THE CORPORATION OF THE CITY OF BRAMPTON

AIR QUALITY IMPACT ASSESSMENT REPORT

MUNICIPAL CLASS EA OF ARTERIAL ROADS WITHIN HIGHWAY 427 INDUSTRIAL SECONDARY PLAN AREA (AREA 47)

DECEMBER 2022

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THE CORPORATION OF THE CITY OF BRAMPTON

PROJECT NO.: TP115086
DECEMBER 2022

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"Effective September 21, 2022, Wood Environment & Infrastructure Solutions Canada Limited is now operating as WSP E&I Canada Limited. No other aspects of our legal entity, contractual terms or capabilities have changed in relation to this report submission."

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SIGNATURES

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EXECUTIVE SUMMARY

WSP E&I Canada Limited (WSP) was retained by the Corporation of the City of Brampton (the City) to complete an air quality impact assessment (AQIA) in support of a Municipal Class Environmental Assessment (EA) of Arterial Roads within Highway 427 Industrial Secondary Plan Area (Area 47) in Brampton, Ontario.

This assessment was carried out as per Ministry of Transportation's (MTO) Environmental Guide for Assessing Air Quality Impacts of Provincial Transportation Projects (May 2020) and Ministry of the Environment, Conservation and Parks (MECP) guidance document – "Scope of the Air Quality Assessment.

The City of Brampton is projecting significant growth in Area 47. In order to service this growth, new infrastructure is required to address the capacity needs and the objectives of protecting established communities and businesses. The Municipal Class Environmental Assessment Schedule 'C' – Environmental Study Report (WSP 2022) examined the need and feasibility for new roadway(s) and improvements to existing arterials to address short-term and long-term issues related to planned future growth, including operational, geometric, capacity, structural and drainage issues for the horizon year of 2031 and 2041. This Area 47 infrastructure change (the Project) is classified as being subject to the Class EA process.

The class EA is divided into two (2) parts (Part A and Part B) due to the complexity of the Study Area and related roadway improvements:

The roadways within Part 'A' will be owned and operated by the Region of Peel and will include the following:

- Arterial A2 – a new six (6) lane north-south roadway that connects Major Mackenzie Drive to Mayfield Road; and
- Coleraine Drive – an existing roadway which will be widened to four (4) lanes and be upgraded to include curb and gutter and multi-use pathways (MUP).

The roadways within Part 'B' will be owned and operated by the City and will include the following:

- Countryside Drive - an existing roadway which will be widened to four (4) lanes and be upgraded to include curb, gutters, and MUPs.
- Clarkway Drive – an existing roadway which will have portions widened to four (4) lanes and upgraded to include storm sewers, sidewalks, and cycle lanes
- East-West Arterial – a new four (4) lane roadway connecting The Gore Road to Arterial A2.

This AQIA report covers both Part A and Part B of the roadways.

As required by MTO guidance document, three (3) scenarios were assessed in AQIA:

- Current (year 2021) traffic and associated vehicle emissions;
- Future no-build (year 2041) traffic and associated vehicle emissions; and
- Future build (year 2041) traffic and associated vehicle emissions.

This AQIA has been developed based on available design information, year 2013 traffic information, which was prorated to the current scenario of 2021, and traffic predictions up to year 2041.

For the Study Area passenger vehicles comprise the majority of the traffic, with the average fleet profile consisting of 93% passenger cars and 7% heavy duty diesel vehicles (HDDV).

The purpose of this AQIA is to:

- Provide estimates of the air emissions resulting from vehicular traffic;
- Predict the resulting air quality effects on ambient air, with consideration of existing background air quality; and
- Provide a qualitative discussion of the significance of potential effects and a quantitative comparison of the future air quality effects year 2041 to the current scenario (year 2021) based on how they compare to the relevant criteria.

CAL3QHCR is considered to be the most appropriate model to predict pollutant concentrations from motor vehicles at roadway intersections. It can process up to one year of meteorological data and vehicular emissions, traffic volume, and signalization (ETS) data in one run using the basic algorithms from CAL3QHC.

The modelling was performed for the target contaminants (SPM, PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, benzo(a)pyrene, benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) stipulated in the scope of work. Note that the model runs for NOx do not take into account any atmospheric reactions or transformations; maximum concentrations were post-processed using an ozone limiting method (OLM) to account for these effects and to predict NO_2 concentrations as required by the regulation.

The findings of the air quality study were as follows:

- The potential effect associated with air emissions from vehicles is an increase in the airborne concentrations of the target contaminants NO_2, SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) in the vicinity of the Project due to the increase of traffic volume for both future 2041 scenarios in comparison with the current 2021 scenario;
- The incremental (Project) effects for NO_2, SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) are predicted to be below the respective ambient air quality criteria;
- Highest predicted effects are located near the receptors along the Castlemore Road for all three (3) scenarios;
- Modelled concentrations were incrementally small compared to the existing baseline air concentrations of the target contaminants;
- The predicted Project effects for NO_2 were highest for the current scenario (2021) and future no-build 2041 scenario, but still in compliance with all air quality limits currently enforced in the province of Ontario. SPM was highest for the future 2041 build scenario. The emission factors for the other target pollutants $PM_{2.5}$, NO_2, CO, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) decreased over time as a result of predicted decreases in tailpipe emissions per vehicle and off-set the increase of traffic volume. This resulted in lower impacts (modelled ambient air concentrations) on air quality in the 2041 scenario of all contaminants except SPM, PM_{10}, and SO_2. SPM, PM_{10}, and SO_2 emission increases result in

marginal increases to predicted ambient air concentrations but are still in compliance with ambient criteria and standards;

- The cumulative effects (Project plus background) of the roadways SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, 1-3 Butadiene, Formaldehyde, Acetaldehyde and Acrolein emissions within the Study Area and the background concentrations were below the respective ambient air quality criteria for all averaging times under each scenario;
- The cumulative effect (Project plus background) of the benzene and benzo(a)pyrene emissions within the Study Area plus the background concentrations were found to be higher than the annual Ambient Air Quality Criteria (AAQC) for both scenarios as a result of high background concentrations; and
- The cumulative effect (Project plus background) of the NO_2 emissions within the Study Area were found to be higher than the respective 1-hour CAAQS for the current 2021 scenario and for the 2041 scenario, due to elevated background concentrations. The annually averaged concentration of NO_2 is predicted to exceed the 2025 CAAQS for both of 2041 scenarios due to high background concentrations. The Project-only impact is in compliance with NO_2 limits (CAAQS and Ontario AAQC) for both current and future build scenarios.

Cumulative effects for the future build scenario were calculated based on the modelled project results plus current background concentrations which is a conservative approach, as it is expected that the background concentration will decrease over the time. Per the Environment and Climate Change Canada's (ECCC) website, the background levels of NO_2, SO_2, and VOCs in the ambient air in Canada have continually decreased between the years 2002 to 2016. NO_2 levels have decreased by 18% in that period. The proposed Project effects are relatively low when compared to background levels and Project effects are expected to diminish as vehicle emission standards improve and as fleets electrify. This conclusion is made based on air dispersion modelling results at the locations of the sensitive receptors presented in this AQA. In the 2041 scenarios, the same sensitive receptor locations were used as the WSP air team was not provided with new land use maps or sensitive receptor lists for 2041. When this information becomes available the modelling assessment may need to be refined.

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1 INTRODUCTION

WSP E&I Canada Limited (WSP) was retained by the Corporation of the City of Brampton (the City) to complete an air quality impact assessment (AQIA) in support of a Municipal Class Environmental Assessment (EA) of Arterial Roads within Highway 427 Industrial Secondary Plan Area (Area 47, the Project) in Brampton, Ontario.

The class EA is divided into two (2) parts (Part A and Part B) due to the complexity of the Study Area and related roadway improvements:

The roadways within Part 'A' will be owned and operated by the Region of Peel and will include the following:

- Arterial A2 – a new six (6) lane north-south roadway that connects Major Mackenzie Drive to Mayfield Road; and
- Coleraine Drive – an existing roadway which will be widened to four (4) lanes and be upgraded to include curb, gutters, and multi-use pathways (MUP).

The roadways within Part 'B' will be owned and operated by the City and will include the following:

- Countryside Drive - an existing roadway which will be widened to four (4) lanes and be upgraded to include curb, gutters, and MUPs.
- Clarkway Drive – an existing roadway which will have portions widened to four (4) lanes and upgraded to include storm sewers, sidewalks, and cycle lanes
- East-West Arterial – a new four (4) lane roadway connecting The Gore Road to Arterial A2.

This AQIA report covers both Part A and Part B of the roadways.

The purposes of this AQIA are to:

- Provide estimates of the air emissions resulting from vehicular traffic;
- Predict the resulting air quality effects on ambient air, with consideration of existing background air quality; and
- Provide a qualitative discussion of the significance of potential effects and a quantitative comparison of the future air quality effects year 2041 to the current scenario (year 2021).

The AQIA addresses the potential for the Project effect air quality, discusses the likelihood of such air quality effects occurring, and the significance of any effects predicted.

1.1 KEY COMPONENTS OF STUDY

The key components of the AQIA include:

1 Development of a baseline scenario considering the current air quality;

2 Development of an emissions scenario for the current level of service (year 2021) along portions of Mayfield Road, Hwy 50, Coleraine Drive, Countryside Drive and Clarkway Drive, The Gore Road, and Castlemore Road within the Study Area;

3 Development of an emissions scenario for the future (year 2041) level of service along portions of Mayfield Road, Hwy 50, Coleraine Drive, Countryside Drive and Clarkway Drive, The Gore Road, Castlemore Road, and two new arterial roadways (Arterial A2 and East-West Arterial) within the Study Area;

4 Qualitative and quantitative analysis of the effects on air quality; the quantitative analysis includes the use of air dispersion modeling to predict off-site air concentrations that result from Study Area activities; and

5 a qualitative discussion of the significance of air quality effects.

1.2 DEFINITION OF STUDY AREA

The Study Area (Figure 1.1) is located in the northeast area of the City of Brampton and encompasses major roadways between Mayfield Road, The Gore Road, Castlemore Road, and Hwy 50.

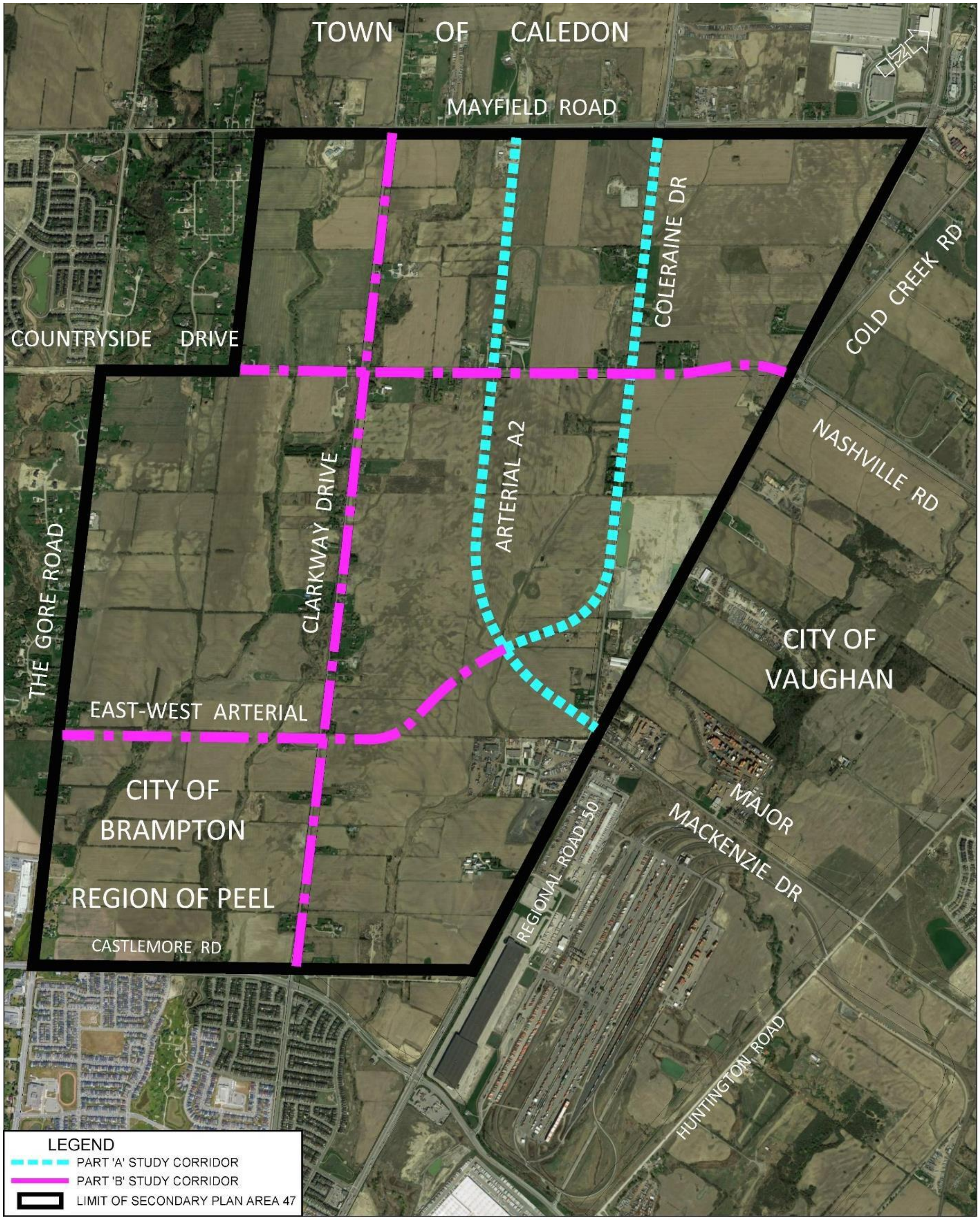

Figure 1.1: Study Area (Future)

The main roadways within the Study Area include:

- **Mayfield Road** - an east-west Regional arterial road that extends from Winston Churchill Boulevard to the west and Highway 50 to the east. Within the Study Area, Mayfield Road has a posted speed of 60 km/h, features an urban and rural cross section and provides 1 travel lane per direction with auxiliary lanes at many intersections.
- **Coleraine Drive** - a north-south two-lane roadway with a rural cross- section that runs from Mayfield Road to the Major Mackenzie Drive / Regional Road 50 intersection in the Study Area. The posted speed limit is 70 km/h.
- **Countryside Drive** - an east-west arterial road that extends from Heart Lake Rd to the west and Highway 50 to the east. The posted speed limit is 70 km/h.
- **Regional Road 50** - a five-lane north-south arterial road with two through lanes of traffic in each direction and a centre two way turning lane. The posted speed limit is 80 km/h.
- **Clarkway Drive** - a two-lane north-south arterial road that extends from Mayfield Road to Castlemore Road in the Study Area. The posted speed limit is 70 km/h in the Study Area.
- **The Gore Road** - a four-lane north-south arterial road that extends from Highway 9 in the north to regional road 50 in the south. The posted speed limit is 50 km/h in the Study Area.
- **Castlemore Road** - an east-west arterial road that extends from Airport Rd to the west and Highway 50 to the east. Within the Study Area, Castlemore Road has a posted speed of 70 km/h.

1.3 DESCRIPTION OF SCENARIOS

Three (3) scenarios were considered as part of the air quality assessment:

1 Current Conditions (2021);

2 Future no-build Conditions (2041); and

3 Future Build Conditions (2041).

2021 Current – This scenario consists of existing roadways portions of Mayfield Road, Hwy 50, Coleraine Drive, Countryside Drive and Clarkway Drive, The Gore Road, and Castlemore Road within the Study Area (Figure A-1, Appendix A).

2041 no-build – This scenario consists of the existing roadways in the Study Area with the projected no-build traffic volume predictions for year 2041 (Figure A-2, Appendix A).

2041 build – The traffic volumes, intersection data, and traffic profile (passenger cars, trucks), detailed in the CIMA+ report were used for the dispersion modelling assessment and the discussion of the air quality effects of traffic along the Study Area routes (e.g. Mayfield Road, Hwy 50, Coleraine Drive, Countryside Drive and Clarkway Drive, the Gore Rd, Castlemore Rd, and two new arterial roadways (Arterial A2 and East-West Arterial) within the Study Area) (Figure 1-1).

The proposed changes to the existing roadways:

Countryside Drive – This road will be widened to four (4) lanes and be upgraded to include curb, gutters, and MUPs.

Coleraine Drive – This road will be widened to four (4) lanes and be upgraded to include curb, gutters, and MUPs.

Clarkway Drive – This road will have portions widened to four (4) lanes and upgraded to include storm sewers, sidewalks, and cycle lanes

The proposed new roads for this scenario:

Arterial A2 – a new six (6) lane north-south roadway that connects Major Mackenzie Drive to Mayfield Road; and

East-West Arterial – a new four (4) lane roadway connecting The Gore Road to Arterial A2.

2 IDENTIFICATION OF POTENTIAL AIR QUALITY EFFECTS

There is the potential for vehicular emissions to increase the ambient air concentrations of certain pollutants in the Study Area.

The air quality effects of the airborne pollutants may be classified as health effects, environmental effects, or nuisance effects. The health and environmental effects are of significance in the ambient air in general. Nuisance effects are not generally expected to result in health or environmental effects and are considered at locations where people reside or frequent; such locations are deemed 'sensitive receptors' for the purposes of air quality studies. In Ontario, the Environmental Protection Act prohibits release of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect, and encompasses potential health, environmental, and nuisance effects.

Nitrogen dioxide, carbon monoxide, sulphur dioxide, particulate matter, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, acrolein) have standards in Ontario that were set based upon health or environmental effects of exposure to these pollutants. For this AQIA, the potential effects of these contaminants were assessed at sensitive receptors as required by applicable MTO and MECP guidance documents.

2.1 PARTICULATE MATTER

Particulate Matter, or more practically fugitive dust in the context of outdoor activities, is assessed and regulated in four forms:

- Suspended particulate matter (SPM) which usually considers the particle size range of up to 44 micrometres (µm) in aerodynamic diameter, and includes the smaller particle size fractions PM_{10} and $PM_{2.5}$. The larger particles are more likely to settle quickly and proximate to the source; it is the particles that are less than 44 micrometres in diameter that are generally considered as SPM. Ambient SPM standards have become a surrogate for visibility effects, and the assessment of SPM effects is related to potential nuisance effects, and not health effects.

  The coarser particulate matter in road dusts has a standard based upon the nuisance effects that may result from site emissions. The potential exists for road dust generated to lead to reduced air quality, impaired visibility, and deposition in the surrounding area. The proximity of the site to residences increases the likelihood that, if unmitigated, dust may become a nuisance to residents in the community.

- Inhalable particulate (PM_{10}) which has a particle size range up to 10 µm in aerodynamic diameter. PM_{10} includes the smaller particles referred to as $PM_{2.5}$. In addition to the nuisance effects, there are possible health effects that may be attributed to PM_{10}.
- Respirable particulate ($PM_{2.5}$) with a particle size range up to 2.5 µm in aerodynamic diameter. $PM_{2.5}$ is considered to be the most important particle size range from a respiratory public health perspective.
- Settleable particulate, or dustfall, that falls to the ground due to gravity and may be visible on surfaces. The dust fall is comprised of the coarser fraction of SPM that is prone to settling within close proximity to the source rather than being transported any significant distances from the site. According to the U.S. EPA's emission factor document (AP-42 Section 13.2, 1995), for a typical wind speed of 4.4 m/s, particles larger than 100 µm typically settle out within 6 to 9 m of the source.

2.2 NITROGEN OXIDES

Nitrogen oxides (NO_X) are a mixture of compounds of oxygen and nitrogen, including nitric oxide (NO), and nitrogen dioxide (NO_2). These compounds are formed during fuel combustion, and are emitted from vehicles, boilers, and diesel generators. Nitrogen oxides may contribute to the formation of smog or may affect human health at higher concentrations.

NO_2 from vehicle tailpipes were estimated and included in the modeling.

Atmospheric NO/NO_2 Reactions

NOx emissions from vehicle exhausts were estimated and modelled for the study, however the Ambient Air Quality Criteria (AAQC) criteria in Ontario is only for nitrogen dioxide (NO_2).

Although NO_2 can be released directly to the atmosphere, formation as a result of atmospheric reactions between NO and various other gases (namely O_3) tend to be the dominant source of NO_2 (Cole & Summerhays 1979). Accordingly, the conversion of NO to NO_2 can be quantified considering whether the ambient levels of O_3 will limit the conversion or not.

CALRoads modelling was done considering NOx emissions and maximum concentrations were post-processed using an ozone limiting method (OLM).

The 90th percentile ozone concentration measured at NAPS Station ID: 60428 (525 Main St. N. Brampton) between 2017 and 2021 was used as the background O_3 concentration for the following post-processing steps.

CALRoads was used to determine the maximum NOx concentration and:

a. If the ambient O_3 concentration was greater than 90% of the maximum modelled NOx concentration, then all NOx compounds were assumed to be in NO_2 form.

b. If the ambient O_3 concentration was less than 90% of the maximum modelled NOx, the NO_2 concentrations were determined as being equal to the ambient O_3 concentration plus 10% of the maximum modelled NOx concentrations (Cole & Summerhays 1979).

For the Project, based on the available ozone background data, "b" above was the relevant approach.

2.3 CARBON MONOXIDE

Carbon monoxide (CO) is a colourless, odourless, tasteless gas, which is produced primarily through the combustion of fossil fuels as a result of incomplete combustion. Over 75% of the CO produced in Ontario is from the transportation sector and 25% is due to the combined effect of power generation, buildings, heating and industrial operations. Exposures at 100 ppm or greater can be dangerous to human health, and larger exposures can lead to significant toxicity of the central nervous system and heart.

The Ontario Regulation 419/05 CO standard is for the ½-hour averaging time; AAQC exist for the 1-hour and 8-hour averaging times.

2.4 SULPHUR DIOXIDE

Sulphur oxides (SO_x) comprise sulphur dioxide (SO_2), sulphur trioxide (SO_3) and solid sulphate forms. Sulphur dioxide is a non-flammable, non-explosive colourless gas. In connection with fuel burning, where the majority is in the form of SO_2, SO_x is normally expressed in terms of the equivalent mass concentration of SO_2 and sometimes as total sulphur. Sulphur oxide has an odour threshold limit of 0.47 to 3.0 ppm, and has pungent irritating odour above 3 ppm. SO_x compounds are significant contributors to acid rain and are precursors to the formation of secondary fine particulate matter.

SO_2 is irritating to the eyes and respiratory system above 5 ppm (exposure for 10 minutes), in the form of higher airway resistance. The effects of SO_2 on human health with respect to the short-term (acute) respiratory effects have been extensively studied. No clear evidence of long-term or chronic effects is apparent.

2.5 VOLATILE ORGANIC COMPOUNDS (VOCS) AND BENZO(A)PYRENE

Some of the VOCs emitted by transportation vehicles are deemed to have significant health impacts and are designated as “air toxics” (MTO Air Quality Guideline).

These are:

- benzene;
- 1, 3-butadiene;
- formaldehyde;
- acetaldehyde; and
- acrolein.

The VOCs released during the fuel combustion were estimated and modelled.

Benzo(a)pyrene is not a VOC, but a polycyclic aromatic hydrocarbon (PAH) that is also released to the air during the combustion of fuels.

2.6 GREENHOUSE GASES

Greenhouse Gas (GHG) emissions, such as methane and carbon dioxide, are a potential contributor to long-term, global climate change effects. However, the offsite effects are not modelled because the ambient air quality criteria are intended to provide limits on short-term effects, with the longest averaging time being an annual average. As the Project is not expected to result in material modal shifts or changes to provincial vehicle volumes, its implementation is not expected to result in a material increase or decrease in GHG emissions.

2.7 OTHER POLLUTANTS

This AQIA covers the substances required by the noted guidelines (i.e., those typically most significant for transportation sources). There may be a number of other pollutants released from the Study Area as a result of the activities carried out, such as trace metals in the particulate matter; these other pollutants have not been considered in the modelling assessment.

3 PROJECT SETTING

3.1 REGULATORY FRAMEWORK AND ASSESSMENT CRITERIA

Various regulatory agencies set specific target criteria to be protective of human health and the environment. Criteria and standards can have different averaging times depending on the type of effect the compound may have.

The MECP has established AAQC limits for various compounds, including most of the target air contaminants identified for this air quality assessment. The AAQCs are set to determine a target concentration for a location, inclusive of all sources and background. The AAQC levels are not compliance standards but set to provide guidance for acceptable ambient air quality in Ontario.

Federal CAAQS for NO_2, $PM_{2.5}$, and SO_2 have been adopted by the Canadian Council of Ministers of the Environment and in addition to the provincial criteria, they were considered in this assessment. These CAAQS are intended as targets for air quality to determine appropriate air quality management actions within an air zone and not intended for local air quality assessment or enforcement. The comparison of the Project air quality effects with CAAQs limits is provided in the study for completeness and is not intended for detailed quantitative analyses.

The relevant air quality criteria for Ontario (provincial and federal) are listed in Table 3.1. This table lists the contaminants, the relevant averaging period for each standard and the standard as a numerical value (where appropriate).

Table 3.1: Air Quality Criteria used for Study

Contaminant	Averaging Time	Ontario Ambient Air Quality Criteria (AAQC) and Canadian Ambient Air Quality Standards (CAAQS)
NO_2	1-hour	400 µg/m³ (200 ppb) 117 (60 ppb) (2020 CAAQS*) 82 µg/m³ (42 ppb) (2025 CAAQS*)
	24-hour	200 µg/m³ (100 ppb)
	Annual	33 µg/m³ (17 ppb) (2020 CAAQS*) 23 µg/m³ (12 ppb) (2025 CAAQS*)
SO_2	10-minute	180 µg/m³
	1-hour	183 µg/m³ (70 ppb) (2020 CAAQS*) 170 µg/m³ (65 ppb) (2025 CAAQS*)
	Annual	10 µg/m³ (4 ppb) 13 µg/m³ (5 ppb) (2020 CAAQS*) 10 µg/m³ (4 ppb) (2025 CAAQS*)
CO	1-hour	36,200 µg/m³ (30 ppm)
	8-hour	15,700 µg/m³ (13 ppm)
SPM	24-hour	120 µg/m³
	Annual	60 µg/m³
PM_{10} (<10µm)	24-hour	50 µg/m³ (Interim)
$PM_{2.5}$ (<2.5 µm)	24-hour	27 µg/m³ (2020 CAAQS*)
	Annual	10 µg/m³ (2015 CAAQS*)
	Annual	8.8 µg/m³ (2020 CAAQS*)
Benzene	24-hour	2.3 µg/m³
	Annual	0.45 µg/m³
1-3 Butadiene	24-hour	10 µg/m³
	Annual	2 µg/m³
Formaldehyde	24-hour	65 µg/m³
Acetaldehyde	½-hour	500 µg/m³
	24-hour	500 µg/m³
Acrolein	1-hour	4.5 µg/m³
	24-hour	0.4 µg/m³
Benzo(a)pyrene	1-hour	0.00005 µg/m³
	24-hour	0.00001 µg/m³

Ambient SPM standards have become a surrogate for visibility effects; the effects are not health related and presented in this table for completeness. The criteria of 50 µg/m^3 as a 24-hour average for PM_{10} is an interim ambient air quality criterion provided as a guide for decision making. For $PM_{2.5}$, the Canadian Ambient Air Quality Standard of 27 µg/m^3 has been set for the protection of health and to reduce environmental risk as a national target for air zones.

3.2 BACKGROUND CONDITIONS

The background concentrations for pollutants CO, NO_2, O_3, $PM_{2.5}$, benzo(a)pyrene, and select VOCs (benzene and 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) considered in this assessment were obtained from the Environment Canada National Air Pollution Surveillance (NAPS) air monitoring stations as outlined in Table 3.2 using a five-year dataset (2017-2021).

Table 3.2: Background Concentrations

Parameter		Background[1] Concentration, µg/m^3	Source of Criteria
CO	1-hour	447	Hamilton Downtown (NAPS ID: 60513)
	8-hour	447	
SO_2	10-min	53.6 [3]	
	1-hour	32.5	
	24-hour	31.7	
	Annual	10.5	
NO_2	1-hour	52.4	525 Main St. N. Brampton Monitoring Station (NAPS ID: 60428)
	24-hour	43.0	
	Annual	21.7	
O_3[2]	1-hour	43 ppb	
$PM_{2.5}$	24-hour	12	
	Annual	6.9	
PM_{10}	24-hour	22.1	$PM_{2.5}/PM_{10}$ = 0.54 (Lall et. All, 2004)
SPM	24-hour	44.3	SPM = PM_{10} Baseline x 2 (Lall et. All, 2004)
	Annual	25.6	
Acetaldehyde	24-hour	2.91	Roadside – 401W Toronto (NAPS ID: 60438)
	½-hour	8.6 [3]	
Acrolein	24-hour	0.082	
	1-hour	0.2 [3]	
Formaldehyde	24-hour	2.76	
Benzene	24-hour	1.43	Hamilton Downtown (NAPS ID: 60513)
	Annual	0.7	

Parameter		Background[1] Concentration, µg/m³	Source of Criteria
1,3-Butadiene	24-hour	0.05	Hamilton Downtown (NAPS ID: 60513)
	Annual	0.03	
Benzo(a)pyrene[4]	24-hour	1.71E-04	
	Annual	5.61E-04	

Note:
[1]Background values are 90th percentiles for averaging periods less then annual periods and averages for annual averaging periods.
[2]Ozone background concentrations was determined for use in NO_2 post-processing.
[3]Background value estimated using *Ontario's Procedure for Preparing an Emission Summary and Dispersion Modeling Report [Guideline A-10]* methodology for converting between averaging period.

3.3 REGIONAL CLIMATE AND METEOROLOGY

Air quality is affected by both the emission sources that release pollutants into the air, and by the climate, or atmospheric conditions, such as wind speed, wind direction, and temperature. The climate in the Greater Toronto Area consists of fairly cold and windy winters and typically hot, humid summers.

For this AQIA, five years of surface meteorological data were obtained for Pearson International Airport (TORONTO INTL A, WMO ID: 71624); this station is located 12 kilometers south of the Study Area. The 5-year period of record for meteorological data is not considered a climate record, but rather a meteorological data set. The term climate normal is the arithmetic average of a meteorological parameter during a 30-year period.

3.3.1 WIND SPEED AND DIRECTION

The wind rose depicted in Figure 3.1 details the distribution of wind directions and wind speeds for 2017 to 2021. A wind rose depicts the predominant wind patterns for a site by graphically illustrating the distribution of wind speed and wind direction. The wind rose is comprised of two parts: the frequency of winds from specified direction around the rose, and the distribution of wind speed indicated by the colours on each bar that represent wind speed ranges. The westerly winds are prevailing, with the average wind speed of 4.61 m/s (16.6 km/h) over the five-years of recorded data.

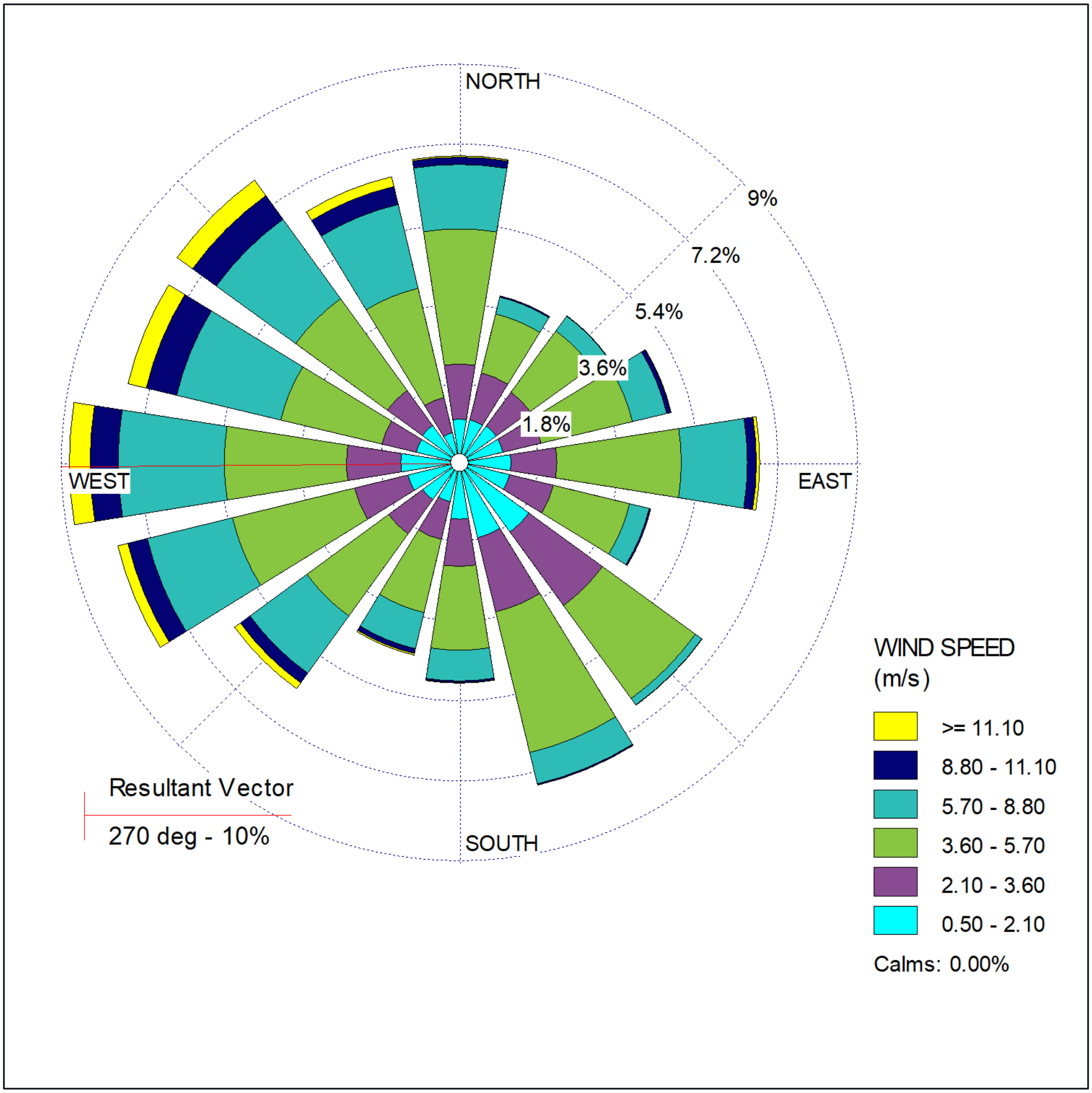

Figure 3.1: Pearson Intl. Airport 5 Year (2017-2021) Windrose

3.3.2 TEMPERATURE

The temperature in the greater Toronto area fluctuates significantly with the seasons (Figure 3.2). The climate normal annual average temperature reported was 7.1 °C; the January daily average was -6.3 °C and a July average 20.0°C. The daily maximum and minimum temperatures were also demonstrative of the large fluctuations in temperature typical of this climate zone. In July, the daily average temperatures ranged from 13.0 to 26.9 °C. In January, the range was -10.9 to -1.7°C.

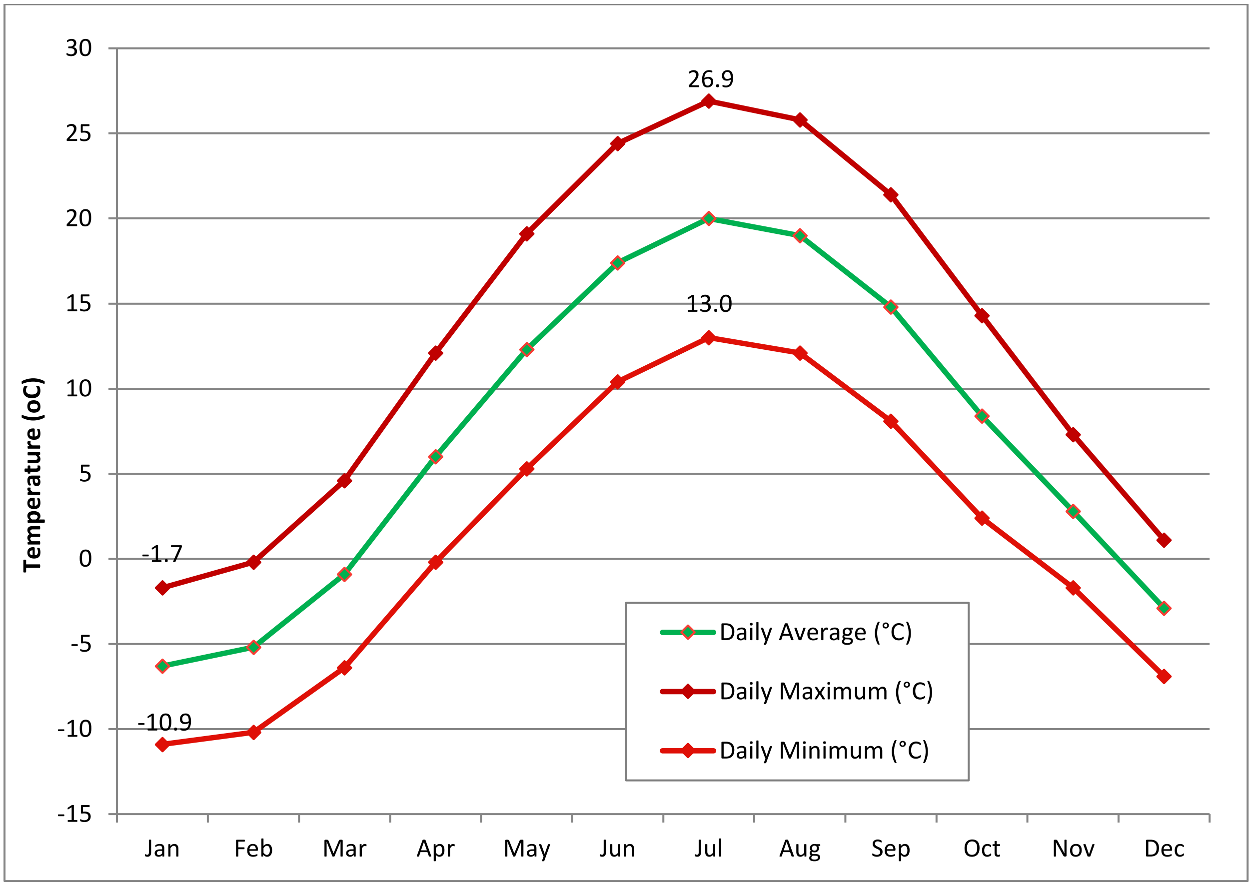

Figure 3.2: Daily Temperature Climate Normals (1981-2010)

3.3.3 PRECIPITATION

Mean annual precipitation for the Project area is estimated at 877 mm (Figure 3.3), with the greatest precipitation contribution occurring as rainfall during the spring and summer.

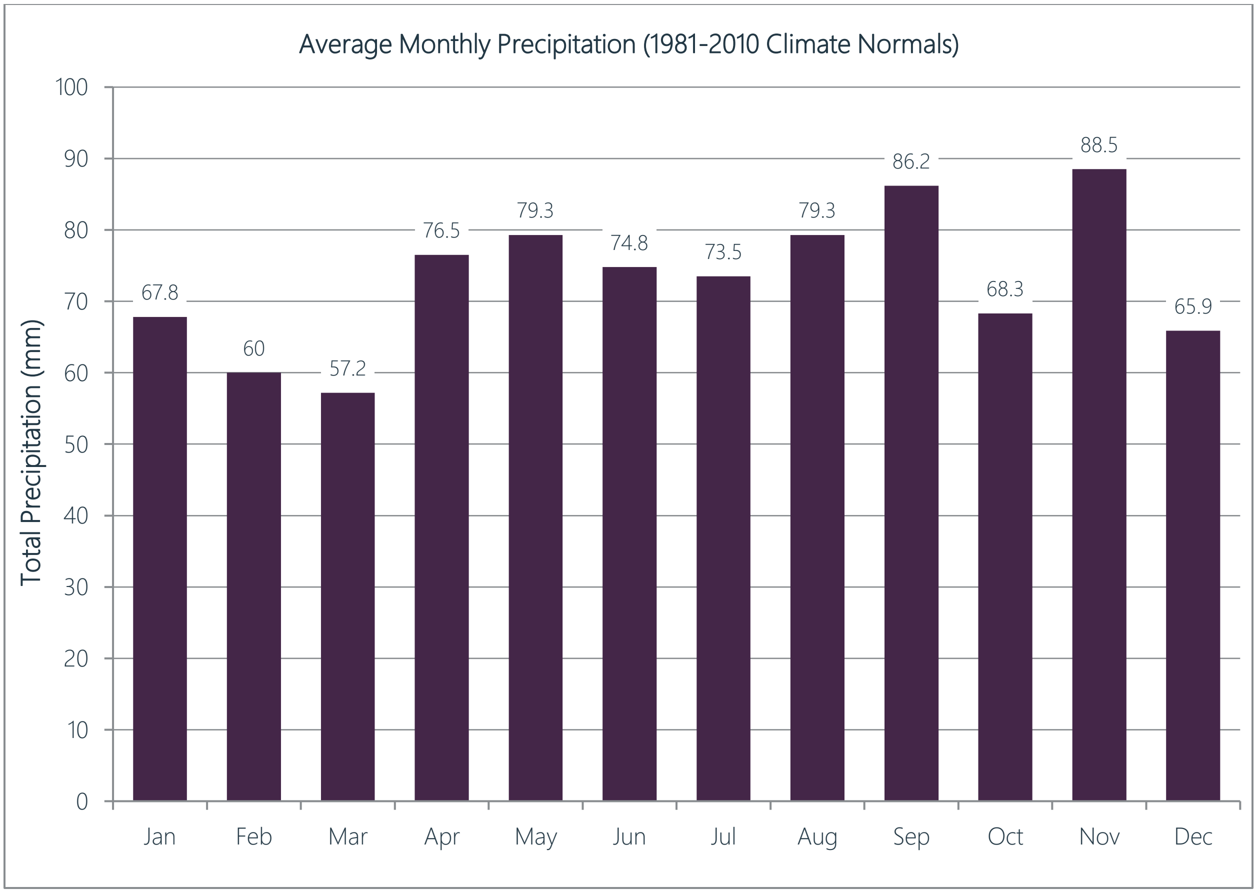

Figure 3.3: Precipitation Climate Normals (1981-2010)

3.4 SURROUNDING LAND USES

The existing land uses in the Study Area are a mix of office/business, agricultural as well as residential type land uses, with some pockets of commercial.

4 IDENTIFICATION OF FLEET PROFILES AND EMISSION RATE ESTIMATION

Identification of fleet profiles and emission rates were estimated based on the following software, traffic study, and US EPA guideline:

- US EPA Motor Vehicle Emission Simulator (MOVES) software (version MOVES3) estimates g/mile emissions for passenger cars and Heavy-Duty Diesel Vehicles (HDDVs).
  - MOVES considers the gradual fleet replacement as the higher polluting vehicles were removed from service.
  - Idling emission factors were calculated using MOVES with the vehicle volume of the link as per one (1) vehicle and assign an average speed of 0 mile per hour (US EPA recommended practice for normal idling).
- Fleet profile averaged from CIMA's 2021 study; predominantly passenger vehicles.

4.1 EMISSION SCENARIOS

The vehicular emission factors (including tailpipe exhaust, brakewear, and tirewear emissions) were estimated for current conditions (2021), future no-build (2041), and future build conditions (2041) using the US EPA MOVES model. This model is the EPA's official model for estimating emissions from highway vehicles, and trucks, and officially accepted by the MTO and the MECP for this type of assessments in the province of Ontario.

Emission scenarios and emission rates estimate are presented in Appendix B.

4.2 EMISSION RATE ESTIMATION

Emission factors for vehicles (cars, trucks, etc.) were developed using MOVES for project scale with "emission rates" calculation type.

Idling emission factors were calculated using MOVES with the vehicle volume of the link as per one (1) vehicle and assign an average speed of 0 mile per hour (US EPA recommended practice for normal idling).

Vehicle Emissions:

The tailpipe emissions, and particulate emissions from brake and tire wear, for passenger vehicles and heavy-duty diesel vehicles were estimated using MOVES3 model.

This model provides estimates of emissions for current and future years, with consideration for gradual fleet replacement as the higher polluting older vehicles were removed from service.

MOVES Input parameters are provided in Table 4.1.

Table 4.1: MOVES3 Model Input Parameters

Parameter	Input
Scale Panel	Model Type: Onroad
	Domain/Scale: Project
	Calculation type: Emission Rates
Time Spans	Years: 2021 (current) and 2041 (future)
Geographic Bounds Panel	Region: Zone & Link – New York Niagara County
Vehicles/Equipment – Onroad vehicles	Fuels: Gasoline/diesel fuel
	Source Use types: Passenger car/combination long-haul truck
Road type	Rural Unrestricted Access
Pollutants and Processes	PM_{10}/$PM_{2.5}$/NO_2/CO/SO_2/ Benzo(a)pyrene/ Benzene/ 1-3 Butadiene/Formaldehyde/Acetaldehyde/Acrolein
Input Database	
Meteorology	Temperature and relative humidity were obtained from meteorological data from Environment Canada and Climate Change station
Age Distribution	Used MOVES default data based on the years, 2021 (current), and 2041 (future)
	Age fractions of fleet by age and source type

The emissions calculations and a summary of the raw traffic data is provided in Appendix B and Appendix C respectively.

Re-entrainment Particulate Matter Emissions:

Re-entrainment of dust from paved roads was considered and added to the particulate matter emissions for this Project. SPM, PM_{10}, and $PM_{2.5}$ emission factors were calculated based on US EPA AP-42, Section 13.2.1.

The equation used to calculate the dust re-entrainment emission factor was:

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

Where:

E = particulate emission factor (g/VKT)
K = particle size multiplier
sL= road surface silt loading factor (g/m^2)
W = average vehicle weight (assumed 3 tons)

Sample calculations of emission factors for re-entrainment particulate matter are provided in Appendix B.

For SPM, PM_{10}, and $PM_{2.5}$ modelling, re-entrainment emissions factors were combined with vehicle exhaust emission factors (generated from MOVES3).

5 DISPERSION MODELLING

Modeling for the site was undertaken using the CALRoads US EPA model, modelling package of Lakes Environmental Consultants Inc., version 6.5.0. CALRoads View is a dynamic and intuitive user-friendly interface for the three air dispersion modelling codes: CALINE4, CAL3QHC and CAL3QHCR. The modelling used the meteorological data set for Toronto as recommended by the Ministry of the Environment, Conservation and Parks (MECP). Concentrations of Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon Monoxide (CO), Suspended Particulate Matter (SPM), Inhalable particulate (PM_{10}), Respirable particulate ($PM_{2.5}$), benzo(a)pyrene (B(a)P), and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, acrolein) were modelled for the three (3) assessment scenarios and included predicted concentration levels at the closest sensitive receptors. The emission rates were developed based on MOVES3 US EPA software and traffic data was based on the traffic study report (dated June 7, 2021) completed by CIMA for the Class EA.

The off-site effects were predicted using the CAL3QHCR dispersion model, using the Tier I approach. In this conservative approach, one hour (peak hour) of Emissions, Traffic, and Signalization (ETS) data are input into the CAL3QHCR model. The program uses the same hour of ETS data for every hour in the day.

Traffic data for all hours of the day, which is required for the refined Tier 2 modelling approach was not available, so the Tier 1 approach (only peak hour traffic volume) in the CAL3QHCR model was used to predict off-site effects.

The CAL3QHCR model incorporates features previously available for two predecessor models CALINE-4 and CAL3QHC. CALINE-4 model is designed to predict air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles operating under free flow conditions. However, it does not permit the direct estimation of the contribution of emissions from idling vehicles. CAL3QHC model enhances CALINE-4 by incorporating methods for estimating queue lengths and the contribution of emissions from idling vehicles, to allow for total air pollution concentrations from both moving and idling vehicles. CAL3QHCR further enhances the model by incorporating local meteorological data rather than the default wind speed and wind directions used by CAL3QHC.

5.1 MODEL INPUTS

The CAL3QHCR modelling input summary table is provided below.

Table 5.1: CAL3QHCR Modelling Input Summary Table

Parameters	**Input**
Job options	
Run information	Pollutant type: PM/CO/Inert Gas
	Approach: Tier I
Job parameters	Settling velocity: Non-PM Contaminants = 0 cm/s $PM_{2.5}$ = 0.02 cm/s, PM_{10} = 0.3 cm/s
	Deposition velocity: : Non-PM Contaminants = 0 cm/s $PM_{2.5}$ = 0.1 cm/s, PM_{10} = 0.5 cm/s
	Setting: Rural
	Surface Roughness Length: 50cm

Parameters	Input
Met Options	
Meteorological data	2017-2021 data from Toronto Pearson International Airport
	Model can process only one year of met data.
	The model was run separately for each year (2017, 2018, 2019, 2020, and 2021). Out of all five individual runs the modelling based on year 2021 data predicted the highest POI concentrations at the receptors. This year meteorological data was selected for all subsequent modelling runs as the most conservative.
Link and Group Link Options	
Free flow link Queue link	The traffic volumes (vph), and intersection data were obtained from Traffic Study Report (CIMA 2021). The emission factors (g/v-mi) were obtained from MOVES3.
Receptors	Receptors were placed (based on the residential locations) along major road and highways.

Within the Study Area, the land use is primarily agricultural and rural residential with some industrial and commercial land use. Surface roughness length 50cm was selected for the modelling based on the land use.

5.2 METEOROLOGICAL DATA

The meteorological data obtained from the MECP was a 5-year (2017 – 2021) dataset. This data consisted of hourly surface data from a met station at Toronto Pearson Airport located approximately 14 kilometres to the southof the Study Area. The meteorological data incorporated into the model included wind speed, wind direction, stability category, air temperature, rural mixing height, and urban mixing height. For the CAL3HQCR modelling, each run considers one year of meteorological data. Based on screening runs, the 2021 meteorological data resulted in the highest air contaminant concentrations and was carried forward for the rest of the modelling.

5.3 RECEPTOR LOCATIONS

The receptors were selected based on road configurations, current and future residential developments, and considering the MTO guidelines regarding typical impact distances from major roads (100 m) and highways (500 m).

400 discrete receptors (1.5m high) were selected for the current scenario (2021) modelling based on road configurations, current residential, and considering the MTO guidelines regarding typical impact distances from major roads (100 m) and highways (500 m).

The development plan or zoning information was not available for the Project future build scenario during the preparation of the report, so, the receptors selected for the current scenario were used for the 2041 future build scenario.

The locations of the sensitive receptors are presented in Appendix A.

5.4 TARGET CONTAMINANTS

The model was run for the target pollutants (PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, benzo(a)pyrene, benzene, 1,3 butadiene, formaldehyde, acetaldehyde, and acrolein). The re-entrainment road dust emissions factors (for PM_{10} and $PM_{2.5}$)

were combined with emission factors generated by MOVES to develop the total particulate matter emission factors used in the CAL3QHCR model.

Note that the model runs for NOx do not take into account any atmospheric reactions or transformations. Post-processing techniques noted in section 2.2 were used to convert NOx to NO^2.

The CALRoads Version 6.5.0 model is designed to model the effects of particulate matter or CO; benzo(a)pyrene, NO_2, SO_2, benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein were modeled as "pollutant type – inert gases" with appropriate molecular weight as recommended by Lakes Environmental technical support.

For this study, the highest predicted concentration is reported in Table 7.1 and portrayed in the sample isopleths (Figures A-5 to A-7, Appendix A).

6 CONSTRUCTION EMISSIONS

Due to the short-term duration of the construction phase of the Project in comparison with the operational phase, the impacts of the construction activities were not quantitatively assessed. Fugitive dust generated from the construction activities (pavement removal, overburden excavation, material movement, etc.) should be addressed through a Best Management Practice (BMP) plan. Emissions of NO2, SO2, B(a)P, and VOCs are also expected to emit from the heavy-duty construction equipment and can be managed through engine emission standards, maintenance standards, and scheduling.

7 ASSESSMENT FINDINGS / RESULTS

Project modelling results are presented in Table 7.1. Combined effect of modelled project effects plus background concentrations is presented in Table 7.2.

Table 7.1: Project Dispersion Modelling Results

Pollutant	Averaging Time	Ambient Air Quality Criteria[1]	Current 2021 CAL3QHCR Max Concentration (µg/m³)	Current 2021 Project Percentage of Criteria	Future 2041 No Build CAL3QHCR Max Concentration (µg/m³)	Future 2041 No Build Project Percentage of Criteria	Future 2041 Build CAL3QHCR Max Concentration (µg/m³)	Future 2041 Build Project Percentage of Criteria
SPM	24hr	120	35.1	29%	38.5	32%	47.5	40%
	Annual	60	15.3	26%	16.4	27%	16.6	28%
PM_{10}	24hr	50	10.1	20%	10.1	20%	12.5	25%
$PM_{2.5}$	24hr	27	3.6	13%	2.4	9%	3.0	11%
	Annual	8.8 (2020 CAAQS)	1.4	16%	1.0	11%	1.0	12%
NO_2	1 hr	400	94.3	24%	74.1	19%	90.0	22%
		117 (2020 CAAQS) [2]	67.3	58%	32.4	28%	18.0	15%
		82 (2020 CAAQS) [2]	67.3	82%	32.4	39%	18.0	22%
	24 hr	200	38.7	19%	30.4	15%	37.0	18%
	Annual	33 (2020 CAAQS)	6.7	20%	5.3	16%	6.4	19%
		23 (2025 CAAQS)	6.7	29%	5.3	23%	6.4	28%
SO_2	10 min	180	0.9	0.5%	1.0	0.6%	1.3	1%
	1 hr	170 (2025 CAAQS)	0.5	0.3%	0.6	0.4%	0.8	0.5%
	Annual	10 (2025 CAAQS)	0.04	0.4%	0.05	0.4%	0.06	1%
CO	1 hr	36200	923	3%	112	0.3%	472	1%
	8 hr	15700	447	3%	57	0.4%	240	2%
Benzene	24hr	2.30	0.72	31%	0.05	2%	0.05	2%
	Annual	0.45	0.13	28%	0.01	2%	0.01	2%
1-3 Butadiene	24hr	10	0.21	2%	0.00	0%	0.00	0%
	Annual	2	0.04	2%	0.00	0%	0.00	0%
Formaldehyde	24hr	65	0.28	0.4%	0.26	0.4%	0.05	0.1%
Acetaldehyde	24hr	500	0.16	0.03%	0.04	0.01%	0.05	0.01%
	1/2-hr	500	0.48	0.10%	0.11	0.02%	0.16	0.03%
Acrolein	24hr	0.40	0.02	5.1%	0.00	0.8%	0.00	1.2%
	1 hr	4.50	0.05	1.1%	0.01	0.2%	0.01	0.3%
Benzo(a)pyrene	24 hr	5.00E-05	1.69E-06	3%	2.69E-07	1%	3.15E-07	1%
	Annual	1.00E-05	2.93E-07	2.9%	4.68E-08	0.5%	5.47E-08	0.5%

1 Unless otherwise noted
2 98th Percentile

Table 7.2: Combined Project and Background Air Concentrations

Pollutant	Averaging Time	Ambient Air Quality Criteria[1]	Background Concentration (µg/m³)	Current 2021 CAL3QHCR Max Concentration (µg/m³)	Current 2021 Cumulative Concentration (Project+Background) (µg/m³)	Current 2021 Project + Background Percentage of Criteria	Future 2041 No Build CAL3QHCR Max Concentration (µg/m³)	Future 2041 No Build Cumulative Concentration (Project+Background) (µg/m³)	Future 2041 No Build Project + Background Percentage of Criteria	Future 2041 Build CAL3QHCR Max Concentration (µg/m³)	Future 2041 Build Cumulative Concentration (Project+Background) (µg/m³)	Future 2041 Build Project + Background Percentage of Criteria
SPM	24hr	120	44.3	35.1	79.4	66%	38.5	82.7	69%	47.5	91.8	76%
	Annual	60	25.6	15.3	40.9	68%	16.4	42.0	70%	16.6	42.2	70%
PM_{10}	24hr	50	22.1	10.1	32.2	64%	10.1	32.2	64%	12.5	34.6	69%
$PM_{2.5}$	24hr	27	14.0	3.6	17.6	65%	2.4	16.4	61%	3.0	17.0	63%
	Annual	8.8 (2020 CAAQS)	6.9	1.4	8.3	95%	1.0	7.9	90%	1.0	7.9	90%
NO_2	1 hr	400	52.4	94.3	146.7	37%	74.1	126.5	32%	90.0	142.4	36%
		117 (2020 CAAQS) [2]	52.4	67.3	119.7	102%	32.4	84.8	72%	18.0	70.4	60%
		82 (2020 CAAQS) [2]	52.4	67.3	119.7	146%	32.4	84.8	103%	18.0	70.4	86%
	24 hr	200	43.0	38.7	81.7	41%	30.4	73.4	37%	37.0	79.9	40%
	Annual	33 (2020 CAAQS)	21.7	6.7	28.5	86%	5.3	27.0	82%	6.4	28.2	85%
		23 (2025 CAAQS)	21.7	6.7	28.5	124%	5.3	27.0	118%	6.4	28.2	122%
SO_2	10 min	180	53.6	0.9	54.5	30%	1.0	54.7	30%	1.3	54.9	31%
	1 hr	170 (2025 CAAQS)	32	0.5	33.0	19.4%	0.6	33.1	19.5%	0.8	33.3	19.5%
	Annual	10 (2025 CAAQS)	10.5	0.04	10.5	100%	0.05	10.5	100%	0.06	10.5	101%
CO	1 hr	36200	447	923	1370	4%	112	559	2%	472	919	3%
	8 hr	15700	447	447	893	6%	57	504	3%	240	687	4%
Benzene	24hr	2.30	1.43	0.72	2.15	93%	0.05	1.47	64%	0.05	1.48	64%
	Annual	0.45	0.70	0.13	0.83	184%	0.01	0.71	158%	0.01	0.71	158%
1-3 Butadiene	24hr	10	0.05	0.21	0.27	3%	0.00	0.05	1%	0.00	0.05	1%
	Annual	2	0.031	0.04	0.07	3%	0.00	0.03	2%	0.00	0.03	2%
Formaldehyde	24hr	65	2.76	0.28	3.04	4.7%	0.26	3.02	4.6%	0.05	2.81	4.3%
Acetaldehyde	24hr	500	2.9	0.16	3.07	0.61%	0.04	2.95	0.59%	0.05	2.97	0.59%
	1/2-hr	500	8.6	0.48	9.09	1.82%	0.11	8.71	1.74%	0.16	8.77	1.75%
Acrolein	24hr	0.40	0.08	0.02	0.10	25.6%	0.00	0.09	21.3%	0.00	0.09	21.7%
	1 hr	4.50	0.20	0.05	0.25	5.5%	0.01	0.21	4.6%	0.01	0.21	4.7%
Benzo(a)pyrene	24 hr	5.00E-05	5.61E-04	1.69E-06	5.62E-04	1125%	2.69E-07	5.61E-04	1122%	3.15E-07	5.61E-04	1122%
	Annual	1.00E-05	1.71E-04	2.93E-07	1.71E-04	1708%	4.68E-08	1.71E-04	1706%	5.47E-08	1.71E-04	1706%

" – " Not available criteria or below modelling threshold results

1 Unless otherwise noted

2 98th Percentile

NOx emissions – expressed as NO_2

The findings of the air quality study were as follows:

- The potential effect associated with air emissions form vehicles is an increase in the airborne concentrations of the target contaminants NO_2, SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) in the vicinity of the Project due to the increase of traffic volume for both future 2041 scenarios in comparison with the current 2021 scenario;
- The incremental (the Project) effects for NO_2, SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) predicted to be below the respective ambient air quality criteria;
- Highest effects located to the receptors along the Castlemore Rd for all three (3) scenarios;
- Modelled concentrations were incrementally small compared to the existing baseline air concentrations of the target contaminants;
- The predicted project effects for NO_2 were highest for the current scenario (2021) and future no-build 2041 scenario, but still in compliance with all air quality limits currently enforced in the province of Ontario. SPM was highest for the future 2041 build scenario. The emission factors for the other target pollutants $PM_{2.5}$, NO_2, CO, benzo(a)pyrene, and VOCs (benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) decreased over time and off-set the increase of traffic volume. This resulted in lower impacts (modelled ambient air concentrations) on air quality in the 2041 scenario of all contaminants except SPM, PM_{10}, SO_2. PM_{10}, SO_2 emissions demonstrate marginal increase in ambient concentrations but still being in compliance with ambient criteria limits;
- The cumulative effects (Project plus background) of the roadways SPM, $PM_{2.5}$, PM_{10}, CO, SO_2, 1-3 Butadiene, Formaldehyde, Acetaldehyde and Acrolein emissions within the Study Area and the background concentrations were below the respective ambient air quality criteria for all averaging times under each scenario;
- The cumulative effect (Project plus background) of the benzene and benzo(a)pyrene emissions within the Study Area plus the background concentrations were found to be higher than the annual Ambient Air Quality Criteria (AAQC) for both scenarios as a result of high background levels, which are conservative; and
- The cumulative effect (Project plus background) of the NO_2 emissions within the Study Area 1-hr concentrations were found to be higher than the respective CAAQS for the current 2021 scenario and for the 2041 scenario, due to elevated background concentrations. The annually averaged concentration of NO_2 is predicted to exceed the 2025 CAAQS for both of 2041 scenarios. The Project only impact is in compliance with NO_2 limits (CAAQS and Ontario AAQC) for both current and future build scenarios.

Cumulative effects for the future build scenario were calculated based on the modelled project results plus current background concentrations which is a conservative approach, as it is expected that the background concentration will decrease over the time. Per the Environment and Climate Change Canada's (ECCC) website, the background levels of NO_2, SO_2, and VOCs in the ambient air in Canada have continually decreased between the years 2002 to 2016. NO_2 levels have decreased by 18% in that period. The proposed Project effects are relatively low when compared to background levels and Project effects are expected to diminish as vehicle emission standards improve and as fleets electrify. This conclusion is made based on air dispersion modelling results at the locations of the sensitive receptors presented in this AQA. In the 2041 scenarios, the same sensitive receptor locations were used as the WSP air team was not provided with new land use maps or sensitive receptor lists for 2041. When this information becomes available the modelling assessment may need to be refined.

7.1 PREDICTED EFFECT LEVELS

The isopleths plots (Figures A-5 to A-7, Appendix A) for NO_2 illustrate how localized the areas are where the maximum predicted concentrations lay, and that all predicted Project-related concentrations are below the regulatory criteria.

The predicted concentrations presented in Tables 7.1 and 7.2 are conservative. The following assumptions and methodology contributed to the conservative assessment:

- The model assumed peak hour traffic emission data to be used for all 24 hours of the day and for the whole year;
- The meteorological data set may contain certain extreme, rare and transient metrological conditions, that is considered outliers as per Ontario air quality modelling guideline. These meteorological anomalies can result in elevated concentrations and these meteorological anomalies were not discarded from this assessment; and
- At the moment there are no federal or provincial ambient air monitoring stations in the vicinity of the Study Area. The background data was obtained from the closest ambient air monitoring stations located primarily in urban setting and so recorded background levels are higher in comparison with the Project Study Area.

8 CONCLUSIONS

The assessment determined that the modelled concentrations of all target pollutants emitted from the proposed Project only were predicted to be below the applicable criteria.

The findings are based upon the information available to WSP at the time the AQIA was prepared. It is recommended that the assessment should be updated in the future to reflect the latest developments in the Study Area.

The cumulative effects of the Project impact plus the baseline concentrations of some target contaminants were predicted to potentially exceed current and future air quality criteria. These exceedances could not be localized as they are a result of elevated baseline data. This finding is typical for similar studies in Ontario and is mainly due to the use of conservative baseline ambient air data. This is especially true for benzene and benzo(a)pyrene (BaP) where the closest applicable available baseline data were the measurements taken in the urban and industrial setting of the city of Hamilton. These data overpredict concentrations of these contaminants for the Study Area located a suburban area of Brampton.

9 REFERENCES

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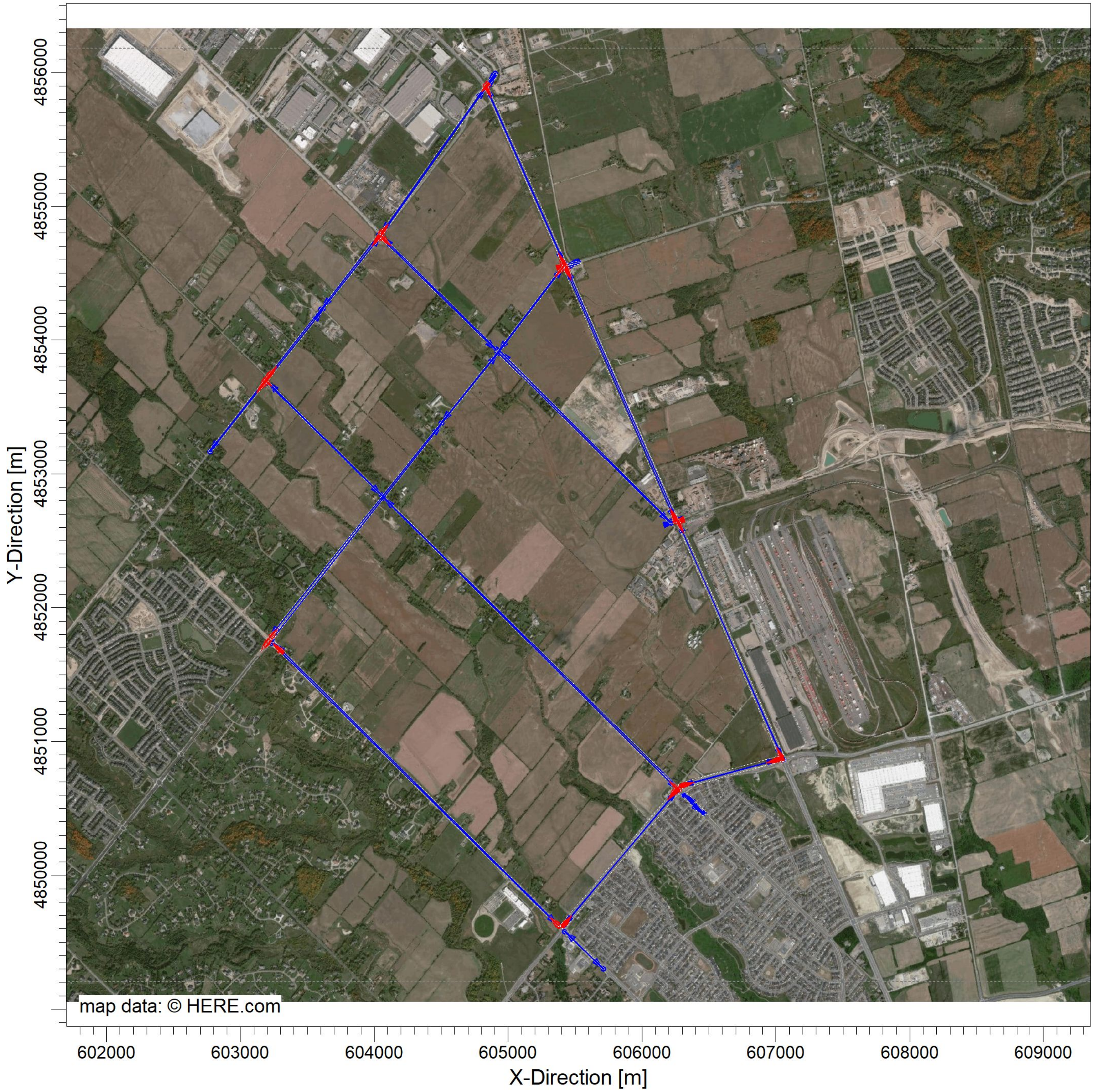
Appendix A

Figures

PROJECT TITLE:

SP47 - Air Quality Assessment
Current (2021) and Study Area



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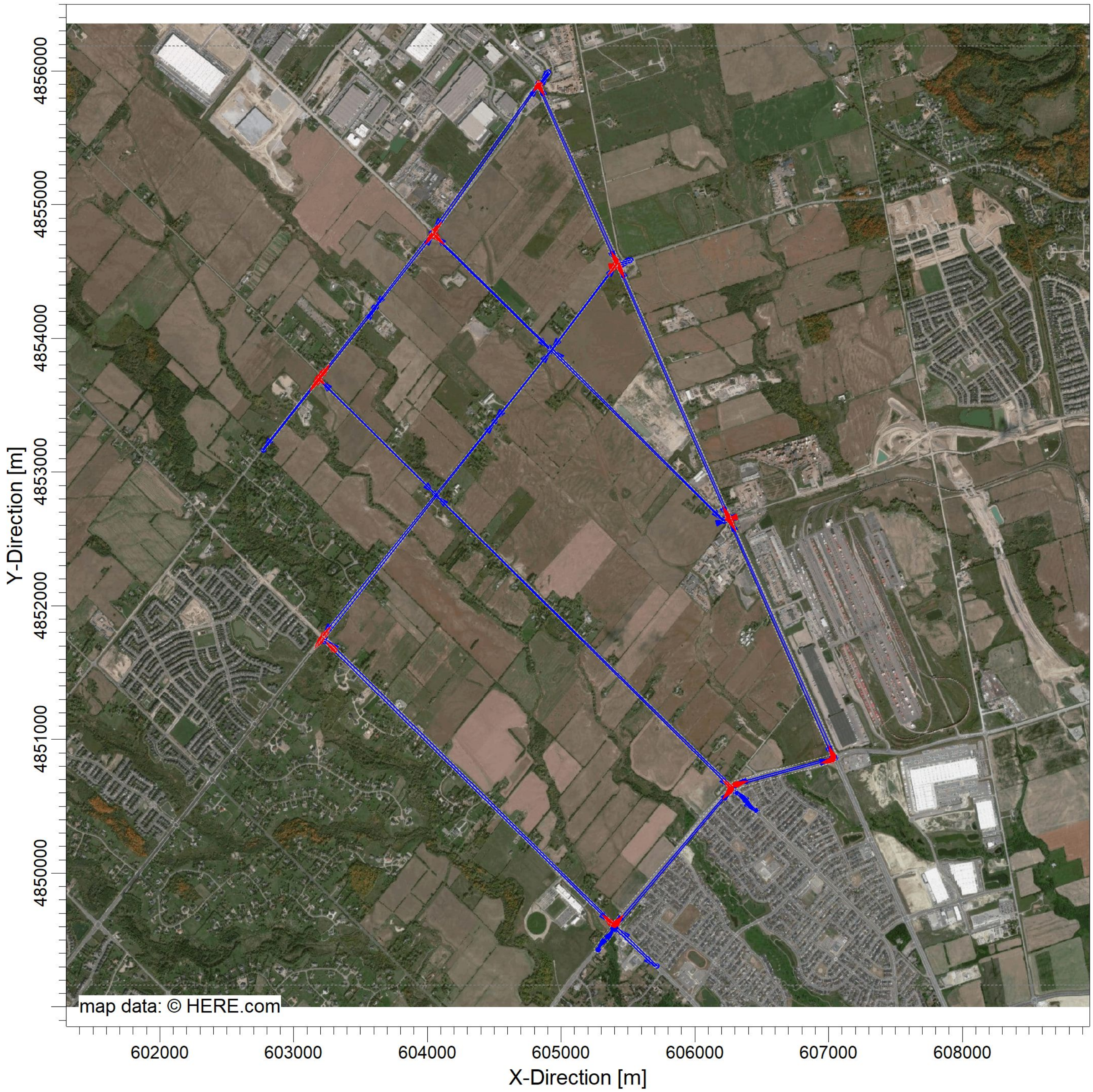
		MODELER: **V.A**	
	SCALE: 1:45,000 0 — 1 m	DATE: **30-Nov-22**	Figure Number: **A-1**

CALRoads View - Lakes Environmental Software

PROJECT TITLE:

SP47 - Air Quality Assessment
Future (2041) No Build



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			MODELER: **V.A**	
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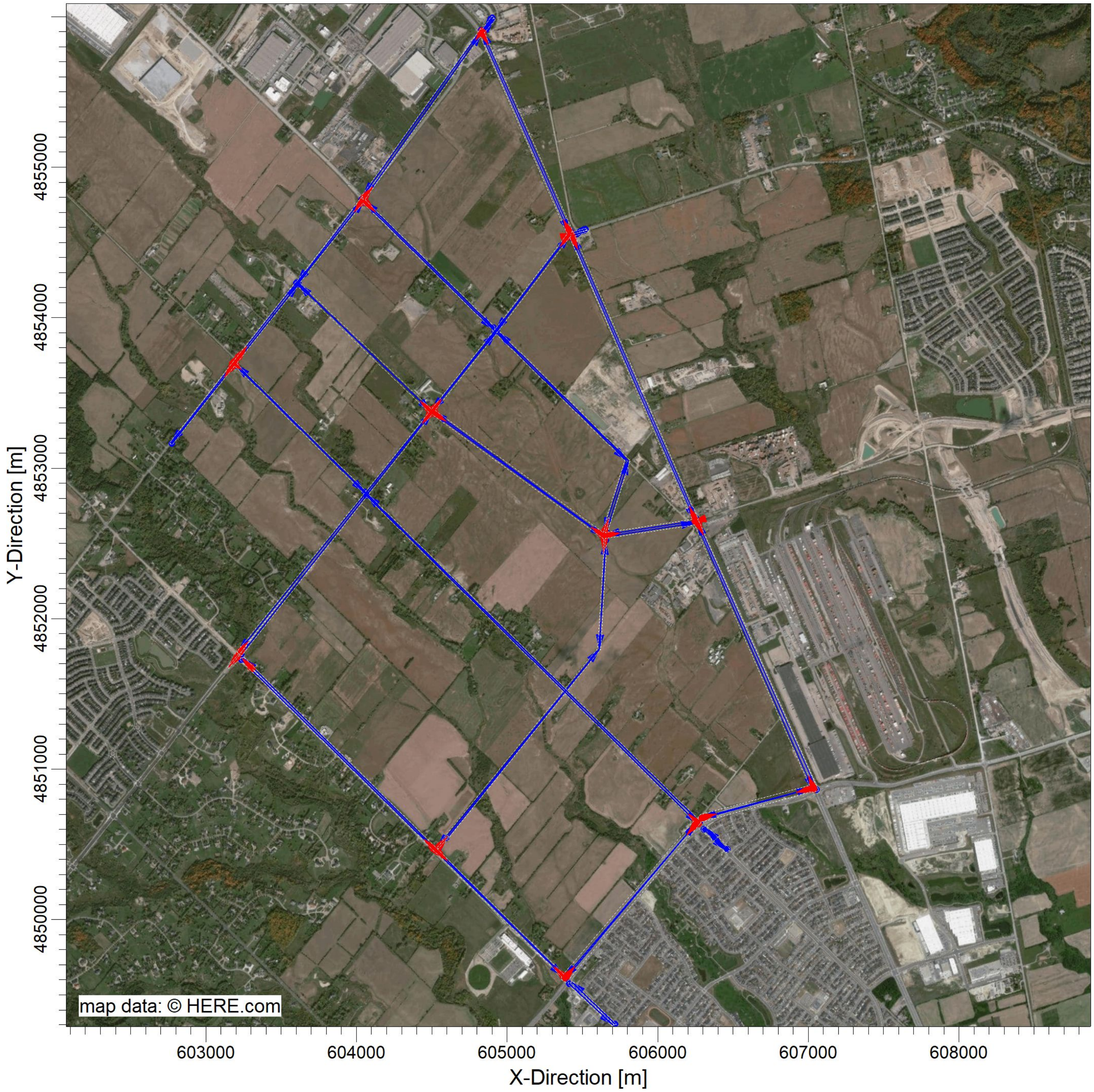
CALRoads View - Lakes Environmental Software

PROJECT TITLE:

SP47 - Air Quality Assessment
Future (2041) Build



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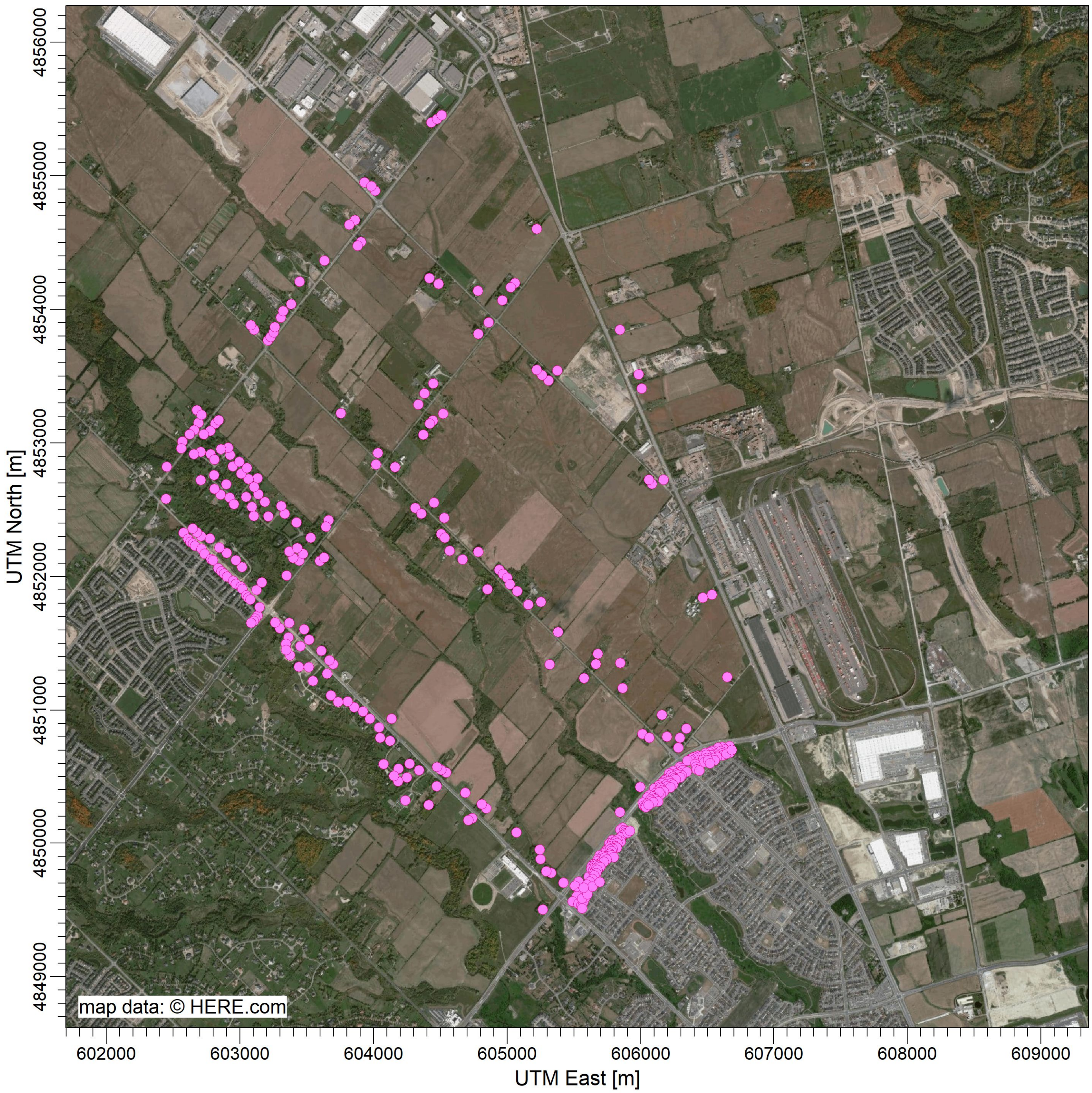
CALRoads View - Lakes Environmental Software

Project Title:

SP47 - Air Quality Assessment
Sensetive Receptors



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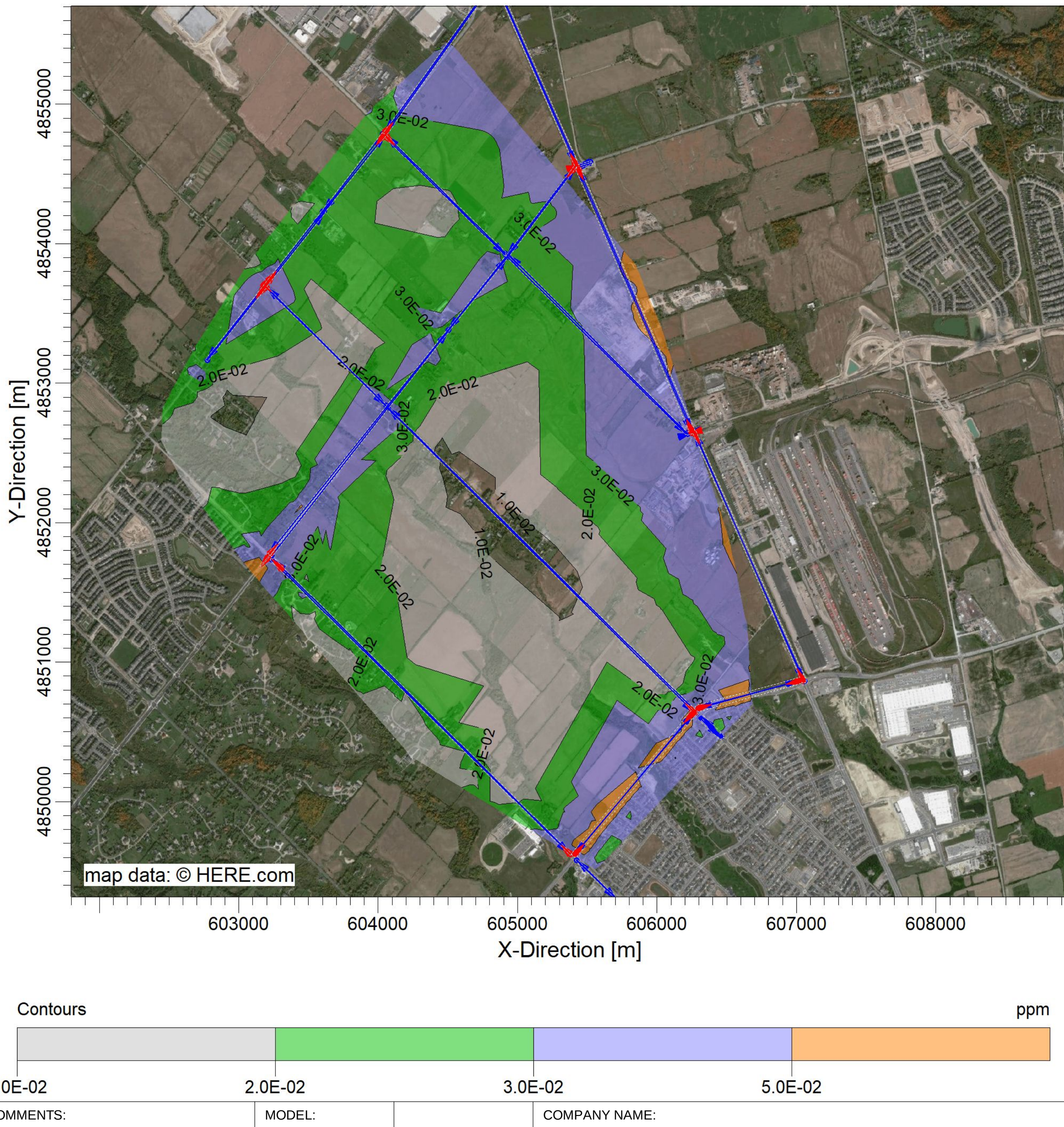
		Date: **30-Nov-22**	Figure Number: **A-4**

PROJECT TITLE:

SP47 - Air Quality Assessment
Maximum 1 hour NO2 - Current (2021)

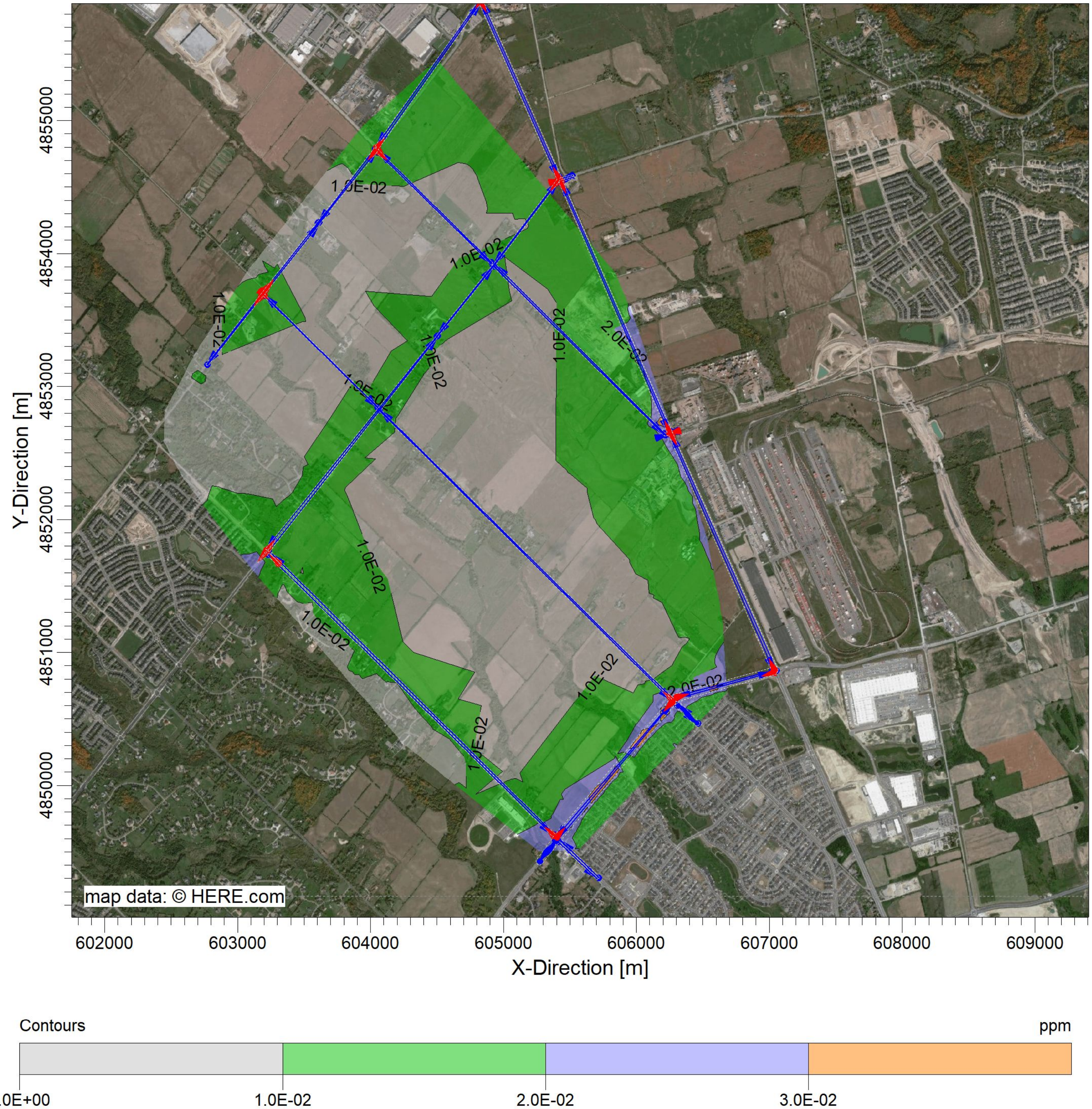


COMMENTS:	MODEL: **CAL3QHCR**	COMPANY NAME: **WSP E&I Canada Limited**	
		MODELER: **V.A**	
	SCALE: 1:45,000 (0 — 1 m)	DATE: **30-Nov-22**	Figure Number: **A-5**

CALRoads View - Lakes Environmental Software

PROJECT TITLE:

SP47 - Air Quality Assessment
Maximum 1 hour NO2 - Future (2041) No Build



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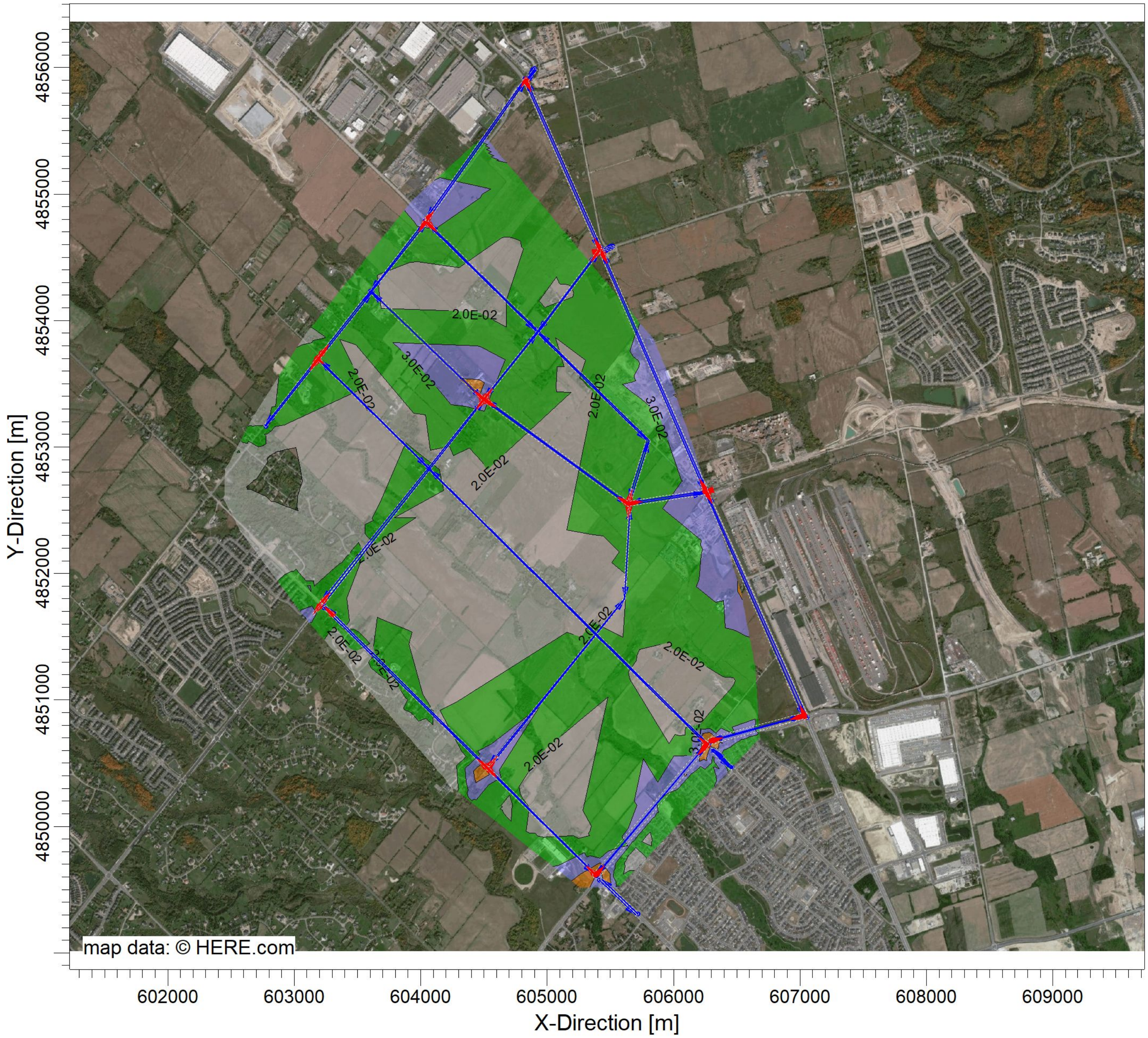
			MODELER: **V.A**	
	SCALE: 1:45,000 (0 — 1 m)		DATE: **30-Nov-22**	Figure Number: **A-6**

CALRoads View - Lakes Environmental Software

PROJECT TITLE:

SP47 - Air Quality Assessment
Maximum 1 hour NO2 - Future (2041) Build



COMMENTS:	MODEL: **CAL3QHCR**		COMPANY NAME: **WSP E&I Canada Limited**	
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Appendix B

Emission Calculations

B-1.1: Traffic Data - Current (2021)

ID	Segment Details	Description	Direction to	Link Type	Length (m)	Mixing Zone Width (m)	Speed (km/h)	ADT - Peak		Peak Traffic Volume (vph) 2013	Year of Traffic Data	Number of Period	Growth Rate	Adjusted Peak Volume
					(m)	(m)	(km/h)	AM	PM	Maximum				Maximum
1aw	Mayfield Rd	East of Hwy 50	WB	At-Grade	100	16.5	50	837	268	837	2013	8	1.08	906
1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	100	16.5	50	245	547	547	2013	8	1.08	592
1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	1350	16.5	80	540	447	540	2013	8	1.08	585
1be	Mayfield Rd	Hwy 50 to Coleraine	EB	At-Grade	1350	16.5	80	355	483	483	2013	8	1.08	523
1cw	Mayfield Rd	Coleraine to A2	WB	At-Grade	700	16.5	80	561	717	717	2013	8	1.08	776
1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	700	16.5	80	627	583	627	2013	8	1.08	679
1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	1350	16.5	80	563	751	751	2013	8	1.08	813
1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	1350	16.5	80	573	665	665	2013	8	1.08	720
2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	2050	13	70	428	1225	1225	2013	8	1.08	1326
2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	2050	13	70	1094	886	1094	2013	8	1.08	1185
2be	Countryside Dr	A2 to Coleraine	EB	At-Grade	670	13	70	266	182	266	2013	8	1.08	288
2bw	Countryside Dr	A2 to Coleraine	WB	At-Grade	670	13	70	142	249	249	2013	8	1.08	270
2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	800	13	70	276	149	276	2013	8	1.08	299
2cw	Countryside Dr	Coleraine to Hwy 50	WB	At-Grade	800	13	70	118	234	234	2013	8	1.08	253
2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	100	13	70	319	642	642	2013	8	1.08	695
2de	Countryside Dr	East of Hwy 50	EB	At-Grade	100	13	70	455	341	455	2013	8	1.08	493
3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	750	44	70	819	1240	1240	2013	8	1.08	1343
3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	750	44	70	1042	909	1042	2013	8	1.08	1128
3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	1350	44	70	863	1227	1227	2013	8	1.08	1329
3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	1350	44	70	1135	915	1135	2013	8	1.08	1229
3cw	Castlemore Rd	East of Gore	WB	At-Grade	200	44	70	780	1030	1030	2013	8	1.08	1115
3ce	Castlemore Rd	East of Gore	EB	At-Grade	200	44	70	848	761	848	2013	8	1.08	918
4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	3000	14.5	50	118	505	505	2013	8	1.08	547
4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	3000	14.5	50	485	160	485	2013	8	1.08	525
4ds	The Gore Rd	South of Castlemore	SB	At-Grade	400	14.5	50	839	375	839	2013	8	1.08	909
4dn	The Gore Rd	South of Castlemore	NB	At-Grade	400	14.5	50	348	763	763	2013	8	1.08	826
5bs	Clarkway Dr	Mayfield to Countryside	SB	At-Grade	1200	13	70	77	26	77	2013	8	1.08	83
5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	1200	13	70	17	48	48	2013	8	1.08	52
5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	3100	13	70	128	44	128	2013	8	1.08	139
5cn	Clarkway Dr	Countryside to Castlemore	NB	At-Grade	3100	13	70	26	62	62	2013	8	1.08	67
5dn	Clarkway Dr	South of Castlemore	NB	At-Grade	200	30	70	93	124	124	2013	8	1.08	134
5ds	Clarkway Dr	South of Castlemore	SB	At-Grade	200	30	70	124	92	124	2013	8	1.08	134
6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	1450	26	70	945	1446	1446	2013	8	1.08	1566
6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	1450	26	70	1732	913	1732	2013	8	1.08	1876
6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	2050	26	70	2552	1279	2552	2013	8	1.08	2763
6cn	Hwy 50	Major Mackenzie to Countryside	NB	At-Grade	2050	26	70	613	1394	1394	2013	8	1.08	1510
6ds	Hwy 50	Major Mackenzie	SB	At-Grade	1950	26	70	2795	1216	2795	2013	8	1.08	3027
6dn	Hwy 50	Major Mackenzie	NB	At-Grade	1950	26	70	706	1589	1589	2013	8	1.08	1721
7bs	Coleraine Dr	Mayfield to Countryside	SB	At-Grade	1200	13	70	401	182	401	2013	8	1.08	434
7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	1200	13	70	123	295	295	2013	8	1.08	319
7es	Coleraine Dr	Countryside to Hwy 50	SB	At-Grade	1800	13	70	332	124	332	2013	8	1.08	360
7en	Coleraine Dr	Countryside to Hwy 50	NB	At-Grade	1800	13	70	110	272	272	2013	8	1.08	295
7fw	Coleraine Dr	Ramp from Hwy 50	WB	At-Grade	30	13	50	206	235	235	2013	8	1.08	254
7fe	Coleraine Dr	Ramp from Hwy 50	EB	At-Grade	30	13	50	272	248	272	2013	8	1.08	295

B-1.2: Queue Traffic Data - Current (2021)

Queue Links

ID	Segment Details	Description	Direction	Link Type	Mixing Zone Width (m)	Number of Lanes	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Volume (vph)	Saturation Flow Rate (v/hr/lane)
Q4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	8.5	2	120	74	44	2	547	1900
Q4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	8.5	2	120	74	44	2	525	1900
Q2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	7	2	120	74	44	2	1326	1900
Q2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	7	2	120	74	44	2	1185	1900
Q6ds	Hwy 50	Major Mackenzie	SB	At-Grade	20	3	140	71	67	2	3027	1900
Q3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	38	3	140	71	67	2	1128	1900
Q6dn	Hwy 50	Major Mackenzie	SB	At-Grade	20	2	120	68	50	2	1721	1900
Q6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	2	120	68	50	2	2763	1900
Q7fe	Coleraine Dr	Ramp from Hwy 50	EB	At-Grade	7	2	120	68	50	2	295	1900
Q6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	20	3	120	67	51	2	1876	1900
Q6cn	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	3	120	67	51	2	2763	1900
Q2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	7	2	120	67	51	2	695	1900
Q2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	7	2	120	67	51	2	299	1900
Q5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	7	2	120	73	45	2	52	1900
Q1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	10.5	2	120	73	45	2	720	1900
Q1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	10.5	2	120	73	45	2	813	1900
Q3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	38	3	100	44	54	2	1329	1900
Q6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	20	3	120	68	50	2	1566	1900
Q1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	10.5	2	120	68	50	2	592	1900
Q7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	7	2	130	66	62	2	319	1900
Q1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	10.5	3	130	66	62	2	679	1900
Q1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	10.5	3	130	66	62	2	585	1900
Q3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	38	3	127	55	70	2	1343	1900
Q3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	38	3	127	55	70	2	1128	1900
Q5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	7	2	127	55	70	2	139	1900

B-2.1: Traffic Data - Future (2041) No Build

ID	Segment Details	Description	Direction to	Link Type	Length (m)	Mixing Zone Width (m)	Speed (km/h)	ADT - Peak		Peak Traffic Volume (vph) 2041
					(m)	(m)	(km/h)	AM	PM	Maximum
1aw	Mayfield Rd	East of Hwy 50	WB	At-Grade	100	16.5	50	1106	354	1106
1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	100	16.5	50	323	722	722
1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	1350	16.5	80	714	591	714
1be	Mayfield Rd	Hwy 50 to Coleraine	EB	At-Grade	1350	16.5	80	469	638	638
1cw	Mayfield Rd	Coleraine to A2	WB	At-Grade	700	16.5	80	741	947	947
1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	700	16.5	80	828	771	828
1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	1350	16.5	80	744	992	992
1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	1350	16.5	80	757	879	879
2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	2050	13	70	566	1619	1619
2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	2050	13	70	1445	1171	1445
2be	Countryside Dr	A2 to Coleraine	EB	At-Grade	670	13	70	188	329	329
2bw	Countryside Dr	A2 to Coleraine	WB	At-Grade	670	13	70	351	240	351
2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	800	13	70	156	309	309
2cw	Countryside Dr	Coleraine to Hwy 50	WB	At-Grade	800	13	70	365	197	365
2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	100	13	70	439	883	883
2de	Countryside Dr	East of Hwy 50	EB	At-Grade	100	13	70	626	469	626
3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	750	44	70	1082	1638	1638
3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	750	44	70	1377	1201	1377
3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	1350	44	70	1141	1621	1621
3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	1350	44	70	1499	1209	1499
3cw	Castlemore Rd	East of Gore	WB	At-Grade	200	44	70	1031	1361	1361
3ce	Castlemore Rd	East of Gore	EB	At-Grade	200	44	70	1120	1006	1120
4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	3000	14.5	50	155	668	668
4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	3000	14.5	50	211	641	641
4ds	The Gore Rd	South of Castlemore	SB	At-Grade	400	14.5	50	495	1109	1109
4dn	The Gore Rd	South of Castlemore	NB	At-Grade	400	14.5	50	460	1008	1008
5bs	Clarkway Dr	Mayfield to Countryside	SB	At-Grade	1200	13	70	35	102	102
5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	1200	13	70	22	63	63
5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	3100	13	70	59	169	169
5cn	Clarkway Dr	Countryside to Castlemore	NB	At-Grade	3100	13	70	35	83	83
5dn	Clarkway Dr	South of Castlemore	NB	At-Grade	200	30	70	123	164	164
5ds	Clarkway Dr	South of Castlemore	SB	At-Grade	200	30	70	122	164	164
6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	1450	26	70	1249	1911	1911
6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	1450	26	70	1623	1872	1872
6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	2050	26	70	1673	3339	3339
6cn	Hwy 50	Major Mackenzie to Countryside	NB	At-Grade	2050	26	70	802	1824	1824
6ds	Hwy 50	Major Mackenzie	SB	At-Grade	1950	26	70	2795	1216	2795
6dn	Hwy 50	Major Mackenzie	NB	At-Grade	1950	26	70	706	1589	1589
7bs	Coleraine Dr	Mayfield to Countryside	SB	At-Grade	1200	13	70	389	163	389
7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	1200	13	70	530	240	530
7es	Coleraine Dr	Countryside to Hwy 50	SB	At-Grade	1800	13	70	163	437	437
7en	Coleraine Dr	Countryside to Hwy 50	NB	At-Grade	1800	13	70	144	357	357
7fw	Coleraine Dr	Ramp from Hwy 50	WB	At-Grade	30	13	50	269	307	307
7fe	Coleraine Dr	Ramp from Hwy 50	EB	At-Grade	30	13	50	356	324	356

B-2.2: Queue Traffic Data - Future (2041) No Build

Queue Links

ID	Segment Details	Description	Direction	Link Type	Mixing Zone Width (m)	Number of Lanes	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Volume (vph)	Saturation Flow Rate (v/hr/lane)
Q4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	8.5	2	120	74	44	2	668	1900
Q4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	8.5	2	120	74	44	2	641	1900
Q2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	7	2	120	74	44	2	1619	1900
Q2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	7	2	120	74	44	2	1445	1900
Q6ds	Hwy 50	Major Mackenzie	SB	At-Grade	20	3	140	71	67	2	2795	1900
Q3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	38	3	140	71	67	2	1377	1900
Q6dn	Hwy 50	Major Mackenzie	SB	At-Grade	20	2	120	68	50	2	1589	1900
Q6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	2	120	68	50	2	3339	1900
Q7fe	Coleraine Dr	Ramp from Hwy 50	EB	At-Grade	7	2	120	68	50	2	356	1900
Q6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	20	3	120	67	51	2	1872	1900
Q6cn	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	3	120	67	51	2	3339	1900
Q2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	7	2	120	67	51	2	883	1900
Q2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	7	2	120	67	51	2	309	1900
Q5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	7	2	120	73	45	2	63	1900
Q1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	10.5	2	120	73	45	2	879	1900
Q1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	10.5	2	120	73	45	2	992	1900
Q3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	38	3	100	44	54	2	1621	1900
Q6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	20	3	120	68	50	2	1911	1900
Q1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	10.5	2	120	68	50	2	722	1900
Q7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	7	2	130	66	62	2	530	1900
Q1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	10.5	3	130	66	62	2	828	1900
Q1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	10.5	3	130	66	62	2	714	1900
Q3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	38	3	127	55	70	2	1638	1900
Q3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	38	3	127	55	70	2	1377	1900
Q5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	7	2	127	55	70	2	169	1900

B-3.1: Traffic Data - Future (2041) Build

ID	Segment Details	Description	Direction to	Link Type	Length (m)	Mixing Zone Width (m)	Speed (km/h)	ADT - Peak		Peak Traffic Volume (vph) 2041
					(m)	(m)	(km/h)	AM	PM	Maximum
1aw	Mayfield Rd	East of Hwy 50	WB	At-Grade	100	16.5	50	959	748	959
1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	100	16.5	50	722	1397	1397
1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	1350	16.5	80	631	586	631
1be	Mayfield Rd	Hwy 50 to Coleraine	EB	At-Grade	1350	16.5	80	305	932	932
1cw	Mayfield Rd	Coleraine to A2	WB	At-Grade	700	16.5	80	1005	1224	1224
1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	700	16.5	80	822	1232	1232
1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	1350	16.5	80	648	1021	1021
1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	1350	16.5	80	1461	1252	1461
2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	2050	18	70	761	1221	1221
2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	2050	18	70	777	378	777
2be	Countryside Dr	A2 to Coleraine	EB	At-Grade	670	18	70	333	1026	1026
2bw	Countryside Dr	A2 to Coleraine	WB	At-Grade	670	18	70	488	407	488
2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	800	18	70	397	473	473
2cw	Countryside Dr	Coleraine to Hwy 50	WB	At-Grade	800	18	70	421	946	946
2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	100	13	70	481	491	491
2de	Countryside Dr	East of Hwy 50	EB	At-Grade	100	13	70	249	299	299
3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	750	44	70	1082	1638	1638
3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	750	44	70	1377	1201	1377
3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	1350	44	70	1141	1621	1621
3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	1350	44	70	1499	1209	1499
3cw	Castlemore Rd	East of Gore	WB	At-Grade	200	44	70	1031	1361	1361
3ce	Castlemore Rd	East of Gore	EB	At-Grade	200	44	70	1120	1006	1120
4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	3000	14.5	50	155	668	668
4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	3000	14.5	50	641	211	641
4ds	The Gore Rd	South of Castlemore	SB	At-Grade	400	14.5	50	460	1008	1008
4dn	The Gore Rd	South of Castlemore	NB	At-Grade	400	14.5	50	1109	495	1109
5bs	Clarkway Dr	Mayfield to Countryside	SB	At-Grade	1200	18	70	102	35	102
5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	1200	18	70	22	63	63
5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	3100	18	70	169	59	169
5cn	Clarkway Dr	Countryside to Castlemore	NB	At-Grade	3100	18	70	35	83	83
5dn	Clarkway Dr	South of Castlemore	NB	At-Grade	200	30	70	123	164	164
5ds	Clarkway Dr	South of Castlemore	SB	At-Grade	200	30	70	164	122	164
6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	1450	26	70	1362	2448	2448
6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	1450	26	70	2041	1358	2041
6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	2050	26	70	2094	1756	2094
6cn	Hwy 50	Major Mackenzie to Countryside	NB	At-Grade	2050	26	70	1258	2797	2797
6ds	Hwy 50	Major Mackenzie	SB	At-Grade	1950	26	70	1248	1548	1548
6dn	Hwy 50	Major Mackenzie	NB	At-Grade	1950	26	70	1686	2867	2867
7bs	Coleraine Dr	Mayfield to Countryside	SB	At-Grade	1200	18	70	877	578	877
7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	1200	18	70	768	269	768
8an	A2	Mayfield to Countryside	NB	At-Grade	1220	24	70	186	713	713
8as	A2	Mayfield to Countryside	SB	At-Grade	1220	24	70	1065	543	1065
8bs	A2	Countryside to Coleraine	SB	At-Grade	1400	24	70	1807	1212	1807
8bn	A2	Countryside to Coleraine	NB	At-Grade	1400	24	70	403	1120	1120
8cs	A2	Coleraine to Hwy 50	SB	At-Grade	600	24	70	1807	1212	1807
8cn	A2	Coleraine to Hwy 50	NB	At-Grade	600	24	70	1741	2555	2555
G_7cn	Coleraine Dr	Countryside to A2	NB	At-Grade	1700	18	70	820	1120	1120
G_7cs	Coleraine Dr	Countryside to A2	SB	At-Grade	1700	18	70	462	295	462
G_7de	E-W Arterial	A2	WB	At-Grade	2450	18	50	552	342	552
G_7dw	E-W Arterial	A2	EB	At-Grade	2450	18	50	796	674	796

B-3.2: Queue Traffic Data - Future (2041) Build
Queue Links

ID	Segment Details	Description	Direction	Link Type	Mixing Zone Width (m)	Number of Lanes	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Volume (vph)	Saturation Flow Rate (v/hr/lane)
Q4cn	The Gore Rd	Countryside to Castlemore	NB	At-Grade	8.5	2	120	74	44	2	668	1900
Q4cs	The Gore Rd	Countryside to Castlemore	SB	At-Grade	8.5	2	120	74	44	2	641	1900
Q2aw	Countryside Dr	Clarkway to A2	WB	At-Grade	12	2	120	74	44	2	1221	1900
Q2ae	Countryside Dr	Clarkway to A2	EB	At-Grade	12	2	120	74	44	2	777	1900
Q6ds	Hwy 50	Major Mackenzie	SB	At-Grade	20	3	140	71	67	2	1548	1900
Q3ae	Castlemore Rd	Hwy 50 to Clarkway	EB	At-Grade	38	3	140	71	67	2	1377	1900
Q6dn	Hwy 50	Major Mackenzie	SB	At-Grade	20	2	120	68	50	2	2867	1900
Q6cs	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	2	120	68	50	2	2094	1900
Q7fe	E-W Arterial	A2	EB	At-Grade	12	2	120	68	50	2	796	1900
Q6bs	Hwy 50	Countryside to Mayfield	SB	At-Grade	20	3	120	67	51	2	2041	1900
Q6cn	Hwy 50	Major Mackenzie to Countryside	SB	At-Grade	20	3	120	67	51	2	2094	1900
Q2dw	Countryside Dr	East of Hwy 50	WB	At-Grade	7	2	120	67	51	2	491	1900
Q2ce	Countryside Dr	Coleraine to Hwy 50	EB	At-Grade	12	2	120	67	51	2	473	1900
Q5bn	Clarkway Dr	Mayfield to Countryside	NB	At-Grade	12	2	120	73	45	2	63	1900
Q1de	Mayfield Rd	A2 to Clarkway	EB	At-Grade	10.5	2	120	73	45	2	1461	1900
Q1dw	Mayfield Rd	A2 to Clarkway	WB	At-Grade	10.5	2	120	73	45	2	1021	1900
Q3bw	Castlemore Rd	Clarkway to the Gore	WB	At-Grade	38	3	100	44	54	2	1621	1900
Q6bn	Hwy 50	Countryside to Mayfield	NB	At-Grade	20	3	120	68	50	2	2448	1900
Q1ae	Mayfield Rd	East of Hwy 50	EB	At-Grade	10.5	2	120	68	50	2	1397	1900
Q7bn	Coleraine Dr	Mayfield to Countryside	NB	At-Grade	12	2	130	66	62	2	768	1900
Q1ce	Mayfield Rd	Coleraine to A2	EB	At-Grade	10.5	3	130	66	62	2	1232	1900
Q1bw	Mayfield Rd	Hwy 50 to Coleraine	WB	At-Grade	10.5	3	130	66	62	2	631	1900
Q3aw	Castlemore Rd	Hwy 50 to Clarkway	WB	At-Grade	38	3	127	55	70	2	1638	1900
Q3be	Castlemore Rd	Clarkway to the Gore	EB	At-Grade	38	3	127	55	70	2	1377	1900
Q5cs	Clarkway Dr	Countryside to Castlemore	SB	At-Grade	12	2	127	55	70	2	169	1900
Q2ae_new	Countryside Dr	Clarkway to A2	EB	At-Grade	12	2	120	68	50	2	777	1900
Q2bw	Countryside Dr	A2 to Coleraine	WB	At-Grade	12	2	120	68	50	2	488	1900
Q8bn	A2	Countryside to Coleraine	NB	At-Grade	18	3	120	68	50	2	1120	1900
Q8as	A2	Mayfield to Countryside	SB	At-Grade	18	3	120	68	50	2	1065	1900
Q8cn	A2	Coleraine to Hwy 50	NB	At-Grade	24	3	120	68	50	2	2555	1900
Q7cs	Coleraine Dr	Countryside to A2	SB	At-Grade	12	2	120	68	50	2	462	1900
Q8bs	A2	Countryside to Coleraine	SB	At-Grade	18	3	120	68	50	2	1807	1900
Q7de	E-W Arterial	A2	WB	At-Grade	12	2	120	68	50	2	552	1900
Q7dw	E-W Arterial	A2	EB	At-Grade	12	2	120	68	50	2	796	1900
Q4cn_new	The Gore Rd	at E-W	NB	At-Grade	8.5	2	120	68	50	2	668	1900
Q4cs_new	The Gore Rd	at E-W	SB	At-Grade	8.5	2	120	68	50	2	641	1900

B-4.1: Traffic Data Existing (2013)

ID	Road	Road Segment	AM Peak Hour				PM Peak Hour				Estimated AADT	Traffic Split		Truck Percentages		Speed (km/h)	Average Vehicles/hour	
			WB	EB	NB	SB	WB	EB	NB	SB		Day (% of AADT)	Night (% of AADT)	Heavy (% of AADT)	Medium (% of AADT)		Day 7:00 23:00 16 hours	Night 23:00 7:00 8 hours
1a	Mayfield Rd	Hwy 50	837	245			268	547			10,820	90%	10%	5%	5%	60	609	135
1b	Mayfield Rd	Hwy 50 to Coleraine	540	355			447	483			11,625	90%	10%	5%	5%	80	654	145
1c	Mayfield Rd	Coleraine to A2	561	627			717	583			16,250	90%	10%	5%	5%	80	914	203
1d	Mayfield Rd	A2 to Mayfield	563	573			751	665			17,700	90%	10%	5%	5%	80	996	221
2a	Countryside Dr	Clarkway to A2	428	1,094			1,225	886			26,388	90%	10%	5%	5%	70	1484	330
2b	Countryside Dr	A2 to Coleraine	142	266			249	182			5,388	90%	10%	5%	5%	70	303	67
2c	Countryside Dr	Coleraine to Hwy 50	118	276			234	149			4,788	90%	10%	5%	5%	70	269	60
2d	Countryside Dr	Hwy 50	319	455			642	341			12,288	90%	10%	5%	5%	70	691	154
3a	Castlemore Rd	Clarkway	819	1,042			1,240	909			26,863	90%	10%	5%	5%	70	1511	336
3b	Castlemore Rd	Clarkway to the Gore	863	1,135			1,227	915			26,775	90%	10%	5%	5%	70	1506	335
3c	Castlemore Rd	The Gore	780	848			1,030	761			22,388	90%	10%	5%	5%	70	1259	280
4a	The Gore Rd	Mayfield			54	389			315	78	4,913	90%	10%	5%	5%	50	276	61
4b	The Gore Rd	Mayfield to Countryside			92	428			354	98	5,650	90%	10%	5%	5%	50	318	71
4c	The Gore Rd	Countryside to Castlemore			118	485			505	160	8,313	90%	10%	5%	5%	50	468	104
4d	The Gore Rd	Castlemore			348	839			763	375	14,225	90%	10%	5%	5%	60	800	178
5a	Clarkway Dr	Mayfield			17	74			30	75	1,313	90%	10%	5%	5%	70	74	16
5b	Clarkway Dr	Mayfield to Countryside			17	77			48	26	940	90%	10%	5%	5%	70	53	12
5c	Clarkway Dr	Countryside to Castlemore			26	128			62	44	1,540	90%	10%	5%	5%	70	87	19
5d	Clarkway Dr	Castlemore			93	124			124	92	2,700	90%	10%	5%	5%	70	152	34
6a	Hwy 50	Mayfield			925	1,312			1,165	869	25,425	90%	10%	5%	5%	70	1430	318
6b	Hwy 50	Countryside to Mayfield			945	1,732			1,446	913	29,488	90%	10%	5%	5%	70	1659	369
6c	Hwy 50	Major Mackenzie to Countryside			613	2,552			1,394	1,279	33,413	90%	10%	5%	5%	70	1879	418
6d	Hwy 50	Major Mackenzie			706	2,795			1,589	1,216	35,063	90%	10%	5%	5%	70	1972	438
7a	Coleraine Dr	Mayfield			342	476			405	403	10,100	90%	10%	5%	5%	70	568	126
7b	Coleraine Dr	Mayfield to Countryside			123	401			295	182	5,963	90%	10%	5%	5%	70	335	75
7c	Coleraine Dr	Countryside to A2			-	-			-	-	-	-	-	-	-	-	-	-
7d	E-W Arterial	A2			-	-			-	-	-	-	-	-	-	-	-	-
7e	Coleraine Dr	Countryside to Hwy 50			110	332			272	124	4,950	90%	10%	5%	5%	70	278	62
7f	Coleraine Dr	Hwy 50			206	272			235	248	6,038	90%	10%	5%	5%	20	340	75

B-4.2: Traffic Data - Future (2041) No Build

ID	Road	Road Segment	AM Peak Hour				PM Peak Hour				Estimated AADT	Traffic Split		Truck Percentages		Speed (km/h)	Average	
			WB	EB	NB	SB	WB	EB	NB	SB		Day (% of AADT)	Night (% of AADT)	Heavy (% of AADT)	Medium (% of AADT)		Day 7:00 23:00 16 hours	Night 23:00 7:00 8 hours
1a	Mayfield Rd	Hwy 50	1,106	323			354	722			14,290	90%	10%	5%	5%	60	804	179
1b	Mayfield Rd	Hwy 50 to Coleraine	714	469			591	638			15,363	90%	10%	5%	5%	80	864	192
1c	Mayfield Rd	Coleraine to A2	741	828			947	771			21,475	90%	10%	5%	5%	80	1208	268
1d	Mayfield Rd	A2 to Mayfield	744	757			992	879			23,388	90%	10%	5%	5%	80	1316	292
2a	Countryside Dr	Clarkway to A2	566	1,445			1,619	1,171			34,875	90%	10%	5%	5%	70	1962	436
2b	Countryside Dr	A2 to Coleraine	188	351			329	240			7,113	90%	10%	5%	5%	70	400	89
2c	Countryside Dr	Coleraine to Hwy 50	156	365			309	197			6,325	90%	10%	5%	5%	70	356	79
2d	Countryside Dr	Hwy 50	439	626			883	469			16,900	90%	10%	5%	5%	70	951	211
3a	Castlemore Rd	Clarkway	1,082	1,377			1,638	1,201			35,488	90%	10%	5%	5%	70	1996	444
3b	Castlemore Rd	Clarkway to the Gore	1,141	1,499			1,621	1,209			35,375	90%	10%	5%	5%	70	1990	442
3c	Castlemore Rd	The Gore	1,031	1,120			1,361	1,006			29,588	90%	10%	5%	5%	70	1664	370
4a	The Gore Rd	Mayfield			59	514			416	103	6,488	90%	10%	5%	5%	50	365	81
4b	The Gore Rd	Mayfield to Countryside			122	566			468	130	7,475	90%	10%	5%	5%	50	420	93
4c	The Gore Rd	Countryside to Castlemore			155	641			668	211	10,988	90%	10%	5%	5%	50	618	137
4d	The Gore Rd	Castlemore			460	1,109			1,008	495	18,788	90%	10%	5%	5%	60	1057	235
5a	Clarkway Dr	Mayfield			22	98			99	40	1,738	90%	10%	5%	5%	70	98	22
5b	Clarkway Dr	Mayfield to Countryside			22	102			63	35	1,240	90%	10%	5%	5%	70	70	16
5c	Clarkway Dr	Countryside to Castlemore			35	169			83	59	2,040	90%	10%	5%	5%	70	115	26
5d	Clarkway Dr	Castlemore			123	164			164	122	3,575	90%	10%	5%	5%	70	201	45
6a	Hwy 50	Mayfield			1,222	1,734			1,539	1,148	33,588	90%	10%	5%	5%	70	1889	420
6b	Hwy 50	Countryside to Mayfield			1,249	1,872			1,911	1,623	44,175	90%	10%	5%	5%	70	2485	552
6c	Hwy 50	Major Mackenzie to Countryside			802	3,339			1,824	1,673	43,713	90%	10%	5%	5%	70	2459	546
6d	Hwy 50	Major Mackenzie			924	3,656			2,079	1,591	45,875	90%	10%	5%	5%	70	2580	573
7a	Coleraine Dr	Mayfield			452	629			535	532	13,338	90%	10%	5%	5%	70	750	167
7b	Coleraine Dr	Mayfield to Countryside			530	163			240	389	7,863	90%	10%	5%	5%	70	442	98
7c	Coleraine Dr	Countryside to A2			-	-	-	-	-	-	-	-	-	-	-	-	-	-
7d	E-W Arterial	A2			-	-	-	-	-	-	-	-	-	-	-	-	-	-
7e	Coleraine Dr	Countryside to Hwy 50			144	437			357	163	6,500	90%	10%	5%	5%	70	366	81
7f	Coleraine Dr	Hwy 50			269	356			307	324	7,888	90%	10%	5%	5%	20	444	99

B-4.3: Traffic Data - Future (2041) Build

ID	Road	Road Segment	AM Peak Hour				PM Peak Hour				Estimated AADT	Traffic Split		Truck Percentages		Speed (km/h)	Average	
			WB	EB	NB	SB	WB	EB	NB	SB		Day (% of AADT)	Night (% of AADT)	Heavy (% of AADT)	Medium (% of AADT)		Day 7:00 - 23:00 16 hours	Night 23:00 - 7:00 8 hours
1a	Mayfield Rd	Hwy 50	959	722			748	1,397			26,813	90%	10%	5%	5%	60	1508	335
1b	Mayfield Rd	Hwy 50 to Coleraine	631	305			586	932			18,975	90%	10%	5%	5%	80	1067	237
1c	Mayfield Rd	Coleraine to A2	1,005	822			1,224	1,232			30,700	90%	10%	5%	5%	80	1727	384
1d	Mayfield Rd	A2 to Mayfield	648	1,461			1,021	1,252			28,413	90%	10%	5%	5%	80	1598	355
2a	Countryside Dr	Clarkway to A2	761	777			1,221	378			19,988	90%	10%	5%	5%	70	1124	250
2b	Countryside Dr	A2 to Coleraine	333	488			1,026	407			17,913	90%	10%	5%	5%	70	1008	224
2c	Countryside Dr	Coleraine to Hwy 50	421	397			946	473			17,738	90%	10%	5%	5%	70	998	222
2d	Countryside Dr	Hwy 50	481	249			491	299			9,875	90%	10%	5%	5%	70	555	123
3a	Castlemore Rd	To Clarkway	1,082	1,377			1,638	1,201			35,488	90%	10%	5%	5%	70	1996	444
3b	Castlemore Rd	Clarkway to the Gore	1,141	1,499			1,621	1,209			35,375	90%	10%	5%	5%	70	1990	442
3c	Castlemore Rd	The Gore	1,031	1,120			1,361	1,006			29,588	90%	10%	5%	5%	70	1664	370
4a	The Gore Rd	Mayfield			59	514			416	103	6,488	90%	10%	5%	5%	50	365	81
4b	The Gore Rd	Mayfield to Countryside			122	566			468	130	7,475	90%	10%	5%	5%	50	420	93
4c	The Gore Rd	Countryside to Castlemore			155	641			668	211	10,988	90%	10%	5%	5%	50	618	137
4d	The Gore Rd	Castlemore			460	1,109			1,008	495	18,788	90%	10%	5%	5%	60	1057	235
5a	Clarkway Dr	Mayfield			22	98			99	40	1,738	90%	10%	5%	5%	70	98	22
5b	Clarkway Dr	Mayfield to Countryside			22	102			63	35	1,240	90%	10%	5%	5%	70	70	16
5c	Clarkway Dr	Countryside to Castlemore			35	169			83	59	2,040	90%	10%	5%	5%	70	115	26
5d	Clarkway Dr	Castlemore			123	164			164	122	3,575	90%	10%	5%	5%	70	201	45
6a	Hwy 50	Mayfield			919	1,773			1,970	1,183	39,413	90%	10%	5%	5%	70	2217	493
6b	Hwy 50	Countryside to Mayfield			1,362	2,041			2,448	1,358	47,575	90%	10%	5%	5%	70	2676	595
6c	Hwy 50	Major Mackenzie to Countryside			1,258	2,094			2,797	1,756	56,913	90%	10%	5%	5%	70	3201	711
6d	Hwy 50	Major Mackenzie			1,686	1,248			2,867	1,548	55,188	90%	10%	5%	5%	70	3104	690
7a	Coleraine Dr	Mayfield			1,155	1,235			1,384	922	28,825	90%	10%	5%	5%	70	1621	360
7b	Coleraine Dr	Mayfield to Countryside			768	877			269	578	16,450	90%	10%	5%	5%	70	925	206
7c	Coleraine Dr	Countryside to A2			820	462			1120	295	17688	90%	10%	5%	5%	70	995	221
7d	E-W Arterial	A2			552	796			342	674	13480	90%	10%	5%	5%	70	758	169
7e	Coleraine Dr	Countryside to Hwy 50			-	-			-	-	-	-	-	-	-	-	-	-
7f	Coleraine Dr	Hwy 50			-	-			-	-	-	-	-	-	-	-	-	-
8a	A2	Mayfield to Countryside			186	1065			713	543	15700	90%	10%	5%	5%	70	883	196
8b	A2	Countryside Dr to Coleraine			403	1807			1120	1212	29150	90%	10%	5%	5%	70	1640	364
8c	A2	Coleraine Dr to Hwy 50			1741	1807			2555	1212	47088	90%	10%	5%	5%	70	2649	589

B-5: Measured Traffic Data (Car and Truck Ratio)

		Cars				Trucks				Ratio of Trucks			
Intersection	**AM/PM Peak**	**N**	**S**	**E**	**W**	**N**	**S**	**E**	**W**	**N**	**S**	**E**	**W**
RR 50 & Countryside Dr	AM	853	1918	356	133	92	146	11	4	10%	7%	3%	3%
	PM	1659	856	408	238	86	61	4	4	5%	7%	1%	2%
The Gore Road & Mayfield Road	AM	49	417	509	483	5	21	70	83	9%	5%	12%	15%
	PM	307	82	573	704	7	10	80	58	2%	11%	12%	8%
Mayfield Road & Clarkway Drive	AM	16	77	517	499	1	2	54	67	6%	3%	9%	12%
	PM	69	21	568	673	5	3	95	72	7%	13%	14%	10%
The Gore Rd & Castlemore Rd	AM	117	800	821	926	18	39	27	39	13%	5%	3%	4%
	PM	543	365	745	1218	16	10	16	14	3%	3%	2%	1%
The Gore Road & Countryside Drive	AM	92	468	280	195	15	17	8	4	14%	4%	3%	2%
	PM	348	125	212	418	17	3	5	2	5%	2%	2%	0%
Highway 50 & Mayfield Road	AM	838	1661	196	480	68	136	42	67	8%	8%	18%	12%
	PM	1391	960	801	392	91	76	62	65	6%	7%	7%	14%
OVERALL										**7%**			

B-6: Re-entrainment of dust from paved roads

Equation from AP-42 (Section 13.2.1-3) :

$$E = k\,(sL)^{0.91} \times (W)^{1.02} \qquad (1)$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m²), and
W = average weight (tons) of the vehicles traveling the road.

Contaminant	AADT vehicles/day	K[1] g/VKT	sL g/m2	W[2] Tons	E g/VKT	E g/VMT
SPM	500 - 5,000	3.23	0.2	2	1.514	2.438
PM_{10}		0.62	0.2	2	0.291	0.468
$PM_{2.5}$		0.15	0.2	2	0.070	0.113
SPM	5,000 - 10,000	3.23	0.06	2	0.506	0.815
PM_{10}		0.62	0.06	2	0.097	0.156
$PM_{2.5}$		0.15	0.06	2	0.024	0.038
SPM	>10,000	3.23	0.03	2	0.269	0.434
PM_{10}		0.62	0.03	2	0.052	0.083
$PM_{2.5}$		0.15	0.03	2	0.013	0.020

[1] MTO Environmental Guide for Assessing and Mitigating the Air Quality Impact and Greenhouse Gas Emissions of Provincial Transportation Projects
The factors provided in MTO AQ Guideline is consistent with USEPA AP-42 13.2.1.3, for PM2.5 and PM10.
[2] Recommended by MTO/MECP
The AADT values were used to apply appropriate emission factors.

Appendix C

Dispersion Modelling Input Data and Assumptions

C-1: Emission Data - Current (2021)

ID	Direction to	Length (m)	Speed (km/h)	Adjusted Peak Volume	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
					Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)	Effective Emission Factor AM/PM (g/veh-mile)
1aw	WB	100	50	906	5.96E-02	1.81E-01	5.32E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
1ae	EB	100	50	592	5.96E-02	1.81E-01	5.32E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
1bw	WB	1350	80	585	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
1be	EB	1350	80	523	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
1cw	WB	700	80	776	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
1ce	EB	700	80	679	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
1dw	WB	1350	80	813	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
1de	EB	1350	80	720	4.25E-02	1.28E-01	4.78E-01	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
2aw	WB	2050	70	1326	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2ae	EB	2050	70	1185	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2be	EB	670	70	288	6.59E-02	2.19E-01	8.78E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2bw	WB	670	70	270	6.59E-02	2.19E-01	8.78E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2ce	EB	800	70	299	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2cw	WB	800	70	253	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2dw	WB	100	70	695	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
2de	EB	100	70	493	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3aw	WB	750	70	1343	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3ae	EB	750	70	1128	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3bw	WB	1350	70	1329	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3be	EB	1350	70	1229	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3cw	WB	200	70	1115	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
3ce	EB	200	70	918	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
4cn	NB	3000	50	547	7.73E-02	2.55E-01	9.13E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
4cs	SB	3000	50	525	7.73E-02	2.55E-01	9.13E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
5bs	SB	1200	70	83	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
5bn	NB	1200	70	52	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
5cs	SB	3100	70	139	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
5cn	NB	3100	70	67	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
5dn	NB	200	70	134	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
5ds	SB	200	70	134	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6bn	NB	1450	70	1566	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6bs	SB	1450	70	1876	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6cs	SB	2050	70	2763	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6cn	NB	2050	70	1510	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6ds	SB	1950	70	3027	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
6dn	NB	1950	70	1721	4.82E-02	1.46E-01	4.96E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
7bs	SB	1200	70	434	6.59E-02	2.19E-01	8.78E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
7bn	NB	1200	70	319	6.59E-02	2.19E-01	8.78E-01	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
7es	SB	1800	70	360	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
7en	NB	1800	70	295	1.41E-01	5.30E-01	2.50E+00	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08
7fw	WB	30	50	254	7.73E-02	2.55E-01	9.13E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
7fe	EB	30	50	295	7.73E-02	2.55E-01	9.13E-01	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08

Idle Emission (g/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
% Cars - AM/PM Peak	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)
93%	1.93E-01	2.11E-01	2.11E-01	4.68E+00	2.11E-02	3.53E+00	1.16E-02	1.65E-03	3.12E-02	1.67E-02	2.52E-03	6.14E-08

Moving Emission Rate

Speed (km/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
40	4.39E-02	1.23E-01	1.23E-01	8.89E-01	2.67E-03	4.50E+00	3.39E-03	4.02E-04	2.44E-04	1.99E-03	2.40E-04	2.23E-08
50	3.94E-02	9.82E-02	9.82E-02	8.19E-01	2.39E-03	4.21E+00	2.93E-03	3.47E-04	2.87E-03	1.72E-03	2.07E-04	1.93E-08
80	2.23E-02	4.46E-02	4.46E-02	6.34E-01	1.55E-03	2.89E+00	1.87E-03	2.24E-04	2.09E-03	1.21E-03	1.54E-04	1.21E-08
70	2.80E-02	6.24E-02	6.24E-02	6.96E-01	1.83E-03	3.33E+00	2.23E-03	2.65E-04	2.35E-03	1.38E-03	1.72E-04	1.45E-08

C-2: Emission Data - Future (2041) No Build

ID	Direction to	Length (m)	Speed (km/h)	Adjusted Peak Volume	$PM_{2.5}$ Effective Emission Factor AM/PM (g/veh-mile)	PM_{10} Effective Emission Factor AM/PM (g/veh-mile)	SPM Effective Emission Factor AM/PM (g/veh-mile)	NOx Effective Emission Factor AM/PM (g/veh-mile)	SO_2 Effective Emission Factor AM/PM (g/veh-mile)	CO Effective Emission Factor AM/PM (g/veh-mile)	Benzene Effective Emission Factor AM/PM (g/veh-mile)	1-3 Butadiene Effective Emission Factor AM/PM (g/veh-mile)	Formaldehyde Effective Emission Factor AM/PM (g/veh-mile)	Acetaldehyde Effective Emission Factor AM/PM (g/veh-mile)	Acrolein Effective Emission Factor AM/PM (g/veh-mile)	B(a)P Effective Emission Factor AM/PM (g/veh-mile)
1aw	WB	100	50	1106	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
1ae	EB	100	50	722	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
1bw	WB	1350	80	714	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1be	EB	1350	80	638	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1cw	WB	700	80	947	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1ce	EB	700	80	828	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1dw	WB	1350	80	992	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1de	EB	1350	80	879	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
2aw	WB	2050	70	1619	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2ae	EB	2050	70	1445	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2be	EB	670	70	329	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2bw	WB	670	70	351	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2ce	EB	800	70	309	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2cw	WB	800	70	365	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2dw	WB	100	70	883	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2de	EB	100	70	626	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3aw	WB	750	70	1638	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3ae	EB	750	70	1377	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3bw	WB	1350	70	1621	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3be	EB	1350	70	1499	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3cw	WB	200	70	1361	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3ce	EB	200	70	1120	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
4cn	NB	3000	50	668	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
4cs	SB	3000	50	641	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
5bs	SB	1200	70	102	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5bn	NB	1200	70	63	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5cs	SB	3100	70	169	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5cn	NB	3100	70	83	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5dn	NB	200	70	164	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5ds	SB	200	70	164	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6bn	NB	1450	70	1911	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6bs	SB	1450	70	1872	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6cs	SB	2050	70	3339	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6cn	NB	2050	70	1824	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6ds	SB	1950	70	2795	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6dn	NB	1950	70	1589	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7bs	SB	1200	70	389	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7bn	NB	1200	70	530	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7es	SB	1800	70	437	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7en	NB	1800	70	357	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7fw	WB	30	50	307	5.03E-02	2.26E-01	8.84E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
7fe	EB	30	50	356	5.03E-02	2.26E-01	8.84E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09

Idle Emission (g/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
% Cars - AM/PM Peak	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)
93%	2.99E-02	3.32E-02	3.32E-02	3.45E+00	1.45E-02	2.00E+00	2.02E-03	0.00E+00	3.27E-03	4.43E-03	3.89E-04	1.18E-08

Moving Emission Rate

Speed (km/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
40	1.58E-02	9.33E-02	9.33E-02	3.73E-01	2.67E-03	1.76E+00	4.74E-04	0.00E+00	3.43E-04	3.73E-04	3.38E-05	2.78E-09
50	1.25E-02	6.94E-02	6.94E-02	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
80	5.88E-03	2.69E-02	2.69E-02	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
70	8.08E-03	4.10E-02	4.10E-02	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09

C-3: Emission Data - Future (2041) Build

ID	Direction to	Length (m)	Speed (km/h)	Adjusted Peak Volume	$PM_{2.5}$ Effective Emission Factor AM/PM (g/veh-mile)	PM_{10} Effective Emission Factor AM/PM (g/veh-mile)	SPM Effective Emission Factor AM/PM (g/veh-mile)	NOx Effective Emission Factor AM/PM (g/veh-mile)	SO_2 Effective Emission Factor AM/PM (g/veh-mile)	CO Effective Emission Factor AM/PM (g/veh-mile)	Benzene Effective Emission Factor AM/PM (g/veh-mile)	1-3 Butadiene Effective Emission Factor AM/PM (g/veh-mile)	Formaldehyde Effective Emission Factor AM/PM (g/veh-mile)	Acetaldehyde Effective Emission Factor AM/PM (g/veh-mile)	Acrolein Effective Emission Factor AM/PM (g/veh-mile)	B(a)P Effective Emission Factor AM/PM (g/veh-mile)
1aw	WB	100	50	959	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
1ae	EB	100	50	1397	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
1bw	WB	1350	80	631	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1be	EB	1350	80	932	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1cw	WB	700	80	1224	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1ce	EB	700	80	1232	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1dw	WB	1350	80	1021	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
1de	EB	1350	80	1461	2.60E-02	1.10E-01	4.61E-01	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
2aw	WB	2050	70	1221	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2ae	EB	2050	70	777	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2be	EB	670	70	1026	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2bw	WB	670	70	488	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2ce	EB	800	70	473	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2cw	WB	800	70	946	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2dw	WB	100	70	491	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
2de	EB	100	70	299	4.59E-02	1.97E-01	8.56E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3aw	WB	750	70	1638	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3ae	EB	750	70	1377	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3bw	WB	1350	70	1621	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3be	EB	1350	70	1499	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3cw	WB	200	70	1361	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
3ce	EB	200	70	1120	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
4cn	NB	3000	50	668	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
4cs	SB	3000	50	641	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
4ds	SB	400	50	1008	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
4dn	NB	400	50	1109	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
5bs	SB	1200	70	102	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5bn	NB	1200	70	63	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5cs	SB	3100	70	169	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5cn	NB	3100	70	83	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5dn	NB	200	70	164	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
5ds	SB	200	70	164	1.21E-01	5.09E-01	2.48E+00	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6bn	NB	1450	70	2448	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6bs	SB	1450	70	2041	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6cs	SB	2050	70	2094	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6cn	NB	2050	70	2797	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6ds	SB	1950	70	1548	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
6dn	NB	1950	70	2867	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7bs	SB	1200	70	877	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
7bn	NB	1200	70	768	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8an	NB	1220	70	713	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8as	SB	1220	70	1065	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8bs	SB	1400	70	1807	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8bn	NB	1400	70	1120	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8cs	SB	600	70	1807	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
8cn	NB	600	70	2555	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
G_7cs	SB	1700	70	462	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
G_7cn	NB	1700	70	1120	2.82E-02	1.24E-01	4.75E-01	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09
G_7de	WB	2450	50	552	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
G_7dw	EB	2450	50	796	3.26E-02	1.53E-01	5.03E-01	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09

Idle Emission (g/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
% Cars - AM/PM Peak	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)	Effective Idle Emission Factor - (g/hr)
93%	2.99E-02	3.32E-02	3.32E-02	3.45E+00	1.45E-02	2.00E+00	2.02E-03	0.00E+00	3.27E-03	4.43E-03	3.89E-04	1.18E-08

Moving Emission Rate

Speed (km/hr)	$PM_{2.5}$	PM_{10}	SPM	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein	B(a)P
40	1.58E-02	9.33E-02	9.33E-02	3.73E-01	2.67E-03	1.76E+00	4.74E-04	0.00E+00	3.43E-04	3.73E-04	3.38E-05	2.78E-09
50	1.25E-02	6.94E-02	6.94E-02	3.22E-01	2.39E-03	1.64E+00	4.09E-04	0.00E+00	3.03E-04	3.34E-04	3.02E-05	2.40E-09
80	5.88E-03	2.69E-02	2.69E-02	1.54E-01	1.55E-03	1.12E+00	2.79E-04	0.00E+00	2.02E-04	2.20E-04	1.99E-05	1.63E-09
70	8.08E-03	4.10E-02	4.10E-02	2.10E-01	1.83E-03	1.29E+00	3.22E-04	0.00E+00	2.36E-04	2.58E-04	2.34E-05	1.89E-09

Appendix D

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:
    a. The contract between WSP and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");
    b. Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by WSP to the Client in connection to the Contract; and
    c. The limitations stated herein.
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