

Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Final Report

February 6, 2026

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Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Limitations and Sign-off

February 6, 2026

Limitations and Sign-off

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Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Executive Summary

February 6, 2026

Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by the Ontario Ministry of Transportation (MTO) to complete a Preliminary Design and Class Environmental Assessment (Class EA) Study for the Highway 401 Planning Study East of Brockville (the Project). The Project includes the replacement and rehabilitation of one bridge (Sharpe's Lane Bridge) and one culvert and identifying the future Highway 401 footprint for an interim six lanes and ultimate eight lanes configuration. The Project study area extends from 0.75 km east of North Augusta Road to 3.3 km west of Maitland Road (approximately 2.6 km) in the Township of Elizabethtown-Kitley, east of Brockville.

The objective of this Air Quality Impact Assessment (AQIA) report is to characterize existing Baseline (2020) air pollutant emissions and predict the potential effects on air quality within the Study Area after implementation of the Project in the Future Interim Build (2034) and Future Ultimate Build (2044) time horizons. Predicted future emissions and effects with Project implementation (Future Build) are compared to both existing baseline and future conditions without the Project, for a total of five (5) assessment scenarios. Changes in greenhouse gas (GHG) emissions are also assessed in this study. Additionally, potential air quality impacts during the construction phase of the Project are assessed qualitatively.

This AQIA report has been prepared in accordance with the MTO's Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO Guide) (MTO 2020).

The air contaminants of potential concern (CoPCs) selected for this study are based on the most relevant transportation-related air contaminants listed in the MTO Guide. These include nitrogen dioxide (NO₂), carbon monoxide (CO), particulate matter with particle diameters less than 10 micrometres (PM₁₀), particulate matter with particle diameters less than 2.5 micrometres (PM_{2.5}), acrolein, benzene, 1,3-butadiene, benzo(a)pyrene [B(a)P], acetaldehyde and formaldehyde. In addition, greenhouse gas



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Executive Summary

February 6, 2026

(GHG) emissions, including carbon dioxide (CO₂), methane (CH₄), and nitrous oxides (N₂O) in the form of carbon dioxide equivalent (CO_{2e}), were also quantified.

Baseline ambient air quality conditions were characterized using historical data from monitoring stations located near to, or representative of, the Study Area. Monitoring data was obtained from Environment and Climate Change Canada's (ECCC) National Air Pollution Surveillance (NAPS) Network and the Ontario Ministry of the Environment, Conservation and Parks (MECP) monitoring stations.

The United States Environmental Protection Agency's (U.S. EPA's) Motor Vehicle Emission Simulator (MOVES) model version 5 (MOVES5) was used to estimate baseline and future emission rates from motor vehicles. The U.S. EPA's dispersion model, CAL3QHCR was used to predict the maximum 1-hour, 8-hour, 24-hour, and annual average ground level concentrations (GLCs) at 25 special receptors (locations of residences, a place of worship and a school) for the following five assessment scenarios:

- 2020 – Baseline (existing conditions), Highway 401 (4 lanes)
- 2034 – Future Interim No-Build, Highway 401 (4 lanes)
- 2034 – Future Interim Build, Highway 401 (6 lanes), replacement of Sharpe's Lane bridge
- 2044 – Future Ultimate No-Build, Highway 401 (6 lanes), replacement of Sharpe's Lane bridge
- 2044 – Future Ultimate Build, Highway 401 (8 lanes), replacement of Sharpe's Lane bridge

A five-year (2020-2024) site specific meteorological dataset pre-processed by the MECP was used as an input to the dispersion model. Since CAL3QHCR can only process one year of meteorological data per run, each of the five years of meteorological data was processed separately. The highest predicted ambient concentrations from across the five-year period were then used in the assessment to ensure a conservative estimate of air quality impacts.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Executive Summary

February 6, 2026

Predicted ambient air quality concentrations for each scenario were compared to applicable provincial Ambient Air Quality Criteria (AAQC) and Canadian Ambient Air Quality Standards (CAAQS). AAQCs are established by the Ministry of Environment, Conservation and Parks (MECP) and represent contaminant concentrations in the air that are intended to protect human health and the environment. The CAAQS are developed collaboratively by federal, provincial, and territorial governments through the Canadian Council of Ministers of the Environment (CCME) and are intended for regional air quality management rather than evaluating the local impacts of individual projects. The GHG emissions were assessed against national and provincial totals, including 2023 levels and 2030 emissions reduction targets.

The following conclusions were made from the air quality and greenhouse gas impact assessment:

Operation Phase – Project Alone (Without Background)

- The maximum predicted Project Alone GLCs (without background) for all CoPCs are below their respective AAQC and/or CAAQS other than NO₂ for all five scenarios and B(a)P in the Baseline (2020), Future Interim (2034) No Build and Future Interim (2034) Build scenarios.
- The maximum predicted 1-hour NO₂ GLC exceeds the CAAQS by 211% for the Baseline scenario, 62% for the Future Interim No Build, 64% for the Future Interim Build, 9% for the Future Ultimate No Build, and 11% for the Future Ultimate Build scenarios. The maximum exceedance occurs at receptor R009 (a residence on Old Sharpe's Lane) for all five scenarios.
- NO₂ concentrations were predicted using the US EPA Ambient Ratio Method (ARM2) methodology, which provides conservative estimates of NO₂ formation in the atmosphere. Maximum predicted hourly average NO₂ concentrations were conservatively compared directly to the 1-hour CAAQS rather than the 98th percentile metric, as the CAL3QHCR model does not provide outputs of the appropriate statistical measure required for direct comparison to the CAAQS.
- Maximum predicted Project Alone hourly and 24-hour average NO₂ concentration were below the provincial NO₂ AAQCs for all scenarios.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Executive Summary

February 6, 2026

- The maximum predicted annual average NO₂ GLCs are above the CAAQS by 141% at receptor R009 for the Baseline scenario, and by 5% at receptor R059* (a residence on Waverly Drive) for the Future Interim Build Scenario.
- The maximum predicted 24-hour and annual average B(a)P concentrations for the Baseline scenario are above the AAQCs by 309% at receptor R059* and 541% at receptor R009, respectively. The maximum predicted B(a)P concentrations decrease for the Future Interim and Future Ultimate scenarios relative to the Baseline scenario, with the maximum predicted 24-hour average concentrations being below their AAQCs for all four future scenarios.
- Exceedances of the annual B(a)P AAQC are predicted for the Future Interim No Build scenario by 48% and the Future Interim Build scenario by 52% for all five modelled years, with no exceedances predicted for the Future Ultimate scenarios.

Operation Phase – Cumulative (With Background)

- Maximum predicted cumulative GLCs (i.e., with background) of all CoPCs other than NO₂ and B(a)P are below their respective AAQC and/or CAAQS at all special receptors for all scenarios.
- Predicted cumulative NO₂ concentrations exceed the 1-hour CAAQS for all scenarios, while cumulative annual average NO₂ concentration exceeds the CAAQS for the Baseline (2020) and Future Interim (2034) scenarios. However, the maximum predicted NO₂ concentrations are well below the provincial hourly and 24-hour average AAQC.
- Maximum predicted cumulative B(a)P concentrations exceed the 24-hour and annual average AAQCs at all special receptor locations for all scenarios, with the background concentrations alone exceeding the 24-hour and annual average AAQCs. The maximum cumulative B(a)P concentrations are predicted to decrease in the Future Interim and Future Ultimate No Build / Build scenarios relative to the Baseline scenario due to expected future reductions in vehicle emissions.
- For all COPCs except PM₁₀, the maximum predicted cumulative concentrations for the future scenarios are lower than the Baseline scenario due to expected advances in cleaner fuels and emissions control technology, which are anticipated to lower all vehicle contaminant tailpipe emissions in the future and are incorporated into the MOVES5 model. The modifications to Highway 401 from the Baseline Scenario to the Future Ultimate Build Scenario should promote



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Executive Summary

February 6, 2026

smoother traffic flow that could also help to improve air quality by reducing gridlock.

Construction

- During Project construction, particulate matter (dust) will be the primary CoPC. NO₂, VOCs, and GHGs will also be emitted from equipment used during construction. As the construction activities will be short-term and intermittent, air contaminant and GHG emissions are expected to be minor provided adequate mitigation measures are implemented.

Mitigation

- During Project construction, industry best management practices should be implemented to minimize air contaminants and GHG emissions.
- During Project operation, air quality levels are generally predicted to decrease relative to Baseline levels and mitigation measures such as retaining existing or integrating additional vegetation barriers to the Project design can be used to further decrease ambient concentrations of particulate matter and NO₂. The vegetation barrier should be thick (approximately 6-metres or more) and have full leaf and branch coverage from the ground to the top of the canopy with no gaps in-between or underneath the vegetation and the barrier should be located close to the emissions sources. Evergreen species are more effective than deciduous species for this objective.

Greenhouse Gases

- Annual GHG emissions from the Project operation are expected to be insignificant (less than 0.1%) compared to Canada and Ontario 2023 GHG emission totals and 2030 emissions reduction targets.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Table of Contents

February 6, 2026

Table of Contents

1	Introduction.....	1
1.1	Project Footprint and Study Area.....	1
1.2	Study Objectives.....	3
1.3	Project Description	3
2	Methodology	4
2.1	Overview	4
2.2	Air Contaminants of Potential Concern.....	5
2.2.1	Air Quality Contaminants.....	5
2.2.2	Greenhouse Gases	8
3	Existing Conditions.....	10
3.1	Climate	10
3.1.1	Temperature	10
3.1.2	Precipitation	10
3.1.3	Humidity	11
3.1.4	Wind Speed and Direction.....	11
3.2	Special Receptors	14
3.3	Local Air Quality	16
3.3.1	Available Published Ambient Monitoring Data	16
3.3.2	Background Concentration Levels	20
3.4	Existing Greenhouse Gas Emissions	24
4	Emission Inventory	25
4.1	Vehicle Emissions	25
4.2	Road Dust Emissions	26
4.3	Greenhouse Gas Emissions	28
5	Air Dispersion Modelling Methodology	29
5.1	Dispersion Model Used	29
5.2	Meteorological Data Sources.....	30
5.3	Wind Speed and Wind Direction.....	31
5.4	Averaging Periods	32
5.5	Receptors	33
5.6	Conversion of Nitrogen Oxides to Nitrogen Dioxide	33
6	Air Dispersion Modelling Results – Project Alone (Without Background) ..	36
7	Cumulative Effects Assessment	42
7.1	Air Dispersion Modelling Results – With Background.....	42
7.2	Greenhouse Gases	46



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Table of Contents

February 6, 2026

8	Potential Impacts and Mitigation During Construction and Operation.....	48
8.1	Potential Impacts and Mitigation During Construction	48
8.2	Potential Impacts and Mitigation During Operation.....	48
9	Conclusions	50
10	References	53

List of Tables

Table 2.1	Summary of Applicable Air Quality Criteria and Standards.....	7
Table 3.1	Summary of Average Temperature Data	12
Table 3.2	Summary of Average Precipitation Data	12
Table 3.3	Summary of Average Relative Humidity Data	12
Table 3.4	Summary of Wind Data	13
Table 3.5	List of Special Receptors	14
Table 3.6	NAPS Locations Considered in the Study.....	17
Table 3.7	Summary of CoPC Background Concentrations	22
Table 3.8	National and Provincial Greenhouse Gas Emissions.....	24
Table 4.1	Summary of MOVES Inputs.....	25
Table 4.2	Summary of Project Annual GHG Emissions (kt CO ₂ e/year)	28
Table 5.1	Key CAL3QHCR Model Input Parameters	30
Table 6.1	Maximum Predicted Concentrations Without Background at Special Receptors.....	40
Table 7.1	Maximum Predicted Cumulative Concentrations (With Background) at Special Receptors	44
Table 7.2	Greenhouse Gas Estimates Compared to National Totals	47
Table 7.3	Greenhouse Gas Estimates Compared to Provincial Totals	47

List of Figures

Figure 1.1	Project Footprint	2
Figure 5.1	Wind Class Frequency Distribution (2020 – 2024) for East of Brockville	31
Figure 5.2	Wind Rose Plot (2020 – 2024) for East of Brockville	32
Figure 5.3	Ambient NO ₂ /NO _x Ratios and the ARM2 Equation	35



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Table of Contents

February 6, 2026

List of Appendices

Appendix A Air Quality Study Area and Special Receptors

Figure A.1 Air Quality Study Area and Special Receptors

Appendix B Preferred Plan

Figure B.1 Highway 401 Technically Preferred Plan

Appendix C Traffic Data and Assumptions

Appendix D Air Quality and Greenhouse Gas Emission Estimation

Appendix E Air Dispersion Modelling Layout

Appendix F Special Receptor Modelled Results

Appendix G Concentration Contour Plots

Figure G.1 Baseline (2020) Scenario 24-Hour Average B(a)P Concentration Contour Plot in ng/m^3 (Meteorological Year 2023)

Figure G.2 Baseline (2020) Scenario Annual Average B(a)P Concentration Contour Plot in ng/m^3 (Meteorological Year 2024)

Figure G.3 Future (2034) Interim No Build Scenario Annual Average B(a)P Concentration Contour Plot in ng/m^3 (Meteorological Year 2024)

Figure G.4 Future (2034) Interim Build Scenario Annual Average B(a)P Concentration Contour Plot in ng/m^3 (Meteorological Year 2024)



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Acronyms/Abbreviations

February 6, 2026

Acronyms/Abbreviations

AAQC	Ambient Air Quality Criteria
ADMGO	Air Dispersion Modelling Guideline for Ontario
AADT/ADT	Annual Average Daily Traffic/Average Daily Traffic
AP-42	U.S. Environmental Protection Agency Compilation of Air Pollution Emission Estimation Factors Document
AQIA	Air Quality Impact Assessment
CAAQS	Canadian Ambient Air Quality Standards
CAC	Criteria Air Contaminants
CAS	Chemical Abstracts Service
CCME	Canadian Council of Ministers of the Environment
CoPC	Contaminant of Potential Concern
DM1H	Daily maximum 1-hour
ECCC	Environment and Climate Change Canada
EA	Environmental Assessment
EPA	Environmental Protection Act
GHG	Greenhouse gas
GLC	Ground Level Concentrations
GWP	Global Warming Potential
Max	Maximum
MECP	Ontario Ministry of the Environment, Conservation and Parks
MTO	Ontario Ministry of Transportation
N/A	Not Applicable



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Acronyms/Abbreviations

February 6, 2026

NAPS	National Air Pollution Surveillance
Stantec	Stantec Consulting Ltd.
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	Vehicle Kilometres Travelled
VMT	Vehicle Mile Travelled

Units of Measurement

cm	centimetre
km	kilometre
m	metre
mm	millimetre

Mass/Weight

Re. Orders of Magnitude: $x 10^2 = x 100$, $x 10^3 = x 1000$

g	gram	
mg	milligrams	1×10^{-3} grams
μg	microgram	1×10^{-6} grams
pg	picrogram	1×10^{-12} grams
kg	kilogram	1×10^3 g
Mg	Megagram	1×10^6 g
t	metric tonne	1×10^3 kg
lb	pound	1 lb = 453.592 grams



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Acronyms/Abbreviations

February 6, 2026

Concentration

ppb	parts per billion
ppm	parts per million
$\mu\text{g}/\text{m}^3$	micrograms per cubic metre

Temperature

$^{\circ}\text{C}$	degrees Celsius
--------------------	-----------------

Speed

km/h	kilometres per hour
mph	miles per hour

Time

s	second
hr	hour
y	year

Compounds

B(a)P	Benzo(a)pyrene
CH ₄	Methane
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO _{2e}	Carbon Dioxide Equivalent
THC	Total Hydrocarbons
N ₂ O	Nitrous Oxide
NO _x	Nitrogen Oxides
NO ₂	Nitrogen Dioxide
NO	Nitric Oxide



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Acronyms/Abbreviations

February 6, 2026

O ₃	Ozone
PAH	Polycyclic Aromatic Hydrocarbon
PM ₁₀	Particulate Matter smaller than 10 microns
PM _{2.5}	Particulate Matter smaller than 2.5 microns
VOC	Volatile Organic Compounds



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Glossary

February 6, 2026

Glossary

Term	Definition
Air Contaminant Emissions	For stationary or mobile sources, the release or discharge of a pollutant (i.e., air contaminant) from a facility or operation into the ambient air either by means of a stack, vent, exhaust pipe or as a fugitive dust, mist, or vapour.
Canadian Council of Ministers of the Environment (CCME)	A council made up of environmental ministers from provincial, federal and territorial levels of government that proposes nationally consistent environmental standards and objectives to achieve high levels of environmental quality for waste management, air pollution, and toxic chemicals across Canada.
Carbon Monoxide (CO)	A colourless, odourless gas produced by incomplete fossil fuel combustion.
Combustion Product	Substance produced during the burning or oxidation of a material.
Combustion	Burning, or rapid oxidation, accompanied by the release of energy in the form of heat and light. Refers to controlled burning of a fuel, in which heat chemically alters organic compounds, converting into stable compounds such as carbon dioxide and water.
Concentration	In air quality, concentration is defined as the abundance (mass or volume) of a substance suspended in a unit volume of ambient air.
Dust	A term used to describe particles of a solid or liquid that are suspended in air. Also referred to as particulate or suspended particulate matter.
Mitigation	Measures taken to reduce adverse effects on the environment.
Monitoring	Periodic or continuous surveillance or testing to determine the characteristics of a substance or the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Glossary

February 6, 2026

Term	Definition
Particulate	A particle of a solid or liquid that is suspended in air.
Particulate Matter	A particle in solid or liquid phase that is suspended in air.
Pollutant	Generally, any substance introduced into the environment that can adversely affect the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	Generally, the presence of a substance in the environment that because of its chemical composition or quantity can prevent the functioning of natural processes and produce undesirable environmental and health effects
Receptor	A person, plant or wildlife species that may be affected due to exposure to a contaminant.
United States Environmental Protection Agency AP-42 (U.S. EPA AP-42)	US EPA document Compilation of Air Emission Factors, Volume 1: Stationary Point and Area Sources.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

1 Introduction

February 6, 2026

1 Introduction

Stantec Consulting Ltd. (Stantec) was retained by the Ontario Ministry of Transportation (MTO) to complete a Preliminary Design and Class Environmental Assessment (Class EA) Study for the Highway 401 Planning Study East of Brockville (the Project). The Project includes the replacement and rehabilitation of one bridge (Sharpe's Lane Bridge) and one culvert and identifying the future Highway 401 footprint for an interim six lanes and ultimate eight lanes configuration.

The Air Quality Impact Assessment (AQIA) prepared for the Project is presented herein.

1.1 Project Footprint and Study Area

The Study Area for this AQIA report has been identified based on the Project footprint and the surrounding geographic area where air quality impacts are expected to occur. The Project footprint encompasses the total area potentially affected by the extent of the proposed design and physical works. A map of the Project footprint is provided in Figure 1.1.

The Study Area includes a segment of Highway 401 extending from approximately 0.75 km east of North Augusta Road to 3.3 km west of Maitland Road (approximately 2.6 km).

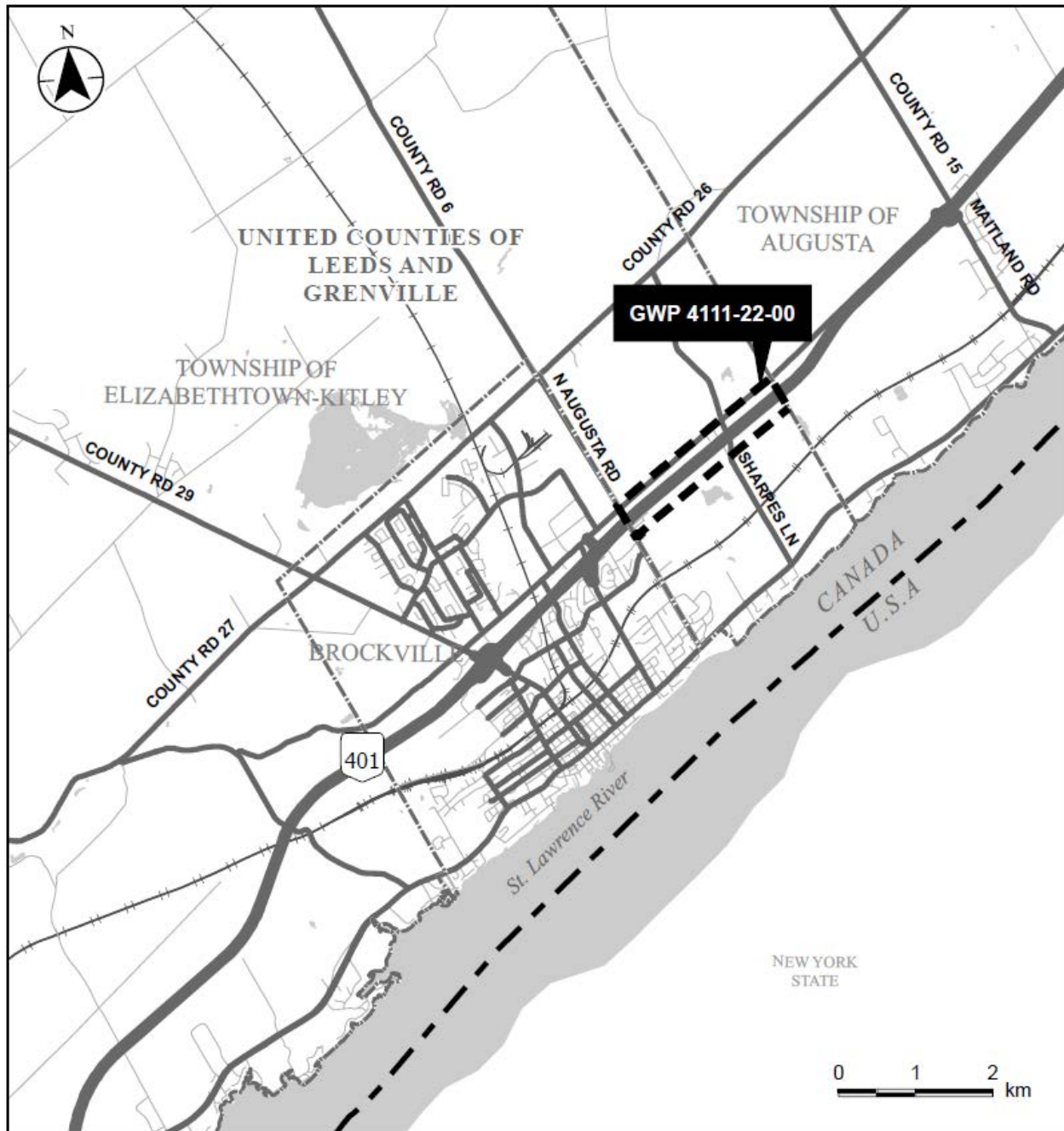


Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

1 Introduction

February 6, 2026

Figure 1.1 Project Footprint



In accordance with the Ontario Ministry of Transportation’s Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO Guide) (MTO 2020), transportation related air



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

1 Introduction

February 6, 2026

quality impacts are typically limited to within 500 metres (m) of a project. Therefore, the AQIA Study Area encompasses both the Project footprint and the surrounding 500 m buffer zone.

A map illustrating the 500 m air quality Study Area is provided in Appendix A, Figure A.1.

1.2 Study Objectives

The objectives of this study are to characterize existing baseline (2020) air pollutant emissions and predict air quality effects within the Study Area after implementation of the Project in Future Interim Build (2034) and Future Ultimate Build (2044) scenarios. Predicted future emissions and effects with Project implementation are also compared to predicted future emissions and effects without implementation of the Project (Future Interim (2034) No Build and Future Ultimate (2044) No Build) for a total of five (5) assessment scenarios. Greenhouse gas (GHG) emissions are also assessed for the five scenarios.

This study has been completed following guidance from the Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO, 2020).

1.3 Project Description

Within the Study Area, Highway 401 currently consists of four lanes, two lanes in each travel direction. The Preferred Plan for the Highway 401 East of Brockville Study Area (GWP 4111-22-00) is depicted in Appendix B and includes the following:

- Footprint of Highway 401 with an interim six (6) lanes and ultimate eight (8) lanes of traffic
- Replacement and/or rehabilitation of Butler Creek Culvert
- Replacement and/or rehabilitation of Sharpes' Lane Bridge



2 Methodology

Potential impacts from the Project construction activities have been assessed qualitatively, while operational impacts have been assessed quantitatively. Air quality impacts during Project operation were assessed through dispersion modelling, which was used to predict downwind concentrations of key transportation-related air contaminants. These predicted concentrations were then compared against applicable regulatory criteria and standards to determine potential effects on ambient air quality.

2.1 Overview

The assessment of potential air quality impacts associated with the Project includes the following key components:

- Identify air contaminants of potential concern (CoPCs) based on the MTO Guide (MTO 2020).
- Establish background concentrations for each relevant transportation-related air contaminant using representative historical data from the nearest Ministry of the Environment, Conservation and Parks (MECP) or National Air Pollution Surveillance (NAPS) air quality monitoring stations.
- Establish baseline quantities of greenhouse gases (GHG) released to the atmosphere using published provincial and national GHG emissions data.
- Predict vehicle tailpipe emissions using the United States Environmental Protection Agency's (U.S. EPA's) Motor Vehicle Emission Simulator version 5 (MOVES5) model (U.S. EPA 2024) and estimate road dust emissions using the U.S. EPA's AP-42 calculation methodology (U.S. EPA 2011) for Project related traffic during operation.
- Identify critical and representative sensitive receptor locations in the Study Area.
- Predict maximum contaminant concentrations due to emissions from Project-related traffic at each critical and sensitive receptor using the U.S. EPA's CAL3QHCR dispersion model (U.S. EPA 2013).
- Estimate cumulative air quality concentrations by combining the maximum predicted concentrations with background levels and compare the results to the applicable provincial and federal air quality criteria and standards.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

2 Methodology

February 6, 2026

- For receptors where the maximum concentration of air contaminants exceeds a criterion or a standard, assess the potential frequency of exceeding the air quality criteria or standard, through a more detailed assessment of the Project-related concentrations.
- Estimate GHG emissions for each operation scenario and compare them to current provincial and national GHG emissions levels and applicable 2030 emissions reduction targets.
- Qualitatively assess the potential air quality impacts during construction and provide recommendations on construction mitigation measures.

2.2 Air Contaminants of Potential Concern

The primary sources of air contaminants from the major roadways near the Project are mobile sources (i.e., cars and trucks) that emit combustion gases from burning fossil fuels (e.g., gasoline and diesel) and fugitive dust generated by vehicle movement. Combustion emissions vary depending on several factors including engine type, fuel composition, fuel consumption rate, and operating time. Fugitive dust emissions occur when vehicles disturb settled dust on or near the road surface.

The air contaminants of potential concern (CoPC) selected for this study are based on the most relevant transportation-related contaminants as listed in the MTO Guide (MTO 2020).

2.2.1 Air Quality Contaminants

The expected CoPCs that would likely be emitted during Project construction and operation are primarily criteria air contaminants (CACs), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The CACs include nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter less than 10 µm in diameter (PM₁₀) and particulate matter less than 2.5 µm in diameter (PM_{2.5}) (MTO 2020).

Nitrogen oxides or NO_x is produced in most combustion processes, consisting of nitric oxide (NO) and nitrogen dioxide (NO₂). Nitric oxide is a colourless gas with no



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

2 Methodology

February 6, 2026

substantive direct effects on health or vegetation at ambient levels and with no regulatory criteria. NO_2 is the regulated form of NO_x .

Effects of particulate matter in the air on human health are primarily associated with PM_{10} and $\text{PM}_{2.5}$ as particles of these sizes can become trapped in the upper airways or in the case of $\text{PM}_{2.5}$, can make their way deep into the lungs and become lodged.

Total hydrocarbons (THC) and volatile organic compounds (VOCs) constitute two other groupings of CoPC for the Project. Key VOCs from fuel combustion processes that are included in the study are benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein. The compliance status of these speciated VOCs are indicative of the compliance of other VOCs.

Polycyclic aromatic hydrocarbons (PAHs) are a subset of total hydrocarbons, of which the key representative substance is benzo(a)pyrene (B(a)P) which can be considered as a surrogate of total PAHs.

Ontario's Ambient Air Quality Criteria (AAQC) are not regulatory limits, but rather concentrations of contaminants in air that are protective against adverse effects on human health and/or the environment (MECP 2020). AAQCs are used to assess general (ambient) air quality resulting from all sources of a contaminant to air (MECP 2020). Federal air quality criteria are published in the Canadian Ambient Air Quality Standards referred to as the CAAQS. The CAAQS were developed through a collaborative process involving the federal, provincial, and territorial governments and stakeholders, as directed by the Canadian Council of Ministers of the Environment (CCME). A summary of the applicable Ontario Ambient Air Quality Criteria (AAQC) and Canadian Ambient Air Quality Standards (CAAQS) used in this study is presented in Table 2.1. The $\text{PM}_{2.5}$ and NO_2 CAAQS are based on specific statistical forms of the standards which are noted in Table 2.1.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

2 Methodology

February 6, 2026

Table 2.1 Summary of Applicable Air Quality Criteria and Standards

CoPC	CAS No.	Averaging Period (Hours)	Air Quality Criteria and Standards ($\mu\text{g}/\text{m}^3$)	Regulatory Framework
CO	630-08-0	1	36,200	AAQC
		8	15,700	AAQC
NO ₂	10102-44-0	1	400	AAQC
			83 ^{A, B}	CAAQS
		24	200	AAQC
		Annual	24 ^{A, C}	CAAQS
PM ₁₀	N/A	24	50 ^D	AAQC
PM _{2.5}	N/A	24	27 ^E	AAQC/2020 CAAQS
			23 ^E	2030 CAAQS
		Annual	8.8 ^F	AAQC/2020 CAAQS
		Annual	8 ^F	2030 CAAQS
Benzene	71-43-2	24	2.3	AAQC
		Annual	0.45	AAQC
Benzo(a)pyrene	50-32-8	24	0.00005	AAQC
		Annual	0.00001	AAQC
1,3-Butadiene	106-99-0	24	10	AAQC
		Annual	2	AAQC
Formaldehyde	50-00-0	24	65	AAQC
Acetaldehyde	75-07-0	0.5	500	AAQC
		24	500	AAQC
Acrolein	107-02-8	1	4.5	AAQC
		24	0.4	AAQC

Notes:



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

2 Methodology

February 6, 2026

- A Converted to $\mu\text{g}/\text{m}^3$ assuming 10°C and 760 mmHg, consistent with the approach for converting AAQCs (MTO 2020).
- B The 3-year average of the annual 98th percentile daily maximum 1-hour (DM1H) average concentrations.
- C The average over a single calendar year of all the 1-hour average concentrations.
- D AAQC for PM_{10} is an interim AAQC provided as a guide for decision-making.
- E The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations.
- F The 3-year average of the annual average concentrations.
- G As a surrogate of total polycyclic aromatic hydrocarbons (PAHs).

2.2.2 Greenhouse Gases

Greenhouse gases (GHG) are gases that contribute to potential climate change by trapping heat in the atmosphere. GHGs are known to contribute to warming of the climate, leading to many other changes around the world: in the atmosphere; on land; and in the oceans (IPCC 2021).

Common GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other GHGs include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). These additional GHGs are typically associated with industrial applications, for example, HFCs and PFCs are used mainly as refrigerants, SF_6 is commonly found in electrical equipment, and NF_3 is used in the plasma etching of silicon wafers.

According to the MTO Guide (MTO 2020), CO_2 is the principal transportation-related GHG, with CH_4 and N_2O identified as additional GHG of concern. The Project is expected to emit CO_2 , CH_4 , and N_2O from the combustion of fuels in vehicles and all three of these GHGs are assessed in this study. Other GHGs, such as HFCs, PFCs, SF_6 and NF_3 are not included in this assessment.

GHGs absorb heat radiated by the Earth and subsequently warm the atmosphere, leading to what is commonly known as the greenhouse effect. The Global Warming Potential (GWP) of a GHG is a measure of how much heat it traps in the atmosphere



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

2 Methodology

February 6, 2026

relative to CO₂. Following Canada's National Inventory Report 1990–2023 (Environment and Climate Change Canada, ECCC 2025a), the GWP values used in this study are 1 for CO₂, 28 for CH₄, and 265 for N₂O.

To account for the different warming potentials of various GHGs, emissions are expressed in kilotonnes of carbon dioxide equivalent (kt CO₂e). This is calculated by multiplying the mass (in tonnes) of each GHG by its GWP and summing the results, then dividing by 1,000 to convert to kilotonnes. For this assessment, CO₂e emissions are predicted based on CO₂, CH₄ and N₂O emission factors from the U.S. EPA's MOVES model (U.S. EPA 2024).

GHG emissions for the operation of the Project are estimated and compared to provincial (Ontario) and national (Canada) GHG totals, including applicable 2030 GHG emission reduction targets.



3 Existing Conditions

Ambient air quality within the Study Area is primarily influenced by emissions from vehicular traffic. In addition to local emission sources, meteorological and climatological conditions play an important role in the formation, dispersion, and transport of air contaminants. This section provides the local meteorological conditions and ambient air quality data relevant to the Study area.

3.1 Climate

The following sections describe the general climatology of the Study Area. The climatology is based on 30-year (1991 to 2020) Canadian Climate Normal data obtained from Environment and Climate Change Canada (ECCC) for the Brockville Station and Ottawa MacDonal-Cartier International Airport Station (ECCC 2025b).

3.1.1 Temperature

A summary of the daily average, daily maximum, and daily minimum temperatures on a monthly basis over the period 1991 to 2020 is presented in Table 3.1. The daily average temperature for the area varies from -7.2°C to 21.3°C with an annual average temperature of 7.8°C.

3.1.2 Precipitation

A summary of the monthly average rainfall, snowfall, and total precipitation (as equivalent rainfall based on a conversion factor for snowfall to equivalent rainfall of 0.1) over the period 1991 to 2020 is presented in Table 3.2. The annual average total precipitation for the area is 1,017.1 millimetres (mm).

Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

3.1.3 Humidity

A summary of the average morning and afternoon relative humidity on a monthly basis over the period 1991 to 2020 is presented in Table 3.3. The annual average relative humidity in the morning is 81.4% and in the afternoon is 59.1%.

3.1.4 Wind Speed and Direction

The climate normal data with respect to wind speed and directionality are presented in Table 3.4. The annual average wind speed for the area is 13.5 km/h and the most frequent wind direction, on an annual basis, is wind blowing from the west.



3 Existing Conditions

February 6, 2026

Table 3.1 Summary of Average Temperature Data

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (°C)	-7.2	-6.0	-0.7	6.6	13.5	18.5	21.3	20.6	16.5	9.7	3.5	-3.0	7.8
Daily Maximum (°C)	-3.1	-1.7	3.7	11.3	18.8	23.4	26.1	25.4	21.2	13.8	7.0	0.4	12.2
Daily Minimum (°C)	-11.3	-10.3	-5.0	1.8	8.3	13.5	16.5	15.7	11.7	5.8	-0.2	-6.5	3.3

Note:

Source: ECCC Climate Normals for Brockville station (ECCC 2025b).

Table 3.2 Summary of Average Precipitation Data

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	34.3	22.6	39.7	81.4	79.4	95.7	99.2	81.9	95.5	92.6	69.8	44.7	836.7
Snowfall (cm)	49.5	41.4	28.6	7.7	0.2	0.0	0.0	0.0	0.0	1.4	11.2	40.6	180.4
Precipitation (mm)	83.8	64.0	68.3	89.1	79.6	95.7	99.2	81.9	95.5	94.0	81.0	85.2	1,017.1

Note:

Source: ECCC Climate Normals for Brockville station (ECCC 2025b).

Table 3.3 Summary of Average Relative Humidity Data

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Relative Humidity - 0600LST (%)	78.1	75.9	74.7	73.4	76.2	81.9	85.2	88.9	90.2	86.1	83.3	82.3	81.4
Average Relative Humidity - 1500LST (%)	68.4	62	57	49.5	49.5	53.5	54.2	55.3	58.4	61.6	66.9	72.3	59.1

Note:

Source: ECCC Climate Normals for the Ottawa MacDonald Cartier International Airport Station (ECCC 2025b).



3 Existing Conditions

February 6, 2026

Table 3.4 Summary of Wind Data

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Speed (km/h)	14.9	14.9	15.2	15.6	13.8	11.9	11.4	10.9	11.6	13.4	14.1	14.5	13.5
Most Frequent Direction ^(A)	W	W	W	W	W	W	W	S	S	W	W	W	W
Extreme Wind Speed (km/h)	65	57	58	61	57	52	50	57	50	57	63	59	- ^B
Extreme Gust Speed (km/h)	100	89	78	95	91	80	96	82	82	82	89	85	- ^B
Direction of Extreme Gust Speed ^(A)	SW	W	NW	SW	W	W	W	NW	W	W	W	W	- ^B

Notes:

A Denotes the direction from which the wind is blowing most frequently.

B Not applicable.

Source: ECCC Climate Normals for the Ottawa MacDonald Cartier International Airport Station (ECCC 2025b).



3.2 Special Receptors

The assessment of air quality impacts was conducted at specific locations within the Study Area known as special receptors. These receptors are placed to represent locations where human activity regularly occurs. In accordance with the MTO Guide (MTO 2020), local air quality impacts should be assessed within 500 m of the Project at both sensitive receptors (such as residences) and critical receptors (including schools, hospitals, retirement homes, childcare centres, and other similar institutional buildings).

Table 3.5 identifies twenty-five (25) special receptors selected for this assessment, representing a mix of residential properties, a place of worship and a school. There are no known future residential developments identified within the air quality study area. These receptors were used to evaluate potential air quality impacts from the Project. The locations of the special receptors are illustrated in Appendix A, Figure A.1.

Table 3.5 List of Special Receptors

Receptor ID	Receptor Description	Receptor Type	UTM Zone	UTM Easting (m)	UTM Northing (m)
R017*	Toniata Public School on Scace Ave	Critical	18	446149	4940184
R018*	New Hope Church on Concession 2 Rd	Sensitive	18	446317	4940783
R034*	Residence on Oxford Ave	Sensitive	18	446123	4940609
R035*	Residence on Oxford Ave	Sensitive	18	446104	4940643
R036*	Residence on Oxford Ave	Sensitive	18	446094	4940664
R037*	Residence on Concession 2 Rd	Sensitive	18	446412	4940923
R059*	Residence on Waverly Dr	Sensitive	18	446153	4940420
R060*	Residence on Oxford Crescent	Sensitive	18	446389	4940625
R001	Residence on Concession 2 Rd	Sensitive	18	446513	4941032



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

Receptor ID	Receptor Description	Receptor Type	UTM Zone	UTM Easting (m)	UTM Northing (m)
R002	Residence on Concession 2 Rd	Sensitive	18	446661	4941156
R003	Residence on Concession 2 Rd	Sensitive	18	446809	4941293
R004	Residence on Concession 2 Rd	Sensitive	18	446934	4941421
R005	Residence on Concession 2 Rd	Sensitive	18	447021	4941481
R006	Residence on Concession 2 Rd	Sensitive	18	447139	4941504
R007	Residence on Applewood Cir	Sensitive	18	447216	4941533
R008	Residence on Applewood Cir	Sensitive	18	447250	4941575
R009	Residence on Old Sharpe's Ln	Sensitive	18	447353	4941620
R010	Residence on Sharpe's Ln	Sensitive	18	447446	4941475
R011	Residence on Sharpe's Ln	Sensitive	18	447454	4941434
R012	Residence on Sharpe's Ln	Sensitive	18	447543	4941494
R013	Residence on Concession 2 Rd	Sensitive	18	447507	4941918
R014	Residence on Concession 2 Rd	Sensitive	18	447645	4942017
R015	Residence on Concession 2 Rd	Sensitive	18	447822	4942151
R016	Residence on Concession 2 Rd	Sensitive	18	448022	4942339
R017	Residence on Concession 2 Rd	Sensitive	18	448172	4942479

Notes:

Receptors IDs with a * were identified as special receptors in the AQIA for the Highway 401 Planning, Preliminary Design and Class Environmental Assessment, Brockville, GWP 4003-19-00 (Stantec 2023). Since these receptors are located within the 500 m air quality study area for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00), they are also included herein.



3.3 Local Air Quality

3.3.1 Available Published Ambient Monitoring Data

Ambient air quality monitoring in populated regions of Canada is conducted by the National Air Pollution Surveillance (NAPS) program which is managed by Environment and Climate Change Canada (ECCC 2025c). NAPS was established in 1969 with the goal of the program being to provide accurate and long-term air quality data of a uniform standard across Canada. The NAPS network continuously monitors ambient concentrations of key pollutants, including CO, NO₂, NO, NO_x, ozone (O₃), SO₂, PM₁₀, and PM_{2.5}. It also conducts integrated measurements of select carbonyl compounds, VOCs, and PAHs.

To establish background air quality levels for the Project, the most recent five years of NAPS data from the nearest and most representative monitoring stations were reviewed. Selection of appropriate stations considers the following factors: proximity to the Project, completeness of data, similarity in land use characteristics and population size. Table 3.6 lists the NAPS monitoring stations reviewed, with those selected to represent background concentrations for this study highlighted in grey.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

Table 3.6 NAPS Locations Considered in the Study

NAPS ID	Location	Station Name	Approximate Distance from Study Area (km)	Contaminant	Availability of Data	Selected for Study?
060104	Rideau & Wurtemberg	Ottawa Downtown	90	CO	2016-2020 ^C	No
054401	1128 De La Guerre	Saint-Anicet	122	CO	2019-2023	Yes
060440	4905 Dufferin Street	Toronto North	317	CO	2019-2023	No
60512	Elgin & Kelly	Hamilton Downtown	365	CO	2019-2022	No
060204	467 University Ave. West	Windsor	650	CO	2019-2023	No
060304	Near 23 Beechgrove Lane	Kingston	80	NO ₂ , PM _{2.5}	2019-2023	Yes
061201	Bedford & Third St.	Cornwall	85	NO ₂ , PM _{2.5}	2019-2023	No
060104	Rideau & Wurtemberg	Ottawa Downtown	90	NO ₂ , PM _{2.5}	2019-2023	No
062601	Experimental Farm	Simcoe	418	benzene, 1,3-butadiene	2019, 2021-2024 ^D	No
				B(a)P	2016 - 2019 ^E	Yes
				acetaldehyde, formaldehyde	2014-2015, 2017-2019 ^F	Yes
				acrolein	2014, 2015, 2017 ^G	Yes



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

NAPS ID	Location	Station Name	Approximate Distance from Study Area (km)	Contaminant	Availability of Data	Selected for Study?
060211	College & South Street/ 928 South Street	Windsor West	650	benzene, 1,3-butadiene	2019, 2021-2024 ^D	No
065101	Eagle Street & McCaffrey Road	Newmarket	310	benzene, 1,3-butadiene	2016, 2017, 2019, 2023, 2024 ^I	Yes
061502	West Avenue & Homewood	Kitchener	408	benzene, 1,3-butadiene	2017-2019, 2023, 2024 ^{D, H}	No
060438	401W – 125 Resources Road	Roadside – 401W Toronto	325	CO	2019-2023	No
				benzene, 1,3-butadiene	2019, 2021-2024 ^D	No
				B(a)P	2017 - 2019, 2021, 2022 ^{D, J}	No
				acetaldehyde, formaldehyde	2017 - 2019, 2023 ^{D, K}	No
				acrolein	2017, 2018 ^L	No



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

Notes:

- A Only contaminants pertinent to this study are listed.
- B Grey shaded locations were selected as representative locations for the study.
- C No data availability beyond 2020.
- D Data availability is less than 75% for 2020.
- E No data available beyond 2019.
- F Data availability less than 75% for 2016. No data available beyond 2019.
- G Data availability less than 75% for 2016. No data available beyond 2017.
- H Data availability less than 75% for 2021 and 2022.
- I Data availability is less than 75% for 2018, 2020, 2021, and 2022.
- J No data available beyond 2022.
- K Data availability is less than 75% for 2021 and 2022.
- L No data available beyond 2018.



3.3.2 Background Concentration Levels

Background concentrations are used in dispersion modelling to represent the effect of the existing sources of air contaminants, both anthropogenic and biogenic, in the area. The background values are added to the concentrations predicted from the dispersion modelling of the Project to arrive at a total (cumulative) value to be compared against the regulatory criteria or standards.

Background pollutant concentrations are the 90th percentile of the most recently measured and complete concentration data from the nearest MECP or ECCC monitoring stations. The use of 90th percentile levels is to account for spatial and temporal variations between the monitoring location(s) and the Study Area, while still providing a conservative assessment. The background levels used in this study were therefore based on the 90th percentile values for short term averages. For annual averages, an annual average value was used as the background level.

The maximum, minimum, average and 90th percentile concentrations for the applicable time periods for each CoPC are presented in Table 3.7. The following observations were made from the ambient monitoring data:

- Maximum measured 1-hour and 8-hour average CO concentrations at the Saint-Anicet station are both less than 9% of their applicable criteria.
- The maximum measured 1-hour and 24-hour average NO₂ concentrations at the Kingston station of 125.1 µg/m³ and 46.1 µg/m³ are below the applicable 1-hour and 24-hour AAQC of 400 µg/m³ and 200 µg/m³, respectively. The annual average NO₂ concentration of 8.6 µg/m³ is below the CAAQS of 24 µg/m³.
- Ambient PM₁₀ concentrations were estimated based on PM_{2.5} measurements at the Kingston station using a ratio of $PM_{2.5} / PM_{10} = 0.54$ (Lall et al 2004). Based on this estimation methodology, the maximum PM₁₀ background concentration of 414.8 µg/m³ exceeds the interim PM₁₀ AAQC of 50 µg/m³.
- The maximum measured 24-hour and annual average PM_{2.5} concentrations are 224.0 µg/m³ and 6.0 µg/m³, respectively. The elevated maximum concentration which occurred in June 2023 is most likely attributable to wildfire smoke that

Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

3 Existing Conditions

February 6, 2026

drifted into Southern Ontario from active fires in northeastern Ontario and Quebec.

- The maximum measured 24-hour average benzene concentration at the Newmarket station of $2.5 \mu\text{g}/\text{m}^3$ is above the 24-hour AAQC of $2.3 \mu\text{g}/\text{m}^3$. The maximum measured annual average benzene concentration of $0.31 \mu\text{g}/\text{m}^3$ is below the annual average AAQC of $0.45 \mu\text{g}/\text{m}^3$.
- The maximum measured 24-hour and annual average B(a)P concentrations at the Simcoe station of $0.00043 \mu\text{g}/\text{m}^3$ and $0.000023 \mu\text{g}/\text{m}^3$ respectively, are above the 24-hour and annual average AAQCs of $0.00005 \mu\text{g}/\text{m}^3$ and $0.00001 \mu\text{g}/\text{m}^3$.
- The maximum measured 24-hour and annual average 1,3-butadiene concentrations at the Newmarket station are both less than 2% of their applicable criteria.
- The maximum measured 24-hour average formaldehyde concentration at the Simcoe station is less than 6% of the AAQC.
- The maximum measured 24-hour average acetaldehyde concentration at the Simcoe station is less than 3% of the applicable half-hour and 24-hour AAQC. Since acetaldehyde is not measured for shorter averaging periods, the 24-hour average concentration was converted to a half-hour concentration using the MECP averaging period conversion factor equation per the Air Dispersion Modelling Guideline for Ontario (ADMGO) (MECP 2017).
- The maximum measured 24-hour average acrolein concentration at the Simcoe station is less than 19% of the applicable 1-hour and 24-hour AAQC. Since acrolein is not measured for shorter averaging periods, the 24-hour average concentration was converted to a 1-hour concentration using the MECP averaging period conversion factor equation (MECP 2017).
- The 90th percentile or annual average concentrations for all CoPCs are below the applicable AAQC except for B(a)P which exceeds the 24-hour and annual average AAQC by 6% and 127%, respectively.

For this assessment, 90th percentile concentrations are used as background concentrations for hourly or 24-hour averaging periods and annual averages are used for annual criteria.



Table 3.7 Summary of CoPC Background Concentrations

CoPC	CAS No.	Averaging Period	Background Concentration (µg/m³)				Air Quality Criteria or Standard	Regulatory Framework	% of Criteria or Standard
		(Hours)	Maximum	Minimum	Mean	90 th Percentile	(µg/m³)		
CO ^A	630-08-0	1	1,495	72	188	277	36,200	AAQC	1%
		8	1,206	121	226	241	15,700	AAQC	2%
NO ₂ ^A	10102-44-0	1	125.1	0	8.6	30.1	400	AAQC	8%
							83	CAAQS	- ^B
		24	46.1	0	7.1	14.5	200	AAQC	7%
		Annual	-	-	8.6	-	24	CAAQS	36%
PM ₁₀ ^D	N/A	24	414.8	0	11.1	22.2	50	AAQC	44%
PM _{2.5}	N/A	24	224.0	0	6.0	12.0	27	AAQC/2020 CAAQS	- ^C
							23	2030 CAAQS	- ^C
		Annual	-	-	6.0	-	8.8	AAQC/2020 CAAQS	- ^C
							8	2030 CAAQS	- ^C
Benzene	71-43-2	24	2.5	0.07	0.31	0.59	2.3	AAQC	26%
		Annual	-	-	0.31	-	0.45	AAQC	68%
Benzo(a)pyrene	50-32-8	24	0.00043	0.000000	0.000023	0.000053	0.00005	AAQC	106%
		Annual	-	-	0.000023	-	0.00001	AAQC	227%
1,3-Butadiene	106-99-0	24	0.11	0	0.015	0.039	10	AAQC	0%
		Annual	-	-	0.015	-	2	AAQC	1%
Formaldehyde	50-00-0	24	3.5	0	0.62	1.9	65	AAQC	3%
Acetaldehyde ^E	75-07-0	0.5	-	-	-	20.7	500	AAQC	4%
		24	12.1	0	0.79	7.0	500	AAQC	1%
Acrolein ^E	107-02-8	1	-	-	-	0.073	4.5	AAQC	2%
		24	0.07	0	0.009	0.030	0.4	AAQC	7%



Notes:

- A The monitoring data was converted to $\mu\text{g}/\text{m}^3$ based on a standard temperature of 10 °C and pressure of 1 atm.
- B The background hourly NO_2 concentration is not explicitly compared with the CAAQS as the 1-hour CAAQS for NO_2 is referenced to the three-year average of the annual 98th percentile of the DM1H average concentrations while the background concentration is the 90th percentile of hourly values, and therefore the calculation basis for these two parameters is inconsistent.
- C Background concentrations of $\text{PM}_{2.5}$ are not explicitly compared with the CAAQS as the 24-hour and annual standards are referenced to the 98th percentile daily average concentration averaged over 3 consecutive years, and 3-year average of the annual average concentrations, respectively. The background concentrations are 90th percentile of hourly values and single year annual averages and therefore the calculation basis for these parameters is inconsistent.
- D Background concentrations of PM_{10} are estimated based on a ratio of $\text{PM}_{2.5}/\text{PM}_{10} = 0.54$ (Lall et al 2004).
- E Monitoring data are based on 24-hour measurements. The 24-hour background concentration is converted to the appropriate averaging period following guidance in the Air Dispersion Modelling Guideline of Ontario (ADMGO) (MECP 2017).
- F Bolded values show exceedance of an AAQC or CAAQS.

3.4 Existing Greenhouse Gas Emissions

Existing national and provincial GHG emission totals were obtained from Canada’s National Inventory Report 1990 - 2023 (ECCC 2025a) and are summarized in Table 3.8. The table also includes the GHG emission reduction targets for 2030 at both the national (ECCC 2022) and provincial (MECP 2018) levels.

Table 3.8 National and Provincial Greenhouse Gas Emissions

Year	GHG Emissions (kt CO₂e)	
	Canada	Ontario
2018	747,000	164,000
2019	747,000	165,000
2020	682,000	149,000
2021	694,000	152,000
2022	700,000	158,000
2023	694,000	159,000
2030 Target	443,000	144,000



4 Emission Inventory

This section presents the methods and results of the air pollutant and GHG emissions estimations for both the baseline and future assessment years due to changes in traffic volumes.

4.1 Vehicle Emissions

The U.S. EPA Motor Vehicle Emission Simulator (MOVES) version 5 (MOVES5) was used to estimate baseline and future emission rates from motor vehicle traffic on local roads (U.S. EPA 2024). MOVES is the U.S. EPA’s tool for estimating vehicle emissions due to the combustion of fuel, brake and tire wear, fuel evaporation, permeation and refueling leaks. It was used to estimate vehicle emissions based on vehicle type, fuel type, road type, model year, and average vehicle speed. Vehicle types, distribution, peak hour, and annual average daily traffic (AADT) volumes in the Study Area were provided by the project design team (Stantec 2025).

Both peak hour and AADT data were used as inputs to the dispersion model and are provided in Appendix C. Table 4.1 presents a summary of the MOVES input parameters.

Table 4.1 Summary of MOVES Inputs

Parameter	Input
Modelling Scale	Project Scale
Calculation Type	Emission Rates
Year, Time	2020, 2034, 2044, 5 PM
Evaluation Months	January and July
Geographic Bounds	Niagara County, NY (36063)
Source Use Types and Distribution	Passenger Cars, Medium Trucks, Heavy Trucks. (See Appendix C for source use type distribution by link)



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

4 Emission Inventory

February 6, 2026

Parameter	Input
Road Type	Rural Restricted Access Rural Unrestricted Access
Air Contaminants	CACs - CO, NO _x , NO ₂ , PM ₁₀ , PM _{2.5} , Acetaldehyde, Formaldehyde, 1,3-Butadiene, Benzene, Acrolein, and Benzo(a)pyrene GHGs - Atmospheric CO ₂ , CH ₄ and N ₂ O
Meteorology	Daily Average Temperatures: January -7.2°C July 21.3°C Average Relative Humidity: January 68.4% July 54.2%
Fuel Type	MOVES defaults
Fuel Data	Ontario
Vehicle Age Distribution	U.S. EPA default for the model year
Average Speed	60 to 110 km/hr based on average travel speeds in the area

Emission factors in grams of pollutant emitted per vehicle mile travelled (g/VMT) for vehicle speeds for the above listed vehicle speeds and vehicle distributions were obtained from MOVES5 and applied to the appropriate emission sources used in the dispersion model. Appendix D summarizes the emission factors obtained from MOVES5.

4.2 Road Dust Emissions

In addition to exhaust, tire wear, brake and evaporative emissions, the re-entrainment of road dust is considered a source of PM₁₀ and PM_{2.5} from vehicles travelling over paved roads. Emissions resulting from travel on paved roads were quantified using the U.S. EPA AP-42 Chapter 13.2.1 calculation methodology.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

4 Emission Inventory

February 6, 2026

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicles travelling on the Project roadways were calculated using the equation suggested in AP-42, Section 13.2 (U.S. EPA 2011):

$$E = K \times (sL)^{0.91} \times (w)^{1.02}$$

Where:

E= particulate emission factor (g/VMT)

sL = road surface silt loading (g/m²):

AADT < 500: 0.6 g/m²

AADT between 500 – 5,000: 0.2 g/m²

AADT between 5,000 – 10,000: 0.06 g/m²

AADT > 10,000: 0.03 g/m²

AADT > 10,000 (limited access highway): 0.015 g/m²

W = average weight (tons) of vehicles traveling the road:

Passenger cars: 1.8 tons

Medium Trucks: 10 tons

Heavy Trucks: 20 tons

K = particle size multiplier of 0.25 (g/VMT) for PM_{2.5} and 1 (g/VMT) for PM₁₀.

The particulate resuspension emission factors were calculated from the above equation and aggregated with the emission factors generated from MOVES for PM_{2.5} and PM₁₀.

The MOVES output emission factors and detailed road dust emissions calculations are presented in Appendix D.



4.3 Greenhouse Gas Emissions

The estimation of GHG emissions for the Project follows the same methodology described for air contaminant emissions, using MOVES5 to predict CO₂, CH₄ and N₂O emission factors. These emission factors were then used to calculate total CO₂e emissions in 2020, 2034 and 2044 with and without the implementation of the Project. The total emissions for each scenario were based on each modelled emission source's emission factor (g/VMT) and the predicted annual vehicle miles travelled (based on the length and AADT of each source). The detailed GHG emissions calculations are also provided in Appendix D. Table 4.2 presents the annual GHG emissions for each scenario.

Table 4.2 Summary of Project Annual GHG Emissions (kt CO₂e/year)

Baseline (2020)	Future Interim (2034) No Build	Future Interim (2034) Build	Future Ultimate (2044) No Build	Future Ultimate (2044) Build
24.9	24.2	24.1	20.0	20.0

The Future Ultimate 2044 Build scenario represents a decrease in GHG emissions of 20% compared to the Baseline scenario and is about the same as the Future Ultimate (2044) No Build scenario. Overall, the CO₂e emissions per vehicle mile travelled are lower in the future compared to the Baseline scenario due to the expected improvements in engine technology and cleaner fuels.



5 Air Dispersion Modelling Methodology

This section provides a general overview of the air dispersion model and the input data used in the assessment. Dispersion modelling of the CoPCs resulting from vehicle traffic on local roads was conducted for the following five assessment scenarios:

- 2020 – Baseline (existing conditions), Highway 401 (4 lanes)
- 2034 – Future Interim No-Build, Highway 401 (4 lanes)
- 2034 – Future Interim Build, Highway 401 (6 lanes), replacement of bridge
- 2044 – Future Ultimate No-Build, Highway 401 (6 lanes), replacement of bridge
- 2044 – Future Ultimate Build, Highway 401 (8 lanes), replacement of bridge

5.1 Dispersion Model Used

The U.S. EPA CAL3QHCR dispersion model (U.S. EPA 2013) was used to predict air quality concentrations at the special receptor locations for all emission scenarios. The model can predict pollutant ground level concentrations (GLCs) from motor vehicles near highways and arterial streets. CAL3QHCR requires inputs such as roadway geometries, receptor locations, meteorological conditions, and vehicular emission factors.

A total of 25 roadway links were included in the dispersion model for all five scenarios. Detailed link data for each scenario are provided in Appendix E.

Link geometries were developed based on the proposed improvements shown in Figure B.1 (Appendix B), along with available traffic volume data (Stantec 2025), average travel speeds, and hourly vehicle distribution patterns, as presented in Appendix C.

Emission factors from MOVES5 and re-suspended road dust (expressed in grams per vehicle mile travelled, g/VMT) were assigned to each link based on the predicted vehicle mix and average speeds. Table 5.1 summarizes the key CAL3QHCR model inputs used for the dispersion modelling.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

5 Air Dispersion Modelling Methodology

February 6, 2026

Table 5.1 Key CAL3QHCR Model Input Parameters

Parameter	Input
Traffic Data	Peak hourly and AADT traffic volumes
Deposition Velocity	Deposition velocities selected as per the MTO Guide PM _{2.5} : 0.1 cm/s PM ₁₀ : 0.5 cm/s CO, NO ₂ , BAP and VOCs: 0 cm/s
Settling Velocity	Settling velocities selected as per MTO Guide PM _{2.5} : 0.02 cm/s PM ₁₀ : 0.3 cm/s CO, NO ₂ , BAP and VOCs: 0 cm/s
Surface Roughness Length	The Study Area is dominated by a mixture of forest and crop land. A value of 50 cm was selected to represent mixed far fields and forest clumps, orchards and scattered buildings.
Emission Factor	Emission Factors from MOVES5 were applied to the appropriate links depending on assigned vehicle mix and average speeds.

5.2 Meteorological Data Sources

The local meteorology of the region must be characterized to evaluate the short-term atmospheric dispersion and transport of emissions released by the Project. A five-year (2020-2024) site specific meteorological dataset pre-processed by the MECP was used as an input to the dispersion model using upper air data from the US National Oceanic and Atmospheric Administration (NOAA)'s High Resolution Rapid Refresh (HRRR-3km) data and surface data from the US NOAA's UnRestricted Mesoscale Analysis (URMA-2.5km) data (MECP 2025).

Since CAL3QHCR can only process one year of meteorological data per run, each of the five years of meteorological data was processed separately. The highest predicted



ambient concentrations from across the five-year period were then used in the assessment to ensure a conservative estimate of air quality impacts.

5.3 Wind Speed and Wind Direction

The frequency distribution of wind speeds from the site-specific meteorological data set is shown in Figure 5.1. High wind speeds (greater than 8.8 m/s) occur infrequently, while wind speeds between 0.50 – 2.10 m/s occur the most frequently. Wind roses are an efficient and convenient means of presenting wind data. A wind rose plot for the Project is presented in Figure 5.2. The length of the radial barbs gives the total percent frequency of winds blowing from the indicated direction, while portions of the barbs of different widths indicate the frequency associated with each wind speed category. The wind rose plot shows that winds blow most frequently from the southwesterly direction whereas as the climate normals data from the closest station (i.e., Ottawa MacDonald Cartier International Airport Station) suggests that the predominant wind direction is from the west. The difference between the two may be attributed to the distance between the Project and the climate normals station.

Figure 5.1 Wind Class Frequency Distribution (2020 – 2024) for East of Brockville

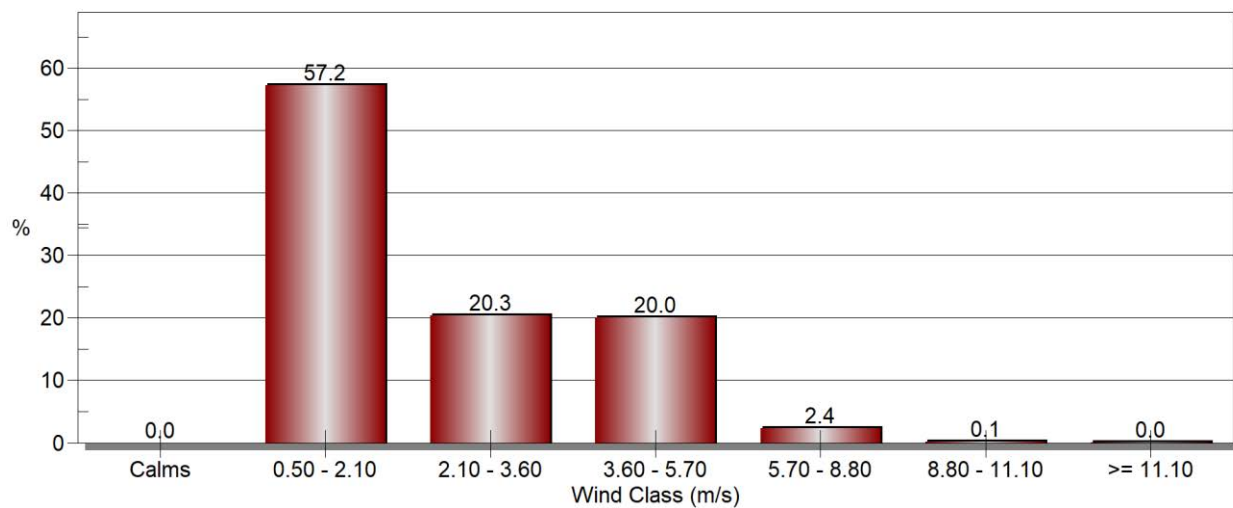
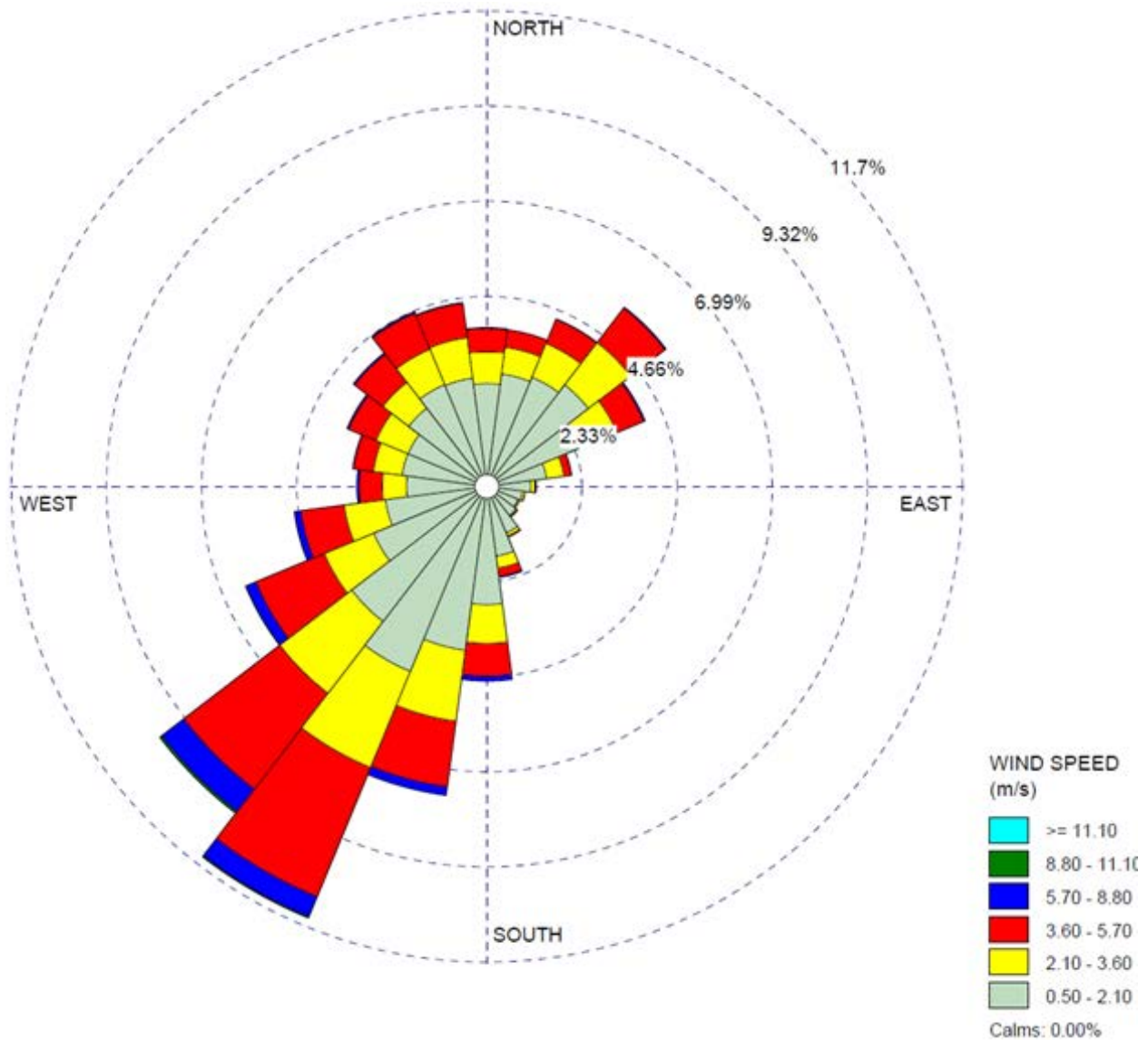


Figure 5.2 Wind Rose Plot (2020 – 2024) for East of Brockville



5.4 Averaging Periods

The CAL3QHCR dispersion model is capable of predicting ground level concentrations for various averaging times greater than 1-hour. For this Project, the model was run for 1-hour, 8-hour, 24-hour and annual averaging times. Where applicable air quality criteria had different averaging periods, predicted concentrations were converted from



the nearest modelled averaging period using the conversion methodology recommended by the MECP (MECP 2017).

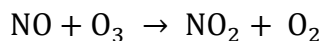
5.5 Receptors

The MTO Guide (MTO 2020) recommends that local air quality impacts should be assessed within 500 m of the Project at both sensitive receptors (such as residences) and critical receptors (including schools, hospitals, retirement homes, childcare centres, and other similar institutional buildings). The choice of a 500 m limit is based on empirical evidence for heavily travelled large highways, which clearly indicates that the concentrations of road-related pollutants drop to within 10% of their background pollution levels over this distance (MTO 2020).

The locations of the representative sensitive and critical receptors used to assess compliance with the air quality criteria and standards are listed in Table 3.5 and are shown in Appendix A.

5.6 Conversion of Nitrogen Oxides to Nitrogen Dioxide

Nitrogen oxide (NO_x) is comprised of nitric oxide (NO) and nitrogen dioxide (NO₂). However, only NO₂ has ambient air quality criteria. In combustion emissions, typically most of the NO_x emissions are NO and only a small percentage are NO₂. Once in the ambient air, NO is irreversibly oxidized by ground level ozone (O₃) to produce NO₂ as follows:



The following lists different conversion treatments recommended by the U.S. EPA:

- Tier 1 - 100% of emitted NO_x converts to NO₂
- Tier 2 - Ambient Ratio Method (ARM2)
- Tier 3 - Ozone Limiting Method (OLM) or Plume Volume Molar Ratio Method (PVMRM)



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

5 Air Dispersion Modelling Methodology

February 6, 2026

The Tier 2 Ambient Ratio Method (ARM2) was used to predict ambient NO₂ concentrations for this study. Since the ARM2 methodology is not included in the CAL3QHCR model, it was applied as a post-processing step to the dispersion modelling results.

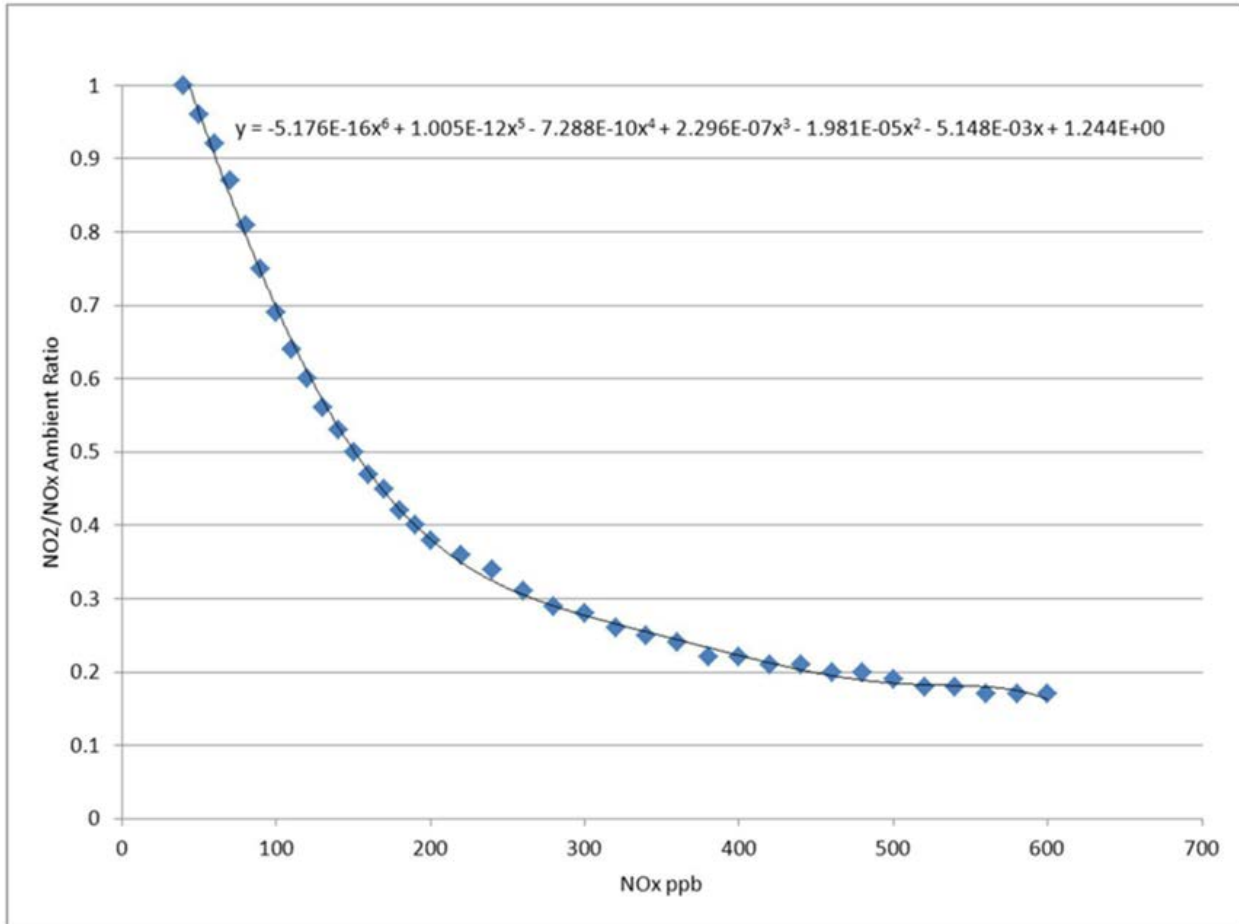
The ARM2 method applies a varying ambient ratio of NO₂ to total NO_x in the atmosphere to calculate NO₂ concentrations based on modelled NO_x concentrations (the ratio decreases with increasing NO_x concentrations). In the application of ARM2, the ratios assume that all NO_x/NO₂ concentrations are expressed in parts per billion (ppb) using the equation from the British Columbia Ministry of Environment and Climate Change Strategy (BCMECCS 2022):

$$\mu\text{g}/\text{m}^3 = \text{ppb} * 1.88$$

Figure 5.3 presents the ambient ratios and the ARM2 equation (RTP 2013).



Figure 5.3 Ambient NO₂/NO_x Ratios and the ARM2 Equation



The ratios applied in this study were constrained to a maximum of 0.90 and a minimum value of 0.50 to maintain an appropriate level of conservatism in the results (based on the current EPA recommendations for maximum and minimum equilibrium ratios).



6 Air Dispersion Modelling Results – Project Alone (Without Background)

This section presents the dispersion modelling results for the baseline and future scenarios for the Project build and no build configurations at the receptor locations discussed in Section 3.2. Table 6.1 compares the maximum predicted concentrations (without background) against the applicable AAQC and/or CAAQS. Predicted concentrations at individual special receptor locations are included in Appendix F.

For PM_{2.5}, the maximum predicted 24-hour average concentrations are conservatively compared to the 24-hour CAAQS as the CAL3QHCR model does not generate the statistical output¹ (i.e., 98th percentile values) required for a direct comparison to the standard.

The NO₂ concentrations were conservatively estimated from the predicted ground level NO_x concentrations using the ARM2 method described in Section 5.6. As with PM_{2.5}, the maximum predicted 1-hour NO₂ concentrations were directly compared to the 1-hour CAAQS rather than using the 98th percentile values. As a result, these comparisons are considered conservative, meaning that the maximum predicted concentrations are higher than using the 98th percentile values. For annual averages, the maximum annual average concentration across all receptors is used for direct comparison to the annual CAAQS.

¹ For PM_{2.5}, the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations is to be used for comparison to the 24-hour CAAQS. The 3-year average of the annual average of the daily 24-hour average concentrations are to be used for comparison to the annual CAAQS.

For NO₂, the 3-year average of the annual 98th percentile of the daily maximum one-hour average concentration is to be used for comparison to the 1-hour CAAQS. The average over a single calendar year of all 1-hour average concentrations is to be used for comparison to the annual CAAQS.

Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

6 Air Dispersion Modelling Results – Project Alone (Without Background)

February 6, 2026

The maximum predicted ground level concentrations (GLCs) without background for all CoPCs are below their respective provincial AAQC and/or federal CAAQS other than NO₂ for all five scenarios and B(a)P in the Baseline (2020), Future Interim (2034) No Build and Future Interim (2034) Build scenarios. For COPCs other than PM₁₀, the maximum predicted concentrations for the future scenarios are lower than the baseline scenario due to advances in cleaner fuels and emissions control technology, which are anticipated to lower all vehicle contaminant tailpipe emissions in the future. The modifications to Highway 401 from the Baseline scenario to the Future Ultimate Build scenario should promote smoother traffic flow that could help improve air quality by reducing gridlock.

The predicted Project Alone concentrations (without background) for all CoPCs are similar for the Future Ultimate No Build scenario and the Future Ultimate Build scenario due to the projected AADT being the same for both scenarios and the differences in the predictions between these two scenarios results from the mixing zone width used in the dispersion model being larger for the Future Ultimate Build scenario (8 lanes) relative to the Future Ultimate No Build scenario (6 lanes).

Carbon Monoxide

Maximum predicted 1-hour, and 8-hour CO concentrations are well below the applicable provincial AAQC in all five scenarios ranging between less than 1% to 4% of the criteria.

Nitrogen Dioxide

The maximum predicted 1-hour and 24-hour NO₂ GLCs are below the provincial AAQCs for all five scenarios.

The maximum predicted 1-hour NO₂ GLC exceeds the CAAQS by 211% for the Baseline scenario, 62% for the Future Interim No Build, 64% for the Future Interim Build, 9% for the Future Ultimate No Build, and 11% for the Future Ultimate Build scenarios. The maximum exceedance occurs at receptor R009 (residence on Old Sharpe's Lane) for all five scenarios. As previously noted, this comparison is



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

6 Air Dispersion Modelling Results – Project Alone (Without Background)

February 6, 2026

conservative as maximum predicted hourly concentrations are compared to the CAAQS rather than 98th percentile values.

The maximum predicted annual average NO₂ GLCs are above the CAAQS by 141% at receptor R009 for the Baseline scenario, and by 5% at receptor R059* for the Future Interim Build Scenario. There are no exceedances predicted for the Future Interim No Build, Future Ultimate No Build, or Future Ultimate Build scenarios.

The AAQC is currently used by the MECP and the NO₂ CAAQS have not been adopted as an AAQC in Ontario and are intended for regional air quality planning rather than assessing the local impacts of individual projects. Exceedances of the 1-hour NO₂ CAAQS are predicted at all twenty-five (25) special receptors for the Baseline scenario, twenty-four (24) receptors for the Future Interim scenarios, one (1) receptor for the Future Ultimate No Build scenario and two (2) receptors for the Future Ultimate Build scenario. Notably, the maximum predicted 1-hour NO₂ concentration for the Future Ultimate Build scenario decreases by 56% compared to the Baseline scenario.

Particulate Matter

The maximum predicted PM₁₀ and PM_{2.5} concentrations are well below the AAQC and CAAQS for all five scenarios, representing between 6% to 11% of the applicable criteria/standard. The maximum predicted PM₁₀ concentrations in the Future Ultimate scenarios are higher than those in Baseline and the Future Interim scenarios despite anticipated improvements in engine technology and the use of cleaner fuel in the future due to the expected increase in vehicle traffic volumes on the highway.

Volatile Organic Compounds

Maximum predicted GLCs of benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein are well below their respective AAQCs for all averaging periods and all five scenarios. Maximum predicted GLCs for all VOCs decrease in the Future No Build scenarios compared to Baseline conditions. In the Future Build scenarios, the maximum



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

6 Air Dispersion Modelling Results – Project Alone (Without Background)

February 6, 2026

predicted GLCs for all VOCs are also lower than Baseline, though they are slightly higher than in the Future No Build scenarios due to the Project being closer to the special receptors.

Benzo(a)pyrene

The maximum predicted 24-hour and annual average B(a)P concentrations for the Baseline scenario are above the AAQCs by 309% at receptor R059* and 541% at receptor R009, respectively. For the Baseline scenario, exceedances of the 24-hour and annual average AAQCs are predicted at all twenty-five special receptors. At receptor R059*, exceedances of the 24-hour AAQC are frequent, occurring 56% of the time and for receptor R009, exceedances are predicted for all 5 modelled years.

The maximum predicted B(a)P concentrations decrease for the Future Interim and Future Ultimate scenarios relative to the Baseline scenario, with the maximum predicted 24-hour average concentrations being below their AAQCs for all four future scenarios. Exceedances of the annual AAQC are predicted for the Future Interim No Build scenario by 48% and the Future Interim Build scenario by 52% for all five modelled years, with no exceedances predicted for the Future Ultimate scenarios due to anticipated further improvements in engine technology and the use of cleaner fuel. Appendix G presents contour plots of B(a)P concentrations for all scenarios and averaging periods where exceedances are predicted.



Table 6.1 Maximum Predicted Concentrations Without Background at Special Receptors

CoPC	CAS No.	Averaging Period	Maximum Concentration Without Background ^A (µg/m ³)					Air Quality Criteria (µg/m ³)	Regulatory Framework	% of Criteria or Standard				
			(hours)	Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build			Future Ultimate Build	Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build
CO	630-08-0	1	792	617	644	307	313	36,200	AAQC	2%	2%	2%	<1%	<1%
		8	591	458	482	229	229	15,700	AAQC	4%	3%	3%	1%	1%
NO ₂	10102-44-0	1	258	135	136	91	92	400	AAQC	65%	34%	34%	23%	23%
			258	135	136	91	92	83	CAAQS	311%	162%	164%	109%	111%
		24	53	20	21	10	10	200	AAQC	26%	10%	10%	5%	5%
		Annual	58	23	25	12	12	24	CAAQS	241%	96%	105%	49%	52%
PM ₁₀	N/A	24	5.0	4.6	4.8	5.4	5.6	50	AAQC	10%	9%	10%	11%	11%
PM _{2.5}	N/A	24	2.6	1.5	1.6	1.5	1.6	27	AAQC/2020 CAAQS	10%	6%	6%	6%	6%
			2.6	1.5	1.6	1.5	1.6	23	2030 CAAQS	11%	7%	7%	7%	7%
		Annual	0.83	0.49	0.50	0.49	0.51	8.8	AAQC/2020 CAAQS	9%	6%	6%	6%	6%
			0.83	0.49	0.50	0.49	0.51	8	2030 CAAQS	10%	6%	6%	6%	6%
Benzene	71-43-2	24	7.9E-02	2.1E-02	2.1E-02	6.5E-03	6.7E-03	2.3	AAQC	3%	<1%	<1%	<1%	<1%
		Annual	2.6E-02	6.7E-03	6.9E-03	2.1E-03	2.1E-03	0.45	AAQC	6%	1%	2%	<1%	<1%
Benzo(a)pyrene	50-32-8	24	2.0E-04	4.7E-05	5.0E-05	1.2E-05	1.2E-05	0.00005	AAQC	409%	94%	99%	24%	25%
		Annual	6.4E-05	1.5E-05	1.5E-05	3.7E-06	3.9E-06	0.00001	AAQC	641%	148%	152%	37%	39%
1,3-Butadiene	106-99-0	24	1.3E-02	2.7E-03	2.8E-03	2.7E-04	2.8E-04	10	AAQC	<1%	<1%	<1%	<1%	<1%
		Annual	4.3E-03	8.6E-04	8.8E-04	8.3E-05	8.7E-05	2	AAQC	<1%	<1%	<1%	<1%	<1%
Formaldehyde	50-00-0	24	0.17	0.049	0.052	0.017	0.018	65	AAQC	<1%	<1%	<1%	<1%	<1%
Acetaldehyde	75-07-0	0.5	0.96	0.35	0.36	0.14	0.14	500	AAQC	<1%	<1%	<1%	<1%	<1%
		24	0.091	0.030	0.032	0.013	0.013	500	AAQC	<1%	<1%	<1%	<1%	<1%



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

6 Air Dispersion Modelling Results – Project Alone (Without Background)

February 6, 2026

CoPC	CAS No.	Averaging Period (hours)	Maximum Concentration Without Background ^A (µg/m ³)					Air Quality Criteria (µg/m ³)	Regulatory Framework	% of Criteria or Standard				
			Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build			Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build
Acrolein	107-02-8	1	0.12	0.036	0.038	0.012	0.012	4.5	AAQC	3%	<1%	<1%	<1%	<1%
		24	0.014	0.0038	0.0040	0.0013	0.0013	0.4	AAQC	3%	<1%	1%	<1%	<1%

Notes:

A. Maximum predicted concentration over all special receptors.

Maximum predicted concentrations in bold are predicted to exceed the air quality criteria/standard.



7 Cumulative Effects Assessment

This section provides an assessment of background air quality and greenhouse gas emissions to evaluate the cumulative impact of the Project's emissions in relation to other existing sources within the Study Area.

7.1 Air Dispersion Modelling Results – With Background

The maximum predicted Project Alone GLCs (without background) in Section 6 were added to the background concentrations presented in Section 3.3.2 to assess the cumulative effects of the Project with existing air quality levels in the Study Area. Table 7.1 presents a summary of the maximum modelled predictions including background concentrations in comparison to the applicable AAQC and/or CAAQS. Predicted cumulative concentrations at individual special receptor locations are also included in Appendix F.

The maximum predicted cumulative GLCs for all CoPCs are below their respective AAQCs/CAAQS for all averaging periods for all five (5) scenarios except for NO₂ and B(a)P.

Carbon Monoxide

Maximum predicted cumulative CO concentrations for all averaging periods are below the AAQC for all scenarios.

Nitrogen Dioxide

The maximum predicted cumulative 1-hour and 24-hour average NO₂ concentrations are below the provincial AAQC for all five (5) scenarios. However, the maximum predicted cumulative 1-hour NO₂ GLC exceeds the CAAQS by 248% for the Baseline scenario, 99% for the Future Interim No Build, 100% for the Future Interim Build, 45% for the Future Ultimate No Build, and 48% for the Future Ultimate Build scenarios.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

7 Cumulative Effects Assessment

February 6, 2026

For annual averages, the maximum predicted cumulative NO₂ GLCs are above the CAAQS by 177% for the Baseline scenario, 32% for the Future Interim No Build scenario and 41% for the Future Interim Build scenarios. There are no predicted cumulative annual average NO₂ exceedances in the Future Ultimate scenarios.

Particulate Matter

The maximum predicted cumulative 24-hour average PM₁₀ concentration is below the AAQC in all five scenarios. Maximum predicted cumulative 24-hour and annual average PM_{2.5} concentrations are below the 2030 CAAQS for all five scenarios.

Volatile Organic Compounds

Maximum predicted cumulative concentrations of benzene, 1,3-butadiene, formaldehyde, acetaldehyde and acrolein for all averaging periods and scenarios are below their respective AAQCs.

Benzo(a)pyrene

The maximum predicted cumulative B(a)P concentrations exceed both the 24-hour and annual average AAQCs at all special receptor locations for all scenarios, with the background concentrations alone exceeding the 24-hour and annual average AAQCs by 6% and 127% respectively. Cumulative B(a)P concentrations in the Future Interim and Future Ultimate scenarios are predicted to decrease relative to Baseline, primarily due to anticipated improvements in engine technology and cleaner fuel over time. In the Future Ultimate Build scenario, the maximum predicted 24-hour, and annual average cumulative B(a)P concentrations are approximately 1% higher than those in the Future Ultimate No Build scenario.



Table 7.1 Maximum Predicted Cumulative Concentrations (With Background) at Special Receptors

CoPC	CAS No.	Averaging Period	Background Concentration	Maximum Concentration Without Background ^A					Air Quality Criteria	Regulatory Framework	% of Criteria or Standard				
		(Hours)	(µg/m ³)	Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build	(µg/m ³)		Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build
CO	630-08-0	1	277	1,069	894	921	584	590	36,200	AAQC	3%	2%	3%	2%	2%
		8	241	832	699	723	470	470	15,700	AAQC	5%	4%	5%	3%	3%
NO ₂	10102-44-0	1	30.1	289	165	166	121	122	400	AAQC	72%	41%	42%	30%	31%
			30.1	289	165	166	121	122	83	2025 CAAQS	348%	199%	200%	145%	148%
		24	14.5	67	34	35	24	25	200	AAQC	33%	17%	18%	12%	12%
		Annual	8.6	66	32	34	20	21	24	2025 CAAQS	277%	132%	141%	85%	88%
PM ₁₀	N/A	24	22.2	27	27	27	28	28	50	AAQC	54%	54%	54%	55%	56%
PM _{2.5}	N/A	24	12.0	15	14	14	14	14	27	AAQC/2020 CAAQS	54%	50%	50%	50%	50%
			12.0	15	14	14	14	14	23	2030 CAAQS	63%	59%	59%	59%	59%
		Annual	6.0	6.8	6.5	6.5	6.5	6.5	8.8	AAQC/2020 CAAQS	78%	74%	74%	74%	74%
			6.0	6.8	6.5	6.5	6.5	6.5	8	2030 CAAQS	85%	81%	81%	81%	81%
Benzene	71-43-2	24	0.59	0.67	0.61	0.61	0.59	0.59	2.3	AAQC	29%	26%	26%	26%	26%
		Annual	0.31	0.33	0.31	0.31	0.31	0.31	0.45	AAQC	74%	70%	70%	69%	69%
Benzo(a)pyrene	50-32-8	24	5.28E-05	2.6E-04	1.0E-04	1.0E-04	6.5E-05	6.5E-05	5.00E-05	AAQC	515%	200%	205%	129%	130%
		Annual	2.27E-05	8.7E-05	3.7E-05	3.8E-05	2.6E-05	2.7E-05	1.00E-05	AAQC	868%	375%	379%	263%	265%
1,3-Butadiene	106-99-0	24	0.039	0.053	0.042	0.042	0.040	0.040	10	AAQC	<1%	<1%	<1%	<1%	<1%
		Annual	0.015	0.019	0.016	0.016	0.015	0.015	2	AAQC	<1%	<1%	<1%	<1%	<1%



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

7 Cumulative Effects Assessment

February 6, 2026

CoPC	CAS No.	Averaging Period	Background Concentration	Maximum Concentration Without Background ^A (µg/m ³)					Air Quality Criteria (µg/m ³)	Regulatory Framework	% of Criteria or Standard				
		(Hours)	(µg/m ³)	Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build			Baseline	Future Interim No Build	Future Interim Build	Future Ultimate No Build	Future Ultimate Build
Formaldehyde	50-00-0	24	1.9	2.1	1.9	1.9	1.9	1.9	65	AAQC	3%	3%	3%	3%	3%
Acetaldehyde	75-07-0	0.5	20.7	22	21	21	21	21	500	AAQC	4%	4%	4%	4%	4%
		24	7.0	7.1	7.0	7.0	7.0	7.0	500	AAQC	1%	1%	1%	1%	1%
Acrolein	107-02-8	1	0.073	0.19	0.11	0.11	0.084	0.084	4.5	AAQC	4%	2%	2%	2%	2%
		24	0.030	0.043	0.034	0.034	0.031	0.031	0.4	AAQC	11%	8%	8%	8%	8%

Notes:

A Maximum predicted concentration over all special receptors.

Maximum predicted cumulative concentrations in bold are predicted to exceed the air quality criteria/standard.



7.2 Greenhouse Gases

The global climate is influenced by the presence of natural and human made GHGs. Current scientific knowledge does not allow for the effects of an individual Project on climate change to be assessed, the Project is therefore assessed in terms of CO_{2e} produced and released to the atmosphere and how this compares with national and provincial levels and emission reduction targets.

To evaluate the potential cumulative effects of GHG emissions due to the Project, estimated emissions with implementation of the Project (presented in Section 4.3) are compared to the existing baseline emissions in Canada and Ontario. Table 7.2 and Table 7.3 presents the GHG emissions estimates for each of the three scenarios compared to Canada and Ontario 2023 totals and 2030 emissions targets.

The incremental increase in GHG emissions due to the Future Ultimate Build scenario, in relation to the Future Ultimate No Build scenario is less than 0.01 kt CO_{2e} per year. This increase represents 0.0000007% of the 2023 GHG emissions in Ontario and 0.0000002% of 2023 GHG emissions in Canada, as well as 0.0000008% of Ontario's 2030 target and 0.0000003% of Canada's 2030 targets.

These potential changes are considered insignificant in relation to the 2023 Canada and Ontario GHG emissions totals and the 2030 emissions targets. While the Project contributions to total GHG emissions are predicted to be small, it is expected that with ongoing advancements of on-road vehicles to newer, lower emission or electric vehicles, the quantities of air contaminants and GHGs released to the atmosphere from transportation sources will be lower in the future.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
7 Cumulative Effects Assessment
 February 6, 2026

Table 7.2 Greenhouse Gas Estimates Compared to National Totals

Scenario	Project (kt CO ₂ e)	Canada			
		2023 Total (kt CO ₂ e)	% of 2023 Total	2030 Target (kt CO ₂ e)	% of 2030 Target
Baseline	24.8	694,000	0.0036%	443,000	0.0056%
Future Interim No Build	24.2		0.0035%		0.0056%
Future Interim Build	24.1		0.0035%		0.0054%
Future Ultimate No Build	20.0		0.0029%		0.0045%
Future Ultimate Build	20.0		0.0029%		0.0045%

Table 7.3 Greenhouse Gas Estimates Compared to Provincial Totals

Scenario	Project (kt CO ₂ e)	Ontario			
		2023 Total (kt CO ₂ e)	% of 2023 Total	2030 Target (kt CO ₂ e)	% of 2030 Target
Baseline	24.8	159,000	0.016%	144,000	0.017%
Future Interim No Build	24.2		0.015%		0.017%
Future Interim Build	24.1		0.015%		0.017%
Future Ultimate No Build	20.0		0.013%		0.014%
Future Ultimate Build	20.0		0.013%		0.014%



8 Potential Impacts and Mitigation During Construction and Operation

This section outlines the potential impacts and corresponding mitigation measures during both the construction and operational phases of the Project.

8.1 Potential Impacts and Mitigation During Construction

During construction of the Project, dust will be the primary CoPC. Other CoPC such as NO₂ and VOCs will also be emitted from equipment used during construction. As the construction activities will be short-term and intermittent, emissions are expected to be minor provided adequate mitigation measures are implemented. The ECCC guideline “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities” (ECCC 2005) provides recommendations for mitigation measures to reduce construction emissions. These measures include material wetting or use of chemical suppressants to reduce dust, use of wind barriers, limiting exposed areas which may be a source of dust, and equipment washing.

It is recommended that appropriate best management practices for each construction activity be followed during Project construction. With implementation of adequate mitigation measures, emissions from Project construction and resulting adverse changes in local air quality can be controlled or reduced.

8.2 Potential Impacts and Mitigation During Operation

The air quality assessment predicts that cumulative 1-hour and annual NO₂ GLCs may exceed the CAAQS in the future no build and build scenarios. Similarly, cumulative B(a)P GLCs may exceed the AAQCs in all the future scenarios, with background concentrations alone being above the 24-hour and annual AAQCs. However, it is noted that cumulative NO₂ and B(a)P concentrations are predicted to be lower for the Future Interim and Future Ultimate No Build and Build scenarios relative to the Baseline scenario.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

8 Potential Impacts and Mitigation During Construction and Operation

February 6, 2026

Although the Project can contribute to these exceedances, the quantities of air contaminants and GHGs released to the atmosphere from transportation sources is expected to be lower in the future due to ongoing advancements in on-road engine technology and transitioning to electric vehicles. Implementation of the Project is also expected to enhance traffic flow and reduce congestion on the local road network, thereby contributing to improved air quality over time.

Additional measures to mitigate the impacts of particulate matter and gaseous emissions may include retaining the existing or the integration of additional vegetative barriers into the landscaping design. The effectiveness of vegetation as a physical barrier for air contaminant control depends on the density, height, and structure of the planting. Effective vegetative barriers are typically at least 6 metres thick, with dense foliage and continuous leaf and branch coverage from the ground to the top of the canopy, without gaps at the base or within the structure. Evergreen species are generally more effective than deciduous trees for this purpose, and the barrier should be located as close as possible to the emission sources (U.S. EPA 2016).



9 Conclusions

The following conclusions were made from the air quality and greenhouse gas impact assessment:

Operation Phase – Project Alone (Without Background)

- The maximum predicted Project Alone GLCs (without background) for all CoPCs are below their respective AAQC and/or CAAQS other than NO₂ for all five scenarios and B(a)P in the Baseline (2020), Future Interim (2034) No Build and Future Interim (2034) Build scenarios.
- The maximum predicted 1-hour NO₂ GLC exceeds the CAAQS by 211% for the Baseline scenario, 62% for the Future Interim No Build, 64% for the Future Interim Build, 9% for the Future Ultimate No Build, and 11% for the Future Ultimate Build scenarios. The maximum exceedance occurs at receptor R009 (a residence on Old Sharpe's Lane) for all five scenarios.
- NO₂ concentrations were predicted using the US EPA Ambient Ratio Method (ARM2) methodology, which provides conservative estimates of NO₂ formation in the atmosphere. Maximum predicted hourly average NO₂ concentrations were conservatively compared directly to the 1-hour CAAQS rather than the 98th percentile metric, as the CAL3QHCR model does not provide outputs of the appropriate statistical measure required for direct comparison to the CAAQS.
- Maximum predicted Project Alone hourly and 24-hour average NO₂ concentration were below the provincial NO₂ AAQCs for all scenarios.
- The maximum predicted annual average NO₂ GLCs are above the CAAQS by 141% at receptor R009 for the Baseline scenario, and by 5% at receptor R059* (a residence on Waverly Drive) for the Future Interim Build Scenario.
- The maximum predicted 24-hour and annual average B(a)P concentrations for the Baseline scenario are above the AAQCs by 309% at receptor R059* and 541% at receptor R009, respectively. The maximum predicted B(a)P concentrations decrease for the Future Interim and Future Ultimate scenarios relative to the Baseline scenario, with the maximum predicted 24-hour average concentrations being below their AAQCs for all four future scenarios.
- Exceedances of the annual B(a)P AAQC are predicted for the Future Interim No Build scenario by 48% and the Future Interim Build scenario by 52% for all five



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

9 Conclusions

February 6, 2026

modelled years, with no exceedances predicted for the Future Ultimate scenarios.

Operation Phase – Cumulative (With Background)

- Maximum predicted cumulative GLCs (i.e., with background) of all CoPCs other than NO₂ and B(a)P are below their respective AAQC and/or CAAQS at all special receptors for all scenarios.
- Predicted cumulative NO₂ concentrations exceed the 1-hour CAAQS for all scenarios, while cumulative annual average NO₂ concentration exceed the CAAQS for the Baseline (2020) and Future Interim (2034) scenarios. However, the maximum predicted NO₂ concentrations are well below the provincial hourly and 24-hour average AAQC.
- Maximum predicted cumulative B(a)P concentrations exceed the 24-hour and annual average AAQCs at all special receptor locations for all scenarios, with the background concentrations alone exceeding the 24-hour and annual average AAQCs. The maximum cumulative B(a)P concentrations are predicted to decrease in the Future Interim and Future Ultimate No Build / Build scenarios relative to the Baseline scenario due to expected future reductions in vehicle emissions.
- For all COPCs except PM₁₀, the maximum predicted cumulative concentrations for the future scenarios are lower than the Baseline scenario due to expected advances in cleaner fuels and emissions control technology, which are anticipated to lower all vehicle contaminant tailpipe emissions in the future and are incorporated into the MOVES5 model. The modifications to Highway 401 from the Baseline Scenario to the Future Ultimate Build Scenario should promote smoother traffic flow that could also help to improve air quality by reducing gridlock.

Construction

- During Project construction, particulate matter (dust) will be the primary CoPC. NO₂, VOCs, and GHGs will also be emitted from equipment used during construction. As the construction activities will be short-term and intermittent, air contaminant and GHG emissions are expected to be minor provided adequate mitigation measures are implemented.



Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

9 Conclusions

February 6, 2026

Mitigation

- During Project construction, industry best management practices should be implemented to minimize air contaminants and GHG emissions.
- During Project operation, air quality levels are generally predicted to decrease relative to Baseline levels and mitigation measures such as retaining existing or integrating additional vegetation barriers to the Project design can be used to further decrease particulates and NO₂ levels. The vegetation barrier should be thick (approximately 6-metres or more) and have full leaf and branch coverage from the ground to the top of the canopy with no gaps in-between or underneath the vegetation and the barrier should be located close to the emissions sources. Evergreen species are more effective than deciduous species for this objective.

Greenhouse Gases

- Annual GHG emissions from the Project operation are expected to be insignificant (less than 0.1%) compared to Canada and Ontario 2023 GHG emission totals and 2030 emissions reduction targets.



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Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

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Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

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**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

February 6, 2026

Appendices



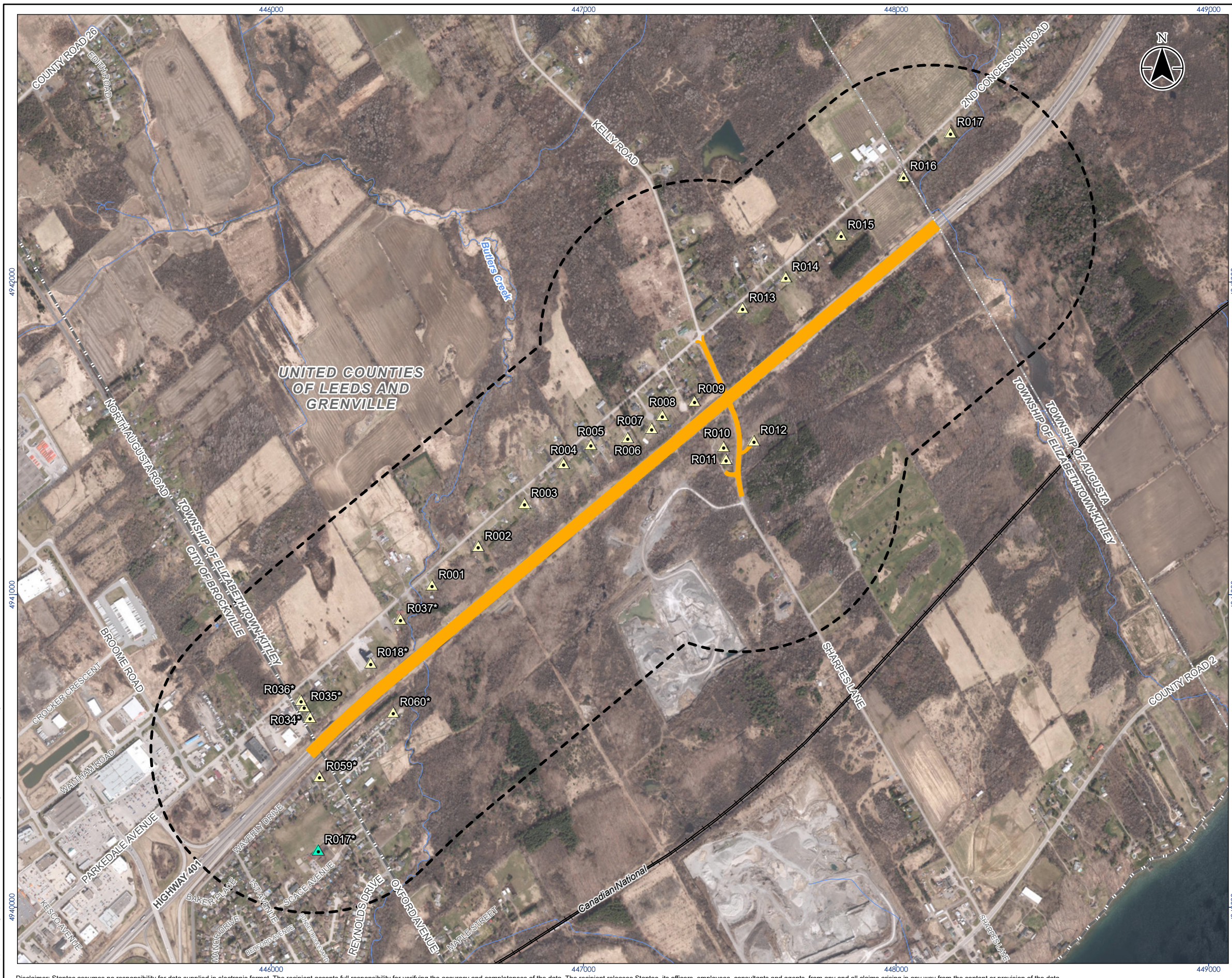
**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

Appendix A Air Quality Study Area and Special Receptors

February 6, 2026

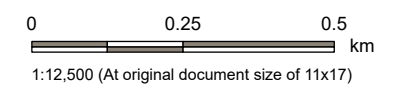
Appendix A Air Quality Study Area and Special Receptors





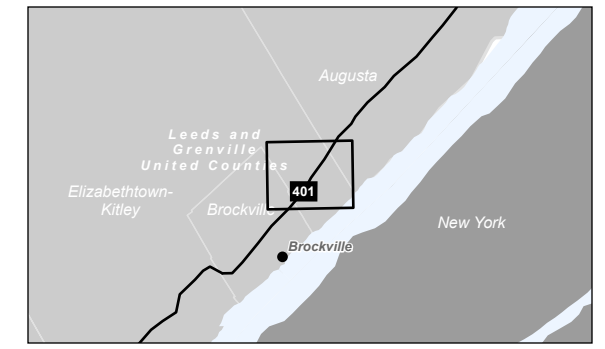
Legend

- Air Quality Receptor**
- Critical
 - Sensitive
 - Preferred Plan - Edge of Pavement
 - Railway
 - Watercourse (Intermittent)
 - Watercourse (Permanent)
 - Municipal Boundary, Upper
 - Municipal Boundary, Lower
 - Air Quality Study Area - 500 m



Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.
3. Orthomagery licensed under Open Government License - Ontario. Imagery Date, 2020.



Project Location: United Counties of Leeds and Grenville
 Prepared by jsa on 2026-02-05
 Technical Review by JWH on 2026-02-05

Client/Project: MINISTRY OF TRANSPORTATION
 HIGHWAY 401 PLANNING STUDY EAST OF BROCKVILLE
 (GWP 4111-22-00)

Figure No.

A.1

Title

Air Quality Receptors

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 Revised: 2026-02-05 by: jsa

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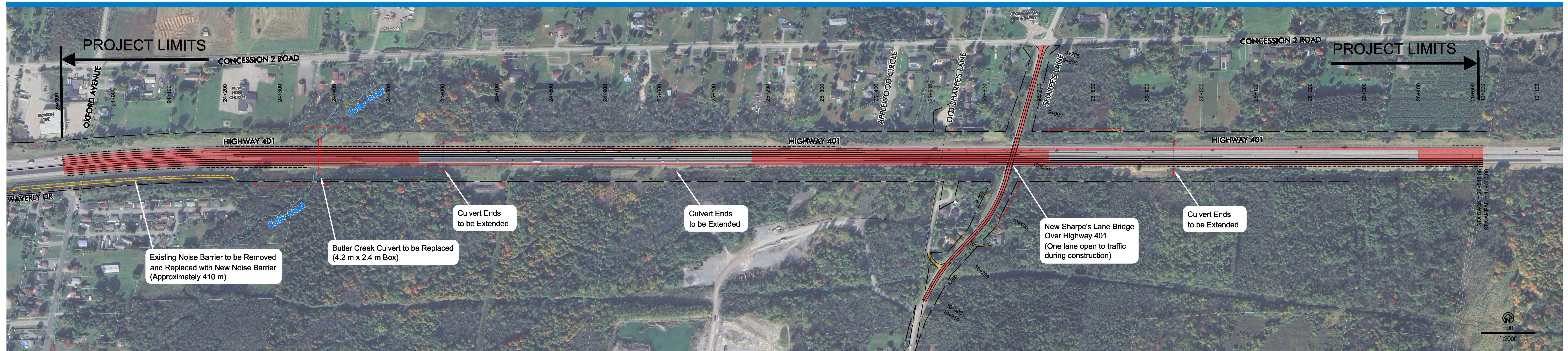
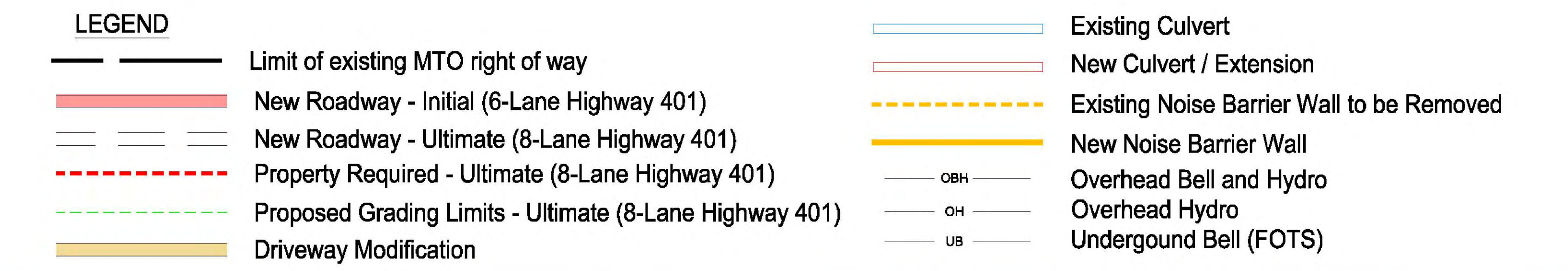
**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**
Appendix B Preferred Plan
February 6, 2026

Appendix B Preferred Plan

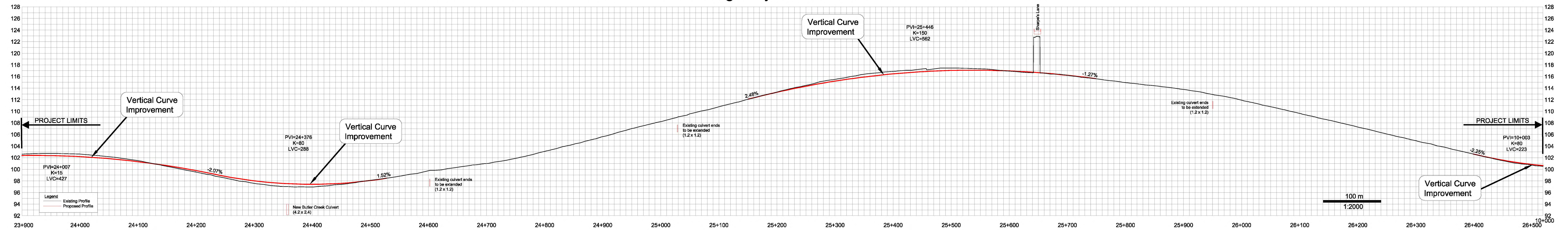


Highway 401 Technically Preferred Plan

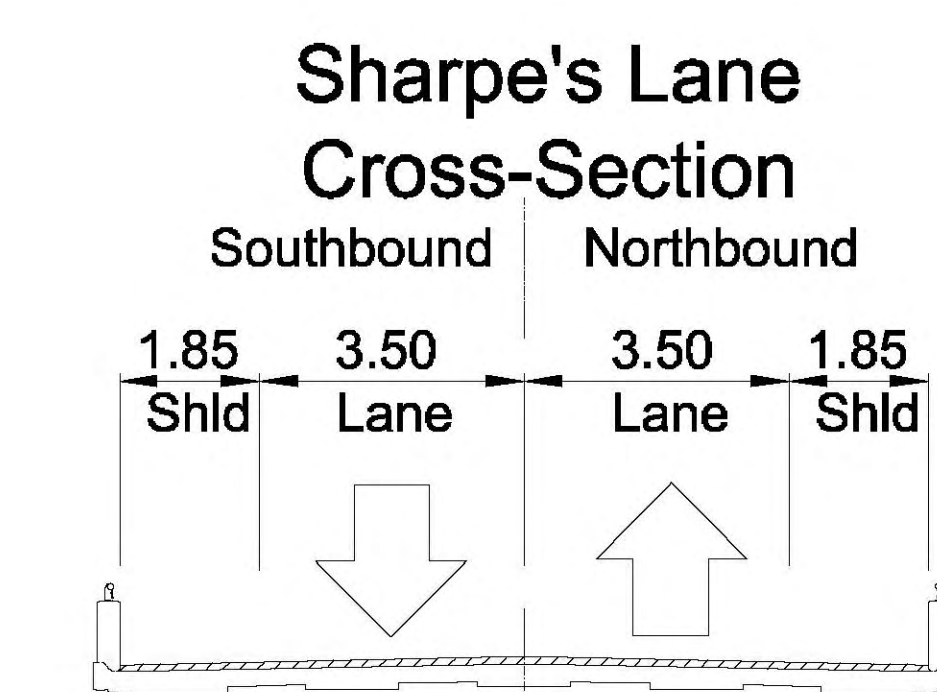
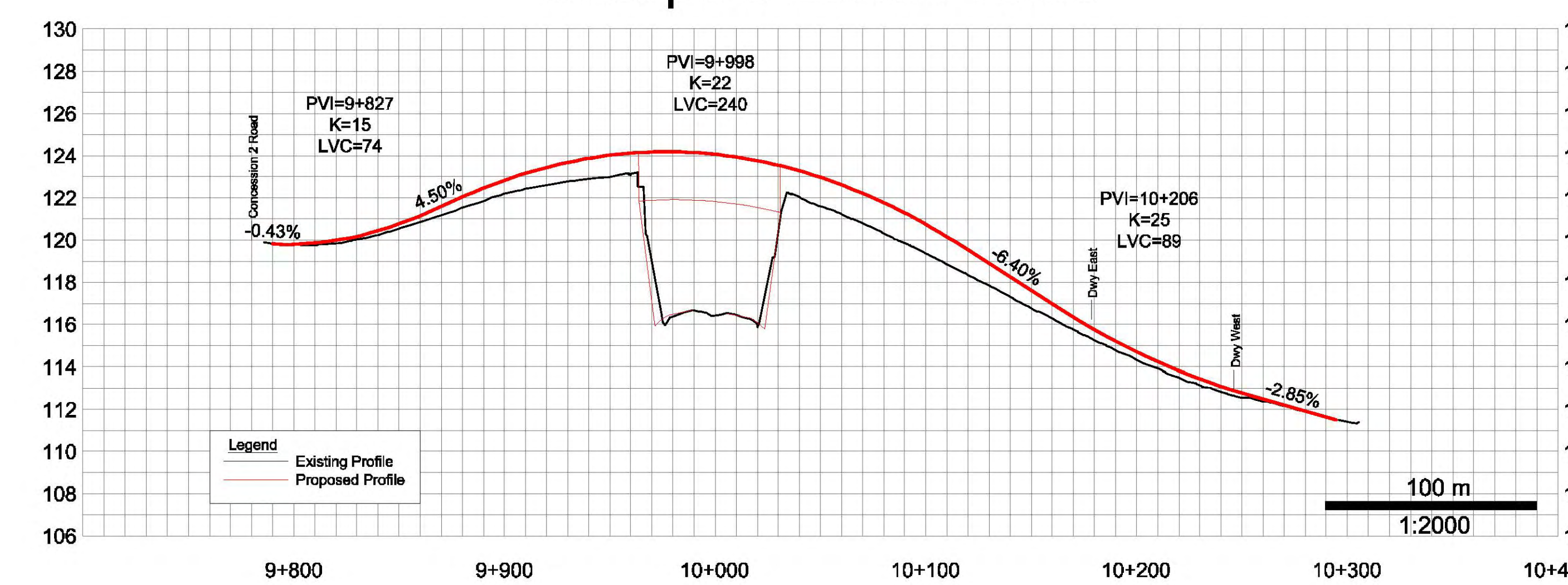
Study Area Improvement Plan



Highway 401 Profile



Sharpe's Lane Profile



**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

Appendix C Traffic Data and Assumptions

February 6, 2026

Appendix C Traffic Data and Assumptions



Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix C: Traffic Data and Assumptions

Assessment Scenario	Baseline				Future No-Build/Do-nothing scenario - 4 lanes for Highway 401					Future Build - 6 lanes for Highway 401 + interchange/alignment/bridge improvements					Future Build - 6 lanes for Highway 401 + interchange/alignment/bridge improvements					Future Build - 8 lanes for Highway 401 + interchange/alignment/bridge improvements					Traffic Volumes as a Percentage of AADT ²				
	2020				10-year (2034)					10-year (2034)					20-year (2044)					20-year (2044)					Vehicles during 07:00 to 23:00 (%)	Autos (%)	Commercial Vehicles (%)	Medium Trucks (%)	Heavy Trucks (%)
Roadway	Peak AM	Peak PM	AADT	Posted Traffic Speed (km/h)	Peak AM	Peak PM	SADT	AADT	Posted Traffic Speed (km/h)	Peak AM	Peak PM	SADT	AADT	Posted Traffic Speed (km/h)	Peak AM	Peak PM	SADT	AADT	Posted Traffic Speed (km/h)	Peak AM	Peak PM	SADT	AADT	Posted Traffic Speed (km/h)					
Highway 401 - from North Augusta Road to Maitland Road Eastbound ¹	996	2,642	20,229	100	1,919	3,929	26,519	27,060	110	1,909	4,329	26,519	27,060	110	2,179	5,108	32,644	33,311	110	2,190	5,182	32,644	33,311	110	86%	78%	22%	3%	18%
Highway 401 - from North Augusta Road to Maitland Road Westbound ¹	1,296	2,020	19,435	100	1,679	2,805	25,479	25,999	110	1,680	2,799	25,479	25,999	110	1,987	3,379	31,364	32,004	110	2,002	3,396	31,364	32,004	110	89%	74%	26%	7%	19%
Sharpe's Lane ^{3,4}	533	748	7,480	60	568	849	-	8,490	60	569	821	-	8,210	60	616	923	-	9,230	60	615	926	-	9,260	60	95%	98%	2%	2%	0%

- Notes:
- Data in the above table were provided by CIMA to Stantec on Sept 17, 2025.
 - The AADT per direction is based on the AADT multiplied by the directional split calculated from 2016 ATR counts. The AADT is converted to the SADT by multiplying by a factor of 0.98 based on the ATR counts. The future peak volumes were extracted from the Aimsun model.
 - The percentage of autos, commercial, medium trucks and heavy trucks is based on the daily average from existing ATR counts along the section of Highway 401 between Stewart Boulevard and North Augusta due to lack of data available.
 - The peak hour volumes were extracted from the Aimsun model. The AADT was estimated by assuming a k-factor of 0.1 applied to the PM peak hour.
 - The traffic volumes as a percentage of AADT was estimated from existing ATR counts collected at N Augusta Road due to lack of data available at Sharpe's Lane.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix C: Traffic Data and Assumptions

Hourly Traffic Distributions - Existing (2020) Baseline Scenario

Hour of Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Highway Traffic Distribution	1.4%	1.1%	0.9%	0.9%	0.9%	1.4%	2.5%	3.9%	4.4%	5.2%	6.0%	6.5%	6.5%	6.6%	7.0%	7.7%	7.8%	7.1%	5.7%	4.7%	3.9%	3.3%	2.5%	2.0%
Interchange Roads Distribution	0.4%	0.1%	0.1%	0.1%	0.3%	0.8%	2.8%	5.2%	5.1%	5.5%	6.6%	6.8%	7.8%	8.0%	7.9%	9.5%	9.5%	7.4%	5.4%	4.1%	2.7%	2.0%	1.1%	0.9%

Hour of day traffic profiles provided by CIMA+ via email on September 17, 2025.

Group Link ID	Link ID	2020 AADT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EB_401	1	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	2	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	3	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	4	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	5	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	6	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
EB_401	7	20,229	293	230	184	175	173	289	497	793	896	1,045	1,221	1,308	1,321	1,330	1,420	1,549	1,584	1,438	1,160	958	792	658	508	408
WB_401	8	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	9	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	10	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	11	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	12	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	13	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
WB_401	14	19,435	281	221	177	168	166	278	477	762	861	1,004	1,173	1,256	1,270	1,278	1,365	1,488	1,522	1,381	1,114	921	761	632	488	392
SL	15	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	16	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	17	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	18	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	19	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	20	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	21	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	22	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	23	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	24	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67
SL	25	7,480	27	10	9	6	24	61	207	388	383	414	492	510	580	599	589	711	707	550	407	307	199	146	85	67

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix C: Traffic Data and Assumptions

Hourly Traffic Distributions - Future (2034) Interim No Build Scenario

Hour of Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Highway Traffic Distribution	1.4%	1.1%	0.9%	0.9%	0.9%	1.4%	2.5%	3.9%	4.4%	5.2%	6.0%	6.5%	6.5%	6.6%	7.0%	7.7%	7.8%	7.1%	5.7%	4.7%	3.9%	3.3%	2.5%	2.0%
Interchange Roads Distribution	0.4%	0.1%	0.1%	0.1%	0.3%	0.8%	2.8%	5.2%	5.1%	5.5%	6.6%	6.8%	7.8%	8.0%	7.9%	9.5%	9.5%	7.4%	5.4%	4.1%	2.7%	2.0%	1.1%	0.9%

Hour of day traffic profiles provided by CIMA+ via email on September 17, 2025.

Group Link ID	Link ID	2034 AADT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EB_401	1	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	2	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	3	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	4	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	5	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	6	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	7	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	8	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
WB_401	9	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	10	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	11	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	12	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	13	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	14	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
SL	15	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	16	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	17	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	18	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	19	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	20	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	21	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	22	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	23	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	24	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76
SL	25	8,490	30	11	11	7	28	69	235	441	435	470	558	579	658	679	669	807	802	624	462	349	226	166	97	76

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix C: Traffic Data and Assumptions

Hourly Traffic Distributions - Future (2034) Interim Build Scenario

Hour of Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Highway Traffic Distribution	1.4%	1.1%	0.9%	0.9%	0.9%	1.4%	2.5%	3.9%	4.4%	5.2%	6.0%	6.5%	6.5%	6.6%	7.0%	7.7%	7.8%	7.1%	5.7%	4.7%	3.9%	3.3%	2.5%	2.0%
Interchange Roads Distribution	0.4%	0.1%	0.1%	0.1%	0.3%	0.8%	2.8%	5.2%	5.1%	5.5%	6.6%	6.8%	7.8%	8.0%	7.9%	9.5%	9.5%	7.4%	5.4%	4.1%	2.7%	2.0%	1.1%	0.9%

Hour of day traffic profiles provided by CIMA+ via email on September 17, 2025.

Group Link ID	Link ID	2034 AADT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EB_401	1	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	2	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	3	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	4	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	5	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	6	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
EB_401	7	27,060	391	308	246	234	231	387	665	1,061	1,199	1,398	1,633	1,749	1,768	1,779	1,900	2,072	2,119	1,923	1,552	1,282	1,060	880	679	546
WB_401	8	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	9	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	10	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	11	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	12	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	13	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
WB_401	14	25,999	376	296	237	225	222	371	639	1,019	1,152	1,343	1,569	1,680	1,698	1,710	1,826	1,991	2,036	1,848	1,491	1,231	1,018	846	652	524
SL	15	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	16	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	17	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	18	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	19	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	20	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	21	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	22	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	23	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	24	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73
SL	25	8,210	29	11	10	7	27	67	228	426	421	455	540	560	637	657	647	780	776	603	447	337	218	161	94	73

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix C: Traffic Data and Assumptions

Hourly Traffic Distributions - Future (2044) Ultimate No Build Scenario

Hour of Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Highway Traffic Distribution	1.4%	1.1%	0.9%	0.9%	0.9%	1.4%	2.5%	3.9%	4.4%	5.2%	6.0%	6.5%	6.5%	6.6%	7.0%	7.7%	7.8%	7.1%	5.7%	4.7%	3.9%	3.3%	2.5%	2.0%
Interchange Roads Distribution	0.4%	0.1%	0.1%	0.1%	0.3%	0.8%	2.8%	5.2%	5.1%	5.5%	6.6%	6.8%	7.8%	8.0%	7.9%	9.5%	9.5%	7.4%	5.4%	4.1%	2.7%	2.0%	1.1%	0.9%

Hour of day traffic profiles provided by CIMA+ via email on September 17, 2025.

Group Link ID	Link ID	2044 AADT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EB_401	1	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	2	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	3	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	4	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	5	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	6	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	7	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
WB_401	8	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	9	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	10	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	11	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	12	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	13	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	14	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
SL	15	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	16	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	17	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	18	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	19	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	20	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	21	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	22	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	23	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	24	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82
SL	25	9,230	33	12	12	8	30	75	256	479	473	511	607	630	716	739	727	877	872	678	502	379	245	181	105	82

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix C: Traffic Data and Assumptions

Hourly Traffic Distributions - Future (2044) Ultimate Build Scenario

Hour of Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Highway Traffic Distribution	1.4%	1.1%	0.9%	0.9%	0.9%	1.4%	2.5%	3.9%	4.4%	5.2%	6.0%	6.5%	6.5%	6.6%	7.0%	7.7%	7.8%	7.1%	5.7%	4.7%	3.9%	3.3%	2.5%	2.0%
Interchange Roads Distribution	0.4%	0.1%	0.1%	0.1%	0.3%	0.8%	2.8%	5.2%	5.1%	5.5%	6.6%	6.8%	7.8%	8.0%	7.9%	9.5%	9.5%	7.4%	5.4%	4.1%	2.7%	2.0%	1.1%	0.9%

Hour of day traffic profiles provided by CIMA+ via email on September 17, 2025.

Group Link ID	Link ID	2044 AADT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EB_401	1	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	2	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	3	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	4	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	5	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	6	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
EB_401	7	33,311	482	379	303	288	285	476	818	1,306	1,475	1,721	2,010	2,153	2,176	2,191	2,339	2,550	2,609	2,367	1,910	1,578	1,304	1,084	836	672
WB_401	8	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	9	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	10	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	11	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	12	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	13	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
WB_401	14	32,004	463	364	291	277	273	457	786	1,255	1,418	1,653	1,931	2,069	2,091	2,105	2,247	2,450	2,506	2,275	1,835	1,516	1,253	1,041	803	645
SL	15	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	16	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	17	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	18	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	19	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	20	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	21	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	22	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	23	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	24	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83
SL	25	9,260	33	12	12	8	30	76	257	481	475	513	609	632	718	741	730	880	875	681	504	380	246	181	106	83

Air Quality Impact Assessment for the Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D Air Quality and Greenhouse Gas Emission Estimation

February 6, 2026

Appendix D Air Quality and Greenhouse Gas Emission Estimation



Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Existing (2020) Baseline Scenario

Group Link or Link ID	Link Description	Link Type	Travel Direction	# of Lanes	Lane Width (m)	Mixing Zone Width (m)	Link Height (m)	2020 AADT	Peak (vehicles/hr)	% Passenger Car	% Medium Truck	% Heavy Truck	Posted Speed (km/h)	Assumed Average Travel Speed (km/h)
EB 401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	Cruise	EB	2	3.75	13.5	0.89	20,229	2,642	78%	3%	18%	100	100
WB 401	Highway 401 - from North Augusta Road to Maitland Road Westbound	Cruise	WB	2	3.75	13.5	0.94	19,435	2,020	74%	7%	19%	100	100
SL	Sharpe's Lane	Cruise	NB/SB	2	3.50	13.0	0.17	7,480	748	98%	2%	0%	60	60

Notes:

Mixing Zone Width (m) = Lane width (m) + 3 m + 3 m

SL's bridge link is assigned a release height of 8.44 m

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Existing (2020) Baseline Scenario

Description:

Dust emissions from public road traffic are estimated in this sheet. All roads in the study area are paved.

Contaminant(s) of Concern:

Particulate matter, including PM₁₀, and PM_{2.5} emissions are the contaminants of concern due to the traffic on paved road. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface of roads.

Methodology: Emission Factor (EF)

Emission factor was calculated using Equation (1a) in the US EPA AP-42 document Chapter 13.2.1. (Paved Road). The equation is:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

where:

E = particulate emission factor (g/VMT)

k = particle size multiplier for particle size range and units of interest (g/VMT)

sL = road surface silt loading (g/m²)

W = average weight of vehicles traveling the road (tons)

Vehicle Weight Calculation:

Group Link or Link ID	Link Description	Weight of Vehicle ⁽¹⁾ , (tons)			Percentage of Vehicle			Average Weight ⁽²⁾ (tons)
		Car	Medium Truck	Heavy Truck	Car	Medium Truck	Heavy Truck	
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	1.8	10	20	78%	3%	18%	5.4
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	1.8	10	20	74%	7%	19%	5.9
SL	Sharpe's Lane	1.8	10	20	98%	2%	0%	2.0

Notes:

(1) Average weight of each type of vehicle is assumed (trucks will include empty load and full load of containers)

(2) Since there are different vehicles running on different schedules and the estimation methodology suggested by US. EPA is intended for a "fleet" average weight of all vehicles travelling on the road, a weighted (based on weight of each vehicle and travelled distance) vehicle mass is used for emissions estimation. Therefore, the average weight on each road is estimated based on the traffic data.

Emission Factor Calculation:

Road Source ID	Road and Direction	Average Vehicle Weight (tons)	Particle Size Factor k ⁽¹⁾ (g/VMT)		2020 AADT	Silt Loading ⁽²⁾	Emission Factor ⁽³⁾ (g/VMT)	
			PM10	PM2.5		g/m ²	PM10	PM2.5
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	5.4	1.00	0.25	20,229	0.015	0.123	0.031
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	5.9	1.00	0.25	19,435	0.015	0.133	0.033
SL	Sharpe's Lane	2.0	1.00	0.25	7,480	0.060	0.154	0.039

Notes:

(1) Reference: US EPA, AP-42 Table 13.2.1-1

(2) Ubiquitous Silt Loading Default Values (AP-42 Chapter 13.2.1 - T2). The ADT on the subject road is used in the evaluation.

ADT Category	sL (g/m ²)
<500	0.6
500-5,000	0.2
5,000-10,000	0.06
>10,000	0.03
>10,000	0.015 (limited access highway)

(3) Emission factors are calculated using the above equation.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emission Factors from MOVES and Resuspended Road Dust By Contaminant and By Link in g/VMT - Existing (2020) Baseline Scenario

Group Link ID	Link ID	Link Description	2020 AADT	2020 Peak Volume (veh/hour)	Assigned Average Speed km/hr	Assigned Average Speed (mph)	Vehicle Distribution & Road Type ID	MOVES Generic Link ID	Pollutant Name, ID and Emission Factor in g/VMT												
									Carbon Monoxide	Oxides of Nitrogen (Nox)	Methane	Nitrous oxide	Atmospheric CO2	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Benzo(a)pyrene	PM10	PM2.5
									2	3	5	6	90	20	24	25	26	27	Benzo(a)pyrene	PM10	PM2.5
EB 401	1	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	2	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	3	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	4	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	5	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	6	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
EB 401	7	Highway 401 - from North Augusta Road to Maitland Road Eastbound	20,229	2,642	100	62.1	78.2% car, 3.4% medium truck, 18.4% heavy truck - 100 km/h, 2	1	3.6096	2.4160	0.0240	0.0243	541.0770	0.0032	0.0005	0.0070	0.0037	0.0005	0.0000	0.2270	0.1091
WB 401	8	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	9	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	10	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	11	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	12	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	13	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
WB 401	14	Highway 401 - from North Augusta Road to Maitland Road Westbound	19,435	2,020	100	62.1	74% car, 7% medium truck, 19% heavy truck - 100 km/h, 2	2	3.6745	2.6080	0.0253	0.0265	569.8360	0.0033	0.0006	0.0078	0.0041	0.0006	0.0000	0.2470	0.1199
SL	15	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	16	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	17	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	18	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	19	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	20	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	21	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	22	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	23	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	24	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537
SL	25	Sharpe's Lane	7,480	748	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	4.9909	0.4403	0.0257	0.0034	327.8950	0.0048	0.0006	0.0026	0.0019	0.0002	0.0000	0.1959	0.0537

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Future (2034) Interim No Build Scenario

Group Link or Link ID	Link Description	Link Type	Travel Direction	# of Lanes	Lane Width (m)	Mixing Zone Width (m)	Link Height (m)	2034 AADT	Peak PM (vehicles/hr)	% Passenger Car	% Medium Truck	% Heavy Truck	Posted Traffic Speed (km/h)	Assumed Average Travel Speed (km/h)
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	Cruise	EB	2	3.75	13.5	0.89	27,060	3,929	78%	3%	18%	110	110
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	Cruise	WB	2	3.75	13.5	0.94	25,999	2,805	74%	7%	19%	110	110
SL	Sharpe's Lane	Cruise	NB/SB	2	3.50	13.0	0.17	8,490	849	98%	2%	0%	110	110

Notes:

Mixing Zone Width (m) = Lane width (m) + 3 m + 3 m
 SL's bridge link is assigned a release height of 8.44 m

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2034) Interim No Build Scenario

Description:

Dust emissions from public road traffic are estimated in this sheet. All roads in the study area are paved.

Contaminant(s) of Concern:

Particulate matter, including PM₁₀, and PM_{2.5} emissions are the contaminants of concern due to the traffic on paved road.
 Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface of roads.

Methodology: Emission Factor (EF)

Emission factor was calculated using Equation (1a) in the US EPA AP-42 document Chapter 13.2.1. (Paved Road). The equation is:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

where:

E = particulate emission factor (g/VMT)

k = particle size multiplier for particle size range and units of interest (g/VMT)

sL = road surface silt loading (g/m²)

W = average weight of vehicles traveling the road (tons)

Vehicle Weight Calculation:

Group Link or Link ID	Link Description	Weight of Vehicle ⁽¹⁾ , (tons)			Percentage of Vehicle			Average Weight ⁽²⁾ (tons)
		Car	Medium Truck	Heavy Truck	Car	Medium Truck	Heavy Truck	
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	1.8	10	20	78%	3%	18%	5.4
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	1.8	10	20	74%	7%	19%	5.9
SL	Sharpe's Lane	1.8	10	20	98%	2%	0%	2.0

Notes:

(1) Average weight of each type of vehicle is assumed (trucks will include empty load and full load of containers)

(2) Since there are different vehicles running on different schedules and the estimation methodology suggested by US. EPA is intended for a "fleet" average weight of all vehicles travelling on the road, a weighted (based on weight of each vehicle and travelled distance) vehicle mass is used for emissions estimation. Therefore, the average weight on each road is estimated based on the traffic data.

Emission Factor Calculation:

Road Source ID	Road and Direction	Average Vehicle Weight (tons)	Particle Size Factor k ⁽¹⁾ (g/VMT)		2034 ADT	Silt Loading ⁽²⁾	Emission Factor ⁽³⁾ (g/VMT)	
			PM10	PM2.5		g/m ²	PM10	PM2.5
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	5.4	1.00	0.25	27,060	0.015	0.123	0.031
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	5.9	1.00	0.25	25,999	0.015	0.133	0.033
SL	Sharpe's Lane	2.0	1.00	0.25	8,490	0.060	0.154	0.039

Notes:

(1) Reference: US EPA, AP-42 Table 13.2.1-1

(2) Ubiquitous Silt Loading Default Values (AP-42 Chapter 13.2.1 - T2). The ADT on the subject road is used in the evaluation.

ADT Category	sL (g/m ²)
<500	0.6
500-5,000	0.2
5,000-10,000	0.06
>10,000	0.03
>10,000	0.015 (limited access highway)

(3) Emission factors are calculated using the above equation.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emission Factors from MOVES and Resuspended Road Dust By Contaminant and By Link in g/VMT - Future (2034) Interim No Build Scenario

Group Link ID	Link ID	Link Description	2034 AADT	2034 Peak Volume (veh/hour)	Assigned Average Speed km/hr	Assigned Average Speed (mph)	Vehicle Distribution & Road Type ID	MOVES Generic Link ID	Pollutant Name, ID and Emission Factors in g/VMT												
									Carbon Monoxide	Oxides of Nitrogen (Nox)	Methane	Nitrous oxide	Atmospheric CO2	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Benzo(a)pyrene	PM10	PM2.5
									2	3	5	6	90	20	24	25	26	27	Benzo(a)pyrene	PM10	PM2.5
EB_401	1	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	2	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	3	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	4	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	5	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	6	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	7	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	6.6765E-01	1.7555E-02	3.4592E-02	394.1960	6.2964E-04	8.0353E-05	1.4574E-03	9.1014E-04	1.1173E-04	1.4115E-06	1.5380E-01	4.7160E-02
EB_401	8	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	3,929	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	4.9387E-02
WB_401	9	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
WB_401	10	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
WB_401	11	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
WB_401	12	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
WB_401	13	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
WB_401	14	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,805	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	7.2945E-01	1.9064E-02	3.7789E-02	421.6010	6.6026E-04	8.9014E-05	1.7175E-03	1.0385E-03	1.3259E-04	1.6050E-06	1.6651E-01	5.1801E-02
SL	15	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	16	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	17	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	18	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	19	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	20	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	21	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	22	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	23	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	24	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02
SL	25	Sharpe's Lane	8,490	849	110	68.4	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	1.3956E-01	9.0169E-03	2.3366E-03	185.4840	9.4908E-04	8.9623E-05	6.0128E-04	4.3013E-04	3.4368E-05	8.0080E-07	1.7622E-01	4.5608E-02

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Future (2034) Interim Build Scenario

Group Link or Link ID	Link Description	Link Type	Travel Direction	# of Lanes	Lane Width (m)	Mixing Zone Width (m)	Link Height (m)	2034 AADT	Peak PM (vehicles/hr)	% Passenger Car	% Medium Truck	% Heavy Truck	Posted Traffic Speed (km/h)	Assumed Average Travel Speed (km/h)
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	Cruise	EB	3	3.75	17.3	0.89	27,060	4,329	78%	3%	18%	110	110
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	Cruise	WB	3	3.75	17.3	0.94	25,999	2,799	74%	7%	19%	110	110
SL	Sharpe's Lane	Cruise	NB	2	3.50	13.0	0.17	8,210	821	98%	2%	0%	60	60

Notes:

Mixing Zone Width (m) = Lane width (m) + 3 m + 3 m

Bridges are modelled at a release height = link height + 8.8 m.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2034) Interim Build Scenario

Description:

Dust emissions from public road traffic are estimated in this sheet. All roads in the study area are paved.

Contaminant(s) of Concern:

Particulate matter, including PM₁₀, and PM_{2.5} emissions are the contaminants of concern due to the traffic on paved road. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface of roads.

Methodology: Emission Factor (EF)

Emission factor was calculated using Equation (1a) in the US EPA AP-42 document Chapter 13.2.1. (Paved Road). The equation is:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

where:

E = particulate emission factor (g/VMT)

k = particle size multiplier for particle size range and units of interest (g/VMT)

sL = road surface silt loading (g/m²)

W = average weight of vehicles traveling the road (tons)

Vehicle Weight Calculation:

Group Link or Link ID	Link Description	Weight of Vehicle ⁽¹⁾ , (tons)			Percentage of Vehicle			Average Weight ⁽²⁾ (tons)
		Car	Medium Truck	Heavy Truck	Car	Medium Truck	Heavy Truck	
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	1.8	10	20	78%	3%	18%	5.4
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	1.8	10	20	74%	7%	19%	5.9
SL	Sharpe's Lane	1.8	10	20	98%	2%	0%	2.0

Notes:

(1) Average weight of each type of vehicle is assumed (trucks will include empty load and full load of containers)

(2) Since there are different vehicles running on different schedules and the estimation methodology suggested by US. EPA is intended for a "fleet" average weight of all vehicles travelling on the road, a weighted (based on weight of each vehicle and travelled distance) vehicle mass is used for emissions estimation. Therefore, the average weight on each road is estimated based on the traffic data.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2034) Interim Build Scenario

Emission Factor Calculation:

Road Source ID	Road and Direction	Average Vehicle Weight (tons)	Particle Size Factor k ⁽¹⁾ (g/VMT)		2034 ADT	Silt Loading ⁽²⁾	Emission Factor ⁽³⁾ (g/VMT)	
			PM10	PM2.5		g/m ²	PM10	PM2.5
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	5.4	1.00	0.25	27,060	0.015	0.123	0.031
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	5.9	1.00	0.25	25,999	0.015	0.133	0.033
SL	Sharpe's Lane	2.0	1.00	0.25	8,210	0.06	0.154	0.039

Notes:

(1) Reference: US EPA, AP-42 Table 13.2.1-1

(2) Ubiquitous Silt Loading Default Values (AP-42 Chapter 13.2.1 - T2). The ADT on the subject road is used in the evaluation.

ADT Category	sL (g/m ²)
<500	0.6
500-5,000	0.2
5,000-10,000	0.06
>10,000	0.03
>10,000	0.015 (limited access highway)

(3) Emission factors are calculated using the above equation.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Source: Emissions Factors from MOVES and Resuspended Road Dust - Future (2034) Interim Build Scenario

Group Link ID	Link ID	Link Description	2034 AADT	2034 Peak Volume (veh/hour)	Assigned Average Speed km/hr	Assigned Average Speed (mph)	Vehicle Distribution & Road Type ID	MOVES Generic Link ID	Pollutant Name, ID and Emission Factor in g/VMT													
									Carbon Monoxide	Oxides of Nitrogen (Nox)	Methane	Nitrous oxide	Atmospheric CO2	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Benzo(a)pyrene	PM10	PM2.5	
										2	3	5	6	90	20	24	25	26	27	Benzo(a)pyrene	PM10	PM2.5
EB_401	1	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	2	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	3	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	4	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	5	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	6	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
EB_401	7	Highway 401 - from North Augusta Road to Maitland Road Eastbound	27,060	4,329	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	1.9488	0.6677	0.0176	0.0346	394.1960	0.0006	0.0001	0.0015	0.0009	0.0001	0.0000	0.0000	0.1538	0.0472
WB_401	8	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1569	0.0494
WB_401	9	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
WB_401	10	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
WB_401	11	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
WB_401	12	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
WB_401	13	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
WB_401	14	Highway 401 - from North Augusta Road to Maitland Road Westbound	25,999	2,799	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	1.9872	0.7294	0.0191	0.0378	421.6010	0.0007	0.0001	0.0017	0.0010	0.0001	0.0000	0.0000	0.1665	0.0518
SL	15	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	16	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	17	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	18	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	19	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	20	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	21	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	22	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	23	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	24	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456
SL	25	Sharpe's Lane	8,210	821	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	2.2865	0.1396	0.0090	0.0023	185.4840	0.0009	0.0001	0.0006	0.0004	0.0000	0.0000	0.0000	0.1762	0.0456

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Future (2044) Ultimate No Build Scenario

Group Link or Link ID	Link Description	Link Type	Travel Direction	# of Lanes	Lane Width (m)	Mixing Zone Width (m)	Link Height (m)	2044 AADT	Peak PM (vehicles/hr)	% Passenger Car	% Medium Truck	% Heavy Truck	Posted Traffic Speed (km/h)	Assumed Average Travel Speed (km/h)
EB 401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	Cruise	EB	3	3.75	17.3	0.89	33,311	5,108	78%	3%	18%	110	110
WB 401	Highway 401 - from North Augusta Road to Maitland Road Westbound	Cruise	WB	3	3.75	17.3	0.94	32,004	3,379	74%	7%	19%	110	110
SL	Sharpe's Lane	Cruise	NB	2	3.50	13.0	0.17	9,230	923	98%	2%	0%	60	60

Notes:

Mixing Zone Width (m) = Lane width (m) + 3 m + 3 m

Bridges are modelled at a release height = link height + 8.8 m.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2044) Ultimate No Build Scenario

Description:

Dust emissions from public road traffic are estimated in this sheet. All roads in the study area are paved.

Contaminant(s) of Concern:

Particulate matter, including PM₁₀, and PM_{2.5} emissions are the contaminants of concern due to the traffic on paved road. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface of roads.

Methodology: Emission Factor (EF)

Emission factor was calculated using Equation (1a) in the US EPA AP-42 document Chapter 13.2.1. (Paved Road). The equation is:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

where:

E = particulate emission factor (g/VMT)

k = particle size multiplier for particle size range and units of interest (g/VMT)

sL = road surface silt loading (g/m²)

W = average weight of vehicles traveling the road (tons)

Vehicle Weight Calculation:

Group Link or Link ID	Link Description	Weight of Vehicle ⁽¹⁾ , (tons)			Percentage of Vehicle			Average Weight ⁽²⁾ (tons)
		Car	Medium Truck	Heavy Truck	Car	Medium Truck	Heavy Truck	
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	1.8	10	20	78%	3%	18%	5.4
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	1.8	10	20	74%	7%	19%	5.9
SL	Sharpe's Lane	1.8	10	20	98%	2%	0%	2.0

Notes:

(1) Average weight of each type of vehicle is assumed (trucks will include empty load and full load of containers)

(2) Since there are different vehicles running on different schedules and the estimation methodology suggested by US. EPA is intended for a "fleet" average weight of all vehicles travelling on the road, a weighted (based on weight of each vehicle and travelled distance) vehicle mass is used for emissions estimation. Therefore, the average weight on each road is estimated based on the traffic data.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2044) Ultimate No Build Scenario

Emission Factor Calculation:

Road Source ID	Road and Direction	Average Vehicle Weight (tons)	Particle Size Factor k ⁽¹⁾ (g/VMT)		2044 ADT	Silt Loading ⁽²⁾	Emission Factor ⁽³⁾ (g/VMT)	
			PM10	PM2.5		g/m ²	PM10	PM2.5
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	5.4	1.00	0.25	33,311	0.015	0.123	0.031
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	5.9	1.00	0.25	32,004	0.015	0.133	0.033
SL	Sharpe's Lane	2.0	1.00	0.25	9,230	0.06	0.154	0.039

Notes:

(1) Reference: US EPA, AP-42 Table 13.2.1-1

(2) Ubiquitous Silt Loading Default Values (AP-42 Chapter 13.2.1 - T2). The ADT on the subject road is used in the evaluation.

ADT Category	sL (g/m ²)
<500	0.6
500-5,000	0.2
5,000-10,000	0.06
>10,000	0.03
>10,000	0.015 (limited access highway)

(3) Emission factors are calculated using the above equation.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Source: Emissions Factors from MOVES and Resuspended Road Dust - Future (2044) Ultimate No Build Scenario

Group Link ID	Link ID	Link Description	2044 AADT	2044 Peak Volume (veh/hour)	Assigned Average Speed km/hr	Assigned Average Speed (mph)	Vehicle Distribution & Road Type ID	MOVES Generic Link ID	Pollutant Name, ID and Emission Factor in g/MT													
									Carbon Monoxide	Oxides of Nitrogen (Nox)	Methane	Nitrous oxide	Atmospheric CO2	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Benzo(a)pyrene	PM10	PM2.5	
									2	3	5	6	90	20	24	25	26	27	Benzo(a)pyrene	PM10	PM2.5	
EB_401	1	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	2	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	3	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	4	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	5	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	6	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	7	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,108	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
WB_401	8	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	9	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	10	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	11	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	12	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	13	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	14	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,379	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
SL	15	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	16	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	17	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	18	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	19	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	20	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	21	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	22	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	23	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	24	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	25	Sharpe's Lane	9,230	923	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Future (2044) Ultimate Build Scenario

Group Link or Link ID	Link Description	Link Type	Travel Direction	# of Lanes	Lane Width (m)	Mixing Zone Width (m)	Link Height (m)	2044 AADT	Peak PM (vehicles/hr)	% Passenger Car	% Medium Truck	% Heavy Truck	Posted Traffic Speed (km/h)	Assumed Average Travel Speed (km/h)
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	Cruise	EB	4	3.75	21.0	0.89	33,311	5,182	78%	3%	18%	110	110
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	Cruise	WB	4	3.75	21.0	0.94	32,004	3,396	74%	7%	19%	110	110
SL	Sharpe's Lane	Cruise	NB	2	3.50	13.0	0.17	9,260	926	98%	2%	0%	60	60

Notes:

Mixing Zone Width (m) = Lane width (m) + 3 m + 3 m

Bridges are modelled at a release height = link height + 8.8 m.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2044) Ultimate Build Scenario

Description:

Dust emissions from public road traffic are estimated in this sheet. All roads in the study area are paved.

Contaminant(s) of Concern:

Particulate matter, including PM₁₀, and PM_{2.5} emissions are the contaminants of concern due to the traffic on paved road. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface of roads.

Methodology: Emission Factor (EF)

Emission factor was calculated using Equation (1a) in the US EPA AP-42 document Chapter 13.2.1. (Paved Road). The equation is:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

where:

E = particulate emission factor (g/VMT)

k = particle size multiplier for particle size range and units of interest (g/VMT)

sL = road surface silt loading (g/m²)

W = average weight of vehicles traveling the road (tons)

Vehicle Weight Calculation:

Group Link or Link ID	Link Description	Weight of Vehicle ⁽¹⁾ , (tons)			Percentage of Vehicle			Average Weight ⁽²⁾ (tons)
		Car	Medium Truck	Heavy Truck	Car	Medium Truck	Heavy Truck	
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	1.8	10	20	78%	3%	18%	5.4
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	1.8	10	20	74%	7%	19%	5.9
SL	Sharpe's Lane	1.8	10	20	98%	2%	0%	2.0

Notes:

(1) Average weight of each type of vehicle is assumed (trucks will include empty load and full load of containers)

(2) Since there are different vehicles running on different schedules and the estimation methodology suggested by US. EPA is intended for a "fleet" average weight of all vehicles travelling on the road, a weighted (based on weight of each vehicle and travelled distance) vehicle mass is used for emissions estimation. Therefore, the average weight on each road is estimated based on the traffic data.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Emissions from Resuspended Road Dust - Future (2044) Ultimate Build Scenario

Emission Factor Calculation:

Road Source ID	Road and Direction	Average Vehicle Weight (tons)	Particle Size Factor k ⁽¹⁾ (g/VMT)		2044 ADT	Silt Loading ⁽²⁾	Emission Factor ⁽³⁾ (g/VMT)	
			PM10	PM2.5		g/m ²	PM10	PM2.5
EB_401	Highway 401 - from North Augusta Road to Maitland Road Eastbound	5.4	1.00	0.25	33,311	0.015	0.123	0.031
WB_401	Highway 401 - from North Augusta Road to Maitland Road Westbound	5.9	1.00	0.25	32,004	0.015	0.133	0.033
SL	Sharpe's Lane	2.0	1.00	0.25	9,260	0.06	0.154	0.039

Notes:

(1) Reference: US EPA, AP-42 Table 13.2.1-1

(2) Ubiquitous Silt Loading Default Values (AP-42 Chapter 13.2.1 - T2). The ADT on the subject road is used in the evaluation.

ADT Category	sL (g/m ²)
<500	0.6
500-5,000	0.2
5,000-10,000	0.06
>10,000	0.03
>10,000	0.015 (limited access highway)

(3) Emission factors are calculated using the above equation.

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Source: Emissions Factors from MOVES and Resuspended Road Dust - Future (2044) Ultimate Build Scenario

Group Link ID	Link ID	Link Description	2044 AADT	2044 Peak Volume (veh/hour)	Assigned Average Speed km/hr	Assigned Average Speed (mph)	Vehicle Distribution & Road Type ID	MOVES Generic Link ID	Pollutant Name, ID and Emission Factors in g/VT													
									Carbon Monoxide	Oxides of Nitrogen (Nox)	Methane	Nitrous oxide	Atmospheric CO2	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Benzo(a)pyrene	PM10	PM2.5	
									2	3	5	6	90	20	24	25	26	27	Benzo(a)pyrene	PM10	PM2.5	
EB_401	1	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	2	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	3	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	4	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	5	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	6	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
EB_401	7	Highway 401 - from North Augusta Road to Maitland Road Eastbound	33,311	5,182	110	68.4	78.2% car, 3.4% medium truck, 18.4% heavy truck - 110 km/h, 2	1	0.7745	2.6113E-01	1.2552E-02	3.0228E-02	263.4590	1.5198E-04	5.6093E-06	3.8371E-04	2.9674E-04	2.8523E-05	2.6316E-07	1.4239E-01	3.7441E-02	
WB_401	8	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	9	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	10	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	11	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	12	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	13	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
WB_401	14	Highway 401 - from North Augusta Road to Maitland Road Westbound	32,004	3,396	110	68.4	74% car, 7% medium truck, 19% heavy truck - 110 km/h, 2	2	0.8007	2.8554E-01	1.3772E-02	3.3259E-02	288.9290	1.6487E-04	7.8487E-06	4.6537E-04	3.4239E-04	3.4765E-05	3.2691E-07	1.5341E-01	4.0642E-02	
SL	15	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	16	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	17	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	18	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	19	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	20	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	21	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	22	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	23	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	24	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	
SL	25	Sharpe's Lane	9,260	926	60	37.3	98% car, 2% medium truck, 0% heavy truck - 60 km/h, 3	3	0.7698	2.2157E-02	3.5591E-03	1.6283E-03	92.5313	2.2659E-04	1.9185E-06	1.5078E-04	7.7591E-05	8.7843E-06	1.6970E-07	1.7070E-01	4.2833E-02	

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Existing (2020) Baseline Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ID	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
1	1	0.635	20,229	4,687,659	541	0.024	0.0243	548	2,570
2	1	0.107	20,229	790,868	541	0.024	0.0243	548	434
3	1	0.975	20,229	7,201,541	541	0.024	0.0243	548	3,948
4	1	0.650	20,229	4,795,709	541	0.024	0.0243	548	2,629
5	1	0.074	20,229	545,082	541	0.024	0.0243	548	299
6	1	0.096	20,229	711,845	541	0.024	0.0243	548	390
7	1	0.330	20,229	2,437,829	541	0.024	0.0243	548	1,336
8	2	0.327	19,435	2,320,188	570	0.025	0.0265	578	1,340
9	2	0.097	19,435	686,987	570	0.025	0.0265	578	397
10	2	0.073	19,435	515,818	570	0.025	0.0265	578	298
11	2	0.650	19,435	4,609,835	570	0.025	0.0265	578	2,662
12	2	0.977	19,435	6,931,657	570	0.025	0.0265	578	4,004
13	2	0.107	19,435	762,279	570	0.025	0.0265	578	440
14	2	0.631	19,435	4,477,344	570	0.025	0.0265	578	2,586
15	3	0.307	7,480	837,754	328	0.026	0.0034	330	276
16	3	0.033	7,480	88,827	328	0.026	0.0034	330	29
17	3	0.317	7,480	865,449	328	0.026	0.0034	330	285
18	3	0.108	7,480	296,037	328	0.026	0.0034	330	98
19	3	0.049	7,480	134,257	328	0.026	0.0034	330	44
20	3	0.022	7,480	61,213	328	0.026	0.0034	330	20
21	3	0.039	7,480	106,260	328	0.026	0.0034	330	35
22	3	0.062	7,480	168,400	328	0.026	0.0034	330	55
23	3	0.059	7,480	160,576	328	0.026	0.0034	330	53
24	3	0.041	7,480	110,927	328	0.026	0.0034	330	37
25	3	0.673	7,480	1,836,444	328	0.026	0.0034	330	605
Totals	-	-	-	46,140,785	-	-	-	-	24,870

Notes:

- (1) Average daily traffic counts provided by project design team.
- (2) Annual Vehicle miles travelled in one year (VMT/year) = Traffic volume per day x Road Length (mile) x 365 day/year
- (3) MOVES emission factor assigned to each model source.
- (4) Annual CO₂ Equivalent Emissions (t CO_{2e}/ year) = Annual miles travelled (VMT/year) x CO₂ Equivalent Emission Factor (g/VMT) / 1000 g/1kg / 1000 kg/1tonne

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2034) Interim No Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2 **CH4** **N2O**
 1 28 265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
1	1	0.635	27,060	6,270,605	394	0.0176	0.03459	404	2,532
2	1	0.107	27,060	1,057,930	394	0.0176	0.03459	404	427
3	1	0.975	27,060	9,633,383	394	0.0176	0.03459	404	3,890
4	1	0.650	27,060	6,415,141	394	0.0176	0.03459	404	2,591
5	1	0.074	27,060	729,147	394	0.0176	0.03459	404	294
6	1	0.096	27,060	952,223	394	0.0176	0.03459	404	385
7	1	0.330	27,060	3,261,044	394	0.0176	0.03459	404	1,317
8	1	0.327	27,060	3,230,475	422	0.0191	0.03779	432	1,396
9	2	0.097	25,999	919,011	422	0.0191	0.03779	432	397
10	2	0.073	25,999	690,030	422	0.0191	0.03779	432	298
11	2	0.650	25,999	6,166,766	422	0.0191	0.03779	432	2,665
12	2	0.977	25,999	9,272,763	422	0.0191	0.03779	432	4,007
13	2	0.107	25,999	1,019,732	422	0.0191	0.03779	432	441
14	2	0.631	25,999	5,989,528	422	0.0191	0.03779	432	2,588
15	3	0.307	8,490	950,873	185	0.0090	0.00234	186	177
16	3	0.033	8,490	100,821	185	0.0090	0.00234	186	19
17	3	0.317	8,490	982,308	185	0.0090	0.00234	186	183
18	3	0.108	8,490	336,010	185	0.0090	0.00234	186	63
19	3	0.049	8,490	152,386	185	0.0090	0.00234	186	28
20	3	0.022	8,490	69,479	185	0.0090	0.00234	186	13
21	3	0.039	8,490	120,608	185	0.0090	0.00234	186	22
22	3	0.062	8,490	191,138	185	0.0090	0.00234	186	36
23	3	0.059	8,490	182,258	185	0.0090	0.00234	186	34

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2034) Interim No Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
24	3	0.041	8,490	125,905	185	0.0090	0.00234	186	23
25	3	0.673	8,490	2,084,412	185	0.0090	0.00234	186	388
Totals	-	-	-	60,903,977	-	-	-	-	24,217

Notes:

(1) Average daily traffic counts provided by project design team.

(2) Annual Vehicle miles travelled in one year (VMT/year) = Traffic volume per day x Road Length (mile) x 365 day/year

(3) MOVES emission factor assigned to each model source.

(4) Annual CO₂ Equivalent Emissions (t CO_{2e}/ year) = Annual miles travelled (VMT/year) x CO₂ Equivalent Emission Factor (g/VMT) / 1000 g/1kg / 1000 kg/1tonne

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2034) Interim Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
1	1	0.634	27,060	6,262,635	394	0.018	0.03459	404	2,529
2	1	0.107	27,060	1,052,639	394	0.018	0.03459	404	425
3	1	0.976	27,060	9,637,440	394	0.018	0.03459	404	3,892
4	1	0.649	27,060	6,413,130	394	0.018	0.03459	404	2,590
5	1	0.075	27,060	741,673	394	0.018	0.03459	404	300
6	1	0.096	27,060	952,223	394	0.018	0.03459	404	385
7	1	0.330	27,060	3,261,044	394	0.018	0.03459	404	1,317
8	2	0.327	25,999	3,103,811	422	0.019	0.03779	432	1,341
9	2	0.097	25,999	919,011	422	0.019	0.03779	432	397
10	2	0.073	25,999	696,363	422	0.019	0.03779	432	301
11	2	0.649	25,999	6,161,659	422	0.019	0.03779	432	2,663
12	2	0.977	25,999	9,272,763	422	0.019	0.03779	432	4,007
13	2	0.107	25,999	1,019,732	422	0.019	0.03779	432	441
14	2	0.631	25,999	5,989,528	422	0.019	0.03779	432	2,588
15	3	0.307	8,210	919,513	185	0.009	0.00234	186	171
16	3	0.033	8,210	97,496	185	0.009	0.00234	186	18
17	3	0.317	8,210	949,911	185	0.009	0.00234	186	177
18	3	0.109	8,210	326,830	185	0.009	0.00234	186	61
19	3	0.048	8,210	145,264	185	0.009	0.00234	186	27
20	3	0.023	8,210	69,356	185	0.009	0.00234	186	13
21	3	0.039	8,210	117,526	185	0.009	0.00234	186	22
22	3	0.062	8,210	185,034	185	0.009	0.00234	186	34
23	3	0.059	8,210	175,603	185	0.009	0.00234	186	33
24	3	0.041	8,210	121,752	185	0.009	0.00234	186	23

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2034) Interim Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
25	3	0.673	8,210	2,015,669	185	0.009	0.00234	186	376
Totals	-	-	-	60,607,605	-	-	-	-	24,131

Notes:

(1) Average daily traffic counts provided by project design team.

(2) Annual Vehicle miles travelled in one year (VMT/year) = Traffic volume per day x Road Length (mile) x 365 day/year

(3) MOVES emission factor assigned to each model source.

(4) Annual CO₂ Equivalent Emissions (t CO_{2e}/ year) = Annual miles travelled (VMT/year) x CO₂ Equivalent Emission Factor (g/VMT) / 1000 g/1kg / 1000 kg/1tonne

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2044) Ultimate No Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2 **CH4** **N2O**
 1 28 265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
1	1	0.634	33,311	7,709,336	263	0.013	0.03023	272	2,096
2	1	0.107	33,311	1,295,803	263	0.013	0.03023	272	352
3	1	0.976	33,311	11,863,739	263	0.013	0.03023	272	3,225
4	1	0.649	33,311	7,894,596	263	0.013	0.03023	272	2,146
5	1	0.075	33,311	913,004	263	0.013	0.03023	272	248
6	1	0.096	33,311	1,172,192	263	0.013	0.03023	272	319
7	1	0.330	33,311	4,014,362	263	0.013	0.03023	272	1,091
8	2	0.327	32,004	3,820,699	289	0.014	0.03326	298	1,139
9	2	0.097	32,004	1,131,275	289	0.014	0.03326	298	337
10	2	0.073	32,004	857,202	289	0.014	0.03326	298	256
11	2	0.649	32,004	7,584,820	289	0.014	0.03326	298	2,261
12	2	0.977	32,004	11,414,497	289	0.014	0.03326	298	3,403
13	2	0.107	32,004	1,255,260	289	0.014	0.03326	298	374
14	2	0.631	32,004	7,372,932	289	0.014	0.03326	298	2,198
15	3	0.307	9,230	1,033,753	93	0.004	0.00163	93	96
16	3	0.033	9,230	109,609	93	0.004	0.00163	93	10
17	3	0.317	9,230	1,067,927	93	0.004	0.00163	93	99
18	3	0.109	9,230	367,434	93	0.004	0.00163	93	34
19	3	0.048	9,230	163,311	93	0.004	0.00163	93	15
20	3	0.023	9,230	77,973	93	0.004	0.00163	93	7
21	3	0.039	9,230	132,127	93	0.004	0.00163	93	12
22	3	0.062	9,230	208,023	93	0.004	0.00163	93	19
23	3	0.059	9,230	197,420	93	0.004	0.00163	93	18
24	3	0.041	9,230	136,879	93	0.004	0.00163	93	13

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2044) Ultimate No Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
25	3	0.673	9,230	2,266,093	93	0.004	0.00163	93	211
Totals	-	-	-	74,060,265	-	-	-	-	19,981

Notes:

(1) Average daily traffic counts provided by project design team.

(2) Annual Vehicle miles travelled in one year (VMT/year) = Traffic volume per day x Road Length (mile) x 365 day/year

(3) MOVES emission factor assigned to each model source.

(4) Annual CO₂ Equivalent Emissions (t CO_{2e}/ year) = Annual miles travelled (VMT/year) x CO₂ Equivalent Emission Factor (g/VMT) / 1000 g/1kg / 1000 kg/1tonne

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2044) Ultimate Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2 **CH4** **N2O**
 1 28 265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
1	1	0.634	33,311	7,707,048	263	0.013	0.03023	272	2,095
2	1	0.106	33,311	1,293,078	263	0.013	0.03023	272	351
3	1	0.976	33,311	11,863,862	263	0.013	0.03023	272	3,225
4	1	0.650	33,311	7,897,924	263	0.013	0.03023	272	2,147
5	1	0.075	33,311	913,004	263	0.013	0.03023	272	248
6	1	0.096	33,311	1,172,192	263	0.013	0.03023	272	319
7	1	0.330	33,311	4,014,362	263	0.013	0.03023	272	1,091
8	2	0.327	32,004	3,820,699	289	0.014	0.03326	298	1,139
9	2	0.097	32,004	1,131,275	289	0.014	0.03326	298	337
10	2	0.073	32,004	849,407	289	0.014	0.03326	298	253
11	2	0.650	32,004	7,591,383	289	0.014	0.03326	298	2,263
12	2	0.977	32,004	11,411,860	289	0.014	0.03326	298	3,402
13	2	0.108	32,004	1,259,055	289	0.014	0.03326	298	375
14	2	0.631	32,004	7,372,429	289	0.014	0.03326	298	2,198
15	3	0.307	9,260	1,037,113	93	0.004	0.00163	93	97
16	3	0.033	9,260	109,965	93	0.004	0.00163	93	10
17	3	0.317	9,260	1,071,398	93	0.004	0.00163	93	100
18	3	0.109	9,260	368,629	93	0.004	0.00163	93	34
19	3	0.048	9,260	163,842	93	0.004	0.00163	93	15
20	3	0.023	9,260	78,226	93	0.004	0.00163	93	7
21	3	0.039	9,260	132,557	93	0.004	0.00163	93	12
22	3	0.062	9,260	208,699	93	0.004	0.00163	93	19
23	3	0.059	9,260	198,061	93	0.004	0.00163	93	18
24	3	0.041	9,260	137,324	93	0.004	0.00163	93	13

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville
Appendix D: Air Quality and Greenhouse Gas Emission Estimation

Greenhouse Gas Emissions - Future (2044) Ultimate Build Scenario

[Intergovernmental Panel on Climate Change IPCC Global Warming Potentials - 100-Year Time Horizon Fifth Assessment Report](#)

CO2	CH4	N2O
1	28	265

Link ⁽¹⁾	MOVES Link ID	Link Length (miles)	Traffic Volume per Day ⁽¹⁾	Annual Miles travelled ⁽²⁾ (VMT/ year)	MOVES Emission Factors ⁽³⁾ (g/VMT)				Annual CO2 Equivalent Emissions ⁽⁴⁾ (t CO2e/ year)
					CO2	CH4	N2O	CO2 Equivalent	
25	3	0.673	9,260	2,273,458	93	0.004	0.00163	93	212
Totals	-	-	-	74,076,848	-	-	-	-	19,982

Notes:

(1) Average daily traffic counts provided by project design team.

(2) Annual Vehicle miles travelled in one year (VMT/year) = Traffic volume per day x Road Length (mile) x 365 day/year

(3) MOVES emission factor assigned to each model source.

(4) Annual CO₂ Equivalent Emissions (t CO_{2e}/ year) = Annual miles travelled (VMT/year) x CO₂ Equivalent Emission Factor (g/VMT) / 1000 g/1kg / 1000 kg/1tonne

**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

Appendix E Air Dispersion Modelling Layout

February 6, 2026

Appendix E Air Dispersion Modelling Layout



PROJECT TITLE:
Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure E.1: Baseline (2020) and Future (2034) Interim No Build Scenario Dispersion Modelling Layout

COMMENTS:
 Blue lines represent modelled road links.
 Highway 401 is a total of 4 lanes (2 in each travel direction).
 Green crosses represent special receptor locations.



MODEL:	
CAL3QHCR	
LINKS:	RECEPTORS:
25	25

DATE:
10/16/2025

SCALE: 1:16,236

0 500 m

PROJECT / PLOT NO.:

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)

Appendix E: Air Dispersion Modelling Layout

CAL3QHCR Modelled Road Links - Existing (2020) Baseline Scenario

Link	Link Type ⁽¹⁾	Start of Link Easting (m)	Start of Link Northing (m)	End of Link Easting (m)	End of Link Northing (m)	Link Height ⁽²⁾ (m)	Mixing Zone Width ⁽³⁾ (m)	Link Length ⁽⁴⁾ (m)	Link Description	Traffic Volume ID
1	AG	445483	4939837	446203	4940561	0.89	13.5	1,022	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
2	AG	446203	4940561	446330	4940678	0.89	13.5	172	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
3	AG	446330	4940678	447535	4941684	0.89	13.5	1,570	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
4	AG	447535	4941684	448337	4942354	0.89	13.5	1,045	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
5	AG	448337	4942354	448420	4942440	0.89	13.5	119	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
6	AG	448420	4942440	448522	4942557	0.89	13.5	155	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
7	AG	448522	4942557	448816	4942999	0.89	13.5	531	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
8	AG	448802	4943006	448511	4942567	0.94	13.5	526	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
9	AG	448511	4942567	448410	4942448	0.94	13.5	156	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
10	AG	448410	4942448	448327	4942366	0.94	13.5	117	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
11	AG	448327	4942366	447525	4941694	0.94	13.5	1,046	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
12	AG	447525	4941694	446318	4940686	0.94	13.5	1,573	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
13	AG	446318	4940686	446190	4940570	0.94	13.5	173	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
14	AG	446190	4940570	445473	4939850	0.94	13.5	1,016	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
15	AG	446836	4942699	447190	4942355	0.17	13.0	494	Sharpe's Lane	SL
16	AG	447190	4942355	447218	4942310	0.17	13.0	52	Sharpe's Lane	SL
17	AG	447218	4942310	447376	4941825	0.17	13.0	510	Sharpe's Lane	SL
18	AG	447376	4941825	447439	4941663	0.17	13.0	175	Sharpe's Lane	SL
19	BR	447439	4941663	447472	4941590	8.17	13.0	79	Sharpe's Lane	SL
20	AG	447472	4941590	447484	4941557	0.17	13.0	36	Sharpe's Lane	SL
21	AG	447484	4941557	447494	4941495	0.17	13.0	63	Sharpe's Lane	SL
22	AG	447494	4941495	447492	4941396	0.17	13.0	99	Sharpe's Lane	SL
23	AG	447492	4941396	447506	4941302	0.17	13.0	95	Sharpe's Lane	SL
24	AG	447506	4941302	447536	4941244	0.17	13.0	65	Sharpe's Lane	SL
25	AG	447536	4941244	448079	4940307	0.17	13.0	1,083	Sharpe's Lane	SL

Notes:

(1) AG - at grade, BR - bridge

(2) Weighted average of assumed vehicle exhaust height. Bridge height is estimated to be 8 m.

(3) Mixing zone widths are based on lane width * # of lanes + 6m.

(4) Calculated based on each link's starting and ending coordinates. Sample calculation: Length (m) = $\sqrt{(Y2-Y1)^2+(X2-X1)^2}$

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix E: Air Dispersion Modelling Layout

CAL3QHCR Modelled Road Links - Future (2034) Interim No Build Scenario

Link	Link Type ⁽¹⁾	Start of Link Easting (m)	Start of Link Northing (m)	End of Link Easting (m)	End of Link Northing (m)	Link Height ⁽²⁾ (m)	Mixing Zone Width ⁽³⁾ (m)	Link Length ⁽⁴⁾ (m)	Link Description	Traffic Volume ID
1	AG	445483	4939837	446203	4940561	0.89	13.50	1,022	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
2	AG	446203	4940561	446330	4940678	0.89	13.50	172	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
3	AG	446330	4940678	447535	4941684	0.89	13.50	1,570	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
4	AG	447535	4941684	448337	4942354	0.89	13.50	1,045	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
5	AG	448337	4942354	448420	4942440	0.89	13.50	119	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
6	AG	448420	4942440	448522	4942557	0.89	13.50	155	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
7	AG	448522	4942557	448816	4942999	0.89	13.50	531	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
8	AG	448802	4943006	448511	4942567	0.89	13.50	526	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
9	AG	448511	4942567	448410	4942448	0.94	13.50	156	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
10	AG	448410	4942448	448327	4942366	0.94	13.50	117	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
11	AG	448327	4942366	447525	4941694	0.94	13.50	1,046	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
12	AG	447525	4941694	446318	4940686	0.94	13.50	1,573	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
13	AG	446318	4940686	446190	4940570	0.94	13.50	173	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
14	AG	446190	4940570	445473	4939850	0.94	13.50	1,016	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
15	AG	446836	4942699	447190	4942355	0.17	13.00	494	Sharpe's Lane	SL
16	AG	447190	4942355	447218	4942310	0.17	13.00	52	Sharpe's Lane	SL
17	AG	447218	4942310	447376	4941825	0.17	13.00	510	Sharpe's Lane	SL
18	AG	447376	4941825	447439	4941663	0.17	13.00	175	Sharpe's Lane	SL
19	BR	447439	4941663	447472	4941590	8.17	13.00	79	Sharpe's Lane	SL
20	AG	447472	4941590	447484	4941557	0.17	13.00	36	Sharpe's Lane	SL
21	AG	447484	4941557	447494	4941495	0.17	13.00	63	Sharpe's Lane	SL
22	AG	447494	4941495	447492	4941396	0.17	13.00	99	Sharpe's Lane	SL
23	AG	447492	4941396	447506	4941302	0.17	13.00	95	Sharpe's Lane	SL
24	AG	447506	4941302	447536	4941244	0.17	13.00	65	Sharpe's Lane	SL
25	AG	447536	4941244	448079	4940307	0.17	13.00	1,083	Sharpe's Lane	SL

Notes:

- (1) AG - at grade, BR - bridge
- (2) Weighted average of assumed vehicle exhaust height.
- (3) Mixing zone widths are based on lane width * # of lanes + 6m.
- (4) Calculated based on each link's starting and ending coordinates. Sample calculation: Length (m) = $\text{SQRT}((Y2-Y1)^2+(X2-X1)^2)$

PROJECT TITLE:
Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure E.2:Future (2034) Interim Build and Future (2044) Ultimate No Build Scenario Dispersion Modelling Layout

COMMENTS:
 Blue lines represent modelled road links.
 Highway 401 is a total of 6 lanes (3 in each travel direction).
 Green crosses represent special receptor locations.



MODEL:
CAL3QHCR

LINKS:
25

RECEPTORS:
25

DATE:
10/16/2025

SCALE: 1:14,315
 0 400 m

PROJECT / PLOT NO.:

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix E: Air Dispersion Modelling Layout

CAL3QHCR Modelled Road Links - Future (2034) Interim Build Scenario

Link	Link Type ⁽¹⁾	Start of Link Easting (m)	Start of Link Northing (m)	End of Link Easting (m)	End of Link Northing (m)	Link Height ⁽²⁾ (m)	Mixing Zone Width ⁽³⁾ (m)	Link Length ⁽⁴⁾ (m)	Link Description	Traffic Volume ID
1	AG	445483	4939837	446205	4940558	0.89	17.25	1020	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
2	AG	446205	4940558	446332	4940673	0.89	17.25	172	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
3	AG	446332	4940673	447538	4941679	0.89	17.25	1570	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
4	AG	447538	4941679	448339	4942350	0.89	17.25	1045	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
5	AG	448339	4942350	448420	4942440	0.89	17.25	121	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
6	AG	448420	4942440	448522	4942557	0.89	17.25	155	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
7	AG	448522	4942557	448816	4942999	0.89	17.25	531	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
8	AG	448802	4943006	448511	4942567	0.94	17.25	526	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
9	AG	448511	4942567	448410	4942448	0.94	17.25	156	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
10	AG	448410	4942448	448327	4942364	0.94	17.25	118	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
11	AG	448327	4942364	447525	4941694	0.94	17.25	1045	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
12	AG	447525	4941694	446318	4940686	0.94	17.25	1573	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
13	AG	446318	4940686	446190	4940570	0.94	17.25	173	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
14	AG	446190	4940570	445473	4939850	0.94	17.25	1016	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
15	AG	446836	4942699	447190	4942355	0.17	13.00	494	Sharpe's Lane	SL
16	AG	447190	4942355	447218	4942310	0.17	13.00	52	Sharpe's Lane	SL
17	AG	447218	4942310	447376	4941825	0.17	13.00	510	Sharpe's Lane	SL
18	AG	447376	4941825	447443	4941663	0.17	13.00	176	Sharpe's Lane	SL
19	BR	447443	4941663	447475	4941592	8.17	13.00	78	Sharpe's Lane	SL
20	AG	447475	4941592	447488	4941557	0.17	13.00	37	Sharpe's Lane	SL
21	AG	447488	4941557	447498	4941495	0.17	13.00	63	Sharpe's Lane	SL
22	AG	447498	4941495	447493	4941395	0.17	13.00	99	Sharpe's Lane	SL
23	AG	447493	4941395	447506	4941302	0.17	13.00	94	Sharpe's Lane	SL
24	AG	447506	4941302	447536	4941244	0.17	13.00	65	Sharpe's Lane	SL
25	AG	447536	4941244	448079	4940307	0.17	13.00	1083	Sharpe's Lane	SL

Notes:

(1) AG - at grade, BR - bridge

(2) Weighted average of assumed vehicle exhaust height. Bridge height is estimated to be 8 m.

(3) Mixing zone widths are based on lane width * # of lanes + 6m.

(4) Calculated based on each link's starting and ending coordinates. Sample calculation: Length (m) = SQRT((Y2-Y1)²+(X2-X1)²)

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix E: Air Dispersion Modelling Layout

CAL3QHCR Modelled Road Links - Future (2044) Ultimate No Build Scenario

Link	Link Type ⁽¹⁾	Start of Link Easting (m)	Start of Link Northing (m)	End of Link Easting (m)	End of Link Northing (m)	Link Height ⁽²⁾ (m)	Mixing Zone Width ⁽³⁾ (m)	Link Length ⁽⁴⁾ (m)	Link Description	Traffic Volume ID
1	AG	445483	4939837	446205	4940558	0.89	17.25	1020	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
2	AG	446205	4940558	446332	4940673	0.89	17.25	172	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
3	AG	446332	4940673	447538	4941679	0.89	17.25	1570	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
4	AG	447538	4941679	448339	4942350	0.89	17.25	1045	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
5	AG	448339	4942350	448420	4942440	0.89	17.25	121	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
6	AG	448420	4942440	448522	4942557	0.89	17.25	155	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
7	AG	448522	4942557	448816	4942999	0.89	17.25	531	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
8	AG	448802	4943006	448511	4942567	0.94	17.25	526	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
9	AG	448511	4942567	448410	4942448	0.94	17.25	156	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
10	AG	448410	4942448	448327	4942364	0.94	17.25	118	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
11	AG	448327	4942364	447525	4941694	0.94	17.25	1045	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
12	AG	447525	4941694	446318	4940686	0.94	17.25	1573	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
13	AG	446318	4940686	446190	4940570	0.94	17.25	173	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
14	AG	446190	4940570	445473	4939850	0.94	17.25	1016	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
15	AG	446836	4942699	447190	4942355	0.17	13.00	494	Sharpe's Lane	SL
16	AG	447190	4942355	447218	4942310	0.17	13.00	52	Sharpe's Lane	SL
17	AG	447218	4942310	447376	4941825	0.17	13.00	510	Sharpe's Lane	SL
18	AG	447376	4941825	447443	4941663	0.17	13.00	176	Sharpe's Lane	SL
19	BR	447443	4941663	447475	4941592	8.17	13.00	78	Sharpe's Lane	SL
20	AG	447475	4941592	447488	4941557	0.17	13.00	37	Sharpe's Lane	SL
21	AG	447488	4941557	447498	4941495	0.17	13.00	63	Sharpe's Lane	SL
22	AG	447498	4941495	447493	4941395	0.17	13.00	99	Sharpe's Lane	SL
23	AG	447493	4941395	447506	4941302	0.17	13.00	94	Sharpe's Lane	SL
24	AG	447506	4941302	447536	4941244	0.17	13.00	65	Sharpe's Lane	SL
25	AG	447536	4941244	448079	4940307	0.17	13.00	1083	Sharpe's Lane	SL

Notes:

(1) AG - at grade, BR - bridge

(2) Weighted average of assumed vehicle exhaust height. Bridge height is estimated to be 8 m.

(3) Mixing zone widths are based on lane width * # of lanes + 6m.

(4) Calculated based on each link's starting and ending coordinates. Sample calculation: Length (m) = SQRT((Y2-Y1)²+(X2-X1)²)

PROJECT TITLE:
Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure E.3: Future (2044) Ultimate Build Scenario Dispersion Modelling Layout

COMMENTS:
 Blue lines represent modelled road links.
 Highway 401 is a total of 8 lanes (4 in each travel direction).
 Green crosses represent special receptor locations.



MODEL:	
CAL3QHCR	
LINKS:	RECEPTORS:
25	25

DATE:
10/16/2025

SCALE: 1:14,328

0 400 m

PROJECT / PLOT NO.:

Project Name: Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-00)
Appendix E: Air Dispersion Modelling Layout

CAL3QHCR Modelled Road Links - Future (2044) Ultimate Build Scenario

Link	Link Type ⁽¹⁾	Start of Link Easting (m)	Start of Link Northing (m)	End of Link Easting (m)	End of Link Northing (m)	Link Height ⁽²⁾ (m)	Mixing Zone Width ⁽³⁾ (m)	Link Length ⁽⁴⁾ (m)	Link Description	Traffic Volume ID
1	AG	445483	4939837	446207	4940556	0.89	21.00	1020	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
2	AG	446207	4940556	446333	4940671	0.89	21.00	171	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
3	AG	446333	4940671	447539	4941677	0.89	21.00	1570	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
4	AG	447539	4941677	448339	4942350	0.89	21.00	1045	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
5	AG	448339	4942350	448420	4942440	0.89	21.00	121	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
6	AG	448420	4942440	448522	4942557	0.89	21.00	155	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
7	AG	448522	4942557	448816	4942999	0.89	21.00	531	Highway 401 - from North Augusta Road to Maitland Road Eastbound	EB_401
8	AG	448802	4943006	448511	4942567	0.94	21.00	526	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
9	AG	448511	4942567	448410	4942448	0.94	21.00	156	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
10	AG	448410	4942448	448327	4942366	0.94	21.00	117	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
11	AG	448327	4942366	447524	4941695	0.94	21.00	1046	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
12	AG	447524	4941695	446317	4940687	0.94	21.00	1572	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
13	AG	446317	4940687	446189	4940571	0.94	21.00	173	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
14	AG	446189	4940571	445473	4939850	0.94	21.00	1016	Highway 401 - from North Augusta Road to Maitland Road Westbound	WB_401
15	AG	446836	4942699	447190	4942355	0.17	13.00	494	Sharpe's Lane	SL
16	AG	447190	4942355	447218	4942310	0.17	13.00	52	Sharpe's Lane	SL
17	AG	447218	4942310	447376	4941825	0.17	13.00	510	Sharpe's Lane	SL
18	AG	447376	4941825	447443	4941663	0.17	13.00	176	Sharpe's Lane	SL
19	BR	447443	4941663	447475	4941592	8.17	13.00	78	Sharpe's Lane	SL
20	AG	447475	4941592	447488	4941557	0.17	13.00	37	Sharpe's Lane	SL
21	AG	447488	4941557	447498	4941495	0.17	13.00	63	Sharpe's Lane	SL
22	AG	447498	4941495	447493	4941395	0.17	13.00	99	Sharpe's Lane	SL
23	AG	447493	4941395	447506	4941302	0.17	13.00	94	Sharpe's Lane	SL
24	AG	447506	4941302	447536	4941244	0.17	13.00	65	Sharpe's Lane	SL
25	AG	447536	4941244	448079	4940307	0.17	13.00	1083	Sharpe's Lane	SL

Notes:

(1) AG - at grade, BR - bridge

(2) Weighted average of assumed vehicle exhaust height. Bridge height is estimated to be 8 m.

(3) Mixing zone widths are based on lane width * # of lanes + 6m.

(4) Calculated based on each link's starting and ending coordinates. Sample calculation: Length (m) = SQRT((Y2-Y1)²+(X2-X1)²)

**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

Appendix F Special Receptor Modelled Results

February 6, 2026

Appendix F Special Receptor Modelled Results



Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
BASELINE (2020) SCENARIO - 4 LANES

Background Concentration (µg/m³)	277	241	30	14	8.6	22	12	6.0	5.3E-05	2.3E-05	0.59	0.31	0.039	0.015	1.9	21	7.0	0.073	0.030	
Predicted Concentrations Without Background (µg/m³)																				
Receptor ID	CO		NO ₂ (ARM2)		NO ₂ (ARM2)	PM ₁₀		PM _{2.5}	PM _{2.5}	B(a)P		Benzene		1,3-Butadiene		Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr
R017*	327	277	135	24	22	2	1.2	0.29	9.5E-05	2.3E-05	3.6E-02	8.7E-03	6.2E-03	1.5E-03	8.0E-02	3.9E-01	4.2E-02	4.8E-02	6.3E-03	
R018*	657	518	210	42	45	4	2.1	0.62	1.6E-04	4.8E-05	6.2E-02	1.8E-02	1.1E-02	3.1E-03	1.4E-01	7.9E-01	7.3E-02	9.7E-02	1.1E-02	
R034*	718	555	231	44	42	4	2.2	0.59	1.7E-04	4.6E-05	6.5E-02	1.7E-02	1.1E-02	2.9E-03	1.4E-01	8.6E-01	7.6E-02	1.1E-01	1.1E-02	
R035*	549	434	176	34	32	3	1.7	0.43	1.3E-04	3.4E-05	5.1E-02	1.3E-02	8.7E-03	2.2E-03	1.1E-01	6.6E-01	6.0E-02	8.1E-02	8.9E-03	
R036*	486	374	155	31	27	3	1.5	0.37	1.2E-04	2.9E-05	4.5E-02	1.1E-02	7.7E-03	1.9E-03	1.0E-01	5.8E-01	5.3E-02	7.2E-02	7.9E-03	
R037*	484	374	154	31	33	3	1.5	0.44	1.2E-04	3.4E-05	4.7E-02	1.3E-02	8.0E-03	2.2E-03	1.0E-01	5.8E-01	5.4E-02	7.1E-02	8.1E-03	
R059*	658	530	211	53	55	5	2.6	0.77	2.0E-04	6.0E-05	7.7E-02	2.2E-02	1.3E-02	3.8E-03	1.7E-01	7.9E-01	9.1E-02	9.7E-02	1.4E-02	
R060*	679	530	217	50	50	5	2.5	0.69	1.9E-04	5.4E-05	7.3E-02	2.0E-02	1.3E-02	3.5E-03	1.6E-01	8.1E-01	8.6E-02	1.0E-01	1.3E-02	
R001	442	338	144	28	30	3	1.4	0.40	1.1E-04	3.1E-05	4.3E-02	1.2E-02	7.3E-03	2.0E-03	9.3E-02	5.4E-01	4.9E-02	6.7E-02	7.3E-03	
R002	454	326	148	28	30	3	1.4	0.40	1.1E-04	3.1E-05	4.3E-02	1.2E-02	7.2E-03	2.0E-03	9.2E-02	5.5E-01	4.9E-02	6.8E-02	7.2E-03	
R003	434	301	142	26	29	3	1.3	0.38	1.0E-04	3.0E-05	4.1E-02	1.2E-02	6.9E-03	2.0E-03	8.7E-02	5.3E-01	4.6E-02	6.5E-02	6.8E-03	
R004	401	277	141	24	27	2	1.2	0.36	9.5E-05	2.8E-05	3.8E-02	1.1E-02	6.4E-03	1.8E-03	7.9E-02	4.9E-01	4.2E-02	6.0E-02	6.2E-03	
R005	417	289	141	25	28	2	1.2	0.37	9.8E-05	2.9E-05	4.0E-02	1.1E-02	6.6E-03	1.9E-03	8.2E-02	5.1E-01	4.4E-02	6.3E-02	6.5E-03	
R006	549	386	179	33	38	3	1.7	0.52	1.3E-04	4.1E-05	5.3E-02	1.6E-02	8.9E-03	2.7E-03	1.1E-01	6.7E-01	5.9E-02	8.3E-02	8.7E-03	
R007	658	482	215	40	47	4	2.0	0.65	1.6E-04	5.1E-05	6.3E-02	2.0E-02	1.1E-02	3.3E-03	1.3E-01	8.0E-01	7.1E-02	9.9E-02	1.0E-02	
R008	611	446	199	37	43	4	1.9	0.60	1.5E-04	4.7E-05	5.9E-02	1.8E-02	9.9E-03	3.1E-03	1.2E-01	7.4E-01	6.6E-02	9.2E-02	9.6E-03	
R009	792	591	258	49	58	5	2.5	0.83	2.0E-04	6.4E-05	7.9E-02	2.6E-02	1.3E-02	4.3E-03	1.6E-01	9.6E-01	8.7E-02	1.2E-01	1.3E-02	
R010	613	518	179	42	43	5	2.2	0.62	1.7E-04	4.8E-05	7.7E-02	2.1E-02	1.2E-02	3.5E-03	1.4E-01	6.9E-01	7.7E-02	8.3E-02	1.1E-02	
R011	543	458	151	35	36	4	1.9	0.52	1.4E-04	4.0E-05	6.9E-02	1.9E-02	1.1E-02	3.0E-03	1.2E-01	5.9E-01	6.6E-02	7.1E-02	9.2E-03	
R012	455	362	142	31	34	3	1.5	0.51	1.2E-04	3.9E-05	5.9E-02	2.0E-02	9.3E-03	3.1E-03	1.0E-01	5.2E-01	5.4E-02	6.5E-02	8.1E-03	
R013	424	301	140	23	26	2	1.2	0.36	9.3E-05	2.8E-05	4.1E-02	1.3E-02	6.6E-03	2.0E-03	7.8E-02	4.8E-01	4.2E-02	5.9E-02	6.1E-03	
R014	433	313	141	25	27	2	1.2	0.37	9.8E-05	2.9E-05	4.1E-02	1.2E-02	6.7E-03	2.0E-03	8.2E-02	5.0E-01	4.4E-02	6.2E-02	6.4E-03	
R015	445	326	141	26	28	2	1.3	0.38	1.0E-04	2.9E-05	4.0E-02	1.2E-02	6.8E-03	2.0E-03	8.5E-02	5.2E-01	4.5E-02	6.5E-02	6.7E-03	
R016	421	313	141	24	26	2	1.2	0.35	9.6E-05	2.7E-05	3.8E-02	1.1E-02	6.3E-03	1.8E-03	8.1E-02	5.0E-01	4.3E-02	6.1E-02	6.3E-03	
R017	406	301	140	23	25	2	1.2	0.33	9.2E-05	2.6E-05	3.6E-02	1.0E-02	6.1E-03	1.7E-03	7.7E-02	4.8E-01	4.1E-02	5.9E-02	6.1E-03	
Maximum	792	591	258	53	58	5	2.6	0.83	2.0E-04	6.4E-05	7.9E-02	2.6E-02	1.3E-02	4.3E-03	1.7E-01	9.6E-01	9.1E-02	1.2E-01	1.4E-02	

Note:

1. Maximum predicted GLCs (without background) are presented in the table.
2. Maximum predicted concentrations in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
BASELINE (2020) SCENARIO - 4 LANES

Receptor ID	Predicted Cumulative Concentrations (With Background) (µg/m ³)																		
	CO		NO ₂ (ARM2)		NO ₂ (ARM2)	PM ₁₀	PM _{2.5}		B(a)P	B(a)P	Benzene	Benzene	1,3-Butadiene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	604	518	165	39	31	24	13	6.3	1.5E-04	4.6E-05	6.2E-01	3.2E-01	4.6E-02	1.6E-02	2.0	21	7.0	1.2E-01	3.6E-02
R018*	934	760	240	56	53	26	14	6.6	2.2E-04	7.1E-05	6.5E-01	3.3E-01	5.0E-02	1.8E-02	2.0	21	7.1	1.7E-01	4.1E-02
R034*	995	796	261	58	51	26	14	6.6	2.2E-04	6.8E-05	6.5E-01	3.2E-01	5.0E-02	1.8E-02	2.0	22	7.1	1.8E-01	4.1E-02
R035*	826	675	206	49	40	25	14	6.4	1.9E-04	5.6E-05	6.4E-01	3.2E-01	4.8E-02	1.7E-02	2.0	21	7.1	1.5E-01	3.9E-02
R036*	763	615	185	45	36	25	14	6.4	1.7E-04	5.2E-05	6.3E-01	3.2E-01	4.7E-02	1.7E-02	2.0	21	7.1	1.4E-01	3.8E-02
R037*	761	615	184	46	41	25	14	6.4	1.8E-04	5.7E-05	6.3E-01	3.2E-01	4.7E-02	1.7E-02	2.0	21	7.1	1.4E-01	3.8E-02
R059*	935	772	241	67	64	27	15	6.8	2.6E-04	8.3E-05	6.6E-01	3.3E-01	5.3E-02	1.8E-02	2.1	21	7.1	1.7E-01	4.3E-02
R060*	956	772	247	64	58	27	14	6.7	2.5E-04	7.7E-05	6.6E-01	3.3E-01	5.2E-02	1.8E-02	2.0	21	7.1	1.7E-01	4.3E-02
R001	719	579	174	43	38	25	13	6.4	1.6E-04	5.4E-05	6.3E-01	3.2E-01	4.7E-02	1.7E-02	2.0	21	7.0	1.4E-01	3.7E-02
R002	731	567	178	42	39	25	13	6.4	1.6E-04	5.4E-05	6.3E-01	3.2E-01	4.7E-02	1.7E-02	2.0	21	7.0	1.4E-01	3.7E-02
R003	711	543	172	41	37	25	13	6.4	1.6E-04	5.3E-05	6.3E-01	3.2E-01	4.6E-02	1.7E-02	2.0	21	7.0	1.4E-01	3.7E-02
R004	679	518	171	38	35	25	13	6.4	1.5E-04	5.1E-05	6.2E-01	3.2E-01	4.6E-02	1.6E-02	2.0	21	7.0	1.3E-01	3.6E-02
R005	695	530	171	39	37	25	13	6.4	1.5E-04	5.2E-05	6.3E-01	3.2E-01	4.6E-02	1.7E-02	2.0	21	7.0	1.4E-01	3.6E-02
R006	826	627	209	48	47	26	14	6.5	1.9E-04	6.4E-05	6.4E-01	3.2E-01	4.8E-02	1.7E-02	2.0	21	7.1	1.6E-01	3.9E-02
R007	935	723	245	55	55	26	14	6.7	2.1E-04	7.3E-05	6.5E-01	3.3E-01	5.0E-02	1.8E-02	2.0	21	7.1	1.7E-01	4.0E-02
R008	889	687	229	52	52	26	14	6.6	2.0E-04	6.9E-05	6.5E-01	3.3E-01	4.9E-02	1.8E-02	2.0	21	7.1	1.6E-01	3.9E-02
R009	1069	832	289	64	66	27	15	6.8	2.5E-04	8.7E-05	6.7E-01	3.3E-01	5.3E-02	1.9E-02	2.0	22	7.1	1.9E-01	4.3E-02
R010	890	760	209	57	52	27	14	6.6	2.2E-04	7.1E-05	6.6E-01	3.3E-01	5.2E-02	1.8E-02	2.0	21	7.1	1.6E-01	4.1E-02
R011	820	699	181	50	44	26	14	6.5	2.0E-04	6.2E-05	6.6E-01	3.3E-01	5.0E-02	1.8E-02	2.0	21	7.1	1.4E-01	3.9E-02
R012	732	603	172	46	43	26	14	6.5	1.7E-04	6.1E-05	6.5E-01	3.3E-01	4.9E-02	1.8E-02	2.0	21	7.1	1.4E-01	3.8E-02
R013	701	543	170	38	35	25	13	6.4	1.5E-04	5.1E-05	6.3E-01	3.2E-01	4.6E-02	1.7E-02	2.0	21	7.0	1.3E-01	3.6E-02
R014	710	555	171	39	36	25	13	6.4	1.5E-04	5.1E-05	6.3E-01	3.2E-01	4.6E-02	1.7E-02	2.0	21	7.0	1.3E-01	3.6E-02
R015	722	567	172	40	37	25	13	6.4	1.5E-04	5.2E-05	6.3E-01	3.2E-01	4.6E-02	1.7E-02	2.0	21	7.0	1.4E-01	3.7E-02
R016	698	555	171	39	35	25	13	6.3	1.5E-04	5.0E-05	6.2E-01	3.2E-01	4.6E-02	1.6E-02	2.0	21	7.0	1.3E-01	3.6E-02
R017	684	543	170	38	34	24	13	6.3	1.4E-04	4.9E-05	6.2E-01	3.2E-01	4.5E-02	1.6E-02	2.0	21	7.0	1.3E-01	3.6E-02
Maximum	1069	832	289	67	66	27	15	6.8	2.6E-04	8.7E-05	6.7E-01	3.3E-01	5.3E-02	1.9E-02	2.1	22	7.1	1.9E-01	4.3E-02

Note:

1. Maximum predicted cumulative GLCs (with background) are presented in the table.
2. Maximum predicted cumulative concentrations in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2034) INTERIM NO BUILD SCENARIO - 4 LANES

Background Concentration (µg/m³)	277	241	30	14	8.6	22	12	6.0	5.3E-05	2.3E-05	0.59	0.31	0.039	0.015	1.9	21	7.0	0.073	0.030		
Predicted Concentrations Without Background (µg/m³)																					
Receptor ID	CO		NO ₂ (ARM2)			PM ₁₀		PM _{2.5}		B(a)P		Benzene		1,3-Butadiene		Formaldehyde		Acetaldehyde		Acrolein	
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	255	217	75	9.1	8.9	2.0	0.69	0.17	2.2E-05	5.3E-06	9.6E-03	2.3E-03	1.2E-03	3.0E-04	2.3E-02	1.4E-01	1.4E-02	1.5E-02	1.8E-03		
R018*	509	398	126	16	18	3.6	1.2	0.36	3.7E-05	1.1E-05	1.6E-02	4.8E-03	2.1E-03	6.2E-04	3.9E-02	2.8E-01	2.4E-02	2.9E-02	3.0E-03		
R034*	557	434	130	16	17	3.8	1.3	0.34	3.9E-05	1.0E-05	1.7E-02	4.5E-03	2.2E-03	5.9E-04	4.1E-02	3.1E-01	2.5E-02	3.2E-02	3.2E-03		
R035*	426	338	116	13	13	2.9	0.98	0.25	3.1E-05	7.7E-06	1.3E-02	3.3E-03	1.7E-03	4.4E-04	3.2E-02	2.4E-01	2.0E-02	2.5E-02	2.5E-03		
R036*	377	289	108	11	11	2.6	0.87	0.22	2.7E-05	6.7E-06	1.2E-02	2.9E-03	1.6E-03	3.8E-04	2.9E-02	2.1E-01	1.8E-02	2.2E-02	2.2E-03		
R037*	375	289	108	12	13	2.7	0.90	0.26	2.8E-05	7.9E-06	1.2E-02	3.4E-03	1.6E-03	4.5E-04	3.0E-02	2.1E-01	1.8E-02	2.2E-02	2.3E-03		
R059*	515	410	126	20	22	4.5	1.5	0.45	4.7E-05	1.4E-05	2.0E-02	5.9E-03	2.7E-03	7.7E-04	4.9E-02	2.8E-01	3.0E-02	3.0E-02	3.8E-03		
R060*	532	410	128	19	20	4.3	1.4	0.40	4.5E-05	1.2E-05	1.9E-02	5.3E-03	2.5E-03	7.0E-04	4.7E-02	2.9E-01	2.9E-02	3.1E-02	3.6E-03		
R001	344	265	103	11	12	2.4	0.82	0.23	2.5E-05	7.2E-06	1.1E-02	3.1E-03	1.5E-03	4.1E-04	2.7E-02	1.9E-01	1.6E-02	2.0E-02	2.1E-03		
R002	354	253	105	10	12	2.4	0.81	0.23	2.5E-05	7.2E-06	1.1E-02	3.1E-03	1.4E-03	4.1E-04	2.6E-02	2.0E-01	1.6E-02	2.1E-02	2.0E-03		
R003	338	241	102	9.8	12	2.3	0.77	0.22	2.4E-05	6.9E-06	1.1E-02	3.0E-03	1.4E-03	3.9E-04	2.5E-02	1.9E-01	1.5E-02	2.0E-02	1.9E-03		
R004	313	217	94	8.9	11	2.1	0.71	0.21	2.2E-05	6.4E-06	9.9E-03	2.8E-03	1.3E-03	3.7E-04	2.3E-02	1.7E-01	1.4E-02	1.8E-02	1.7E-03		
R005	325	217	98	9.3	11	2.2	0.73	0.22	2.3E-05	6.7E-06	1.0E-02	3.0E-03	1.3E-03	3.9E-04	2.4E-02	1.8E-01	1.5E-02	1.9E-02	1.8E-03		
R006	428	301	117	12	15	3.0	0.99	0.31	3.0E-05	9.4E-06	1.4E-02	4.2E-03	1.8E-03	5.4E-04	3.2E-02	2.4E-01	2.0E-02	2.5E-02	2.4E-03		
R007	512	374	127	15	19	3.6	1.2	0.38	3.7E-05	1.2E-05	1.6E-02	5.2E-03	2.1E-03	6.7E-04	3.8E-02	2.9E-01	2.4E-02	3.0E-02	2.9E-03		
R008	476	350	123	14	17	3.4	1.1	0.35	3.4E-05	1.1E-05	1.5E-02	4.8E-03	2.0E-03	6.2E-04	3.5E-02	2.7E-01	2.2E-02	2.8E-02	2.7E-03		
R009	617	458	135	18	23	4.6	1.5	0.49	4.5E-05	1.5E-05	2.1E-02	6.7E-03	2.6E-03	8.6E-04	4.7E-02	3.5E-01	2.9E-02	3.6E-02	3.6E-03		
R010	472	386	119	16	17	4.2	1.4	0.38	4.0E-05	1.1E-05	2.0E-02	5.5E-03	2.4E-03	6.8E-04	4.1E-02	2.5E-01	2.5E-02	2.6E-02	3.1E-03		
R011	410	350	108	13	14	3.6	1.2	0.32	3.4E-05	9.2E-06	1.7E-02	4.7E-03	2.1E-03	5.8E-04	3.4E-02	2.1E-01	2.1E-02	2.2E-02	2.6E-03		
R012	349	277	104	12	14	3.1	0.98	0.32	2.8E-05	9.1E-06	1.5E-02	4.9E-03	1.8E-03	5.8E-04	2.9E-02	1.9E-01	1.8E-02	2.0E-02	2.3E-03		
R013	320	229	91	8.6	11	2.2	0.72	0.22	2.2E-05	6.5E-06	1.0E-02	3.2E-03	1.3E-03	4.0E-04	2.2E-02	1.7E-01	1.4E-02	1.8E-02	1.7E-03		
R014	330	229	96	9.2	11	2.2	0.74	0.22	2.3E-05	6.6E-06	1.1E-02	3.1E-03	1.3E-03	3.9E-04	2.4E-02	1.8E-01	1.5E-02	1.9E-02	1.8E-03		
R015	342	253	100	9.6	11	2.2	0.76	0.22	2.3E-05	6.8E-06	1.1E-02	3.1E-03	1.4E-03	3.9E-04	2.4E-02	1.9E-01	1.5E-02	1.9E-02	1.9E-03		
R016	323	241	95	9.1	11	2.1	0.71	0.20	2.2E-05	6.3E-06	9.8E-03	2.8E-03	1.3E-03	3.6E-04	2.3E-02	1.8E-01	1.4E-02	1.8E-02	1.8E-03		
R017	313	229	92	8.7	10	2.0	0.68	0.20	2.1E-05	6.0E-06	9.4E-03	2.7E-03	1.2E-03	3.4E-04	2.2E-02	1.7E-01	1.4E-02	1.8E-02	1.7E-03		
Maximum	617	458	135	20	23	4.6	1.5	0.49	4.7E-05	1.5E-05	2.1E-02	6.7E-03	2.7E-03	8.6E-04	4.9E-02	3.5E-01	3.0E-02	3.6E-02	3.8E-03		

Note:
1. Maximum predicted GLCs without background are presented in the table.
2. Maximum predicted GLCs in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2034) INTERIM NO BUILD SCENARIO - 4 LANES

Receptor ID	Predicted Cumulative Concentrations (With Background) (µg/m ³)																		
	CO		NO ₂ (ARM2)		NO ₂ (ARM2)	PM ₁₀	PM _{2.5}		B(a)P	B(a)P	Benzene		1,3-Butadiene		Formaldehyde	Acetaldehyde		Acrolein	
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	533	458	105	24	17	24	13	6.2	7.5E-05	2.8E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	8.7E-02	3.2E-02
R018*	786	639	156	30	26	26	13	6.4	9.0E-05	3.4E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02
R034*	835	675	160	31	25	26	13	6.3	9.2E-05	3.3E-05	6.0E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02
R035*	703	579	146	27	21	25	13	6.2	8.4E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.7E-02	3.2E-02
R036*	654	530	138	26	20	25	13	6.2	8.0E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02
R037*	652	530	138	26	22	25	13	6.3	8.1E-05	3.1E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02
R059*	793	651	157	34	31	27	14	6.4	1.0E-04	3.6E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.4E-02
R060*	810	651	158	33	29	27	13	6.4	9.7E-05	3.5E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02
R001	622	506	134	25	20	25	13	6.2	7.8E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02
R002	631	494	135	25	21	25	13	6.2	7.8E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02
R003	615	482	132	24	20	24	13	6.2	7.7E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02
R004	590	458	124	23	19	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02
R005	603	458	128	24	20	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02
R006	705	543	147	27	24	25	13	6.3	8.3E-05	3.2E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.8E-02	3.2E-02
R007	790	615	157	29	27	26	13	6.4	8.9E-05	3.4E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02
R008	754	591	153	28	26	26	13	6.4	8.7E-05	3.3E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02
R009	894	699	165	33	32	27	13	6.5	9.8E-05	3.7E-05	6.1E-01	3.1E-01	4.2E-02	1.6E-02	1.9	21	7.0	1.1E-01	3.3E-02
R010	749	627	149	30	26	26	13	6.4	9.3E-05	3.4E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	9.8E-02	3.3E-02
R011	688	591	138	28	23	26	13	6.3	8.6E-05	3.2E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02
R012	626	518	134	26	22	25	13	6.3	8.1E-05	3.2E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02
R013	597	470	121	23	19	24	13	6.2	7.4E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.0E-02	3.2E-02
R014	607	470	126	24	19	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02
R015	619	494	130	24	20	24	13	6.2	7.6E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02
R016	601	482	125	24	19	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02
R017	590	470	122	23	19	24	13	6.2	7.4E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02
Maximum	894	699	165	34	32	27	14	6.5	1.0E-04	3.7E-05	6.1E-01	3.1E-01	4.2E-02	1.6E-02	1.9	21	7.0	1.1E-01	3.4E-02

Note:
1. Maximum predicted cumulative GLCs (with background) are presented in the table.
2. Maximum predicted cumulative concentrations in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2034) INTERIM BUILD SCENARIO - 6 LANES

Background Concentration (µg/m³)	277	241	30	14	8.6	22	12	6.0	5.3E-05	2.3E-05	0.59	0.31	0.039	0.015	1.9	21	7.0	0.073	0.030
Predicted Concentrations Without Background (µg/m³)																			
Receptor ID	CO	CO	NO ₂ (ARM2)	NO ₂ (ARM2)	NO ₂ (ARM2)	PM ₁₀	PM _{2.5}	PM _{2.5}	B(a)P	B(a)P	Benzene	Benzene	1,3-Butadiene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	272	229	80	9.3	9.8	2.0	0.71	0.18	2.2E-05	5.5E-06	9.8E-03	2.4E-03	1.3E-03	3.1E-04	2.3E-02	1.5E-01	1.4E-02	1.5E-02	1.8E-03
R018*	532	410	128	16	19	3.7	1.2	0.37	3.8E-05	1.1E-05	1.7E-02	4.9E-03	2.2E-03	6.4E-04	4.0E-02	2.9E-01	2.5E-02	3.1E-02	3.1E-03
R034*	580	446	132	17	18	3.9	1.3	0.35	4.0E-05	1.1E-05	1.7E-02	4.7E-03	2.3E-03	6.1E-04	4.2E-02	3.2E-01	2.6E-02	3.4E-02	3.3E-03
R035*	446	350	119	13	14	3.0	1.0	0.26	3.1E-05	8.0E-06	1.4E-02	3.4E-03	1.8E-03	4.5E-04	3.3E-02	2.5E-01	2.0E-02	2.6E-02	2.5E-03
R036*	396	301	111	12	12	2.6	0.89	0.22	2.8E-05	6.9E-06	1.2E-02	3.0E-03	1.6E-03	3.9E-04	2.9E-02	2.2E-01	1.8E-02	2.3E-02	2.3E-03
R037*	393	301	111	12	14	2.7	0.92	0.26	2.9E-05	8.1E-06	1.2E-02	3.5E-03	1.6E-03	4.6E-04	3.0E-02	2.2E-01	1.8E-02	2.3E-02	2.3E-03
R059*	565	446	131	21	25	4.8	1.6	0.48	5.0E-05	1.5E-05	2.1E-02	6.4E-03	2.8E-03	8.4E-04	5.2E-02	3.1E-01	3.2E-02	3.2E-02	4.0E-03
R060*	584	446	132	20	23	4.5	1.5	0.43	4.7E-05	1.3E-05	2.0E-02	5.8E-03	2.7E-03	7.6E-04	5.0E-02	3.2E-01	3.0E-02	3.3E-02	3.8E-03
R001	363	277	107	11	13	2.4	0.83	0.24	2.6E-05	7.4E-06	1.1E-02	3.2E-03	1.5E-03	4.2E-04	2.7E-02	2.0E-01	1.7E-02	2.1E-02	2.1E-03
R002	372	265	108	11	13	2.4	0.83	0.24	2.6E-05	7.4E-06	1.1E-02	3.2E-03	1.5E-03	4.2E-04	2.7E-02	2.1E-01	1.7E-02	2.2E-02	2.1E-03
R003	356	241	105	10	12	2.3	0.78	0.23	2.4E-05	7.1E-06	1.1E-02	3.1E-03	1.4E-03	4.1E-04	2.5E-02	2.0E-01	1.6E-02	2.1E-02	2.0E-03
R004	330	229	99	9.1	11	2.1	0.72	0.21	2.2E-05	6.6E-06	1.0E-02	2.9E-03	1.3E-03	3.8E-04	2.3E-02	1.8E-01	1.4E-02	1.9E-02	1.8E-03
R005	343	229	103	9.5	12	2.2	0.75	0.23	2.3E-05	6.9E-06	1.0E-02	3.1E-03	1.3E-03	4.0E-04	2.4E-02	1.9E-01	1.5E-02	2.0E-02	1.9E-03
R006	450	313	120	13	16	3.0	1.0	0.32	3.1E-05	9.7E-06	1.4E-02	4.3E-03	1.8E-03	5.5E-04	3.2E-02	2.5E-01	2.0E-02	2.6E-02	2.5E-03
R007	536	398	129	15	20	3.7	1.2	0.39	3.7E-05	1.2E-05	1.7E-02	5.3E-03	2.2E-03	6.9E-04	3.9E-02	3.0E-01	2.4E-02	3.1E-02	3.0E-03
R008	500	362	126	14	19	3.4	1.1	0.36	3.4E-05	1.1E-05	1.6E-02	4.9E-03	2.0E-03	6.4E-04	3.6E-02	2.8E-01	2.2E-02	2.9E-02	2.8E-03
R009	644	482	136	19	25	4.6	1.5	0.50	4.6E-05	1.5E-05	2.1E-02	6.9E-03	2.7E-03	8.8E-04	4.8E-02	3.6E-01	2.9E-02	3.8E-02	3.7E-03
R010	502	422	123	16	19	4.3	1.4	0.40	4.1E-05	1.2E-05	2.0E-02	5.7E-03	2.5E-03	7.1E-04	4.3E-02	2.7E-01	2.6E-02	2.8E-02	3.2E-03
R011	432	362	112	14	16	3.7	1.2	0.33	3.5E-05	9.7E-06	1.8E-02	4.9E-03	2.1E-03	6.0E-04	3.5E-02	2.2E-01	2.2E-02	2.3E-02	2.7E-03
R012	370	301	108	12	15	3.2	1.0	0.34	2.9E-05	9.6E-06	1.5E-02	5.1E-03	1.8E-03	6.1E-04	3.1E-02	2.1E-01	1.9E-02	2.1E-02	2.4E-03
R013	336	241	96	8.9	11	2.2	0.73	0.23	2.2E-05	6.7E-06	1.1E-02	3.3E-03	1.3E-03	4.1E-04	2.3E-02	1.8E-01	1.4E-02	1.9E-02	1.7E-03
R014	347	241	101	9.3	12	2.2	0.75	0.22	2.3E-05	6.8E-06	1.1E-02	3.1E-03	1.3E-03	4.0E-04	2.4E-02	1.9E-01	1.5E-02	2.0E-02	1.8E-03
R015	359	265	104	9.7	12	2.3	0.77	0.23	2.4E-05	6.9E-06	1.1E-02	3.1E-03	1.4E-03	4.0E-04	2.5E-02	2.0E-01	1.5E-02	2.0E-02	1.9E-03
R016	340	253	100	9.2	11	2.1	0.72	0.21	2.2E-05	6.4E-06	9.9E-03	2.8E-03	1.3E-03	3.7E-04	2.3E-02	1.9E-01	1.4E-02	1.9E-02	1.8E-03
R017	329	241	97	8.9	11	2.0	0.69	0.20	2.2E-05	6.2E-06	9.5E-03	2.7E-03	1.2E-03	3.5E-04	2.3E-02	1.8E-01	1.4E-02	1.9E-02	1.7E-03
Maximum	644	482	136	21	25	4.8	1.6	0.50	5.0E-05	1.5E-05	2.1E-02	6.9E-03	2.8E-03	8.8E-04	5.2E-02	3.6E-01	3.2E-02	7.5E-03	4.0E-03

Note:

1. Maximum predicted GLCs without background are presented in the table.
2. Maximum predicted GLCs in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2034) INTERIM BUILD SCENARIO - 6 LANES

Receptor ID	Predicted Cumulative Concentrations (With Background) (µg/m ³)																			
	CO		NO ₂ (ARM2)		NO ₂ (ARM2)		PM ₁₀	PM _{2.5}		B(a)P		Benzene		1,3-Butadiene		Formaldehyde	Acetaldehyde		Acrolein	
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr
R017*	549	470	110	24	18	24	13	6.2	7.5E-05	2.8E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	8.8E-02	3.2E-02	
R018*	809	651	158	30	28	26	13	6.4	9.1E-05	3.4E-05	6.0E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02	
R034*	857	687	162	31	27	26	13	6.4	9.3E-05	3.4E-05	6.0E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.1E-01	3.3E-02	
R035*	723	591	149	27	22	25	13	6.3	8.4E-05	3.1E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.8E-02	3.2E-02	
R036*	673	543	141	26	20	25	13	6.2	8.1E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.5E-02	3.2E-02	
R037*	670	543	141	26	23	25	13	6.3	8.1E-05	3.1E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.5E-02	3.2E-02	
R059*	842	687	161	35	34	27	14	6.5	1.0E-04	3.7E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.1E-01	3.4E-02	
R060*	862	687	162	34	31	27	14	6.4	1.0E-04	3.6E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.1E-01	3.4E-02	
R001	640	518	137	25	21	25	13	6.2	7.9E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02	
R002	649	506	138	25	21	25	13	6.2	7.9E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02	
R003	633	482	136	24	21	25	13	6.2	7.7E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02	
R004	607	470	129	24	20	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02	
R005	620	470	133	24	21	24	13	6.2	7.6E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02	
R006	727	555	150	27	25	25	13	6.3	8.4E-05	3.2E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.9E-02	3.2E-02	
R007	814	639	159	30	29	26	13	6.4	9.0E-05	3.5E-05	6.0E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02	
R008	777	603	156	29	27	26	13	6.4	8.7E-05	3.4E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02	
R009	921	723	166	33	33	27	14	6.5	9.9E-05	3.8E-05	6.1E-01	3.1E-01	4.2E-02	1.6E-02	1.9	21	7.0	1.1E-01	3.4E-02	
R010	780	663	153	31	28	26	13	6.4	9.4E-05	3.4E-05	6.1E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	1.0E-01	3.3E-02	
R011	709	603	142	28	24	26	13	6.3	8.7E-05	3.2E-05	6.0E-01	3.1E-01	4.2E-02	1.5E-02	1.9	21	7.0	9.6E-02	3.3E-02	
R012	648	543	138	27	24	25	13	6.3	8.2E-05	3.2E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.4E-02	3.2E-02	
R013	614	482	126	23	20	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02	
R014	624	482	131	24	20	24	13	6.2	7.6E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02	
R015	636	506	135	24	21	24	13	6.2	7.6E-05	3.0E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.3E-02	3.2E-02	
R016	618	494	130	24	20	24	13	6.2	7.5E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.2E-02	3.2E-02	
R017	606	482	127	23	19	24	13	6.2	7.4E-05	2.9E-05	6.0E-01	3.1E-01	4.1E-02	1.5E-02	1.9	21	7.0	9.1E-02	3.2E-02	
Maximum	921	723	166	35	34	27	14	6.5	1.0E-04	3.8E-05	6.1E-01	3.1E-01	4.2E-02	1.6E-02	1.9	21	7.0	8.0E-02	3.4E-02	

Note:
1. Maximum predicted cumulative GLCs (with background) are presented in the table.
2. Maximum predicted cumulative concentrations in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2044) ULTIMATE NO BUILD SCENARIO - 6 LANES

Background Concentration (µg/m³)	277	241	30	14	8.6	22	12	6.0	5.3E-05	2.3E-05	0.59	0.31	0.039	0.015	1.9	21	7.0	0.073	0.030
Predicted Concentrations Without Background (µg/m³)																			
Receptor ID	CO		NO ₂ (ARM2)		NO ₂ (ARM2)	PM ₁₀		PM _{2.5}		B(a)P		Benzene		1,3-Butadiene		Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	24-hr	0.5-hr	24-hr	1-hr
R017*	129	109	37	4.5	4.5	2.3	0.69	0.17	5.4E-06	1.3E-06	2.9E-03	7.2E-04	1.2E-04	3.0E-05	7.7E-03	5.8E-02	5.8E-03	4.8E-03	5.7E-04
R018*	253	193	74	7.6	8.9	4.2	1.2	0.36	9.2E-06	2.8E-06	5.0E-03	1.5E-03	2.1E-04	6.2E-05	1.3E-02	1.1E-01	9.9E-03	9.5E-03	9.9E-04
R034*	276	217	81	8.0	8.5	4.4	1.2	0.34	9.7E-06	2.6E-06	5.2E-03	1.4E-03	2.2E-04	6.0E-05	1.4E-02	1.3E-01	1.0E-02	1.0E-02	1.0E-03
R035*	212	169	62	6.3	6.3	3.4	0.97	0.25	7.6E-06	1.9E-06	4.1E-03	1.0E-03	1.7E-04	4.4E-05	1.1E-02	9.6E-02	8.2E-03	7.9E-03	8.1E-04
R036*	188	145	55	5.6	5.5	3.0	0.87	0.22	6.8E-06	1.7E-06	3.7E-03	9.0E-04	1.5E-04	3.8E-05	9.7E-03	8.5E-02	7.3E-03	7.0E-03	7.2E-04
R037*	186	145	54	5.7	6.5	3.1	0.89	0.26	6.9E-06	2.0E-06	3.8E-03	1.1E-03	1.6E-04	4.5E-05	9.9E-03	8.4E-02	7.4E-03	6.9E-03	7.4E-04
R059*	268	217	78	9.9	11.7	5.4	1.5	0.47	1.2E-05	3.6E-06	6.5E-03	1.9E-03	2.7E-04	8.0E-05	1.7E-02	1.2E-01	1.3E-02	9.9E-03	1.3E-03
R060*	277	217	81	9.4	10.6	5.2	1.5	0.42	1.1E-05	3.2E-06	6.2E-03	1.7E-03	2.6E-04	7.2E-05	1.6E-02	1.3E-01	1.2E-02	1.0E-02	1.2E-03
R001	173	133	51	5.2	6.0	2.8	0.81	0.23	6.3E-06	1.8E-06	3.4E-03	9.7E-04	1.4E-04	4.0E-05	9.0E-03	7.9E-02	6.7E-03	6.5E-03	6.7E-04
R002	177	121	52	5.1	6.0	2.8	0.80	0.23	6.2E-06	1.8E-06	3.4E-03	9.8E-04	1.4E-04	4.1E-05	8.9E-03	8.1E-02	6.6E-03	6.7E-03	6.6E-04
R003	170	121	50	4.8	5.8	2.6	0.76	0.22	5.9E-06	1.7E-06	3.3E-03	9.4E-04	1.3E-04	3.9E-05	8.4E-03	7.7E-02	6.3E-03	6.4E-03	6.2E-04
R004	157	109	46	4.4	5.3	2.4	0.70	0.21	5.4E-06	1.6E-06	3.0E-03	8.7E-04	1.2E-04	3.6E-05	7.6E-03	7.2E-02	5.7E-03	5.9E-03	5.7E-04
R005	163	109	48	4.6	5.6	2.5	0.73	0.22	5.6E-06	1.7E-06	3.1E-03	9.2E-04	1.3E-04	3.8E-05	7.9E-03	7.5E-02	5.9E-03	6.1E-03	5.9E-04
R006	214	157	63	6.0	7.6	3.4	0.98	0.31	7.5E-06	2.3E-06	4.2E-03	1.3E-03	1.7E-04	5.3E-05	1.1E-02	9.8E-02	7.9E-03	8.1E-03	7.9E-04
R007	255	193	75	7.3	9.3	4.2	1.2	0.38	9.0E-06	2.9E-06	5.0E-03	1.6E-03	2.0E-04	6.6E-05	1.3E-02	1.2E-01	9.6E-03	9.6E-03	9.6E-04
R008	238	169	70	6.8	8.6	3.9	1.1	0.35	8.3E-06	2.7E-06	4.7E-03	1.5E-03	1.9E-04	6.0E-05	1.2E-02	1.1E-01	8.8E-03	9.0E-03	8.8E-04
R009	307	229	91	8.9	11.5	5.3	1.5	0.49	1.1E-05	3.7E-06	6.2E-03	2.1E-03	2.5E-04	8.3E-05	1.6E-02	1.4E-01	1.2E-02	1.2E-02	1.2E-03
R010	235	193	66	7.8	8.8	4.8	1.4	0.39	9.9E-06	2.8E-06	5.9E-03	1.7E-03	2.2E-04	6.1E-05	1.4E-02	1.0E-01	1.0E-02	8.4E-03	1.0E-03
R011	201	169	55	6.4	7.2	4.1	1.2	0.33	8.3E-06	2.3E-06	5.2E-03	1.4E-03	1.8E-04	5.0E-05	1.2E-02	8.6E-02	8.5E-03	7.1E-03	8.5E-04
R012	176	145	52	5.9	6.9	3.6	1.0	0.34	7.0E-06	2.3E-06	4.4E-03	1.5E-03	1.6E-04	4.8E-05	1.0E-02	8.0E-02	7.6E-03	6.6E-03	7.5E-04
R013	158	109	45	4.2	5.1	2.5	0.72	0.22	5.3E-06	1.6E-06	3.1E-03	9.7E-04	1.2E-04	3.5E-05	7.5E-03	7.0E-02	5.6E-03	5.7E-03	5.5E-04
R014	164	121	47	4.4	5.4	2.5	0.73	0.22	5.5E-06	1.6E-06	3.2E-03	9.3E-04	1.2E-04	3.6E-05	7.8E-03	7.3E-02	5.8E-03	6.0E-03	5.8E-04
R015	170	121	49	4.6	5.6	2.6	0.75	0.22	5.7E-06	1.7E-06	3.2E-03	9.4E-04	1.3E-04	3.8E-05	8.1E-03	7.6E-02	6.1E-03	6.3E-03	6.0E-04
R016	161	121	47	4.4	5.2	2.4	0.70	0.20	5.4E-06	1.6E-06	3.0E-03	8.6E-04	1.2E-04	3.5E-05	7.7E-03	7.3E-02	5.8E-03	6.0E-03	5.7E-04
R017	156	109	45	4.3	5.1	2.3	0.67	0.19	5.2E-06	1.5E-06	2.9E-03	8.2E-04	1.2E-04	3.4E-05	7.4E-03	7.0E-02	5.6E-03	5.8E-03	5.5E-04
Maximum	290	229	91	9.9	11.7	5.4	1.5	0.49	1.2E-05	3.7E-06	6.5E-03	2.1E-03	2.7E-04	8.3E-05	1.7E-02	1.4E-01	1.3E-02	1.2E-02	1.3E-03

Note:

1. Maximum predicted GLCs without background are presented in the table.
2. Maximum predicted GLCs in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2044) ULTIMATE NO BUILD SCENARIO - 6 LANES

Receptor ID	Predicted Cumulative Concentrations (With Background) (µg/m ³)																		
	CO		NO ₂ (ARM2)		NO ₂ (ARM2)	PM ₁₀	PM _{2.5}		B(a)P	B(a)P	Benzene	Benzene	1,3-Butadiene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	406	350	67	19	13	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.7E-02	3.0E-02
R018*	530	434	104	22	17	26	13	6.4	6.2E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02
R034*	553	458	111	22	17	27	13	6.3	6.3E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02
R035*	489	410	92	21	15	26	13	6.2	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02
R036*	465	386	85	20	14	25	13	6.2	6.0E-05	2.4E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02
R037*	464	386	84	20	15	25	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02
R059*	545	458	108	24	20	28	14	6.5	6.5E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02
R060*	554	458	111	24	19	27	13	6.4	6.4E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02
R001	450	374	81	20	15	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.1E-02
R002	454	362	82	20	15	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R003	447	362	80	19	14	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R004	434	350	76	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R005	441	350	78	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R006	491	398	93	20	16	26	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02
R007	533	434	105	22	18	26	13	6.4	6.2E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02
R008	516	410	100	21	17	26	13	6.4	6.1E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02
R009	584	470	121	23	20	27	13	6.5	6.4E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.4E-02	3.1E-02
R010	513	434	96	22	17	27	13	6.4	6.3E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02
R011	478	410	85	21	16	26	13	6.3	6.1E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02
R012	453	386	82	20	15	26	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.1E-02
R013	435	350	75	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.8E-02	3.0E-02
R014	441	362	77	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R015	447	362	79	19	14	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R016	438	362	77	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02
R017	433	350	75	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.8E-02	3.0E-02
Maximum	568	470	121	24	20	28	14	6.5	6.5E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.4E-02	3.1E-02

Note:
1. Maximum predicted cumulative GLCs (with background) are presented in the table.
2. Maximum predicted cumulative concentrations in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2044) ULTIME BUILD SCENARIO - 8 LANES

Background Concentration (µg/m³)	277	241	30	14	8.6	22	12	6.0	5.3E-05	2.3E-05	0.59	0.31	0.039	0.015	1.9	21	7.0	0.073	0.030
Predicted Concentrations Without Background (µg/m³)																			
Receptor ID	CO	CO	NO ₂ (ARM2)	NO ₂ (ARM2)	NO ₂ (ARM2)	PM ₁₀	PM _{2.5}	PM _{2.5}	B(a)P	B(a)P	Benzene	Benzene	1,3-Butadiene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acetaldehyde	Acrolein	Acrolein
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr	24-hr
R017*	132	109	38	4.6	4.7	2.4	0.70	0.18	5.5E-06	1.4E-06	3.0E-03	7.4E-04	1.2E-04	3.1E-05	7.9E-03	5.9E-02	5.9E-03	4.8E-03	5.9E-04
R018*	257	205	75	7.8	9.3	4.3	1.2	0.37	9.5E-06	2.9E-06	5.1E-03	1.5E-03	2.2E-04	6.5E-05	1.4E-02	1.2E-01	1.0E-02	9.6E-03	1.0E-03
R034*	281	217	82	8.2	8.8	4.5	1.3	0.35	1.0E-05	2.7E-06	5.4E-03	1.5E-03	2.3E-04	6.2E-05	1.4E-02	1.3E-01	1.1E-02	1.1E-02	1.1E-03
R035*	215	169	63	6.4	6.6	3.4	0.99	0.26	7.7E-06	2.0E-06	4.2E-03	1.1E-03	1.8E-04	4.5E-05	1.1E-02	9.8E-02	8.3E-03	8.0E-03	8.3E-04
R036*	191	145	56	5.7	5.7	3.0	0.88	0.22	6.9E-06	1.7E-06	3.7E-03	9.3E-04	1.6E-04	3.9E-05	9.9E-03	8.7E-02	7.4E-03	7.1E-03	7.4E-04
R037*	189	145	55	5.8	6.8	3.1	0.91	0.26	7.1E-06	2.0E-06	3.8E-03	1.1E-03	1.6E-04	4.6E-05	1.0E-02	8.6E-02	7.6E-03	7.1E-03	7.5E-04
R059*	276	217	80	10	12	5.6	1.6	0.50	1.2E-05	3.8E-06	6.7E-03	2.0E-03	2.8E-04	8.5E-05	1.8E-02	1.2E-01	1.3E-02	1.0E-02	1.3E-03
R060*	285	217	83	9.8	11	5.3	1.5	0.44	1.2E-05	3.4E-06	6.4E-03	1.8E-03	2.6E-04	7.6E-05	1.7E-02	1.3E-01	1.3E-02	1.1E-02	1.2E-03
R001	176	133	52	5.2	6.2	2.8	0.82	0.24	6.4E-06	1.8E-06	3.5E-03	1.0E-03	1.4E-04	4.2E-05	9.1E-03	8.0E-02	6.9E-03	6.6E-03	6.8E-04
R002	180	133	53	5.2	6.2	2.8	0.82	0.24	6.3E-06	1.9E-06	3.5E-03	1.0E-03	1.4E-04	4.2E-05	9.0E-03	8.2E-02	6.8E-03	6.8E-03	6.7E-04
R003	173	121	51	4.9	6.0	2.7	0.78	0.23	6.0E-06	1.8E-06	3.3E-03	9.7E-04	1.3E-04	4.0E-05	8.5E-03	7.9E-02	6.4E-03	6.5E-03	6.3E-04
R004	160	109	47	4.5	5.5	2.4	0.71	0.21	5.5E-06	1.6E-06	3.1E-03	9.0E-04	1.2E-04	3.7E-05	7.8E-03	7.3E-02	5.8E-03	6.0E-03	5.8E-04
R005	166	109	49	4.6	5.8	2.6	0.74	0.23	5.7E-06	1.7E-06	3.2E-03	9.5E-04	1.3E-04	3.9E-05	8.1E-03	7.6E-02	6.0E-03	6.2E-03	6.0E-04
R006	218	157	64	6.2	7.9	3.5	1.0	0.32	7.7E-06	2.4E-06	4.3E-03	1.3E-03	1.7E-04	5.5E-05	1.1E-02	1.0E-01	8.1E-03	8.2E-03	8.1E-04
R007	260	193	77	7.6	9.7	4.3	1.2	0.40	9.3E-06	3.0E-06	5.2E-03	1.7E-03	2.1E-04	6.9E-05	1.3E-02	1.2E-01	9.9E-03	9.8E-03	9.8E-04
R008	243	181	72	7.0	8.9	4.0	1.1	0.37	8.6E-06	2.8E-06	4.8E-03	1.5E-03	1.9E-04	6.3E-05	1.2E-02	1.1E-01	9.1E-03	9.1E-03	9.0E-04
R009	313	229	92	9.2	12	5.4	1.5	0.51	1.1E-05	3.9E-06	6.4E-03	2.1E-03	2.6E-04	8.7E-05	1.6E-02	1.4E-01	1.2E-02	1.2E-02	1.2E-03
R010	241	205	67	8.0	9.3	5.0	1.4	0.41	1.0E-05	2.9E-06	6.1E-03	1.7E-03	2.2E-04	6.4E-05	1.4E-02	1.1E-01	1.1E-02	8.6E-03	1.1E-03
R011	206	169	56	6.5	7.5	4.2	1.2	0.34	8.5E-06	2.4E-06	5.2E-03	1.5E-03	1.8E-04	5.2E-05	1.2E-02	8.8E-02	8.7E-03	7.2E-03	8.6E-04
R012	180	145	53	6.0	7.2	3.7	1.0	0.35	7.2E-06	2.4E-06	4.6E-03	1.5E-03	1.6E-04	5.0E-05	1.0E-02	8.2E-02	7.8E-03	6.7E-03	7.7E-04
R013	161	109	45	4.3	5.3	2.5	0.73	0.23	5.4E-06	1.7E-06	3.2E-03	9.9E-04	1.2E-04	3.6E-05	7.6E-03	7.1E-02	5.7E-03	5.8E-03	5.6E-04
R014	167	121	48	4.5	5.6	2.6	0.75	0.23	5.7E-06	1.7E-06	3.2E-03	9.6E-04	1.3E-04	3.8E-05	8.0E-03	7.4E-02	6.0E-03	6.1E-03	5.9E-04
R015	173	121	50	4.8	5.8	2.6	0.77	0.23	5.9E-06	1.7E-06	3.3E-03	9.7E-04	1.3E-04	3.9E-05	8.4E-03	7.8E-02	6.3E-03	6.4E-03	6.2E-04
R016	164	121	47	4.5	5.4	2.4	0.72	0.21	5.5E-06	1.6E-06	3.1E-03	8.8E-04	1.2E-04	3.6E-05	7.9E-03	7.4E-02	5.9E-03	6.1E-03	5.9E-04
R017	159	121	46	4.3	5.3	2.3	0.69	0.20	5.3E-06	1.5E-06	2.9E-03	8.5E-04	1.2E-04	3.5E-05	7.6E-03	7.1E-02	5.7E-03	5.9E-03	5.6E-04
Maximum	313	229	92	10	12	5.6	1.6	0.51	1.2E-05	3.9E-06	6.7E-03	2.1E-03	2.8E-04	8.7E-05	1.8E-02	1.4E-01	1.3E-02	1.2E-02	1.3E-03

Note:

1. Maximum predicted GLCs without background are presented in the table.
2. Maximum predicted GLCs in bold exceed the air quality criteria.

Project Name: MTO Highway 401 East of Brockville Study
Appendix F: Special Receptor Modelled Results
FUTURE (2044) ULTIME BUILD SCENARIO - 8 LANES

Receptor ID	Predicted Cumulative Concentrations (With Background) (µg/m ³)																			
	CO		NO ₂ (ARM2)		NO ₂ (ARM2)		PM ₁₀	PM _{2.5}		B(a)P		Benzene		1,3-Butadiene		Formaldehyde	Acetaldehyde		Acrolein	
	1-hr	8-hr	1-hr	24-hr	annual	24-hr	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	annual	24-hr	0.5-hr	24-hr	1-hr
R017*	409	350	68	19	13	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.8E-02	3.0E-02	
R018*	535	446	105	22	18	27	13	6.4	6.2E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02	
R034*	558	458	112	23	17	27	13	6.4	6.3E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02	
R035*	492	410	93	21	15	26	13	6.3	6.1E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02	
R036*	468	386	86	20	14	25	13	6.2	6.0E-05	2.4E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02	
R037*	467	386	85	20	15	25	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02	
R059*	553	458	111	25	21	28	14	6.5	6.5E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02	
R060*	563	458	113	24	20	28	14	6.4	6.4E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.3E-02	3.1E-02	
R001	453	374	82	20	15	25	13	6.2	5.9E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.1E-02	
R002	457	374	83	20	15	25	13	6.2	5.9E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.1E-02	
R003	450	362	81	19	15	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R004	437	350	77	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R005	443	350	79	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R006	495	398	94	21	16	26	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02	
R007	538	434	107	22	18	27	13	6.4	6.2E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02	
R008	520	422	102	21	17	26	13	6.4	6.1E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.2E-02	3.1E-02	
R009	590	470	122	24	21	28	14	6.5	6.4E-05	2.7E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.4E-02	3.1E-02	
R010	519	446	98	22	18	27	13	6.4	6.3E-05	2.6E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.1E-02	3.1E-02	
R011	483	410	86	21	16	26	13	6.3	6.1E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.0E-02	3.1E-02	
R012	457	386	83	20	16	26	13	6.3	6.0E-05	2.5E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.1E-02	
R013	438	350	75	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.8E-02	3.0E-02	
R014	444	362	78	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R015	450	362	80	19	14	25	13	6.2	5.9E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R016	441	362	77	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
R017	436	362	76	19	14	25	13	6.2	5.8E-05	2.4E-05	5.9E-01	3.1E-01	3.9E-02	1.5E-02	1.9	21	7.0	7.9E-02	3.0E-02	
Maximum	590	470	122	25	21	28	14	6.5	6.5E-05	2.7E-05	5.9E-01	3.1E-01	4.0E-02	1.5E-02	1.9	21	7.0	8.4E-02	3.1E-02	

- Note:
1. Maximum predicted cumulative GLCs (with background) are presented in the table.
 2. Maximum predicted cumulative concentrations in bold exceed the air quality criteria.

**Air Quality Impact Assessment for the Highway 401 Planning Study East of
Brockville (GWP 4111-22-00)**

Appendix G Concentration Contour Plots

February 6, 2026

Appendix G Concentration Contour Plots



PROJECT TITLE:

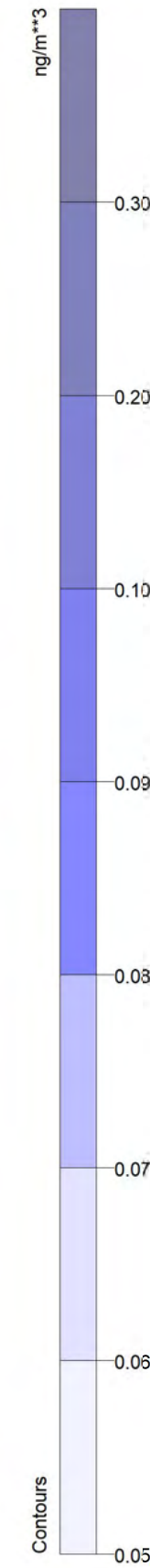
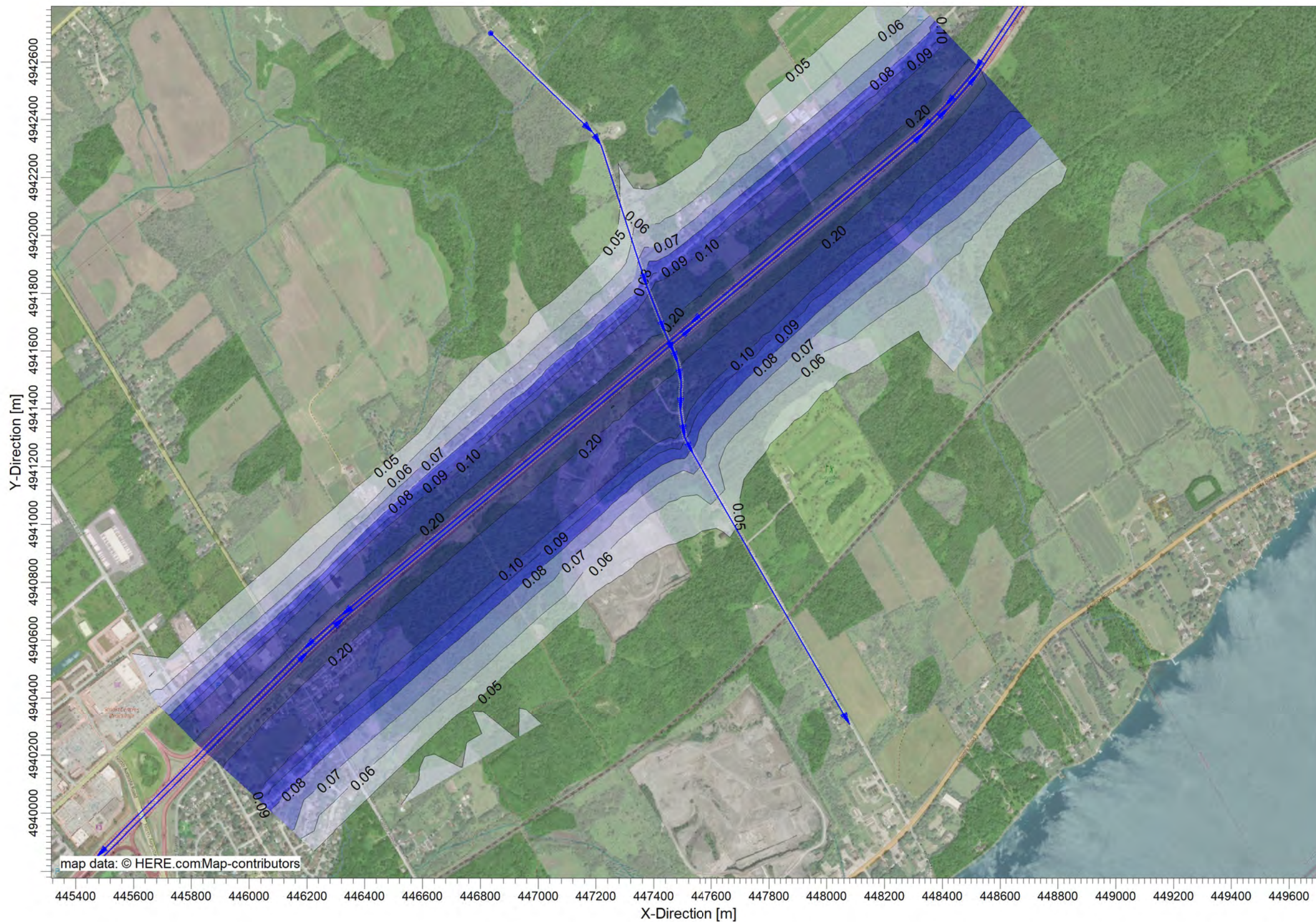
Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure G.1: Baseline (2020) Scenario 24-Hour Average B(a)P Concentration Contour Plot in ng/m³ (Meteorological Year 2023)

COMMENTS:

Blue lines represent modelled road links.

Results:
- are in nanograms per cubic metre
- are for meteorological year 2023
- do not include background concentrations

The 24-hr AAQC for B(a)P is 0.00005 ug/m³ or 0.05 ng/m³.



MODEL:
CAL3QHCR

LINKS:
25

RECEPTORS:
1474

DATE:
10/20/2025

SCALE: 1:14,512
0 400 m

PROJECT / PLOT NO.:

PROJECT TITLE:

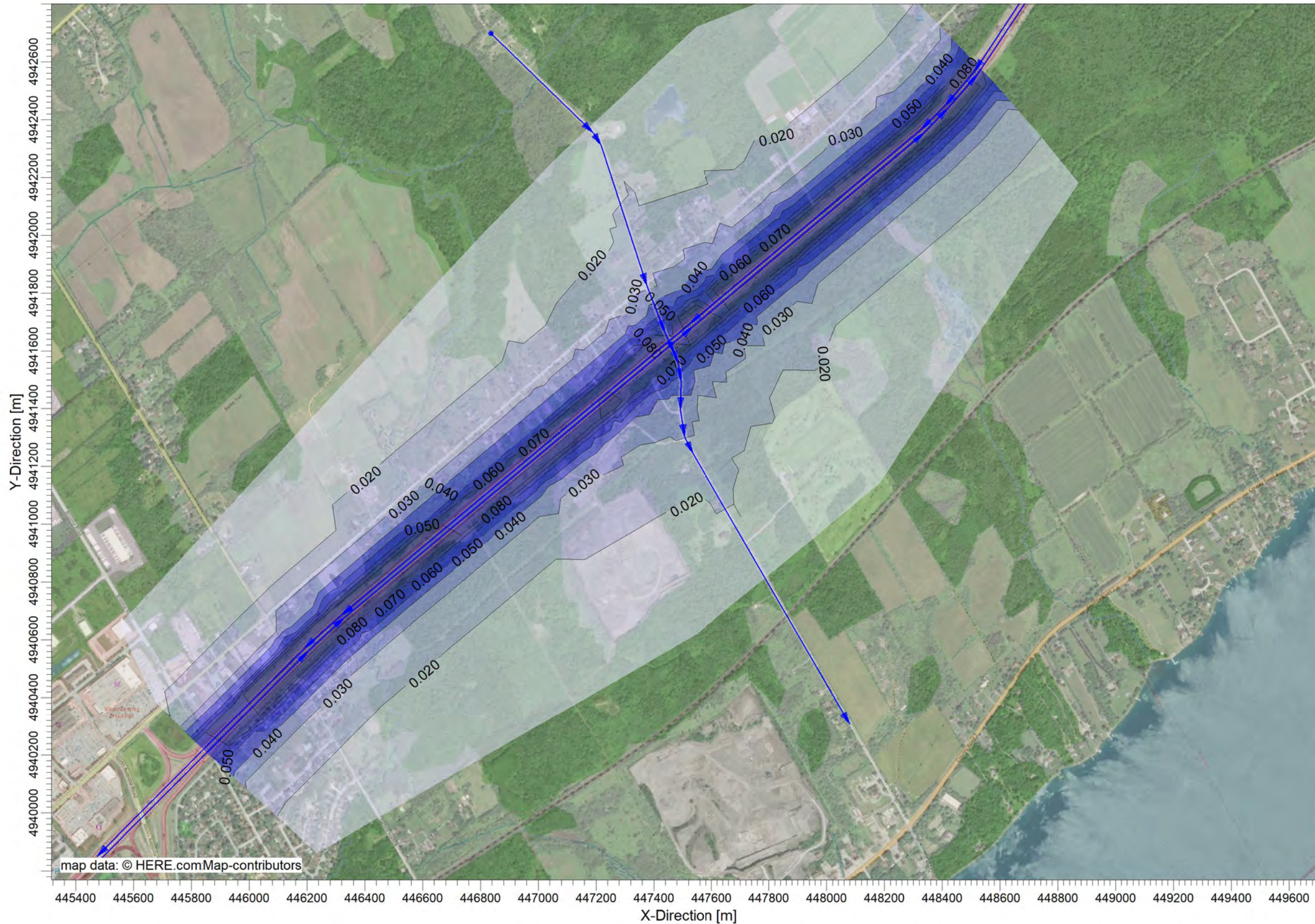
Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure G.2: Baseline (2020) Scenario Annual Average B(a)P Concentration Contour Plot in ng/m3 (Meteorological Year 2024)

COMMENTS:

Blue lines represent modelled road links.

Results:
- are in nanograms per cubic metre
- are for meteorological year 2024
- do not include background concentrations

The annual AAQC for B(a)P is 0.00001 ug/m3 or 0.01 ng/m3.



ug/m**3

Contours

MODEL:

CAL3QHCR

LINKS:

25

RECEPTORS:

1474

DATE:

10/20/2025

SCALE:

1:14,584

0

400 m

PROJECT / PLOT NO.:

PROJECT TITLE:

Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure G.3: Future (2034) Interim No Build Scenario Annual Average B(a)P Concentration Contour Plot in ng/m³ (Meteorological Year 2024)

COMMENTS:

Blue lines represent modelled road links.

Results:
- are in nanograms per cubic metre
- are for meteorological year 2024
- do not include background concentrations

The annual AAQC for B(a)P is 0.00001 ug/m³ or 0.01 ng/m³.



ng/m³

Contours

MODEL:

CAL3QHCR

LINKS:

25

RECEPTORS:

1474

DATE:

10/20/2025

SCALE:

1:14,513

0 400 m

PROJECT / PLOT NO.:

PROJECT TITLE:

Air Quality Impact Assessment Report for the MTO Highway 401 Planning Study East of Brockville (GWP 4111-22-0)
Figure G.4:Future (2034) Interim Build Scenario Annual Average B(a)P Concentration Contour Plot in ng/m³ (Meteorological Year 2024)

COMMENTS:

Blue lines represent modelled road links.

Results:
- are in nanograms per cubic metre
- are for meteorological year 2024
- do not include background concentrations

The annual AAQC for B(a)P is 0.00001 ug/m³ or 0.01 ng/m³.



Contours
0.01
0.02
ug/m³

MODEL:

CAL3QHCR

LINKS:

25

RECEPTORS:

1474

DATE:

10/20/2025

SCALE:

1:15,790



PROJECT / PLOT NO.: