maximum modelled results. This provides additional conservatism to model results. Details specific to this additional sensitivity testing are documented in **Appendix G – Operations Phase Supporting Documentation.**

Terrain

CAL3QHCR does not require terrain data be incorporated into the model. The model assumes a flat surface.

Receptors

The Ministry of Transportation's Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO, 2020) indicates that for the majority of roads, the affected immediate vicinity is limited to the area within approximately 500 m of the road. The Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO, 2020) also indicates that concentrations of road-related pollutants drop to within 10% of their background pollution outside of 500 m from the roadway. For conservatism, receptors

were extended to 1 km from the shoulder of the roadway to include the potential effects further away than the suggested 500 m zone of influence.

To capture the influence of traffic emissions on the vicinity of roadways a tiered receptor grid was developed within the CAL3QHCR model. A dense receptor spacing was used in the near-field area from the roadway to provide refined model results (i.e., 10 m receptor spacing from 0 to 40 m from edge of road followed by 20 m spacing out to 100 m).

**Table 4-15** provides tiered spacing of receptors. The developed receptor grid has a minimum receptor spacing (10 m) in the vicinity of the roadway while a coarser receptor resolution for the distances far away.

**Table 4-15: CAL3QHCR Receptor Grid**

| Tier # | Distance from Road Centre (Link) (m) | Distance from the edge of the Construction Disturbance Area (m) | Receptor Spacing (m) |
|---|---|---|---|
| **1** | 50 | 0 | 10 |
| **2** | 60 | 10 | 10 |
| **3** | 70 | 20 | 10 |
| **4** | 80 | 30 | 10 |
| **5** | 90 | 40 | 10 |
| **6** | 110 | 60 | 20 |
| **7** | 130 | 80 | 20 |
| **8** | 150 | 100 | 20 |
| **9** | 200 | 150 | 50 |
| **10** | 250 | 200 | 50 |
| **11** | 300 | 250 | 50 |
| **12** | 350 | 300 | 50 |
| **13** | 400 | 350 | 50 |
| **14** | 450 | 400 | 100 |
| **15** | 550 | 500 | 100 |
| **16** | 650 | 600 | 100 |
| **17** | 750 | 700 | 100 |
| **18** | 850 | 800 | 100 |
| **19** | 950 | 900 | 100 |
| **20** | 1,050 | 1,000 | 100 |

Averaging Time and Conversions

The shortest time scale that CAL3QHCR predicts is a 1-hour average value. Models were developed for indicator compounds based on their respective criteria averaging periods. These included 1-hour, 8-hour, 24-hour, and annual averaging times. In the cases where specific indicator compounds have criteria with averaging periods less than 1-hr (i.e. $SO_2$ 10-min) model results were scaled followed guidance from the MECP Guideline A-11 Section 4.4 Averaging Periods (Conversion Factor). For example, 1-hr results were converted to 10-min results by multiplying results by the recommended 1.65 conversion factor.

Meteorological anomalies were not removed as part of the presentation of results from the dispersion modelling assessment. Therefore, the results included within the impact assessment represent maximum modelled results. This provides additional conservatism to model results.

$NO_X$ to $NO_2$ Conversion

The CAL3QHCR model does not account for the effects of ozone conversion. For this assessment a 100% conversion of $NO_X$ to $NO_2$ has been used.

Representative Segment for Modelling

As the total length of the roadway extends over a large boundary (>190 km), the following technical limitations were present with respect to developing a dispersion model for the road operations phase of Community Access Road:

- Receptor identification;
- Emission source parameters;
- Fluctuations in anticipated traffic levels between North-South and East-West road corridors;
- Consistency of roadway layout and geography; and
- Model run time.

To overcome these limitations, a scaled down, representative segment of the roadway was developed for each orientation of the roadway (North-South and East-West). The location of the representative segments was selected to match the area of modelling coverage of the construction phase to maintain consistency with the presentation of results. In addition to consistency with the construction phase, the following was considered:

- The location of the N/S segment was selected to be consistent with the location of the Construction Phase representative segment. The construction segment was selected as an area which has the potential for all construction-related activity to occur within a defined area (i.e., road construction located near quarry operations);
- The location of the E/W segment was selected as its location is the closest proximity of roadway to the MFFN community. This was consistent with the selection of the construction segment; and
- Fluctuations in anticipated traffic levels between N/S and E/W road segments were accounted for within the Operation Phase modelling assessment.

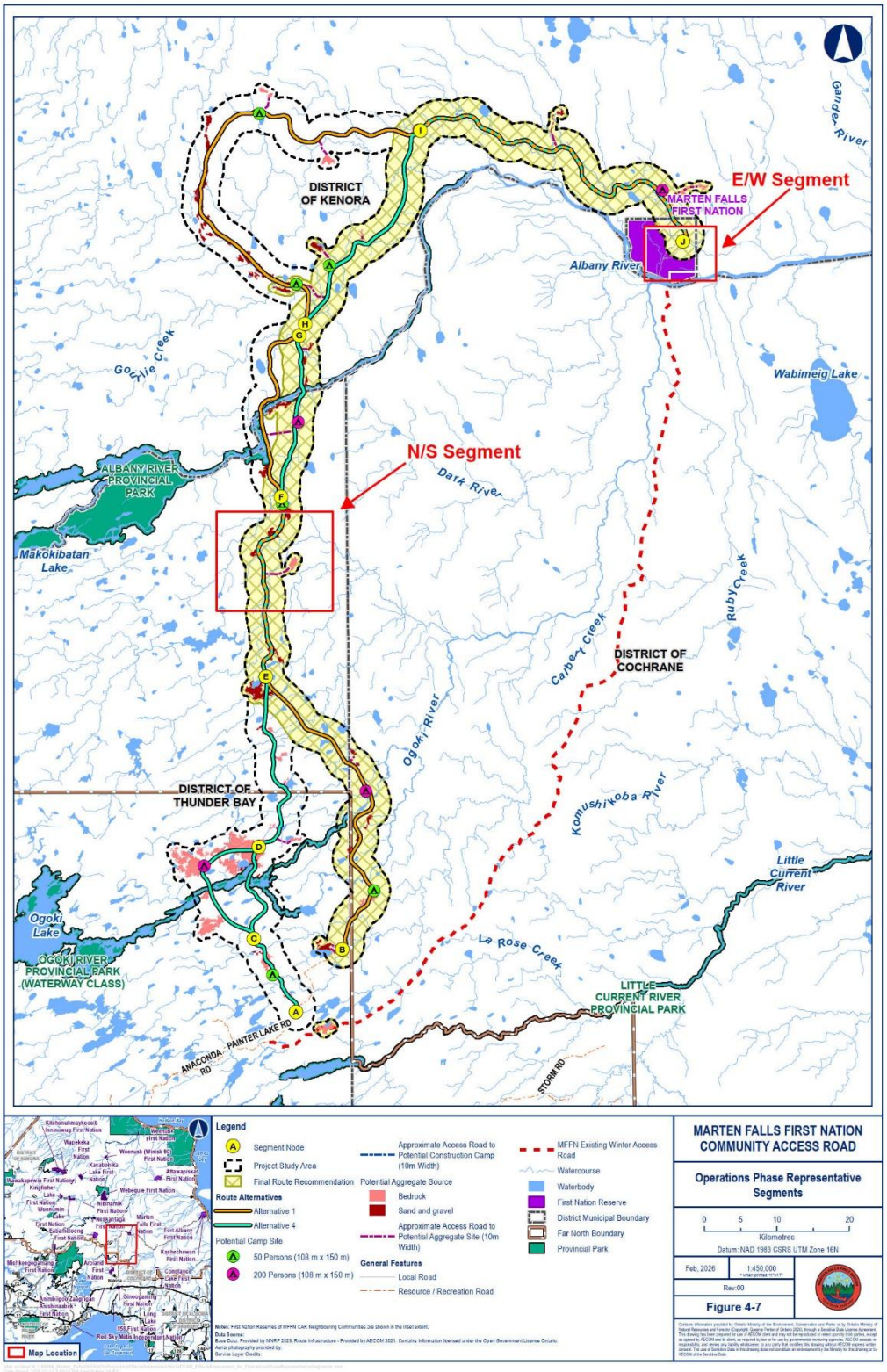
The N/S and E/W segments were both modelled as 5 km segments with 500 m link lengths. A link is a straight-line segment and can be specified as either a free-flow or queue link. For this assessment, all links were specified as free-flow links as traffic lights or stop signs are not expected on the Marten Falls First Nation Community Access Road.

A 5 km segment was selected to be representative for each section of roadway corridor with the following rationale:

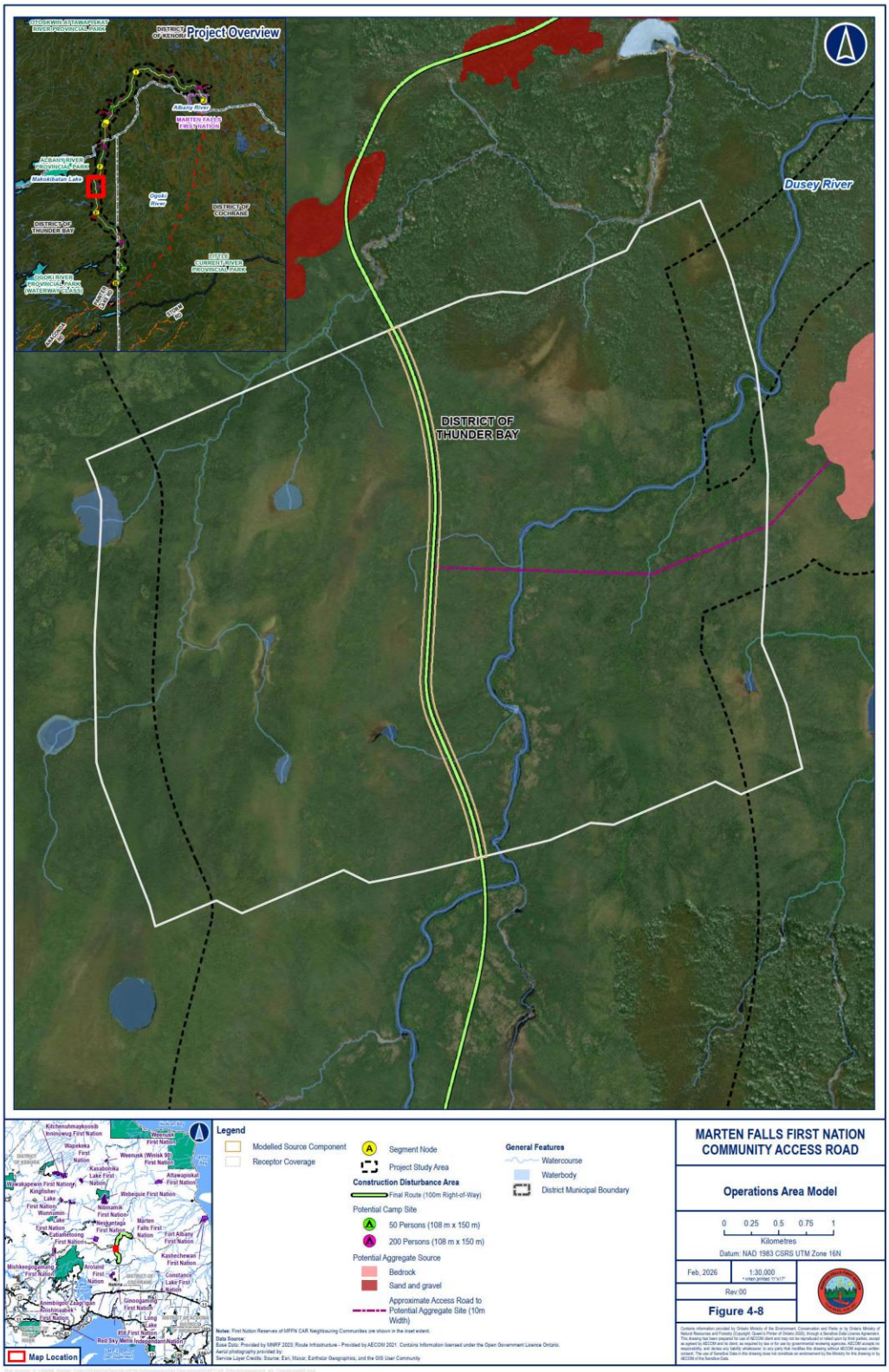
- The emission rates are consistent across each section of road corridor;
- The meteorological data is consistent across the entire corridor;
- The terrain is relatively consistent across the corridor with a gradual elevation change (approximately 250 m in the south to 150 m in the northeast) across the entire 190 km corridor; and
- As shown in Figure X, the road corridor is relatively straight, with some noted gradual bends and turns throughout the 190 km.

Results from modelling the representative segments were used to estimate potential air quality impacts within the entire study area in terms of distance from roadway to specific air quality criteria or thresholds. The location of the operations representative segments are presented in **Figure 4-7**, **Figure 4-8**, and **Figure 4-9**.

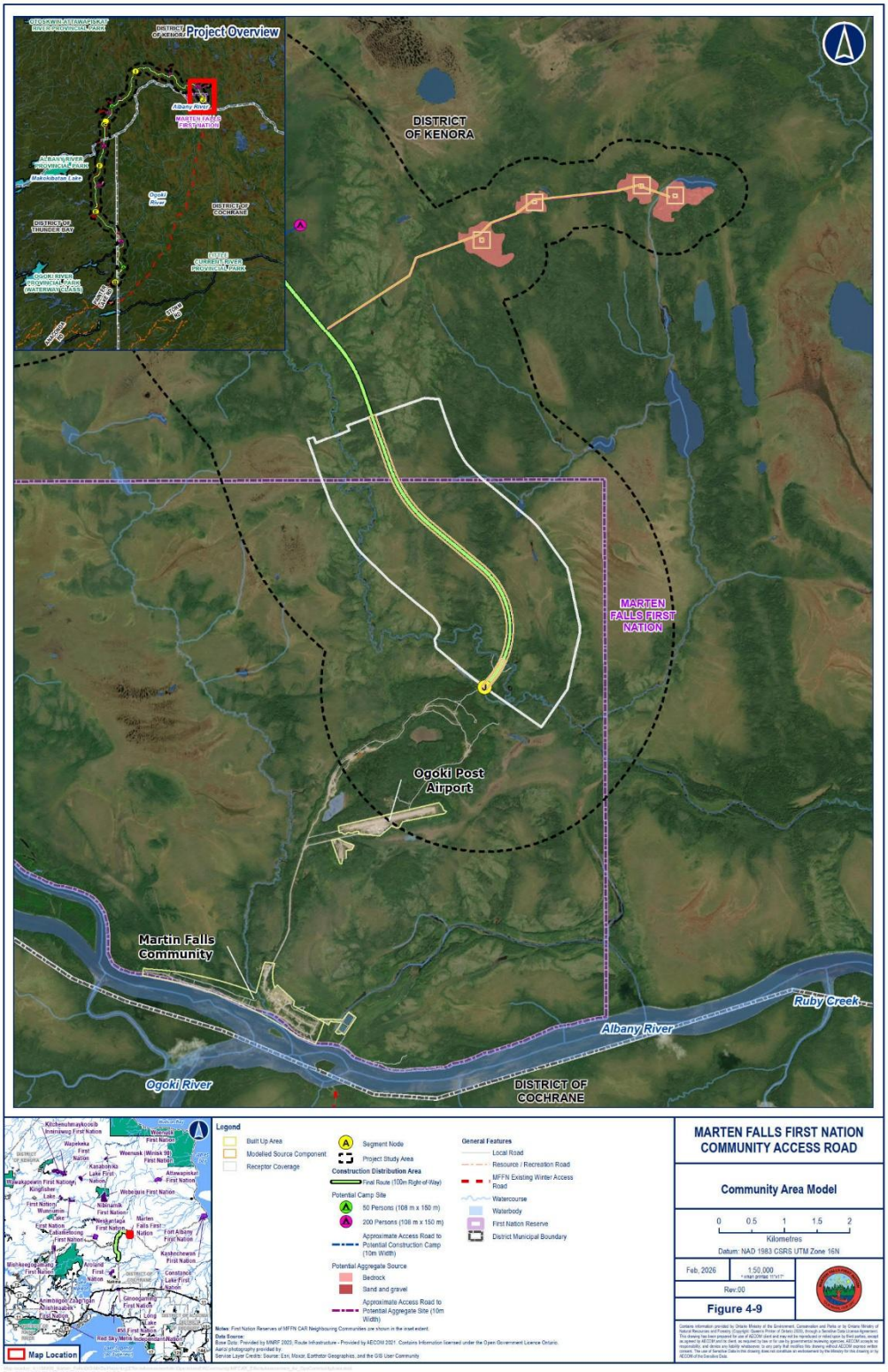
## Figure 4-7: Operations Phase Representative Segments



## Figure 4-8: Operations Model N/S Representative Segment



## Figure 4-9: Operations Model E/W Community Representative Segment



#### Acid Deposition

Acid deposition potential was also evaluated for the Operations Phase of Community Access Road, following the same documented approach previously noted in the construction methodology section. A total daily $H^+$ equivalent was calculated to be equal to 0.006 tonnes / day of H+ equivalent. This is also well below the 0.175 tonnes / day threshold recommended in the Alberta Acid Deposition Management Framework and equated to only 3.2% of the threshold limit.

#### Particulate Deposition

For modelling particulates, deposition parameters including settling velocity and deposition velocity are specified in **Table 4-16**. In the absence of deposition parameters for Total Suspended Particulate, the $PM_{10}$ deposition parameters were used for Total Suspended Particulate modelling. The course particles found in Total Suspended Particulate have deposition rates an order of magnitude higher than fine particles (Wilson and Suh, 1997). Using $PM_{10}$ parameters for Total Suspended Particulate results in a conservative estimate of ground-level Total Suspended Particulate concentrations due to the likely underestimation of Total Suspended Particulate depositions. For gas-phase compounds, the deposition parameters were set at zero, indicating no measurable gas deposition under any condition. **Table 4-16** provides a summary of deposition parameters used.

**Table 4-16: CAL3QHCR Particulate Deposition Parameters**

| | Settling Velocity (cm/s) | Deposition Velocity (cm/s) |
|---|---|---|
| **Total Suspended Particulate** | 0.3 | 0.5 |
| **$PM_{10}$** | 0.3 | 0.5 |
| **$PM_{2.5}$** | 0.02 | 0.1 |

### 4.4.4 Residual Effects Characteristics

The characteristics used to complete the impact assessment are described in detail in the Environmental Assessment / Impact Assessment Report. The section that follows outlines how these characteristics were applied and provides discipline specific definitions where applicable. The impact assessment characteristics have been described in **Table 4-17**.

## Table 4-17: Residual Effects Characteristics

| Effects Characteristic | Definition | Description |
|---|---|---|
| **Context** | ■ Ecological context | ■ See Description in **Section 4.4.5**. |
| **Direction** | ■ Direction of change from existing conditions | ■ Positive: net gain or positive effect;<br>■ Neutral: no change to existing condition; and<br>■ Negative: net loss or adverse effect. |
| **Magnitude** | ■ Magnitude is the expected change from existing conditions | ■ Negligible, low, medium, high; and<br>■ See description in **Section 4.4.5**. |
| **Geographic Extent** | ■ The spatial area that the effect is expected to occur | ■ Construction Disturbance Area: effect is confined within the direct physical disturbance of Community Access Road;<br>■ Local: effect extends into the Local Study Area;<br>■ Regional: effect extends into the Regional Study Area; and<br>■ Beyond Regional: effect extends beyond the Regional Study Area. |
| **Duration** | ■ The period of time that the effect is expected to occur | ■ Short-term: effect ends before the end of construction;<br>■ Medium-term: the effect occurs during construction and ends soon after operation begins and / or maintenance ends soon after the activity causing the effect ends; and<br>■ Long-term: the effect occurs during construction and persists into operation and / or the effect is considered permanent, or the likelihood of reversibility is low or uncertain. |
| **Frequency** | ■ How often the effect is expected to occur | ■ Infrequent: The effect is expected to occur rarely;<br>■ Frequent: The effect is expected to occur intermittently; and<br>■ Continuous: the effect is expected to occur continuously. |
| **Reversibility** | ■ The ability to return to existing conditions | ■ Reversible: the effect is not permanent; and<br>■ Irreversible: the effect is permanent. |
| **Likelihood** | ■ Probability that the effect will occur | ■ Unlikely: the effect is not likely to occur;<br>■ Possible: the effect may occur but is not likely;<br>■ Probable: the effect is likely to occur; and<br>■ Certain: the effect will occur. |
| **Uncertainty** | ■ The potential for observed results to deviate from predictions made | ■ See description in **Section 4.4.5**. |

### 4.4.5 Discipline Specific Characteristics

In addition to the residual effects characteristics described in **Table 4-17** above, the Air Quality Study has prepared specific definition.

#### Ecological Context

The ecological context within which potential environmental, health, social and economic effects may occur has been taken into account when considering the effects criteria, such as species sensitivity and resilience, and includes Indigenous Knowledge where it was available. The ecological context of the effect includes a discussion of the environmental consequences of the predicted effect.

For the Air Quality assessment ecological context is directly related to changes in air quality with respect to relevant air quality criteria.

#### Magnitude

Magnitude refers to the amount of change in a measurable parameter relative to the existing conditions of a valued component, with and without Community Access Road in place, or to other standards or guidelines. When evaluating the magnitude of effects this study considers both the proportion of the Valued Component affected within identified spatial boundaries and the relative effect.

For magnitude, environmental discipline-specific definitions are required and are provided below in **Table 4-18**.

**Table 4-18: Air Quality Magnitude Definition**

| Magnitude Level | Definition | Rationale |
|---|---|---|
| **Negligible** | Cumulative concentrations (Project + background) are below Air Quality criteria and an increase of < 50% of baseline values at sensitive receptors | Magnitude definitions consider compliance with air quality criteria (AAQC (MECP, 2020) and CAAQS (CCME, 2021)) and changes from existing conditions |
| **Low** | Cumulative concentrations (Project + background) are below Air Quality criteria and an increase of >50% of baseline values at sensitive receptors | |
| **Medium** | Cumulative concentrations (Project + background) exceed Air Quality criteria, and an increase of < 50% of baseline values at sensitive receptors | |

| Magnitude Level | Definition | Rationale |
|---|---|---|
| **High** | Cumulative concentrations (Project + background) exceed Air Quality criteria, and an increase of > 50% of baseline values at sensitive receptors | |

### Frequency

Frequency refers to how often the effect is expected to occur. Specific to residual effects with respect to air quality, frequency is directly correlated to the continuousness of emission generating activities which will result in the predicted effect.

Depending on the emission generating activity the frequency would be influenced by whether the activity occurs intermittently (e.g., blasting) or consistently (e.g., material handling and hauling) during the phases of Project development.

### Reversibility

Reversibility refers to the ability for conditions to return to existing conditions. In respect to air quality, reversibility is considered based on the potential for air quality conditions to return to previous state (i.e., if sources of emissions are removed will air quality return to existing conditions). If emission generating activities are stopped, in most cases, ambient air quality will return to existing state.

Reversibility of potential indirect effects that short-term air quality impacts may have on other discipline specific components (i.e., sensitive vegetation) is not considered in this effects characterization. Other discipline specific reports may comment on this further.

### Uncertainty / Likelihood

All impact assessments involve some level of uncertainty, often over many geographic, biophysical, and social dimensions, and observed results may deviate, to some degree, from predictions made in the assessment. Uncertainty could be related to a number of factors, such as Project design and components, existing conditions, spatial and temporal scope, valued component response, effectiveness of mitigation measures, overall scope of factors considered, cumulative effects, and natural and human causes of accidental events. Note that all uncertainties related to the effectiveness of mitigation measures must be considered when determining residual effects. Transparency in describing sources of uncertainty is critical to understanding the confidence that can be attributed to the analysis of effects and is important to decision-making. Efforts to address uncertainties has been focused on those uncertainties that are most meaningful to decision-making, such as how

the biophysical and human environment will respond to changes and the efficacy of mitigation measures.

A level of uncertainty exists due to conservative methodologies used in the preparation of the emission calculations and dispersion models.

Emission calculations were based on a worst-case construction or operations condition. By using the worst-case emissions condition, the predicted impacts are not likely to be exceeded and presents an upper-bound for the potential residual effects.

The air dispersion models are prepared using five years of meteorological data, with the result presented as maximum ground level concentrations for their respective averaging periods. The maximum ground level concentrations occur under the worst-case meteorological condition (wind speed, wind direction, temperature, etc.). Additionally, as indicator compounds are compared to criteria with various averaging periods (e.g., 10-minute, 1-hour, 24-hour, annual), the shorter the averaging period, there exists an increased potential for anomalous meteorological events to over-predict expected impacts.

### Prediction Confidence

Prediction confidence refers to the degrees of certainty in the predicted residual effects and associated determination of significance. All Impact Assessments involve some level of uncertainty, often over many geographic, biophysical, and social dimensions, and observed results may deviate, to some degree, from predictions made in the assessment. Therefore, the residual effects predictions vary in their level of certainty, which could be related to a number of factors such as Project design and components, existing conditions, spatial and temporal scope, Valued Component response, effectiveness of mitigation measures, overall scope of factors considered, and natural and human-induced influences on the biophysical and human environment. Accuracy of the data (e.g., vegetation mapping) used for the assessment also influences prediction confidence and has been considered for this assessment.

Transparency in describing sources of uncertainty is critical to understanding the confidence that can be attributed to the analysis of effects and is important to decision-making. Efforts to address uncertainties have been focused on those uncertainties that are most meaningful to decision-making, such as how the biophysical and human environment will respond to changes and the efficacy of mitigation measures. Each potential residual effect was assigned a confidence level as a means of ranking potential effects and vegetation Valued Components. The confidence levels are defined as:

- **Low**: Confidence levels were considered to be low if there were no representative baseline air quality data available for the indicator compounds, the operations activity

associated with the maximum predicted impacts are poorly understood, and the level of certainty associated with receptor data is low or unknown;

- **Moderate**: Confidence levels were considered to be moderate if there was representative data available to estimate background air quality for the indicator compounds, the operations activity associated with the maximum predicted impacts are reasonably understood, and the level of certainty associated with receptor data or Project conditions is moderate to high; and
- **High**: Confidence levels were considered to be high if there was representative data available to estimate background air quality for the indicator compounds, the operations activity associated with the maximum predicted impacts are clearly understood, and the level of certainty associated with receptor data or Project conditions is high.

### Determination of Significance

A conclusion on significance will be made using the characteristics described in **Section 4.4.4** as well as taking into consideration professional judgement.

Significance of residual effects was made using the effects characteristics described above. The assessment of significance of residual effects of Community Access Road was informed by the interaction between the residual effects characteristics, with magnitude, duration, reversibility, and geographic extent being the most important factors, along with consideration of context.

To evaluate significance of potential residual effects, modelling results discussed in **Section 7.1.1 – Potential Effects** and **Section 7.2.1 – Potential Effects** were used in conjunction with the effects characteristics defined in **Table 4-17**. The determination of significance was generally as follows:

- **Significant:** Residual effects were generally considered as significant if the residual effects assessed as a high magnitude with potential residual impacts occurring at sensitive receptors, at either a frequent occurrence or in long term duration with irreversible effects.
- **Not Significant:** Residual effects were generally considered Not Significant if they demonstrated any other combination.

An assessment of significance was completed for all construction activities as well as operations. It is noted that the predicted residual effects are presented for an activity that is intermittent (e.g., blasting) or continuous (e.g., material handling and hauling) in nature to provide a more comprehensive summary of potential residual effects.

## 4.5 Mitigation and Enhancement Measures Methodology

Following the identification of potential effects, the effects assessment has explored technically and economically feasible mitigation measures to avoid or minimize the identified negative effects. The recommended enhancement measures are anticipated to increase positive effects beyond those that are already inherent to the design. These measures consist of industry-standard practices, federal and provincial standard specifications, regulator-mandated measures, best management practices, Indigenous and community recommendations and recommendations from environmental professionals based on expertise, scientific publications, experience, and judgement.

It is important that mitigation and enhancement measures are achievable, measurable, and verifiable and monitored for compliance and effectiveness during all temporal phases as part of Community Access Road follow-up monitoring plan. Recommended environmental monitoring will verify the potential environmental effects predicted, evaluate the effectiveness of mitigation and enhancement measures, and identify the process the Proponent will follow if mitigation and enhancement measures are not effective.

## 4.6 Data Management and Analysis Methodology

Data management including quality assurance / quality control has been employed to minimize potential for data entry and analysis errors, prepare data sets for analysis and limit sensitive data distribution in accordance with established agreements.

### 4.6.1 Field Surveys

To maintain consistency and for quality assurance / quality control of the data collected, standardized datasheets (either digital or paper) paired with mapping software have been used in the field. Field studies have followed technical protocols that outlined specific work instructions and have been developed to follow provincially and federally acceptable methods. Completeness and accuracy of field data was verified daily during field verification and field photos and coordinate information has been backed up on a regular basis.

### 4.6.2 Geographic Information Systems

Where existing conditions data is available in Geographic Information Systems format, this information will be provided to the Agency as electronic geospatial data file(s) compliant with the International Organization for Standardization 19115 standard. This will support the Government of Canada’s commitment to Open Science and Data and will facilitate the

sharing of information with the public through the Canadian Impact Assessment Registry Internet Site and the Government's Open Science and Data Platform. The Agency intends to make the geospatial data files available to the public under the terms of the Open Government Licence– Canada as applicable with exclusion of sensitive species at risk and Indigenous Knowledge.

Complete data sets from all survey sites will be provided upon finalization of this Report. They will be in the form of complete and quality assured relational databases, with precisely georeferenced site information, precise observation / visit information and with observations and measurements in un-summarized form. Databases and Geographic Information Systems files will be accompanied by detailed metadata that meets International Organization for Standardization 19115 standards. Documentation and digital files will be provided for all results of analyses that allow for a clear understanding of the methods and a replication of the results. All geographic data, along with accompanying metadata, pertaining to species at risk will be provided to Natural Heritage Information Centre and the Ministry of Environment, Conservation and Parks – Species at Risk Branch.

## 4.7 Deviations from Draft Study Plan

Deviations from the Draft Community Access Road: Air Quality and Greenhouse Gas Study Plan (AECOM CANADA ULC 2021) in **Attachment A** were anticipated to be required as Community Access Road evolved due to challenges encountered in the field, alternative methodologies being developed, comments from regulators, and as updated guidance became available.

**Table 4-19** below outlines these deviations. General changes such as changes to section headings, organization of sections and subsections and, changes to phrasing and tense have been made throughout. These administrative changes have not been documented in **Table 4-19**.

**Table 4-19: Deviations from Draft Study Plan**

| Section Reference | Description of Change | Rationale |
|---|---|---|
| **3.2.3 Spatial Boundaries** | The Draft Study Plan previously used the term 'Local Study Area' to define the 5 km corridor which is being studied in the Existing Conditions section, and within which the footprint of Community Access Road will be further refined. This area has been retitled as the 'Project Study Area'. | This change eliminates confusion between Community Access Road Study Area and the Discipline Specific Local Study Area. |

| Section Reference | Description of Change | Rationale |
|---|---|---|
| **3.4 Data Management** | In **Section 3.4.1**, the Study Plan previously identified that data would be backed up on a 'daily basis'. This wording has been revised to state that data would be backed up on a 'regular basis'. | This change brings alignment with the proponent's various data backup policies. |
| **3.4 Data Management** | In **Section 3.4.2** wording was updated to note that data sets from all survey sites will be provided upon report finalization. No timeline had been previously identified. | The revision provides added clarity around when the data would be provided. |
| **4.4.3 Methods for Predicting Future Conditions** | **Sub Section $NO_x$ and $NO_2$ Conversion within Section 4.4.3** describes $NO_x$ to $NO_2$ conversion methods. | When representative NO and $NO_2$ ambient monitoring data is available, a more accurate estimate can be made when implementing the Ozone Limiting Method. |

# 5. Existing Environment Description

The Existing Conditions are described based on a combination of information obtained through engagement and consultation, desktop assessment, and field investigation.

## 5.1 Existing Meteorology

Meteorological parameters (wind speed, wind direction, temperature, relative humidity, barometric pressure, and rain precipitation) were measured through the ambient air quality monitoring program (May 2021 to May 2022). **Table 5-1** provides a summary of meteorological parameters collected during the one-year monitoring period. The hourly observations of meteorological parameters are summarized for an annual average.

**Table 5-1: Meteorological Parameter Summary**

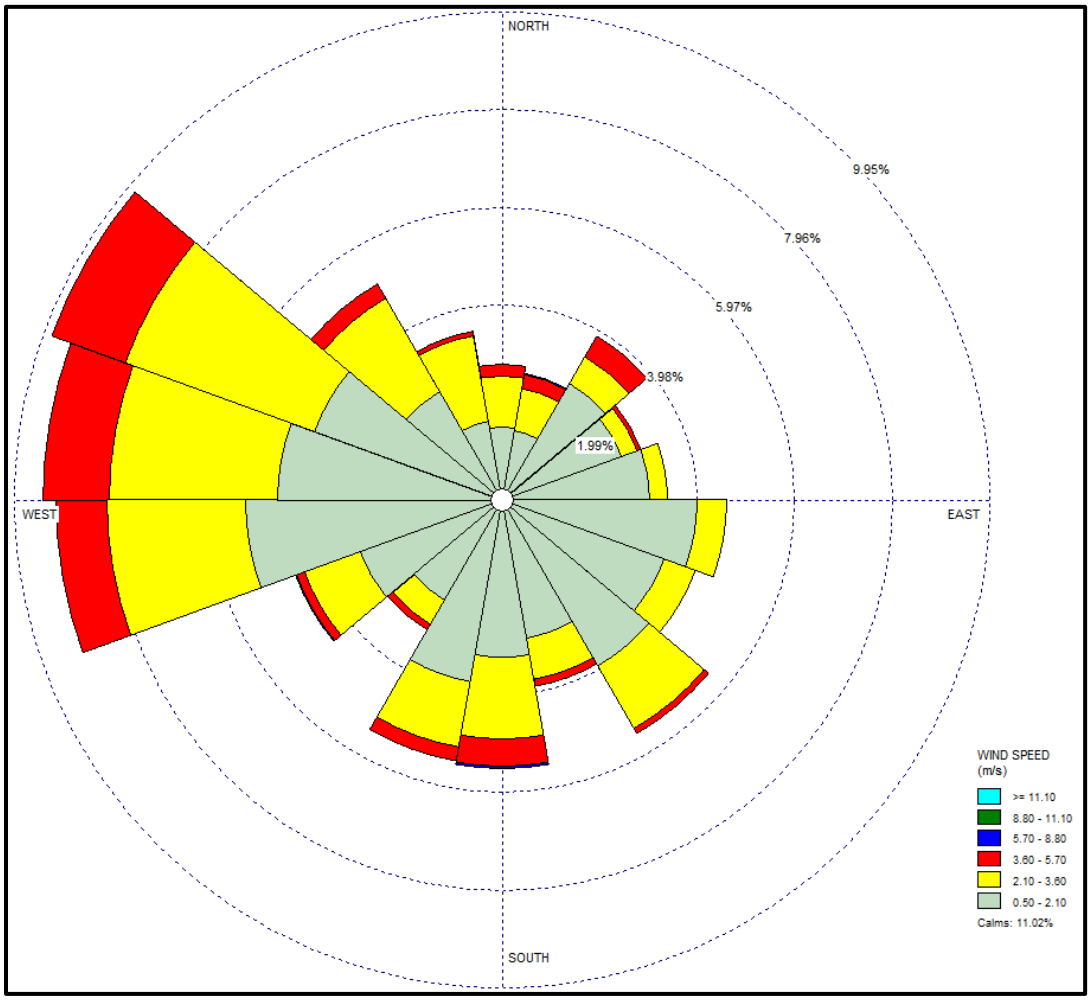
| Hourly Data Parameter | Hourly Max | Hourly Min | Annual Average | Annual Total |
|---|---|---|---|---|
| **Wind Speed (m/s)** | 6.3 | 0.03 | 1.72 | - |
| **Temperature (°C)** | 36 | -39 | 0.3 | - |
| **Relative Humidity (%)** | 100 | 13 | 71 | - |
| **Barometric Pressure (mmHg)** | 765 | 718 | 746 | - |
| **Rain Precipitation (mm)** | 17 | 0 | 0.06 | 565 |

It was found that the annual average wind speed for the site was relatively low (1.72 m/s). Marten Falls is characterized by short warm summers and long cold winters with an ambient temperature at the site varying significantly throughout the year. The highest measured temperature during the one-year monitoring program was 36°C in the summer and the lowest recorded temperature was -39°C in the winter.

The site has a relatively high annual average humidity of 71%. Humidity varies in the summer and generally remains above 70% in the winter. In general, higher rain precipitation is observed in the summer season than in the winter season.

The predominant wind direction and speeds observed during the monitoring program are summarized in the windrose provided in **Figure 5-1**. The windrose shows that the prevailing wind direction at the site is blowing from the west direction and the majority of wind observations have low wind speeds.

**Figure 5-1: Windrose (2021-05-16 to 2022-05-19) – Marten Falls First Nation Ambient Monitoring Station**




## 5.2 Existing Air Quality

The existing conditions are described based on a combination of information obtained through ambient air monitoring and desktop review and study.

A summary of measured or estimated existing ambient air quality results is presented in **Table 4-7**. Monitored or estimated values presented were calculated following statistical methods identified by both the Ambient Air Quality Criteria (Ministry of the Environment, Conservation and Parks, 2020) and the Canadian Ambient Air Quality Standards (Canadian Council of Ministers of the Environment, 2023) from a one-year data set of either continuous hourly or discrete samples depending on the indicator compound monitoring method. Some statistical methods referenced in the Canadian Council of Ministers of the Environment *Canadian Ambient Air Quality Standards* require an average

over a period of three years of monitoring data; as the Marten Falls First Nation monitoring program's duration was restricted to one year, only this single year of data was utilized. Statistical methods as indicated by both the Ministry of the Environment, Conservation and Parks Ambient Air Quality Criteria and the Canadian Council of Ministers of the Environment Canadian Ambient Air Quality Standards are referenced below.

Unless otherwise specified, contaminants with 1-hour and 24-hour criteria, are presented with the maximum and 90$^{th}$ percentile monitored values for comparison against their relevant criteria. The 90$^{th}$ percentile data is included within the table to demonstrate a reasonably conservative background concentration with the removal of data outliers due to isolated events such as forest fires that may cause elevated results. Where pollutants have specific statistical assessment requirements (i.e. 24-hour PM2.5 CAAQS which is based on a the 3-year average of the annual 98$^{th}$ percentile of the daily 24-hour average concentrations) statistical methods were incorporated as appropriate to compare against criteria and standards. Documentation of statistical methods is included within the notes section of **Table 5-2** below.

For contaminants with annual criteria, annual average concentrations are summarized using the available monitoring data. When evaluating combined impacts of ambient background and Project impacts as part of the impact assessment the 90$^{th}$ percentile value for 1-hr and 24-hr averaging periods were used and the annual average was used for annual periods.

## Table 5-2: Ambient Air Quality Results

| Indicator Compound | CAS # | Averaging Period (hour) | Criteria ($ug/m^3$) | Maximum Monitored or Estimated ($ug/m^3$) | 90th Percentile Monitored or Estimated ($ug/m^3$) | % of Guideline for the Maximum | % of Guideline for the 90th Percentile | Guideline |
|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 10102-44-0 | 1-hour | 400 | 20.7 | 3.8 | 5.2% | 1.0% | Ontario AAQC |
| | | | **79** | 16.2 | | 20.5% | 4.8% | CAAQS (2025) |
| | | 24-hour | 200 | 8.1 | 3.1 | 4.1% | 1.6% | Ontario AAQC |
| | | Annual | **23** | 1.3 | - | 5.8% | - | CAAQS (2025) |
| **$PM_{2.5}$** | – | 24-hour | 27 | 32 | 8 | 118.5% | 29.6% | Ontario AAQC |
| | | Annual | 9 | 5.1 | - | 58.0% | - | CAAQS (2020) |
| | | | 9 | 5.1 | - | 58.0% | - | Ontario AAQC |
| **$PM_{10}$** | – | 24-hour | 50 | 130.3 | 31.2 | 260.6% | 62.4% | Ontario AAQC |
| **Total Suspended Particulate** | – | 24-hour | 120 | 840.3 | 89.1 | 700.3% | 74.3% | Ontario AAQC |
| | | Annual | 60 | 56.60 | - | 94.3% | - | Ontario AAQC |
| **$SO_2$** | 7446-09-05 | 10min | **178** | 21.6 | 4.29 | 12.1% | 2.4% | Ontario AAQC |
| | | 1-hour | **100** | 13.1 | 2.6 | 13.1% | 2.6% | Ontario AAQC |
| | | | **170** | 7.9 | | 4.6% | 1.5% | CAAQS (2025) |
| | | Annual | **10** | 1.3 | - | 13.0% | - | Ontario AAQC |
| | | | **10** | 1.3 | - | 13.0% | - | CAAQS (2025) |
| **CO** | 630-08-0 | 1-hour | 36200 | 4812 | 470 | 13.3% | 1.3% | Ontario AAQC |
| | | 8-hour | 15700 | 2255 | 454 | 14.4% | 2.9% | Ontario AAQC |
| **Acrolein** | 107-02-8 | 1-hour | 4.5 | 9.1 | 0.1 | 202.8% | 2.2% | Ontario AAQC |
| | | 24-hour | 0.4 | 3.7 | 0.04 | 912.5% | 10.0% | Ontario AAQC |
| **Acetaldehyde** | 75-07-0 | 0.5-hour | 500 | 49.3 | 13.04 | 9.9% | 2.6% | Ontario AAQC |
| | | 24-hour | 500 | 10.3 | 3.4 | 2.1% | 0.7% | Ontario AAQC |
| **Benzene** | 71-43-2 | 24-hour | 2.3 | 1.1 | 0.5 | 47.8% | 21.7% | Ontario AAQC |
| | | Annual | 0.45 | 0.30 | - | 66.7% | - | Ontario AAQC |
| **Formaldehyde** | 50-00-0 | 24-hour | 65 | 31.9 | 10.7 | 49.1% | 16.5% | Ontario AAQC |
| **1,3 Butadiene** | 106-99-0 | 24-hour | 10 | 2.5 | 0.8 | 25.0% | 8.0% | Ontario AAQC |
| | | Annual | 2 | 0.9 | - | 45.0% | - | Ontario AAQC |
| **Toluene** | 108-88-3 | 24-hour | 2000 | 1.3 | 0.5 | 0.1% | 0.03% | Ontario AAQC |
| **Ethylbenzene** | 100-41-4 | 10-minute | 1900 | 2.5 | 0.32 | 0.1% | 0.02% | Ontario AAQC |
| | | 24-hour | 1000 | 0.7 | 0.2 | 0.1% | 0.02% | Ontario AAQC |
| **Xylene** | 1330-20-7 | 24-hour | 730 | 2.5 | 0.7 | 0.3% | 0.1% | Ontario AAQC |
| **Benzo(a)pyrene** | 50-32-8 | 24-hour | 0.0001 | 0.0001 | 0.0000333 | 230.0% | 66.6% | Ontario AAQC |
| | | Annual | 0.00001 | 0.00002 | - | 177.1% | - | Ontario AAQC |

**Notes:**

1. $NO_2$ Canadian Ambient Air Quality Standards 1-hour averaging based on a 3-year average of the annual 98$^{th}$ percentile of the daily maximum 1-hour average concentrations
2. $PM_{2.5}$ Canadian Ambient Air Quality Standards 24-hour averaging based on the 24-hour 98$^{th}$ percentile ambient measurement annually, averaged over 3 consecutive years
3. $PM_{2.5}$ Canadian Ambient Air Quality Standards annual averaging based on a 3-year average of the annual 98$^{th}$ percentile of the daily 24-hour average concentrations
4. $SO_2$ Canadian Ambient Air Quality Standards 1-hour averaging based on a 3-year average of the annual 99$^{th}$ percentile of the $SO_2$ daily maximum 1-hour average concentrations
5. CO values based on the maximum 90$^{th}$ percentile of data obtained from the following Environment Canada National Air Pollution Surveillance stations (Hope Airport, Fort Smith, Inuvik)
6. Acrolein, Acetaldehyde, Formaldehyde and 1,3 Butadiene values are based on an Ethylbenzene ratio of United States Environmental Protection Agency Speciate Emission Profiles
7. BAP is estimated based on an averaged ratio of measured B(a)P to $PM_{2.5}$ at representative National Air Pollution Surveillance stations
8. 1,3 Butadiene annual value is based on a ratio of Benzene from the United States Environmental Protection Agency SPECIATE Emission Profile
9. **Bold** values indicate that guideline values were reported in ppb/ppm values were converted to µg/m3 for comparison purposes
10. Ontario AAQC = Ontario Ambient Air Quality Criteria
11. CAAQS = Canadian Ambient Air Quality Standards
12. Sample frequency for each monitored contaminant is referenced in **Table 4-5**.

### 5.2.1 Ambient Air Quality Discussion

Averaging period criteria are defined by both the Ontario Ambient Air Quality Criteria as well as the Canadian Council of Ministers of the Environment Canadian Ambient Air Quality Standards. It should be noted that the Canadian Ambient Air Quality Standards are stringent, aspirational regional air quality targets and not Project-specific air quality criteria.

All contaminants were shown to be below the Ontario Ambient Air Quality Criteria and / or Canadian Ambient Air Quality Standards Criteria when compared against their maximum and 90$^{th}$ percentile concentrations with the exception of particulates, Acrolein, and Benzo(a)Pyrene.

#### Particulates

The maximum 24-hour concentrations of particulates, including Total Suspended Particulate, $PM_{10}$, and $PM_{2.5}$, exceeded the criteria while the 90$^{th}$ percentiles are below their respective criteria. This indicates the concentrations exceeded the criteria on an intermittent basis. The exceedances may be due to isolated events such as forest fires influencing ambient air quality. Community wood burning can also contribute to elevated short-term particulate levels. The annual average concentrations of particulates (Total Suspended Particulate, $PM_{10}$, and $PM_{2.5}$) are below the criteria. Given the proximity of the station to an unpaved community roadway and the Marten Falls diesel generating station, the measured particulates can be partially attributed to emissions from these sources.

It should be noted that the ambient annual total suspended particulates was observed to be 94% of its relevant criteria. This is due to the potentially anomalous values that have not been removed from the calculation of annual averaged concentrations. For additional context, the 90$^{th}$ percentile Total Suspended Particulate concentration was shown to be 10% of the maximum observed 24-hour Total Suspended Particulate concentration. Therefore, the calculation of annual particulates is anticipated to be conservative.

#### Benzo(a)Pyrene

Benzo(a)pyrene concentrations were estimated from the ECCC Simcoe Ontario NAPS monitoring station, based on measurements from 2017 to 2019. Although this station is located within a rural location, the population within 50 km of Simcoe is over 150,000. The main industries in that region are agriculture and manufacturing and combustion processes in these industries emit Benzo(a)Pyrene. The use of Simcoe data to reflect Benzo(a)pyrene in Community Access Road area substantially over-estimates background air quality.

Benzo(a)Pyrene is a by-product of incomplete combustion of burning organic matter such as wood. The maximum 24-hour concentration of benzo(a)pyrene exceeded the criteria while the 90$^{th}$ percentile is well below the criteria. The annual benzo(a)pyrene is above the Ontario Ambient Air Quality Criteria.

### Acrolein

The maximum ambient 1-hour and 24-hour concentrations of Acrolein are shown to exceed criteria, while the 90$^{th}$ percentiles are below their respective criteria. It should be noted that Acrolein was not a measured indicator compound within the sampling program. Acrolein baseline concentrations were estimated from measured ethylbenzene concentrations. This method of calculation is described in **Section 4.3.2**. The methodology considered conservative and may overestimate actual acrolein ambient levels as the ethylbenzene ratios resulted in the highest calculated existing concentrations of each volatile organic compound.

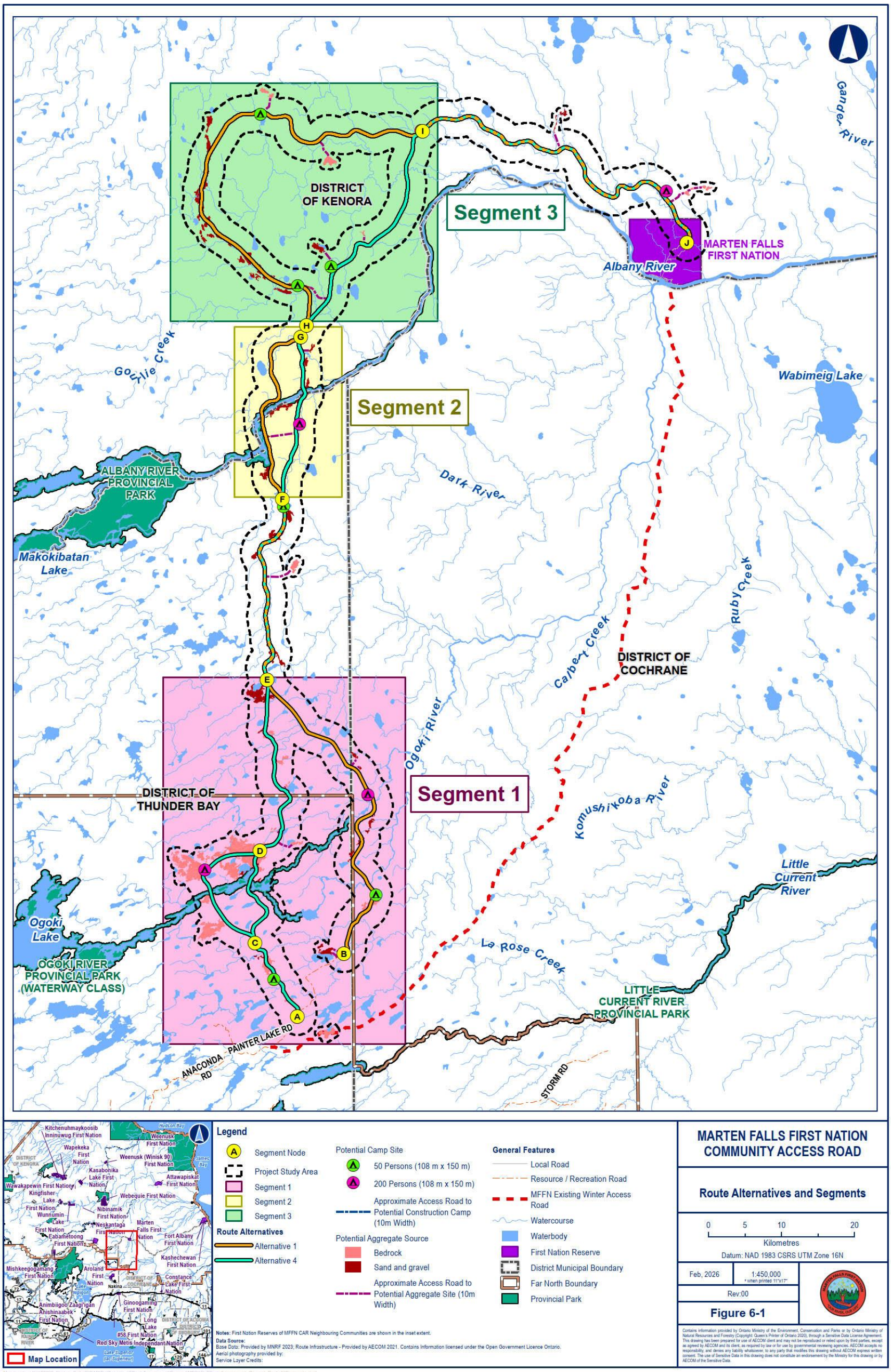
# 6. Selection of the Preferred Route

Following the collection of existing condition information on the two alternative route alignments described in **Section 4**, Community Access Road undertook an exercise to select a Preferred Route. The methodology and detailed results of this exercise are described in the Environmental Assessment / Impact Assessment and are summarized at a high level below. The Preferred Route includes the footprint of any ancillary features such as pits and quarries, temporary access roads, and worker camps associated with the construction of that route. The Impact assessment will be completed using the identified preferred route.

## 6.1 Alternative Segments and Routes Within Each Segment

In order to simplify the evaluation of the alternatives, the alternatives were divided into three separate segments based on their geographical locations (**Figure 6-1**). The segments were also determined so that any alternative route in one segment could connect with any alternative route in the next segment, allowing for decisions to be made based on the environment in each segment, and not based on the whole. This approach considers the variable environmental conditions within Community Access Road area, allowing for flexibility to avoid sensitive natural features encountered within Community Access Road disturbance area for each segment instead of requiring decision makers to balance trade offs of one long route versus the other.

## Figure 6-1: Route Alternatives and Segments



## 6.2 Preferred Route

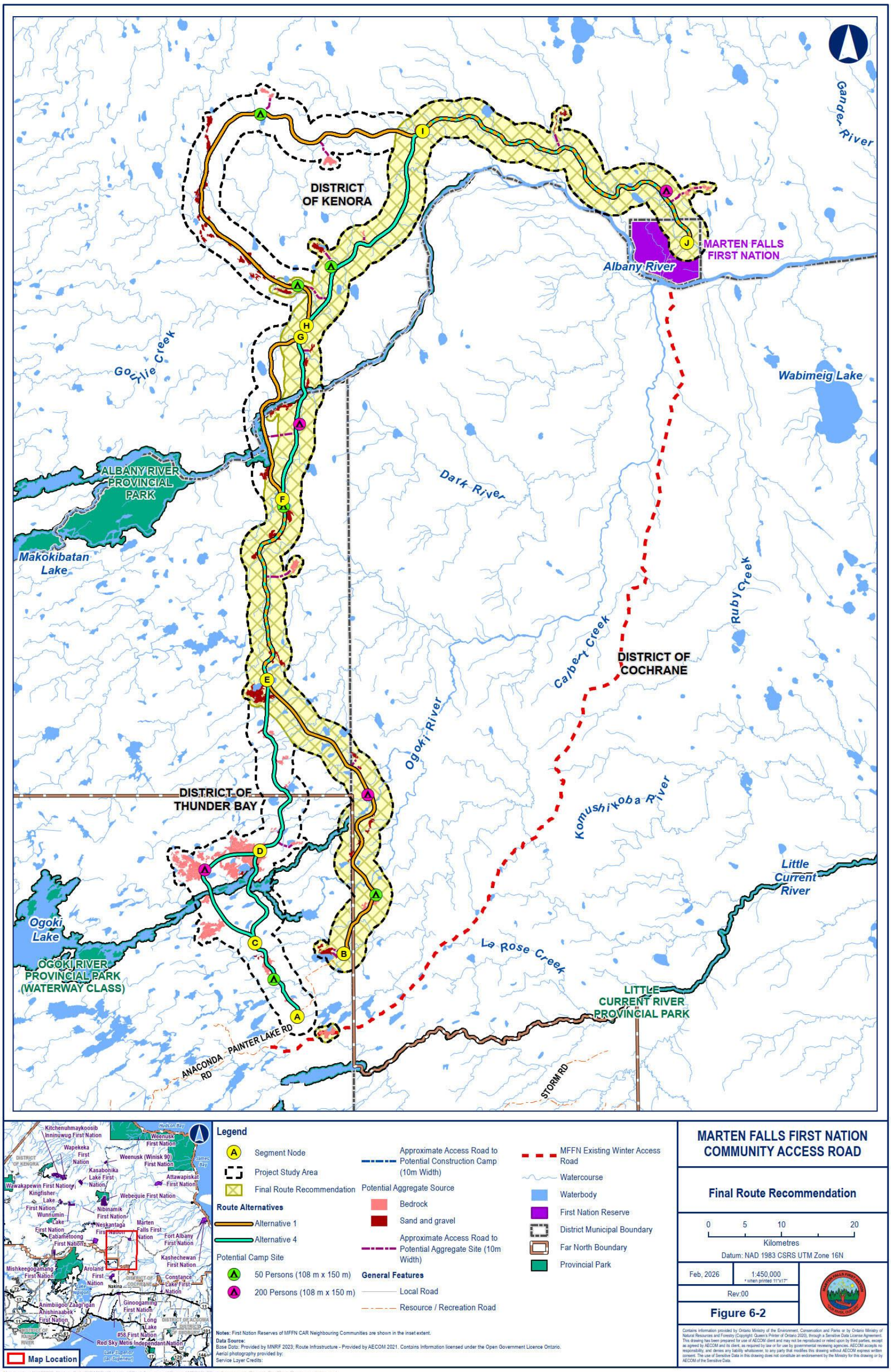
The selection of the preferred route within each segment involved a thorough analysis of technical, economic, natural, social, and cultural factors. The route alternative evaluation took into account the potential impacts and standard or known mitigation approaches to determine the net positive or negative effects of each alternative and was completed using the reasoned argument (trade-off) method. The reasoned argument method qualitatively compares the advantages and disadvantages of each alternative including the relative significance of the potential net effects.

Following the completion of the steps outlined above, and direction from the Marten Falls First Nation community of Marten Falls First Nation, Aroland First Nation and input from the public and regulators, the Proponent identified a preferred route alignment for each segment.

- Segment 1 – Ogoki Crossing: Alternative 1;
- Segment 2 – Albany Crossing: Alternative 4; and
- Segment 3 – North of the Albany: Alternative 4.

The combination of Segments 1, 2, and 3 create the final Preferred Route (**Figure 6-2**).

## Figure 6-2: Preferred Route



## 6.3 Refined Study Areas / Presumed Impact Areas

The selection of a Preferred Route resulted in refined study areas which represent only one route corridor instead of two (as is described in **Section 4.2.3**). The revised areas are described in **Table 6-1** below. These areas include ancillary features such as pits & quarries, temporary access roads, and worker camps.

**Table 6-1: Discipline Specific Study Areas Description and Rationale**

| Study Area | Geographic Extent | Rationale | Area Size |
|---|---|---|---|
| **Local Study Area** | ■ Air Quality: Construction Disturbance Area plus a 5 km buffer that extends from the perimeter of the Construction Disturbance Area | ■ Air Quality: A local study area has been selected to align with the Ontario Ministry of the Environment, Conservation and Parks recommendations for local dispersion modelling, which is that effects be assessed up to 5 km from a source (Ministry of the Environment, Conservation and Parks, 2019). | ■ 239,095 ha |
| **Regional Study Area** | ■ Air Quality: Not applicable | ■ Air Quality: Not Applicable as effects are not expected beyond the Local Study Area. | ■ N/A |

# 7. Impact Assessment of Community Access Road

Impact Assessment results are provided for the Preferred Route, by each temporal phase of Community Access Road as described in **Section 4.2**. This includes the potential effects (positive and negative), mitigation measures, residual effects, and indirect effects. Where applicable Gender-Based Analysis Plus has been considered within the assessment for each Valued Component.

## 7.1 Construction Phase

As described in **Section 4.2.1** the construction phase encompasses the time from start of construction, including site preparation activities, to the start of operations of the Marten Falls First Nation Community Access Road. Decommissioning of construction works (temporary pits and quarries, worker camps, temporary access roads) is included in the construction phase. The construction phase is anticipated to take approximately three to ten years to complete.

Modelling was completed for the construction and operation phases of this Project. Predicted impacts from the model were combined with monitored background air quality to determine the potential effects.

The potential residual effects were assessed along the Construction Disturbance Area and at the Marten Falls First Nation community for the construction and operational scenarios. The following sections provide a summary of model results for both construction and operations scenarios.

**Table 7-1** provides a summary of the maximum distance from each source / construction activity where compliance to indicator compound specific criteria / limits are achieved. Additionally, a maximum distance to criteria / limit minus ambient background, maximum distance to 50% of criteria and maximum distance to 50% of background are also summarized. These concentration thresholds were selected to inform the magnitude of the potential residual effect which is based on a percent change from existing conditions as well as a comparison to indicator compound specific criteria / limits.

Results of predicted maximum ground level concentrations are summarized on a construction source / activity basis. It should be noted that some sources of emissions such as blasting are short term in duration, and the location of construction activities will change as road development progresses. The location of active quarries will be reflective of the location of roadway under development.

Community specific models were developed to provide predicted impacts of road construction activities in close proximity to the Marten Falls First Nation community. Community model results were based on a worst-case operations condition assuming the worst-case emissions for each indicator compound across all construction operations / activities where all equipment and construction related activities are occurring at the same time. This includes blasting and burning emissions. This scenario is unlikely to occur during periods of construction however it was assessed to provide the most conservative model results for the purpose of evaluating potential air quality impacts at the Marten Falls First Nation community location.

**Table 7-2** provides a summary of predicted criteria exceedances during the construction phase at the Marten Falls First Nation community and Ogoki Post Airport locations. Included in this table is a summary of both Project and Project plus background predicted impacts.

Included within **Attachment C – Isopleths** are isopleths (concentration contour maps) for each indicator compound where construction activities would result in ground level concentrations greater than their relevant criteria. Contour plots were not prepared for pollutants that did not exceed criteria.

The Marten Falls First Nation community models include the Marten Falls First Nation community infrastructure located on the shoreline of the Dark River as well as the Ogoki Post Airport located to the north. The Marten Falls First Nation community infrastructure includes dwellings, etc., and places of human activity. The Ogoki Post Airport is located outside of the central Marten Falls First Nation community boundary, however as it is also a location where human activity can occur, it has been included separately for completeness.

## Table 7-1: Summary of Maximum Distances to Criteria / Thresholds – Construction Phase N/S Segment

| Indicator Compound | Averaging Period | Background Concentration (µg/m³) | Criteria Source[1] | Criteria (µg/m³) | 50% Criteria (µg/m³) | 50% Background (µg/m³) | Criteria Minus Background (µg/m³) | Road Blasting | | | | Road Construction | | | | Bridge | | | | Access Road | | | | Burning | | | | Quarry Blast | | | | Quarry Aggregate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
| **$NO_2$** | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | N/A | N/A | 4870 | N/A | N/A | N/A | 7600 | N/A | N/A | 50 | EMD | N/A | N/A | N/A | 3,500 | N/A | N/A | N/A | EMD | N/A | N/A | 616 | EMD | N/A | N/A | N/A | EMD | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | NA | 112 | 4870 | N/A | N/A | N/A | 7600 | N/A | 900 | 2000 | EMD | 919 | N/A | N/A | 3,500 | N/A | 2598 | 5,441 | EMD | 2,733 | 3960 | EMD | EMD | 5700 | N/A | 621 | EMD | N/A |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | N/A | N/A | 137 | N/A | N/A | N/A | 800 | N/A | N/A | N/A | 2368 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 4551 | N/A | N/A | N/A | 1696 | N/A | N/A | N/A | 905 | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 50 | 80 | 340 | 52 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **$PM_{2.5}$** | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19 | N/A | N/A | N/A | N/A | 297 | 601 | 1,706 | 440 | N/A | 20 | 71 | N/A | N/A | N/A | 218 | N/A | 711 | 1,341 | 3,525 | 1,030 | N/A | N/A | N/A | N/A | N/A | 305 | 943 | 199 |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **$PM_{10}$** | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | N/A | N/A | N/A | N/A | 157 | 327 | 515 | 439 | N/A | N/A | N/A | N/A | 125 | 387 | 551 | 461 | 455 | 852 | 1,276 | 1,099 | N/A | N/A | 459 | 366 | N/A | N/A | 372 | 299 |
| **TSP** | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | N/A | N/A | N/A | N/A | 82 | 186 | 251 | 355 | N/A | N/A | N/A | N/A | 78 | 175 | 243 | 434 | 194 | 399 | 529 | 709 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 174 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **$SO_2$** | 10min | 4.29 | Ontario AAQC | 178 | 89 | 2.145 | 173.7 | 742 | 1060 | EMD | 766 | N/A | N/A | N/A | N/A | N/A | N/A | 350 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | EMD | EMD | EMD | EMD | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | 754 | 1191 | EMD | 764 | N/A | N/A | N/A | N/A | N/A | N/A | 19 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | EMD | EMD | EMD | EMD | N/A | N/A | N/A | N/A |
| | | 7.9 | CAAQS (2025) | 170 | 85 | 3.95 | 162.1 | 543 | 984 | EMD | 564 | N/A | N/A | N/A | N/A | N/A | N/A | 73 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | EMD | EMD | EMD | EMD | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **CO** | 1 hr | 469.7 | Ontario AAQC | 36,200 | 18,100 | 235 | 35730 | N/A | N/A | 4,483 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 85 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 7,429 | N/A | 1,459 | 5,233 | EMD | 1,458 | N/A | N/A | N/A | N/A |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 227 | 15246 | N/A | N/A | 803 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2,794 | N/A | 687 | 1,177 | EMD | 699 | N/A | N/A | N/A | N/A |
| **Acrolein** | 1 hr | 0.1 | Ontario AAQC | 4.5 | 2.25 | 0.05 | 4.4 | N/A | N/A | N/A | N/A | N/A | 5 | 2500 | N/A | N/A | 5 | 2508 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 950 | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 0.4 | 0.2 | 0.02 | 0.36 | N/A | N/A | N/A | N/A | N/A | N/A | 350 | N/A | N/A | N/A | 170 | 10 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Acetaldehyde** | 0.5 hr | 10.1 | Ontario AAQC | 500 | 250 | 5.0 | 489.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 24 hr | 3.4 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Benzene** | 24 hr | 0.5 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.30 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Formaldehyde** | 24 hr | 10.7 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **1,3 Butadiene** | 24 hr | 0.8 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.9 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Toluene** | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 1,999.50 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 51 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Ethylbenzene** | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 999.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2,190 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Xylene** | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 29 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Benzo(a)pyrene** | 24 hr | 0.00003 | Ontario AAQC | 0.00005 | 0.000025 | 0.0000 | -- | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 6 | 57 | 75 | 74 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.00002 | Ontario AAQC | 0.00001 | 0.000005 | 0.00001 | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- | N/A | 30 | N/A | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | N/A | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- |

**Notes:**

(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.

Max Distances to - represents the distance where the indicator compound's GLC will no longer exceed their respective criteria/threshold.

N/A - not applicable, the maximum GLC does not meet or exceed their respective criteria/threshold

"--" - The measured benzo(a)pyrene background concentrations exceed benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

Max Distances were based on GIS analysis of model results and are approximate

Criteria Minus Background represents the maximum (Point of Impingement) POI value that Community Access Road can contribute to before indicator compound specific criteria are exceeded due to the combined effect of Project and Ambient conditions.

EMD = Exceeds Modelling Domain, concentrations are greater than threshold within modelling domain

## Table 7-2: Summary of Predicted Criteria Exceedance – Construction Phase – East/West Community Segment

| Indicator Compound | Averaging Period | Background Concentration (µg/m$^3$) | Criteria Source[(1)] | Criteria (µg/m$^3$) | 50% Criteria (µg/m$^3$) | 50% Background (µg/m$^3$) | Criteria Minus Background (µg/m$^3$) | Expected to Exceed Criteria (Project Only) | | Expected to Exceed Criteria (Project + Background) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Airport | Community | Airport | Community |
| **$NO_2$** | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.9 | 396.2 | No | No | No | No |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.9 | 75.2 | Yes | No | Yes | No |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.5 | 196.9 | No | No | No | No |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.6 | 21.3 | No | No | No | No |
| **$PM_{2.5}$** | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.0 | 19.0 | No | No | No | No |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.6 | 3.7 | No | No | No | No |
| **$PM_{10}$** | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.6 | 18.8 | No | No | No | No |
| **TSP** | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.6 | 30.9 | No | No | No | No |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.3 | 3.4 | No | No | No | No |
| **$SO_2$** | 10min | 4.29 | Ontario AAQC | 178 | 89 | 2.1 | 173.7 | Yes | Yes | Yes | Yes |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.3 | 97.4 | Yes | Yes | Yes | Yes |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.3 | 167.4 | Yes | Yes | Yes | Yes |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.6 | 8.7 | No | No | No | No |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.6 | 8.7 | No | No | No | No |
| **CO** | 1 hr | 469.70 | Ontario AAQC | 36,200 | 18,100 | 234.9 | 35730 | No | No | No | No |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 227 | 15246 | No | No | No | No |
| **Acrolein** | 1 hr | 0.10 | Ontario AAQC | 4.5 | 2.25 | 0.05 | 4.4 | No | No | No | No |
| | 24 hr | 0.04 | Ontario AAQC | 0.4 | 0.2 | 0.02 | 0.36 | No | No | No | No |
| **Acetaldehyde** | 0.5 hr | 13.04 | Ontario AAQC | 500 | 250 | 5.0 | 489.9 | No | No | No | No |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.7 | 496.6 | No | No | No | No |
| **Benzene** | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.3 | 1.8 | No | No | No | No |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.2 | 0.1 | No | No | No | No |
| **Formaldehyde** | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.3 | 54.3 | No | No | No | No |
| **1,3 Butadiene** | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.4 | 9.2 | No | No | No | No |
| | Annual | 0.90 | Ontario AAQC | 2 | 1 | 0.5 | 1.1 | No | No | No | No |
| **Toluene** | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.2 | 2000 | No | No | No | No |
| **Ethylbenzene** | 10 min | 0.32 | Ontario AAQC | 1900 | 950 | 0.4 | 1899 | No | No | No | No |
| | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.1 | 999.8 | No | No | No | No |
| **Xylene** | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.3 | 729.4 | No | No | No | No |
| **Benzo(a)pyrene** | 24 hr | 0.00003 | Ontario AAQC | 0.00005 | 0.00003 | 0.00002 | - | No | No | No | No |
| | Annual | 0.00002 | Ontario AAQC | 0.00001 | 0.000005 | 0.000009 | - | No | No | Yes | Yes |

## 7.1.1 Potential Effects

### Description of Potential Effects

The following sections discuss the potential effects that Project construction activities may have for each of the identified indicator compound.

#### Nitrogen Dioxide ($NO_2$)

Road Construction

The largest contributor to the predicted impact of hourly $NO_2$ emissions are quarry blasting operations. Comparing the predicted impacts against the hourly $NO_2$ Ambient Air Quality Criteria, no individual construction activity predicted an impact that would result in an exceedance of the 1-hour thresholds besides demonstrating an increase in background concentrations above 50% of the existing conditions. As previously noted, the Canadian Ambient Air Quality Standards are stringent aspirational regional air quality targets and not Project-specific air quality criteria. It was shown that predicted impacts of road blasting, quarry blasting, bridge building, quarry aggregate material handing as well as burning activities result in modelled results that exceeded these stringent targets at various distances from the Construction Disturbance Area.

The largest contributor to the predicted impact of 24-hour $NO_2$ emissions is land clearing operations (i.e., biomass / tree burning). No activity resulted in an exceedance of the 24-hour thresholds besides demonstrating an increase in background concentrations above 50% of the existing conditions.

Annual results were elevated above CAAQS criteria.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background assessment indicated that 1-hour, 24-hour, and annual $NO_2$ concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community with the exception of the 1-hour Canadian Ambient Air Quality Standards.

The worst-case predicted impact from Community Access Road-only and Project plus background assessment indicated that 1-hour, 24-hour, and annual $NO_2$ concentrations are expected to be less than their respective criteria at the Ogoki Post Airport, with the exception of the 1-hour Canadian Ambient Air Quality Standards.

As previously noted, the Canadian Ambient Air Quality Standards are stringent aspirational regional air quality targets and not Project-specific air quality criteria. It is noted that the highest contributors to the 1-hour $NO_2$ predicted impacts are blasting and burning operations which are anticipated to be short-term in duration and are expected to occur before other construction operations transition along the Construction Disturbance Area.

Contour plots showing modelled ground level concentrations from Project emissions plus background of all activity sources for the 1-hour averaging period are provided in **Attachment C – Isopleths.**

#### Total Suspended Particulates (TSP)

Road Construction

The largest contributor to the predicted impact of 24-hour Total Suspended Particulate emissions is biomass burning operations. Exceedances of the 24-hour thresholds (Ambient Air Quality Criteria, 50% of Ambient Air Quality Criteria and 50% of ambient background), may occur during road construction activities, access road usage and burning operations.

No construction activity was shown to exceed any threshold for the annual averaging period with the exception of the access road. The access road was shown to exceed the threshold for maximum distance to criteria with background removed. This threshold indicates that when effects of Project and ambient background concentrations are considered, there is the potential for exceedance of the Ambient Air Quality Criteria. As previously noted, the ambient Total Suspended Particulate concentrations represent 94% of the Ambient Air Quality Criteria.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour, and annual Total Suspended Particulate concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour, and annual Total Suspended Particulate concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Particulate Matter 10 micrometres or less in diameter ($PM_{10}$)

Road Construction

The largest contributor to the predicted impact of 24-hour $PM_{10}$ emissions is biomass burning operations. Exceedances of the 24-hour thresholds (Ambient Air Quality Criteria, 50% of criteria, 50% of ambient background and criteria minus background) may occur during road construction activities, access road usage and burning operations.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour $PM_{10}$ concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour $PM_{10}$ concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Particulate Matter 2.5 micrometres or less in diameter ($PM_{2.5}$)

Road Construction

The largest contributor to the predicted impact of 24-hour $PM_{2.5}$ emissions is biomass burning operations. Exceedances of the 24-hour thresholds (Ambient Air Quality Criteria, Canadian Ambient Air Quality Standards, 50% of criteria, 50% of ambient background and criteria minus background) may occur during road construction activities and burning operations.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual $PM_{2.5}$ concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual $PM_{2.5}$ concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Sulfur Dioxide ($SO_2$)

Road Construction

The largest contributor to the predicted impact of 10-min as well as 1-hour $SO_2$ emissions is quarry blasting operations. With the exception of quarry blasting and road blasting, comparing the predicted impacts against both the 10-min and hourly Ambient Air Quality Criteria as well as the 1-hour Canadian Ambient Air Quality Standards, no individual construction activity predicted an impact that would result in an exceedance of either the 10-min or 1-hour thresholds except for demonstrating an increase in background concentrations above 50% of the existing conditions. As previously noted, the Canadian Ambient Air Quality Standards are stringent aspirational regional air quality targets and not Project-specific air quality criteria.

No activities were shown to exceed any threshold for the annual averaging period.

Mitigative measure such as the implementation of strategic blasting plans and efforts to utilize low sulphur containing explosives can help reduce the magnitude of effect during blasting events.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 10-min and 1-hour $SO_2$ concentrations are expected to exceed respective criteria at locations within the Marten Falls First Nation community and the Ogoki Post Airport. It is noted that the highest contributors to the 10-min and 1-hour $SO_2$ predicted impacts are blasting and burning operations which are anticipated to be short-term in duration before these operations transition along the Construction Disturbance Area. During periods when blasting does not occur exceedances to 10-min and 1-hour criteria are not expected at the Marten Falls First Nation community or Ogoki Post Airport. Blasting at the quarries occurs on an intermittent basis, approximately once every 15 days and the duration of the blast is short in duration.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that annual $SO_2$ concentrations are expected

to be less than their respective criteria at all locations within the Marten Falls First Nation community and Ogoki Post Airport.

Contour plots showing modelled ground level concentrations from Project emissions plus background air quality of all activity sources for 10-min and 1-hour averaging periods are provided in **Attachment C – Isopleths**.

#### Carbon Monoxide (CO)

Road Construction

The largest contributor to the predicted impact of 1-hour and 8-hour CO emissions is quarry blasting operations. With the exception of quarry blasting, comparing the predicted impacts against the hourly Ambient Air Quality Criteria, no individual construction activity predicted an impact that would result in an exceedance of the 1-hour or 8-hour thresholds with except for demonstrating an increase in background concentrations above 50% of the existing conditions.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 1-hour and 8-hour CO concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 1-hour and 8-hour CO concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

#### Acrolein

Road Construction

The largest contributor to the predicted impact of hourly acrolein emissions is bridge building operations. The activity associated with bridge building including fossil fuel combustion from heavy duty construction equipment and the location of bridge building sources compared to distance to the edge of the Construction Disturbance Area (i.e., operations occurring in close proximity to the edge of the road) contribute to the maximum predicted impacts from volatile organic compounds. With the exception of bridge building, comparing the predicted impacts against the hourly Ambient Air Quality Criteria, no

individual construction activity predicted an impact that would result in an exceedance of the 1-hour thresholds.

No construction activity was shown to exceed any threshold for the 24-hour averaging period with the exception of bridge building activities that demonstrating an increase in background concentrations above 50% of the existing conditions as well as concentrations greater than the 24-hr criteria when background ambient is considered in addition to project impacts.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 1-hour and 24-hour acrolein concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 1-hour and 24-hour acrolein concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

#### Acetaldehyde

Road Construction

No construction activity was shown to exceed any threshold for the 0.5-hour or 1-hour averaging periods with the exception of bridge building activities that demonstrating an increase in background concentrations above 50% of the existing conditions.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 0.5-hour and 24-hour acetaldehyde concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 0.5-hour and 24-hour acetaldehyde concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Benzene

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour or annual averaging periods.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual benzene concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual benzene concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Formaldehyde

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour averaging period.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour formaldehyde concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour formaldehyde concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### 1,3-Butadiene

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour or annual averaging periods.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual 1,3-Butadiene concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual 1,3-Butadiene concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Toluene

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour averaging period with the exception of bridge building which demonstrated an increase in background concentrations above 50% of the existing conditions. The activity associated with bridge building including fossil fuel combustion from heavy duty construction equipment and the location of bridge building sources compared to distance to the edge of the Construction Disturbance Area (i.e., operations occurring in close proximity to the edge of the road) of operations contribute to the maximum predicted impacts from volatile organic compounds.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour toluene concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour toluene concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

### Ethylbenzene

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour averaging period with the exception of burning operations which demonstrated an increase in background concentrations above 50% of the existing conditions.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour ethylbenzene concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour ethylbenzene concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

#### Xylene

Road Construction

No construction activity was shown to exceed any threshold for the 24-hour averaging period with the exception of bridge building which demonstrated an increase in background concentrations above 50% of the existing conditions. The activity associated with bridge building including fossil fuel combustion from heavy duty construction equipment and the location of bridge building sources compared to distance to the edge of the Construction Disturbance Area (i.e., operations occurring in close proximity to the edge of the road) of operations contribute to the maximum predicted impacts.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour xylene concentrations are expected to be less than their respective criteria at all locations within the Marten Falls First Nation community.

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour xylene concentrations are expected to be less than their respective criteria at the Ogoki Post Airport.

#### Benzo(a)Pyrene

Road Construction

The largest contributor to the predicted impact of 24-hour Benzo(a)Pyrene emissions is bridge building operations. The activity associated with bridge building including fossil fuel combustion from heavy duty construction equipment and the location of bridge building sources compared to distance to the edge of the Construction Disturbance Area (i.e., operations occurring in close proximity to the edge of the road) contribute to the maximum predicted impacts from volatile organic compounds. With the exception of bridge building, comparing the predicted impacts against the 24-hour Ambient Air Quality Criteria, no

individual construction activity predicted an impact that would result in an exceedance of the 24-hour thresholds with except for demonstrating an increase in background concentrations above 50% of the existing conditions.

No individual construction activity predicted an impact that would result in an exceedance of the annual thresholds with except for demonstrating an increase in background concentrations above 50% of the existing conditions.

**Attachment C – Isopleths** provides a contour plot of modelled ground level concentrations that would result if all operations / activities were occurring simultaneously.

Community Impacts

The worst-case predicted impact from Community Access Road-only and Project plus background air quality assessment indicated that 24-hour and annual Benzo(a)Pyrene concentrations are expected to exceed criteria at all locations within the Marten Falls First Nation community and the Ogoki Post Airport. It should be noted that background levels of Benzo(a)Pyrene exceed criteria without the contribution of construction emissions.

#### Diesel Particulate Matter (DPM)

Road Construction

Diesel Particulate Matter emissions are generated from tailpipe emissions of diesel-fired combustion equipment. To provide a conservative estimate of Diesel Particulate Matter emissions, it is assumed that they are equal tailpipe emissions of $PM_{2.5}$.

There are currently no Ontario Ambient Air Quality Criteria to evaluate the predicted impact of Diesel Particulate Matter emissions. A summary of the predicted maximum Diesel Particulate Matter concentrations is included within **Attachment B – Tables**.

The maximum 24 hour and annual Diesel Particulate Matter concentrations during construction are 15.1 µg/m$^3$ and 2.0 µg/m$^3$ respectively. The maximum concentrations of Diesel Particulate Matter occur in close proximity to diesel-fired heavy construction equipment.

Contour plots indicating maximum ground level concentrations of Diesel Particulate Matter are included in **Attachment C – Isopleths.**

As previously noted, Diesel Particulate Matter is not an indicator for air quality but has been included within this assessment to inform the Community Well-Being Assessment.

Community Impacts

Due to the lack of available Ontario Ambient Air Quality Criteria or other criteria to evaluate the predicted impact of Diesel Particulate Matter emissions, an analysis of predicted concentrations compared to a criterion at either the Marten Falls First Nation community or Ogoki Post Airport has not been provided. A summary of predicted maximum Diesel Particulate Matter concentrations is included within **Attachment B – Tables.** Potential effects of Diesel Particulate Matter will be assessed as part of the Community Well-Being Report.

Contour plots indicating maximum ground level concentrations of Diesel Particulate Matter are included in **Attachment C – Isopleths.**

### Dustfall

Included within **Attachment B – Tables** is a summary of modelled dustfall loadings for both the North/South and East/West Road segments. Dustfall is expected from particulate emissions related to construction activities such as blasting, fugitive particulate emissions and material handling.

The Ontario Ambient Air Quality Criteria includes annual (4.6 g/m$^2$) and 30-day (7 g/m$^2$) criteria for dustfall.

Road Construction

Model results indicate that predicted dustfall loadings that are above annual criteria during road construction at some receptors. Contour plots indicate that the predominate contributing source modelled is the quarry access road. The dustfall loading is expected to be influenced by fugitive dust generated by haul trucks transporting aggregate material from quarries on an unpaved access road. Dustfall levels were modelled to be elevated above annual criteria up to approximately 280 m from the edge of the road.

Model results do not predict elevated dustfall loadings greater than the 30-day criteria during construction activities.

Included within **Attachment C – Isopleths** are predicted concentration contours for dustfall.

Community Impacts

Model results do not indicate elevated dustfall loadings greater than the 30-day or annual criteria at community and Ogoki Post Airport receptor locations.

Included within **Attachment C – Isopleths** are predicted concentration contours for dustfall.

### Discussion of Maximum POI Results

**Table 7-3** and **Table 7-4** is an indication of the predicted maximum Point of Impingement (POI) ground level concentrations. Maximum concentrations are typically observed at the edge of the roadway and reduce in magnitude further from the road. Maximum ground level concentrations have been included for the purpose of informing other technical studies such as the Community Well-Being Report.

It should be noted that during the construction phase of Community Access Road mitigative measures such as restricting access to construction areas can be implemented to help limit human exposure to the reported maximum ground level concentrations of indicator compounds predicted adjacent to construction operations.

**Table 7-3** and **Table 7-4** present the maximum predicted ground level concentration of each indictor compound without the removal of meteorological anomalies or mitigation. Results are included for both a maximum construction scenario (i.e., all equipment and activities operations at the same time, this would include blasting operations occurring at the same time of other activities) as well as a summary of modelled maximum ground level concentrations on an individual activity basis. Where exceedances to criteria were not present or indicator compounds were not released as part of an individual activity's emissions (i.e., benzene emissions during quarry blasting) maximum ground level concentrations are not provided.

Maximum ground level concentrations carried forward for the assessment represent a construction scenario with all equipment and activities operations or taking place at the same time. This scenario is highly unlikely to occur and as such results from this assessment are considered very conservative (i.e., road blasting will not occur at the same time workers are present and performing other road construction activities such as material handling). Maximum ground level concentrations are observed near the edge of the roadway or immediately adjacent to activities and are shown to reduce in magnitude further from the road.

Isopleths (concentration contour plots) provided in **Attachment C** provide a visual representation of the extent that elevated levels are expected to occur during construction activities.

## Table 7-3: Summary of Maximum POI Results - Construction N/S Segment

| Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 1 hr | 400 | Ontario AAQC | Health | 3.8 | 275 | 69% | 70% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.8 | 275 | >100 | >100 |
| | 24 hr | 200 | Ontario AAQC | Health | 3.1 | 88 | 44% | 46% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.3 | 27 | >100 | >100 |
| **$PM_{2.5}$** | 24 hr | 27 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 8.0 | 245 | >100 | >100 |
| | Annual | 8.8 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 5.1 | 2 | 26% | 84% |
| **$PM_{10}$** | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 308 | >100 | >100 |
| **TSP** | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 433 | >100 | >100 |
| | Annual | 60 | Ontario AAQC | Visibility | 56.7 | 12 | 20% | >100 |
| **$SO_2$** | 10 min | **178** | Ontario AAQC | Health | 4.3 | 18250 | >100 | >100 |
| | 1 hr | **100** | MECP ACB List | Health | 2.6 | 11060 | >100 | >100 |
| | | **170** | CAAQS (2025) | Health & Environment | 2.6 | 11060 | >100 | >100 |
| | Annual | **10** | CAAQS (2025) | Health & Environment | 1.3 | 0.23 | 2% | 15% |
| | | **10** | Ontario AAQC | Vegetation | 1.3 | 0.23 | 2% | 15% |
| **CO** | 1 hr | 36,200 | Ontario AAQC | Health | 469.7 | 189631 | >100 | >100 |
| | 8 hr | 15,700 | Ontario AAQC | Health | 454.0 | 31419 | >100 | >100 |
| **Acrolein** | 1 hr | 4.5 | Ontario AAQC | Health | 0.1 | 2 | 52% | 54% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 0.39 | 97% | >100 |
| **Acetaldehyde** | 0.5 hr | 500 | Ontario AAQC | Health | 10.05 | 13 | 3% | 5% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.4 | 2 | 0% | 1% |
| **Benzene** | 24 hr | 2.3 | Ontario AAQC | Health | 0.5 | 0.8 | 35% | 57% |
| | Annual | 0.45 | Ontario AAQC | Health | 0.3 | 0.1 | 23% | 90% |
| **Formaldehyde** | 24 hr | 65 | Ontario AAQC | Health | 10.7 | 5.0 | 8% | 24% |
| **1,3 Butadiene** | 24 hr | 10 | Ontario AAQC | Health | 0.8 | 0.1 | 1% | 9% |
| | Annual | 2 | Ontario AAQC | Health | 0.9 | 0.004 | 0% | 45% |
| **Toluene** | 24 hr | 2,000 | Ontario AAQC | Odour | 0.5 | 0.64 | 0% | 0% |
| **Ethylbenzene** | 10 min | 1,900 | Ontario ACB List | Odour | 0.8 | 8.2 | 0% | 0% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.2 | 2.0 | 0% | 0% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **Xylene** | 10 min | 3,000 | Ontario AAQC | Odour | 2.8 | 2.5 | 0% | 0% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.7 | 0.6 | 0% | 0% |
| **Benzo(a)pyrene** | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 0.00008 | >100 | >100 |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 0.00001 | 98% | >100 |
| **DPM** | 24 hr | N/A | N/A | N/A | 0.6 | 15.1 | N/A | N/A |
| | Annual | N/A | N/A | N/A | 0.4 | 2.0 | N/A | N/A |
| **Dustfall** | 30-day | 7 | Ontario AAQC | Soiling | N/A | 3.0 | 42% | N/A |
| | Annual | 4.6 | Ontario AAQC | Soiling | N/A | 28 | >100 | N/A |

**Notes:**

1. Maximum POI results occur immediately adjacent to construction activities
2. 10-min averaging periods were converted from 1-hr results
3. N/A indicates not applicable
4. Bold values were converted from ppb

## Table 7-4: Summary of Maximum POI Results - Construction E/W Community Segment

| Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 1 hr | 400 | Ontario AAQC | Health | 3.8 | 170 | 43% | 43% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.8 | 170 | >100 | >100 |
| | 24 hr | 200 | Ontario AAQC | Health | 3.1 | 54 | 27% | 28% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.3 | 3 | 14% | 20% |
| **$PM_{2.5}$** | 24 hr | 27 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 8.0 | 156 | >100 | >100 |
| | Annual | 8.8 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 5.1 | 0.79 | 9% | 67% |
| **$PM_{10}$** | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 175 | >100 | >100 |
| **TSP** | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 348 | >100 | >100 |
| | Annual | 60 | Ontario AAQC | Visibility | 56.7 | 3 | 5% | 100% |
| **$SO_2$** | 10 min | **178** | Ontario AAQC | Health | 4.3 | 939 | >100 | >100 |
| | 1 hr | **100** | Ontario AAQC | Health | 2.6 | 569 | >100 | >100 |
| | | **170** | CAAQS (2025) | Health & Environment | 2.6 | 569 | >100 | >100 |
| | Annual | **10** | CAAQS (2025) | Health & Environment | 1.3 | 0.04 | 0.4% | 13% |
| | | **10** | Ontario AAQC | Vegetation | 1.3 | 0.04 | 0.4% | 13% |
| **CO** | 1 hr | 36,200 | Ontario AAQC | Health | 469.7 | 12472 | 34.5% | 36% |
| | 8 hr | 15,700 | Ontario AAQC | Health | 454.0 | 3102 | 19.8% | 23% |
| **Acrolein** | 1 hr | 4.5 | Ontario AAQC | Health | 0.1 | 0.9 | 19.1% | 21% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 0.1 | 17.1% | 27% |
| **Acetaldehyde** | 0.5 hr | 500 | Ontario AAQC | Health | 10.1 | 5 | 1.0% | 3% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.4 | 0.3 | 0.1% | 1% |
| **Benzene** | 24 hr | 2.3 | Ontario AAQC | Health | 0.6 | 0.1 | 6.2% | 30% |
| | Annual | 0.45 | Ontario AAQC | Health | 0.3 | 0.0 | 2.2% | 71% |
| **Formaldehyde** | 24 hr | 65 | Ontario AAQC | Health | 10.7 | 0.9 | 1.4% | 18% |
| **1,3 Butadiene** | 24 hr | 10 | Ontario AAQC | Health | 0.8 | 0.1 | 0.7% | 9% |
| | Annual | 2 | Ontario AAQC | Health | 0.9 | 0.01 | 0.3% | 45% |
| **Toluene** | 24 hr | 2,000 | Ontario AAQC | Odour | 0.5 | 0.1 | 0.01% | 0.03% |
| **Ethylbenzene** | 10 min | 1,900 | Ontario ACB List | Odour | 0.8 | 5.6 | 0.3% | 0.3% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.2 | 1.3 | 0.1% | 0.2% |
| **Xylene** | 10 min | 3,000 | Ontario ACB List | Odour | 2.8 | 0.5 | 0.02% | 0.1% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.7 | 0.1 | 0.02% | 0.1% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **Benzo(a)pyrene** | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 0.00002 | 40% | >100 |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 0.000001 | 12% | >100 |
| **DPM** | 24 hr | N/A | N/A | N/A | 0.6 | 3 | N/A | N/A |
| | Annual | N/A | N/A | N/A | 0.4 | 0.2 | N/A | N/A |
| **Dustfall** | 30-day | 7 | Ontario AAQC | Soiling | N/A | 0.1 | 2% | N/A |
| | Annual | 4.6 | Ontario AAQC | Soiling | N/A | 1 | 25% | N/A |

**Notes:**

1. Maximum POI results occur immediately adjacent to construction activities
2. 10-min averaging periods were converted from 1-hr results
3. N/A indicates not applicable
4. Bold values were converted from ppb

### 7.1.2 Mitigation

Best management practices that are typically employed during construction activity will be implemented to help reduce overall Project impacts on the surrounding environment during periods of construction. The Ontario Ministry of Transportation identifies potential mitigation measures that may be taken, if feasible, for transportation related Projects in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas emissions for Provincial Transportation Projects (Ontario Ministry of Transportation, 2020).

Where feasible the following mitigation measures are suggested to help reduce overall residual effects. Suggested mitigation measures come from both Ontario Ministry of Transportation recommendations as well as construction industry best practices.

It is recommended that as the construction activities progress along the Construction Disturbance Area, the proximity to receptors to the development area should be considered when employing mitigation techniques.

It is recommended to develop a construction fugitive dust management plan after the final design and before construction begins. This plan should detail the selected mitigation measures, allowing for a more refined and efficient approach to controls, costing, and Project scheduling. The specifics of the mitigation measures and best management practices will be clearer during the detailed design and construction submittal process. **Table 7-5** provides examples of these practices and measures. Additionally, a construction monitoring plan should be created during the final design and construction submittal periods to confirm best management practices are being followed.

The development of a construction monitoring plan to validate that best management practices are being performed shall be developed during the final design and construction submittal periods.

**Table 7-5: Mitigation Measures**

| Mitigation Measure | Potential Reduction |
|---|---|
| ■ **Development of a construction best management practice plan as well as a fugitive dust management plan prior to construction. Examples of best management practices that may be included are:**<br>o **Implement watering during fugitive dust generating activities such as drilling, material handling and on quarry access roads;**<br>o **Limit vehicle speed, where feasible;** | ■ Fugitive dust (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$);<br>■ Products of combustion ($NO_2$, $SO_2$, CO); |

| Mitigation Measure | Potential Reduction |
|---|---|
| **o Strategic haul planning to reduce overall number of haul trips required for aggregate material demands. Consider sourcing material from the closest available material transfer points;**<br>**o Where possible, reduce the quantity of material that is either burned or chipped (i.e., consider salvageable material such as salable lumber);**<br>**o When burning is required, consider avoiding periods where meteorological conditions (e.g., wind speed) that may result in smoke impacting sensitive receptor locations;**<br>**o Maintain equipment as per manufacturing specifications;**<br>**o Implement anti-idling policies or procedures to reduce total vehicle idling times;**<br>**o Implement blasting mitigation (e.g., charge size) in quarries to minimize potential effects;**<br>**o Consider the use explosives with lower sulphur content where possible;**<br>**o Use explosives only if alternate methods of excavation to remove materials for foundation systems and roads are not feasible; and**<br>**o Prepare a Blasting and Communication Management Plan that is in accordance with Ontario Provincial Standard Specification General Specifications for the Use of Explosives (OPSS, 2014) and describes specific measures that would be implemented if blasting is required.** | ■ Benzene, toluene, ethylbenzene, and xylenes;<br>■ Volatile organic compounds; and<br>■ Polycyclic aromatic hydrocarbons. |
| ■ **Development of a construction monitoring plan. This plan may be used to validate that best management practices are being implemented and that mitigation actions taken are effective. Where mitigation is not providing a reduction to overall impacts, mitigation options should be re-assessed.** | ■ Fugitive dust (Total Suspended Particulate, PM10, PM2.5);<br>■ Products of combustion (NO2, SO2, CO);<br>■ Benzene, toluene, ethylbenzene, and xylenes; and<br>■ Volatile organic compounds Polycyclic aromatic hydrocarbons. |

### Frequency Analysis

As noted, the predicted impacts from construction activities have been assessed in terms of distance from the CDA to threshold as defined in **Table 4-18**.

The receptors were provided as a defined area of interest rather than a defined single point, therefore, the distance from CDA to threshold method was selected as the most appropriate method of assessing effects. Defined areas of interest provided may represent culturally significant locations, habitats for sensitive species or in some cases represent an area which included a buffer zone to maintain confidentiality of sensitive information.

As the assessment was not performed to determine predicted concentration at specified sensitive receptor locations, a frequency of exceedance analysis was not completed.

The following should be considered when commenting on the model results from the perspective of frequency of predicted impacts:

- Construction activities are transient, as construction progress and move along the roadway the influence that activity emissions will have on local air quality levels at individual receptors will decrease as activities move further away from receptors;
- It is assumed that annually 20 km of road will be built, and a maximum of 10 days will be spent at any given working area (working area = 500 m segment of road);
- A maximum of 24 blasts per year (1 blast every 15 days) will occur at quarry locations; and
- A maximum of 4 blasts per day will occur along the roadway.

## 7.1.3 Characterization of Residual Effects

The predicted impacts of indicator compounds from the representative segment air dispersion model were used for the characterization of residual effects and determination of significance. The predicted impacts at the representative segment are assumed to be extrapolated across the entire Construction Disturbance Area.

Depending on the emission generating activity, the frequency of impact would be influenced by whether the activity occurs intermittently (e.g., blasting) or consistently (e.g., material handling and hauling) during the phases of Project development. Therefore, an assessment of significance was completed with activity-related distinction (intermittent or consistent) for potential residual effects of the entire Project has been provided.

The predicted impacts from the represented segment on a individual activity basis are provided in **Table 7-3**.

In addition to the predicted impacts from the representative segment, predicted air quality at both the Marten Falls First Nation community and Ogoki Post Airport locations were assessed. These are locations where prolonged human presence is anticipated. The predicted impacts are provided in **Table 7-4**.

As previously noted, potential effects from the construction phase were determined through modelling a discrete receptor grid specific to the areas where human activity is likely to occur (e.g., the Ogoki Post Airport and the community). The results were presented as the East/West construction model to evaluate if indicator compounds may be exceeding criteria within Marten Falls First Nation. This differentiates from the assessment of the North/South segment for the construction phase, which predicted the extent to which potential effects may occur. As such, predicted impacts from an individual activity summary have not been prepared for the East/West construction model; results of a worst-case construction scenario (i.e., all construction activities operations simultaneously) are presented in **Table 7-4** and summarized based on the potential for exceedances to criteria at both Marten Falls First Nation and Ogoki Post Airport locations.

Residual effects characteristics as well as criteria to establish significance as described in **Section 4.4.3** were used in the characterization of residual effects.

The majority of this Project Construction Disturbance Area is located in areas where prolonged human presence is not anticipated. It should also be noted that due to the transient nature of construction activities (i.e., major construction activities will be short-term at any given location as road development continues), the predicted impacts may be considered temporary in nature.

The criteria for the magnitude of adverse effects are intended to assess the ability of Community Access Road to meet provincial and federal air quality criteria and standards. Most air quality criteria are based on the protection of human health. The characterization of residual effects were evaluated based on a distance from roadway. This assessment methodology allows results to be extrapolated across the full length of the roadway. Other technical disciplines such as the Community Well-Being discipline can translate results by distance and evaluate potential effects at defined human health receptor locations.

The following list provides a summary of receptor-types identified and considered in the residual impact assessment:

- Cabins and campsites;
- Places of dwelling;
- Spiritual and sacred sites;
- Traditional gathering and meeting places; and

- Burial sites and areas.

Although receptor locations were identified for consideration in this assessment, the available data did not include sufficient detail to evaluate a meaningful interpretation of the receptors at a discrete point. Potential residual effects at sensitive receptors defined by other disciplines will be commented in their discipline specific reports (i.e., potential residual effects on vegetation). As previously stated, potential impacts from construction and operation phases were evaluated based on a distance from activity. These distances can be used to interpret results at individual receptor locations.

**Figure 7-1** presented below provides a visual representation of the geographic locations of these receptors. Please note that this figure is provided as a visual aid, and as previously discussed, the receptors provided in this figure are an approximation of location and some locations represented as a single point are representative as a centroid of a larger area of interest.

## Figure 7-1: Air Quality Sensitive Receptor Locations

Construction occurs in a short-term duration and is transient in nature. Construction at any location of the roadway is only expected for a short period of time before the next section of roadway is worked on. After periods of construction are completed, elevated levels of indicator compounds contributed by construction related activities should return to previous conditions. It is expected that residual effects with a high magnitude will occur during construction periods and may impact sensitive receptors for periods of times when construction activities are either located in close proximity to receptors, or during periods of intermittent activities such as blasting and burning.

The dispersion modelling assessment was prepared using conservative emission rates and modelling parameters to present a worst-case impact predicted result. Therefore, the predicted impact is not likely to be exceeded.

The likelihood of effects would range from possible to probable. The likelihood for residual effects were considered probable for indicator compounds assessed with annual averaging periods. It is possible that construction activities will not affect some receptors for an entire year, the annual prediction is therefore conservative. The residual effects presented for annual averaging periods is less likely to be impacted by anomalous meteorological conditions and worst-case activity operations hours. For indicator compounds assessed with shorter averaging periods the likelihood for residual effects was determined to be possible to probable.

The uncertainty of effects is contributed to conservatism is built into the emission rate calculations and dispersion modelling assessment to where the maximum emission rates and modelling results are presented. The predicted impacts from construction activities presented are not likely to be exceeded.

Uncertainty of receptor characteristics, such as frequency of human presence at receptor locations are also present within this assessment. Sensitive receptors considered as part of this significance assessment included those where human presence is expected for a potentially long duration in time. In the event that humans are not at sensitive receptor locations during construction phases the significance of effects is further reduced. For example, spiritual and sacred sites were considered as sensitive receptors however if humans are not present at these locations, particularly those in close proximity to the roadway or quarry locations during periods of intermittent and consistent construction activities, residual effects could be avoided.

Prediction confidence of effects was determined to be moderate. Representative baseline data was known for receptor locations, potential for Project related effects are mostly understood, and the level of uncertainty associated with receptor data or Project conditions is moderate.

Residual effects were generally considered as significant if the residual effect was assessed at a high magnitude with potential residual impacts occurring at sensitive receptors, at either a frequent occurrence or in long term duration with irreversible effects. The construction phase of Community Access Road is both transient in nature as well as temporary (short term), and the residual effects are considered reversible. Through the significance assessment it was found that no significant residual effects in the context of air quality are anticipated through the construction phase of Community Access Road.

It is noted that that select construction activities may result in receptors experiencing air quality levels considered to be high magnitude (i.e., elevated levels of $SO_2$ from blasting) however, as previously indicated these activities occur infrequently, over a short term duration and are not considered to result in a significant residual effect. This finding was largely driven by the reversibility of air quality effects from construction activity. It should be noted that a maximum number of daily and annual blasts was considered as part of this assessment. In the event that blasting frequency is reduced the frequency of potential effect will also decrease.

**Table 7-6** provides a summary of the evaluation of residual effects significance for both intermittent and consistent operations. A residual impact assessment and assessment of significance was completed for all indicator compounds considered in this assessment and their respective averaging periods. Where multiple criteria were present for an averaging period, residual effects were evaluated against the most stringent criteria. Results summarized in **Table 7-6** represent construction activities that resulted in the highest magnitude of residual effects.

## Table 7-6: Characterization of Predicted Residual Effects and Determination of Significance for Air Quality – Construction

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air Quality** | $NO_2$ - Quarry Blasting | $NO_2$ - 1hr - CAAQS | Direct | Negative | High | N/A | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - Quarry Aggregate Operations | | | | High | N/A | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - Burning / Clearing | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 4,551 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - Bridge Building | | | | Low | 2,368 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - Blasting or Burning | $NO_2$ - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | $NO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - Burning | $PM_{2.5}$ - 24hr - AAQC & CAAQS | Direct | Negative | High | 1,030 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - Road Construction | | | | High | 440 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - Blasting or Burning | $PM_{2.5}$ - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | $PM_{10}$ - Burning | $PM_{10}$ - 24hr - AAQC | Direct | Negative | High | 1,099 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | $PM_{10}$ - Road Construction | | | | High | 439 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Burning | TSP - 24hr - AAQC | Direct | Negative | High | 529 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Road Construction | | | | High | 355 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Blasting or Burning | TSP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | TSP - Access Road | | | | Medium | 174 | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | $SO_2$ - Quarry Blasting | $SO_2$ - 10min - AAQC | Direct | Negative | High | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | $SO_2$ - 10min - AAQC | Direct | Negative | Low | 350 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Blasting | $SO_2$ - 1hr - AAQC | Direct | Negative | High | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Bridge Building | | | | Low | 19 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Blasting | $SO_2$ - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | $SO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | CO - Blasting | CO - 1hr - AAQC | Direct | Negative | High | 1,458 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Bridge Building | CO - 1hr - AAQC | Direct | Negative | Low | 85 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Blasting | CO - 8hr - AAQC | Direct | Negative | High | 699 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Bridge Building, Road Construction, Access Road or Aggregate Operations | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Blasting, Burning | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Bridge Building | Acrolein - 1hr - AAQC | Direct | Negative | Low | 2508 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Blasting, Burning | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Bridge Building | Acrolein - 24hr - AAQC | Direct | Negative | Low | 170 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acetaldehyde - Bridge Building | Acetaldehyde - 24hr - AAQC | Direct | Negative | Low | 6 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Blasting, Burning | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Blasting, Burning | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | Formaldehyde - Blasting, Burning | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Formaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | Toluene - Blasting, Burning | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Toluene - Bridge Building | Toluene - 24hr - AAQC | Direct | Negative | Low | 51 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ethylbenzene - Burning | Ethylbenzene- 24hr - AAQC | Direct | Negative | Low | 2190 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Ethylbenzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Ethylbenzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Xylene - Blasting, Burning | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Xylene - Bridge | Xylene - 24hr - AAQC | Direct | Negative | Low | 29 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Blasting, Burning | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Bridge | BaP - 24hr - AAQC | Direct | Negative | High | 6 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Blasting, Burning | BaP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Bridge | BaP - Annual - AAQC | Direct | Negative | Low | 30 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |

**Notes:**

Geographic extent listed is specific to the highest magnitude rating, lower magnitude of residual effects may be experienced at distances that surpass the listed geographic extent (i.e., <50% of criteria but >50% of baseline ambient)

Calculation of Geographic Extent were based on GIS analysis of model results and are approximate

### 7.1.4 Indirect Effects

Indirect effects may occur when a change to one valued component resulting from a Project activity causes a change to another valued component. Changes in ambient air quality may indirectly impact the following disciplines:

- Surface water;
- Vegetation;
- Wildlife; and
- Human Health and Safety.

Potential indirect effects that changes in air quality may have on the mentioned disciplines will be commended in discipline specific reports.

## 7.2 Operations Phase

As described in **Section 4.2.1** the operations phase starts once construction activities are complete and lasts for the life of Community Access Road. The operations phase of Community Access Road is considered to be permanent based on the expected timeline for when major refurbishment of road components (e.g., bridges), is anticipated.

Modelling was completed for the operations phase of Community Access Road. Indicator compound specific models were developed for each relevant averaging period. Model results are summarized in the following sections and includes a combined impact assessment of Project emissions with the addition of existing background concentrations.

For the operations phase of Community Access Road, the potential residual effects were assessed along the North-South road segment as well as the road segment towards the Marten Falls First Nation community location. As described in **Section 4.4.3 – Methods for Predicting Future Conditions – Air Quality Emissions – Operations Phase** these two road sections have different traffic volumes and compositions, as such potential effects vary between them. The north-south segment's higher annual average daily traffic as well as larger composition of vehicles classified as heavy is a result of anticipated mining traffic from the Ring of Fire mining operations.

**Table 7-7** provides a summary of the maximum distance from operation activities where compliance to indicator compound specific criteria / limits are achieved. Results in this table are specific to the north-south road segment.

Additionally, a maximum distance to criteria / limit minus ambient background, maximum distance to 50% of criteria and maximum distance to 50% of background are also

summarized. These concentration thresholds were selected to inform the magnitude of the potential residual effect which is based on a percent change from existing conditions as well as a comparison to indicator compound specific criteria / limits.

**Table 7-8** provides a summary of the maximum distance from operation activities where compliance to indicator compound specific criteria / limits are achieved. Results in this table are specific to the community road segment. The concentration thresholds described above were also assessed for the community road segment.

**Table 7-7** provides a summary of the maximum concentrations modelled for the N/S road segment during the operational phase of Community Access Road. These maximum concentrations are located on the edge of the road and decrease with distance from the roadway.

**Table 7-8** provides a summary of the maximum concentrations modelled for the E/W road segment during the operational phase of Community Access Road. These maximum concentrations are located on the edge of the road and decrease with distance from the roadway.

Maximum ground level concentrations were not used to evaluate potential effects or significance; however, they have been included for the purpose of informing other technical studies such as the Community Well-Being Report.

Included within **Attachment C – Isopleths** are isopleths (concentration contour maps) for each indicator compound where operation activities would result in ground level concentrations greater than their respective criteria. Contours plots provided in **Appendix C** provide a representation of the geographical extent of elevated concentrations.

Sensitive receptor locations were provided in a format that did not allow for a single discrete receptor point to be defined. In some cases, sensitive receptors were identified to be an area which in many cases overlapped with the CDA. Areas provided may represent culturally significant locations, habitats for sensitive species or in some cases represent an area which included a buffer zone to maintain confidentiality of sensitive information. By evaluating results as a maximum distance to a specific criteria or threshold a more meaningful impact assessment can be completed and more context of potential air quality levels and be interpreted on a case-by-case basis.

The following section provides a summary of model results for both road segments during the operations phase of Community Access Road.

### Table 7-7: Summary of Maximum Distances to Criteria / Threshold – Operations Phase N/S Segment

| Indicator Compound | Averaging Period | Background Concentration (µg/m³) | Criteria Source[1] | Criteria (µg/m³) | 50% Criteria (µg/m³) | 50% Background (µg/m³) | Criteria Minus Background (µg/m³) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.9 | 396.2 | N/A | N/A | 700 | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.9 | 75.3 | N/A | N/A | 700 | N/A |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.5 | 196.9 | N/A | N/A | 34 | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.6 | 21.3 | N/A | N/A | 38 | N/A |
| **$PM_{2.5}$** | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.0 | 19 | 115 | 433 | 2,868 | 207 |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.6 | 3.7 | 134 | 336 | 629 | 414 |
| **$PM_{10}$** | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.6 | 18.8 | 1,986 | 2,987 | outside of model domain | 2,987 |
| **TSP** | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.6 | 30.9 | outside of model domain | outside of model domain | outside of model domain | outside of model domain |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.3 | 3.4 | 899 | 1,591 | 1,657 | outside of model domain |
| **$SO_2$** | 10min | 21.62 | Ontario AAQC | 178 | 89 | 10.8 | 156.4 | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.3 | 97.4 | N/A | N/A | N/A | N/A |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.3 | 167.7 | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.6 | 8.7 | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.6 | 9.2 | N/A | N/A | N/A | N/A |
| **CO** | 1 hr | 469.7 | Ontario AAQC | 36,200 | 18,100 | 235 | 35,730 | N/A | N/A | N/A | N/A |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 227 | 15,246 | N/A | N/A | N/A | N/A |
| **Acrolein** | 1 hr | 0.1 | Ontario AAQC | 4.5 | 2.25 | 0.05 | 4.4 | N/A | N/A | N/A | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 0.4 | 0.2 | 0.02 | 0.36 | N/A | N/A | N/A | N/A |
| **Acetaldehyde** | 0.5 hr | 10.05 | Ontario AAQC | 500 | 250 | 5.03 | 489.9 | N/A | N/A | N/A | N/A |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.7 | 496.6 | N/A | N/A | N/A | N/A |
| **Benzene** | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.3 | 1.8 | N/A | N/A | N/A | N/A |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.2 | 0.1 | N/A | N/A | N/A | N/A |
| **Formaldehyde** | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.3 | 54.3 | N/A | N/A | N/A | N/A |
| **1,3 Butadiene** | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.4 | 9.2 | N/A | N/A | N/A | N/A |
| | Annual | 0.9 | Ontario AAQC | 2 | 1 | 0.5 | 1.1 | N/A | N/A | N/A | N/A |

| Indicator Compound | Averaging Period | Background Concentration (µg/m$^3$) | Criteria Source[(1)] | Criteria (µg/m$^3$) | 50% Criteria (µg/m$^3$) | 50% Background (µg/m$^3$) | Criteria Minus Background (µg/m$^3$) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Toluene** | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.2 | 2,000 | N/A | N/A | N/A | N/A |
| **Ethylbenzene** | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.1 | 1,000 | N/A | N/A | N/A | N/A |
| **Xylene** | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.3 | 729 | N/A | N/A | N/A | N/A |
| **Benzo(a)pyrene** | 24 hr | 0.00003 | Ontario AAQC | 0.00005 | 0.000025 | 0.00002 | 0.00002 | N/A | N/A | N/A | N/A |
| | Annual | 0.00002 | Ontario AAQC | 0.00001 | 0.000005 | 0.000009 | -- | N/A | N/A | N/A | -- |

**Notes:**

(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.

Max Distances to - represents the distance where the indicator compound's GLC will no longer exceed their respective criteria / threshold.

N/A - not applicable, the maximum GLC does not meet or exceed their respective criteria / threshold

"--" - The measured Benzo(a)pyrene background concentrations exceed Benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

"outside of model domain" - The model result is predicted to be higher than the noted threshold throughout the boundary of the modelling domain

Criteria Minus Background represents the maximum POI value that Community Access Road contributes before the indicator compound's relevant criteria is exceeded due to the combined effect of Project and Background/Ambient concentrations.

## Table 7-8: Summary of Maximum Distances to Criteria / Threshold – Operation Phase E/W Segment

| Indicator Compound | Averaging Period | Background Concentration (µg/m³) | Criteria Source(1) | Criteria (µg/m³) | 50% Criteria (µg/m³) | 50% Background (µg/m³) | Criteria Minus Background (µg/m³) | Community | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
| **$NO_2$** | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | N/A | N/A | N/A | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | N/A | N/A | N/A | N/A |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | N/A | N/A | N/A | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | N/A | N/A | N/A | N/A |
| **$PM_{2.5}$** | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19 | N/A | N/A | 92 | NA |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | N/A | N/A | N/A | N/A |
| **$PM_{10}$** | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | 50 | 224 | 508 | 374 |
| **TSP** | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | 119 | 436 | 696 | 1,001 |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | N/A | 27 | 32 | 639 |
| **$SO_2$** | 10min | 21.62 | Ontario AAQC | 178 | 89 | 10.81 | 156.4 | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | N/A | N/A | N/A | N/A |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.31 | 167.7 | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | N/A | N/A | N/A | N/A |
| **CO** | 1 hr | 469.7 | Ontario AAQC | 36,200 | 18,100 | 235 | 35,730 | N/A | N/A | N/A | N/A |

| Indicator Compound | Averaging Period | Background Concentration (µg/m³) | Criteria Source(1) | Criteria (µg/m³) | 50% Criteria (µg/m³) | 50% Background (µg/m³) | Criteria Minus Background (µg/m³) | Community | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 227 | 15,246 | N/A | N/A | N/A | N/A |
| **Acrolein** | 1 hr | 0.1 | Ontario AAQC | 4.5 | 2.25 | 0.05 | 4.4 | N/A | N/A | N/A | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 0.4 | 0.2 | 0.02 | 0.36 | N/A | N/A | N/A | N/A |
| **Acetaldehyde** | 0.5 hr | 10.05 | Ontario AAQC | 500 | 250 | 5.03 | 489.9 | N/A | N/A | N/A | N/A |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | N/A | N/A | N/A | N/A |
| **Benzene** | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | N/A | N/A | N/A | N/A |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | N/A | N/A | N/A | N/A |
| **Formaldehyde** | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | N/A | N/A | N/A | N/A |
| **1,3 Butadiene** | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | N/A | N/A | N/A | N/A |
| | Annual | 0.9 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | N/A | N/A | N/A | N/A |
| **Toluene** | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 2,000 | N/A | N/A | N/A | N/A |
| **Ethylbenzene** | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 1,000 | N/A | N/A | N/A | N/A |
| **Xylene** | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729 | N/A | N/A | N/A | N/A |
| **Benzo(a)pyrene** | 24 hr | 0.00003 | Ontario AAQC | 0.00005 | 0.000025 | 0.000017 | 0.00002 | N/A | N/A | N/A | N/A |
| | Annual | 0.00002 | Ontario AAQC | 0.00001 | 0.000005 | 0.000009 | -- | N/A | N/A | N/A | -- |

**Notes:**

(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.

"--" - The measured Benzo(a)pyrene background concentrations exceed Benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.
Criteria Minus Background represents the maximum POI value that Community Access Road can contribute to before indicator compound specific criteria are exceeded due to the combined effect of Project and Ambient conditions.

## 7.2.1 Potential Effects

### Description of Potential Effects

The following sections discuss the potential effects that Project operational activities (road traffic) may have for each of the identified indicator compound of concern.

As indicated in **Table 7-7** and **Table 7-8**, model results indicate that maximum ground level concentrations outside of the roadway footprint are not significant enough for most indicator compounds to exceed indicator compound specific criteria/standards or to cause exceedances to indicator compound specific criteria when the effects of background ambient air quality concentrations are considered in addition to Project impacts. The following sections discuss indicator compounds where maximum ground level concentrations do exceed indicator compound specific criteria or were greater than the additional threshold values established in this assessment (i.e., 50% of criteria or 50% of background).

### Nitrogen Dioxide ($NO_2$)

#### North-South Road Segment Potential Effects

Along the north-south road segment predicted impacts of $NO_2$ (Project-only and Project plus background air quality) are not expected to exceed the criteria for either 1-hour, 24-hour or annual averaging periods.

#### Community Road Segment Potential Effects

Along the east-west road segment predicted impacts of $NO_2$ (Project-only and Project plus background air quality) are not expected to exceed $NO_2$ criteria for either 1-hour, 24-hour, or annual averaging periods. None of the thresholds developed to assess potential effects were exceeded (i.e., criteria, 50% of criteria, 50% of background, criteria minus background).

### Total Suspended Particulate Matter (TSP)

#### North-South Road Segment Model Results

Along the north-south road segment the maximum predicted impact of Total Suspended Particulate (Project-only) are expected to exceed Total Suspended Particulate criteria for both 24-hour and annual averaging periods. Total Suspended Particulate 24-hour and annual impacts are predicted to exceed criteria 3,000 m and 899 m from the roadway, respectively. The impact of Total Suspended Particulate with background concentrations added to Community Access Road impacts extended outside of the modelling domain (3,000 m from the Construction Disturbance Area).

Maximum ground level concentrations of Total Suspended Particulate (Project-only) are expected to exceed 50% of 24-hour and annual criteria greater than 3,000 m and up to 1,591 m from the edge of the road, respectively.

#### Community Road Segment Potential Effects

Along the east to west road segment maximum predicted impacts of Total Suspended Particulate are expected to exceed Total Suspended Particulate criteria for the 24-hour averaging period. Maximum ground level concentrations are expected to exceed or equal 24-hour criteria up to 119 m from the roadway. When impacts of background ambient air quality are considered in addition to Project impacts, this distance is extended to 1,001 m. Maximum predicted impacts are expected to exceed or be equal to 50% of 24-hour criteria up to 436 m.

Exceedances to annual criteria are not expected from Project contributions only, however when background ambient conditions are in addition to Project impacts, the annual criteria is expected to exceed up to 639 m from the roadway. Fifty percent of the value of annual criteria is expected to be exceeded up to 27 m without the contribution of ambient background.

#### Considerations

It should be noted that background concentrations of Total Suspended Particulate are relatively high and account for more than 70% of both 24-hour and annual criteria. Background concentrations of Total Suspended Particulate will vary seasonally due to the presence of forest fires.

Fugitive road dust emissions from vehicular travel on an unpaved road will be the leading contributor to ground level concentrations of Total Suspended Particulate during the operations phases of Community Access Road. Model results were presented without the effects of mitigation. Pending on mitigation methods applied up to an 80% control efficiency may be achieved. Mitigation will result in a reduction in the extent at which TSP levels are elevated from the edge of the roadway.

### Particulate Matter 10 micrometres or less in Diameter ($PM_{10}$)

#### North-South Road Segment Model Results

Along the north-south road segment maximum predicted impacts of $PM_{10}$ are expected to exceed $PM_{10}$ 24-hour criteria. During the operations phases of Community Access Road, maximum ground level concentrations of $PM_{10}$ are expected to exceed or be equal to $PM_{10}$ criteria up to 1,986 m from the roadway. When considering the impacts of background concentrations in addition to Project impacts this distance is extended to 2,987 m from the roadway.

Maximum predicted impacts are expected to exceed or be equal to 50% of 24-hour criteria up to 2,987 m without the contribution of ambient background.

#### Community Road Segment Potential Effects

Along the east to west road segment maximum predicted impacts of $PM_{10}$ are expected to exceed $PM_{10}$ 24-hour averaging criteria. Maximum ground level concentrations are expected to exceed or equal 24-hour criteria up to 50 m from the roadway. When impacts of background ambient air quality are considered in addition to Project impacts, this distance is extended to 375 m.

Maximum predicted impacts are expected to exceed or be equal to 50% of 24-hour criteria up to 224 m without the contribution of ambient background.

#### Considerations

It should be noted that background concentrations of $PM_{10}$ are relatively high and account for greater than 60% of 24-hour criteria. Background concentrations of $PM_{10}$ may be overstated because of the location of the monitoring station at the community and will also vary seasonally due to the presence of forest fires.

Fugitive road dust emissions from vehicular travel on an unpaved road will be the leading contributor to ground level concentrations of $PM_{10}$ during the operations phases of Community Access Road.

### Particulate Matter 2.5 micrometres or less in Diameter ($PM_{2.5}$)

#### North-South Road Segment Model Results

Along the north-south road segment maximum predicted impacts of $PM_{2.5}$ are expected to exceed $PM_{2.5}$ 24-hour and annual criteria. During the operations phases of Community Access Road, maximum ground level concentrations of $PM_{2.5}$ are expected to exceed or be equal to $PM_{10}$ criteria up to 115 m and 134 m from the roadway for 24-hour and annual criteria respectively. When considering impacts of background concentrations of $PM_{2.5}$ in addition to Project impacts this distance is extended to 207 m and 414 m for 24-hour and annual criteria respectively.

Maximum predicted impacts are expected to exceed or be equal to 50% of 24-hr and annual criteria up to 433 m and 336 m respectively, without the contribution of ambient background.

Along the east to west road segment maximum predicted impacts of $PM_{2.5}$ are not expected to exceed $PM_{2.5}$ 24-hour or annual averaging criteria. Exceedances are also not expected when impacts of background ambient air quality are considered in addition to Project impacts.

Maximum predicted impacts are not expected to exceed or be equal to 50% of 24-hour criteria without the contribution of ambient background.

The maximum distance to 50% of 24-hour background conditions is 92 m from the roadway.

#### Considerations

Fugitive road dust emissions from vehicular travel on an unpaved road will be the leading contributor to ground level concentrations of $PM_{2.5}$ during the operations phases of Community Access Road.

### Diesel Particulate Matter (DPM)

Diesel Particulate Matter emissions are generated from tailpipe emissions of diesel-fired combustion equipment. To provide a conservative estimate of Diesel Particulate Matter emissions, it is assumed that they are equal tailpipe emissions of $PM_{2.5}$.

There are currently no Ontario Ambient Air Quality Criteria to evaluate the predicted impact of Diesel Particulate Matter emissions.

A summary of the predicted maximum Diesel Particulate Matter concentrations is included within **Attachment B – Tables**. The maximum concentrations of Diesel Particulate Matter occur in close proximity to the edge of the roadway. Diesel Particulate Matter results will inform the Community Well-Being Assessment.

### Dustfall

Included within **Attachment B – Tables** is a summary of maximum modelled dustfall loadings for both the North/South and East/West Road segments. Included within this table are approximate distances from the edge of the road where model results indicate dustfall loadings are elevated above Ontario Ambient Air Quality Criteria as well as the approximate distance at which 50% of criteria is expected to occur. Dustfall is expected to result from fugitive dust emissions.

Included within **Attachment C – Isopleths** are predicted concentration contours for dustfall.

#### North-South Road Segment Model Results

Model results indicate that predicted dustfall loadings are above the 30-day and annual criteria at some receptors during the operations phase of the roadway along the North/South section.

The predicted exceedances of 30-day criteria are expected to occur up to an approximate maximum distance of 45 m from the edge of the road. The predicted exceedances of annual criteria are expected to occur up to an approximate maximum distance of 681 m from the edge of the road. Background ambient dustfall was assumed to be zero due to data unavailability.

#### Community Road Segment Potential Effects

Model results indicate that predicted dustfall loadings are above the annual criteria at some receptors during the operations phase of the roadway along the Community Road Segment. No exceedances of the 30-day criteria were predicted.

The predicted exceedances of annual criteria are expected to occur up to an approximate maximum distance of 28 m from the edge of the road.

### Discussion of Maximum POI Results

**Table 7-9** and **Table 7-10** provide a summary of maximum ground level concentrations for each road segment during the operational phase of Community Access Road.

Maximum concentrations are observed to occur at the edge of the roadway and reduce in magnitude further from the road. Maximum ground level concentrations were not utilized to evaluate potential effects or significance; however, they have been included for the purpose of informing other technical studies such as the Community Well-Being Report.

For the N/S road segment maximum ground level concentrations of indictor compounds did not exceed relevant criteria with the exception of particulate matter (TSP, $PM_{10}$, $PM_{2.5}$).

Criteria was exceeded for B(a)P along the N/S road segment, only when background ambient concentrations where included. It should be noted that background ambient concentrations exceed criteria without the contribution of Community Access Road. Project contributions account for less than 1% of B(a)P criteria.

Besides particulate matter (TSP, PM10, and PM2.5) Community Access Road-only impact of all other indicator compounds (i.e. gaseous compounds) along the N/S road segment was shown to be less than 14% of their respective criteria. This indicates that the driver of potential effects is due to the fugitive road dust generated from agitation of the road opposed to the tailpipe emissions of indicator compounds.

For the E/W road segment maximum ground level concentrations of indictor compounds did not exceed relevant criteria with the exception of particulate matter (TSP and $PM_{10}$).

Criteria was exceeded for B(a)P along the E/W road segment, only when background ambient concentrations where included. It should be noted that background ambient

concentrations exceed criteria without the contribution of Community Access Road. It should also be noted that B(a)P ambient data was collected from the Simcoe County Station and may over estimate B(a)P ambient levels within Community Access Road area. Project contributions account for less than 0.1% of criteria.

Besides particulate matter (TSP, PM10, and PM2.5) Community Access Road-only impact of all other indicator compounds (e.g. gaseous compounds) along the E/W road segment was shown to be less than 1% of their respective criteria. This indicates that the driver of potential effects is due to the fugitive road dust generated from agitation of the road surface as opposed to the tailpipe emissions of indicator compounds.

## Table 7-9: Operation Phase N/S Segment - Maximum POI Summary

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 1 hr | 400 | Ontario AAQC | Health | 3.8 | 10.8 | 3% | 4% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.8 | 10.8 | 14% | 18% |
| | 24 hr | 200 | Ontario AAQC | Health | 3.1 | 2.3 | 1% | 3% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.3 | 0.9 | 4% | 10% |
| **$PM_{2.5}$** | 24 hr | 27 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 8.0 | 67.4 | >100% | >100% |
| | Annual | 8.8 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 5.1 | 10.0 | >100% | >100% |
| **$PM_{10}$** | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 655.5 | >100% | >100% |
| **TSP** | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 2292.6 | >100% | >100% |
| | Annual | 60 | Ontario AAQC | Visibility | 56.7 | 344.6 | >100% | >100% |
| **$SO_2$** | 10 min | **178** | Ontario AAQC | Health | 4.3 | 0.02 | 0.01% | 2% |
| | 1 hr | **100** | Ontario AAQC | Health | 2.6 | 0.01 | 0.01% | 3% |
| | | **170** | CAAQS (2025) | Health & Environment | 2.6 | 0.01 | 0.01% | 2% |
| | Annual | **10** | CAAQS (2025) | Health & Environment | 1.3 | 0.001 | 0.01% | 13% |
| | | **10** | Ontario AAQC | Vegetation | 1.3 | 0.001 | 0.01% | 13% |
| **CO** | 1 hr | 36,200 | Ontario AAQC | Health | 469.7 | 6.90 | 0.02% | 1% |
| | 8 hr | 15,700 | Ontario AAQC | Health | 454.0 | 2.70 | 0.02% | 3% |
| **Acrolein** | 1 hr | 4.5 | Ontario AAQC | Health | 0.1 | 0.001 | 0.02% | 2% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 0.0001 | 0.04% | 10% |
| **Acetaldehyde** | 0.5 hr | 500 | Ontario AAQC | Health | 10.1 | 0.01 | 0.001% | 2% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.4 | 0.002 | 0.0003% | 1% |
| **Benzene** | 24 hr | 2.3 | Ontario AAQC | Health | 0.6 | 0.0001 | 0.003% | 24% |
| | Annual | 0.45 | Ontario AAQC | Health | 0.3 | 0.00003 | 0.01% | 69% |
| **Formaldehyde** | 24 hr | 65 | Ontario AAQC | Health | 10.7 | 0.001 | 0.002% | 16% |
| **1,3 Butadiene** | 24 hr | 10 | Ontario AAQC | Health | 0.8 | 0.000005 | 0.00005% | 8% |
| | Annual | 2 | Ontario AAQC | Health | 0.9 | 0.000002 | 0.0001% | 45% |
| **Toluene** | 24 hr | 2,000 | Ontario AAQC | Odour | 0.5 | 0.001 | 0.00004% | 0.02% |
| **Ethylbenzene** | 10 min | 1,900 | Ontario ACB List | Odour | 0.8 | 0.001 | 0.00004% | 0.04% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.2 | 0.0004 | 0.00004% | 0.02% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **Xylene** | 10 min | 3,000 | Ontario ACB List | Odour | 2.8 | 0.01 | 0.0002% | 0.1% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.7 | 0.003 | 0.0004% | 0.1% |
| **Benzo(a)pyrene** | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 0.0000001 | 0.27% | 67% |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 0.0000001 | 1% | >100% |
| **DPM** | 24 hr | N/A | N/A | N/A | 0.6 | 0.02 | N/A | N/A |
| | Annual | N/A | N/A | N/A | 0.4 | 0.01 | N/A | N/A |
| **Dustfall** | 30-day | 7 | Ontario AAQC | Soiling | N/A | 11.5 | >100% | N/A |
| | Annual | 4.6 | Ontario AAQC | Soiling | N/A | 54.3 | >100% | N/A |

**Notes:**

1. "N/A" = Not applicable
2. 10-min averaging period results were converted from 1-hr results
3. Bold values were converted from PPB and/or PPM to ug/m3

## Table 7-10: Operation Phase E/W Segment - Maximum POI Summary

| Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **$NO_2$** | 1 hr | 400 | Ontario AAQC | Health | 3.8 | 0.5 | 0.1% | 1% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.8 | 0.5 | 1% | 5% |
| | 24 hr | 200 | Ontario AAQC | Health | 3.1 | 0.2 | 0.1% | 2% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.3 | 0.1 | 0.2% | 6% |
| **$PM_{2.5}$** | 24 hr | 27 | AAQC/CAAQS (2025) | Health/Health & Environment | 8.0 | 9.7 | 36% | 66% |
| | Annual | 8.8 | AAQC/CAAQS (2025) | Health/Health & Environment | 5.1 | 1.2 | 13% | 71% |
| **$PM_{10}$** | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 94.0 | >100% | >100% |
| **TSP** | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 328.8 | >100% | >100% |
| | Annual | 60 | Ontario AAQC | Visibility | 56.7 | 39.9 | 66.5% | >100% |
| **$SO_2$** | 10 min | **178** | Ontario AAQC | Health | 4.3 | 0.001 | 0.001% | 2% |
| | 1 hr | **100** | Ontario AAQC | Health | 2.6 | 0.001 | 0.001% | 3% |
| | | **170** | CAAQS (2025) | Health & Environment | 2.6 | 0.001 | 0.001% | 2% |
| | Annual | **10** | CAAQS (2025) | Health & Environment | 1.3 | 0.0001 | 0.001% | 13% |
| | | **10** | Ontario AAQC | Vegetation | 1.3 | 0.0001 | 0.001% | 13% |
| **CO** | 1 hr | 36,200 | Ontario AAQC | Health | 469.7 | 0.6 | 0.002% | 1% |
| | 8 hr | 15,700 | Ontario AAQC | Health | 454.0 | 0.3 | 0.002% | 3% |
| **Acrolein** | 1 hr | 4.5 | Ontario AAQC | Health | 0.1 | 0.00004 | 0.001% | 2% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 0.00001 | 0.003% | 10% |
| **Acetaldehyde** | 0.5 hr | 500 | Ontario AAQC | Health | 10.1 | 0.001 | 0.0001% | 2% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.4 | 0.0001 | 0.00003% | 1% |
| **Benzene** | 24 hr | 2.3 | Ontario AAQC | Health | 0.6 | 0.00003 | 0.001% | 24% |
| | Annual | 0.45 | Ontario AAQC | Health | 0.3 | 0.00001 | 0.002% | 69% |
| **Formaldehyde** | 24 hr | 65 | Ontario AAQC | Health | 10.7 | 0.0001 | 0.00019% | 16% |
| **1,3 Butadiene** | 24 hr | 10 | Ontario AAQC | Health | 0.8 | 0.000002 | 0.00002% | 8% |
| | Annual | 2 | Ontario AAQC | Health | 0.9 | 0.000001 | 0.00003% | 45% |
| **Toluene** | 24 hr | 2,000 | Ontario AAQC | Odour | 0.5 | 0.0001 | 0.000004% | 0.02% |
| **Ethylbenzene** | 10 min | 1,900 | Ontario ACB List | Odour | 0.8 | 0.0002 | 0.00001% | 0.04% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.2 | 0.00004 | 0.00000% | 0.02% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| **Xylene** | 10 min | 3,000 | Ontario ACB List | Odour | 2.8 | 0.001 | 0.00003% | 0.09% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.7 | 0.0003 | 0.00003% | 0.09% |
| **Benzo(a)pyrene** | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 0.00000003 | 0.07% | 67% |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 0.00000001 | 0.10% | >100% |
| **DPM** | 24 hr | N/A | N/A | N/A | 0.6 | 0.001 | N/A | N/A |
| | Annual | N/A | N/A | N/A | 0.4 | 0.0004 | N/A | N/A |
| **Dustfall** | 30-day | 7 | Ontario AAQC | Soiling | N/A | 1.6 | 23.5% | N/A |
| | Annual | 4.6 | Ontario AAQC | Soiling | N/A | 6.3 | >100% | N/A |

**Notes:**

1. "N/A" = Not applicable
2. 10-min averaging period results were converted from 1-hr results
3. Bold values were converted from PPB and/or PPM to ug/m3

### 7.2.2 Mitigation

Best management practices that are typically employed during the operation of unpaved roadways can be implemented to help reduce overall Project impacts on the surrounding environment. The Ontario Ministry of Transportation identifies potential mitigation measures that may be taken, if feasible, for transportation related Projects in the Ontario Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas emissions for Provincial Transportation Projects (Ontario Ministry of Transportation, 2020).

Suggested mitigation measures that may be included in the fugitive dust management plan come from both Ontario Ministry of Transportation recommendations as well as construction industry best practices.

It is recommended to develop an operational fugitive dust management plan after the final design and before Community Access Road is operational. This plan should detail the selected mitigation measures, allowing for a more refined and efficient approach to controls, costing, and Project scheduling. The specifics of the mitigation measures and best management practices will be clearer during the detailed design and construction submittal process. **Table 7-11** provides examples of these practices and measures.

It is recommended that the proximity of receptors to the development area should be considered when employing mitigation techniques. It should be noted that maximum traffic volumes used to assess potential effects are those Projected for the 2046 year (maximum Projected AADT). Mitigation techniques can be both evaluated and implemented during earlier operational years when traffic volumes are lower than Community Access Road maximum.

### Table 7-11: Mitigation Measures

| Mitigation Measures | Potential Reduction |
|---|---|
| ■ **Development of a Best Management Plan for fugitive dust prior to operation phase of Community Access Road. Examples of best management practices that may be included are:**<br>o **Implement watering or application of Ontario Ministry of Transportation approved dust suppressants that are environmentally friendly; and**<br>o **Keep vegetation such as grasses shrubs and trees along the highway to enhance gravitational deposition of particles and natural windbreaks. Specifics to this are documented in the Rehabilitation Plan.**<br>■ **Consideration of input gathered through other technical monitoring programs specific to potential air quality concerns (i.e., potential dust deposition on vegetation) is completed and evaluated for consideration of future mitigation or monitoring options.** | ■ Fugitive dust (Total Suspended Particulate, $PM_{10}$, $PM_{2.5}$) |

## Mitigation Assessment

The impacts from fugitive dust generation are typically managed by selected mitigation measures during the detailed design process. Potential mitigation measures are included in **Table 7-11**. Operational best management practices can have a significant impact on reducing potential effects of fugitive dust.

**Table 7-12** presents the predicted concentrations with no mitigation and with the use of road dust suppressants (80% control efficiency) applied as a best management practice for the mitigation of road dust. An 80% control efficiency is a documented control level by Environment Climate Change Canada for chemical suppressants as indicated in the National Pollutant Release Inventory Road Dust Emissions from Unpaved Surfaces: Guide to Reporting (ECCC, 2024).

For the purpose of this assessment the influence of natural mitigation (i.e., rain or snow) were not considered. Meteorological anomalies were also not removed.

The results indicate that the application of mitigation on the road corridor would decrease the predicted impact such that only Community Access Road-only impact of $PM_{10}$ and TSP have criteria exceeded (at their maximum POI) along the N/S road section.

### Table 7-12: Operations Phase Predicted Concentrations With and Without Mitigation

| Road Segment | Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Ambient [µg/m$^3$] | No Mitigation Maximum POI [µg/m$^3$] | No Mitigation % Criteria [Project Only] | No Mitigation % Criteria [Project + Background] | With Mitigation Maximum POI [µg/m$^3$] | With Mitigation % Criteria [Project Only] | With Mitigation % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **N/S** | $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | 8.0 | 67 | >100% | >100% | 13.5 | 50% | 80% |
| | | Annual | 8.8 | AAQC/CAAQS (2025) | 5.1 | 10 | >100% | >100% | 5.5 | 62% | >100% |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | 31.2 | 656 | >100% | >100% | 131.2 | >100% | >100% |
| | TSP | 24 hr | 120 | Ontario AAQC | 89.1 | 2,293 | >100% | >100% | 458.7 | >100% | >100% |
| | | Annual | 60 | Ontario AAQC | 56.7 | 345 | >100% | >100% | 187.8 | >100% | >100% |
| **E/W** | $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | 8.0 | 10 | 36% | 66% | 1.9 | 7% | 37% |
| | | Annual | 8.8 | AAQC/CAAQS (2025) | 5.1 | 1 | 13% | 71% | 0.6 | 7% | 65% |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | 31.2 | 94 | >100% | >100% | 18.8 | 38% | 100% |
| | TSP | 24 hr | 120 | Ontario AAQC | 89.1 | 329 | >100% | >100% | 65.8 | 55% | >100% |
| | | Annual | 60 | Ontario AAQC | 56.7 | 40 | 67% | >100% | 22 | 36% | >100% |

**Table 7-13** below provides a comparison of the maximum distance where the 24-hr and annual criteria for TSP are exceeded with and without the addition of mitigation. A significant decrease in extent of effect is noted with the application of mitigation. For example, without mitigation TSP 24-hr criteria is exceeded in excess of 3 km from the N/S roadway segment, with the application of mitigation this extent is reduced to approximately 226 m from the edge of the road.

Included within **Attachment C – Isopleths** are contour plots showing the influence that a chemical dust suppressant may have on the extent at which elevated particulate levels are extended from the edge of the road.

## Table 7-13: Mitigation Assessment - Maximum Distance Comparison

| Road Segment | Indicator Compound | Averaging Period | Ambient [µg/m³] | Guideline | Criteria [µg/m³] | No Mitigation | | With 80% Mitigation | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Max Distance to Criteria (m) | Max Distance to Criteria Minus Background (m) | Max Distance to Criteria (m) | Max Distance to Criteria Minus Background (m) |
| **North South Operations** | TSP | 24 hr | 89.12 | Ontario AAQC | 120 | > 3000 | > 3000 | 226 | 2,298 |
| | | Annual | 56.65 | Ontario AAQC | 60 | 899 | > 3000 | 135 | 2,336 |
| **East West Operations** | TSP | 24 hr | 89.12 | Ontario AAQC | 120 | 119 | 1001 | N/A | 65 |
| | | Annual | 56.65 | Ontario AAQC | 60 | N/A | 639 | N/A | 319 |

**Notes:**

1. N/A indicates that criteria is not exceeded
2. Distances noted are approximate and calculated with GIS tools.

## Frequency Analysis

A 90$^{th}$ percentile frequency analysis was included to contextualize the maximum predicted concentrations, characterizing a 'reasonable worst-case' scenario. Fugitive dust modelling for unpaved roads is inherently conservative often generating maximum values based on the unlikely coincidence of peak vehicle throughput and worst-case meteorological conditions. The 90$^{th}$ percentile filters out statistical outliers to present an upper-range concentration likely to be frequently experienced by receptors. This allows for mitigation planning to be calibrated to address consistent operational risks rather than transient improbable events driven by model limitations.

The 90$^{th}$ percentile predicted concentrations compared to maximum ground level concentrations are summarized in **Table 7-14** below.

It should be noted that in addition to a reduction in maximum ground level concentrations there is a reduction in the extent at which exceedances to criteria and thresholds are observed when frequency is considered. **Table 7-15** provides a comparison of these extents for maximum results without mitigation and maximum, 90$^{th}$ percentile results with mitigation.

The results of the frequency analysis indicate there is a significant reduction in the magnitude and extent of impact from the Operations Phase when removing anomalous conditions. Contour plots for TSP 24 hour averaging periods presenting this are included in **Attachment C – Isopleths.**

## Table 7-14: Comparison of Maximum POI - Maximum and 90th Percentile

| Road Segment | Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | 80% Mitigation Applied | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Maximum | | | 90th Percentile | | |
| | | | | | | | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
| **N/S** | $PM_{2.5}$ | 24 hr | 27 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 8.0 | 13.5 | 50% | 80% | 8.9 | 33% | 63% |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 131.2 | >100% | >100% | 87.0 | 174% | >100% |
| | TSP | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 458.7 | >100% | >100% | 304.0 | >100% | >100% |
| **E/W** | $PM_{2.5}$ | 24 hr | 27 | AAQC (2023)/CAAQS (2025) | Health/Health & Environment | 8.0 | 1.9 | 7% | 37% | 1.1 | 4% | 34% |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | Health | 31.2 | 18.8 | 38% | 100% | 10.7 | 21% | 84% |
| | TSP | 24 hr | 120 | Ontario AAQC | Visibility | 89.1 | 65.8 | 55% | >100% | 37.5 | 31% | >100% |

## Table 7-15: Comparison of Distance to Criteria - Maximum and Maximum + 90th Percentile with Mitigation

| Road Segment | Indicator Compound | Averaging Period | Criteria [µg/m³] | No Mitigation | | Mitigation Applied (80%) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum | | Maximum | | 90th Percentile | |
| | | | | Max Distance to Criteria | Max Distance to Criteria Minus Background | Max Distance to Criteria | Max Distance to Criteria Minus Background | Max Distance to Criteria | Max Distance to Criteria Minus Background |
| **N/S** | TSP | 24 hr | 120 | > 3000 | > 3000 | 226 | 2298 | 105 | 675 |
| **E/W** | TSP | 24 hr | 120 | 119 | 1001 | N/A | 65 | N/A | 28 |

### 7.2.3 Characterization of Residual Effects

An assessment of significance was completed for the operations phase of Community Access Road (post-construction). Traffic volume and vehicle fleet composition vary between the north-south segment and Community segment resulting in different residual effects characterization between the road networks. The north-south segment towards the Ring of Fire will have seven times higher traffic volume than the east-west segment. The majority of traffic on the north-south segment towards the Ring of Fire will be heavy trucks and the majority of traffic on the east-west segment to Marten Falls community will be auto traffic.

Residual effects characteristics as well as criteria to establish significance as described in **Section 4.4.3** were used in the characterization of residual effects.

As noted in the construction phase assessment the majority of Community Access Road footprint and geographic extent where potential air quality impacts may be expected are in areas where prolonged human presence is not anticipated. Effects characterization presented in this report reflects that of a worst-case predicted impact condition. The maximum vehicular traffic volume Projected on the roadway is anticipated to occur in 2046. This worst-case operations condition was used to characterize residual effects as well as determine significance.

Sensitive receptors considered as part of this significance assessment included those where human presence is expected for a potentially long duration in time. In the event that humans are not at sensitive receptor locations for periods of time less than indicator compound specific criteria averaging periods the significance of residual effects is reduced. For example, sensitive receptor exceedances to annual Total Suspended Particulate criteria may not occur if human presence at a particular receptor is limited to periods of less than one year at a time.

The dispersion modelling assessment was prepared using conservative emission rates and modelling parameters to present a worst-case impact predicted result. Therefore, the predicted impact is not likely to be exceeded, however it is not reasonable to assert that the predicted effect would be unlikely to occur or certain to occur. The likelihood of effects would more appropriately range from possible to probable. The likelihood for residual effects were considered probable for indicator compounds assessed with annual averaging periods. The residual effects presented for annual averaging periods is less likely to be impacted by anomalous meteorological conditions and worst-case activity operations hours. For indicator compounds assessed with shorter averaging periods the likelihood for residual effects was determined to be possible to probable.

Uncertainty of receptor characteristics, such as frequency of human presence at receptor locations are also present within this assessment. Sensitive receptors considered as part of this significance assessment included those where human presence is expected for a potentially long duration in time. Unknown details of human presence at sensitive receptor locations adds to uncertainty in the residual impact assessment.

Prediction confidence of effects was determined to be moderate. Representative baseline data was known for receptor locations, potential for Project related effects are mostly understood, and the level of uncertainty associated with receptor data or Project conditions is moderate.

Residual effects were generally considered as significant if the residual effect was assessed at a high magnitude with potential residual impacts occurring at sensitive receptors, at either a frequent occurrence or in long term duration with irreversible effects. As operations phases of Community Access Road are not planned to end all residual effects are considered irreversible. Residual effects from operation that were classified to have a high magnitude were determined to be significant.

The residual impact assessment indicates there is the potential for a predicted impact with a high magnitude from particulate emissions due to the emissions generated from fugitive road dust. High magnitude impacts are predicted for the following indicator compounds and their respective averaging periods (without mitigation applied):

- $PM_{2.5}$ – 24-hour – North / South Road Segment – 207 m from roadway;
- $PM_{2.5}$ – Annual – North / South Road Segment – 414 m from roadway;
- $PM_{10}$ – 24-hour – North / South Road Segment – 2,987 m from roadway;
- $PM_{10}$ – 24-hour – Community Road Segment – 374 m from roadway;
- Total Suspended Particulate – 24-hour – North / South Road Segment – >3,000 m from roadway;
- Total Suspended Particulate – 24-hour – Community Road Segment – 1001 m from roadway;
- Total Suspended Particulate – Annual – North / South Road Segment – > 3000 m from roadway; and
- Total Suspended Particulate – Annual – Community Road Segment – 639 m from roadway.

**Table 7-16** provides a summary of the evaluation of residual effects significance for the road network during the operations phase of Community Access Road. An assessment of the significance of the residual effects was completed for all indicator compounds. Where multiple criteria was present for an averaging period, residual effects were evaluated against the most stringent criteria.

## Table 7-16: Characterization of Predicted Residual Effects and Determination of Significance for Air Quality

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air Quality** | $NO_2$ - N/S Road Segment | $NO_2$ - 1hr - CAAQS | Direct | Negative | Low | 700 | Long Term | Continuous | Irreversible | Possible | Not Significant | Moderate |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible | Not Significant | Moderate |
| | $NO_2$ - N/S Road Segment | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 34 | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $NO_2$ - N/S Road Segment | $NO_2$ - Annual - AAQC | Direct | Negative | Low | 38 | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - N/S Road Segment | $PM_{2.5}$ - 24hr - AAQC & CAAQS | Direct | Negative | High | 207 | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | PM2.5 - Community Road Segment | | | | Low | 92 | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $PM_{2.5}$ - N/S Road Segment | $PM_{2.5}$ - Annual - AAQC & CAAQS | Direct | Negative | High | 414 | Long Term | Continuous | Irreversible | Probable | **Significant** | Moderate |
| | $PM_{2.5}$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | $PM_{10}$ - N/S Road Segment | $PM_{10}$ - 24hr - AAQC | Direct | Negative | High | 2,987 | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | $PM_{10}$ - Community Road Segment | | | | High | 374 | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP - N/S Road Segment | TSP 24hr - AAQC | Direct | Negative | High | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP- Community Road Segment | | | | High | 1,001 | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP - N/S Road Segment | TSP Annual - AAQC | Direct | Negative | High | Local Study Area | Long Term | Continuous | Irreversible | Probable | **Significant** | Moderate |
| | TSP- Community Road Segment | | | | Low | 639 | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | $SO_2$ - N/S Road Segment | $SO_2$ - 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Community Road Segment | $SO_2$ - 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - N/S Road Segment | $SO_2$ - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SO_2$ - N/S Road Segment | $SO_2$ - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - N/S Road Segment | $SO_2$ - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | $SO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - N/S Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - Community Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - N/S Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - Community Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - N/S Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Community Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - N/S Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Community Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - N/S Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - Community Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - N/S Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | Benzene - Community Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Formaldehyde - N/S Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Formaldehyde - Community Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Xylene - N/S Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Xylene - Community Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - N/S Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - Community Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - N/S Road Segment | BaP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - Community Road Segment | BaP - Annual- AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |

**Notes:**

Geographic extent listed is specific to the highest magnitude rating, lower magnitude of residual effects may be experienced at distances that surpass the listed geographic extent (i.e., <50% of criteria but >50% of baseline ambient)

### 7.2.4 Indirect Effects

Indirect effects may occur when a change to one valued component resulting from a Project activity causes a change to another valued component. Changes in ambient air quality may indirectly impact the following disciplines:

- Surface water;
- Vegetation;
- Wildlife; and
- Human Health and Safety.

Potential indirect effects that change in air quality may have on the mentioned disciplines will be commended in discipline specific reports.

## 7.3 Decommissioning Phase

There are currently no plans to decommission Community Access Road as there is no expected / known end date for its need. Therefore, future suspension, decommissioning, and eventual abandonment will not be considered in this report. Should a future need to decommission or abandon the road arise, a separate study will be required to assess those effects due to the change in environment over time around the roadway.

## 7.4 Summary of the Assessment of Effects

Refer to **Table 7-6** and **Table 7-16**.

# 8. Cumulative Effects of Community Access Road

The *Canadian Environmental Assessment Act, 2012* (Government of Canada, 2019) requires that each environmental assessment of a Project take into account any cumulative environmental effects that are likely to result from Community Access Road in combination with the environmental effects of other physical activities that have been or will be carried out.

This section presents the assessment of potential cumulative effects completed as part of Community Access Road. The effects of past and present activities on the Study Area and Valued Components identified for Community Access Road were assessed and results are described in the following sections.

The cumulative impact assessment builds on the results of the impact assessment described in **Section 7** and will consider the incremental changes that are predicted to have a likely residual adverse effect on a Valued Component.

## 8.1 Cumulative Effects Methodology

### 8.1.1 Definitions

The Agency defines **Cumulative effects** as ‘changes to the environment, health, social, and economic conditions, as a result of Community Access Road’s residual environmental, health, social and economic effects combined with the existence of other past, present and reasonably foreseeable physical activities, as well as within activities of Community Access Road itself from multiple emissions and discharges (e.g., simultaneous operations) to understand synergistic or additive effects’ (the Agency, 2020). Cumulative effects may result if:

- The implementation of Community Access Road may cause direct residual adverse effects to the valued components, taking into account the application of technically and economically feasible mitigation measures; and
- The same valued component may be affected by other past, present and future physical activities.

A cumulative effect on an environmental, health, social or economic component may be important even if Community Access Road’s effects to this component by themselves are minor.

**Temporal boundaries** for the cumulative impact assessment as described in **Section 4.2**, correspond to the duration that the likely residual adverse effects of Community Access Road are predicted to occur. The Tailored Impact Statement Guidelines (Impact Assessment Agency of Canada, 2020) indicates the cumulative impact assessment should look at potential effects throughout the lifecycle of Community Access Road, including decommissioning and abandonment; however, there are currently no plans to decommission Community Access Road. Therefore, **Section 8.2.2** is limited to identifying and assessing cumulative effects during Community Access Road construction, and operations phases.

**Spatial boundaries**, which are the study area(s) within which the geographic extent of cumulative effects will be studied, may vary by each Valued Component selected (e.g., caribou). Finalization of the boundaries were informed through consultation with Indigenous communities, agencies and interested persons. The spatial boundaries used to assess cumulative effect are described in **Section 8.2.2**.

The Characteristics described in **Section 4.4** for the residual impact assessment have also been used to determine significance of cumulative effect, a summary of these is described in **Table 8-1** below.

**Table 8-1: Residual Effects Characteristics – Definitions**

| Effects Characteristic | Definition | Description |
|---|---|---|
| **Context** | ■ Ecological context; and<br>■ Timing of effect in relation to sensitive activities. | ■ See Description in **Section 4.4.4**. |
| **Direction** | ■ Direction of change from existing conditions | ■ Positive: net gain or positive effect;<br>■ Neutral: no change to existing condition; and<br>■ Negative: net loss or adverse effect. |
| **Magnitude** | ■ Magnitude is the expected change from existing conditions | ■ Negligible, low, medium, high; and<br>■ See description in **Section 4.4.4**. |
| **Geographic Extent** | ■ The spatial area that the effect is expected to occur | ■ Construction Distrubance Area: effect is confined within the direct physical disturbance of Community Access Road;<br>■ Local: effect extends into the Local Study Area;<br>■ Regional: effect extends into the Regional Study Area; and<br>■ Beyond Regional: effect extends beyond the Regional Study Area. |

| Effects Characteristic | Definition | Description |
|---|---|---|
| **Duration** | ■ The period of time that the effect is expected to occur | ■ Short-term: effect ends before the end of construction;<br>■ Medium-term: the effect occurs during construction and ends soon after operation begins and / or maintenance ends soon after the activity causing the effect ends; and<br>■ Long-term: the effect occurs during construction and persists into operation and / or the effect is considered permanent, or the likelihood of reversibility is low or uncertain. |
| **Frequency** | ■ How often the effect is expected to occur | ■ Infrequent: The effect is expected to occur rarely;<br>■ Frequent: The effect is expected to occur intermittently; and<br>■ Continuous: the effect is expected to occur continuously. |
| **Reversibility** | ■ The ability to return to existing conditions | ■ Reversible: the effect is not permanent; and<br>■ Irreversible: the effect is permanent. |
| **Likelihood** | ■ Probability that the effect will occur | ■ Unlikely: the effect is not likely to occur;<br>■ Possible: the effect may occur, but is not likely;<br>■ Probable: the effect is likely to occur; and<br>■ Certain: the effect will occur. |
| **Uncertainty** | ■ The potential for observed results to deviate from predictions made | ■ See description in **Section 4.4.4**. |
| **Direct / Indirect** | ■ Nature of the pathway through which the effect occurs. | ■ Direct effects are typically immediate and spatially aligned with the activity. Indirect effects may be delayed or spatially removed but are causally linked and predictable. |

## 8.1.2 Valued Component Specific Definitions

In addition to the residual effects characteristics described in **Table 8-1** above, the assessment of cumulative effects has prepared the following specific definition.

### Ecological Context

The ecological context within which potential environmental, health, social, and economic effects may occur has been taken into account when considering the cumulative effects

criteria, such as species sensitivity and resilience, and includes Indigenous Knowledge where it was available. The ecological context of the effect includes a discussion of the environmental consequences of the predicted effect.

For the cumulative impact assessment of air quality, ecological context is directly related to changes in air quality with respect to relevant air quality criteria.

### Magnitude

Magnitude refers to the amount of change in a measurable parameter relative to the existing conditions of a valued component, with and without Community Access Road in place and any additional activity within the temporal and spatial boundary of Community Access Road. When evaluating the magnitude of effects this study considers both the proportion of the Valued Component affected within identified spatial boundaries and the relative effect.

For magnitude, environmental discipline-specific definitions are required and are provided below in **Table 4-18**. The magnitude is characterized by the impact of Project effects plus background. Potential Project effects plus background ambient conditions were considered when establishing the magnitude of effects presented in **Section 7: Impact Assessment of Community Access Road**. Ambient air quality monitoring was completed between May 2021 to May 2022 which defined the potential impacts of other Projects operations within the Local Study Area during the one-year period of monitoring. Measured ambient concentrations of each air quality indicator compound were added to Community Access Road's (construction and operation) predicted modelled effects for comparison to relevant criteria and standards. Community Access Road-only and Project effects plus background predicted impacts were considered when defining magnitude levels. Results of this magnitude assessment are summarized in **Table 7-6** and **Table 7-16**.

For the assessment of cumulative effects, no information related to the cumulative impact assessment Project inclusion list has been provided. Therefore, an assessment of magnitude is limited to a qualitative understanding that an additional Projects or activities with the potential to emit like contaminants may increase the magnitude of the predicted residual effect from an air quality perspective.

### Frequency

Frequency refers to how often the effect is expected to occur. Specific to residual effects with respect to cumulative effects of air quality, frequency is directly correlated to the continuousness of emission generating activities which will result in the predicted effect.

Depending on the emission generating activity the frequency would be influenced by whether the activity occurs intermittently (e.g., blasting) or consistently (e.g., material handling and hauling) during the phases of Project development.

For the assessment of cumulative effects, no information related to the cumulative impact assessment Project inclusion list has been provided. Therefore, an assessment of frequency is limited to a qualitative understanding that an additional Projects or activities with the potential to emit like contaminants may increase the frequency of the predicted residual effect from an air quality perspective.

### Reversibility

Reversibility refers to the ability for conditions to return to existing conditions. With respect to air quality, reversibility is considered based on the potential for air quality conditions to return to previous state (i.e., if sources of emissions are removed will air quality return to existing conditions). If emission generating activities are stopped, in most cases, ambient air quality will return to existing state.

Reversibility of potential indirect effects that short-term air quality impacts may have on other discipline specific components (i.e., sensitive vegetation) is not considered in this effects characterization. Other discipline specific reports may comment on this further.

For the assessment of cumulative effects, no information related to the cumulative impact assessment Project inclusion list has been provided. Therefore, an assessment of reversibility is limited to a qualitative understanding that any construction Projects or activities would result in reversible (short-term) impacts, however, continuous operations of additional Projects or activities within the spatial and temporal boundary of Community Access Road may result in irreversible cumulative effects from an air quality perspective.

### Uncertainty / Likelihood

All impact assessments involve some level of uncertainty, often over many geographic, biophysical, and social dimensions, and observed results may deviate, to some degree, from predictions made in the assessment. Uncertainty could be related to a number of factors, such as Project design and components, existing conditions, spatial and temporal scope, valued component response, effectiveness of mitigation measures, overall scope of factors considered, cumulative effects, and natural and human causes of accidental events. Note that all uncertainties related to the effectiveness of mitigation measures must be considered when determining residual effects. Transparency in describing sources of uncertainty is critical to understanding the confidence that can be attributed to the analysis of effects and is important to decision-making. Efforts to address uncertainties has been focused on those uncertainties that are most meaningful to decision-making, such as how

the biophysical and human environment will respond to changes and the efficacy of mitigation measures.

For the assessment of cumulative effects, no information related to the cumulative impact assessment Project inclusion list has been provided. Therefore, an assessment of the likelihood of residual cumulative effects is limited to a qualitative understanding that any additional Projects or activities with the potential to emit like contaminants occurring within the spatial and temporal boundary of Community Access Road may result in an increased likelihood of cumulative effects from an air quality perspective.

### Prediction Confidence

Prediction confidence refers to the degrees of certainty in the predicted residual effects and associated determination of significance. All Impact Assessments involve some level of uncertainty, often over many geographic, biophysical, and social dimensions, and observed results may deviate, to some degree, from predictions made in the assessment. Therefore, the residual effects predictions vary in their level of certainty, which could be related to a number of factors such as Project design and components, existing conditions, spatial and temporal scope, Valued Component response, effectiveness of mitigation measures, overall scope of factors considered, and natural and human-induced influences on the biophysical and human environment. Accuracy of the data (e.g., vegetation mapping) used for the assessment also influences prediction confidence and has been considered for this assessment.

Transparency in describing sources of uncertainty is critical to understanding the confidence that can be attributed to the analysis of effects and is important to decision-making. Efforts to address uncertainties have been focused on those uncertainties that are most meaningful to decision-making, such as how the biophysical and human environment will respond to changes and the efficacy of mitigation measures.

For the assessment of cumulative effects, no information related to the cumulative impact assessment Project inclusion list has been provided. Therefore, an assessment of the prediction confidence of residual cumulative effects is limited to a qualitative understanding that with available data for additional Projects or activities with the potential to emit like contaminants located within the spatial and temporal boundaries results in a low prediction confidence of any cumulative effects from an air quality perspective.

### Determination of Significance

A conclusion on significance will not be possible using the characteristics described in this section. Taking into consideration professional judgement, we can only comment that Projects or activities that are shown to overlap with the spatial and temporal boundary of

Community Access Road may result in the following cumulative impact to the residual effects presented in **Section 7**:

- Increase in magnitude of Project's residual effect;
- Increase in frequency of Project's residual effect;
- Potential for irreversible cumulative effects to Community Access Road's residual effect;
- Increase in the likelihood of Project's residual effect; and
- Low prediction confidence based on available information of additional Projects or activities.

The extent of significance would be influenced greatly by the magnitude, frequency, and reversibility of the cumulative effect. With the limited information available, the significance rating of the cumulative effects of Community Access Road plus additional Projects and activities can be considered equal to or greater than the residual effects of Community Access Road.

## 8.2 Cumulative Effects Scoping

### 8.2.1 Valued Components with Residual Effects

The results of the Impact assessment completed in **Section 7** which have been carried forward for assessment of cumulative effect are described in **Table 8-2** below.

Indicator compounds carried forward for the cumulative impact assessment as identified in **Table 8-2** were selected as the predicted impacts were shown to have a Project residual effect with a magnitude level greater than negligible.

**Table 8-2: Valued Components and Residual Effects**

| Valued Component | Residual Effect |
|---|---|
| **Air Quality** | Elevated concentrations of indicator compounds during the construction phase as specified in **Section 7.1.1**:<br>■ $NO_2$;<br>■ $PM_{2.5}$;<br>■ $PM_{10}$;<br>■ TSP;<br>■ $SO_2$;<br>■ CO;<br>■ Acrolein;<br>■ Acetaldehyde; |

| Valued Component | Residual Effect |
|---|---|
| | ■ Toluene;<br>■ Ethylbenzene;<br>■ Xylene; and<br>■ BaP.<br><br>Elevated concentrations of indicator compounds during the operation phase as specified in **Section 7.2.1**:<br>■ $NO_2$;<br>■ $PM_{2.5}$;<br>■ $PM_{10}$; and<br>■ TSP. |

## 8.2.2 Spatial and Temporal Boundaries

Spatial boundaries were considered when evaluating the potential for cumulative effects during the construction and operation phases of Community Access Road. The spatial boundary was defined by the area where potential Project impacts are anticipated to occur. Specifically, the area where a Project has the potential to cause changes to air quality was considered.

In the case of this Project, cumulative effects are anticipated to occur within the Construction Disturbance Area plus a conservative buffer distance where the modelled effect (magnitude) was shown to be greater than negligible. This buffer distance was determined to be approximately 12,250 m (specifically, occurring during the SO2, 10-minute averaging period).

Conversely, the Local Study Area was defined for this Project (where the modelled receptors was set) were 5,000 m from the perimeter of the Construction Disturbance Area. It should be noted that due to the physical footprint of the Construction Disturbance Area (including access roads and aggregate pits), the modelled results where impacts of an emission generating activity were evaluated at receptors greater than 5,000 m from the source (i.e. effects of blasting activities at the most eastern pit locations were evaluated at receptors spanning from the most western section of the Construction Disturbance Area). Due to this the Cumulative Effects Study Area has an expanded footprint than that of the Local Study Area.

Temporal boundaries were also considered when evaluating the potential for cumulative effects. Temporal boundaries correspond to the duration that the likely residual adverse effects of Community Access Road are predicted to occur.

In the case of this Project, temporal boundaries were defined to be any period during Project construction and operation where another Project within the spatial boundary is occurring. Emissions from multiple Projects occur at the same time and have the potential to have cumulative impacts on air quality (e.g., two construction Projects occurring at the same time).

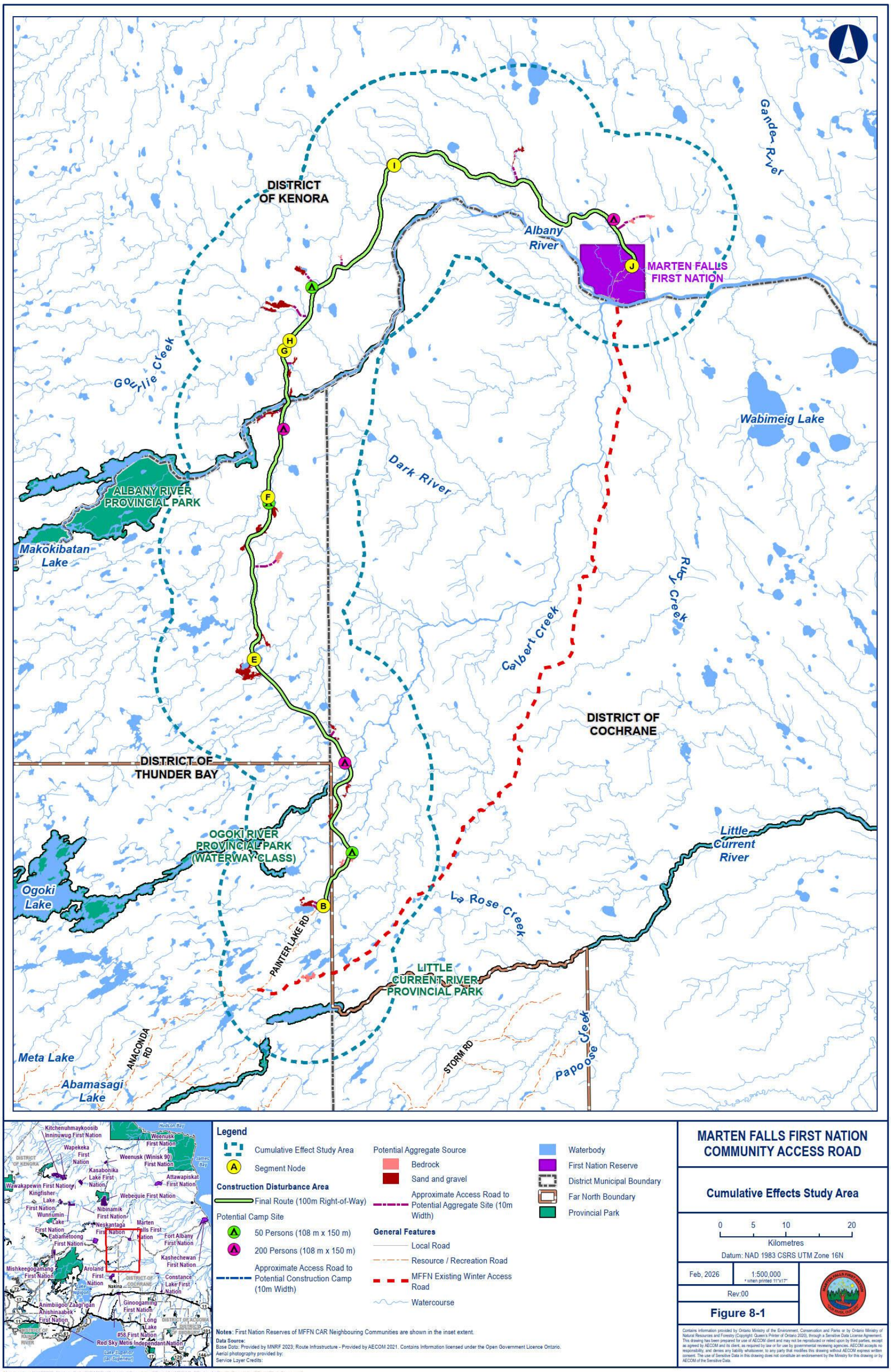
**Table 8-3** provides a summary of spatial and temporal boundaries.

**Table 8-3: Spatial and Temporal Boundaries**

| Valued Component | Spatial Boundary | Temporal Boundary |
|---|---|---|
| **Air Quality** | Cumulative Effects Study Area: Construction Disturbance Area plus a 12.25 km buffer | Congruent periods of emissions between Community Access Road construction or operation and other Projects within the spatial boundary<br>(i.e., emissions occurring at the same time from multiple Projects) |

**Figure 8-1** provides an overview of the Cumulative Effects Study Area. A description of how this Study Area was developed in is included in **Section 8.2.3**.

## Figure 8-1: Cumulative Effects Study Area



### 8.2.3 Physical Activities Inclusion List

It is anticipated that each of Community Access Roads on the **cumulative impact assessment Project inclusion list** contains elements of construction and / or operation that would share the potential for emissions of like contaminants (such as particulates and products of combustion) with Community Access Road.

Therefore, the additional Projects in the region with potential overlapping spatial and temporal boundaries with Community Access Road was considered for in the Cumulative Impact assessment. The additional Projects list was refined by evaluating Community Access Roads within the spatial boundary identified in **Table 8-4**. It is anticipated that any Project within the spatial boundary has the potential to meet the criteria for the temporal boundary for cumulative effects.

Therefore, Community Access Roads considered for cumulative effects are listed in **Table 8-4**.

## Table 8-4: Cumulative Impact assessment Project Inclusion List

*Please note that the information and Projects presented in this table represent the information publicly available at the time this Cumulative Impact assessment was completed.

| Project | Identified in TISG (yes / no) | Location | Status | Distance (km) and direction from MFFN Community Access Road Study Area | Developer / Company | Project Start Date | Project Duration | Project Completion Date | Assumed Temporal Overlap with Community Access Road Activities (yes / no) | Project Description | Map Feature Type | Map Buffer | Buffer Rationale | VC Temporal Overlap with Project (yes / no) | VC Spatial Overlap with Project (yes / no) | Included in CEA (yes / no) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Northern Road Link** | Yes | Between Marten Falls Community Access Road and WSR, northwestern Ontario | Impact Assessment ongoing | 0 (adjacent or overlapping) | Webequie First Nation Marten Falls First Nation | October 28, 2020 | Unknown | Unknown | Yes – construction and operation will overlap with Community Access Road construction (expected for Northern Road Link to begin construction during construction of northern portion of Community Access Road) | ■ Marten Falls First Nation and Webequie First Nation are proposing to build, operate and maintain an all-season multi-use road and associated infrastructure between the community access road that has been proposed by Marten Falls First Nation and the supply road that has been proposed by Webequie First Nation; and<br>■ Terms of Reference for the preparation of an Environmental Assessment approved March 3, 2023. | Line | 100 m | N/A | Yes, overlaps with Air Quality temporal boundaries | Yes, overlaps with Air Quality spatial boundaries | Yes |
| **Anaconda and Painter Lake Forestry Access Road Upgrades** | Yes | James Bay Lowlands | Unknown | 0 (adjacent or overlapping) | In discussions: MTO and Aroland First Nation | Not Started | 2-5 years | Unknown | Yes –operation expected to overlap with Community Access Road construction and operation | ■ Upgrades to existing road will be required for heavy vehicles accessing the Community Access Road route during construction and operations;<br>■ Currently discussions on proponency and | Line | 100 m | N/A | Unknown | Yes, overlaps with Air Quality spatial boundaries | Yes |

| Project | Identified in TISG (yes / no) | Location | Status | Distance (km) and direction from MFFN Community Access Road Study Area | Developer / Company | Project Start Date | Project Duration | Project Completion Date | Assumed Temporal Overlap with Community Access Road Activities (yes / no) | Project Description | Map Feature Type | Map Buffer | Buffer Rationale | VC Temporal Overlap with Project (yes / no) | VC Spatial Overlap with Project (yes / no) | Included in CEA (yes / no) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | scope of work are underway;<br>■ Potential scope of work is expected to include roadway widening, culvert and bridge replacements / rehabilitations to accommodate higher weight vehicles, and road base improvements; and<br>■ This Project will be completed prior to the start of the construction of the Community Access Road and therefore the upgrades to these roads is not expected to overlap with the construction of the Community Access Road. | | | | | | |
| **Rapid Lynx Broadband** | Yes | Matawa First Nation communities | Phase 1 Complete<br><br>Phase 2 Ongoing | Phase 1 – 0 (adjacent or overlapping)<br><br>Phase 2 – 57.69 | Rapid Lynx | February 2020 | Unknown | Unknown | Yes – construction of Phase 1 and operations of Phase 1 and 2 expected to overlap with Community Access Road construction and operations | ■ Approximately 810 km of fibre optic cables, providing reliable high-speed internet service to 5 Matawa First Nation communities: Eabametoong, Marten Falls, Neskantaga, Nibinamik and Webequie with an interconnection at Aroland. | Line | 100 m | N/A | Unknown | Yes overlaps with Air Quality spatial boundaries | Yes |

| Project | Identified in TISG (yes / no) | Location | Status | Distance (km) and direction from MFFN Community Access Road Study Area | Developer / Company | Project Start Date | Project Duration | Project Completion Date | Assumed Temporal Overlap with Community Access Road Activities (yes / no) | Project Description | Map Feature Type | Map Buffer | Buffer Rationale | VC Temporal Overlap with Project (yes / no) | VC Spatial Overlap with Project (yes / no) | Included in CEA (yes / no) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ogoki Forest Management Plans** | Yes | Ogoki Forest, Ontario | Operations | Forest Management Plans: Varies<br><br>Ogoki Primary Roads: 6.2 km | GreenForest Management Inc. and Geraldton Area Natural Resources Advisory Committee | 2020 | 10 years | 2030 | Yes – operations overlap with Community Access Road construction and operations | ■ Forest Management Plans for the Ogoki Forest;<br>■ Includes Ogoki-Armstrong Primary Roads as these roads are being used for forest management;<br>■ Includes plans for future harvest;<br>■ Ogoki Forest is approximately 10,900 square km in size, and includes approximately 9,798 square km of forested area; and<br>■ Majority of the forest is Crown Land and is subject to forest management planning and forest management operations. | Polygon | 100 m | N/A | Yes overlaps with Air Quality temporal boundaries | Yes overlaps with Air Quality spatial boundaries | Yes |

**Assumptions**

- Information and Projects presented in this table represent the information publicly available at the time the Cumulative Impact assessment was completed.
- Construction of Marten Falls Community Access Road is anticipated to start within 2-5 years of Environmental Assessment approval, depending on funding and permit acquisition.
- Construction of Marten Falls Community Access Road duration is anticipated to be 10 years.

**Definitions**

Project Start Date: Date that the Environmental Assessment or other permitting processes for Community Access Road started. Where information was available on the IAAC website, start date and Notice of Determination date and recommendations is included.

Project Duration: Amount of time (years) Project activities will take place. Where information was available and applicable, duration of each Project phase is noted.

Project Completion Date: Date all activities for Community Access Road will be completed. Completion date varies depending on type of Project, i.e. bridge or highway updates completion date reflects when construction of Community Access Road is complete, and mining Projects completion date reflects when the decommissioning and rehabilitation activities are complete / mine is abandoned.

Assumed Temporal Overlap with Community Access Road Activities: The phases each Project is anticipated to overlap with the Community Access Road. Overlap is assumed based on the information provided in Community Access Road Start Date, Project Duration and Project Completion Date columns.

Ongoing: Active Project work is taking place; Project is active at the time of preparation of this table. Where available, information on specific work that is ongoing for Community Access Road has been included.

Unknown: Information or Project details were not publicly available, or it was not possible to determine the required details based on the information available at the time of preparation of this table.

On Hold: Project has been put on pause for various reasons, currently no active Project work.

Not Active / N/A: Applies to mineral deposits. These are not active Projects and are not included as part of the cumulative impact assessment.

Operation: Construction is complete on Community Access Road and Project is currently in use/active.

Decommissioning / Rehabilitation: Applies to mining Projects only. Refers to activities following operations phase to rehabilitate the land.

### 8.2.4 Summary of Outcome

It is noted that there is potential for cumulative effects from Community Access Roads / activities listed in **Table 8-4**, however, the extent of a cumulative effect is not quantifiable with the limited information available. While Air Quality residual effects cannot be screened out, only a qualitative review of the potential for cumulative effects can be completed.

Therefore, there is expected to be potential for cumulative effects with Community Access Road as a result of the activities identified in **Table 8-5**.

**Table 8-5: Summary of Outcome**

| Past, Existing and Future Physical Activities/Projects | Valued Component Carried Forward Air Quality | Description |
|---|---|---|
| **Northern Road Link** | Yes | Community Access Roads / activities noted are located within the spatial and temporal boundaries identified for the cumulative impact assessment.<br>There exists the potential for cumulative effects. |
| **Rapid Lynx Broadband Project – Phase 1** | | |
| **Anaconda and Painter Lake Forestry Access Road Upgrades** | | |
| **Ogoki-Armstrong Primary Roads** | | |

## 8.3 Cumulative Impact Assessment

It is expected that when the spatial and temporal boundaries of Community Access Roads listed in **Table 8-5** overlap, there exists the potential for cumulative effects with respect to Air Quality. The extent of the potential impact will vary depending on the type of activity and location compared to the Cumulative Effects Study Area.

Detailed operational information (equipment, operations schedules, and location of activities, etc.) is required to estimate emissions from these Project activities listed in **Table 8-4**. As this information was not available at the time of this assessment, a quantitative analysis of these Projects to determine the potential for cumulative effects was not completed. An evaluation of cumulative effects characteristics described in **Section 7** was not completed for potential cumulative effects. However, it can be reasonably understood that there exists the potential for additional Project activity to increase the magnitude, frequency, irreversibility, and likelihood of Community Access Road's residual effects.

As previously noted in **Section 8.1.2**, the modelled impacts of construction and operations phases of this Project were evaluated with the combination of ambient air quality concentrations. This assessment of Project effects plus background was considered when establishing the magnitude effect rating of Community Access Road within **Section 7 – Impact Assessment of Community Access Road**.

It is noted that during periods when multiple Project activities occur at the same time and spatial boundaries overlap, ambient concentrations of indicator compounds identified in **Table 8-2** may increase above predicted levels documented in **Section 7 – Impact Assessment of Community Access Road**. The magnitude of increase may be influenced by meteorological conditions (e.g., prevailing wind direction), operations activity (e.g., blasting), and location of additional Project activity. The magnitude of this increase is unknown at this time and cannot be quantitatively defined.

The extent of significance of the cumulative effect is influenced by the magnitude, frequency, and reversibility. With the limited information available, the significance rating of the cumulative effects of Community Access Road plus the additional Projects identified in **Table 8-5** can be considered equal to or greater than the residual effects of Community Access Road.

Characterization of cumulative effects are summarized in **Table 8-6** for the construction phase of Community Access Road and **Table 8-7** for the operation phase of Community Access Road. As described in **Section 8.1.2** no information related to the cumulative effects assessment Project inclusion list has been provided, therefore, the cumulative effects characterizations are limited to a qualitative understanding that any additional Project or activity with the potential to emit like contaminants may increase the magnitude, geographic extent, duration, frequency, significance, and likelihood of effect. Reversibility will be dependant on additional Project type and lifespan and duration may depend on the nature of activity (e.g. construction or long-term operations) Therefore, the characterization of cumulative effects is noted as being equal to or greater than the effects presented in **Section 7 – Impact Assessment.** Prediction confidence is considered to be low due to data availability at this time.

Proposed mitigation measures to manage potential cumulative effects are summarized in **Table 8-8**.

## Table 8-6: Characterization of Cumulative Effects – Construction

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air Quality** | $NO_2$ - Quarry Blasting | $NO_2$ - 1hr - CAAQS | Direct | Negative | High | N/A | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | $NO_2$ - Quarry Aggregate Operations | | | | High | N/A | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | $NO_2$ - Burning / Clearing | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 4551 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | $NO_2$ - Bridge Building | | | | Low | 2368 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | $NO_2$ - Blasting or Burning | $NO_2$ - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | $NO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | $PM_{2.5}$ - Burning | $PM_{2.5}$ - 24hr - AAQC & CAAQS | Direct | Negative | High | 1030 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | $PM_{2.5}$ - Road Construction | | | | High | 440 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | $PM_{2.5}$ - Blasting or Burning | $PM_{2.5}$ - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | $PM_{2.5}$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | $PM_{10}$ - Burning | $PM_{10}$ - 24hr - AAQC | Direct | Negative | High | 1099 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | $PM_{10}$ - Road Construction | | | | High | 439 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | TSP - Burning | TSP - 24hr - AAQC | Direct | Negative | High | 529 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | TSP - Road Construction | | | | High | 355 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | TSP - Blasting or Burning | TSP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | TSP - Access Road | | | | Medium | 174 | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | $SO_2$ - Quarry Blasting | $SO_2$ - 10min - AAQC | Direct | Negative | High | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | $SO_2$ - 10min - AAQC | Direct | Negative | Low | 350 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | $SO_2$ - Blasting | $SO_2$ - 1hr - AAQC | Direct | Negative | High | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | $SO_2$ - Bridge Building | | | | Low | 19 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | $SO_2$ - Blasting | $SO_2$ - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | $SO_2$ - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | CO - Blasting | CO - 1hr - AAQC | Direct | Negative | High | 1458 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | CO - Bridge Building | CO - 1hr - AAQC | Direct | Negative | Low | 85 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | CO - Blasting | CO - 8hr - AAQC | Direct | Negative | High | 699 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | CO - Bridge Building, Road Construction, Access Road or Aggregate Operations | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Acrolein - Blasting, Burning | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Acrolein - Bridge Building | Acrolein - 1hr - AAQC | Direct | Negative | Low | 2508 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Acrolein - Blasting, Burning | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Acrolein - Bridge Building | Acrolein - 24hr - AAQC | Direct | Negative | Low | 170 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Bridge Building | Acetaldehyde - 24hr - AAQC | Direct | Negative | Low | 6 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Benzene - Blasting, Burning | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Benzene - Blasting, Burning | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | Formaldehyde - Blasting, Burning | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Formaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Low |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Low |
| | Toluene - Blasting, Burning | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Toluene - Bridge Building | Toluene - 24hr - AAQC | Direct | Negative | Low | 51 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Ethylbenzene - Burning | Ethylbenzene- 24hr - AAQC | Direct | Negative | Low | 2190 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | Ethylbenzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Ethylbenzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | Xylene - Blasting, Burning | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |

| Discipline/ Valued Component | Predicted Residual Effect | Context | Direct/ Indirect | Direction | Magnitude | Geographic Extent (m) | Duration | Frequency | Reversibility | Likelihood/ Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Xylene - Bridge | Xylene - 24hr - AAQC | Direct | Negative | Low | 29 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | BaP - Blasting, Burning | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | BaP - Bridge | BaP - 24hr - AAQC | Direct | Negative | High | 6 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |
| | BaP - Blasting, Burning | BaP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Low |
| | BaP - Bridge | BaP - Annual - AAQC | Direct | Negative | Low | 30 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Low |

**Notes:**

- Effects characterizations (besides prediction confidence) provided in **Table 8-6** are noted to be equal to or greater than those presented in **Table 7-6**. As no information related to the cumulative effects assessment Project inclusion list has been provided, the prediction confidence is set to low with respect to cumulative effects from an air quality perspective.
- Calculation of Geographic Extent were based on GIS analysis of model results and are approximate

## Table 8-7: Characterization of Cumulative Effects – Operation

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct / Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood / Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air Quality** | $NO_2$ - N/S Road Segment | $NO_2$ - 1hr - CAAQS | Direct | Negative | Low | 700 | Long Term | Continuous | Irreversible | Possible | Not Significant | Low |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible | Not Significant | Low |
| | $NO_2$ - N/S Road Segment | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 34 | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $NO_2$ - N/S Road Segment | $NO_2$ - Annual - AAQC | Direct | Negative | Low | 38 | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | $NO_2$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | $PM_{2.5}$ - N/S Road Segment | $PM_{2.5}$ - 24hr - AAQC & CAAQS | Direct | Negative | High | 207 | Long Term | Continuous | Irreversible | Possible to Probable | Significant | Low |
| | $PM_{2.5}$ - Community Road Segment | | | | Low | 92 | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | PM2.5 - N/S Road Segment | $PM_{2.5}$ - Annual - AAQC & CAAQS | Direct | Negative | High | 414 | Long Term | Continuous | Irreversible | Probable | Significant | Low |
| | $PM_{2.5}$ - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | $PM_{10}$- N/S Road Segment | $PM_{10}$ - 24hr - AAQC | Direct | Negative | High | 2,987 | Long Term | Continuous | Irreversible | Possible to Probable | Significant | Low |
| | $PM_{10}$ - Community Road Segment | | | | High | 374 | Long Term | Continuous | Irreversible | Possible to Probable | Significant | Low |
| | TSP - N/S Road Segment | TSP 24hr - AAQC | Direct | Negative | High | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Significant | Low |
| | TSP- Community Road Segment | | | | High | 1001 | Long Term | Continuous | Irreversible | Possible to Probable | Significant | Low |
| | TSP - N/S Road Segment | TSP Annual - AAQC | Direct | Negative | High | Local Study Area | Long Term | Continuous | Irreversible | Probable | Significant | Low |
| | TSP- Community Road Segment | | | | Low | 639 | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | $SO_2$ - N/S Road Segment | $SO_2$- 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct / Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood / Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SO_2$- Community Road Segment | $SO_2$- 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- N/S Road Segment | $SO_2$- 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- N/S Road Segment | $SO_2$- 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- N/S Road Segment | $SO_2$- Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | $SO_2$- Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | CO - N/S Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | CO - Community Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | CO - N/S Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | CO - Community Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acrolein - N/S Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acrolein - Community Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acrolein - N/S Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acrolein - Community Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct / Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood / Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Benzene - N/S Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Benzene - Community Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Benzene - N/S Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | Benzene - Community Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | Formaldehyde - N/S Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Formaldehyde - Community Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Low |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |

| Discipline / Valued Component | Predicted Residual Effect | Context | Direct / Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood / Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Xylene - N/S Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | Xylene - Community Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | BAP - N/S Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | BAP - Community Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | BAP - N/S Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |
| | BAP - Community Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Low |

**Notes:**

- Effects characterizations (besides prediction confidence) provided in **Table 8-7** are noted to be equal to or greater than those presented in **Table 7-16**. As no information related to the cumulative effects assessment Project inclusion list has been provided, the prediction confidence is set to low with respect to cumulative effects from an air quality perspective.
- Calculation of Geographic Extent were based on GIS analysis of model results and are approximate.

## Table 8-8: Proposed Mitigation Measures for Cumulative Effects

| Valued Component | Potential Impact | Proposed Mitigation Measure/Commitment | Proposed Follow Up Measure |
|---|---|---|---|
| **Air Quality** | Increase in magnitude, geographic extent, frequency, irreversibility, likelihood, and significance of residual effect | N/A(1) | N/A(1) |

**Notes:**

(1) The implementation of mitigation measures of Projects listed in **Table 8-4** is outside of the control of this Project. Recognizing that there is the potential for cumulative effects between Project interactions, efforts may be taken to communicate between the various Project teams and identify opportunities to reduce the potential for cumulative effects. An example of mitigation may include the scheduling of blasting activities (if applicable and possible) between Projects on different days to avoid cumulative air quality impacts.

# 9. Monitoring Programs and Future Commitments

A monitoring program verifies the accuracy of the effects assessment and evaluates the effectiveness of mitigation measures. Monitoring programs also include future commitments related to mitigating residual effects.

## 9.1 Pre-Construction Monitoring Program

Pre-construction monitoring for air quality is not recommended. An air quality monitoring program has previously been executed and used to inform existing conditions.

## 9.2 Construction Monitoring Program

A construction monitoring program is recommended as a mechanism to help mitigate and / or identify potential conditions that may lead to air quality impacts from construction related activities. A monitoring program, where feasible, may involve either or both air monitoring as well construction activity monitoring. Construction activity may include verification that construction best management practices are being applied or identify where additional efforts / mitigation techniques may be necessary to help reduce air quality impacts. Construction monitoring may be beneficial in locations where sensitive receptors are in close proximity to the Construction Disturbance Area. Details specific to the scope of the monitoring program would need to be evaluated further following final detailed design phases of Community Access Road. Engagement with the Ministry of the Environment, Conservation and Parks to establish an appropriate monitoring program may be beneficial.

## 9.3 Operations Monitoring Program

Due to the size of the road network, as well as its geographic location, feasibility / limitations will be present for long term operations monitoring. It is recommended that consideration of input gathered through other technical monitoring programs specific to potential air quality concerns (i.e., potential dust deposition on vegetation) is completed and evaluated for consideration of future mitigation or monitoring options.

## 9.4 Future Commitments

The development of Best Management Plans to mitigate fugitive dust generating potential during both construction and operation phases is recommended. Re-evaluation of potential significance or effect from temporary work camps is recommended following final design.

## 9.5 Future Permits and Approvals

To facilitate the construction of the Community Access Road, including construction activities and temporary infrastructure, permits and approvals from provincial, federal government and other jurisdictional agencies will need to be acquired. A preliminary list of permits and approvals anticipated to be applicable or potentially applicable to the Project for Air Quality are detailed in **Table 9-1**. This list is based on a conceptual level of design, and the final determination of permits and approvals that will be required will occur as the design is further advanced.

**Table 9-1: Summary of Potential Permits and Approvals List**

| Permit / Approval | Issuing Authority | Purpose / Scope | Considerations / Next Steps |
|---|---|---|---|
| **Environmental Compliance Approval** | Ministry of Environment, Conservation and Parks | Required for discharges to air, land, or water | To be confirmed in detail design. |
| **Permit to Take Water** | Ministry of Environment, Conservation and Parks | Authorizes water withdrawals exceeding 50,000 L/day | Applicable if dewatering or water supply is required, to be determined in detail design. |
| **Aggregate Permit** | Ministry of Natural Resources and Forestry | Authorizes the operation of pits and quarries | As noted in **Section 2.1.3**, all pits and quarries will be subject to the *Aggregate Resources Act* permitting process. |

# 10. Summary and Recommendations

**Table 10-1: Potential Effects Summary and Recommendations**

| ID | Valued Component | Environmental Concern and Potential Effect | Project Phase | Mitigation, Protection, Monitoring, and Study Commitments to be carried forward to Construction / Operation |
|---|---|---|---|---|
| **1** | Air Quality | Elevated concentrations of particulate matter resulting from fugitive emission sources during construction. The effects assessment for the construction phase indicates that significant residual effects are not anticipated and residual effects will be short term in duration. | Construction | ■ **Development of a construction best management practices plan as well as a fugitive dust management plan prior to construction. Examples of best management practices that may be included are:**<br>o Implement watering during fugitive dust generating activities such as drilling and material handling;<br>o Limit vehicle speed, where feasible;<br>o Strategic haul planning to reduce overall number of haul trips required for aggregate material demands. Consider sourcing material from the closest available material transfer points;<br>o Where possible, reduce the quantity of material that is either burned or chipped (i.e., consider salvageable material such as salable lumber);<br>o When burning is required consider avoiding periods where meteorological conditions (e.g., wind speed) may result in smoke impacting sensitive receptor locations;<br>o Maintain equipment as per manufacturing specifications;<br>o Implement anti-idling policies or procedures to reduce total vehicle idling times;<br>o Implement blasting mitigation (e.g., charge size) in quarries;<br>o Use explosives only if alternate methods of excavation to remove materials for foundation systems and roads are not feasible; and<br>o Prepare a Blasting and Communication Management Plan that is in accordance with Ontario Provincial Standard Specification General Specifications for the Use of Explosives (OPSS, 2014) and describes specific measures that would be implemented if blasting is required.<br>■ **Development of a construction monitoring plan. This plan may be used to validate that best management practices are being implemented and that mitigation actions taken are effective. Where mitigation is not providing a reduction to overall impacts, mitigation options should be revised; and**<br>■ **Re-evaluation of potential significance or effect from temporary work camps is recommended following final design.** |
| **2** | Air Quality | Elevated concentrations of particulate matter resulting from fugitive road dust. Residual effects from construction that were classified to have a high magnitude were determined to be significant. | Operations | ■ **Development of a Best Management Plan for fugitive dust prior to operation phase of Community Access Road. Best management practices that may be included within the plan include:**<br>o Implement watering or application of Ontario Ministry of Transportation approved dust suppressants that are environmentally friendly; and<br>o Keep vegetation such as grasses shrubs and trees along the highway to enhance gravitational deposition of particles and natural windbreaks. Specifics to this are documented in the Revegetation Plan.<br>■ **Consideration of input gathered through other technical monitoring programs specific to potential air quality concerns (i.e., potential dust deposition on vegetation) is completed and evaluated for consideration of future mitigation or monitoring options.** |

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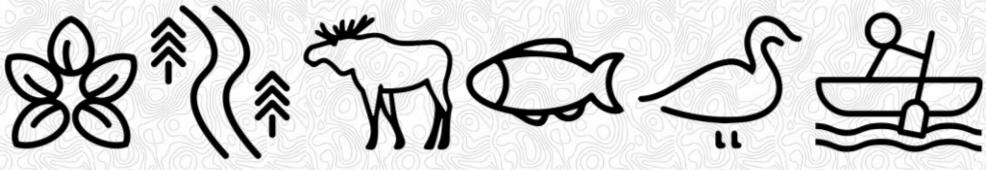
# Attachment A – Draft Study Plan, Workplan and Regulator Comments

MARTEN FALLS FIRST NATION
**ALL SEASON COMMUNITY ACCESS ROAD**

FINAL

# Atmospheric Environment and Greenhouse Gases (GHG) Study Plan

***June 2021***



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## Revision History

| Rev # | Date | Revision Description |
|---|---|---|
| Draft | *May* 2020 | Submitted “\DRAFT Study Plan – Atmospheric Environment” to the Agency. |
| Final | May 2021 | Revised to address federal and provincial agency comments. |

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# Appendices

Appendix A. Preliminary List of Data Sources
Appendix B. Agency Comments on Draft Study Plan

# Acronyms

Agency, the ... Impact Assessment Agency of Canada
CAR ..... Community Access Road
CAAQS ..... Canadian Ambient Air Quality Standards
BTEX ..... Benzene, Toluene, Ethylbenzene, and Xylene

CO ..... Carbon Monoxide
DPM ..... Diesel Particulate Matter
EA..... Environmental Assessment
ECCC ..... Environment and Climate Change Canada
GHG ..... Greenhouse Gases
IA ..... Impact Assessment
IAA..... Impact Assessment Act
IAAC ..... Impact Assessment Agency of Canada
IS ..... Impact Statement
km..... kilometre
LSA..... Local Study Area
MECP ..... Ontario Ministry of the Environment, Conservation and Parks
MFFN ..... Marten Falls First Nation
MOVES ..... Motor Vehicle Emission Simulator
NAPS..... National Air Pollution Surveillance Program
NIR ..... National Inventory Report
NOx ..... Nitrogen Oxides
O3..... Ozone
PDA ..... Project Development Area
PM ..... Particulate Matter
ROW..... Right of Way
RSA ..... Regional Study Area
SAR ..... Species at Risk
SO2 ..... Sulphur Dioxide
TISG ..... Tailored Impact Statement Guidelines
ToR..... Terms of Reference
TSP ..... Total Suspended Particulate Matter
US EPA ..... United Stated Environmental Protection Agency
VC ..... Valued Component
VOC..... Volatile Organic Compounds
WRF ..... Weather Research and Forecasting model

# 1. Introduction

The Proponent of the Community Access Road (CAR or the Project) is Marten Falls First Nation (MFFN), a remote First Nation community in northern Ontario located at the junction of the Albany and Ogoki rivers, approximately 430 kilometres (km) from Thunder Bay, Ontario. The MFFN community is proposing an all-season Community Access Road that will connect the MFFN community to Ontario's provincial highway network (Highway 643) to the south via the existing Painter Lake Road. MFFN, as the Proponent of the Project, has formed a MFFN CAR Project Team that includes MFFN CAR Community Member Advisors and MFFN CAR Project Consultants who act with input, guidance and direction from the MFFN Chief and Council.

This document outlines the study plan for the Atmospheric Environment and Greenhouse Gases (GHGs) discipline to support a co-ordinated Impact Assessment (IA) required for Project review by the Impact Assessment Agency of Canada (the Agency) under the federal *Impact Assessment Act* (IAA) and Environmental Assessment (EA) required for Project review by the Ontario Ministry of the Environment, Conservation and Parks (MECP) under the Ontario *Environmental Assessment Act*.

## 1.1 Federal and Provincial Terminology

The study plans have been prepared using federal terminology, however, the respective provincial terminology has been provided in **Table 1-1** for reference. The terms can be used interchangeably.

**Table 1-1: Equivalent Federal and Provincial Terms**

| Provincial Term | Federal Term |
|---|---|
| **Criteria** | Valued Component |
| **Impact Management Measure** | Mitigation Measure |
| **Net Effects** | Residual Effects |
| **Record of Consultation** | Record of Engagement |

# 1.2 Project Study Plans

This Study Plan is one of a group of study plans created for the Project. **Table 1-2** includes the study plans for each environmental[1] discipline currently planned for the Project and the valued components (VCs) covered by the study plans where applicable.

**Table 1-2: Project Study Plans and Valued Components**

| Environmental Discipline | Study Plan Name | Valued Component(s) |
|---|---|---|
| **Aboriginal and Treaty Rights and Interests** | ■ Aboriginal and Treaty Rights and Interests Study Plan | ■ Indigenous Current Use of Lands and Resources for Traditional Purposes<br>■ Cultural Continuity (ability to practice and transmit cultural traditions) |
| **Atmospheric Environment** | ■ Atmospheric Environment and Greenhouse Gases Study Plan | ■ Air Quality<br>■ Greenhouse Gas Emissions |
| **Climate Change** | ■ Climate Adaptation and Resiliency Study Plan | ■ Climate Change |
| **Acoustic and Vibration Environment** | ■ Acoustic and Vibration Environment Study Plan | ■ Noise<br>■ Vibration |
| **Physiography, Geology, Terrain and Soils** | ■ Physiography, Terrain and Soils Study Plan | ■ Physiography, Terrain and Soils |
| **Surface Water** | ■ Surface Water Study Plan | ■ Surface Water |
| **Groundwater and Geochemistry** | ■ Groundwater and Geochemistry Study Plan | ■ Groundwater |
| **Vegetation** | ■ Vegetation Study Plan | ■ Wetland and Riparian Ecosystems<br>■ Upland Ecosystems<br>■ Designated Areas (Areas of Natural and Scientific Interest, Environmentally Significant Areas, Significant Woodlands, Critical Landform / Vegetation Associations)<br>■ Traditional Use Plants and SAR Plant Populations (including species with special conservation status or rarity in the province) |
| | ■ Peatlands Study Plan | ■ Peatland Ecosystems (bogs and fens) |

1. *The use of the term environment in this document is inclusive of the components of the environment that are included in the Ontario Environmental Assessment Act definition, which includes a general description of the social, cultural, built and natural environments.*

| Environmental Discipline | Study Plan Name | Valued Component(s) |
|---|---|---|
| **Wildlife** | ■ Wildlife Study Plan | ■ Bats (including SAR-bats such as: Little Brown Myotis [*Myotis lucifugus*], Northern Myotis [*Myotis septentrionalis*] and Tricolored Bat [*Perimyotis subflavus*])<br>■ Fur Bearers (proxy VC[2] American Marten [*Martes americana*], Beaver [*Castor canadensis*] and Wolverine [*Gulo gulo*])<br>■ Amphibians and Reptiles<br>■ Pollinating Insects |
| | ■ Ungulates (Moose and Caribou) Study Plan | ■ Moose (*Alces alces*)<br>■ Caribou, boreal population (*Rangifer tarandus*) |
| | ■ Bird Study Plan | ■ Forest Birds (proxy VC of Red-eyed Vireo [*Vireo olivaceus*] for deciduous forest, Ovenbird [*Seirus aurocapilla*] for mixedwood forest, Dark-eyed Junco [*Junco hyemalis*] for coniferous forest and disturbed forest<br>■ Raptors (proxy VC of Osprey [*Pandion haliaetus*] for diurnal raptors and Boreal Owl [*Aegolius funereus*] for nocturnal raptors<br>■ Shorebirds (proxy VC of Wilson's Snipe [*Gallingo delicata*])<br>■ Waterfowl (proxy VC of Mallard [*Anas* platyrhynchos])<br>■ Bog / Fen Birds and Other Wetland Birds (proxy VC of Palm Warbler [*Setophaga palmarum*] for bogs, Common Yellowthroat [*Geothlypis trichas*] for fens; and Northern Waterthrush [*Parkesia noveboracensis*] for swamps .<br>■ SAR birds: Canada Warbler (*Cardellina canadensis*), Chimney Swift (*Chaetura pelagica*), Common Nighthawk (*Chordeiles minor*), Eastern Whip-poor-will (*Antrostomus vociferous*), Eastern Wood-Pewee (*Contopus virens*), Evening Grosbeak (*Coccothraustes vespertinus*), Olive-sided Flycatcher (*Contopus cooperi*), Bald Eagle (*Haliaeetus leucocephalus)*, Peregrine Falcon (*Falco peregrinus*), Short-eared Owl (*Asio flammeus)*, Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Black Tern (*Childonias niger*), Rusty Blackbird (*Euphagus carolinus*), Yellow Rail (*Coturnicops noveboracensis*) |
| **Fish and Fish Habitat** | ■ Fish and Fish Habitat Study Plan | ■ Lake Sturgeon (*Acipenser fulvescens*)<br>■ Walleye (*Sander vitreus*)<br>■ Brook Trout (*Salvelinus fontinalis*)<br>■ Northern Pike (*Esox lucius*)<br>■ Lake Whitefish (*Coregonus clupeaformis*)<br>■ Chain Pickerel (*Esox niger*)<br>■ Yellow Perch (*Perca flavescens*)<br>■ Cisco (*Coregonus artedii*) |

2. *A proxy VC is used when looking at the effects of one species that represents many others.*

| Environmental Discipline | Study Plan Name | Valued Component(s) |
|---|---|---|
| | | ■ Burbot (*Lota lota*)<br>■ Longnose Sucker (*Catostomus catostomus*)<br>■ White Sucker (*Catostomus commersonii*)<br>■ Forage / Prey Species (including species such as Lake Chub [*Couesius plumbeus*])<br>■ Lower Trophic Organisms (e.g., benthic invertebrates) |
| **Social** | ■ Social Study Plan | ■ Housing and Accommodation<br>■ Community Service and Infrastructure<br>■ Transportation<br>■ Community Well-being<br>■ Populations and Demographics |
| **Economy** | ■ Economic Study Plan | ■ Regional Economy<br>■ Labour Force and Employment<br>■ Government Finances |
| **Land and Resource Use** | ■ Land and Resource Use Study Plan | ■ Land Use Compatibility<br>■ Parks and Protected Areas<br>■ Extractive Industry<br>■ Forestry Industry<br>■ Energy and Linear Infrastructure<br>■ Recreation and Tourism |
| **Human Health and Community Safety** | ■ Human Health and Community Safety Study Plan | ■ Public Safety<br>■ Public Health<br>■ Diet<br>■ Environmental Factors Influencing Health |
| **Visual Aesthetics** | ■ Visual Aesthetics Study Plan | ■ Visual Contrast / Character<br>■ Visibility<br>■ Visual Sensitivity |
| **Archaeological and Cultural Heritage** | ■ Cultural Heritage Study Plan | ■ Archaeological Sites and Resources<br>■ Built Heritage Resources and Cultural Heritage Landscapes |

It should be noted that while there is not a consultation study plan, the Project has developed the *Consultation and Engagement Plan to Support the Environmental Assessment / Impact Statement* (AECOM 2020) (referred to as the Impact Statement [IS] / EA Consultation Plan).

# 2. Purpose and Objectives

The key objectives of conducting an IA / EA are to describe the existing environment, gather sufficient information to predict Project-related effects (positive and negative, direct and indirect) of the Project and alternatives on the environment, determine measures needed to avoid or minimize adverse Project effects, and enhance beneficial Project effects where feasible, and to undertake consultation and engagement throughout. The purpose of this Study Plan is to explain:

- A baseline[3] study methodology that will result in a comprehensive description of the existing environment potentially impacted by the Project;
- How efficient and transparent data management and analysis will be undertaken;
- Effects assessment scoping inputs specific to the atmospheric environment that will allow for potential effects of the Project on the existing environment to be appropriately assessed in the IS / EA Report; and
- How the study plan aligns with federal and provincial requirements and guidance, including the Agency's Tailored Impact Statement Guidelines (TISG), dated February 24, 2020 (the Agency 2020c), for this Project and applicable provincial agency comments on the Draft Terms of Reference (ToR)4.

As required by the IAA and referenced in TISG Section 7.3, work plans will also be developed for disciplines as required. It is anticipated the work plans will include further details on how to action the study plans; for example they would contain such information as location of sampling sites, scheduling, and sequencing.

For the purposes of establishing appropriate context, the Study Plan begins with background and relevant information on:

- Study Plan related discussions with the Agency, the MECP and applicable agencies to date (**Section 3**);
- The approach to Project consultation and engagement (**Section 4)**;
- How Indigenous Knowledge will be collected and used in the IA / EA (**Section 5**); and
- The spatial and temporal boundaries that will be used for the IA / EA (**Section 6**).

3. *Baseline refers to the current conditions of the environment potentially impacted by the Project. Baseline conditions serve as a reference against which changes due the Project are measured.*
4. *If necessary, the Study Plan will be updated to reflect the approved ToR if approval is obtained.*

# 2.1 Approach to Handling Confidential Information

## 2.1.1 Indigenous Knowledge

Permission from the Indigenous community will be sought before including Indigenous Knowledge in the IS / EA Report, regardless of the source of the Indigenous Knowledge. Sensitive and / or confidential information will be specifically collected through the Indigenous Knowledge Program to inform the IS / EA Report, and its use and publication will be governed by Indigenous community-specific Indigenous Knowledge Sharing Agreements. Sensitive and / or confidential information collected through Indigenous Knowledge Sharing Agreements will be protected from public or third-party disclosure and will be established between the Proponent and Indigenous communities participating in the Indigenous Knowledge Program prior to the sharing and use of any sensitive information. Instances where Indigenous Knowledge sharing has taken place during consultation activities (e.g., meetings) will be recorded in the Record of Consultation and Engagement, including where Indigenous Knowledge was incorporated into Project decisions and into the IS / EA Report (i.e., specifics will not be included in the Record of Consultation and Engagement given the potential sensitivity and / or confidentiality of the information shared).

# 3. Study Plan Technical Discussions

To facilitate the development of satisfactory study plans and eventually a satisfactory IS / EA Report, MFFN held technical discussions with the Agency, the MECP and applicable agencies on the content of the study plans. A summary of technical discussions and correspondence held to date on this Study Plan has been provided in **Table 3-1**.

**Table 3-1: Summary of Study Plan Technical Discussions**

| Attendees / Responsible Party | Correspondence Date(s) | Discussion Points | Solution |
|---|---|---|---|
| ■ **MECP**<br>■ **The Agency**<br>■ **Health Canada (HC)**<br>■ **Environment and Climate Change Canada (ECCC)**<br>■ **MFFN CAR Project Team** | Meeting - July, 2020 | ■ Types of monitoring equipment to be used for monitoring program<br>■ Compounds to be monitored<br>■ Approach to estimating baseline conditions for compounds that cannot be monitored<br>■ Siting of monitoring equipment in the community<br>■ Technical discussion with the MECP regarding general approach of monitoring plan and conformance to the MECP Operations Manual for Air Quality Monitoring (MECP, 2019) | ■ There was agreement on the proposed monitoring, as detailed in the Study Plan |
| ■ **MECP**<br>■ **The Agency**<br>■ **Health Canada (HC)**<br>■ **Environment and Climate Change Canada (ECCC)**<br>■ **Northern Development and Mines (ENDM)**<br>■ **NRCan**<br>■ **MFFN CAR Project Team** | Meeting - September 2020 | ■ Discuss comments submitted by the FRT on the draft atmospheric environment study plan.<br>■ Key receptors and establishing representative background concentrations<br>■ Model inputs / model design within the study plan<br>■ Discussion on applicable atmospheric phenomena<br>■ Relevant assessment standards and guidelines<br>■ Technical challenges with monitoring for PAHs | ■ There was agreement on the proposed monitoring, as detailed in the Study Plan<br>■ Methodology for estimating baseline PAHs to be refined and discussed with agencies |
| ■ **MECP**<br>■ **The Agency, Health Canada (HC)**<br>■ **Environment and Climate Change Canada (ECCC)**<br>■ **Ministry of Energy, Northern Development and Mines (ENDM)**<br>■ **MFFN CAR Project Team** | Meeting - December 2020 | ■ Changes to equipment to be used based on emerging technical (equipment) limitations and cellular network access within the community<br>■ Revised equipment and compounds to be monitored | ■ There was agreement on the proposed monitoring, as detailed in the Study Plan |

# 4. IS / EA Report Consultation and Engagement Process

## 4.1 Interested Persons and Government Agencies

The Proponent will provide Project notices and advise of opportunities for consultation and engagement with interested persons[5] which includes, at a minimum members of the public outlined in the *Public Participation Plan for the Marten Falls Community Access Road Project Impact Assessment* (the Agency 2020) (referred to as the Public Participation Plan). This will include the opportunity to provide input on the existing environment, VCs, effects assessment methods, effects assessment results, and mitigation and follow-up program measures as applicable. A variety of activities will be offered so that members of the public are informed of the IS / EA Report as it progresses and are aware of the opportunities and means to provide their input. The study plans have recognized public and agency input received on the Project to date. Government agencies and interested persons will have the opportunity to comment on components of the study plans throughout the IS / EA Report consultation and engagement process. The Project's approach to handling confidential and sensitive information is outlined in **Section 2.1**.

## 4.2 Indigenous Communities

The Proponent will provide Project notices and opportunities for consultation and engagement with Indigenous communities identified in **Table 4-1**, which is inclusive of all Indigenous communities identified in the *Indigenous Partnership and Engagement Plan for the Marten Falls Community Access Road Project Impact Assessment* (the Agency 2020a) (referred to as the Indigenous Engagement and Partnership Plan).

Indigenous communities will be provided the opportunity to be involved at critical decision-making points throughout the IS / EA Report so that the Proponent can consider and incorporate, where appropriate Indigenous Knowledge and Indigenous land and resource use information into the Project as it pertains to the existing environment, VCs, effects assessment methods, effects assessment results, and mitigation and follow-up program measures. A variety of activities will be offered so that Indigenous communities are informed of the IS / EA Report as it progresses and are aware of the opportunities, means and timelines to

5. *Interested persons, as defined in the IS / EA Consultation Plan, are individuals and groups (e.g., associations, non-governmental organizations, industry and academia) who could have an interest in the Project, including but not limited to communities in the region, those with commercial interests (e.g., forestry, trappers, outfitters, other mineral tenure holders in the area) and recreational users or those with recreational interest (e.g., campers, hunters and environmental groups).*

provide their input. The study plans have recognized Indigenous community input received on the Project to date. Indigenous communities will have the opportunity to comment on components of the study plans throughout the IS / EA Report consultation and engagement process.

### Table 4-1: Identified Neighbouring Indigenous Communities, including their Provincial Territorial Organizations and / or Tribal Council Affiliations

| Tribal Council Affiliation | Indigenous Community or Organization |
|---|---|
| **Matawa First Nations Management** *(Nishnawbe Aski Nation)* | ■ **Marten Falls First Nation** (Proponent and potentially affected Indigenous community)<br>■ Aroland First Nation<br>■ Constance Lake First Nation<br>■ Eabametoong First Nation<br>■ Ginoogaming First Nation<br>■ Neskantaga First Nation<br>■ Nibinamik First Nation<br>■ Webequie First Nation |
| **Matawa First Nation and the Union of Ontario Indians / Nishnawbe Aski Nation** | ■ Long Lake #58 First Nation** |
| **Mushkegowuk Council** *(Nishnawbe Aski Nation)* | ■ Attawapiskat First Nation<br>■ Fort Albany First Nation<br>■ Kashechewan First Nation |
| **Shibogama First Nations Council** *(Nishnawbe Aski Nation)* | ■ Kasabonika Lake First Nation<br>■ Kingfisher Lake First Nation<br>■ Wapekeka First Nation<br>■ Wawakapewin First Nation<br>■ Wunnumin Lake First Nation |
| **Independent First Nations Alliance** *(Nishnawbe Aski Nation)* | ■ Kitchenuhmaykoosib Inninuwug First Nation |
| **Independent First Nations** *(Nishnawbe Aski Nation)* | ■ Mishkeegogamang First Nation<br>■ Weenusk First Nation |
| **Nokiiwin Tribal Council** | ■ Animbiigoo Zaagi'igan Anishinaabek First Nation* |
| **Métis Nation of Ontario** | ■ Métis Nation of Ontario; Region 2* |
| **Independent Métis Nation** | ■ Red Sky Independent Métis Nation* |

*Notes: * Indigenous communities or organizations identified by the MECP who should be consulted on the basis that they may be interested in the Community Access Road.*
*** The MECP indicated in a letter to MFFN that Long Lake #58 First Nation was moved from interest-based to rights-based.*

## 4.3 Consideration of Identity and Gender-Based Analysis Plus in Engagement

To fulfill requirements of the IAA, the Consultation and Engagement Program will consider a diverse range of perspectives from interested persons and interested Indigenous communities and their members identified in the Agency's Indigenous Engagement and Partnership Plan and the Public Participation Plan. This will include at a minimum providing ongoing opportunities for engagement to:

- **Neighbouring Indigenous communities, including relevant subpopulations:**
  - Women;
  - Youth; and
  - Elders.
- **Non-Indigenous communities including:**
  - Women;
  - Youth; and
  - Activity-based subgroups (e.g., recreationalists, snowmobilers, tourism establishment operators).

The Proponent will also consult and engage with other subpopulations identified by communities during consultation and engagement. The information from these activities and any additional identity groups identified by communities through consultation and engagement will be considered by applicable environmental disciplines for the purposes of data collection and considering disproportionate effects.

During consultation and engagement, these aforementioned groups will be consulted and engaged with on targeted input**.**

When feedback is received from interested persons and Indigenous communities, issues, comments and questions will be tracked, which is consistent with the process described in the IS / EA Consultation Plan. Specific to Gender-Based Analysis Plus objectives, this will include efforts to engage with diverse populations. It is expected this will include activities specific to subgroups and tabulation of consultation and engagement participation with respect to identity factors. This will provide summary statistics to demonstrate the diversity achieved in consultation and engagement.

# 5. Consideration of Indigenous Knowledge in the IS / EA Report

The following provides a general description of how Indigenous Knowledge will be considered in the IA / EA process. The extent to which Indigenous Knowledge is considered by each specific VC will vary depending on the nature of the VC, the potential for Project effects on the VC and whether Indigenous knowledge that relates to a VC is provided / obtained. As such, not all aspects of the general approach described below may apply to all VCs / study plans.

There are two concurrent and complementary avenues for Indigenous communities and groups to be engaged with and provide input on the Project: the Indigenous Knowledge Program and the Consultation and Engagement Program. Both programs serve to support the collection of Indigenous perspectives, values, and input on the Project, including Aboriginal and Treaty Rights and how they may be impacted by the Project, to be integrated throughout the IA / EA process. However, the Indigenous Knowledge Program specifically aims to solicit and incorporate information that is considered sensitive and may have confidentiality requirements, including Indigenous Knowledge and information on Indigenous land and resource use. Indigenous Knowledge Sharing Agreements will be established between the Proponent and Indigenous communities participating in the Indigenous Knowledge Program prior to the sharing and use of any sensitive information.

All Indigenous communities and groups identified by the MECP and the Agency through the Indigenous Engagement and Partnership Plan have the opportunity to participate in the Indigenous Knowledge Program. The Indigenous Knowledge Program provides interested Indigenous communities an opportunity to: share existing Indigenous Knowledge and information on Indigenous land and resource use and cultural values that may be relevant to the Project, and / or complete Project-specific studies to collect and share Indigenous Knowledge and information on Indigenous land and resource use and cultural values. The Indigenous Knowledge Program includes opportunities for Indigenous communities and groups to meet with the Proponent to discuss the program, ask questions, and share concerns and interests. In support of this, the Proponent has created an Indigenous Knowledge Program Guidance Document (the Guidance Document) that provides:

- An overview of the Indigenous Knowledge Program and information on how Indigenous Knowledge, Indigenous land and resource use and cultural values and practices can be collected and / or shared;

- Information on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values and practices may be used in the planning and design processes; and
- A suite of guidance materials that were developed based on the information requirements of both the federal and provincial assessment processes, including: question guides to support the collection of information on historical and current community context; Indigenous Knowledge that may be relevant to the various technical disciplines; information on Indigenous land and resource use, cultural values and practices and associated spatial data; and perspective on potential Project-related effects and associated mitigation and / or enhancement measures.

The Guidance Document will also support participating Indigenous communities in providing Project-specific information in a manner that facilitates meaningful incorporation into the IS / EA Report.

The IS / EA Consultation Plan outlines the process for obtaining information and feedback about the Project from Indigenous communities (i.e., the Consultation and Engagement Program). All Indigenous communities identified by the MECP and the Agency have the opportunity to participate in the Consultation and Engagement Program through community-specific meetings, Public Information Centres, web conferences, and other formats. All Indigenous communities identified by the MECP and the Agency will be provided information related to the Project and invited to participate at various points throughout the IA / EA process.

There are also opportunities for technical teams to engage with Indigenous communities to solicit perspectives and information relevant to the Project, including information related to collection of existing information and the development of the IS / EA Report. The Proponent also invites feedback and inputs throughout the Project via the Project website and ongoing communications with the Proponent.

The Indigenous Knowledge and Consultation and Engagement programs are designed to be complementary and provide multiple opportunities for communities to offer feedback and information, including perspectives on Aboriginal and Treaty Rights and interests and how these may be impacted by the proposed Project. Relevant information collected through both the Indigenous Knowledge and Consultation and Engagement programs, including potential effect pathways on Aboriginal and Treaty Rights and interests, will be shared with each of the relevant disciplines throughout the IA / EA to: guide and inform VCs; support characterization of the existing environment; identify the potential effects of the Project on VCs; help identify mitigation measures and potential monitoring programs; and ultimately guide Project planning. The nature of how the Indigenous Knowledge becomes integrated into the IS / EA Report will be dictated by the specific information provided by each Indigenous community and the parameters set out in

the Indigenous Knowledge Sharing Agreements. A description of how Indigenous Knowledge was considered in the IA / EA and in each of the technical discipline areas will be included in the IS / EA Report.

It is also important to note that information collected through the various activities (e.g., field studies and programs, effects assessments) of each discipline area (e.g., wildlife, vegetation, cultural heritage) will be shared with the Indigenous Knowledge Program leads. This will support the establishment of the existing environment and the effects assessment for the Aboriginal and Treaty Rights and Interests discipline, as well as the identification of potential mitigation measures and monitoring programs, given the interrelated nature of Indigenous peoples and other environmental disciplines.

The Proponent will strive to respectfully collaborate with Indigenous communities on how Indigenous Knowledge and information on Indigenous land and resource use and cultural values will become part of the IS / EA Report, and how potential effects to Aboriginal and Treaty Rights and interests will be assessed. It is expected that measures to support this may include but are not limited to: engaging Indigenous communities to solicit information on Indigenous Knowledge and Indigenous land and resource use and cultural values to inform baseline conditions, providing Indigenous communities with draft sections of the IS / EA Report to illustrate how Indigenous Knowledge and information on Indigenous land and resource use and cultural values has been integrated and to confirm it has been presented appropriately, and completing collaborative working sessions with Indigenous communities for the effects assessment on Aboriginal and Treaty Rights and Interests. Further information on how potential effects on Indigenous rights will be assessed is provided in the Aboriginal and Treaty Rights and Interests Study Plan.

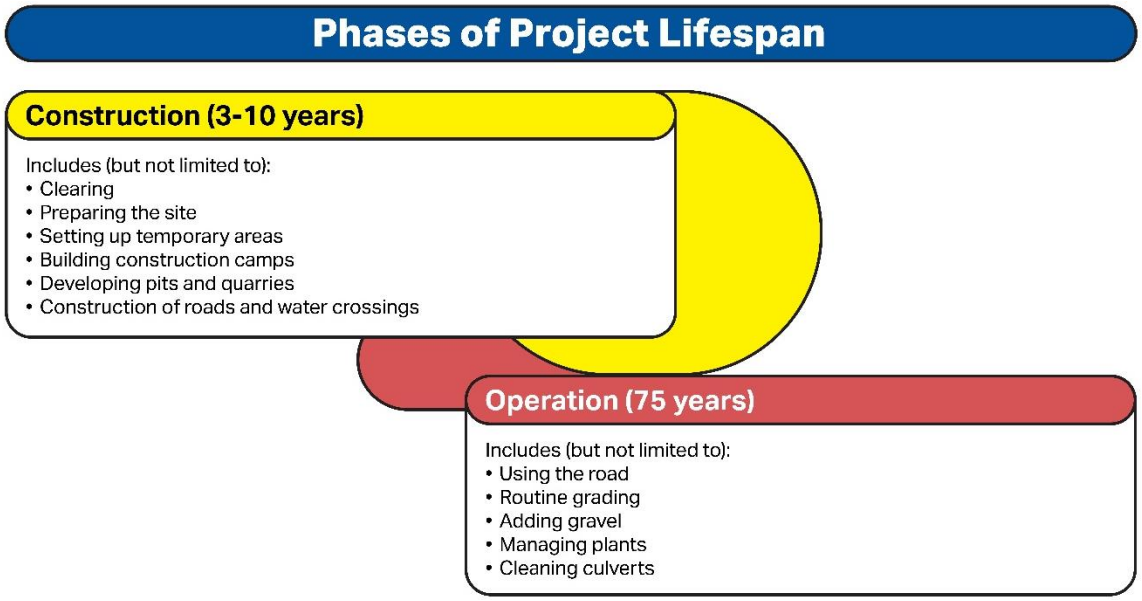
# 6. Assessment Boundaries

## 6.1 Temporal Boundaries: Project Phases

Project phases, which are temporal boundaries, are developed to establish the timeframes within which potential effects of the Project will be considered in the IS / EA Report. The Project is planned to occur in two phases, which are briefly described below and shown in **Figure 6-1**.

- **Construction Phase:**
  The time from start of construction, including site preparation activities, to the start of operations and maintenance of the CAR. Decommissioning of construction works is included in the construction phase. The construction phase is anticipated to take approximately 3 to 10 years to complete.
- **Operations and Maintenance Phase:**
  The operations and maintenance phase starts once construction activities are complete and lasts for the life of the Project. The operations and maintenance phase of the Project is considered to be 75 years based on the expected timeline for when major refurbishment of road components (e.g., bridges), is anticipated.

**Figure 6-1: Project Schedule**



There are currently no plans to decommission the CAR as there is no expected / known end date for its need. Therefore, future suspension, decommissioning and eventual abandonment of the CAR will not be considered in the IS / EA Report. It will be considered if and when a decommissioning or abandonment application is made for the road.

In determining the temporal boundaries, in particular the long operations and maintenance phase, consideration was given to the long-term effects on the well-being of present and future generations (Sustainability Principle #2). The final temporal boundaries to be used in the IS / EA Report will be based on regulatory agency guidance, professional judgement and input received through the Project consultation process.

## 6.2 Spatial Boundaries: Study Areas

Study areas identify the geographic extents within which potential effects of the Project are likely to occur and will be considered in the IS / EA Report. The existing conditions and potential effects are documented for three study areas selected for the Project:

- **Project Development Area (PDA):** area of direct disturbance;
- **Local Study Area (LSA):** the area where most of the direct effects of the Project are likely to occur; and
- **Regional Study Area (RSA):** the area where indirect effects of the Project are likely to occur.

The PDA encompasses the 100 metre-wide CAR right-of-way (ROW), temporary construction access roads, work areas, worker camps, and pits, quarries and associated access roads. The preliminary LSA currently being considered within the scope of the ongoing provincial regulatory review process generally includes the area within 2.5 km of the centreline of Alternative 1 and Alternative 4. The preliminary study area generally allows for the documentation of existing conditions and prediction of potential environmental effects for the Project. A 5 km wide study area also allows for route refinements during development of Project design (e.g., adjustment of the alignment to avoid sensitive features).

The specific location of Project components, including the roadway, quarries, pits and temporary infrastructure, are not yet known and will be included in the IS / EA Report. While most of the Project components are expected to be located within the preliminary 5 km wide study area, benefits (e.g., reduced environmental disturbance, avoidance of sensitive features, technical considerations, concerns received through consultation) for locating Project components on lands outside of the 5 km wide study area may

become known during the IA / EA process. If the need to locate Project components outside the 5 km wide study area is determined to be required or of benefit to the Project, the study area would be adjusted.

The study area for each environmental discipline may vary from the above-described general study area based on the potential for the Project to directly or indirectly affect each environmental discipline; therefore, discipline-specific LSAs and RSAs have been defined for the Project. In defining the final LSAs and RSAs, each environmental discipline will consider:

- Location and other characteristics of the environmental discipline relative to the Project;
- The anticipated extent of the potential Project effects;
- Federal, provincial, regional, and local government administrative boundaries;
- Indigenous groups listed in **Table 4-1**;
- Community knowledge and Indigenous Knowledge;
- Current or traditional land and resource use by Indigenous communities;
- Exercise of Aboriginal and Treaty Rights of Indigenous peoples, including cultural and spiritual practices; and
- Physical, ecological, technical, social, health, economic and cultural considerations.

The study areas included in this document are preliminary, covering the extent to which readily available information suggests the Project may have noticeable effects on the environment. The size, nature and location of past, present and reasonably foreseeable projects will be taken into consideration in the development of the cumulative effects assessment study area(s). The appropriate study area(s) to assess cumulative effects are dependent on the VCs predicted to have direct residual adverse effects as a result of the Project, and therefore, cannot to defined until the IS / EA Report has sufficiently advanced.

For an activity to be considered foreseeable and included in the cumulative effects assessment, the activity will have to be known at the time of preparing the IS / EA Report. That is, sufficient information about the activity must be available to make a reasonable assessment of its potential effects. This will include development that is certain or reasonably foreseeable and activities with additive effects where appropriate (Canadian Environmental Assessment Agency 2018). Reasonably foreseeable activities that will not be considered are those for which formal plans have not been publicly disclosed and information is not available. If sufficient information is not available about a potential future activity to be able to include it within the Project cumulative effects assessment, it is anticipated that should that activity proceed, the proponent of that activity would consider the cumulative effects of their activity with the CAR as appropriate.

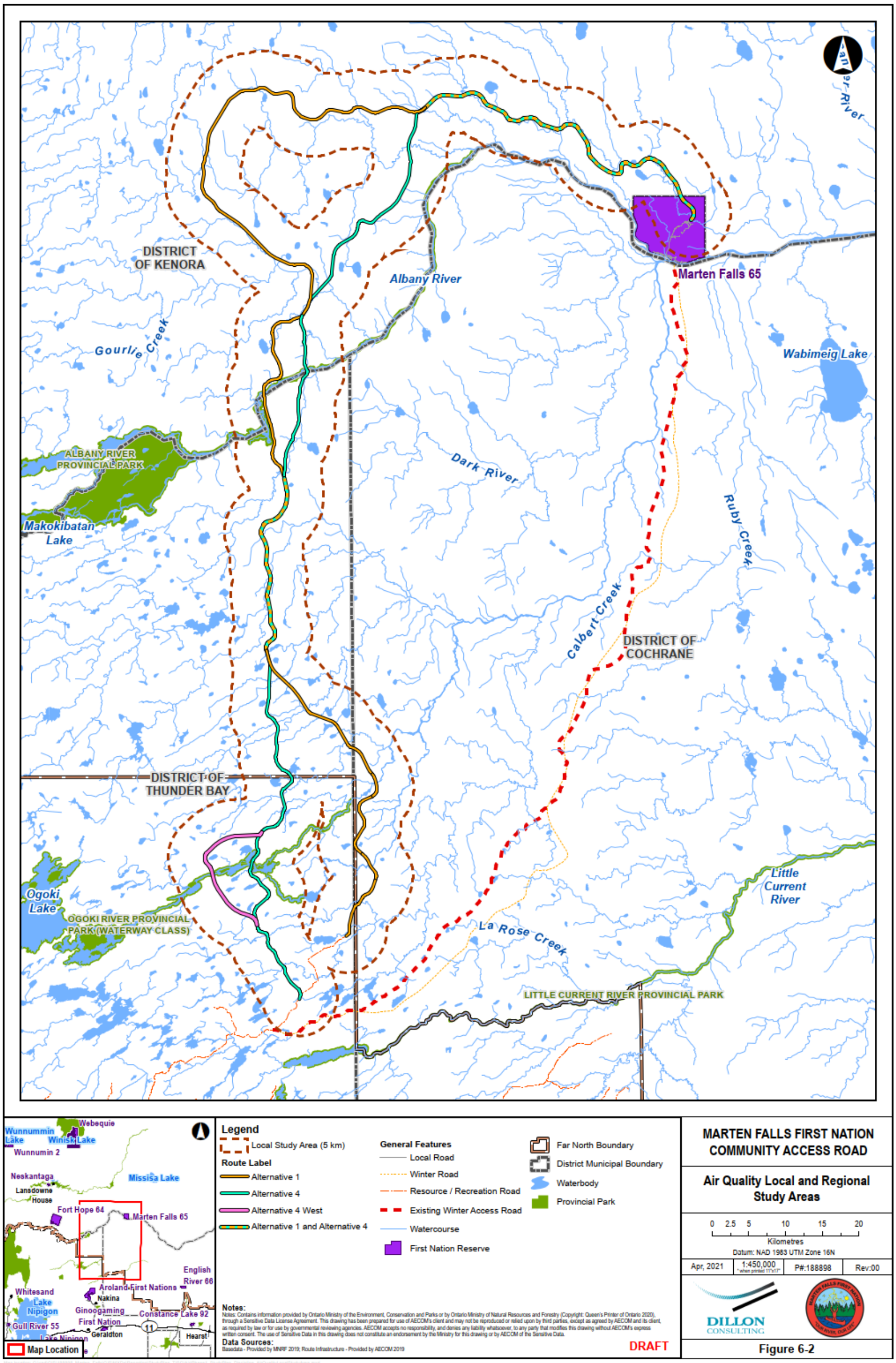
As further detailed in **Section 4**, the Proponent will continue to provide opportunities for neighbouring Indigenous communities and interested persons to provide input and inform the effects assessment, including the LSAs and RSAs.

The LSA and RSA boundaries for the Atmospheric Environment are detailed in **Table 6-1** and on **Figure 6-2.**

### Table 6-1: Atmospheric Environment Study Areas

| Study Area | Geographic Extent | Rationale |
|---|---|---|
| **Local Study Area** | ■ Air Quality: PDA plus a 5 km buffer that extends from the perimeter of the PDA<br>■ GHGs: Physical footprint of the project during construction and operations, which is equal to the PDA | ■ Air Quality: Local study area has been selected to align with the Ontario MECP recommendations for local dispersion modelling, which is that effects be assessed up to 5 km from a source (MECP, 2019).<br>■ GHGs: Direct GHG emissions impacts of the project will be limited to the PDA. |
| **Regional Study Area** | ■ Air Quality: Not applicable<br>■ GHGs: Province (Ontario) | ■ Air Quality: Not Applicable as effects are not expected beyond the Local Study Area.<br>■ GHGs: Will be assessed against provincial-scale emissions as well as federal and sectoral totals documented within the 2020 (or most current) National Inventory Report (NIR) by Environment and Climate Change Canada (ECCC, 2020a). |

## Figure 6-2: Atmospheric Environment Local and Regional Study Areas



# 7. Baseline Study Design

## 7.1 Desktop Assessment

A desktop review of existing information sources will be completed to identify information gaps that will need to be addressed through further study. A preliminary list of applicable information sources has been included in **Appendix A** and reflects federal and provincial guidance received to date. This Study Plan focuses on the additional studies that are anticipated to be required to gather information beyond what is currently available through existing information sources, including those as described in Section 7.2 'Sources of baseline information' in the Agency's TISG for this Project.

## 7.2 Study Methods

The following sections summarize the approaches to be deployed for development of baseline GHGs and Air Quality.

### 7.2.1 Air Quality Baseline

To characterize baseline Air Quality within the LSA a field monitoring program will be deployed. Up to one year of ambient air quality data will be collected within the community of Marten Falls to characterize baseline air quality.

Within the LSA, the community of Marten Falls is the primary area of human settlement and is the only location with sufficient power and serviceability access to support air quality monitoring equipment. The measured values in the community are a reasonably conservative characterization of baseline ambient air quality across the LSA. Concentrations of indicator compounds within Marten Falls are expected to be elevated in comparison with the remainder of the LSA due to the presence of sustained human activity (e.g., power generation, airport). Therefore, using background data collected from within Marten Falls is expected to result in a conservative characterization of baseline conditions.

The intention of the air quality assessment is to provide a realistic worst-case estimate of the cumulative[6] air quality as a result of the Project. The air quality assessment will add background concentrations to the

6. *The cumulative impacts discussed here are distinct from the cumulative effects assessment, which will assess the effects of the Project with the effects of past, present and reasonably foreseeable projects.*

predicted Project emissions to determine cumulative air quality within the LSA. Therefore, using the maximum background concentrations which would reasonably be expected within the LSA will result in a conservative air quality assessment.

Ambient air quality monitoring equipment will be deployed in the MFFN community to monitor the following indictor compounds:

- Particulate matter ($PM_{2.5}$);
- Ozone;
- Nitrogen oxides ($NO_x$);
- Sulphur dioxide ($SO_2$), and;
- BTEX (benzene, toluene, ethylbenzene, and xylene)

Meteorological parameters (wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation) will also be measured. These contaminants are selected as they are commonly associated with transportation and construction activities, as prescribed by the Ontario Ministry of Transportation (MTO, 2020).Some of these indicator compounds may be monitored non-continuously, based on equipment limitations. Meteorological parameters that are not utilized in dispersion modelling (e.g., pan evaporation, extreme weather events) will not be monitored.

Other particulate matter size fractions (TSP and $PM_{10}$) will be determined by using measured $PM_{2.5}$ data to calculate TSP and $PM_{10}$ background data. As $PM_{2.5}$ is a size fraction subset of $PM_{10}$, and $PM_{10}$ is a size fraction subset of TSP, the $PM_{10}$ and TSP background concentrations can be estimated based on the $PM_{2.5}$ background concentration. A literature review will be completed to gather representative particulate ratios that are considered to be reflective of the study area. This literature review may include an analysis of historical data collected at representative monitoring stations such as those included within the Environment and Climate Change Canada National Air Pollution Surveillance Program (NAPS), and a review of the United States Environmental Protection Agency (US EPA) studies and supporting documentation.

The ambient air quality monitoring equipment will be deployed for up to one year to address seasonal variations in baseline concentration. Collection of one full year of data may not be possible due to unforeseen circumstances such as power outages or equipment failure. BTEX and particulate matter will be used as surrogates for polycyclic aromatic hydrocarbons and diesel particulate matter which cannot be sampled for due to equipment limitations coupled with serviceability challenges given the remote location of the community. Concentrations of specific relevant contaminants such as acetaldehyde, formaldehyde, 1,3-

butadiene, and acrolein will be estimated based on monitored BTEX concentrations and published emission factors, such as the United Stated Environmental Protection Agency's (US EPA) AP-42 emissions database.

Diesel particulate matter (DPM) emissions as a result of the Project will be included in the air quality assessment. Due to the technical limitations of measuring DPM in the community, background DPM concentrations will be estimated based on the relative magnitude of emissions in the community. A cursory emission inventory will be developed for the community based on available data. This inventory will be used to speciate measured particulate concentrations.

The ambient air quality monitoring equipment is proposed to be located near the MFFN community's nursing station. Attempts will be made to adhere to station and probe siting criteria documented in the MECP Operations Manual for Air Quality Monitoring in Ontario (MECP, 2019) (hereafter referred to as the MECP Manual), however due to the location of project and limited power supply options, not all criteria may be met. If deviations from the MECP Manual (MECP, 2019) occur they will be documented and justified in the final baseline report. An Air Quality Monitoring Plan will be submitted to the MECP and IAAC prior to conducting the program to document alignment with the MECP Manual, as applicable.

The results will be statistically summarized based on the averaging period of the applicable standards and criteria. The Canadian Council of Ministers of the Environment Canadian Ambient Air Quality Standards (CAAQS) (CCME, 2021) and the MECP Ontario's Ambient Air Quality Criteria (AAQC) (MECP, 2020) will be considered in this assessment.

Monitored concentrations collected within the Community will be considered to be representative of all locations within the community and will be used as background concentrations within the LSA.

### 7.2.2 GHG Baseline

Releases of GHGs and their accumulation in the atmosphere influence provincial and national climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially. As such, GHGs will be presented in context relative to provincial, federal, and sectoral totals for comparison. The most current provincial, federal, and sectoral totals from the NIR (ECCC, 2020a) will be documented to contextualize project emissions within the effects assessment.

Baseline GHG emissions as a result of existing activities, such as air travel, will be quantified. GHG sinks such as forest sequestration along the proposed CAR will be considered in total GHG quantification. GHG emissions will be calculated using Environment and Climate Change (ECCC) guidance and emission

factors from the appropriate United States Environmental Protection Agency AP-42: Complication of Air Emission Factors (US AP-42) resources, along with the most current NIR (ECCC, 2020a).

### 7.2.3 Reporting

The findings of the Baseline Study will be summarized in a Baseline Study Report which will support the development of the IS / EA Report. In addition to the monitoring data and baseline GHGs, the Baseline Study Report will include a description of the types of emissions that were identified within the Study Area.

# 8. Data Management and Analysis

Data management including quality assurance / quality control (QA / QC) will be deployed to minimize the potential for data entry and analysis errors, prepare data sets for analysis and limit sensitive data distribution in accordance with established agreements. Modelled and monitored data will be evaluated using method-specific quality assurance / quality control procedures.

## 8.1 Field Data Collection

Quality assurance measures will be implemented to manage data integrity. The operation, service and maintenance of the station and sampling equipment would be in accordance with both the manufacturers' operating manuals and the protocols outlined in the MECP's Operations Manual for Air Quality Monitoring in Ontario (MECP, 2019). Where the remote nature of the site requires deviations from these, those deviations will be documented.

The following quality control measures will be implemented to help ensure consistent data capture to meet the MECP protocols:

- The station installation will be best sited to meet criteria as outlined in the MECP Operation Manual for Air Quality Monitoring in Ontario (MECP, 2019);
- Selected monitoring equipment will be EPA designated and verified prior to use with NIST traceable calibration standards;
- Station temperature will be monitored and reported to help ensure adequate control of interior temperature;
- Gaseous analysers will include Internal Zero / Span options so that automatic instrument response checks can be conducted nightly to assess ongoing performance such as zero / span drift, repeatability and response time to adhere to the MECP reporting practices;
- VOC sampling will be conducted on a 6 day schedule (NAPS) using a Xontech 910 canister sampler. The sampler will be audited quarterly. Exposed samples will be shipped to the laboratory on a schedule not to jeopardize sample integrity;
- VOC analysis will be conducted by an accredited laboratory as per the MECP protocols;
- Instrument status and operation checks will be conducted and logged weekly by field monitors;

- Monitoring instrumentation will be audited at quarterly intervals using NIST certified standards;
- Meteorological instrumentation will be audited upon installation and annually as per the MECP protocols;
- Back-up or duplicate instrumentation will be made available to minimize data loss or if reported data are questionable;
- Data will be transmitted daily from the station via satellite communications. Manual download protocol available if needed;
- Data will be reviewed daily and quality assured by experienced and qualified analysts. Data will be subjected to various QA / QC tests prior to release;
- A Data Edit log will be implemented and retained for the data set. Data reports will be submitted monthly, and;
- Data will be compared to all applicable AAQCs, Standards and Guidelines.

## 8.2 Desktop Analysis

The desktop analysis (emissions quantification, modelling and reporting) will be subject to primary and secondary review processes in accordance with MFFN CAR Project Consultant protocols. Each task will have an assigned primary analyst, and work product will be reviewed at key steps in the overall analysis (e.g., calculation of emissions, setup of models, execution of models, draft report, final report). In addition to this ongoing review process, there will be an independent review of analysis conducted by an individual who did not generate content or conduct earlier reviews.

# 9. Effects Assessment

The following sections provide discipline-specific input and considerations as they pertain to the methodology for effects assessment. The Project is in the early stage of the IS / EA Report preparation and it is expected that the effects assessment methodology will be refined iteratively based on regulatory agency guidance, professional judgment and input received through the Project consultation and engagement process.

## 9.1 Project-Environment Interactions

The Project activities that may result in changes to the environment are described within the identified temporal and spatial boundaries. This includes identification of both direct and indirect changes by comparing the existing setting to the conditions anticipated to occur as a result of the Project. For each environmental discipline, the likely Project-environment interactions will be identified based on professional judgment, activities listed in TISG Section 3.2 as well as projects of similar magnitude and / or location.

A preliminary analysis of Project-environment interactions with the atmospheric environment is provided in **Table 9-1** and will be confirmed during the IA / EA process to identify the Project-environment interactions that are likely to have a potential effect, and to identify measures to avoid or minimize potential negative effects and enhance benefits.

**Table 9-1: Project – Environment Interactions**

| Project Phases | Project Activities | Atmospheric Environment |
|---|---|---|
| **Construction Phase** | *Mobilization of Equipment and Supplies* | X |
| | *Temporary Construction Staging Areas*[1] | X |
| | *Temporary Access Roads and Trails*[1] | X |
| | *Temporary Construction Camps*[1] | X |
| | *ROW Clearing and Grubbing* | X |
| | *Brush and Timber Disposal* | |
| | *Pits and Quarries*[1] | X |
| | *Drilling / Blasting / Aggregate Production* | X |
| | *Road Construction (stripping, subgrade excavation, embankment fill placement, grading, ditching)* | X |
| | *Bridge and Culvert Installation (approach embankments, foundations, substructures, superstructures, traffic protection, erosion controls)* | X |
| | *Construction Site Restoration* | X |

| Project Phases | Project Activities | Atmospheric Environment |
|---|---|---|
| **Construction Phase: Decommissioning** | *Pits and Quarries* | **X** |
| | *Temporary Camps, Roads / Trails and Staging Areas* | **X** |
| **Operations Phase** | *Road Usage* | **X** |
| | *Maintenance*[2] | **x** |

*Notes: 1. Includes construction and use of*
*2. Includes General Maintenance (e.g., grading, erosion control, quarrying, pits), Seasonal Maintenance (e.g., snow clearing, bridge and culvert maintenance), and Special Maintenance (e.g., slope failures, road settlement / break-up.).*

## 9.2 Valued Components and Indicators

VCs are the environmental, health, social, economic or additional elements or conditions of the natural and human environment that may be impacted by a proposed project and are of concern or value to the public, Indigenous peoples, federal authorities and interested parties (the Agency 2020b). Indicators represent the resource, feature, or issue related to the VC that, if changed, may demonstrate an effect on the environment. The indicators and rationale for selection and measurement of potential effects, to be used to assess and evaluate the alternative routes in the IS / EA Report are provided in **Table 9-2**. The table includes both quantitative and qualitative indicators. The final list of VCs and indicators to be used in the IS / EA Report will be based on regulatory agency guidance, professional judgement and input received through the Project consultation and engagement process.

The VCs for Atmospheric Environment and GHGs discipline have been determined through consideration of the following factors listed in the TISG[7]:

- VC presence in the study area;
- the extent to which the VC is linked to the interests or exercise of Aboriginal and Treaty Rights of Indigenous peoples, and whether an Indigenous group has requested the VC;
- the extent to which the effects (real or perceived) of the Project and related activities have the potential to interact with the VC;
- the extent to which the VC may be under cumulative stress from other past, existing or future undertakings in combination with other human activities and natural processes;

7. *The TISG also states that information from ongoing and completed regional assessments in the proposed area of the Project should be used to inform VCs for the Project. In February 2020 a regional assessment of the Ring of Fire region commenced; however, it is not sufficiently advanced at this time to inform the Project VCs. The VCs will be consulted and engaged on early in the IA/ EA process and finalized taking into consideration the input received. Therefore, only information relevant to the Project that arises from the regional assessment of the Ring of Fire within an appropriate timeline will inform the VCs for the Project.*

- the extent to which the VC is linked to federal, provincial, territorial or municipal government priorities (e.g., legislation, programs, policies);
- the possibility that adverse or positive effects on the VC would be of particular concern to Indigenous groups, the public, or federal, provincial, territorial, municipal or Indigenous governments; and
- whether the potential effects of the Project on the VC can be measured and / or monitored or would be better ascertained through the analysis of a proxy VC.

As well as consideration of:

- Industry standards and best practice;
- Provincial and federal guidance for assessments of Air Quality and GHG Emissions; and
- Other relevant and credible sources, such as scientific or academic publications or input from the public.

Inputs received to date from Indigenous communities, agencies and interested persons through the Consultation and Engagement Program, including inputs received on the Draft ToR, have also been used to inform the selection of the VCs and indicators for the Atmospheric Environment.

### Table 9-2: Atmospheric Environment Indicators

| Valued Component | Indicators | Rationale for Selection |
|---|---|---|
| **Air Quality** | ■ Change in concentration of Air Contaminants :<br>– $NO_x$<br>– CO<br>– SO<br>– TSP<br>– $PM_{10}$<br>– $PM_{2.5}$<br>– Selected VOCs (acrolein, acetaldehyde, benzene, formaldehyde, 1,3-butadiene, toluene, ethylbenzene and xylene)<br>– PAHs (benzo(a)pyrene) | ■ The contaminants chosen for the indicators are based on those commonly associated with transportation and construction activities, as prescribed by the Ontario Ministry of Transportation (MTO, 2020). |
| **Greenhouse Gases** | ■ Quantification of GHG emissions ($CO_2$, $CH_4$, $N_2O$) expressed as $CO_2e$ | ■ The contaminants chosen for the indicators are those prescribed by The Ontario Ministry of Transportation (MTO, 2020) |

## 9.3 Indirect Effects

A direct effect occurs through the direct interaction of an activity with an environmental discipline. The Project-environment interactions currently anticipated, based upon preliminary analysis, to result in direct effects to the Atmospheric Environment Discipline have been identified in **Table 9-1**. The potential direct effects resulting from the Project-environment interactions will be confirmed during the IA / EA process and will be based on input received through the Indigenous Knowledge Program and Consultation and Engagement Program, regulatory agency guidance, and professional judgement.

An indirect effect occurs when a change to one environmental discipline resulting from a Project activity causes a change to another environmental discipline (e.g., changes in vegetation could indirectly affect wildlife). **Table 9-3** provides a preliminary identification of how changes to the atmospheric environment may result in indirect effects to other environmental disciplines.

Changes occurring in the following disciplines may result in a change to the Atmospheric Environment: Vegetation, Social and Land and Resource Use. Details are provided below that provide some examples of potential changes that may occur.

**Vegetation**

- Increases or decreases in quantity, or changes to vegetation type may affect the quantity of carbon sinks which can result in changes to GHG emissions and capture.

**Social**

- Changes in housing and accommodation types may result in changes in fuel consumption (heating fuel, wood burning), this can result in either an increase or decrease in community emissions of indicator compounds and GHGs.
- Changes in community services and infrastructure may result in changes in energy input method and consumption (switch from heating fuel to electricity), this can result in either an increase or decrease in community emissions of indicator compounds and GHGs.
- Changes in transportation mode (vehicle type) and volume (traffic loading) will result in either an increase or decrease in community emissions of indicator compounds and GHGs.
- Changes in population and demographics can result in either an increase or decrease in fuel usage for transportation, heating and community services. This change in fuel usage may result in either an increase or decrease in community emissions of indicator compounds and GHGs.

**Land and Resource Use**

- Changes in land use compatibility, parks and protected areas, local industries and linear infrastructure may have an effect on emission sources and quantities that may result in either an increase or decrease in community emissions of indicator compounds and GHGs.
- Changes to linear infrastructure may result in changes in fuel type and usage quantities that may result in either an increase or decrease in community emissions of indicator compounds and GHGs.
- Changes in recreation and tourism quantities can affect traffic loading and energy consumption within the community and may result in either an increase or decrease in community emissions of indicator compounds and GHGs.

## Table 9-3: Potential Discipline Interactions

| Discipline and Associated Valued Components | Aboriginal Treaty Rights and Interests | Atmospheric Environment and GHG | Acoustic and Vibration | Physiography, Geology, Terrain and Soils | Surface Water | Groundwater and Geochemistry | Vegetation | Wildlife | Fish and Fish Habitat | Social | Economy | Land and Resource Use | Human Health and Community Safety | Visual Aesthetics | Archaeological and Cultural Heritage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atmospheric Environment**<br>■ **Air Quality**<br>■ **GHG Emissions** | - | [redacted] | - | - | X | - | X | X | - | X | - | - | X | - | - |

*Notes: X = Potential pathway for indirect effect as a result of the Project.*
*- = No pathway for indirect effect is anticipated as a result of the Project.*

# 9.4 Methods for Predicting Future Conditions

With respect to quantitative models and predictions, the IS / EA Report must detail the model assumptions, parameters, the quality of the data and the degree of certainty of the predictions obtained.

The following sub-sections describe the methods which will be used to predict future conditions associated with the indicators for the Project. In general, the assessment will involve quantifying emissions of selected contaminants from project activities, dispersion modelling to predict effects within the LSA, recommendation of mitigation measures to avoid or minimize identified effects, as well as identify opportunities to enhance benefits to the environment, and the prediction and assessment of potential environmental effects remaining after taking into consideration the recommended mitigation measures (i.e., residual effects).

## 9.4.1 Air Quality Emissions

As described earlier, a conservative air quality assessment is one which describes the reasonable worst-case impact of the Project. Background concentrations within Marten Falls are expected to be higher than the rest of the LSA. Therefore, using measured concentrations in the LSA will result in a conservative air quality assessment. The air quality assessment will include two bounding scenarios: roadway construction and roadway operation.

### 9.4.1.1 Construction Phase

Emissions will be estimated for the construction phase based on the projected types of activity and duration. Anticipated construction activity, such as land clearing, blasting, pit and quarry development, material hauling, road construction, and equipment and vehicle operation will be included in the estimate of emissions. Emissions will be estimated based on published emission factors, such as those found in the US EPA's AP-42 (US EPA, 2021), those generated in the most current version of US EPA Motor Vehicle Emissions Simulator (MOVES) (US EPA, 2020), or engineering principles, as applicable. Fugitive emissions such as wind erosion from uncovered soil or stockpiles will be estimated based on the size of the projected working area. A bounding scenario for construction activities will be developed (i.e., a scenario describing the maximum simultaneous construction activities) and will be used for the emission calculations.

### 9.4.1.2 Operation Phase

Emissions due to the operation phase will include vehicle emissions as well as roadway emissions of re-suspended particulate matter due to vehicle travel on the roadway. Routine road maintenance activities

such as snow clearing are expected to be captured in the roadway vehicle data (traffic volumes and vehicle types) within the roadway operation scenario, and therefore will be included in the air quality assessment. Minor roadway maintenance activities, such as re-grading, are expected to have a lower impact than the initial construction bounding scenario, therefore the impact of these activities would have been assessed within that bounding scenario. Where applicable and available Canadian emission factors from NIR (ECCC, 2020a) will be used in lieu of US EPA emission factors. Within the MOVES (US EPA, 2020) emission model, meteorological and fuel composition data reflective of the study area will be used as inputs to generate emission factors.

Vehicle fleet information such as vehicle volumes will be based on the CAR design criteria. Vehicles will be assumed to travel at the posted speed limit. Fuel formulation will be based on the nearest available representative data source. Vehicle classification and traffic volume will be incorporated in emission calculations (i.e., light duty, heavy duty) if available as different vehicle classifications will have different traffic loadings and emission factors.

Re-suspended road dust will be estimated based on emission factors included in the US EPA's AP-42 (US EPA, 2021) emission factor database.

#### 9.4.1.3 Meteorology

Project-specific meteorological data will be developed for the LSA to be used in the dispersion modelling assessments detailed in **Section 9.4.3**. Prognostic data using the Weather Research and Forecasting model (WRF) will be purchased.

Data will be processed for use with the most currently approved version of the US EPA AERMOD (US EPA, 2019) dispersion modelling software, and CAL3QHCR (US EPA, 1995) models (as described in the following sections) using US EPA AERMET (US EPA, 2019) and RAMMET (US EPA, 1999) respectively. The meteorological dataset will include 5-years of data for the entire project, including the required AERMOD (US EPA, 2019) parameters: wind speed and direction, air temperature, net radiation, turbulence and precipitation data. Meteorological parameters such as pan evaporation and evapotranspiration, and climate data such as extreme weather events, are not considered in air dispersion modelling. Parameters not used as direct inputs into the air dispersion modelling software will have no influence on the model results and therefore the impact assessment. As such they will not be monitored nor documented in the AQIA Report.

#### 9.4.1.4 Dispersion Modelling

Dispersion modelling will be conducted to assess Project effects. Modelling will be conducted following published guidance, as applicable, such as the MECPs' Guideline A-11 Air Dispersion Modelling Guideline for Ontario (MECP, 2017). The models selected for use in this assessment are ideally suited for near-field effects (i.e., on the scale of metres to <50 kilometres). Models that will be utilized within this assessment include the US EPA AERMOD (US EPA, 2019), US EPA's CAL3QHCR / CALINE (US EPA, 1995), and US EPA MOVES (US EPA, 2020). These models were selected as both construction and roadway activity will have the highest potential contaminant concentrations in the near-field immediately adjacent to activity, which disperse rapidly with downwind distance. Given the low projected traffic volumes on the roadway and the primarily near-field effects from roadways, secondary formation will not be included in the assessments.

#### 9.4.1.5 Construction Phase

Air quality effects within the LSA from roadway construction will be assessed for the selected alternatives. Dispersion modelling will be performed using the MECPs' regulatory version of the US EPA's AERMOD (US EPA, 2019) dispersion model (version 19191 or newer at the time of modelling). AERMOD (US EPA, 2019) is the recognized model for regulatory purposes and is appropriate for assessing contaminant dispersion in the near-field to 5 km from the road with a higher degree of resolution. Modelling the full Project in one domain will not provide the resolution nor capture the localized effects of emissions at ground-level in the near-field based on the geography covered by the full length of the road and the predominance of near-field effects. Therefore, modelling utilizing AERMOD (US EPA, 2019) will be performed for an estimated representative construction area (physical size and level of activity). The representative area will be selected based on a review of the construction program for the entire CAR, identification of activities that represent a maximum operating condition, and proximity to receptors. Modelling results from the representative scenario will be extrapolated to predict the effects at sensitive receptors within the LSA. Additionally, a model representative of the community will be developed to assess the Project effects within the MFFN community. This model will include the CAR segments closest to the community of MFFN, and receptors specific to the MFFN community.

#### 9.4.1.6 Operations Phase

Air quality effects within the LSA from roadway operations will be assessed for the selected alternatives. Project emissions will be modelled using the US EPA's CAL3QHCR / CALINE (US EPA, 1995) transportation source model, or equivalent, following modelling guidance from the MTO's *Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO, 2020)* as well as the MECP Guideline A-11: Air Dispersion Modelling

Guideline for Ontario (ADMGO) (MECP, 2017). As outlined in the Construction Phase, the modelling will be performed for a representative section of roadway in order to capture effects at a resolution appropriate for the Local Study Area (i.e., within 5 km of the roadway). The representative area will be selected based on a review of the operations phase for the entire CAR, identification of activities that represent a maximum operating condition, and proximity to receptors. The results of the modelling for the representative section of roadway will be extrapolated along the entire corridor to predict effects at sensitive receptors within the LSA. Additionally, a model representative of the community will be developed to assess the Project effects within the MFFN community.

One modelling scenario will be developed which considers the projected vehicle fleet (i.e., vehicle age, fuel type, and vehicle type), driving cycles, and roadway configuration. One future-build scenario will be assessed (i.e., build year plus 20 years as recommended by the Ontario Ministry of Transportation (MTO, 2020). The future-build scenario is aligned with MTO guidance to allow for predictability of key inputs to relevant models (e.g., vehicle fleet composition, vehicle age, fuel type). Selection of timelines beyond this may reduce the accuracy of model outputs. The results of the modelling will be extrapolated along the corridor to determine local air quality effects. Design case vehicle fleet information and published default vehicle fleet information (e.g., US EPA defaults) will be used as applicable.

#### 9.4.1.7 Ground-Level Ozone

In the Ministry of Transportation's *Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO, 2020)*, the MTO states that with respect to the formation of ground-level ozone, "ground-level ozone $O_3$ is typically formed many kilometres downwind of the source of its precursors" and "concentrations are usually depressed around highways since NO emissions react relatively rapidly to convert $O_3$ into oxygen gas." The MTO also states that "For major roads, the collective experience of the scientific community suggests that the affected immediate vicinity is limited to the area within approximately 500 metres of the road". Based on this, the contribution of the Project to ground-level ozone is likely to be minor in comparison to the near-field concentration of precursors (i.e., $NO_x$.

The potential for the Project to contribute to ground-level ozone will be qualitatively assessed for both the construction and operation phases. This qualitative analysis will focus on the predicted increase in $NO_x$ and Volatile Organic Compounds around the PDA which will provide an indication of the potential for ground-level ozone formation. Ozone formation will not be quantitatively assessed as the potential for ground level ozone formation is negligible.

#### 9.4.1.8 Acid Deposition

The potential for the Project to contribute to acid deposition will be qualitatively assessed for both the construction and operation phases. Potential for acid formation will be evaluated based on the predicted increase in $NO_x$ and $SO_x$ to the airshed[8] and subsequent potential nitrate and sulphate formation. Acid deposition will not be quantitatively assessed as the magnitude of effects is expected to be negligible. Acid deposition is a regional effect, meaning that the potential of formation is minimal in close proximity to the roadway when compared to the larger airshed. It is estimated that the Project will partially displace air travel with road vehicle traffic. The impact of this modal shift on the contribution of $NO_x$ and $SO_x$ to the airshed will be assessed and a qualitative statement regarding the potential for acid deposition will be provided in IS / EA Report.

#### 9.4.1.9 Secondary Transformation

Formation of secondary contaminants (fine particulate matter) through chemical and physical transformation is expected to be low-level based on the predicted roadway volumes. While some formation of secondary particulate is expected, the Project is in a pristine setting without large industrial or transportation sources. Secondary formation is dependent on the presence of precursor species[9] which will be limited because of the nature of the environment. Based on a low number of projected vehicles per day, the emissions of precursor species are expected to be relatively dilute in the atmosphere.

Additionally, the formation of secondary contaminants is not instantaneous, and happens downwind of the source at which point the initial precursor contaminants have begun to disperse. In consideration of these factors, it is expected that assessing the near-road impacts of primary contaminants will result in a reasonably conservative air quality assessment.

One exception to the above is the conversion of NO to $NO_2$. It will be conservatively assumed that 100% of all NO emitted from the Project will be converted to $NO_2$.

### 9.4.2 Air Quality Analysis

The predicted at-receptor concentrations of the indicator compounds will be statistically summarized based on the applicable standards and criteria (i.e., AAQC (MECP, 2020) and CAAQS (CCME, 2021)) for each sensitive receptor. 90$^{th}$ percentile monitored or calculated baseline concentrations of the contaminants will

*8. Geographically defined area of the atmosphere.*
*9. Contaminants that are required to be present and to react to form a secondary contaminant*

be added to the modelled concentrations to conservatively predict the cumulative effects at each sensitive receptor. Sensitive receptors include areas where occupants may be more susceptible to adverse effects. Sensitive receptors include but are not limited to hospitals, schools, child care facilities and elderly housing. A detailed listed of sensitive receptors will be provided in the IS / EA Report. The selection of sensitive receptors will be done in collaboration with other disciplines and incorporate Indigenous Knowledge. Where exceedances of the standards or criteria are predicted (based on dispersion modelling), frequency analysis will be performed.

Differential effects will not be considered within the air quality assessment. The air quality assessment will consider the previously mentioned provincial and federal criteria and standards (AAQC (MECP, 2020) and CAAQS (CCME, 2021)) to evaluate the Project impacts on air quality. The results of the air quality dispersion modelling assessment will be used to inform air quality related human health effects in the Human Health and Community Safety Assessment. It is expected that the studies listed in **Table 9-3** will use evaluation criteria specific to each study's individual receptor types.

## 9.4.3 GHG Emissions

Net GHG emission related to the Project will be calculated based on the Strategic Assessment on Climate Change (SACC) (ECCC, 2020b) Equation 1 below:

*Net GHG = Direct GHG emissions + Acquired energy GHG emissions*
*CO2 captured and stored - Avoided domestic GHG emissions - Offset credits.*

It should be noted that not all components of this equation are relevant to the Project; only direct and avoided GHG emissions are relevant.

### 9.4.3.1 Construction Phase

GHG emissions will be estimated for the construction phase based on the projected types of activity and duration. Anticipated construction activity (direct GHG emissions), such as land clearing, blasting, pit and quarry development, material hauling, and road construction will be included in the estimate of emissions. Emissions will be estimated based on published emission factors, such as those found in the US EPA's AP-42 (US EPA, 2021) emission factor database, those generated with the US EPA Motor Vehicle Emission Simulator (MOVES) (ES EPA, 2020), or engineering principles, as applicable. A bounding scenario for construction activities will be developed (i.e., a scenario describing the maximum simultaneous construction activities) and will be used for the emission calculations.

GHG emissions will be estimated for vehicle and equipment activity as well as land use changes (direct GHG emissions), i.e., those associated with land use changes, including peatlands, and the removal of sources, sinks, and reservoirs).

#### 9.4.3.2 Operation Phase

The GHG assessment will include two bounding scenarios, these being roadway construction (described above, and comprising direct emissions) and roadway operation (comprising direct emissions). Routine road maintenance activities such as snow clearing are expected to be captured in the roadway vehicle data (traffic volumes and vehicle types) within the roadway operation scenario, and therefore will be included in the GHG assessment. Minor roadway maintenance activities, such as re-grading, are expected to have a lower impact than the roadway construction scenario, therefore the impact of these activities would have been assessed within that bounding scenario. Where applicable and available, Canadian emission factors from ECCC NIR Reports (ECCC, 2020a) will be used in lieu of US EPA emission factors (US EPA, 2021). Vehicle emission factors, including GHGs, will be estimated using the most current approved version of the US EPA's MOVES (US EPA, 2020) emissions database which considers factors such as: vehicle type, vehicle age, road type, fuel formulation, ambient conditions, and vehicle speed to develop vehicle fleet emission factors per kilometre travelled.

As with the air quality assessment, vehicle fleet information such as vehicle volumes will be based on the CAR design criteria. Vehicles will be assumed to travel at the posted speed limit. Fuel formulation will be based on the nearest available representative data source. Vehicle classification and traffic volume will be incorporated in emission calculations (i.e., light duty, heavy duty) as different vehicle classifications will have different traffic loadings and emission factors.

The assessment of GHG emissions will also consider the potential change in emissions from existing sources (e.g., aircraft, winter road usage) as a result of the Project (avoided domestic GHG emissions).

### 9.4.4 GHG Analysis

Releases of GHGs and their accumulation in the atmosphere influence provincial and national climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially. As such, GHGs will be assessed relative to provincial totals for comparison. Net GHG emissions will be evaluated in terms of overall contribution over the life of the Project, which will be assumed to be 20 years starting from the initial phases of construction. This will provide consistency with the future-build scenario as prescribed by the Ontario Ministry of Transportation (MTO, 2020). The average

per-annum GHG contribution as a result of the Project will be compared to provincial, federal, and sectoral totals where applicable.

Net GHG emissions as a result of the Project will be calculated using ECCC and SACC (ECCC, 2020b) guidance. The modal shift analysis identified in the Study Plan will be conducted based on the guidelines identified by IAAC (e.g., ECCC guidance, Infrastructure Canada's Climate Lens guidance), and will consider partial or full displacement of current forms of travel (e.g., winter road travel, air travel) with on-road vehicular traffic. The level of modal shift for each mode of transportation will be documented as part of the assessment. The Project is not anticipated to displace international emissions, and therefore this aspect will not be addressed within the analysis.

Emission factors for mobile and stationary equipment used during construction and operation phases will be gathered from the appropriate US EPA AP-42 (US EPA, 2021) resources, those generated from the most current approved version of MOVES (ES EPA, 2020), along with the most current NIR. Vehicle emissions will be estimated using the US EPA's Motor Vehicle Emission Simulator emissions database.

A qualitative description of the Project's net effects on Climate Change will include consideration of the requirements of the SACC guidance (ECCC, 2020). It is expected that in following the SAAC guidance (ECCC, 2020), Section 15.5 of the TISG will be met.

The impact assessment will not include a plan to achieve net zero by 2050 because the majority of the Project's emissions would arise from fuel consumption by third party users of the CAR. These emissions would not be owned by the Proponent and further policies to reduce or fully mitigate those emissions would fall under the jurisdiction of the federal and / or provincial governments. Additionally, emissions from fuel associated with vehicular travel on the CAR would have been subject to Government of Canada carbon price.

## 9.5 Mitigation and Enhancement Measures

Once potential effects have been identified, the effects assessment will explore technically and economically feasible mitigation measures to avoid or minimize the identified negative effects and enhancement measures to increase positive effects beyond those that are already inherent to the design. These measures will consist of industry-standard practices, federal and provincial standard specifications, regulator-mandated measures, best management practices, Indigenous and community recommendations and recommendations from industry and environmental professionals based on expertise, scientific publications, experience and judgement.

It is important that mitigation and enhancement measures are achievable, measurable and verifiable and monitored for compliance and effectiveness during all temporal phases as part of the Project follow-up monitoring plan. Required environmental monitoring will verify the potential environmental effects predicted in the IS / EA Report, evaluate the effectiveness of mitigation and enhancement measures, and identify the process the Proponent will follow if mitigation and enhancement measures are not effective.

### 9.5.1 TISG Section 20 Requirements

TISG section 20 includes the following requirements related to the atmospherics discipline. For each, the corresponding approach to fulfilling the requirement is documented.

- Identify and describe the use and application of best available technology and best environmental practice, including its effectiveness on the contaminants of concern, to prevent adverse effects on the receiving environment other than for GHG reduction purposes;
  - Following the ambient background air quality monitoring, a review of monitoring results in combination with an analysis of dispersion modelling outputs will be completed and used to provide input on what or if any mitigation and enhancement measures should be implemented. These mitigation and enhancement measures will be documented. During initial emission calculations select mitigation measures such as road watering will be taken into consideration when developing emissions rates for both mobile and stationary sources.
- Information on any offset credits that have been or will be obtained, including the offset regime that issued the credits, project type, project start date and vintage year. Proponents may also provide information on their intent to acquire or generate international offset credits;
  - It is not anticipated that the Project will generate any GHG offsets. However, as project activities are detailed through the EA process, these activities will be reviewed to gauge their alignment with typical GHG offset project types. The Project scope does not include the acquisition of offsets.
- To inform potential mitigation measures, a comparison of the Project's projected GHG emission intensity of similar projects in Canada and internationally that are a good example of energy efficiency or low emissions intensity projects. The comparison should explain why the emissions intensity may be different;
  - Where emissions intensity data exists in the public domain for comparable new road construction, this information will be used to compare the Project's projected emission intensity. A literature review will be conducted to identify potential data points for comparison, and intensity data captured in this review (if any) will be used as comparison

points. The focus of this assessment will be on the construction of the Project, as emissions from the Project's operations phase would be outside of the control of the Proponent. Specifically, the types of vehicles and resulting energy forms (fossil fuel or electricity) used within vehicles accessing the Project during operations would be outside of the scope of management of the Proponent. Further, the management of the types of vehicles and resulting energy forms used within vehicles would be within the purview of the Government of Canada and Government of Ontario.

## 9.6 Residual Effects

Residual effects are the effects remaining after the application of mitigation measures. The IS / EA Report will describe the potential adverse and positive residual effects in relation to each temporal phase of the Project (e.g., construction, operation). Residual effects will be described using criteria to quantify or qualify adverse and positive effects, taking into account important contextual factors. The residual effects will be described in terms of the direction, magnitude, geographic extent, duration, frequency, likelihood, and whether effects are reversible or irreversible[10]. For magnitude, environmental discipline-specific definitions are required and are proposed below in **Table 9-4**. Ecological and socio-economic context may also be relevant when describing a residual effect. Context relates to the existing setting, its level of disturbance and resilience to adverse effects. Context can also relate to timing as it applies to assessing the worst-case scenario (e.g., effect during migratory or calving season for wildlife). Where appropriate, information regarding residual effects will be disaggregated by sex, gender, age and other community relevant identify factors to identify disproportionate residual effects for diverse subgroups. For magnitude, VC-specific definitions are required and are proposed below in **Table 9-4** for Air Quality and **Table 9-5** for GHGs. The adverse effects magnitude criteria are intended to assess the ability of the Project to meet provincial and federal air quality criteria and standards. The air quality criteria and standards were developed to be protective of human health. Additionally, the results of the air quality assessment will be considered within the Human Health and Community Safety Study Plan.

*10. TISG Section 13.1 identifies additional effects characteristics for certain disciplines (e.g., wetlands, birds, terrestrial wildlife, species at risk). These additional effects characteristics are described in the respective discipline-specific study plans.*

### Table 9-4: Atmospheric Environment – Air Quality Magnitude Definition

| Magnitude Level | Definition | Rationale |
|---|---|---|
| **Negligible** | ■ Cumulative concentrations are below Air Quality criteria and an increase of < 50% of baseline values at sensitive receptors | ■ Magnitude definitions consider compliance with air quality criteria (AAQC (MECP, 2020) and CAAQS (CCME, 2021)) and changes from baseline conditions |
| **Low** | ■ Cumulative concentrations are below Air Quality criteria and an increase of >50% of baseline values at sensitive receptors | |
| **Medium** | ■ Cumulative concentrations exceed Air Quality criteria, and an increase of < 50% of baseline values at sensitive receptors | |
| **High** | ■ Cumulative concentrations exceed Air Quality criteria, and an increase of > 50% of baseline values at sensitive receptors | |

### Table 9-5: Atmospheric Environment - Greenhouse Gas Magnitude Definition

| Magnitude Level | Definition | Rationale |
|---|---|---|
| **Negligible** | ■ Up to 0.1% of provincial totals[11] | ■ Releases of GHGs and their accumulation in the atmosphere influence regional, national and global climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially. As there is no provincial or federal guidance to establish magnitude level of GHGs, the magnitude has been established as a percent contribution to provincial totals to assess the significance of Project emissions and hence potential effect on provincial reduction targets that may exist. |
| **Low** | ■ 0.1%-0.5% of provincial totals | |
| **Medium** | ■ 0.5%-1% of provincial totals | |
| **High** | ■ >1% of provincial totals | |

## 9.7 Consideration of Sustainability Principles

The sustainability assessment for the Project will be undertaken on the preferred alternative and will characterize the Project's contribution to sustainability incorporating the requirements set out in Section 25 of the TISG.

One aspect of the sustainability assessment is describing the process in selecting the preferred alternative to the Project and how the sustainability principles were considered. The effects assessment approach for the Project has included the consideration of the sustainability principles outlined in the Project TISG and the Agency's guidance on sustainability. The sustainability principles that have been considered include:

1. Consider the interconnectedness and interdependence of human-ecological systems;
2. Consider the well-being of present and future generations;
3. Consider positive effects and reduce adverse effects of the Project; and
4. Apply the precautionary principle by considering uncertainty and risk of irreversible harm.

*11. Provincial totals refer to Provincial Transportation GHG Totals*

The interconnectedness and interdependence of human-ecological systems will be considered through the assessment of potential indirect effects of each alternative. An indirect effect occurs when a change to one environmental discipline resulting from a Project activity causes a change to another environmental discipline (e.g., changes in vegetation could indirectly affect wildlife). A preliminary assessment of indirect effects has been included in **Section 9.3**.

The well-being of present and future generations will be considered in the effects assessment through the application of the long-term operations phase temporal boundary of 75 years (**Section 6.1**) and through the effects characteristics description of duration and reversibility for each residual effect predicted.

The consideration of positive effects and reducing adverse effects of the Project is fundamental to the effects assessment methodology through the identification of mitigation measures to reduce potential adverse effects and the identification of the preferred alternative through the evaluation of advantages (e.g., positive effects) and disadvantages (e.g., adverse effects).

The effects assessment will apply the precautionary principle by clearly describing and documenting all uncertainties and assumptions underpinning the analysis and identifying information sources. The effects assessment will consider risk of irreversible harm through the effects characteristics description of reversibility for each residual effect predicted and will describe any uncertainty associated with the assessment of residual effects.

The scope of the sustainability assessment will be defined by issues of importance identified by Indigenous communities and interested persons through consultation and engagement activities, while also ensuring to be inclusive of the diversity of views expressed. The selection of VCs that will be the focus of the sustainability assessment will be aligned with the issues of importance identified by Indigenous communities and interested persons, as well as residual effects identified through the effects assessment process. The sustainability assessment will describe how the planning and design of the Project, in all phases including follow-up monitoring, considered the sustainability principles.

## 9.8 Consideration of Identity and Gender-Based Analysis Plus in Effects Assessment

The Proponent recognizes that communities and sub-populations within those communities may be impacted differently by the Project with respect to VCs and indicators. As such, the Project aims to collect baseline information for the purpose of assessing differential effects and establishing relevant mitigation measures, as further elaborated on in **Section 4.3**. Gender-Based Analysis Plus will not be limited to

community feedback, when offered or discussed in secondary texts, additional sub-population information as is applicable to the relevant assessment will be incorporated.

## 9.9 Follow-up Programs

A follow-up program verifies the accuracy of the effects assessment and evaluates the effectiveness of mitigation measures. Identification of follow-up programs for the Project are not described in this Study Plan as the information needed to determine environmental monitoring requirements is dependent on the outcome of the effects assessment and consultation with Indigenous communities, agencies and interested persons. Therefore, the Proponent will include information on follow-up programs, that address the requirements outlined in Section 26 of the TISG, in the IS / EA Report and will identify the compliance and effects monitoring activities to be undertaken during all phases of the Project, as required.

### 9.9.1 TISG Section 26 Requirements

Results of the air quality assessment will aid in determining if there is a need for follow-up monitoring programs described in TISG Section 26. The requirements of TISG section 26 will be considered when evaluating the air quality assessment results. The need for potential follow-up, such as additional monitoring, will be considered based on the air quality impact assessment results.

# 10. Assumptions

Any assumption used in the effects assessment will be clearly identified and a rationale provided in the IS / EA Report.

Examples of assumptions that will be used include but are not limited to:

- The average annual daily traffic on the CAR is considered to be a low traffic volume;
- Human settlement areas which will be assessed are assumed to be representative of all potential settlement areas over the lifespan of the Project;
- A worst-case year of vehicle emission rates will be used within modelling. Year over year improvements in vehicle fuel efficiency will not be considered;
- Specific inputs to the analysis will be selected based on currently available information (e.g., land use along the corridor, fuel type and composition). Changes to these types of parameters over the life of the Project cannot be accurately predicted, and;
- Vehicles will travel along the roadway at the posted speed limit.

# 11. Concordance with Federal and Provincial Guidance

This section provides the best information currently available on how federal and provincial requirements identified for the Project to date will be addressed. The final concordance with federal and provincial requirements will be included in the IS / EA Report, and will be based on regulatory agency guidance, professional judgement and input received through the Project consultation and engagement process.

## Table 11-1: Study Plan Federal Concordance – Conformance with Requirements

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| 1 | TISG Section 1.1, page 4 | ■ The Guidelines correspond to factors to be considered in the impact assessment. These factors are listed in subsection 22(1) of IAAC and prescribe that the impact assessment of a designated project must take into account any change to the designated project that may be caused by the environment; | ■ The potential effects of the Project on the atmospheric environment and the potential effects of the environment on the Project will be assessed in accordance with applicable standards and guidance. | ■ Section 9 |
| 2 | TISG Section 14.1, page 84 | ■ The Impact Statement must include an atmospheric dispersion model of the common air pollutants in order to estimate the contaminant concentrations present in the entire area that could potentially be affected by atmospheric emissions resulting from project activities (air pollutant emission sources); | ■ AERMOD and CAL3QHCR modelling will be performed to assess atmospheric dispersion of pollutants within the LSA as a result of the Project. | ■ Section 9.4.1 |
| 3 | TISG Section 14.1, page 84 | ■ The Impact Statement must provide a comprehensive list of project activities (air pollutant emission sources) that may affect ambient air quality, such as, but not limited to:<br>– the use of heavy machinery such as construction equipment;<br>– vehicles and diesel generators during construction;<br>– blasting activities;<br>– exhaust emissions due to increased vehicular traffic during construction and operations; and<br>– dust generation from material stockpiles, transportation and road maintenance during construction and operation. | ■ All Project activities expected to contribute air pollutant emissions will be described in the Impact Statement. | ■ Section 9.4 |
| 4 | TISG Section 14.1, page 84 | ■ The Impact Statement must provide appropriately scaled contour map(s) plotting the predicted emission concentrations (isopleths). The choice of air quality model must be appropriate for the complexity of sources, terrain and meteorology; | ■ Results will be presented for the LSA in scaled contour maps. The air quality models which have been selected (AERMOD, CAL3QHCR) are appropriate for the source types and nature of dispersion within the LSA. | ■ Section 9.4.4 |
| 5 | TISG Section 14.1, page 84 | ■ The Impact Statement must provide a quantitative assessment of common air pollutants (total particulate matter, fine particulate matter (PM2.5), respirable particulate matter with a diameter less than 10 microns (PM10), sulphur oxides, nitrogen oxides, volatile organic compounds polycyclic aromatic hydrocarbons, diesel particulate matter, and carbon monoxide), as well as any air contaminants potentially associated with the Project such as dust resulting from construction activities and ongoing vehicle use during operations or maintenance of the gravel road bed; | ■ The Project will be assessed following the MECP dispersion modelling guidance and the MTO guidance for transportation air quality assessments for the requested contaminants. The contaminants assessed will be those required by the MTO guidance (i.e., NOx, CO, PM2.5, PM10, formaldehyde, acetaldehyde, benzene, 1,3-butadiene, and acrolein). Additionally, toluene, ethylbenzene, and xylene will be considered based on inclusion in the human health risk assessment. | ■ Section 9.2 |
| 6 | TISG Section 14.1, page 85 | ■ for air pollutants with numerical standards and/or established air quality criteria [e.g., Canadian Ambient Air Quality Standards (CAAQS), or Ontario Ambient Air Quality Criteria (AAQC)], observe the averaging time period and the statistical form associated with each numerical standard; | ■ Predicted contaminant concentrations will be compared against applicable standards and / or criteria following the averaging time and statistical form associated with each standard and/or criteria. | ■ Section 9.4.2 |
| 7 | TISG Section 14.1, page 85 | ■ provide a description of all methods and practices (e.g., dust suppression strategies and guidelines, control equipment) to be implemented to reduce and control emissions. If the best available technologies are not included in the Project design, the proponent needs to provide a rationale for the technologies selected; | ■ A description of the applicable control methods and practices will be included where applicable. | ■ Section 9.4.1 |
| 8 | TISG Section 14.1, page 85 | ■ provide justification for all control efficiencies used to reduce emission rates of sources within the model, including details of all assumptions associated with the related mitigation measures, and their achievability; | ■ All modelling inputs and assumptions will be documented in the Impact Statement. | ■ Section 9.4 |
| 9 | TISG Section 14.1, page 85 | ■ The Impact Statement must describe the source characteristics (e.g., point emissions, area sources, incineration emissions, and fugitive sources, including dust generated by exposed soils that are cleared and stockpiled); | ■ Each source included within the modelling will be described in the Impact Statement. | ■ Section 9.4 |
| 10 | TISG Section 14.1, page 85 | ■ The Impact Statement must use established methods for estimating emissions from on-road and off-road activities; | ■ Emission rates will be estimated using the US EPA's Motor Vehicle Emission Simulator as well as established methods from ECCC and the US EPA. | ■ Section 9.4 |
| 11 | TISG Section 14.1, page 86 | ■ In regard to changes to the atmospheric, acoustic, and visual environment, the Impact Statement must describe any positive changes. | ■ The Atmospheric and GHG effects assessment will identify positive and adverse effects that may be caused by the Project, on the environment. | ■ Section 9.6 |

*12. Federal TISG Reference should be the Section or subsection, page etc. that clearly identifies where comment/issue we are addressing can be found (ex. Section 8.1 of TISG)*

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| 12 | TISG Section 14.1, page 86 | ■ describe consultation with regulators, stakeholders, community groups, landowners and Indigenous groups about potential effects to the atmospheric, acoustic, and visual environment | ■ All consultation will be described in the Impact Statement. | ■ Section 4 |
| 13 | TISG Section 15.5, page 100 | ■ provide a description of each of the Project's main sources of GHG emissions | ■ The Impact Statement will include a description and assessment of the total net GHG emissions associated with the Project, including each of the main sources. This assessment will include consideration of land use changes, such as the removal or alteration of existing peatlands. | ■ Section 9.4.4 |
| 14 | TISG Section 15.5, page 100 | ■ provide the estimated annual GHG emissions from each source, including calculation methods, assumptions and related parameters that would enable calculations to be reproduced | ■ The Impact Statement will include a description and assessment of the total net GHG emissions associated with the Project. | ■ Section 9.4.4 |
| 17 | TISG Section 15.5, page 100 | ■ provide an estimate of yearly net GHG emissions for each year of the project lifetime, , including an uncertainty assessment, as per section 3 of the draft Strategic Assessment of Climate Change;" | ■ The Impact Statement will provide an estimate of the annual net GHG emissions for each year of the Project. An uncertainty assessment will be conducted following guidance from section 3.3 of the SACC (2020). Assumptions that may result in variance to calculated GHG levels will be discussed relating both to data and methods used. | ■ Section 9.4.4 |
| 18 | TISG Section 15.5, page 100 | ■ provide a description of large sources of GHG emissions that may be the consequence of accidents or malfunctions | ■ Where reasonable, the Impact Statement will provide an estimate of GHG emissions associated with accidents or malfunctions. | ■ Section 9.4.4 |
| 19 | TISG Section 15.5, page 100 | ■ provide a qualitative description of the Project's positive or negative effects on carbon sinks, including from the removal and alteration of wetlands | ■ The Impact Statement will include an assessment of land use changes (e.g., wetlands or peatlands) and the resultant net GHG emissions. | ■ Section 9.4.4 |
| 20 | TISG Section 15.5, page 100 | ■ describe how the Project may contribute to Canada's efforts to reduce GHG emissions, if applicable (e.g., the Impact Statement could explain how the Project would result in emission reductions in Canada by avoiding emissions from another source) | ■ The Impact Statement will present the predicted net change in GHG emissions. | ■ Section 9.4.4 |
| 21 | TISG Section 16.1, Page 103 | ■ With respect to biophysical determinants of health, the Impact Statement must provide an assessment of adverse and positive effects on human health in consideration of, but not limited to, potential changes in air quality. | ■ The effects assessment will identify positive and adverse effects that may be caused by the Project, on the environment, related to the atmospheric environment. Refer to the Human Health and Community Safety Study Plan for more information on human health effects. | ■ Human Health and Community Safety Study Plan |
| 22 | TISG Section 2.3, pages 6-7 | ■ The description should focus on aspects of the Project and its setting that are important in order to understand the potential environmental, health, social and economic effects and impacts of the Project. The following information must be included and, where appropriate, located on map(s):<br>– geographic co-ordinates (i.e., longitude/latitude using international standard representation in degrees, minutes, seconds) for the beginning and end points of the proposed road;<br>– current land and/or aquatic uses within the study areas;<br>– distance of the project components to any federal lands and the location of any federal lands within the study areas;<br>– all waterbodies and their location on a map;<br>– navigable waterways;<br>– the environmental significance and value of the geographical setting in which the Project will take place and the study areas;<br>– environmentally sensitive areas, such as national, provincial, territorial and regional parks, UNESCO World Heritage Sites, geological heritage sites, ecological reserves, ecologically and biologically sensitive areas, wetlands, and habitats of federally or provincially listed species at risk and other sensitive areas;<br>– Dedicated Protected Areas and any other areas of ecological and social significance identified by the community during the community-based land use planning processes with the Province of Ontario (e.g., Enhanced Management Areas; see Section 6.1 for requirements related to confidentiality);<br>– lands subject to conservation agreements;<br>– current mineral development proposals, and areas of early and advanced mineral exploration in the study areas; | ■ The information related to landscape features, sensitive or protected areas and select others listed in the TISG will be illustrated on maps and / or described within the IS / EA Report, where appropriate. | ■ Section 7 |

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| | | – current areas of aggregate extraction;<br>– description and locations of all potable drinking water sources (i.e., municipal or private), including spring water sources;<br>– description of local communities and Indigenous groups that is culturally relevant and gender sensitive;<br>– if the information is not confidential, provide a description and location of Indigenous traditional territories and/or consultation areas, Treaty and/or Title lands, Indian Reserve lands, Indigenous harvesting regions (with permission of Indigenous groups), Métis settlements; and<br>– culturally important features of the landscape. | | |
| 22 | TISG Section 20, page 119-128 | ■ Section 20 of the TISG describes the requirements around mitigation and enhancement measures that must be considered in the Impact Statement. | ■ Identification of and assessment of effectiveness of impact management measures will be done as a discipline or VC-specific exercise where mitigation is required, and will be done as part of the IA / EA. | ■ Section 9.5 |
| 23 | TISG Section 21, pages 129-130 | ■ Section 21 of the TISG describes the requirements and guidance associated with determining residual effects. | ■ Residual effects will be assessed in the IA / EA. | ■ Section 9 |
| 24 | TISG Section 26, Page 141 | ■ Section 26 of the TISG includes a description of the considerations for developing a follow-up program for environmental, health, social or economic effects, as applicable. | ■ The IS / EA Report will include descriptions of follow-up programs, as required by VC. | ■ Section 9 |
| 25 | TISG Section 7.1, page 30 | ■ The Impact Statement must establish appropriate study area boundaries to describe the baseline conditions. The study area boundaries need to encompass the spatial boundaries of the Project, including any associated project components or activities, and the anticipated boundaries of the Project effects, including all potentially impacted local communities, municipalities and Indigenous groups. Considerations in assigning appropriate study areas or boundaries would include, but not be limited to:<br>– areas potentially effected by changes to water quality and quantity or changes in flow in the watershed and hydrologically connected waters;<br>– areas potentially effected by airborne emissions or odours;<br>– areas determined by dispersion and deposition modelling;<br>– areas within the range of vision, light and sound and the locations and characteristics of the most sensitive receptors;<br>– species habitat areas, usage timing and migratory patterns;<br>– emergency planning and emergency response zones;<br>– the geographic extent of local and regional services;<br>– any impacted local communities, including municipalities;<br>– all potentially impacted Indigenous groups;<br>– areas of known Indigenous land, cultural, spiritual and resource use; and<br>– existing effected infrastructure. | ■ The Study Areas are defined and described in this Study Plan, in Section 3. | ■ Section 3 |
| 26 | TISG Section 7.1, page 30 | ■ If the baseline data have been extrapolated or otherwise manipulated to depict environmental, health, social and/or economic conditions within the study area, modelling methods must be described and must include assumptions, calculations of margins of error and other relevant statistical information. Models that are developed should be validated using field data from the appropriate local and regional study areas. Ensure baseline data are representative of project site conditions. If surrogate data from reference sites are used rather than site-specific surveys, the proponent should demonstrate that the data are representative of project site conditions. | ■ Baseline air quality monitoring will be collected at one location so will be considered representative of the entire study area, as described in the Study Plan. | ■ Section 4 |
| 27 | TISG Section 7.1, page 31 | ■ Where baseline data are available in geographic information system (GIS) format, this information is to be provided to the Agency as electronic geospatial data file(s) compliant with the ISO 19115 standard. This would support the Government of Canada's commitment to Open Science and Data and would facilitate the sharing of information with the public through the Canadian Impact Assessment Registry Internet Site | ■ Complete data sets from all survey sites will be provided. They will be in the form of complete and quality assured relational databases, with precisely georeferenced site information, precise observation / visit information and with observations and measurements in un-summarized form. Databases and GIS files will be accompanied by detailed metadata that meets ISO 19115 standards (or equivalent). Documentation | ■ Section 5.1 |

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| | | and the Government's Open Science and Data Platform. The Agency intends to make the geospatial data files available to the public under the terms of the Open Government License – Canada. | and digital files will be provided for all results of analyses that allow for a clear understanding of the methods and a replication of the results. | |
| 28 | TISG Section 7.2, page 32 | ■ The Impact Statement must provide detailed descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental, health, social and economic condition that is described, in order to corroborate the validity and accuracy of the baseline information collected. | ■ Descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental condition will be provided in the IS / EA Report and are summarized in this Study Plan. | ■ Section 4 |
| 29 | TISG Section 7.2, page 33 | ■ If using existing data sources, the Impact Statement must provide justification to show that the data sources are relevant in spatial and temporal coverage to the Project. Some data sources may have good coverage in Southern Ontario or existing road networks but be unsuitable as a baseline for these northern areas where there are not roads. | ■ Justification for using existing data sources will be provided in the IS / EA Report | ■ Section 7<br>■ Appendix A |
| 30 | TISG Section 7.2, page 33 | ■ Existing data should be considered as a limited augmentation of this new data. See the "Establishing Baseline Conditions" (sections 8.5, 8.9, 8.10, 8.11) in this Tailored Impact Statement Guidelines for recommendations on survey design and methodology. Surveys and analyses should be conducted by qualified experts. Baseline data must be collected in a manner that enables reliable analysis, extrapolations and predictions. Resulting data should be suitable for analyses to estimate pre-project baseline conditions, derive predictions of impacts, and evaluate and compare post-project conditions and at scales of within and across the Project, Local and Regional Assessment areas. Modelling methods, error estimates and assumptions should be reported (as per section 7.1). Modelling and simulations should be used early in the planning phase to estimate the necessary sampling intensity and to quantitatively evaluate the effectiveness of design options. Ethical guidelines and relevant cultural protocols governing research, data collection and confidentiality must be adhered to. | ■ Descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental condition will be provided in the IS / EA Report and are summarized in this Study Plan. | ■ Section 4 |
| 31 | TISG Section 7.2, page 33 | ■ Baseline data must be collected in a manner that enables reliable analysis, extrapolations and predictions. Resulting data should be suitable for analyses to estimate pre-project baseline conditions, derive predictions of impacts, and evaluate and compare post-project conditions and at scales of within and across the Project, Local and Regional Assessment areas. Modelling methods, error estimates and assumptions should be reported (as per section 7.1). Modelling and simulations should be used early in the planning phase to estimate the necessary sampling intensity and to quantitatively evaluate the effectiveness of design options. Ethical guidelines and relevant cultural protocols governing research, data collection and confidentiality must be adhered to. | ■ Descriptions of specific data sources, data collection, sampling, survey and research protocols and methods followed for each baseline environmental condition will be provided in the IS / EA Report and are summarized in this Study Plan. | ■ Section 4 |
| 32 | TISG Section 7.2, pages 31-33 | ■ Information sources and data collection methods used for describing the baseline environmental, health, social and economic setting may consist of the following sources of information. For specific sources of baseline information, see Appendix 1.<br>– Federal government (e.g., Environment and Climate Change Canada, Health Canada, Indigenous Services Canada, Statistics Canada, Women and Gender Equality Canada);<br>– Ontario provincial government (e.g., Ministry of Environment, Conservation, and Parks, Ministry of Natural Resources and Forestry;<br>– Bird Conservation Region plans;<br>– academic institutions;<br>– field studies, including site-specific survey methods;<br>– database searches, including:<br>– federal, provincial, territorial, municipal and local data banks;<br>– Breeding Bird Atlas - Ontario (2001-2005)<br>– monitoring program databases protected areas, watershed or coastal management plans;<br>– natural resource management plans;<br>– species recovery and restoration plans; | ■ Data sources are being reviewed for their appropriateness and will be included in Study Plans where applicable. Information on specific data sources and their relevance to the Project will be included in the IS / EA Report. | ■ Section 7<br>■ Appendix A |

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| | | – field measurements to gather data on ambient or background levels for air, water, soil and sediment quality, light levels or acoustic environment (soundscape);<br>– land cover data, including:<br>• terrestrial ecosystem mapping products;<br>• forest cover maps;<br>• remote sensing resources;<br>• important habitats and features to include:<br>○ water bodies, wetlands, watercourses;<br>○ riparian habitat;<br>○ river banks or other eroded habitats;<br>○ artificial water sources;<br>○ forest, tree patches, solitary trees (especially old decaying trees);<br>○ forest edges and tree rows;<br>○ ridges, including eskers;<br>○ caves and mines;<br>○ cliffs, rock outcrops, exposed bedrock, talus, and other karst topography;<br>○ buildings, bridges, and other anthropogenic features, including linear features;<br>○ sources of artificial lighting attracting insects;<br>○ critical habitat; and<br>○ and any other habitat features known to be important in the area.<br>– Published literature, such as peer reviewed journals, reports by think tanks, non-government organizations and government reports;<br>– environmental assessment documentation, including monitoring reports, from prior projects in the area and similar projects outside the area;<br>– regional studies, project assessments and strategic assessments;<br>– renewable harvest data;<br>– Indigenous knowledge, including oral histories and knowledge gathered by spending time on the land with knowledge holders;<br>– community based monitoring and studies conducted by Indigenous communities;<br>– expert, community, public and Indigenous engagement and consultation activities, including workshops, meetings, open houses, surveys;<br>– qualitative information gathered from interviews, focus groups or observation;<br>– census data;<br>– baseline human health risk assessments;<br>– community and regional economic profiles;<br>– community well-being studies; and<br>– statistical surveys, as applicable. | | |
| 33 | TISG Section 7.3, page 34 | ■ The list of valued components must be informed, validated and finalized through engagement with the public, Indigenous groups, lifecycle regulators, jurisdictions, federal authorities, and other interested parties. The Impact Statement must describe valued components, processes, and interactions that are identified to be of concern or that the Agency considers likely to be impacted by the Project and are included in the Guidelines. | ■ A summary of the consultation plan for Indigenous communities, government agencies, and interested persons has been provided in Section 4 of the Study Plan; further details can be found in the IS / EA Consultation Plan included as Appendix B of the Proposed ToR. Specific consultation and engagement activities and schedules are currently in development and will be shared with the MECP and the Agency once available. | ■ Section 4 |

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| 34 | TISG Section 7.4.1, page 36 | ■ For valued components establish three study area spatial boundaries to assess impacts to each valued component:<br>1) Project Study Area: defined as the project footprint for each alternative route; "<br>2) Local Study Area: defined for each valued component – see below;<br>3) Regional Study Area: defined for each valued component – see below<br>■ Provide a rationale for boundaries of the project study area, local study area, and regional study area for each valued component and indicate how the above objectives were met in establishing the boundaries. | ■ Geographic extant, and the extant rationale, of the Project, Local, and Regional Study Areas for this VC are provided in this Study Plan. | ■ Section 6 |
| 35 | TISG Section 7.4.1, pages 35-36 | ■ The Impact Statement must describe the spatial boundaries, including project, local and regional study areas, for each valued component included in assessing the potential adverse and positive environmental, health, social and economic effects of the Project and provide a rationale for each boundary. Spatial boundaries are defined taking into account the appropriate scale and spatial extent of potential effects and impacts of the Project; community knowledge and Indigenous knowledge; current or traditional land and resource use by Indigenous groups; exercise of Aboriginal and Treaty rights of Indigenous peoples, including cultural and spiritual practices; and physical, ecological, technical, social, health, economic and cultural considerations. The size, nature and location of past, present and foreseeable future projects and activities are factors that should be included in the definition of spatial boundaries. It should be noted that in some cases, spatial boundaries might extend to areas outside of Canada. These transboundary spatial boundaries should be identified where transboundary effects are expected. | ■ Geographic extant, and the extant rationale, of the Project, Local, and Regional Study Areas for this VC are provided in this Study Plan. | ■ Section 6 |
| 36 | TISG Section 8.1, page 39 | ■ The Impact Statement must provide the approximate number, distance and identity factors of likely human receptors, including any foreseeable future receptors, that may be impacted by changes in air, water, country food quality (e.g., dust deposition on vegetation), and noise levels. At minimum, provide a map showing approximate locations of permanent residences, temporary land uses (e.g., cabins and traditional sites) and known locations of sensitive human receptors (e.g., schools, hospitals, community centres, retirement complexes or assisted care homes). | ■ Identified receptor locations will be described in the IS / EA Report. The sensitive receptors described in this TISG requirement are captured by other disciplines (e.g., Human Health and Community Safety and Aboriginal and Treaty Rights and Interests). Results from the Atmospheric Environment and GHG assessment will be used by other disciplines in assessing impacts to receptors. The relevant criteria (AAQC, CAAQS) have been developed in consideration of effects at any applicable receptor type. | ■ Section 9.4 |
| 37 | TISG Section 8.1, pages 38-39 | ■ The Impact Statement must:<br>– provide the results of a baseline survey of ambient air quality by identifying and describing emission sources for the following contaminants: total suspended particulates, fine particulates smaller than 2.5 microns (PM2.5), respirable particulates of less than 10 microns (PM10), carbon monoxide (CO), ozone, sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs)25, polycyclic aromatic hydrocarbons (PAHs), diesel particulate matter (DPM), and any other toxic air pollutants (mobile and stationary sources); "<br>– "for air pollutants with numerical standards and/or established air quality criteria, [e.g., Canadian Ambient Air Quality Standards (CAAQS), or Ontario Ambient Air Quality Criteria (AAQC)], observe the averaging time period and the statistical form associated with each numerical standard; "<br>– "address seasonal variability in the baseline survey and include a determination of background or ambient contaminant concentrations at key receptor points (e.g., traditional land users, sensitive human receptors such as daycares, schools, hospitals, community centres, retirement complexes or assisted care homes) with monitoring data of appropriate duration, representativeness, data completeness, data validation and quality control, baseline air quality monitoring is to be provided for a minimum of one year to represent seasonal variability;<br>– provide dispersion modelling of a base case to account for existing pollutant sources and to determine the spatial distribution of pollutants within the study area;<br>– describe all direct and indirect sources of baseline air emissions, including mobile, stationary and fugitive; | ■ These items are addressed in our study plan. Brief summary:<br>– we will use monitoring to develop baseline concentrations of PM10, PM2.5, NOx, acetaldehyde, formaldehyde, benzene, acrolein, and 1,3-butadiene.<br>– addressed above. Included within scope<br>– we will use monitoring to represent baseline. No modelling of baseline concentrations will be performed to predict concentrations at specific receptor locations.<br>– monitoring will be used to address base case. Dispersion modelling is not practical to quantify base case.<br>– a description of general sources in the area will be included, but no quantification of emissions or modelling is included. | ■ Section 7 |

| ID # | Federal TISG Reference[12] | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|
| 38 | TISG Section 8.2, page 40 | ■ The Impact Statement must:<br>– describe the local and regional climate including historical records of relevant meteorological information (e.g., total precipitation (rain and snow));<br>– provide mean, maximum and minimum temperatures;<br>– provide typical wind speed and direction;<br>– identify the potential for extreme weather events such as, wind, precipitation and temperature extremes; | ■ The IS / EA Report will describe local and regional climate, based on data availability. Up to one-year of meteorological data will be developed from prognostic data and will be provided, including: wind speed and direction, temperature, and precipitation. | ■ Section 7.2 |
| 39 | TISG Section 8.6, page 44 | ■ The Impact Statement must provide complete hydrometeorological (temperature, precipitation, evapotranspiration) information based on data from nearby weather stations or from a weather station on site; | ■ Weather parameters will be summarized for the area and presented in the IS / EA Report. | ■ Section 7.2 |
| 40 | TISG Section 7.3, page 35 | ■ For each of the valued components that will be assessed in the Impact Statement, the proponent must create a study plan and a work plan to be validated by the Agency. Upon receipt of a study plan, the Agency may request that the proponent present and discuss the study plan at technical meetings, which will be scheduled during the impact statement phase. | ■ The Study Plan meets this requirement. A summary of the technical discussions with agencies have been provided in Section 3 of the Study Plan. | ■ Section 3 |
| 41 | TISG Section 7.3, page 35 | ■ The valued components must be described in sufficient detail to allow the reviewer to understand their importance and to assess the potential adverse and positive environmental, health, social and economic effects and impacts arising from the Project activities. | ■ The IS / EA Report will include detailed descriptions of the VCs and the rationale for their inclusion to describe their importance and the predicted residual effects (adverse and positive) as a result of the Project. | ■ Section 9 |
| 42 | TISG Section 7.4.2, page 37 | ■ The temporal boundaries of the impact assessment span all phases of the Project determined to be within the impact assessment. If potential effects are predicted after project decommissioning or abandonment, this should be taken into consideration in defining specific boundaries. In order to assess a project's contribution to sustainability, consideration should be given to the long-term effects on the well-being of present and future generations. When defining temporal boundaries, the proponent should consider how elements of environmental, health, social and economic well-being that local communities, including municipalities, and Indigenous groups identify as being valuable could change over time. | ■ Modelling scenarios based on the MTO guidance (i.e., build year plus 20 years in future). The future-build scenario is aligned with MTO guidance to allow for predictability of key inputs to relevant models (e.g., vehicle fleet composition, vehicle age, fuel type). Selection of timelines beyond this may reduce the accuracy of model outputs. | ■ Section 9.4.1 |
| 43 | TISG Section 7.3, pages 34-35 | ■ In selecting a valued component to be included, the following factors should be considered:<br>– valued component presence in the study area; "<br>– "the extent to which the valued component is linked to the interests or exercise of Aboriginal and Treaty rights of Indigenous peoples, and whether an Indigenous group has requested the valued component;<br>– "the extent to which the effects (real or perceived) of the Project and related activities have the potential to interact with the valued component;<br>– "the extent to which the valued component may be under cumulative stress from other past, existing or future undertakings in combination with other human activities and natural processes;<br>– "the extent to which the valued component is linked to federal, provincial, territorial or municipal government priorities (e.g., legislation, programs, policies);<br>– "the extent to which the valued component is being addressed through any ongoing or completed regional assessment processes;<br>– "the possibility that adverse or positive effects on the valued component would be of particular concern to Indigenous groups, the public, or federal, provincial, territorial, municipal or Indigenous governments; and<br>– whether the potential effects of the Project on the valued component can be measured and/or monitored or would be better ascertained through the analysis of a proxy valued component. | ■ The IS / EA Report will include detailed descriptions of the VCs and the rationale for their inclusion to describe their importance and the predicted residual effects (adverse and positive) as a result of the Project. | ■ Section 9 |

## Table 11-2: Study Plan Provincial Concordance – Conformance with Requirements

| ID | Comment From Regulatory Agency | Comment Type | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|---|
| 1 | MECP | ■ Email from Agni Papageorgiou & Sasha McLeod, Special Project Officer Environmental Assessment Services Section, Ministry of the Environment, Conservation and Parks with comments of the Draft ToR | ■ #17 Section 8 Page 54<br>– Consultation on Assessment Methodology - MFFN acknowledges that the proposed methodology will be open to input during the draft ToR review, but also says a more detailed method will be presented in the EA. Page 47 indicates the effects assessment criteria will be developed during the EA. While it is appropriate to defer some detailed work planning to the EA phase, the ToR should include commitments for how technical reviewers, and other interested persons, will be consulted during the development of specific evaluation methodologies or technical work plans. It is strongly recommended that those opportunities for review occur prior to the completion of studies (e.g., prior to the submission of a draft or final EA document).It is not clear whether MFFN plans to consult on the more detailed methodology and criteria during the EA phase or if the ToR phase is the main opportunity to provide input.<br>– Please indicate how consultation on the ToR has informed the preliminary criteria and indicators. Please clarify when MFFN will consult and provide opportunity for input on the detailed assessment method, including criteria and indicators (and work plans as MECP has proposed), with agencies, communities and stakeholders during the EA phase in order to finalize the methodologies before EA studies get advanced. | ■ The Study Plan meets this requirement.<br>■ As identified in Section 4.2 of the Study Plan, the Proponent will provide opportunities for consultation and engagement with Indigenous communities identified in Table 4-1, which is inclusive of all Indigenous communities identified in the Indigenous Partnership and Engagement Plan for the Marten Falls Community Access Road Project Impact Assessment (The Agency 2020a).<br>■ Further information on how Indigenous Knowledge will be considered in the IS / EA Report has been included in Section 5 of the Study Plan. Section 5 of the Study Plan provides further details on the two concurrent and complementary avenues for Indigenous communities and groups to be engaged with and provide input on the Project: the Indigenous Knowledge Program and the Consultation and Engagement Program. | ■ Section 4<br>■ Section 5 |
| 2 | MECP | ■ Email from Agni Papageorgiou & Sasha McLeod, Special Project Officer Environmental, MECP Assessment Services Section, Ministry of the Environment, Conservation and Parks with comments of the Draft ToR | ■ Assessment Methods<br>– For the most part, section 7.2 provides a description of potential environmental effects for each discipline. However this section also includes assessment methodologies for some subsections (7.2.1 and 7.2.2 AERMOD modelling, quantitative noise assessment) while the majority do not (7.2.3 – 12). The level of detail in the ToR about assessment methods should be consistent for all environmental components.<br>– It is strongly recommended to include commitments to develop work plans at the outset of the EA phase, including opportunities for technical review by agencies and others. The work plans should include assessment methodology appropriate for each environmental component. The ToR could include a high level summary table for each environmental discipline listing data collection and assessment methods, with a commitment to develop the work plans at the outset of the EA phase to provide more details. Consider where the information about air and noise modelling is best placed. | ■ The Study Plan meets this requirement. | ■ Section 7<br>■ Section 8 |
| 3 | MECP | ■ Email from Agni Papageorgiou & Sasha McLeod, Special Project Officer Environmental, MECP Assessment Services Section, Ministry of the Environment, Conservation and Parks with comments of the Draft ToR | ■ #16 Section 8 Page 54<br>– Work Plans - Section 8 describes the approach that will be taken to evaluate alternative methods during the EA, including proposed criteria and indicators (presented in Appendix A). The information presented is high level and does not provide an opportunity for technical review of the methodologies that will be applied to evaluate those specific criteria and indicators.<br>It is strongly recommended to include commitments to develop work plans at the outset of the EA phase, including opportunities for technical review by agencies and others. | ■ This Study Plan will be reviewed by relevant federal and provincial agencies. | ■ Section 9 |

| ID | Comment From Regulatory Agency | Comment Type | Requirement / Comment / Concern | Response | Study Plan Reference |
|---|---|---|---|---|---|
| 4 | MECP | ■ Email from Guowang Qiu, Air Quality Analyst Technical Support, Northern Region, Ministry of the Environment, Conservation and Parks with comments of the Draft ToR | ■ #1 Section 7.1.4.1<br>– The Draft ToR indicates that a one-year air quality monitoring program is planned to measure concentrations of nitrogen oxides, particulate matter (e.g., PM2.5, PM10, total suspended particulate), carbon monoxide, sulphur dioxide, benzene, toluene, ethylbenzene, and xylene, which will be used to establish baseline air quality for the project. It is recommended that the proponent consult the ministry as early as possible to ensure that the proposed ambient air monitoring program will meet requirements as specified in the Operations Manual for Air Quality Monitoring in Ontario (2018 revised version).Section 7.1.4.1 should include a discussion on how the planned air quality monitoring program will meet the requirements of the Operations Manual for Air Quality Monitoring in Ontario to ensure the collection of accurate air monitoring data. | ■ MECP will be consulted regarding the implementation of the monitoring program. Note: consultation is underway. | ■ Section 7.2.1 |
| 5 | MECP | ■ Email from Guowang Qiu, Air Quality Analyst Technical Support, Northern Region, Ministry of the Environment, Conservation and Parks with comments of the Draft ToR | ■ #3 Appendix A<br>– Ambient Air Quality Criteria should be added into the Appendix A – Draft Criteria & Indicators for Alternatives Evaluation as one of the Potential Data Sources.<br>– Please add Ontario's Ambient Air Quality Criteria into the Appendix A as one of the Potential Data Sources for Atmospheric Environment. | ■ This source has been included in our provided Study Plan. | ■ Appendix A |
| 6 | MECP | ■ Completeness Review Memorandum compiled from MECP emails and August 2019 meetings with MECP and ENDM | ■ Study areas are missing and lack clarity – maps show study area for 4 routes even though only 2 (or 1?) routes are proposed to be assessed; no indication of local and regional study areas for each environmental component (e.g., groundwater, surface water, caribou, etc.). | ■ The Study Areas are defined and described in the Study Plan. | ■ Section 6 |
| 7 | MNRF | ■ Letter received from Dave Barker, Resources Management Supervisor, Nipigon District, MNRF on the Draft Terms of Reference | ■ Sec. 7 pg. 19<br>– Nearly one-half of the 190 to 230 km proposed road is through the James Bay Lowlands. Road construction through landscapes dominated by wetlands has a potential to significantly alter watershed hydrology, with changes in greenhouse gases (GHG) a likely outcome. This can have negative implications on GHG production, possibly altering carbon balances well beyond the 35-m width of the corridor. Retaining background carbon and GHG balances in response to land development remain national and international priorities. We strongly recommend that a carbon and GHG evaluation be completed as part of the EA so that these effects can be considered. At minimum, the review of literature on road construction effects on carbon should be undertaken for this EA. Data exists for the study region that the client should review and evaluate. These include government and conservation society reports, peer-reviewed manuscripts, and databases of carbon/GHG, weather, geology, vegetation, etc. The client is encouraged to apply the carbon/GHG calculations provided in 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. It is further recommended the project test the IPCC calculations against data collected along the length of road network. | ■ The potential GHG emissions resulting from the Project will be assessed in accordance with applicable standards and guidance. As an example, IPCC resources may be used in the estimation of greenhouse gas emissions as a result of land use changes. | ■ Section 9.4.8 |

## Table 11-3: Study Plan Federal and Provincial Concordance – Requirement Deviations

| ID # | Federal TISG Reference[13] or Provincial Draft ToR Comment Reference[14] | Requirement / Comment / Concern | Response (Rationale for not meeting requirement) | Justification (for not complying with requirement including for example scientific research, precedence) | Proposed TISG Amendment |
|---|---|---|---|---|---|
| 1 | TISG Section 7.2, page 33 | ■ With regard to field studies, survey work must be planned to include multiple sampling locations and multiple visits to each location to support all required assessment analyses. | ■ The Atmospherics and Greenhouse Study Plan does not include multiple locations for survey work. | ■ Within the LSA the community of Marten Falls is the primary area of human settlement and is the only location with sufficient power and serviceability access to support air quality monitoring equipment. The measured values in the community are a reasonably conservative characterization of baseline ambient air quality across the LSA. Concentrations within Marten Falls are expected to be elevated in comparison with the remainder of the LSA due to the presence of sustained human activity (e.g., power generation, airport). Therefore, using background data collected from within Marten Falls is expected to result in a conservative characterization of baseline conditions. | ■ TISG should be updated to remove the requirement to include multiple sampling locations for the Atmospherics and Greenhouse Gasses Study Plan. |
| 2 | TISG Section 8.2, page 40 | ■ The Impact Statement must:<br>– provide hourly meteorological data (wind speed and direction, air temperature, net radiation, turbulence and precipitation data) from a minimum of one year to support dispersion modelling that captures the normal variability of meteorological conditions; and<br>– provide pan evaporation measurements or estimates of monthly (or daily) evapotranspiration. | ■ Parameters not directly used within dispersion modelling will not be included within the Atmospheric and GHG Study Plan. | ■ The Potential for extreme weather events and pan evaporation measurements are not relevant to the air quality study and will not be provided. These values are not included within dispersion modelling. | ■ TISG should be updated to remove the requirement to include extreme weather events, and pan evaporation measurements , as well as parameters not directly used within dispersion modelling, |
| 3 | TISG Section 14.1, page 84 | ■ "provide an assessment of the Project's emissions potentially contributing or adding to existing ground ozone levels;" | ■ The potential for the Project to contribute to ground-level ozone will be qualitatively assessed for both the construction and operation phases. Potential for the generation of ground-level ozone will be evaluated based on the predicted increase in NOx and Volatile Organic Compounds around the Project area. Ozone formation will not be quantitatively assessed as the magnitude of effects is expected to be negligible. | ■ In the Ministry of Transportation's Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects, the MTO states that, with respect to the formation of ground-level ozone, "ground-level ozone O3 is typically formed many kilometres downwind of the source of its precursors" and "concentrations are usually depressed around highways since NO emissions react relatively rapidly to convert O3 into oxygen gas." The MTO also states that "For major roads, the collective experience of the scientific community suggests that the affected immediate vicinity is limited to the area within approximately 500 metres of the road". Based on this, the contribution of the Project to ground-level ozone is likely to be minor in comparison to the near-field concentration of precursor species (i.e., NOx). | ■ TISG should be updated to remove the requirement to evaluate ground level ozone |

*13. Federal TISG Reference should be the Section or subsection, page etc. that clearly identifies where comment/issue we are addressing can be found (ex. Section 8.1 of TISG)*
*14. This should include ID # reference (from excel table you were provided with all Draft ToR comments) and commenter.*

| ID # | Federal TISG Reference[13] or Provincial Draft ToR Comment Reference[14] | Requirement / Comment / Concern | Response (Rationale for not meeting requirement) | Justification (for not complying with requirement including for example scientific research, precedence) | Proposed TISG Amendment |
|---|---|---|---|---|---|
| 4 | TISG Section 14.1, page 85 | ■ The Impact Statement must provide details of all air quality model configuration, including meteorology, land use, gridded and sensitive receptors and chemical and physical transformation settings | ■ The air quality modelling will be described in detail within the Impact Statement. No chemical or physical transformation will be included in the modelling as the dispersion of emissions are expected to be generally low-level and near-field with respect to the Project. | ■ The Study Plan intended to communicate that the formation of secondary contaminants through chemical and physical transformation is expected to be low-level based on the predicted roadway volumes. While some formation of secondary particulate is expected, the Project is in a pristine setting without large industrial or transportation sources. Secondary formation is dependent on the presence of precursor species which will be limited because of the pristine nature of the environment. Based on a projected AADT of 400 vehicles per day, the emissions of precursor species are expected to be relatively dilute in the atmosphere.<br>■ Additionally, the formation of secondary contaminants is not instantaneous, and occurs downwind of the source at which point the initial precursor contaminants have begun to disperse. In consideration of these factors, it is expected that assessing the near-road impacts of primary contaminants will result in a reasonably conservative Air Quality Assessment<br>■ One exception to the above is the conversion of NO to NO2. It will be conservatively assumed that 100% of all NO emitted from the Project will be converted to NO2. | ■ TISG should be updated to remove the requirement to evaluate secondary transformation |
| 5 | TISG Section 14.1, page 85 | ■ The Impact Statement must assess the potential for emissions from the Project to contribute to acid deposition and exceedances of critical loads for terrestrial and aquatic ecosystems; | ■ The potential for the Project to contribute to acid deposition will be qualitatively assessed for both the construction and operation phases. Potential for acid formation will be evaluated based on the predicted increase in NOx and SOx to the airshed and subsequent potential nitrate and sulphate formation. Acid deposition will not be quantitatively assessed as the magnitude of effects is expected to be negligible. | ■ Acid deposition is a regional effect, meaning that near-roadway concentrations are not as important as airshed concentrations. It is estimated that the Project will partially displace air travel with road vehicle traffic. The impact of this modal shift on the contribution of NOx and SO2 to the airshed will be assessed and a qualitative statement regarding the implications for acid deposition will be provided. | ■ TISG should be updated to remove requirement for quantitative analysis of acid deposition |
| 6 | TISG Section 14.1, page 85 | ■ The Impact Statement must provide emission rates for all project and regional sources within the study area, including emission factors (with methodology, uncertainty assessment and references) and all assumptions and related parameters that would enable calculations to be reproduced” | ■ Baseline air quality monitoring will be used to represent the Project Area and is assumed to include in the effect of any relevant regional sources. Therefore, regional source emissions will not be quantified or included in the dispersion modelling. | ■ The majority of sources are expected to be personal vehicles, residential heating, and other miscellaneous activities. There are no significant sources (e.g., large industries) which would contribute to emissions in the Study Area.<br>■ As described earlier, a conservative Air Quality Assessment is one which describes the reasonable worst-case impact of the Project. Background concentrations within Marten Falls are expected to be higher than the rest of the Study Area. Therefore, using measured concentrations in the Study Area will result in a conservative Air Quality Assessment. | ■ TISG updated to remove requirement of providing emission rates for all Project and regional sources |

| ID # | Federal TISG Reference[13] or Provincial Draft ToR Comment Reference[14] | Requirement / Comment / Concern | Response (Rationale for not meeting requirement) | Justification (for not complying with requirement including for example scientific research, precedence) | Proposed TISG Amendment |
|---|---|---|---|---|---|
| 7 | TISG Section 14.1, page 85 | ■ The Impact Statement must provide a comparison of predicted air quality concentration against the Canadian Ambient Air Quality Standards (CAAQS) for fine particulate matter (PM2.5), sulphur dioxide (SO2) and nitrogen dioxide (NO2), and ozone (O3).” | ■ Ozone is not a primary contaminant related to the Project. | ■ Considering the projected roadway volumes (200-300 vehicles per day), an assessment of the formation of ozone is not warranted. Ozone formation will be qualitatively assessed. | ■ TISG should be updated to remove requirement to provide comparison of ozone (O3) against CAAQS |
| 8 | TISG Section 14.1, page 85 | ■ "provide details of the achievement of emission standards for all mobile and stationary engines used in the Project;" | ■ The Project is a public roadway. Ongoing operation of the roadway is not controlled by the project team. The project team cannot guarantee the types of vehicles that drive on the road. | ■ The Project is a public roadway. Ongoing operation of the roadway is not controlled by the MFFN CAR Project Team. The MFFN CAR Project Team cannot guarantee the types of vehicles that drive on the road. | ■ TISG should be updated to remove requirement to provide details of the achievement of emission standards for all mobile and stationary engines used in the Project |
| 9 | TISG Section 14.1, page 86 | ■ "describe the locations and characteristics of the most sensitive receptors including species at risk and differential effects for sensitive receptors;" | ■ Identified receptor locations will be described in the Impact Statement. Differential effects will not be considered in the Atmospheric Environment assessment. Results from the Atmospheric Environment will be used by individual disciplines in assessing impacts to receptors. | ■ The relevant criteria (AAQC, CAAQS) have been developed in consideration of effects at any applicable receptor type. | ■ TISG should be updated to remove requirement of assessing differential effects for sensitive receptors |
| 10 | TISG Section 15.5, page 100 | ■ “describe how the Project could impact global GHG emissions, including if the Project is expected to displace emissions internationally. The Impact Statement should describe how the Project is likely to result in global emission reductions. For example, a Project that enables the displacement of high-emitting energy abroad with lower emitting energy produced in Canada could be considered as having a positive impact." | ■ The Project will not displace international GHG emissions. GHG emissions will be assessed against provincial, federal and sector GHG totals. | ■ Due to the size and nature of the Project the Project is not expected to displace international GHG emissions. | ■ TISG should be updated to remove requirement to describe impact on global GHG emissions |

# 12. References

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# Appendix A

## Preliminary List of Data Sources

Environment and Climate Change Canada:
Historical Weather Data, https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Environment and Climate Change Canada:
Greenhouse Gas Reporting Program, https://open.canada.ca/data/en/dataset/a8ba14b7-7f23-462a-bdbb-83b0ef629823

Environment and Climate Change Canada:
National Air Pollution Surveillance Program, https://open.canada.ca/data/en/dataset/1b36a356-defd-4813-acea-47bc3abd859b

Ontario GeoHub:
Ontario Provincial Digital Elevation Model data, https://geohub.lio.gov.on.ca/datasets/882a9059ec7c4881abbdb6afa0ae73e6

# Appendix B

## Agency Comments on the Draft Study Plan

# Draft Study Plan Comments – Federal

| Comment # / Ref # | Study Plan Section | TISG Section | Agency/ Regulatory Body Comments Received From | Comment / Context | Action Item | Response | Study Plan Reference |
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| GC | ■ General Comment | ■ Sections 5, 6, 7, 13, 19.2 and 25 | The Agency | ■ In addition to the required actions detailed below, other required actions to be addressed in the update to this study plan are detailed in a separate table titled "2020-07-02 – IAAC to MFCAR - General Comments on MFCAR Draft Study Plans". The Agency has provided these other required actions to highlight common sections of the Guidelines where requirements were not met in the draft study plans submitted to the Agency. These additional actions must be addressed in the updated study plans. | ■ Please see Comment / Context | ■ We have reviewed the relevant comments and incorporated where appropriate. Please refer to the General Comments Table Response submitted separately to the Agency for specific responses. | ■ Various Sections |
| GC | ■ General Comment | ■ Section 15.5 | The Agency | ■ It is unclear whether all requirements related to the Project's impact on climate change were integrated into the atmospheric environment study plan. The climate change study plan only addresses requirements related to the effects of climate change on the Project. The Impact Statement must address all requirements related to the Project's impact on climate change that are outlined in Section 15.5 of the Guidelines and the study plan should demonstrate clear approaches to meet those requirements. | ■ Provide detail in the atmospheric environment study plan to explain the proposed approaches and methods used to integrate all of the requirements in the Guidelines related to the Project's impact on climate change, particularly Section 15.5. | ■ The Project's impact on climate change is addressed in this Study Plan, and the impact of climate change on the Project is addressed in the Climate Adaptation and Resiliency Study Plan. | ■ Section 9.4 |
| AQ-01 | ■ Section 4.2 Study Methods<br>– "The baseline Atmospheric Environment study will characterize the existing conditions for air quality. The study will involve a year-long field monitoring program. Quantifying existing emission sources for the Community as well as the remainder of the project footprint is not practical nor could it be completed to a degree that would produce reliable model results as a basis for establishing background." | ■ Section 8.1<br>– "address seasonal variability in the baseline survey and include a determination of background or ambient contaminant concentrations at key receptor points (e.g., traditional land users, sensitive human receptors such as daycares, schools, hospitals, community centres, retirement complexes or assisted care homes) with monitoring data of appropriate duration, representativeness, data completeness, data validation and quality control… provide the | The Agency | ■ Section 8.1 of the Guidelines outlines the type of receptors and key receptor location points to be considered for baseline studies (e.g., traditional land users, sensitive human receptors such as daycares, schools, hospitals, community centres, retirement complexes or assisted care homes).<br>The only reference to key receptors in the study plan is in Table 7-1. The study plan does not provide any details about the applicable receptor types and their potential locations. It is unclear whether the requirements of Section 8.1 of the Guidelines will | ■ Provide details to demonstrate that key receptor points have been or will be identified and include details on how monitoring data of background or ambient contaminant concentrations will be collected for all key receptor points.<br>■ Explain how the selection of sensitive receptors will take into account the views of all Indigenous groups listed in the IEPP. This includes incorporating into the plan where Indigenous groups will be provided with opportunities to: | ■ Sensitive receptor locations within the study area will be identified and evaluated in the IS / EA Report. Sensitive receptors will include the typical receptor types used in atmospheric assessments: residences, schools, healthcare facilities, daycares. In addition to the typical receptor types, indigenous receptor locations will be included in the assessment based on engagement completed as part of the project.<br>■ Background concentrations will be collected in the community of Marten Falls for a period of up to | ■ Section 9.4 |

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| | ■ Section 7 Conformance with Federal and Provincial Guidance<br>– "Identified receptor locations will be described in the Impact Statement. Differential effects will not be considered in the Atmospheric Environment assessment. The relevant criteria (AAQC, CAAQS) have been developed in consideration of effects at any applicable receptor type". | approximate number, distance and identity factors of likely human receptors, including any foreseeable future receptors, that may be impacted by changes in air, water, country food quality (e.g., dust deposition on vegetation), and noise levels. At minimum, provide a map showing approximate locations of permanent residences, temporary land uses (e.g., cabins and traditional sites) and known locations of sensitive human receptors (e.g., schools, hospitals, community centres, retirement complexes or assisted care homes)." | | be met by the study plan. It is also unclear how the views of the Indigenous groups identified in the Indigenous Engagement and Partnership Plan (IEPP) would be included in the selection of key receptors and receptor locations. | – provide Indigenous knowledge during baseline data collection;<br>– comment on the list of valued components and indicators;<br>– inform the effects assessment and review its conclusions; and<br>– inform the development of mitigation measures and follow-up programs. | one year. The data collected within the community will be conservatively assumed to represent the entire study area. It is expected that baseline concentrations within Marten Falls will be higher than the remainder of the Study Area. As a result, the use of data collected within Marten Falls will provide a more conservative assessment of impacts (based on cumulative impacts being defined as background concentrations plus predicted Project impacts), and will result in an assessment which is more protective of receptors.<br>■ Additionally, the logistics of collecting reference-level data in the remote wilderness of Northern Ontario is prohibitive to deploying any additional monitoring. Monitoring equipment requires a reliable power source and routine maintenance (e.g., snow cleared from around the inlet ports, filter changes) which are not feasible outside of a community. It is important to note that reference-level data are not practical using solely solar powered equipment. | |
| AQ-02 | ■ Section 4.2 Study Methods<br>– "Quantifying existing emission sources for the Community as well as the remainder of the project footprint is not practical nor could it be completed to a degree that would produce reliable model results as a basis for establishing background. Therefore, modelling is not proposed for this aspect." | ■ Section 8.2<br>– "provide hourly meteorological data (wind speed and direction, air temperature, net radiation, turbulence and precipitation data) from a minimum of one year to support dispersion modelling that captures the normal variability of meteorological conditions" | The Agency | ■ It is unclear how the requirements from Section 8.2 of the Guidelines will be collected to support dispersion modelling that captures the normal variability of meteorological conditions. | ■ Provide details on how the requirements of Section 8.2 of the Guidelines for hourly meteorological data to support dispersion modelling will be met in the Impact Statement. | ■ A 5-year hourly meteorological data to support dispersion modelling will be developed. Environment and Climate Change Canada measured data from stations in proximity to the study area and prognostic data (e.g., WRF data) for the study area will be used. | ■ Section 9.4 |

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| AQ-03 | ■ Section 4.2.1 Ambient Air Quality Monitoring<br>– "An airpointer(2) will be deployed in the Community to monitor…as well as meteorological parameters including: wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation." | ■ Section 8.2<br>– "describe the local and regional climate including historical records of relevant meteorological information (e.g., total precipitation (rain and snow)); provide mean, maximum and minimum temperatures; provide typical wind speed and direction; identify the potential for extreme weather events such as, wind, precipitation and temperature extremes; provide hourly meteorological data (wind speed and direction, air temperature, net radiation, turbulence and precipitation data) from a minimum of one year to support dispersion modelling that captures the normal variability of meteorological conditions; and provide pan evaporation measurements or estimates of monthly (or daily) evapotranspiration." | The Agency | ■ Section 4.2.1 of the study plan provides a list of meteorological parameters for the proposed ambient air quality monitoring that does not include all parameters outlined in Section 8.2 of the Guidelines. The Impact Statement must include all the requirements found in Section 8.2 of the Guidelines, and the study plan must describe a clear approach to meeting those requirements. | ■ Provide details on how all requirements of Section 8.2 of the Guidelines will be included in the Impact Statement. | ■ Meteorological parameters such as pan evaporation and evapotranspiration, and climate data such as extreme weather events, are not considered in air dispersion modelling. Any parameter not used as an input into the air dispersion modelling assessment will have no influence on the impact assessment and will therefore not be provided in the Air Quality Assessment Report. | ■ Section 9.4 |
| AQ-04 | ■ Section 4.2.1 Ambient Air Quality Monitoring<br>– "Monitored concentrations collected within the Community will be considered to be representative of all locations within the community and will be used to help establish background concentrations within the PSA.<br>– Baseline monitoring for the remainder of the PSA is not feasible given the remote nature of the Project corridor and lack of practical power and serviceability access. Therefore, monitoring at the Community will have to serve as the basis for establishing baseline and background values." | ■ Section 7.1<br>– "Ensure baseline data are representative of project site conditions." | The Agency | ■ It is unclear how it was determined that monitored concentrations from the monitoring station within the community will be representative of all receptor locations within the project study area (PSA). | ■ Provide details and rationale for how data collected from the monitoring station located at the community nursing station will be representative of baseline emissions at all receptor locations within the PSA. | ■ The intention of the Air Quality Assessment is to provide a realistic worst-case estimate of the impact on air quality as a result of the Project. The air quality assessment will add background concentrations to the predicted Project emissions to determine cumulative impacts within the PSA. Therefore, using the maximum background concentrations which would reasonably expected within the PSA will result in a conservative Air Quality Assessment.<br>■ Concentrations within Marten Falls are expected to be elevated in comparison with the remainder of the study area due to the presence of sustained human activity (e.g., power generation, airport, and heating fuel use). Therefore, using background data collected from within Marten Falls is expected to result in a conservative Air Quality Assessment. | ■ Section 7.2.1 |

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| AQ-05 | ■ Section 4.2.1 Ambient Air Quality Monitoring<br>– "….An airpointer2 will be deployed in the Community to monitor particulate matter (PM2.5), ozone, nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide (CO), and BTEX (benzene, toluene, ethylbenzene, and xylene) (…). BTEX and particulate matter will be used as surrogates for polycyclic aromatic hydrocarbons and diesel particulate matter which cannot be sampled for due to equipment limitations coupled with serviceability challenges given the relatively remote location. Concentrations of specific relevant contaminants such as acetaldehyde, formaldehyde, 1,3-butadiene, and acrolein will be estimated based on monitored BTEX concentrations and published emission factors, such as the United States Environmental Protection Agency's (US EPA) AP-42 emissions database."<br>– (Note 2: Health Canada. 2016. Guidance for Evaluating Human Health Impacts in Environmental Assessment: AIR QUALITY. ) | ■ Section 8.1<br>– "• provide the results of a baseline survey of ambient air quality by identifying and describing emission sources for the following contaminants: total suspended particulates, fine particulates smaller than 2.5 microns (PM2.5), respirable particulates of less than 10 microns (PM10), carbon monoxide (CO), ozone, sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs)(25), polycyclic aromatic hydrocarbons (PAHs), diesel particulate matter (DPM), and any other toxic air pollutants (mobile and stationary sources);<br>– (Note 25: It is recommended to assess specific aldehydes that are associated with diesel exhaust (DE), such as acetaldehyde, formaldehyde, 1,3-butadiene and acrolein, as well as benzene, for the evaluation of VOCs.)" | The Agency | ■ The study plan suggests that levels of PAHs and VOCs will be estimated based on measured surrogate (i.e., BTEX) levels. Most PAHs are toxic (and carcinogenic) at very low concentrations. To ensure that PAH emissions during the different phases of the project are not underestimated, it is preferable to use benzo(a)pyrene [BaP] as a surrogate to assess the total PAHs. A less resource-intensive measurement method may be available for this approach. Alternately, a qualitative assessment based on reliable and verifiable information may be proposed.<br>■ BTEX analysis generally provides a good indication of the concentration of the total VOCs in the air. However, as the approach is limited to four substances (i.e., BTEX), the use of emission factors combined with air dispersion modelling to predict the concentrations of the target VOCs (i.e., acetaldehyde, formaldehyde, 1,3-butadiene and acrolein) is necessary to fully assess human health risks of exposure to these air pollutants during the different phases of the project. It is not clear whether the recommended approach is adequately considered in the Study Plan. | ■ Describe any on-site sampling and quantitative analyses of common air pollutants (including SO2, PAHs, and DPM) listed in Section 8.1 and 14.1 of the Guidelines that is being considered to help assess the project impacts on contaminant levels with confidence.<br>■ Should other assessment approaches, including the use of surrogates and/or a qualitative assessment, be deemed more appropriate, or should an assessment be deemed unnecessary for any air pollutants, provide a detailed rationale for any deviation from recommended characterization/assessment approaches, as well as an estimate of the uncertainty associated with the use of the alternative approaches. | ■ Background SO2 concentrations will be measured in the community.<br>■ Background concentrations of PAHs will be estimated based on monitoring data collected within the community. The monitoring program includes an assessment of up to 1-year of data for benzene, toluene, ethylbenzene, and xylenes (i.e., BTEX).<br>■ DPM emissions as a result of the Project will be included in the Air Quality Assessment. Due to the technical limitations of measuring DPM in the community, background DPM concentrations will be estimated based on the breakdown of fuel sources in the community.<br>■ The Air Quality Assessment will include quantitative assessments (numerical estimates or monitoring of background concentrations and numerical modelling of Project impacts) of the following contaminants:<br>– NOx, PM2.5, PM10, Diesel Particulate Matter (DPM), SO2, CO, Formaldehyde, Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Total PAHs, Total VOCs | ■ Section 7.2.1 |
| AQ-06 | ■ Section 6.1 Indicators and Expression of Change<br>– "The indicators and rationale for selection and measurement of potential effects, to be used to assess and evaluate the alternative routes in the IA/EA are provided in Table 6-1. The table includes both quantitative and qualitative indicators. The final list of indicators to be used in the IA/EA will be based on regulatory | ■ Section 14.1<br>– "provide a quantitative assessment of common air pollutants (total particulate matter, fine particulate matter (PM2.5), respirable particulate matter with a diameter less than 10 microns (PM10), sulphur oxides, nitrogen oxides, volatile organic compounds, polycyclic aromatic hydrocarbons, diesel particulate matter, and carbon monoxide), as | The Agency | ■ It is unclear which air quality parameters will be assessed quantitatively (or qualitatively). It is also unclear why sulfur oxide (SO) is selected for the effect assessment, when SO2 is used in the baseline study.<br>■ Additionally, the assessment plan does not include some of the common air pollutants (e.g., PAHs, DPM, Carbon Monoxide), which is inconsistent with the baseline study | ■ Provide details to demonstrate which air quality parameters will be assessed quantitatively and which will be assessed qualitatively. Clarify why sulfur oxide (SO) is selected for the effect assessment when SO2 is used in the baseline study. Resolve inconsistencies between lists of air contaminants to be assessed during the baseline and the effects assessment. | ■ The following compounds will be quantitatively assessed within the Air Quality Assessment:<br>– NOx, PM2.5, PM10, Diesel Particulate Matter (DPM), SO2, CO, Formaldehyde, Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Total PAHs, Total VOCs<br>■ The following will be monitored during the baseline program: | ■ Section 7.2.1 |

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| | agency guidance, professional judgement and input received through the Project consultation process…."<br>■ Table 6-1: Atmospheric Environment Indicators<br>– "Expression of Change: NOx, CO, SO, TSP, PM10, PM2.5, Selected Volatile Organic Compounds (acrolein, acetaldehyde, benzene, formaldehyde, 1,3-butadiene, toluene, ethylbenzene and xylene)<br>■ Rationale for Selection:<br>– The contaminants chosen for the expression of change are based on those commonly associated with transportation and construction activities, as prescribed by the Ontario Ministry of Transportation (MTO, 2012)."<br>■ Section 7 Conformance with Federal and Provincial Guidelines<br>– "The Project will be assessed following MECP and MTO guidance for the requested contaminants. The contaminants assessed will be those required by MTO guidance (i.e., NOx, CO, PM2.5, PM10, formaldehyde, acetaldehyde, benzene, 1,3-butadiene, and acrolein). Additionally, toluene, ethylbenzene, and xylene will be consider based on inclusion in the human health risk assessment." | well as any air contaminants potentially associated with the Project such as dust resulting from construction activities and ongoing vehicle use during operations or maintenance of the gravel road bed;" | | plan and also deviates from the Guidelines requirement. Given the extensive use of heavy-duty diesel vehicles during project construction, DPM should be added to the list of contaminants selected for the expression of change. | ■ Provide details to demonstrate that all common air pollutants listed in Section 14.1 of the Guidelines will be included in the effects assessment, including DPM. | – NOx, PM2.5, PM10, SO2, , BTEX (benzene, toluene, ethylbenzene, and xylene)<br>■ Baseline concentrations for the following compounds will be calculated from results of the monitoring program:<br>– TSP, PAHs, DPM, Formaldehyde, Acetaldehyde, Acrolein, 1,3-Butadiene<br>■ Relevant literature, emission factors, referenced methods and other representative stations will be utilized to estimate baseline concentrations for compounds that are not monitored. | |
| AQ-07 | ■ Section 6.2.1 Emissions<br>– "GHG emissions will be estimated using published emission factors, approved estimation guidance, or engineering calculations as applicable." | ■ Section 15.5<br>– "provide the estimated annual GHG emissions from each source, including calculation methods, assumptions and related parameters that would enable calculations to be reproduced"<br>■ Section 20<br>– "describe measures included in the design of the Project to | The Agency | ■ The study plan does not describe the approach proposed to calculate GHG emissions, including calculation methods, assumptions and related parameters that would enable calculations to be reproduced, as required in Section 15.5 of the Guidelines.<br>■ The study plan also does not link and describe the measures and practices | ■ Provide details on how GHG emissions will be calculated and the measures to mitigate the Project's GHG emissions, as required in Sections 15.5 and 20 of the Guidelines.<br>■ Provide details to demonstrate how the measures and practices proposed to mitigate the Project's GHG emissions, as required in | ■ The GHG analysis will include mitigative measures as part of the quantification of emissions. As part of the impact assessment, an analysis will be conducted to identify if additional mitigative measures are required for GHG emissions. All mitigative measures identified will be documented and | |

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| | | mitigate its greenhouse gas emissions. These could include design decisions such as the use of low-emitting technologies, the use of low-carbon or renewable fuel or carbon capture and storage; describe practices that will be taken to mitigate the Project's greenhouse gas emissions, such as anti-idling practices for mobile equipment, or continuous monitoring systems". | | proposed to mitigate the Project's GHG emissions, as required in Section 20 of the Guidelines or how those measures and practices will be factored into the GHG estimates in Section 15.5 of the Guidelines. | Section 20 of the Guidelines, will be factored into the GHG estimates in Section 15.5 of the Guidelines. | reported on as part of the IS / EA Report. | |
| AQ-08 | ■ 6.2.1.1 Construction Phase<br>– "Emissions will be estimated for the construction phase based on the projected types of activity and duration. All anticipated construction activity, such as land clearing, blasting, aggregate extraction, material hauling, and road construction will be included in the estimate of emissions. Emissions will be estimated based on published emission factors, such as those found in the US EPA's AP-42 emission factor database, or engineering principles, as applicable. …)".<br>■ 6.2.1.2 Operation Phase<br>– "The assessment of the operations phase will not include any ongoing road maintenance activities such as road repairs as they are considered short-term and insignificant". | ■ Section 13.1<br>– "The Impact Statement must describe in detail the project's potential adverse and positive effects in relation to each phase of the Project (construction, operation, maintenance, suspension, decommissioning, and abandonment)."<br>■ Section 14.1<br>– "provide a quantitative assessment of common air pollutants …., as well as any air contaminants potentially associated with the Project such as dust resulting from construction activities and ongoing vehicle use during operations or maintenance of the gravel road bed;".<br>– "provide a comprehensive list of project activities (air pollutant emission sources) that may affect ambient air quality, such as, but not limited to: dust generation from material stockpiles, transportation and road maintenance during construction and operation."<br>■ Section 15.5<br>– "provide the estimated annual GHG emissions from each source, including calculation methods, assumptions and related parameters that would enable calculations to be reproduced" | The Agency | ■ Road maintenance activities are not included in the proposed assessment however these activities include the use of heavy machinery, result in vehicle emissions, and generate dust from vehicular travel and other activities. It is unclear how these activities are going to be included in the assessment, as per Section 14.1 of the Guidelines.<br>■ In addition to the proposed emission predictions during the construction and operation phases, an on-site monitoring at sensitive receptor locations (e.g., children or seniors) near the Project sites as per Section 6.8 of Health Canada's guidance (2016)2 is recommended.<br>■ Canadian-specific emission factors would be preferable to use over the proposed U.S. emission factors. | ■ Provide details on the assessment of short-term effects, inclusive of road maintenance activities, during the operation phase relative to the applicable standards and/or criteria. Describe any on-site monitoring that is being considered during the construction and operation phases where sensitive receptors are identified near the project sites.<br>■ Use Canadian-specific emission factors where possible, and provide justification if Canadian data sources are not used in the estimation of GHG emissions. | ■ The Air Quality Assessment will include two bounding scenarios: roadway construction and roadway operation. Routine road maintenance activities such as snow clearing are expected to be captured in the roadway vehicle data (traffic volumes and vehicle types) within the roadway operation scenario, and therefore will be included in the Air Quality Assessment.<br>■ Minor roadway maintenance activities, such as re-grading, are expected to have a lower impact than the initial construction bounding scenario, therefore the impact of these activities would have been assessed within that bounding scenario.<br>■ Where applicable and available Canadian emission factors will be used in lieu of US EPA emission factors. Within the MOVES emission model, meteorological conditions reflective of the study area and Canadian fuel composition data will be used as inputs, where possible. | ■ Section 9.4 |

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| AQ-09 | ■ Section 6.2.1.2 Operations Phase<br>– "The assessment of GHG emissions will also consider the potential change in emissions from existing sources (e.g., aircraft, winter road usage) as a result of the project." | ■ Section 15.5<br>– "describe how the Project may contribute to Canada's efforts to reduce GHG emissions, if applicable (e.g., the Impact Statement could explain how the Project would result in emission reductions in Canada by avoiding emissions from another source)" | The Agency | ■ It appears that a modal shift analysis would be conducted to justify that GHG emissions would be avoided with this project.<br>■ Environment and Climate Change Canada provides the following guidance for the development of scenarios to demonstrate avoided GHG emissions with the operation of this project:<br>– Only avoided domestic GHG emissions may be subtracted from the project's net GHG emissions. Avoided domestic GHG emissions are GHG emissions that are reduced or eliminated in Canada as a result of the project.<br>– Infrastructure Canada's Climate Lens General Guidance3 provides general guidance on how to quantify avoided emissions. The proponent must select the appropriate "total net baseline scenario emissions" and the "total net baseline scenario removals", and provide the rationale for those scenarios. The scenarios must consider new measures (e.g., policies, regulations, plans and programs) applicable to the project put in place by provincial, territorial and federal governments, be realistic, conservative and take into account market conditions and feasibility.<br>– The quantification approach should ensure that the avoided emissions represent reductions or removals that are real, additional, quantified, verifiable, unique, and permanent. Avoided foreign emissions should not be quantified in the avoided domestic GHG emissions. | ■ Provide details on how the "potential change in emissions from existing sources" will be determined, and explain if and how the change in emissions would be calculated as part of the net GHG emissions of the project, in order to meet the requirements of Section 15.5 of the Guidelines. | ■ Net GHG emissions as a result of the Project will be calculated using ECCC guidance. The modal shift analysis identified in the Study Plan will rely on the guidelines identified by The Agency (e.g., ECCC guidance, Infrastructure Canada's Climate Lens guidance), and will consider partial or full displacement of current forms of travel (e.g., winter road travel, air travel) with on-road vehicular traffic. The level of modal shift for each mode of transportation will be determined and documented as part of the assessment.<br>■ Foreign emissions will not be considered in the analysis. | ■ Section 9.4 |

| Comment # / Ref # | Study Plan Section | TISG Section | Agency/ Regulatory Body Comments Received From | Comment / Context | Action Item | Response | Study Plan Reference |
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| AQ-10 | ■ Table 6-2: Air Quality Magnitude Definition<br>– Low: Up to 10% above applicable Criteria.<br>– Medium: 11%-30% above applicable Criteria<br>– High: 31%-70% above applicable Criteria<br>– Very High: >70% above applicable Criteria<br>■ Rationale:<br>– To align with IAAC evaluation criteria presented in the Tailored Impact Statement Guidelines. | ■ Section 13.1<br>– "The effects to each valued component outlined in sub-sections 14.3, 15.2, 15.3, 15.4 must be described using the following criteria:"<br>■ 21. Residual effects<br>– "Proponents must describe the extent to which residual effects are adverse. Where relevant, or where best practice or evidence-based thresholds exist, effects should be described using criteria to quantify adverse effects. (…) Where the potential for human health effects exist due to exposure to a particular contaminant at any level (e.g., non-threshold air pollutants, including particulate matter and nitrogen dioxide, and water pollutants, such as but not limited to arsenic and lead) mitigation measures should aim to reduce the residual effects to as low as reasonably achievable….<br>– The Impact Statement must:<br>• characterize the residual effects using criteria most appropriate for the effect;<br>• characterize residual effects for human health using human health-related criteria most appropriate for the carcinogenic and non-carcinogenic health effects of non-threshold contaminants;"<br>• provide the rationale for the choice of criteria used to determine the extent to which the predicted effects are adverse. The information provided must be clear and sufficient to enable the Agency, review panel, technical and regulatory agencies, Indigenous | The Agency | ■ The definition of the magnitude criteria for adverse effects proposed in Section 13.1 of the Guidelines are provided specifically for the ecological valued components described in Sections 14.3, 15.2, 15.3, and 15.4 of the Guidelines. A rationale is not provided for the use of the magnitude ranges provided in Table 6.2 for the evaluation of potential changes to air quality and associated potential for human health risks. It is noted that a change of "up to 10% above the applicable Criteria" would be considered "low" magnitude, yet there is a risk to human health any time pollutant levels are above the applicable criteria.<br>■ Furthermore, the proposed ranges do not consider residual effects from pollutant levels below the applicable criteria. For example, the Canadian Air Quality Management System (AQMS) explicitly recognizes that health effects occur below the maximum thresholds (i.e., the Canadian Ambient Air Quality Standards, or CAAQS), and proposes additional management levels in recognition of the health and environmental benefits that can be realized by taking actions to decrease or maintain background levels of air pollution.<br>■ Health Canada recommends the use of the AQMS approach, under which the CAAQS were developed, to inform the magnitude criteria definitions. The AQMS sets achievable air quality management targets (or thresholds) based on the fundamental principles of Keeping Clean Areas Clean, and Preventing Air Quality<br>■ Deterioration. More information on air quality management threshold values is available (Canadian Council of | ■ Clarify how the proposed adverse effects magnitude criteria definitions are relevant to the protection of human health in relation to air quality. | ■ The Air Quality magnitude criteria have been updated. These criteria will characterize impacts on Air Quality using Air Quality criteria that are protective of human health. More specific analysis of Human Health impacts will be conducted within the Human Health assessment as is described within the Human Health and Community Safety Study Plan | ■ Section 9.6 |

| Comment # / Ref # | Study Plan Section | TISG Section | Agency/ Regulatory Body Comments Received From | Comment / Context | Action Item | Response | Study Plan Reference |
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| | | groups, and the public to review the proponent's analysis of effects;" | | Ministers of the Environment. 2012)-(Note 4: Canadian Council of Ministers of the Environment. 2012. Guidance Document on Air Zone Management. Available at : http://www.ccme.ca/files/Resources/air/aqms/pn_1481_gdazm_e.pdf). Health Canada also encourages the proponent to use all available technologies to reduce their emissions as low as reasonably achievable (ALARA) and beyond those required to achieve maximum AQMS thresholds (i.e., CAAQS levels), in order to reduce the burden of air pollution on the population. | | | |
| AQ-11 | ■ Section 6.3 Magnitude of Effect. Table 6-3<br>– "Releases of GHGs and their accumulation in the atmosphere influence regional, national and global climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially. The magnitude is therefore established as a percent contribution to provincial totals to assess the significance of Project emissions and hence potential effect on provincial reduction targets that may exist." | ■ Section 15.5<br>– "describe how the Project may contribute to Canada's efforts to reduce GHG emissions, if applicable (e.g., the Impact Statement could explain how the Project would result in emission reductions in Canada by avoiding emissions from another source)". | The Agency | ■ The study plan should not be making a determination of the magnitude of the project's GHG emissions against national or provincial emissions or emissions targets. When compared to provincial and national GHG emissions, the project's GHG emissions will often be considered as low which does not help to contextualize the project's emissions against Canada's emissions targets. | ■ Update the study plan to reflect that the requirement to describe the residual environmental, health, social or economic effects of the project does not extend to discussing the magnitude of the Project's GHG emissions against national and provincial emissions and emissions targets. | ■ The Study Plan identifies the sources of GHGs and limits the assessment of GHGs to the specified magnitude criteria. | ■ Section 9.4.3 |
| AQ-12 | ■ Section 7 Conformance with Federal and Provincial Guidance<br>– "….will be described in the Impact Statement.<br>– The Impact statement will include….<br>– The Impact Statement will provide…. " | ■ Section 14.1 and Section 15.5 [Relevant to many requirements] | The Agency | ■ It is unclear if all requirements of Sections 14.1 and 15.5 of the Guidelines will be met. Table 7.1 provides general statements that the requirements will be included in the Impact Statement, but there is not enough information to determine how the requirements will be met. The Impact Statement must address all requirements outlined in the Guidelines and the study plan should demonstrate a clear approach to meet those requirements. | ■ Provide details on the proposed approaches and methods used to ensure that all requirements of Sections 14.1 and 15.5 of the Guidelines are met in the Impact Statement.<br>■ Provide details to demonstrate that the effects assessment will consider the effects of each of the project components and physical activities, in all phases, and be based on a comparison to the proposed baseline work. | ■ Traffic levels defined within the Project scope will be used for the Air Quality and GHG Assessment. | ■ Section 9.4 |

| Comment # / Ref # | Study Plan Section | TISG Section | Agency/ Regulatory Body Comments Received From | Comment / Context | Action Item | Response | Study Plan Reference |
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| | | | | ■ The effects assessment must consider the effects of each of the project components and physical activities, in all phases, and be based on a comparison to the proposed baseline work. The effects assessment for the operation phase must include the effect cause by all different users (traffic volume, type of vehicles, etc.), including Indigenous groups, the general public, and mining proponents of reasonably foreseeable future projects ((e.g., Eagle's Nest, Blackbird, Black Thor, Black Label, Big Daddy, anticipated future community access roads);". | ■ Provide details to demonstrate that the effects assessment for the operation phase will include the effect cause by all different users (traffic volume, type of vehicles, etc.), including Indigenous groups, the general public, and mining proponents of reasonably foreseeable future projects ((e.g., Eagle's Nest, Blackbird, Black Thor, Black Label, Big Daddy, anticipated future community access roads);". | | |
| AQ-13 | ■ Section 7.0 Conformance with Federal and Provincial Guidance<br>– "The Impact Statement will include an assessment of land use changes (e.g., wetlands or peatlands) and the resultant net GHG emissions." | ■ Section 15.5<br>– "provide a qualitative description of the Project's positive or negative effects on carbon sinks, including from the removal and alteration of wetlands" | The Agency | ■ Environment and Climate Change Canada concurs with the study plan to quantify land use change emissions and that these are estimated with the net GHG emissions of the Project. However, they note that the qualitative description of the Project's effects on carbon sinks goes beyond estimating land use change emissions. This is because some projects may improve or reduce the ability of an ecosystem, land area or ocean to absorb carbon dioxide from the atmosphere. An impact on a carbon sink implies the interruption or alteration of a natural continual process that removes carbon from the atmosphere. The qualitative description of the project's positive or negative effects on carbon sinks should include:<br>– Description of project activities in relation to significant landscape features such as topography, hydrology and regionally dominant ecosystems.<br>– Land areas directly impacted by the project, by ecosystem type (forests, cropland, grassland, | ■ Provide details to demonstrate that a qualitative description of the Project's positive or negative effects on carbon sinks will include consideration of the guidance provided by ECCC in the context column, in order to meet the requirements of Section 15.5 of the Guidelines. | ■ The qualitative description of the Project's net effects on Climate Change will include consideration of the requirements of the Government of Canada's Strategic Assessment of Climate Change (SACC) guidance document (2020, and the guidance provided by ECCC). It is expected that in following the SAAC guidance, Section 15.5 of the Guidelines will be met. | ■ Section 9.4 |

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| | | | | wetlands, built-up land) over the course of the project lifetime; this includes the areas of restored or reclaimed ecosystem(s).<br>– Initial carbon stocks in living biomass, dead biomass and soils (by ecosystem type) on land directly impacted by the project over the course of the project lifetime.<br>– Fate of carbon stocks on directly impacted land, by ecosystem type: immediate emissions, delayed emissions (timeframe), storage (e.g., in wood products).<br>– Anticipated land cover on the impacted land areas after the project is in place.<br>■ The above guidance was not included in the August 2019 draft SACC but provides more clarity on what information the study plan could provide to fulfill this requirement. This guidance, however, will be published in the forthcoming publication of the SACC (tentative publication in July 2020). | | | |
| AQ-14 | ■ Section 7 Conformance with Federal and Provincial Guidance<br>– "Considering the projected roadway volumes (200-300 vehicles per day), an assessment of the formation of ozone is not warranted." | | The Agency | ■ The Marten Falls Community Access Road Detailed Project Description states that the road "will be designed using an Annual Average Daily Traffic amount of up to 400…". It is unclear why Table 7-1 provides a different average daily traffic amount. | ■ Clarify why Table 7-1 has a different average daily traffic amount than what was described in the Detailed Project Description. Provide details to demonstrate that the effects assessment will consider the highest annual average daily traffic amount of vehicles the road is designed for, which was described as 400. | ■ The effects assessment will consider the highest AADT over the life of the Project. | ■ Section 9.4 |
| AQ-15 | ■ Section 7 Conformance with Federal Guidance<br>– "The air quality modelling will be described in detail within the Impact Statement. No chemical or physical transformation will be included in the modelling as the dispersion of emissions are | ■ Section 13.1<br>– "Predictions must be made on clearly stated assumptions and the Impact Statement must clearly describe how it has tested each assumption."<br>■ Section 14.1 | The Agency | ■ It is unclear how the requirements of Section 14.1 of the Guidelines will be met if modelling of chemical and physical transformation is not proposed. It is also unclear how it was determined that the dispersion of emissions are "generally expected to be generally low-level." | ■ Provide further detail on proposed methodologies, including the rationale, to meet the requirements of Section 14.1 of the Guidelines, including chemical and physical transformation. Provide details and rationale for describing the dispersion of emissions are | ■ Any reference to the "dispersion of emissions" being low-level within the Study Plan is unintentional. The Study Plan intended to communicate that the formation of secondary contaminants through chemical and physical transformation is expected to be | ■ Section 9.4 |

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| | generally expected to be generally low-level and near-field with respect to the Project." | – "provide details of all air quality model configuration ,including meteorology, land use, gridded and sensitive receptors and chemical and physical transformation settings;" | | | expected to be "generally low-level". | low-level based on the predicted roadway volumes. While some formation of secondary particulate is expected, the Project is in a pristine setting without large industrial or transportation sources. Secondary formation is dependent on the presence of precursor species which will be limited because of the pristine nature of the environment. Based on a projected low AADT, the emissions of precursor species are expected to be relatively dilute in the atmosphere.<br>■ Additionally, the formation of secondary contaminants is not instantaneous, and happens downwind of the source at which point the initial precursor contaminants have begun to disperse. In consideration of these factors, it is expected that assessing the near-road impacts of primary contaminants will result in a reasonably conservative Air Quality Assessment<br>■ One exception to the above is the conversion of NO to NO2. It will be conservatively assumed that 100% of all NO emitted from the Project will be converted to NO2. | |
| AQ-16 | ■ Section 7 Conformance with Federal Guidance<br>– "The potential for the Project to contribute to acid deposition will be qualitatively assessed for both the construction and operation phases. Potential for acid formation will be evaluated based on the predicted increase in NOx and SOx to the airshed and subsequent potential nitrate and sulphate formation. Acid deposition will not be | ■ Section 13.1<br>– "Predictions must be made on clearly stated assumptions and the Impact Statement must clearly describe how it has tested each assumption."<br>■ Section 14.1<br>– "assess the potential for emissions from the Project to contribute to acid deposition and exceedances of critical loads for terrestrial and aquatic ecosystems;" | The Agency | ■ It is unclear if the potential for exceedances of critical loads for terrestrial and aquatic ecosystems will be assessed, as required in Section 14.1 of the Guidelines. It is also unclear how it was determined that the magnitude of effects related to acid deposition is expected to be negligible. | ■ Provide details on how the potential for emissions from the Project to contribute to exceedances of critical loads for terrestrial and aquatic ecosystems will be assessed, to meet the requirements of Section 14.1 of the Guidelines.<br>■ Provide a rationale for determining that the magnitude of effects related to acid deposition is expected to be "negligible". | ■ Acid deposition is a regional effect, meaning that near-roadway concentrations are not as important as airshed concentrations. It is estimated that the Project will partially displace air travel with road vehicle traffic. The impact of this modal shift on the contribution of NOx and SO2 to the airshed will be assessed and a qualitative statement regarding the implications for acid deposition will be provided in the IS / EA Report. | ■ Section 9.4 |

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| | quantitatively assessed as the magnitude of effects is expected to be negligible." | | | | | ■ There will be no assessment of emissions from the Project to contribute exceedances of critical loads for terrestrial and aquatic ecosystems. There is no threshold established to determine that a specific concentration of NOX and SO2 would be detrimental to the terrestrial and aquatic valued components. | |
| AQ-17 | ■ Section 7 Conformance with Federal Guidance<br>– "The potential for the Project to contribute to ground-level ozone will be qualitatively assessed for both the construction and operation phases. Potential for the generation of ground-level ozone will be evaluated based on the predicted increase in NOx and Volatile Organic Compounds around the Project area. Ozone formation will not be quantitatively assessed as the magnitude of effects is expected to be negligible." | ■ Section 13.1<br>– "Predictions must be made on clearly stated assumptions and the Impact Statement must clearly describe how it has tested each assumption."<br>■ Section 14.1<br>– "provide an assessment of the Project's emissions potentially contributing or adding to existing ground ozone levels;" | The Agency | ■ It is unclear how it was determined that the magnitude of effects for ozone formation is expected to be negligible. | ■ Provide a rationale for determining that the magnitude of effects for ozone formation is expected to be "negligible". | ■ In the Ministry of Transportation's Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects, the MTO states that, with respect to the formation of ground-level ozone, "ground-level ozone O3 is typically formed many kilometres downwind of the source of its precursors" and "concentrations are usually depressed around highways since NO emissions react relatively rapidly to convert O3 into oxygen gas." The MTO also states that "For major roads, the collective experience of the scientific community suggests that the affected immediate vicinity is limited to the area within approximately 500 metres of the road". Based on this, the contribution of the Project to ground-level ozone is likely to be minor in comparison to the near-field concentration of precursor species (i.e., NOx). | ■ Section 9.4 |

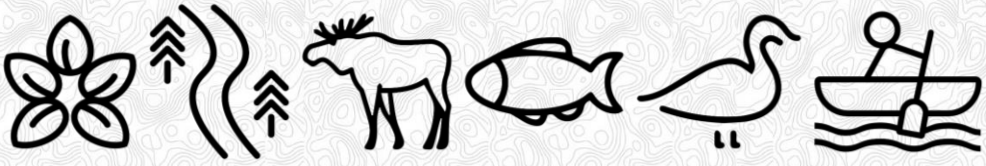
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| AQ-18 | ■ Section 7 Conformance with Federal Guidance<br>– “Baseline air quality monitoring will be used to represent the Project Area and is assumed to include in the effect of any relevant regional sources. Therefore, regional source emissions will not be quantified or included in the dispersion modelling.” | ■ Section 13.1<br>– “Predictions must be made on clearly stated assumptions and the Impact Statement must clearly describe how it has tested each assumption.”<br>■ Section 14.1<br>– "provide emission rates for all project and regional sources within the study area, including emission factors(with methodology, uncertainty assessment and references) and all assumptions and related parameters that would enable calculations to be reproduced;" | The Agency | ■ It is unclear how the requirements of Section 14.1 of the Guidelines will be met if emission rates for regional sources will not be included in the dispersion modelling. It is also unclear how it was determined that baseline air quality monitoring will include the effect of regional sources. | ■ Provide details on proposed methodologies, including rationales, to demonstrate how the studies described in the study plan will meet all requirements of Section 14.1 of the Guidelines, including emission rates for all regional sources within the study area.<br>■ Provide a rationale for how it was determined that baseline air quality monitoring will include the effect of regional sources. | ■ Baseline air quality monitoring will be used to represent the Project Area and is assumed to include in the effect of any relevant regional sources. Therefore, regional source emissions will not be quantified or included in the dispersion modelling.<br>■ The majority of sources are expected to be personal vehicles, residential heating, and other miscellaneous activities. There are no significant sources (e.g., large industries) which would contribute to emissions in the Study Area.<br>■ A conservative Air Quality Assessment is one which describes the reasonable worst-case impact of the Project. Background concentrations within Marten Falls are expected to be higher than the rest of the Study Area. Therefore, using measured concentrations in the Study Area will result in a conservative Air Quality Assessment. | ■ Section 7 |
| AQ-19 | ■ Section 7 Conformance with Federal Guidance<br>– “Identified receptor locations will be described in the Impact Statement. Differential effects will not be considered in the Atmospheric Environment assessment. The relevant criteria (AAQC, CAAQS) have been developed in consideration of effects at any applicable receptor type.” | ■ Section 14.1<br>– “describe the locations and characteristics of the most sensitive receptors including species at risk and differential effects for sensitive receptors;” | The Agency | ■ It is unclear how the locations and characteristics of sensitive receptors, including species at risk, will be identified. It is also unclear how the requirement of Section 14.1 of the Guidelines will be met if differential effects will not be considered. | ■ Provide details on how the locations and characteristics of sensitive receptors, including species at risk, will be identified.<br>■ Provide details on how the requirement in Section 14.1 of the Guidelines will be met, including differential effects for sensitive receptors. | ■ Differential effects will not be considered within the air quality assessment. The air quality assessment will consider provincial and federal criteria and standards to evaluate the Project impacts on air quality. The results of the air quality dispersion modelling assessment will be used in subsequent assessments, such as the human health assessment and ecological assessments, which will form a part of the IA / EA. It is expected that the subsequent studies will use evaluation criteria specific to the receptor types. Locations of sensitive receptors, including species at risk, will be identified in various other study plans. | ■ Fish and Fish Habitat Study Plan<br>■ Wildlife Study Plan<br>■ Vegetation Study Plan<br>■ Ungulates Study Plan<br>■ Bird Study Plan<br>■ Human Health and Community Safety Study Plan<br>■ Aboriginal and Treaty Rights and Interest Study Plan |

# Draft Study Plan Comments – Provincial

| Comment ID | Study Plan Section | Agency / Regulatory Body Comments Received From | Comment / Context | Action Item | Response | Study Plan Reference |
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| 1 | N/A | ■ MECP, Environmental Assessment Branch | ■ Please review EAB comments on the Wildlife, Ungulates and Vegetation work plans that may apply to this work plan. | ■ Please review EAB comments on the Wildlife, Ungulates and Vegetation work plans that may apply to this work plan | ■ We have reviewed the relevant comments and incorporated where appropriate. Please refer to the Comment Tables appended to the Wildlife, Ungulates and Vegetation Study Plans for specific responses. | ■ Wildlife Study Plan<br>■ Ungulates Study Plan<br>■ Vegetation Study Plan |
| 2 | General | ■ MECP, Environmental Assessment Branch | ■ Ontario's Guide for Considering Climate Change in the Environmental Assessment Process (MOECC, 2017) was not included in the draft work plan. | ■ Please indicate that Ontario's Guide for Considering Climate Change in the Environmental Assessment Process (MOECC, 2017) will be considered and applied in this work plan as it pertains to climate change | ■ Ontario's Guide for Considering Climate Change in the Environmental Process (MOECC, 2017) will be considered in the atmospheric and climate change components of the Project. | ■ Section 9.4 |
| 1 | Section 4.2.1 | ■ MECP, Air Quality Analyst | ■ One year of ambient air quality data will be collected within the Community to characterize baseline air quality as stated in the Draft Work Plan, and an airpointer is proposed to be located at the community's nursing station. Please ensure that the proposed ambient air quality monitoring will meet the minimum requirements specified in the Operations Manual for Air Quality Monitoring in Ontario. The Draft Work Plan states that the collection of one full year of data may not be possible due to unforeseen circumstances such as power outages or equipment failure. For continuous air monitoring, a minimum target of 90% valid data collection per quarter per parameter can be routinely attained, and at least 75% of valid data are required to calculate the valid mean. Please ensure enough valid data to be obtained from the proposed air monitoring program to establish baseline air quality for the project site.<br>■ The work plan provides approaches that will be used to estimate baseline air quality for some contaminants if these contaminants cannot be sampled for due to equipment limitations, i.e., PAH, diesel PM, and some VOC compounds, etc. How about TSP and PM10? | ■ To ensure that the data collected is accurate and acceptable to the MECP, please include a discussion on how the proposed air quality monitoring activities will meet the requirements of the Operations Manual for Air Quality Monitoring in Ontario.<br>■ Describe how the baseline concentrations of TSP and PM10 will be estimated for the proposed project site if these contaminants will not be monitored. | ■ MECP will be consulted regarding the implementation of the monitoring program. An Air Quality Monitoring Plan that conforms with the requirements of the MECP Operations Manual for Air Quality Monitoring in Ontario will be developed. Deviations from the manual may be required due to the location of the Project. Deviations will be reviewed with the MECP and documented in the Air Quality Monitoring Plan. | ■ Section 3 and Section 7.2.1 |
| 2 | Section 6.1 | ■ MECP, Air Quality Analyst | ■ There is a typo in Table 6-1: Atmospheric Environment Indicator. It should be SO2 instead of SO. | ■ Please correct the typo in Table 6-1. | ■ This has been corrected | ■ N/A |
| 3 | Section 6.2.2 | ■ MECP, Air Quality Analyst | ■ Project-specific meteorological data, generated from US Weather Research and Forecasting Model (WRF), will be used in the air dispersion modelling assessments as indicated in the Draft Work Plan. Air Dispersion Modelling Guideline for Ontario (ADMGO) states that if data other than the ministry's Regional Meteorological data sets are used in air dispersion modelling assessments, careful quality control must be used throughout the entire processing phase to ensure that the data set is complete and representative of the site being modelled. Section 6.4.1 of the ADMGO also lists the ministry's expectations for local meteorological data use, and there are different expectations for raw data obtained from Environment Canada, on-site meteorological stations, or data generated by advanced meteorological models. | ■ It is strongly recommended that the modeller consult with Environmental Monitoring and Reporting Branch (EMRB) for guidance in advance of running the meteorological model. Please copy Sasha McLeod and Shannon Gauthier on this outreach, and please contact us if you need a contact name. | ■ EMRB will be consulted in the selection and use of meteorological data for the air quality assessment | ■ Section 9.4 |

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| 4 | Section 6.3 | ■ MECP, Air Quality Analyst | ■ Air quality magnitude definition is proposed and listed in Table 6-2. The draft work plan indicates that the air quality magnitude definition is aligned with the IAAC evaluation criteria presented in the Tailored Impact Statement Guidelines. It should be noted that these criteria are used for evaluating species and ecosystem risk.<br>■ It may be more appropriate to describe the definition of air quality magnitude using the general approach as follows, i.e., the magnitude is low if the air quality level is well below the applicable criteria, and moderate if the air quality level is close to the criteria, but still below the criteria, and high if the air quality level is well above the criteria. In addition, the frequency of exceedances should also be included to assess the residue effects if the air quality level is well above the criteria | ■ Please describe the air quality magnitude definition using an appropriate approach. | ■ The magnitude definitions have been updated within the Study Plan. | ■ Section 9.6 |
| 1 | Section 4.2.1, page 6 | ■ MTO, Transportation Infrastructure Management Division | ■ The list of contaminants to be monitored is appropriate. The study plan notes that diesel particulate matter is of interest. Please clarify how results related to diesel particulate matter will be interpreted given that there are no provincial or federal ambient air quality standards. | ■ The Near-Road Air Pollution Pilot Study by the University of Toronto includes a discussion on potential standards for diesel exhaust. Consider consulting this or any other relevant documents. | ■ Appropriate toxicological literature and studies will be consulted when interpreting results related to DPM. | ■ Section 7.2 |
| 2 | Section 6.2.1.2, Page 8 | ■ MTO, Transportation Infrastructure Management Division | ■ It is recommended that non-tailpipe emissions such as brake and tire wear are also included. | ■ Include non-tailpipe emissions into the air quality analysis. These are readily available through the MOVES model. | ■ Non-tailpipe emissions will be included with emission calculations/quantification. | ■ Section 9.4 |

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DILLON CONSULTING

MARTEN FALLS FIRST NATION

# Ambient Air Quality Monitoring Plan

August, 2021 – 18-8898

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# 1.0 Background

Marten Falls First Nation (the Community) is a remote First Nation community in northern Ontario located at the junction of the Albany and Ogoki rivers, approximately 430 kilometres (km) north of Thunder Bay, Ontario. Figure 1 below shows the community location.



**Figure 1: Marten Falls First Nation Community Location**

The Community is proposing an all-season Community Access Road (CAR; the Project) that will connect the Community to Ontario's provincial highway network (Highway 643) to the south via the existing Painter Lake Road. This ambient air quality monitoring plan has been completed to support a coordinated Impact Assessment (IA) required by the Impact Assessment Agency of Canada (IAAC) under the federal Impact Assessment Act and Environmental Assessment (EA) required by the Ministry of the Environment, Conservation and Parks (MECP) under the Ontario Environmental Assessment Act.

# 2.0 Purpose/Objectives of the Monitoring Plan

The monitoring program will characterize the existing conditions within Marten Falls to inform the air quality impact assessment. Baseline monitoring for the remainder of the Project Study Area (PSA) is not feasible given the remote nature of the Project corridor and lack of access to power and service access (to maintain equipment).

Ambient contaminant concentrations will be continuously monitored. The results will be statistically summarized based on the averaging period of the applicable standards and criteria. The May 2021 Marten Falls First Nation Atmospheric Environment and Greenhouse Gases (GHG) Study Plan[1] describes how the monitored concentrations collected within the Community will be considered to be representative of all locations within the community and will be used to help establish background concentrations within the PSA.

# 3.0 Expected Duration of the Monitoring Program

The monitoring program is to be conducted over the period of up to one (1) year. Deployment of the monitoring equipment occurred in May 2021. It should be noted that the collection of one full year of data is not likely due to circumstances such as power outages or equipment failure that may occur. A minimum target of 75% data capture is specified within the MECP Operations Manual for Air Quality Monitoring in Ontario (MECP Manual)[2]. This data capture percentage is recognized and will be targeted through the program. In the event that 75% data capture is unlikely to be achieved, Dillon will revisit the monitoring plan, in consultation with MFFN and the MECP and with consideration of the averaging periods of compounds being monitored and trends in the dataset, to assess the robustness of the data set and any additional actions required (e.g., extending the sampling period).

# 4.0 Identified and Suspected Air Emission Sources

The Community is a remote First Nation in northern Ontario located at the junction of the Albany and Ogoki rivers, approximately 430 kilometres (km) from Thunder Bay, Ontario. There are currently no industrial facilities, heavily used transportation routes such as major highways, and no large residential developments. The Community population is less than 1000 people. Suspected air emission sources within the Community include airport activity, community power generation by a large diesel generator, personal vehicles, heating oil used for residential heating, and open fire burning.

[1] Dillon Consulting Limited. May 2021. Marten Falls First Nation Study Plan – Atmospheric Environment and Greenhouse Gases (GHG) Study Plan

[2] Ministry of the Environment, Conservation and Parks. 2019. Operations Manual For Air Quality Monitoring in Ontario

# 5.0 Identified and Suspected Receptors

Receptors within the PSA include local residential dwellings and the natural environment. The air quality assessment will inform assessments for human health, wildlife, and vegetation. The concentrations collected within the Community will be considered to be representative of baseline values at all receptor locations. The Canadian Ambient Air Quality Standards (CAAQS) and Ontario's Ambient Air Quality Criteria will be considered in this assessment and used to evaluate impacts on air quality.

# 6.0 Location of Monitoring Site & Monitoring Equipment

An enclosed trailer equipped with air monitoring equipment was installed within Marten Falls located by the Community's nursing station (51.638645, -85.929023). The air monitoring equipment is connected to satellite communication so instrument diagnostics and data can be sent on a daily frequency. Monitoring within the Community is necessary based on the power requirements of the equipment, as well as to allow for daily inspections of the monitor and for maintenance activities such as clearing snow from around the monitor. Attempts were made to adhere to station and probe siting criteria documented in the MECP Manual, however due to the location of project, and limited power supply option, it was not possible to meet all the criteria. The MECP Manual indicates that metrological parameters are recommended to be taken from a height of 10 metres. For this project a 4.75 metre tower height was achievable and deployed.

Deviations from the MECP Manual will be documented in data reporting. Figure 2 below shows the proposed location of the monitor.



**Figure 2: Monitor Location**

Figure 3 below shows the location of the monitor in reference to a generator located at the airport. The location of the monitor has a separation distance of approximately 2.6 km. This distance is sufficient to minimize the potential for the generator to bias monitoring results.

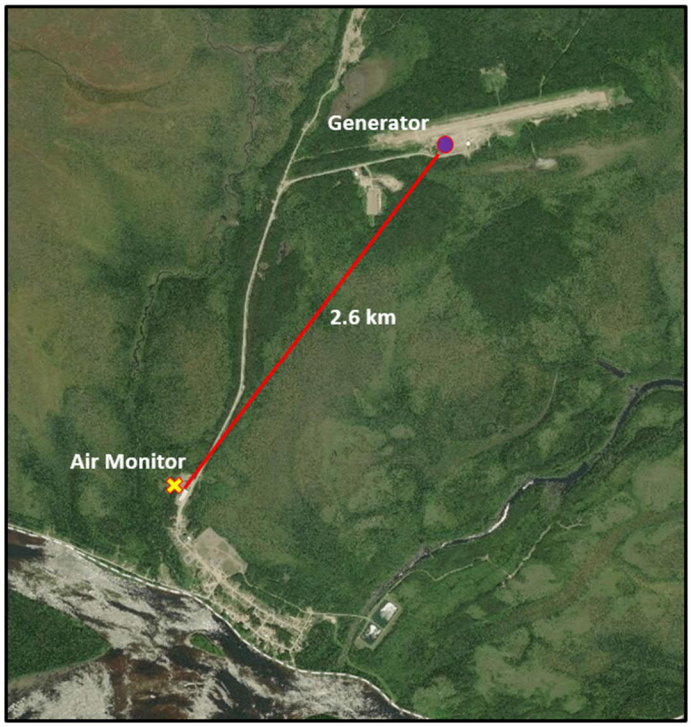



**Figure 3: Generator Location in Reference to Monitor**

# 7.0 Air Quality Parameters to be Monitored and the Monitoring Frequency

The air monitoring equipment deployed in the Community will monitor:

- Particulate matter ($PM_{2.5}$ and $PM_{10}$);
- Ozone ($O_3$), nitrogen oxides ($NO_x$);
- Sulphur dioxide ($SO_2$);
- BTEX (benzene, toluene, ethylbenzene, and xylene); and,
- Meteorological parameters including: wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation.

The air monitoring equipment will be deployed for up to one year to try to capture seasonal variations in baseline concentration. All parameters can be recorded in both 5 minute and hourly data resolution with the exception of VOC/BTEX which will be collected on a six (6) day schedule using a Xontech 910 canister sampler. .

# 8.0 Analytical Methods/Procedures

The air monitoring trailer contains multiple analyzer units which utilize a number of modules to monitor specific species. Below is a summary of the methods the equipment uses to analyze each contaminant:

| Contaminant | Detection Method |
|---|---|
| Particulate Matter ($PM_{2.5}$)[1] | Nephelometry |
| Ozone ($O_3$) | UV absorption (EN 14625) |
| Nitrogen Oxides ($NO_x$) | Chemiluminescence (EN14211) |
| Sulphur Dioxide ($SO_2$) | UV fluorescence (EN14212) |
| BTEX (benzene, toluene, ethylbenzene, and xylene) | Canister Method TO-15, GC/MS |

*[1] The air monitoring trailer is equipped with a $PM_{2.5}$ sensor, other particulate matter size fractions (TSP and $PM_{10}$) will be calculated from $PM_{2.5}$ results.*

BTEX and particulate matter will be used as surrogates for polycyclic aromatic hydrocarbons and diesel particulate matter which cannot be sampled for due to equipment limitations coupled with serviceability challenges given the remote location of the community. Concentrations of specific relevant contaminants such as acetaldehyde, formaldehyde, 1,3- butadiene, and acrolein will be estimated based on monitored BTEX concentrations and published emission factors, such as the United Stated Environmental Protection Agency's (US EPA) AP-42 emissions database.

# 9.0 QA/QC Plan

Quality assurance measures are implemented to ensure data integrity. The operation, service and maintenance of the station and sampling equipment are in accordance with both the manufacturers' operating manuals and the protocols outlined in the MECP's 'Operations Manual for Air Quality Monitoring in Ontario.

The following quality control measures will be implemented to help ensure consistent data capture to meet the MECP protocols:

- The station installation will be best sited to meet criteria as outlined in the MECP Operation Manual for Air Quality Monitoring in Ontario (MECP, 2019);
- Selected monitoring equipment will be EPA designated and verified prior to use with NIST traceable calibration standards;
- Station temperature will be monitored and reported to help ensure adequate control of interior temperature;
- Gaseous analysers will include Internal Zero / Span options so that automatic instrument response checks can be conducted nightly to assess ongoing performance such as zero / span drift, repeatability and response time to adhere to the MECP reporting practices;
- VOC sampling will be conducted on a 6 day schedule (NAPS) using a Xontech 910 canister sampler. The sampler will be audited quarterly. Exposed samples will be shipped to the laboratory on a schedule not to jeopardize sample integrity;
- VOC analysis will be conducted by an accredited laboratory as per the MECP protocols;
- Instrument status and operation checks will be conducted and logged weekly by field monitors;
- Monitoring instrumentation will be audited at quarterly intervals using NIST certified standards;
- Meteorological instrumentation will be audited upon installation and annually as per the MECP protocols;
- Back-up or duplicate instrumentation will be made available to minimize data loss or if reported data are questionable;
- Data will be transmitted daily from the station via satellite communications. Manual download protocol available if needed;
- Data will be reviewed daily and quality assured by experienced and qualified analysts. Data will be subjected to various QA / QC tests prior to release; and

- A Data Edit log will be implemented and retained for the data set. Data reports will be submitted monthly.

# *10.0* Data Reporting Procedures

The data logger will format a report each day which will submitted via satellite transmission to a server located at Rotek Environmental in Hamilton, Ontario. The data are then verified, quality assured and archived in a central database. The central database server is backed up daily for contingency. A monthly report will be submitted to client in Excel format and include both hourly and five minute data, statistics and an exceedance summary as per applicable AAQC's, Standards and Guidelines. All data review and editing will be conducted by experienced staff and in accordance with Ministry protocols.

A back up protocol will be implemented to manually download data from the site in the event of issues with satellite communications. The data will be retrieved and emailed to the Rotek server by a local community member field technician trained by Rotek.

# Attachment B – Tables

**Table A1 - MFCAR Source Summary Table**
**1hr Averaging Period**

| Source IDs | Source Description | Contaminant | CAS # | Emission Rate | Averaging Period | Data Quality | Estimation | Percent of Overall |
|---|---|---|---|---|---|---|---|---|
| | | | | [g/s] | [hours] | | | Emissions |
| QURRY_29 | Quarry Drilling and Material Handling (Drilling, Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.4E-01 | 1-hr | Above Average | Emission Factor | 2.8% |
| | | Carbon Monoxide (CO) | 630-08-0 | 4.8E-02 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Sulfur Dioxide (SO2) | 2025884 | 4.2E-04 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 2.1E-04 | 1-hr | Above Average | Emission Factor | 24.0% |
| | | Acetaldehyde | 75-07-0 | 8.9E-04 | 1-hr | Above Average | Emission Factor | 22.1% |
| BLAST_6 | Quarry Aggregate Blasting (Blasting Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 2.8E+00 | 1-hr | Above Average | Emission Factor | 56.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E+02 | 1-hr | Above Average | Emission Factor | 93.8% |
| | | Sulfur Dioxide (SO2) | 2025884 | 1.4E+01 | 1-hr | Above Average | Emission Factor | 98.3% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| ACCESS_8 | Quarry Access Road Traffic (Material Haul Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 6.8E-02 | 1-hr | Above Average | Emission Factor | 1.4% |
| | | Carbon Monoxide (CO) | 630-08-0 | 4.4E-02 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Sulfur Dioxide (SO2) | 2025884 | 6.6E-05 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 4.1E-06 | 1-hr | Above Average | Emission Factor | 0.5% |
| | | Acetaldehyde | 75-07-0 | 3.6E-05 | 1-hr | Above Average | Emission Factor | 0.9% |
| | | Benzene | 71-43-2 | 2.3E-06 | 1-hr | Above Average | Emission Factor | 0.1% |
| QURRY_23 to QURRY_28 | Sand and Gravel Material Handling (Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.4E-01 | 1-hr | Above Average | Emission Factor | 2.8% |
| | | Carbon Monoxide (CO) | 630-08-0 | 4.8E-02 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Sulfur Dioxide (SO2) | 2025884 | 4.2E-04 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 2.1E-04 | 1-hr | Above Average | Emission Factor | 24.0% |
| | | Acetaldehyde | 75-07-0 | 8.9E-04 | 1-hr | Above Average | Emission Factor | 22.1% |
| BRIDGE_20 | Bridge Building Equipment (Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 2.0E-01 | 1-hr | Above Average | Emission Factor | 4.1% |
| | | Carbon Monoxide (CO) | 630-08-0 | 6.3E-02 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Sulfur Dioxide (SO2) | 2025884 | 9.8E-04 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 2.9E-04 | 1-hr | Above Average | Emission Factor | 33.3% |
| | | Acetaldehyde | 75-07-0 | 1.4E-03 | 1-hr | Above Average | Emission Factor | 34.9% |
| ROAD_242 | Road Construction Sources (Clearing, Mobile Equipment, Material Handling) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.5E-01 | 1-hr | Above Average | Emission Factor | 2.9% |
| | | Carbon Monoxide (CO) | 630-08-0 | 5.6E-02 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Sulfur Dioxide (SO2) | 2025884 | 8.6E-04 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 1.6E-04 | 1-hr | Above Average | Emission Factor | 18.3% |
| | | Acetaldehyde | 75-07-0 | 8.1E-04 | 1-hr | Above Average | Emission Factor | 20.0% |
| ROAD_BLAST | Road Blasting (Blasting on roadway) | Oxides of Nitrogen (NOx) | 11104-93-1 | 5.0E-02 | 1-hr | Above Average | Emission Factor | 1.0% |
| | | Carbon Monoxide (CO) | 630-08-0 | 4.3E+00 | 1-hr | Above Average | Emission Factor | 1.7% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.5E-01 | 1-hr | Above Average | Emission Factor | 1.7% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| WOOD | Burning And Chipping | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.4E+00 | 1-hr | Above Average | Emission Factor | 28.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.1E+01 | 1-hr | Above Average | Emission Factor | 4.4% |
| | | Sulfur Dioxide (SO2) | 2025884 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 1-hr | Above Average | Emission Factor | 0.0% |

**Table A2 - MFCAR Source Summary Table**
**24hr Averaging Period**

| Source IDs | Source Description | Contaminant | CAS # | Emission Rate [g/s] | Averaging Period [hours] | Data Quality | Estimation | Percent of Overall Emissions |
|---|---|---|---|---|---|---|---|---|
| QURRY_29 | Quarry Drilling and Material Handling (Drilling, Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.1E-02 | 24-hr | Above Average | Emission Factor | 6.7% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.1E-04 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 1.0E-04 | 24-hr | Above Average | Emission Factor | 24.0% |
| | | Acetaldehyde | 75-07-0 | 4.5E-04 | 24-hr | Above Average | Emission Factor | 22.2% |
| | | Benzene | 71-43-2 | 1.8E-04 | 24-hr | Above Average | Emission Factor | 22.0% |
| | | Formaldehyde | 50-00-0 | 1.2E-03 | 24-hr | Above Average | Emission Factor | 22.8% |
| | | 1,3-Butadiene | 106-99-0 | 8.5E-06 | 24-hr | Above Average | Emission Factor | 1.3% |
| | | Toluene | 108-88-3 | 1.4E-04 | 24-hr | Above Average | Emission Factor | 18.9% |
| | | Ethyl Benzene | 100-41-4 | 3.6E-05 | 24-hr | Above Average | Emission Factor | 0.3% |
| | | Xylene | 1330-20-7 | 1.3E-04 | 24-hr | Above Average | Emission Factor | 18.9% |
| | | PM2.5 | NA_PM2.5 | 1.8E-01 | 24-hr | Above Average | Emission Factor | 8.8% |
| | | PM10 | NA_PM10 | 3.0E-01 | 24-hr | Above Average | Emission Factor | 6.7% |
| | | TSP | NA_TSP | 6.1E-01 | 24-hr | Above Average | Emission Factor | 5.0% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.0E-08 | 24-hr | Above Average | Emission Factor | 14.3% |
| | | Diesel Particulate Matter | NA_DPM | 4.2E-03 | 24-hr | Above Average | Emission Factor | 23.0% |
| BLAST_6 | Quarry Aggregate Blasting (Blasting Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.2E-01 | 24-hr | Above Average | Emission Factor | 11.0% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.0E+01 | 24-hr | Above Average | Emission Factor | 47.4% |
| | | Sulfur Dioxide (SO2) | 2025884 | 5.9E-01 | 24-hr | Above Average | Emission Factor | 95.1% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | 1,3-Butadiene | 106-99-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Toluene | 108-88-3 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Ethyl Benzene | 100-41-4 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Xylene | 1330-20-7 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | PM2.5 | NA_PM2.5 | 1.3E-02 | 24-hr | Above Average | Emission Factor | 0.6% |
| | | PM10 | NA_PM10 | 2.2E-01 | 24-hr | Above Average | Emission Factor | 4.8% |
| | | TSP | NA_TSP | 4.2E-01 | 24-hr | Above Average | Emission Factor | 3.5% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| ACCESS_8 | Quarry Access Road Traffic (Material Haul Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 2.8E-02 | 24-hr | Above Average | Emission Factor | 2.7% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.8E-02 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.8E-05 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 1.7E-06 | 24-hr | Above Average | Emission Factor | 0.4% |
| | | Acetaldehyde | 75-07-0 | 1.5E-05 | 24-hr | Above Average | Emission Factor | 0.7% |
| | | Benzene | 71-43-2 | 9.4E-07 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Formaldehyde | 50-00-0 | 1.7E-05 | 24-hr | Above Average | Emission Factor | 0.3% |
| | | 1,3-Butadiene | 106-99-0 | 3.3E-07 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Toluene | 108-88-3 | 5.3E-06 | 24-hr | Above Average | Emission Factor | 0.7% |
| | | Ethyl Benzene | 100-41-4 | 3.2E-06 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Xylene | 1330-20-7 | 2.2E-05 | 24-hr | Above Average | Emission Factor | 3.2% |
| | | PM2.5 | NA_PM2.5 | 2.0E-01 | 24-hr | Above Average | Emission Factor | 10.1% |
| | | PM10 | NA_PM10 | 2.1E+00 | 24-hr | Above Average | Emission Factor | 46.0% |
| | | TSP | NA_TSP | 7.2E+00 | 24-hr | Above Average | Emission Factor | 59.8% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 4.9E-09 | 24-hr | Above Average | Emission Factor | 3.5% |
| | | Diesel Particulate Matter | NA_DPM | 4.8E-04 | 24-hr | Above Average | Emission Factor | 2.6% |
| QURRY_23 to QURRY_28 | Sand and Gravel Material Handling (Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.1E-02 | 24-hr | Above Average | Emission Factor | 6.7% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.1E-04 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 1.0E-04 | 24-hr | Above Average | Emission Factor | 24.0% |
| | | Acetaldehyde | 75-07-0 | 4.5E-04 | 24-hr | Above Average | Emission Factor | 22.2% |
| | | Benzene | 71-43-2 | 1.8E-04 | 24-hr | Above Average | Emission Factor | 22.0% |
| | | Formaldehyde | 50-00-0 | 1.2E-03 | 24-hr | Above Average | Emission Factor | 22.8% |
| | | 1,3-Butadiene | 106-99-0 | 8.5E-06 | 24-hr | Above Average | Emission Factor | 1.3% |
| | | Toluene | 108-88-3 | 1.4E-04 | 24-hr | Above Average | Emission Factor | 18.9% |
| | | Ethyl Benzene | 100-41-4 | 3.6E-05 | 24-hr | Above Average | Emission Factor | 0.3% |
| | | Xylene | 1330-20-7 | 1.3E-04 | 24-hr | Above Average | Emission Factor | 18.9% |
| | | PM2.5 | NA_PM2.5 | 4.0E-02 | 24-hr | Above Average | Emission Factor | 2.0% |
| | | PM10 | NA_PM10 | 1.8E-01 | 24-hr | Above Average | Emission Factor | 4.0% |
| | | TSP | NA_TSP | 3.7E-01 | 24-hr | Above Average | Emission Factor | 3.1% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.0E-08 | 24-hr | Above Average | Emission Factor | 14.3% |
| | | Diesel Particulate Matter | NA_DPM | 4.2E-03 | 24-hr | Above Average | Emission Factor | 23.0% |
| BRIDGE_20 | Bridge Building Equipment (Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.0E-01 | 24-hr | Above Average | Emission Factor | 9.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 3.1E-02 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Sulfur Dioxide (SO2) | 2025884 | 4.9E-04 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Acrolein | 107-02-8 | 1.5E-04 | 24-hr | Above Average | Emission Factor | 33.3% |
| | | Acetaldehyde | 75-07-0 | 7.0E-04 | 24-hr | Above Average | Emission Factor | 35.0% |
| | | Benzene | 71-43-2 | 3.0E-04 | 24-hr | Above Average | Emission Factor | 36.5% |
| | | Formaldehyde | 50-00-0 | 1.8E-03 | 24-hr | Above Average | Emission Factor | 35.2% |
| | | 1,3-Butadiene | 106-99-0 | 1.2E-05 | 24-hr | Above Average | Emission Factor | 1.9% |
| | | Toluene | 108-88-3 | 2.4E-04 | 24-hr | Above Average | Emission Factor | 32.4% |
| | | Ethyl Benzene | 100-41-4 | 5.5E-05 | 24-hr | Above Average | Emission Factor | 0.4% |
| | | Xylene | 1330-20-7 | 2.3E-04 | 24-hr | Above Average | Emission Factor | 32.9% |
| | | PM2.5 | NA_PM2.5 | 5.6E-03 | 24-hr | Above Average | Emission Factor | 0.3% |
| | | PM10 | NA_PM10 | 5.7E-03 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | TSP | NA_TSP | 5.7E-03 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.8E-08 | 24-hr | Above Average | Emission Factor | 20.2% |
| | | Diesel Particulate Matter | NA_DPM | 5.6E-03 | 24-hr | Above Average | Emission Factor | 30.4% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ROAD_242 | Road Construction Sources (Clearing, Mobile Equipment, Material Handling) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.1E-02 | 24-hr | Above Average | Emission Factor | 6.6% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Sulfur Dioxide (SO2) | 2025884 | 4.2E-04 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | Acrolein | 107-02-8 | 8.0E-05 | 24-hr | Above Average | Emission Factor | 18.3% |
| | | Acetaldehyde | 75-07-0 | 4.0E-04 | 24-hr | Above Average | Emission Factor | 19.9% |
| | | Benzene | 71-43-2 | 1.6E-04 | 24-hr | Above Average | Emission Factor | 19.3% |
| | | Formaldehyde | 50-00-0 | 9.9E-04 | 24-hr | Above Average | Emission Factor | 18.9% |
| | | 1,3-Butadiene | 106-99-0 | 6.6E-06 | 24-hr | Above Average | Emission Factor | 1.0% |
| | | Toluene | 108-88-3 | 1.4E-04 | 24-hr | Above Average | Emission Factor | 19.0% |
| | | Ethyl Benzene | 100-41-4 | 3.7E-05 | 24-hr | Above Average | Emission Factor | 0.3% |
| | | Xylene | 1330-20-7 | 1.8E-04 | 24-hr | Above Average | Emission Factor | 26.0% |
| | | PM2.5 | NA_PM2.5 | 4.5E-01 | 24-hr | Above Average | Emission Factor | 22.3% |
| | | PM10 | NA_PM10 | 5.4E-01 | 24-hr | Above Average | Emission Factor | 12.1% |
| | | TSP | NA_TSP | 1.7E+00 | 24-hr | Above Average | Emission Factor | 14.0% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.1E-08 | 24-hr | Above Average | Emission Factor | 15.3% |
| | | Diesel Particulate Matter | NA_DPM | 3.9E-03 | 24-hr | Above Average | Emission Factor | 21.0% |
| ROAD_BLAST | Road Blasting (Blasting on roadway) | Oxides of Nitrogen (NOx) | 11104-93-1 | 5.9E-03 | 24-hr | Above Average | Emission Factor | 0.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 5.0E-01 | 24-hr | Above Average | Emission Factor | 2.4% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.9E-02 | 24-hr | Above Average | Emission Factor | 4.7% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | 1,3-Butadiene | 106-99-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Toluene | 108-88-3 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Ethyl Benzene | 100-41-4 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Xylene | 1330-20-7 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | PM2.5 | NA_PM2.5 | 1.8E-04 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | PM10 | NA_PM10 | 3.1E-03 | 24-hr | Above Average | Emission Factor | 0.1% |
| | | TSP | NA_TSP | 6.0E-03 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Total BaP (Particulate and Gas) | NA_TSP | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| WOOD | Burning And Chipping | Oxides of Nitrogen (NOx) | 11104-93-1 | 6.0E-01 | 24-hr | Above Average | Emission Factor | 56.3% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.1E+01 | 24-hr | Above Average | Emission Factor | 49.7% |
| | | Sulfur Dioxide (SO2) | 2025884 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 1.5E-08 | 24-hr | Above Average | Emission Factor | 0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0% |
| | | 1,3-Butadiene | 106-99-0 | 6.1E-04 | 24-hr | Above Average | Emission Factor | 94% |
| | | Toluene | 108-88-3 | 7.4E-05 | 24-hr | Above Average | Emission Factor | 10% |
| | | Ethyl Benzene | 100-41-4 | 1.3E-02 | 24-hr | Above Average | Emission Factor | 99% |
| | | Xylene | 1330-20-7 | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0% |
| | | PM2.5 | NA_PM2.5 | 1.1E+00 | 24-hr | Above Average | Emission Factor | 56% |
| | | PM10 | NA_PM10 | 1.2E+00 | 24-hr | Above Average | Emission Factor | 26% |
| | | TSP | NA_TSP | 1.8E+00 | 24-hr | Above Average | Emission Factor | 15% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 4.5E-08 | 24-hr | Above Average | Emission Factor | 32% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | 24-hr | Above Average | Emission Factor | 0% |

**Tbale A3 - MFCAR Source Summary Table**
**Annual Averaging Period**

| Source IDs | Source Description | Contaminant | CAS # | Emission Rate [g/s] | Averaging Period [hours] | Data Quality | Estimation | Percent of Overall Emissions |
|---|---|---|---|---|---|---|---|---|
| QURRY_29 | Quarry Drilling and Material Handling (Drilling, Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.1E-02 | Annual | Above Average | Emission Factor | 23.8% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | Annual | Above Average | Emission Factor | 2.2% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.1E-04 | Annual | Above Average | Emission Factor | 0.5% |
| | | Acrolein | 107-02-8 | 1.0E-04 | Annual | Above Average | Emission Factor | 29.2% |
| | | Acetaldehyde | 75-07-0 | 4.5E-04 | Annual | Above Average | Emission Factor | 27.5% |
| | | Benzene | 71-43-2 | 1.8E-04 | Annual | Above Average | Emission Factor | 27.1% |
| | | Formaldehyde | 50-00-0 | 1.2E-03 | Annual | Above Average | Emission Factor | 27.9% |
| | | 1,3-Butadiene | 106-99-0 | 8.5E-06 | Annual | Above Average | Emission Factor | 18.2% |
| | | Toluene | 108-88-3 | 1.4E-04 | Annual | Above Average | Emission Factor | 26.3% |
| | | Ethyl Benzene | 100-41-4 | 3.6E-05 | Annual | Above Average | Emission Factor | 7.2% |
| | | Xylene | 1330-20-7 | 1.3E-04 | Annual | Above Average | Emission Factor | 25.4% |
| | | PM2.5 | NA_PM2.5 | 1.8E-01 | Annual | Above Average | Emission Factor | 53.8% |
| | | PM10 | NA_PM10 | 3.0E-01 | Annual | Above Average | Emission Factor | 23.6% |
| | | TSP | NA_TSP | 6.1E-01 | Annual | Above Average | Emission Factor | 16.4% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.0E-08 | Annual | Above Average | Emission Factor | 21.2% |
| | | Diesel Particulate Matter | NA_DPM | 4.2E-03 | Annual | Above Average | Emission Factor | 28.9% |
| BLAST_6 | Quarry Aggregate Blasting (Blasting Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.8E-03 | Annual | Above Average | Emission Factor | 2.6% |
| | | Carbon Monoxide (CO) | 630-08-0 | 6.6E-01 | Annual | Above Average | Emission Factor | 60.9% |
| | | Sulfur Dioxide (SO2) | 2025884 | 3.9E-02 | Annual | Above Average | Emission Factor | 95.7% |
| | | Acrolein | 107-02-8 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | 1,3-Butadiene | 106-99-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Toluene | 108-88-3 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Ethyl Benzene | 100-41-4 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Xylene | 1330-20-7 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | PM2.5 | NA_PM2.5 | 8.3E-04 | Annual | Above Average | Emission Factor | 0.2% |
| | | PM10 | NA_PM10 | 1.4E-02 | Annual | Above Average | Emission Factor | 1.1% |
| | | TSP | NA_TSP | 2.8E-02 | Annual | Above Average | Emission Factor | 0.7% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| ACCESS_8 | Quarry Access Road Traffic (Material Haul Operations) | Oxides of Nitrogen (NOx) | 11104-93-1 | 2.8E-02 | Annual | Above Average | Emission Factor | 9.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.8E-02 | Annual | Above Average | Emission Factor | 1.7% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.8E-05 | Annual | Above Average | Emission Factor | 0.1% |
| | | Acrolein | 107-02-8 | 1.7E-06 | Annual | Above Average | Emission Factor | 0.5% |
| | | Acetaldehyde | 75-07-0 | 1.5E-05 | Annual | Above Average | Emission Factor | 0.9% |
| | | Benzene | 71-43-2 | 9.4E-07 | Annual | Above Average | Emission Factor | 0.1% |
| | | Formaldehyde | 50-00-0 | 1.7E-05 | Annual | Above Average | Emission Factor | 0.4% |
| | | 1,3-Butadiene | 106-99-0 | 3.3E-07 | Annual | Above Average | Emission Factor | 0.7% |
| | | Toluene | 108-88-3 | 5.3E-06 | Annual | Above Average | Emission Factor | 1.0% |
| | | Ethyl Benzene | 100-41-4 | 3.2E-06 | Annual | Above Average | Emission Factor | 0.6% |
| | | Xylene | 1330-20-7 | 2.2E-05 | Annual | Above Average | Emission Factor | 4.3% |
| | | PM2.5 | NA_PM2.5 | 7.6E-02 | Annual | Above Average | Emission Factor | 22.7% |
| | | PM10 | NA_PM10 | 7.6E-01 | Annual | Above Average | Emission Factor | 59.2% |
| | | TSP | NA_TSP | 2.6E+00 | Annual | Above Average | Emission Factor | 71.5% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 4.9E-09 | Annual | Above Average | Emission Factor | 5.2% |
| | | Diesel Particulate Matter | NA_DPM | 4.8E-04 | Annual | Above Average | Emission Factor | 3.3% |
| QURRY_23 to QURRY_28 | Sand and Gravel Material Handling (Material Drop Operations, Crushing, Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 7.1E-02 | Annual | Above Average | Emission Factor | 23.8% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | Annual | Above Average | Emission Factor | 2.2% |
| | | Sulfur Dioxide (SO2) | 2025884 | 2.1E-04 | Annual | Above Average | Emission Factor | 0.5% |
| | | Acrolein | 107-02-8 | 1.0E-04 | Annual | Above Average | Emission Factor | 29.2% |
| | | Acetaldehyde | 75-07-0 | 4.5E-04 | Annual | Above Average | Emission Factor | 27.5% |
| | | Benzene | 71-43-2 | 1.8E-04 | Annual | Above Average | Emission Factor | 27.1% |
| | | Formaldehyde | 50-00-0 | 1.2E-03 | Annual | Above Average | Emission Factor | 27.9% |
| | | 1,3-Butadiene | 106-99-0 | 8.5E-06 | Annual | Above Average | Emission Factor | 18.2% |
| | | Toluene | 108-88-3 | 1.4E-04 | Annual | Above Average | Emission Factor | 26.3% |
| | | Ethyl Benzene | 100-41-4 | 3.6E-05 | Annual | Above Average | Emission Factor | 7.2% |
| | | Xylene | 1330-20-7 | 1.3E-04 | Annual | Above Average | Emission Factor | 25.4% |
| | | PM2.5 | NA_PM2.5 | 2.8E-02 | Annual | Above Average | Emission Factor | 8.5% |
| | | PM10 | NA_PM10 | 1.5E-01 | Annual | Above Average | Emission Factor | 12.0% |
| | | TSP | NA_TSP | 3.2E-01 | Annual | Above Average | Emission Factor | 8.7% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.0E-08 | Annual | Above Average | Emission Factor | 21.2% |
| | | Diesel Particulate Matter | NA_DPM | 4.2E-03 | Annual | Above Average | Emission Factor | 28.9% |
| BRIDGE_20 | Bridge Building Equipment (Mobile Equipment) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.0E-01 | Annual | Above Average | Emission Factor | 34.0% |
| | | Carbon Monoxide (CO) | 630-08-0 | 3.1E-02 | Annual | Above Average | Emission Factor | 2.9% |
| | | Sulfur Dioxide (SO2) | 2025884 | 4.9E-04 | Annual | Above Average | Emission Factor | 1.2% |
| | | Acrolein | 107-02-8 | 1.5E-04 | Annual | Above Average | Emission Factor | 40.5% |
| | | Acetaldehyde | 75-07-0 | 7.0E-04 | Annual | Above Average | Emission Factor | 43.4% |
| | | Benzene | 71-43-2 | 3.0E-04 | Annual | Above Average | Emission Factor | 44.9% |
| | | Formaldehyde | 50-00-0 | 1.8E-03 | Annual | Above Average | Emission Factor | 43.2% |
| | | 1,3-Butadiene | 106-99-0 | 1.2E-05 | Annual | Above Average | Emission Factor | 26.6% |
| | | Toluene | 108-88-3 | 2.4E-04 | Annual | Above Average | Emission Factor | 45.2% |
| | | Ethyl Benzene | 100-41-4 | 5.5E-05 | Annual | Above Average | Emission Factor | 10.9% |
| | | Xylene | 1330-20-7 | 2.3E-04 | Annual | Above Average | Emission Factor | 44.0% |
| | | PM2.5 | NA_PM2.5 | 5.6E-03 | Annual | Above Average | Emission Factor | 1.7% |
| | | PM10 | NA_PM10 | 5.7E-03 | Annual | Above Average | Emission Factor | 0.4% |
| | | TSP | NA_TSP | 5.7E-03 | Annual | Above Average | Emission Factor | 0.2% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.8E-08 | Annual | Above Average | Emission Factor | 29.9% |
| | | Diesel Particulate Matter | NA_DPM | 5.6E-03 | Annual | Above Average | Emission Factor | 38.2% |
| ROAD_242 | Road Construction Sources (Clearing, Mobile Equipment, Material Handling) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.9E-03 | Annual | Above Average | Emission Factor | 0.6% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.4E-02 | Annual | Above Average | Emission Factor | 2.2% |
| | | Sulfur Dioxide (SO2) | 2025884 | 1.2E-05 | Annual | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 2.2E-06 | Annual | Above Average | Emission Factor | 0.6% |
| | | Acetaldehyde | 75-07-0 | 1.1E-05 | Annual | Above Average | Emission Factor | 0.7% |
| | | Benzene | 71-43-2 | 4.3E-06 | Annual | Above Average | Emission Factor | 0.7% |
| | | Formaldehyde | 50-00-0 | 2.7E-05 | Annual | Above Average | Emission Factor | 0.6% |
| | | 1,3-Butadiene | 106-99-0 | 1.8E-07 | Annual | Above Average | Emission Factor | 0.4% |
| | | Toluene | 108-88-3 | 3.8E-06 | Annual | Above Average | Emission Factor | 0.7% |
| | | Ethyl Benzene | 100-41-4 | 1.0E-06 | Annual | Above Average | Emission Factor | 0.2% |
| | | Xylene | 1330-20-7 | 5.0E-06 | Annual | Above Average | Emission Factor | 1.0% |
| | | PM2.5 | NA_PM2.5 | 1.2E-02 | Annual | Above Average | Emission Factor | 3.7% |
| | | PM10 | NA_PM10 | 1.5E-02 | Annual | Above Average | Emission Factor | 1.2% |
| | | TSP | NA_TSP | 4.6E-02 | Annual | Above Average | Emission Factor | 1.2% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 2.0E-08 | Annual | Above Average | Emission Factor | 21.2% |
| | | Diesel Particulate Matter | NA_DPM | 1.1E-04 | Annual | Above Average | Emission Factor | 0.7% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ROAD_BLAST | Road Blasting<br>(Blasting on roadway) | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.6E-04 | Annual | Above Average | Emission Factor | 0.1% |
| | | Carbon Monoxide (CO) | 630-08-0 | 1.4E-02 | Annual | Above Average | Emission Factor | 1.3% |
| | | Sulfur Dioxide (SO2) | 2025884 | 8.1E-04 | Annual | Above Average | Emission Factor | 2.0% |
| | | Acrolein | 107-02-8 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | 1,3-Butadiene | 106-99-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Toluene | 108-88-3 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Ethyl Benzene | 100-41-4 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Xylene | 1330-20-7 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | PM2.5 | NA_PM2.5 | 4.9E-06 | Annual | Above Average | Emission Factor | 0.0% |
| | | PM10 | NA_PM10 | 8.5E-05 | Annual | Above Average | Emission Factor | 0.0% |
| | | TSP | NA_TSP | 1.6E-04 | Annual | Above Average | Emission Factor | 0.0% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| WOOD | Burning And Chipping | Oxides of Nitrogen (NOx) | 11104-93-1 | 1.7E-02 | Annual | Above Average | Emission Factor | 5.5% |
| | | Carbon Monoxide (CO) | 630-08-0 | 2.9E-01 | Annual | Above Average | Emission Factor | 26.6% |
| | | Sulfur Dioxide (SO2) | 2025884 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Acrolein | 107-02-8 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Acetaldehyde | 75-07-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0.0% |
| | | Benzene | 71-43-2 | 4.1E-10 | Annual | Above Average | Emission Factor | 0% |
| | | Formaldehyde | 50-00-0 | 0.0E+00 | Annual | Above Average | Emission Factor | 0% |
| | | 1,3-Butadiene | 106-99-0 | 1.7E-05 | Annual | Above Average | Emission Factor | 36% |
| | | Toluene | 108-88-3 | 2.0E-06 | Annual | Above Average | Emission Factor | 0% |
| | | Ethyl Benzene | 100-41-4 | 3.7E-04 | Annual | Above Average | Emission Factor | 74% |
| | | Xylene | 1330-20-7 | 0.0E+00 | Annual | Above Average | Emission Factor | 0% |
| | | PM2.5 | NA_PM2.5 | 3.1E-02 | Annual | Above Average | Emission Factor | 9% |
| | | PM10 | NA_PM10 | 3.2E-02 | Annual | Above Average | Emission Factor | 3% |
| | | TSP | NA_TSP | 4.8E-02 | Annual | Above Average | Emission Factor | 1% |
| | | Total BaP (Particulate and Gas) | 50-32-8 | 1.2E-09 | Annual | Above Average | Emission Factor | 1% |
| | | Diesel Particulate Matter | NA_DPM | 0.0E+00 | Annual | Above Average | Emission Factor | 0% |

**Table A4 - Source Parameters**

| Source IDs | Source Description | Source Type | Plume Height [m] | Plume Width [m] | Release Height [m] | Length of Side [m] | Initial Lateral [m] | Initial Vertical [m] |
|---|---|---|---|---|---|---|---|---|
| QURRY_29 | Quarry Drilling and Material Handling (Drilling, Material Drop Operations, Crushing, Mobile Equipment) | Volume | - | - | 2 | 250 | 58.14 | 1.86 |
| BLAST_6 | Quarry Aggregate Blasting (Blasting Operations) | Volume | - | - | 5 | 55 | 12.79 | 4.65 |
| ACCESS_8 | Quarry Access Road Traffic (Material Haul Operations) | Line Volume | 6.8 | 23 | Surface Based | - | - | - |
| QURRY_23 to QURRY_28 | Sand and Gravel Material Handling (Material Drop Operations, Crushing, Mobile Equipment) | Volume | - | - | 2 | 250 | 58.14 | 1.86 |
| BRIDGE_20 | Bridge Building Equipment (Mobile Equipment) | Volume | - | - | 1 | 60 | 13.95 | 0.93 |
| ROAD_242 | Road Construction Sources (Clearing, Mobile Equipment, Material Handling) | Line Volume | 6.8 | 66 | Surface Based | - | - | - |
| ROAD_BLAST | Road Blasting (Blasting on roadway) | Volume | - | - | 5 | 8.4 | 1.95 | 4.65 |
| WOOD | Burning And Chipping | Line Volume | 10 | 60 | Surface Based | - | - | - |

**Table B1 - Summary of Maximum Distances to Criteria/Thresholds - Construction Phase**
**Construction Phase - North - South Road Segment**

| | | | | | | | | Road Blasting | | | | Road Construction | | | | Bridge | | | | Access Road | | | | Burning | | | | Quarry Blast | | | | Quarry Aggregate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Indicator Compound** | **Averaging Period** | **Background Concentration** | **Criteria Source[1]** | **Criteria** | **50% Criteria** | **50% Background** | **Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** | **Max Distance to Criteria** | **Max Distance to 50% Criteria** | **Max Distance to 50% Background** | **Max Distance to Criteria Minus Background** |
| | | (µg/m3) | | (µg/m3) | (µg/m3) | (µg/m3) | (µg/m3) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) |
| $NO_2$ | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | N/A | N/A | 7,301 | N/A | N/A | N/A | 8,877 | N/A | N/A | N/A | 9,767 | N/A | N/A | N/A | 7,434 | N/A | N/A | N/A | 11,228 | N/A | 370 | 4,680 | 12,203 | 373 | N/A | N/A | 11,830 | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | 10 | 102 | 7,301 | 32 | N/A | N/A | 8,877 | N/A | 525 | 2,279 | 9,767 | 564 | N/A | N/A | 7,434 | N/A | 986 | 5,294 | 11,228 | 2,813 | 12,056 | 12,271 | 12,203 | 12,085 | 157 | 616 | 11,830 | 176 |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | N/A | N/A | 128 | N/A | N/A | N/A | 667 | N/A | N/A | N/A | 2,375 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 4,560 | N/A | N/A | N/A | 1,704 | N/A | N/A | N/A | 904 | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| $PM_{2.5}$ | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19.0 | N/A | N/A | N/A | N/A | 297 | 601 | 1,706 | 440 | N/A | 20 | 71 | N/A | N/A | N/A | 218 | N/A | 711 | 1,341 | 3,525 | 1,030 | N/A | N/A | N/A | N/A | N/A | 305 | 943 | 199 |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| $PM_{10}$ | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | N/A | N/A | N/A | N/A | 157 | 327 | 515 | 439 | N/A | N/A | N/A | N/A | 125 | 387 | 551 | 461 | 455 | 852 | 1,276 | 1,099 | N/A | N/A | 459 | 366 | N/A | N/A | 372 | 299 |
| TSP | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | N/A | N/A | N/A | N/A | 82 | 186 | 251 | 355 | N/A | N/A | N/A | N/A | 78 | 175 | 243 | 434 | 194 | 399 | 529 | 709 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 174 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| SO2 | 10min | - | Ontario AAQC | 178 | 89 | - | - | 746 | 1,178 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 12,250 | 12,238 | N/A | N/A | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | 756 | 1,194 | 12,054 | 765 | N/A | N/A | N/A | N/A | N/A | N/A | 305 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 12,249 | 12,237 | 12,223 | 12,248 | N/A | N/A | N/A | N/A |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.31 | 167.7 | 560 | 970 | 12,054 | 561 | N/A | N/A | N/A | N/A | N/A | N/A | 305 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 12,264 | 12,245 | 12,223 | 12,264 | N/A | N/A | N/A | N/A |
| | 24 hr | 2.73 | Ontario AAQC | 275 | 137.5 | 1.36 | 272.3 | N/A | N/A | 713 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| CO | 1 hr | 469.70 | Ontario AAQC | 36,200 | 18,100 | 235 | 35730 | N/A | N/A | 4,483 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 85 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 7,429 | N/A | 1,459 | 5,233 | 12,226 | 1,458 | N/A | N/A | N/A | N/A |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 227 | 15246 | N/A | N/A | 803 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2,794 | N/A | 687 | 1,177 | 12,250 | 699 | N/A | N/A | N/A | N/A |
| Acrolein | 1 hr | - | Ontario AAQC | 0.4 | 0.2 | - | - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 308 | 682 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 4.5 | 2.25 | 0.02 | 4.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 312 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Acetaldehyde | 0.5 hr | - | Ontario AAQC | 500 | 250 | - | - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Benzene | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Formaldehyde | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1,3 Butadiene | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.90 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Toluene | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 1,999.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 51 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Ethylbenzene | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 999.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2,190 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Xylene | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 29 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Benzo(a)pyrene | 24 hr | 0.00002 | Ontario AAQC | 0.00005 | 0.000025 | 0.0000093 | 0.00003 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 6 | 57 | 129 | 45 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Annual | 0.00001 | Ontario AAQC | 0.00001 | 0.000005 | 0.0000059 | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- | N/A | 30 | 15 | -- | N/A | N/A | N/A | -- | N/A | N/A | N/A | -- |

**Notes:**
(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.
Max Distances to - represents the distance where the indicator compound's GLC will no longer exceed their respective criteria/threshold.
N/A - not applicable, the maximum GLC does not meet or exceed their respective criteria/threshold
"-" - The measured benzo(a)pyrene background concentrations exceed benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

**Table B2 - Summary of Predicted Criteria Exceedance**
**Construction Phase - Community**

| | | | | | | | | Expected to Exceed Criteria (Project Only) | | Expected to Exceed Criteria (Project + Background) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicator Compound | Averaging Period | Background Concentration (µg/m3) | Criteria Source [1] | Criteria (µg/m3) | 50% Criteria (µg/m3) | 50% Background (µg/m3) | Criteria Minus Background (µg/m3) | Airport | Community | Airport | Community |
| $NO_2$ | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | No | No | No | No |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | Yes | No | Yes | No |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | No | No | No | No |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | No | No | No | No |
| $PM_{2.5}$ | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19.0 | No | No | No | No |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | No | No | No | No |
| $PM_{10}$ | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | No | No | No | No |
| TSP | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | No | No | No | No |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | No | No | No | No |
| SO2 | 10min | - | Ontario AAQC | 178 | 89 | - | - | Yes | Yes | Yes | Yes |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | Yes | Yes | Yes | Yes |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.31 | 167.7 | Yes | Yes | Yes | Yes |
| | 24 hr | 2.73 | Ontario AAQC | 275 | 137.5 | 1.36 | 272.3 | No | No | No | No |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | No | No | No | No |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | No | No | No | No |
| CO | 1 hr | 469.70 | Ontario AAQC | 36,200 | 18,100 | 234.85 | 35,730.3 | No | No | No | No |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 226.97 | 15,246.1 | No | No | No | No |
| Acrolein | 1 hr | - | Ontario AAQC | 0.4 | 0.2 | - | - | No | No | No | No |
| | 24 hr | 0.04 | Ontario AAQC | 4.5 | 2.25 | 0.02 | 4.5 | No | No | No | No |
| Acetaldehyde | 0.5 hr | - | Ontario AAQC | 500 | 250 | - | - | No | No | No | No |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | No | No | No | No |
| Benzene | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | No | No | No | No |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | No | No | No | No |
| Formaldehyde | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | No | No | No | No |
| 1,3 Butadiene | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | No | No | No | No |
| | Annual | 0.90 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | No | No | No | No |
| Toluene | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 1,999.5 | No | No | No | No |
| Ethylbenzene | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 999.8 | No | No | No | No |
| Xylene | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729.4 | No | No | No | No |
| Benzo(a)pyrene | 24 hr | 0.00002 | Ontario AAQC | 0.00005 | 0.000025 | 0.0000093 | 0.00003 | No | No | No | No |
| | Annual | 0.000012 | Ontario AAQC | 0.00001 | 0.000005 | 0.0000059 | -- | No | No | Yes | Yes |

Notes:
(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.
"--" - The measured benzo(a)pyrene background concentrations exceed benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

**Table B3 - Summary of Maximum Distances to Criteria/Threshold**
**Operation Phase - North - South Road Segment**

| Indicator Compound | Averaging Period | Background Concentration (µg/m3) | Criteria Source[1] | Criteria (µg/m3) | 50% Criteria (µg/m3) | 50% Background (µg/m3) | Criteria Minus Background (µg/m3) | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | N/A | N/A | 700 | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | N/A | N/A | 700 | N/A |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | N/A | N/A | 34 | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | N/A | N/A | 38 | N/A |
| $PM_{2.5}$ | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19.0 | 115 | 433 | 2,868 | 207 |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | 134 | 336 | 629 | 414 |
| $PM_{10}$ | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | 1,986 | 2,987 | outside of model domain | 2,987 |
| TSP | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | 3,004 | 3,235 | outside of model domain | outside of model domain |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | 899 | 1,591 | 1,657 | outside of model domain |
| SO2 | 10min | - | Ontario AAQC | 178 | 89 | - | - | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | N/A | N/A | N/A | N/A |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.31 | 167.7 | N/A | N/A | N/A | N/A |
| | 24 hr | 2.73 | Ontario AAQC | 275 | 137.5 | 1.36 | 272.3 | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | N/A | N/A | N/A | N/A |
| CO | 1 hr | 469.70 | Ontario AAQC | 36,200 | 18,100 | 234.85 | 35,730.3 | N/A | N/A | N/A | N/A |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 226.97 | 15,246.1 | N/A | N/A | N/A | N/A |
| Acrolein | 1 hr | - | Ontario AAQC | 0.4 | 0.2 | - | - | N/A | N/A | N/A | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 4.5 | 2.25 | 0.02 | 4.5 | N/A | N/A | N/A | N/A |
| Acetaldehyde | 0.5 hr | - | Ontario AAQC | 500 | 250 | - | - | N/A | N/A | N/A | N/A |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | N/A | N/A | N/A | N/A |
| Benzene | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | N/A | N/A | N/A | N/A |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | N/A | N/A | N/A | N/A |
| Formaldehyde | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | N/A | N/A | N/A | N/A |
| 1,3 Butadiene | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | N/A | N/A | N/A | N/A |
| | Annual | 0.90 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | N/A | N/A | N/A | N/A |
| Toluene | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 1,999.5 | N/A | N/A | N/A | N/A |
| Ethylbenzene | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 999.8 | N/A | N/A | N/A | N/A |
| Xylene | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729.4 | N/A | N/A | N/A | N/A |
| Benzo(a)pyrene | 24 hr | 0.00002 | Ontario AAQC | 0.00005 | 0.000025 | 0.0000093 | 0.00003 | N/A | N/A | N/A | N/A |
| | Annual | 0.00001 | Ontario AAQC | 0.00001 | 0.000005 | 0.0000059 | -- | N/A | N/A | N/A | -- |

**Notes:**

(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.

Max Distances to - represents the distance where the indicator compound's GLC will no longer exceed their respective criteria/threshold.

N/A - not applicable, the maximum GLC does not meet or exceed their respective criteria/threshold

"--" - The measured Benzo(a)pyrene background concentrations exceed Benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

"outside of model domain" - The model result is predicted to be higher than the noted threshold throughout the boundary of the modelling domain

**Table B4 - Summary of Maximum Distances to Criteria /Threshold - Operation Phase at Community**
**Operation Phase at Community**

| Indicator Compound | Averaging Period | Background Concentration (µg/m3) | Criteria Source[1] | Criteria (µg/m3) | 50% Criteria (µg/m3) | 50% Background (µg/m3) | Criteria Minus Background (µg/m3) | Community | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Max Distance to Criteria (m) | Max Distance to 50% Criteria (m) | Max Distance to 50% Background (m) | Max Distance to Criteria Minus Background (m) |
| $NO_2$ | 1 hr | 3.76 | Ontario AAQC | 400 | 200 | 1.88 | 396.2 | N/A | N/A | N/A | N/A |
| | | 3.76 | CAAQS (2025) | 79 | 39.5 | 1.88 | 75.3 | N/A | N/A | N/A | N/A |
| | 24 hr | 3.06 | Ontario AAQC | 200 | 100 | 1.53 | 196.9 | N/A | N/A | N/A | N/A |
| | Annual | 1.28 | CAAQS (2025) | 22.6 | 11.3 | 0.64 | 21.3 | N/A | N/A | N/A | N/A |
| $PM_{2.5}$ | 24 hr | 8.02 | AAQC and CAAQS (2020) | 27 | 13.5 | 4.01 | 19.0 | N/A | N/A | 92 | NA |
| | Annual | 5.09 | AAQC and CAAQS (2020) | 8.8 | 4.4 | 2.55 | 3.7 | N/A | N/A | N/A | N/A |
| $PM_{10}$ | 24 hr | 31.23 | Ontario AAQC | 50 | 25 | 15.62 | 18.8 | 50 | 224 | 508 | 374 |
| TSP | 24 hr | 89.12 | Ontario AAQC | 120 | 60 | 44.56 | 30.9 | 119 | 436 | 696 | 1,001 |
| | Annual | 56.65 | Ontario AAQC | 60 | 30 | 28.32 | 3.4 | N/A | 27 | 32 | 639 |
| SO2 | 10min | - | Ontario AAQC | 178 | 89 | - | - | N/A | N/A | N/A | N/A |
| | 1 hr | 2.62 | Ontario AAQC | 100 | 50 | 1.31 | 97.4 | N/A | N/A | N/A | N/A |
| | | 2.62 | CAAQS (2025) | 170 | 85 | 1.31 | 167.7 | N/A | N/A | N/A | N/A |
| | 24 hr | 2.73 | Ontario AAQC | 275 | 137.5 | 1.36 | 272.3 | N/A | N/A | N/A | N/A |
| | Annual | 1.29 | Ontario AAQC | 10 | 5 | 0.64 | 8.7 | N/A | N/A | N/A | N/A |
| | | 1.29 | CAAQS (2025) | 10 | 5 | 0.64 | 9.2 | N/A | N/A | N/A | N/A |
| CO | 1 hr | 469.70 | Ontario AAQC | 36,200 | 18,100 | 234.85 | 35,730.3 | N/A | N/A | N/A | N/A |
| | 8 hr | 453.95 | Ontario AAQC | 15,700 | 7,850 | 226.97 | 15,246.1 | N/A | N/A | N/A | N/A |
| Acrolein | 1 hr | - | Ontario AAQC | 0.4 | 0.2 | - | - | N/A | N/A | N/A | N/A |
| | 24 hr | 0.04 | Ontario AAQC | 4.5 | 2.25 | 0.02 | 4.5 | N/A | N/A | N/A | N/A |
| Acetaldehyde | 0.5 hr | - | Ontario AAQC | 500 | 250 | - | - | N/A | N/A | N/A | N/A |
| | 24 hr | 3.44 | Ontario AAQC | 500 | 250 | 1.72 | 496.6 | N/A | N/A | N/A | N/A |
| Benzene | 24 hr | 0.55 | Ontario AAQC | 2.3 | 1.15 | 0.27 | 1.8 | N/A | N/A | N/A | N/A |
| | Annual | 0.31 | Ontario AAQC | 0.45 | 0.23 | 0.15 | 0.1 | N/A | N/A | N/A | N/A |
| Formaldehyde | 24 hr | 10.66 | Ontario AAQC | 65 | 32.5 | 5.33 | 54.3 | N/A | N/A | N/A | N/A |
| 1,3 Butadiene | 24 hr | 0.83 | Ontario AAQC | 10 | 5 | 0.42 | 9.2 | N/A | N/A | N/A | N/A |
| | Annual | 0.90 | Ontario AAQC | 2 | 1 | 0.45 | 1.1 | N/A | N/A | N/A | N/A |
| Toluene | 24 hr | 0.49 | Ontario AAQC | 2,000 | 1,000 | 0.24 | 1,999.5 | N/A | N/A | N/A | N/A |
| Ethylbenzene | 24 hr | 0.22 | Ontario AAQC | 1,000 | 500 | 0.11 | 999.8 | N/A | N/A | N/A | N/A |
| Xylene | 24 hr | 0.65 | Ontario AAQC | 730 | 365 | 0.33 | 729.4 | N/A | N/A | N/A | N/A |
| Benzo(a)pyrene | 24 hr | 0.00002 | Ontario AAQC | 0.00005 | 0.000025 | 0.0000093 | 0.00003 | N/A | N/A | N/A | N/A |
| | Annual | 0.00001 | Ontario AAQC | 0.00001 | 0.000005 | 0.0000059 | -- | N/A | N/A | N/A | -- |

**Notes:**
(1) Ontario AAQC - Ontario Ambient Air Quality Criteria, dated Oct 24, 2023. CAAQS - Canadian Ambient Air Quality Standards, with an effective date of 2020 or 2025.
"--" - The measured Benzo(a)pyrene background concentrations exceed Benzo(a)pyrene criteria, as such comparison for a "Max Distance to" Criteria Minus Background is not included.

**Table B5 - Residual Effects - Construction**
**Characterization of Predicted Residual Effects and Determination of Significance for Air Quality**

| Discipline/Valued Component | Predicted Residual Effect | Context | Direct/Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood/Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air Quality | NO2 - Quarry Blasting | NO2 - 1hr - CAAQS | Direct | Negative | High | 373 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | NO2 - Quarry Aggregate Operations | | | | High | 157 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | NO2 - Burning/Clearing | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 4,560 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | NO2 - Bridge Building | | | | Low | 2,375 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | NO2 - Blasting or Burning | $NO_2$ - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | NO2 - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | PM2.5 - Burning | PM2.5 - 24hr - AAQC & CAAQS | Direct | Negative | High | 711 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | PM2.5 - Road Construction | | | | High | 297 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | PM2.5 - Blasting or Burning | PM2.5 - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | PM2.5 - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | PM10 - Burning | PM10 - 24hr - AAQC | Direct | Negative | High | 455 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | PM10 - Road Construction | | | | High | 157 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Burning | TSP - 24hr - AAQC | Direct | Negative | High | 194 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Road Construction | | | | High | 82 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | TSP - Blasting or Burning | TSP - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | TSP - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | SO2 - Quarry Blasting | SO2 - 10min - AAQC | Direct | Negative | High | 12,250 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Bridge Building, Road Construction, Access Road or Aggregate Operations | SO2 - 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Blasting | SO2 - 1hr - AAQC | Direct | Negative | High | 12,249 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Bridge Building | | | | Low | 305 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Blasting | SO2 - 24hr - AAQC | Direct | Negative | Low | 8,586 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Bridge Building | | | | Low | 305 | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | SO2 - Blasting | SO2 - Annual - AAQC & CAAQS | Direct | Negative | Low | 713 | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | SO2 - Bridge Building, Road Construction, Access Road or Aggregate Operations | | | | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | CO - Blasting | CO - 1hr - AAQC | Direct | Negative | High | 1,459 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Bridge Building | CO - 1hr - AAQC | Direct | Negative | Low | 85 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Blasting | CO - 8hr - AAQC | Direct | Negative | High | 687 | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | CO - Bridge Building, Road Construction, Access Road or Aggregate Operations | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Blasting, Burning | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Bridge Building | Acrolein - 1hr - AAQC | Direct | Negative | High | 308 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Blasting, Burning | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Bridge Building | Acrolein - 24hr - AAQC | Direct | Negative | Low | 312 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Blasting, Burning | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Bridge Building | Acetaldehyde - 24hr - AAQC | Direct | Negative | Low | 8 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Blasting, Burning | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Benzene - Blasting, Burning | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | Benzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | Formaldehyde - Blasting, Burning | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Formaldehyde - Bridge Building, Road Construction, Access Road or Aggregate Operations | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Blasting, Burning | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Bridge Building, Road Construction, Access Road or Aggregate Operations | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Probable | Not Significant | Moderate |
| | Toluene - Blasting, Burning | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Toluene - Bridge Building | Toluene - 24hr - AAQC | Direct | Negative | Low | 51 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Ethylbenzene - Burning | Toluene - 24hr - AAQC | Direct | Negative | Low | 2,190 m | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Ethylbenzene - Bridge Building, Road Construction, Access Road or Aggregate Operations | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | Xylene - Blasting, Burning | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | Xylene - Bridge | Xylene - 24hr - AAQC | Direct | Negative | Low | 29 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Blasting, Burning | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Bridge | BaP - 24hr - AAQC | Direct | Negative | High | 6 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Blasting, Burning | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Short Term | Infrequent | Reversable | Possible to Probable | Not Significant | Moderate |
| | BaP - Bridge | BaP - 24hr - AAQC | Direct | Negative | High | 6 m | Short Term | Continuous | Reversable | Possible to Probable | Not Significant | Moderate |

**Notes:**
Geographic extent listed is specific to the highest magnitude rating, lower magnitude of residual effects may be experienced at distances that surpass the listed geographic extent (i.e. <50% of criteria but >50% of baseline ambient)

**Table B6 - Residual Effects - Operations**
**Characterization of Predicted Residual Effects and Determination of Significance for Air Quality**

| Discipline/Valued Component | Predicted Residual Effect | Context | Direct/Indirect | Direction | Magnitude | Geographic Extent | Duration | Frequency | Reversibility | Likelihood/Probability of Occurrence | Significance | Prediction Confidence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air Quality | NO2 - N/S Road Segment | NO2 - 1hr - CAAQS | Direct | Negative | Low | 700 m | Long Term | Continuous | Irreversible | Possible | Not Significant | Moderate |
| | NO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible | Not Significant | Moderate |
| | NO2 - N/S Road Segment | $NO_2$ - 24hr - AAQC | Direct | Negative | Low | 34 m | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | NO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | NO2 - N/S Road Segment | $NO_2$ - Annual - AAQC | Direct | Negative | Low | 38 m | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | NO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | PM2.5 - N/S Road Segment | PM2.5 - 24hr - AAQC & CAAQS | Direct | Negative | High | 115 m | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | PM2.5 - Community Road Segment | | | | Low | 92 m | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | PM2.5 - N/S Road Segment | PM2.5 - Annual - AAQC & CAAQS | Direct | Negative | High | 134 m | Long Term | Continuous | Irreversible | Probable | **Significant** | Moderate |
| | PM2.5 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | PM10 - N/S Road Segment | PM10 - 24hr - AAQC | Direct | Negative | High | 1,986 m | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | PM10 - Community Road Segment | | | | High | 50 m | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP - N/S Road Segment | TSP 24hr - AAQC | Direct | Negative | High | 3,004 m | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP- Community Road Segment | | | | High | 119 m | Long Term | Continuous | Irreversible | Possible to Probable | **Significant** | Moderate |
| | TSP - N/S Road Segment | TSP Annual - AAQC | Direct | Negative | High | 899 m | Long Term | Continuous | Irreversible | Probable | **Significant** | Moderate |
| | TSP- Community Road Segment | | | | Low | 32 m | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | SO2 - N/S Road Segment | SO2 - 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - Community Road Segment | SO2 - 10min - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - N/S Road Segment | SO2 - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - N/S Road Segment | SO2 - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - N/S Road Segment | SO2 - Annual - AAQC & CAAQS | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | SO2 - Community Road Segment | | | | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - N/S Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - Community Road Segment | CO - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - N/S Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | CO - Community Road Segment | CO - 8hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - N/S Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Community Road Segment | Acrolein - 1hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - N/S Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acrolein - Community Road Segment | Acrolein - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 0.5hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - N/S Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Acetaldehyde - Community Road Segment | Acetaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - N/S Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - Community Road Segment | Benzene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Benzene - N/S Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | Benzene - Community Road Segment | Benzene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | Formaldehyde - N/S Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Formaldehyde - Community Road Segment | Formaldehyde - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | 1,3 Butadiene - N/S Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | 1,3 Butadiene - Community Road Segment | 1,3 Butadiene - Annual - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Probable | Not Significant | Moderate |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - N/S Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Toluene - Community Road Segment | Toluene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Xylene - N/S Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | Xylene - Community Road Segment | Xylene - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - N/S Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - Community Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - N/S Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |
| | BAP - Community Road Segment | BaP - 24hr - AAQC | Direct | Negative | Negligible | Local Study Area | Long Term | Continuous | Irreversible | Possible to Probable | Not Significant | Moderate |

**Notes:**
Geographic extent listed is specific to the highest magnitude rating, lower magnitude of residual effects may be experienced at distances that surpass the listed geographic extent (i.e. <50% of criteria but >50% of baseline ambient)

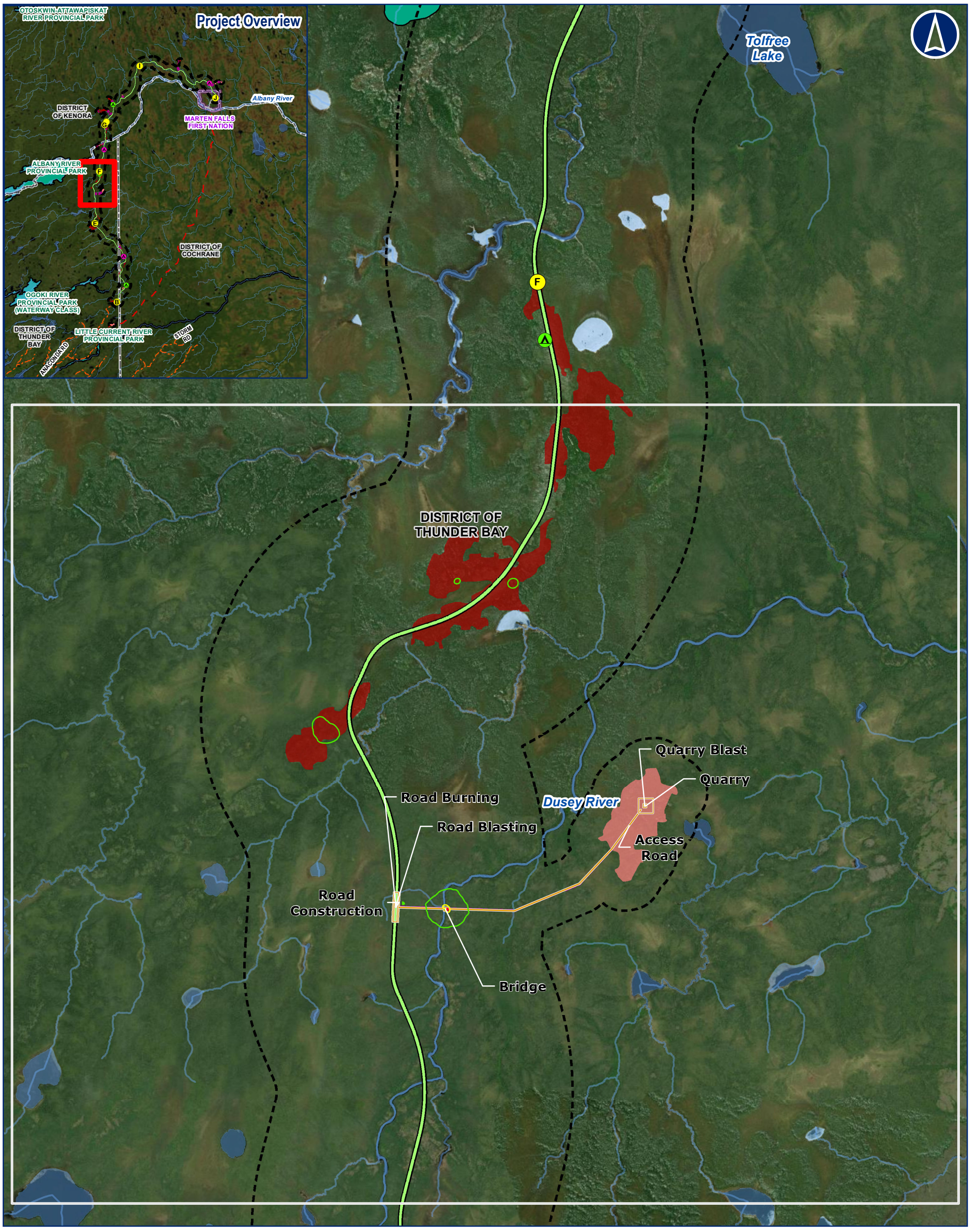
**Dustfall Summary**

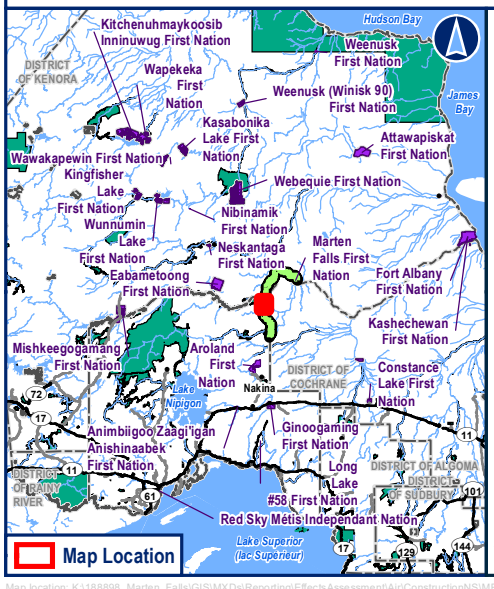
| Project Phase | Road Segment | Period | MECP Criteria | Maximum Deposition | % Criteria | Approximate Max Distance from Edge of Road[2] [Criteria] | Approximate Max Distance from Edge of Road[3] [50% Criteria] |
|---|---|---|---|---|---|---|---|
| | | | [g/m2] | [g/m2] | | [m] | [m] |
| Construction | N/S | 30-day | 7 | 3.0 | 42% | N/A | N/A |
| | | Annual | 4.6 | 28 | >100% | 280 | 500 |
| | E/W | 30-day | 7 | 0.1 | 2% | N/A | N/A |
| | | Annual | 4.6 | 1.1 | 25% | N/A | N/A |
| Operations[1] | N/S | 30-day | 7 | 11.5 | >100% | 45 | 174 |
| | | Annual | 4.6 | 54.3 | >100% | 681 | 1280 |
| | E/W | 30-day | 7 | 1.6 | 23% | N/A | N/A |
| | | Annual | 4.6 | 6.3 | >100% | 28 | 102 |

Notes:
[1] Calroads model does not compute deposition as such deposition from operations was calculated from concentration values using the formula F = VdC, where F = deposition flux, Vd = deposition velocity and C = concentration

[2] Maximum distance from edge of road indicates the distance which an exceedance to criteria is present
[3] Maximum distance from edge of road indicates the distance from road until dustfall equals 50% of respective criteria

# Attachment C – Isopleths




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (22.6)
- 50% Criteria (11.3)
- Criteria Minus Background (21.32)

**Background (ug/m3)**
- 50% Background (0.64)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: $NO_2$
## Averaging Period: Annual

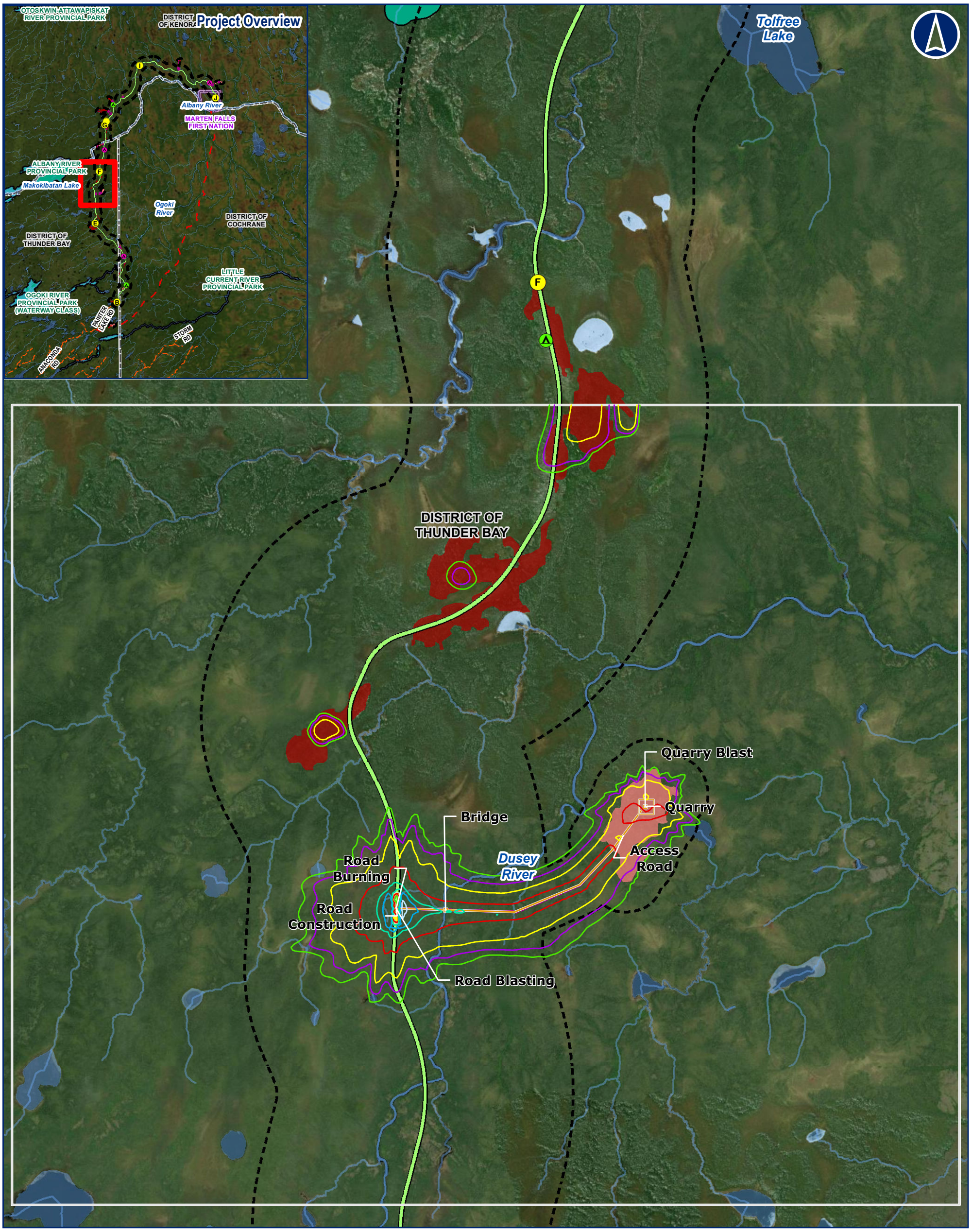
0 0.5 1 1.5 2
Kilometres

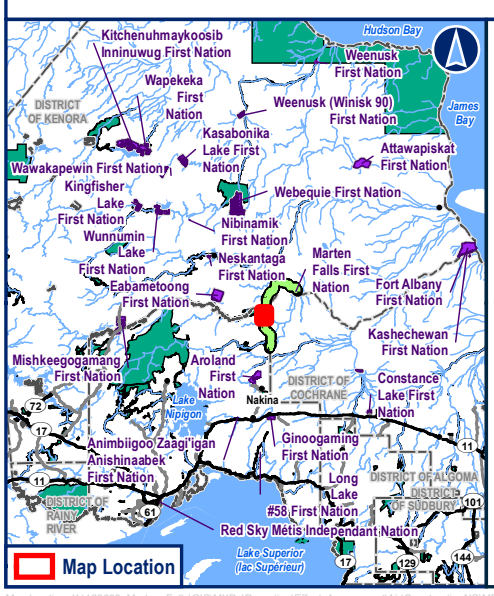
Datum: NAD 1983 CSRS UTM Zone 16N

| | |
|---|---|
| Feb, 2026 | 1:62,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188888_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-NO2-Annual.mxd
Date Saved: 2026-02-02 8:35:05 PM User Name: 34LM




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (50)
- 50% Criteria (25)
- Criteria Minus Background (18.8)
- 2x Criteria (100)
- 3x Criteria (150)
- 5x Criteria (250)

**Background (ug/m3)**
- 50% Background (15.6)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: PM10
## Averaging Period: 24 Hours

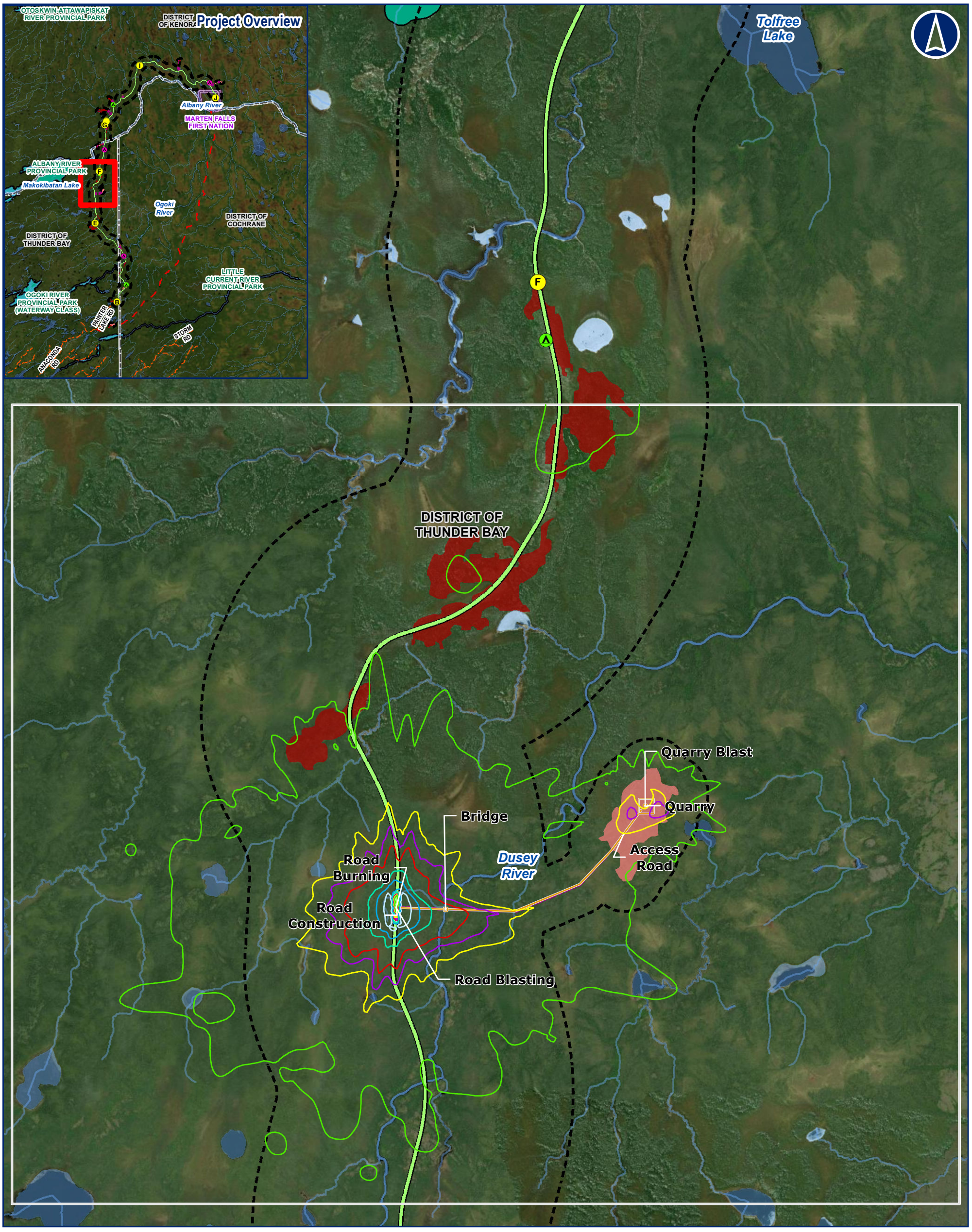
0 0.5 1 1.5 2
Kilometres

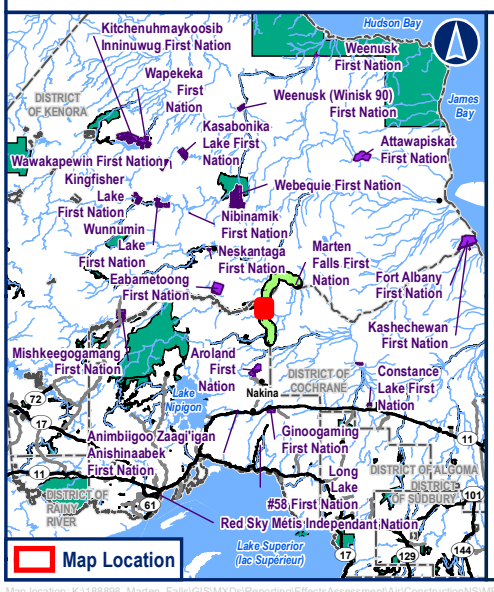
Datum: NAD 1983 CSRS UTM Zone 16N

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| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-PM10_24HR.mxd
Date Saved: 2026-01-12 9:48:40 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (27)
- 50% Criteria (13.5)
- Criteria Minus Background (19)
- 2x Criteria (54)
- 3x Criteria (81)
- 5x Criteria (135)

**Background (ug/m3)**
- 50% Background (4.01)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

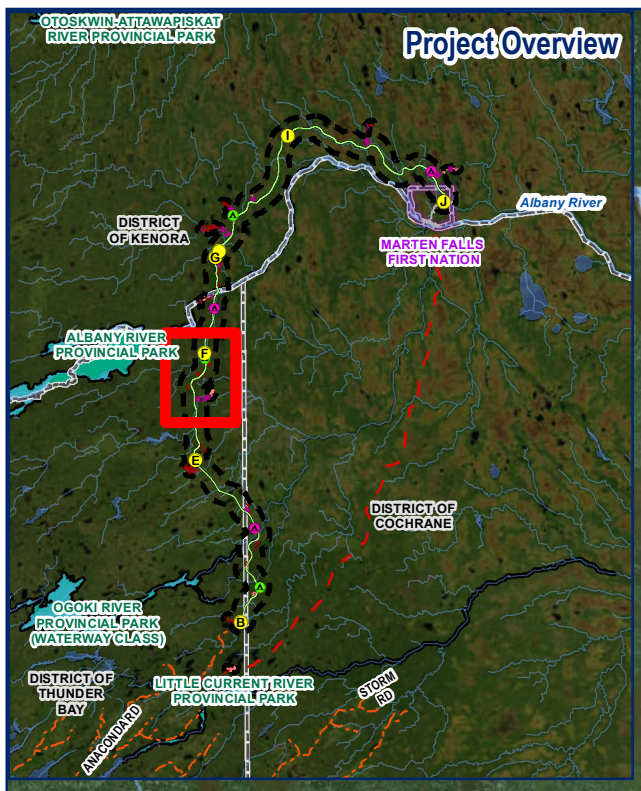
## Construction - N/S Segment
## Pollutant: PM 2.5
## Averaging Period: 24 Hours

0 0.5 1 1.5 2
Kilometres

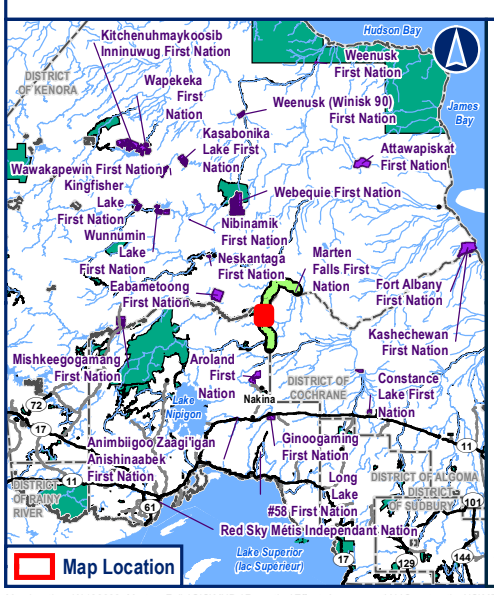
Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (170)
- 50% Criteria (85)
- Criteria Minus Background (167.4)
- 2x Criteria (340)
- 3x Criteria (510)
- 5x Criteria (850)

**CAAQS, 2025 (ug/m^3)**
- Criteria (100)
- Criteria Minus Background (97.38)
- 2x Criteria (200)
- 3x Criteria (300)
- 5x Criteria (500)

**Background (ug/m3)**
- 50% Background (1.31)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

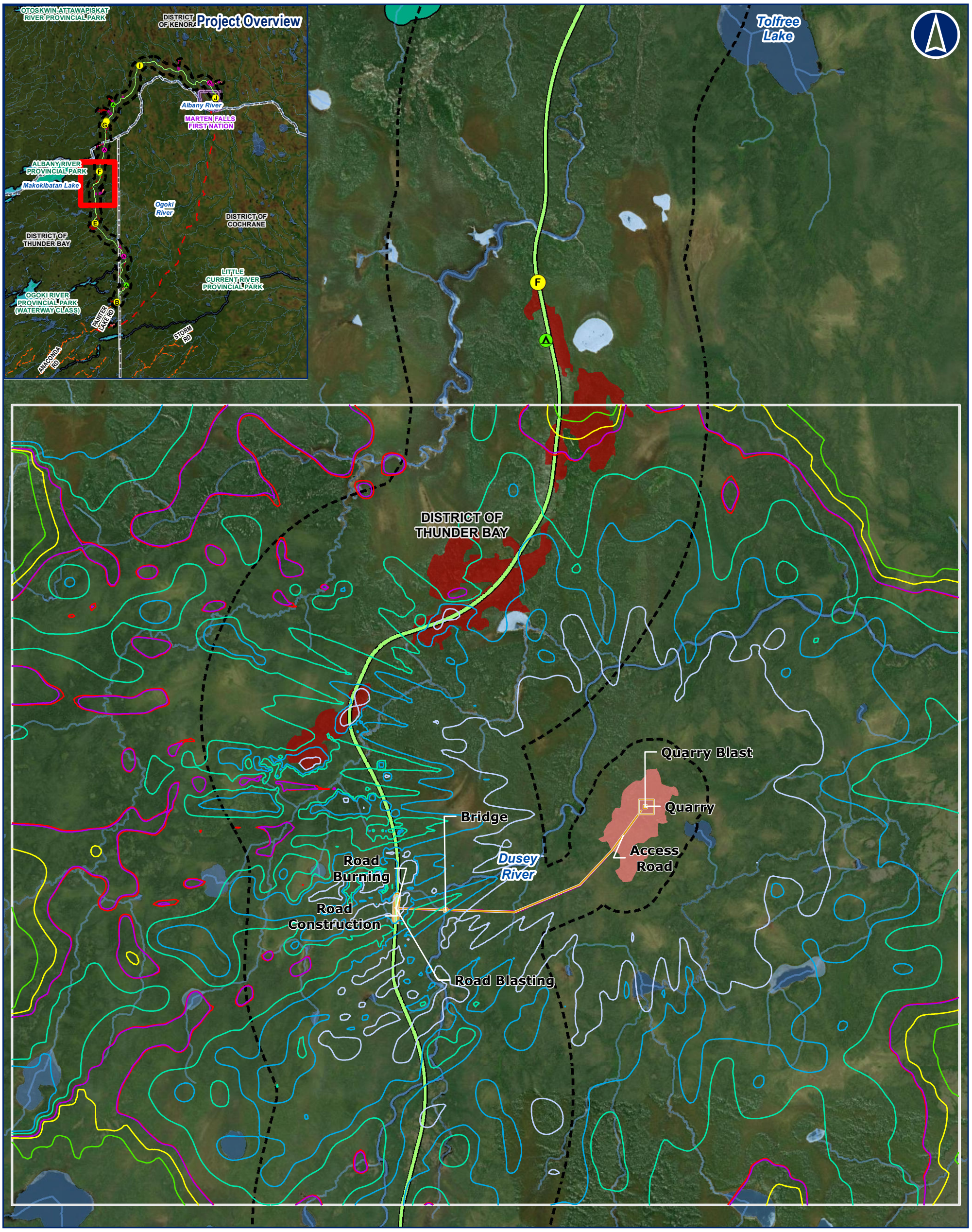
## Construction - N/S Segment
## Pollutant: $SO_2$
## Averaging Period: 1 Hour

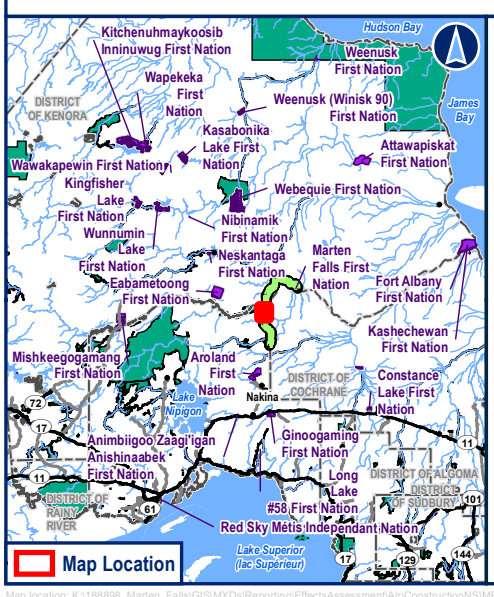
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**

- Criteria (178)
- 50% Criteria (89)
- Criteria Minus Background (173.7)
- 2x Criteria (356)
- 3x Criteria (534)
- 5x Criteria (890)

**Background (ug/m3)**

- 50% Background (2.1615)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (100m Width)

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

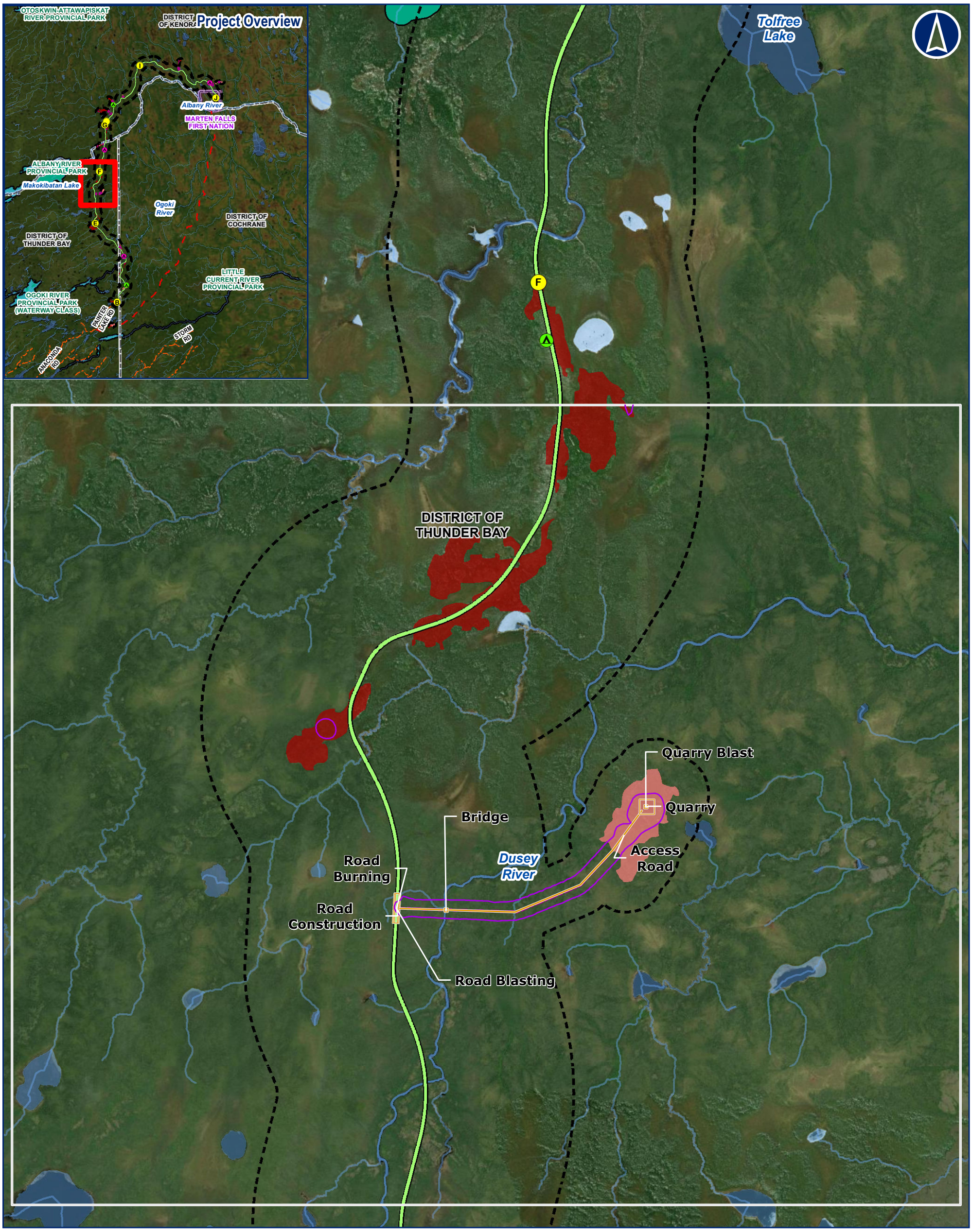
## Construction - N/S Segment
## Pollutant: $SO_2$
## Averaging Period: 10 Minutes

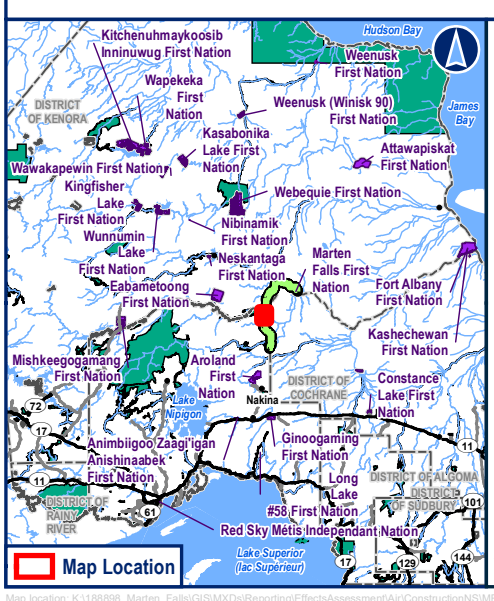
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**

- Criteria Minus Background (3.4)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: TSP
## Averaging Period: Annual

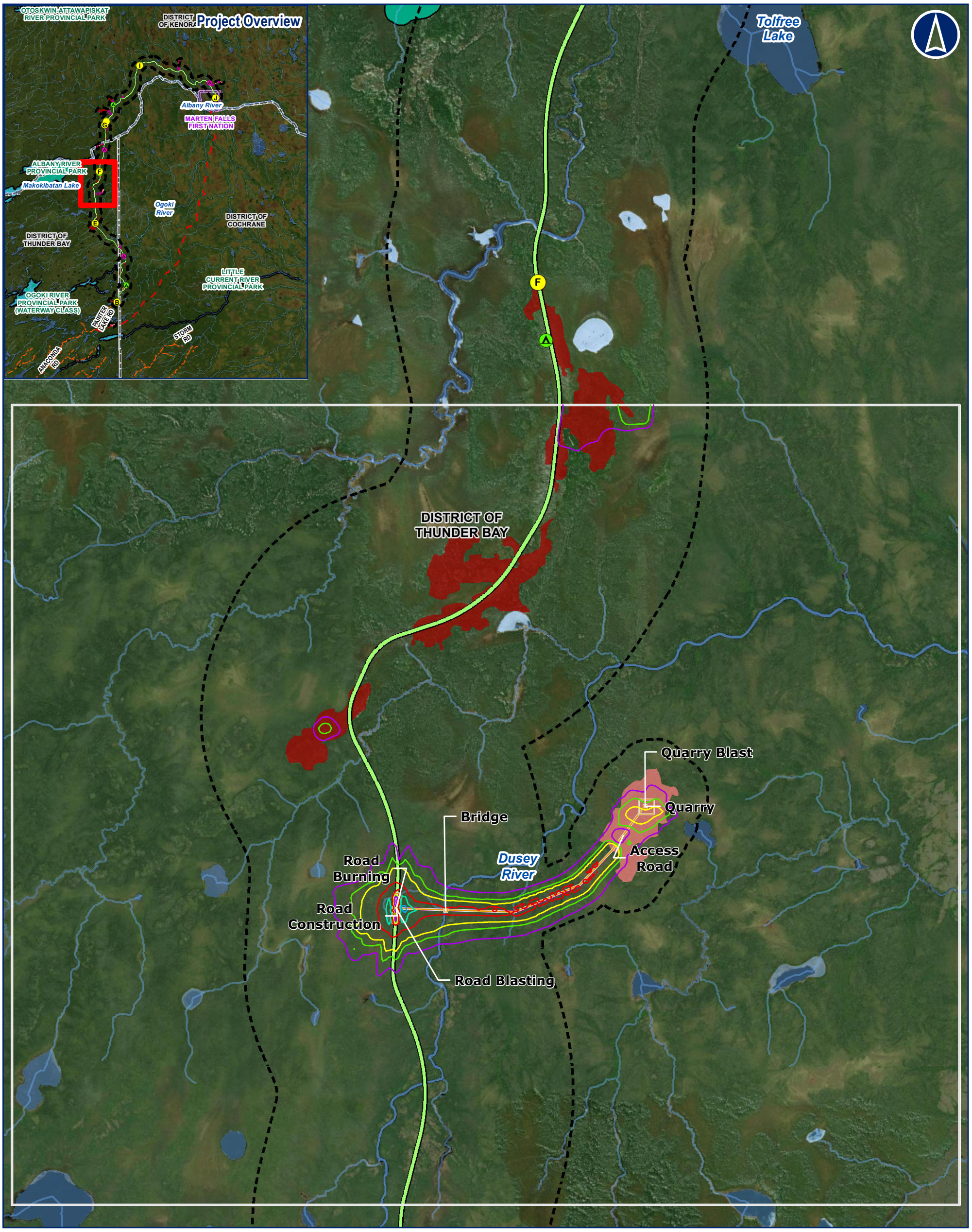
0 0.5 1 1.5 2
Kilometres

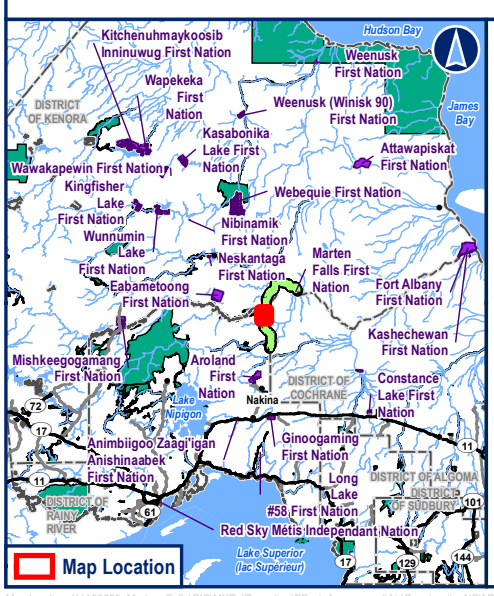
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-TSP_Annual.mxd
Date Saved: 2026-01-12 10:15:26 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (120)
- 50% Criteria (60)
- Criteria Minus Background (30.9)
- 2x Criteria (240)
- 3x Criteria (360)

**Background (ug/m3)**
- 50% Background (44.6)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: TSP
## Averaging Period: 24 Hours

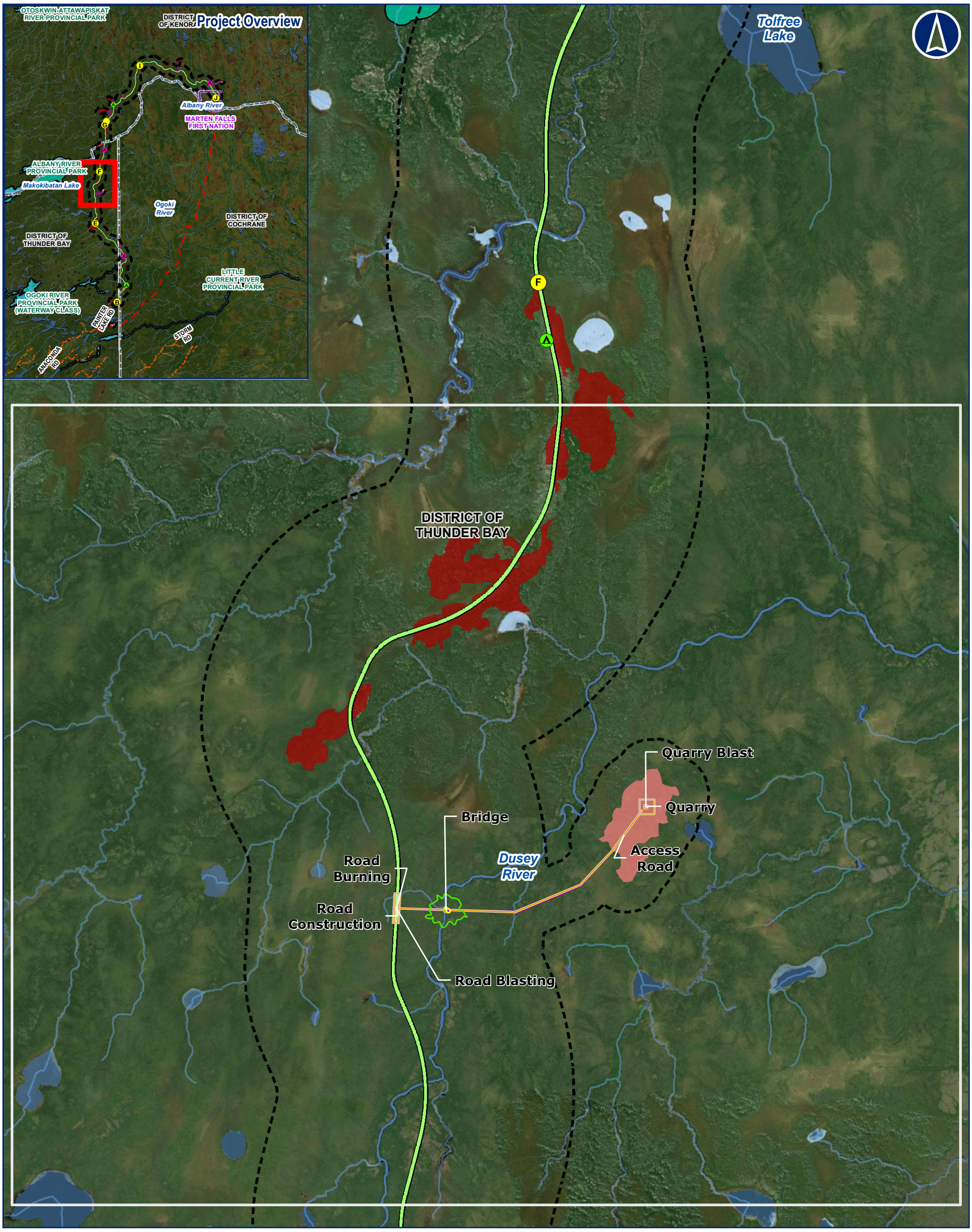
0 0.5 1 1.5 2
Kilometres

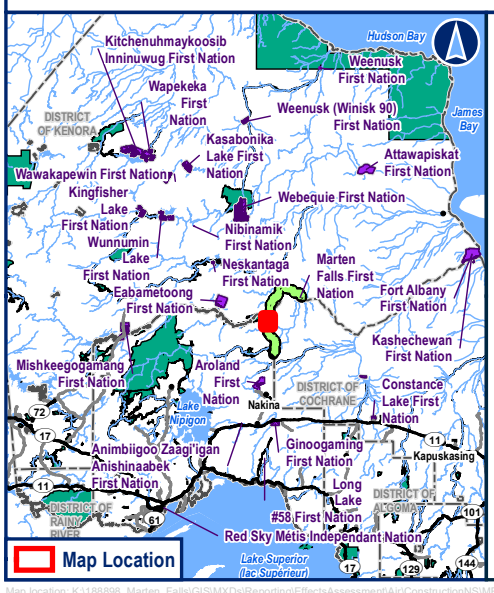
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-TSP-24HR.mxd
Date Saved: 2026-01-12 10:19:13 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- 50% Criteria (0.2)
- Criteria Minus Background (0.36)

**Background (ug/m3)**
- 50% Background (0.02)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10 m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: Acrolein
## Averaging Period: 24 Hours

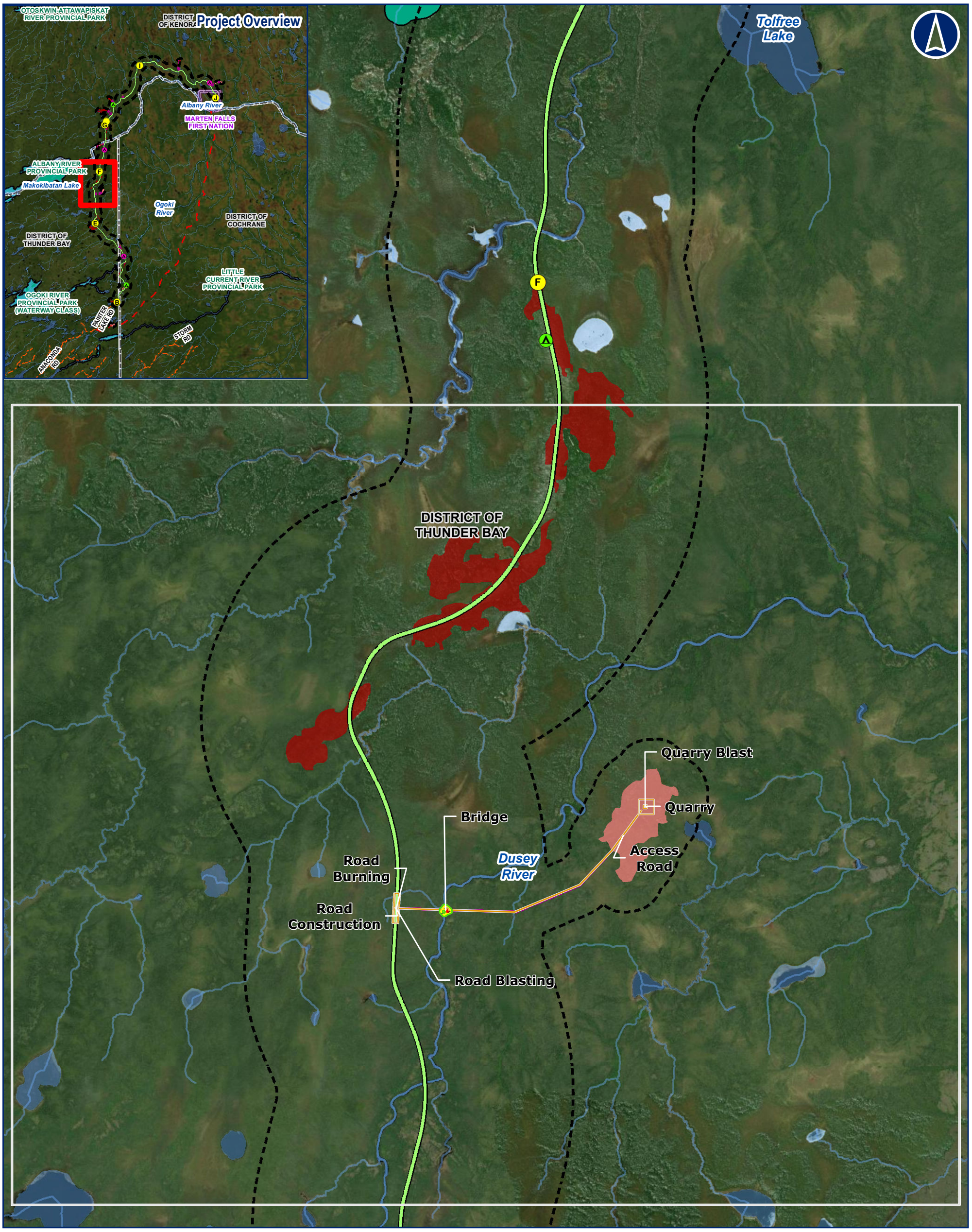
0 0.5 1 1.5 2
Kilometres

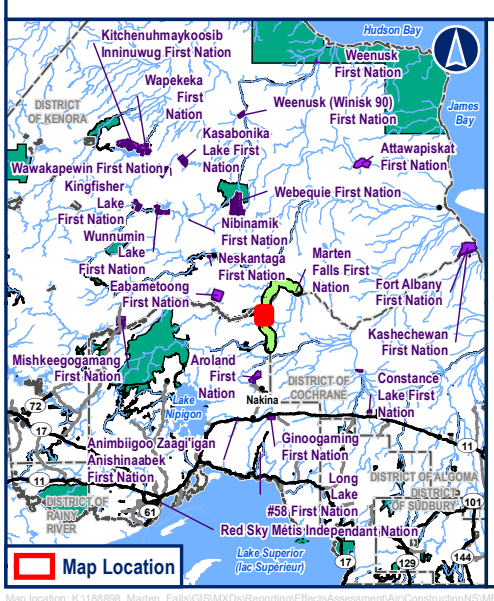
Datum: NAD 1983 CSRS UTM Zone 16N

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| **Figure #** | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-Acrolein-24HR.mxd
Date Saved: 2026-02-12 9:54:18 AM User Name: 34JFC




## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (0.00005)
- 50% Criteria (0.000025)
- Criteria Minus Background (0.0000167)

**Background (ug/m3)**
- 50% Background (0.00001665)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: Benzo(a)pyrene
## Averaging Period: 24 Hours

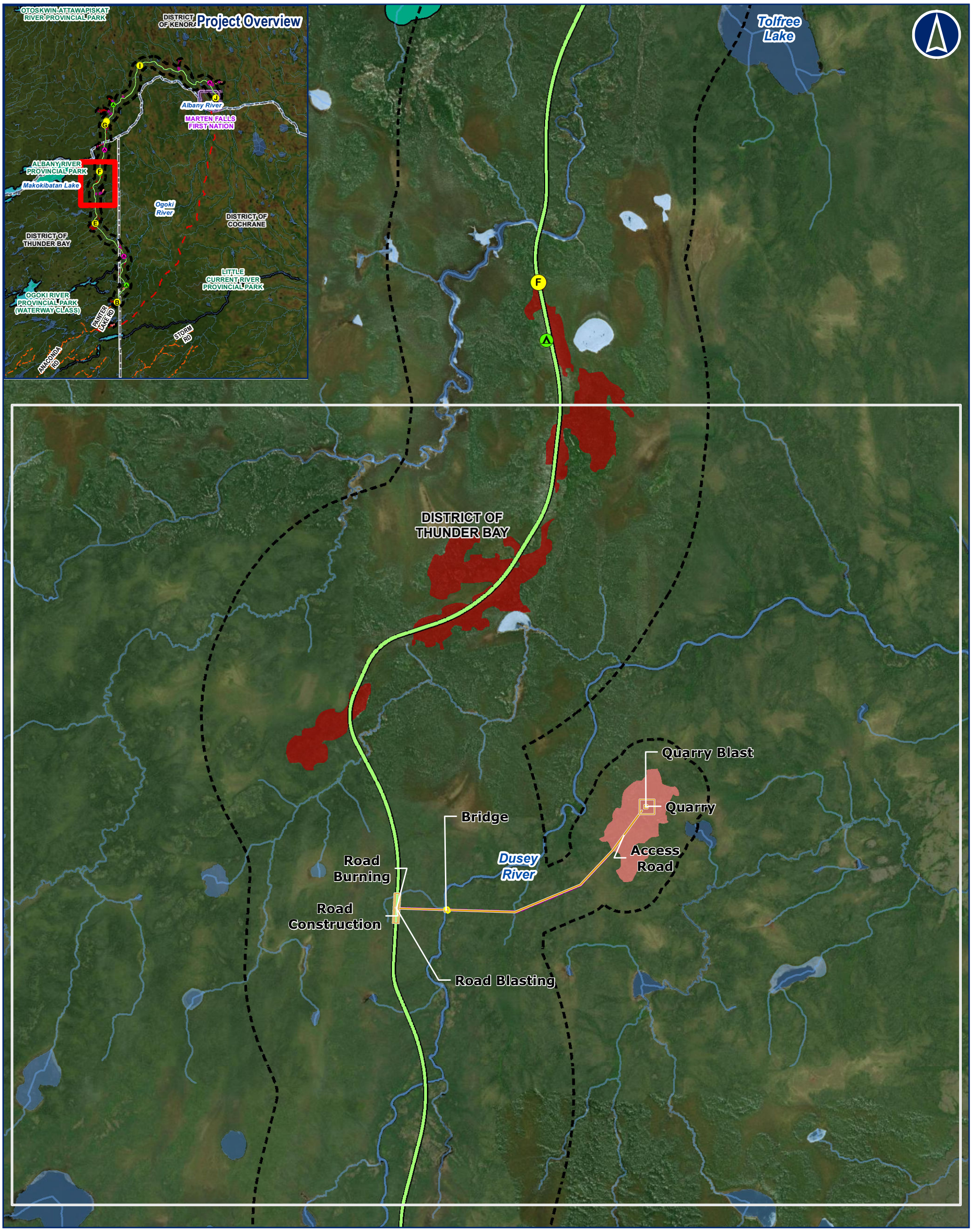
0 0.5 1 1.5 2
Kilometres

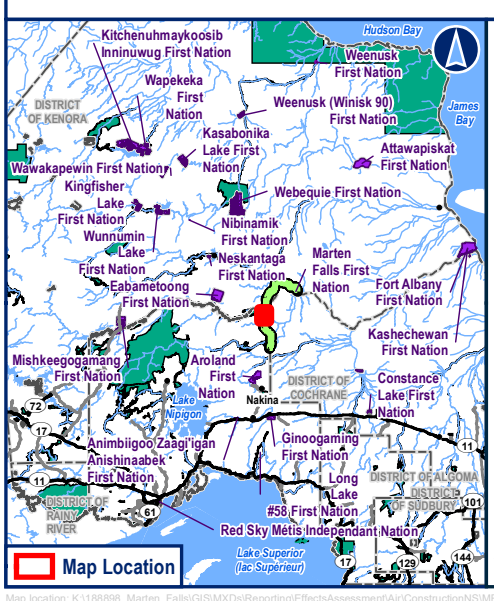
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-BAP-24HR.mxd
Date Saved: 2026-01-12 9:11:11 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**

- 50% Criteria (0.000005)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: Benzo(a)pyrene
## Averaging Period: Annual

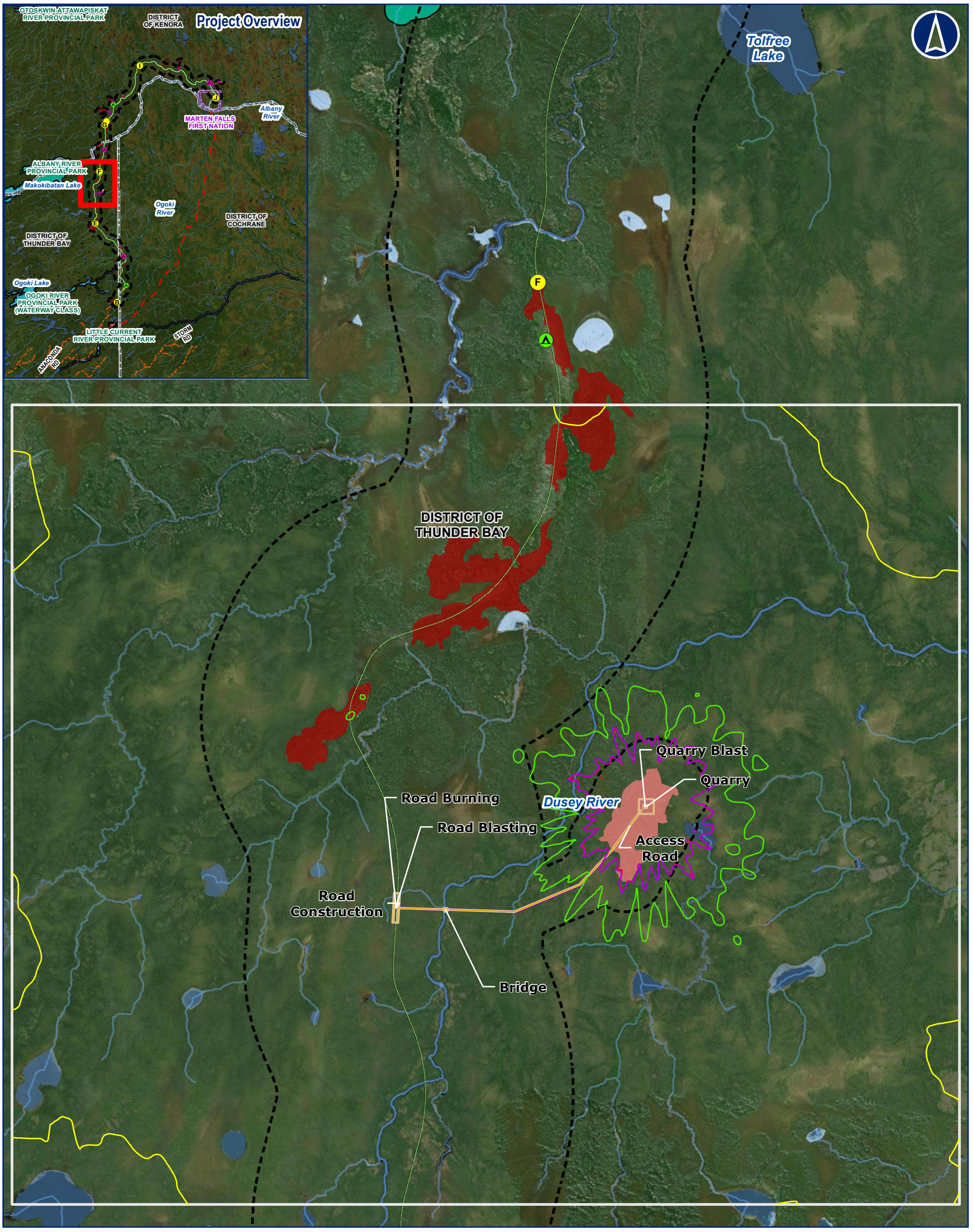
0 0.5 1 1.5 2
Kilometres

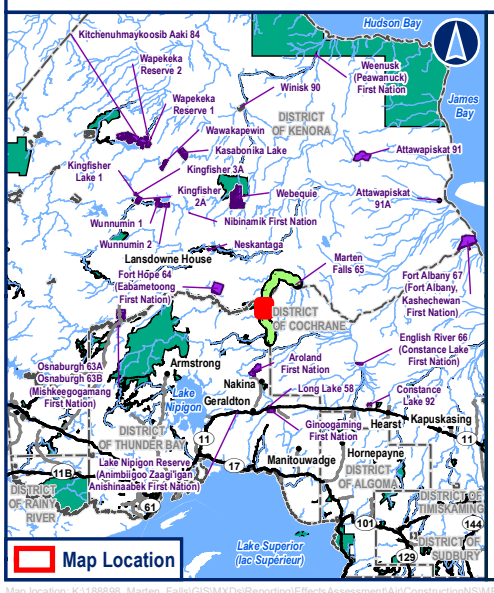
Datum: NAD 1983 CSRS UTM Zone 16N

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| Jan, 2026 | 1:62,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-BAP-Annual.mxd
Date Saved: 2026-01-12 9:21:52 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (36200)
- 50% Criteria (234.85)
- Criteria Minus Background (35730.3)

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- 50% Background (18100)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**
- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** None

**Data Source:**
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

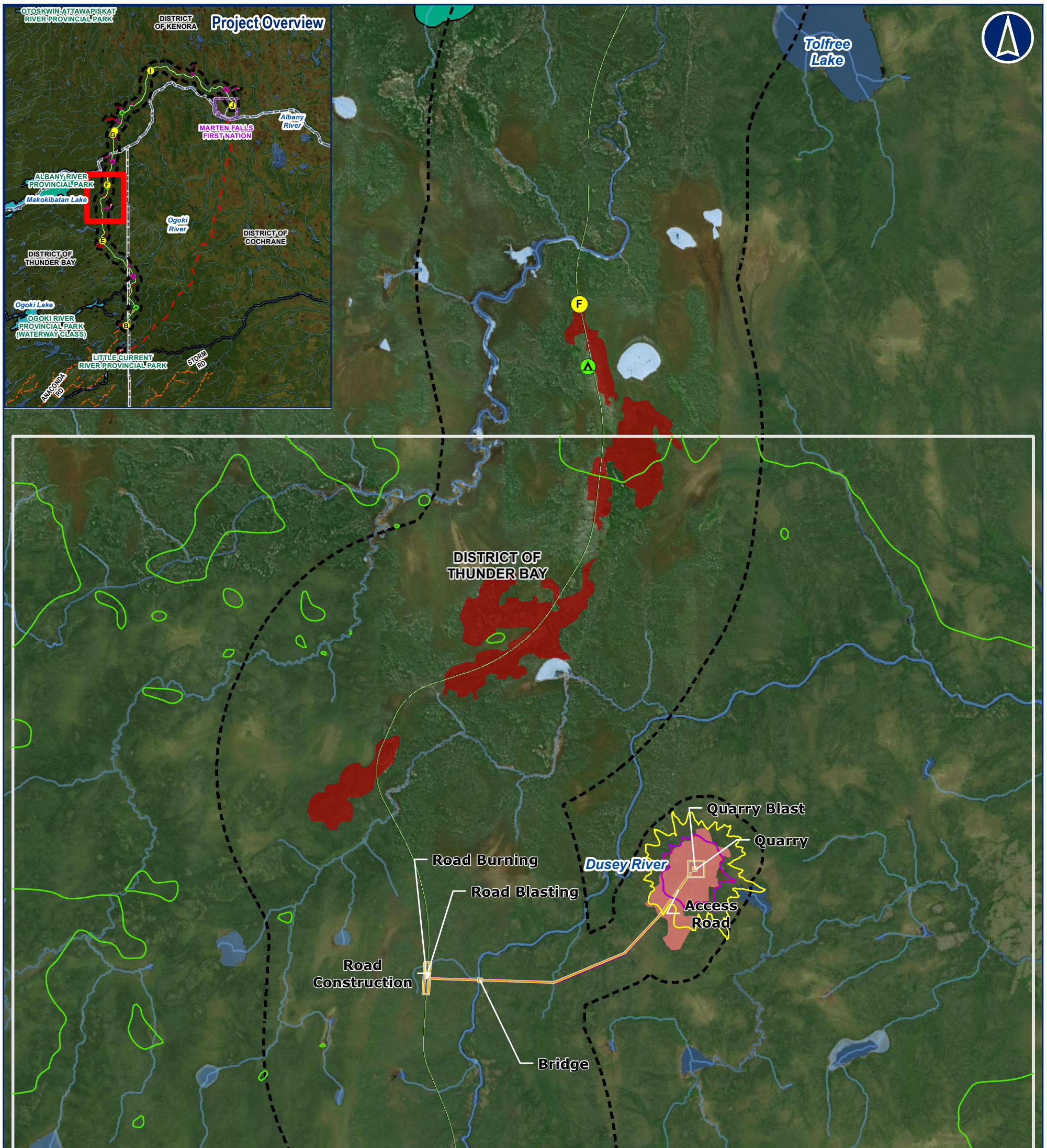
## Pollutant: CO
## Averaging Period: 1 Hour

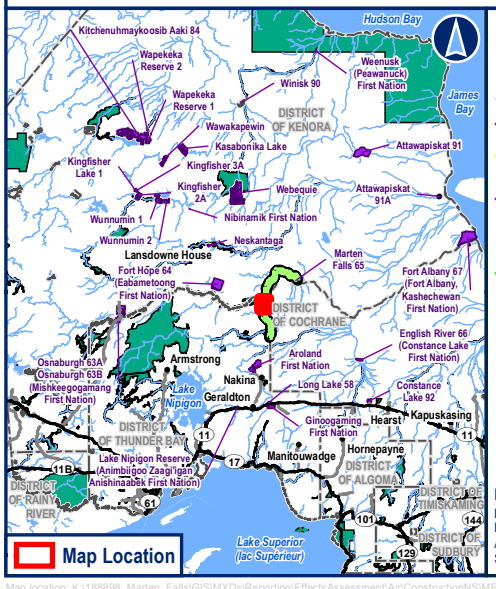
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (15700)
- 50% Criteria (7850)
- Criteria Minus Background (15246.05)

**Background (ug/m3)**
- 50% Background (226.97)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**
- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** None

**Data Source:**
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Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

**Pollutant: CO**
**Averaging Period: 8 Hours**

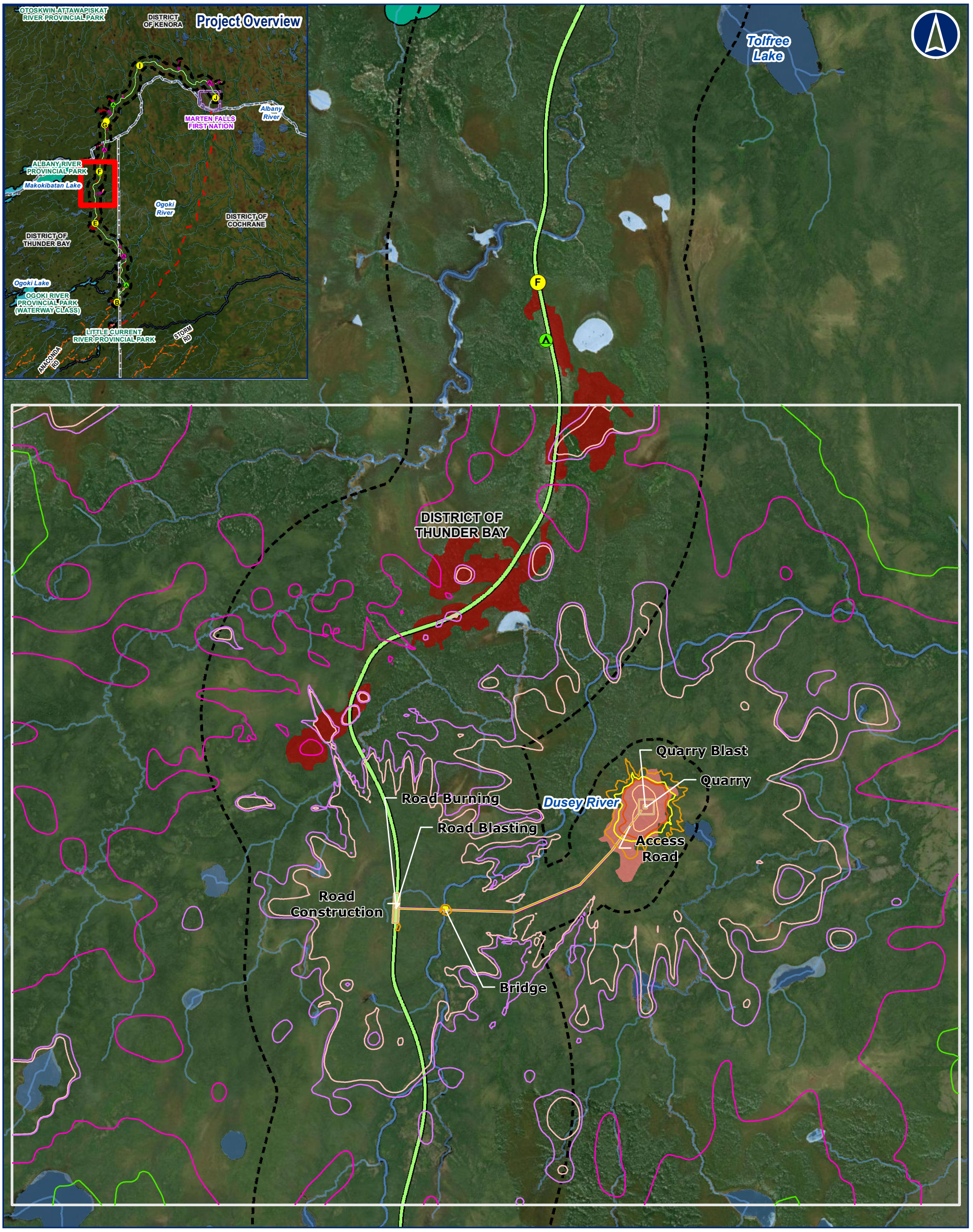
0 0.5 1 1.5 2
Kilometres

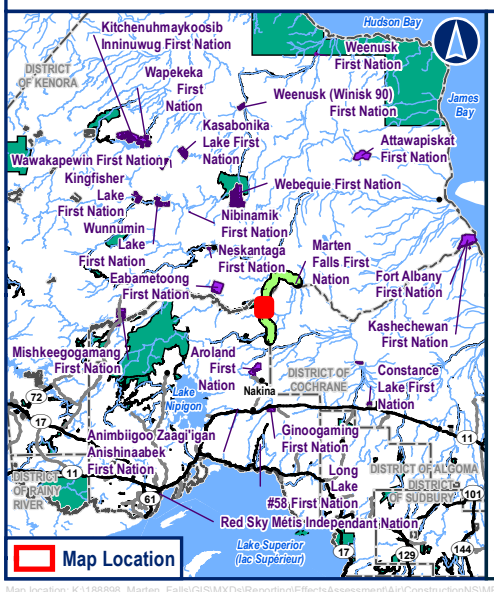
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-CO-08HR.mxd
Date Saved: 2024-10-24 5:24:59 AM User Name: 34LM




## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (400)
- 50% Criteria (200)
- Criteria Minus Background (396.2)

**CAAQS, 2025 (ug/m^3)**
- Criteria (79)
- 50% Criteria (39.5) (CAAQS)
- Criteria Minus Background (75.2)
- 2x Criteria (158)
- 3x Criteria (237)
- 5x Criteria (395)

**Background (ug/m3)**
- 50% Background (1.88)

- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

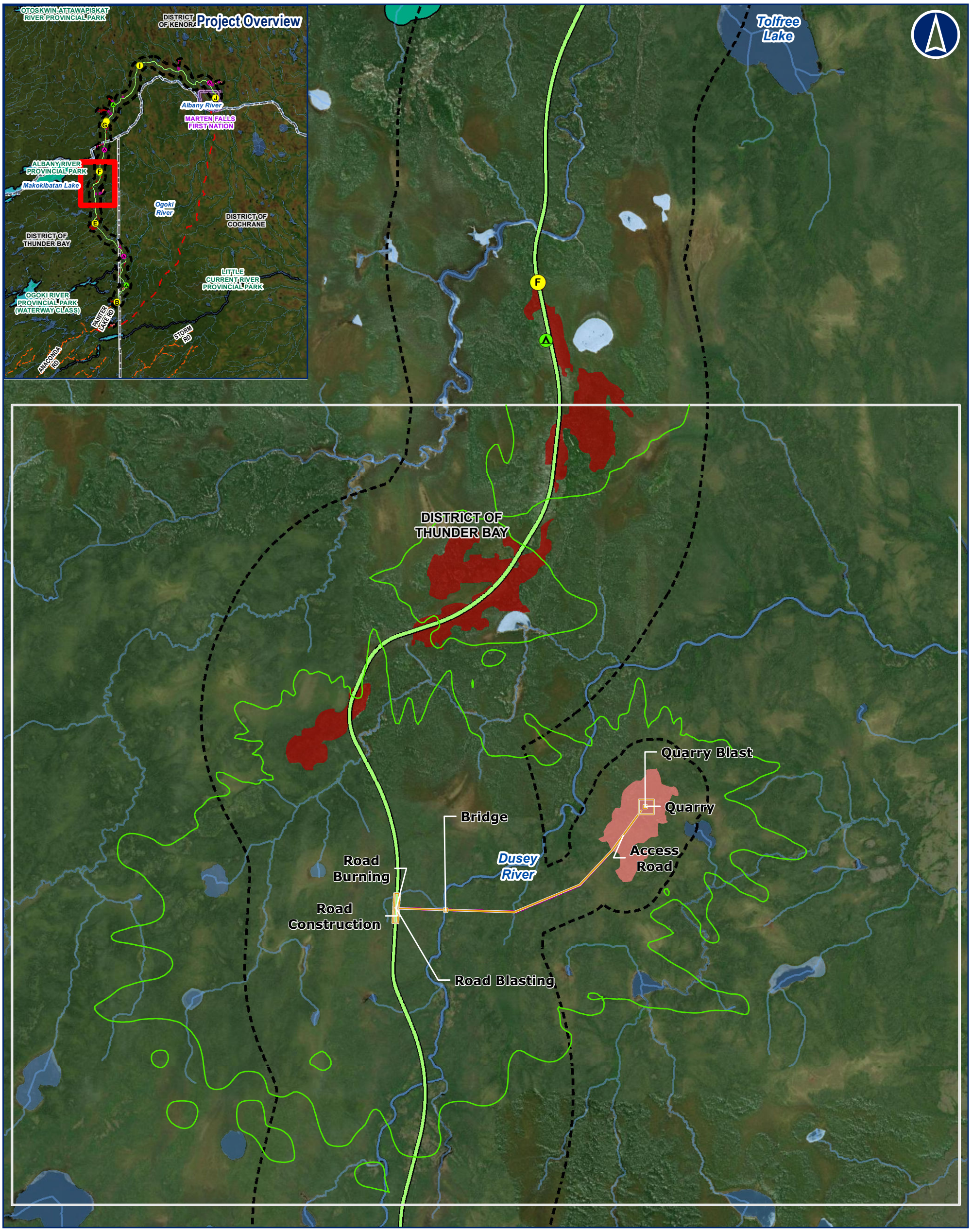
## Construction - N/S Segment
## Pollutant: $NO_2$
## Averaging Period: 1 Hour

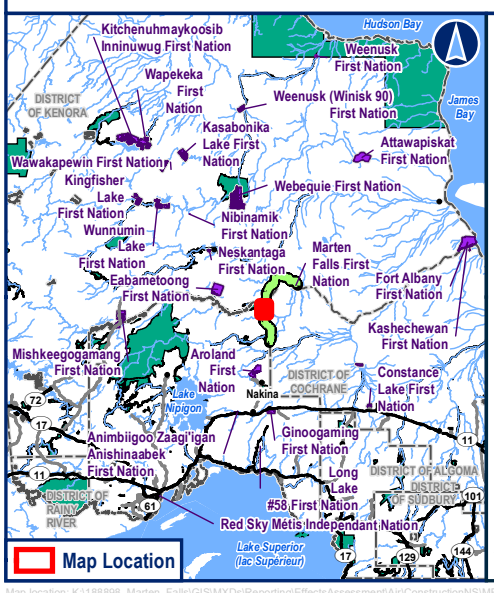
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Background (ug/m3)**
- 50% Background (1.53)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: $NO_2$
## Averaging Period: 24 Hours

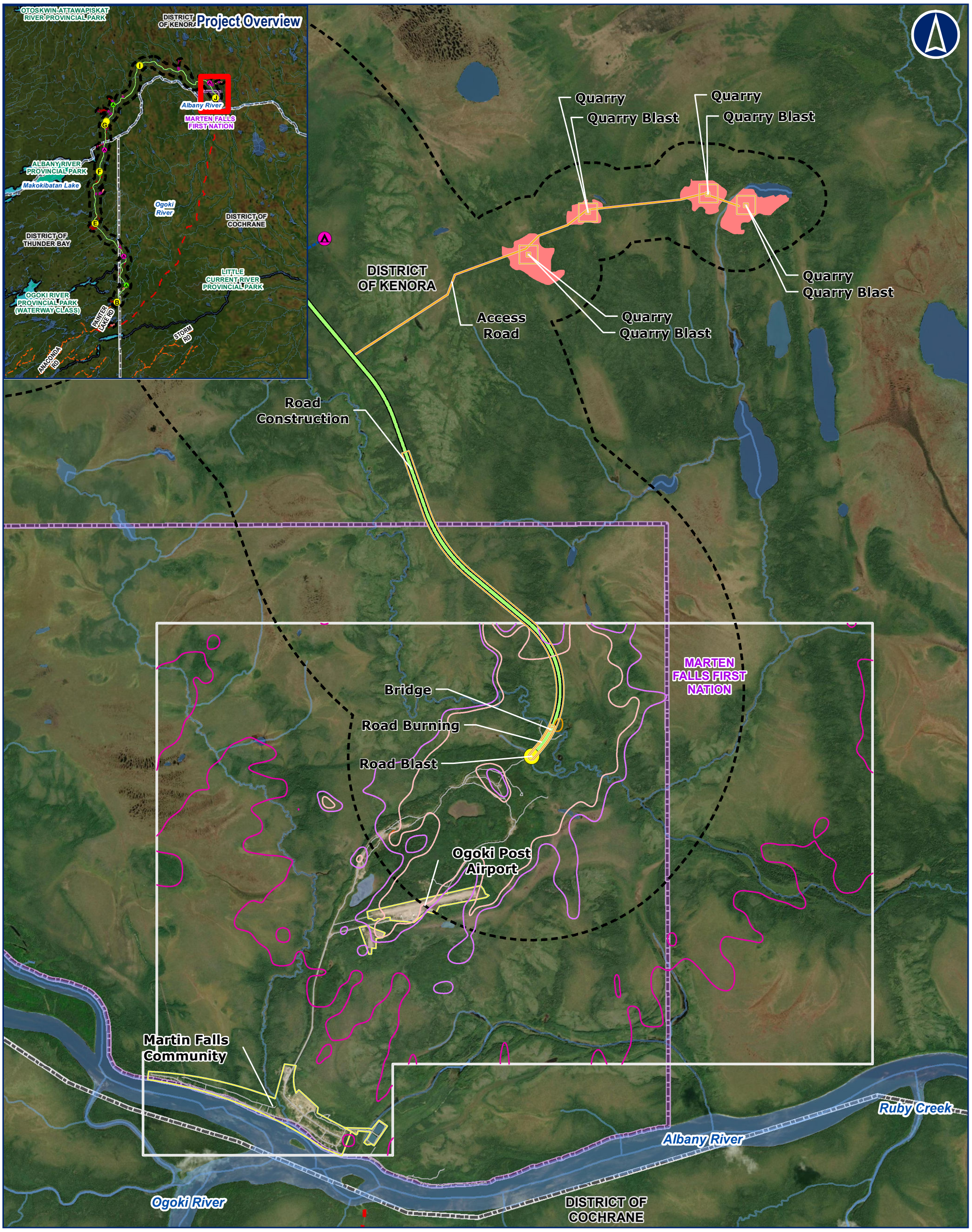
0 0.5 1 1.5 2
Kilometres

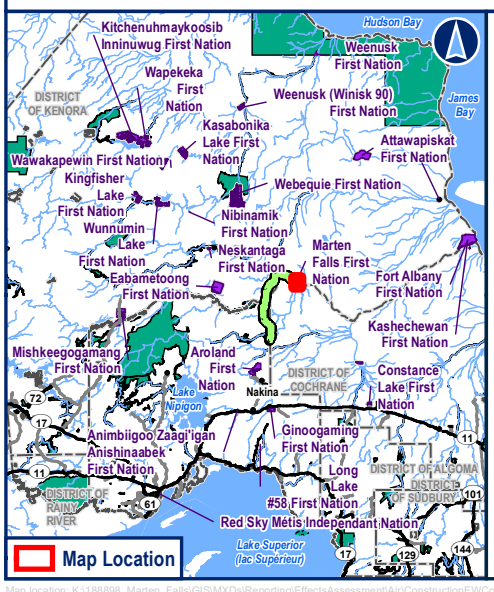
Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Jan, 2026 | 1:62,000 * when printed 11"x17" |
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-NO2-24HR.mxd
Date Saved: 2026-01-12 9:30:59 PM User Name: 30AEE




## Legend

**CAAQS, 2025 (ug/m^3)**

- Criteria (79)
- 50% Criteria (39.5)
- Criteria Minus Background (75.2)
- 2x Criteria (158)
- Built Up Area
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

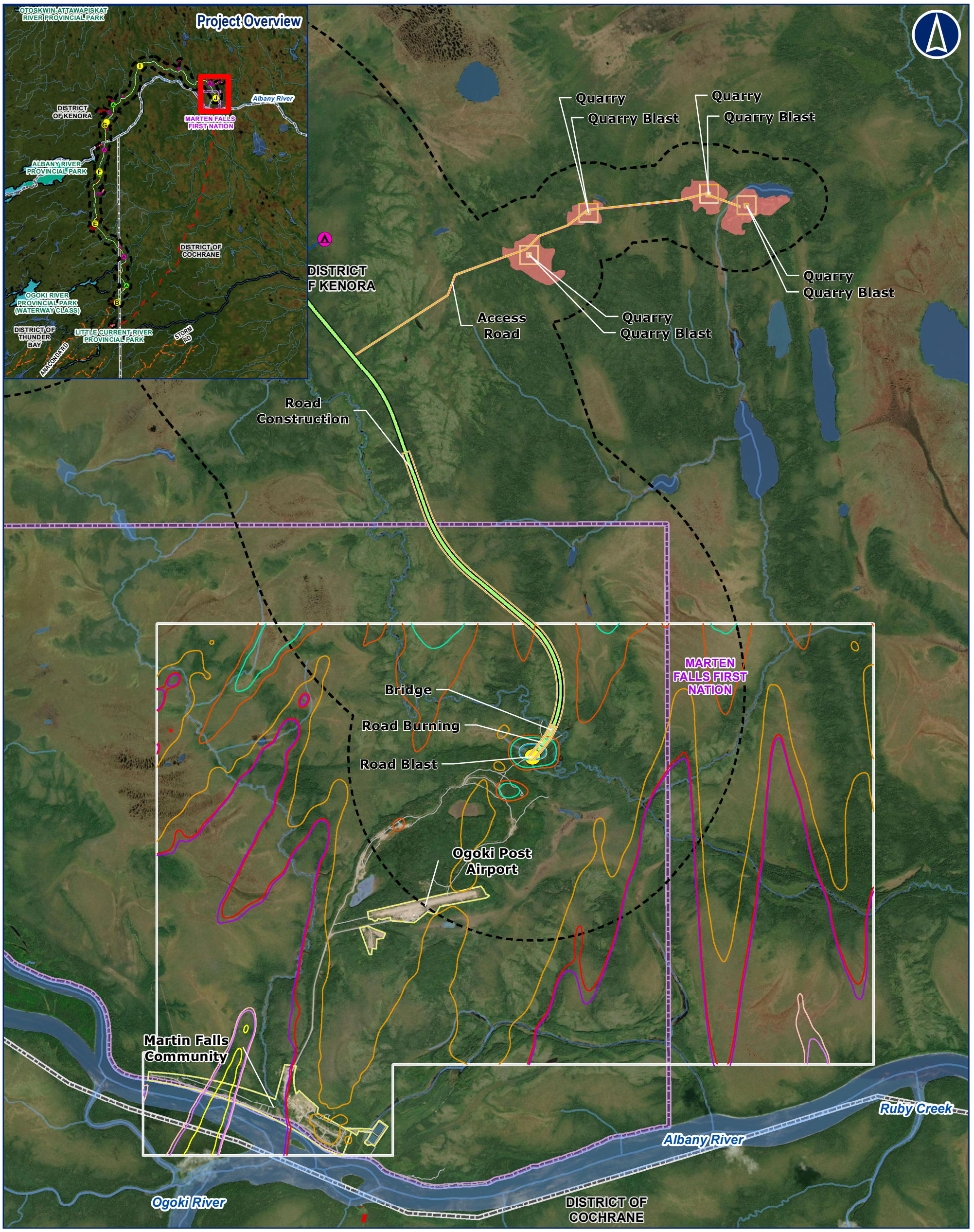
## Construction - E/W Segment
## Pollutant: $NO_2$
## Averaging Period: 1 Hour

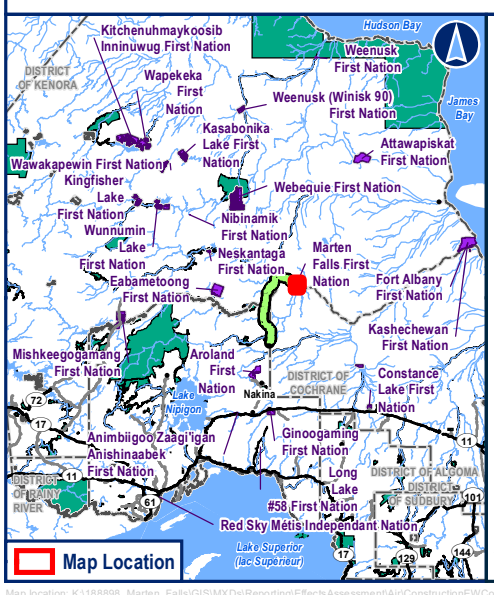
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (170)
- 50% Criteria (85)
- Criteria Minus Background (167.4)
- 2x Criteria (340)
- 3x Criteria (510)

**CAAQS, 2025 (ug/m^3)**
- Criteria (100)
- Criteria Minus Background (97.38)
- 2x Criteria (200)
- 3x Criteria (300)
- 5x Criteria (500)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - E/W Segment
## Pollutant: $SO_2$
## Averaging Period: 1 Hour

0 0.5 1 1.5 2
Kilometres

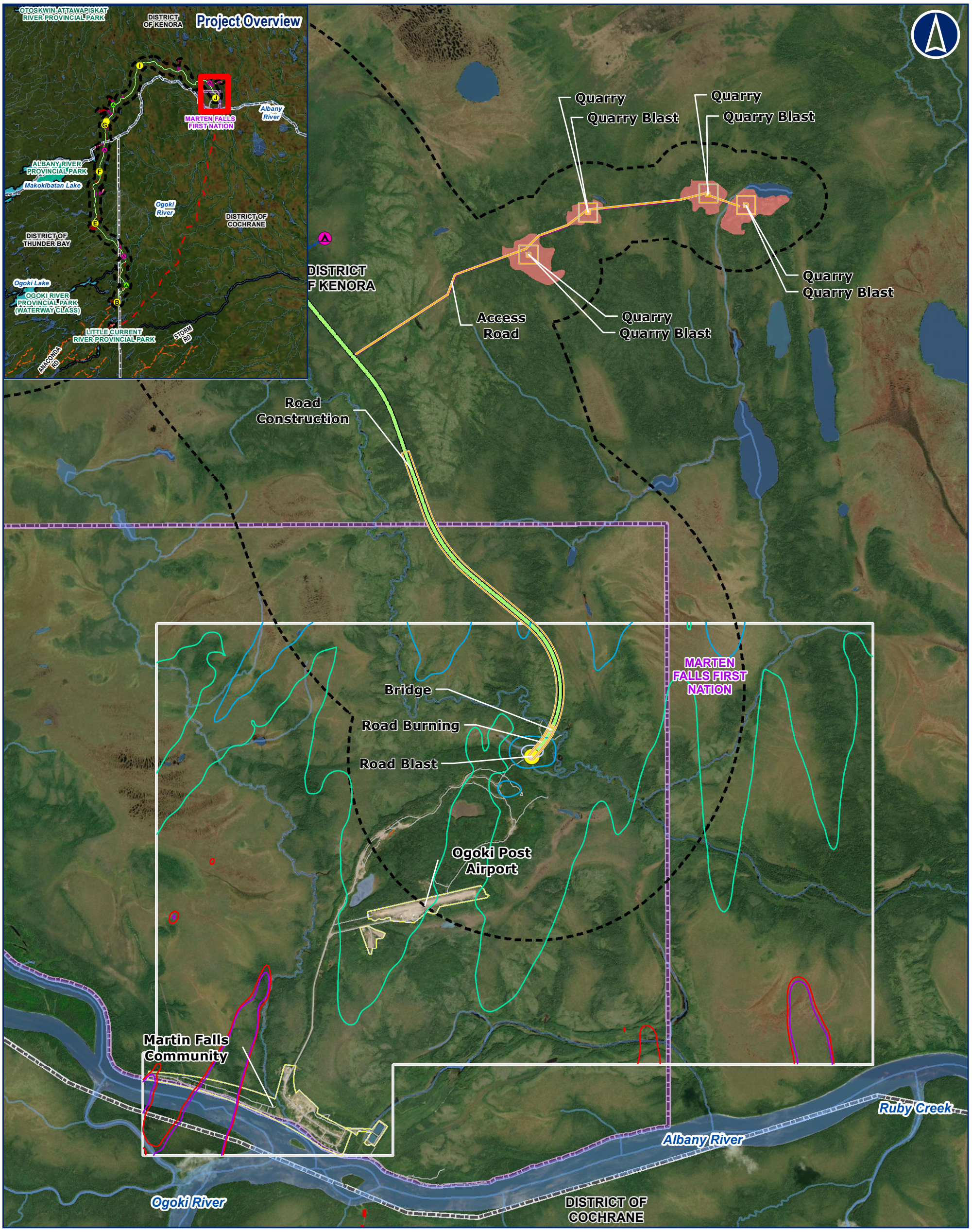
Datum: NAD 1983 CSRS UTM Zone 16N

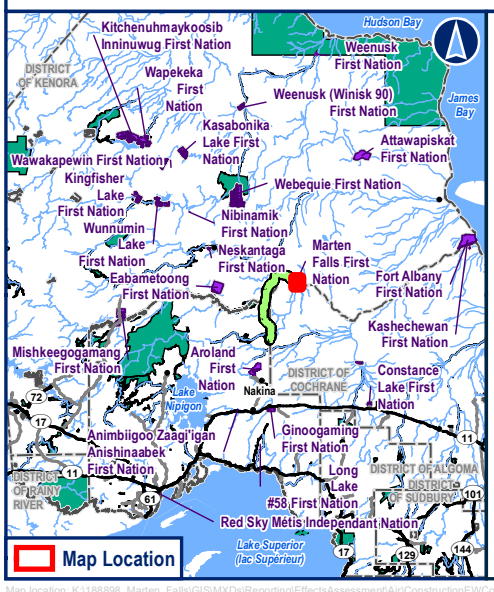
Jan, 2026 | 1:50,000 * when printed 11"x17"

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionEWCommunity\MFCAR_EffectsAssessment_Air_ConsComm_SO2-01HR.mxd
Date Saved: 2026-01-30 1:23:06 PM User Name: 34LM




**Legend**

**Pollutant Model Result Contour - Ontario AAQC (ug/m^3)**
- Criteria (178)
- Criteria Minus Background (173.7)
- 2x Criteria (356)
- 3x Criteria (534)
- 5x Criteria (890)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - E/W Segment
## Pollutant: $SO_2$
## Averaging Period: 10 Minutes

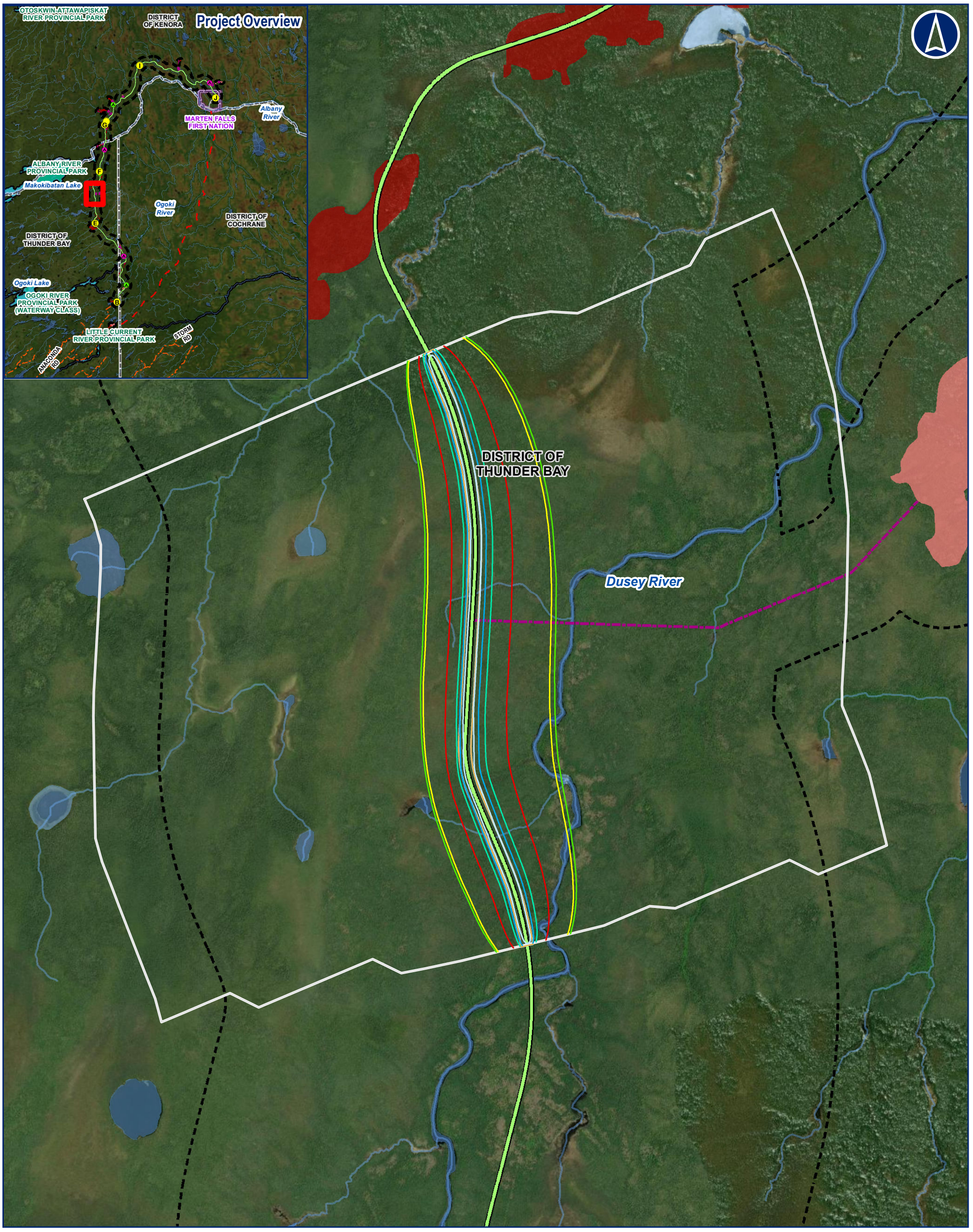
0 0.5 1 1.5 2
Kilometres

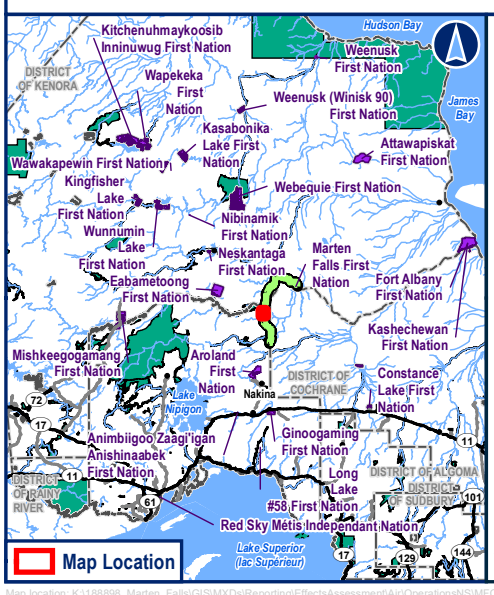
Datum: NAD 1983 CSRS UTM Zone 16N

| Jan, 2026 | 1:50,000 * when printed 11"x17" |
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionEWCommunity\MFCAR_EffectsAssessment_Air_ConsComm_SO2-10MIN.mxd
Date Saved: 2026-01-13 9:01:45 AM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (60)
- 50% Criteria (30)
- 2x Criteria (120)
- 3x Criteria (180)
- 5x Criteria (300)

**Background (ug/m3)**
- 50% Background (28.3)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: TSP
## Averaging Period: Annual

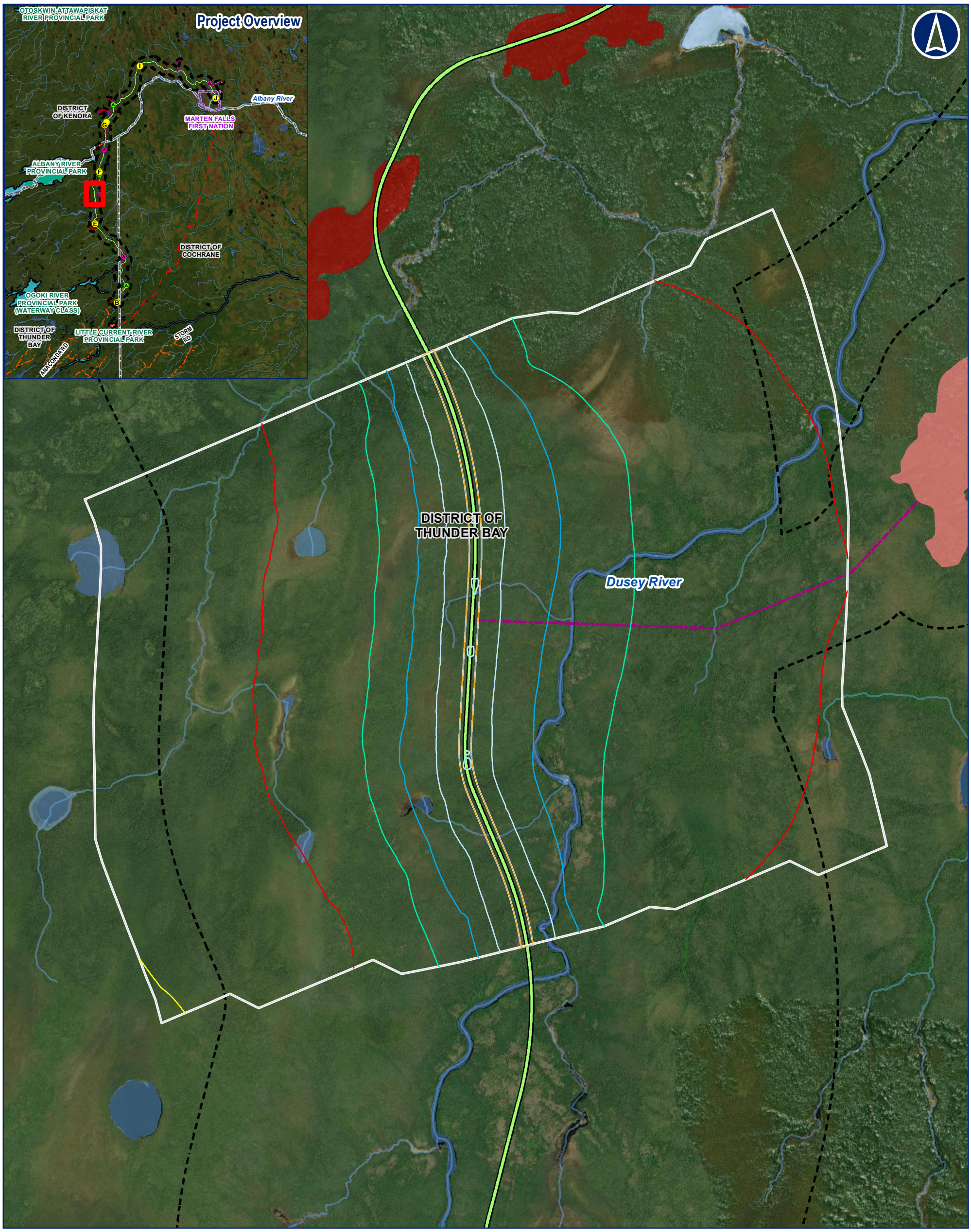
0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

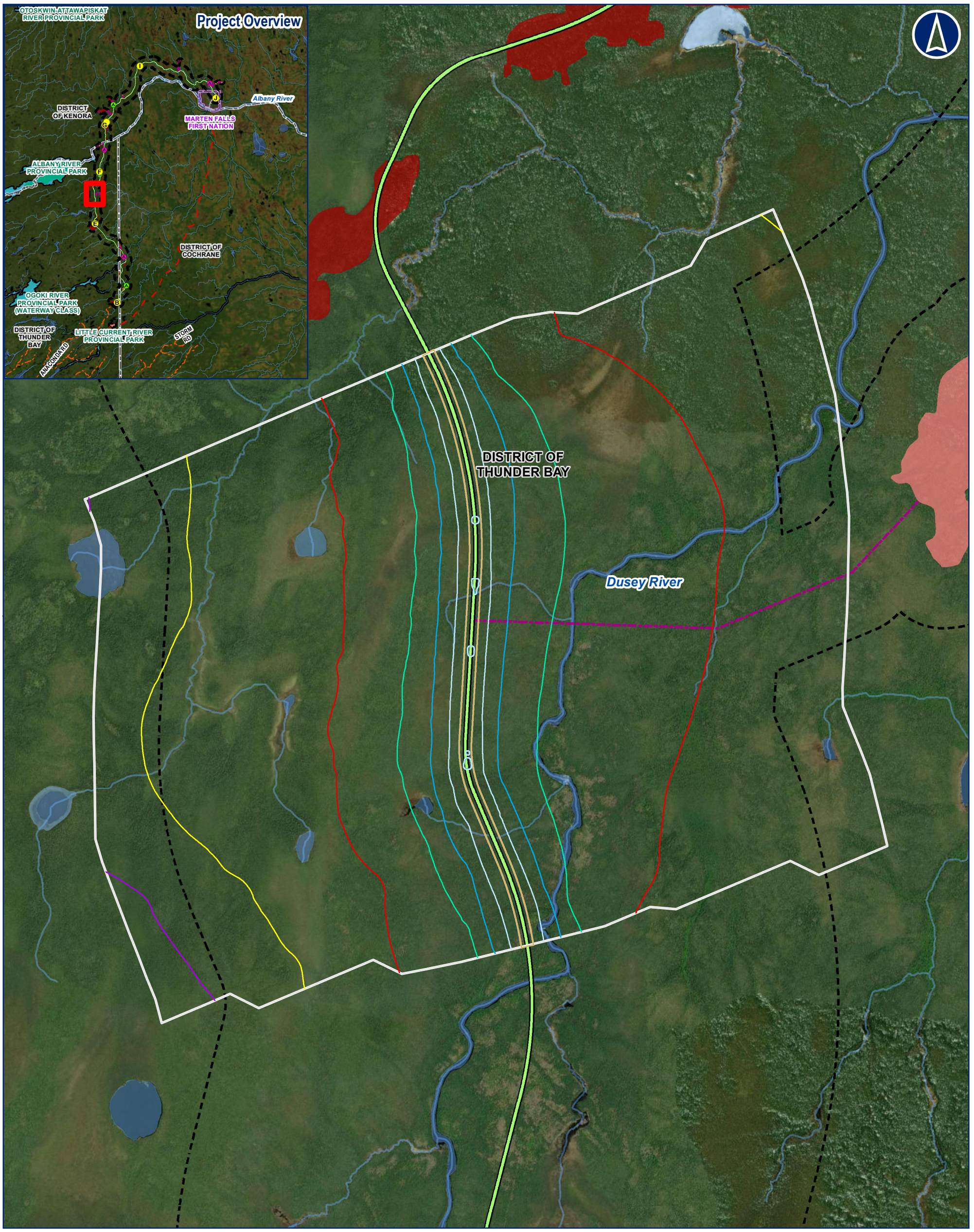
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-TSP_Annual.mxd
Date Saved: 2026-01-21 3:24:44 PM User Name: 30AEE




Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-TSP-24HR.mxd
Date Saved: 2026-02-03 11:03:37 PM User Name: 34LM




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (50)
- 50% Criteria (25)
- Criteria Minus Background (18.8)
- 2x Criteria (100)
- 3x Criteria (150)
- 5x Criteria (250)

**Background (ug/m3)**
- 50% Background (15.6)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: PM 10
## Averaging Period: 24 Hours

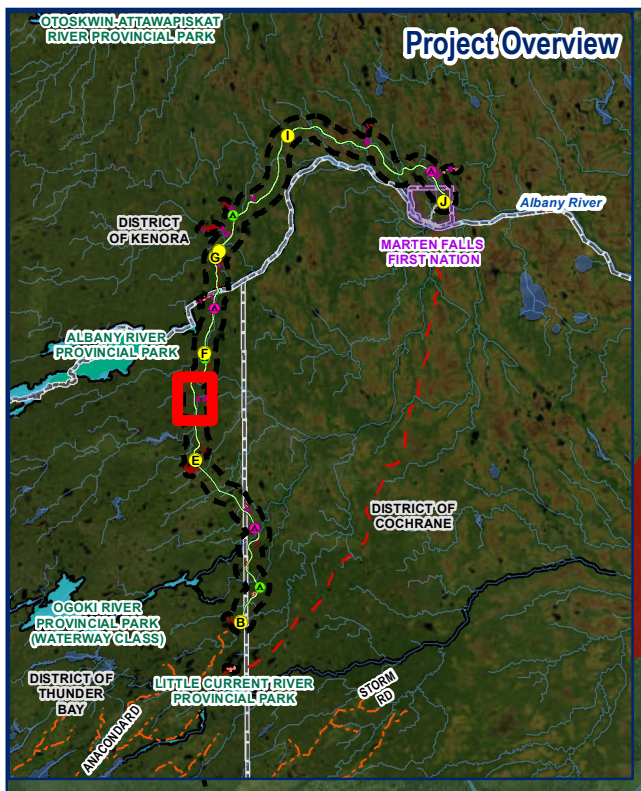
0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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| Feb, 2026 | 1:30,000 * when printed 11"x17" |
| Rev:00 | |

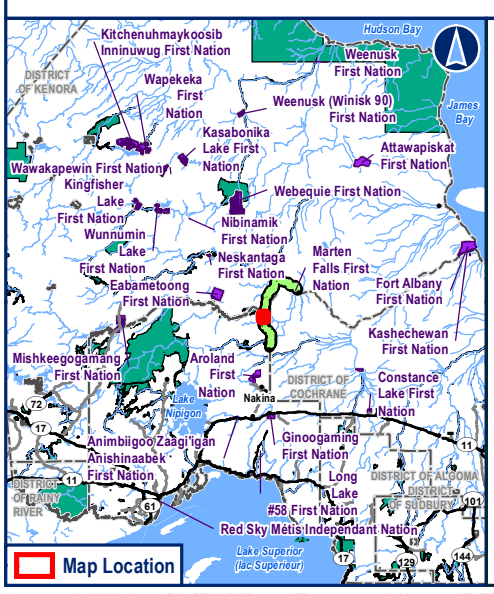
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-PM10-24HR.mxd
Date Saved: 2026-02-03 11:17:50 PM User Name: 34LM




DISTRICT OF THUNDER BAY

Dusey River




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (27)
- 50% Criteria (13.5)
- Criteria Minus Background (19)
- 2x Criteria (54)
- 3x Criteria (81)
- 5x Criteria (135)

**Background (ug/m3)**
- 50% Background (4)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: PM 2.5
## Averaging Period: 24 Hours

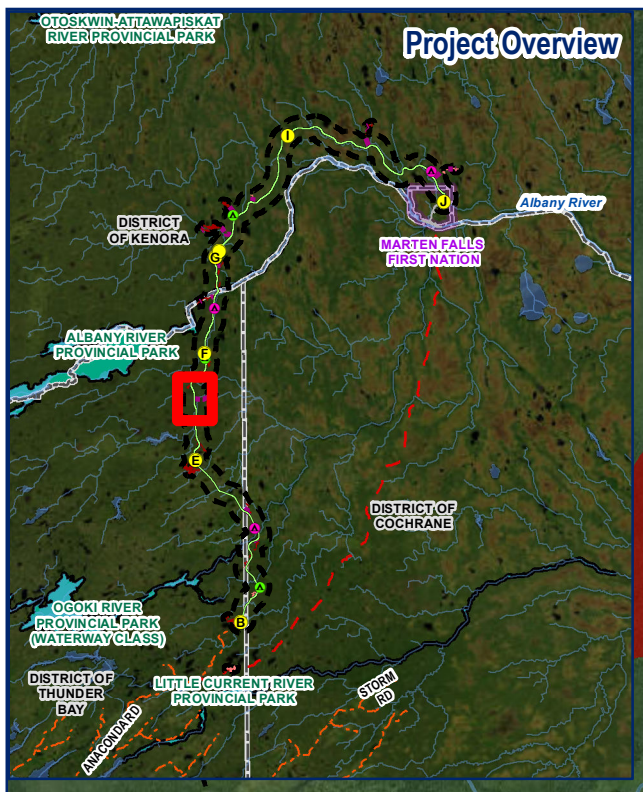
0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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| Feb, 2026 | 1:30,000 * when printed 11"x17" |
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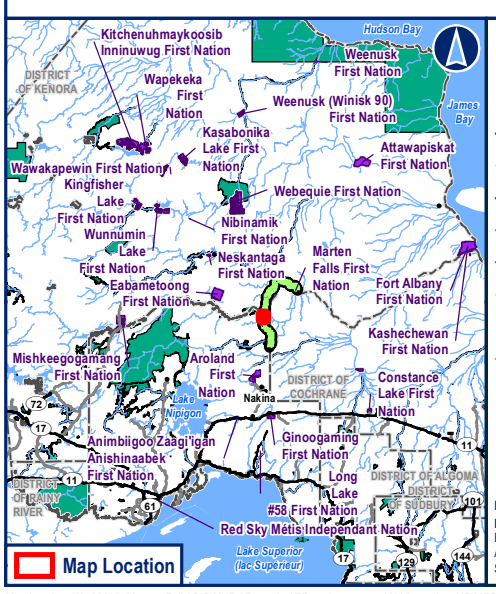
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-PM25-24HR.mxd
Date Saved: 2026-02-03 11:21:52 PM User Name: 34LM




DISTRICT OF THUNDER BAY

Dusey River




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (60)
- 50% Criteria (30)
- Criteria Minus Background (3.4)
- 2x Criteria (120)
- 3x Criteria (180)
- 5x Criteria (300)

**Background (ug/m3)**
- 50% Background (28.3)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: PM 2.5
## Averaging Period: Annual

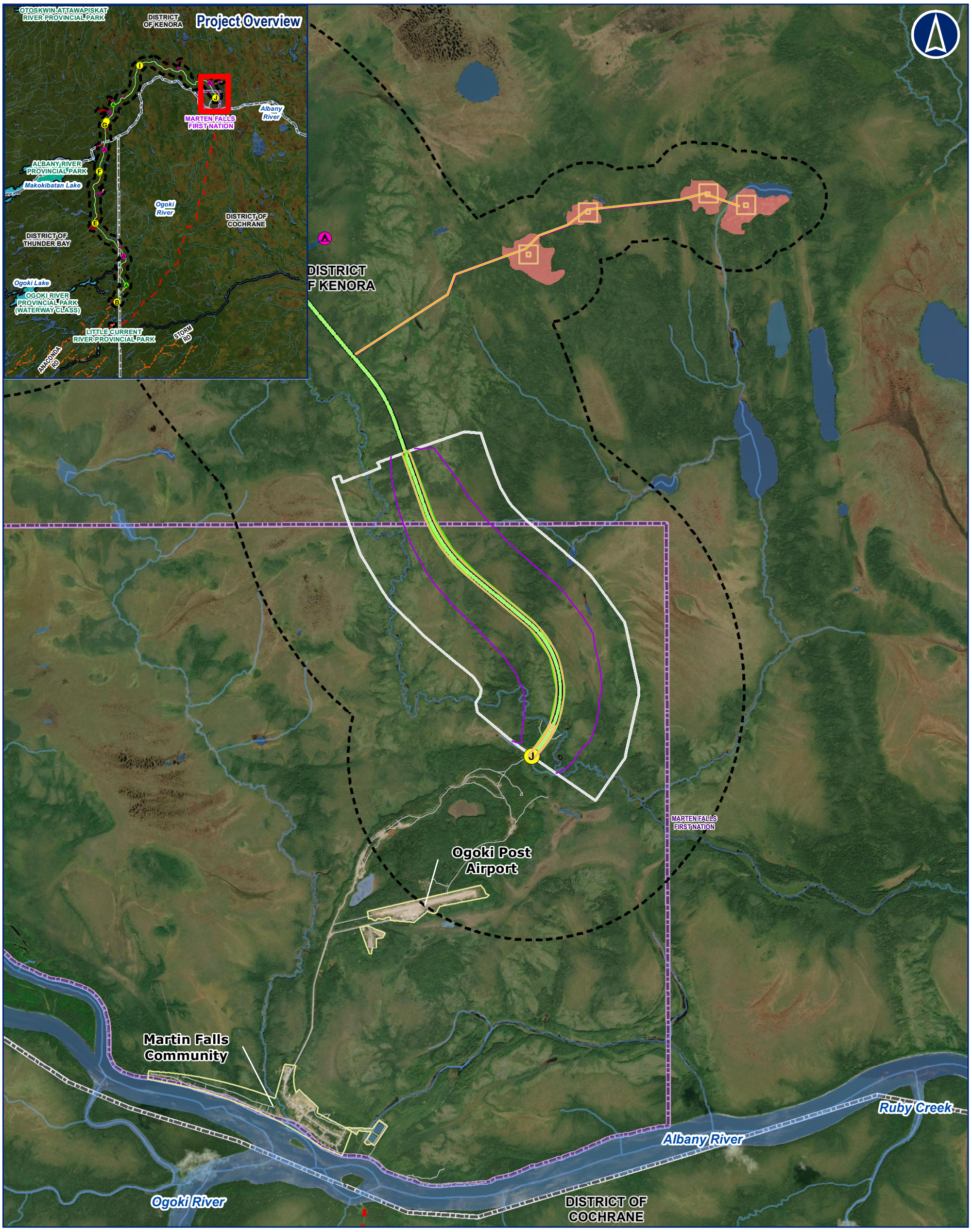
0 0.25 0.5 0.75 1
Kilometres

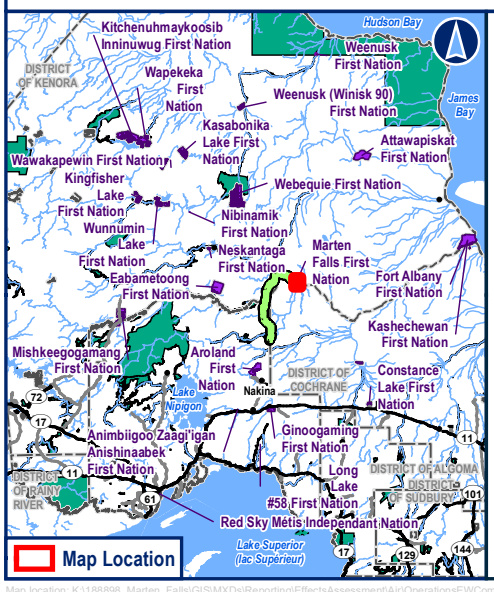
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-PM25-Annual.mxd
Date Saved: 2026-02-03 11:32:02 PM User Name: 34LM




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- 50% Criteria (30)
- Criteria Minus Background (3.4)

**Background (ug/m3)**
- 50% Background (28.3)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - E/W Segment
## Pollutant: TSP
## Averaging Period: Annual

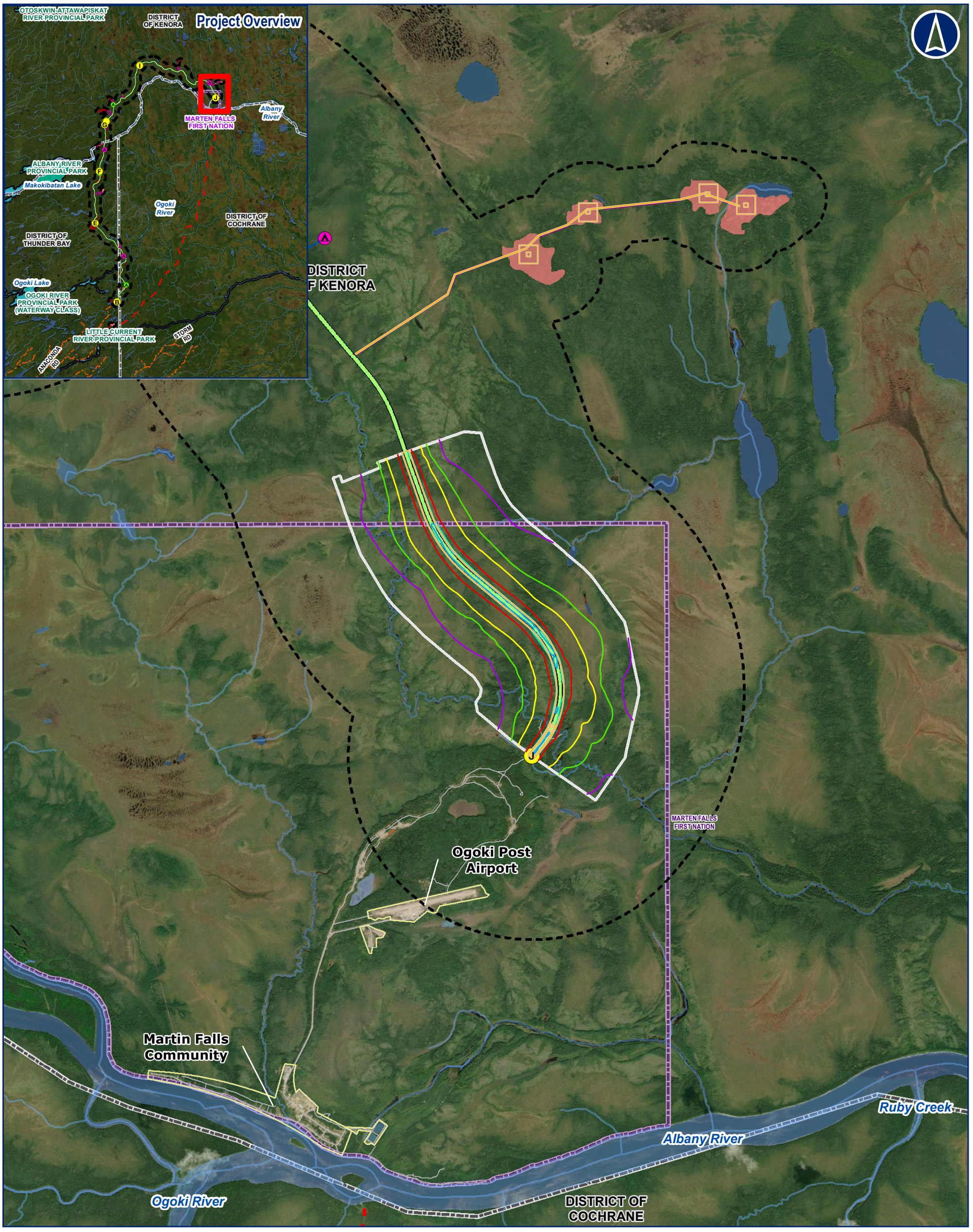
0 0.5 1 1.5 2
Kilometres

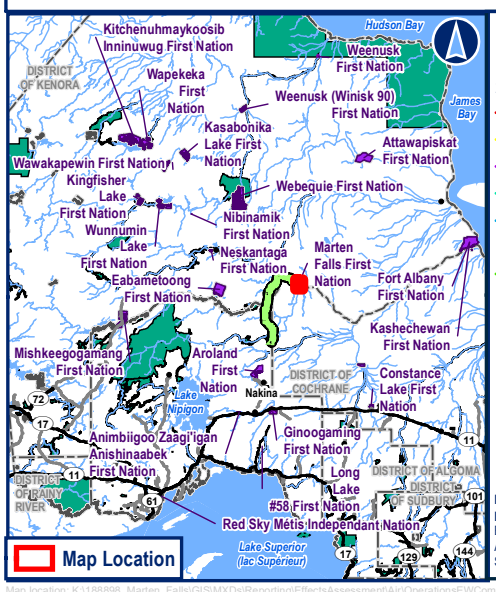
Datum: NAD 1983 CSRS UTM Zone 16N

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsEWCommunity\MFCAR_EffectsAssessment_Air_OpsComm_Pollutant-TSP_Annual.mxd
Date Saved: 2026-02-05 4:24:17 PM User Name: 30AEE




## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (120)
- 50% Criteria (60)
- Criteria Minus Background (30.9)
- 2x Criteria (240)
- 3x Criteria (360)

**Background (ug/m3)**
- 50% Background (44.6)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

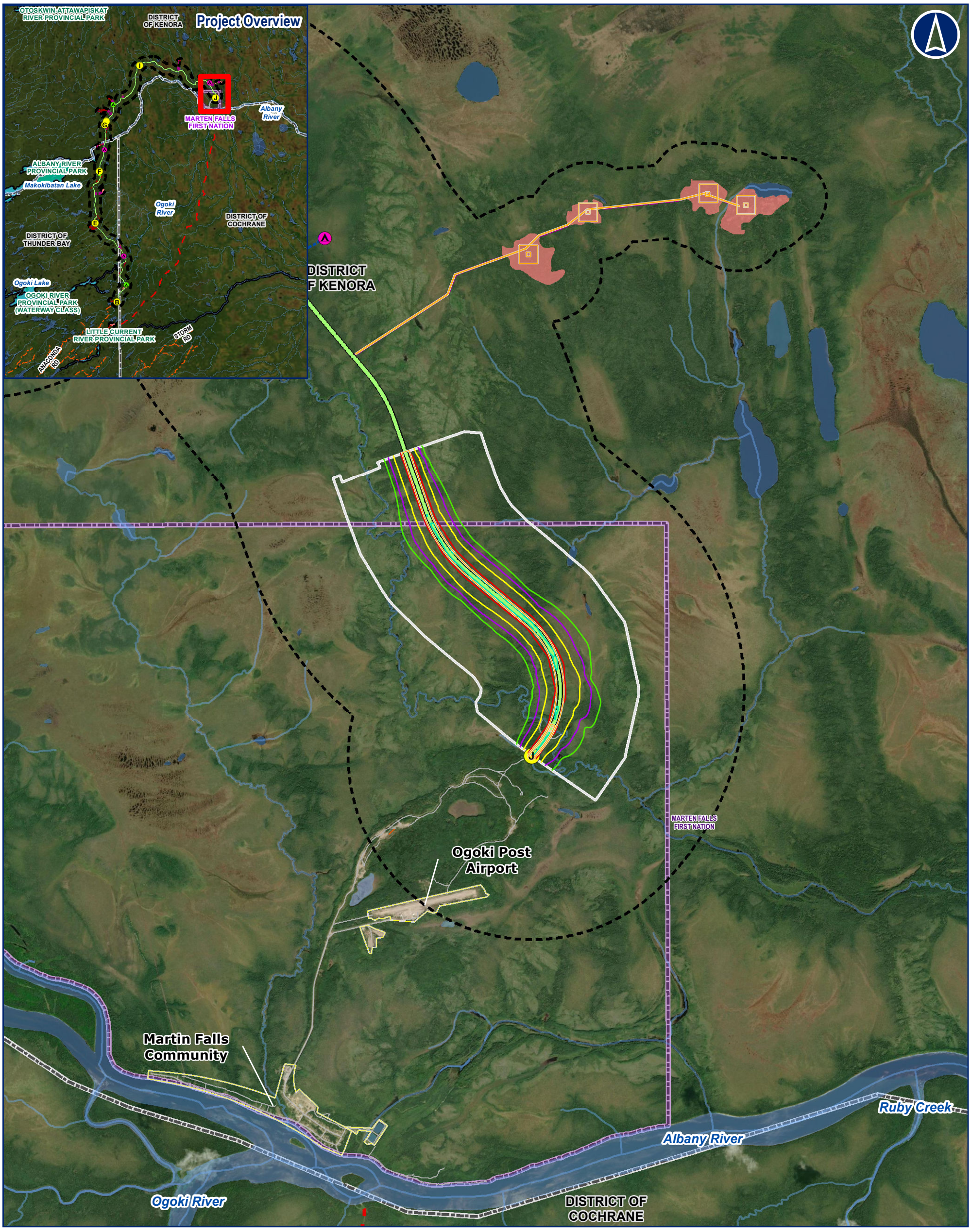
## Operation - E/W Segment
## Pollutant: TSP
## Averaging Period: 24 Hours

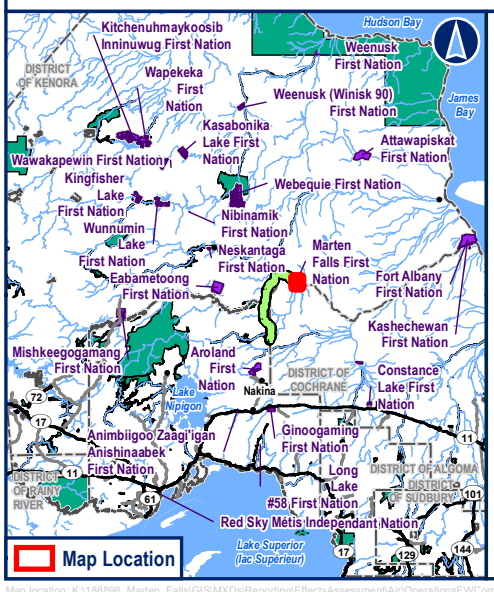
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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| Jan, 2026 | 1:50,000 * when printed 11"x17" |
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## Legend

**Pollutant Model Result Contour - CAAQS, 2025 (ug/m^3)**
- Criteria (50)
- 50% Criteria (25)
- Criteria Minus Background (18.8)
- 2x Criteria (100)

**Background (ug/m3)**
- 50% Background (15.6)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10 m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

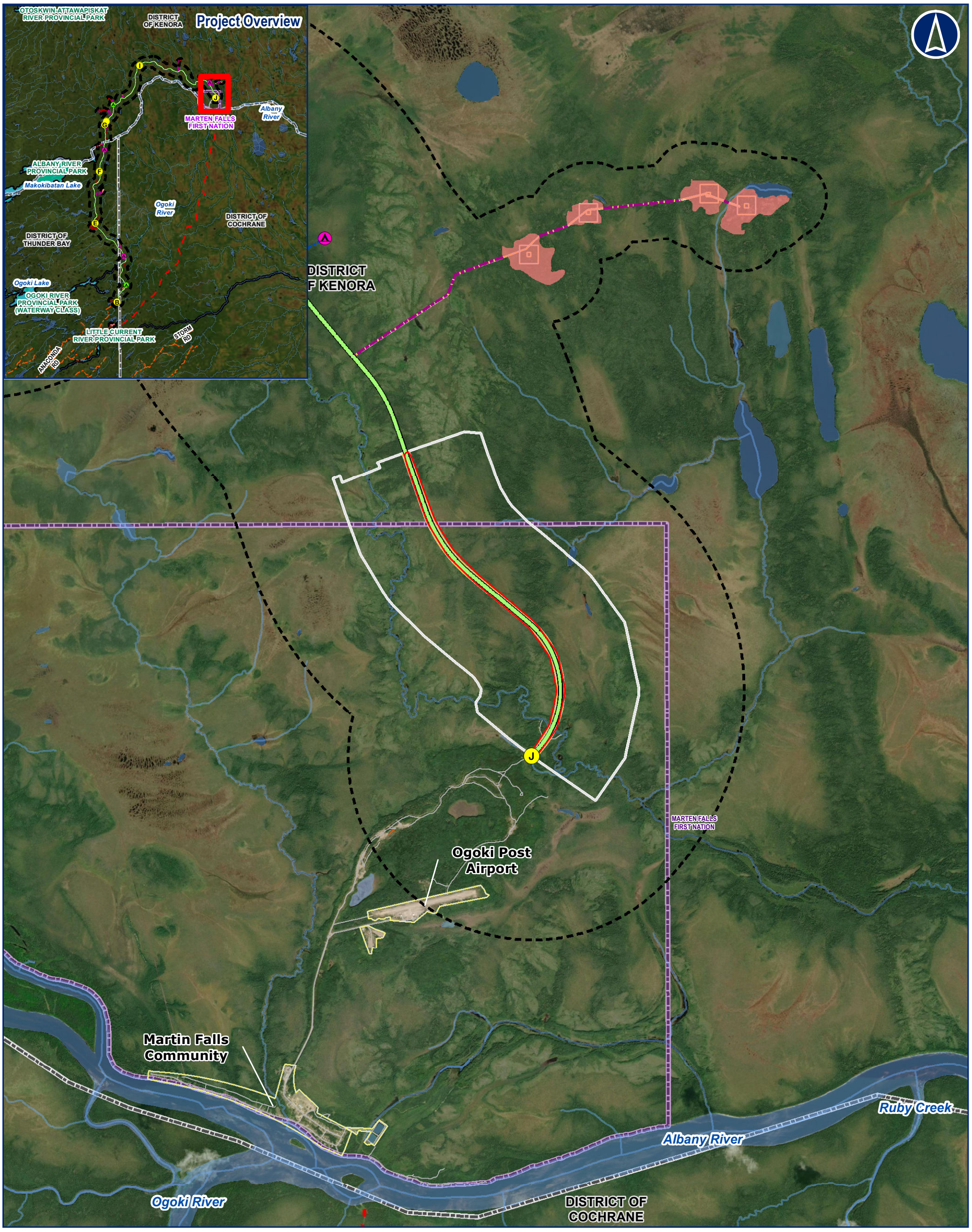
## Operation - E/W Segment
## Pollutant: PM 10
## Averaging Period: 24 Hours

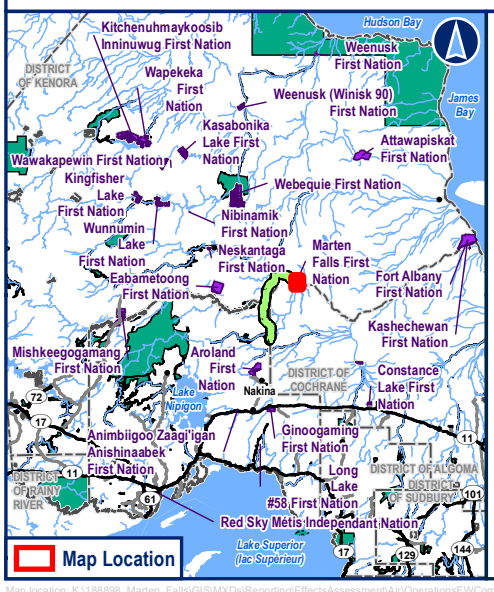
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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## Legend

**Pollutant Model Result Contour - (g/m2)**

- MECP Criteria (4.6)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

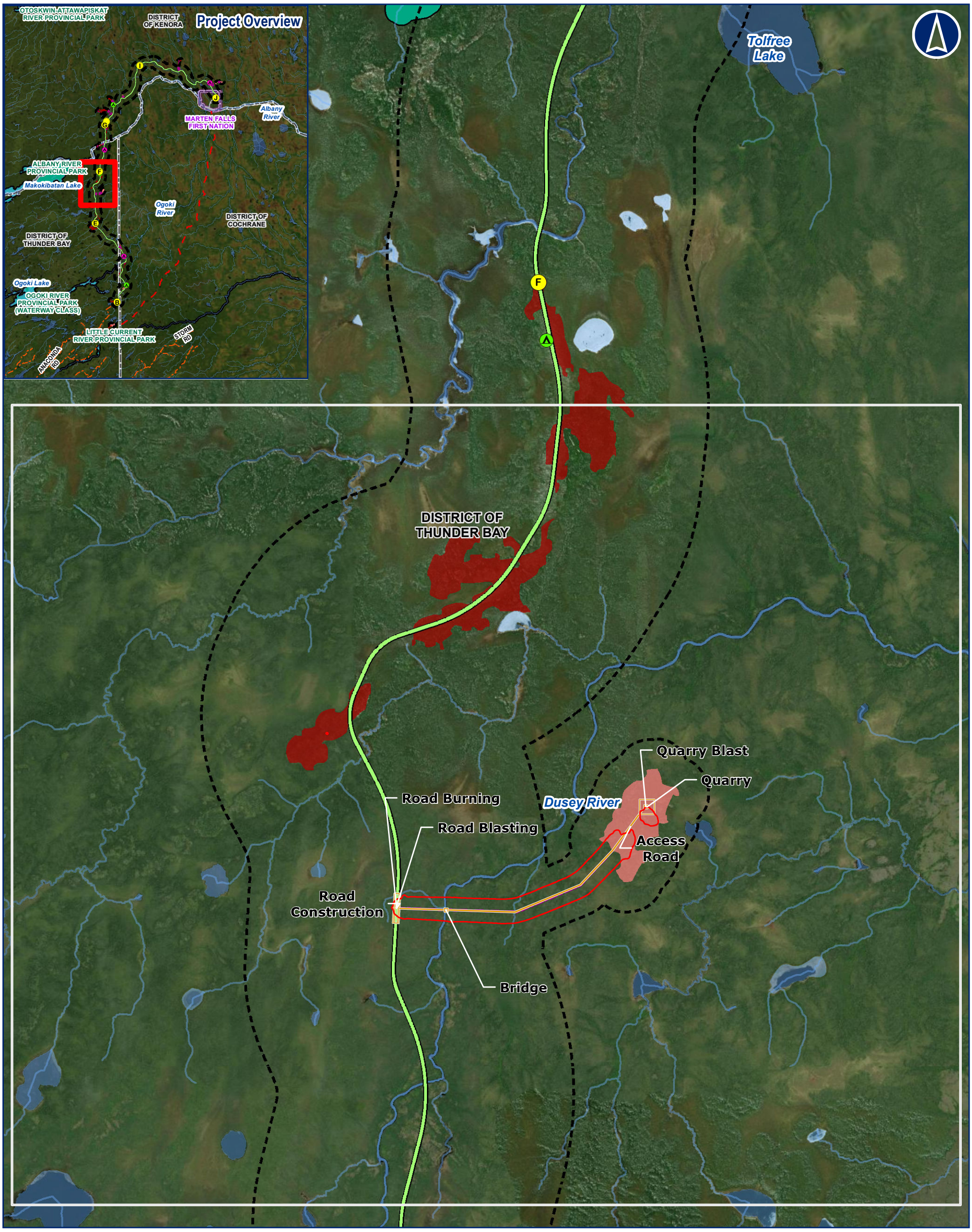
## Operation - E/W Segment
## Pollutant: Dustfall
## Averaging Period: Annual

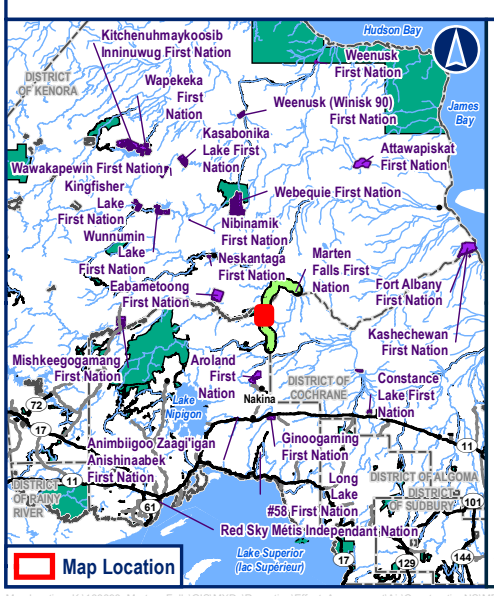
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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| Feb, 2026 | 1:50,000 * when printed 11"x17" |
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## Legend

**Pollutant Model Result Contour - (g/m2)**
- MECP Criteria (4.6)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction - N/S Segment
## Pollutant: Dustfall
## Averaging Period: Annual

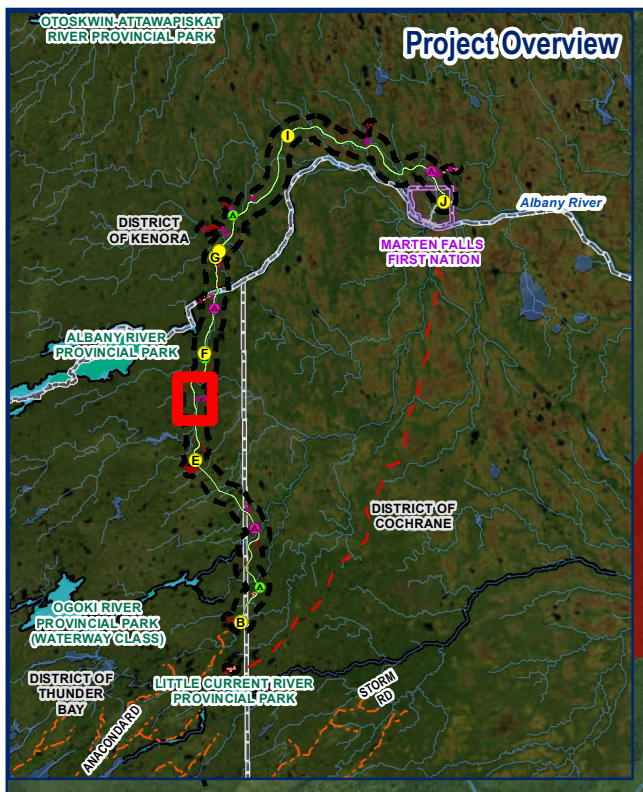
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

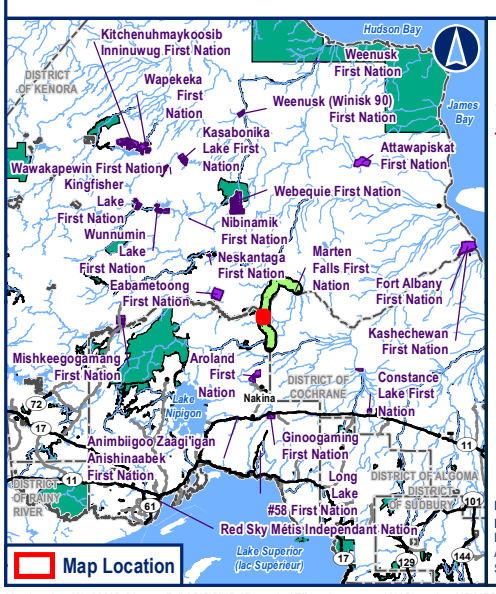
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| Feb, 2026 | 1:62,000 * when printed 11"x17" |
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-Dustfall_Annual.mxd
Date Saved: 2026-02-06 11:03:19 AM User Name: 30AEE






## Legend

**Pollutant Model Result Contour - (g/m2)**
- MECP Criteria (4.6)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: Dustfall
## Averaging Period: Annual

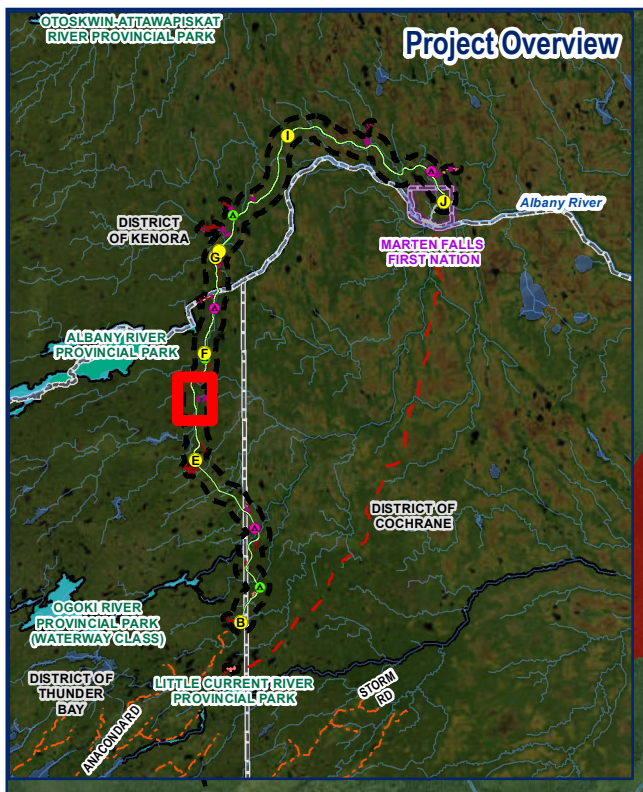
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Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

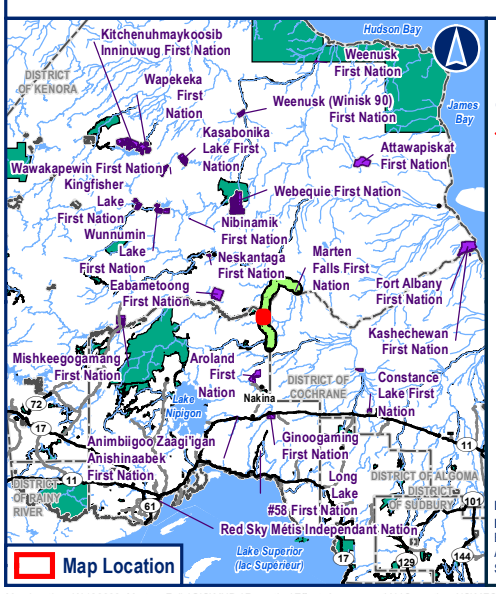
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-Dustfall-Annual.mxd
Date Saved: 2026-02-03 6:38:05 PM User Name: 34LM






## Legend

**Pollutant Model Result Contour - (g/m2)**
- MECP Criteria (7)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

**Potential Camp Site**
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

**Potential Aggregate**
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: Dustfall
## Averaging Period: 30 Day

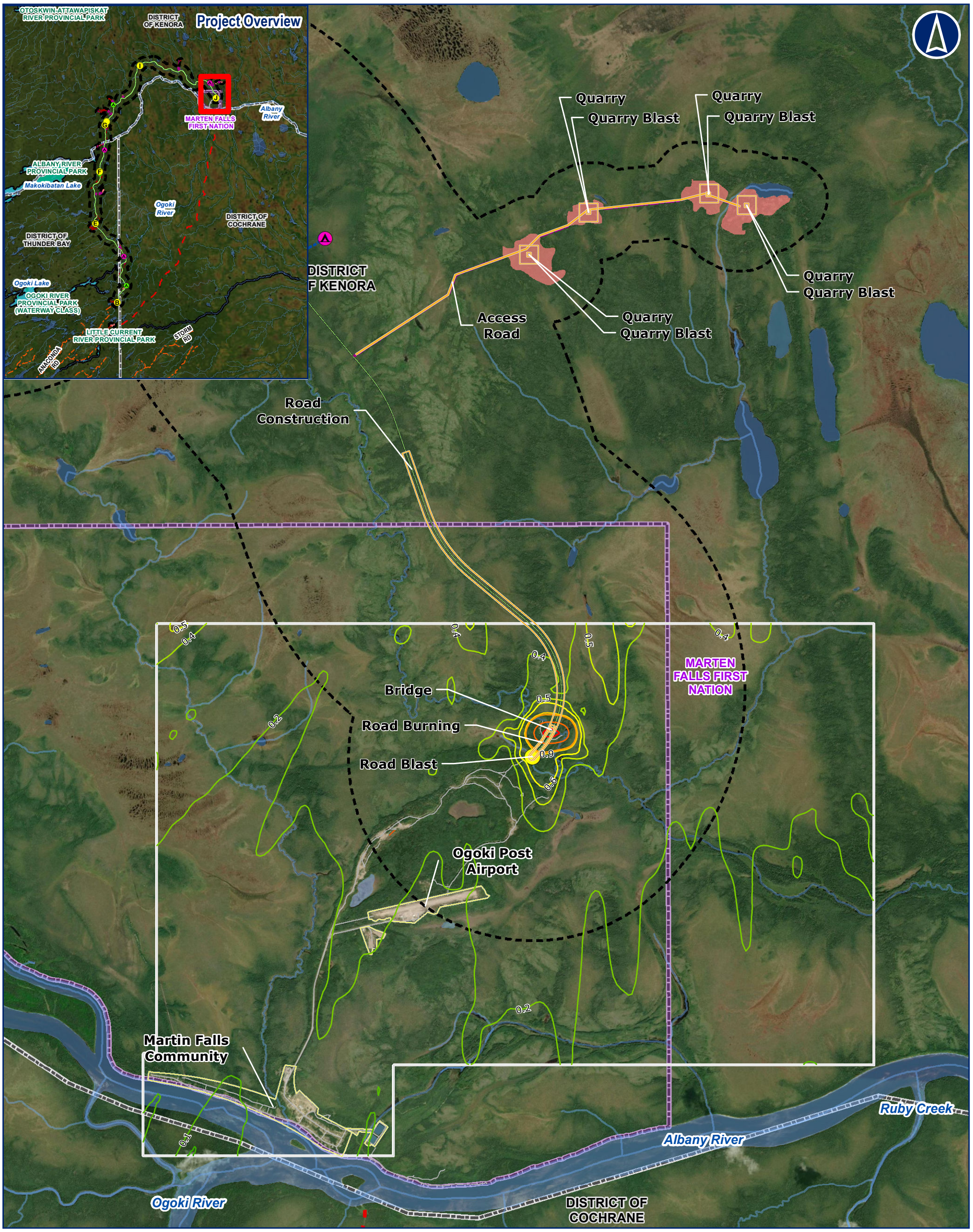
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Kilometres

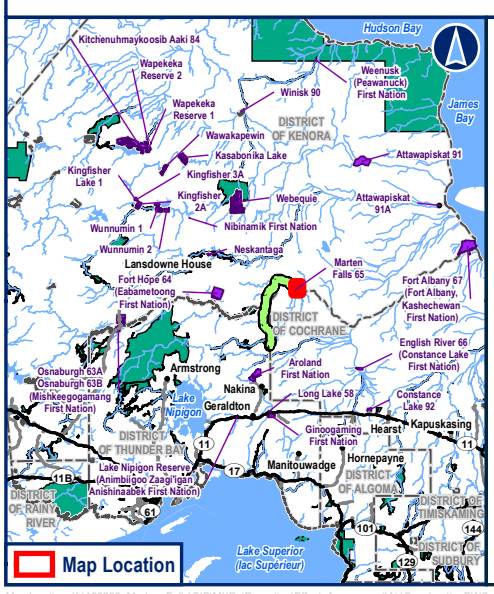
Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Feb, 2026 | 1:30,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-Dustfall-30Day.mxd
Date Saved: 2026-02-03 6:20:07 PM User Name: 34LM




## Legend

- Diesel Particulate Matter Isopaths (0.085 - 3.001 ug/m3)
- Built Up Area
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**

- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** None

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

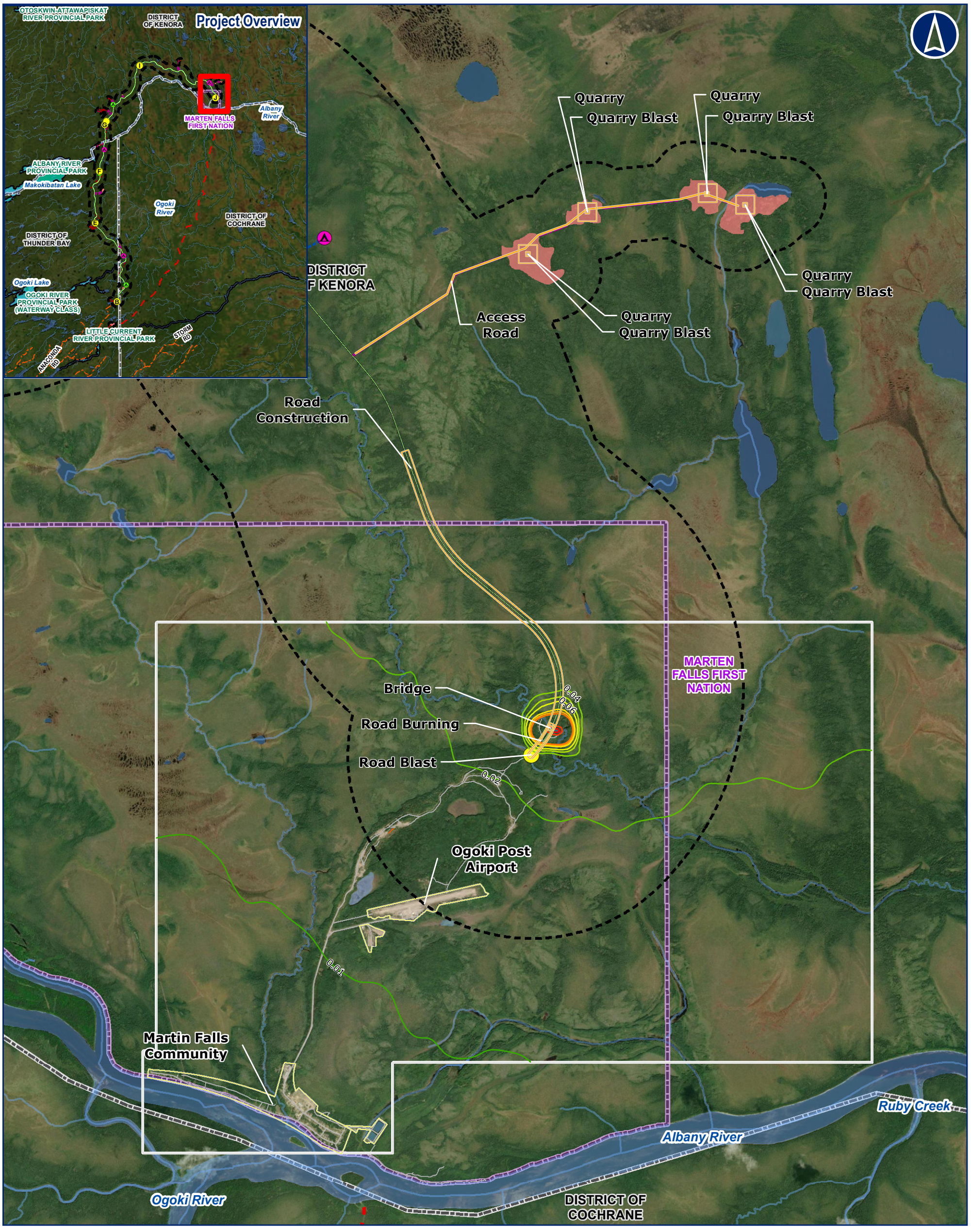
## Construction Community Segment Diesel Particulate Matter Averaging Period: 24 Hours

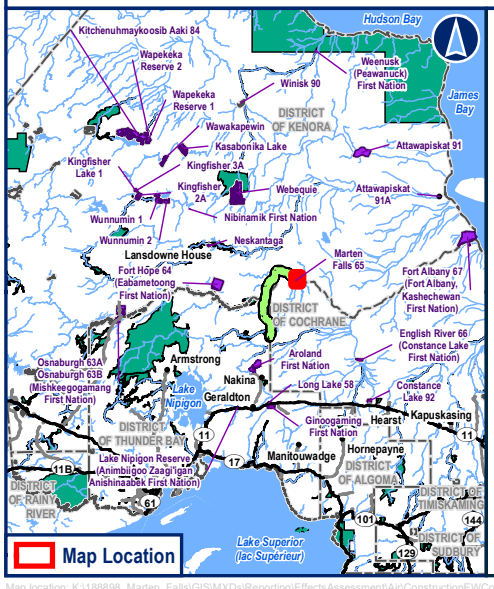
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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| Oct, 2024 | 1:50,000 * when printed 11"x17" |
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## Legend

- Diesel Particulate Matter Isopaths (0.01 - 0.212 ug/m3)
- Built Up Area
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**

- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** None

**Data Source:**
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction Community Segment Diesel Particulate Matter Averaging Period: Annual

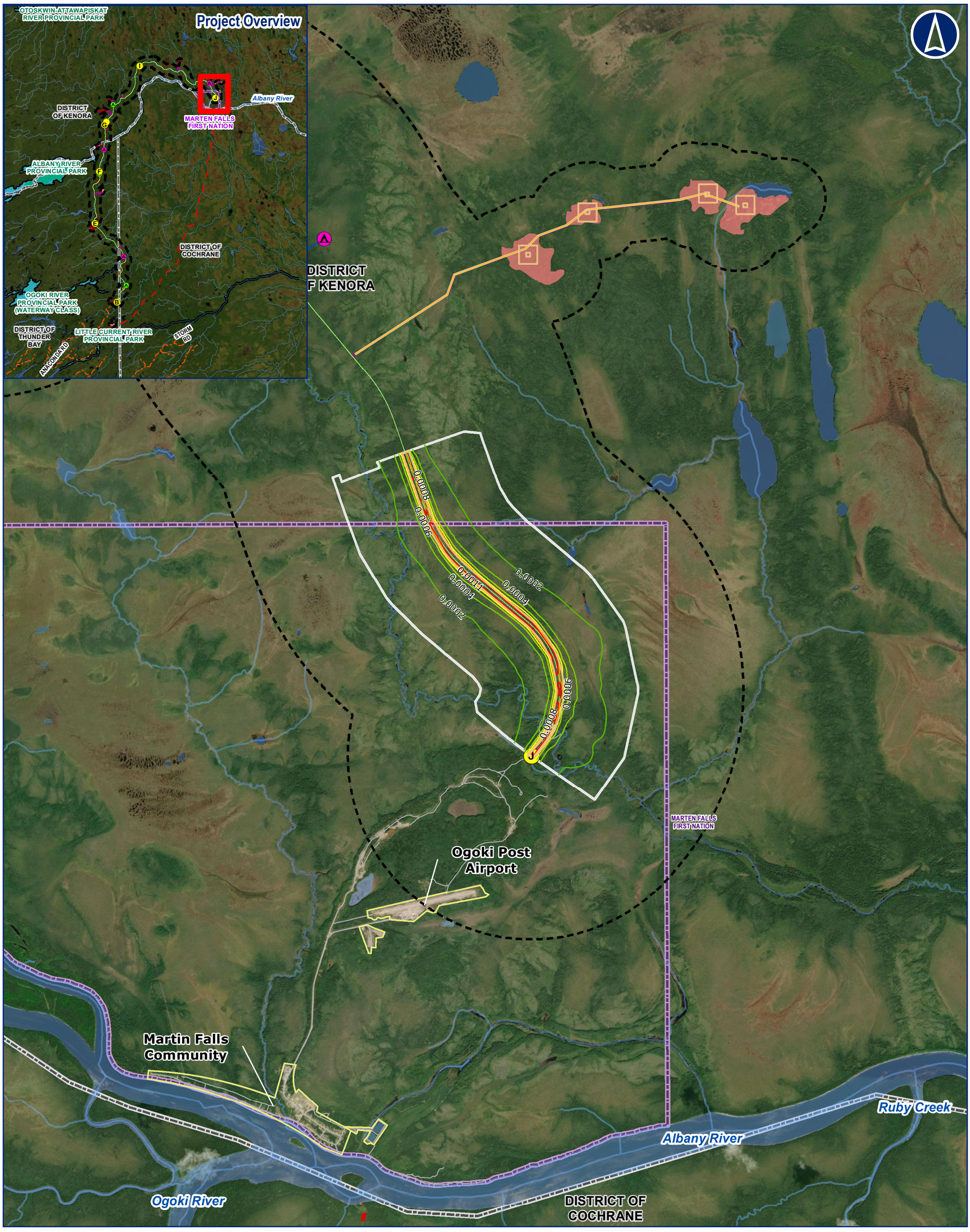
0 0.5 1 1.5 2
Kilometres

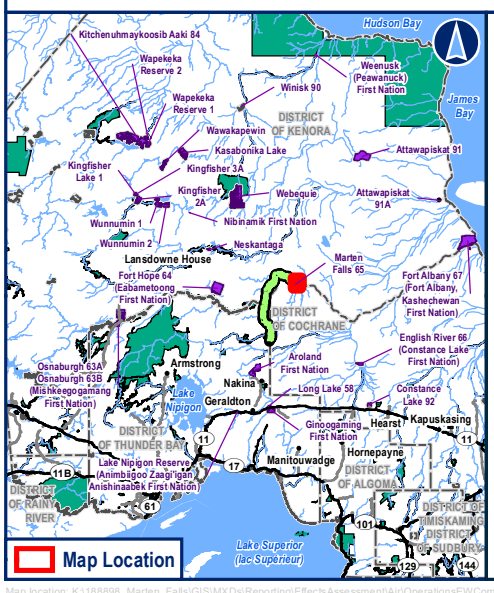
Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Oct, 2024 | 1:50,000 * when printed 11"x17" |
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionEWCommunity\MFCAR_EffectsAssessment_Air_ConsComm_DPM-Annual.mxd
Date Saved: 2024-10-24 4:54:40 AM User Name: 34LM




## Legend

- Diesel Particulate Matter Isopaths (0.00007 - 0.0132 ug/m3)
- Built Up Area
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**

- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** None

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

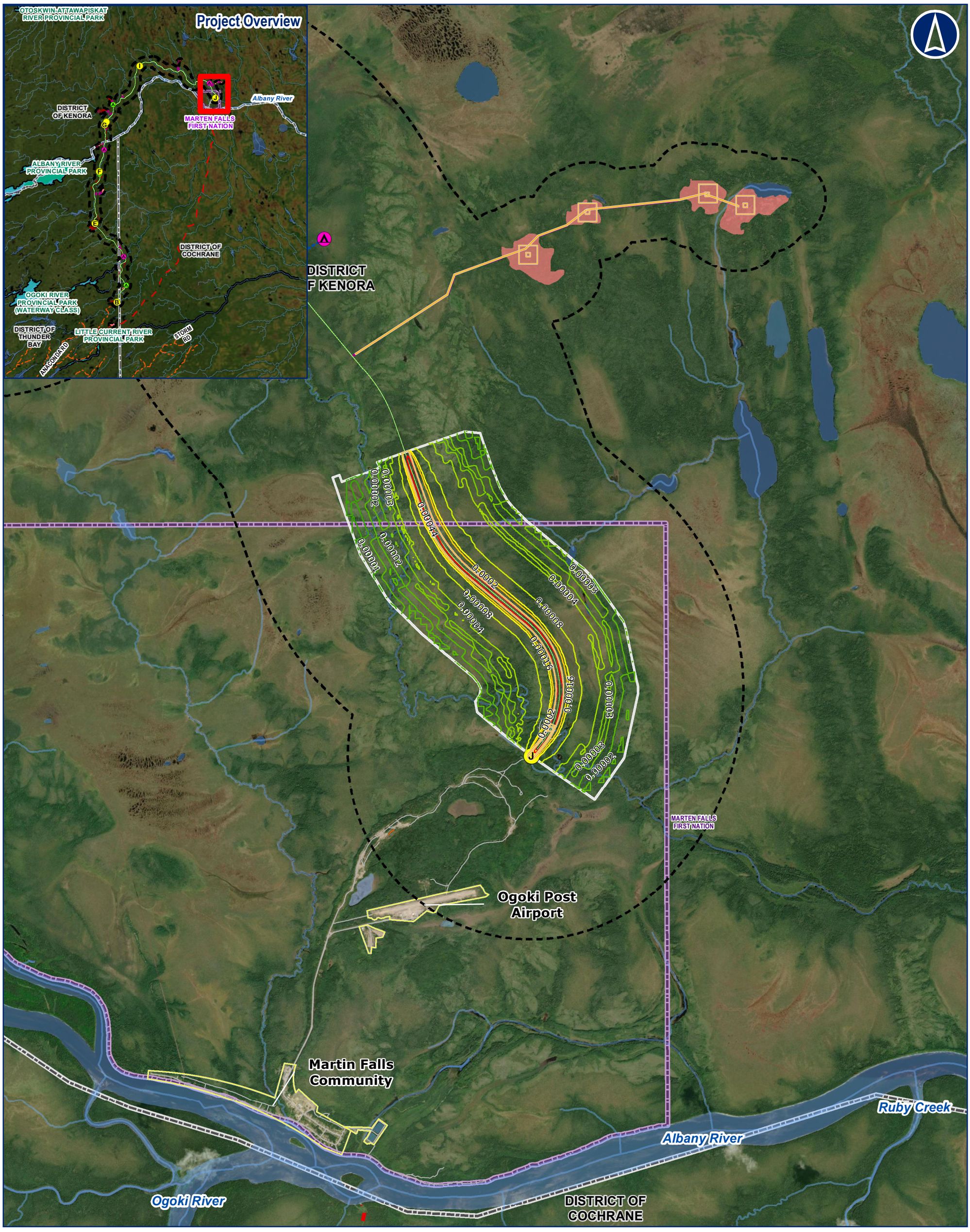
## Operation Community Segment Diesel Particulate Matter Averaging Period: 24 Hours

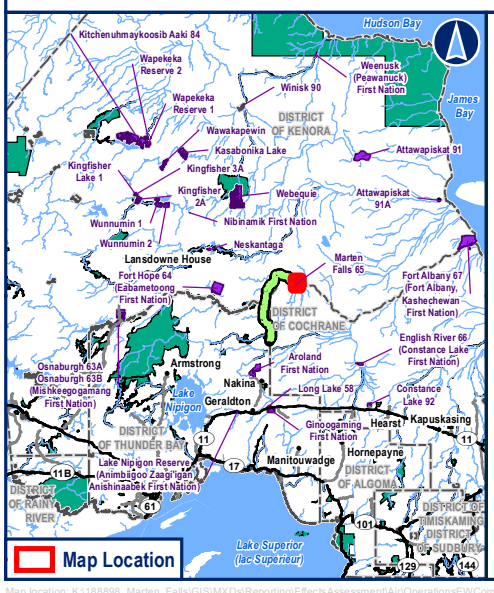
0 0.5 1 1.5 2
Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

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| Oct, 2024 | 1:50,000 * when printed 11"x17" |
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Map location: K:\168896_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\Operations\EWCommunity\MFCAR_EffectsAssessment_Air_OpsComm_Pollutant-DMP_24HR.mxd
Date Saved: 2024-10-24 4:21:28 AM User Name: 34LM




## Legend

- Diesel Particulate Matter Isopaths (0.00001 - 0.00044 ug/m3)
- Built Up Area
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**

- 50 Persons
- 200 Persons
- Approximate Access Road to Potential Construction Camp

**Potential Aggregate**

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**

- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** None

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

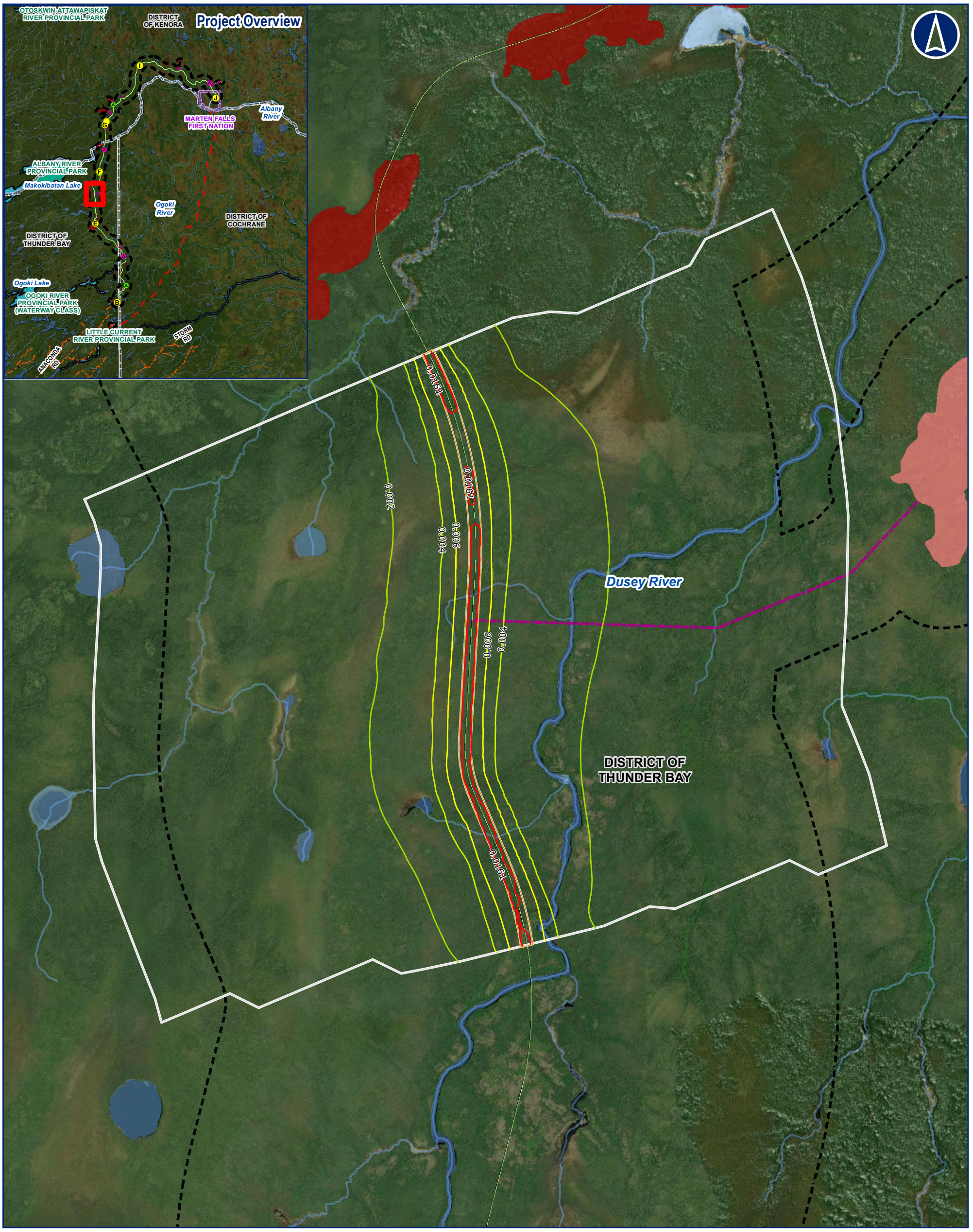
## Operation Community Segment Diesel Particulate Matter Averaging Period: Annual

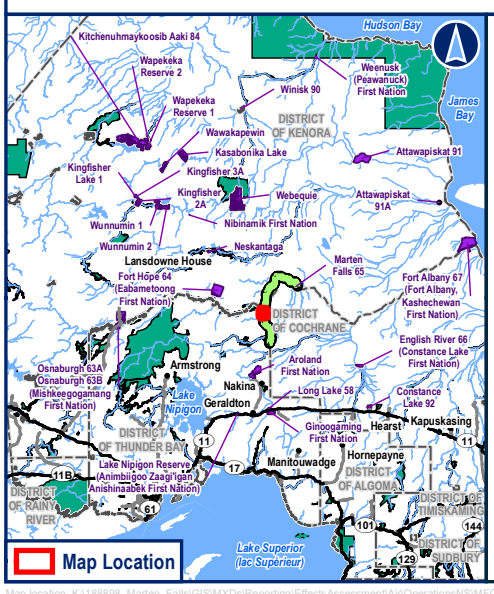
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Kilometres
Datum: NAD 1983 CSRS UTM Zone 16N

| Feb, 2026 | 1:50,000 * when printed 11"x17" |
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Map location: K:\168896_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\Operations\EWCommunity\MFCAR_EffectsAssessment_Air_OpsComm_Pollutant-DMP_Annual.mxd
Date Saved: 2026-02-06 3:06:22 PM User Name: 34LM




## Legend

- Diesel Particulate Matter Isopaths (0.0001 - 0.0161 ug/m3)
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area
- Preferred Route

**Potential Camp Site**

- 50 Persons
- 200 Persons

**Potential Aggregate**

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** None

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Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operating N-S Segment Diesel Particulate Matter Averaging Period: 24 Hours

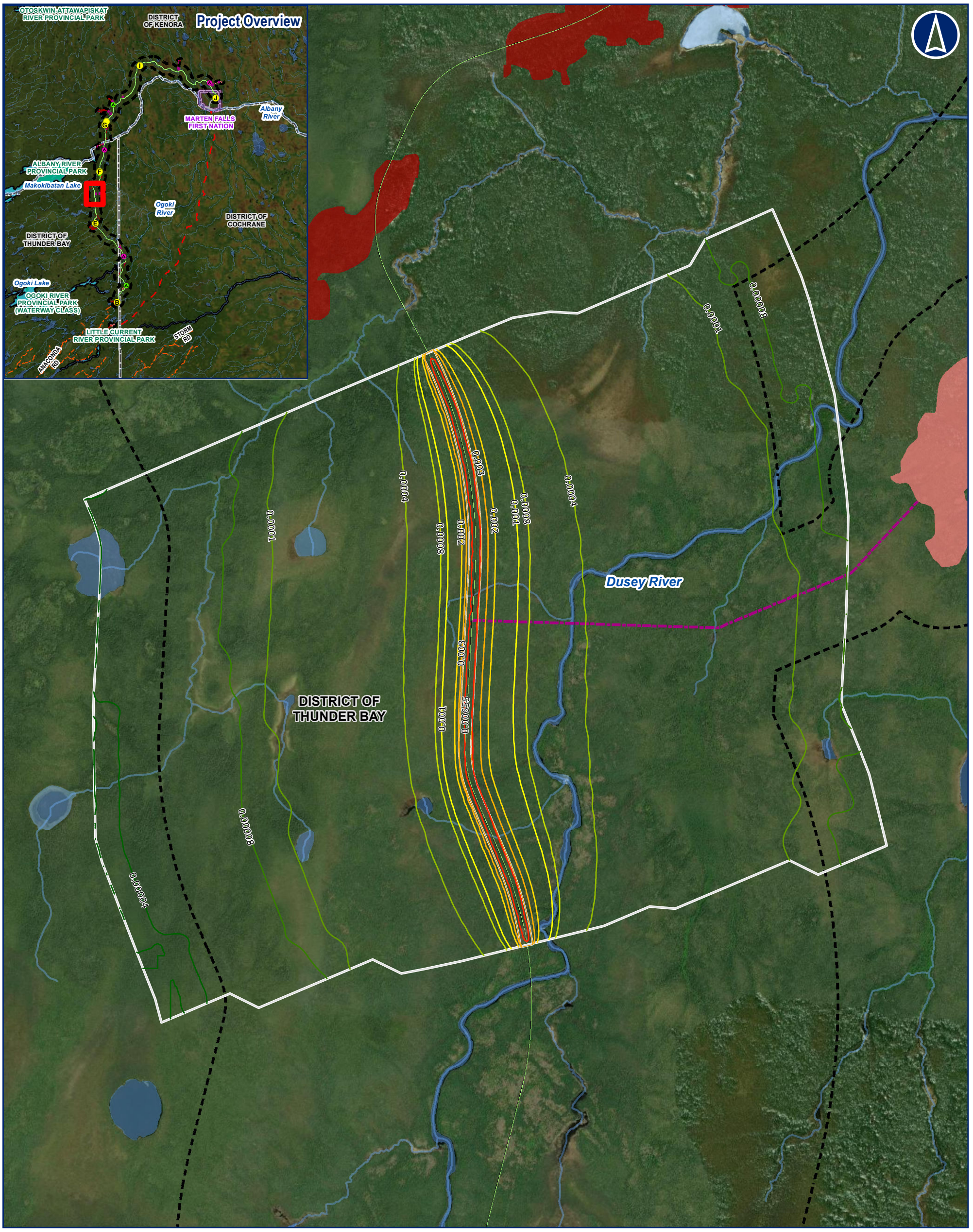
0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

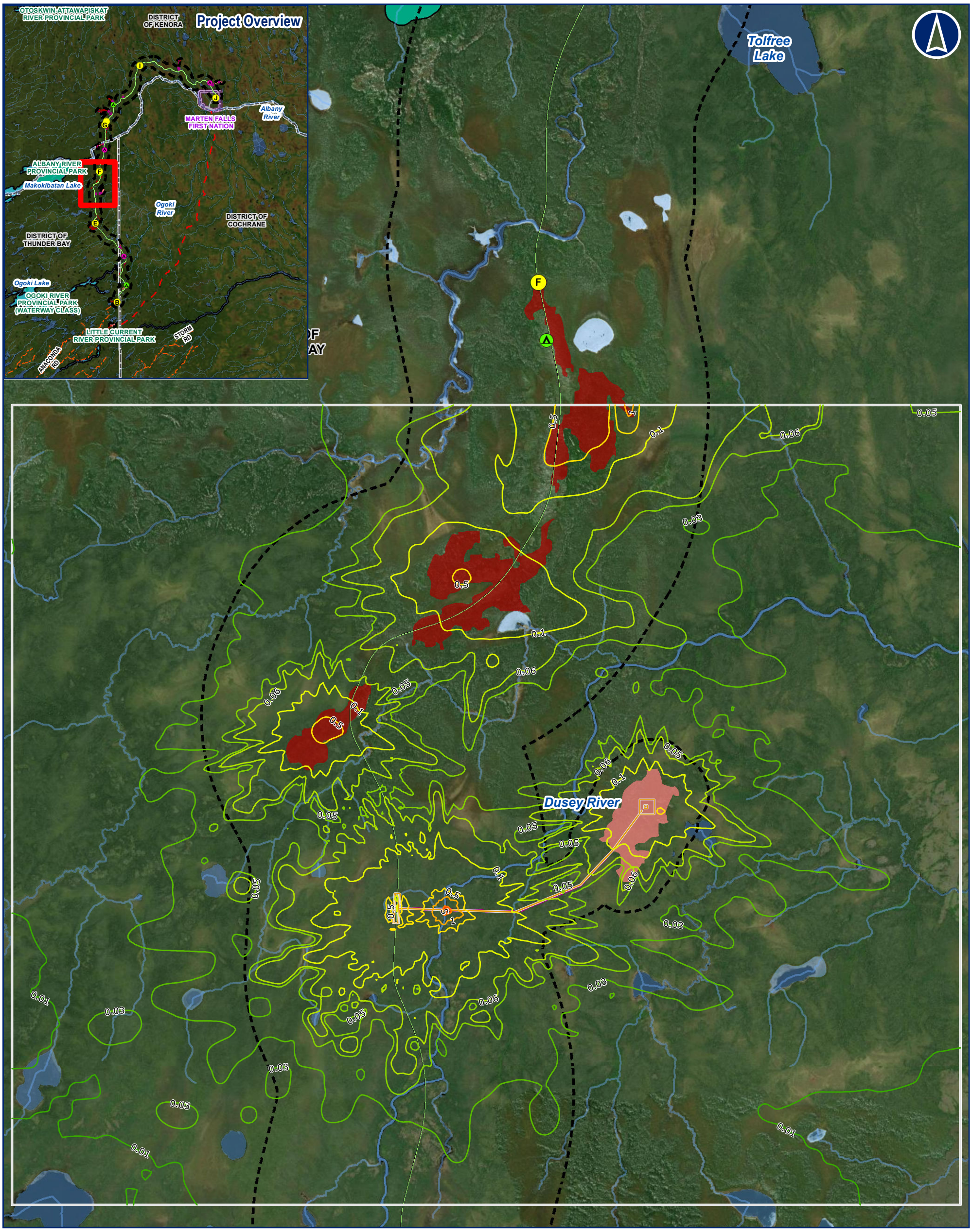
| Oct, 2024 | 1:30,000 * when printed 11"x17" |
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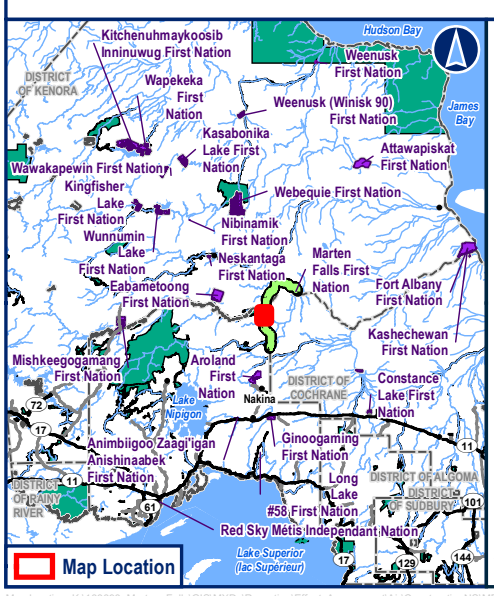
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-DPM_24HR.mxd
Date Saved: 2024-10-24 4:08:01 AM User Name: 34LM




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## Legend

- Diesel Particulate Matter Isopaths (0.01 - 10 ug/m3)
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area

**Construction Distribution**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

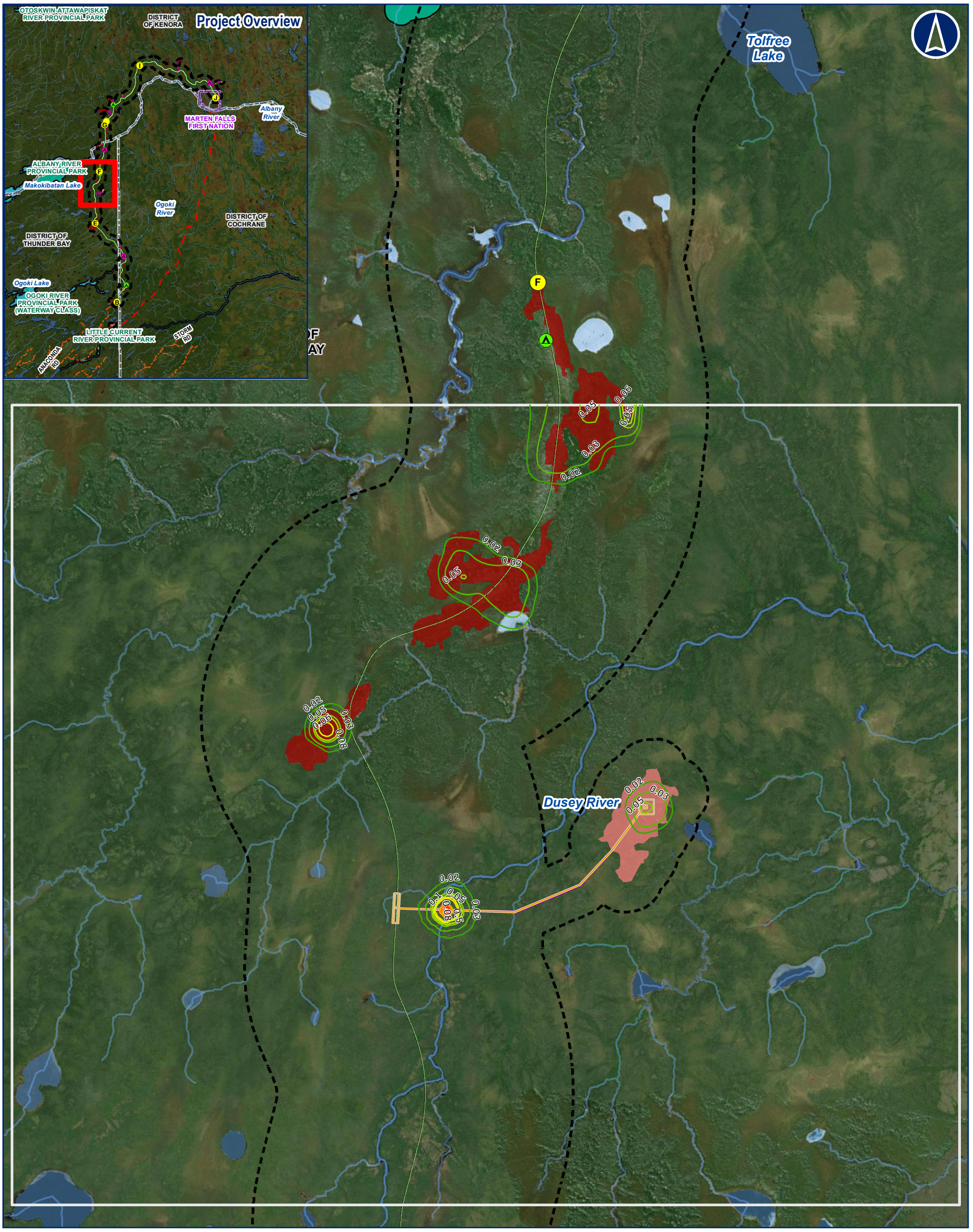
## Construction N-S Segment Diesel Particulate Matter Averaging Period: 24 Hours

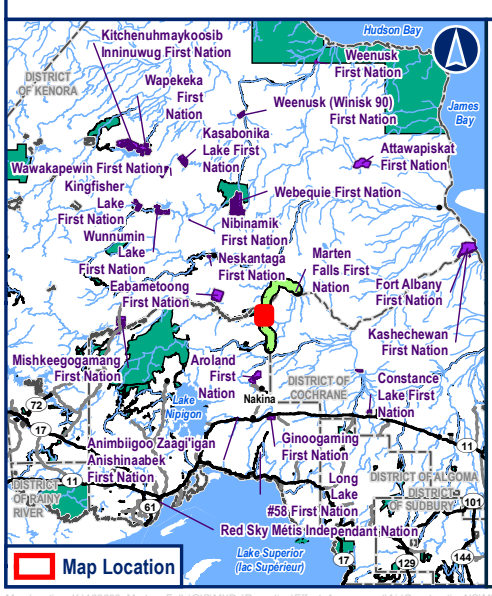
Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Feb, 2026 | 1:62,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-DPM_24HR.mxd
Date Saved: 2026-02-05 12:17:03 PM User Name: 30AEE




**Legend**

- Diesel Particulate Matter Isopaths (0.02 - 1.0 ug/m3)
- Modelled Source Component
- Receptor Coverage
- Segment Node
- Project Study Area

**Construction Distribution Area**

- Final Route (100m Right-of-Way)

Potential Camp Site

- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate

- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**

- Watercourse
- Waterbody
- District Municipal Boundary
- Provincial Park

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

**Data Source:**
Base Data: Provided by MNRF 2023; Route Infrastructure - Provided by AECOM 2021. Contains Information licensed under the Open Government Licence Ontario.
Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Construction N-S Segment Diesel Particulate Matter Averaging Period: Annual

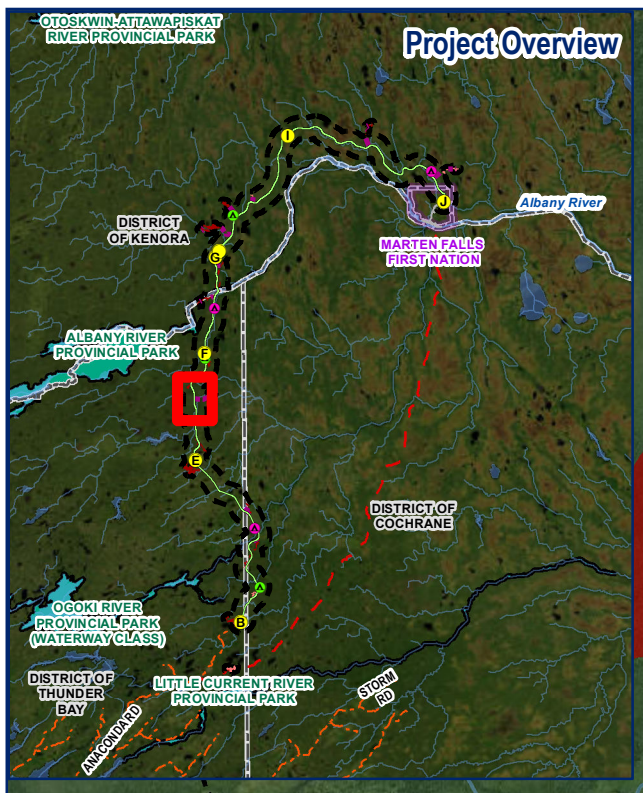
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Feb, 2026 | 1:62,000 * when printed 11"x17" |
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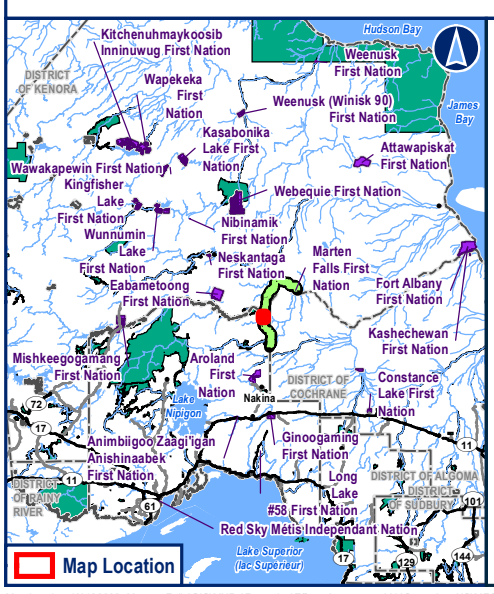
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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\ConstructionNS\MFCAR_EffectsAssessment_Air_Pollutant-DPM_Annual.mxd
Date Saved: 2026-02-05 12:51:39 PM User Name: 30AEE




DISTRICT OF THUNDER BAY

Dusey River




## Legend

**Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (120)
- Criteria Minus Background (30.9)

**80% Mitigation - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (120)
- Criteria Minus Background (30.9)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: TSP vs. 80% Mitgation
## Averaging Period: 24 Hours

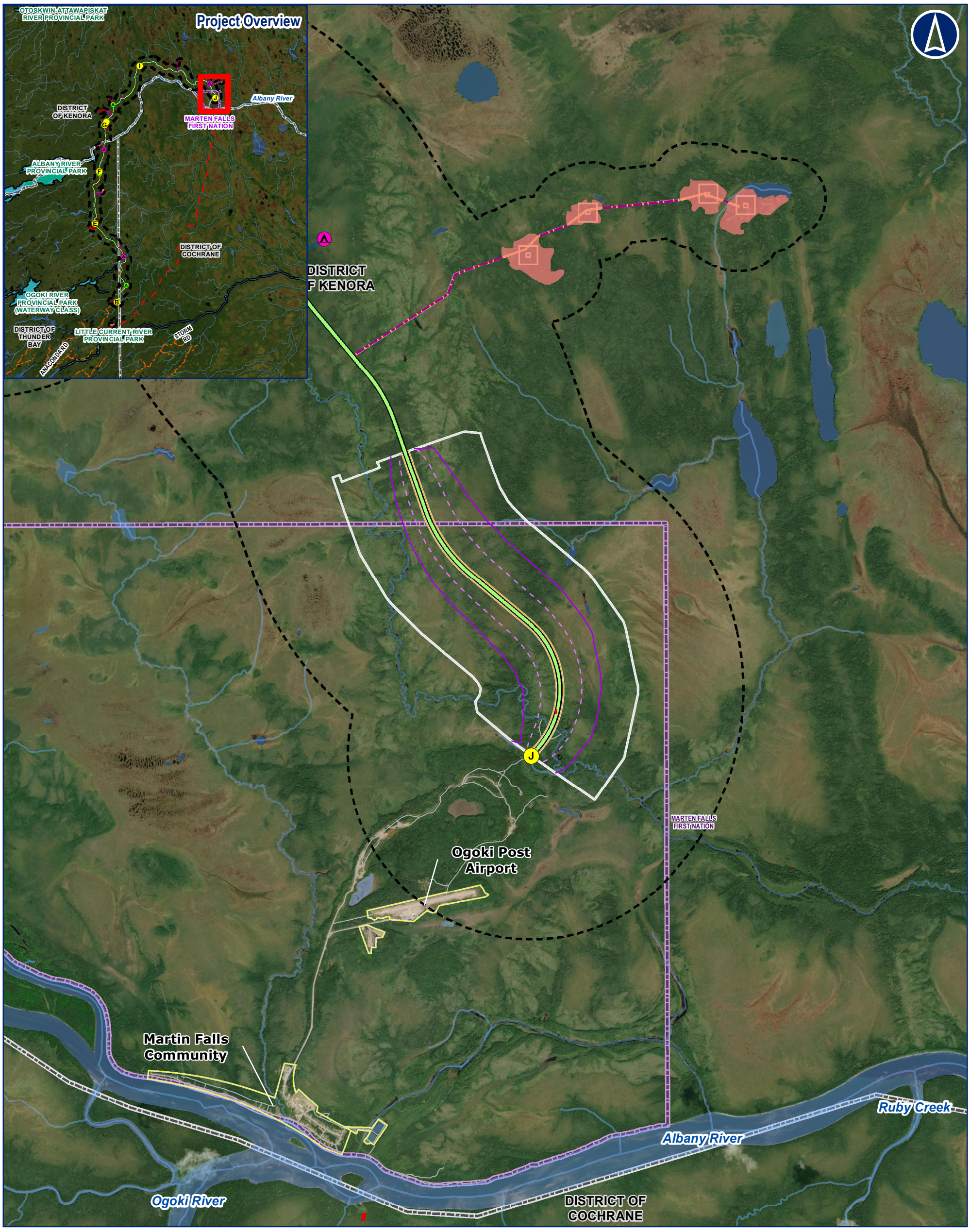
0 0.25 0.5 0.75 1
Kilometres

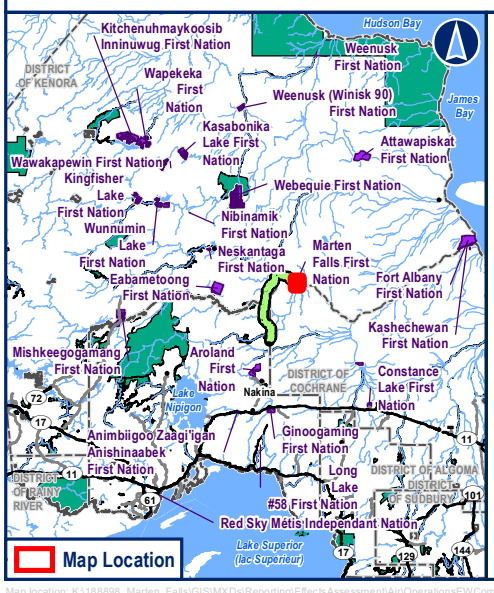
Datum: NAD 1983 CSRS UTM Zone 16N

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| Feb, 2026 | 1:30,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-TSP-24HR 80Percent_Ori.mxd
Date Saved: 2026-02-03 11:10:55 PM User Name: 34LM




**Legend**

**Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (60)
- Criteria Minus Background (3.4)

**80 % Mitigation - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (60)*
- Criteria Minus Background (3.4)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

* Contour not generated.

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10 m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

**Notes:** First Nation Reserves of MFFN CAR Neighbouring Communities are shown in the inset extent.

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Aerial photography provided by:
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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - E/W Segment
## Pollutant: TSP vs. 80% Mitigation
## Averaging Period: Annual

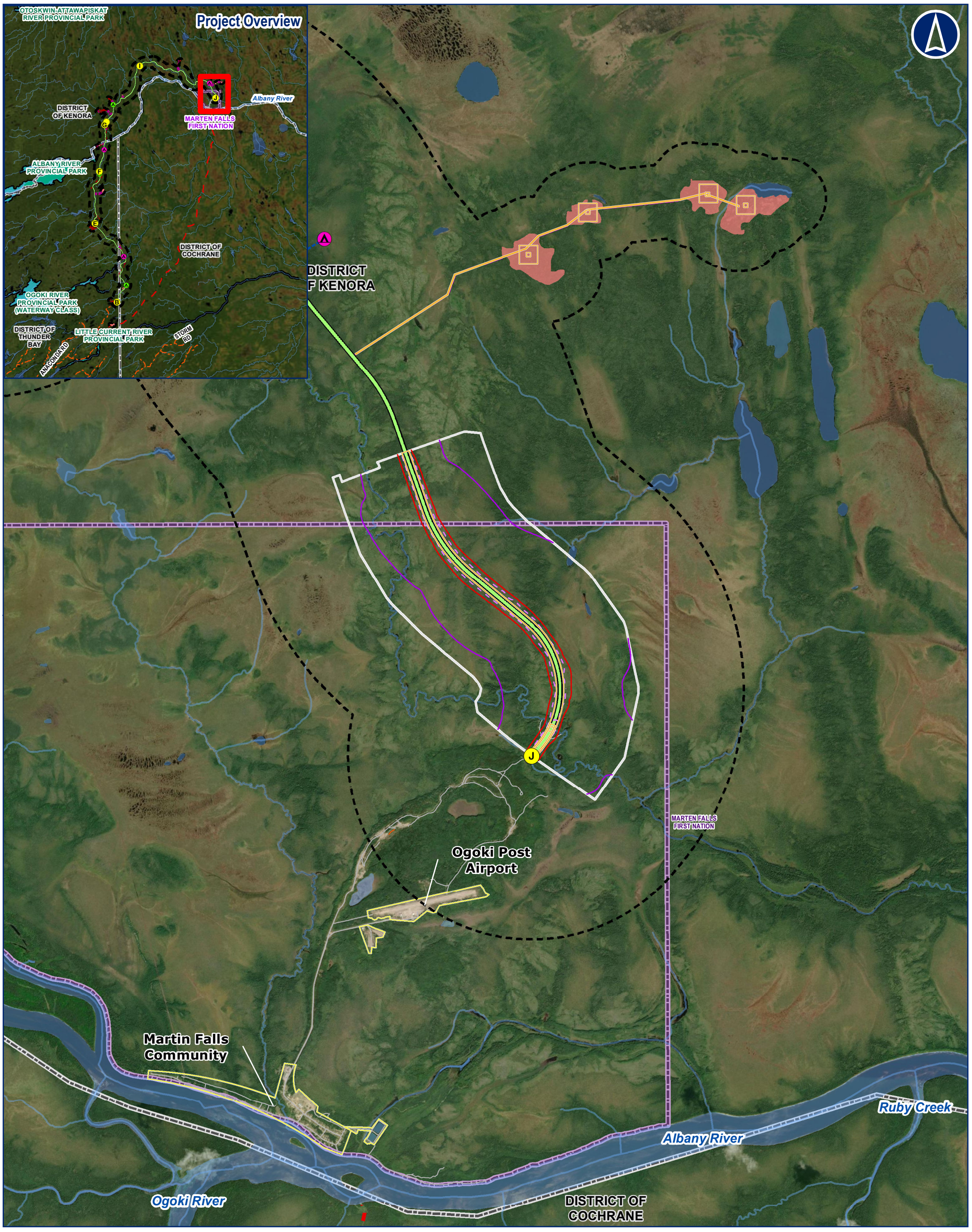
0 0.5 1 1.5 2
Kilometres

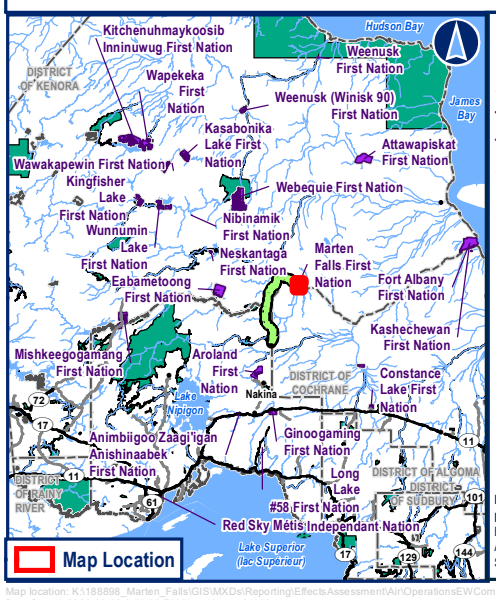
Datum: NAD 1983 CSRS UTM Zone 16N

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|---|---|
| Feb, 2026 | 1:50,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\168896_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\Operations\EWCommunity\MFCAR_EffectsAssessment_Air_OpsComm_Pollutant-TSP_Annual 80percent_Ori.mxd
Date Saved: 2026-02-03 10:08:57 PM User Name: 34LM




## Legend

**Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (120)
- Criteria Minus Background (30.9)

**80% Mitigation - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (120)*
- Criteria Minus Background (30.9)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

* Contour not generated.

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)
- Approximate Access Road to Potential Construction Camp (10m Width)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Local Road
- Resource / Recreation Road
- MFFN Existing Winter Access Road
- Watercourse
- Waterbody
- First Nation Reserve
- District Municipal Boundary

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Aerial photography provided by:
Service Layer Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - E/W Segment
## Pollutant: TSP vs. 80% Mitigation
## Averaging Period: 24 Hours

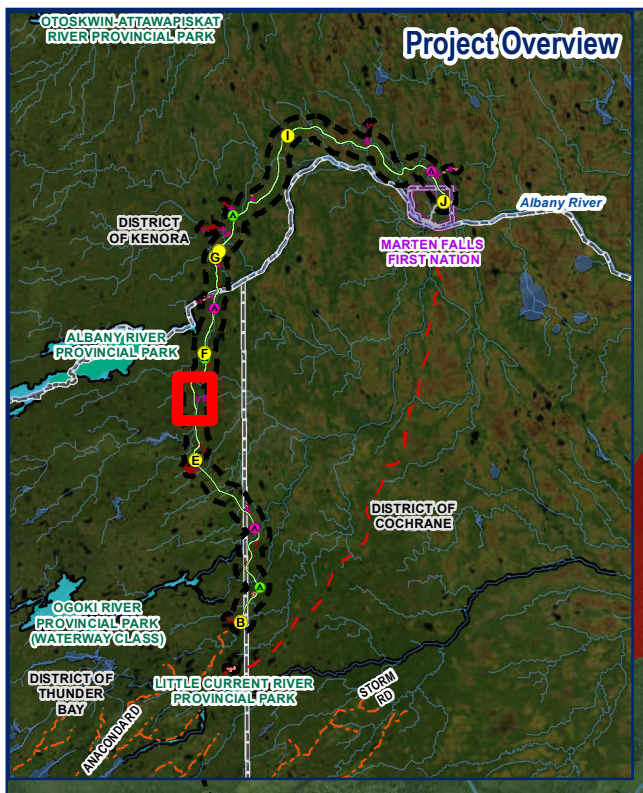
0 0.5 1 1.5 2
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

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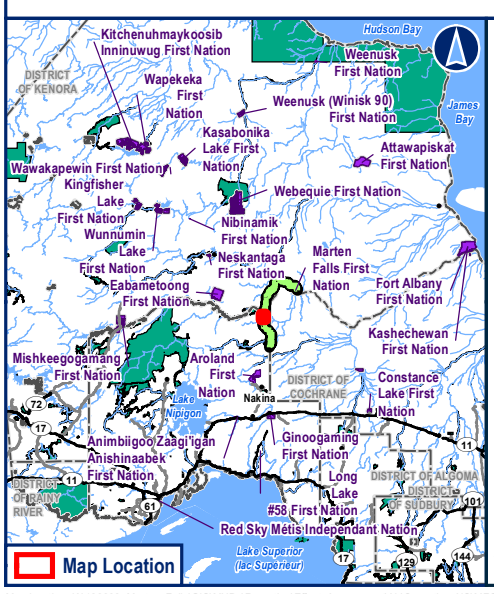
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Map location: K:\188896 -Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\Operations\EWCommunity\MFCAR_EffectsAssessment_Air_OpsComm_Pollutant-TSP-24HR 80percent_Orl.mxd
Date Saved: 2026-02-03 9:59:09 PM User Name: 34LM




DISTRICT OF THUNDER BAY

Dusey River




## Legend

**Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (60)
- Criteria Minus Background (3.4)*

**80% Mitigation - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (60)
- Criteria Minus Background (3.4)
- Modelled Source Component
- Receptor Coverage

* >3000m away from Modelled Source Component

- A — Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
- 50 Persons (108 m x 150 m)
- 200 Persons (108 m x 150 m)

Potential Aggregate
- Bedrock
- Sand and gravel
- Approximate Access Road to Potential Aggregate Site (10m Width)

**General Features**
- Watercourse
- Waterbody
- District Municipal Boundary

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

## Operation - N/S Segment
## Pollutant: TSP vs. 80% Mitigation
## Averaging Period: Annual

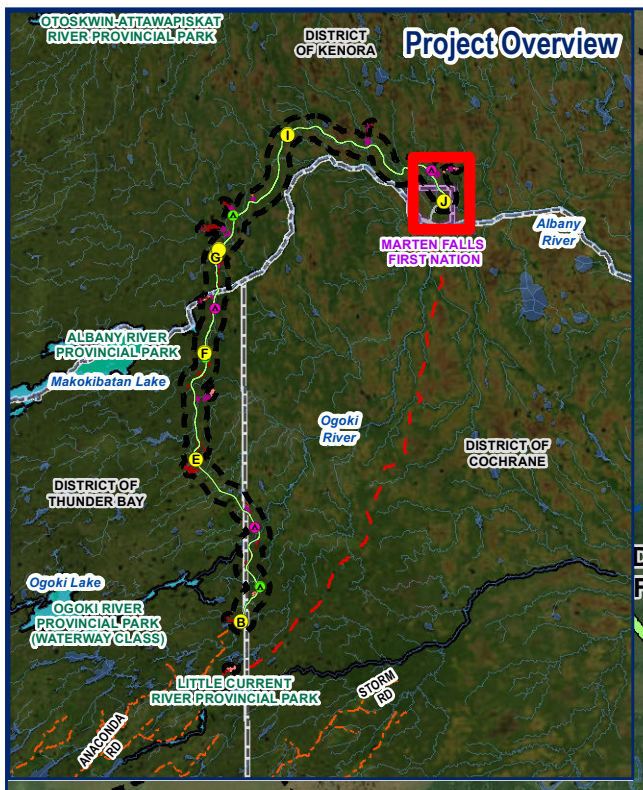
0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

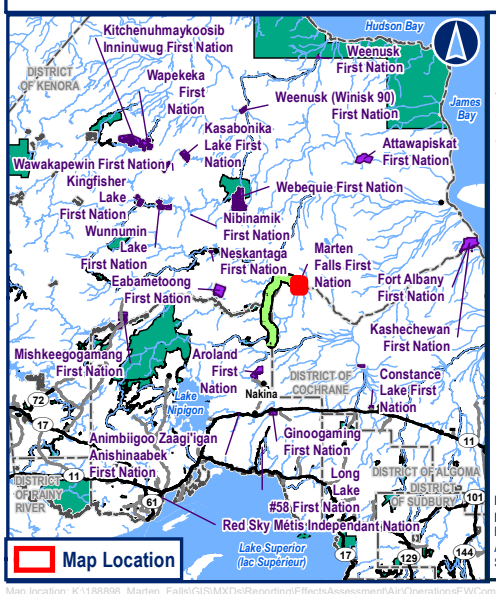
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|---|---|
| Feb, 2026 | 1:30,000 * when printed 11"x17" |
| Rev:00 | |

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Map location: K:\188898_Marten_Falls\GIS\MXDs\Reporting\EffectsAssessment\Air\OperationsNS\MFCAR_EffectsAssessment_Air_OpsSeg_Pollutant-TSP_Annual 80Percent_Ori.mxd
Date Saved: 2026-02-03 9:39:59 PM User Name: 34LM






## Legend

**Max - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria Minus Background (30.9)

**90th Percentile - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria Minus Background (30.9)
- Built Up Area
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Disturbance Area**
- Final Route (100m Right-of-Way)

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

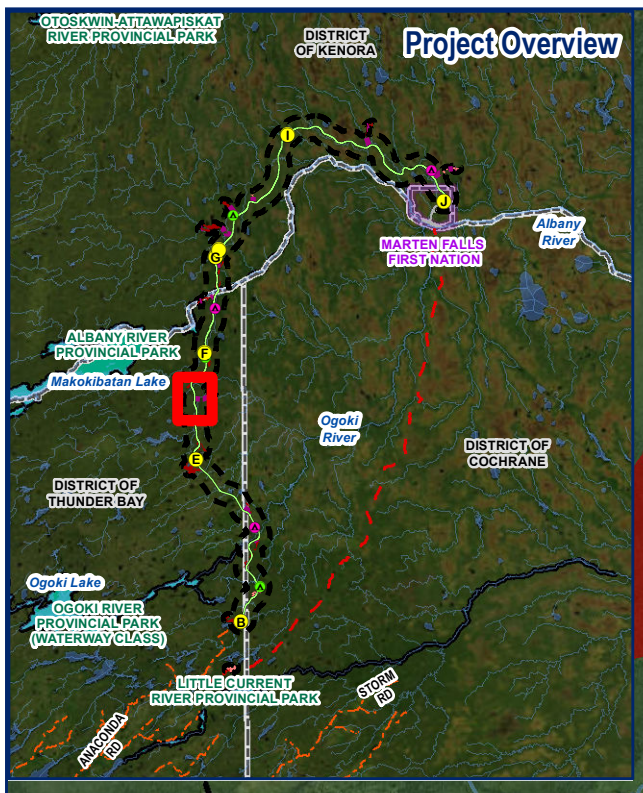
**Operation - E/W Segment**
**Pollutant: TSP Frequency Analysis (80% Mitigation)**
**Averaging Period: 24 Hours**

0 0.5 1 1.5 2
Kilometres

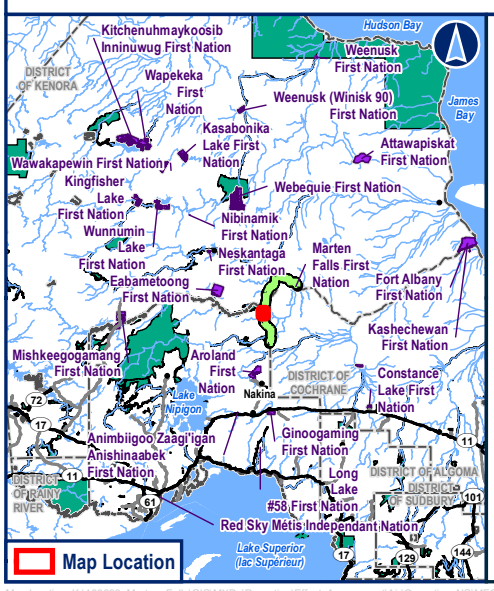
Datum: NAD 1983 CSRS UTM Zone 16N

| Feb, 2026 | 1:50,000 * when printed 11"x17" |
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| Rev:00 | |

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## Legend

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- Criteria (120)
- Criteria Minus Background (30.9)

**90th Percentile - Pollutant Model Result Contour - AAQC, 2025 (ug/m^3)**
- Criteria (120)
- Criteria Minus Background (30.9)
- Modelled Source Component
- Receptor Coverage

- Segment Node
- Project Study Area

**Construction Distribution Area**
- Final Route (100m Right-of-Way)

Potential Camp Site
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- 200 Persons (108 m x 150 m)

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# MARTEN FALLS FIRST NATION COMMUNITY ACCESS ROAD

**Operation - N/S Segment**
**Pollutant: TSP Frequency Analysis (80% Mitigation)**
**Averaging Period: 24 Hours**

0 0.25 0.5 0.75 1
Kilometres

Datum: NAD 1983 CSRS UTM Zone 16N

| | |
|---|---|
| Feb, 2026 | 1:30,000 * when printed 11"x17" |
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# Attachment D – Construction Supporting Information

## Construction Phase Equipment and Operation Info

### Nonroad Machinery Equipment

| Equipment Location | Construction Activity | Equipment Type/Model | Quantity | MOVES Source Type | MOVES Horsepower Range Bin | Percentage of Equipment Operating in a Given Hour[1] | Maximum Operating hours (hrs/day) | Maximum Operating days (days/yr) | Equipment Total Operating Time in a given hour (hrs/hr) | Equipment Total Operating Time (hrs/day) | Equipment Total Operating Time (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarry | Drilling | Rock Drills | 2 | Bore/Drill Rigs | 300 < hp <=600 | 65% | 12 | 365 | 1.3 | 15.6 | 5,694 |
| Roadway | Drilling | Rock Drills | 1 | Bore/Drill Rigs | 300 < hp <=600 | 65% | 12 | 365 | 0.65 | 7.8 | 2,847 |
| Roadway | Placing Rock | CAT D8 Dozer | 2 | Crawler Tractor/Dozers | 300 < hp <=600 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Roadway | Removing Snow/Clearing & Grubbing | CAT D6 Dozer | 3 | Crawler Tractor/Dozers | 175 < hp <=300 | 100% | 12 | 365 | 3 | 36 | 13,140 |
| Roadway | Heavier ROW Work | CAT D7 Dozer | 2 | Crawler Tractor/Dozers | 175 < hp <=300 | 100% | 12 | 365 | 2 | 24 | 8,760 |
| Roadway | Rock Crushing | Crusher | 1 | Crushing/Proc. Equipment | 300 < hp <=600 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Quarry | Loading Trucks with Blast Rock | Deere 450D Exc. | 2 | Excavators | 300 < hp <=600 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Roadway | Working Blast Mats and Removing | Deere 350D Exc. | 2 | Excavators | 175 < hp <=300 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Roadway | Clearing Overburden/Culverts | CAT 325D Exc. | 2 | Excavators | 175 < hp <=300 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Roadway | Deere 872GP | Grader | 1 | Graders | 175 < hp <=300 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Roadway | Volvo A20 (Converted) | Water Truck | 1 | Off-highway Trucks | 175 < hp <=300 | 40% | 12 | 365 | 0.4 | 4.8 | 1,752 |
| Roadway | Packing aggregates (Volvo SD116B) | Smooth Drum | 2 | Rollers | 100 < hp <=175 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Quarry | Quarry Operation | CAT 972 Loader | 1 | Rubber Tire Loaders | 300 < hp <=600 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Quarry | Quarry Operation | CAT 988H Loader | 1 | Rubber Tire Loaders | 300 < hp <=600 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | skid steers- JD323 & JD 333 Tracked | 2 | Skid Steer Loaders | 75 < hp <=100 | 50% | 12 | 365 | 1 | 12 | 4,380 |
| Bridge | Bridge Building | pile driving rigs- PMx22 | 1 | Bore/Drill Rigs | 300 < hp <=600 | 65% | 12 | 365 | 0.65 | 7.8 | 2,847 |
| Bridge | Bridge Building | moveable cranes XCR40 | 2 | Cranes | 175 < hp <=300 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Bridge | Bridge Building | concrete pump truck 65-METER Z FOLD | 1 | Off-highway Trucks | 175 < hp <=300 | 35% | 12 | 365 | 0.35 | 4.2 | 1,533 |
| Bridge | Bridge Building | concrete mixing trucks - Western Star 4700 | 3 | Off-highway Trucks | 300 < hp <=600 | 80% | 12 | 365 | 2.4 | 28.8 | 10,512 |
| Bridge | Bridge Building | concrete screed machine- Gamco PS-2600 | 1 | Pavers | 175 < hp <=300 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | Haul Trucks Kenworth- t800 tandem | 1 | Off-highway Trucks | 300 < hp <=600 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | portable concrete batch plant- TRIA Products | 1 | Other Construction Equipment | 75 < hp <=100 | 35% | 12 | 365 | 0.35 | 4.2 | 1,533 |
| Bridge | Bridge Building | Excavator- Komatsu PC 210 LC | 1 | Excavators | 100 < hp <=175 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | Compressor- 260 Sullair | 1 | Air Compressors | 50 < hp <=75 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | Heater- Flargo FVO-400RC | 6 | Other General Industrial Eqp | 100 < hp <=175 | 80% | 12 | 365 | 4.8 | 57.6 | 21,024 |
| Bridge | Bridge Building | Generator -Magnum MMG55FH | 1 | Generator Sets | 50 < hp <=75 | 80% | 12 | 365 | 0.8 | 9.6 | 3,504 |
| Bridge | Bridge Building | Light Plant -Magnum MLT5080/MLT 3060 | 3 | Signal Boards/Light Plants | 11 < hp <=16 | 35% | 12 | 365 | 1.05 | 12.6 | 4,599 |
| Bridge | Bridge Building | Forklift Zoom Boom- ZB8044-44 | 2 | Rough Terrain Forklifts | 100 < hp <=175 | 65% | 12 | 365 | 1.3 | 15.6 | 5,694 |
| Bridge | Bridge Building | Skylack- SJB-46TK-RJ | 1 | Aerial Lifts | 25 < hp <=40 | 65% | 12 | 365 | 0.65 | 7.8 | 2,847 |
| Bridge | Bridge Building | Pickup Trucks -F150 or RAM2500 | 3 | Off-highway Trucks | 300 < hp <=600 | 80% | 12 | 365 | 2.4 | 28.8 | 10,512 |
| Bridge | Bridge Building | Generators- BE Gen 3100W | 2 | Generator Sets | 6 < hp <=11 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Bridge | Bridge Building | Water Pumps- Honday WB30XT | 2 | Pumps | 3 < hp <=6 | 80% | 12 | 365 | 1.6 | 19.2 | 7,008 |
| Bridge | Bridge Building | Water Truck- CAT740 | 1 | Off-highway Trucks | 300 < hp <=600 | 40% | 12 | 365 | 0.4 | 4.8 | 1,752 |

### Onroad Vehicle Equipment

| | Construction Activity | Equipment Type | Quantity[3] | MOVES Source Type[2] | Regulatory Class | Fuel Type | Average Gross Weight (lbs) | Maximum Travel Speed (km/hr) | Max number of trucks (Access Road/Daily Working Road Segment) | No. of trips per truck in a hour | No. of Loads per truck in a day [3] | KM Driven Per Trip (Access Road Daily Working Road Segment) | Operating days (days/yr) | Total hourly VKT (Access Road/Daily Working Road Segment) (VKT/hour) | Total daily VKT (Access Road/Daily Working Road Segment) (VKT/day) | Total Annual VKT (Access Road/Daily Working Road Segment) (VKT/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarry Access Road | Haul Rockfill to ROW | Rock Trucks 40T/45T | 10 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 32,000 | 30 | 10 | 1 | 10 | 6.0 | 365 | 60 | 600 | 219,000 |
| Quarry Access Road | Processed Aggregate Haul | Semi Trailers | 0 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 35,000 | 40 | 0 | 0 | 0 | - | 365 | 0 | 0 | 0 |
| Roadway | Haul Rockfill to ROW | Rock Trucks 40T/45T | 10 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 32,000 | 30 | 10 | 1 | 10 | 1.0 | 365 | 10 | 100 | 36,500 |
| Roadway | Processed Aggregate Haul | Semi Trailers | 0 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 35,000 | 40 | 0 | 1 | 2 | - | 365 | 0 | 0 | 0 |
| Roadway | Road Construction Supply | Fuel Truck | 1 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 26,000 | 50 | 1 | 1 | 2 | 1.0 | 365 | 1 | 1 | 365 |
| Roadway | Road Construction Supply | Flatbed Truck | 2 | Single Unit Long-Haul Trucks | Heavy Heavy Duty Trucks | Diesel | 48,000 | 50 | 2 | 1 | 2 | 1.0 | 365 | 2 | 2 | 730 |
| Roadway | Road Construction Supply | Mechanic Truck | 1 | Light Commercial Trucks | Light Heavy Duty Trucks | Diesel | 7,500 | 50 | 1 | 1 | 2 | 1.0 | 365 | 1 | 1 | 365 |
| Roadway | General use | half ton trucks | 30 | Light Commercial Trucks | Light Heavy Duty Trucks | Gasoline | 7,500 | 50 | 15 | 1 | 2 | 1.0 | 365 | 15 | 15 | 5,475 |

*1. Construction equipment usage are provided by the CAR engineering team based on prior experience with similar projects.*

*2. the number of trips per truck in a day is approximately estimated based on the material handled per day, truck's haul capacity, and the maximum number of trucks within a daily working area.*

*Representative Quarry Access Road distance = 3 (km)*

*For a conservative assessment of emissions from the Quarry Access Roads which can have different haul distances (i.e., VKT), a 3km distance is assumed for all haul roads based on the maximum length of access roads.*

*Daily working road segment = 0.5 (km)*

3. As rock trucks and trailers will not operate at the same time, the quantity of semi-trailers is assumed to be zero and emission estimates are based on using rock trucks.

Estimates of required trips for access road trucks:

| | | |
|---|---|---|
| Material handlled per day | 3,000 | tonne/ day |

| | Total material hauled | |
|---|---|---|
| Rock Trucks 40T/45T | 32 tonne*10 trucks= 320 tonne | 10 trips |

**C-1: Construction Mobile Equipment (Nonroad and Onroad)**

**1-hr Mobile Equipment Emission Rates (g/s)**

| 1- hour Emission Rate (g/s) | | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Pollutant ID* | 3 | 2 | 31 | 100 | 106 | 107 | 110 | 116 | 117 | 74 | 174 | 27 | 26 | 20 | 25 | 24 | 45 | 41 | 46 | 90 | 5 | 6 | 88 | 130+116+117 | 100+106+107 | 74+174 |
| | | *CAS #* | *11104-93-1* | *630-08-0* | *7446-09-05* | - | - | - | - | - | - | - | - | *107-02-8* | *75-07-0* | *71-43-2* | *50-00-0* | *106-99-0* | *108-88-3* | *100-41-4* | *1330-20-7* | *124-38-9* | *74-82-8* | *10024-97-2* | *NA CO2e* | *NA PM2.5* | *NA PM10* | *50-32-8* |
| **MOVES Source type** | **Equipment Type/Model** | **Equipment Category** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rock/Drill Rigs | Rock Drills | Nonroad | 9.2E-02 | 3.1E-02 | 1.1E-04 | 5.2E-03 | 0.0E+00 | 0.0E+00 | 5.0E-03 | 0.0E+00 | 0.0E+00 | 2.0E-08 | 0.0E+00 | 1.6E-04 | 5.8E-04 | 2.2E-04 | 1.6E-03 | 1.2E-05 | 1.8E-04 | 4.8E-05 | 1.4E-04 | 3.7E+01 | 2.6E-04 | 0.0E+00 | 3.7E+01 | 5.0E-03 | 5.2E-03 | 2.0E-08 |
| Bore/Drill Rigs | Rock Drills | Nonroad | 4.6E-02 | 1.5E-02 | 5.4E-05 | 2.6E-03 | 0.0E+00 | 0.0E+00 | 2.5E-03 | 0.0E+00 | 0.0E+00 | 9.8E-09 | 0.0E+00 | 7.9E-05 | 2.9E-04 | 1.1E-04 | 8.0E-04 | 6.1E-06 | 7.9E-05 | 2.4E-05 | 6.9E-05 | 1.8E+01 | 1.3E-04 | 0.0E+00 | 1.8E+01 | 2.5E-03 | 2.6E-03 | 9.8E-09 |
| Crawler Tractor/Dozers | CAT D8 Dozer | Nonroad | 2.1E-02 | 6.2E-03 | 1.6E-04 | 1.4E-03 | 0.0E+00 | 0.0E+00 | 1.4E-03 | 0.0E+00 | 0.0E+00 | 8.1E-09 | 0.0E+00 | 2.0E-05 | 1.3E-04 | 5.2E-05 | 3.0E-04 | 1.9E-06 | 4.7E-05 | 1.1E-05 | 3.1E-05 | 6.0E+01 | 9.2E-05 | 0.0E+00 | 6.0E+01 | 1.4E-03 | 1.4E-03 | 8.1E-09 |
| Crawler Tractor/Dozers | CAT D6 Dozer | Nonroad | 1.4E-02 | 4.7E-03 | 1.6E-04 | 8.2E-04 | 0.0E+00 | 0.0E+00 | 7.9E-04 | 0.0E+00 | 0.0E+00 | 4.4E-09 | 0.0E+00 | 1.2E-05 | 8.3E-05 | 3.0E-05 | 1.8E-04 | 1.0E-06 | 3.2E-05 | 9.7E-06 | 5.9E-05 | 6.2E+01 | 4.9E-05 | 0.0E+00 | 6.2E+01 | 7.9E-04 | 8.2E-04 | 4.4E-09 |
| Crawler Tractor/Dozers | CAT D7 Dozer | Nonroad | 9.2E-03 | 1.8E-03 | 1.1E-04 | 5.4E-04 | 0.0E+00 | 0.0E+00 | 5.3E-04 | 0.0E+00 | 0.0E+00 | 2.9E-09 | 0.0E+00 | 8.3E-06 | 5.5E-05 | 2.0E-05 | 1.2E-04 | 6.8E-07 | 2.1E-05 | 6.5E-06 | 4.0E-05 | 4.1E+01 | 3.3E-05 | 0.0E+00 | 4.1E+01 | 5.3E-04 | 5.4E-04 | 2.9E-09 |
| Crushing/Proc. Equipment | Crusher | Nonroad | 1.7E-02 | 4.5E-03 | 5.0E-05 | 8.4E-04 | 0.0E+00 | 0.0E+00 | 8.2E-04 | 0.0E+00 | 0.0E+00 | 4.8E-09 | 0.0E+00 | 1.7E-05 | 9.9E-05 | 4.6E-05 | 2.6E-04 | 1.7E-06 | 3.6E-05 | 6.2E-06 | 2.7E-05 | 2.1E+01 | 7.8E-05 | 0.0E+00 | 2.1E+01 | 8.2E-04 | 8.4E-04 | 4.8E-09 |
| Excavators | Deere 450D Exc. | Nonroad | 1.4E-02 | 3.2E-03 | 1.5E-04 | 8.7E-04 | 0.0E+00 | 0.0E+00 | 8.4E-04 | 0.0E+00 | 0.0E+00 | 4.8E-09 | 0.0E+00 | 1.3E-05 | 8.5E-05 | 3.2E-05 | 1.9E-04 | 1.1E-06 | 3.3E-05 | 9.3E-06 | 5.6E-05 | 5.8E+01 | 5.4E-05 | 0.0E+00 | 5.8E+01 | 8.4E-04 | 8.7E-04 | 4.8E-09 |
| Excavators | Deere 350D Exc. | Nonroad | 6.9E-03 | 1.2E-03 | 8.6E-05 | 3.9E-04 | 0.0E+00 | 0.0E+00 | 3.8E-04 | 0.0E+00 | 0.0E+00 | 2.0E-09 | 0.0E+00 | 5.9E-06 | 4.0E-05 | 1.4E-05 | 8.3E-05 | 4.7E-07 | 1.6E-05 | 5.0E-06 | 3.1E-05 | 3.3E+01 | 2.3E-05 | 0.0E+00 | 3.3E+01 | 3.8E-04 | 3.9E-04 | 2.0E-09 |
| Excavators | CAT 325D Exc. | Nonroad | 6.9E-03 | 1.2E-03 | 8.6E-05 | 3.9E-04 | 0.0E+00 | 0.0E+00 | 3.8E-04 | 0.0E+00 | 0.0E+00 | 2.0E-09 | 0.0E+00 | 5.9E-06 | 4.0E-05 | 1.4E-05 | 8.3E-05 | 4.7E-07 | 1.6E-05 | 5.0E-06 | 3.1E-05 | 3.3E+01 | 2.3E-05 | 0.0E+00 | 3.3E+01 | 3.8E-04 | 3.9E-04 | 2.0E-09 |
| Graders | Grader | Nonroad | 3.6E-03 | 6.8E-04 | 4.3E-05 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.1E-09 | 0.0E+00 | 3.2E-06 | 2.1E-05 | 7.5E-06 | 4.5E-05 | 2.6E-07 | 8.3E-06 | 2.5E-06 | 1.6E-05 | 1.6E+01 | 1.2E-05 | 0.0E+00 | 1.6E+01 | 2.0E-04 | 2.1E-04 | 1.1E-09 |
| Off-highway Trucks | Water Truck | Nonroad | 1.8E-03 | 3.1E-04 | 2.3E-05 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 9.8E-05 | 0.0E+00 | 0.0E+00 | 5.3E-10 | 0.0E+00 | 1.5E-06 | 1.0E-05 | 3.5E-06 | 2.1E-05 | 1.2E-07 | 4.0E-06 | 1.3E-06 | 8.1E-06 | 8.6E+00 | 5.8E-06 | 0.0E+00 | 8.6E+00 | 9.8E-05 | 1.0E-04 | 5.3E-10 |
| Rollers | Smooth Drum | Nonroad | 6.6E-03 | 2.1E-03 | 4.1E-05 | 4.7E-04 | 0.0E+00 | 0.0E+00 | 4.6E-04 | 0.0E+00 | 0.0E+00 | 3.0E-09 | 0.0E+00 | 5.2E-06 | 3.1E-05 | 1.4E-05 | 8.0E-05 | 5.5E-07 | 1.1E-05 | 2.5E-06 | 9.2E-06 | 1.5E+01 | 2.5E-05 | 0.0E+00 | 1.5E+01 | 4.6E-04 | 4.7E-04 | 3.0E-09 |
| Rubber Tire Loaders | CAT 972 Loader | Nonroad | 1.8E-02 | 6.9E-03 | 8.0E-05 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 7.9E-09 | 0.0E+00 | 1.9E-05 | 1.1E-04 | 5.2E-05 | 2.9E-04 | 1.8E-06 | 4.2E-05 | 7.5E-06 | 3.5E-05 | 3.0E+01 | 9.0E-05 | 0.0E+00 | 3.0E+01 | 1.3E-03 | 1.3E-03 | 7.9E-09 |
| Rubber Tire Loaders | CAT 980H Loader | Nonroad | 1.8E-02 | 6.9E-03 | 8.0E-05 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 7.9E-09 | 0.0E+00 | 1.9E-05 | 1.1E-04 | 5.2E-05 | 2.9E-04 | 1.8E-06 | 4.2E-05 | 7.5E-06 | 3.5E-05 | 3.0E+01 | 9.0E-05 | 0.0E+00 | 3.0E+01 | 1.3E-03 | 1.3E-03 | 7.9E-09 |
| Skid Steer Loaders | skid steers - JD323 & JD 333 Tracked | Nonroad | 1.1E-02 | 1.1E-02 | 1.0E-05 | 1.5E-03 | 0.0E+00 | 0.0E+00 | 1.5E-03 | 0.0E+00 | 0.0E+00 | 5.5E-09 | 0.0E+00 | 4.9E-05 | 1.8E-04 | 6.8E-05 | 4.9E-04 | 3.8E-06 | 4.8E-05 | 1.4E-05 | 3.6E-05 | 3.4E+00 | 7.9E-05 | 0.0E+00 | 3.4E+00 | 1.5E-03 | 1.5E-03 | 5.5E-09 |
| Bore/Drill Rigs | pile divino rios- PRn22 | Nonroad | 4.6E-02 | 1.5E-02 | 5.4E-05 | 2.6E-03 | 0.0E+00 | 0.0E+00 | 2.5E-03 | 0.0E+00 | 0.0E+00 | 9.8E-09 | 0.0E+00 | 7.9E-05 | 2.9E-04 | 1.1E-04 | 8.0E-04 | 6.1E-06 | 7.9E-05 | 2.4E-05 | 6.9E-05 | 1.8E+01 | 1.3E-04 | 0.0E+00 | 1.8E+01 | 2.5E-03 | 2.6E-03 | 9.8E-09 |
| Cranes | moveable cranes XCR40 | Nonroad | 6.0E-03 | 1.2E-03 | 8.4E-05 | 3.3E-04 | 0.0E+00 | 0.0E+00 | 3.2E-04 | 0.0E+00 | 0.0E+00 | 1.8E-09 | 0.0E+00 | 5.6E-06 | 3.6E-05 | 1.4E-05 | 8.0E-05 | 4.7E-07 | 1.4E-05 | 4.0E-06 | 2.4E-05 | 2.4E+01 | 2.3E-05 | 0.0E+00 | 2.4E+01 | 3.2E-04 | 3.3E-04 | 1.8E-09 |
| Off-highway Trucks | concrete pump truck 65-METER Z FOLD | Nonroad | 1.6E-03 | 2.7E-04 | 2.0E-05 | 8.9E-05 | 0.0E+00 | 0.0E+00 | 8.6E-05 | 0.0E+00 | 0.0E+00 | 4.6E-10 | 0.0E+00 | 1.3E-06 | 9.1E-06 | 3.1E-06 | 1.9E-05 | 1.1E-07 | 3.5E-06 | 1.1E-06 | 7.1E-06 | 7.5E+00 | 5.1E-06 | 0.0E+00 | 7.5E+00 | 8.6E-05 | 8.9E-05 | 4.6E-10 |
| Off-highway Trucks | concrete mixing trucks - Western Star 4700 | Nonroad | 1.9E-02 | 3.3E-03 | 2.3E-04 | 1.1E-03 | 0.0E+00 | 0.0E+00 | 1.0E-03 | 0.0E+00 | 0.0E+00 | 5.5E-09 | 0.0E+00 | 1.6E-05 | 1.1E-04 | 3.7E-05 | 2.2E-04 | 1.3E-06 | 4.2E-05 | 1.3E-05 | 8.4E-05 | 6.9E+01 | 6.1E-05 | 0.0E+00 | 6.9E+01 | 1.0E-03 | 1.1E-03 | 5.5E-09 |
| Pavers | concrete screed machine- Gamco PS-2600 | Nonroad | 3.7E-03 | 7.5E-04 | 4.1E-05 | 2.2E-04 | 0.0E+00 | 0.0E+00 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 1.2E-09 | 0.0E+00 | 3.4E-06 | 2.2E-05 | 8.1E-06 | 4.8E-05 | 2.8E-07 | 8.5E-06 | 2.5E-06 | 1.5E-05 | 1.6E+01 | 1.4E-05 | 0.0E+00 | 1.6E+01 | 2.1E-04 | 2.2E-04 | 1.2E-09 |
| Off-highway Trucks | Haul Trucks Kenworth- 1800 tandem | Nonroad | 6.2E-03 | 1.1E-03 | 7.8E-05 | 3.5E-04 | 0.0E+00 | 0.0E+00 | 3.4E-04 | 0.0E+00 | 0.0E+00 | 1.8E-09 | 0.0E+00 | 5.3E-06 | 3.6E-05 | 1.2E-05 | 7.4E-05 | 4.2E-07 | 1.4E-05 | 4.1E-06 | 2.8E-05 | 3.0E+01 | 2.0E-05 | 0.0E+00 | 3.0E+01 | 3.4E-04 | 3.5E-04 | 1.8E-09 |
| Other Construction Equipment | portable concrete batch plant- TRIA Products | Nonroad | 4.7E-03 | 8.0E-04 | 7.7E-06 | 1.3E-04 | 0.0E+00 | 0.0E+00 | 1.3E-04 | 0.0E+00 | 0.0E+00 | 7.6E-10 | 0.0E+00 | 1.6E-06 | 8.7E-06 | 4.2E-06 | 2.4E-05 | 1.5E-07 | 3.1E-06 | 4.3E-07 | 1.5E-06 | 2.9E+00 | 6.9E-06 | 0.0E+00 | 2.9E+00 | 1.3E-04 | 1.3E-04 | 7.6E-10 |
| Excavators | Excavator- Komatsu PC 210 LC | Nonroad | 3.1E-03 | 9.0E-04 | 2.6E-05 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.9E-04 | 0.0E+00 | 0.0E+00 | 1.3E-09 | 0.0E+00 | 2.2E-06 | 1.3E-05 | 6.0E-06 | 3.4E-05 | 2.1E-07 | 4.9E-06 | 9.5E-07 | 4.5E-06 | 9.7E+00 | 1.0E-05 | 0.0E+00 | 9.7E+00 | 1.9E-04 | 2.0E-04 | 1.3E-09 |
| Air Compressors | Compressor- 260 Sullair | Nonroad | 1.5E-02 | 1.5E-03 | 9.4E-06 | 1.6E-04 | 0.0E+00 | 0.0E+00 | 1.6E-04 | 0.0E+00 | 0.0E+00 | 1.6E-09 | 0.0E+00 | 4.5E-06 | 3.7E-05 | 1.6E-05 | 1.0E-04 | 6.5E-07 | 1.3E-05 | 3.6E-06 | 4.9E-06 | 3.4E+00 | 5.7E-05 | 0.0E+00 | 3.4E+00 | 1.6E-04 | 1.6E-04 | 1.0E-09 |
| Other General Industrial Equ | Heater- Flargo FVO-400RC | Nonroad | 2.0E-02 | 5.5E-03 | 1.1E-04 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.2E-03 | 0.0E+00 | 0.0E+00 | 8.1E-09 | 0.0E+00 | 1.6E-05 | 9.4E-05 | 4.5E-05 | 2.5E-04 | 1.6E-06 | 3.5E-05 | 5.5E-06 | 2.3E-05 | 4.0E+01 | 7.9E-05 | 0.0E+00 | 4.0E+01 | 1.2E-03 | 1.3E-03 | 8.1E-09 |
| Generator Sets | Generator - Magnum MMG5SFH | Nonroad | 1.9E-02 | 5.0E-03 | 1.0E-05 | 7.4E-04 | 0.0E+00 | 0.0E+00 | 7.2E-04 | 0.0E+00 | 0.0E+00 | 3.1E-09 | 0.0E+00 | 2.1E-05 | 9.8E-05 | 4.3E-05 | 2.6E-04 | 1.5E-06 | 3.1E-05 | 5.5E-06 | 1.6E-05 | 3.4E+00 | 8.1E-05 | 0.0E+00 | 3.4E+00 | 7.2E-04 | 7.4E-04 | 3.1E-09 |
| Signal Boards/Light Plants | Light Plant -Magnum ML7S080/MLT 3060 | Nonroad | 6.5E-03 | 2.5E-03 | 3.7E-06 | 2.9E-04 | 0.0E+00 | 0.0E+00 | 2.8E-04 | 0.0E+00 | 0.0E+00 | 1.9E-09 | 0.0E+00 | 1.1E-05 | 6.3E-05 | 3.3E-05 | 1.8E-04 | 1.1E-06 | 2.3E-05 | 2.7E-06 | 7.0E-06 | 1.4E+00 | 5.3E-05 | 0.0E+00 | 1.4E+00 | 2.8E-04 | 2.9E-04 | 1.9E-09 |
| Rough Terrain Forklifts | Forklift Zoom Boom- 2SB044-44 | Nonroad | 5.7E-03 | 1.8E-03 | 3.9E-05 | 4.2E-04 | 0.0E+00 | 0.0E+00 | 4.1E-04 | 0.0E+00 | 0.0E+00 | 2.7E-09 | 0.0E+00 | 4.6E-06 | 2.7E-05 | 1.3E-05 | 7.0E-05 | 4.4E-07 | 9.9E-06 | 1.7E-06 | 7.4E-06 | 1.4E+01 | 2.2E-05 | 0.0E+00 | 1.4E+01 | 4.1E-04 | 4.2E-04 | 2.7E-09 |
| Aerial Lifts | Sky-Jack- SJB-46TK-RJ | Nonroad | 4.0E-03 | 1.5E-03 | 2.6E-06 | 2.2E-04 | 0.0E+00 | 0.0E+00 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 1.1E-09 | 0.0E+00 | 8.7E-06 | 3.8E-05 | 1.7E-05 | 1.1E-04 | 7.5E-07 | 1.2E-05 | 2.3E-06 | 8.0E-06 | 8.7E-01 | 2.9E-05 | 0.0E+00 | 8.7E-01 | 2.1E-04 | 2.2E-04 | 1.1E-09 |
| Off-highway Trucks | Pickup Trucks -F150 or RAM2500 | Nonroad | 1.9E-02 | 3.3E-03 | 2.3E-04 | 1.1E-03 | 0.0E+00 | 0.0E+00 | 1.0E-03 | 0.0E+00 | 0.0E+00 | 5.5E-09 | 0.0E+00 | 1.6E-05 | 1.1E-04 | 3.7E-05 | 2.2E-04 | 1.3E-06 | 4.2E-05 | 1.3E-05 | 8.4E-05 | 6.9E+01 | 6.1E-05 | 0.0E+00 | 6.9E+01 | 1.0E-03 | 1.1E-03 | 5.5E-09 |
| Generator Sets | Generators- BE Gen 3100W | Nonroad | 6.8E-03 | 4.1E-03 | 3.5E-08 | 4.2E-04 | 0.0E+00 | 0.0E+00 | 4.1E-04 | 0.0E+00 | 0.0E+00 | 2.6E-09 | 0.0E+00 | 2.5E-05 | 1.4E-04 | 7.1E-05 | 3.9E-04 | 2.5E-06 | 5.0E-05 | 5.9E-06 | 1.6E-05 | 9.5E-01 | 1.1E-04 | 0.0E+00 | 9.5E-01 | 4.1E-04 | 4.2E-04 | 2.6E-09 |
| Pavers | Water Pumps- Hondav WB30XT | Nonroad | 4.2E-03 | 2.5E-03 | 2.2E-06 | 2.5E-04 | 0.0E+00 | 0.0E+00 | 2.4E-04 | 0.0E+00 | 0.0E+00 | 1.6E-09 | 0.0E+00 | 1.6E-05 | 8.6E-05 | 4.5E-05 | 2.4E-04 | 1.5E-06 | 3.1E-05 | 3.5E-06 | 9.7E-06 | 5.9E-01 | 7.3E-05 | 0.0E+00 | 5.9E-01 | 2.4E-04 | 2.5E-04 | 1.6E-09 |
| Off-highway Trucks | Water Truck- CAT740 | Nonroad | 3.1E-03 | 5.5E-04 | 3.9E-05 | 1.8E-04 | 0.0E+00 | 0.0E+00 | 1.7E-04 | 0.0E+00 | 0.0E+00 | 9.2E-10 | 0.0E+00 | 2.7E-06 | 1.8E-05 | 6.1E-06 | 3.7E-05 | 2.1E-07 | 7.0E-06 | 2.2E-06 | 1.4E-05 | 1.5E+01 | 1.0E-05 | 0.0E+00 | 1.5E+01 | 1.7E-04 | 1.8E-04 | 9.2E-10 |
| Single Unit Long-Haul Trucks | Rock Trucks 40T/45T | Onroad | 6.8E-02 | 4.4E-02 | 6.6E-05 | 3.6E-04 | 6.0E-03 | 4.9E-04 | 3.3E-04 | 7.4E-04 | 7.4E-05 | 1.2E-08 | 0.0E+00 | 4.1E-06 | 3.6E-05 | 2.3E-06 | 4.0E-05 | 7.9E-07 | 1.3E-05 | 7.7E-06 | 5.3E-05 | 2.0E+01 | 3.2E-04 | 4.3E-05 | 2.0E+01 | 1.1E-03 | 6.8E-03 | 1.2E-08 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Rock Trucks 40T/45T | Onroad | 1.1E-02 | 7.3E-03 | 1.1E-05 | 6.0E-05 | 9.9E-04 | 8.2E-05 | 5.5E-05 | 1.2E-04 | 1.2E-05 | 2.0E-09 | 0.0E+00 | 6.8E-07 | 6.0E-06 | 3.8E-07 | 6.7E-06 | 1.3E-07 | 2.1E-06 | 1.3E-06 | 8.9E-06 | 3.3E+00 | 5.4E-05 | 7.1E-06 | 3.3E+00 | 1.9E-04 | 1.1E-03 | 2.0E-09 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Fuel Truck | Onroad | 1.3E-04 | 1.3E-04 | 2.8E-07 | 3.9E-06 | 8.7E-06 | 2.6E-06 | 3.6E-06 | 1.1E-06 | 3.9E-07 | 1.7E-10 | 0.0E+00 | 8.5E-08 | 5.1E-07 | 9.2E-08 | 1.0E-06 | 3.3E-08 | 9.6E-08 | 5.5E-08 | 2.3E-07 | 8.3E-02 | 1.6E-06 | 4.8E-07 | 8.4E-02 | 5.0E-06 | 1.5E-05 | 1.7E-10 |
| Single Unit Long-Haul Trucks | Flatbed Truck | Onroad | 2.5E-04 | 2.7E-04 | 5.6E-07 | 7.7E-06 | 1.7E-05 | 5.3E-06 | 7.1E-06 | 2.2E-06 | 7.8E-07 | 3.5E-10 | 0.0E+00 | 1.7E-07 | 1.0E-06 | 1.8E-07 | 2.0E-06 | 6.6E-08 | 1.9E-07 | 1.1E-07 | 4.6E-07 | 1.7E-01 | 3.3E-06 | 9.5E-07 | 1.7E-01 | 1.0E-05 | 3.0E-05 | 3.5E-10 |
| Light Commercial Trucks | Mechanic Truck | Onroad | 1.3E-04 | 1.3E-04 | 2.8E-07 | 3.9E-06 | 8.7E-06 | 2.6E-06 | 3.6E-06 | 1.1E-06 | 3.9E-07 | 1.7E-10 | 0.0E+00 | 8.5E-08 | 5.1E-07 | 9.2E-08 | 1.0E-06 | 3.3E-08 | 9.6E-08 | 5.5E-08 | 2.3E-07 | 8.3E-02 | 1.6E-06 | 4.8E-07 | 8.4E-02 | 5.0E-06 | 1.5E-05 | 1.7E-10 |
| Light Commercial Trucks | half ton trucks | Onroad | 1.1E-03 | 1.3E-02 | 1.2E-05 | 5.7E-05 | 1.3E-04 | 3.9E-05 | 5.0E-05 | 1.6E-05 | 5.9E-06 | 2.6E-08 | 1.4E-10 | 3.6E-07 | 3.9E-06 | 2.3E-05 | 7.3E-06 | 6.3E-07 | 3.8E-05 | 8.5E-06 | 3.1E-05 | 1.8E+00 | 8.3E-05 | 2.1E-05 | 1.8E+00 | 7.3E-05 | 2.3E-04 | 2.6E-08 |

*Notes:*

*Equivalent emission rates calculated by US EPA MOVES model include running exhaust and crankcase running exhaust. The emissions from vehicle starting are exxected to be insignificant.*

*1-hr emission rate (g/s) of **nonroad** equipment = Equipment Total operating time in a given hour (hrs/hr) x nonroad emission factors (g/hr)/3600 (s/hr).*

*1-hr emission rate (g/s) of **onroad** equipment = Equipment Total distance travelled in a given hour (VKT/hr) x onroad emission factors (g/VKT)/3600 (s/hr)*

*Particulates from brake wear and tire wear processes for nonroad equipment are expected to be insignificant and thus not calculated by the MOVES nonroad model.*

*CO2 Equivalent are calculated based on the Global Warming Potential (GWP) in the IPCC Fifth Assessment Report.*

**Summary of 1-hr Emission Rates (g/s) by Source Locations**

| Source Locations | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *CAS #* | *11104-93-1* | *630-08-0* | *7446-09-05* | - | - | - | - | - | - | - | - | *107-02-8* | *75-07-0* | *71-43-2* | *50-00-0* | *106-99-0* | *108-88-3* | *100-41-4* | *1330-20-7* | *124-38-9* | *74-82-8* | *10024-97-2* | *NA CO2e* | *NA PM2.5* | *NA PM10* | *50-32-8* |
| Quarry | - | 1.4E-01 | 4.8E-02 | 4.2E-04 | 8.7E-03 | 0.0E+00 | 0.0E+00 | 8.4E-03 | 0.0E+00 | 0.0E+00 | 4.0E-08 | 0.0E+00 | 3.2E-04 | 8.9E-04 | 3.6E-04 | 2.4E-03 | 1.7E-05 | 2.7E-04 | 7.2E-05 | 2.6E-04 | 1.5E+02 | 4.9E-04 | 0.0E+00 | 1.5E+02 | 8.7E-03 | 8.7E-03 | 4.0E-08 |
| Roadway | - | 1.5E-01 | 5.6E-02 | 8.6E-04 | 7.9E-03 | 1.2E-03 | 1.3E-04 | 7.7E-03 | 1.4E-04 | 2.0E-05 | 6.7E-08 | 1.4E-10 | 1.6E-04 | 8.1E-04 | 3.3E-04 | 2.0E-03 | 1.4E-05 | 3.1E-04 | 8.3E-05 | 3.9E-04 | 3.2E+02 | 6.1E-04 | 3.0E-05 | 3.2E+02 | 7.8E-03 | 9.2E-03 | 6.8E-08 |
| Bridge | - | 2.0E-01 | 6.3E-02 | 9.8E-04 | 1.1E-02 | 0.0E+00 | 0.0E+00 | 1.1E-02 | 0.0E+00 | 0.0E+00 | 5.6E-08 | 0.0E+00 | 2.9E-04 | 1.4E-03 | 5.9E-04 | 3.7E-03 | 2.5E-05 | 4.7E-04 | 1.1E-04 | 4.6E-04 | 3.7E+02 | 9.3E-04 | 0.0E+00 | 3.7E+02 | 1.1E-02 | 1.1E-02 | 5.6E-08 |
| Quarry Access Road | - | 6.8E-02 | 4.4E-02 | 6.6E-05 | 3.6E-04 | 6.0E-03 | 4.9E-04 | 3.3E-04 | 7.4E-04 | 7.4E-05 | 1.2E-08 | 0.0E+00 | 4.1E-06 | 3.6E-05 | 2.3E-06 | 4.0E-05 | 7.9E-07 | 1.3E-05 | 7.7E-06 | 5.3E-05 | 2.0E+01 | 3.2E-04 | 4.3E-05 | 2.0E+01 | 1.1E-03 | 6.8E-03 | 1.2E-08 |
| Roadway with Bridge(s) [1] | - | 3.5E-01 | 1.2E-01 | 1.8E-03 | 1.9E-02 | 1.2E-03 | 1.3E-04 | 1.9E-02 | 1.4E-04 | 2.0E-05 | 1.2E-07 | 1.4E-10 | 4.5E-04 | 2.2E-03 | 9.2E-04 | 5.7E-03 | 3.9E-05 | 7.8E-04 | 1.9E-04 | 8.5E-04 | 6.9E+02 | 1.5E-03 | 3.0E-05 | 6.9E+02 | 1.9E-02 | 2.1E-02 | 1.2E-07 |

*Notes:*

*1. As per the CAR construction team, bridge construction activities can occur simultaneously with roadway construction within a 500m daily working area. Therefore, mobile emissions from both roadway construction amd bridge construction accounted for the road segments with bridge(s).*

**C-1: Construction Mobile Equipment (Nonroad and Onroad)**

**24-hr Mobile Equipment Emission Rates (g/s)**

| 24- hour Emission Rate (g/s) | | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pollutant ID | 3 | 2 | 31 | 100 | 106 | 107 | 110 | 116 | 117 | 74 | 174 | 27 | 26 | 20 | 25 | 24 | 45 | 41 | 46 | 90 | 5 | 6 | 98 | 150+116+117 | 100+106+107 | 74+174 |
| **MOVES Source type** | **Equipment Type/Model** | Equipment Category | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bore/Drill Rigs | Rock Drills | Nonroad | 4.6E-02 | 1.5E-02 | 5.4E-05 | 2.6E-03 | 0.0E+00 | 0.0E+00 | 2.5E-03 | 0.0E+00 | 0.0E+00 | 9.8E-09 | 0.0E+00 | 7.9E-05 | 2.9E-04 | 1.1E-04 | 8.0E-04 | 8.1E-06 | 7.9E-05 | 2.4E-05 | 6.9E-05 | 1.9E+01 | 1.3E-04 | 0.0E+00 | 1.8E+01 | 2.5E-03 | 2.6E-03 | 9.8E-09 |
| Bore/Drill Rigs | Rock Drills | Nonroad | 2.3E-02 | 7.7E-03 | 2.7E-05 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 4.9E-09 | 0.0E+00 | 4.0E-05 | 1.5E-04 | 5.5E-05 | 4.0E-04 | 3.1E-06 | 4.0E-05 | 1.2E-05 | 3.4E-05 | 9.2E+00 | 6.5E-05 | 0.0E+00 | 9.2E+00 | 1.3E-03 | 1.3E-03 | 4.9E-09 |
| Crawler Tractor/Dozers | CAT D6 Dozer | Nonroad | 1.0E-02 | 3.1E-03 | 8.0E-05 | 7.0E-04 | 0.0E+00 | 0.0E+00 | 6.8E-04 | 0.0E+00 | 0.0E+00 | 4.1E-09 | 0.0E+00 | 1.0E-05 | 6.3E-05 | 2.6E-05 | 1.5E-04 | 9.0E-07 | 2.4E-05 | 5.6E-06 | 3.1E-05 | 3.0E+01 | 4.6E-05 | 0.0E+00 | 3.0E+01 | 6.8E-04 | 7.0E-04 | 4.1E-09 |
| Crawler Tractor/Dozers | CAT D6 Dozer | Nonroad | 6.8E-03 | 1.3E-03 | 8.2E-05 | 4.1E-04 | 0.0E+00 | 0.0E+00 | 4.0E-04 | 0.0E+00 | 0.0E+00 | 2.2E-09 | 0.0E+00 | 6.2E-06 | 4.1E-05 | 1.5E-05 | 8.8E-05 | 5.1E-07 | 1.6E-05 | 4.9E-06 | 3.0E-05 | 3.1E+01 | 2.4E-05 | 0.0E+00 | 3.1E+01 | 4.0E-04 | 4.1E-04 | 2.2E-09 |
| Crawler Tractor/Dozers | CAT D7 Dozer | Nonroad | 4.6E-03 | 8.9E-04 | 5.5E-05 | 2.7E-04 | 0.0E+00 | 0.0E+00 | 2.6E-04 | 0.0E+00 | 0.0E+00 | 1.5E-09 | 0.0E+00 | 4.2E-06 | 2.8E-05 | 9.8E-06 | 5.9E-05 | 3.4E-07 | 1.1E-05 | 3.3E-06 | 2.0E-05 | 2.1E+01 | 1.6E-05 | 0.0E+00 | 2.1E+01 | 2.6E-04 | 2.7E-04 | 1.5E-09 |
| Crawler/Pvr. Equipment | Crusher | Nonroad | 8.4E-03 | 2.3E-03 | 2.9E-05 | 4.2E-04 | 0.0E+00 | 0.0E+00 | 4.1E-04 | 0.0E+00 | 0.0E+00 | 2.4E-09 | 0.0E+00 | 8.6E-06 | 5.0E-05 | 2.3E-05 | 1.3E-04 | 8.3E-07 | 1.8E-05 | 3.1E-06 | 1.4E-05 | 1.1E+01 | 3.9E-05 | 0.0E+00 | 1.1E+01 | 4.1E-04 | 4.2E-04 | 2.4E-09 |
| Excavators | Deere 450D Exc. | Nonroad | 7.1E-03 | 1.6E-03 | 7.6E-05 | 4.3E-04 | 0.0E+00 | 0.0E+00 | 4.2E-04 | 0.0E+00 | 0.0E+00 | 2.4E-09 | 0.0E+00 | 6.5E-06 | 4.3E-05 | 1.6E-05 | 9.3E-05 | 5.5E-07 | 1.8E-05 | 4.7E-06 | 2.8E-05 | 2.9E+01 | 2.7E-05 | 0.0E+00 | 2.9E+01 | 4.2E-04 | 4.3E-04 | 2.4E-09 |
| Excavators | Deere 350D Exc. | Nonroad | 3.4E-03 | 6.6E-04 | 4.3E-05 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.9E-04 | 0.0E+00 | 0.0E+00 | 1.0E-09 | 0.0E+00 | 3.0E-06 | 2.0E-05 | 6.9E-06 | 4.1E-05 | 2.4E-07 | 7.8E-06 | 2.5E-06 | 1.6E-05 | 1.6E+01 | 1.1E-05 | 0.0E+00 | 1.6E+01 | 1.9E-04 | 2.0E-04 | 1.0E-09 |
| Excavators | CAT 325D Exc. | Nonroad | 3.4E-03 | 6.0E-04 | 4.3E-05 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.9E-04 | 0.0E+00 | 0.0E+00 | 1.0E-09 | 0.0E+00 | 3.0E-06 | 2.0E-05 | 6.9E-06 | 4.1E-05 | 2.4E-07 | 7.8E-06 | 2.5E-06 | 1.6E-05 | 1.6E+01 | 1.1E-05 | 0.0E+00 | 1.6E+01 | 1.9E-04 | 2.0E-04 | 1.0E-09 |
| Graders | Grader | Nonroad | 1.8E-03 | 3.4E-04 | 2.1E-05 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 5.6E-10 | 0.0E+00 | 1.6E-06 | 1.1E-05 | 3.8E-06 | 2.3E-05 | 1.3E-07 | 4.1E-06 | 1.3E-06 | 7.8E-06 | 8.1E+00 | 6.2E-06 | 0.0E+00 | 8.1E+00 | 1.0E-04 | 1.0E-04 | 5.6E-10 |
| Off-highway Trucks | Water Truck | Nonroad | 8.9E-04 | 1.5E-04 | 1.1E-05 | 5.1E-05 | 0.0E+00 | 0.0E+00 | 4.9E-05 | 0.0E+00 | 0.0E+00 | 2.6E-10 | 0.0E+00 | 7.6E-07 | 5.2E-06 | 1.7E-06 | 1.1E-05 | 6.0E-08 | 2.0E-06 | 6.5E-07 | 4.1E-06 | 4.3E+00 | 2.9E-06 | 0.0E+00 | 4.3E+00 | 4.9E-05 | 5.1E-05 | 2.6E-10 |
| Rollers | Smooth Drum | Nonroad | 3.3E-03 | 1.0E-03 | 2.5E-05 | 2.4E-04 | 0.0E+00 | 0.0E+00 | 2.3E-04 | 0.0E+00 | 0.0E+00 | 1.5E-09 | 0.0E+00 | 2.6E-06 | 1.5E-05 | 7.2E-06 | 4.0E-05 | 2.5E-07 | 5.7E-06 | 1.5E-06 | 4.6E-06 | 9.3E+00 | 1.2E-05 | 0.0E+00 | 9.3E+00 | 2.3E-04 | 2.4E-04 | 1.5E-09 |
| Rubber Tire Loaders | CAT 972 Loader | Nonroad | 9.2E-03 | 3.5E-03 | 4.0E-05 | 6.6E-04 | 0.0E+00 | 0.0E+00 | 6.4E-04 | 0.0E+00 | 0.0E+00 | 3.9E-09 | 0.0E+00 | 9.7E-06 | 5.7E-05 | 2.6E-05 | 1.5E-04 | 9.2E-07 | 2.1E-05 | 3.7E-06 | 1.7E-05 | 1.5E+01 | 4.5E-05 | 0.0E+00 | 1.5E+01 | 6.4E-04 | 6.6E-04 | 3.9E-09 |
| Rubber Tire Loaders | CAT 988H Loader | Nonroad | 9.2E-03 | 3.5E-03 | 4.0E-05 | 6.6E-04 | 0.0E+00 | 0.0E+00 | 6.4E-04 | 0.0E+00 | 0.0E+00 | 3.9E-09 | 0.0E+00 | 9.7E-06 | 5.7E-05 | 2.6E-05 | 1.5E-04 | 9.2E-07 | 2.1E-05 | 3.7E-06 | 1.7E-05 | 1.5E+01 | 4.5E-05 | 0.0E+00 | 1.5E+01 | 6.4E-04 | 6.6E-04 | 3.9E-09 |
| Skid Steer Loaders | skid steers- JD323 & JD 333 Tracked | Nonroad | 5.7E-03 | 6.4E-03 | 5.0E-05 | 7.6E-04 | 0.0E+00 | 0.0E+00 | 7.4E-04 | 0.0E+00 | 0.0E+00 | 2.7E-09 | 0.0E+00 | 2.4E-05 | 8.8E-05 | 3.4E-05 | 2.1E-04 | 1.9E-06 | 2.4E-05 | 6.9E-06 | 1.8E-05 | 1.7E+00 | 4.0E-05 | 0.0E+00 | 1.7E+00 | 7.4E-04 | 7.6E-04 | 2.7E-09 |
| Bore/Drill Rigs | crawler drilling rigs, DM-D3 | Nonroad | 2.3E-02 | 7.7E-03 | 2.7E-05 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 4.9E-09 | 0.0E+00 | 4.0E-05 | 1.5E-04 | 5.5E-05 | 4.0E-04 | 3.1E-06 | 4.0E-05 | 1.2E-05 | 3.4E-05 | 9.2E+00 | 6.5E-05 | 0.0E+00 | 9.2E+00 | 1.3E-03 | 1.3E-03 | 4.9E-09 |
| Cranes | moveable cranes (CRN) | Nonroad | 3.0E-03 | 5.8E-04 | 3.2E-05 | 1.7E-04 | 0.0E+00 | 0.0E+00 | 1.6E-04 | 0.0E+00 | 0.0E+00 | 9.0E-10 | 0.0E+00 | 2.8E-06 | 1.8E-05 | 6.8E-06 | 4.0E-05 | 2.3E-07 | 7.0E-06 | 2.0E-06 | 1.2E-05 | 1.4E+01 | 1.1E-05 | 0.0E+00 | 1.4E+01 | 1.7E-04 | 1.8E-04 | 9.0E-10 |
| Off-highway Trucks | concrete pump truck 65-METER Z FOLD | Nonroad | 7.5E-04 | 1.3E-04 | 9.9E-06 | 4.4E-05 | 0.0E+00 | 0.0E+00 | 4.3E-05 | 0.0E+00 | 0.0E+00 | 2.3E-10 | 0.0E+00 | 6.7E-07 | 4.5E-06 | 1.5E-06 | 9.3E-06 | 5.3E-08 | 1.8E-06 | 5.7E-07 | 3.6E-06 | 3.8E+00 | 2.5E-06 | 0.0E+00 | 3.8E+00 | 4.3E-05 | 4.4E-05 | 2.3E-10 |
| Off-highway Trucks | concrete mixer trucks - Western Star 4700 | Nonroad | 9.3E-03 | 1.6E-03 | 1.2E-04 | 5.3E-04 | 0.0E+00 | 0.0E+00 | 5.1E-04 | 0.0E+00 | 0.0E+00 | 2.8E-09 | 0.0E+00 | 8.0E-06 | 5.4E-05 | 1.8E-05 | 1.1E-04 | 6.3E-07 | 2.1E-05 | 6.7E-06 | 4.2E-05 | 4.4E+01 | 3.1E-05 | 0.0E+00 | 4.4E+01 | 5.1E-04 | 5.3E-04 | 2.8E-09 |
| Pavers | concrete spread machine- Gamco PS-2600 | Nonroad | 1.8E-03 | 3.8E-04 | 2.1E-05 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 5.9E-10 | 0.0E+00 | 1.7E-06 | 1.1E-05 | 4.1E-06 | 2.4E-05 | 1.4E-07 | 4.3E-06 | 1.2E-06 | 7.5E-06 | 7.8E+00 | 6.0E-06 | 0.0E+00 | 7.8E+00 | 1.1E-04 | 1.1E-04 | 5.9E-10 |
| Off-highway Trucks | Haul Trucks Kenworth- t800 tandem | Nonroad | 1.1E-03 | 5.5E-04 | 3.9E-05 | 1.9E-04 | 0.0E+00 | 0.0E+00 | 1.7E-04 | 0.0E+00 | 0.0E+00 | 9.2E-10 | 0.0E+00 | 2.7E-06 | 1.8E-05 | 5.1E-06 | 3.7E-05 | 2.1E-07 | 7.0E-06 | 2.2E-06 | 1.4E-05 | 1.5E+01 | 1.0E-05 | 0.0E+00 | 1.5E+01 | 1.7E-04 | 1.9E-04 | 9.2E-10 |
| Other Construction Equipment | portable concrete batch plant- TBA Products | Nonroad | 2.3E-03 | 4.0E-04 | 3.8E-06 | 6.8E-05 | 0.0E+00 | 0.0E+00 | 6.4E-05 | 0.0E+00 | 0.0E+00 | 3.8E-10 | 0.0E+00 | 7.8E-07 | 4.3E-06 | 2.1E-06 | 1.2E-05 | 7.7E-08 | 1.6E-06 | 2.2E-07 | 7.7E-07 | 1.4E+00 | 1.4E-06 | 0.0E+00 | 1.4E+00 | 6.4E-05 | 6.8E-05 | 3.8E-10 |
| Excavators | Excavator- Komatsu PC 210 LC | Nonroad | 1.5E-03 | 4.5E-04 | 1.3E-05 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 9.7E-05 | 0.0E+00 | 0.0E+00 | 6.3E-10 | 0.0E+00 | 1.1E-06 | 8.6E-06 | 3.0E-06 | 1.7E-05 | 1.0E-07 | 2.5E-06 | 4.7E-07 | 2.3E-06 | 4.8E+00 | 5.2E-06 | 0.0E+00 | 4.8E+00 | 9.7E-05 | 1.0E-04 | 6.3E-10 |
| Air Compressors | Compressor- 260 Sullair | Nonroad | 7.4E-03 | 7.4E-04 | 4.6E-06 | 8.0E-05 | 0.0E+00 | 0.0E+00 | 7.4E-05 | 0.0E+00 | 0.0E+00 | 5.0E-10 | 0.0E+00 | 3.3E-06 | 1.8E-05 | 9.2E-06 | 5.2E-05 | 3.2E-07 | 8.7E-06 | 8.1E-07 | 2.4E-06 | 1.7E+00 | 2.8E-05 | 0.0E+00 | 1.7E+00 | 7.8E-05 | 8.0E-05 | 5.0E-10 |
| Other General Industrial Equ. | Heater, Flame PVFLAVIRC | Nonroad | 1.0E-02 | 2.7E-03 | 5.3E-05 | 6.4E-04 | 0.0E+00 | 0.0E+00 | 6.2E-04 | 0.0E+00 | 0.0E+00 | 4.0E-09 | 0.0E+00 | 9.2E-06 | 4.7E-05 | 2.3E-05 | 1.3E-04 | 7.9E-07 | 1.7E-05 | 2.7E-06 | 1.1E-05 | 2.0E+01 | 3.9E-05 | 0.0E+00 | 2.0E+01 | 6.2E-04 | 6.4E-04 | 4.0E-09 |
| Generator Sets | Generator, Magnum MMG05RH | Nonroad | 9.3E-03 | 2.5E-03 | 5.0E-06 | 3.7E-04 | 0.0E+00 | 0.0E+00 | 3.6E-04 | 0.0E+00 | 0.0E+00 | 1.6E-09 | 0.0E+00 | 1.1E-05 | 4.9E-05 | 2.2E-05 | 1.4E-04 | 9.7E-07 | 1.6E-05 | 2.8E-06 | 8.0E-06 | 1.7E+00 | 4.6E-05 | 0.0E+00 | 1.7E+00 | 3.6E-04 | 3.7E-04 | 1.6E-09 |
| Signal Boards/Light Plants | Light Plant -Magnum ML7582/MLT 3060 | Nonroad | 3.2E-03 | 1.3E-03 | 1.9E-06 | 1.4E-04 | 0.0E+00 | 0.0E+00 | 1.4E-04 | 0.0E+00 | 0.0E+00 | 9.3E-10 | 0.0E+00 | 5.7E-06 | 3.1E-06 | 1.6E-05 | 8.8E-05 | 5.6E-07 | 1.1E-05 | 1.3E-06 | 3.5E-06 | 5.1E-01 | 2.7E-05 | 0.0E+00 | 5.1E-01 | 1.4E-04 | 1.4E-04 | 9.3E-10 |
| Rough Terrain Forklifts | Forklift Rough Boom, 7RRHL44 | Nonroad | 2.8E-03 | 9.0E-04 | 1.9E-05 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.3E-09 | 0.0E+00 | 2.3E-06 | 1.3E-05 | 6.3E-06 | 3.5E-05 | 2.2E-07 | 4.9E-06 | 8.4E-07 | 3.7E-06 | 7.2E+00 | 1.1E-05 | 0.0E+00 | 7.2E+00 | 2.0E-04 | 2.1E-04 | 1.3E-09 |
| Aerial Lifts | Sky-lark, SJB-40TK-B1 | Nonroad | 2.0E-03 | 7.4E-04 | 1.3E-06 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 5.3E-10 | 0.0E+00 | 4.3E-06 | 1.9E-05 | 8.7E-06 | 5.4E-05 | 3.7E-07 | 6.1E-06 | 1.1E-06 | 3.0E-06 | 4.4E-01 | 1.4E-05 | 0.0E+00 | 4.4E-01 | 1.0E-04 | 1.1E-04 | 5.3E-10 |
| Off-highway Trucks | Pickup Trucks -F150 or RAM2500 | Nonroad | 9.2E-03 | 1.6E-03 | 1.2E-04 | 5.3E-04 | 0.0E+00 | 0.0E+00 | 5.1E-04 | 0.0E+00 | 0.0E+00 | 2.8E-09 | 0.0E+00 | 8.0E-06 | 5.4E-05 | 1.8E-05 | 1.1E-04 | 6.3E-07 | 2.1E-05 | 6.7E-06 | 4.2E-05 | 4.4E+01 | 3.1E-05 | 0.0E+00 | 4.4E+01 | 5.1E-04 | 5.3E-04 | 2.8E-09 |
| Generator Sets | Generators, RF Gen 910NW | Nonroad | 3.4E-03 | 2.1E-03 | 1.7E-06 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.3E-09 | 0.0E+00 | 1.3E-06 | 6.9E-06 | 3.5E-06 | 1.9E-05 | 1.2E-06 | 2.5E-05 | 3.6E-06 | 7.9E-06 | 4.7E-01 | 5.7E-05 | 0.0E+00 | 4.7E-01 | 2.0E-04 | 2.1E-04 | 1.3E-09 |
| Pumps | Water Pumps, Hewlet WRYXT | Nonroad | 2.1E-03 | 1.2E-03 | 1.1E-06 | 1.2E-04 | 0.0E+00 | 0.0E+00 | 1.2E-04 | 0.0E+00 | 0.0E+00 | 7.8E-10 | 0.0E+00 | 2.9E-06 | 4.3E-06 | 2.2E-06 | 1.2E-05 | 7.1E-07 | 1.6E-06 | 1.9E-06 | 4.9E-06 | 2.9E-01 | 9.9E-06 | 0.0E+00 | 2.9E-01 | 1.2E-04 | 1.2E-04 | 7.8E-10 |
| Off-highway Trucks | Water Truck- CAT740 | Nonroad | 1.6E-03 | 2.7E-04 | 1.9E-05 | 8.8E-05 | 0.0E+00 | 0.0E+00 | 8.5E-05 | 0.0E+00 | 0.0E+00 | 4.6E-10 | 0.0E+00 | 1.3E-06 | 9.0E-06 | 3.1E-06 | 1.9E-05 | 1.1E-07 | 3.5E-06 | 1.1E-06 | 7.0E-06 | 7.4E+00 | 5.1E-06 | 0.0E+00 | 7.4E+00 | 8.5E-05 | 8.8E-05 | 4.6E-10 |
| Single Unit Long-Haul Trucks | Work Trucks 40T14ST | Onroad | 2.8E-02 | 1.8E-02 | 2.8E-05 | 1.5E-04 | 2.5E-03 | 2.1E-04 | 1.4E-04 | 3.1E-04 | 3.1E-05 | 4.9E-09 | 0.0E+00 | 1.7E-06 | 1.5E-05 | 9.4E-07 | 1.7E-05 | 3.3E-07 | 5.3E-06 | 3.2E-06 | 2.2E-05 | 8.2E+00 | 1.3E-04 | 1.8E-05 | 8.2E+00 | 4.8E-04 | 2.8E-03 | 4.9E-09 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Rock Trucks 40T14ST | Onroad | 4.7E-03 | 3.0E-03 | 4.6E-06 | 2.5E-05 | 4.1E-04 | 3.4E-05 | 2.3E-05 | 5.2E-05 | 5.1E-06 | 8.2E-10 | 0.0E+00 | 2.9E-07 | 2.5E-06 | 1.6E-07 | 2.8E-06 | 5.5E-08 | 8.9E-07 | 5.3E-07 | 3.7E-06 | 1.4E+00 | 2.2E-05 | 3.0E-06 | 1.4E+00 | 8.0E-05 | 4.7E-04 | 8.2E-10 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Fuel Truck | Onroad | 5.3E-06 | 5.5E-06 | 1.2E-08 | 1.6E-07 | 3.6E-07 | 1.1E-07 | 1.5E-07 | 4.6E-08 | 1.6E-08 | 7.2E-12 | 0.0E+00 | 3.5E-09 | 2.1E-08 | 3.8E-09 | 4.2E-08 | 1.4E-09 | 4.0E-09 | 2.3E-09 | 9.6E-09 | 3.5E-03 | 6.9E-08 | 2.0E-08 | 3.5E-03 | 2.1E-07 | 6.4E-07 | 7.2E-12 |
| Single Unit Long-Haul Trucks | Flatbed Truck | Onroad | 1.1E-05 | 1.1E-05 | 2.3E-08 | 3.2E-07 | 7.3E-07 | 2.2E-07 | 3.0E-07 | 9.1E-08 | 3.3E-08 | 1.4E-11 | 0.0E+00 | 7.1E-09 | 4.2E-08 | 7.7E-09 | 8.3E-08 | 2.8E-09 | 8.0E-09 | 4.6E-09 | 1.9E-08 | 7.0E-03 | 1.4E-07 | 4.0E-08 | 7.0E-03 | 4.2E-07 | 1.3E-06 | 1.4E-11 |
| Light Commercial Trucks | Mechanic Truck | Onroad | 5.3E-06 | 5.5E-06 | 1.2E-08 | 1.6E-07 | 3.6E-07 | 1.1E-07 | 1.5E-07 | 4.6E-08 | 1.6E-08 | 7.2E-12 | 0.0E+00 | 3.5E-09 | 2.1E-08 | 3.8E-09 | 4.2E-08 | 1.4E-09 | 4.0E-09 | 2.3E-09 | 9.6E-09 | 3.5E-03 | 6.9E-08 | 2.0E-08 | 3.5E-03 | 2.1E-07 | 6.4E-07 | 7.2E-12 |
| Light Commercial Trucks | half ton trucks | Onroad | 4.6E-05 | 5.2E-04 | 5.0E-07 | 2.4E-06 | 5.5E-06 | 1.6E-06 | 2.1E-06 | 6.8E-07 | 2.5E-07 | 1.1E-09 | 6.0E-12 | 1.5E-08 | 1.6E-07 | 9.7E-07 | 3.1E-07 | 2.6E-08 | 1.6E-06 | 3.5E-07 | 1.3E-06 | 7.9E-02 | 3.4E-06 | 8.6E-07 | 7.6E-02 | 3.0E-06 | 9.5E-06 | 1.1E-09 |

*Notes:*
*24-hr emission rate (g/s) of* ***nonroad*** *equipment = Equipment total operating time of equipment in a day (hrs/day) x nonroad emission factors (g/hr)/ 24 (hr/day) /3600 (s/hr)*
*24-hr emission rate (g/s) of* ***onroad*** *equipment = Equipment total distance travelled in a day(VKT/day) x onroad emission factors (g/VKT)/ 24 (hr/day) /3600 (s/hr)*

**Summary of 24-hr Emission Rates (g/s) by Source Locations**

| Source Locations | | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *CAS #* | *11104-93-1* | *630-08-0* | *7446-09-05* | | | | | | | | | *107-02-8* | *75-07-0* | *71-43-2* | *50-00-0* | *106-99-0* | *108-88-3* | *100-41-4* | *1330-20-7* | *124-38-9* | *74-82-8* | *10024-97-2* | *NA CO2e* | *NA PM2.5* | *NA PM10* | *50-32-8* |
| Quarry | | - | 7.1E-02 | 2.4E-02 | 2.1E-04 | 4.3E-03 | 0.0E+00 | 0.0E+00 | 4.2E-03 | 0.0E+00 | 0.0E+00 | 2.0E-08 | 0.0E+00 | 1.0E-04 | 4.5E-04 | 1.8E-04 | 1.2E-03 | 8.5E-06 | 1.4E-04 | 3.6E-05 | 1.3E-04 | 7.7E+01 | 2.5E-04 | 0.0E+00 | 7.7E+01 | 4.2E-03 | 4.3E-03 | 2.0E-08 |
| Roadway | | - | 7.1E-02 | 2.2E-02 | 4.2E-04 | 3.9E-03 | 4.2E-04 | 3.6E-05 | 3.6E-03 | 5.3E-05 | 5.3E-05 | 5.5E-08 | 2.1E-08 | 6.0E-12 | 8.0E-05 | 4.0E-04 | 1.6E-04 | 9.9E-04 | 6.6E-06 | 1.4E-04 | 3.7E-05 | 1.8E-04 | 1.4E+02 | 2.6E-04 | 3.5E-06 | 1.4E+02 | 3.9E-03 | 4.4E-03 | 2.1E-08 |
| Bridge | | - | 1.0E-01 | 3.1E-02 | 4.9E-04 | 5.7E-03 | 0.0E+00 | 0.0E+00 | 5.6E-03 | 0.0E+00 | 0.0E+00 | 2.8E-08 | 0.0E+00 | 1.5E-04 | 7.0E-04 | 3.0E-04 | 1.8E-03 | 1.2E-05 | 2.4E-04 | 5.5E-05 | 2.3E-04 | 1.8E+02 | 4.6E-04 | 0.0E+00 | 1.8E+02 | 5.6E-03 | 5.7E-03 | 2.8E-08 |
| Quarry Access Road | | - | 2.8E-02 | 1.8E-02 | 2.8E-05 | 1.5E-04 | 2.5E-03 | 2.1E-04 | 1.4E-04 | 3.1E-04 | 3.1E-05 | 4.9E-09 | 0.0E+00 | 1.7E-06 | 1.5E-05 | 9.4E-07 | 1.7E-05 | 3.3E-07 | 5.3E-06 | 3.2E-06 | 2.2E-05 | 8.2E+00 | 1.3E-04 | 1.8E-05 | 8.2E+00 | 4.8E-04 | 2.8E-03 | 4.9E-09 |
| Roadway with Bridge(s) [1] | | - | 1.7E-01 | 5.3E-02 | 9.1E-04 | 9.7E-03 | 4.2E-04 | 3.6E-05 | 9.4E-03 | 5.3E-05 | 5.5E-06 | 4.9E-08 | 6.0E-12 | 2.3E-04 | 1.1E-03 | 4.5E-04 | 2.8E-03 | 1.9E-05 | 3.7E-04 | 9.2E-05 | 4.1E-04 | 3.4E+02 | 7.3E-04 | 3.9E-06 | 3.4E+02 | 9.4E-03 | 1.0E-02 | 5.0E-08 |

*Notes:*
*1. As per the CAR construction team. bridge construction activities can occur simultaneously with roadway construction within a 500m daily working area. Therefore. mobile emissions from both roadway construction amd bridge construction accounted for the road segements with bridge(s).*

**C-1: Construction Mobile Equipment (Nonroad and Onroad)**
**Annual Mobile Equipment Emission Rates (g/a)**

| Annual Emission Rate (g/a) | | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pollutant ID | 3 | 2 | 31 | 100 | 106 | 107 | 110 | 116 | 117 | 74 | 174 | 27 | 26 | 20 | 25 | 24 | 45 | 41 | 46 | 90 | 5 | 6 | 98 | 110+116+117 | 100+106+107 | 74+174 |
| **MOVES Source type** | **Equipment Type/Model** | Equipment Category | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bore/Drill Rigs | Rock Drills | Nonroad | 4.6E-02 | 1.5E-02 | 5.4E-05 | 2.6E-03 | 0.0E+00 | 0.0E+00 | 2.5E-03 | 0.0E+00 | 0.0E+00 | 9.8E-09 | 0.0E+00 | 7.9E-05 | 2.9E-04 | 1.1E-04 | 8.0E-04 | 6.1E-06 | 7.9E-05 | 2.4E-05 | 6.9E-05 | 1.8E+01 | 1.3E-04 | 0.0E+00 | 1.8E+01 | 2.5E-03 | 2.6E-03 | 9.8E-09 |
| Bore/Drill Rigs | Rock Drills | Nonroad | 6.3E-04 | 2.1E-04 | 7.4E-07 | 3.6E-05 | 0.0E+00 | 0.0E+00 | 3.5E-05 | 0.0E+00 | 0.0E+00 | 1.3E-10 | 0.0E+00 | 1.1E-06 | 4.0E-06 | 1.5E-06 | 1.1E-05 | 8.4E-08 | 1.1E-06 | 3.3E-07 | 9.4E-07 | 2.5E-01 | 1.8E-06 | 0.0E+00 | 2.5E-01 | 3.5E-05 | 3.6E-05 | 1.3E-10 |
| Crawler Tractor/Dozers | CAT D8 Dozer | Nonroad | 2.8E-04 | 9.5E-05 | 2.2E-06 | 1.6E-05 | 0.0E+00 | 0.0E+00 | 1.5E-05 | 0.0E+00 | 0.0E+00 | 1.1E-10 | 0.0E+00 | 1.2E-07 | 1.7E-06 | 7.1E-07 | 4.1E-06 | 2.5E-08 | 6.5E-07 | 1.5E-07 | 8.4E-07 | 8.3E-01 | 1.3E-06 | 0.0E+00 | 8.3E-01 | 1.9E-05 | 1.9E-05 | 1.1E-10 |
| Crawler Tractor/Dozers | CAT D6 Dozer | Nonroad | 1.5E-04 | 3.7E-05 | 2.2E-08 | 1.1E-05 | 0.0E+00 | 0.0E+00 | 1.1E-05 | 0.0E+00 | 0.0E+00 | 6.0E-11 | 0.0E+00 | 1.7E-07 | 1.1E-06 | 4.0E-07 | 2.4E-08 | 1.4E-08 | 4.4E-07 | 1.3E-07 | 5.1E-07 | 6.7E-07 | 0.0E+00 | 8.5E-01 | 1.1E-05 | 1.1E-05 | 6.0E-11 |
| Crawler Tractor/Dozers | CAT D7 Dozer | Nonroad | 1.3E-04 | 2.4E-05 | 1.5E-08 | 7.5E-06 | 0.0E+00 | 0.0E+00 | 7.2E-06 | 0.0E+00 | 0.0E+00 | 4.0E-11 | 0.0E+00 | 1.1E-07 | 7.6E-07 | 2.7E-07 | 1.6E-06 | 9.3E-09 | 2.9E-07 | 8.9E-08 | 5.4E-07 | 5.7E-01 | 4.5E-07 | 0.0E+00 | 5.7E-01 | 7.2E-06 | 7.5E-06 | 4.0E-11 |
| Crusher/Proc. Equipment | Crusher | Nonroad | 2.3E-04 | 6.2E-05 | 8.0E-07 | 1.2E-05 | 0.0E+00 | 0.0E+00 | 1.1E-05 | 0.0E+00 | 0.0E+00 | 6.6E-11 | 0.0E+00 | 2.4E-07 | 1.4E-06 | 5.2E-07 | 3.6E-06 | 2.3E-08 | 4.0E-07 | 8.4E-08 | 3.7E-07 | 2.3E-01 | 1.1E-06 | 0.0E+00 | 2.3E-01 | 1.1E-05 | 1.2E-05 | 6.6E-11 |
| Excavators | Deere 450D Exc. | Nonroad | 7.1E-03 | 1.6E-03 | 7.6E-05 | 4.3E-04 | 0.0E+00 | 0.0E+00 | 4.2E-04 | 0.0E+00 | 0.0E+00 | 2.4E-09 | 0.0E+00 | 6.5E-06 | 4.3E-05 | 1.6E-05 | 9.3E-05 | 5.5E-07 | 1.6E-05 | 4.7E-06 | 2.8E-05 | 2.9E+01 | 2.7E-05 | 0.0E+00 | 2.9E+01 | 4.2E-04 | 4.3E-04 | 2.4E-09 |
| Excavators | Deere 350D Exc. | Nonroad | 9.4E-05 | 1.7E-05 | 1.2E-06 | 5.4E-06 | 0.0E+00 | 0.0E+00 | 5.2E-06 | 0.0E+00 | 0.0E+00 | 2.8E-11 | 0.0E+00 | 8.1E-08 | 5.5E-07 | 1.9E-07 | 1.1E-06 | 6.5E-09 | 2.1E-07 | 6.8E-08 | 4.3E-07 | 4.5E-01 | 3.1E-07 | 0.0E+00 | 4.5E-01 | 5.2E-06 | 5.4E-06 | 2.8E-11 |
| Excavators | CAT 325D Exc. | Nonroad | 9.4E-05 | 1.7E-05 | 1.2E-06 | 5.4E-06 | 0.0E+00 | 0.0E+00 | 5.2E-06 | 0.0E+00 | 0.0E+00 | 2.8E-11 | 0.0E+00 | 8.1E-08 | 5.5E-07 | 1.9E-07 | 1.1E-06 | 6.5E-09 | 2.1E-07 | 6.8E-08 | 4.3E-07 | 4.5E-01 | 3.1E-07 | 0.0E+00 | 4.5E-01 | 5.2E-06 | 5.4E-06 | 2.8E-11 |
| Graders | Grader | Nonroad | 4.9E-05 | 9.3E-06 | 5.9E-07 | 2.9E-06 | 0.0E+00 | 0.0E+00 | 2.8E-06 | 0.0E+00 | 0.0E+00 | 1.5E-11 | 0.0E+00 | 4.4E-08 | 2.9E-07 | 1.0E-07 | 6.2E-07 | 3.6E-09 | 1.1E-07 | 3.5E-08 | 2.1E-07 | 2.2E-01 | 1.7E-07 | 0.0E+00 | 2.2E-01 | 2.8E-06 | 2.9E-06 | 1.5E-11 |
| Off-highway Trucks | Water Truck | Nonroad | 2.4E-05 | 4.2E-06 | 3.1E-07 | 1.4E-06 | 0.0E+00 | 0.0E+00 | 1.3E-06 | 0.0E+00 | 0.0E+00 | 7.2E-12 | 0.0E+00 | 2.1E-08 | 1.4E-07 | 4.8E-08 | 2.9E-07 | 1.6E-09 | 5.5E-08 | 1.8E-08 | 1.1E-07 | 1.2E-01 | 7.9E-08 | 0.0E+00 | 1.2E-01 | 1.3E-06 | 1.4E-06 | 7.2E-12 |
| Rollers | Smooth Drum | Nonroad | 9.0E-05 | 2.8E-05 | 6.7E-07 | 6.5E-06 | 0.0E+00 | 0.0E+00 | 6.3E-06 | 0.0E+00 | 0.0E+00 | 4.1E-11 | 0.0E+00 | 7.2E-08 | 4.2E-07 | 2.0E-07 | 1.1E-06 | 6.8E-09 | 1.8E-07 | 2.7E-08 | 1.3E-07 | 2.5E-01 | 1.4E-07 | 0.0E+00 | 2.5E-01 | 6.3E-06 | 6.5E-06 | 4.1E-11 |
| Rubber Tire Loaders | CAT 972 Loader | Nonroad | 9.2E-03 | 3.5E-03 | 4.0E-05 | 6.8E-04 | 0.0E+00 | 0.0E+00 | 6.4E-04 | 0.0E+00 | 0.0E+00 | 3.9E-09 | 0.0E+00 | 9.7E-06 | 5.7E-05 | 2.6E-05 | 1.5E-04 | 9.2E-07 | 2.1E-05 | 3.7E-06 | 1.7E-05 | 1.5E+01 | 4.5E-05 | 0.0E+00 | 1.5E+01 | 6.4E-04 | 6.8E-04 | 3.9E-09 |
| Rubber Tire Loaders | CAT 988H Loader | Nonroad | 9.2E-03 | 3.5E-03 | 4.0E-05 | 6.8E-04 | 0.0E+00 | 0.0E+00 | 6.4E-04 | 0.0E+00 | 0.0E+00 | 3.9E-09 | 0.0E+00 | 9.7E-06 | 5.7E-05 | 2.6E-05 | 1.5E-04 | 9.2E-07 | 2.1E-05 | 3.7E-06 | 1.7E-05 | 1.5E+01 | 4.5E-05 | 0.0E+00 | 1.5E+01 | 6.4E-04 | 6.8E-04 | 3.9E-09 |
| Skid Steer Loaders | skid steers- JD323 & JD 333 Tracked | Nonroad | 5.7E-03 | 5.4E-03 | 5.0E-05 | 7.6E-04 | 0.0E+00 | 0.0E+00 | 7.4E-04 | 0.0E+00 | 0.0E+00 | 2.7E-09 | 0.0E+00 | 2.4E-05 | 8.8E-05 | 3.4E-05 | 2.5E-04 | 1.9E-06 | 2.4E-05 | 6.9E-06 | 1.8E-05 | 1.7E+00 | 4.0E-05 | 0.0E+00 | 1.7E+00 | 7.4E-04 | 7.6E-04 | 2.7E-09 |
| Bore/Drill Rigs | pile drivino rigs- Pihn22 | Nonroad | 2.3E-02 | 7.7E-03 | 2.7E-05 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 1.3E-03 | 0.0E+00 | 0.0E+00 | 4.9E-09 | 0.0E+00 | 4.0E-05 | 1.5E-04 | 5.5E-05 | 4.0E-04 | 3.1E-06 | 4.0E-05 | 1.2E-05 | 3.4E-05 | 9.2E+00 | 6.5E-05 | 0.0E+00 | 9.2E+00 | 1.3E-03 | 1.3E-03 | 4.9E-09 |
| Cranes | moveable cranes XCP40 | Nonroad | 3.0E-03 | 5.8E-04 | 3.2E-05 | 1.7E-04 | 0.0E+00 | 0.0E+00 | 1.6E-04 | 0.0E+00 | 0.0E+00 | 9.0E-10 | 0.0E+00 | 2.2E-06 | 1.8E-05 | 6.8E-06 | 4.0E-05 | 2.3E-07 | 7.0E-06 | 2.0E-06 | 1.2E-05 | 1.2E+01 | 1.1E-05 | 0.0E+00 | 1.2E+01 | 1.6E-04 | 1.7E-04 | 9.0E-10 |
| Off-highway Trucks | concrete pump truck 65-METER Z FOLD | Nonroad | 7.8E-04 | 1.3E-04 | 9.0E-06 | 4.4E-05 | 0.0E+00 | 0.0E+00 | 4.3E-05 | 0.0E+00 | 0.0E+00 | 2.3E-10 | 0.0E+00 | 6.7E-07 | 4.5E-06 | 1.5E-06 | 9.3E-06 | 5.3E-08 | 1.8E-06 | 5.7E-07 | 3.6E-06 | 3.8E+00 | 2.5E-06 | 0.0E+00 | 3.8E+00 | 4.3E-05 | 4.4E-05 | 2.3E-10 |
| Off-highway Trucks | concrete mixing trucks - Western Star 4700 | Nonroad | 9.3E-03 | 1.6E-03 | 1.2E-04 | 5.3E-04 | 0.0E+00 | 0.0E+00 | 5.1E-04 | 0.0E+00 | 0.0E+00 | 2.8E-09 | 0.0E+00 | 8.0E-06 | 5.4E-05 | 1.8E-05 | 1.1E-04 | 6.3E-07 | 2.1E-05 | 6.7E-06 | 4.2E-05 | 4.4E+01 | 3.1E-05 | 0.0E+00 | 4.4E+01 | 5.1E-04 | 5.3E-04 | 2.8E-09 |
| Pavers | concrete screed machine- Gamco PS-2600 | Nonroad | 1.8E-03 | 3.8E-04 | 2.1E-05 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 5.9E-10 | 0.0E+00 | 1.7E-06 | 1.1E-05 | 4.1E-06 | 2.4E-05 | 1.4E-07 | 4.3E-06 | 1.2E-06 | 7.5E-06 | 7.8E+00 | 6.9E-06 | 0.0E+00 | 7.8E+00 | 1.1E-04 | 1.1E-04 | 5.9E-10 |
| Off-highway Trucks | Haul Trucks Kenworth- t800 tandem | Nonroad | 3.1E-03 | 5.5E-04 | 3.9E-05 | 1.8E-04 | 0.0E+00 | 0.0E+00 | 1.7E-04 | 0.0E+00 | 0.0E+00 | 9.2E-10 | 0.0E+00 | 2.7E-06 | 1.8E-05 | 6.1E-06 | 3.7E-05 | 2.1E-07 | 7.0E-06 | 2.2E-06 | 1.4E-05 | 1.5E+01 | 1.0E-05 | 0.0E+00 | 1.5E+01 | 1.7E-04 | 1.8E-04 | 9.2E-10 |
| Other Construction Equipment | portable concrete batch plant- TRIA Products | Nonroad | 2.3E-03 | 4.0E-04 | 3.8E-06 | 6.8E-05 | 0.0E+00 | 0.0E+00 | 6.4E-05 | 0.0E+00 | 0.0E+00 | 3.8E-10 | 0.0E+00 | 7.8E-07 | 4.3E-06 | 2.1E-06 | 1.2E-05 | 7.7E-08 | 1.6E-06 | 2.2E-07 | 7.7E-07 | 1.4E+00 | 3.4E-06 | 0.0E+00 | 1.4E+00 | 6.4E-05 | 6.6E-05 | 3.8E-10 |
| Excavators | Excavator- Komatsu PC 210 LC | Nonroad | 1.5E-03 | 4.5E-04 | 1.3E-05 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 9.7E-05 | 0.0E+00 | 0.0E+00 | 6.3E-10 | 0.0E+00 | 1.1E-06 | 6.6E-06 | 3.0E-06 | 1.7E-05 | 1.0E-07 | 2.5E-06 | 4.7E-07 | 2.3E-06 | 4.5E+00 | 5.2E-06 | 0.0E+00 | 4.6E+00 | 9.7E-05 | 1.0E-04 | 6.3E-10 |
| Air Compressors | Compressor- 260 Sullair | Nonroad | 7.6E-03 | 7.9E-04 | 4.6E-06 | 8.0E-05 | 0.0E+00 | 0.0E+00 | 7.8E-05 | 0.0E+00 | 0.0E+00 | 5.0E-10 | 0.0E+00 | 3.3E-06 | 1.8E-05 | 9.2E-06 | 5.2E-05 | 3.2E-07 | 6.7E-06 | 8.1E-07 | 2.4E-06 | 1.7E+00 | 2.8E-05 | 0.0E+00 | 1.7E+00 | 7.8E-05 | 8.0E-05 | 5.0E-10 |
| Other General Industrial Equ | Heater- Flarco FVO-400RC | Nonroad | 1.5E-02 | 2.7E-03 | 5.3E-05 | 9.4E-04 | 0.0E+00 | 0.0E+00 | 9.2E-04 | 0.0E+00 | 0.0E+00 | 4.0E-09 | 0.0E+00 | 9.2E-06 | 4.7E-05 | 2.3E-05 | 1.3E-04 | 7.9E-07 | 1.7E-05 | 2.7E-06 | 1.1E-05 | 2.9E+01 | 3.9E-05 | 0.0E+00 | 2.9E+01 | 6.2E-04 | 6.4E-04 | 4.0E-09 |
| Generator Sets | Generator -Maxnum MMGSSFH | Nonroad | 9.3E-03 | 2.5E-03 | 5.0E-06 | 3.7E-04 | 0.0E+00 | 0.0E+00 | 3.6E-04 | 0.0E+00 | 0.0E+00 | 1.6E-09 | 0.0E+00 | 1.1E-05 | 4.9E-05 | 2.2E-05 | 1.4E-04 | 9.7E-07 | 1.6E-05 | 2.8E-06 | 8.0E-06 | 1.7E+00 | 4.0E-05 | 0.0E+00 | 1.7E+00 | 3.6E-04 | 3.7E-04 | 1.6E-09 |
| Signal Boards/Light Plants | Light Plant -Maxnum ML7S080/MLT 3060 | Nonroad | 3.2E-03 | 1.3E-03 | 1.9E-06 | 1.4E-04 | 0.0E+00 | 0.0E+00 | 1.4E-04 | 0.0E+00 | 0.0E+00 | 9.3E-10 | 0.0E+00 | 5.7E-06 | 3.1E-05 | 1.6E-05 | 8.8E-05 | 5.6E-07 | 1.1E-05 | 1.3E-06 | 3.5E-06 | 5.1E-01 | 2.7E-05 | 0.0E+00 | 5.1E-01 | 1.4E-04 | 1.4E-04 | 9.3E-10 |
| Roush Terrain Forklifts | Forklift Zoom Boom- ZB8044-44 | Nonroad | 2.8E-03 | 9.0E-04 | 1.9E-05 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.3E-09 | 0.0E+00 | 3.3E-06 | 1.3E-05 | 6.3E-06 | 3.5E-05 | 2.2E-07 | 4.9E-06 | 8.4E-07 | 3.7E-06 | 7.2E+00 | 1.1E-05 | 0.0E+00 | 7.2E+00 | 2.0E-04 | 2.1E-04 | 1.3E-09 |
| Aerial Lifts | SkyJack SJB-46TK-RJ | Nonroad | 2.0E-03 | 7.4E-04 | 1.3E-06 | 1.1E-04 | 0.0E+00 | 0.0E+00 | 1.0E-04 | 0.0E+00 | 0.0E+00 | 5.3E-10 | 0.0E+00 | 4.3E-06 | 1.9E-05 | 8.7E-06 | 5.4E-05 | 3.7E-07 | 6.1E-06 | 1.1E-06 | 3.0E-06 | 4.4E-01 | 1.4E-05 | 0.0E+00 | 4.4E-01 | 1.0E-04 | 1.1E-04 | 5.3E-10 |
| Off-highway Trucks | Pickup Trucks -F150 or RAM2500 | Nonroad | 9.3E-03 | 1.6E-03 | 1.2E-04 | 5.3E-04 | 0.0E+00 | 0.0E+00 | 5.1E-04 | 0.0E+00 | 0.0E+00 | 2.8E-09 | 0.0E+00 | 8.0E-06 | 5.4E-05 | 1.8E-05 | 1.1E-04 | 6.3E-07 | 2.1E-05 | 6.7E-06 | 4.2E-05 | 4.4E+01 | 3.1E-05 | 0.0E+00 | 4.4E+01 | 5.1E-04 | 5.3E-04 | 2.8E-09 |
| Generator Sets | Generators- BE Gen 3100W | Nonroad | 3.4E-03 | 2.1E-03 | 1.7E-06 | 2.1E-04 | 0.0E+00 | 0.0E+00 | 2.0E-04 | 0.0E+00 | 0.0E+00 | 1.3E-09 | 0.0E+00 | 1.3E-05 | 6.9E-05 | 3.5E-05 | 1.9E-04 | 1.2E-06 | 2.5E-05 | 3.6E-06 | 7.9E-06 | 4.7E-01 | 5.7E-05 | 0.0E+00 | 4.7E-01 | 2.0E-04 | 2.1E-04 | 1.3E-09 |
| Pumps | Water Pumps- Honday WB30XT | Nonroad | 2.1E-03 | 1.2E-03 | 1.1E-06 | 1.2E-04 | 0.0E+00 | 0.0E+00 | 1.2E-04 | 0.0E+00 | 0.0E+00 | 7.8E-10 | 0.0E+00 | 7.8E-06 | 4.3E-05 | 2.2E-05 | 1.2E-04 | 7.7E-07 | 1.6E-05 | 1.8E-06 | 4.8E-06 | 2.3E-01 | 3.9E-05 | 0.0E+00 | 2.3E-01 | 1.2E-04 | 1.2E-04 | 7.8E-10 |
| Off-highway Trucks | Water Truck- CAT740 | Nonroad | 1.6E-03 | 2.7E-04 | 1.9E-05 | 8.8E-05 | 0.0E+00 | 0.0E+00 | 8.5E-05 | 0.0E+00 | 0.0E+00 | 4.6E-10 | 0.0E+00 | 1.3E-06 | 9.0E-06 | 3.1E-06 | 1.9E-05 | 1.1E-07 | 3.5E-06 | 1.1E-06 | 7.0E-06 | 7.4E+00 | 5.1E-06 | 0.0E+00 | 7.4E+00 | 8.5E-05 | 8.8E-05 | 4.6E-10 |
| Single Unit Long-Haul Trucks | Rock Trucks 40T14ST | Onroad | 2.8E-02 | 1.8E-02 | 2.1E-05 | 1.5E-04 | 2.5E-03 | 2.1E-04 | 1.4E-04 | 3.1E-04 | 3.1E-05 | 4.9E-09 | 0.0E+00 | 1.7E-06 | 1.5E-05 | 9.4E-07 | 1.7E-05 | 3.3E-07 | 5.3E-06 | 3.2E-06 | 2.2E-05 | 8.2E+00 | 1.3E-04 | 1.8E-05 | 8.2E+00 | 4.8E-04 | 2.8E-03 | 4.9E-09 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Rock Trucks 40T14ST | Onroad | 1.3E-04 | 8.3E-05 | 1.3E-07 | 6.9E-07 | 1.1E-05 | 9.4E-07 | 6.3E-07 | 1.4E-06 | 1.4E-07 | 2.2E-11 | 0.0E+00 | 7.8E-09 | 6.8E-08 | 4.3E-09 | 7.6E-08 | 1.5E-09 | 2.4E-08 | 1.5E-08 | 1.0E-07 | 3.8E-02 | 6.1E-07 | 8.2E-08 | 3.8E-02 | 2.2E-06 | 1.3E-05 | 2.2E-11 |
| Single Unit Long-Haul Trucks | Semi Trailers | Onroad | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Single Unit Long-Haul Trucks | Fuel Truck | Onroad | 1.4E-07 | 1.5E-07 | 3.2E-10 | 4.4E-09 | 1.0E-08 | 3.0E-09 | 4.1E-09 | 1.2E-09 | 4.5E-10 | 2.0E-13 | 0.0E+00 | 9.7E-11 | 5.8E-10 | 1.0E-10 | 1.1E-09 | 3.8E-11 | 1.1E-10 | 6.3E-11 | 2.6E-10 | 9.5E-05 | 1.9E-09 | 5.4E-10 | 9.6E-05 | 5.8E-09 | 1.7E-08 | 2.0E-13 |
| Single Unit Long-Haul Trucks | Flatbed Truck | Onroad | 2.9E-07 | 3.0E-07 | 6.4E-10 | 8.8E-09 | 2.0E-08 | 6.0E-09 | 8.1E-09 | 2.5E-09 | 9.0E-10 | 3.9E-13 | 0.0E+00 | 1.9E-10 | 1.2E-09 | 2.1E-10 | 2.3E-09 | 7.4E-11 | 2.2E-10 | 1.3E-10 | 5.3E-10 | 1.9E-04 | 3.9E-09 | 1.1E-09 | 1.9E-04 | 1.2E-08 | 3.5E-08 | 3.9E-13 |
| Light Commercial Trucks | Mechanic Truck | Onroad | 1.4E-07 | 1.5E-07 | 3.2E-10 | 4.4E-09 | 1.0E-08 | 3.0E-09 | 4.1E-09 | 1.2E-09 | 4.5E-10 | 2.0E-13 | 0.0E+00 | 9.7E-11 | 5.8E-10 | 1.0E-10 | 1.1E-09 | 3.8E-11 | 1.1E-10 | 6.3E-11 | 2.6E-10 | 9.5E-05 | 1.9E-09 | 5.4E-10 | 9.6E-05 | 5.8E-09 | 1.7E-08 | 2.0E-13 |
| Light Commercial Trucks | half ton trucks | Onroad | 1.3E-06 | 1.4E-05 | 1.4E-08 | 6.5E-08 | 1.5E-07 | 4.5E-08 | 6.7E-08 | 1.9E-08 | 6.8E-09 | 3.0E-11 | 1.6E-13 | 4.1E-10 | 4.5E-09 | 2.7E-08 | 8.4E-09 | 7.2E-10 | 4.4E-08 | 9.7E-09 | 3.5E-08 | 2.1E-03 | 9.4E-08 | 2.4E-08 | 2.1E-03 | 8.3E-08 | 2.6E-07 | 3.0E-11 |

*Notes:*
*Annual emission rate (g/a) of* ***nonroad*** *equipment = Total Operating Time of Equipment in a year (hrs/year) x nonroad emission factors (g/hr)/ 8760 (hrs/year) /3600 (s/hr)*
*Annual emission rate (g/a) of* ***onroad*** *equipment = Total distance travelled in a year (VKT/year)x onroad emission factors (g/VKT)/ 8760 (hrs/year) /3600 (s/hr)*
*Bridge Building activities can occur from 16months to 2 years, as such annual emission rates for bridge building equipment equal 24hr emission rates*
*Quarry Access Road Assumed to Operate 365 days per year*
*Quarry Activities Assumed to Operate 365 days per year*

**Summary of Annual Emission Rates (g/a) by Source Locations**

| Source Locations | Pollutants | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Primary Exhaust PM10 - Total | Primary PM10 - Brakewear Particulate | Primary PM10 - Tirewear Particulate | Primary Exhaust PM2.5 - Total | Primary PM2.5 - Brakewear Particulate | Primary PM2.5 - Tirewear Particulate | Benzo(a)pyrene particle | Benzo(a)pyrene gas | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | Atmospheric CO2 | Methane (CH4) | Nitrous Oxide (N2O) | CO2 Equivalent | Total PM2.5 (Exhaust + Brakewear + tirewear) | Total PM10 (Exhaust + Brakewear + tirewear) | Total BaP (Particulate and Gas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *CAS #* | 71104-93-1 | 630-08-0 | 7446-09-05 | | | | | | | | | 107-02-8 | 75-07-0 | 71-43-2 | 50-00-0 | 106-99-0 | 108-88-3 | 100-41-4 | 1330-20-7 | 124-38-9 | 74-82-8 | 10024-97-2 | NA CO2e | NA PM2.5 | NA PM10 | 50-32-8 |
| Quarry | - | 7.1E-02 | 2.4E-02 | 2.1E-04 | 4.3E-03 | 0.0E+00 | 0.0E+00 | 4.2E-03 | 0.0E+00 | 0.0E+00 | 2.0E-08 | 0.0E+00 | 1.0E-04 | 4.1E-04 | 1.8E-04 | 1.2E-03 | 8.5E-06 | 1.4E-04 | 3.6E-05 | 1.3E-04 | 7.7E+01 | 2.3E-04 | 0.0E+00 | 7.7E+01 | 4.2E-03 | 4.3E-03 | 2.1E-08 |
| Roadway | - | 1.9E-03 | 5.9E-04 | 1.2E-05 | 1.1E-04 | 1.2E-05 | 1.0E-06 | 1.0E-04 | 1.4E-06 | 1.5E-07 | 5.8E-10 | 1.6E-13 | 2.2E-06 | 1.1E-05 | 4.3E-06 | 2.7E-05 | 1.6E-07 | 3.8E-06 | 1.0E-06 | 5.0E-06 | 4.3E+00 | 7.2E-06 | 1.7E-07 | 4.3E+00 | 1.1E-04 | 1.2E-04 | 5.8E-10 |
| Bridge | - | 1.0E-01 | 3.1E-02 | 4.9E-04 | 5.7E-03 | 0.0E+00 | 0.0E+00 | 5.6E-03 | 0.0E+00 | 0.0E+00 | 2.8E-08 | 0.0E+00 | 1.5E-04 | 7.0E-04 | 3.0E-04 | 1.8E-03 | 1.2E-05 | 2.4E-04 | 5.5E-05 | 2.3E-04 | 1.8E+02 | 4.6E-04 | 0.0E+00 | 1.8E+02 | 5.6E-03 | 5.7E-03 | 2.8E-08 |
| Quarry Access Road | - | 2.8E-02 | 1.8E-02 | 2.8E-05 | 1.5E-04 | 2.5E-03 | 2.1E-04 | 1.4E-04 | 3.1E-04 | 3.1E-05 | 4.9E-09 | 0.0E+00 | 1.7E-06 | 1.5E-05 | 9.4E-07 | 1.7E-05 | 3.3E-07 | 5.3E-06 | 3.2E-06 | 2.2E-05 | 8.2E+00 | 1.3E-04 | 1.8E-05 | 8.2E+00 | 4.8E-04 | 2.8E-03 | 4.9E-09 |
| Roadway with Bridge(s) [1] | - | 1.0E-01 | 3.2E-02 | 5.0E-04 | 5.9E-03 | 1.2E-05 | 1.0E-06 | 5.7E-03 | 1.4E-06 | 1.5E-07 | 2.9E-08 | 1.6E-13 | 1.5E-04 | 7.1E-04 | 3.0E-04 | 1.9E-03 | 1.3E-05 | 2.4E-04 | 5.6E-05 | 2.3E-04 | 1.9E+02 | 4.7E-04 | 1.7E-07 | 1.9E+02 | 5.7E-03 | 5.9E-03 | 2.9E-08 |

*Notes:*
*1. As per the CAR construction team. bridge construction activities can occur simultaneously with roadway construction within a 500m daily working area. Therefore. mobile emissions from both roadway construction and bridge construction accounted for the road segments with bridge(s).*

**C-2-Q: Rock Drilling at Quarry**

**Estimation Technique:**
The following emission factors are used to estimate the PM emissions from hole drilling activities in general.
PM released (tonnes/yr) = PM emission factor (kg /hole) x number of holes drilled per year x (1 tonne/1 000 kg)

**Blast Hole Drilling**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Estimated number of holes drilled | 15,695 | holes per year | Engineering Provided Info |
| | 43.0 | holes per day | Calculated |
| | 4.0 | holes per hour | Calculated |

*The blast hole drilling estimate is based on the Berens River First Nation project.*

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP (<30um) | 0.59 | kg/hole | AP-42 Table 11.9-4 for TSP. Particle Size Multipliers based on ECCC pits and quarries reporting guide |
| PM10 | 0.31 | kg/hole | |
| PM2.5 | 0.31 | kg/hole | |

**Calculated Emission Rates**

| Contaminant | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| | Annual | 24hr | 1hr |
| TSP (<30um) | 2.9E-01 | 2.9E-01 | 6.6E-01 |
| PM10 | 1.5E-01 | 1.5E-01 | 3.4E-01 |
| PM2.5 | 1.5E-01 | 1.5E-01 | 3.4E-01 |

**Sample Calculation for PM10:**

24-hr Emission Rate (g/s) = Emission Factor (kg/hole) * (holes/day) * 1000 (g/kg)/ 24 (hr/day)/ 3600 (s/hr)

= 1.5E-01 (g/s)

**C-2-R: Rock Drilling at Roadway**

**Estimation Technique:**
The following emission factors are used to estimate the PM emissions from hole drilling activities in general.
PM released (tonnes/yr) = PM emission factor (kg /hole) x number of holes drilled per year x (1 tonne/1 000 kg)

**Blast Hole Drilling**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Estimated number of holes drilled | 46,355 | holes per year | Engineering Provided Info |
| | 127.0 | holes per day | Calculated |
| | 12.0 | holes per hour | Calculated |

*The blast hole drilling estimate is based on the Berens River First Nation project.*

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP (<30um) | 0.59 | kg/hole | AP-42 Table 11.9-4 for TSP. Particle Size Multipliers based on ECCC pits and quarries reporting guide |
| PM10 | 0.31 | kg/hole | |
| PM2.5 | 0.31 | kg/hole | |

**Calculated Emission Rates**

| Contaminant | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| | Annual | 24hr | 1hr |
| TSP (<30um) | 2.4E-02 | 8.7E-01 | 2.0E+00 |
| PM10 | 1.2E-02 | 4.5E-01 | 1.0E+00 |
| PM2.5 | 1.2E-02 | 4.5E-01 | 1.0E+00 |

**Sample Calculation for PM10:**

24-hr Emission Rate (g/s) = Emission Factor (kg/hole) * (holes/day) * 1000 (g/kg)/ 24 (hr/day)/ 3600 (s/hr)
= 4.5E-01 (g/s)

**C-3-Q: Rock Blasting Quarry**

**Estimation Technique:**
Emissions from blasting activities include particulates and gases released from blasting explosives including CO, NOx and SO2.
Parameters influencing emission rates include: number of blasts per a year, horizontal blasting area and typical blasting depth.

**Quarry Rock Blasting**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Typical Blasting Depth | 11.0 | m | |
| Typical Blasting Horizontal Area | 3000 | m² | |
| Holes per Blast | 512 | | |
| Quantity of Dynamite Ammonia per Blast | 51.1 | tonnes per blast | Engineering Provided Info |
| Blasting frequency | 24 | blasts per year | |
| | 15 | Days until next blast | |
| | 1 | blasts per day | |
| | 1 | blasts per hour | |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP (<30um) | 36.150 | kg/blast | Section 11.9 Western Surface Coal Mining of AP-42 (US EPA 1998) |
| PM10 | 18.798 | kg/blast | |
| PM2.5 | 1.084 | kg/blast | |
| CO | 17 | kg/tonne | Australian Government National Pollutant Inventory Emission Estimation Technique |
| NOx | 0.2 | kg/tonne | |
| SO2 | 1 | kg/tonne | AP-42 Section 13.3-1 Explosive Detonations |

Blasting Emission Factors were based on the usage of Emulsion with the exepction of SO2 which was based on ANFO

**Calculated Emission Rates**

| Contaminant | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| | Annual | 24hr | 1hr |
| TSP | 2.8E-02 | 4.2E-01 | 1.0E+01 |
| PM10 | 1.4E-02 | 2.2E-01 | 5.2E+00 |
| PM2.5 | 8.3E-04 | 1.3E-02 | 3.0E-01 |
| CO | 6.6E-01 | 1.0E+01 | 2.4E+02 |
| NOx | 7.8E-03 | 1.2E-01 | 2.8E+00 |
| SO2 | 3.9E-02 | 5.9E-01 | 1.4E+01 |

*Note:*

*Maximum emission rates for a 1-hr averaging period were calculated based on a worst case emission scenario which assumes a maximum number of blasts per a hour.*

*Sample Calculation for PM10:*

*PM10 EF (kg/blast) = 0.52 * 0.00022 * [horizontal blast area (m²)]$^{1.5}$*
*1.9E+01*

*Hourly PM10 Emission Rate (g/s) = [Emission Factor (kg/yr) / 3600 (s/hr)]* 1000 (g/kg)*
*5.2E+00*

*Sample Calculation for NOx:*

*24hr Emission Rate (g/s) = [Emission Factor (kg/tonne) *( tonnes of ANFO per Blast) *number of blasts per day * 1000 (g/kg)/ 3600 (s/hr) / 24(hr/day)*
*1.2E-01*

**C-3-R: Rock Blasting Road**

**Estimation Technique:**
Emissions from blasting activities include particulates and gases released from blasting explosives including CO, NOx and SO2.
Parameters influencing emission rates include: number of blasts per a year, horizontal blasting area and typical blasting depth.
Emissions factors for CO, NOx and SO2 are from Environment Canada, Pits and quarries reporting guide- Blasting explosives for the detonation of ammonium nitrate with fuel oil (ANFO).

**Quarry Rock Blasting**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Typical Blasting Depth | 4.5 | m | |
| Typical Blasting Horizontal Area | 70 | $m^2$ | |
| Holes Per Blast | 45 | Average Holes Per Blast | |
| Holes Blasted Per Day | 127 | Holes Drilled Per Day | |
| Holes Blasted Per Year | 46355 | Holes Drilled Per Year | |
| Quantity of explosive per Blast | 0.90 | tonnes per blast | Engineering Provided Info |
| Quantify of explosive per Day | 2.54 | tonnes per day | |
| Quantify of explosive per Year | 927.10 | tonnes per year | |
| | 1460 | Max blasts per year | |
| Blasting frequency | 4 | Max blasts per day | |
| | 1 | Max blasts per hour | |

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP (<30um) | 0.129 | kg/blast | Section 11.9 Western Surface Coal Mining of AP-42 (US EPA 1998) |
| PM10 | 0.067 | kg/blast | |
| PM2.5 | 0.004 | kg/blast | |
| CO | 17 | kg/tonne | Australian Government National Pollutant Inventory Emission Estimation Technique Manual for Explosive Detonation and Firing Ranges Version 3.1 August 2016 |
| NOx | 0.2 | kg/tonne | |
| SO2 | 1 | kg/tonne | AP-42 Section 13.3-1 Explosive Detonations |

Blasting Emission Factors were based on the usage of Emulsion with the exepction of SO2 which was based on ANFO. It is estimated that the emulsion product will contain the same amount of fuel oil as ANFO, therefore have similar emissions of SO2

**Calculated Emission Rates**

| Contaminant | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| | Annual | 24hr | 1hr |
| TSP | 1.6E-04 | 6.0E-03 | 3.6E-02 |
| PM10 | 8.5E-05 | 3.1E-03 | 1.9E-02 |
| PM2.5 | 4.9E-06 | 1.8E-04 | 1.1E-03 |
| CO | 1.4E-02 | 5.0E-01 | 4.3E+00 |
| NOx | 1.6E-04 | 5.9E-03 | 5.0E-02 |
| SO2 | 8.1E-04 | 2.9E-02 | 2.5E-01 |

*Note:*

*Maximum emission rates for a 1-hr averaging period is based on a worst case emission scenario which assumes a maximum number of blasts in a hour.*

*Sample Calculation for PM10:*

*PM10 EF (kg/blast) = 0.52 * 0.00022 * [horizontal blast area ($m^2$)]$^{1.5}$*
*6.7E-02*

*Hourly PM10 Emission Rate (g/s) = [Emission Factor (kg/yr) / 3600 (s/hr)]* 1000 (g/kg)*
*1.9E-02*

*Sample Calculation for NOx:*

*24hr Emission Rate (g/s) = [Emission Factor (kg/tonne) *( tonnes of ANFO per Blast) *number of blasts per day * 1000 (g/kg)/ 3600 (s/hr) / 24(hr/day)*
*5.9E-03*

**C-4-R: Material Crushing at Roadway**

**Estimation Technique:**

Environment Canada, Pits and quarries reporting guide- Crushing.

Emission factors for crushing operations (Primary, secondary and tertiary crushing)

The general equation for estimating emissions is:

PM released (tonnes/yr) = PM emission factor (kg /tonne) x annual throughput (tonne/yr) x (1 tonne/1000 kg)

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Crushing Operating hours | 10.0 | hours/day | Calculated |
| | 500 | hours/year | Engineering Provided |
| | 200 | tonne/hour | |
| Quantity of material crushed | 2,000 | tonne/day | Calculated |
| | 100,000 | tonne/year | |

**Emission Factors**

| Process | Crushing, uncontrolled EF[1] (kg/tonne) | Reference |
|---|---|---|
| TSP (<30um) | 0.0027 | Environment Canada, Pits and quarries reporting guide- Crushing |
| PM10 | 0.0012 | |
| PM2.5 | 0.0006 | |

1. Same crushing EF for Primary, secondary and tertiary crushing .

**Calculated Emission Rates**

| | Maximum Emission Rate (Uncontrolled) [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 8.6E-03 | 6.3E-02 | 1.5E-01 |
| PM10 | 3.8E-03 | 2.8E-02 | 6.7E-02 |
| PM2.5 | 1.9E-03 | 1.4E-02 | 3.3E-02 |

Sample Calculations for PM10

24-hr PM10 Emission Rate (g/s) = [Uncontrolled Emission Factor (kg/Tonne) * (tonnes/hr) * 1000 (g/kg)] / 3600 (s/hr)

= 2.8E-02 (g/s)

**C-5-R: Bulldozing (Overburden Removal)**

**Estimation Technique:**
Environment Canada, Pits and quarries reporting guide- Overburden removal
The general equation for estimating emissions is:
PM released (tonnes/yr) = PM emission factor (kg/hr) x annual activity (hr/yr) x (1 tonne/1 000 kg)
PM Emission Factors:
$EF(TPM) = 2.6\ (s)^{1.2} / (M)^{1.3}$
$EF(PM10) = (0.45\ (s)^{1.5} / (M)^{1.4}) \times 0.75$
$EF(PM2.5) = (2.6\ (s)^{1.2} / (M)^{1.3}) \times 0.105$
Where
EF is the emission factor for the corresponding PM fraction (kg/hr)
s is the material silt content (%)
M is the average material moisture content (%)

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| **Bulldozing** | | | |
| Operating hours of Bulldozer | 3650 | hr/year | Engineering Provided |
| | 10 | hr/day | |
| Material silt content (s) | 6.90 | % | US EPA AP42 11.9 Table 11.9-3 |
| Material moisture content (M) | 7.90 | % | - moisture and silt for overburden |

The silt content and moisture content are based on the geometric mean of overburden samples collected by the US EPA.

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP | 1.80 | kg/hr | Environment Canada, Pits and quarries reporting guide- Overburden removal |
| PM10 | 0.339 | kg/hr | |
| PM2.5 | 0.189 | kg/hr | |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 5.7E-03 | 2.1E-01 | 5.0E-01 |
| PM10 | 1.1E-03 | 3.9E-02 | 9.4E-02 |
| PM2.5 | 6.0E-04 | 2.2E-02 | 5.2E-02 |

Sample Calculations for TSP

TSP EF (kg/hr) = [2.6 * [material silt content (%)]$^{1.2}$] / [material moisture content (%)]$^{1.3}$
1.80E+00 (kg/hr)

24-hr TSP Emission Rate (g/s) = Emission Factor (kg/hr) * bulldozer operating hours per day (hr/day)/ 24 (hr/day)/ 3600 (s/hr) * 1000 (g/kg)
2.1E-01 (g/s)

**C-6-Q: Stockpile Material Loading at Quarry**
General loading/unloading of overburden and rock at quarry

**Estimation Technique:**
AP42 13.2.4 Aggregate Handling And Storage Piles
$EF = k * 0.0016 * (U/2.2)^{1.3} / (M/2)^{1.4}$

Where,
EF is the emission factor (kg/tonne)
U is the mean wind speed (m/s)
M is the material moisture content (%)
k is the particle size multiplier.

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| **Material Handling** | | | |
| operating hours per day | 12 | hr/day | |
| operating days per year | 365 | day/yr | Engineering Provided |
| material handled per day | 3,000 | tonne/ day | |
| material handled per year | 1,095,000 | tonne/ year | |
| material handled per hour | 250 | tonne/ hour | Calculated |
| Mean wind speed (U) | 3.34 | m/s | ECCC 2023 Weather Data at OGOKI POST Airport |
| Material moisture content (M) | 0.70 | % | AP42 13.2.4 Aggregate Handling And Storage Piles Table 13.2.4-1, Crushed limestone |
| TSP (<30um) | 0.74 | | |
| PM10 | 0.35 | Aerodynamic Particle Size Multiplier (k) | AP42 13.2.4.3 Predictive Emission Factor Equations |
| PM2.5 | 0.053 | | |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP | 0.01 | kg/tonne handled | |
| PM10 | 0.00 | kg/tonne handled | AP42 13.2.4 Aggregate Handling And Storage Piles |
| PM2.5 | 0.00 | kg/tonne handled | |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 3.1E-01 | 3.1E-01 | 6.2E-01 |
| PM10 | 1.5E-01 | 1.5E-01 | 2.9E-01 |
| PM2.5 | 2.2E-02 | 2.2E-02 | 4.4E-02 |

Sample Calculation for PM10

PM 10 EF (kg/tonne handled) = particle size multiplier (k) * 0.0016 * [(wind speed (m/s) / 2.2)$^{1.3}$ / (moisture content (%) / 2)$^{1.4}$]
0.00 (kg/tonne handled)

Hourly PM10 Emission Rate (g/s) = Material handled per hour (Tonne/hr) * Emission Factor (kg/Mg) / 3600 (s/hr) * 1000 (g/kg)
2.9E-01 (g/s)

**C-6-R: Stockpile Material Loading at Roadway**
General unloading of overburden and rock at roadway

**Estimation Technique:**
AP42 13.2.4 Aggregate Handling And Storage Piles
$EF = k * 0.0016 * (U/2.2)^{1.3} / (M/2)^{1.4}$

Where,
EF is the emission factor (kg/tonne)
U is the mean wind speed (m/s)
M is the material moisture content (%)
k is the particle size multiplier.

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| **Material Handling** | | | |
| operating hours per day | 12 | hr/day | Engineering Provided |
| operating days per year | 365 | day/yr | |
| material handled per day | 3,000 | tonne/ day | |
| material handled per year | 1,095,000 | tonne/ year | |
| material handled per hour | 250 | tonne/ hour | Calculated |
| Mean wind speed (U) | 3.34 | m/s | ECCC 2023 Weather Data at OGOKI POST Airport |
| Material moisture content (M) | 0.70 | % | AP42 13.2.4 Aggregate Handling And Storage Piles Table 13.2.4-1, Crushed limestone |
| TSP (<30um) | 0.74 | | |
| PM10 | 0.35 | Aerodynamic Particle Size Multiplier (k) | AP42 13.2.4.3 Predictive Emission Factor Equations |
| PM2.5 | 0.053 | | |

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP | 0.01 | kg/tonne handled | AP42 13.2.4 Aggregate Handling And Storage Piles |
| PM10 | 0.00 | kg/tonne handled | |
| PM2.5 | 0.00 | kg/tonne handled | |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 8.4E-03 | 3.1E-01 | 6.2E-01 |
| PM10 | 4.0E-03 | 1.5E-01 | 2.9E-01 |
| PM2.5 | 6.0E-04 | 2.2E-02 | 4.4E-02 |

Sample Calculation for PM10

PM 10 EF (kg/tonne handled) = particle size multiplier (k) * 0.0016 * [(wind speed (m/s) / 2.2)$^{1.3}$ / (moisture content (%) / 2)$^{1.4}$]
0.00 (kg/tonne handled)

Hourly PM10 Emission Rate (g/s) = Material handled per hour (Tonne/hr) * Emission Factor (kg/Mg) / 3600 (s/hr) * 1000 (g/kg)
2.9E-01 (g/s)

**C-7-Q: Stockpiles Wind Erosion**

**Estimation Technique:**

AP-42, CH 13.2.5: Industrial Wind Erosion (2006)

The method calculates the total emissions between pile disturbances, and the total annual emission factor is calculated as the sum of the individual erosion events.

The emission factor for wind-generated particulate emissions from surface material subject to disturbance may be calculated as follow:

EF [g/m2 per year] = k x ∑NPi

k = Particulate size multiplier

Pi = Erosion potential corresponding to the fastest mile of wind between disturbances (g/m2)

N = Number of disturbances per year (N = 365 per year where there are daily disturbances)

$P = 58 \times (u^* - u^*t)^2 + 25 \times (u^* - ut^*)$

$P = 0$ for $u^* \leq ut^*$

Where:

P = erosion potential

u* = Friction velocity (m/s)

ut* = Threshold friction velocity (m/s)

$u^* = 0.053 \times u+_{10}$

Where $u+_{10}$ is the fastest mile for a reference anemometer at 10 metres height for the period between disturbances.

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Active Stockpile Area | 20,000 | $m^2$ | Engineering Provided |
| Particle Size Multiplier k (TPM) | 1 | - | AP42 13.2.5-3 Equation 2 |
| Particle Size Multiplier k (PM10) | 0.5 | - | |
| Particle Size Multiplier k (PM2.5) | 0.075 | - | |
| # of disturbances/year | 365 | - | |
| Fastest wind speed (u+) | 18.9 | m/s | ECCC 2021 to 2023 Weather Data (3-year) at OGOKI POST Airport |
| Anemometer Elevation | 10 | m | |
| 10 m corrected wind speed ($u+_{10}$) | 18.9 | m/s | AP42 13.2.5-3 Equation 5 |
| Calculated Friction Velocity (u*) | 1.0 | m/s | |
| threshold friction velocity (ut*) | 1.02 | m/s | AP42 13.2.5-2 overburden material |
| Calculated Erosion Potential (P) | 0.0 | $g/m^2$ | P = 0 for u* ≤ut* |
| # of construction days/year | 365 | days | Engineering Provided |
| # of construction days/year with precip >0.254mm or snow | 231 | days | Marten Fall Community air monitoring data |
| Adjustment factor (ADJ) for Annual Emissions | 0.37 | - | Calculated |

*The adjustment factor is applied to annual emissions but not short-term (1hr and 24-hr) emissions.*

**Emission Factors**

| Contaminant | Emission Factor | Unit |
|---|---|---|
| TSP | 0 | $g/m^2$/year |
| PM10 | 0 | $g/m^2$/year |
| PM2.5 | 0 | $g/m^2$/year |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| Contaminant | Annual | 24hr | 1hr |
| TSP | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PM10 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PM2.5 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Sample Calculations for stockpile wind erosion**

Fastest wind speed from monitoring data = 18.9 (m/s)

Fastest wind speed correctd to 10m height (u+10) = 18.9 (m/s)

Calculated Friction Velocity (u*) = 0.053*(u+10)

= 1.0 (m/s)

threshold friction velocity (u*t) = 1.02 (m/s)

As the Calculated Friction Velocity (u*) is lower than the threshold friction velocity (u*t), the Wind Erosion Potential is zero (P = 0 for u* ≤ut*) which indicates negligible wind-generated particulate emissions from stockpiles.

**C-8-R: Grading Roadway**
Grading involves the removal or leveling of loose road material (on unpaved roads) by scraping and planing.

**Estimation Technique:**
Environment Canada, Pits and quarries reporting guide- Grading activities
PM released (tonnes/yr) = PM emission factor (kg /VKT) x VKT (km travelled) x (1 tonne/1 000 kg)

The emission factors for releases of PM from grading (kg/VKT) are calculated using the mean vehicle speed of the grader.
$EF(TPM) = 0.0034 \times (S)^{2.5}$
$EF(PM10) = 0.60 \times (0.0056 \times (S)^{2.0})$
$EF(PM2.5) = 0.031 \times (0.0034 \times (S)^{2.5})$
Where,
EF is the emission factor for the corresponding PM fraction (kg/VKT)
S is the mean vehicle operational speed (km/h)

| Description of Process Parameter | | Parameter Value | Reference |
|---|---|---|---|
| Mean Vehicle Speed (S) | 6 | km/hr | Engineering Provided |
| Daily use | 10 | hours/day | Engineering Provided |
| Annual Use | 3650 | hours/year | Engineering Provided |
| Movement per Day | 20% | Percent of Operating Time | Engineering Provided |
| grader travelled per year | 4380 | VKT/yr | calculated |
| grader travelled per day | 2.4 | VKT/day | calculated |
| grader travelled per hour | 1.2 | VKT/hour | calculated |

**Working Area**

| Description of Process Parameter | | Parameter Value | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units |
|---|---|---|
| TSP | 0.30 | kg/VKT |
| PM10 | 0.12 | kg/VKT |
| PM2.5 | 0.01 | kg/VKT |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 2.28E-04 | 8.33E-03 | 9.99E-02 |
| PM10 | 9.21E-05 | 3.36E-03 | 4.03E-02 |
| PM2.5 | 7.07E-06 | 2.58E-04 | 3.10E-03 |

*Sample Calculations for PM10*

*PM10 EF (kg/VKT) = 0.6 * 0.0056 * [mean vehicle speed (km/hr)]$^{2.0}$*
*0.121 kg/VKT*

*1-hr PM10 Emission Rate (g/s) = [Emission Factor (kg/VKT) * (km/hr) * 1000 (g/kg)] / 3600 (s/hr)*
*0.202 g/s*

**C-9-A: Construction Unpaved Road Dust from Access Road**

Dust emissions due to vehicular traffic on unpaved roads such as gravel surfaced roads.
USEPA has developed an empirical equation for vehicles travelling on unpaved road surfaces at industrial sites.
The equation takes into account the silt content of the roadway and the mean weight of the vehicles travelling on the road.

**Estimation Technique:**

AP42, Section 13.2.2 Unpaved Roads & Environment Canada, Road dust emissions from unpaved surfaces

For vehicles traveling on unpaved road surfaces, emissions are estimated from the following equation:

**E = VKT*EF*ADJ*(1-CE/100)**

Where:
E: Emission of particulates, kg
VKT: Total vehicle kilometres travelled, km
EF: Emission factor, kg/VKT
ADJ: Adjustment factor for precipitation, snow cover and frozen days
CE: Applied Dust Control Method's efficiency, %

**$EF = k\,(s/12)^a (W/2.72)^b$**

Where:
EF: Size-specific emission factor, kg/VKT
s: Surface material silt content, %
W: Mean vehicle weight, tonnes (metric)
k, a, b: Numerical constants for calculation in the table below

| Contaminant | Constants (unpaved industrial road) | | |
|---|---|---|---|
| | k (kg/VKT) | a | b |
| TSP | 1.381 | 0.7 | 0.45 |
| PM10 | 0.423 | 0.9 | 0.45 |
| PM2.5 | 0.042 | 0.9 | 0.45 |

**ADJ = (Working Days-(p+snow))/Working Days**

Where:
ADJ: Adjustment factor for precipitation, snow cover and frozen days
Working Days: The number of operating days per year
p: Estimated Annual Working Days with precipitation exceeding 0.254 mm
snow: The estimated Annual Working Days when the roads were frozen or snow-covered and wet for winter

| | | | |
|---|---|---|---|
| # of construction days/year | 365 | days | Provided by Client |
| # of construction days/year with precip >0.254mm or snow | 231 | days | ECCC 2023 Weather Data at OGOKI POST Airport |
| Adjustment factor (ADJ) for Annual Emissions | 0.37 | | Calculated |

The adjustment factor is applied to annual emissions but not short-term (1hr and 24-hr) emissions.

**Quarry Access Road**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Mean Silt Content (s) | 8.5 | | US EPA AP42 Table 13.2.2-1 scraper routes for construction sites |
| Mean vehicle weight (W) | 15 | tonnes | Calculated based on averaged vehicle VKT and gross weight |
| Dust control methods and efficiencies | 55% | | Environment Canada, Road dust emissions from unpaved surfaces; Watering twice a day |
| Total Quarry Access Road VKT by year | 219,000 | VKT/yr | Calculated |
| Total Quarry Access Road VKT in a day | 600 | VKT/day | Calculated |
| Total Quarry Access Road VKT n a hour | 60 | VKT/hour | Calculated |

*Total Quarry Access Road VKT are conservatively estimated based on the representative Quarry Access Road distance (3km) and the number of trucks and trips.*

**Emission Factors**

| Contaminant | Emission Factor | Units |
|---|---|---|
| TSP | 2.3047 | kg/VKT |
| PM10 | 0.6589 | kg/VKT |
| PM2.5 | 0.0654 | kg/VKT |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| Contaminant | Annual | 24hr | 1hr |
| TSP | 2.64E+00 | 7.20E+00 | 1.73E+01 |
| PM10 | 7.56E-01 | 2.06E+00 | 4.94E+00 |
| PM2.5 | 7.51E-02 | 2.04E-01 | 4.91E-01 |

*Daily and hourly emission rates are worst-case senarios without applying the adjustment factor for natural mitigation by rain and snow cover.*

*Sample Calculations for PM10*

*PM10 EF (kg/VKT) = k* (silt content % /12)$^a$ * (mean vehicle weight (tons) /2.72)$^b$*
*6.59E-01 (kg/VKT)*

*24-hr PM10 ER(g/s) = VKT per day (VKT/day)* PM10 EF (kg/VKT)) *1000 (g/kg) / 86400 (s/day) *(1-control efficiency)*
*2.06E+00 (g/s)*

*Annual PM10 ER (g/s) = VKT per year (VKT/yr)* PM10 EF (kg/VKT)) * Adjustment factor *(1-control efficiency) *1000 (g/kg) / 31536000 (s/yr)*
*7.56E-01 (g/s)*

**C-9-R: Construction Unpaved Road Dust from Roadway**

Dust emissions due to vehicular traffic on unpaved roads such as gravel surfaced roads.
USEPA has developed an empirical equation for vehicles travelling on unpaved road surfaces at industrial sites.
The equation takes into account the silt content of the roadway and the mean weight of the vehicles travelling on the road.

**Estimation Technique:**

AP42, Section 13.2.2 Unpaved Roads & Environment Canada, Road dust emissions from unpaved surfaces

For vehicles traveling on unpaved road surfaces, emissions are estimated from the following equation:

**E = VKT*EF*ADJ*(1-CE/100)**

Where:
E: Emission of particulates, kg
VKT: Total vehicle kilometres travelled, km
EF: Emission factor, kg/VKT
ADJ: Adjustment factor for precipitation, snow cover and frozen days
CE: Applied Dust Control Method's efficiency, %

**$EF = k\ (s/12)^a (W/2.72)^b$**

Where:
EF: Size-specific emission factor, kg/VKT
s: Surface material silt content, %
W: Mean vehicle weight, tonnes (metric)
k, a, b: Numerical constants for calculation in the table below

| Contaminant | Constants (unpaved industrial road) | | |
|---|---|---|---|
| | k (kg/VKT) | a | b |
| TSP | 1.381 | 0.7 | 0.45 |
| PM10 | 0.423 | 0.9 | 0.45 |
| PM2.5 | 0.042 | 0.9 | 0.45 |

**ADJ = (Working Days-(p+snow))/Working Days**

Where:
ADJ: Adjustment factor for precipitation, snow cover and frozen days
Working Days: The number of operating days per year
p: Estimated Annual Working Days with precipitation exceeding 0.254 mm
snow: The estimated Annual Working Days when the roads were frozen or snow-covered and wet for winter

| | | | |
|---|---|---|---|
| # of construction days/year | 365 | days | Engineering Provided |
| # of construction days/year with precip >0.254mm or snow | 231 | days | ECCC 2023 Weather Data at OGOKI POST Airport |
| Adjustment factor (ADJ) for Annual Emissions | 0.37 | | Calculated |

The adjustment factor is applied to annual emissions but not short-term (1hr and 24-hr) emissions.

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Mean Silt Content (s) | 8.5 | | US EPA AP42 Table 13.2.2-1 scraper routes for construction sites |
| Mean vehicle weight (W) | 13.1 | tonnes | Calculated based on averaged vehicle VKT and gross weight |
| Dust control methods and efficiencies | 55% | | Environment Canada, Road dust emissions from unpaved surfaces; Watering twice a day |
| Total VKT on Roadway by year | 43,435 | VKT/yr | Calculated |
| Total VKT on Roadway in a day | 119 | VKT/day | Calculated |
| Total VKT on Roadway in a hour | 29 | VKT/hour | Calculated |

*Total VKT on Roadway represents the vehicle total distance travelled in the daily working road segment.*
*As road watering will be performed in 7 to 8 months per year for a maximum 10% to 15% of the operation, an average watering twice a day is assumed for estimating dust control.*

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units |
|---|---|---|
| TSP | 2.2023 | kg/VKT |
| PM10 | 0.6296 | kg/VKT |
| PM2.5 | 0.0625 | kg/VKT |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| Contaminant | Annual | 24hr | 1hr |
| TSP | 3.7E-02 | 1.4E+00 | 8.0E+00 |
| PM10 | 1.1E-02 | 3.9E-01 | 2.3E+00 |
| PM2.5 | 1.1E-03 | 3.9E-02 | 2.3E-01 |

*Daily and hourly emission rates are worst-case senarios without applying the adjustment factor for natural mitigation by rain and snow cover.*

***Sample Calculations for PM10***

*PM10 EF (kg/VKT) = k* (silt content % /12)$^a$ * (mean vehicle weight (tons) /2.72)$^b$*
*6.3E-01 (kg/VKT)*

*24-hr PM10 ER(g/s) = VKT per day (VKT/day)* PM10 EF (kg/VKT)) *1000 (g/kg) / 86400 (s/day) *(1-control efficiency)*
*3.9E-01 (g/s)*

**C-10-R: Wood chipping**

Trees are cut, trimmed, chipped, and stockpiled for open burnning.
Emissions from wood chipping include fugitive dust and wood chipper fuel combustion emissions.

**Estimation Technique:**

ECCC, NPRI tool for wood products operations
The general equation for estimation using an emission factor is:
E = A x EF
where:
E = emissions
A = activity rate
EF = emission factor

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Average wood tonnage | 74 | Tonne within a daily working area | Estimated[1] |
| Operating Hours per day (intermittently) | 10 | hours/day | Estimated[3] |
| Operating days per year | 365 | days/year | Estimated |
| Maximum Annual Working Area | 20 | KM | Engineering Provided |
| Percentage of wood chipped within a daily working area | 50% | % | Client Provided[4] |
| Max Hourly Wood Chipped within a daily working area | 37 | Tonne/hr | Estimated |
| Max Daily Wood Chipped within a daily working area | 37 | Tonne/day | Estimated |
| Wood chipper horsepower | 1,200 | HP | CBI Magnum Force 6800CT Horizontal Grinde |
| Wood chipper chipping capacity | 181 | Tonne/hour | |
| Wood chipper max operating hours per day (continuously) | 1 | hour/day | Estimated |

*Notes*

*1. Max wood tonnage within a daily working area is estimated by assuming 100% of the daily working area (60m x 500m) is covered by wood.*
*2 Average wood tonnage within a daily working area is estiamted based on the average wood percentage within the construction development area.*
*3. It is assumed the wood chipping operation occurs intermittently for 80% time of a 12-hour day to account for the time required for wood cutting, loading, and chipping.*
*4. It is asssume that 50% of wood within the area is chipped.*
*5. Tonnes of wood chipped annually are conservatively estimated based on 365 operating days in a year.*

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP | 0.118 | kg/tonne | ECCC NPRI emission factors for a Dry wood chipper |
| PM10 | 0.091 | kg/tonne | |
| PM2.5 | 0.008 | kg/tonne | |
| CO | 2.6 | g/hp-hr | US EPA Tier 4 Emission Standards |
| NOx | 2.6 | g/hp-hr | |

*1. Emission estimates are based on a typical wood chipper used for tree disposal for road construction*
*i.e., CBI Magnum Force 6800CT Horizontal Grinder (200 ton/hr capacity) with a CAT C32 1200 HP engine (EPA tier 4 emission).*

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| Contaminant | Annual | 24hr | 1hr |
| TSP | 1.38E-03 | 5.03E-02 | 1.21E+00 |
| PM10 | 1.06E-03 | 3.88E-02 | 9.30E-01 |
| PM2.5 | 9.34E-05 | 3.41E-03 | 8.18E-02 |
| CO | 9.89E-04 | 3.61E-02 | 8.67E-01 |
| NOx | 9.89E-04 | 3.61E-02 | 8.67E-01 |

*Sample Calculations for TSP*

*24-hr TSP Emission rate (g/s) = wood chipped in a day (tonnes/day) * TSP EF (kg/tonne) * 1000 (g/kg) / 86400 (s/day)*
*= 0.050 (g/s)*

*Sample Calculations for NOx*

*24-hr NOx Emission rate (g/s) = Wood Chipper Horsepower (hp) * NOx EF (g/hp-hr)*operating hours in a day (hours/day) / 86400 (s/day)*
*= 0.036 (g/s)*

**C-11-R: Wood Burning**
Trees are stockpiled for open burnning.
Emissions from wood burning include sources of combustion.

**Estimation Technique:**
AP-42 13.1 Wildfires and Prescribed Burning
The general equation for estimation using an emission factor is:
E = T x EF
where:
E = emissions
A = tonnes of material burned
EF = emission factor

**Average Tree Biomass within the CDA** 50 (tonne/ha)
Natural Resources Canada. 2006 . Canada's Forest Inventory 2001. Figure 41
https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/26795.pdf

Canada Tree Type and Total Biomass avaliable provided by Canada's National Forest Inventory
https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t5_forage20_area_en.html
https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t17_forage20_biom_en.html

| | ha | % of Area | Classification | Average Ha of Land Type in a Daily Working Area (60m width x 500m length) | Average Tonnes of Wood in a Daily Working Area |
|---|---|---|---|---|---|
| Bog | 29.17 | 0.006 | Non-treed | 0.019 | |
| Fen | 786.19 | 0.167 | Non-treed | 0.502 | |
| Swamp | 1500.23 | 0.319 | Non-treed | 0.958 | |
| Marsh | 37.36 | 0.008 | Non-treed | 0.024 | |
| Coniferous Forest | 1640.08 | 0.349 | Treed Coniferous | 1.047 | 52.3 |
| Water | 19.69 | 0.004 | Non-treed | 0.013 | |
| Rock / Barren | 14.12 | 0.003 | Non-treed | 0.009 | |
| Deciduous Forest | 526.73 | 0.112 | Treed Broadleaf | 0.336 | 16.8 |
| Mixed Forest | 139.39 | 0.030 | Treed Mixedwood | 0.089 | 4.4 |
| Early Successional / Sparse Treed | 5.49 | 0.001 | Non-treed | 0.004 | |
| Anthropogenic | 1.76 | 0.000 | Non-treed | 0.001 | |
| **Total** | **4700.21** | **1.00** | | **3** | **73.6** |

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Average wood tonnage | 74 | Tonne within a daily working area | Estimated[2] |
| Percentage of wood burned | 50% | % | Engineering Provided[3] |
| Average Burn time | 1.5 | day | Engineering Provided[4] |
| Operating Hours per day | 24 | hours/day | |
| Operating days per year | 365 | days/year | |
| Maximum Annual Working Area | 20 | km | |
| Max hourly tonnes of wood burned within a daily working area | 1.0 | Tonne/hr | Estimated[5,6] |
| Max daily tonnes of wood burned within a daily working area | 24.5 | Tonne/day | Estimated[5,6] |
| Hectare of Wood Burned per hour | 0.02 | Ha | Calculated |
| Hectare of Wood Burned per day | 0.5 | Ha | Calculated |

*Notes:*
*1. Max wood tonnage within a daily working area is estimated by assuming 100% of the daily working area (60m x 500m) is covered by wood.*
*2 Average wood tonnage within a daily working area is estiamted based on the average wood percentage within the construction development area.*
*3. It is asssume that 50% of wood within the area is burned.*
*4.Piles of logs are burned in either open piles or in caged burn pits. Open piles take 2 days to burn fully while caged piles take 1 day to burn fully.*
*Average burn time is estimated to be equal to 1.5 days.*
*5. The 1hr and 24hr emissions are conservatively estimated based on the max wood burning (i.e., 100% of the cleared daily working area (60m x 500m) is covered by wood*
*6. Annual wood burning are reasonably estiamted based on the average wood percentage within the construction development area.*
*7. Tonnes of wood burnned annually are conservatively estimated based on 365 operating days in a year.*

**Working Area**

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Daily Working Area | 0.5 | km | Engineering Provided |
| Annual Road Construction Complete | 20 | km | |
| Days per Daily Working Area | 10 | days | Calculated |

**Emission Factors**

| Contaminant | Emission Factor | Units | Reference |
|---|---|---|---|
| TSP | 6.0 | g/kg | |
| PM10 | 4.0 | g/kg | |
| PM2.5 | 4.0 | g/kg | AP42 Table 13.1-3 |
| CO | 37.0 | g/kg | |
| Methane | 1.8 | g/kg | |
| Non Methane VOC | 4.2 | g/kg | |
| NOX | 2.0 | g/kg | AP42 Table 13.1-2 |

NOX Emission factor based on average emission factor provided in AP42 Chapter 13.1
SO2 Emissions are considered to be negligible as indicated in AP42 Chapeter 13.1

**Non-Methane VOC %**

| Non Methane VOC | Max Weight % |
|---|---|
| Ethylbenzene | 1.13 |
| 1,3-butadiene | 4.55 |
| Toluene | 12.13 |
| Benzo[a]pyrene (or BaP) | 0.06 |
| Benzene | 33.24 |

*Notes:*
1. Weight percentages taken from US EPA SPECIATE for Residential Wood Combustion of Pine and Spruce.
2. Weight percentages are equal to the maximum weight percentage from Canadian specific data sets
3. B[a]P weight percentage includes both particulate and gas weight contribution

*Emission factors based on combustion of Dozer Piled Conifer (no mineral soil).*
*Nonmethane VOC based on combustion of Conifer Long Needle*

**Calculated Emission Rates**

| | Maximum Emission Rate [g/s] | | |
|---|---|---|---|
| **Contaminant** | **Annual** | **24hr** | **1hr** |
| TSP | 4.7E-02 | 1.7E+00 | 1.7E+00 |
| PM10 | 3.1E-02 | 1.1E+00 | 1.1E+00 |
| PM2.5 | 3.1E-02 | 1.1E+00 | 1.1E+00 |
| CO | 2.9E-01 | 1.1E+01 | 1.1E+01 |
| Methane | 1.4E-02 | 5.1E-01 | 5.1E-01 |
| *Non Methane VOC* | *3.3E-02* | *1.2E+00* | *1.2E+00* |
| Ethylbenzene | 3.7E-04 | 1.3E-02 | 1.3E-02 |
| 1,3-butadiene | 1.7E-05 | 6.1E-04 | 6.1E-04 |
| Toluene | 2.0E-06 | 7.4E-05 | 7.4E-05 |
| Benzo[a]pyrene (or BaP) | 1.2E-09 | 4.5E-08 | 4.5E-08 |
| Benzene | 4.1E-10 | 1.5E-08 | 1.5E-08 |
| NOX | 1.6E-02 | 5.7E-01 | 5.7E-01 |

*Sample Calculations for TSP*
*24-hr TSP Emission rate (g/s) = Tonnes wood burned in a day (tonne/day) * 1000 (kg/tonne)* TSP EF (g/kg) / 86400 (s/day)*
*= 1.70 (g/s)*

# Attachment E – Operation Supporting Emissions

**Table E1: Emission Source Identification**

| Project Phase | Source ID | Major Activities or Sources | Source Locations | AQ and GHG Effects |
|---|---|---|---|---|
| **Operation phase** | N-S | Vehicle Tailpipe Emissions (North-South segment) | Roadway- South to North segments (to ROF) | Air contaminants and GHGs |
| | | Road dust (North-South segment) | Roadway- South to North segments (to ROF) | Particulates |
| | S-W | Vehicle Tailpipe Emissions (East-West segment) | Roadway- East to West segments (to MFFN) | Air contaminants and GHGs |
| | | Road dust (East-West segment) | Roadway- East to West segments (to MFFN) | Particulates |

*Notes:*

*Air contaminants include NOx, CO, SO2, Particulates (TSP, PM10, and PM2.5), Benzo(a)pyrene (BaP), and VOCs including Acrolein, Acetaldehyde, Benzene, Formaldehyde, 1,3-Butadiene, Toluene, Ethylbenzene, and Xylene.*

*GHGs (CO2e) include CO2, CH4, and N2O.*

**Table E2. Traffic Data for Road Segments - Opertaions**

| | Vehicle Types | Annual Average Daily Traffic (AADT)[1] | Vehicle Type Percentages (%)[1] | Representative MOVES Source Type | MOVES Source Type ID | Fuel Type | Fuel Type ID | Average Travel Speed (Km/hr)[6] | Mean Gross Vehicle Weight (Tonne)[7] | Total Vehicle Kilometer Travelled (VKT) in a hour (km/hr) | Road Segment Length (km) | Total VKT in a day[8] (km/day) | Total VKT in a year (km/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North-South Segment (to ROF)[4] | Heavy Trucks[2] | 448 | 64% | Combination Long-Haul Trucks | 62 | Diesel | 2 | 30 | 33 | 13,440 | 134.4 | 60,211 | 21,977,043 |
| | Median Trucks[3] | 49 | 7% | Light Commercial Trucks | 32 | Diesel | 2 | 80 | 12 | 3,920 | 134.4 | 6,586 | 2,403,739 |
| | Auto Traffic | 203 | 29% | Passenger Cars | 21 | Gasoline | 1 | 80 | 4.5 | 16,240 | 134.4 | 27,283 | 9,958,348 |
| | **Total** | **700** | **100%** | | | | | | | **33,600** | - | **94,080** | **34,339,130** |
| | **Vehicle Types** | **Annual Average Daily Traffic (AADT)[1]** | **Vehicle Type Percentages (%)** | **Representative MOVES Source Type** | **MOVES Source Type ID** | **Fuel Type** | **Fuel Type ID** | **Average Travel Speed (Km/hr)[6]** | **Mean Gross Vehicle Weight (Tonne)[7]** | **Total Vehicle Kilometer Travelled (VKT) in a hour** | **Road Segment Length (km)** | **Total VKT in a day[8] (km/day)** | **Total VKT in a year (km/year)** |
| East-West Segment (to MFFN)[5] | Heavy Trucks | 3 | 3% | Combination Long-Haul Trucks | 62 | Diesel | 2 | 30 | 33 | 90 | 49.4 | 148 | 54,088 |
| | Median Trucks | 20 | 20% | Light Commercial Trucks | 32 | Diesel | 2 | 80 | 12 | 1,600 | 49.4 | 988 | 360,585 |
| | Auto Traffic | 77 | 77% | Passenger Cars | 21 | Gasoline | 1 | 80 | 4.5 | 6,160 | 49.4 | 3,803 | 1,388,251 |
| | **Total** | **100** | **100%** | | | | | | | **7,850** | - | **4,940** | **1,802,923** |

*Notes:*
*1. Traffic AADT and vehicle type percentage estimates are provided by AECOM for the 2046 year which is predicted to have the highest vehicular traffic on the CAR.*
*2. Heavy trucks: all vehicles with three or more axles designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 12,000 kg. Intercity buses are also included in this category.*
*An average empty vehicle weight of 15 tonne is conservatively assumed for heavy trucks based on the MOVES weight class for Heavy Heavy Duty Trucks (greater than 33,000 lbs).*
*Heavy trucks on the CAR are mainly mine trucks which have an average load of 36 tonnes as per the Eagle's Nest Access Road Traffic Study prepared by Hatch in August 2022.*
*3. Medium trucks: all vehicles with two axles and six wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 4,500 kg but less than 12,000 kg. City buses are also included in this category.*
*4. The North-south segment between the Northern Road Link and Aroland will be a public road serving traffic heading to and from Webequie, Marten Falls, and the Ring of Fire.*
*5. The East-west segment between the Northern road Link and Marten Falls will serve local traffic heading to and from Marten Falls.*
*6. The heavy trucks mainly consists of mine trucks are assumed to travel at an average speed of 30 km/hr. The median trucks and auto traffic are assumed to travel at the road speed limit (80 km/hr).*
*7. Mean gross vechile weight is the average of empty and loaded vehicle weight.*
*8. Daily VKT in a day is estimated based on the road length and the AADT for each vehicle type.*

**Table E3. Estimated Traffic Volume by Hour of the Day - Operations**

| Hour of a day | Hour VKT Distribution[1] | North-South Segment (to ROF) | | | | East-West Segment (to MFFN) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Heavy Trucks | Median Trucks | Auto Traffic | Total | Heavy Trucks | Median Trucks | Auto Traffic | Total |
| 1 | 0.011 | 5 | 1 | 3 | 9 | 1 | 1 | 1 | 3 |
| 2 | 0.008 | 4 | 1 | 2 | 7 | 1 | 1 | 1 | 3 |
| 3 | 0.007 | 3 | 1 | 2 | 6 | 1 | 1 | 1 | 3 |
| 4 | 0.007 | 3 | 1 | 2 | 6 | 1 | 1 | 1 | 3 |
| 5 | 0.010 | 5 | 1 | 2 | 8 | 1 | 1 | 1 | 3 |
| 6 | 0.020 | 9 | 1 | 5 | 15 | 1 | 1 | 2 | 4 |
| 7 | 0.041 | 19 | 3 | 9 | 31 | 1 | 1 | 4 | 6 |
| 8 | 0.058 | 26 | 3 | 12 | 41 | 1 | 2 | 5 | 8 |
| 9 | 0.053 | 24 | 3 | 11 | 38 | 1 | 2 | 5 | 8 |
| 10 | 0.053 | 24 | 3 | 11 | 38 | 1 | 2 | 5 | 8 |
| 11 | 0.055 | 25 | 3 | 12 | 40 | 1 | 2 | 5 | 8 |
| 12 | 0.058 | 26 | 3 | 12 | 41 | 1 | 2 | 5 | 8 |
| 13 | 0.059 | 27 | 3 | 13 | 43 | 1 | 2 | 5 | 8 |
| 14 | 0.061 | 28 | 3 | 13 | 44 | 1 | 2 | 5 | 8 |
| 15 | 0.065 | 30 | 4 | 14 | 48 | 1 | 2 | 6 | 9 |
| 16 | 0.073 | 33 | 4 | 15 | 52 | 1 | 2 | 6 | 9 |
| 17 | 0.077 | 35 | 4 | 16 | 55 | 1 | 2 | 6 | 9 |
| 18 | 0.075 | 34 | 4 | 16 | 54 | 1 | 2 | 6 | 9 |
| 19 | 0.059 | 27 | 3 | 12 | 42 | 1 | 2 | 5 | 8 |
| 20 | 0.044 | 20 | 3 | 9 | 32 | 1 | 1 | 4 | 6 |
| 21 | 0.036 | 17 | 2 | 8 | 27 | 1 | 1 | 3 | 5 |
| 22 | 0.031 | 14 | 2 | 7 | 23 | 1 | 1 | 3 | 5 |
| 23 | 0.024 | 11 | 2 | 5 | 18 | 1 | 1 | 2 | 4 |
| 24 | 0.017 | 8 | 1 | 4 | 13 | 1 | 1 | 2 | 4 |
| **Total[2]** | **1.000** | **457** | **59** | **215** | **731** | **24** | **36** | **89** | **149** |

*Notes:*
*1. In the absence of traffic distribution by hour of the day for the CAR Road, the default traffic distribution from the US EPA MOVES model for a rural roadway during weekdays is used for estimating hourly traffic. All vehicle types are assumed to have the same distribution.*

*2. The estimated hourly vehicle counts are rounded up to the nearest integer for CAL3QHR model inputs. As such, the summed hourly AADT counts in a day are higher than the AADT counts. This provides conservative estimates of vehicular emission impacts.*

**Table E4. Estimated vehicular type percentages by hour of the day**

| Hour of a day | Hour VKT Distribution | North-South Segment (to ROF) | | | | East-West Segment (to MFFN) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Heavy Trucks | Median Trucks | Auto Traffic | Total | Heavy Trucks | Median Trucks | Auto Traffic | Total |
| 1 | 0.011 | 56% | 11% | 33% | 100% | 33% | 33% | 33% | 100% |
| 2 | 0.008 | 57% | 14% | 29% | 100% | 33% | 33% | 33% | 100% |
| 3 | 0.007 | 50% | 17% | 33% | 100% | 33% | 33% | 33% | 100% |
| 4 | 0.007 | 50% | 17% | 33% | 100% | 33% | 33% | 33% | 100% |
| 5 | 0.010 | 63% | 13% | 25% | 100% | 33% | 33% | 33% | 100% |
| 6 | 0.020 | 60% | 7% | 33% | 100% | 25% | 25% | 50% | 100% |
| 7 | 0.041 | 61% | 10% | 29% | 100% | 17% | 17% | 67% | 100% |
| 8 | 0.058 | 63% | 7% | 29% | 100% | 13% | 25% | 63% | 100% |
| 9 | 0.053 | 63% | 8% | 29% | 100% | 13% | 25% | 63% | 100% |
| 10 | 0.053 | 63% | 8% | 29% | 100% | 13% | 25% | 63% | 100% |
| 11 | 0.055 | 63% | 8% | 30% | 100% | 13% | 25% | 63% | 100% |
| 12 | 0.058 | 63% | 7% | 29% | 100% | 13% | 25% | 63% | 100% |
| 13 | 0.059 | 63% | 7% | 30% | 100% | 13% | 25% | 63% | 100% |
| 14 | 0.061 | 64% | 7% | 30% | 100% | 13% | 25% | 63% | 100% |
| 15 | 0.065 | 63% | 8% | 29% | 100% | 11% | 22% | 67% | 100% |
| 16 | 0.073 | 63% | 8% | 29% | 100% | 11% | 22% | 67% | 100% |
| 17 | 0.077 | 64% | 7% | 29% | 100% | 11% | 22% | 67% | 100% |
| 18 | 0.075 | 63% | 7% | 30% | 100% | 11% | 22% | 67% | 100% |
| 19 | 0.059 | 64% | 7% | 29% | 100% | 13% | 25% | 63% | 100% |
| 20 | 0.044 | 63% | 9% | 28% | 100% | 17% | 17% | 67% | 100% |
| 21 | 0.036 | 63% | 7% | 30% | 100% | 20% | 20% | 60% | 100% |
| 22 | 0.031 | 61% | 9% | 30% | 100% | 20% | 20% | 60% | 100% |
| 23 | 0.024 | 61% | 11% | 28% | 100% | 25% | 25% | 50% | 100% |
| 24 | 0.017 | 62% | 8% | 31% | 100% | 25% | 25% | 50% | 100% |
| **Total** | **1.000** | - | - | - | - | - | - | - | - |

**Operation Road Dust Emissions for the East-West Segement (to MFFN)**

**Equipment/Process Specifications:**
Resuspended dust emissions due to vehicular traffic on unpaved roads such as gravel-surfaced roads.
The USEPA has developed an empirical equation for vehicles travelling on unpaved road surfaces.
The equation takes into account the silt content of the roadway and the mean weight of the vehicles travelling on the road.

**Estimation Technique:**
AP42, Section 13.2.2 Unpaved Roads & Environment Canada, road dust emissions from unpaved surfaces
For vehicles traveling on unpaved road surfaces, emissions are estimated from the following equation:

**E = VKT*EF*ADJ*(1-CE/100)**
Where:
E: Emission of particulates, kg
VKT: Total vehicle kilometres travelled, km
EF: Emission factor, kg/VKT
ADJ: Adjustment factor for precipitation, snow cover and frozen days
CE: Applied Dust Control Method's efficiency, %

**$EF= k (s/12)^a(W/2.72)^b$**
Where:
EF: Size-specific emission factor, kg/VKT
s: Surface material silt content, %
W: Mean vehicle weight, tonnes (metric)
k, a, b: Numerical constants for calculation in the table below

| | Constants (unpaved industrial road) | | |
|---|---|---|---|
| **Contaminant** | **k (kg/VKT)** | **a** | **b** |
| TPM | 1.381 | 0.7 | 0.45 |
| PM10 | 0.423 | 0.9 | 0.45 |
| PM2.5 | 0.042 | 0.9 | 0.45 |

**ADJ = (Working Days-(p+snow))/Working Days**
Where:
ADJ: Adjustment factor for precipitation, snow cover and frozen days
Working Days: The number of operating days per year
p: Estimated Annual Working Days with precipitation exceeding 0.2 mm
snow: The estimated Annual Working Days when the roads were frozen or snow-covered and wet for winter

| | | | |
|---|---|---|---|
| # of operation days/year | 365 | days | Provided by Client |
| # of operation days/year with either precip >0.254mm or snow cover | 231 | days | ECCC 2023 Weather Data at OGOKI POST Airport |
| Calculated Adjustment factor (ADJ) | 0.37 | | Calculated |

*The adjustment factor is applied to annual emissions but not short-term (1hr and 24-hr) emissions.*

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Mean Silt Content (s) | 8.5 | % | US EPA AP42 Table 13.2.2-1 scraper routes for construction sites |
| Mean weight of the fleet | 6.9 | tonnes | Estiamted based on the mean gross vehicle weight of each vehicle type and the vehicle type percentages on the road |

**Emission Factors**

| Contaminant | Emission Factor | Units | Emission Factor[1,2,3] | Units |
|---|---|---|---|---|
| TPM | 1.6444 | kg/VKT | 2646.4 | g/VMT |
| PM10 | 0.4701 | kg/VKT | 756.6 | g/VMT |
| PM2.5 | 0.0467 | kg/VKT | 75.1 | g/VMT |

*Notes:*

*1) Road dust emission factors were estimated based on vehicle percentages on the road segment. The road dust emission factors are assumed unchanged by the hour of the day and over the years.*

*2) Convert kg/VKT to g/VMT*

*1 kg/VKT = 1609 g/VMT*

*3) Due to the limitation of the emission data format supported by CAL3Q models (hourly emission in g/VMT), the weather adjustment factor is not applied in calculating particulate emission factors. However, the weather adjustment factor is applied to the annual concentration results to account for natural dust mitigation due to rain and snow.*

**Operation Road Dust Emissions for the North-South Segment (to ROF)**

**Equipment/Process Specifications:**
Resuspended dust emissions due to vehicular traffic on unpaved roads such as gravel-surfaced roads.
The USEPA has developed an empirical equation for vehicles travelling on unpaved road surfaces.
The equation takes into account the silt content of the roadway and the mean weight of the vehicles travelling on the road.

**Estimation Technique:**
AP42, Section 13.2.2 Unpaved Roads & Environment Canada, road dust emissions from unpaved surfaces
For vehicles traveling on unpaved road surfaces, emissions are estimated from the following equation:

**E = VKT*EF*ADJ*(1-CE/100)**
Where:
E: Emission of particulates, kg
VKT: Total vehicle kilometres travelled, km
EF: Emission factor, kg/VKT
ADJ: Adjustment factor for precipitation, snow cover and frozen days
CE: Applied Dust Control Method's efficiency, %

**$EF= k (s/12)^a(W/2.72)^b$**
Where:
EF: Size-specific emission factor, kg/VKT
s: Surface material silt content, %
W: Mean vehicle weight, tonnes (metric)
k, a, b: Numerical constants for calculation in the table below

| | Constants (unpaved industrial road) | | |
|---|---|---|---|
| **Contaminant** | **k (kg/VKT)** | **a** | **b** |
| TPM | 1.381 | 0.7 | 0.45 |
| PM10 | 0.423 | 0.9 | 0.45 |
| PM2.5 | 0.042 | 0.9 | 0.45 |

**ADJ = (Working Days-(p+snow))/Working Days**
Where:
ADJ: Adjustment factor for precipitation, snow cover and frozen days
Working Days: The number of operating days per year
p: Estimated Annual Working Days with precipitation exceeding 0.2 mm
snow: The estimated Annual Working Days when the roads were frozen or snow-covered and wet for winter

| | | | |
|---|---|---|---|
| # of operation days/year | 365 | days | Provided by Client |
| # of operation days/year with either precip >0.254mm or snow cover | 231 | days | ECCC 2023 Weather Data at OGOKI POST Airport |
| Calculated Adjustment factor (ADJ) | 0.37 | | Calculated |

*The adjustment factor is applied to annual emissions but not short-term (1hr and 24-hr) emissions.*

| Description of Process Parameter | Parameter Value | | Reference |
|---|---|---|---|
| Mean Silt Content (s) | 8.5 | % | US EPA AP42 Table 13.2.2-1 scraper routes for construction sites |
| Mean weight of the fleet | 23.3 | tonnes | Estiamted based on the mean gross vehicle weight of each vehicle type and the vehicle type percentages on the road |

**Emission Factors**

| Contaminant | Emission Factor | Units | Emission Factor[1,2,3] | Units |
|---|---|---|---|---|
| TPM | 2.8498 | kg/VKT | 4586.4 | g/VMT |
| PM10 | 0.8147 | kg/VKT | 1311.2 | g/VMT |
| PM2.5 | 0.0809 | kg/VKT | 130.2 | g/VMT |

*Notes:*

*1) Road dust emission factors were estimated based on vehicle percentages on the road segment. The road dust emission factors are assumed unchanged by the hour of the day and over the years.*
*2) Convert kg/VKT to g/VMT*

*1 kg/VKT = 1609 g/VMT*

*3) Due to the limitation of emission data format supported by CAL3Q models (hourly emission in g/VMT), the weather adjustment factor is not applied in calculating particulate emission factors. However, the weather adjustment factor is applied to the annual concentration results to account for natural dust mitigation due to rain and snow.*

**Table E5: Contaminant Emission Factors (g/VMT) for Vehicle Fleet Mix**
**Vehicle Emission Calculations (East - West Segment to MFFN)**

| Pollutants[1,2,3] | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | CO2 Equivalent | Total BaP (Particulate and Gas) | Total PM2.5 (Exhaust + Brakewear + tirewear + Road dust[4]) | Total PM10 (Exhaust + Brakewear + tirewear + Road dust[4]) | Total TSP (Exhaust + Brakewear + tirewear + Road dust[4]) | DPM (PM2.5 from Vehicle Exhaust) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***CAS #*** | *11104-93-1* | *630-08-0* | *7446-09-05* | *107-02-8* | *75-07-0* | *71-43-2* | *50-00-0* | *106-99-0* | *108-88-3* | *100-41-4* | *1330-20-7* | *NA_CO2e* | *50-32-8* | *NA_PM2.5* | *NA_PM10* | *NA_TSP* | *NA_DPM_V* |
| **1** | 2.4E+00 | 1.8E+00 | 2.9E-03 | 1.9E-04 | 1.9E-03 | 1.6E-04 | 1.6E-03 | 1.7E-05 | 9.1E-04 | 4.9E-04 | 3.5E-03 | 7.9E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.9E-02 |
| **2** | 2.4E+00 | 1.8E+00 | 2.9E-03 | 1.9E-04 | 1.9E-03 | 1.6E-04 | 1.6E-03 | 1.7E-05 | 9.1E-04 | 4.9E-04 | 3.5E-03 | 7.9E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.9E-02 |
| **3** | 2.4E+00 | 1.8E+00 | 2.9E-03 | 1.9E-04 | 1.9E-03 | 1.6E-04 | 1.6E-03 | 1.7E-05 | 9.1E-04 | 4.9E-04 | 3.5E-03 | 7.9E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.9E-02 |
| **4** | 2.4E+00 | 1.8E+00 | 2.9E-03 | 1.9E-04 | 1.9E-03 | 1.6E-04 | 1.6E-03 | 1.7E-05 | 9.1E-04 | 4.9E-04 | 3.5E-03 | 7.9E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.9E-02 |
| **5** | 2.4E+00 | 1.8E+00 | 2.9E-03 | 1.9E-04 | 1.9E-03 | 1.6E-04 | 1.6E-03 | 1.7E-05 | 9.1E-04 | 4.9E-04 | 3.5E-03 | 7.9E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.9E-02 |
| **6** | 1.8E+00 | 1.6E+00 | 2.5E-03 | 1.4E-04 | 1.4E-03 | 2.0E-04 | 1.2E-03 | 1.3E-05 | 8.1E-04 | 4.0E-04 | 2.7E-03 | 6.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.4E-02 |
| **7** | 1.2E+00 | 1.4E+00 | 2.1E-03 | 9.5E-05 | 9.6E-04 | 2.4E-04 | 8.6E-04 | 8.6E-06 | 7.0E-04 | 3.0E-04 | 1.9E-03 | 4.9E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 9.9E-03 |
| **8** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **9** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **10** | 9.3E-01 | 1.2E+00 | **1.9E-03** | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **11** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **12** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **13** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **14** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **15** | 8.3E-01 | 1.2E+00 | 1.8E-03 | 7.8E-05 | 7.4E-04 | 2.4E-04 | 7.5E-04 | 1.0E-05 | 5.9E-04 | 2.3E-04 | 1.4E-03 | 4.1E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 7.6E-03 |
| **16** | 8.3E-01 | 1.2E+00 | 1.8E-03 | 7.8E-05 | 7.4E-04 | 2.4E-04 | 7.5E-04 | 1.0E-05 | 5.9E-04 | 2.3E-04 | 1.4E-03 | 4.1E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 7.6E-03 |
| **17** | 8.3E-01 | 1.2E+00 | 1.8E-03 | 7.8E-05 | 7.4E-04 | 2.4E-04 | 7.5E-04 | 1.0E-05 | 5.9E-04 | 2.3E-04 | 1.4E-03 | 4.1E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 7.6E-03 |
| **18** | 8.3E-01 | 1.2E+00 | 1.8E-03 | 7.8E-05 | 7.4E-04 | 2.4E-04 | 7.5E-04 | 1.0E-05 | 5.9E-04 | 2.3E-04 | 1.4E-03 | 4.1E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 7.6E-03 |
| **19** | 9.3E-01 | 1.2E+00 | 1.9E-03 | 8.7E-05 | 8.3E-04 | 2.3E-04 | 8.3E-04 | 1.2E-05 | 6.0E-04 | 2.5E-04 | 1.6E-03 | 4.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 8.4E-03 |
| **20** | 1.2E+00 | 1.4E+00 | 2.1E-03 | 9.5E-05 | 9.6E-04 | 2.4E-04 | 8.6E-04 | 8.6E-06 | 7.0E-04 | 3.0E-04 | 1.9E-03 | 4.9E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 9.9E-03 |
| **21** | 1.4E+00 | 1.5E+00 | 2.2E-03 | 1.1E-04 | 1.1E-03 | 2.2E-04 | 1.0E-03 | 1.0E-05 | 7.4E-04 | 3.4E-04 | 2.2E-03 | 5.5E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.2E-02 |
| **22** | 1.4E+00 | 1.5E+00 | 2.2E-03 | 1.1E-04 | 1.1E-03 | 2.2E-04 | 1.0E-03 | 1.0E-05 | 7.4E-04 | 3.4E-04 | 2.2E-03 | 5.5E+02 | 2.6E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.2E-02 |
| **23** | 1.8E+00 | 1.6E+00 | 2.5E-03 | 1.4E-04 | 1.4E-03 | 2.0E-04 | 1.2E-03 | 1.3E-05 | 8.1E-04 | 4.0E-04 | 2.7E-03 | 6.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.4E-02 |
| **24** | 1.8E+00 | 1.6E+00 | 2.5E-03 | 1.4E-04 | 1.4E-03 | 2.0E-04 | 1.2E-03 | 1.3E-05 | 8.1E-04 | 4.0E-04 | 2.7E-03 | 6.4E+02 | 2.7E-07 | 7.5E+01 | 7.6E+02 | 2.6E+03 | 1.4E-02 |

*Notes:*

*1. The emissions factors are developed based on the vehicle type percentages on the road segment and MOVES emission factors for each vehicle type.*

*2. The particulates (TSP, PM10, PM2.5) emission factors include both re-suspended road dust and particulates from vehicle exhaust, brakewear, and tire wear.*

*3. MOVES output emission factors are converted from g/VKT to g/VMT for input in the CAL3QHR model:*

*1 g/VKT= 1.609 g/VMT*

*3. Sample Calculation for SO2 EF for vehicle fleet mix on the* ***East-West Segment to MFFN***

*Hour 10 of SO2 (g/VMT) = Heavy Trucks EF (g/VMT) * Heavy Trucks % in the hour + Median Trucks EF (g/VMT) * Median Trucks % in the hour + Auto Traffic (g/VMT) * Auto Traffic % in the hour (g/VMT)*

= **1.9E-03**

4. Road dust emissions for the N-S and E-W segements are calculated seperately and the road dust emissions (in g/VMT) are added to the particulates from vehicle exhaust, brakewear and tirewear.

TSP can't be directly modelled by MOVES. However, the USEPA has determined that >97% of tailpipe particulate matter is PM10 or less. Therefore, it is assumed the TSP exhaust emission rate equals PM10.

**Table E6: Contaminant Emission Factors (g/VMT) for Vehicle Fleet Mix**
**Vehicle Emission Calculations (North-South Segment to ROF)**

| Pollutants[1,2,3] | Oxides of Nitrogen (NOx) | Carbon Monoxide (CO) | Sulfur Dioxide (SO2) | Acrolein | Acetaldehyde | Benzene | Formaldehyde | 1,3-Butadiene | Toluene | Ethyl Benzene | Xylene | CO2 Equivalent | Total BaP (Particulate and Gas) | Total PM2.5 (Exhaust + Brakewear + tirewear + Road dust[4]) | Total PM10 (Exhaust + Brakewear + tirewear + Road dust[4]) | Total TSP (Exhaust + Brakewear + tirewear + Road dust[4]) | DPM (PM2.5 from Vehicle Exhaust) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CAS #* | *11104-93-1* | *630-08-0* | *7446-09-05* | *107-02-8* | *75-07-0* | *71-43-2* | *50-00-0* | *106-99-0* | *108-88-3* | *100-41-4* | *1330-20-7* | *NA_CO2e* | *50-32-8* | NA_PM2.5 | NA_PM10 | NA_TSP | *NA_DPM_V* |
| **1** | 3.9E+00 | 2.6E+00 | 3.9E-03 | 2.5E-04 | 2.8E-03 | 1.4E-04 | 2.1E-03 | 1.0E-05 | 1.3E-03 | 7.5E-04 | 5.5E-03 | 1.1E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 2.8E-02 |
| **2** | 4.0E+00 | 2.6E+00 | 4.0E-03 | 2.7E-04 | 2.9E-03 | 1.3E-04 | 2.2E-03 | 1.2E-05 | 1.4E-03 | 7.7E-04 | 5.6E-03 | 1.1E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 2.9E-02 |
| **3** | 3.5E+00 | 2.4E+00 | 3.6E-03 | 2.4E-04 | 2.6E-03 | 1.4E-04 | 2.0E-03 | 1.2E-05 | 1.2E-03 | 6.9E-04 | 5.0E-03 | 1.0E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 2.6E-02 |
| **4** | 3.5E+00 | 2.4E+00 | 3.6E-03 | 2.4E-04 | 2.6E-03 | 1.4E-04 | 2.0E-03 | 1.2E-05 | 1.2E-03 | 6.9E-04 | 5.0E-03 | 1.0E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 2.6E-02 |
| **5** | 4.4E+00 | 2.8E+00 | 4.2E-03 | 2.9E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 1.1E-05 | 1.4E-03 | 8.3E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **6** | 4.2E+00 | 2.7E+00 | 4.1E-03 | 2.7E-04 | 3.0E-03 | 1.4E-04 | 2.2E-03 | 8.6E-06 | 1.4E-03 | 8.0E-04 | 5.9E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.0E-02 |
| **7** | 4.3E+00 | 2.7E+00 | 4.2E-03 | 2.8E-04 | 3.0E-03 | 1.3E-04 | 2.3E-03 | 1.0E-05 | 1.4E-03 | 8.2E-04 | 6.0E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **8** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **9** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 9.4E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **10** | 4.4E+00 | 2.8E+00 | **4.3E-03** | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 9.4E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **11** | 4.3E+00 | 2.8E+00 | 4.2E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.3E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **12** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **13** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.0E-06 | 1.5E-03 | 8.3E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **14** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.0E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **15** | 4.3E+00 | 2.8E+00 | 4.2E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.5E-06 | 1.5E-03 | 8.3E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **16** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 9.4E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **17** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.4E-04 | 6.2E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **18** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.4E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **19** | 4.5E+00 | 2.8E+00 | 4.3E-03 | 2.9E-04 | 3.2E-03 | 1.2E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.5E-04 | 6.3E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.2E-02 |
| **20** | 4.3E+00 | 2.8E+00 | 4.2E-03 | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 1.0E-05 | 1.5E-03 | 8.3E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **21** | 4.4E+00 | 2.8E+00 | 4.3E-03 | 2.8E-04 | 3.1E-03 | 1.3E-04 | 2.3E-03 | 9.2E-06 | 1.5E-03 | 8.4E-04 | 6.1E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **22** | 4.2E+00 | 2.7E+00 | 4.2E-03 | 2.7E-04 | 3.0E-03 | 1.3E-04 | 2.2E-03 | 9.5E-06 | 1.4E-03 | 8.1E-04 | 6.0E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.0E-02 |
| **23** | 4.3E+00 | 2.7E+00 | 4.2E-03 | 2.8E-04 | 3.1E-03 | 1.2E-04 | 2.3E-03 | 1.1E-05 | 1.4E-03 | 8.1E-04 | 6.0E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |
| **24** | 4.3E+00 | 2.8E+00 | 4.2E-03 | 2.8E-04 | 3.0E-03 | 1.3E-04 | 2.2E-03 | 9.2E-06 | 1.4E-03 | 8.2E-04 | 6.0E-03 | 1.2E+03 | 2.6E-07 | 1.3E+02 | 1.3E+03 | 4.6E+03 | 3.1E-02 |

*Notes:*

*1. The emissions factors are developed based on the vehicle type percentages on the road segment and MOVES emission factors for each vehicle type.*

*2. The particulates (TSP, PM10, PM2.5) emission factors include both re-suspended road dust and particualtes from vehicle exhaust, brakewear, and tire wear.*

*3. MOVES output emission factors are converted from g/VKT to g/VMT for input in the CAL3QHR model:*

*1 g/VKT= 1.609 g/VMT*

*3. Sample Calculation for SO2 EF for vehicle fleet mix on the* ***North-South Segment to ROF***

*Hour 10 of SO2 (g/VMT) = Heavy Trucks EF (g/VMT) * Heavy Trucks % in the hour + Median Trucks EF (g/VMT) * Median Trucks % in the hour + Auto Traffic (g/VMT) * Auto Traffic % in the hour*

**= 4.3E-03** *(g/VMT)*

4. Road dust emissions for N-S and E-W segements are calculated seperately and the emissions (in g/VMT) are added to the particulates from vehicle exhaust, brakewear and tirewear.

TSP can't be directly modelled by MOVES. However, the USEPA has determined that >97% of tailpipe particulate matter is PM10 or less. Therefore, it is assumed TSP exhaust emission rate including brakewear and tirewear equals PM10.

**Table E7: Annual Emission Summary for the CAR Operation Phase**

| | North-South Segment (to ROF) | | | | East-West Segment (to MFFN) | | | | Community Access Road - Total |
|---|---|---|---|---|---|---|---|---|---|
| | Heavy Trucks | Median Trucks | Auto Traffic | All Vehicle | Heavy Trucks | Median Trucks | Auto Traffic | All Vehicle | All Vehicle |
| Total VKT in a year (km/year) | 21,977,043 | 2,403,739 | 9,958,348 | 34,339,130 | 54,088 | 360,585 | 1,388,251 | 1,802,923 | 36,142,053 |
| **Contaminants** | **Annual Emissions (ton/year)** | | | | **Annual Emissions (ton/year)** | | | | **Annual Emissions (ton/year)** |
| Oxides of Nitrogen (NOx) | 9.44E+01 | 3.36E-01 | 6.56E-02 | 9.48E+01 | 2.32E-01 | 5.05E-02 | 9.15E-03 | 2.92E-01 | 9.51E+01 |
| Carbon Monoxide (CO) | 5.36E+01 | 8.13E-01 | 5.88E+00 | 6.03E+01 | 1.32E-01 | 1.22E-01 | 8.19E-01 | 1.07E+00 | 6.14E+01 |
| Sulfur Dioxide (SO2) | 8.21E-02 | 1.86E-03 | 8.08E-03 | 9.20E-02 | 2.02E-04 | 2.79E-04 | 1.13E-03 | 1.61E-03 | 9.36E-02 |
| DPM (PM2.5 from Vehicle Exhaust) | 6.64E-01 | 9.93E-03 | 6.62E-03 | 6.80E-01 | 1.63E-03 | 1.49E-03 | 9.23E-04 | 4.05E-03 | 6.84E-01 |
| Acrolein | 5.89E-03 | 1.80E-04 | 3.03E-05 | 6.10E-03 | 1.45E-05 | 2.70E-05 | 4.23E-06 | 4.57E-05 | 6.15E-03 |
| Acetaldehyde | 6.60E-02 | 1.17E-03 | 2.71E-04 | 6.74E-02 | 1.62E-04 | 1.75E-04 | 3.78E-05 | 3.76E-04 | 6.78E-02 |
| Benzene | 4.90E-04 | 1.77E-04 | 1.99E-03 | 2.65E-03 | 1.21E-06 | 2.65E-05 | 2.77E-04 | 3.05E-04 | 2.96E-03 |
| Formaldehyde | 4.66E-02 | 2.06E-03 | 6.13E-04 | 4.93E-02 | 1.15E-04 | 3.10E-04 | 8.55E-05 | 5.10E-04 | 4.98E-02 |
| 1,3-Butadiene | 1.32E-04 | 6.27E-05 | 0.00E+00 | 1.95E-04 | 3.25E-07 | 9.41E-06 | 0.00E+00 | 9.73E-06 | 2.04E-04 |
| Toluene | 2.85E-02 | 2.73E-04 | 2.95E-03 | 3.17E-02 | 7.01E-05 | 4.10E-05 | 4.11E-04 | 5.22E-04 | 3.22E-02 |
| Ethyl Benzene | 1.73E-02 | 1.58E-04 | 6.58E-04 | 1.81E-02 | 4.25E-05 | 2.37E-05 | 9.17E-05 | 1.58E-04 | 1.82E-02 |
| Xylene | 1.30E-01 | 8.40E-04 | 2.40E-03 | 1.33E-01 | 3.20E-04 | 1.26E-04 | 3.34E-04 | 7.80E-04 | 1.34E-01 |
| Total PM2.5 (Exhaust + Brakewear + tirewear) | 1.48E+00 | 1.53E-02 | 2.24E-02 | 1.51E+00 | 3.63E-03 | 2.30E-03 | 3.13E-03 | 9.06E-03 | 1.52E+00 |
| Total PM10 (Exhaust + Brakewear + tirewear) | 7.09E+00 | 5.07E-02 | 1.24E-01 | 7.26E+00 | 1.74E-02 | 7.61E-03 | 1.73E-02 | 4.23E-02 | 7.30E+00 |
| Total BaP (Particulate and Gas) | 3.57E-06 | 4.37E-07 | 1.59E-06 | 5.59E-06 | 8.79E-09 | 6.55E-08 | 2.21069E-07 | 2.95E-07 | 5.89E-06 |

**Table E8: Operation Phase Mobile Equipment Emission Factors**

| | *Heavy Trucks* | *Median Trucks* | *Auto Traffic* |
|---|---|---|---|
| **Variables** | **Description** | **Description** | **Description** |
| **Assessment Year** | 2035 | 2035 | 2035 |
| **Source Type** | Combination Long-Haul Trucks | Light Commercial Trucks | Passenger Cars |
| **Fuel type** | Diesel | Diesel | Gasoline |
| **Speed bin** | 30 km/hr | 80 km/hr | 80 km/hr |
| **Pollutants** | **Emission Rate[1,2,3] (g/VKT)** | **Emission Rate[1,2,3] (g/VKT)** | **Emission Rate[1,2,3] (g/VKT)** |
| Oxides of Nitrogen (NOx) | 4.3E+00 | 1.4E-01 | 6.6E-03 |
| Carbon Monoxide (CO) | 2.4E+00 | 3.4E-01 | 5.9E-01 |
| Sulfur Dioxide (SO2) | 3.7E-03 | 7.7E-04 | 8.1E-04 |
| Primary Exhaust PM10 - Total | 3.3E-02 | 4.5E-03 | 7.5E-04 |
| Primary PM10 - Brakewear Particulate | 2.6E-01 | 9.9E-03 | 6.6E-03 |
| Primary PM10 - Tirewear Particulate | 3.0E-02 | 6.7E-03 | 5.1E-03 |
| Primary Exhaust PM2.5 - Total | 3.0E-02 | 4.1E-03 | 6.7E-04 |
| Primary PM2.5 - Brakewear Particulate | 3.2E-02 | 1.2E-03 | 8.2E-04 |
| Primary PM2.5 - Tirewear Particulate | 4.4E-03 | 1.0E-03 | 7.6E-04 |
| Benzo(a)pyrene particle | 1.6E-07 | 1.8E-07 | 1.6E-07 |
| Benzo(a)pyrene gas | 0.0E+00 | 0.0E+00 | 1.2E-09 |
| Acrolein | 2.7E-04 | 7.5E-05 | 3.0E-06 |
| Acetaldehyde | 3.0E-03 | 4.9E-04 | 2.7E-05 |
| Benzene | 2.2E-05 | 7.4E-05 | 2.0E-04 |
| Formaldehyde | 2.1E-03 | 8.6E-04 | 6.2E-05 |
| 1,3-Butadiene | 6.0E-06 | 2.6E-05 | 0.0E+00 |
| Toluene | 1.3E-03 | 1.1E-04 | 3.0E-04 |
| Ethyl Benzene | 7.9E-04 | 6.6E-05 | 6.6E-05 |
| Xylene | 5.9E-03 | 3.5E-04 | 2.4E-04 |
| Atmospheric CO2 | 1.1E+03 | 2.3E+02 | 1.2E+02 |
| Methane (CH4) | 1.8E-02 | 2.0E-03 | 2.1E-03 |
| Nitrous Oxide (N2O) | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| CO2 Equivalent | 1.1E+03 | 2.3E+02 | 1.2E+02 |
| Total PM2.5 (Exhaust + Brakewear + tirewear) | 6.7E-02 | 6.4E-03 | 2.3E-03 |
| Total PM10 (Exhaust + Brakewear + tirewear) | 3.2E-01 | 2.1E-02 | 1.2E-02 |
| Total BaP (Particulate and Gas) | 1.6E-07 | 1.8E-07 | 1.6E-07 |

Notes:

1. Pollutant Emission rates include running exhaust (process ID=1) and crankcase running exhaust (process ID=15).
2. Total particulates (PM2.5 and PM10) emission rates include running exhaust,crankcase running exhaust, brakewear, and tireware .
3. CO2 Equivalent are calculated based on the Global Warming Potential (GWP) in the IPCC Fifth Assessment Report.

# Attachment F – Particle Deposition

**Assessment of Particle Deposition**
**MFCAR**

| Major sources of TSP emissions | Applicable AERMOD Sources |
|---|---|
| Road dust | Roadway; Quarry Access Roads |
| Material handling | Quarry |
| wood burnning and chipping | Wood burning and chipping |
| Blasting | Quarry blasting |

**TSP**

| particle size range (µm) | | Particle Mean Diameter | Particle density | Particle Size Distribution(%) | | |
|---|---|---|---|---|---|---|
| From | to | (µm) | (g/cm3) | Road Dust | Material Handling | Blasting |
| 0 | 2.5 | 1.25 | 2.65 | 2.8% | 10.0% | 3.0% |
| 2.5 | 5 | 3.75 | 2.65 | 8.5% | 13.4% | 18.2% |
| 5 | 10 | 7.5 | 2.65 | 17.2% | 23.6% | 30.8% |
| 10 | 15 | 12.5 | 2.65 | 17.5% | 19.5% | 23.3% |
| 15 | 20 | 17.5 | 2.65 | 17.7% | 15.3% | 15.8% |
| 20 | 25 | 22.5 | 2.65 | 18.0% | 11.2% | 8.2% |
| 25 | 30 | 27.5 | 2.65 | 18.2% | 7.0% | 0.7% |
| Total (0 to 30 µm) | | - | - | 100.0% | 100.0% | 100.0% |

**TSP**

| particle size range (µm) | | Particle Mean Diameter | Particle density | Particle Size Distribution(%) |
|---|---|---|---|---|
| From | to | (µm) | (g/cm3) | wood burnning and chipping |
| 0 | 2.5 | 1.25 | 2.65 | 66.7% |
| 2.5 | 10 | 6.25 | 2.65 | 0.0% |
| 10 | 15 | 12.5 | 2.65 | 3.8% |
| 15 | 20 | 17.5 | 2.65 | 6.8% |
| 20 | 25 | 22.5 | 2.65 | 9.8% |
| 25 | 30 | 27.5 | 2.65 | 12.9% |
| Total (0 to 30 µm) | | - | - | 100.0% |

**PM10**

| particle size range (µm) | | Particle Mean Diameter | Particle density | Particle Size Distribution(%) | | |
|---|---|---|---|---|---|---|
| From | to | (µm) | (g/cm3) | Road Dust | Material Handling | Blasting |
| 0 | 2.5 | 1.25 | 2.65 | 0.099 | 0.212 | 0.058 |
| 2.5 | 5 | 3.75 | 2.65 | 0.298 | 0.285 | 0.350 |
| 5 | 10 | 7.5 | 2.65 | 0.603 | 0.503 | 0.592 |
| Total (0 to 10 µm) | | | | 100% | 100% | 100% |

**PM10**

| particle size range (µm) | | Particle Mean Diameter | Particle density | Particle Size Distribution(%) |
|---|---|---|---|---|
| Total (0 to 30 µm) | 0 | (µm) | (g/cm3) | wood burnning and chipping |
| 0 | 2.5 | 1.25 | 2.65 | 1.00 |
| 2.5 | 10 | 6.25 | 2.65 | 0.00 |
| Total (0 to 10 µm) | | - | - | 100.0% |

**PM2.5**

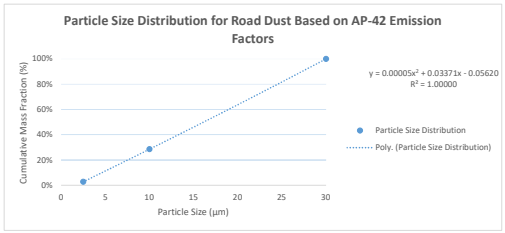
| particle size range (µm) | | Particle Mean Diameter | Particle density | Particle Size Distribution(%) | | | |
|---|---|---|---|---|---|---|---|
| From | to | (µm) | (g/cm3) | Road Dust | Material Handling | Blasting | wood burnning and chipping |
| 0 | 2.5 | 1.25 | 2.65 | 1 | 1 | 1 | 1 |
| Total (0 to 2.5 µm) | | | | 100% | 100% | 100% | 100% |

**Particle size distribution- Road Dust**

*The particulate emission factors for road dust are used to develop the particle size distribution.*
*Although the size-specfic particle emission factors for EW and NS road sections are different due to difference in vehicle compostions, a same particle size distribution is obtained.*

**AP-42 Size-Specific Emission Factors**

| Particulate sizes (µm) | Size Specific Emission Factor (E-W road section) | | Particle Size Distribution(%) |
|---|---|---|---|
| 2.5 | 75.1 | g/VMT | 2.8% |
| 10 | 756.6 | g/VMT | 28.6% |
| 30 | 2646.4 | g/VMT | 100.0% |




**Particle size distribution- Road Dust**

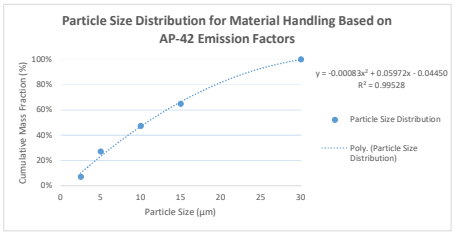
| particle size range (µm) | | Particle Mean Diameter[1] (µm) | Particle Size Distribution(%) |
|---|---|---|---|
| From | to | | |
| 0 | 2.5 | 1.25 | 2.8% |
| 2.5 | 5 | 3.75 | 8.5% |
| 5 | 10 | 7.5 | 17.2% |
| 10 | 15 | 12.5 | 17.5% |
| 15 | 20 | 17.5 | 17.7% |
| 20 | 25 | 22.5 | 18.0% |
| 25 | 30 | 27.5 | 18.2% |
| **Total (0 to 30 µm)** | | - | **100.0%** |

*1. Particle mean diameter is assumed equal to the average of each particle size range, given the relatively linear distribution of particle within each size range.*

**Particle size distribution- Material handling (droping operations)**

The emission estimates for material handling are based on AP-42 13.2.4 Aggregate Handling And Storage Piles. The size-specific emission factors (in kg/tonne handled) are calculated from an Aerodynamic Particle Size Multiplier (k) below and other constants including mean wind speed and material moisture content. Therefore, the particle size distribution for material handling can be determined based on the Aerodynamic Particle Size Multiplier.

| Particulate sizes (µm) | Aerodynamic Particle Size Multiplier (k) | Particle Size Distribution(%) |
|---|---|---|
| 2.5 | 0.053 | 7.2% |
| 5 | 0.2 | 27.0% |
| 10 | 0.35 | 47.3% |
| 15 | 0.48 | 64.9% |
| 30 | 0.74 | 100.0% |




**Particle size distribution- Material handling**

| particle size range (µm) | | Particle Mean Diameter[1] (µm) | Particle Size Distribution(%) |
|---|---|---|---|
| From | to | | |
| 0 | 2.5 | 1.25 | 10.0% |
| 2.5 | 5 | 3.75 | 13.4% |
| 5 | 10 | 7.5 | 23.6% |
| 10 | 15 | 12.5 | 19.5% |
| 15 | 20 | 17.5 | 15.3% |
| 20 | 25 | 22.5 | 11.2% |
| 25 | 30 | 27.5 | 7.0% |
| **Total (0 to 30 µm)** | | - | **100.0%** |

*1. Particle mean diameter is assumed equal to the average of each particle size range, given the relatively linear distribution of particle within each size range.*

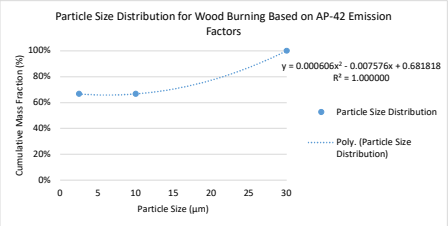
**Particle size distribution- Wood Burning and chipping**

Wood burning and chipping acitvities are modelled as a single source in the AERMOD. The daily emissions of particulates from wood combustions are about two order of magnitudes higher than wood chipping. therefore, the particle size distribution for wood burning is used for assessing particle depositions from both wood burnning and chipping

**Particle size distribution- Wood Burning**

Wood burnning particle emission estimates followed the AP-42 13.1 Wildfires And Prescribed Burning. The particle emission factors below are based on combustion of Dozer Piled Conifer (no mineral soil).

| Particulate sizes (µm) | Emission Factor | Units | Particle Size Distribution(%) |
|---|---|---|---|
| 2.5 | 4.0 | g/kg | 66.7% |
| 10 | 4.0 | g/kg | 66.7% |
| 30 | 6.0 | g/kg | 100.0% |




**Particle size distribution- Wood Burning**

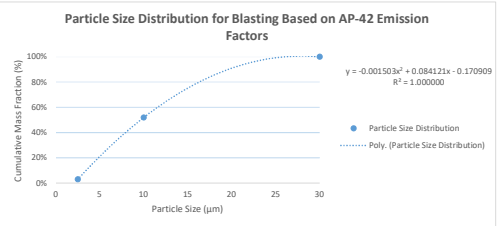
| particle size range (µm) | | Particle Mean Diameter[1] (µm) | Particle Size Distribution(%) |
|---|---|---|---|
| From | to | | |
| 0 | 2.5 | 1.25 | 66.7% |
| 2.5 | 10 | 6.25 | 0.0% |
| 10 | 15 | 12.5 | 3.8% |
| 15 | 20 | 17.5 | 6.8% |
| 20 | 25 | 22.5 | 9.8% |
| 25 | 30 | 27.5 | 12.9% |
| **Total (0 to 30 µm)** | | - | **100.0%** |

*1. Particle mean diameter is assumed equal to the average of each particle size range, given the relatively linear distribution of particle within each size range.*

**Particle size distribution- Blasting**

Blasting emission factors are based on AP-42 11.9 Western Surface Coal Mining. PM10 and PM2.5 emission factors are scaled from TSP emission by multiplying scaling factors of 0.52 and 0.03.

| Particulate sizes (µm) | Scaling factors | Particle Size Distribution(%) |
|---|---|---|
| 2.5 | 0.03 | 3% |
| 10 | 0.52 | 52% |
| 30 | 1 | 100% |




Particle size distribution- Blasting

| particle size range (µm) | | Particle Mean Diameter[1] (µm) | Particle Size Distribution(%) |
|---|---|---|---|
| From | to | | |
| 0 | 2.5 | 1.25 | 3.0% |
| 2.5 | 5 | 3.75 | 18.2% |
| 5 | 10 | 7.5 | 30.8% |
| 10 | 15 | 12.5 | 23.3% |
| 15 | 20 | 17.5 | 15.8% |
| 20 | 25 | 22.5 | 8.2% |
| 25 | 30 | 27.5 | 0.7% |
| **Total (0 to 30 µm)** | | - | **100.0%** |

*1. Particle mean diameter is assumed equal to the average of each particle size range, given the relatively linear distribution of particle within each size range.*

# Attachment G – Operations Model Supporting Documentation

# 1.0 Introduction

Dillon Consulting Limited (Dillon) completed the Air Quality and Greenhouse Gas Technical Support Document: Existing Conditions & Effects Assessment – Volume 1 – Air Quality, dated February 2026 (AQ Effects Assessment) to support the Marten Falls Community Access Road Environmental Assessment/Impact Statement Report. The AQ Effects Assessment included a dispersion modelling assessment of the Operations Phase of the Project using the United States Environmental Protection Agency CAL3QHCR dispersion model. Modelling was completed for two representative road segments. A model was developed for the north-south (N/S) road segment, and another was developed for the segment of roadway closest to the Marten Falls Community (E/W). Projected traffic volumes as well as vehicle classification distribution were incorporated in both models.

The following sections outline conservatisms and quality assurance and quality control (QA/QC) procedures undertaken to provide further justification to the representativeness of the road segments carried forward for modelling.

# 2.0 Representative Segments

## 2.1 Operations Segment Location

The Final Study Plan – Atmospheric Environment and Greenhouse Gases (GHG) Study Plan, dated March 2021 (AQ Study Plan) outlined methodologies to be used in the AQ Effects Assessment. The AQ Study Plan indicated that a representative section of the roadway would be used to capture effects at a resolution appropriate for the Local Study Area. The results from the representative section would be extrapolated along the entire corridor to predict effects. **Figure 1** presents the complete road corridor with the locations of the two selected representative roadway segments.

The approach outlined below identifies how conservatism and representativeness were incorporated into the modelling assessment:

- The location of the N/S segment was selected to be consistent with the location of the Construction Phase representative segment. The construction segment was selected as an area which has the potential for all construction-related activity to occur within a defined area (i.e., road construction located near quarry operations);
- The location of the E/W segment was selected as its location is the closest proximity of roadway to the MFFN community. This was consistent with the selection of the construction segment; and
- Fluctuations in anticipated traffic levels between N/S and E/W road segments were accounted for within the Operation Phase modelling assessment.

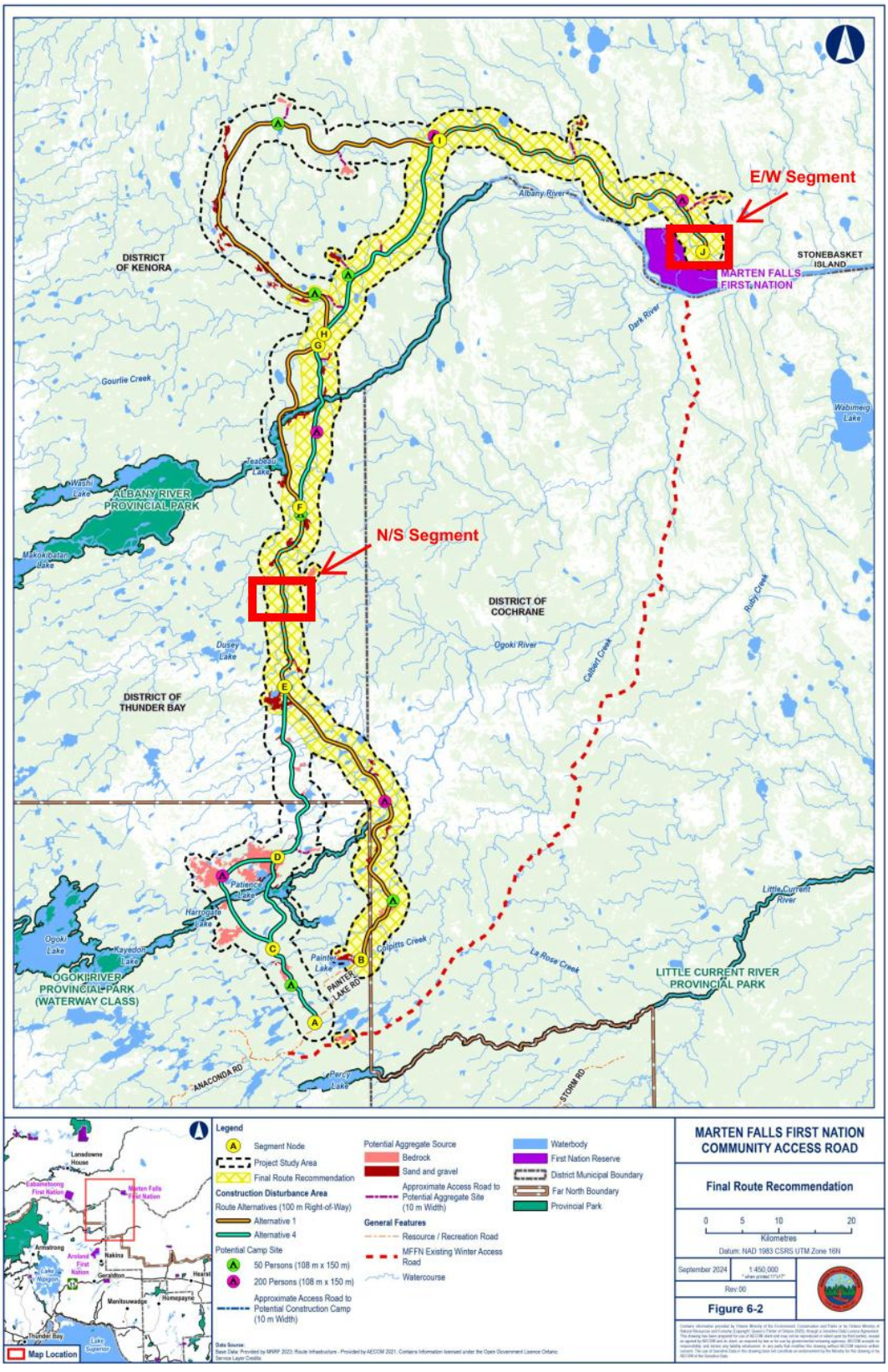



**Figure 1: Roadway Layout and Representative Segments**

## 2.2 Dispersion Modelling Parameters

These N/S and E/W segment orientation and receptor grid are presented in **Figure 2** and **Figure 3**, respectively. A 5 km segment was selected to be representative for each section of roadway corridor with the following rationale:

- The emission rates are consistent across each section of road corridor;
- The meteorological data is consistent across the entire corridor;
- The terrain is relatively consistent across the corridor with a gradual elevation change (approximately 250 m in the south to 150 m in the northeast) across the entire 190 km corridor; and
- As shown in **Figure 1**, the road corridor is relatively straight, with some noted gradual bends and turns throughout the 190 km.

### 2.2.1 Configuration of the Segment

The MTO Guideline[1] for assessing AQ and GHG impacts from transportation projects indicates that the potential effects are expected to occur in the areas in the immediate vicinity of the roadway (< 500 m) which has been confirmed through dispersion modelling. As the emissions from operations along each representative segment are modelled as homogenous throughout each segment and all N/S segments, it is not anticipated to materially change the result of the effects assessment, particularly in terms of defining significance of effects.

As noted, the selected E/W segment was chosen as it is the closest road link to the MFFN Community. Increasing the road segment length to extend in the northwest direction is not expected to result in changes to the Effects Assessment findings specific to the MFFN Community location.

The MTO Guideline indicates that links should be substantially uniform in geometry and traffic conditions and that no link will stretch over 10 km. The modelling assessment satisfies these conditions. Links included within operation modelling were set to a length of 500 m. Due to the fairly uniform road footprint (no sharp/drastic changes in orientation) a link length of 500 m accurately depicts the road footprint at a reasonable resolution. Therefore, the link lengths provide a reasonable characterization of the road to assess impacts along the corridor.

**Figure 2** and **Figure 3** provide a depiction of the link layout for the N/S and E/W segments, respectively. Included within these figures are the locations of receptors included in the model. A dense receptor grid was included in close proximity to the roadway to better capture potential air quality effects within the immediate vicinity of the roadway.

[1] Ministry of Transportation (2020). Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects.

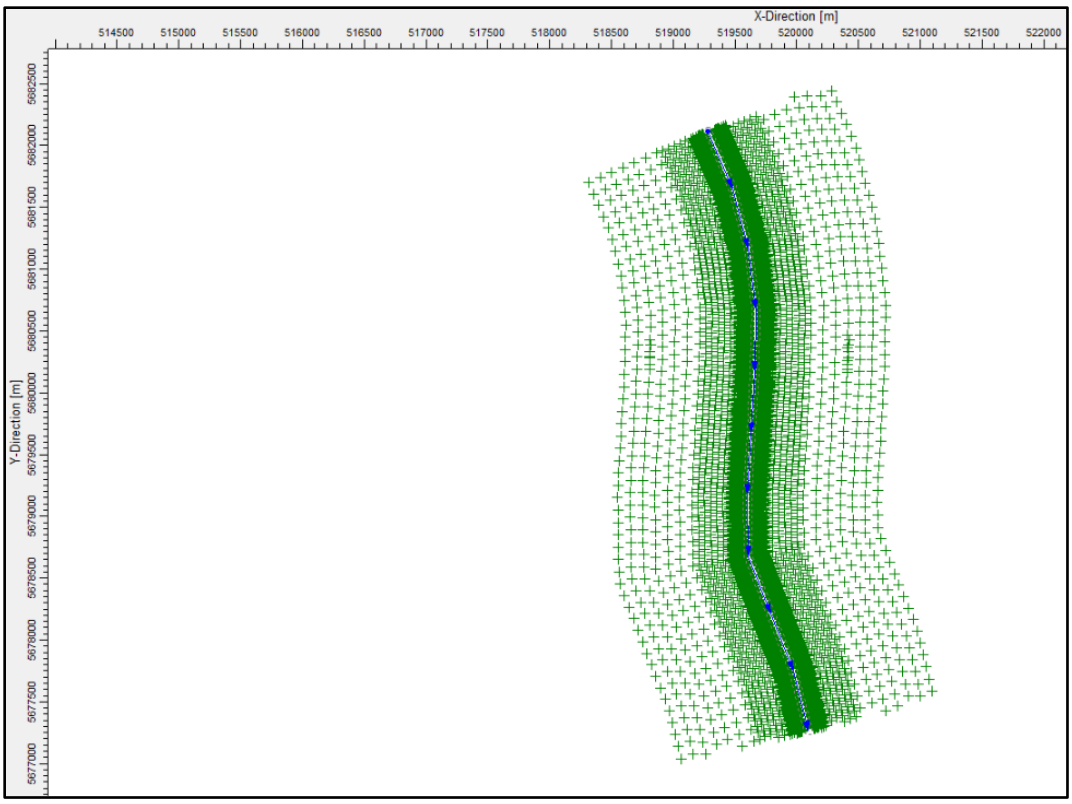



**Figure 2: N/S Representative Segment**

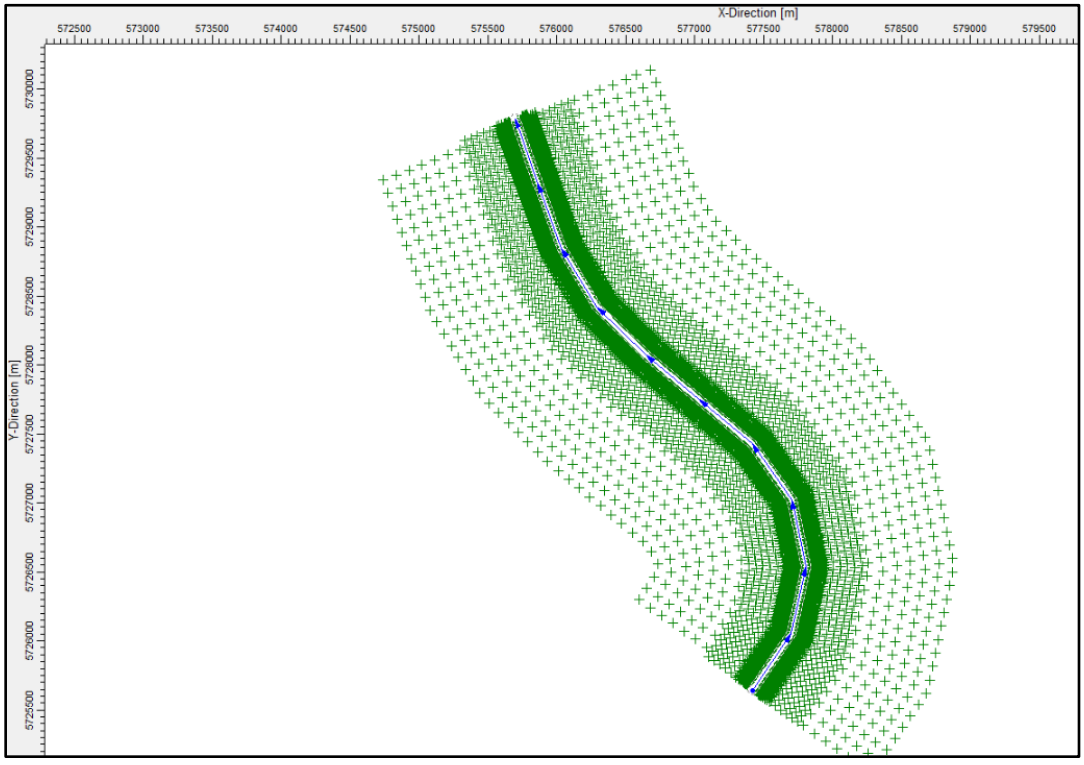



**Figure 3: E/W Representative Segment**

### 2.2.2 Receptors

As noted, the MTO Guideline indicates that for the majority of roads the affected immediate vicinity is limited to the area within approximately 500 m of the road. For conservatism, receptors were extended to 1 km from the shoulder of the roadway to include potential effects further away than the suggested 500 m zone of influence from the MTO.

A dense receptor spacing was used in the near-field area from the roadway to provide refined model results (i.e., 10 m receptor spacing from 0 to 40 m from edge of road followed by 20 m spacing out to 100 m). The MTO Guideline indicates that concentrations of road-related pollutants drop to within 10% of their background pollution outside of 500 m from the roadway. Although maximum ground level concentrations of pollutants are expected to occur within the immediate vicinity of the roadway, additional receptor coverage was extended 1 km from the edge of the road to capture the potential extent of effects.

### 2.2.3 Deposition

The MTO Guideline provides settling and deposition velocities for $PM_{2.5}$ and $PM_{10}$. As setting and deposition velocities for TSP are not available within the guideline, the parameters for $PM_{10}$ were used as a conservative surrogate for TSP (conservative in the sense that less TSP is deposited, leaving a conservatively high concentration suspended in air). It is expected that the use of a TSP specific settling and deposition velocity have the potential to result in a reduction in the extent from the roadway at which TSP air quality impacts exceed criteria.

### 2.2.4 Daily Traffic Activity Conservatism

The emission rate calculations represent the maximum traffic activity along the roadway (700 AADT for the N/S and 100 AADT for the E/W). The AADT were converted to hourly values for inclusion in the model, however, the CALRoads interface for CAL3QHCR has limitations within the program which requires the input of whole numbers for hourly traffic distribution. For conservatism, when accounting for traffic distribution, hourly traffic levels were rounded up to the nearest whole number.

This conservatism resulted in new maximum AADT values of 731 for the N/S (4% increase) and 149 for the E/W (49% increase). The significant increase in the E/W AADT values is due to the low expected activity of heavy and medium trucks distributed over the day. This rounding of hourly traffic levels presents a conservative assessment of the N/S segment activity and a significantly conservative assessment of the E/W segment activity.

### 2.2.5 Terrain and Land Use

The CALRoads interface requires the selection of surface roughness as part of the parameter inputs. From the available recommended options in CALRoads, the surface roughness length for fir forest landscape (283 cm) was selected as the noted land use in the vicinity of the roadway is dominated by

forested areas. While it is understood that there may be some areas of more sparse forest, the fir forest landscape is predominant and is deemed representative from the context of the entire roadway corridor. A review of available vegetation mapping data in the *Draft Vegetation Technical Support Document* (WSP, 2025) indicates that up to 55% of the Local Study Area (LSA) and 81% of the Construction Disturbance Area (CDA) are comprised of tree covered area (e.g., forest land and conifer swamp). As air quality impacts from transportation sources are predominantly limited to the immediate vicinity of the roadway (< 500 m from the road) a surface roughness selection which closely represents that of the CDA was considered to be a representative selection.

Dillon recognizes that the meteorological data for the construction phase modelling utilized a surface roughness length of 50 cm. As this data was provided to Dillon from Lakes Environmental for use it was not deemed necessary or appropriate to adjust the surface roughness for use in the construction model. The use of the smaller surface roughness for the construction model would present a less representative, but more conservative analysis for the effects from the construction phase.

The most conservative surface roughness along the corridor for use would likely be 20 cm. Dillon has completed a sensitivity analysis for adjusting the surface roughness from 283 cm to 20 cm. As summarized in **Table 1**, adjusting the surface roughness results in a maximum deviation of 12% (24-hr) and 3% (annual) in predicted maximum ground level concentrations for the N/S and E/W road segments.

**Table 1: Surface Roughness Sensitivity Test**

| Model | Pollutant | Year | Surface Roughness 283 cm | | Surface Roughness 20 cm | | % Difference | |
|---|---|---|---|---|---|---|---|---|
| | | | 1st Highest 24-hour | Annual | 1st Highest 24-hour | Annual | 1st Highest 24-hour | Annual |
| N/S | NOX | 2023 | 2.3 | 0.9 | 2.5 | 0.9 | 11% | 2% |
| N/S | TSP | 2023 | 2292.6 | 938.6 | 2540.0 | 964.3 | 11% | 3% |
| N/S | PM2.5 | 2023 | 67.4 | 27.3 | 74.8 | 28.1 | 11% | 3% |
| E/W | NOX | 2023 | 0.2 | 0.1 | 0.2 | 0.1 | 12% | 0% |
| E/W | TSP | 2023 | 328.8 | 108.6 | 364.9 | 112.2 | 11% | 3% |
| E/W | PM2.5 | 2023 | 9.7 | 3.2 | 10.8 | 3.3 | 11% | 3% |

The magnitude of change as a result of using an overly conservative surface roughness representative of small portions of the entire corridor is not expected to result in changes significant enough to materially impact the result of the effects assessment for the operations phase, particularly in terms of determining the significance of effects or in guiding the extent of mitigation that may be considered for road dust.

### 2.2.6 Meteorology

The modelling used meteorological data (met data) from the Weather Research and Forecasting Model (WRF), which was provided to Dillon. In CAL3QHCR, this met data is extrapolated across the entire modelling domain and treated the same across the entire 190 km corridor. Therefore, modelling the 5 km roadway segments provide a reasonable characterization of the road to assess impacts along the corridor from a meteorology perspective.

#### 2.2.6.1 Worst-Case Year Selection

The CAL3QHCR model is limited to processing one year of met data. In advance of the Operations Phase modelling, a sensitivity assessment of the five years of met data was completed to determine the worst-case year to carry forward in the modelling assessment. The sensitivity assessment was completed for the E/W roadway which was closest in proximity to the MFFN community. When completing this sensitivity analysis, $NO_2$ was used as a representative pollutant to determine the worst-case year. The meteorological year 2023 was identified as the worst-case year and was carried forward to represent a conservative approach to the modelling assessment.

Meteorological anomalies were not removed as part of the dispersion modelling assessment. Results included within the effects assessment represent maximum modelled results. This was intentionally done as a means of added conservatism to model results.

#### 2.2.6.2 Wind Rose

The wind roses presented in **Figure 4** and **Figure 5** demonstrate the direction, speed, and frequency of wind over the full 5-years of meteorological data and isolated for the 2023 meteorological year, respectively. The wind roses demonstrate alignment with the predominant wind direction blowing from the west (to the east). The frequency of occurrence of lower wind speeds is greater in the one-year data set compared to the full 5-year dataset. Lower/calm winds typically present worst-case conditions for near-ground volume sources (as used in the operation phase model).

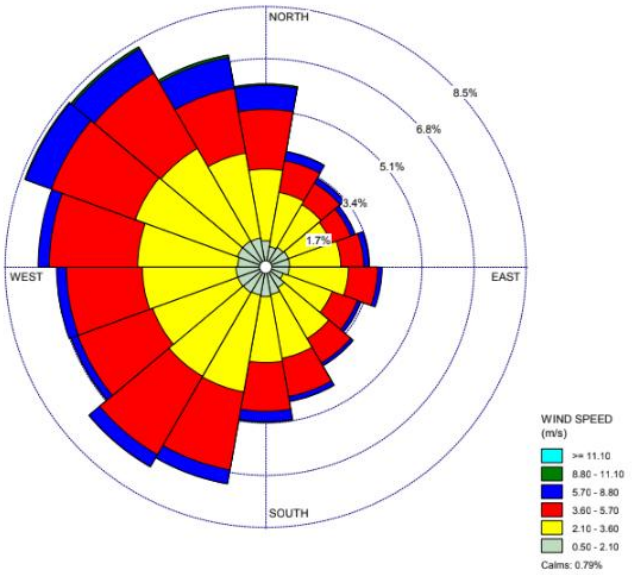



**Figure 4: Lakes (WRF) Wind Rose (2019-2023)**

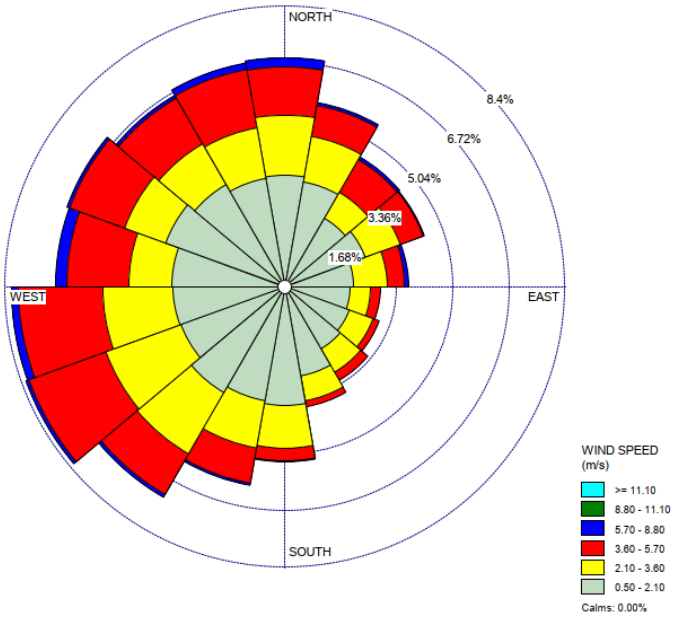



**Figure 5: Lakes (WRF) Wind Rose (2023)**

### 2.2.6.3 Worst-Case Year Sensitivity Analysis

It is acknowledged that variation in the worst-case year exists for the N/S and E/W segments as well as from gaseous pollutants (e.g., $NO_2$) and particulate emissions (due to influence of settling and deposition). A comprehensive sensitivity test including model runs of each year has been completed for the N/S and E/W segments and for the following pollutants: TSP, $PM_{10}$, $PM_{2.5}$, and $NO_2$ (as a surrogate for all gaseous pollutants).

It should be noted that results presented in the AQ Effect Assessment represent the worst-case meteorological condition from year 2023 without the removal of meteorological anomalies. As per Section 6.5 of the MECP's Air Quality Dispersion Modelling Guideline (ADMGO), dated February 2017, for assessments of 24-hour average concentrations, the highest 24-hour average predicted concentration in each single meteorological year may be discarded, and the Ministry will consider for compliance assessments the highest concentration after elimination of these five 24-hour average concentrations over the five-year period from the modelling results.

For this sensitivity test, the year 2023 maximum 24-hour predicted concentration of each pollutant/segment was compared to the 2$^{nd}$ highest 24-hour predicted concentration from 2019 to 2023. The 2$^{nd}$ highest predicted concentration still may present additional conservatism as it may fall under the same meteorological day as the 1$^{st}$ highest value and would technically be allowed to be removed under the same anomalous day. To simplify the comparison, anomalous 2$^{nd}$ highest values were not considered for removal.

Results are presented in **Table 2** below. The results indicate that the 2023 maximum 24-hour predicted concentrations are 7% higher for gaseous pollutants and 16% higher for particulates than the 2$^{nd}$ highest 24-hour predicted concentrations from 2019 to 2023 along the E/W segment. For the N/S segment, the results indicate that the 2023 maximum 24-hour predicted concentrations are 2 to 3% lower for gaseous pollutants and particulates than the 2$^{nd}$ highest 24-hour predicted concentrations from 2019 to 2023.

Similarly, a comprehensive sensitivity test was completed for the annual average predicted concentrations for each pollutant/segment. The results indicated that the 2023 maximum annual predicted concentrations were accurately predicted (<0.1% difference) for gaseous pollutants along both segments and 0.2-0.4% lower than the predicted concentrations for particulates from 2019-2023 along both segments as shown in **Table 3** below.

**Table 2: Sensitivity Assessment for 24-hour Worst-Case Year**

| Road Segment | Pollutant | Worst-Case Year | 2023 24-hr 1st Highest ($\mu g/m^3$) | Worst-Case Year 24-hr 2nd Highest ($\mu g/m^3$) | % Difference |
|---|---|---|---|---|---|
| E/W | $NO_2$ | 2023 | 0.16 | 0.15 | 7% |
| E/W | TSP | 2019 | 329 | 277 | 19% |
| E/W | $PM_{10}$ | 2019 | 94 | 79 | 19% |
| E/W | $PM_{2.5}$ | 2019 | 9.7 | 8.2 | 19% |
| N/S | $NO_2$ | 2021 | 2.26 | 2.34 | -3% |
| N/S | TSP | 2021 | 2293 | 2347 | -2% |
| N/S | $PM_{10}$ | 2021 | 656 | 671 | -2% |
| N/S | $PM_{2.5}$ | 2021 | 67 | 69 | -3% |

**Table 3: Unitized Sensitivity Assessment for Annual Worst-Case Year**

| Road Segment | Pollutant | Worst-Case Year | 2023 Annual ($\mu g/m^3$) | Worst-Case Annual ($\mu g/m^3$) | % Difference |
|---|---|---|---|---|---|
| E/W | $NO_2$ | 2023 | 0.05 | 0.05 | 0.0% |
| E/W | TSP | 2019 | 108.6 | 109.0 | -0.4% |
| E/W | $PM_{10}$ | 2019 | 31.0 | 31.2 | -0.4% |
| E/W | $PM_{2.5}$ | 2019 | 3.17 | 3.18 | -0.3% |
| N/S | $NO_2$ | 2021 | 0.92 | 0.92 | 0.0% |
| N/S | TSP | 2021 | 938.6 | 941.8 | -0.3% |
| N/S | $PM_{10}$ | 2021 | 268.4 | 269.3 | -0.3% |
| N/S | $PM_{2.5}$ | 2021 | 27.3 | 27.4 | -0.2% |

The modelling approach in the AQ Effects assessment may result in the potential for an under-representation of predicted impacts of 2-3% along the N/S segment for 24-hour concentrations of gaseous pollutants and particulates and an under-representation of predicted impacts of 0.2-0.4% along both segment for annual concentrations of particulates. These percentages are well within the range of uncertainties in model input parameters and the model itself. The magnitude of the potential under-prediction identified is not anticipated to materially change the result of the effects assessment, particularly in terms of determining the significance of effects.

# 3.0 Summary and Conclusions

## 3.1 Operations Phase Results

The results from the Operation Phase modelling assessment are provided in **Table 4** and **Table 5** below. The results indicate that the only contaminants that are predicted to exceed relevant criteria during the operations phase at the N/S and E/W segments are particulates ($PM_{2.5}$, $PM_{10}$, and TSP).

As detailed in the AQ Effects Assessment, the exceedances of criteria associated with B(a)P are dominated by ambient concentrations (project contribution <1%). The ambient B(a)P is calculated from a southern Ontario monitoring station and is considered to be very conservative.

**Table 4: N/S Operations Phase Dispersion Modelling Results**

| Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 1 hr | 400 | Ontario AAQC | Health | 3.76 | 1.08E+01 | 3% | 4% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.76 | 1.08E+01 | 14% | 18% |
| | 24 hr | 200 | Ontario AAQC | Health | 3.06 | 2.26E+00 | 1% | 3% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.28 | 9.20E-01 | 4% | 10% |
| $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | Health/Health & Environment | 8.02 | 6.74E+01 | **>100%** | **>100%** |
| | Annual | 8.8 | AAQC/CAAQS (2025) | Health/Health & Environment | 5.09 | 1.00E+01 | **>100%** | **>100%** |
| $PM_{10}$ | 24 hr | 50 | Ontario AAQC | Health | 31.23 | 6.56E+02 | **>100%** | **>100%** |
| TSP | 24 hr | 120 | Ontario AAQC | Visibility | 89.12 | 2.29E+03 | **>100%** | **>100%** |
| | Annual | 60 | Ontario AAQC | Visibility | 56.65 | 3.45E+02 | **>100%** | **>100%** |
| $SO_2$ | 10 min | 178 | Ontario AAQC | Health | 4.32 | 1.74E-02 | 0.01% | 2% |
| | 1 hr | 100 | Ontario AAQC | Health | 2.62 | 1.05E-02 | 0.01% | 3% |
| | | 170 | CAAQS (2025) | Health & Environment | 2.62 | 1.05E-02 | 0.01% | 2% |
| | Annual | 10 | CAAQS (2025) | Health & Environment | 1.29 | 8.96E-04 | 0.01% | 13% |
| | | 10 | Ontario AAQC | Vegetation | 1.29 | 8.96E-04 | 0.01% | 13% |
| CO | 1 hr | 36,200 | Ontario AAQC | Health | 469.70 | 6.90E+00 | 0.02% | 1% |
| | 8 hr | 15,700 | Ontario AAQC | Health | 453.95 | 2.70E+00 | 0.02% | 3% |
| Acrolein | 1 hr | 4.5 | Ontario AAQC | Health | 0.10 | 6.97E-04 | 0.02% | 2% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 1.47E-04 | 0.04% | 10% |
| Acetaldehyde | 0.5 hr | 500 | Ontario AAQC | Health | 10.05 | 6.66E-03 | 0.001% | 2% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.44 | 1.61E-03 | 0.0003% | 1% |
| Benzene | 24 hr | 2.3 | Ontario AAQC | Health | 0.55 | 6.64E-05 | 0.003% | 24% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| | Annual | 0.45 | Ontario AAQC | Health | 0.31 | 2.68E-05 | 0.01% | 69% |
| Formaldehyde | 24 hr | 65 | Ontario AAQC | Health | 10.66 | 1.17E-03 | 0.002% | 16% |
| 1,3 Butadiene | 24 hr | 10 | Ontario AAQC | Health | 0.83 | 4.95E-06 | 0.00005% | 8% |
| | Annual | 2 | Ontario AAQC | Health | 0.90 | 2.00E-06 | 0.0001% | 45% |
| Toluene | 24 hr | 2,000 | Ontario AAQC | Odour | 0.49 | 7.61E-04 | 0.00004% | 0.02% |
| Ethylbenzene | 10 min | 1,900 | Ontario ACB List | Odour | 0.80 | 7.15E-04 | 0.00004% | 0.04% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.22 | 4.33E-04 | 0.00004% | 0.02% |
| Xylene | 10 min | 3,000 | Ontario ACB List | Odour | 2.81 | 5.26E-03 | 0.0002% | 0.1% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.65 | 3.18E-03 | 0.0004% | 0.1% |
| Benzo(a)pyrene | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 1.37E-07 | 0.27% | 67% |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 6.00E-08 | 1% | **>100** |
| DPM | 24 hr | N/A | N/A | N/A | N/A | 1.61E-02 | N/A | N/A |
| | Annual | N/A | N/A | N/A | N/A | 6.55E-03 | N/A | N/A |

**Table 5: E/W Operations Phase Dispersion Modelling Results**

| Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Basis | Ambient [µg/m³] | Maximum POI [µg/m³] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 1 hr | 400 | Ontario AAQC | Health | 3.76 | 5.13E-01 | 0.1% | 1% |
| | | **79** | CAAQS (2025) | Health & Environment | 3.76 | 5.13E-01 | 1% | 5% |
| | 24 hr | 200 | Ontario AAQC | Health | 3.06 | 1.57E-01 | 0.1% | 2% |
| | Annual | **22.6** | CAAQS (2025) | Health & Environment | 1.28 | 5.00E-02 | 0.2% | 6% |
| $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | Health/Health & Environment | 8.02 | 9.70E+00 | 36% | 66% |
| | Annual | 8.8 | AAQC/CAAQS (2025) | Health/Health & Environment | 5.09 | 1.16E+00 | 13% | 71% |
| $PM_{10}$ | 24 hr | 50 | Ontario AAQC | Health | 31.23 | 9.40E+01 | **>100** | **>100** |
| TSP | 24 hr | 120 | Ontario AAQC | Visibility | 89.12 | 3.29E+02 | **>100** | **>100** |
| | Annual | 60 | Ontario AAQC | Visibility | 56.65 | 3.99E+01 | 66.5% | **>100** |
| $SO_2$ | 10 min | 178 | Ontario AAQC | Health | 4.32 | 1.45E-03 | 0.001% | 2% |
| | 1 hr | 100 | Ontario AAQC | Health | 2.62 | 8.78E-04 | 0.001% | 3% |
| | | 170 | CAAQS (2025) | Health & Environment | 2.62 | 8.78E-04 | 0.001% | 2% |
| | Annual | 10 | CAAQS (2025) | Health & Environment | 1.29 | 8.81E-05 | 0.001% | 13% |
| | | 10 | Ontario AAQC | Vegetation | 1.29 | 8.81E-05 | 0.001% | 13% |
| CO | 1 hr | 36,200 | Ontario AAQC | Health | 469.70 | 5.70E-01 | 0.002% | 1% |
| | 8 hr | 15,700 | Ontario AAQC | Health | 453.95 | 2.50E-01 | 0.002% | 3% |
| Acrolein | 1 hr | 4.5 | Ontario AAQC | Health | 0.10 | 4.07E-05 | 0.001% | 2% |
| | 24 hr | 0.4 | Ontario AAQC | Health | 0.04 | 1.34E-05 | 0.003% | 10% |

| Indicator Compound | Averaging Period | Criteria [µg/m$^3$] | Guideline | Basis | Ambient [µg/m$^3$] | Maximum POI [µg/m$^3$] | % Criteria [Project Only] | % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|
| Acetaldehyde | 0.5 hr | 500 | Ontario AAQC | Health | 10.05 | 5.44E-04 | 0.0001% | 2% |
| | 24 hr | 500 | Ontario AAQC | Health | 3.44 | 1.32E-04 | 0.00003% | 1% |
| Benzene | 24 hr | 2.3 | Ontario AAQC | Health | 0.55 | 2.96E-05 | 0.001% | 24% |
| | Annual | 0.45 | Ontario AAQC | Health | 0.31 | 9.53E-06 | 0.002% | 69% |
| Formaldehyde | 24 hr | 65 | Ontario AAQC | Health | 10.66 | 1.24E-04 | 0.00019% | 16% |
| 1,3 Butadiene | 24 hr | 10 | Ontario AAQC | Health | 0.83 | 1.52E-06 | 0.00002% | 8% |
| | Annual | 2 | Ontario AAQC | Health | 0.90 | 5.00E-07 | 0.00003% | 45% |
| Toluene | 24 hr | 2,000 | Ontario AAQC | Odour | 0.49 | 8.77E-05 | 0.000004% | 0.02% |
| Ethylbenzene | 10 min | 1,900 | Ontario ACB List | Odour | 0.80 | 1.60E-04 | 0.00001% | 0.04% |
| | 24 hr | 1,000 | Ontario AAQC | Health | 0.22 | 3.88E-05 | 0.00000% | 0.02% |
| Xylene | 10 min | 3,000 | Ontario ACB List | Odour | 2.81 | 1.04E-03 | 0.00003% | 0.09% |
| | 24 hr | 730 | Ontario AAQC | Health | 0.65 | 2.53E-04 | 0.00003% | 0.09% |
| Benzo(a)pyrene | 24 hr | 0.00005 | Ontario AAQC | Health | 0.00003 | 3.48E-08 | 0.07% | 67% |
| | Annual | 0.00001 | Ontario AAQC | Health | 0.00002 | 1.00E-08 | 0.10% | **>100** |
| DPM | 24 hr | N/A | N/A | N/A | N/A | 1.32E-03 | N/A | N/A |
| | Annual | N/A | N/A | N/A | N/A | 4.40E-04 | N/A | N/A |

### 3.1.1 Gaseous Pollutants

Dillon notes that the predicted impacts of gaseous pollutants are below 1% and 14% of their respective criteria from project-only impacts along the E/W segment and N/S segment, respectively. For context, it would take an increase of more than 700% (safety factor of 7) to the emission rates (and corresponding predicted concentrations) to materially change the result of the effects assessment for gaseous pollutants (potential effects of project contributions of gaseous pollutants are still below relevant criteria/guidelines), particularly in terms of defining significance of effects.

### 3.1.2 Particulates

Dillon notes that there are exceedances of criteria from project-only impacts at the edge of road for $PM_{2.5}$, $PM_{10}$, and TSP along the N/S segment and $PM_{10}$ and TSP along the E/W segment. Predicted exceedances are lower and less frequent at the edge of the right-of-way. The contribution of emissions associated with particulates from the roadway are dominated by the potential for fugitive dust generation, this is due to unpaved road agitation, not tailpipe emissions.

The following are potential for over-prediction in the AQ Effects Assessment:

- The AADT values used in the AQ Effects Assessment were conservative for the N/S segment (4% increase from actual maximum activity) and significantly conservative for the E/W segment (49% increase from the actual maximum activity);
- Deposition parameters for TSP were conservatively estimated to be equal to those for $PM_{10}$ deposition; and
- No mitigation or control factors were included in the emission rate estimates carried forward in the dispersion modelling.

#### 3.1.2.1 Natural Mitigation

The effect of vegetation on dust concentrations beyond the edge of the road is well documented with respect to dispersion modelling and the capacity for impact abatement. The US EPA[2] has summarized fugitive dust capture fractions (CF) for five basic land cover types presented below in **Table 6**. The amount of depletion is similar for $PM_{10}$ and $PM_{2.5}$.

[2]Pace, T.G., (2005). *Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses.* US EPA Publication, Research Triangle Park, North Carolina. August 3, 2005.

**Table 6: Recommended CF (%) for Five Land Cover Types**

| Land Cover Type | Average Height (m) | Recommended CF (%) | Estimated CF Range (%) | Comment |
|---|---|---|---|---|
| Forest | 18 to 20 | 100% | 80 to 100% | Forested areas will capture dust effectively |
| Urban | 5 to 50+ | 50% | 25 to 75% | Structures are interspersed with open areas |
| Scrub, Sparsely Wooded and Grasses | 1 to 2 | 25% | 10 to 40% | Portion of plume is below sparse vegetation |
| Agricultural (seasonal) | 1 to 2 | 25% | 10 to 40% | Portion of plume is below crop (seasonally) |
| Barren/Water | 0 | 0% | 0 to 10% | Impediment-free surfaces are unable to capture dust |

The recommended CF for the land use for the Community Access Road would result in an expected conservative 25% (Scrub, Sparsely Wooded and Grasses) or more (up to 100% for Forest) reduction in particulate concentration.

### *3.1.2.2* Operational Mitigation

In addition to natural mitigation, the impacts from fugitive dust generation are typically managed by selected mitigation measures during the detailed design process. Potential mitigation measures are included in Table 7-7 of the AQ Effects Assessment. Operational best management practices can have a significant impact on reducing potential effects of fugitive dust.

**Table 7** presents the predicted concentrations with no mitigation and with the use of road dust suppressants (80% control efficiency) applied as a best management practice for the mitigation of road dust.

The results indicate that the application of mitigation on the road corridor would decrease the predicted impact such that only the project-only impact of $PM_{10}$ and TSP have criteria exceeded (at their maximum POI) along the N/S road section.

The use of best management practices is shown to be effective in mitigating the impact from fugitive road dust.

**Table 7: Operations Phase Predicted Concentrations with and Without Mitigation**

| Road Segment | Indicator Compound | Averaging Period | Criteria [µg/m³] | Guideline | Ambient [µg/m³] | No Mitigation Maximum POI [µg/m³] | No Mitigation % Criteria [Project Only] | No Mitigation % Criteria [Project + Background] | With Mitigation Maximum POI [µg/m³] | With Mitigation % Criteria [Project Only] | With Mitigation % Criteria [Project + Background] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N/S | $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | 8.0 | 67 | >100 | >100 | 13.5 | 50% | 80% |
| | | Annual | 8.8 | AAQC/CAAQS (2025) | 5.1 | 10 | >100 | >100 | 5.5 | 62% | >100 |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | 31.2 | 656 | >100 | >100 | 131.2 | >100 | >100 |
| | TSP | 24 hr | 120 | Ontario AAQC | 89.1 | 2,293 | >100 | >100 | 458.7 | >100 | >100 |
| | | Annual | 60 | Ontario AAQC | 56.7 | 345 | >100 | >100 | 187.8 | >100 | >100 |
| E/W | $PM_{2.5}$ | 24 hr | 27 | AAQC/CAAQS (2025) | 8.0 | 10 | 36% | 66% | 1.9 | 7% | 37% |
| | | Annual | 8.8 | AAQC/CAAQS (2025) | 5.1 | 1 | 13% | 71% | 0.6 | 7% | 65% |
| | $PM_{10}$ | 24 hr | 50 | Ontario AAQC | 31.2 | 94 | >100 | >100 | 18.8 | 38% | 100% |
| | TSP | 24 hr | 120 | Ontario AAQC | 89.1 | 329 | >100 | >100 | 65.8 | 55% | >100 |
| | | Annual | 60 | Ontario AAQC | 56.7 | 40 | 67% | >100 | 22 | 36% | >100 |

## 3.2 Conclusions

The AQ Effects Assessment included a dispersion modelling assessment of the Operations Phase of the Project using two representative road segments (N/S and E/W).

It is noted; there is potential for underreporting of maximum predicted values due to the selection of surface roughness (potential for 12% underreporting) and the worst-case meteorological year (potential for 3% underreporting).

These areas for potential underreporting would not be anticipated to materially change the result of the effects assessment for gaseous pollutants. As noted, a safety factor of 7 could be applied to gaseous pollutants and assessment results would still demonstrate compliance at all receptors during the operations phase.

With consideration given to the conservatisms inherent in the model; particularly, 49% activity over-prediction along the E/W segment (due to conservative AADT), and the potential for 25%-100% reductions due to surrounding land use, and potential mitigation controls during detailed design process (e.g. dust suppressants). These levels of conservatism offset the potential underreporting as noted above.

The resulting AQ Effects Assessment can be concluded to fairly represent the expected impact of project emissions along the entire corridor, particularly in terms of determining significance of effects. Potential mitigation techniques proposed/applied in the future are not expected to change due to further model refinements.

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