Air Quality Assessment DRAFT

Eglinton East LRT

HDR. Inc.

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Making Sustainability Happen

Revision Record

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A (00)	December 22, 2023	Draft Version 1
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Executive Summary

SLR Consulting (Canada) Ltd., was retained by HDR Inc., on behalf of the City of Toronto to conduct an environmental air quality assessment in the City of Toronto, Ontario. The purpose of the study is to address the proposed Eglinton East Light Rail Transit (EELRT) Project. The proposed EELRT will operate along Eglinton Avenue, Kingston Road, Morningside Avenue, Ellesmere Road, Military Trail, Sheppard Avenue East, and Neilson Road. This work is being done as part of the TPAP (Transit Project Assessment Process) for the overall 10% design Environmental Project Report (EPR). The study length is approximately 18 kilometers with 27 proposed stops. The assessment is intended to address noise and vibration portions following Ontario Regulation 231/08: Transit Project and Metrolinx Undertakings (O.Reg. 231/08) for the City of Toronto (City) to obtain a Notice to Proceed for the EELRT from the Minister of the Environment, Conservation, and Parks (MECP). This assessment has considered:

- Transportation-related air pollution.

In particular, the Air Quality Assessment objectives are as follows:

- Review and summarize available pollutant ambient monitoring data from nearest MECP/Environment Canada monitoring stations to establish baseline conditions;
- Complete an emissions inventory for the No Build (existing) and Future Build (with EELRT) operations;
- Conduct Air Dispersion Modelling (ADM) to assess air quality impacts from the Maintenance and Storage Facility (MSF);
- Conduct ADM to assess air quality impacts from idling bus vehicles at a representative worst case bus station location;
- Review proposed construction activities, identify nearby sensitive receptor locations and prepare a Construction Air Quality Management Plan. The plan will describe the potential impacts from construction activities and outline general mitigation measures and best management practices to reduce emissions.

The potential environmental air quality impacts of the proposed undertaking have been assessed. Both operational and construction air quality impacts have been considered. The conclusions and recommendations are as follows:

- An emissions inventory of vehicle traffic along the main line route has been completed, examining “future build” (with the EELRT in place) and “future no-build” (assuming the EELRT is not constructed) scenarios. The proposed EELRT system will result in a decrease in vehicle-related emissions along the route, which would result in improvements in local air quality.
- Specific air quality impacts from the Maintenance and Storage Facility and from new bus stations along the line were assessed. Air dispersion modelling was conducted. All provincial standards at the property line. Minor excesses of the annual Canadian Ambient Air Quality Standards (CAAQS) due to the fact the background concentrations already exceed the criteria. In these situations, contributions from the MSF and bus stations will be less than 2% of the total. The results show that the MSF and bus stations will have negligible effects on air quality in the area.
- The predicted maximum concentrations at sensitive receptors were conservatively combined with the 90th percentile of the background concentrations for the assessment. data for both the MSF and the worst-case transit vehicle station

- A screening level assessment of greenhouse gases from the project (GHG). The proposed EELRT system will result in decrease in vehicle-related GHG emissions by 17.5%.
- Guidance has been provided for addressing fugitive dust emissions from construction. This should in included in a code of practice for future Contactors to reduce the potential for air quality impacts during the construction phase of the project.

Table of Contents

Tables in Text

Appended Figures

1.0 Introduction

SLR Consulting (Canada) Ltd., was retained by HDR Inc., on behalf of the City of Toronto to conduct an environmental air quality assessment in the City of Toronto, Ontario. The purpose of the study is to address the proposed Eglinton East Light-rail Transit (EELRT) as part of the TPAP (Transit Project Assessment Process). This work is being done to contribute to the overall 10% design Environmental Project Report (EPR).

The assessment is intended to address air quality portions of the Ontario Regulation 231/08: Transit Project and Metrolinx Undertakings (O. Reg. 231/08) in order for the City of Toronto (City) to obtain a Notice to Proceed for the EELRT from the Minister of the Environment, Conservation, and Parks (MECP).

In this assessment, SLR has reviewed the surrounding area with respect to the following guidelines:

- Public Health Toronto report "City of Toronto. Avoiding the TRAP: Traffic-Related Air Pollution in Toronto and Options for Reducing Exposure. Technical Report", dated October 2017;
- MTO's Environmental Guide for Assessment and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects;
- MECP Ambient Air Quality Criteria (AAQC);
- Health Canada/Environment Canada National Ambient Air Quality Objectives (NAAQOs); and
- Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS).

1.1 Project Understanding

The Eglinton East Light-Rail Transit (EELRT) is a 18 kilometer project that includes up to 27 stops, three connections to GO Transit (Kennedy, Eglinton & Guildwood), and connection to the proposed Durham-Scarborough Bus Rapid Transit. Of particular importance, the EELRT will serve historically underserved communities in the City travelling through or adjacent to seven Neighbourhood Improvement Areas (NIAs) and would bring higher-order transit to within walking distance of an additional 49,000 people, including an equity-weighted population of 30,000. A context plan and overview of the study area for the project is shown in **Figure 1**.

The EELRT network is divided into three major project areas or components:

1 Kennedy Station to Malvern alignment;

2 Maintenance and Storage Facility, north of Sheppard Avenue and Conlins Road;

3 McCowan to Neilson alignment along Sheppard Avenue.

1.2 Report Objectives

The main objectives of the study are as follows:

1 To identify air quality contaminants of interest, applicable guideline limits, and existing local background concentrations.

2 To assess the effect of LRT operations on local air quality impacts along the alignment from Kennedy Station to Sheppard and McCowan, as well as the branch from Sheppard and Neilson to Malvern Town Centre, by completing an emissions inventory for “future build” (with the EELRT in place) and “future no-build” scenarios (assuming the EELRT is not constructed).

3 To examine specific air quality impacts from the Maintenance and Storage Facility and from new bus stations along the line.

4 To provide a screening level assessment of greenhouse gases from the project (GHG).

5 To provide guidance for addressing fugitive dust emissions from construction.

2.0 Air Quality Contaminants of Interest

The contaminants of interest from transit fleet vehicle emissions are based on the regularly assessed contaminants of interest for transportation assessments in Ontario, as determined by the Ministry of Transportation Ontario (MTO) and Ministry of Environment, Conservation and Parks (MECP). Motor vehicle emissions have largely been determined by scientists and engineers with United States and Canadian government agencies such as the U.S. Environmental Protection Agency (EPA), the MECP, Environment Canada (EC), Health Canada (HC), and the MTO. These contaminants are emitted due to fuel combustion, brake wear, tire wear, the breakdown of dust on the roadway, fuel leaks, evaporation and permeation, and refuelling leaks and spills as illustrated in **Figure 2**. Note that emissions related to refuelling leaks and spills are not applicable to motor vehicle emissions from roadway travel. Instead, these emissions contribute to the overall background levels of the applicable contaminants. All of the selected contaminants are emitted during fuel combustion, while emissions from brake wear, tire wear, and breakdown of road dust include only the particulates. A summary of these contaminants is provided in **Table 1**. In addition to the contaminants presented in **Table 1**, greenhouse gases (GHG) will be assessed for the Project however, GHG’s are not monitored and are not included as part of the baseline conditions.

Table 1: Contaminants of Interest Associated with Vehicle Emissions

Criteria Air Contaminants		Volatile Organic Compounds (VOCs)		Polycyclic Aromatic Hydrocarbons (PAH)	
Name	Symbol	Name	Symbol	Name	Symbol
Nitrogen Dioxide	NO_2	Acetaldehyde	C_2H_4O	Benzo[a]Pyrene	$C_{20}H_{12}$
Carbon Monoxide	CO	Acrolein	C_3H_4O		
Fine Particulate Matter (<2.5 microns in diameter)	$PM_{2.5}$	Formaldehyde	CH_2O		
Coarse Particulate Matter (<10 microns in diameter)	PM_{10}	1,3-Butadiene	C_4H_6		
Total Suspended Particulate Matter (<44 microns in diameter)	TSP	Benzene	C_6H_6		

3.0 Applicable Guidelines

In order to understand the existing conditions in the study area, ambient background concentrations should be compared to guidelines established by government agencies and organizations. Relevant agencies and organizations in Ontario and Canada, and their applicable contaminant guidelines are:

- MECP Ambient Air Quality Criteria (AAQC);
- Health Canada/Environment Canada National Ambient Air Quality Objectives (NAAQOs); and
- Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS).

The threshold values and averaging periods regularly used in air quality assessments are presented in **Table 2**.

Table 2: Applicable Contaminant Guidelines

Contaminant	Averaging Period (hrs)	Threshold Value ($\mu g/m^3$)	Source
NO_2	1	400	AAQC
	24	200	AAQC
	1	42 ppb[1]	CAAQS (standard is to be phased-in in 2025)
	Annual	12 ppb[2]	CAAQS (standard is to be phased-in in 2025)
SO_2	1	106	AAQC
	Annual	10.6	AAQC
	1	65 ppb[3]	CAAQS
	Annual	4 ppb[4]	CAAQS
CO	1	36,200	AAQC
	8	15,700	AAQC
$PM_{2.5}$	24	27[5]	CAAQS
	Annual	8.8[6]	CAAQS
PM_{10}	24	50	Interim AAQC
TSP	24	120	AAQC
Acetaldehyde	24	500	AAQC
Acrolein	1	4.5	AAQC
	24	0.4	AAQC
Benzene	24	2.3	AAQC
	Annual	0.45	AAQC
1,3-Butadiene	24	10	AAQC
	Annual	2	AAQC
Formaldehyde	24	65	AAQC

Contaminant	Averaging Period (hrs)	Threshold Value ($\mu g/m^3$)	Source
Benzo[a]Pyrene	24	0.00005	AAQC
	Annual	0.00001	AAQC

Notes:
[1] The 1-hour NO_2 CAAQs is based on the 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations.
[2] The annual NO_2 CAAQs is based on the average over a single calendar year of all the 1-hour average NO_2 concentrations.
[3] The 1-hour SO_2 CAAQs is based on the 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations.
[4] The annual SO_2 CAAQs is based on the average over a single calendar year of all the 1-hour average SO_2 concentrations.
[5] 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.
[6] The annual $PM_{2.5}$ CAAQS is based on the average of the three highest annual average values over the study period.

4.0 Local Background Concentrations

A review of MECP and NAPS ambient monitoring stations in Ontario was undertaken to identify the monitoring stations that are in relative proximity to the study area and that would be representative of background contaminant concentrations. The nearest monitoring stations to the study area are shown in **Table 3**. Background concentrations from these stations are summarized for the available contaminants of interest from 2017 to 2021. Note that CO is only monitored at the Toronto West Station. In addition, Windsor is the only station in Ontario at which background concentrations of Acrolein, Formaldehyde and Acetaldehyde are measured in recent years. Only these contaminants were considered from the Windsor station. The locations of the relevant ambient monitoring stations in relation to the study area are shown in **Figure 3**.

Two NAPS stations were considered for the Benzo[a]Pyrene ambient background data. It was found that the available ambient Benzo[a]Pyrene data was measured at inconsistent frequencies and time intervals. Therefore, the 90^{th} percentile value of all measured concentrations between 2016 to 2021 at the Toronto West NAPS station, and between 2010 to 2014 at the Toronto Gage NAPS Station are provided, rather than the maximum, 90^{th} and average concentrations. It should be noted that PM_{10} and TSP were calculated based on their relationship to $PM_{2.5}$.

Table 4 shows the selected worst-case monitoring station for the various contaminants considered in the assessment. A detailed statistical analysis of the selected worst-case background monitoring station for each of the contaminants of interest was performed. **Figure 4** shows a summary of the maximum background concentrations at for each contaminant and various averaging periods at the worst-case ambient monitoring station.

The NO_2 CAAQS guidelines, benzene annual, and Benzo[a]Pyrene guidelines are exceeded. It should be noted that the assessment was done on a conservative approach comparing maximum, 90^{th} percentile, and average concentration to standards. Note that Benzo[a]Pyrene is not shown on this graph, due to the fact that it exceeds the guideline by a significant amount and therefore skews the scale. For the remaining contaminants and averaging periods, the ambient concentrations meet the respective guidelines.

Table 3: Relevant MECP and NAPS Station Information

City/Town	Station ID	Location	Operator	Contaminants
Toronto North	34020	Hendon Ave./Young St.	MECP	CO | NO_2 | $PM_{2.5}$
Toronto West	35125	125 Resources Rd	MECP	CO | NO_2 | $PM_{2.5}$
Toronto East	33003	Kennedy Rd./Lawrence Ave. E.	MECP	CO | NO_2 | $PM_{2.5}$
Toronto Downtown	31103	Bay St./Wellesley St. W.	MECP	CO | NO_2 | $PM_{2.5}$
Toronto West Roadside	60438	401W - 125 Resources Road	NAPS	Benzo[a]Pyrene
Toronto Gage Institute	60427	223 College Street	NAPS	Benzo[a]Pyrene
Etobicoke West	60413	Elmcrest Road	NAPS	1,3-Butadiene | Benzene
Etobicoke South	60435	461 Kipling Ave.	NAPS	1,3-Butadiene | Benzene
Windsor	60211	College St/Prince St	NAPS	Formaldehyde | Acetaldehyde | Acrolein

Table 4: Ambient Background Concentration

Contaminant	Averaging Period (hrs)	Threshold Value (µg/m^3)	Maximum Ambient Concentration (µg/m^3)	90th Percentile Ambient Concentration (µg/m^3)	Average Ambient Concentration (µg/m^3)	Worst-Case Station
NO_2	1	400	155	42	20	Toronto East
	24	200	81	44	27	Toronto West
	1	79[1]	-	42	-	Toronto West
	Annual	23[2]	30	-		Toronto West
CO	1	36,200	1866	409	286	Toronto West
	8	15,700	1294	391	284	Toronto West
$PM_{2.5}$	24	27[3]	-	20	-	Toronto East
	Annual	8.8[4]	-	-	8	Toronto West
PM_{10}	24	50	80	23	14	Toronto West
TSP	24	120	144	41	25	Toronto West
Acetaldehyde	24	500	3	2	1	Windsor
Acrolein	24	0.4	0.12	0.07	0.06	Windsor
	1	4.4	0.12	0.07	0.06	Windsor
Benzene	Annual	0.45	-	-	0.93	Etobicoke South
	24	2.3	1.48	1.07	0.60	Etobicoke South
1,3-Butadiene	24	10	0.22	0.09	0.05	Etobicoke West
	Annual	2	-	-	0.08	Etobicoke West
Formaldehyde	24	65	4	3	2	Windsor
Benzo[a]Pyrene	24	0.00005	-	0.00013	-	Toronto Gage
	Annual	0.00001	-	-	0.00011	Toronto Gage

Notes:
[1] The 1-hour NO_2 CAAQS is based on the 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations.
[2] The annual NO_2 CAAQS is based on the average over a single calendar year of all the 1-hour average NO_2 concentrations.
[3] 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.
[4] The annual $PM_{2.5}$ CAAQS is based on the average of the three highest annual average values over the study period.

4.1 Summary of Ambient Background Review

A review of MECP and NAPS ambient monitoring stations in Ontario was undertaken to identify the monitoring stations that are in relative proximity to the study area and that would be representative of background contaminant concentrations in the study area. This report is presenting a summary of the maximum background concentrations for each of the contaminants of interest and various averaging periods at the worst-case ambient monitoring station.

Based on a review of ambient monitoring data, background concentrations were generally below their respective guidelines. The exceptions are 24-hour and annual Benzo[a]Pyrene, annual benzene, as well as the 1-hour and annual NO_2 CAAQS standards. It should be noted that the assessment was completed based on a conservative approach comparing maximum, 90^{th} percentile, and average concentrations of ambient background data to applicable standards.

5.0 Identification of Sensitive Receptors

Land uses which are defined as sensitive receptors for evaluating potential air quality effects are:

- Health care facilities;
- Senior citizens' residences or long-term care facilities;
- Childcare facilities;
- Educational facilities;
- Places of worship; and,
- Residential dwellings.

Worst-case impacts generally occur at the sensitive receptors closest to roadway sources. This is due to the fact that contaminant concentrations disperse significantly with downwind distance from the roadway resulting in reduced contaminant concentrations. At approximately 500 m from the roadway, contaminant concentrations from motor vehicles generally become indistinguishable from background levels. The maximum predicted contaminant concentrations at the closest sensitive receptors will usually occur during weather events which produce calm to light winds (< 3 m/s). During weather events with higher wind speeds, the contaminant concentrations disperse much more quickly.

Sensitive receptors within the study area were identified showing in **Figure 6A**, **6B**, and **6C**. The study area is surrounded by numerous residential areas. Within the 500 m of the study area, there are several schools, day cares, community centres, and place of worships.

6.0 Air Quality Assessment – Main Route

6.1 Motor Vehicle Emission Rates

The US EPA Motor Vehicle Emission Simulator ("MOVES") model provides estimates of future emission rates from the buses based on a variety of factors such as local meteorology, vehicle fleet composition and speed. MOVES 4.0, released in August 2023, is the US EPA's latest tool for estimating vehicle emissions resulting from the combustion of fuel, brake and tire wear, fuel evaporation, permeation, and refuelling leaks.

The MOVES 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 transit fleet vehicle emissions based on road type, model year, and bus speed. Emission rates were estimated for the year 2041. Vehicle age is based on the US EPA standard vehicle age distribution.

The emission rates for transit vehicles at a speed of 50 km/hr and during idle operations are shown in **Table 5**, and **Table 6**. Emission rates are provided in grams per vehicle mile travelled (g/VMT), and grams per vehicle hour (g/VH), respectively. Note that 1,3-Butadiene emissions in the model year 2041 is predicted to be zero by the MOVES model.

Table 5: MOVES Output Emission Factors for On-Road Vehicles (g/VMT)

Pollutant	Transit Buses 50 km/hr Segment	General Vehicle Road Traffic 50 km/hr Segment
Carbon Monoxide	1.92E-02	7.88E-01
Oxides of Nitrogen	2.78E-03	2.13E-02
Nitrogen Dioxide	5.04E-04	2.40E-03
Benzene	3.79E-06	7.50E-04
1,3-Butadiene	0.00E+00	0.00E+00
Formaldehyde	4.05E-05	2.77E-04
Acetaldehyde	3.50E-05	1.35E-04
Acrolein	2.12E-07	1.27E-05
Total PM_{10}	5.41E-01	5.69E-01
Total $PM_{2.5}$	1.35E-01	1.40E-01
Benzo[a]Pyrene	5.28E-09	3.55E-07

Table 6: MOVES Output Emission Factors for Idling Vehicles (g/Vehicle Hour)

Pollutant	Transit Buses Idling	General Vehicle Road Traffic Idling
Carbon Monoxide	7.99E-02	2.21E+00
Oxides of Nitrogen	7.67E-02	2.40E-01
Nitrogen Dioxide	1.39E-02	3.85E-02
Benzene	3.18E-05	1.15E-02
1,3-Butadiene	0.00E+00	0.00E+00
Formaldehyde	6.43E-04	3.28E-03
Acetaldehyde	5.63E-04	1.63E-03
Acrolein	3.90E-06	1.73E-04
Total PM_{10}	8.51E-05	1.09E-02
Total $PM_{2.5}$	7.65E-05	9.66E-03
Benzo[a]Pyrene	1.77E-08	3.12E-06

A large portion of roadway particulate matter (PM) emissions is generated from dust/debris on the pavement which is re-suspended by vehicles travelling on the roadway. These emissions are estimated using empirically derived values presented by the US EPA in their AP-42 report, Chapter 13.2.1.3. The emission factors for re-suspended PM were estimated in accordance with this document and were added to the predicted MOVES particulate emission rates, to estimate total emissions of particulates. The particulate emission rates are shown in **Table 7**.

Table 7: Re-Suspended Particulate Matter Emission Factors

AADT	Particle Size Multiplier, K ($PM_{2.5}$/PM_{10})	Silt Loading (g/m^2)	Weight (Tons)	Emission (g/VMT)	
				$PM_{2.5}$	PM_{10}
>10,000	0.25/1.0	0.03	13	0.13	0.54
5000-10000	0.25/1.0	0.06	13	0.25	1.01
500-5000	0.25/1.0	0.2	13	0.75	3.03

6.2 Road Traffic Data

Local vehicle traffic data for the EELRT study area was provided in the form of annual average daily traffic (AADT) volumes of the year 2041, as shown in **Table 8**. The EELRT is expected to result in decreases in daily traffic levels on the majority of local roadways near the route. Roadway traffic data was supplied by HDR.

Table 8: Year 2041 "No-Build" and “Build” Road Traffic Information

Roadway	Section	Road Traffic Volumes (AADT)		Percent Commercial Traffic		Posted Speed (km/h)
		Future No-Build	Future Build, With LRT in Operation	% Medium Trucks	% Heavy Trucks	
Eglinton Avenue East	Kennedy to McCowan - EB	10,000	9,000	1.8	0.2	50
	Danforth to Kennedy - WB	14,500	13,250	1.8	0.2	50
	McCowan to Kingston - EB	6,250	5,750	1.8	0.2	50
	Kingston to Danforth - WB	10,500	7,500	1.8	0.2	50
Kingston Road	Eglington to Guildwood/Westlake - EB	22,250	14,500	1.8	0.2	50
	Guildwood/Westlake to Eglington - WB	23,000	11,750	1.8	0.2	50
	Guildwood/Westlake to Morningside - EB	16,000	11,000	1.8	0.2	50
	Morningside to Guildwood/Westlake - WB	18,000	11,000	1.8	0.2	50
Morningside Avenue	Kingston-Ellesmere - NB	10,000	8,500	1.8	0.2	50
	Kingston-Ellesmere - SB	9,500	8,000	1.8	0.2	50
UTSC Campus (Military Trail)	Ellesmere and Morningside - NB	3,450	3,500	1.8	0.2	50
	Ellesmere and Morningside - SB	3,750	3,750	1.8	0.2	50

Roadway	Section	Road Traffic Volumes (AADT)		Percent Commercial Traffic		Posted Speed (km/h)
		Future No-Build	Future Build, With LRT in Operation	% Medium Trucks	% Heavy Trucks	
Ellesmere Road	Morningside and Military Trail - EB	10,000	8,500	1.8	0.2	50
	Morningside and Military Trail - WB	9,500	8,000	1.8	0.2	50
Morningside Avenue.	South of Hwy 401 to UTSC - NB	13,500	11,500	1.8	0.2	50
	South of Hwy 401 to UTSC - SB	12,500	11,000	1.8	0.2	50
	North of Hwy 401 to Sheppard Ave. East - NB	15,750	16,000	1.8	0.2	50
	North of Hwy 401 to Sheppard Ave. East - SB	11,500	10,750	1.8	0.2	50
Sheppard Avenue East	Markham to Washburn Way - EB	5,000	6,000	1.8	0.2	50
	Markham to Morningside – WB	8,500	5,500	1.8	0.2	50
	Washburn Way to Morningside – EB	7,250	6,000	1.8	0.2	50
	Markham to Morningside – WB	8,500	5,500	1.8	0.2	50
	West of Markham Road – EB	7,500	9,500	1.8	0.2	50
	West of Markham Road - WB	8,250	7,250	1.8	0.2	50
	Morningside to Meadowvale - EB	6,000	6,500	1.8	0.2	50
	Morningside to Meadowvale - WB	10,500	11,500	1.8	0.2	50
Neilson Avenue	Sheppard to Tapscott - NB	10,500	10,000	1.8	0.2	50
	Sheppard to Tapscott - SB	10,500	8,500	1.8	0.2	50

Transit vehicle traffic data for the EELRT study area was provided in the form of annual average daily traffic (AADT) volumes of the year 2041. The traffic data used in the assessment is provided in **Table 8** and **9**. Bus traffic volumes were supplied by HDR from the City of Toronto.

Table 9: 2041 Traffic Data

Roadway Link	2041 NB Bus Traffic Volume (AADT)	2041 FB LRT Traffic Volume (AADT)	Speed Limit (km/hr)
EELRT	954	206	50

6.3 Emissions Inventory for the 2041 NB, and 2041 FB Scenarios

An emissions inventory was conducted using the US EPA MOVES emission rates. For this project, MOVES was used to estimate transit bus and other vehicle emissions based on road type, model year, and bus speed.

Emission rates were estimated for the year 2041. Vehicle age is based on the US EPA standard vehicle age distribution.

The emission rates for vehicle speed of 50 km/hr and idle are shown in **Table 5**, and **Table 6**. Emission rates are provided in grams per vehicle mile travelled (g/VMT).

No direct emissions are predicted from the LRT associated to buses for the 2041 FB scenario. However, emissions from nearby roadways will decrease. **Table 10** provides an emissions inventory for the Main Line area for both Future No-Build and Future Build scenarios. The total emissions are predicted to decrease by 17.5% in Future Build scenario.

Table 10: Emission Inventory for Main Line

Operating Mode	Carbon Monoxide	Oxides of Nitrogen	Benzene	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Nitrogen Dioxide	Total PM_{10}	Total $PM_{2.5}$	Total Benzo[a]Pyrene	CO2 Equivalent
2041 NB Scenario Emissions Inventory (tonnes/year)												
Buses Travelling	8.11E-02	1.17E-02	1.60E-05	0.00E+00	1.71E-04	1.48E-04	8.96E-07	2.13E-03	2.28E+00	5.71E-01	2.23E-08	2.08E+01
Buses Idling	4.74E-04	4.55E-04	1.89E-07	0.00E+00	3.81E-06	3.34E-06	2.31E-08	8.23E-05	5.05E-07	4.54E-07	1.05E-10	1.61E-01
Other Vehicles Travelling	1.05E+03	2.84E+01	1.00E+00	0.00E+00	3.70E-01	1.81E-01	1.70E-02	3.21E+00	7.61E+02	1.87E+02	4.75E-04	2.76E+05
Other Vehicles Idling	1.58E+01	1.72E+00	8.23E-02	0.00E+00	2.35E-02	1.17E-02	1.24E-03	2.76E-01	7.83E-02	6.93E-02	2.24E-05	1.35E+04
Total	1.07E+03	3.02E+01	1.09E+00	0.00E+00	3.94E-01	1.93E-01	1.82E-02	3.49E+00	7.64E+02	1.88E+02	4.98E-04	2.90E+05
2041 Build Scenario Emissions Inventory (tonnes/year)												
Buses Travelling	-	-	-	-	-	-	-	-	-	-	-	-
Buses Idling	-	-	-	-	-	-	-	-	-	-	-	-
Other Vehicles Travelling	8.70E+02	2.35E+01	8.28E-01	0.00E+00	3.05E-01	1.49E-01	1.40E-02	2.65E+00	6.28E+02	1.54E+02	3.92E-04	2.28E+05
Other Vehicles Idling	1.31E+01	1.42E+00	6.79E-02	0.00E+00	1.94E-02	9.66E-03	1.02E-03	2.28E-01	6.46E-02	5.72E-02	1.85E-05	1.12E+04
Total	8.83E+02	2.49E+01	8.96E-01	0.00E+00	3.25E-01	1.59E-01	1.50E-02	2.88E+00	6.28E+02	1.54E+02	4.11E-04	2.39E+05
Change (%) Increase or Decrease in Emissions												
Change	-17.5%	-17.5%	-17.5%	-	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%	-17.5%

7.0 Air Quality Assessment – Maintenance and Storage Facility

The proposed project includes the construction of a new Maintenance and Storage Facility (MSF) for the EELRT. The proposed MSF is located northwest of the Sheppard Avenue East and Morningside Avenue intersection. This new facility will be used for general maintenance and repairs of the railcars, as well as storage when not in use. **Figure 1** shows the location of the MSF site and the roadways assessed. Some flagpole sensitive receptors were identified and added to the ADM; east of the proposed MSF site are the school and some residential houses and there is a couple of sensitive receptors located at southeast of the MSF.

7.1 Air Dispersion Modelling

Air dispersion modelling (ADM) was completed to assess emissions from the maintenance storage facility as well as from a representative bus station. The air quality assessment was carried out using the U.S. EPA AERMOD atmospheric dispersion model, as per Provincial guidance. Version 22112 of US EPA AERMOD dispersion model was applied. Dispersion modelling was completed in accordance with the MECP Air Dispersion Modelling Guideline for Ontario, Version 4.0, dated February 2017 (the “ADMGO”).

The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. 22112);
- AERMAP surface pre-processor (v. 18081); and
- AERMET meteorological preprocessor (v. 22112).

Combined concentrations were determined by adding modelled and background (i.e., ambient data) concentrations together on an hourly basis. Background concentrations for all available contaminants were determined from MECP and NAPS (National Air Pollution Surveillance) stations nearest to the study area with applicable datasets.

Maximum 1-hour, 8-hour, 24-hour, and annual predicted combined concentrations were determined for comparison with the applicable guidelines using emission and dispersion models published by the U.S. Environmental Protection Agency (EPA). The worst-case predicted impacts are presented in this report; however, it is important to note that the worst-case impacts may occur infrequently and at only one receptor location.

7.1.1 Meteorology and Terrain

As required by the ADMGO, the AERMOD model was run using MECP pre-processed meteorological data collected from Toronto, Pearson International Airport (surface data) and Buffalo, USA Airport (upper air data) between 1996 and 2000, as prescribed by O.Reg. 419/05. The wind rose for this meteorological data set is provided in **Figure 5** and shows that predominant winds are from the north through northwest to the west and southwest directions.

As required by the ADMGO and based on a review of the land uses surrounding the Project site, the “Suburban” dataset was selected. Five years of meteorology were modelled to capture the worst-case meteorological conditions.

The Canadian Digital Elevation Model (CDEM) terrain data in GeoTIFF format used in this assessment was obtained from the MECP online repository and parsed using the built-in processor with the Lakes Environmental AERMOD software package for the modelling domain.[1]

7.1.2 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system, as per Section 5.2.2 of the ADMGO was used to specify model object sources, buildings, and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83).

7.1.3 Receptors

In the modelling assessment, discrete flagpole receptors were included the sensitive receptors around the maintenance and storage facility (MSF) identified through review of available satellite imagery.

Discrete receptors were also placed along the property line of the MSF approximately every 10m horizontally.

A square receptor grid 9.6 km in width was placed over the yard following the ADMGO requirements. Receptors were selected based on guidance provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O. Reg. 419/05. Specifically, the nested receptor grid used for modelling was centered on the MSF sources and used the following spacing:

1. 20 m spacing, within an area of 200 m by 200 m
2. 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a)
3. 100 m spacing, within an area surrounding the area described in (b) with a boundary at 800 m by 800 m outside the boundary of the area described in (b)
4. 200 m spacing, within an area surrounding the area described in (c) with a boundary at 1,800 m by 1,800 m outside the boundary of the area described in (c)
5. 500 m spacing, within an area surrounding the area described in (d) with a boundary at 4,800 m by 4,800 m outside the boundary of the area described in (d)

7.2 Sources

Emission sources considered onsite include HVAC equipment. Emissions from employee vehicles arriving onsite are expected to be insignificant and minimal with little to no idling time, they were therefore not included in the assessment of the MSF. Maintenance and janitorial activities are expected to be minimal and infrequent on the light rail cars, emissions from these activities are not expected to be emitted in significant amounts. Should the facility emit contaminants to air from future onsite activities such as welding or metal work, the MSF will need to assess the requirements of filing for an Environmental Activity and Sector Registry, or for an Environmental Compliance Approval and maintain compliance with O.Reg. 419/05 at the property line and beyond for these activities.

21 HVAC units was assumed for the proposed MSF and US. EPA chapter AP-42 emission factors were applied to calculate the emission rates (ER). **Table 11** shows the AERMOD

[1] The files used were: cdem_dem_030M.tif

emission parameters from a representative unit heater.

Table 11: AERMOD Parameters and Emission Data

Source ID	Source Description	Temp (K)	Heat Input (MBH)	Stack Diameter (m)	Flow (m^3/s)	Velocity (m/s)	NO_X ER (g/s)	CO ER (g/s)	PM ER (g/s)	SO_2 ER (g/s)
GUH	Unit Heater	323.15	100	0.152	0.0134	0.7	1.24E-03	1.04E-03	9.39E-05	7.41E-06

7.3 Air Dispersion Modelling Results for the MSF

Results of the modelling are provided in **Table 12** and **Table 13**. As the results presented in **Table 12** are maximum concentration at Point of Impingement (POI), they compared against the O. Reg 419/05 limits while in **Table 13** the maximum concentrations at sensitive receptors are compared against CAAQS limits.

The maximum combined concentrations for the MSF were below their respective MECP guidelines or CAAQS, with the exception of the 1-hr and annual NO_2 CAAQS. Note that background concentrations exceeded the guideline for this contaminant averaging periods. The overall contribution from the MSF emissions to the combined concentrations was small.

Table 12: Summary of MSF Modelling Results – Maximum Concentrations at POIs

Contaminant	Averaging Period	Threshold O. Reg 419/05 (µg/m^3)	Maximum Model Concentration (µg/m^3)	Background 90th Percentile Concentration (µg/m^3)	Total (µg/m^3)	Percentage of Threshold
NO_X	1-Hour	400	22.92	41.54	64.92	16.12%
	24-Hour	200	9.10	43.91	53.10	26.51%
TSP	24-Hour	120	0.69	40.97	41.70	34.72%
CO	1/2-Hour	36200	19.22	409.36	428.22	1.18%
	8-Hour	15700	10.76	391.30	401.76	2.56%
SO_2	1-Hour	106	0.14	2.75	2.89	2.72%
	Annual	10.6	0.01	1.27	1.28	12.07%

Table 13: Summary of MSF Modelling Results – Maximum Concentrations at Sensitive Receptors for CAAQS

Contaminant	Averaging Period	Threshold CAAQs (µg/m^3)	Maximum Model Concentration (µg/m^3)	Background 90th Percentile Concentration (µg/m^3)	Total (µg/m^3)	Percentage of Threshold
NO_2	1-Hour	79.0	2.06	41.53	43.59	55.18%
	Annual	22.6	0.31	29.59	29.90	**132.30%** [1]
SO_2	1-Hour	172.9	0.021	2.75	2.78	1.60%
	Annual	10.6	0.008	1.27	1.28	12.06%
Notes:						

Contaminant	Averaging Period	Threshold CAAQs (µg/m³)	Maximum Model Concentration (µg/m³)	Background 90th Percentile Concentration (µg/m³)	Total (µg/m³)	Percentage of Threshold
[1] - The background concentrations of NO_2 is the main contribution to the exceedance of the CAAQS. The MSF emissions contribute to less than 3% of the CAAQS.						

Considering the above, the MSF will have negligible effects on air quality in the area.

8.0 Air Quality Assessment – Individual Bus Stations

Air dispersion modelling was conducted to assess the air quality impact from idling buses at the station locations along the Project.

One station location with nearby sensitive receptors was selected to assess the existing conditions. The station has been selected to represent a worst-case scenario for idling buses based on its proximity to sensitive receptors. Results from the assessment of one station is representative of predicted impacts at alternate station locations, given the similar operations. Emission rates from MOVES was used for the bus idling at the station for the 2041 NB scenario. Flagpole sensitive receptors were identified withing the zone of influence and added to the ADM.

8.1 Air Dispersion Modelling Results

Results of the modelling for the worst-case station for 2041 NB scenario are provided in **Table 14.** For each contaminant, combined concentrations are presented as a percentage of the applicable guideline.

The maximum combined concentrations for the 2041 No Build were below their respective MECP guidelines or CAAQS, with the exception of the 1-hr and annual NO_2 CAAQS, annual benzene, and 24-hour and annual Benzo[a]pyrene. Note that background concentrations exceeded the guideline for all of these contaminant averaging periods as well. The overall contribution from the bus station emissions to the combined concentrations was small.

Table 14: Summary of Bus Station Modelling Results

Contaminant	Averaging Period	Threshold (µg/m³)	Maximum Model Concentration (µg/m³)	Background 90th Percentile Concentration (µg/m³)	Total (µg/m³)	% of Threshold [Total]	% of Threshold [Bus Station Only]
Oxides of Nitrogen	1-Hour	400	1.81E-02	4.20E+01	4.20E+01	10.50%	0.00%
	24-Hour	200	1.34E-01	4.40E+01	4.41E+01	22.07%	0.07%
Nitrogen Dioxide	1-Hour (CAAQS)	83	1.14E-03	4.15E+01	4.15E+01	52.57%	0.00%
	Annual (CAAQS)	23	3.29E+00	2.96E+01	3.29E+01	**142.96%[1]**	14.30%
$PM_{2.5}$	24-Hour	27	4.86E-02	2.01E+01	2.00E+01	74.25%	0.18%
	Annual	8.8	1.81E-02	8.00E+00	8.02E+00	91.12%	0.21%
PM_{10}	24-Hour	50	5.41E-02	2.28E+01	2.31E+01	46.11%	0.11%
Benzene	24-Hour	2.3	5.53E-05	1.07E+00	1.07E+00	46.52%	0.00%

Contaminant	Averaging Period	Threshold ($\mu g/m^3$)	Maximum Model Concentration ($\mu g/m^3$)	Background 90th Percentile Concentration ($\mu g/m^3$)	Total ($\mu g/m^3$)	% of Threshold [Total]	% of Threshold [Bus Station Only]
	Annual	0.45	7.54E-03	9.30E-01	9.38E-01	**208.34%**[1]	1.68%
1,3 - Butadiene	24-Hour	10	0.00E+00	9.00E-02	9.00E-02	0.90%	0.00%
	Annual	2	0.00E+00	8.00E-02	8.00E-02	4.00%	0.00%
BaP	24-Hour	0.00005	3.09E-08	1.26E-04	1.26E-04	**252.06%**[1]	0.06%
	Annual	0.00001	4.21E-06	1.05E-04	1.09E-04	**1092.10%**[1]	42.10%
CO	1-Hour	36200	1.89E-02	4.09E+02	4.09E+02	1.13%	0.00%
	8-Hour	15700	6.00E-02	3.91E+02	3.91E+02	2.49%	0.00%
Acrolein	1-Hour	4.5	9.19E-07	7.50E-02	7.50E-02	1.67%	0.00%
	24-Hour	0.4	6.78E-06	7.50E-02	7.50E-02	18.75%	0.00%
Acetaldehyde	24-Hour	500	9.80E-04	1.56E+00	1.56E+00	0.31%	0.00%
Formaldehyde	24-Hour	65	1.12E-03	2.52E+00	2.52E+00	3.88%	0.00%
Notes: [1] - The background concentrations are the main contribution to the exceedance of the thresholds.							

Considering the above, bus stations located along the line will have negligible effects on air quality in the area.

9.0 Greenhouse Gas Assessment

In addition to the contaminant of interest assessed in the local air quality assessment, greenhouse gas (GHG) emissions were predicted from the project. Potential impacts were assessed by calculating the relative change in total emissions between the 2041 No Build and 2041 Future Build scenarios as well as comparing the total emission to the 2030 provincial and Canada-wide GHG targets. Total GHG emissions from the transit vehicles were determined based on the length of the study area, transit fleet vehicle volumes, and predicted emission rates. The emissions (and the change in emissions) in local roadway traffic were also reviewed.

From a GHG perspective, the contaminants of concern from motor vehicle emissions are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These GHGs can be further classified according to their Global Warming Potential. The Global Warming Potential is a multiplier developed for each GHG, which allows comparison of the ability of each GHG to trap heat in the atmosphere, relative to carbon dioxide. Using these multipliers, total GHG emissions can be classified as CO_2 equivalent emissions. For this assessment, the MOVES model was used to determine total CO_2 equivalent emission rates for the posted speed on the study area. **Table 15 Table 16** summarize the length of the study area, hours of operating, traffic volumes, and emission rates used to determine total GHG emissions on study area in the 2041 No Build scenario.

Table 15: Summary of the Study Area Traffic Volumes, Study Area Length, and On-Road Emission Rates

Study Area	2041 Bus AADT	Length of Roadway (Miles)	Posted Speed (km/hr)	2041 CO_2 Equivalent Emission Rate (g/VMT)
EELRT	954	12.12	50	4.93
Study Area	**2041 general Vehicle AADT**	**Length of Roadway (Miles)**	**Posted Speed (km/hr)**	**2041 CO2 Equivalent Emission Rate (g/VMT)**
NB	302,450	12.12	50	206.36
FB	249,500			

Table 16: Summary of the Study Area Traffic Volumes, Study Area Length, and Idle Emission Rates

Study Area	2041 Bus AADT	Total Idle Time (Hour/day)	Operating Mode	2041 CO_2 Equivalent Emission Rate (g/Vehicle Hour)
EELRT NB	483	4.10	Idle	27.18 (g/vehicle Hour)
Study Area	**2041 general Vehicle AADT**	**Total Idle Time (Hour/day)**	**Posted Speed (km/hr)**	**2041 CO_2 Equivalent Emission Rate (g/Vehicle Hour)**
NB	302,450	0.065	Idle	1,888.22
FB	249,500			

The total predicted annual GHG emissions for the 2041 No Build and 2041 Future Build scenarios are shown in **Table 17**. Also shown is the percent change in total GHG emissions between the scenarios. Note that there would not be direct GHG emissions from LRT as all trains are electric and would only result in indirect GHG emissions from associated power generation. The results show that due to replacing the transit buses to LRT on study area, the total direct GHG emissions decrease by 18%.

Table 17: Annual GHG emissions for the 2041 NB and 2041 FB

Roadway	2041 NB CO_2 Equivalent Emission Rate (tonnes/year)	2041 FB CO_2 Equivalent Emission Rate (tonnes/year)	Changes in Emission (%)
EELRT	289,175	238,516	-18%

10.0 Construction Air Quality Plan

During construction of the maintenance storage facility, and the roadway/light-rail system, dust is the primary contaminant of concern. Other contaminants, including NO_x and VOC's, may be emitted from equipment used during construction activities. Due to the temporary nature of construction activities, there are no air quality criteria specific to construction activities. However, the Environment Canada "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" document provides several mitigation measures for reducing emissions during construction activities. Mitigation techniques discussed in the document include material wetting or use of non-chloride dust suppressants to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust and equipment washing. Furthermore, as annual $PM_{2.5}$, 24-hr PM_{10}, and 24-hr TSP levels will exceed their corresponding guidelines in the future build scenario of the MSF, additional mitigation measures such as planting vegetation (for example coniferous species and shrubs) or leaving vegetated areas and natural shrubs and trees in areas not currently under construction would assist in minimizing fugitive dust emissions and particulate impacts at nearby sensitive receptors. Continuous monitoring of fugitive dust releases to sensitive receptors during construction of the MSF by site construction managers should be conducted, use of particulate monitoring devices should be considered. It is recommended that these best management practices be followed during construction of the MSF and LRT to reduce any impacts associated with fugitive dust emissions that may occur. Prior to construction the Phase 1 Environmental Site Assessment should also be reviewed to identify potential areas of ground contamination along the construction route. In addition to the dust suppression techniques provided in this plan, any areas that have the potential to emit other contaminants as a part of the fugitive dust should be reviewed further and consideration should be given to additional onsite monitoring at sensitive receptors for any site specific contaminants identified. The following Air Quality Management Plan has been developed to make recommendations to reduce fugitive dust emissions during construction activities.

10.1 Fugitive Dust from Vehicle Movement

10.1.1 Paved Roads

The most significant source of dust emissions from construction activities is typically from vehicle traffic on unpaved roads or open construction areas. Emissions from paved roads can also occur, typically due to material spillage, the transportation of uncovered material, or from dirty equipment. Additionally, paved roads surrounding a construction area can become dirty if left unattended, and vehicle traffic on these roads can cause the re-suspension of dust.

Mitigation and control measures to reduce dust emissions from paved surfaces include:

- Street sweeping as required, based on visual inspection. Roads should be kept clear of dust as much as possible;
- Swift removal of spilled materials;
- Use enclosed cargo holds on trucks and vehicles or cover open bodied trucks;
- Minimize or limit the number of trucks accessing the site; and
- Clean the wheels and empty cargo holds of vehicles prior to leaving the site.
- Frequently suppress dust using non-chloride dust suppressants based on the current weather conditions and frequently monitor surface conditions.

10.1.2 Unpaved Roads and Exposed Surfaces

Dust from unpaved roads and exposed construction sites will occur due to vehicle travel as well as wind erosion. The predominant mechanism of dust generation from unpaved roads is the re-suspension of surface particulate due to vehicle traffic.

Mitigation and control measures to minimize fugitive dust from unpaved areas include:

- Minimize vehicle traffic on-site;

- Set low speed limits (i.e., 15 km/hr or less) for on-site traffic;
- Apply water or a dust suppressant on unpaved surfaces, including all roads and lots; and
- Vegetating disturbed lands (e.g., seed disturbed lands) to reduce potential for dust to develop from exposed soil.
- Frequently suppress dust using water application, or non-chloride dust suppressants as available based on the current weather conditions and frequently monitor surface conditions. Increased application may be required on during dry and hot periods.

10.2 Fugitive Dust from Storage of Materials and Residual Waste

10.2.1 Material Storage

Dust generation occurs from wind erosion of storage piles. Larger surface areas exposed to oncoming winds have more potential to generate fugitive dust emissions.

Mitigation and control measures to control fugitive dust from aggregate material and earth storage include:

- Minimize uncovered storage of materials on-site;
- Apply water or a dust suppressant to storage piles;
- Construct wind breaks surrounding storage piles; and
- Construct storage piles to be more aerodynamic with smooth, contoured piles.

10.2.2 Unloading and Loading

Loading, unloading, and transferring materials is a significant source of fugitive dust. Dust generation from these activities is increased during strong wind conditions.

Mitigation and control measures for unloading, loading, and transferring aggregate materials include:

- Minimizing the amount of material being transferred on-site at any one time;
- Lower drop distances when unloading material onto piles or surfaces;
- Loading trucks and vehicles so that the dump load will not spill over the sides of the target vehicle. Loads should be dropped as close to the vehicle opening as possible;
- Apply a water spray or dust suppressant to the materials being transferred; and
- Cover loads when hauling or transferring materials.

10.3 On-Site Operations

10.3.1 Machinery Exhaust

All diesel operated vehicles and machinery including generators, excavators, crushers, etc., will emit suspended particulate matter and odours as part of exhaust emissions. Higher amounts of particulate emissions can be expected during long idling times and when many vehicles or engines are operating at any one time.

Mitigation and control measures to control particulate matter and odours from engine exhaust include:

- Minimize the number of vehicles and engines operating at any one time;
- Increase separation distances between sensitive receptors, such as schools, residences, and parks and all exhaust points;
- When possible, ensure that engine exhausts are oriented upwards;
- Limit idle times of vehicles and engines. Shut off engines when not in use;
- When possible, limit operations to times when winds are blowing away from sensitive receptors and minimize use when winds would direct exhaust gases towards sensitive receptors; and
- Ensure equipment and vehicles are well-maintained and in good working order.

10.3.2 Excavation

Drilling, blasting, crushing, and excavating during construction are all sources of fugitive dust. Mitigation and control measures to minimize fugitive dust from excavation operations include:

- Minimizing the number of machines in operation concurrently;
- Use water or dust suppressants on the work surface;
- Decrease the travel distance between the work area and storage piles or trucks; and
- Lower drop distances of the excavated earth and materials.

10.4 Demolition and Deconstruction

Demolition activities such as infrastructure reconstruction can result in fugitive dust emissions resulting from blasting or removal of structures. In addition to the measures described above, mitigation measures for demolition and deconstruction include:

- Applying deconstruction techniques, rather than demolition;
- Minimize drop heights for debris;
- Enclose chutes and cover bins;
- Vacuum or remove debris from paved and other surfaces prior to conducting re-construction activities; and
- Avoid prolonged storage of debris onsite.

10.5 Development and Implementation of the Air Quality Plan

The recommendations provided in this Construction Air Quality Plan should be incorporated or referenced in the project's Environmental Training Manual before the start of construction and should be followed for the duration of all construction activities. The Air Quality Plan should also be used as a tool for staff training, along with the Environmental Training Manual. The construction air quality management practices should remain in effect for the life of the construction job with the understanding that the plan will be reviewed and updated periodically, as needed. The following conditions should be followed by designated construction managers and personnel:

- The Air Quality Plan, along with other project specific documents shall be kept on file in the site office and available for review upon request;
- Training on new and existing operating procedures shall be provided to relevant staff;
- Refresher training shall be provided as needed;
- Management shall communicate the construction air quality management practices to responsible personnel, who shall ensure staff are following operating procedures defined in the Environmental Training Manual;
- Updates including air quality practices will be provided through project communications;
- The site manager shall be responsible for ensuring the Environmental Training Manual is followed;
- Management shall ensure Environmental Training Manual and Air Quality Plan are reviewed as required; and
- The staff shall follow the Environmental Training Manual and Air Quality Plan procedures.

10.6 Staff Training

Staff should be trained to follow the construction air quality management practices efficiently and safely. The Environmental Training Manual and Environmental Awareness Training Presentation includes information about construction air quality mitigation and a reference to this plan. Staff should review this plan and the identified best management practices.

These documents will be reviewed with existing staff and new hires, as well as prior to the start of the construction project to identify site-specific measures to be implemented. The manual and plan may be updated from time to time, if required.

All employees directly involved with activities relating to the construction of the EELRT project will be trained in the following:

- Housekeeping requirements
- Importance of following the Environmental Training Manual
- Procedures for refusal of unacceptable loads
- Procedures for control of dust and odour
- Record keeping procedures; and
- Reporting adverse conditions which have the potential to cause dust or odour to the site manager.

A written record of employee training, including the date of training, the name and signature of the employee, and a description of the training received should be kept on file by management.

Trained personnel will be present during construction activities to supervise receiving, handling, transfer of materials, and all other relevant site operations.

10.7 Inspection, Monitoring, Record Keeping, and Reporting

Inspection and maintenance of the site and equipment is important to reducing dust emissions during construction activities.

Records will be maintained in accordance with the Environmental Construction Monitoring Tracking System for the Project. Records will be kept by the designated individual (likely the environmental inspector) responsible for completing daily site inspections. The designated individual should be trained in the requirements and objectives of the project plans. Records that will be kept as part of the Environmental Construction Monitoring Tracking System include:

- Identify that the inspection has been completed and that the items on the checklist have been addressed;
- Weather conditions, such as wind speed and direction, cloud cover, precipitation and temperature;
- Any actions taken to control nuisance issues, on-site; and
- A summary of any on-site spills that were reported to the MECP.

The foreman should be informed of issues that arise during inspections performed. Operations may be curtailed if dust control equipment and measures are not performing adequately.

10.8 Complaint Procedure

Formal complaints will be recorded, kept on file and addressed in accordance with the response protocol. When a formal complaint is made, the following information should be recorded:

- Employee name and title receiving the complaint;
- Personal information of the complainant, such as name, address, and telephone number;
- Date and time the complaint was made;
- Nature and description of the complaint;
- Weather conditions including wind speed and wind direction at time complaint was made;
- Record of what corrective action was performed to resolve the issue; and
- Follow up with complainant in the form of a formal response.

Formal complaints should initiate an inspection of the suspected cause of the complaint. Corrective action should be implemented to mitigate the cause of the complaint wherever possible.

10.9 Summary of the Air Quality Impact During Construction Activities

From an air quality perspective, the main concerns relating to construction activities typically include fugitive dust and diesel exhaust emissions. We have reviewed the proposed construction sites and identified potential air-sensitive receptors including residences, schools, hotels, and places of worship. Preferred locations for site access and storage have been identified for some of the construction sites. Examples of common management plans and controls have been provided in this document. Details regarding daily management practices incorporating the recommendations provided in this report, and a reference to this document, should be included in the project specific materials, including the Environmental Training Manual and any associated training presentation materials.

11.0 Conclusions

The potential environmental air quality impacts of the proposed Eglinton East LRT (EELRT) have been assessed. Both operational and construction air quality impacts have been considered.

The conclusions and recommendations are as follows:

- An emissions inventory of vehicle traffic along the main line route has been completed, examining "future build" (with the EELRT in place) and "future no-build" (assuming the EELRT is not constructed) scenarios. The proposed EELRT system will result in a decrease in vehicle-related emissions along the route, which would result in improvements in local air quality.
- Specific air quality impacts from the Maintenance and Storage Facility and from new bus stations along the line were assessed. Air dispersion modelling was conducted. All provincial standards at the property line. Minor excesses of the annual Canadian Ambient Air Quality Standards (CAAQS) due to the fact the background concentrations already exceed the criteria. In these situations, contributions from the MSF and bus stations will be less than 2% of the total. The results show that the MSF and bus stations will have negligible effects on air quality in the area.
- The predicted maximum concentrations at sensitive receptors were conservatively combined with the 90th percentile of the background concentrations for the assessment. data for both the MSF and the worst-case transit vehicle station
- A screening level assessment of greenhouse gases from the project (GHG). The proposed EELRT system will result in a decrease in vehicle-related GHG emissions by 18%.
- Guidance has been provided for addressing fugitive dust emissions from construction. This should in included in a code of practice for future Contactors to reduce the potential for air quality impacts during the construction phase of the project.

12.0 Closure

Should you have questions on the above report, please contact the undersigned.

Regards,

SLR Consulting (Canada) Ltd.

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13.0 References

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Figures

Air Quality Assessment DRAFT

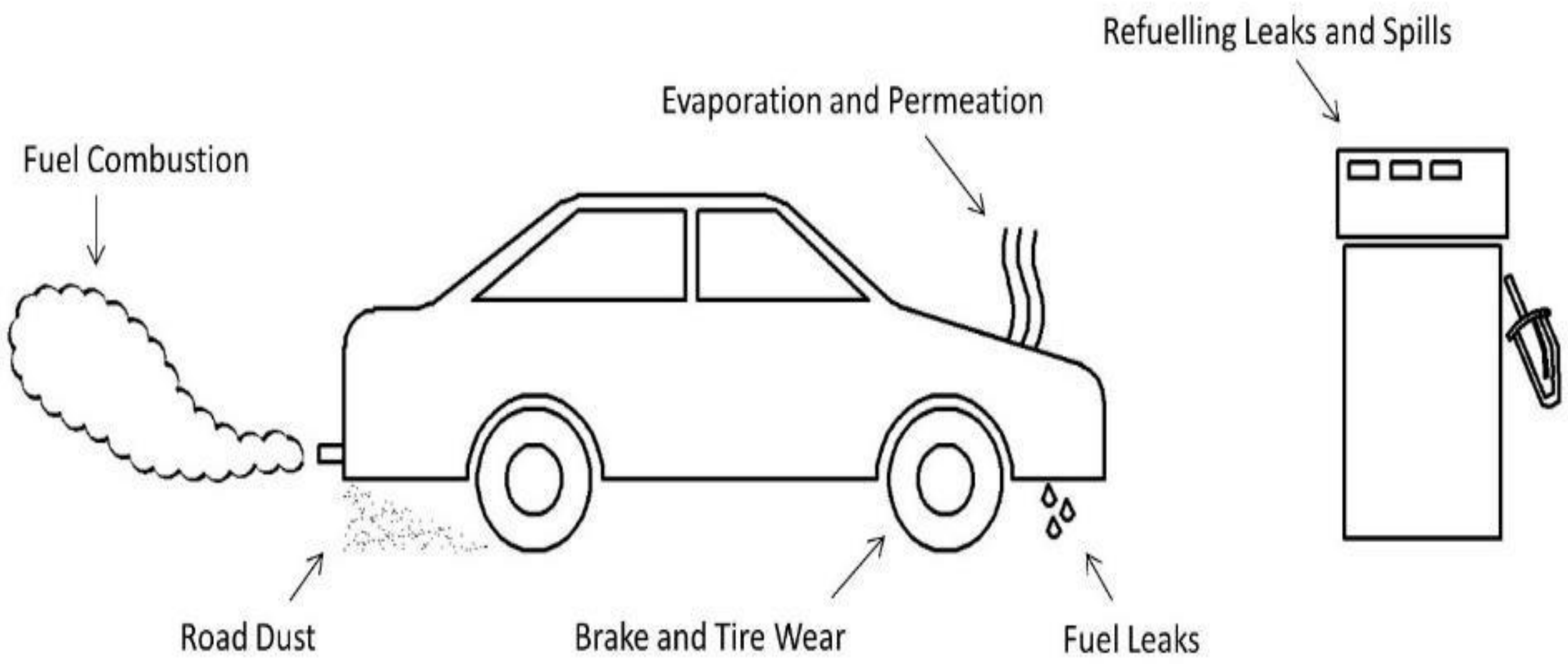
Eglinton East LRT

HDR. Inc.

SLR Project No.: 241.030932.00001

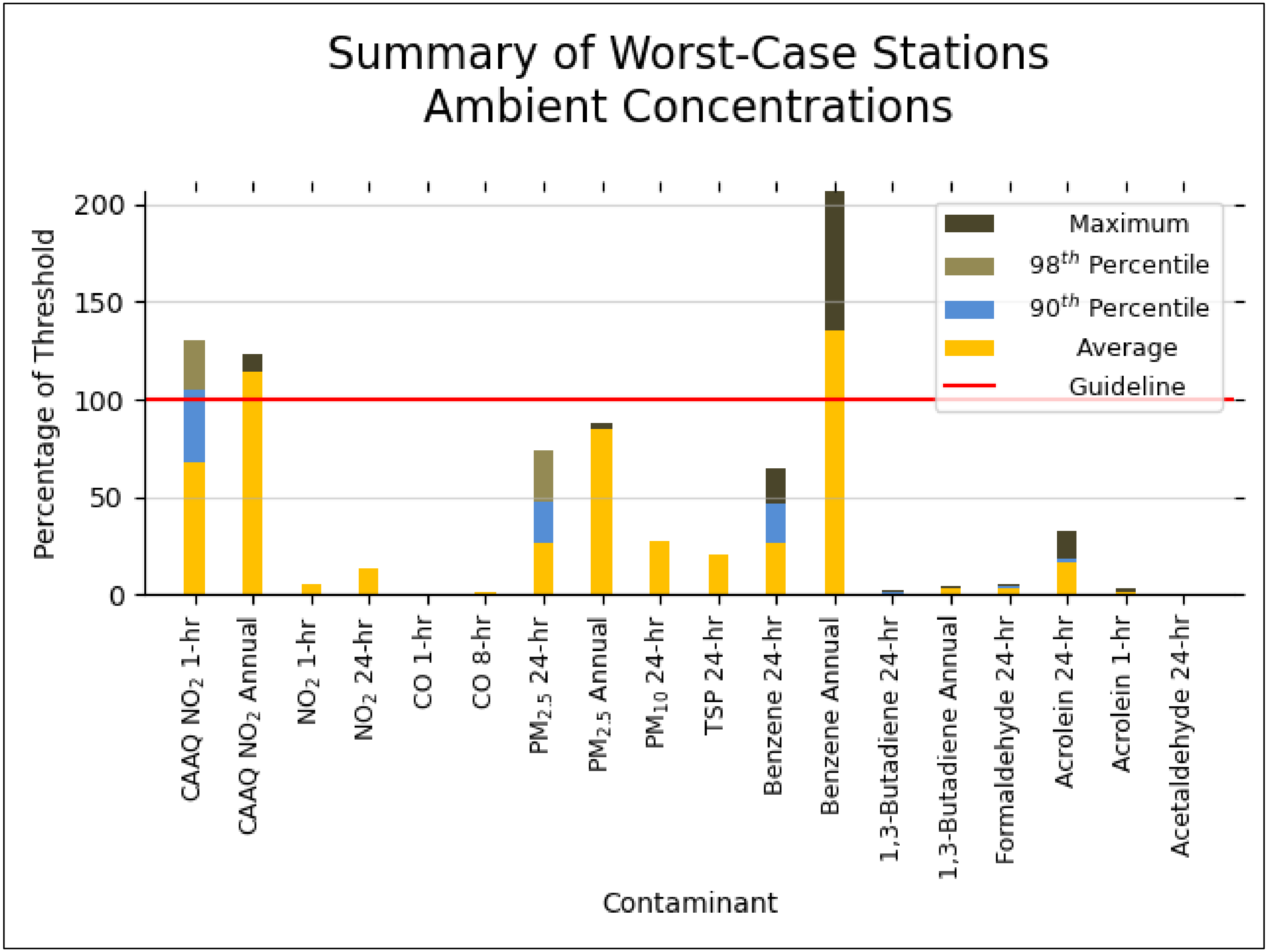
May 3, 2024

HDR CORPORATION	True North	Scale: 1:24,000	METRES	SLR
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 Rev 0.0	Figure No. 1	
EXCERPTS FROM STUDY AREA		Project No. 241.030932.00001		

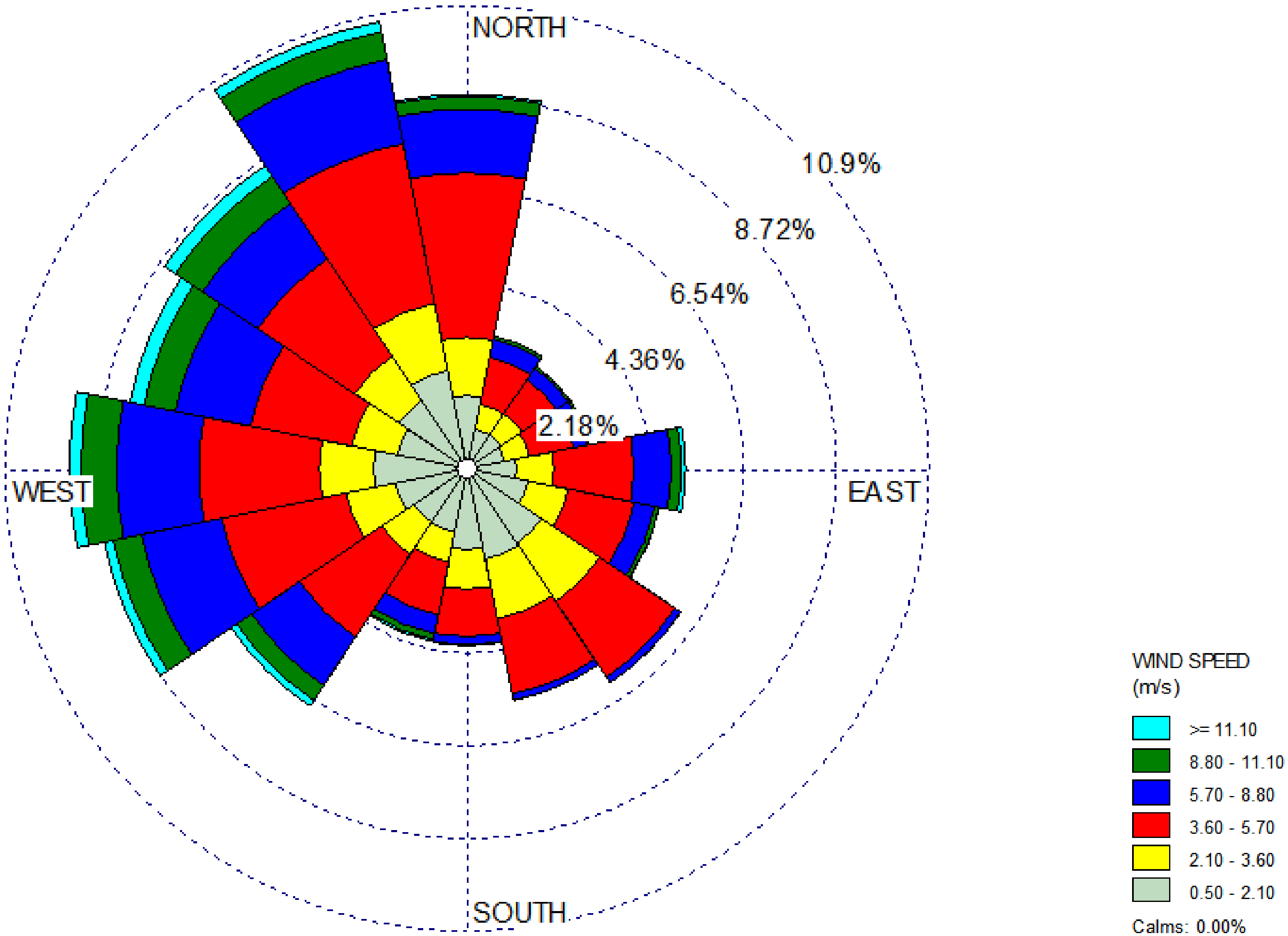


HDR CORPORATION	True North	Scale: N/A	METRES
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 / Rev 0.0	Figure No. 2
MOTOR VEHICLE EMISSION SOURCES		Project No. 241.030932.00001	

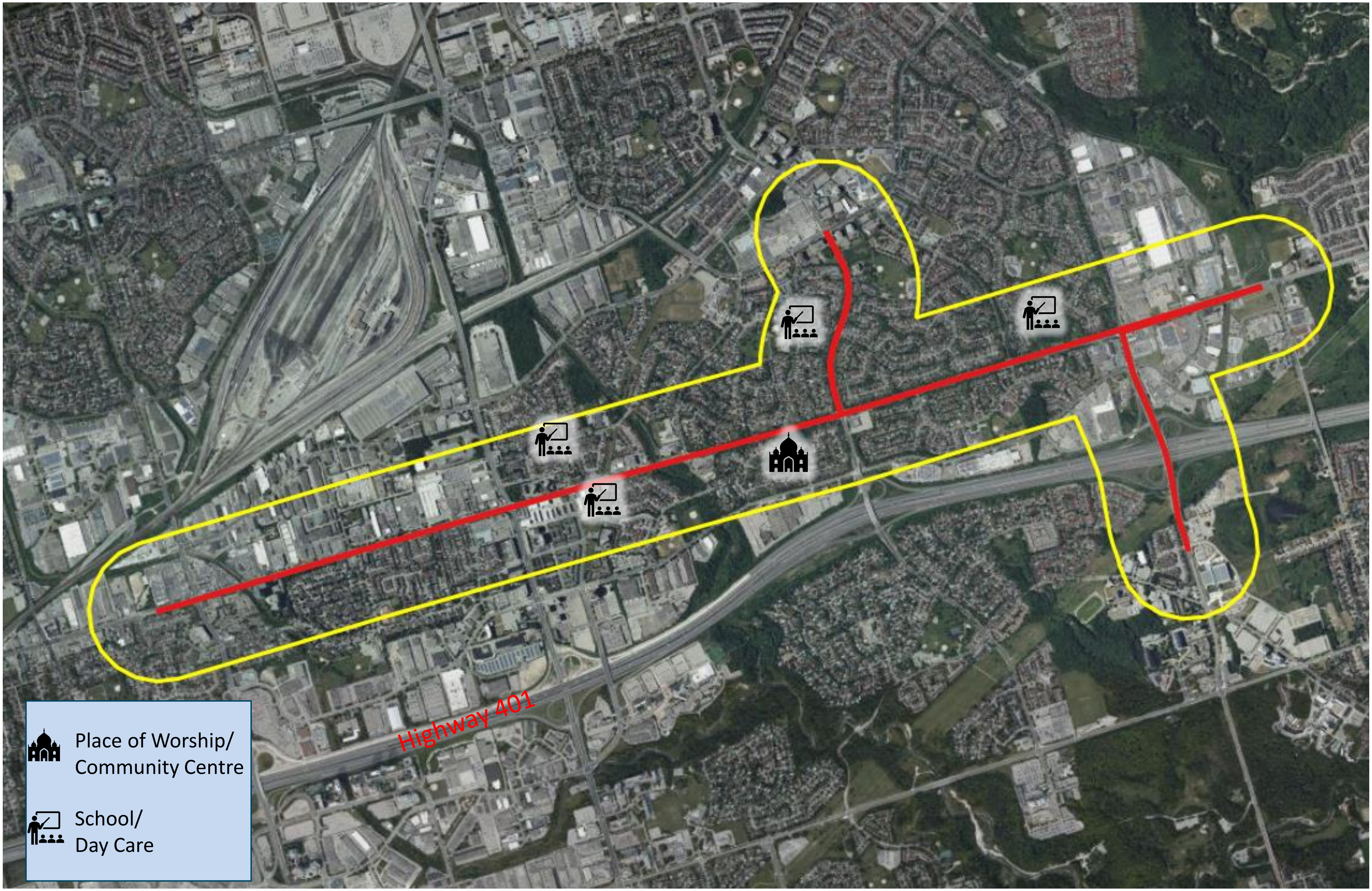
HDR CORPORATION	True North	Scale: 1:56,000	METRES	SLR
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 Rev 0.0	Figure No. **3**	
LOCATION OF AMBIENT MONITORING STATIONS, RELEVANT TO THE STUDY AREA		Project No. 241.030932.00001		



HDR CORPORATION	True North	Scale: N/A	METRES	SLR
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 · Rev 0.0	Figure No. 4	
SUMMARY OF AMBIENT CONCENTRATIONS		Project No. 241.030932.00001		

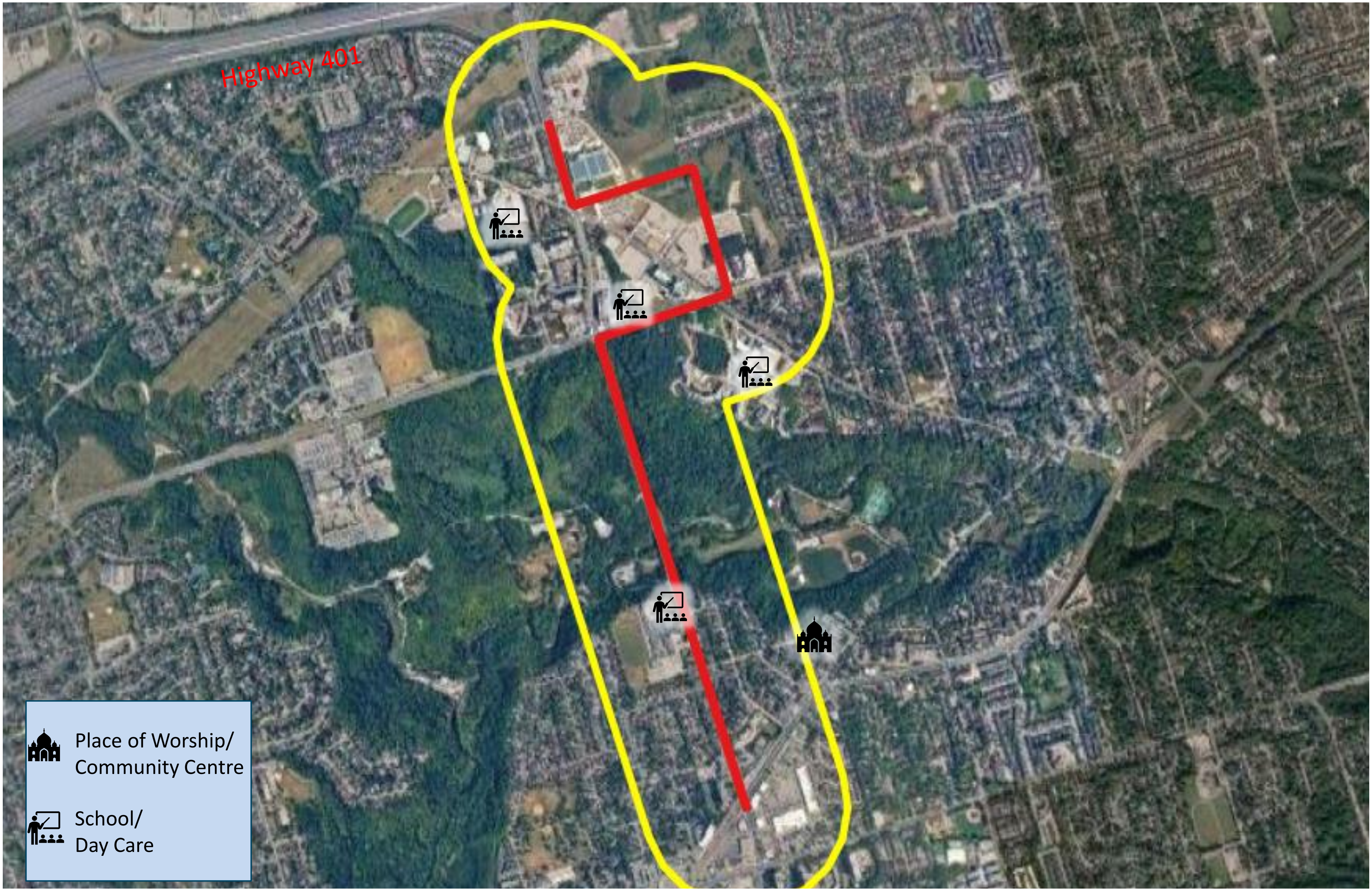


HDR CORPORATION	True North	Scale: N/A	METRES	SLR
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 / Rev 0.0	Figure No. 5	
WIND ROSE (1996-2000)		Project No. 241.030932.00001		



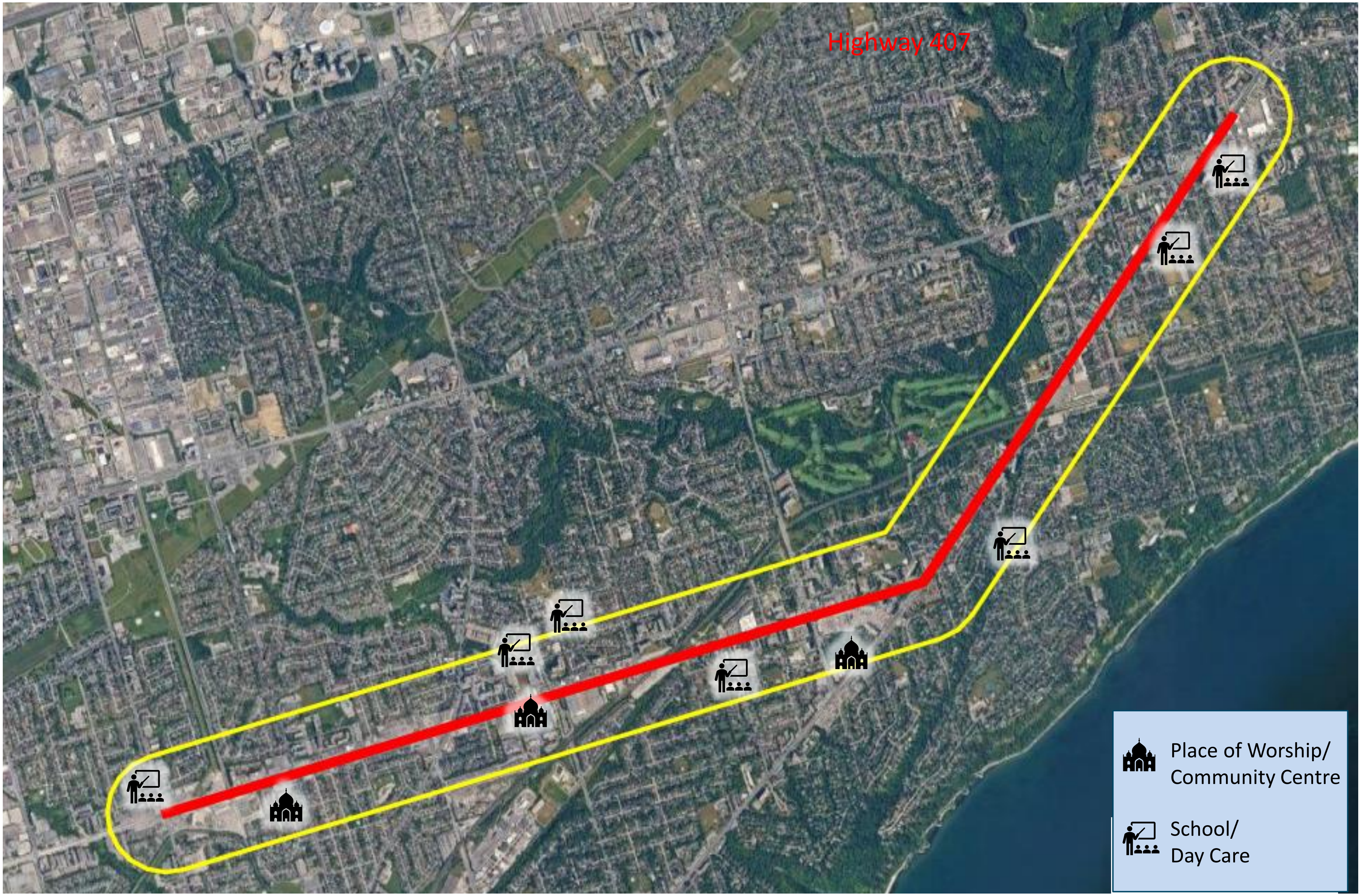
HDR CORPORATION	Scale: 1:24,000	METRES
EGLINTON EAST LRT, TORONTO, ONTARIO	Date: May 3, 2024 Rev 0.0	Figure No. 6A
500M SETBACK FROM NORTH PORTION OF STUDY AREA	Project No. 241.030932.00001	

SLR



HDR CORPORATION	True North	Scale: 1:24,000	METRES
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024 Rev 0.0	Figure No. 6B
500M SETBACK FROM CENTRAL PORTION OF STUDY AREA		Project No. 241.030932.00001	

SLR



HDR CORPORATION	True North	Scale: 1:24,000		METRES	SLR
EGLINTON EAST LRT, TORONTO, ONTARIO		Date: May 3, 2024	Rev 0.0	Figure No. 6C	
500M SETBACK FROM SOUTH PORTION OF STUDY AREA		Project No. 241.030932.00001			

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