

Tim Horton's Air Quality Assessment

**16054, 16060 & 16068 Airport Road
Caledon, ON**

**SLR Project No: 241.20201.00000
Town File No: POPA 19-07, RZ 19-10, SPA 19-66**

May 31, 2022



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Caledon, ON
SLR Project No: 241.20201.00000**

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May 31, 2022

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INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) was retained by Ganni Properties Inc. to complete an air quality assessment for the town of Caledon in support of the proposed Tim Horton’s Restaurant on 16054, 16060, and 16068 Airport Road in Caledon, Ontario.

Through the planning process, concerns have been raised regarding changes to air quality in the area resulting from the increase in road traffic due to the new restaurant. As a result, the city planners have asked that an assessment of the impacts of the development on local air quality be conducted.

This report assesses the potential air quality impacts of the increased vehicle emissions from the proposed restaurant on the surrounding area. The study area is shown in **Figure 1**.

1.1 DESCRIPTION OF DEVELOPMENT

The proposed development is located at 16054, 16060, 16068 Airport Road, between Walker Road West and Old Church Road, in Caledon. The site is currently occupied by two single dwelling residences. Both residences will be removed and replaced with a single storey Tim Horton’s restaurant with a drive-through.

The site context is shown in **Figure 1**. Immediately to the east of the site is Airport Road with houses facing onto the roadway. Residential lots surround the proposed development in all directions.



Figure 1: Site Context Plan

1.2 STUDY APPROACH

The following approach was followed to determine the potential for air quality impacts to occur. A local study area of 500 m, extending 250 m in either direction from the proposed Tim Horton’s was defined to be the study area. Potential impacts due to increased traffic from the proposed development were assessed by comparing the total vehicle emissions from the proposed Tim Horton’s to vehicle emissions on Airport Road in the absence of the project. Total emissions were determined based on the length of the roadway, traffic volumes and vehicle emission rates. Dispersion modelling was then conducted to predict air quality impacts from vehicle emissions surrounding the proposed Tim Horton’s restaurant.

CONTAMINANTS OF INTEREST

Three of the criteria air contaminants typically considered as contaminants of interest from motor vehicle emissions were selected to be representative of air quality impacts for this project. A summary of these contaminants is provided in **Table 1.**

Table 1: Contaminants of Interest

| Contaminants | |
|--|-------------------|
| Name | Symbol |
| Oxides of Nitrogen | NO _x |
| Carbon Monoxide | CO |
| Fine Particulate Matter (<2.5 microns in diameter) | PM _{2.5} |

1.3 APPLICABLE GUIDELINES

There are no guidelines which specifically apply to this type of project, which includes vehicle emissions at a restaurant drive-through. Restaurants are not required to obtain air quality permits, and vehicle activity is not typically considered within air permits. Air quality impacts from transportation sources are normally only assessed on either:

- a) A regional basis, as part of large-scale impact assessments; or
- b) When a new or expanded roadway is proposed by the province, as part of a Class Environmental Assessment process.

The Ontario Ministry of the Environment, Conservation and Park (MECP) D-series of guidelines outline the required types of air quality, noise and vibration studies which should be performed form land use planning applications. None of the D-Series guidelines requires an assessment of transportation air quality impacts.

In order to determine air quality impacts from the proposed Tim Horton’s restaurant, the predicted concentrations were compared to guidelines established by government agencies and organizations. Relevant agencies and organizations in Canada and their applicable contaminant guidelines are:

- MECP Ambient Air Quality Criteria (AAQC);
- Canadian Ambient Air Quality Standards (CAAQS).

Within the guidelines, the threshold value for each contaminant and its applicable averaging period were used to assess the maximum predicted impact offsite, determined through dispersion modelling. The contaminants of interest are compared against 1-hour, 8-hour, 24-hour, and annual averaging periods. The threshold values and averaging periods used in this assessment are presented in **Table 2**.

Table 2: Applicable Contaminant Guidelines

| Contaminant | Averaging Period (hrs) | Threshold Value ($\mu\text{g}/\text{m}^3$) | Source |
|------------------------------|------------------------|--|---|
| NO _x ¹ | 1 | 400 | AAQC |
| | 24 | 200 | AAQC |
| CO | 1 | 36,200 | AAQC |
| | 8 | 15,700 | AAQC |
| PM _{2.5} | 24 | 27 ^[1] | CAAQS (standard is to be phased-in in 2020) |
| | Annual | 8.8 ^[2] | CAAQS |

[1] The 24-hr PM_{2.5} CAAQS is based on the 3-year average of the annual 98th percentile of the 24-hr average concentrations

[2] The annual PM_{2.5} CAAQS is based on the average of the three highest annual average values over the study period

AIR QUALITY ASSESSMENT

To determine potential air quality impacts from the proposed Tim Horton’s restaurant, an emissions inventory was prepared to determine the relative contribution of emissions from the Tim Horton’s in comparison to local roadway emissions from Airport Road. Then dispersion modelling was conducted to predict offsite concentrations of contaminants of interest surrounding the proposed Tim Hortons restaurant.

2.1 ROAD TRAFFIC DATA

Traffic volumes were obtained from the traffic report completed by Nextrans consulting engineers. The Future (2024) background traffic levels (i.e. without traffic from the Tim Horton’s) were used to complete an emissions inventory for Airport Road. Site traffic trip generation data projected for 2024 was used to complete the emissions inventory for the Tim Horton’s.

Peak hour traffic volumes were provided. A typical conversion factor of 10 was used to determine Annual Average Daily Traffic (AADT) volumes. The traffic volumes used in the assessment are provided in **Table 4**. A heavy-duty vehicle percentage of 5% was applied in this study, which is considered typical for an arterial road such as Airport Road.

Table 3: Traffic Volumes

| Roadway Section | Annual Average Daily Traffic (AADT) | Medium/Heavy Duty Vehicle Percentage | Vehicle Speed (km/hr) |
|-----------------|-------------------------------------|--------------------------------------|-----------------------|
| Airport Road | 8830 | 5% | 50 |
| Tim Horton’s | 510 | 5% | 20/idle |

2.2 MOTOR VEHICLE EMISSION RATES

The U.S. EPA’s Motor Vehicle Emission Simulator (MOVES) model provides estimates of current and future emission rates from motor vehicles based on a variety of factors such as local meteorology, vehicle fleet composition and speed. MOVES 2014b, released in December 2018, is the U.S. EPA’s latest tool for estimating vehicle emissions due to the combustion of fuel, brake and tire wear, fuel evaporation, permeation, and refueling leaks. This model is accepted by the Province of Ontario for determining vehicle emissions for large roadway projects.

The model is based on “an analysis of millions of emission test results and considerable advances in the Agency’s understanding of vehicle emissions and accounts for changes in emissions due to proposed standards and regulations”. For this project, MOVES was used to estimate vehicle emissions based on vehicle type, road type, model year, and vehicle speed. Emission rates were estimated for the year 2024, for a heavy-duty vehicle percentage of 5%. Vehicle age was based on the U.S. EPA’s default distribution.

From the MOVES outputs, the highest monthly value for each contaminant was selected to represent a worst-case emission rate. The emission rates for each contaminant modelled for a vehicle speed of 100 km/hr are shown in **Table 4**. Emission rates are provided in grams per vehicle mile travelled (g/VMT).

Table 4: MOVES Emission Rates by Contaminant

| Pollutant | Driving Emission – 50 km/hr (g/VMT) | Driving Emission – 20 km/hr (g/VMT) | Idling Emission – (g/hr) |
|--------------------|-------------------------------------|-------------------------------------|--------------------------|
| Carbon Monoxide | 1.90 | 3.04 | 4.71 |
| Oxides of Nitrogen | 0.13 | 0.17 | 0.81 |
| PM2.5 | 0.014 | 0.025 | 0.072 |

2.3 EMISSIONS INVENTORY

To understand the overall impact of vehicle emissions from the proposed Tim Horton’s restaurant, an emissions inventory was completed. The inventory compares emissions from vehicles in the Tim Horton’s drive-through to total vehicle emissions from Airport Road, in the absence of the project. To determine total emissions per day, the MOVES emission rates were multiplied by the daily traffic volumes and distance travelled. In the case of idling vehicles at the Tim Hortons, it was assumed each vehicle would idle for 5 minutes at the drive-through. It was conservatively assumed all vehicles would travel the 175 m through the drive-through at 20 km/hr and also idle for 5 minutes while on-site. The study area is to be considered a 500 m area, extending 250 m from the Tim Hortons in either direction. The results of the emissions inventory are presented in **Table 5**. As can be seen from the emissions inventory, the total emissions from the Tim Horton’s drive-through are generally considered small in comparison to vehicle emissions from the nearby Airport Road, with emissions from the drive-through being 13% or less of the emissions from Airport Road. Note the completed inventory is conservative, as it considers all vehicles to travel through the drive-through at 20-km/hr and idle for 5 minutes, which is expected to be a worst-case scenario which may only occur during peak hours.

Table 5: Emissions Inventory

| Emissions Source | Annual Average Daily Traffic (AADT) | Distance/Time | Daily NO _x Emissions (g/day) | Daily CO Emissions (g/day) | Daily PM _{2.5} Emissions (g/day) |
|--|-------------------------------------|---------------|---|----------------------------|---|
| Airport Road | 8830 | 500 m | 346 | 5,223 | 37 |
| Tim Horton's (Driving 20 km/hr) | 510 | 175 m | 9.7 | 168 | 1.41 |
| Tim Horton's Drive Thru | 510 | 5 minutes | 34 | 200 | 3 |
| TOTAL Tim Hortons | | | 44 | 368 | 4.5 |
| Tim Hortons Emissions as percentage of Airport Road Emissions | | | 13% | 7% | 12% |

2.4 AIR DISPERSION MODELLING

To further predict the air quality impacts from the drive-through on the surrounding lands, dispersion modelling of on-site vehicle activity at the proposed Tim Horton's was conducted. Air dispersion modelling was conducted using the MECP approved version of the US EPA AERMOD Model, version 19191. The Tim Horton's site was modelled utilizing volume line sources and following US EPA guidance for plume width, plume height and release height.

Similar to the emissions inventory, it was conservatively assumed all vehicles would travel the 175 m through the drive-through at 20 km/hr and also idle for 5 minutes while on-site. Vehicle emissions were modelled utilizing MOVES emission rates. Variable emissions by hour of day were modelled to account for changes in traffic volumes throughout the day, using the US EPA hourly distribution for urban roadways. Modelling was conducted in accordance with the Ontario Air Dispersion Modelling Guideline. **Appendix A** shows images of the AERMOD model inputs including source and receptor locations.

In the modelling assessment, a nested grid of receptors was placed at grade-level surrounding the proposed site to predict impacts at the property line and beyond.

The maximum concentrations of each contaminant predicted for the area surrounding the proposed Tim Horton's are provided in **Table 6** with corresponding averaging periods.

The predicted concentrations for each contaminant are well below the applicable threshold values. Therefore, though not a requirement, emissions from vehicle emissions at the proposed Tim Hortons would meet the applicable air quality guidelines at the property line and surrounding residences.

The highest maximum concentration is 3.01% of the 1-hour guideline for nitrogen oxides (NO_x). A contour plot showing the predicted 1-hour NO_x concentrations is provided in **Appendix A**.

Table 6: Maximum Predicted Concentrations

| Contaminant | Averaging Period | Threshold (µg/m ³) | Maximum Model Concentration (µg/m ³) | Percentage of Threshold |
|--------------------|------------------|--------------------------------|--|-------------------------|
| Carbon Monoxide | 1-Hour | 36,200 | 94 | 0.26% |
| | 8-Hour | 15,700 | 38 | 0.24% |
| Oxides of Nitrogen | 1-Hour | 400 | 12 | 3.01% |
| | 24-Hour | 200 | 4.1 | 2.06% |
| PM2.5 | 24-Hour | 27 | 0.32 | 1.19% |
| | Annual | 8.8 | 0.06 | 0.67% |

2.5 RWDI PEER REVIEW RESPONSE

Initially, an air quality assessment was completed for this site in December of 2020. The report is entitled *Tim Horton’s Air Quality Assessment, 16054 & 16060 Airport Road* dated December 8, 2020, (completed by SLR) and provides details of the completed air quality study.

RWDI was subsequently retained by the Town of Caledon (Town) to conduct a peer review of the initial air quality study. Provided below is our response to the comments noted in the peer review prepared by RWDI.

Overall, the conclusions of the completed peer review generally agreed with the methodology and findings of the air quality assessment completed by SLR. One concern was raised, noting that the assessment did not consider background air quality concentrations when comparing the model results against the Ontario Ambient Air Quality Criteria (AAQC) and Canadian Ambient Air Quality Standard (CAAQS) benchmarks.

For completeness and in response to the peer review comments, background concentrations were summarized and added to the model results for comparison against applicable benchmarks.

Background concentrations were determined for the criteria air contaminants (CACs) considered in the assessment (carbon monoxide, oxides of nitrogen and fine particulate matter – PM2.5) from the nearest Ministry of Environment, Conservation and Parks (MECP) monitoring station to the site, which is located in Brampton (ID 46089). Note that carbon monoxide is only measured at select stations in Ontario, therefore, this data was taken from the Toronto West Station (ID 35125) as it is not monitored in Brampton. The 90th percentile background concentrations for each contaminant and applicable averaging period were calculated based on the most recent five years of monitoring data, from 1996-2020. The 90th percentile value is considered to be a conservative representation of background concentrations in the area and is typically considered in cumulative assessments. The 90th percentile background concentrations were combined with maximum model concentrations to determine cumulative concentrations for comparison against the applicable benchmarks. The combined concentrations are presented in **Table 7** below.

Table 7: Maximum Predicted Concentrations

| Contaminant | Averaging Period | Threshold (µg/m ³) | Maximum Model Concentration (µg/m ³) | 90 th Percentile Background Concentration (µg/m ³) | Combined Concentration (µg/m ³) | Percentage of Threshold |
|--------------------|------------------|--------------------------------|--|---|---|-------------------------|
| Carbon Monoxide | 1-Hour | 36,200 | 94 | 409 | 503 | 1% |
| | 8-Hour | 15,700 | 38 | 400 | 438 | 3% |
| Oxides of Nitrogen | 1-Hour | 400 | 12 | 47 | 59 | 15% |
| | 24-Hour | 200 | 4.1 | 43 | 47.1 | 24% |
| PM _{2.5} | 24-Hour | 27 | 0.32 | 12 | 12.32 | 46% |
| | Annual | 8.8 | 0.058 | 7.3 | 7.36 | 84% |

When considering background concentrations, the cumulative worst-case predicted concentrations remain below the applicable benchmarks for all contaminants assessed. The highest maximum concentration is 84% of the annual PM_{2.5} CAAQS value. Note that in all cases, the combined concentrations are dominated by the background concentrations.

CONCLUSIONS

A local air quality study for the proposed Tim Horton’s Restaurant on Airport Road has been completed, based on a review of total vehicle emissions within the study area and dispersion modelling.

The emissions inventory found that total emissions from the Tim Horton’s restaurant will be equal to 13% or less of the total vehicle emissions on Airport Road. Air dispersion modelling showed that maximum predicted contaminant concentrations are below the applicable guidelines for all the contaminants and averaging periods at the Tim Horton’s property line and beyond.

The combined results of the background concentrations and the maximum predicted model concentrations showed all predicted contaminant concentrations to be below the applicable benchmark values for the applicable averaging periods at the Tim Horton’s property line and beyond.

Based on the updated results of the assessment, the conclusions remain the same. The small increase in vehicle emissions from the Tim Horton’s will have a negligible impact on local air quality.

REFERENCES

Ontario Ministry of the Environment, Conservation & Parks (MECP, 2017), Air Dispersion Modelling Guideline for Ontario [Guideline A-11]

Ontario Publication 6570e, 2008. *Ontario's Ambient Air Quality Criteria*. Standards Development Branch, Ontario Ministry of the Environment

Ontario Regulation 419/01 – *Local Air Quality*.

United States Environmental Protection Agency, 2018. *MOVES 2014b Highway Vehicles: Population and Activity Data*. USEPA.

STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Ganni Properties Inc., hereafter referred to as the “Client”. It is intended for the sole and exclusive use of the Client. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

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 **Appendix A**
AERMOD Results



data: © HERE.com

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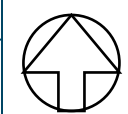
UTM East [m]

GANNI PROPERTIES INC.

TIM HORTON'S AIR QUALITY ASSESSMENT

LINE VOLUME SOURCE AND BUILDING

True North



Scale: 1:1,630

Date: May 31, 2022

Project No. 241.20201.00000

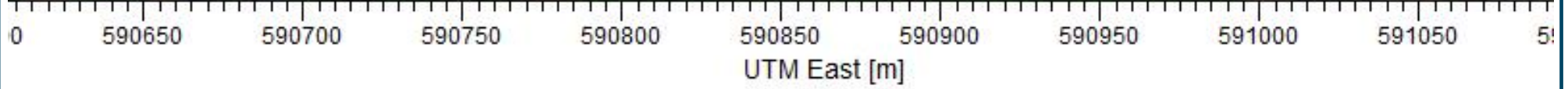
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Figure No.
1

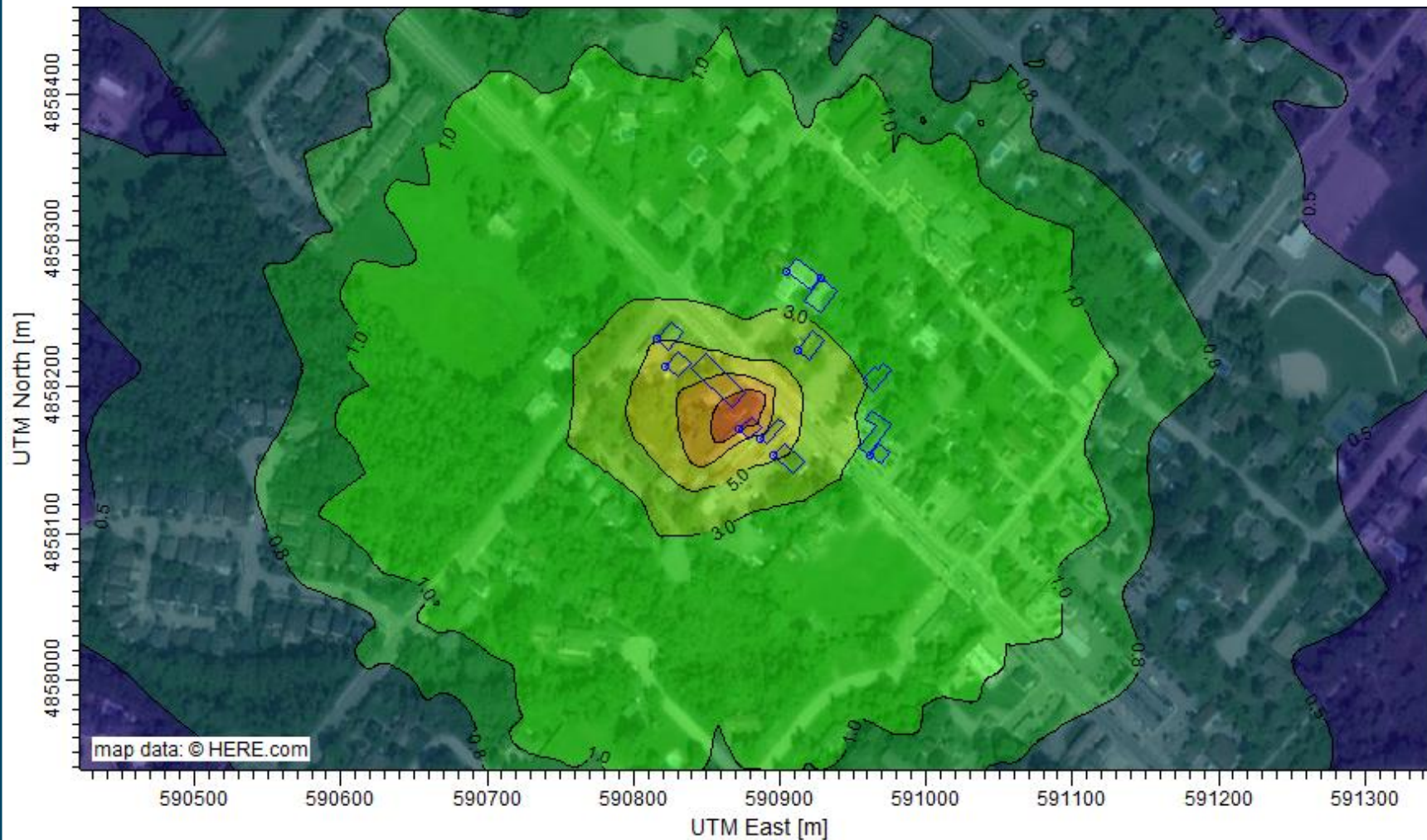




ta: © HERE.com



| | | | | |
|--|---|------------------------------------|-------------------|---|
| <p>GANNI PROPERTIES INC.</p> | <p>True North</p> | <p>Scale: 1:2,450</p> | <p>METRES</p> |  |
| <p>TIM HORTON'S AIR QUALITY ASSESSMENT</p> |  | <p>Date: May 31, 2022</p> | <p>Figure No.</p> | |
| <p>RECEPTOR GRID</p> | | <p>Project No. 241.20201.00000</p> | <p>2</p> | |



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TIM HORTON'S AIR QUALITY ASSESSMENT

1 HOUR NOX CONCENTRATION CONTOUR

True North



Scale: 1:3,250

Date: May 31, 2022

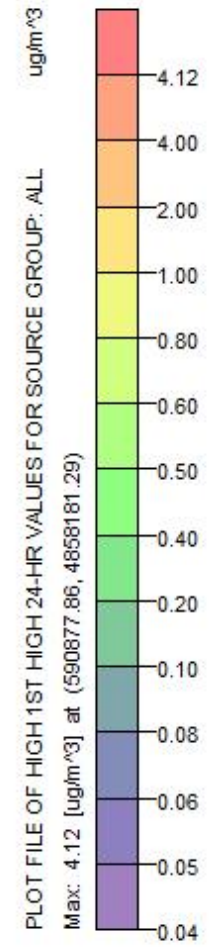
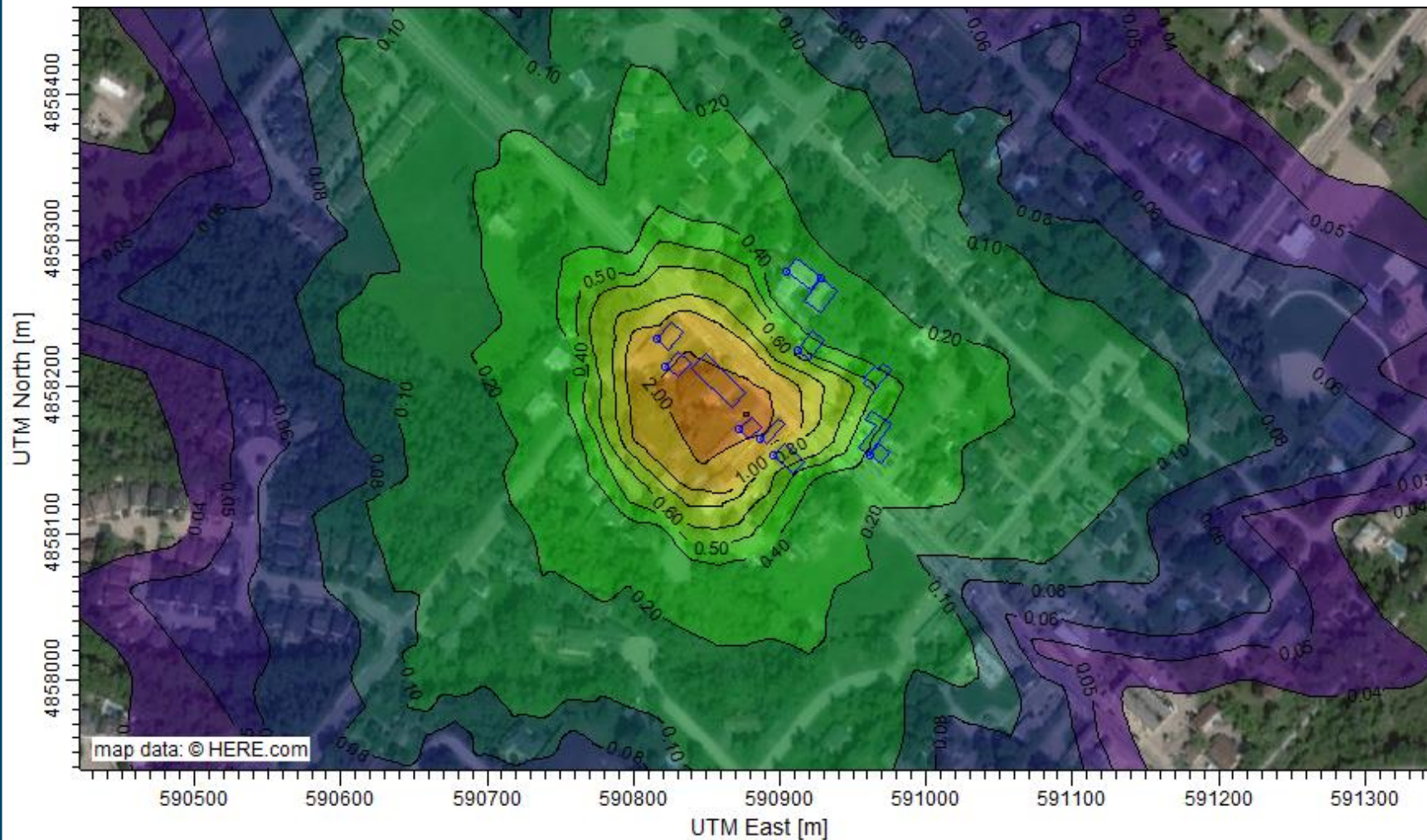
Project No. 241.20201.00000

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Figure No.

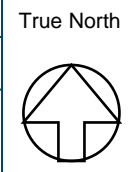
3





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TIM HORTON'S AIR QUALITY ASSESSMENT
 24 HOUR NOX CONCENTRATION CONTOUR



Scale: 1:3,250
 Date: May 31, 2022
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METRES
 Figure No. **4**

