Air Quality Assessment Report (ver.1.3)

GO Mobility Hubs
Burlington, Ontario
Project # TPB178008S

Prepared for:

Brook McIlroy Inc.

161 Spadina Avenue, 2nd Floor Toronto, Ontario M5V 2L6

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Executive Summary

The City of Burlington (the City) retained Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (hereinafter referred to as Wood), through Brook McIlroy Inc. to undertake an air quality impact assessment (AQIA) for the areas surrounding the Burlington GO, Aldershot GO, and Appleby GO mobility hubs.

The purpose of this study is to predict the potential impacts of emissions from industrial and transportation sources on the nearby proposed development and recommend necessary mitigation measures, where appropriate. This study contributes to the overall Area Specific Plans (ASPs) for each hub.

The undertaking of ASPs for Burlington's Mobility Hubs represents the City's continuing implementation of its vision for appropriate intensification and the protection of established neighbourhoods by focusing future population growth to key areas.

This air quality assessment was prepared based on design information, traffic measurements from the City taken between 2011 and 2016, building density planning, public reporting of air emissions, and Halton Region's Land Use Compatibility Guidelines. Air emissions forecasted to 2020 and 2041 were approximated using a 2% annual increase in vehicle volume and a 2% increase in rail traffic. The purpose of this study is to:

- Define the study areas, receptors, pollutants of interest, and background conditions;
- Assess the current (2020 prorated based on the 2011-2016 Road Traffic Data and 2018 Train Schedules) and horizon year (2041) fleet profile and traffic flow;
- Provide estimates of the air emissions resulting from rail traffic, automotive traffic, and local industry;
- Setup and run air dispersion modelling (AERMOD and CALRoads);
- 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 forecasted air quality effects in 2041 to the current baseline scenario.

The US EPA AERMOD version 19191 air dispersion model was utilized for modelling emissions to the atmosphere from industrial and railroad sources. AERMOD is a Gaussian steady-state plume model which is commonly used for this type of assessments. AERMOD is also accepted as a main regulatory air dispersion model by the Ontario Ministry of the Environment, Conservation and Parks (MECP) and the Ministry of Transportation (MTO) in the province of Ontario.

The effects of emissions from vehicular traffic were modelled using the US EPA traffic modelling CAL3QHCR. The emission rates were developed using MOVES3 (2020) US EPA software and based on traffic data provided by City of Burlington's Transportation Service Department. The impacts potentially created by vehicles were modelled with the CAL3QHCR dispersion model, using the most conservative Tier I approach that considers peak hour traffic volume and emissions.

The modelling was performed using a five-year (2012-2016) meteorological data set for Burlington Piers provided by the MECP. The meteorological data incorporated into the model included wind speed, wind direction, stability category, air temperature, rural mixing height, and urban mixing height. The same range of years of meteorological data was used for AERMOD and CAL3QHCR modelling.

The modelling was performed using a five-year (2012-2016) meteorological data set for Burlington Piers provided by the MECP. The meteorological data incorporated into the model included wind speed, wind direction, stability category, air temperature, rural mixing height, and urban mixing height. The same range of years of meteorological data was used for AERMOD and CAL3QHCR modelling.

Both dispersion models (AERMOD and CAL3QHCR) were run for the target pollutants stipulated in the scope of work. Air emissions of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), inhalable particulate (PM_{10}), respirable particulate ($PM_{2.5}$), five VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, Acrolein), and Benzo(a)pyrene (B(a)P) were modelled for the described current and horizon scenarios and included predicted concentration levels at the closest sensitive receptors.

The findings of the air quality study were as follow:

- The air dispersion modelling study, which included the highway and railway emissions and select Class III industries in each Hub, found that all target pollutants were predicted to be at concentrations lower than the relevant air quality criteria in both the current and year 2041 scenarios, with one exception – NO_2 under the current scenario;
- The predicted effects for NO2 were highest for the current scenario, as the NO2 emissions reductions to be achieved as older vehicles/trains are removed from service were significant and off-set the increased traffic volumes for year 2041 scenario;
- The highest effects were modelled within 25 metres of the railway corridor;
- The proposed developments are located adjacent to highway (403, QEW), and may lie within the MTO permit control area under the Public Transportation and Highway Improvement Act. If so, the development may also be subject to MTO approval;
- Class I facilities are unlikely to result in significant land use compatibility issues, with the possible exception of minor odour or dust nuisance effects. Class II and III facilities have the potential to result is incompatibilities and nuisance effects, however these are generally required an Environmental Compliance Approval (ECA) or an Environmental Activity and Sector Registry (EASR) Registration to operate and are regulated by the MECP. In order to obtain an ECA or to register on the EASR a facility must demonstrate compliance with the air quality standards and Air Contaminant Benchmarks in Ontario;
- Construction activities are also a source of air emissions, most commonly fugitive dusts, odours, lighting, and tailpipe emissions from diesel equipment and vehicles. Construction activities should be managed to control air quality effects, with consideration of scheduling, monitoring and mitigation;
- On the part of the industrial, commercial, or warehousing / distribution facilities, there are effective best management practices (BMPs) that may be employed to control fugitive dust and odour. Facilities subject to the Ontario EPA Section 9 requirement for approval may be required to prepare a BMP Plan in support of the approval that outlines procedures and practices to prevent nuisance odour or dust effects;
- Odour is the most complex of the potential nuisance effects as it may be caused by discharges from stationary point sources, area sources, buildings, outdoor sources, or fugitive sources. The likelihood of odorous effects is very specific to the type of facility. Facility specific odour assessment, odour management plans and control measures should be required to avoid odour release and off-site effects;
- Odour mitigation measures that could be incorporated into new high-rise developments in the hubs:
    - Site design to use buffer commercial space;
    - Ensure odour free indoor space (air filtration); and

  - At highest impact locations, sealed units (no open balconies).

The specific recommendations to how the above listed measures could be implemented, require the detailed assessments and should be conducted on per area/facility basis.

- The traffic related air emissions from vehicles on Highway 403/QEW are significant and will likely impact the proposed development.

It is recommended that the proposed development also incorporate additional mitigation measures on an as needed basis to limit the impact of air emissions from the Highway 403/QEW, including, but not limited to:

- Effective and meaningful communication with current residents and industrial facilities during planning and construction phases has proven beneficial for other redevelopment projects, with consideration given to establishing a public liaison committee to encourage resident participation. There may be opposition to any development that might amplify potential nuisances.
- The Region should consider a requirement for site specific land use compatibility studies and air quality assessments for proposed developments;
- Developments within close proximity to major highways should include:
  - Maintain separation distances, which set a minimum distance between high-traffic roadways and places where people live, work, and play;
  - Strategic orientation of buildings, play areas, and air intakes;
  - Maintain slightly positive internal air pressures in buildings;
  - Incorporate vegetative and physical barriers; and
  - Incorporate superior ventilation, filtration, and air-conditioning systems into building design.

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1.0 Introduction

The City of Burlington (the City) retained Wood Environment & Infrastructure Solutions (Wood) through Brook McIlroy Inc. to undertake air quality impact assessment (AQIA) for the areas surrounding the Burlington GO, Aldershot GO, and Appleby GO mobility hubs.

The purpose of this study is to determine the potential effects of emissions from industrial and transportation sources on the nearby proposed development and to recommend mitigation measures where appropriate. This study contributes to the overall Area Specific Plans (ASPs) for each hub.

The milestones of the study are as follows:

- Define the study areas, receptors, pollutants of interest, and background conditions;
- Assess the current (2020) and horizon year (2041) fleet profile and traffic flow;
- Provide estimates of the air emissions resulting from rail traffic, automotive traffic, and local industry;
- Setup and run air dispersion modelling (AERMOD and CALRoads) to 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 forecasted air quality effects in 2041 to the current baseline scenario.

1.1 Key Components of Study

The key components of the study include:

1. Develop a baseline scenario considering the current air quality;
2. Develop an emission scenario for current transportation modes across major routes in each HUB (including rail lines, HWY 403, provincial highways, and other major routes);
3. Develop an emission scenario for industries in each HUB study area that manufacture, process, or otherwise use the respective substance of concern and report air emissions publicly to the National Pollutant Release Inventory (NPRI);
4. Provide a quantitative analysis of the effects on air quality that will include the use of modeling to predict off-site air concentrations that result from site activities;
5. Provide a qualitative discussion of the significance of air quality effects; and
6. Provide a qualitative discussion of the odour and dust from industries surrounding the hubs.

1.2 Study Areas and Sensitive Land Uses

The Burlington GO, Aldershot GO, and Appleby GO mobility hub study areas are all within Burlington, Ontario city limits on the western shore of Lake Ontario. All three study areas are bordered by provincial highway 403 and contain a mix of residential, commercial, and industrial zoning.

The elevated receptors to represent buildings of different heights were selected based on the preferred land use plans and described in section 2.2.

Roadways

The main roadways within the Study Areas include:

- **Provincial Highway 403** is a mostly east-west 400-series highway between Woodstock and Mississauga. It has a posted speed limit of 100 km/h and has mostly 8 lanes of traffic for the section bordering the study area.
- **Queen Elizabeth Way (QEW)** is a 400-series highway between Toronto and the Peach Bridge at the Canadian border. It has a posted speed limit of 100 km/h and has mostly 8 lanes of traffic for the section bordering the study area.
- **Brant Street** is a four (4) to six (6) lane, north-south City of Burlington Arterial road stretching from residential areas north of the 403 to the lakeshore within the Study Area. It has a posted speed limits of 50 km/h and 60 km/h .
- **Appleby Line** is a four lane, north-south City of Burlington Arterial road with interchanges at the 403 and 407. It has a posted speed limits of 50 km/h and 60 km/h.
- **Burloak Drive** is a four lane, north-south City of Burlington Arterial road bordering Oakville with an interchange at the 403. It has a posted speed limit of 60 km/h.
- **Fairview Street/Plains Road East** is a four (4) to six (6) lane, east-west City of Burlington Major Arterial road stretching from Aldershot to Appleby within the Study Area. It has a posted speed limit of 60 km/h.

There are also several local roads that intersect with Fairview Street/Plains Road East within the Study Area or the setbacks:

- **Guelph Line** passes through the Burlington HUB setbacks and has an interchange with the QEW. It has a posted speed limit of 60 km/h.
- **Appleby Line** passes through the Burlington HUB setbacks and has an interchange with the QEW. It has a posted speed limits of 50 km/h and 60 km/h.

Rail Lines

The operating rail lines within the Study Areas include:

CN Rail's Western Lakeshore Line runs along Lake Ontario's northwestern shore and intersects all 3 Study Areas. Canadian National (CN), VIA, and GO trains all use this corridor with the GO train making stops at the Aldershot, Burlington, and Appleby Stations. VIA trains make stops at the Aldershot Station.

CN Rail's Hamilton & Northwestern Line runs from the Burlington Study Area north through Milton and ending in Georgetown. CN trains use this corridor.

The Preferred Land Use Concept figure was provided to Wood and is presented below as Figure 1.1 to illustrate the existing and proposed land uses for Aldershot hub. The Preferred Land Use Concept figure is presented as Figure 1.2 to illustrate the existing and proposed land uses for Burlington hub. The Preferred Land Use Concept figure is presented as Figure 1.3 to illustrate the existing and proposed land uses for Appleby hub.

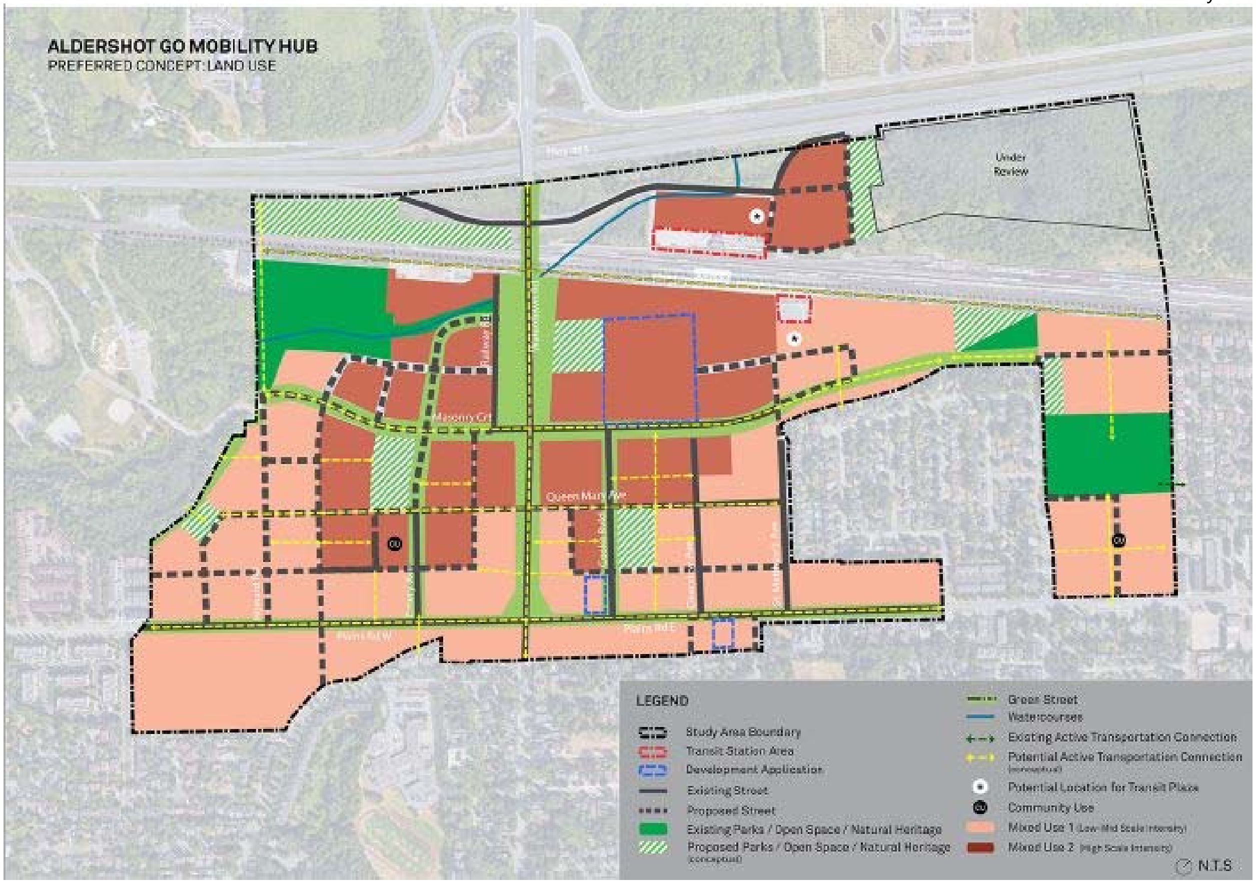

Figure 1.1: Preferred Land Use Concept for Aldershot Hub

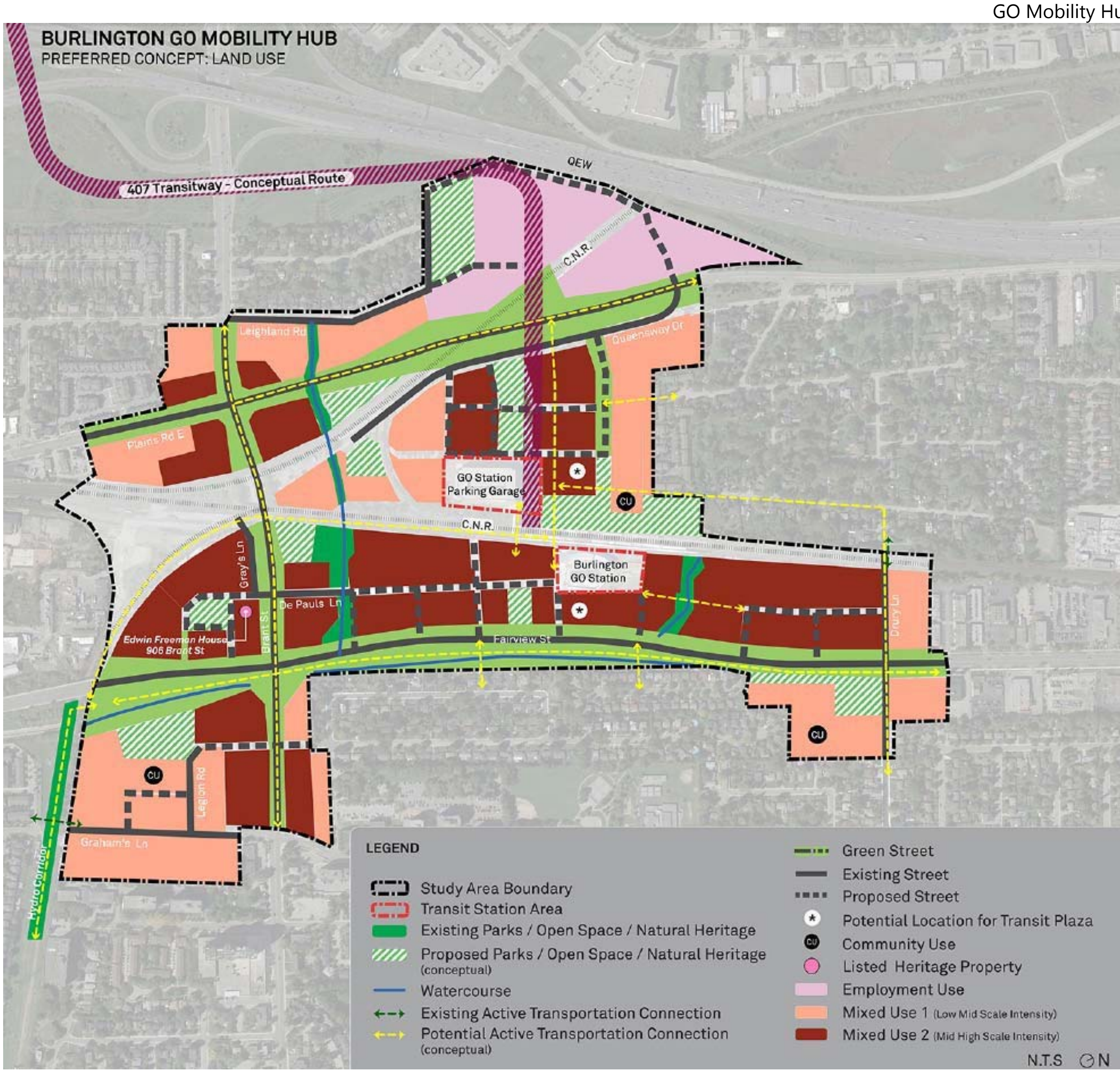

Figure 1.2: Preferred Land Use Concept for Burlington Hub

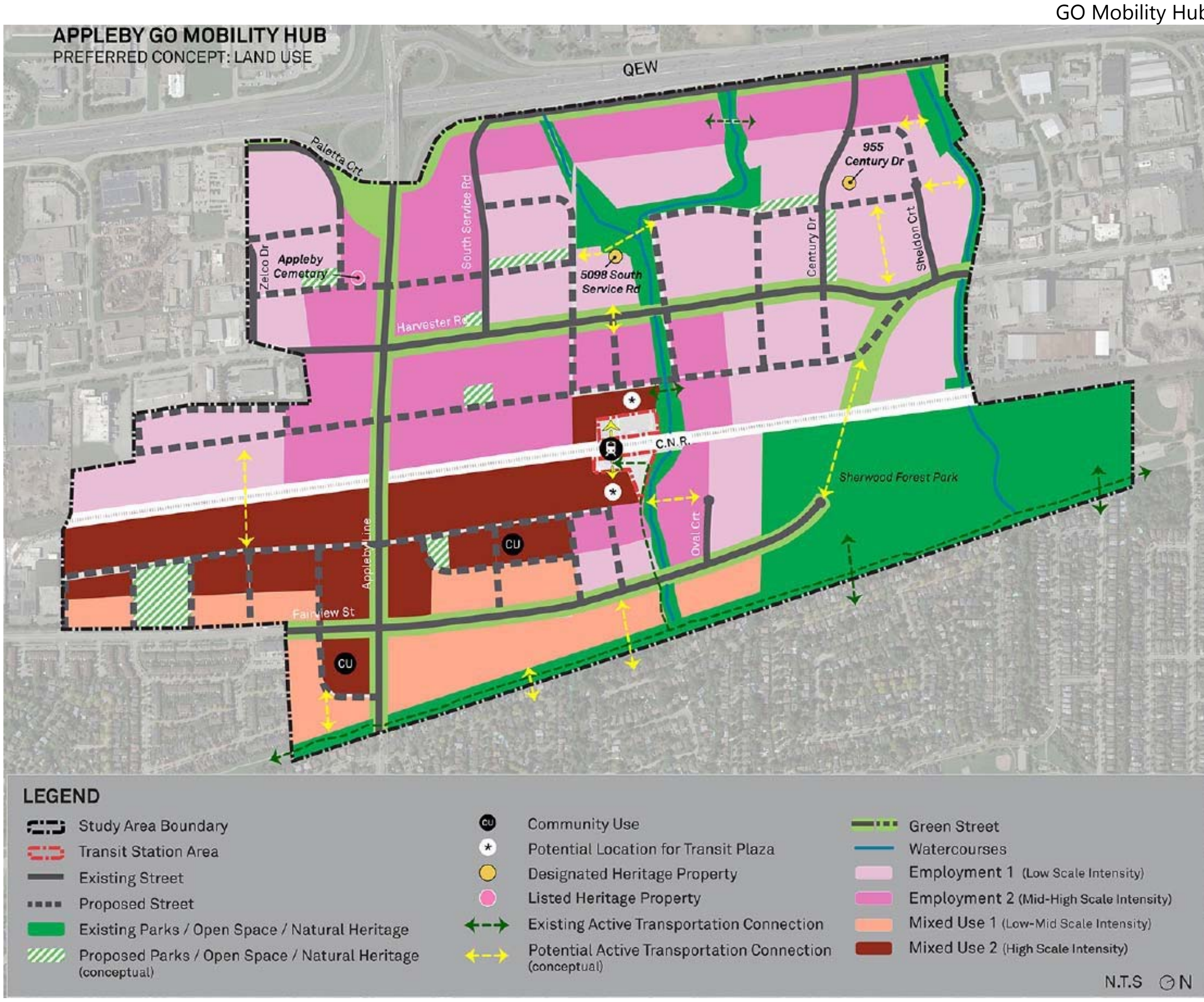

Figure 1.3: Preferred Land Use Concept for Appleby Hub

2.0 Methodology

There is the potential for rail, automotive, and industrial sources of emissions to increase the ambient air concentrations of certain pollutants in the local 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.

2.1 Key Contaminants of Concern

Odour, fine particulate matter, nitrogen oxides, carbon monoxide, sulphur dioxide, benzo(a)pyrene, and VOCs (specifically benzene, 1-3 butadiene, formaldehyde, acetaldehyde, and acrolein) have standards and ambient air quality criteria in Ontario that were set based upon health or environmental effects of exposure to these pollutants.

2.1.1 Odour

Odour has a high potential to become a nuisance to people that live near industrial facilities, or frequent sports fields, community centres, or other sensitive land uses. What prompts odours to be a nuisance varies widely from person to person, as there are varying degrees of sensitivity and opinions about what is considered offensive. Five factors that contribute to odour nuisance have been defined to help deal with the complex and subjective nature of odours. These are referred to as the FIDOL factors, and consist of:

Frequency – how often odour is detected

Intensity – how strong is the odour

Duration – are odours very brief or are episodes lengthy

Offensiveness - the hedonics or descriptors (putrid, solvent)

Location – is someone present to smell the odour

2.1.2 Particulate Matter

Particulate Matter, including fugitive dusts from outdoor activities, is assessed and regulated in four forms:

Total Suspended Particulate (TSP)

TSP 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 µm in diameter that are generally considered as TSP. Ambient TSP standards have become a surrogate for visibility effects, and the assessment of TSP 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.

Total Particulate Matter (TPM), which are particles that are less than 100 µm, was used as an approximation of TSP when considering industrial air emissions as TPM is what is reported to NPRI.

In 2017, 277 Ontario facilities reported releases of TPM to the air for a total of 30,361tonnes. Mines, pulp and paper mills, steel manufacturing, quarries, cement plants were some of the main contributors.

One facility in the Aldershot Study Area reported TPM emissions to the NPRI in 2017.

Inhalable Particulate (PM_{10})

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}.

In 2017, 705 Ontario facilities reported releases of PM_{10} to the air for a total of 17,255 tonnes. Mines, pulp and paper mills, steel manufacturing, quarries, cement plants were some of the main contributors.

One facility in the Aldershot Study Area reported PM_{10} emissions to the NPRI in 2017.

Inhalable Particulate ($PM_{2.5}$)

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.

In 2017, 696 Ontario facilities reported releases of $PM_{2.5}$ to the air for a total of 8,911 tonnes. Mines, pulp and paper mills, steel manufacturing, quarries, cement plants were some of the main contributors.

One facility in the Aldershot Study Area reported $PM_{2.5}$ emissions to the NPRI in 2017.

Dustfall

Settleable particulate, or dustfall, that falls to the ground due to gravity and may be visible on surfaces. The dustfall is comprised of the coarser fraction of TSP that is prone to settling in 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.

Dustfall is not reported to NPRI.

Fugitive Dusts

Fugitive dust generally refers to dust generated from open sources that is not captured and discharged to the atmosphere from a point source (a stack). Common sources of fugitive dust include unpaved roads, aggregate storage piles, and heavy construction operations, although there may be other site-specific sources such as crushing, screening, and material handling.

It is the larger size fractions of particulate matter, namely total suspended particulates (TSP) and particulates less than 10 micron in diameter (PM_{10}) that constitute the nuisance fugitive dusts through dust deposition and visibility impairment. The smaller respirable particle $PM_{2.5}$ size fraction is of greater concern with respect to health and usually are emitted from combustion activities including vehicular tailpipe and diesel engine exhaust. It is emphasized that that these particle size fractions are not separate compounds, nor are they additive. The smaller particle sizes are a subset of the large particulate matter size fractions.

Fugitive road dust was not quantified and modeled, as the majority the roads in the study areas are paved.

2.1.3 Nitrogen Oxides

Nitrogen oxides (NO_x) are a mixture of compounds of oxygen and nitrogen, including nitric oxide (NO), nitrous oxide (N_2O), nitrogen dioxide (NO_2), and others. 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.

In 2017, 304 Ontario facilities reported releases of NOx to the air for a total of 62,503 tonnes. Cement plants, steel manufacturing, chemical plants, and refineries were some of the main contributors.

One facility in the Aldershot Study Area reported NOx emissions (expressed as NO_2) to the NPRI in 2017.

Atmospheric NO/NO_2 Reactions

NOx emissions from vehicle and locomotive exhausts were estimated and modelled for the current study, however the AAQC criteria in the province is only for nitrogen dioxide (NO_2). The current assessment was done utilizing two main modelling software packages CALRoads and AERMOD to be discussed in further details in Section 7 of the report.

To follow the conservative approach in estimating and modelling of NO_2 emissions the CALRoads modelling was done considering all NOx emissions to be in NO_2 form as this modelling package is not providing an algorithm to simulate NOx to NO_2 conversion.

The AERMOD software has the capacity to simulate the NOx/NO_2 conversion which was utilized in the modelling. In the atmosphere ozone (O_3) reacts with nitric oxide (NO) emissions to create NO_2, so the levels of ozone in the atmosphere is the limiting factor of how much NO_2 can be generated by this reaction. The 90^{th} percentile ozone levels measured at NAPS Station ID: 63001 (HWY 2 & North Shore Blvd.) in year 2016 was used as the background O_3 concentration in AERMOD modelling. The default equilibrium ratio of 0.9 for NO_2/NOx was conservatively applied as one of the variables in the ozone limiting method (OLM).

Depending on the background ozone concentrations and meteorological condition (i.e. cloud cover and temperature), this ratio can be much lower which would result in lower NO_2 concentrations at receptors. The second variable affecting NO_2 concentrations is the NO_2/NOx in-stack ratio which represents the balance of NOx species being emitted from sources. As locomotive diesel emissions were the largest contributors to NO_2 concentration in the model, an in-stack ratio of 0.1 applied was based on ratios of diesel sources publicly available from the US EPA's NO_2/NOx In-Stack Ratio (ISR) Database.

2.1.4 Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless, tasteless gas, which is produced primarily through the combustion of fossil fuels because 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 level of CO concentration in the air can be dangerous to human health, and exposures to higher concentrations of CO can lead to significant toxicity of the central nervous system and heart.

The O. Reg. 419 CO standard is for the ½ hour averaging time; AAQCs exist for the 1-hour and 8-hour averaging times. The standards and AAQCs for CO are all based upon potential health effects, and are presented in Table 2.1.

In 2017, 254 Ontario facilities reported releases of CO to the air for a total of 61,413 tonnes. Wood products, steel manufacturing, refineries, chemical plants, and power generation were some of the main contributors.

One facility in the Aldershot Study Area reported CO emissions to the NPRI in 2017.

2.1.5 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. Regarding 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 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.

Air quality standards for SO_2 have been set for the 1-hour and 24-hour averaging times, with equivalent AAQCs, as shown in Table 2.1. In addition, Ontario has an annual AAQC of 55 $\mu g/m^3$ for SO_2. The standards and AAQC are based upon potential health effects of SO_2, as well as potential effects on vegetation.

In 2017, 103 Ontario facilities reported releases of SO_2 to the air for a total of 172,862 tonnes. Three smelting/refining facilities contributed 66% of the total. A variety of industries made up the remainder.

No facilities in any of the study areas reported SO_2, indicating that none of the reporting facilities released more than 20 tonnes in the air.

2.1.6 Volatile Organic Compounds (VOCs)

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

- Benzene;
- 1,3-Butadiene;
- Formaldehyde;
- Acetaldehyde; and
- Acrolein.

These speciated VOCs released during the fuel combustion were estimated and modelled.

464 facilities in Ontario reported Total VOCs to the NPRI in 2017; this indicates that the facilities released cumulative VOC usage were greater than 10 tonnes.

2.1.7 Benzene

In 2017, 32 Ontario facilities reported releases of benzene to the air for a total of 163 tonnes. Large-scale steel manufacturers were the top contributors at 50% of the total. Chemical plants, cement plants, refineries, and terminals made up most of the remaining emissions.

No facilities in any of the study areas reported benzene, indicating that none of the reporting facilities released benzene in quantities greater than 1 tonne.

2.1.8 1,3-Butadiene

In 2017, 9 Ontario facilities reported releases of 1,3-butadiene to the air for a total of 19 tonnes. Synthetic rubber manufacturing and chemical plants reported 13% and 68% of the total respectively. Chemical plants, cement plants, refineries, and terminals made up most of the remaining emissions.

No facilities in any of the study areas reported benzene, indicating that none of the reporting facilities released 1,3 butadiene in quantities greater than 1 tonne.

2.1.9 2.1.9 Formaldehyde

In 2017, 31 Ontario facilities reported releases of formaldehyde to the air for a total of 228 tonnes. Wood product manufacturers were the top contributors at 72% of the total.

No facilities in any of the study areas reported formaldehyde, indicating that none of the reporting facilities released formaldehyde in quantities greater than 1 tonne.

2.1.10 Acetaldehyde

In 2017, 11 Ontario facilities reported releases of acetaldehyde to the air for a total of 86 tonnes. Wood product manufacturers were the top contributors at 60% of the total.

No facilities in any of the study areas reported acetaldehyde, indicating that none of the reporting facilities released acetaldehyde in quantities greater than 1 tonne.

2.1.11 Acrolein

In 2017, one Ontario facility, the Brock University Power Generation Facility, reported releases of acrolein to the air for a total of 1 tonne.

No facilities in any of the study areas reported acrolein, indicating that none of the reporting facilities released acrolein in quantities greater than 1 tonne.

2.2 Sensitive Receptors

Receptors were placed inside the hub study areas based on the preferred land use and building height plans:

- Low-rise, elevated receptors were placed at 9m;
- Mid-rise, elevated receptors were placed at a range of 16.5m - 33m;
- Tall, elevated receptors were placed at a range of 28.5m - 57m; and

- Tallest, elevated receptors were placed at a range of 30m - 60m.

Receptors were plotted approximately every 100 metres along the perimeters of the different building height zones. For the low-rise and shorter mid-rise buildings, receptors were plotted at the maximum height for the building at the same Universal Transverse Mercator (UTM) coordinates of their respective ground level receptors. For the taller midrise, tall, and tallest building types, receptors were plotted at the maximum height for the building and at half of the maximum height at the same Universal Transverse Mercator (UTM) coordinates of their respective ground level receptors. The same receptors use in the AERMOD model were imported into the CALRoads.

Maps showing the receptor locations are presented in Appendix A.

2.3 Assessment Criteria

Halton's Land Use Compatibility Guidelines (Halton 2014) outlines applicable regulations and standards which include Ontario's Ambient Air Quality Criteria. The relevant air quality criteria for Ontario are listed in Table 2.1. This table lists the contaminants, the relevant averaging period for each standard and the standard as a numerical value (where appropriate).

Table 2.1: Air Quality Criteria used for Study

Contaminant	Averaging Time	Ontario Ambient Air Quality Criteria (unless otherwise indicated)
TSP	24-hr	120 µg/m³
	Annual	60 µg/m³ (++)
PM_{10} (<10µm)	24 hr	50 µg/m³ (Interim)
$PM_{2.5}$ (<2.5 µm)	24 hr	27 µg/m³ (CAAQS*)
NO_2	1 hr	400 µg/m³ (0.2 ppm)
	24 hr	200 µg/m³ (0.1 ppm)
SO_2	1 hr	690 µg/m³ (0.25 ppm)
	24 hr	275 µg/m³ (0.10 ppm)
	Annual	55 µg/m³ (0.02 ppm)
CO	1 hr	36,200 µg/m³ (30 ppm)
	8 hr	15,700 µg/m³ (13ppm)
Benzene	24 hr	2.3 µg/m³
	Annual	0.45 µg/m³
1-3 Butadiene	24 hr	10 µg/m³
	Annual	2 µg/m³
Benzo(a)pyrene	24 hr	5.E-05 µg/m³
	Annual	1.E-05 µg/m³
Formaldehyde	24 hr	65 µg/m³
Acetaldehyde	24 hr & 0.5 hr	500 µg/m³

Contaminant	Averaging Time	Ontario Ambient Air Quality Criteria (unless otherwise indicated)
Acrolein	1 hr	4.5 µg/m^3
	24 hr	0.4 µg/m^3

*CAAQS - Canadian Ambient Air Quality Standards
SO_2 has a proposed 1-hr CAAQS of 70ppb and Annual CAAQS
of 5ppb NO_2 has a proposed 1-hr CAAQS of 60ppb and Annual
CAAQS of 17ppb (++) – Geometric Mean

TSP is the oldest and least used parameter for determining particulate related environmental effects. Ambient TSP standards have become a surrogate for visibility effects; the effects are not health related. 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; this level has been set for the protection of health and to reduce environmental risk.

3.0 Existing Ambient Conditions

3.1 Background Conditions

The background concentrations for pollutants NO_2, and $PM_{2.5}$ considered in this assessment were obtained primarily from the nearest operational Environment Canada National Air Pollution Surveillance (NAPS) air monitoring station which is located 100 m south of the Joseph Brant Hospital Parking Structure on Lakeshore Road in Burlington, ON (NAPS ID: 63001). This station is located approximately 4 kilometers (km) east of the Aldershot GO hub, 3 km south of the Burlington Go hub, and 7 km southwest of the Appleby GO hub.

The background concentrations for pollutants CO, SO_2, benzo(a)pyrene and select VOCs (benzene and 1-3 Butadiene) considered in this assessment were obtained primarily from the next nearest operational Environment Canada National Air Pollution Surveillance (NAPS) air monitoring station which is in Hamilton near the intersection of Wilson Street and Mary Street (NAPS ID: 60512). This station is located approximately 6 kilometers (km) south of the Aldershot GO hub, 10 km southwest of the Burlington Go hub, and 16 km southwest of the Appleby GO hub.

The background concentrations for pollutants Formaldehyde, Acetaldehyde, and Acrolein considered in this assessment were obtained primarily from the Environment Canada National Air Pollution Surveillance (NAPS) air monitoring station in Experimental Farm Simcoe (NAPS ID: 62601). This station, the nearest available to the project site, is located approximately in 60 to 70 kilometers to the southwest of three project areas (Aldershot GO hub, Burlington Go hub and Appleby GO hub), and PM_{10} were not measured by the province's ambient air monitoring program.

At the time of writing, the most recent five years (2015-2019) of published data (Table 3.1) were used for the processing of background concentration.

Table 3.1: Background Concentrations

Compound	CAS Number	Averaging Time	Baseline Concentration (μg/m³)	Reference for Baseline Concentration
PM_{10}	n/a	1-hour	27.8	$PM_{2.5}/PM_{10}$ = 0.54 (Lall et. all, 2004)
		24-hour	25.2	
$PM_{2.5}$	n/a	24-hour	13.6	90th percentile of 24-hr averaging data measured at Burlington, combined (2015-2019)
		Annual	7.64	Annual average measured at Burlington, combined (2015-2019)
		1-hour	15	90th percentile of 24-hr averaging data measured at Burlington, combined (2015-2019)
Nitrogen dioxide (NO_2)	10102-44-0	1-hour	40.8	90th percentile of 24-hr averaging data measured at Burlington, combined (2015-2019)
		24-hour	31.7	90th percentile of 24-hr averaging data measured at Burlington, combined (2015-2019)
		Annual	19.3	Annual average measured at Burlington, combined (2015-2019)
Sulphur Dioxide (SO_2)	7446-09-5	1-hour	33.6	90th percentile of 24-hr averaging data measured at Hamilton, combined (2015-2019)
		24-hour	33.1	90th percentile of 24-hr averaging data measured at Hamilton, combined (2015-2019)
		Annual	11.4	Annual average measured at Hamilton, combined (2015-2019)

Compound	CAS Number	Averaging Time	Baseline Concentration (µg/m³)	Reference for Baseline Concentration
Carbon monoxide (CO)	630-08-0	8-hour	462	As a conservative assumption, same value with one hour average background was assumed.
		1-hour	462	90th percentile of 1-hr averaging data measured at Hamilton, combined (2015-2019)
Benzo(a)pyrene	50-32-8	Annual	1.5E-04	Annual average measured at Hamilton, combined (2015-2019)
		24 Hour	3.7E-04	90th percentile of 24-hr averaging data measured at Hamilton, combined (2015-2019)
Benzene	71-43-2	Annual	0.73	Annual average measured at Hamilton, combined (2015-2019)
		24-hour	1.45	90th percentile of 24-hr averaging data measured at Hamilton, combined (2015-2019)
Acetaldehyde	75-07-0	24-hour	0.87	90th percentile of 24-hr averaging data measured at Experimental Farm, combined (2015-2019)
		½-hour	2.6	Approximated from 24-hour averaging value
Acrolein	107-02-8	24-hour	0.030	90th percentile of 24-hr averaging data measured at Experimental Farm, combined (2015-2019)
		1-hour	0.07	Approximated from 24-hour averaging value
1,3-Butadiene	106-99-0	Annual	0.03	Annual average measured at Hamilton, combined (2015-2019)
		24-hour	0.06	90th percentile of 24-hr averaging data measured at Hamilton, combined (2015-2019)
Formaldehyde	500-00-0	24-hour	1.52	90th percentile of 24-hr averaging data measured at Experimental Farm, combined (2015-2019)

3.2 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 Burlington area consists of fairly cold and windy winters and typically hot, humid summers.

For the air quality study, five years of surface meteorological data were obtained for the Burlington Piers (Aut) station WMO ID 71437; this station is located 5 km southeast of Aldershot GO, 5 km south of Burlington GO, and 9 km southwest of Appleby GO. 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.

3.2.1 Wind Speed and Direction

The wind rose depicted in Figure 3.1 for the nearest recent meteorological dataset (BURLINGTON PIERS (AUT)) details the distribution of wind directions and wind speeds for 2012 to 2016. 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. Winds from the west-southwest were the most common.

The average wind speed for the five-year period was 3.75 m/s (13.5 km/h).

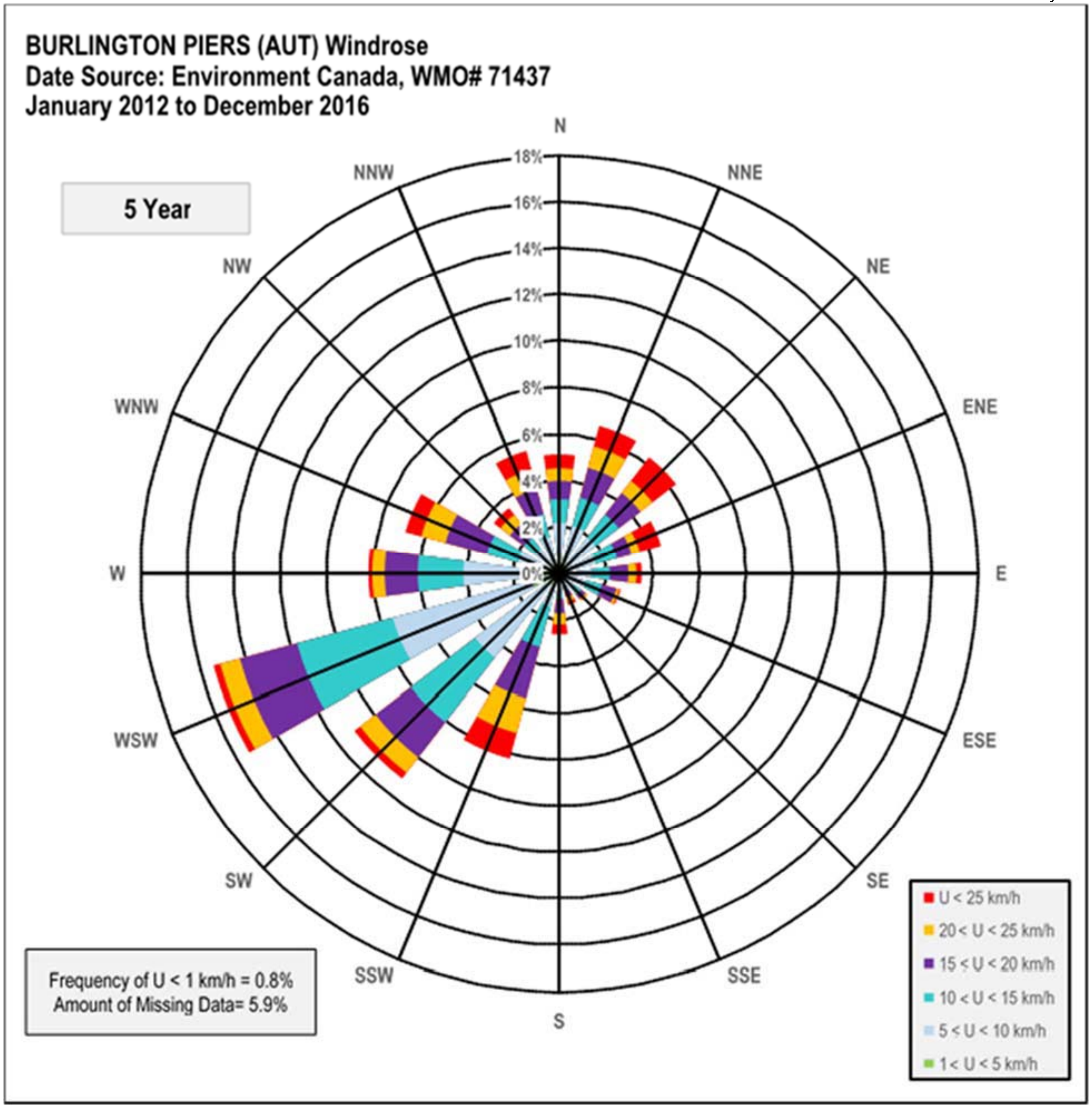

Figure 3.1: Burlington Piers (AUT) 5 Year Windrose

3.2.2 Temperature

The temperature in the Burlington area fluctuates significantly with the seasons (Figure 3.2). The climate normal annual average temperature reported was 9.1 ºC; the January daily average was -4.4ºC and a July average 22.2ºC. The daily maximum and minimum temperatures are 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 ºC. In January, the range was -10.9 to -1.7ºC.

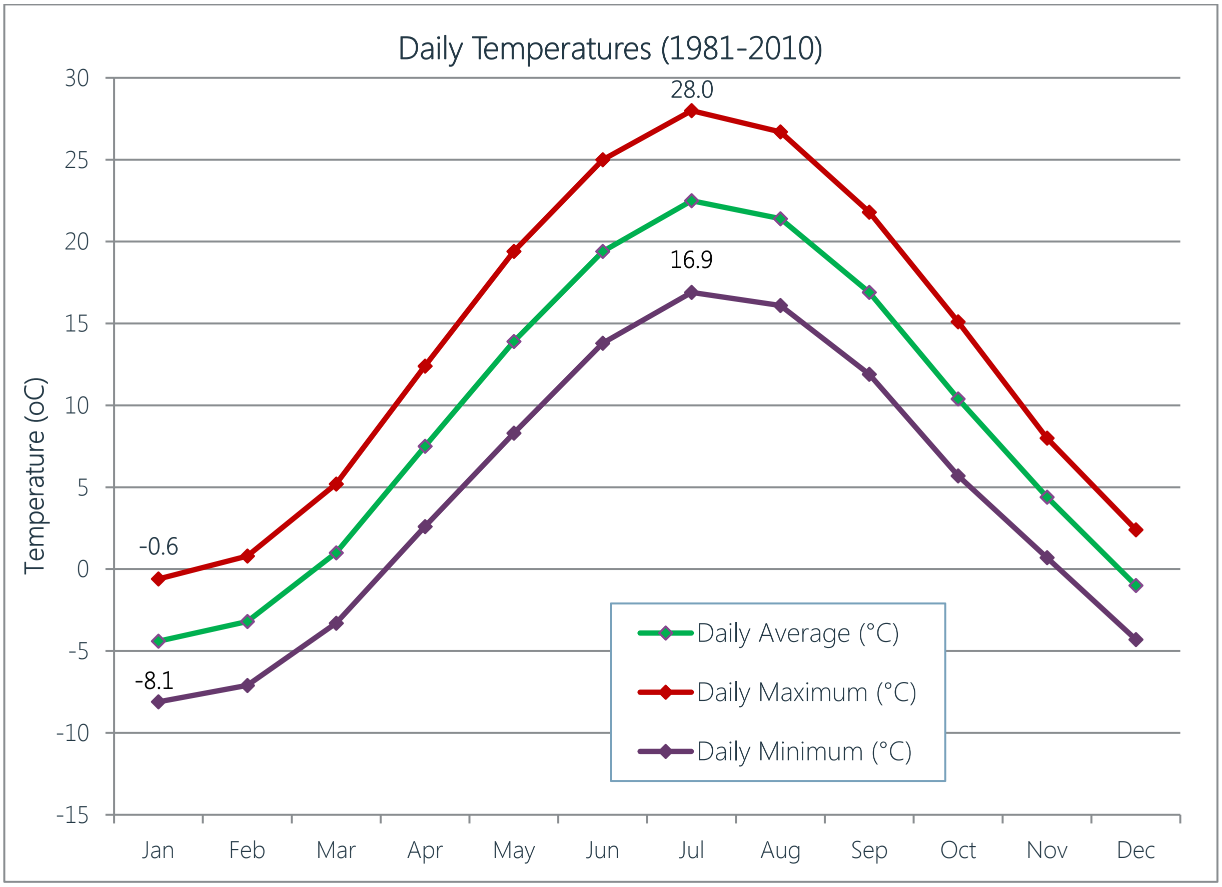

Figure 3.2: Daily Temperature Climate Normals (1981-2010)

3.2.3 Precipitation

Mean annual precipitation for Burlington is estimated at 863 mm (Figure 3.3), with the greatest precipitation contribution occurring as rainfall during the spring and summer.

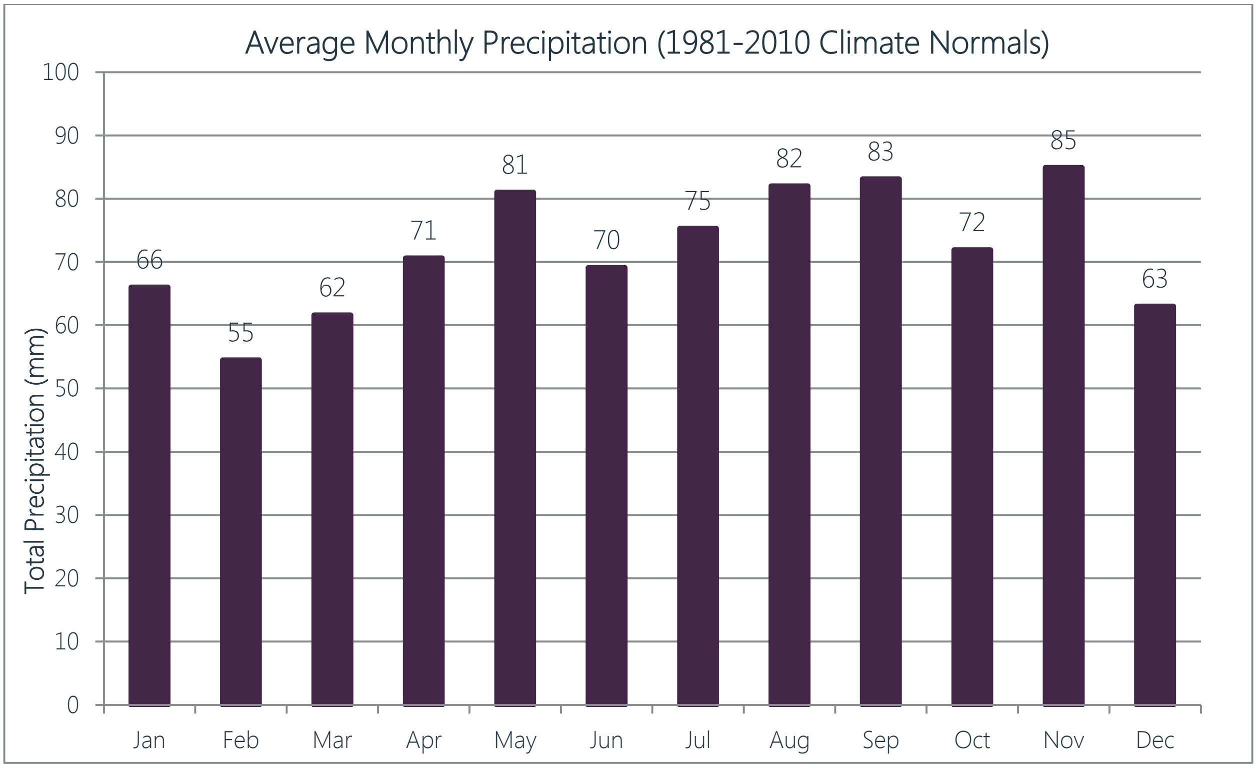

Figure 3.3: Precipitation Climate Normals (1981-2010)

3.3 Current Study Area Land Use

The study areas are large and a mix of residential, commercial, and industrial land uses. The terrain is relatively flat surrounding the study areas. Each study area is in close proximity to Lake Ontario. The meteorological files were developed by the MECP using the exact coordinates of the HUB locations taking into account parameters significant to dispersion modelling such as surface roughness.

4.0 Relevant Guidelines and Legislation

4.1 Halton Region's Land Use Compatibility Guidelines and MECP Land Use Compatibility Guidelines (D1-D6)

The Halton Region Land Use Compatibility Guidelines (LCG) provide guidance on the Region's land use policies. These policies are intended to minimize the potential for conflicts between non-compatible land uses. The LCG uses Ministry of the Environment, Conservation and Parks (MECP) guidelines (D-Series) which were developed in the 1990s to help municipalities assess land use compatibility in the context air, noise, and odour emissions.

The D-Series guidelines provide three Industry classifications which can, for brevity purposes, be simplified to the following criteria:

- Class I – Small-scale facilities with minimal to no offsite effects
  - Examples – autobody shops, electronics repair, linen supply
- Class II – Mid-scale facilities with frequent, but usually low intensity, effects
  - Examples – paint spray booths, metal command, electronics manufacturing
- Class III – Large-scale facilities with frequent, often persistent and/or intense, effects
  - Examples – chemical manufacturing, metal manufacturing, breweries

The D-Series guidelines outline "minimum separation distances" between emission sources and sensitive land uses as well as more conservative potential areas of influence (PAI) setback as seen in Table 4.1

Table 4.1: MECP D-Series Potential Areas of Influence and Minimum Separation Distances

Industrial Facility Classification	Potential Area of Influence (metres)	Minimum Separation Distance (metres)
Class I	70	20
Class II	300	70
Class III	1000	300

The PAIs are subject to site-specific considerations but were used as reference setbacks in determining whether an industry should be considered as relevant to the air quality assessment.

The study areas, with the PAI setbacks for the different industry classes, are presented in Figure A.1, A.2, and A.3 respectively (Appendix A).

4.2 City of Toronto (TRAP)

The City of Toronto recently released a report on the health risks from Traffic Related Air Pollution (TRAP). TRAP as a mixture of pollutants emitted from cars, trucks and busses include PM_{10}, $PM_{2.5}$, nitrogen oxides (NO_2 and NO), carbon monoxide and volatile organic compounds (VOCs). The report indicates that health risks from TRAP are higher within 500m of highways with an average daily traffic volume of 100,000 vehicles or more.

The City has recommended several options for mitigation of TRAP including modifying the built environment to reduce exposure. These recommended strategies include:

- Separation distances, which set a minimum distance between high-traffic roadways and places where people live, work, and play;
- Orientation of buildings, play areas, and air intakes away from known pollution sources;
- Slightly positive internal air pressures in buildings;
- Combinations of vegetative and physical barriers; and
- Superior ventilation, filtration, and air-conditioning systems.

4.3 Environmental Protection Act

In Ontario, local air quality impacted by industry is regulated under the Environmental Protection Act (EPA) and O. Reg. 419[1] "Air Pollution – Local Air Quality" (O. Reg. 419). Any stationary discharge to the environment requires an Environmental Compliance Approval (ECA) or an EASR registration under Section 9 of the Ontario EPA. An ECA or EASR registration must be obtained prior to the construction and operation of a process that will emit to the atmosphere. Within the ECA, issued by the MECP, there will be terms and conditions of the MECP's approval. These can include emission limits, operating conditions, maintenance requirements and source testing. Compliance with an ECA does not imply overall compliance with the EPA. Facilities are still governed by other provisions in the EPA including the provision to not cause an adverse effect (EPA s.14).

Section 9 approvals or registration under the EPA are obtained by demonstrating compliance with O.Reg. 419 requirements and with other applicable guidance documents for obtaining approvals. O. Reg. 419 requires that specific sources cannot cause exceedances of air quality standards provided in the regulation and the Air Contaminants Benchmarks (ACB) list published by the MECP. These standards are applied against specific modelled maximum concentrations (point-of-impingement) calculated at off-site locations. The modelled maximum points-of-impingement concentrations are typically at the property line for near-ground level sources of emissions and further off-property for elevated sources (e.g., tall stacks).

O. Reg. 419 is prescriptive in its reporting and modelling requirements necessary to demonstrate compliance and is a requirement to obtaining a Section 9 approval or registration. O. Reg. 419 specifies the type of dispersion model and standards to be used to demonstrate compliance for different industrial sectors.

1 O. Reg. 419 is the air quality regulation which replaced O. Reg. 346.

4.4 Odour Policies and Regulations

O. Reg. 419 does not directly deal with adverse effects of odorous mixtures or fugitive dust, except as these impacts relate directly to the numerical standards and criteria for specific compounds. For example, compounds such as acetic acid, have mass concentration (i.e., $\mu g/m^3$) standards based on odour impacts. The MECP considers meeting these numerical criteria to be verification that a facility should not have an adverse impact as a result of the chemical specific emissions. Complex odorous mixtures do not have specific mass concentration based standards and so require case by case assessments.

Meeting these numerical standards does not ensure that a facility will not have an adverse impact. Other emissions or nuisance emissions (specifically odour) that have no current numerical standards can still lead to adverse effects under Section 14 of the EPA. This section of the EPA states that "no person shall discharge a contaminant or cause or permit the discharge of a contaminant into the environment that causes or is likely to cause an adverse effect." An adverse effect is defined in the EPA as:

- Impairment of the quality of the natural environment for any use that can be made of it;
- Injury or damage to property or to plant or animal life;
- Harm or material discomfort to any person;
- An adverse effect on the health of any person;
- Impairment of the safety of any person;
- Rendering any property or plant or animal life unfit for human use;
- Interference with normal conduct of business; and
- Loss of enjoyment of normal use of property. (EPA, RSO 1990, c. E.19, as amended, s.1(1)).

The MECP bases their consideration of adverse effects on processes that have known odour emissions (e.g., odours from ethanol plants) or on the complaint history of the facility. If sufficient complaints are received by the MECP for nuisance adverse effects, the MECP can still take action against a site under Section 14 of the EPA, even for facilities that are fully compliant with all criteria under O. Reg. 419 and with all conditions of their ECA.

O. Reg. 1/17 (REGISTRATIONS UNDER PART II.2 OF THE ACT - ACTIVITIES REQUIRING ASSESSMENT OF AIR EMISSIONS) sets out requirements related to odour emissions from facilities. As per the MECP"A person engaging in a prescribed activity must have an odour screening report available at all times at the facility (section 24). Based on the results of the screening, a BMPP for odour may be required (section 26), and an odour control report may also be required (section 27)".

Facilities are required to complete a Best Management Practice Plan (BMPP) for odour and an odour control report if the actual distance between a facility and the property boundary of a point of odour reception is less than the required setbacks listed in "Environmental Activity and Sector Registry – Limits and Other Requirements" version 1.1 published by the ministry in January 2017.

In circumstances where the MECP has received sufficient complaints or where the MECP believes further action is required to manage odour and fugitive emissions due to the likelihood of complaints, the MECP may require the facility to develop a Best Management Practices (BMP) Plan to control odour and/or dust emissions. The MECP may also require a facility to prepare an odour assessment as a condition of an ECA, in support of an EASR registration, or by other instrument; the odour assessment includes quantification of odour sources and dispersion modelling in order to demonstrate no nuisance odour effects at a sensitive receptive, or to identify the need for odour controls. The MECP technical bulletin methodology for *Modeling Assessments of Contaminants with 10-minute Average Standards and Guidelines Under O.Reg. 419/05* should be followed.

The MECP uses the following definition for a sensitive receptor:

"Sensitive Receptor" means any location where routine or normal activities occurring at reasonably expected times would experience adverse effect(s) from odour discharges from the Facility, including one or a combination of:

a) Private residences or public facilities where people sleep (e.g., single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.);

b) Institutional facilities (e.g., schools, churches, community centres, day care centres, recreational centres, etc.);

c) Outdoor public recreational areas (e.g., trailer parks, playgrounds, picnic areas, etc.); and

d) Commercial areas where there are continuous outdoor public activities (e.g., commercial plazas and office buildings), where such outdoor public areas are deemed "sensitive receptors" only for the periods when there are such activities.

5.0 Odour Mitigation Strategies

As per the MECP guidance documents, a variety of odour mitigation strategies can be employed to mitigate odour sources at the facility, such as:

Control Measure	Applicability and Limitations
Thermal Treatment	Recuperative, regenerative or catalytic oxidizers may be feasible, and some waste heat may be recovered. With direct-fired thermal oxidation, exhaust gas may be directed to a boiler, dryer burner or to a flare.
Adsorption	Activated carbon or other sorbent material may be used to remove VOCs and other odorous compounds from waste gas. Fluidized or packed bed designs available. Activated carbon filters can control odours from outdoor silo bin vent outlets.
Biofilter	Process exhausts are directed to a conditioning system and biofilter where microorganisms biologically degrade the organic compounds.
Oxidation Scrubbers	Wet scrubbers use an oxidizing agent such as hydrogen peroxide, bleach, or others, as the scrubbing solution.
Ozonation	Concentrated ozone injected into waste gas stream to oxidize VOCs.
Non-Thermal Plasma	Activated oxygen injected into waste gas stream to oxidize VOCs.
Process Optimization: Decreased temperature of condenser heat-transfer liquid	Increase VOC removal efficiency by decreasing temperature of cooling water used in condenser or using an alternate, lower temperature refrigerant.
Process Optimization: Production Scheduling	Scheduling of process stages or activities/production runs to avoid simultaneous odour releases from multiple sources.
Process Optimization: Enhance Automation	Reduce leaks, spills, manual transfers and other potential sources of odour.

The above table is highlighting what information may be considered significant when assessing the feasibility of odour control measures.

6.0 Identified Facilities for Potential Air Emission Effects

The MECP Guideline D-6 define a Potential Area of Influence for Class I, II, and III facilities; if a proposed development lies outside of the Potential Area of Influence it is not expected to have an adverse effect on air quality at the site of the proposed development and is, in general, not considered further in Land Use Compatibility studies. The Potential Area of Influence ranges from 70 metres for a Class I facility to 1000 metres for a Class III facility. Figures A.1, A.2, and A.3 depict each of the three Mobility Hubs with the Potential Areas of Influence measured from the property line of the hub. Facility classification was undertaken using professional judgement to compare aerial photography, publicly available emissions data, and process type against the detailed descriptions given in the MECP Guideline D-6. Where classification was unclear the higher Class was assigned.

All industrial facilities that lie within the bounds of a Mobility Hubs, as well as those within 1,000 meters of the hub boundary are identified in Appendix D and were considered in this assessment. The information was obtained through the MECP's Access Environment website and Environmental Compliance Approvals (ECAs) for industries.

The air emission compliance of these facilities are addressed by provincial permitting and review tools such as Environmental Compliance Approvals, Environmental Activity and Sector Registry (EASR) registration, or Environmental Assessments. In some cases, these mechanisms also address odour and fugitive dust emissions.

6.1 Aldershot Hub

The following are large facilities and operations that would discharge air contaminants and potentially influence ambient air quality in the Aldershot Hub Study Area. Note that not while all Class III facilities (if any) are discussed, only those Class II facilities with potential for emissions of Key Contaminant of Concern in quantities significant to this study are discussed:

KPM Industries (1077 Howard Road)

This KPM facility is located inside the hub and was considered a Class III facility as this is a type of facility (scale of production and process type) has the potential of causing persistent and/or intense odours. It is a batch-type hot mix asphalt plant, for a maximum production rate of 190 tonnes per hour.

The ECA (No. 3669-5TPS2E, issued December 4, 2003) identified one (1) dryer/mixer, equipped with one (1) natural gas fired burner (maximum heat input of 73.9 million kilojoules per hour), with particulate emissions controlled by one (1) cyclone separator and one (1) baghouse dust collector system.

For the Hot Mix Asphalt plant, VOCs emissions (including the five VOCs that are target compounds for the study) would be expected from the heating of aggregates and liquid asphalt cement.

The information about specific contaminants and sources pertaining to the facility was not available in the MECP and NPRI databases, so it was not included in the model. Considering that the facility is not a major emitter the impact on the air quality was captured by the ambient air quality data which is sufficient.

St. Mary's Cement (1093 Howard Road)

This St. Mary's Cement facility is located inside the hub and was considered a Class III facility as this is a type of facility (scale of production, open process type, and open storage) has the potential of causing persistent and/or intense dust. It is a ready-mix concrete batching plant, with a production limit of 1,000 cubic metres per day.

The information about specific contaminants and sources pertaining to the facility was not available in the MECP and NPRI databases, so it was not included in the model. Considering that the facility is not a major emitter the impact on the air quality was captured by the ambient air quality data which is sufficient.

Operations at the site include stockpiling, silo filling, conveyance and truck loading. The main source of emissions from ready-mix concrete plants are fugitive dust emissions from concrete production and dust generated from truck traffic to and from the site.

According to the facility’s ECA (No. 5639-ABLLKT, issued October 24, 2016), all storage silos, cement scale, and loading are equipped with dust collectors to control PM emissions. The facility is required to maintain a Best Management Practices Plan (BMPP) to control fugitive emissions.

Meridian Brick (1570 Yorkton Court)

The Meridian Brick facility is a clay brick manufacturing facility located within the 1000m “Potential Area of Influence”. It was considered a Class III facility as this is a type of facility (scale of production, open process type, and open storage) has the potential of causing persistent and/or intense dust. Per the facility’s ECA (No. 8-3729-98-996, issued January 3, 2002), the production limit is 150,000,000 brick equivalent per year.

For the brick manufacturing plant, CO, NO2, and Particulate (TPM, PM10, PM2.5) emissions would be expected from material processing and from the drying and baking of bricks.

As per 2017 NPRI reporting, the facility released (air/water/land) 13kg of Manganese (Mn) (and its compounds). Manganese was not modelled due to lack of information related to sources of air emissions and ratio between Mn emissions released to the atmosphere versus releases to water and land is unknown The modelling assessment of future transportation hubs is not suited for detailed modelling analyses of metals potentially released by the neighboring industry.

6.2 Burlington Hub

The following are large facilities and operations that would discharge air contaminants and potentially influence ambient air quality in the Burlington Hub Study Area. Note that not while all Class III facilities (if any) are discussed, only those Class II facilities with potential for emissions of Key Contaminant of Concern in quantities significant to this study are discussed:

NALCO Canada ULC (1055 Truman Street)

The Nalco Canada facility is located inside the hub and produces chemicals for water and process treatment. It was considered a Class II facility based on size of production, presence of outdoor tanks and truck loading, and chemical nature of production; frequent and occasionally intense odour and/or dust may be possible. The processes and support units are: Polymer plant, Liquid Room, Brownstock Room, Repackage Area, Warehouse Area, Maintenance Shop, IBC Testing and Repair Facility, Truck & Rail Tanker

Loading and Unloading, Quality Assurance Laboratory, Natural gas fired process boiler(s), and Cooling Tower(s).

Per the facility's ECA (No. 1357-9SYQ4B, issued February 13, 2015), the production limit is 30,000,000 kilograms of chemicals for water and process treatment per year. The facility is required to implement operating procedures and maintenance programs for all Processes with Significant Environmental Aspects (to prevent upset conditions, to minimize all fugitive emissions, to prevent and/or minimize odorous emissions, and to prevent and/or minimize noise emissions).

The facility released (air/water/land) very small amount (1 kg each) of Acrylic acid (and its salts), and Diethanolamine (and its salts) in 2017 NPRI reporting year. These emissions were considered to be minimal and so were not modelled. This approach is in agreement with the main goal of the study to assess the impact associated with the future development of transportation hubs.

A.H. Tallman Bronze Company Ltd. (2220 Industrial Street)

The A.H. Tallman Bronze Company facility is located within the 300m "Potential Area of Influence" and is involved in the design, casting, machining, and fabricating of Original Equipment Manufacturer (OEM) and aftermarket products. It was considered a Class II facility based on the type of operation (metal command) and potential for fugitive emissions.

According to the facility's ECA (No. 0251-63KL4F, issued October 21, 2004), air emissions sources are related to melting furnaces, pouring, cooling, moldmaking, and coremaking operations, coresand mixer, Wheelabrator swing-table steelshot unit, finishing area, weld shop, machine shop, and core oven.

The facility has two (2) baghouse dust collectors, to control emissions from eight (8) natural gas fired melting furnaces, one (1) Rotoclone serving the swing-table steelshot unit, and two (2) Rotoclones serving the finishing area.

Sun Chemical Limited (1274 Plains Road East)

The Sun Chemical facility is located within the 300m "Potential Area of Influence" and the main sources of emissions are printing ink transfer activities, storage tank to receive and dispense a wax-oil solution and a system to transport carbon black from railcars into process tanks. It was considered a Class II facility based on the scale of production and rail/truck loading activities.

According to the facility's ECA (No. 0564-4R5SFL, issued December 20, 2012), there is one (1) dust collector to control emissions from Clay Skid, and one (1) dust collector to control emissions from Smoot System for Carbon Black.

This facility was not reporting to the NPRI system, and so was considered insignificant for the modelling assessment.

Hercules Canada (2002) Limited (942 Brant Street)

The Hercules Canada facility is located in the hub and produces specialty products for the pulp and paper and resin industries. It consists of the following processes:

- Defoamer Process: producing silicone base and soap base defoamers;

- Emulsion Size Blending Process: producing Alkyl Ketene Dimer emulsions and wax emulsions; and
- Process Chemical Operation: producing different chemical products, emissions controlled by a venturi wet scrubber.

It was considered a Class II facility based on the chemical manufacturing nature of the business.

Per the facility's ECA (No. 3448-8PJRH9, issued September 7, 2012), the production Limit is 40 million kilograms per year of the various products (process chemical, defoamer, and emulsion).

The emission sources are related to process boiler, silica dryers, backup generator, cooling tower, truck loading, and storage tanks.

The facility has one dust collector servicing silica dryers, and one (1) venturi wet scrubber servicing the chemical blending process.

Bull Moose Tube Ltd. (2170 Queensway Drive)

The Bull Moose Tube facility is located in the hub and manufactures carbon steel welded tube and pipe products for construction, industrial, and fire protection sectors. It was considered a Class II facility based on the presence of spray booths.

According to the facility's ECA (No. 6419-AXBH6F, issued on May 25, 2018), the air emission sources are spray booth, ultraviolet cure oven, plasma arc cutting and coil slitting operations, welding operations, and cooling tower. The spray booth is equipped with an overspray collection system and dry filters.

In 2017, the facility released (air/water/land) 7.9kg of Zinc (and its compounds). Zinc was not modelled due to lack of source information. These emissions were considered to be minimal and so not modelled. This approach is in agreement with the main goal of the study to assess the impact associated with the future development of transportation hubs.

Solenis Canada ULC (formerly Ashland Canada Corp.) (942 Brant St, Burlington, ON),

This specialty chemicals (process chemical, defoamer, and emulsion) manufacturing facility located within the 1000m "Potential Area of Influence". It was considered a Class II facility based on the scale of production, open process type, and open storage. It has the potential of causing frequent or occasionally intense odour. Per the facility's ECA (No. 3448-8PJRH9, issued September 07, 2012), the production limit is 40 million kilograms of chemical products per year. The emissions from the process chemicals are controlled by a venturi wet scrubber. In 2017 NPRI, the facility reported very small amount of Ethylene glycol emissions (0.1kg). These emissions were considered to be minimal and so not modelled. This approach is in agreement with the main goal of the study to assess the impact associated with the future development of transportation hubs.

6.3 Appleby Hub

The following are large facilities and operations that would discharge air contaminants and potentially influence ambient air quality in the Appleby Hub Study Area. Note that not while all Class III facilities (if any) are discussed, only those Class II facilities with potential for emissions of Key Contaminant of Concern in quantities significant to this study are discussed:

Fearman's Pork-Sofina Foods Inc. (821 Appleby Line)

The Fearman's Pork-Sofina Foods pork processing facility is located in the hub on a 9.8-hectare site in an industrial neighbourhood. The plant maintains facilities for receiving and holding live hogs, slaughtering and eviscerating, deboning, chilling, processing, and shipping. The plant also houses support services such as wastewater treatment, knife sharpening, and general maintenance facilities. All inedible by-products are shipped off-site for further processing/rendering.

The facility was considered a Class III facility as it has the potential of causing persistent and/or intense odours in the neighbourhood. Per the facility's ECA (No. 4494-685MWW, issued April 1, 2005), they are required to conduct source testing to measure odour emissions from exhaust systems related to production.

Lafarge Canada Inc. (800 Appleby Line)

The Lafarge Canada facility is located in the hub and is a ready mix concrete manufacturing facility having a maximum production rate of 110 cubic metres per hour. It was considered a Class III facility as this is a type of facility (scale of production, open process type, and open storage) has the potential of causing persistent and/or intense dust.

The main source of emissions from Ready Mix concrete plants are fugitive dust emissions from concrete production and dust generated from truck traffic to and from the site

According to the facility's ECA (No. 8783-6P7RER, issued May 16, 2006), there is a baghouse dust collector, to control emissions from the truck loading point, complete with polyester filter material, and four (4) baghouse dust collectors to control emissions from the cement silos.

Suncor Energy Products Partnership (3275 Rebecca Street)

The Suncor facility is located within the 1000m "Potential Area of Influence" of the hub and distributes petroleum products. The facility consists of the following processes and support units:

- Tanks receiving;
- Distillate via pipeline;
- Ethanol from trucks;
- Vacuum gas oil from rail car tanks;
- Distillate via ships; and
- Truck loading.

Main emissions from the facility are fugitive and consist of volatile organic compounds from:

- Working and breathing losses from storage tanks; and
- Emissions from vapour recovery unit.

The facility was considered a Class III facility based on the chemical nature of the business and scale of operations.

VOCs emissions would be expected from the handling and loading of the petroleum products.

Per the facility's ECA (No. 2890-ACJPHF, dated October 28, 2016), the maximum processing capacity is 9.5 million litres of petroleum products per day.

Atotech Canada Ltd. (1180 Corporate Drive)

The Atotech Canada Ltd. facility is located inside the 1000m "Potential Area of Influence" of the hub and was considered a Class II facility based on the process type and reporting particulate emissions.

It's a chemical mixing and blending facility that manufactures products for the electroplating industry. Per the facility's ECA (No. 6619-A4LJWT, issued on March 4, 2016), the production limit for this facility is 25,000 tonnes of finished products per year. The facility is required to conduct source testing to measure Titanium emissions from dip spin and curing oven. For the electroplating plant, titanium emissions would be expected from dip spin and curing oven processes.

As per 2017 NPRI data, this facility reported emissions of Cobalt (103kg), Hexavalent Chromium (15kg), and very small amount of Nickel. Due to lack of sources and streams information, these metals were not modelled. This approach is in agreement with the main goal of the study to assess the air quality impact associated with the future development of transportation hubs.

Bericap Inc. (835 Syscon Court)

The Bericap Inc. facility is located inside the 1000m "Potential Area of Influence" from the hub and is considered a Class II facility based on the reported particulate emissions.

This facility produces plastic caps and enclosures for food, automotive and pharmaceutical industries. Per the facility's ECA (No. 1852-A4EP8N, issued on April 3, 2017), the maximum production limit is 24,420,000 kilograms per year of resins consumed.

Particulate matter emissions would be expected from plastic extrusion process.

Laurel Steel, a division of Harris Steel ULC (5400 Harvester Rd)

This facility is located inside the 1000m "Potential Area of Influence" from the hub. It's a steel product manufacturing from purchased steel and is considered a Class II facility based on the process type. This facility is reported emissions of Hydrochloric Acid (25kg), and Lead (240kg) to 2017 NPRI. Due to lack of source and streams information, these metals were not modelled. This approach is in agreement with the main goal of the study to assess the impact associated with the future development of transportation hubs

Triple M Burlington (961 Zelco Dr)

This facility is located inside the 1000m "Potential Area of Influence" from the hub. It's a scrap metal recycling company and is considered a Class II facility based on the process type. Emissions data was not available for this company.

Dominion Nickel Alloys Ltd.(834 Appleby Line)

This facility is located inside the hub area. . It's a scrap metal recycling company and is considered a Class II facility based on the process type. Emissions data was not available for this company.

7.0 Emission Sources and Emission Rate Estimation

The following emission sources are considered for this assessment:

- Mobile GO, VIA, CN rails within the study areas;
- Idling GO, VIA rails within the study areas;
- Vehicle, trucks on the major roads within study areas; and
- Industrial facilities.

7.1 Description of Scenarios

1. Current Baseline Scenario (2020 prorated based on the 2011-2016 Traffic Data, 2016/2017 NPRI Data);
2. The current baseline consists of industrial air releases reported to the NPRI in 2016/2017 and 2020 prorated traffic data from the City of Burlington's Transportation Services Department; and
3. 2041 Forecast Scenario.

The City's average population growth was 1.3% (EDB, 2018) between 2001 and 2016 and Ontario's population is projected to grow between 0.4% and 1.2% (StatsCan, 2015) leading to 2038. As no forecasts were provided for vehicular emissions, a 2% annual growth of vehicle traffic by volume and a 2% increase in rail activity were conservatively used to forecast an approximate 2041 scenario. The same industrial emissions from 2016/2017 were used for the future scenario. We are considering this approach to be conservative as the industrial sources in the province are tending to decrease the level of emissions to the atmosphere.

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

7.2 Emission Rate Estimation

GO, VIA, and CN Rail Emissions

For the Current scenario, it was assumed that GO, VIA, and CN rails meet US EPA Tier 2 emission factors. NOx, CO, and PM emissions from the diesel equipment were calculated based on the US EPA Tier 2 emission factors. SO2 emission rates were calculated based on the US EPA AP-42 emission factor, Section 3.3, Table 3.3-1.

NOx emission rates were prorated down by 5% (Fritz, 2000) based on a lower sulphur content in the fuel (15 ppm) accepted in the province rather than high sulphur (up to 2000ppm) diesel fuels accepted for Tier 2 certification.

For the 2041 scenario, it was assumed that GO, VIA, and CN rails meet US EPA Tier 4 emission factors; NOx, CO, and PM emissions from the diesel equipment were calculated based the US EPA Tier 4 emission factors. SO2 emission rates were calculated based on the US EPA AP-42 emission factor, Section 3.3, Table 3.3-1 and prorated based on a lower sulphur content in the fuel (15 ppm) accepted in the province.

Sample calculations are provided in Appendix B.

Vehicle and Trucks Emissions

The tailpipe emissions, and particulate emissions from brake and tire wear, for passenger vehicles and heavy-duty diesel vehicles were estimated using the Motor Vehicle Emission Simulator (MOVES) 2014a model. This model is the EPA's official model for estimating emissions from highway vehicles, and has replaced the Mobile6.2C model emission factor database used previously.

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

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

The traffic profiles, and distribution of vehicles by passenger car and truck, were tabulated by traffic counts in 2011 to 2016; the distribution was assumed to be applicable to the current and future scenarios considered in the assessment (2020, and 2041).

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

Emissions from Industrial Facilities

An inventory of every industry with an approved Environmental Compliance Approval Air and Noise (ECA) in each of the study areas and whether they reported to the NPRI was compiled in Appendix D using publicly accessible databases.

NPRI reporting is typically in tonnes per year. If no other information was available, a facility was assumed to operate 24/7/365 to calculate an average emission rate in grams per second for the purposes of the dispersion modelling.

The individual facility NPRI data used at the time of writing the report may have changed as facilities can update data at any time.

8.0 Dispersion Modelling

Industrial and rail emissions sources were modelled with the US EPA AERMOD model version 19191, AERMOD is a Gaussian steady-state plume model which is commonly used for this type of assessment and accepted by the MECP as a main regulatory dispersion model in the province. AERMOD package incorporates meteorological AERMET and terrain AERMAP sub models. This allows to use the site specific meteorological data and real digital terrain files, which makes the modelling results more accurate.

The US EPA CALRoads model (CAL3QHCR) was used for assessing impacts from the emissions of motor vehicles. CALRoads View is a dynamic and intuitive user-friendly interface for the three air dispersion modelling codes: CALINE, CAL3QHC and CAL3QHCR. The advanced modelling option CAL3QHCR, which combines all previous models available in CALRoads package was used for the study.

The package consists of three sub models:

- CALINE-3 which 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 enhances CALINE-3 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.

8.1 Transportation Sources (Vehicles and Trains)

Transportation sources considered in this assessment are vehicle traffic on major roadways and rail traffic close to the hubs.

8.1.1 Vehicles

Emissions from vehicles to the atmosphere are the combinations of tailpipe emissions from internal combustion engines and emissions from brake pad and tire wear. The off-site effects for vehicles emissions were predicted using the CAL3QHCR dispersion model, using the Tier I approach, utilizing the worst case peak hour's emissions. This approach is more conservative than Tier 2 approach which is accounting for reduction of vehicle emissions during the off-peak hours.

8.1.2 Trains

Rail activity including freight and passenger traffic was included in the AERMOD modelling for each study area (Figures A.4, A.5, and A.6). Line area sources were used to represent emissions within the study area from the pass-bys of each train type per hour or using the total daily pass-bys of each train type depending on the criteria's averaging time for a given pollutant. The idling of passenger trains (picking up passengers at stations) was modelled as an area source at each relevant station (GO idling in all study areas stations and VIA idling in the Aldershot Station).

Rail activity for the current scenario was estimated from rail schedules either publicly available or provided by the City of Burlington. Current activity was forecasted to 2041 assuming a 2% annual (See Section 6.1) increase in rail traffic. Train engine emissions were estimated considering the train schedules, number of rail lines, typical cruising speeds, station stop times, the length of rail in each of the study areas, the total time spent in the study area by each train type, and the maximum number of trains in a study area over any given period of time, and the worst case combination of train types.

Emissions from GO, VIA, and CN rail sources were estimated based on the emission factors of the MP40, P42DC, and GE C44-9W locomotives respectively.

8.2 Industrial Sources

The model included only those major Class III industrial facilities for which sufficient data were available through the NPRI reporting to estimate air emissions. Industrial emission sources were modelled as either volume or area sources in AERMOD. The level of available details did not allow the precise modelling of industrial facilities incorporating point sources and footprint of buildings. The modelling approach using volume and area sources is more conservative for the close-range impact assessment.

8.2.1 Aldershot Study Area

Only one of the three Class III industrial sources was included in the air dispersion modelling that was located in the 1000 metre setback for the Aldershot Study Area. The facility was a source of CO, NOx (expressed as NO2), TPM, PM10, and PM2.5. The industrial source included multiple quarry sites and a plant. Based on publicly available data, quarry activities are expected to be predominant in those quarries outside of any setbacks. As a conservative estimate, and lacking a detailed breakdown of emission sources, all emissions were attributed to the plant which would be nearest source of emissions from this industrial source. Emissions from the plant (stacks, rooftop vents etc.) were modelled in AERMOD as a single volume source.

8.2.2 Burlington Study Area

Three (3) facilities reported to the NPRI in the Burlington Study Area in 2017. These facilities were not included in the AERMOD modelling as sources Information was not available.

8.2.3 Appleby Study Area

Of the Class II and III facilities listed in Appendix D, there were two Class II industrial sources (Bericap North America Inc. and Atotech Canada Ltd.) included in the air dispersion modelling of industry impacts. These industrial sources were the only reporters of PM10 and PM2.5 air emission to the NPRI. Each of the facilities' buildings were modelled and each was modelled as an area source over its respective plant area to approximate the emissions reported to the NPRI. As none of the VOCs designated as "air toxics" were specifically reported to the NPRI in any of the study areas, no modelling of industrial VOC (or Total VOC) air emissions were performed.

8.3 Meteorological Inputs

For AERMOD modelling, a fully-processed 5-year (2012 to 2016) meteorological data set was prepared by the Ministry of the Environment, Conservation and Parks (MECP). The surrounding land uses for each study area were specified based upon wind-sector. Upper air data from the Buffalo station and surface data from the Burlington Piers station, with cloud cover data from the Hamilton airport and Toronto international airport stations were used by the MECP. The site-specific meteorological data referenced as the Burlington Piers data was deemed reasonable for the proposed modelling assessments at the three hubs.

The elevation of the Burlington Piers station is 77 m and the data was processed with AERMET v.19191. For CALRoads modelling, MECP also provided a fully-processed 5-year (2012 to 2016) meteorological data set. The CAL3QHCR dispersion model can process only one year of met data per model run. The model was run separately for each year and the year 2012 that predicted the highest concentrations, was selected for all subsequent model runs.

8.4 Receptors

The discussion about sensitive receptors used in the modelling study is provided in Section 4.2 of the report.

The receptor placement was based on the proposed development plan for the hub study areas. Based on the provided site plans, higher density residential areas were represented using flagpole receptors in addition to the ground-level receptors representing single-family dwellings.

The resultant number of receptors in each Study Area is provided in Table 8.4.

Table 8.4: Dispersion Model Receptors

Model (AERMOD and CALRoads)	No. of Receptors
Aldershot Hub	584
Burlington Hub	717
Appleby Hub	890

8.5 Target Contaminants

The AERMOD version 19191 model was run for the target pollutants (PM10, PM2.5, NO2, CO, and SO2) where data was available. As none of the VOCs designated as "air toxics" were released in quantities large enough to be specifically reported to the NPRI in any of the study areas, no modelling of industrial Total VOC air emissions was included in this report.

The CALRoads model was run for the target pollutants (PM10, PM2.5, NO2, CO, SO2, Benzene, 1-3 Butadiene, Benzo(a)pyrene, Formaldehyde, Acetaldehyde, and Acrolein). Note that the model runs for NO2 do not take into account any atmospheric reactions or transformations so result based on NOx emission rates may be biased high. The CALRoads Version 6.5.0 model is designed to model the effects of particulate matter or carbon monoxide; 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.

9.0 Assessment Findings / Results

To assess impact in the hub study areas, the model was run for target contaminants and the resulting concentrations were obtained for the scenarios as follows:

- Current 2020 Baseline Conditions (prorated based on the 2011-2016 Traffic Data, 2016/2017 NPRI Data for industry); and
- Forecasted Conditions (2041).

As a conservative approach, the maximum concentrations of a pollutant are considered the summation of maximum concentrations predicted from industrial and rail emissions using AERMOD and the maximum concentrations predicted from vehicle emissions using CALRoads.

This approach is very conservative as it is not likely that the maximum impact from the different source type will happen at the same hour of the same day. Where available, the baseline concentrations are provided in Tables 9.1, 9.2, and 9.3 to show that the more regional air quality measured at the MECP / ECCC station suggests reasonably good air quality with the 90th percentiles well below the respective AAQCs. Note that the baseline concentrations were not added to the modelled concentrations for this assessment, as the concentrations measured by the MECP and ECCC already include influences of the existing roadways, railway corridors, and local industry.

The background concentrations measured by nearby MECP stations are below the modelled results which indicate the modelled results are conservative for all contaminants. Lower concentrations of SO2 as acceptable even the summation of the background concentrations and modelled impact would be well below the criteria.

The modelling results are presented for all three hubs in the following sections.

9.1 Aldershot Hub

The modelling Results are presented in Table 9.1.

Table 9.1: Aldershot HUB Modelling Results

Pollutant	Averaging Time	Unit	Background Concentrations	Scenario: Current (2020) Max Concentration (combined for rails, industries, and roadways)	Current (2020) Ambient Air Quality Criteria*	Current (2020) Percentage of Criteria	Future (2041) Max Concentration (combined for rails, industries, and roadways)	Future (2041) Ambient Air Quality Criteria*	Future (2041) Percentage of Criteria
TSP	24hr	µg/m³	50.4	4.79	120	4.0%	2.04	120	1.7%
	Annual		—	1.47	60	2.4%	0.544	60	0.9%
PM_{10}	24hr	µg/m³	25.2	8.1	50	16.3%	2.42	50	4.8%
$PM_{2.5}$	24hr (+)	µg/m³	15	8.6	27	31.9%	1.66	27	6.1%
NO_2	1 hr	µg/m³	40.8 (21ppb)	200	400	49.9%	174	400	43.6%
	24 hr	µg/m³	31.7 (16.3 ppb)	94	200	46.9%	62.9	200	31.4%
SO_2	1 hr	µg/m³	12.4 (33.6 ppb)	122	690	17.6%	201	690	29.1%
	24 hr	µg/m³	12.2 (33.1 ppb)	21.2	275	7.7%	60.0	275	21.8%
	Annual	µg/m³	11.4 (4.2 ppb)	6.9	55	12.5%	18.9	55	34.4%
CO	1 hr	µg/m³	462 (0.4 ppm)	879	36200	2.4%	732	36200	2.0%
	8 hr	µg/m³	462 (0.4 ppm)	690	15700	4.4%	499	15700	3.2%
Benzene	24hr	µg/m³	1.45	0.63	2.3	27.2%	0.857	2.3	37.3%
	Annual	µg/m³	0.73	0.182	0.45	40.6%	0.267	0.45	59.3%
1-3 Butadiene	24hr	µg/m³	0.06	0.035	10	0.3%	0.0282	10	0.3%
	Annual	µg/m³	0.03	0.0089	2	0.4%	0.00890	2	0.4%
Formaldehyde	24hr	µg/m³	1.52	3.05	65	4.7%	4.47	65	6.9%
Acetaldehyde	1/2-hr	µg/m³	2.6	4.47	500	0.9%	6.57	500	1.3%
	24hr	µg/m³	0.87	1.15	500	0.2%	1.64	500	0.3%
B(a)P	24hr	µg/m³	3.69E-04	6.73E-07	5.00E-05	1.3%	2.31E-07	5.00E-05	0.5%
	Annual	µg/m³	1.48E-04	1.35E-07	1.00E-05	1.3%	4.61E-08	1.00E-05	0.5%
Acrolein	1 hr	µg/m³	0.07	0.65	4.5	14.5%	0.960	4.5	21.3%
	24 hr	µg/m³	0.03	0.202	0.4	50.5%	0.288	0.4	72.1%

— No background concentration available, see Section 3.1 for explanation
*All results are based on the current enforceable criteria. When new criteria are enforced, these results will need to be reassessed.
(+) This value is not an AAQC per se but is included in the AAQC for decision-making and is equivalent to the CAAQS
(++) Geometric Mean

The air dispersion modelling for the Aldershot Hub determined the following:

- The maximum modelled concentrations of all targeted contaminants from rail, roadways, and one Class III industrial facility within the hub study area were found to be below the current ambient air quality criteria for all averaging times for both current and future scenarios;
- The maximum modelled concentrations for SO2, Benzene, Formaldehyde, Acetaldehyde, and Acrolein are predicted to be higher for 2041 scenario than for the current scenario.
- Other targeted contaminants concentrations are predicted to be lower fro 2041 scenarion in comparison with the current 2020 scenario. This is mainly due to future changes in fuel characteristics and engines performance.

The isopleths plots (Figures A7 to A9, Appendix A) for NO_2 illustrate how localized the areas are where the maximum predicted concentrations lay, and that all concentrations are below the air quality criteria.

The predicted concentrations presented in Table 9.1 are conservative, as they represent the highest hour or day over the year of meteorological data used for the modelling.

9.2 Burlington Hub

The modelling Results are presented in Table 9.2.

Table 9.2: Burlington HUB Modelling Results

				Scenario					
				Current (2020)			Future (2041)		
Pollutant	Averaging Time	Unit	Background Concentrations	Max Concentration (combined for rails, industries, and roadways)	Ambient Air Quality Criteria*	Percentage of Criteria	Max Concentration (combined for rails, industries, and roadways)	Ambient Air Quality Criteria*	Percentage of Criteria
TSP	24hr	µg/m³	50.4	3.50	120	2.9%	1.13	120	0.9%
	Annual		—	1.25	60	2.1%	0.405	60	0.7%
PM_{10}	24hr	µg/m³	25.2	7.6	50	15.1%	1.53	50	3.1%
$PM_{2.5}$	24hr (+)	µg/m³	15	7.63	28	27.3%	1.407	28	5.0%
NO_2	1 hr	µg/m³	40.8 (21ppb)	276	400	69.0%	219	400	54.7%
	24 hr	µg/m³	31.7 (16.3 ppb)	90	200	44.8%	70.3	200	35.2%
SO_2	1 hr	µg/m³	12.4 (33.6 ppb)	121	690	17.5%	194	690	28.1%
	24 hr	µg/m³	12.2 (33.1 ppb)	17.9	275	6.5%	55.0	275	20.0%
	Annual	µg/m³	11.4 (4.2 ppb)	6.2	55	11.3%	19.6	55	35.7%
CO	1 hr	µg/m³	462 (0.4 ppm)	811	36200	2.2%	662	36200	1.8%
	8 hr	µg/m³	462 (0.4 ppm)	558	15700	3.6%	412	15700	2.6%
Benzene	24hr	µg/m³	1.45	0.623	2.3	27.1%	0.798	2.3	34.7%
	Annual	µg/m³	0.73	0.198	0.45	44.0%	0.278	0.45	61.8%
1-3 Butadiene	24hr	µg/m³	0.06	0.036	10	0.4%	0.0258	10	0.3%
	Annual	µg/m³	0.03	0.010	2	0.5%	0.00923	2	0.5%
Formaldehyde	24hr	µg/m³	1.52	2.96	65	4.5%	4.12	65	6.3%
Acetaldehyde	1/2-hr	µg/m³	2.6	4.52	500	0.9%	6.41	500	1.3%
	24hr	µg/m³	0.87	1.13	500	0.2%	1.527	500	0.3%
B(a)P	24hr	µg/m³	3.69E-04	6.73E-07	5.00E-05	1.3%	2.31E-07	5.00E-05	0.5%
	Annual	µg/m³	1.48E-04	1.35E-07	1.00E-05	1.3%	4.61E-08	1.00E-05	0.5%
Acrolein	1 hr	µg/m³	0.07	0.656	4.5	14.6%	1.031	4.5	22.9%
	24 hr	µg/m³	0.03	0.196	0.4	49.1%	0.306	0.4	76.6%

— No background concentration available, see Section 3.1 for explanation

*All results are based on the current enforceable criteria. When new criteria are enforced, these results will need to be reassessed.

(+) This value is not an AAQC per se but is included in the AAQC for decision-making and is equivalent to the CAAQS

(++) Geometric Mean

The findings of the Burlington Hub air quality study were as follows:

- The maximum modelled concentrations of all targeted contaminants from rail, roadways, and one Class III industrial facility within the hub study area were found to be below the current ambient air quality criteria for all averaging times for both current and future scenarios;
- The maximum modelled concentrations for SO2, Benzene, Formaldehyde, Acetaldehyde, and Acrolein are predicted to be higher for 2041 scenario than for the current scenario.
- Other targeted contaminants concentrations are predicted to be lower from 2041 scenario in comparison with the current 2020 scenario. This is mainly due to future changes in fuel characteristics and engines performance.

The isopleths plots (Figures A10 to A12, Appendix A) for NO_2 illustrate how localized the areas are where the maximum predicted concentrations lay, and that all concentrations are below the air quality criteria.

The predicted concentrations presented in Table 9.2 are conservative, as they represent the highest hour or day over the year of meteorological data used for the modelling.

9.3 Appleby Hub

The modelling Results are presented in Table 9.3.

Table 9.3: Appleby HUB Modelling Results

				Scenario					
				Current (2020)			Future (2041)		
Pollutant	Averaging Time	Unit	Background Concentrations	Max Concentration (combined for rails, industries, and roadways)	Ambient Air Quality Criteria*	Percentage of Criteria	Max Concentration (combined for rails, industries, and roadways)	Ambient Air Quality Criteria*	Percentage of Criteria
TSP	24hr	µg/m³	50.4	4.30	120	3.6%	1.30	120	1.1%
	Annual		—	1.35	60	2.3%	0.420	60	0.7%
PM_{10}	24hr	µg/m³	25.2	8.9	50	17.8%	1.63	50	3.3%
$PM_{2.5}$	24hr (+)	µg/m³	15	8.3	28	29.6%	1.48	28	5.3%
NO_2	1 hr	µg/m³	40.8 (21ppb)	133	400	33.1%	181	400	45.4%
	24 hr	µg/m³	31.7 (16.3 ppb)	111	200	55.3%	73.3	200	36.6%
SO_2	1 hr	µg/m³	12.4 (33.6 ppb)	106	690	15.4%	158	690	22.9%
	24 hr	µg/m³	12.2 (33.1 ppb)	22.3	275	8.1%	61.6	275	22.4%
	Annual	µg/m³	11.4 (4.2 ppb)	9.1	55	16.6%	19.5	55	35.4%
CO	1 hr	µg/m³	462 (0.4 ppm)	774	36200	2.1%	592	36200	1.6%
	8 hr	µg/m³	462 (0.4 ppm)	816	15700	5.2%	717.1	15700	4.6%
Benzene	24hr	µg/m³	1.45	0.39	2.3	17.0%	0.89	2.3	38.5%
	Annual	µg/m³	0.73	0.119	0.45	26.4%	0.275	0.45	61.2%
1-3 Butadiene	24hr	µg/m³	0.06	0.0429	10	0.4%	0.0289	10	0.3%
	Annual	µg/m³	0.03	0.0106	2	0.5%	0.00916	2	0.5%
Formaldehyde	24hr	µg/m³	1.52	3.34	65	5.1%	4.60	65	7.1%
Acetaldehyde	1/2-hr	µg/m³	2.6	4.24	500	0.8%	5.25	500	1.1%
	24hr	µg/m³	0.87	1.28	500	0.3%	1.70	500	0.3%
B(a)P	24hr	µg/m³	3.69E-04	6.73E-07	5.00E-05	1.3%	2.31E-07	5.00E-05	0.5%
	Annual	µg/m³	1.48E-04	1.35E-07	1.00E-05	1.3%	4.61E-08	1.00E-05	0.5%
Acrolein	1 hr	µg/m³	0.07	0.446	4.5	9.9%	0.522	4.5	11.6%
	24 hr	µg/m³	0.03	0.222	0.4	55.6%	0.298	0.4	74.4%

— No background concentration available, see Section 3.1 for explanation
*All results are based on the current enforceable criteria. When new criteria are enforced, these results will need to be reassessed.
(+) This value is not an AAQC per se but is included in the AAQC for decision-making and is equivalent to the CAAQS
(++) Geometric Mean

The findings of the air quality study for the Appleby Hub were as follows:

- The maximum modelled concentrations of all targeted contaminants from rail, roadways, and one Class III industrial facility within the hub study area were found to be below the current ambient air quality criteria for all averaging times for both current and future scenarios;
- The maximum modelled concentrations for SO2, Benzene, Formaldehyde, Acetaldehyde, and Acrolein are predicted to be higher for 2041 scenario than for the current scenario.
- Other targeted contaminants concentrations are predicted to be lower from 2041 scenario in comparison with the current 2020 scenario. This is mainly due to future changes in fuel characteristics and engines performance.

The isopleths plots (Figures A13 to A15, Appendix A) for NO_2 illustrate how localized the areas are where the maximum predicted concentrations lay, and that all concentrations are below the air quality criteria.

The predicted concentrations presented in Table 9.3 are conservative, as they represent the highest hour or day over the year of meteorological data used for the modelling.

10.0 Conclusions

The following is a summary of the findings based upon existing knowledge of the proposed development and the sensitive land uses both within the bounds of the hubs and those proximate to the study area that may fall within areas of influence:

- The air dispersion modelling study, which included the highway and railway emissions and select Class III industries in each Hub, found that all target pollutants were predicted to be at concentrations lower than the relevant air quality criteria in both the current and year 2041 scenarios,;
- The predicted effects for NO_2 were highest for the current scenario, as the NO_2 emissions reductions to be achieved as older vehicles/trains are removed from service were significant and off-set the increased traffic volumes for year 2041 scenario;
- The highest effects were modelled within 25 metres of the railway corridor;
- The proposed developments are located adjacent to highway (403, QEW), and may lie within the MTO permit control area under the Public Transportation and Highway Improvement Act. If so, the development may also be subject to MTO approval;
- Class I facilities are unlikely to result in significant land use compatibility issues, with the possible exception of minor odour or dust nuisance effects. Class II and III facilities have the potential to result is incompatibilities and nuisance effects, however these are generally required an Environmental Compliance Approval (ECA) or an Environmental Activity and Sector Registry (EASR) Registration to operate and are regulated by the MECP. In order to obtain an ECA or to register on the EASR a facility must demonstrate compliance with the air quality standards and Air Contaminant Benchmarks in Ontario;
- Construction activities are also a source of air emissions, most commonly fugitive dusts, odours, lighting, and tailpipe emissions from diesel equipment and vehicles. Construction activities should be managed to control air quality effects, with consideration of scheduling, monitoring and mitigation;
- On the part of the industrial, commercial, or warehousing / distribution facilities, there are effective best management practices (BMPs) that may be employed to control fugitive dust and odour. Facilities subject to the Ontario EPA Section 9 requirement for approval may be required to prepare a BMP Plan in support of the approval that outlines procedures and practices to prevent nuisance odour or dust effects;
- Odour is the most complex of the potential nuisance effects as it may be caused by discharges from stationary point sources, area sources, buildings, outdoor sources, or fugitive sources. The likelihood of odorous effects is very specific to the type of facility. Facility specific odour assessment, odour management plans and control measures should be required to avoid odour release and off-site effects;
- Odour mitigation measures that could be incorporated into new high-rise developments in the hubs:
    - Site design to use buffer commercial space;
    - Ensure odour free indoor space (air filtration);
    - At highest impact locations, sealed units (no open balconies);
- The specific recommendations to how the above listed measures could be implemented, require the detailed assessments and should be conducted on per area/facility basis; and

- The traffic related air emissions from vehicles on Highway 403/QEW are significant and will likely impact the proposed development.

It is recommended that the proposed development also incorporate additional mitigation measures on an as needed basis to limit the impact of air emissions from the Highway 403/QEW, including, but not limited to:

- Effective and meaningful communication with current residents and industrial facilities during planning and construction phases has proven beneficial for other redevelopment projects, with consideration given to establishing a public liaison committee to encourage resident participation. There may be opposition to any development that might amplify potential nuisances.
- The Region should consider a requirement for site specific land use compatibility studies and air quality assessments for proposed developments:
    - Developments within close proximity to major highways should include:
    - Maintain separation distances, which set a minimum distance between high-traffic roadways and places where people live, work, and play;
    - Strategic orientation of buildings, play areas, and air intakes;
    - Maintain slightly positive internal air pressures in buildings;
    - Incorporate vegetative and physical barriers; and
    - Incorporate superior ventilation, filtration, and air-conditioning systems into building design.
- The presented conclusions and recommendations could be refined in case additional information regarding industrial and transportation sources is available.

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12.0 Disclaimer

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Yours truly,

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Appendix A

Figures

Industrial Facility D6 Classification	Potential Area of Influence (metres)	Minimum Separation Distance (metres)
Class I	70m	20m
Class II	300m	70m
Class III	1000m	300m

NOTES:
-

CITY OF Burlington

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BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

Aldershot Mobility Hub - D6 Influence Setbacks

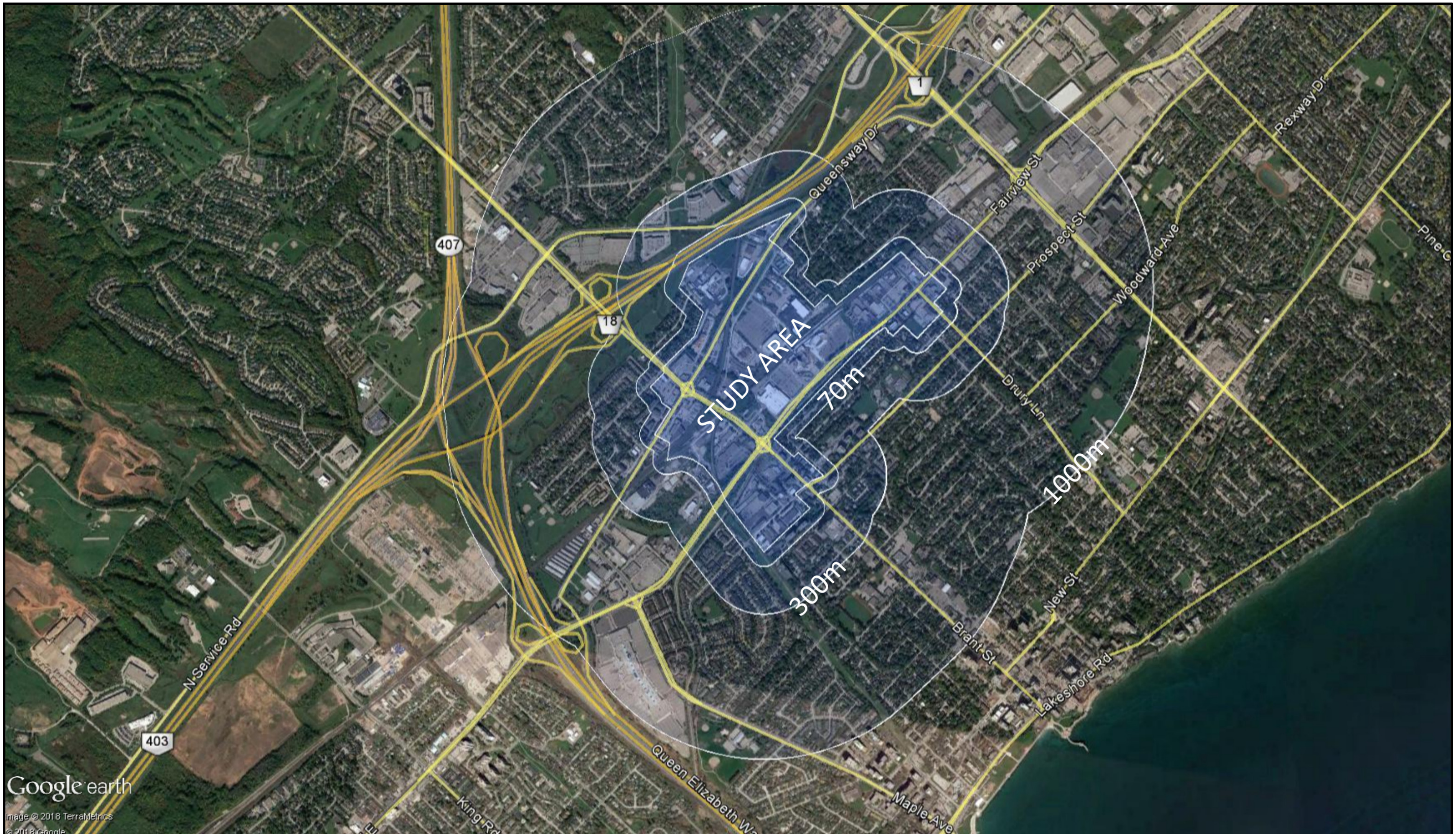
N

PROJECT N°: TPB178008S

FIGURE: A.1

SCALE: NTS

DATE: February 2018



Industrial Facility D6 Classification	Potential Area of Influence (metres)	Minimum Separation Distance (metres)
Class I	70m	20m
Class II	300m	70m
Class III	1000m	300m

NOTES:
-

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BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

Burlington Mobility Hub - D6 Influence Setbacks

N

PROJECT N°:	TPB178008S	FIGURE:	A.2
SCALE:	NTS	DATE:	February 2018

Industrial Facility D6 Classification	Potential Area of Influence (metres)	Minimum Separation Distance (metres)
Class I	70m	20m
Class II	300m	70m
Class III	1000m	300m

NOTES:
-

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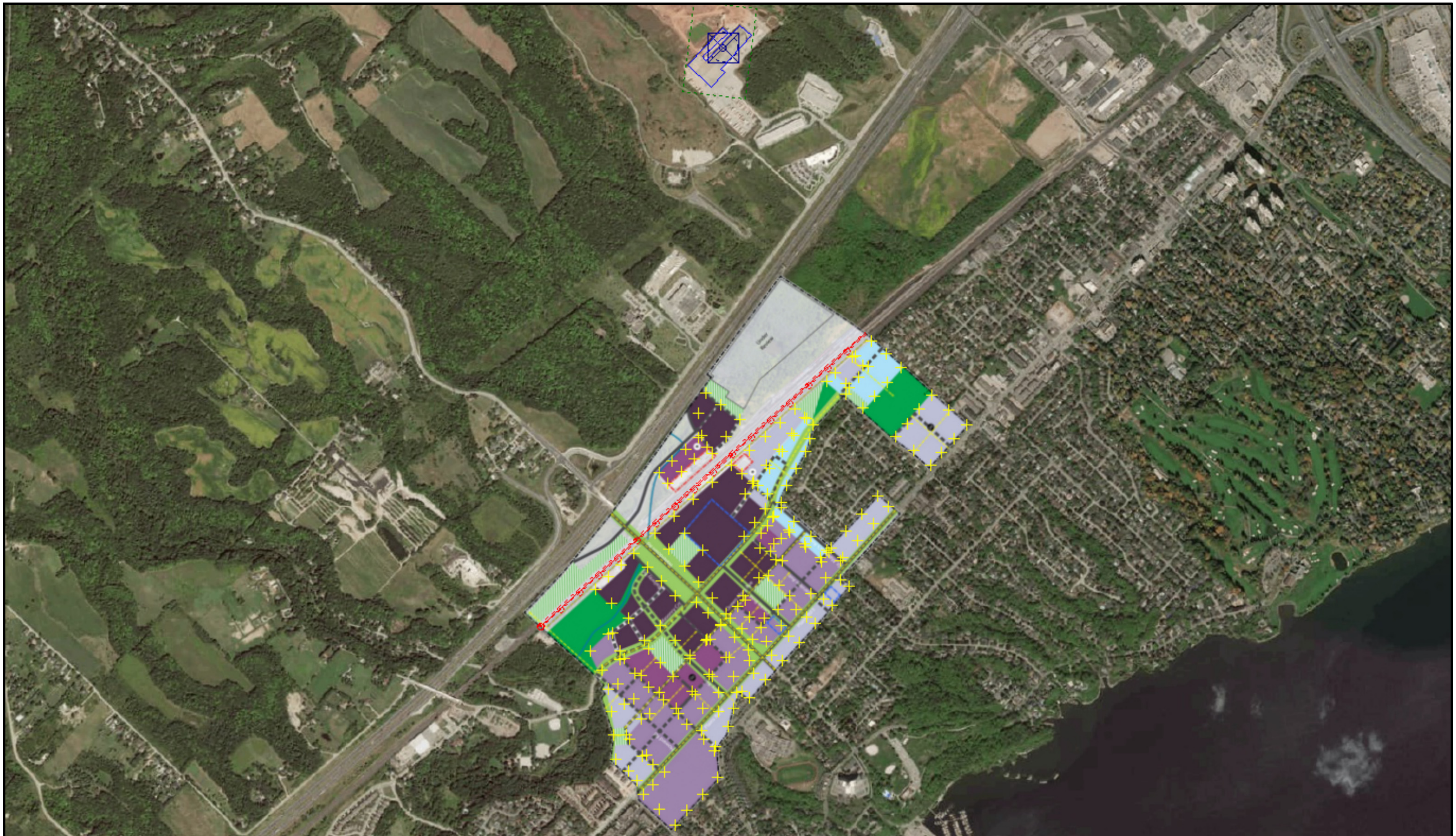
BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

Appleby Mobility Hub - D6 Influence Setbacks

N

PROJECT N°:	TPB178008S	FIGURE:	A.3
SCALE:	NTS	DATE:	February 2018



Low Rise (1-3 Storeys)	Industry Building and Sources
Mid Rise (4-6 Storeys)	Area Line Source (Rail)
Mid Rise (7-11 Storeys)	Receptor
Tall (12-19 Storeys)	
Tallest (20+ Storeys)	

NOTES:
-

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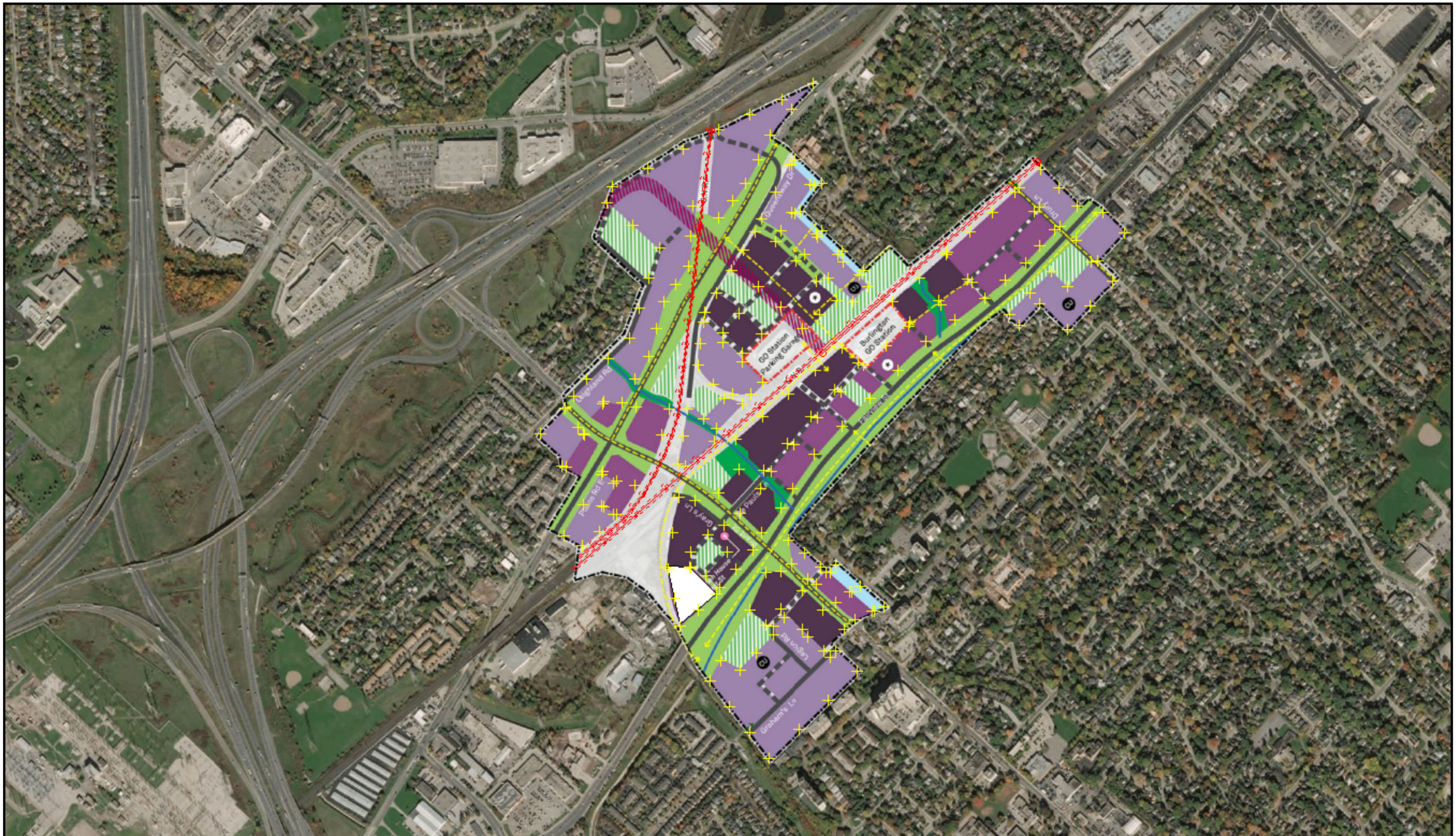
BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

Aldershot Mobility Hub - AERMOD Setup

N

PROJECT N°: TPB178008S	FIGURE: A.4
SCALE: NTS	DATE: February 2018



Low Rise (3 Storeys)
Mid Rise (4 to 11 Storeys)
Tall (12-19 Storeys)
Tallest (20+ Storeys)

Area Line Source (Rail)

Receptor

NOTES:
-

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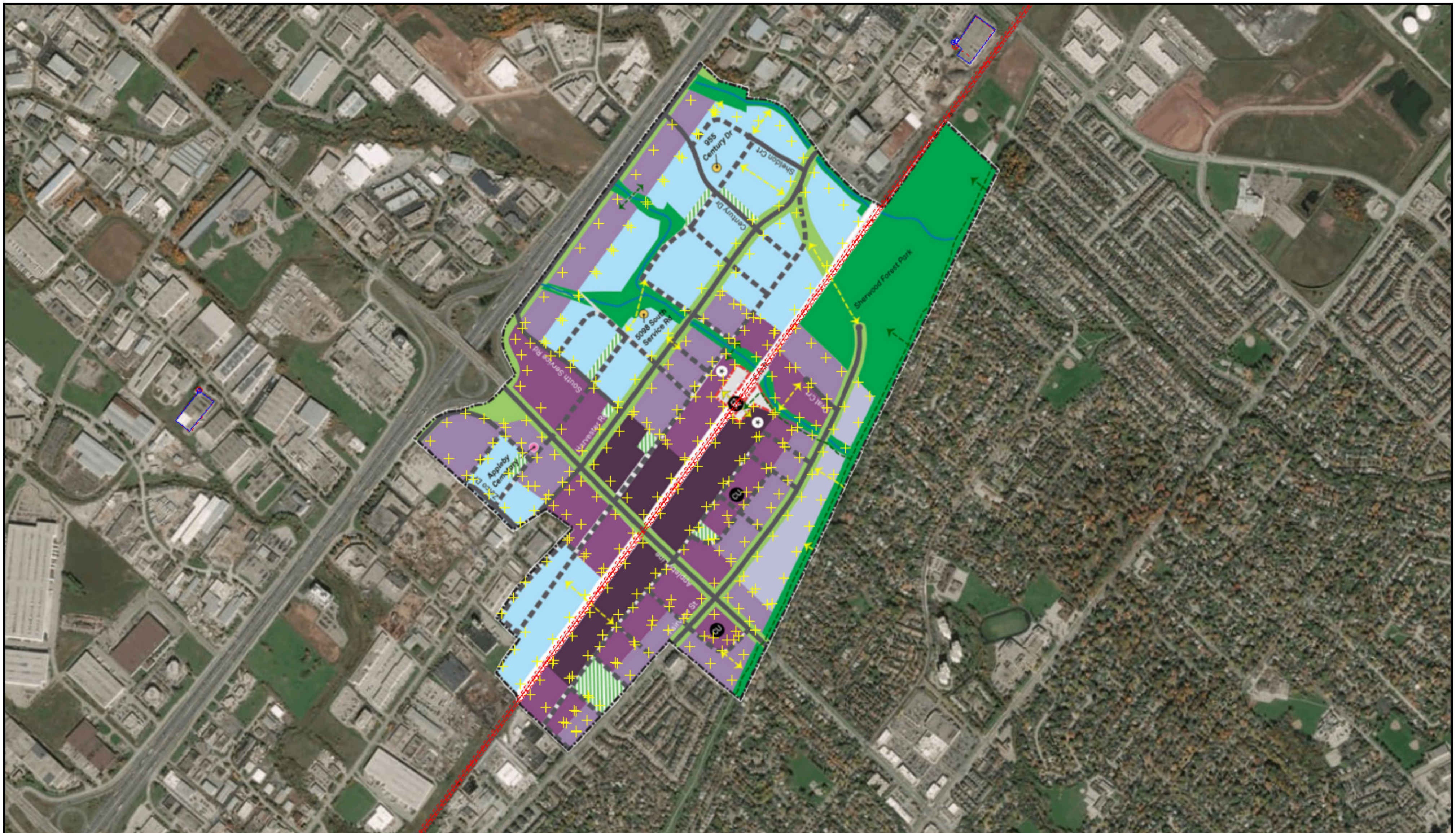
BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

Burlington Mobility Hub - AERMOD Setup

PROJECT N°: TPB178008S	FIGURE: A.5
SCALE: NTS	DATE: February 2018

N



Low Rise (1-3 Storeys)
Mid Rise (4-6 Storeys)
Mid Rise (7-11 Storeys)
Tall (12-19 Storeys)
Tallest (20+ Storeys)

Industry Building and Sources
Area Line Source (Rail)
Receptor

NOTES:
-

CITY OF Burlington

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BURLINGTON MOBILITY HUBS - AIR QUALITY ASSESSMENT

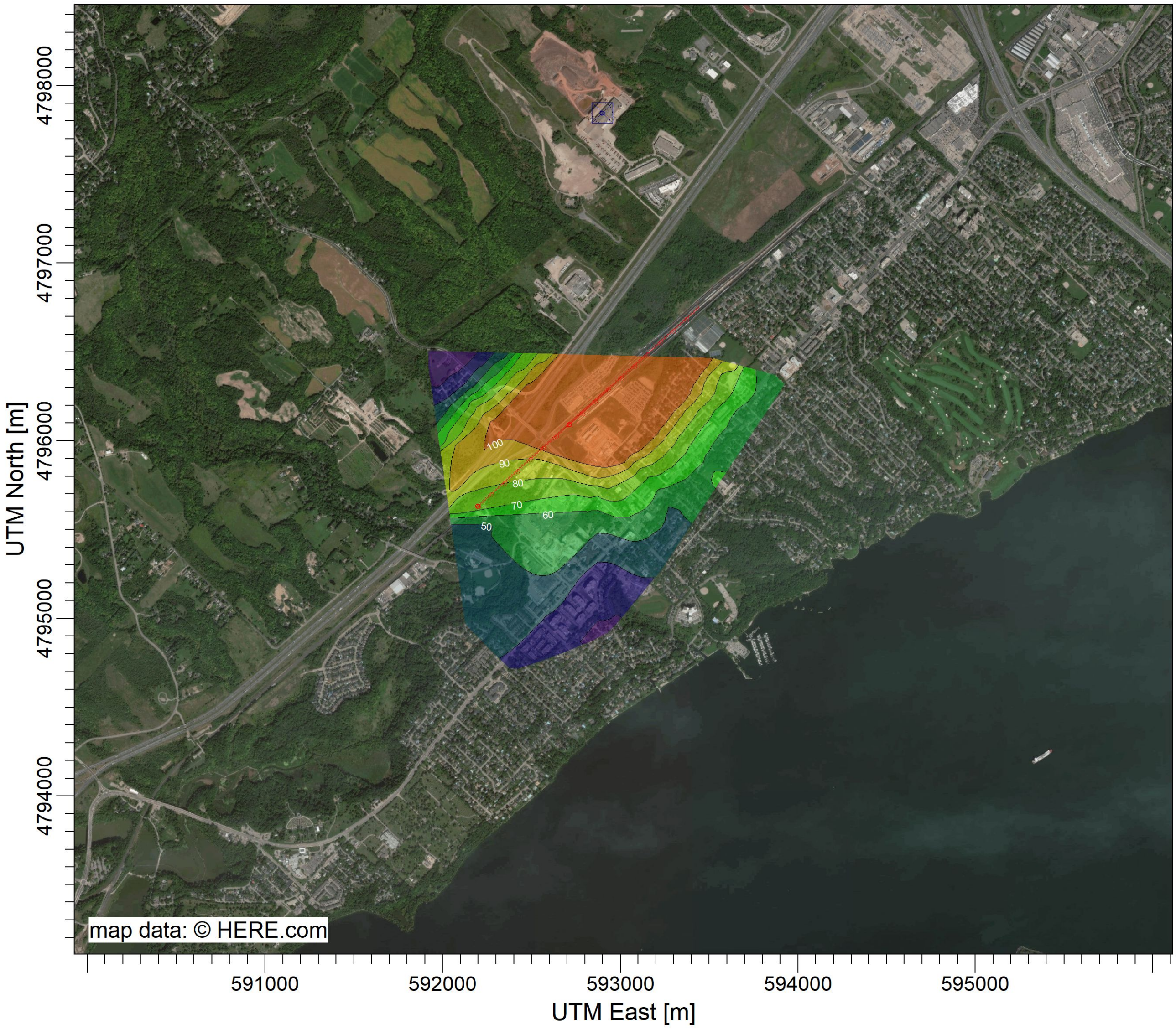
Appleby Mobility Hub - AERMOD Setup

N

PROJECT N°: TPB178008S		FIGURE:	A.6
SCALE:	NTS	DATE:	February 2018

Project Title:

FIGURE A7 - Aldershot Study Area
1hr Rail and Industry NO2 Contours - Current Scenario



PLOT FILE OF 1ST-HIGHEST MAX DAILY 1-HR VALUES AVERAGED OVER 5 YEARS FOR SOURCE GROUP: ALL ug/m^3

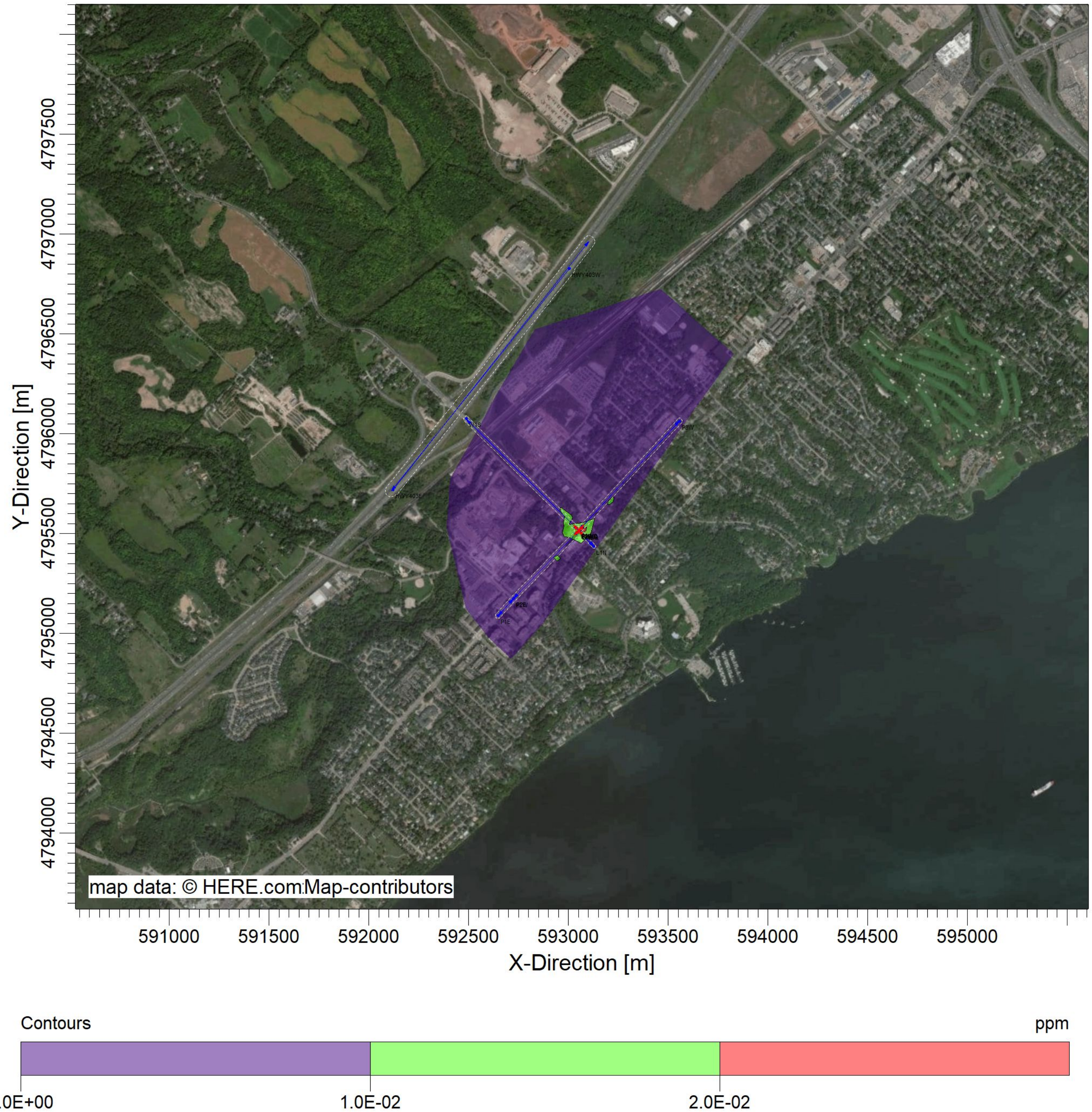
Max: 160 [ug/m^3] at (593224.81, 4796318.61)

18 30 40 50 60 70 80 90 100 160

Comments:	Sources: **6**		
	Receptors: **369**		wood.
	Output Type: **Concentration**	SCALE: 1:38,859 0 — 1 km	
		Date: **16-Nov-21**	Figure Number: **TPB178008S**

PROJECT TITLE:

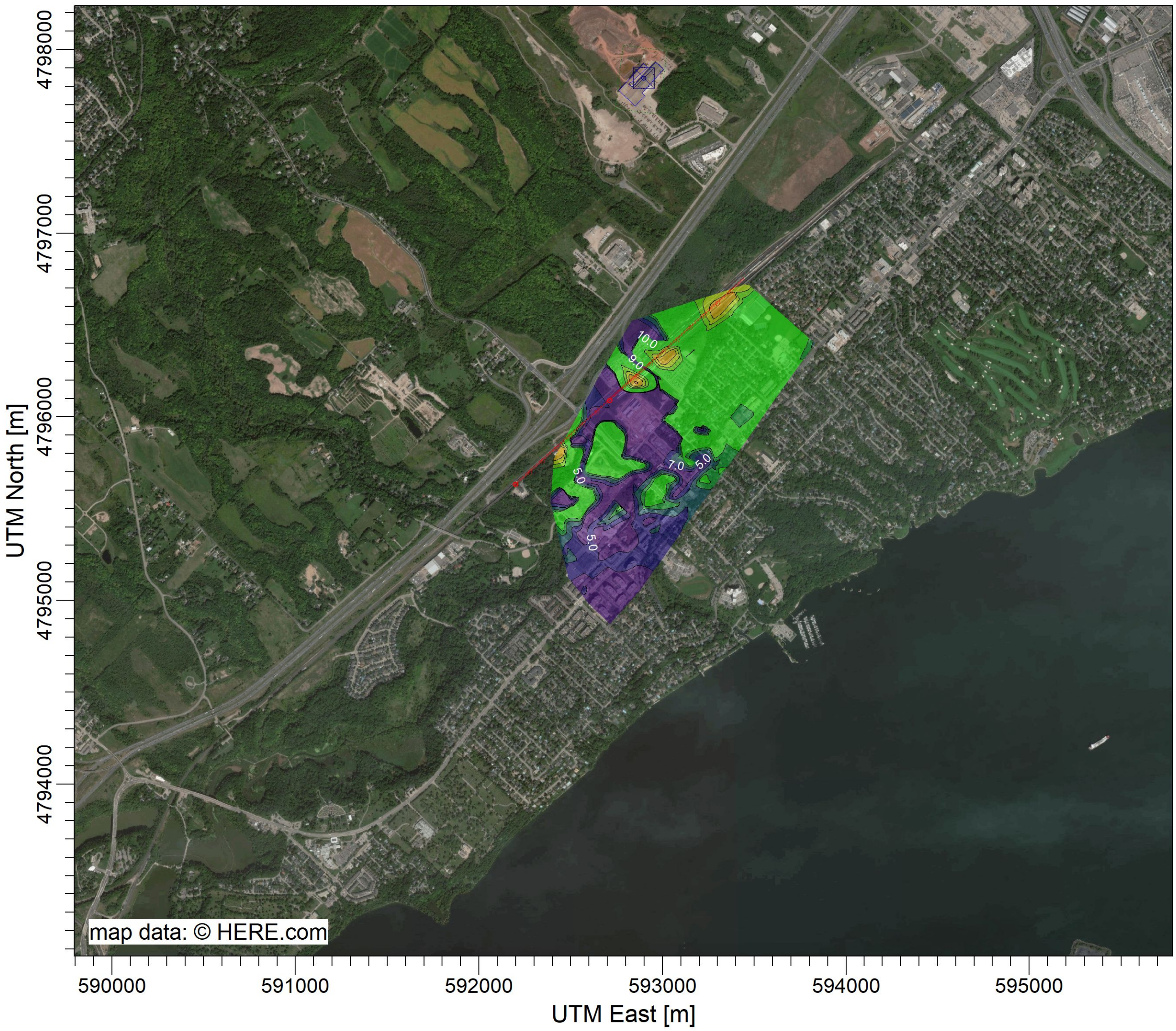
FIGURE A8 - Aldershot Study Area
1hr Road NO2 Contours - Current Scenario



COMMENTS:	MODEL: **CAL3QHCR**	POLLUTANT: **CO**	COMPANY NAME:
	MAX: **0.02**	UNITS: **ppm**	MODELER:
	LINKS: **16**	RECEPTORS: **584**	
	SCALE: 1:31,924 (0 — 1 m)	DATE: **16-Nov-21**	PROJECT / PLOT NO.: **TPB178008S**

Project Title:

FIGURE A9 - Aldershot Study Area
24hr Rail and Industry NO2 Contours - Current Scenario



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

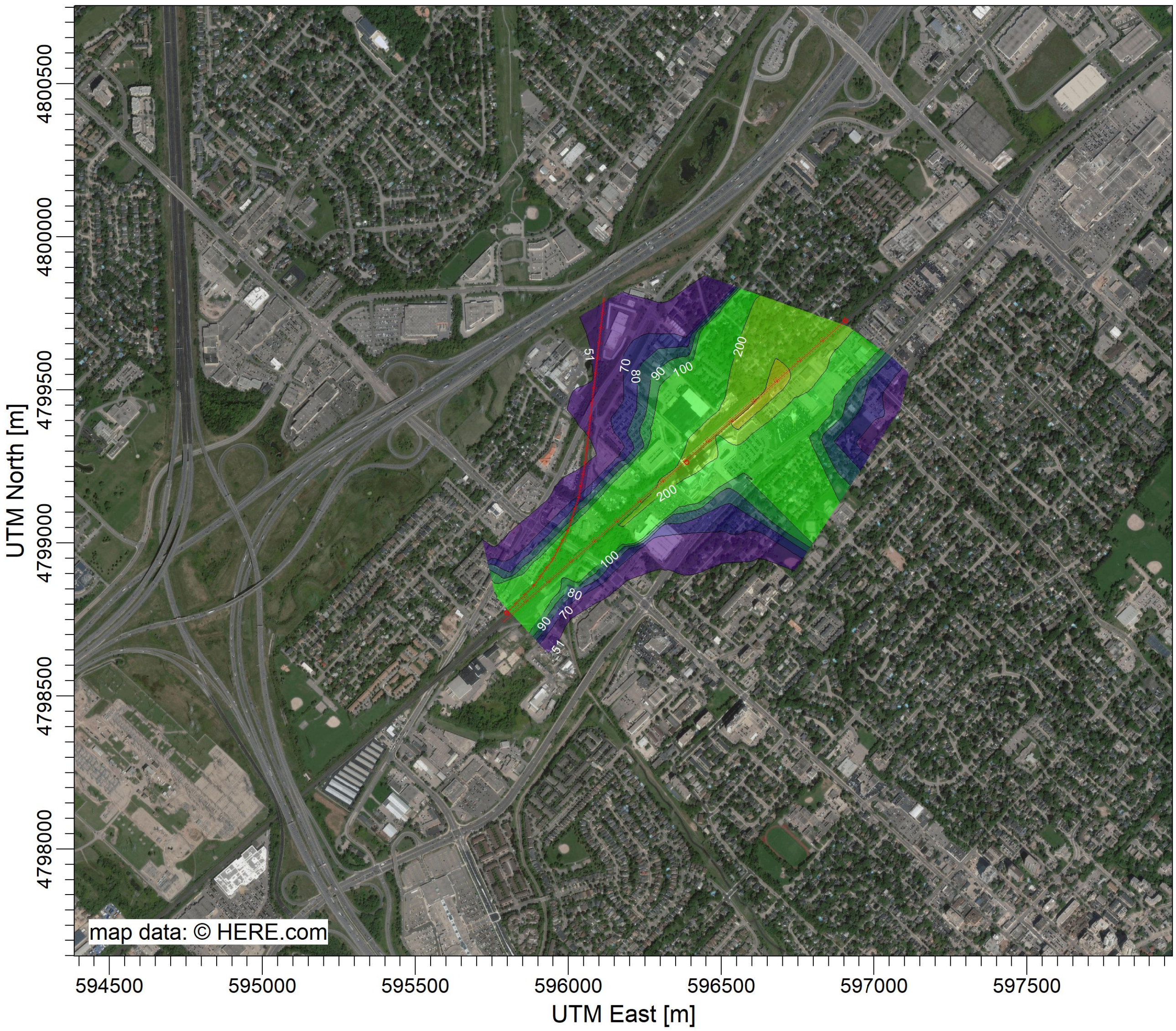
Max: 87.8 [ug/m^3] at (592782.29, 4796118.18)

1.3 | 5.0 | 7.0 | 9.0 | 10.0 | 40.0 | 50.0 | 60.0 | 80.0 | 87.8

Comments:	Sources: **6**		
	Receptors: **584**		
	Output Type: **Concentration**	SCALE: 1:37,613 0 — 1 km	wood.
		Date: **16-Nov-21**	Figure Number: **TPB178008S**

Project Title:

FIGURE A10 - Burlington Study Area
1hr Rail NO2 Contours - Current Scenario



PLOT FILE OF 1ST-HIGHEST MAX DAILY 1-HR VALUES AVERAGED OVER 1 YEARS FOR SOURCE GROUP: ALL ug/m^3

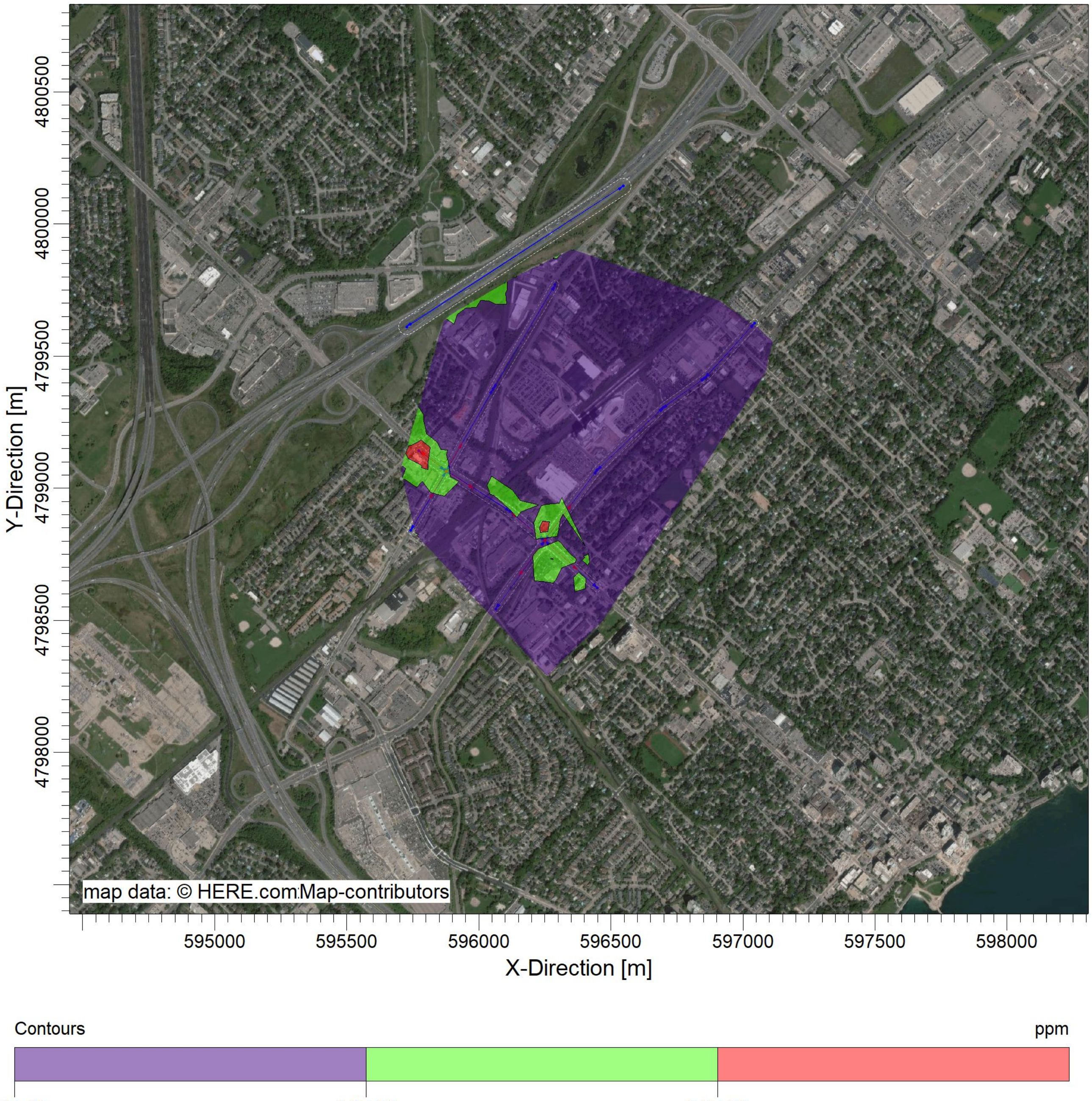
Max: 333 [ug/m^3] at (596686.99, 4799508.26)

51 70 80 90 100 200 300 400 500 534

Comments:	Sources: **5**		
	Receptors: **245**		wood.
	Output Type: **Concentration**	SCALE: 1:22,562 0 — 0.5 km	
		Date: **16-Nov-21**	Figure Number: **TPB178008S**

PROJECT TITLE:

FIGURE A11 - Burlington Study Area
1hr Road NO2 Contours - Current Scenario



COMMENTS:	MODEL: **CAL3QHCR**	POLLUTANT: **CO**	COMPANY NAME:	
	MAX: **0.03**	UNITS: **ppm**	MODELER:	
	LINKS: **34**	RECEPTORS: **717**		
	SCALE: 1:24,259 0 0.5 m		DATE: **16-Nov-21**	PROJECT / PLOT NO.: **TPB178008S**

Project Title:

FIGURE A12 - Burlington Study Area
24hr Rail NO2 Contours - Current Scenario

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 71 [ug/m^3] at (596794.98, 4799605.17)

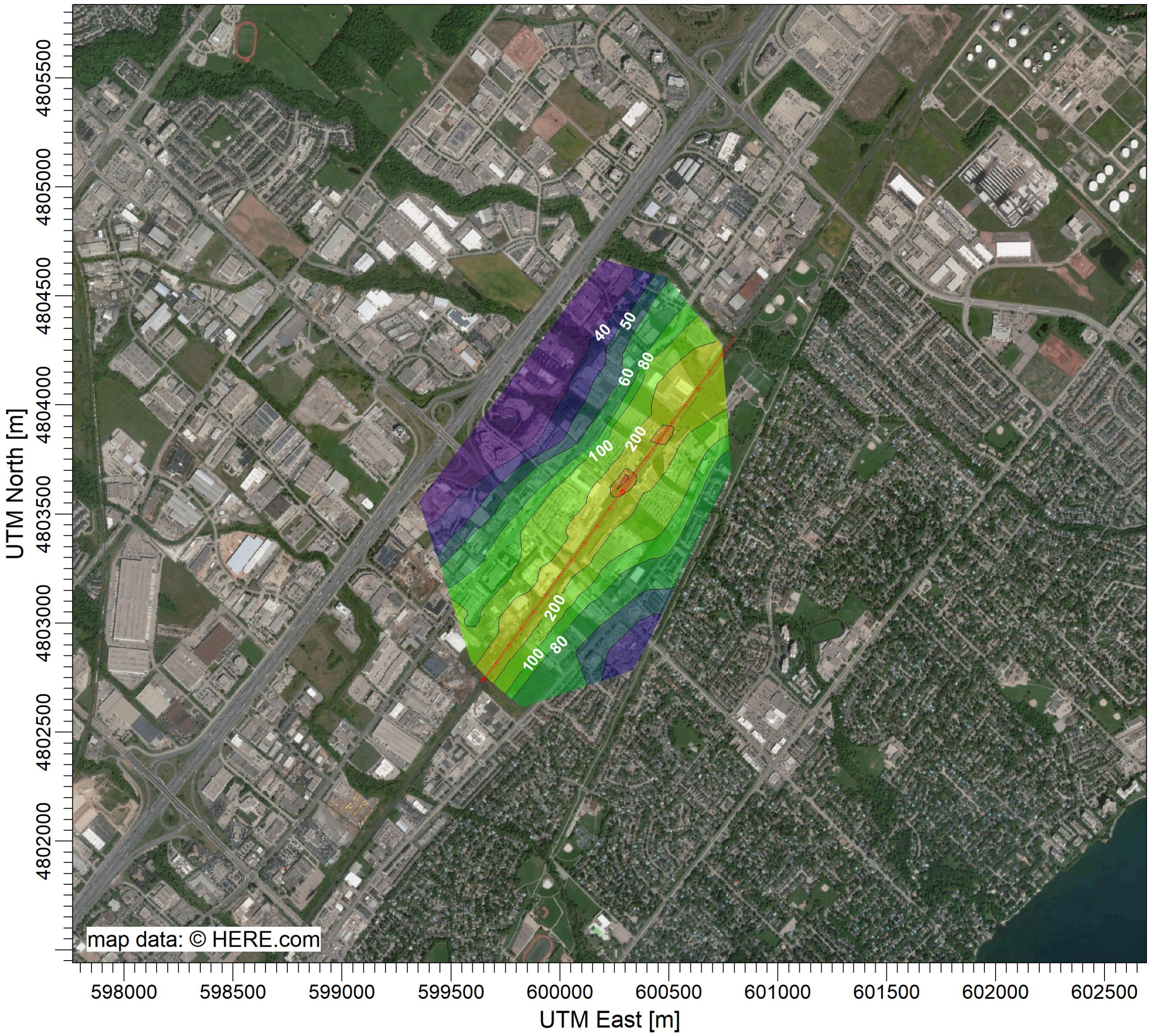
5	5	6	7	9	10	40	50	60	70	71

Comments:	Sources: **5**	
	Receptors: **245**	
	Output Type: **Concentration**	SCALE: 1:34,392 (0 — 1 km)
		Date: **16-Nov-21**
		Figure Number: **TPB178008S**

wood.

Project Title:

FIGURE A13 - Appleby Study Area
1hr Rail NO2 Contours - Current Scenario



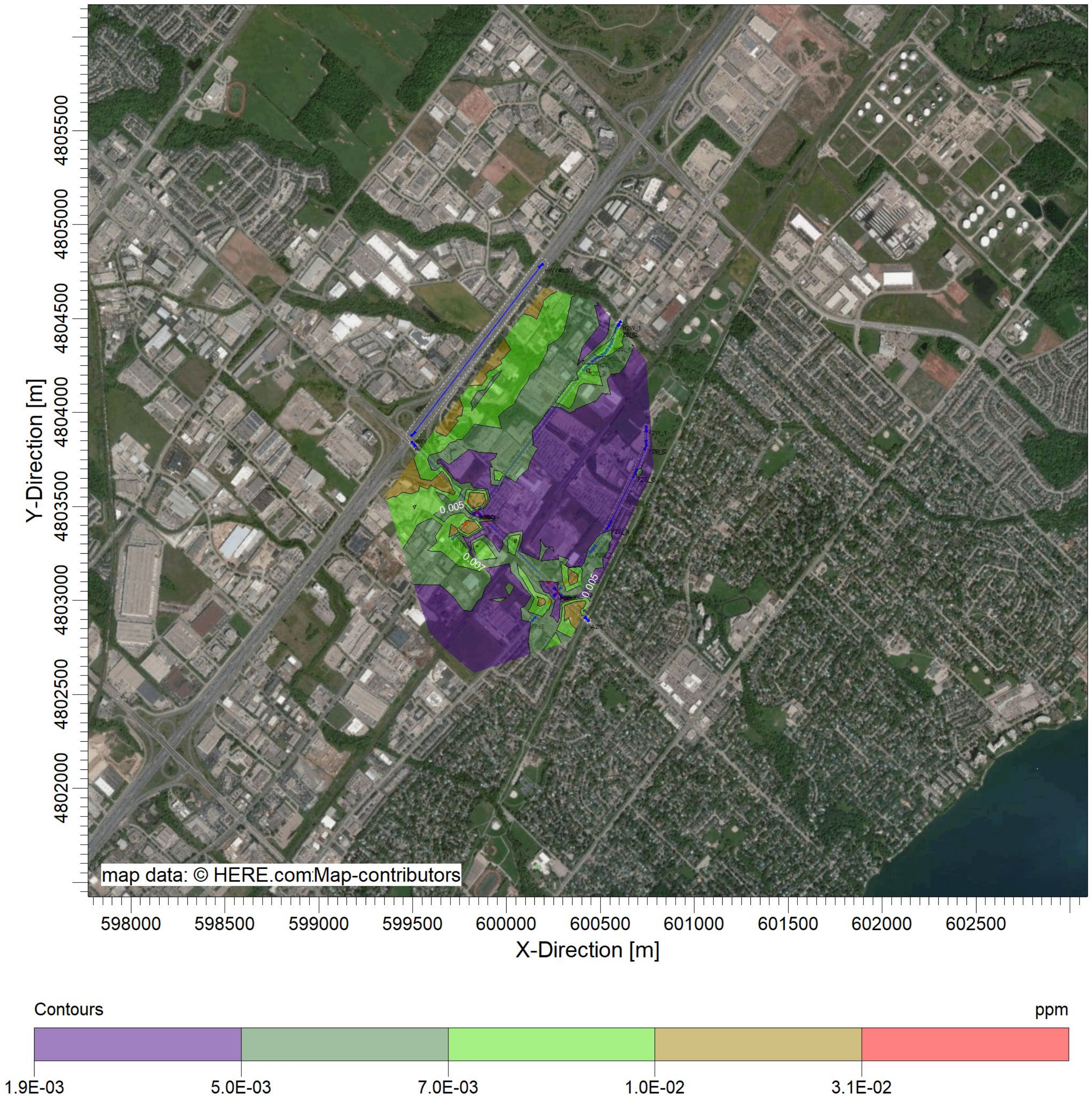
PLOT FILE OF 1ST-HIGHEST MAX DAILY 1-HR VALUES AVERAGED OVER 5 YEARS FOR SOURCE GROUP: ALL ug/m^3

19 40 50 60 80 100 200 400 500 533

Comments:	Sources: **4**	
	Receptors: **328**	
	Output Type: **Concentration**	SCALE: 1:30,969 — 0 — 1 km
		Date: **16-Nov-21** / Figure Number: **TPB178008S**

PROJECT TITLE:

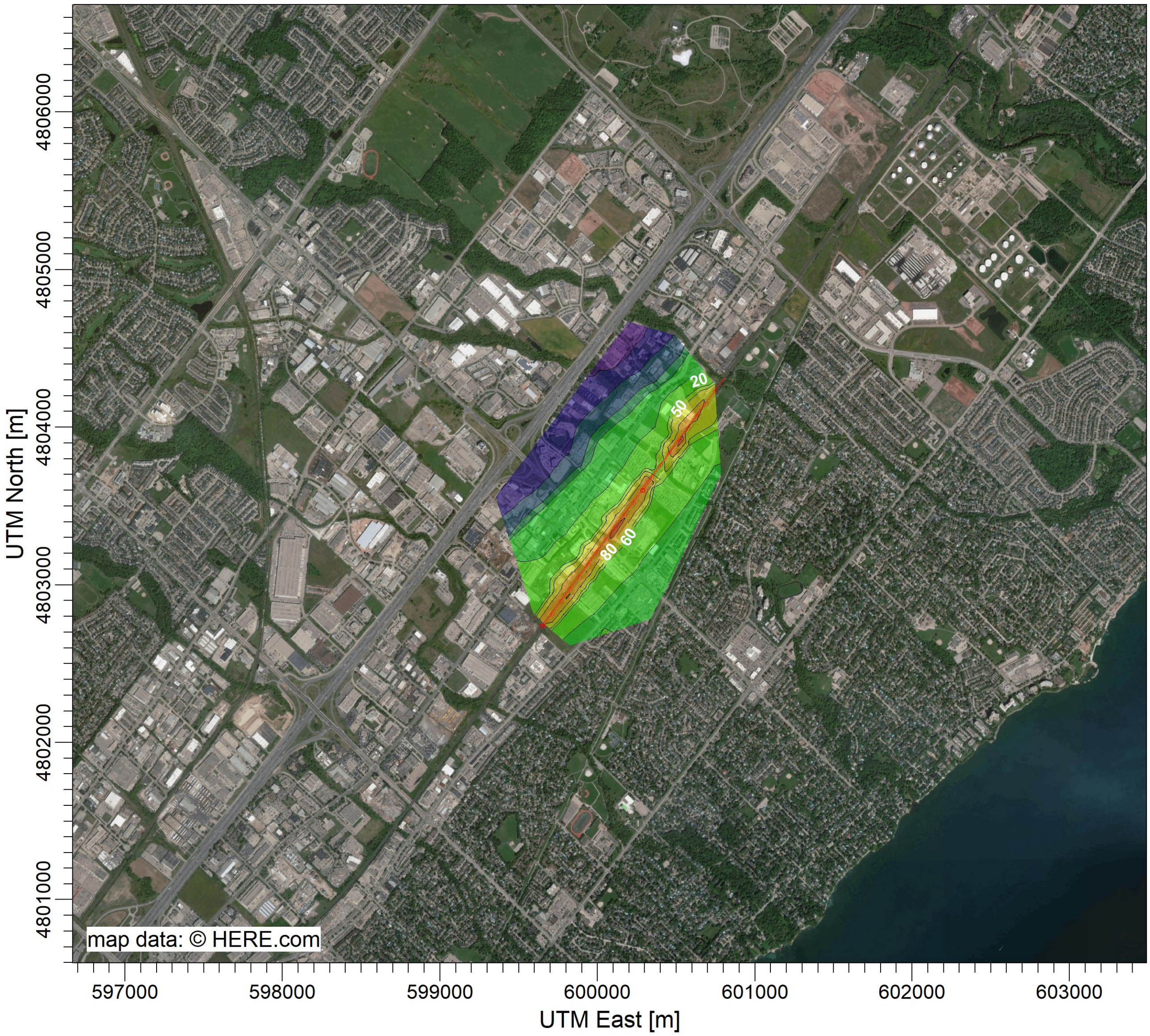
FIGURE A14 - Appleby Study Area
1hr Road NO2 Contours - Current Scenario



COMMENTS:	MODEL: **CAL3QHCR**	POLLUTANT: **CO**	COMPANY NAME:	
	MAX: **0.03**	UNITS: **ppm**	MODELER:	
	LINKS: **42**	RECEPTORS: **890**		
	SCALE: 1:33,470 0 — 1 m		DATE: **16-Nov-21**	PROJECT / PLOT NO.:

Project Title:

FIGURE A15 - Appleby Study Area
24hr Rail NO2 Contours - Current Scenario



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL — ug/m^3

4 | 5 | 7 | 9 | 10 | 20 | 50 | 60 | 80 | 100 | 108

Comments:	Sources: **4**	
	Receptors: **328**	
	Output Type: **Concentration**	SCALE: 1:42,863 (0 — 1 km)
		Date: **16-Nov-21**	Figure Number: **TPB178008S**

wood.

Appendix B

Emission Calculations

Sample Calculations

Locomotive Exhaust Emissions (GO, VIA, CN rails)

The GO and VIA locomotive includes a main engine, and a diesel powered generator (Head End Power unit) which provides electricity (for lighting and heating/cooling) to passenger cars.

GO main engine capacity = 4,000 hp (2,982 kW), Head End Power (HEP) unit = 1,200hp (895kW)

VIA main engine capacity = 4,250 hp (3,170 kW), HEP unit = 1,072hp (800 kW)

CN main engine capacity = 4,400 hp (3,281 kW)

For current scenario, NOx, CO, and PM emissions from the main engine are calculated based on the US EPA Tier 2 emission factors. These emission factors are published in EPA-420-B-16-024 (March 2016).

SO_2 emission rate is calculated based on the US EPA AP-42 emission factor, Section 3.3, table 3.3-1, and prorated based on the sulphur content 15ppm.

US EPA Tier 0-2 Locomotive Emission Standards, g/bhp·hr

Duty Cycle	HC*	CO	NOx	PM
Tier 0 (1973 - 2001)				
Line-haul	1	5	9.5	0.6
Switch	2.1	8	14	0.72
Tier 1 (2002 - 2004)				
Line-haul	0.55	2.2	7.4	0.45
Switch	1.2	2.5	11	0.54
Tier 2 (2005 and later)				
Line-haul	0.3	1.5	5.5	0.2
Switch	0.6	2.4	8.1	0.24
Non-Regulated Locomotives (1997 estimates)				
Line-haul	0.5	1.5	13.5	0.34
Switch	1.1	2.4	19.8	0.41

* HC standard is in the form of THC for diesel, NMHC for natural gas, and THCE for ethanol engines. The THCE (THC equivalent) is the sum of the carbon mass contributions of hydrocarbons, alcohols, aldehydes, and other organic compounds, expressed as gasoline-fueled vehicle HCs.

Sample calculations for NOx

NOx emission factor = 5.5 (g/bhp-hr) (Tier 2)

Power output for main engine = 4,000 hp, HEP units are usually operated at a constant 50% load, as per to Metrolinx Guideline (2019).

Total power output = 4,000hp + (1200 x 50%) hp

= 4,600 hp

= (4,600 x 0.986) bhp (bhp – brake horse power)

= 4,537 bhp

Potential NOx emission rate = 5.5 g/bhp-hr x 4,537 bhp x 1 hr ÷ 3600 s

= 6.93 g/s

Burlington Hub area

Maximum 7 trains pass per hour.

Track length = 1500m

Train speed = 80 km/hr

Duration of train in the study area = 1500 m x 1 hr/80,000m x 60 min/1hr

= 1.13 min

NOx emission rate = 6.93 g/s x 7 trains/hr x 1.13 min x 1 hr /60min

= 0.91 g/s

Sample calculations for SO_2

SO_2 emission rates were calculated based on the US EPA AP-42 emission factor, Section 3.3, Table 3.3-1.

SO_2 emission factor = 1.25 (g/bhp-hr)

Total power output = 4,000hp + (1200 x 50%) hp

= 4,600 hp

= (4,600 x 0.986) bhp (bhp – brake horse power)

= 4,537 bhp

SO_2 emission rate = 1.25 g/bhp-hr x 4,537 bhp x 1 hr ÷ 3600 s

SO_2 emission rate = 1.57 g/s

Burlington Hub area

Maximum 7 trains pass per hour.

Track length = 1500m

Train speed = 80 km/hr

Duration of train in the study area = 1500 m x 1 hr/80,000m x 60 min/1hr

= 1.13 min

Potential SO_2 emission rate = 1.57 g/s x 7 trains/hr x 1.13 min x 1 hr /60min

= 0.20 g/s

US EPA AP-42 SO_2 emission factor is based on Sulphur content 0.4%
(US EPA AP-42 Section 1.3, Background docuement)

Sulphur in diesel fuel (as per Canada regulations) for locomotive is 0.0015% (15ppm)

SO_2 emission rate = 0.20 g/s x 0.0015/0.4

= 0.00075 g/s

Sample Calculation for GO Train Idling NOx

Maximum 7 trains pass per hour

Each train will stop for 90 seconds

Total Train power = 1200 bhp

Tier 2 NO_x emission factor = 4.8 (g/bhp-hr)

NOx emission for one train = 4.8 (g/bhp-hr) x 1200 bhp / 3600s = 1.59 g/s

Overall NOx emissions from Idling = number of trains x idling time x emission rate of 1 train

= 1.59 g/s x 7 trains/hr x 90s x 1hr/3600s = 0.28 g/s

MOVES3 Emission Factors

Emission Factors - 2020

Speed (km/h)	**Speed (mph)**	**% Cars - AM/PM Peak**	**$PM_{2.5}$**	**PM_{10}**	**NO2**	**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)
50	31	90%	0.043	0.046	0.211	0.0025	3.254	0.001605354	0.000173	0.00340	0.00181	0.000268302	8.75794E-09
60	37	90%	0.032	0.035	0.170	0.0024	2.781	0.001392417	0.000153	0.00305	0.00160	0.000240707	7.5119E-09
100	62	90%	0.021	0.022	0.120	0.0022	2.250	0.000992495	0.000110	0.00225	0.00117	0.000178662	5.26874E-09

Idle Emission Rate

% 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 - (g/hr)	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)
90%	0.288	0.313	1.536	0.020	4.122	0.012	0.002	0.044	0.023	0.0036	5.28E-08

MOVES3 Emission Factors

Emission Factors - 2041

Speed (km/h)	Speed (mph)	% Cars - AM/PM Peak	$PM_{2.5}$	PM_{10}	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)
50	31	90%	0.00493	0.00540	0.203	0.00178	1.310	3.51E-04	0.00E+00	3.46E-04	4.20E-04	3.74817E-05	2.05564E-09
60	37	90%	0.00385	0.00423	0.148	0.00164	1.092	3.04E-04	0.00E+00	2.79E-04	3.32E-04	2.97272E-05	1.77884E-09
100	62	90%	0.00261	0.00287	0.070	0.00147	0.841	2.20E-04	0.00E+00	1.94E-04	2.28E-04	2.04565E-05	1.28963E-09

Idle Emission Rate

% 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 - (g/hr)	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)
90%	0.034	0.037	2.256	0.01383	2.350	0.002	0.000	0.004	0.006	0.0005	1.03E-08

Appendix C

Dispersion Modelling Input Data and Assumptions

Burlington GO
Raw Traffic Data - Current and Future Traffic Volumes

ID	Description	Direction	Link Type	Length (m)	Mixing Zone Width (m)	2011-2016 Traffic Volume*	2020 Current Traffic Volume**	2041 Traffic Volume**
						Cars/Trucks per hour	Cars/Trucks per hour	Cars/Trucks per hour
B1N	Brant St. South of Fairview St.	North	At-Grade	265.99	29.5	1298	1433	2129
B1S	Brant St. South of Fairview St.	South	At-Grade	265.99	29.5	1298	1433	2129
B2N	Brant St. North of Fairview St.	North	At-Grade	464	35	1431	1580	2348
B2S	Brant St. North of Fairview St.	South	At-Grade	464	35	1431	1580	2348
F1E	Fairview St. East of Brant St.	East	At-Grade	1149.92	29	1117	1233	1832
F1W	Fairview St. East of Brant St.	West	At-Grade	1149.92	29	1117	1233	1832
F2E	Fairview St. West of Brant St.	East	At-Grade	317.57	29	1225	1353	2010
F2W	Fairview St. West of Brant St.	West	At-Grade	317.57	29	1225	1353	2010
B3N	Brant St. North of Plains Rd. E.	North	At-Grade	124.65	35	1645	1816	2698
B3S	Brant St. North of Plains Rd. E.	South	At-Grade	124.65	35	1645	1816	2698
P1E	Plains Rd. E. East of Brant St.	East	At-Grade	812.72	28.5	614	678	1007
P1W	Plains Rd. E. East of Brant St.	West	At-Grade	812.72	28.5	614	678	1007
P2E	Plains Rd. E. West of Brant St.	East	At-Grade	260.56	25	895	988	1468
P2W	Plains Rd. E. West of Brant St.	West	At-Grade	260.56	25	895	988	1468
Q4E	QEW	East	At-Grade	977.37	59	6192	6836	10159
Q4W	QEW	West	At-Grade	977.37	59	6192	6836	10159

*Traffic Volume was based on City of Burlington AADT Map with surveys from 2011 to 2016. AADT values for current and future scenarios were converted directional peak hourly traffic flow per: U.S. Department of Transportation (2015) *Freight Performance Measure Approaches for Bottlenecks, Arterials, and Linking Volumes to Congestion Report*

** Traffic Volume was forecasted assuming a 2% annual growth as no projections were provided. See Section 6.0 for further details.

Aldershot GO
Raw Traffic Data - Current and Future Traffic Volumes

ID	Description	Direction	Link Type	Mixing Zone Width (m)	2011-2016 Traffic Volume*	2020 Current Traffic Volume**	2041 Traffic Volume**
					Cars/Trucks per hour	Cars/Trucks per hour	Cars/Trucks per hour
P1E	Plains Rd. W. West of Haward Rd	East	At-Grade	26	865	954	1418
P1W	Plains Rd. W. West of Haward Rd	West	At-Grade	26	865	954	1418
L1N	LaSalle Park Rd. South of Plains Rd. W.	North	At-Grade	18	197	218	324
L1S	LaSalle Park Rd. South of Plains Rd. W.	South	At-Grade	18	197	218	324
P2E	Plains Rd. W. West of Waterdown Rd.	East	At-Grade	26	1095	1209	1797
P2W	Plains Rd. W. West of Waterdown Rd.	West	At-Grade	26	1095	1209	1797
P3E	Plains Rd. E. East of Waterdown Rd.	East	At-Grade	26	1098	1212	1802
P3W	Plains Rd. E. East of Waterdown Rd.	West	At-Grade	26	1098	1212	1802
HWY403E	Hwy 403	East	At-Grade	59	6790	7497	11140
HWY403W	Hwy 403	West	At-Grade	59	7250	8005	11894

*Traffic Volume was based on City of Burlington AADT Map with surveys from 2011 to 2016. AADT values for current and future scenarios were converted directional peak hourly traffic flow per: U.S. Department of Transportation (2015) *Freight Performance Mea*sure Approaches for Bottlenecks, Arterials, and Linking Volumes to Congestion Report

** Traffic Volume was forecasted assuming a 2% annual growth as no projections were provided. See Section 6.0 for further details.

Appleby GO
Raw Traffic Data - Current and Future Traffic Volumes

ID	Description	Direction	Link Type	Mixing Zone Width (m)	2011-2016 Traffic Volume*	2020 Current Traffic Volume**	2041 Traffic Volume**
					Cars/Trucks per hour	Cars/Trucks per hour	Cars/Trucks per hour
F1E	Fairview St. West of Appleby Line	East	At-Grade	28.5	907	1001	1488
F1W	Fairview St. West of Appleby Line	West	At-Grade	28.5	907	1001	1488
H1E	Harvester Rd. West of Appleby Line	East	At-Grade	24.5	961	1061	1576
H1W	Harvester Rd. West of Appleby Line	West	At-Grade	24.5	961	1061	1576
H2E	Harvester Rd. East of Appleby Line	East	At-Grade	24.5	1081	1193	1773
H2W	Harvester Rd. East of Appleby Line	West	At-Grade	24.5	1081	1193	1773
A3N	Appleby Line North of Harvester Rd.	North	At-Grade	28	2015	2224	3305
A3S	Appleby Line North of Harvester Rd.	South	At-Grade	28	2015	2224	3305
A1N	Appleby Line North of Fairview St.	North	At-Grade	28	1612	1780	2645
A1S	Appleby Line North of Fairview St.	South	At-Grade	28	1612	1780	2645
A2N	Appleby Line South of Fairview St.	North	At-Grade	28	1313	1449	2154
A2S	Appleby Line South of Fairview St.	South	At-Grade	28	1313	1449	2154
HWY403E	Hwy 403	East	At-Grade	59	8695	9600	14265
HWY403W	Hwy 403	West	At-Grade	59	8600	9495	14109

*Traffic Volume was based on City of Burlington AADT Map with surveys from 2011 to 2016. AADT values for current and future scenarios were converted directional peak hourly traffic flow per: U.S. Department of Transportation (2015) *Freight Performance Mea* sure Approaches for Bottlenecks, Arterials, and Linking Volumes to Congestion Report

** Traffic Volume was forecasted assuming a 2% annual growth as no projections were provided. See Section 6.0 for further details.

Appendix D

Study Area Industries

Aldershot Mobility Hub
Summary of Industries

Company Name	Address	Municipality	Location	D6 Class	Air ECA	ECALOF	Source Data	2017 NPRI Air Data	Frequent and Occasionally Intense Fugitive Dust Likely	Frequent and Occasionally intense Odour Likely	Reported Contaminants	Facility Description or Sources	Modelling Inclusion Status
Category 5 Imaging Ltd.	1062 Cooke Boulevard	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Digital Printing, Print Dryers	No Data Exclusion
Cumis Group Limited	151 North Service Road	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Insurance Office Building, HVAC	No Data Exclusion
Etratech Inc.	1047 Cooke Boulevard	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Electronics manufacturer	No Data Exclusion
Pro Concrete & Paving	1160 Waterdown Road	Burlington	HUB	Class 1	No	—	—	No	No	No	—	From provided industry list, Storage Yard	No Data Exclusion
2033940 Ontario Inc.	1070 Waterdown Road	Burlington	HUB	Class 2	No	—	—	No	No	Yes	—	Storage and Warehousing	No Data Exclusion
Bulkwood Products Inc.	300 Plains Road	Burlington	HUB	Class 2	Yes	Yes	Yes	No	No	No	—	Wood Chipping	No Data Exclusion
KPM Industries	1077 Howard Road	Burlington	HUB	Class 3	Yes	Yes	Yes	No	Yes	Yes	—	Hot Mix Asphalt Plant	No Data Exclusion
St. Mary's Cement	1093 Howard Road	Burlington	HUB	Class 3	Yes	Yes	Yes	No	Yes	No	—	Ready Mix Cement Plant	No Data Exclusion
1582974 Ontario Ltd.	425 Enfield Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Granite Works	D6 Setback Exclusion
Aaon Canada Inc.	279 Sumach Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Spray Booth	D6 Setback Exclusion
Burlington Retirement Group Inc.	30 Plains Road West	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Retirement home	D6 Setback Exclusion
The Regional Municipality of Halton	59 Oaklands Park Court	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Pumping Station, Standby Diesel Generator	D6 Setback Exclusion
Forterra Brick	1570 Yorkton Court	Burlington	1000m	Class 3	Yes	Yes	No	Yes	Yes	No	CO, NO_2, PM_{10}, $PM_{2.5}$, TPM	Quarry/Brick Manufacturing	Included

Notes:
ECA - Environmental Compliance Approval
ECALOF - ECA with Limited Operational Flexibility

Burlington Mobility Hub
Summary of Industries

Company Name	Address	Municipality	Location	D6 Class	Air ECA	ECALOF	Source Data	2017 NPRI Air Data	Frequent and Occasionally Intense Fugitive Dust Likely	Frequent and Occasionally intense Odour Likely	Reported Contaminants	Facility Description or Sources	Modelling Inclusion Status
1704326 Ontario Inc.	2188 Queensway Drive	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Furniture Restoration - Paith Booth	No Data Exclusion
Greater Toronto Transit Authority	2132 Queensway Drive	Burlington	HUB	Class 1	Yes	No	No	No	No	No	—	Emerg. Gen.	No Data Exclusion
Smit Autobody	1400 Graham's Lane	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Autobody paint booth	No Data Exclusion
Bull Moose Tube Ltd.	2170 Queensway Drive	Burlington	HUB	Class 2	Yes	No	No	Yes	No	No	—	Metal tubing manufacturing	No Source Data Exclusion
Hercules Canada (2002) Limited	942 Brant Street	Burlington	HUB	Class 2	Yes	Yes	No	No	No	No	—	Chemical Manufacturing	No Data Exclusion
NALCO Canada ULC	1055 Truman Street	Burlington	HUB	Class 2	Yes	Yes	No	Yes	No	No	—	Water quality solutions	No Data Exclusion
Costco	1225 Brant Street	Burlington	300m	Class 1	Yes	Yes	No	No	No	No	—	Retail, HVAC	D6 Setback Exclusion
Hood Packaging Corporation	2380 McDowell Road	Burlington	300m	Class 2	Yes	Yes	No	No	No	No	—	Packaging Manufacturer	D6 Setback Exclusion
Sun Chemical Limited	1274 Plains Road East	Burlington	300m	Class 2	Yes	No	Yes	No	No	No	—	Chemical Manufacturing	No Data Exclusion
1263337 Ontario Inc.	2499 Industrial Street	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Paith Booth	D6 Setback Exclusion
Aro Motors Collision Ltd.	2397 Fairview Street	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Paith Booth	D6 Setback Exclusion
Detour Coffee Inc.	2234 Harold Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	Yes	—	Coffee Roaster	D6 Setback Exclusion
Ivanhoe Cambridge II Inc.	900 Maple Avenue	Burlington	1000m	Class 1	Yes	No	No	No	No	No	—	Shopping Centre, HVAC, Emerg. Gen etc.	D6 Setback Exclusion
Leggat Pontiac Buick Cadillac Limited	629 Brant Street	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Dealership - Paint Booth, HVAC	D6 Setback Exclusion
Mountain Collision Service Inc.	2481 Industrial Street	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Paith Booth	D6 Setback Exclusion
Randy Pickard Incorporated	1167 Pettit Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Paith Booth	D6 Setback Exclusion
Rice Tool & Manufacturing Inc.	2247 Harold Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Tool & Manufacturing	D6 Setback Exclusion
A.H. Tallman Bronze Company Ltd.	2220 Industrial Street	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Bronze Manufacturing	D6 Setback Exclusion
Burlington Hydro Inc.	1340 Brant Steet	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Micro Turbine Cogeneration Project	D6 Setback Exclusion
Solenis Canada ULC (formerly Ashland Canada Corp.)	942 Brant St	Burlington	1000m	Class 2	Yes	Yes	Yes	Yes	No	Yes	—	manufacture process chemical, defoamer, and emu lsion	D6 Setback Exclusion

Notes:
ECA - Environmental Compliance Approval
ECALOF - ECA with Limited Operational Flexibility

Appleby Mobility Hub
Summary of Industries

Company Name	Address	Municipality	Location	D6 Class	Air ECA	ECALOF	Source Data	2017 NPRI Air Data	Frequent and Occasionally Intense Fugitive Dust Likely	Frequent and Occasionally intense Odour Likely	Reported Contaminants	Facility Description or Sources	Modelling Inclusion Status
Amcan Consolidated Technologies Corp.	5195 Harvester Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Die Casting	No Data Exclusion
Artcraft Label Inc.	5205 Harvester Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Art	No Data Exclusion
Burlington Technologies Inc.	920 Century Drive	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Aluminum Die Casting	No Data Exclusion
Cant Rust Company Limited	930 Sheldon Court	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Rustproofing	No Data Exclusion
Citi Commerce Solution of Canada Ltd.	5050 South Service Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Office, HVAC	No Data Exclusion
Dana Canada Corporation	5300 Harvester Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Vehicle Part Manufacturing	No Data Exclusion
Discovery Collision Inc.	5135 Fairview Street	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Spray Booth	No Data Exclusion
Greater Toronto Transit Authority	5111 Fairview Street	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Station, Standby Gen.	No Data Exclusion
Janthy Inc.	5050 South Service Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Office, HVAC	No Data Exclusion
Patheon Inc.	977 Century Drive	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Laboratory	No Data Exclusion
Premier Fluid Systems Inc.	4460 Harvester Road	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Repair Shop - Spray Booth, Oven	No Data Exclusion
Sandvik Mining and Construction Canada Inc.	445 Harvester Road	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Mining Equipment - Paint Booth, HVAC	No Data Exclusion
Smurfit-Stone Container Canada Inc.	747 Appleby Line	Burlington	HUB	Class 1	Yes	No	Yes	No	No	No	—	Packaging Manufacturing	No Data Exclusion
Thames River Chemical Corp.	5230 Harvester Road	Burlington	HUB	Class 1	Yes	Yes	No	No	No	No	—	Chemical Manufacturing	No Data Exclusion
Cargill Limited	4370 Harvester Road	Burlington	HUB	Class 2	Yes	No	Yes	No	No	No	—	Sweeteners Manufacturing	No Data Exclusion
Cargill Limited	5305 Harvester Road	Burlington	HUB	Class 2	Yes	No	Yes	No	No	No	—	Food Manufacturing	No Data Exclusion
Fisher & Ludlow Steel	750 Appleby Line	Burlington	HUB	Class 2	Yes	No	Yes	No	No	No	—	Steel Manufacturing	No Data Exclusion
Halton Chemical Inc.	840 Appleby Line	Burlington	HUB	Class 2	Yes	Yes	No	Yes	No	No	VOCs	Chemical Plant/Warehouse	No speciated VOCs Exclusion
Henniges Automotive Schlegel	4445 Fairview Street	Burlington	HUB	Class 2	Yes	Yes	No	No	No	No	—	Automotive material manufacturing	No Data Exclusion
Fearman's Pork-Sofina Foods Inc.	821 Appleby Line	Burlington	HUB	Class 3	Yes	No	Yes	Yes	No	Yes	—	Food, Ammonia, H2SO4	No Relevant Contaminants Exclusion
Lafarge Canada Inc.	800 Appleby Line	Burlington	HUB	Class 3	Yes	No	Yes	No	Yes	No	—	Ready Mix cement plant	No Data Exclusion
Seymour-Smith Elecctric Motor & Pump Service Inc.	4380 Harvester Road	Burlington	70m	Class 1	Yes	No	Yes	No	No	No	—	Repair Shop - Spray Booth, Oven	D6 Setback Exclusion
Union Gas Limited	4450 Paletta Court	Burlington	70m	Class 1	Yes	No	Yes	No	No	No	—	Maintenance Shop	No Data Exclusion
1166908 Ontario Inc.	4325 Harvester Road	Burlington	300m	Class 1	Yes	No	Yes	No	No	No	—	Sign Manufacturer - Spray Booth, HVAC	D6 Setback Exclusion
567179 Ontario Inc.	4169 Harvester Road	Burlington	300m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Paith Booth	D6 Setback Exclusion
Alsco Canada Corporation	5475 North Service Road	Burlington	300m	Class 1	Yes	No	Yes	No	No	No	—	Uniform Supply	D6 Setback Exclusion
Liebherr-Canada	1015 Sutton Drive	Burlington	300m	Class 1	Yes	Yes	No	No	No	No	—	Machinery repair and maintenance	D6 Setback Exclusion
SITQ National Service Road	5420 North Service Road	Burlington	300m	Class 1	Yes	No	Yes	No	No	No	—	Office - HVAC, Standby Gen.	D6 Setback Exclusion
987016 Ontario Inc.	1040 Sutton Drive	Burlington	300m	Class 2	Yes	No	Yes	No	No	No	—	Custom Plastics Fabricator	No Data Exclusion
Associate Paving & Materials	850 Syscon Court	Burlington	300m	Class 2	Yes	No	Yes	No	Yes	Yes	—	Hot Mix Asphalt Plant	No Data Exclusion
Bericap Inc.	835 Syscon Court	Burlington	300m	Class 2	Yes	No	Yes	Yes	No	No	PM2.5, PM10	Plastic Product Manufacturing	Included
Hamsar Diversco Inc.	5320 Downey Street	Burlington	300m	Class 2	Yes	No	Yes	Yes	No	No	—	Lightint Manufacturer, Lead	No Data Exclusion
RHI Canada Inc.	4355 Fairview Street	Burlington	300m	Class 2	Yes	No	Yes	No	No	No	—	Refractory castable Manufacturer	No Data Exclusion
Teff-Line Limited	4415 North Service Road	Burlington	300m	Class 2	Yes	No	Yes	No	No	No	—	Spary Booth and Oven	No Data Exclusion
Voortman Cookies Limited	4455 North Service Road	Burlington	300m	Class 2	Yes	Yes	No	No	No	No	—	Cookie Manufacturing	No Data Exclusion
ALS Canada Ltd.	1435 Norjohn Court	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Laboratory	D6 Setback Exclusion
Asbury Wilkinson Inc.	115 Sutton Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Graphite Processing/Supply Kiln, HVAC	D6 Setback Exclusion
Bank of America	4280 Harvester Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Bank - Standby Gen.	D6 Setback Exclusion
Cogeco Cable Canada GP Inc.	950 Syscon Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Office - Standby Gen.	D6 Setback Exclusion
GE Betz Canada Company	5316 John Lucas Drive	Burlington	1000m	Class 1	Yes	Yes	No	No	No	No	—	Manufacturing of Membranes	D6 Setback Exclusion
Halton District School Board	5151 New Street	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	School - Spray Booth	D6 Setback Exclusion
House of Kevin Inc.	5035 Noth Service road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Design Build - Spray Booth	D6 Setback Exclusion
Hunter Amenities International Ltd.	1205 Corporate Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Spa Supplier - HVAC	D6 Setback Exclusion
InnVest Hotels GP Ltd.	975 Syscon Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Office - HVAC	D6 Setback Exclusion
Islip Flow Controls	1145 Sutton Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Industrial Strainer Manufacturer	No Data Exclusion
Lairman A. Lowe	750 Darlene Court	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Autobody - Spray Booth	D6 Setback Exclusion
Natirx Separations Inc.	5295 John Lucas Drive	Burlington	1000m	Class 1	Yes	Yes	No	No	No	No	—	Manufacturing of Membranes	D6 Setback Exclusion
Newalta Corporation	1100 Burloak Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Office - HVAC, Standby Gen.	D6 Setback Exclusion
Philip Analytical Services Inc.	5555 North Service Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Laboratory	D6 Setback Exclusion
Redbourne Realty Advisors Inc.	5500 North Service Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Office - HVAC	D6 Setback Exclusion
Semtech Canada Corporation	4281 Harvester Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Electronics Manufacturer - HVAC	D6 Setback Exclusion
Strongco Limited Partnership	1051 Heritage Road	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Mining Equipment Distributor	D6 Setback Exclusion
Tempel Canada Company	5055 Benson Drive	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Steel Laminating - Powder Coating	D6 Setback Exclusion
Tyco Valves & Controls Canada Inc.	1080 Clay Avenue	Burlington	1000m	Class 1	Yes	No	Yes	No	No	No	—	Manufacturer of Valves	D6 Setback Exclusion
Whiting Door Manufacturing Limited	3435 South Service Road	Burlington	1000m	Class 1	Yes	Yes	No	No	No	No	—	Door Manufacturing	D6 Setback Exclusion
Atotech Canada Ltd.	1180 Corporate Drive	Burlington	1000m	Class 2	Yes	Yes	No	Yes	No	No	PM10	Plating services	Included
Baycomp Company	5035 Noth Service road	Burlington	1000m	Class 2	Yes	Yes	No	No	No	No	—	Fiberglass Product Manufacturing	D6 Setback Exclusion
Capo Industries Limted	1200 Corporate Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Chemical Manufacturing	D6 Setback Exclusion
Gentek Building Products Limited	1001 Corporate Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Building Products	D6 Setback Exclusion
Goodrich Aerospace Canada Ltd.	5415 North Service Road	Burlington	1000m	Class 2	Yes	Yes	No	Yes	No	No	VOCs	Aerospace Manufacturing	No speciated VOCs Exclusion
Irco Automation Inc.	1080 Clay Avenue	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Manufacturer of Welding Equipment	D6 Setback Exclusion
M.G. Chemicals Ltd.	1210 Corporate Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Chemical Manufacturing	D6 Setback Exclusion
Marswell Metal Industries Ltd.	4130 Morris Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Lead Casting Facility	D6 Setback Exclusion
Samuel, Son & Co., Limited	1250 Appleby Line	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Manufacturing - Carpentry, HVAC	D6 Setback Exclusion
TCI Powder Coating Canada Inc.	1435 Norjohn Court	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Powder Coating	D6 Setback Exclusion
Wheelabrator & BCP Products	1219 Corporate Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Manufacturing - Spray Booth	D6 Setback Exclusion
Zeton Inc.	455 Michigan Drive	Burlington	1000m	Class 2	Yes	No	Yes	No	No	No	—	Pilot Plant Design - Spray Booth, HVAC	D6 Setback Exclusion
Suncor Energy Products Partnership	3275 Rebecca Street	Oakville	1000m	Class 3	Yes	Yes	No	Yes	No	No	VOCs	Petroleum Product Wholesaler-Distributer	No speciated VOCs Exclusion
Laurel Steel, A division of Harris Steel ULC	5400 Harvester Road	Burlington	1000m	Class 2	Yes	No	No	Yes	No	No	—	Steel Product Manufacturing from Purchased Steel	D6 Setback Exclusion
Triple M Burlington	961 Zelco Dr	Burlington	1000m	Class 2	No	No	No	No	Yes	No	—	Scrap metal recycling company	No Data Exclusion
Dominion Nickel Alloys	834 Appleby Line	Burlington	HUB	Class 2	No	No	No	No	Yes	No	—	Scrap metal recycling company	No Data Exclusion

Notes:
ECA - Environmental Compliance Approval
ECALOF - ECA with Limited Operational Flexibility

Limitations

Limitations

- The work performed in the preparation of this report and the conclusions presented herein are subject to the following:
    a. The contract between Wood 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 Wood to the Client in connection to the Contract; and
    c. The limitations stated herein.
- **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.
- **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.
- **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.
- **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.
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