

Victoria Square Boulevard Class
Environmental Assessment

Woodbine Avenue (north
connection) to Woodbine Avenue
(south connection)

Environmental Study Report

Appendix

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Air Quality and Noise Assessment

DATE May 28, 2018**PROJECT No.** 1544413**TO** Veronica Restrepo and Anthony Reitmeier
HDR Inc.**CC** Joe Tomaselli**FROM** Katie Armstrong**EMAIL** ksarmstrong@golder.com**QUALITATIVE ASSESSMENT OF AIR QUALITY AND NOISE IMPACTS FOR ROAD IMPROVEMENTS TO VICTORIA SQUARE BOULEVARD, MARKHAM**

In 2016, HDR Inc., on behalf of the City of Markham (the City), retained Golder Associates Ltd. (Golder) to conduct a qualitative air quality and noise assessment as part of a Schedule C Municipal Class Environmental Assessment (MCEA) for road and infrastructure improvements to Victoria Square Boulevard (formerly Woodbine Avenue), between the north and south connections to the Woodbine By-Pass (the Study Area), in the City of Markham, Regional Municipality of York (the Region), Ontario. The scale and design of the proposed project (the Project) varies according to the location in the Study Area, but in general involves:

- Minor road widening and curb construction;
- Creating roadside parking, treed boulevards, and cycling lanes;
- Installing new lighting and drainage infrastructure;
- Accessibility enhancement; and,
- Utility upgrades.

The primary goal of the air quality and noise assessment is to provide a qualitative assessment of the potential air and noise impacts resulting from the proposed Project. Existing air quality data was compared to relevant federal and provincial standards and guidelines. The noise assessment was completed by reviewing the potential changes in background noise levels. Using the available background air quality data and information as it relates to noise levels, a qualitative assessment was prepared to discuss the following:

- Background air quality and noise levels, including:
 - existing background air quality and noise levels in the vicinity of proposed Project; and,
 - contribution of emissions from the existing road to background air quality and noise levels.
- Project Impacts, including:
 - potential impacts of the Project on local air quality and noise levels; and,
 - effects of any potential impacts that arise as a result of the proposed Project.

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1.0 METHODOLOGY

1.1 Air Quality

1.1.1 Indicator Compounds

The assessment of background air quality is focused on criteria air contaminants (CACs), compounds that are expected to be released from mobile sources, and VOCs for which relevant air quality criteria exist, and which are generally accepted as indicative of changing air quality. These compounds result from fuel combustion, brake wear, tire wear and fugitive dust emitted from the movement of vehicles on roadways. The indicator compounds include:

- particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 micrometres (μm) in diameter (PM_{10}), and particles nominally smaller than 2.5 μm in diameter ($\text{PM}_{2.5}$);
- nitrogen dioxides (NO_x) (expressed as nitrogen dioxide [NO_2]);
- carbon monoxide (CO); and
- Volatile Organic Compounds (including acrolein, acetaldehyde, 1,3- butadiene, benzene and formaldehyde which are typically associated with road traffic).

Although CACs typically also include sulphur dioxide and ammonia, these emissions are considered as insignificant for transportation projects, and therefore were not included in the assessment (MTO, 2012). It is assumed that emissions from construction operations will be managed through best management practices for construction operations and monitoring and mitigation requirements will be considered as part of the special provisions that are typically written to the construction tender documents.

1.1.2 Applicable Guidelines / Criteria

The air quality criteria used for assessing the air quality effects of the Project include the Ontario criteria, and federal standards and objectives where provincial guidelines are not available. The Ministry of the Environment and Climate Change (MOECC) has issued guidelines related to ambient air concentrations, which are summarized in *Ontario's Ambient Air Quality Criteria* (MOECC, 2012). There are two sets of federal objectives and criteria: the Canadian Ambient Air Quality Standards (CAAQs) (formerly National Ambient Air Quality Standards (NAAQS)), and the National Ambient Air Quality Objectives (NAAQOs).

The NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale, and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME, 1999). The federal government has established the following levels of NAAQOs (Health Canada, 1994):

- the maximum desirable level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of control technology; and
- the maximum acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

The CAAQs have been developed under the *Canadian Environmental Protection Act*, and include standards for $\text{PM}_{2.5}$ that must be achieved by 2020.

A summary of the applicable Ontario and federal standards, objectives and criteria are listed in Table 1, along with the selected project criteria, which were selected to be the most stringent.

Table 1: Ontario and Canadian Regulatory Air Quality Objectives and Criteria

Substance	Averaging Period	Ontario Ambient Air Quality Criteria ^(a)	Canadian Ambient Air Quality Standards ^(b)	National Ambient Air Quality Standards and Objectives ^(c)		Project Criteria
				Desirable	Acceptable	
SPM ^(d) (µg/m ³)	24-Hour	120	—	—	120	120
	Annual	60 ^(e)	—	60	70	60
PM ₁₀ (µg/m ³)	24-Hour	50 ^(f)	—	—	—	50
PM _{2.5} (µg/m ³)	24-Hour	30 ^(g)	28/27	—	—	27
	Annual	—	10/8.8	—	—	8.8
NO ₂ (µg/m ³)	1-Hour	400	—	—	400	400
	24-Hour	200	—	—	200	200
	Annual	—	—	60	100	60
CO (µg/m ³)	1-Hour	36,200	—	15,000	35,000	15,000
	8-Hour	15,700	—	6,000	15,000	6,000
Acrolein (µg/m ³)	1-Hour	4.5	—	—	—	4.5
	24-Hour	0.4	—	—	—	0.4
Acetaldehyde (µg/m ³)	24-Hour	500	—	—	—	500
	½ hour	500	—	—	—	500
1,3-Butadiene (µg/m ³)	24-Hour	10	—	—	—	10
	Annual	2	—	—	—	2
Benzene (µg/m ³)	24-hour	2.3	—	—	—	2.3
	Annual	0.45	—	—	—	0.45
Formaldehyde (µg/m ³)	24-hour	65	—	—	—	65

(a) MOECC 2012.

(b) CAAQS for PM_{2.5} published in the Canada Gazette Volume 147, No. 21 - May 25, 2013. The standards for PM_{2.5} will be phased in in 2015 and 2020, with both numbers shown in the table. The larger (first) value represents the CAAQS for 2015.

(c) CCME 1999

(d) SPM in Ontario is defined as Suspended Particulate Matter (<44 µm diameter).

(e) Geometric Mean Value.

(f) Interim Ambient Air Quality Criteria (AAQC).

(g) Compliance is based on the 98th percentile of the annual monitored data averaged over three years of measurements.

— = No guideline available.

1.2 Noise

1.2.1 Assessment Criteria

Provincial bodies (MOECC and the Ontario Ministry of Transportation (MTO)) have provided guidance documents that set out methods and criteria for the assessment of environmental noise levels, specifically due to road traffic. In addition to documents provided by provincial bodies, the Region has made available various documents detailing the methods of assessing road traffic noise (Traffic Noise Mitigation Policy for Regional Roads (March 2006) and Transportation Services, Capital Delivery – Roads Standard Operating Procedures for Traffic Noise Mitigation on Regional Roads (July 2010)). The relevant guidance documents referenced for this assessment are summarized in Table 2 below.

Table 2: Applicable Noise Criteria

Governing Body	Guidance Document	Intended Use	Criteria
Ontario Ministry of Environment and Climate Change (MOECC)	NPC-300 (August 2013) (formerly LU-131)	Permitting of stationary sources (i.e., industry) or land use planning (i.e., residential development)	<ul style="list-style-type: none"> ■ Threshold Noise Limit
Ontario Ministry of Transportation (MTO)	Environmental Guide for Noise (October 2006)	Roadways	<ul style="list-style-type: none"> ■ Threshold Noise Limit & ■ Change over background with and without the project
York Region	York Region Traffic Noise Mitigation Policy for Regional Roads (March 2006)	Regional Roads	<ul style="list-style-type: none"> ■ Threshold Noise Limit & ■ Change over background with and without the project
York Region	Transportation Services, Capital Delivery – Roads Standard Operating Procedures for Traffic Noise Mitigation on Regional Roads (July 2010)	Regional Roads	<ul style="list-style-type: none"> ■ Threshold Noise Limit & ■ Change over background with and without the project

Reviewing the potential change over background noise levels, with a project, can be an effective metric to assess the potential impact of a project. When a roadway exists, and a project is not expected to significantly alter the corridor layout, a review of the expected changes in traffic volumes can be an appropriate approach as an alternative to completing detailed noise modelling.

1.3 Sensitive Receptors

As outlined in the MTO guidance, sensitive receptors within a given distance of the study area (i.e. 500m for air quality and 600m for noise) should be identified and assessed. The area surrounding the Project contains various land use types, including industrial, commercial and natural, however various sensitive receptors have also been identified in the vicinity of the Project and are as follows:

- Residences:
 - There are residential areas to the east and west of the Project, adjacent to Victoria Square Boulevard
- Place of Worship:
 - Cathedral of the Transfiguration is located along Victoria Square Boulevard within the Project limits (approximately 750 m east of Highway 404).
 - Victoria Square United Church is located along Victoria Square Boulevard within the Project limits (approximately 950 m east of Highway 404).
- Schools:
 - Sir Wilfred Laurier Public School is located along Victoria Square Boulevard within the Project limits (approximately 950 m east of Highway 404).
- Recreational areas:
 - There are 3 Parks along Victoria Square Boulevard within the Project limits including Victoria Square Park, Cathedral (King David) Park and Mossy Stone Park

All of the above identified receptors are located close to other major arterial and highways roads, in particular Highway 404. These roads have a much higher traffic volume than the proposed Project and in many cases are located closer than the Project. As a result, they are likely to have a greater influence on air quality and noise levels at the sensitive receptors.

2.0 PROJECT ASSESSMENT

2.1 Air Quality

2.1.1 Existing Conditions

The background air quality in the area around the proposed Project has been described by considering regional concentrations, based on publicly available monitoring data. The background air quality represents the existing conditions of air quality before the operation of the proposed Project. Sources include roadways, long range transboundary air pollution, small regional sources and large industrial sources.

This section details the selection of compounds considered in the assessment, applicable guidelines for this assessment, selection of the monitoring stations, and comparison of the selected data to the ambient air quality criteria (AAQCs).

In Ontario, regional air quality is monitored through a network of air quality monitoring stations operated by the MOECC and Environment Canada National Air Pollution Surveillance (NAPS) Network. These stations are operated under strict quality assurance and quality control procedures. Existing air quality was characterized using background air concentrations from monitoring data sources in the Project area. For this assessment, data from 2015 was used, which is the most recent complete year for which all data is Quality Assured by Environment Canada.

The two stations identified as being most relevant to the proposed Project are located at Eagle Street and McCaffrey Road in Newmarket (the Newmarket Station) and the station located at Highway 47 and Highway 48 (the York Region Station). The Newmarket Station is located approximately 18 km from the Project and is also near Highway 404. The monitoring data for this station is therefore anticipated to be appropriate to represent the combined effect of emissions from local sources, as well as the effect of emissions transported into the region. The York Region Station is located closer to the Project; however, no data was available for 2015 and it was therefore not considered further. Details of the Newmarket station are provided in Table 2.

Table 3: Ambient Air Quality Monitoring Parameters

Station Name	NAPS Station ID	Data Available					Distance from Project
		PM _{2.5}	PM ₁₀	NO ₂	CO	VOCs	
Newmarket	65101	Y	—	Y	—	Y	Approximately 18 km north-north west

Note: “—” Station not used for obtaining compound data.

For analyzing monitoring data, the 90th percentile of the available monitoring data is typically considered a conservative estimate of background air quality (CEA Agency and CNSC, 2009). As a result, the 90th percentile of the measured concentrations were used to represent background air quality for parameters with shorter averaging periods (i.e., 1-hour and 24-hour). Annual background concentrations were calculated based on the mean of the available data. A summary of the background air quality concentrations for all compounds is provided below in Table 3. No local monitoring data was available for SPM and PM₁₀, however, an estimate of the background SPM and PM₁₀ concentrations can be determined from the available PM_{2.5} monitoring data. Fine particulate matter (i.e., PM_{2.5}) is a subset of PM₁₀, and PM₁₀ is a subset of SPM. Therefore, it is reasonable to assume that the ambient concentrations of SPM will be greater than corresponding PM₁₀ levels, and PM₁₀ concentrations will be greater than the corresponding levels of PM_{2.5}. The overall levels of PM_{2.5} in Canada were found to be about 54% of the PM₁₀ concentrations and about 30% of the SPM concentrations (Lall et al, 2004). By applying this ratio, it was possible to estimate the background SPM and PM₁₀ concentrations for the region.

Table 4: 2015 Air Quality Monitoring Data from Newmarket Station

Indicator Compound	Averaging Period	Background Concentration [µg/m ³]	Regulatory Criteria [µg/m ³]	% of AAQC
SPM	24-Hour	54	120	44%
	Annual	23.7	60	39%
PM ₁₀	24-Hour	30	50	59%
PM _{2.5}	24-Hour	16	27	59%
	Annual	7.1	8.8	81%
NO _x (expressed as NO ₂)	1-Hour	33.87	400	8%
	24-Hour	30.1	200	15%
	Annual	8.5	60	14%
Benzene	24-Hour	0.665	2.3	29%
	Annual	0.422	0.45	94%
1,3-Butadiene	24-Hour	0.034	10	<1%

Note: All values are based on 90th percentile with the exception of annual averages

Overall, the monitoring data indicates that background air quality concentrations are below the AAQC for all indicator compounds. AAQC are typically an indicator of good air quality, and therefore air quality in the Study Area, may be classified as good. Furthermore, in 2015, the Newmarket Station had an Air Quality Health Index of “low” 89.8% of the year, with only 0.1% of the year, classified as “high” (MOECC, 2016). The Air Quality Health Index is a risk-based scale designed to help classify the quality of the air and its impact on health. A number from 1 to 10 is identified by Environment Canada to indicate the level of health risk associated with local air quality. Therefore a “Low” rating indicates a “low” risk to health.

2.1.2 Local Emission Sources

The proposed Project is located in a relatively residential area, as a result, there are no industrial facilities within a 2km radius of the Project that reported to the National Pollutant Release Inventory in 2015 for the indicator compounds (ECCC, 2016). The main source of emissions close to the Project is anticipated to be Highway 404, which has annual average daily traffic of over 100,000 vehicles, approximately 5 times greater than the existing traffic volumes on Victoria Square Boulevard.

2.1.3 Project Emissions

The proposed Project involves road improvements including minor road widening and curb construction. As a result, no substantial change in road traffic and accordingly to road traffic emissions. Road traffic emissions from the Project is expected to be similar to those expected without the Project. Therefore, it is not expected the Project will substantially alter the existing conditions.

2.2 Noise

2.2.1 Existing Conditions

The background noise levels in the vicinity of the Project has been described based on a review of publicly available information. The background noise levels represent the existing conditions before the operation of the proposed Project. As there was limited Study Area-specific quantitative noise studies available, the review of available information was limited to a review of aerial imagery and Golder’s experience of similar environments.

It is expected the background noise levels in the Project Study Area are made up of road traffic noise from other major roadways in the vicinity of the Study Area, existing traffic along the Project corridor and to a lesser extent from other anthropogenic activities such as mechanical/electrical equipment (e.g. heating, cooling and ventilation equipment). The background noise levels are expected to be similar to other urbanized environments across Ontario with elevated levels during the daytime period and quieter levels during the nighttime period. When anthropogenic activities are minimal, it is further expected there will be periods where the background levels are made up of sounds of nature.

2.2.2 Project Emissions

The proposed Project involves road improvements including minor road widening and curb construction. As a result, no substantial change in road traffic is expected. Accordingly, future road traffic noise emissions with the Project is expected to be similar to those expected without the Project. Therefore, it is not expected the Project will substantially alter the background noise levels.

3.0 CONCLUSIONS

Based on the existing air quality monitoring data in the Project area, the levels of particulate matter, nitrogen oxides, benzene and 1,3-butadiene are shown to be below the current standards and guidelines and thus existing air quality in the study area would be considered good. The Project results in no changes to traffic volume compared to the existing scenario, therefore no significant changes to air quality in the region are expected. Highway 404, lies within 1 km of the proposed Project, and is the largest sources of road emissions in the immediate surrounding area, with average daily traffic much greater than the Project. Roadways typically only have a very localized influence on air quality and predicted concentrations decline within a very short distance from the road edge. The Project itself is therefore anticipated to be a relatively minor source when compared to other larger sources within the area and is necessary to help alleviate congestion. Therefore, the impact on overall air quality in the region is expected to be negligible.

As it is not expected the Project will result in a substantial alteration to the road corridor, and the Project is not expected to substantially change the existing traffic volumes, it is expected the Project will result in a negligible change to the background noise levels.

4.0 REFERENCES

- Canadian Council of Ministers of the Environment (CCME) (1999). *Canadian National Ambient Air Quality Objectives: Process and Status*. Available at ceqg-rcqe.ccme.ca/download/en/133/. Retrieved March 29, 2017.
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