Environmental Noise Assessment
Part (A) Huntington Road from Langstaff Road to McGillivray Road and Part (B) from Major Mackenzie Drive to Nashville Road
City of Vaughan

Novus Reference No. 13-0253 Version No. 1.1 (Final) October 18, 2017

NOVUS PROJECT TEAM:

Scientist:	Stephanie Seebach, B.Eng., EIT
Senior Specialist:	Chris Blaney, B.A.
Senior Engineer	Darron Chin-Quee, M.B.A., P.Eng., LEED AP
Project Manager:	Jason Slusarczyk, P.Eng.

This page intentionally left blank
for 2-sided printing purposes

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

Novus Environmental Inc. (Novus) was retained by Parsons Corporation to conduct an environmental noise impact assessment for the proposed Huntington Road improvements, from Nashville Road to Langstaff Road, in the City of Vaughan, Ontario.

The objectives of this study are as follows:

- to assess future "build" and existing "no-build" sound levels from road traffic noise sources in the area (i.e., noise levels with and without the proposed project taking place);
- to use these predictions to assess potential impacts according to the applicable guidelines;
- to specify mitigation measures where required; and
- to assess the potential for construction noise and provide a Code of Practice to minimize potential impacts.

A glossary of common terms and a description of transportation sound basics can be found in **Appendix A**.

1.1 Project Description (Nature of the Undertaking)

The proposed roadway improvements are located in the City of Vaughan and include the widening and urbanization of Huntington Road between Nashville Road and Langstaff Road. Due to ongoing and proposed development, as well as the future extension of Highway 427, Huntington Road will be discontinued and has thus been analysed as two separate parts in this assessment:

- Part A: Langstaff Road to McGillivray Road
- Part B: North of Major Mackenzie Drive to Nashville Road

Figure 1 illustrates the future discontinuity on Huntington Road and the project limits.

1.2 Future Road Improvements Outside of Study Area

The following road improvements have been proposed in different studies and were approved by the applicable agencies:

- The extension of Highway 427 to Major Mackenzie Drive
- The realignment and widening of Major Mackenzie from two lanes to six lanes, including one HOV lane in each direction
- Construction of the following new roads and their intersection with Huntington Road:

- Future Road (see **Figure 1**)
- MacTier Drive (see **Figure 2**)
- Algoma Drive (see **Figure 3**)
- East Corner's Boulevard (see **Figure 3**)
- "Street A" (see **Figure 6**)

The future extension of Highway 427 and the realignment of Major Mackenzie are illustrated in **Figure 1**.

2.0 ROAD TRAFFIC NOISE IMPACTS (OPERATIONAL NOISE)

For roadway projects, operational noise is of primary importance. This section of the report provides an analysis of operational noise impacts from road traffic noise related to this undertaking.

2.1 Applicable Guidelines

There are several transportation noise guidelines that are applicable to this project. Ontario Provincial policies and guidelines from the Ontario Ministry of Transportation (MTO) and the Ontario Ministry of the Environmental and Climate Change (MOECC) are directly applicable under the Municipal Class EA process for transportation projects, and are discussed in detail in this report.

2.1.1 Ontario Provincial Guidelines and Policies

Ontario has a number of guidelines and documents related to assessing road traffic noise impacts. The document most applicable to municipal roadway projects is:

- Ontario MOE/MTO, "Joint Protocol", A Protocol for Dealing with Noise concerns during the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments (MTO & MOECC, 1986)

In May 2007, the MTO released the Environmental Guide for Noise (MTO, 2006) which supersedes the Joint Protocol and previous MTO Quality and Standards Directive QST-A1 for Provincial highways and freeways (MTO 1992). It is our understanding that the Environmental Guide for Noise (the Guide) has not been adopted by the MOECC for municipal projects. Therefore, the Joint Protocol has been used for this study.

The Joint Protocol sets out an Outdoor Objective sound level of 55 dBA L_{eq}, or the existing ambient. For sound levels on the order of magnitudes shown in **Table 6** (i.e. less than 60 dBA), either the Guide or the Joint Protocol assesses noise impacts in the same manner. Only in the case where sound levels exceed 65 dBA, is the Guide more stringent. The evaluation of

noise impacts is determined by the change in cumulative sound levels from the future "no-build" scenario to the future "build" scenario. The 2015 condition was applied as the future "no-build" condition in this assessment. Assessments are based on a minimum 10-year future horizon year (i.e., traffic volumes 10 years after the completion of the project). Accordingly, a design year of 2034 applies to this project, corresponding to the traffic forecasts provided by Parsons Corporation.

Noise mitigation is warranted when increases in sound level over the "no-build" ambient are greater than 5 dBA. Mitigation measures can include changes in vertical profiles and horizontal alignments, noise barriers, and noise reducing asphalts. Noise mitigation, where applied, must be administratively, economically, and technically feasible, and must provide at least 5 dBA of reduction averaged over the first row of noise-sensitive receivers. Mitigation measures are restricted to within the roadway right-of-way. Off right-of-way noise mitigation, such as window upgrades and air conditioning, is not considered. Noise mitigation requirements are summarized below:

Table 1: Summary of Mitigation Efforts Under Ontario Road Traffic Noise Guidelines

Future Sound Levels	Change in Noise Level Above Future "No-Build" Ambient (dBA)	Mitigation Effort Required
< 55 dBA	0 to 5	None
	> 5	
> 55 dBA	0 to 5	None
	> 5	• Investigate noise control measures within right-of-way • Noise control measures where used must provide a minimum of 5 dBA of attenuation, averaged over the first row of receivers • Mitigated to as close to ambient as possible, where technically, economically and administratively feasible

Notes: Values are L_{eq} (16h) levels for municipal roads and provincial highways, and L_{eq} (24h) for freeways

2.2 Location of Noise Sensitive Areas Within the Area of Investigation

2.2.1 Definition of Noise Sensitive Areas

Noise impacts from transportation projects are evaluated at noise sensitive receptors commonly referred to as Noise Sensitive Areas (NSAs). Under the Joint Protocol, NSAs include the following land uses, provided they have an Outdoor Living Area (OLA) associated with them:

- Private homes (single family units and townhouses)
- Multiple unit buildings such as apartments, provided they have a communal OLA associated with them
- Hospitals and nursing homes for the aged, provided they have an OLA for use by patients
- Schools, educational facilities, and daycare centres where there are OLAs for students
- Campgrounds that provide overnight accommodation

- Hotels and motels with outdoor communal OLAs for visitors
- Churches and places of worship

The following land uses are generally not considered to qualify as NSAs:

- Apartment balconies
- Cemeteries
- Parks and picnic areas not part of a defined OLA
- All commercial
- All industrial

Land use zoning maps are included in **Appendix B**.

2.2.2 Representative NSAs for Analysis

A number of NSAs have been used in the analysis to represent worst-case potential noise impacts at all surrounding noise sensitive land uses within the study area. NSAs were grouped into areas with similar overall noise levels and similar changes in noise ("build" versus "no-build"). Both quantitative analysis and qualitative observations are used to assess whether an NSA falls within a respective grouping. Some qualitative factors that are used to judge acoustic equivalence, and thus NSA grouping, include screening of OLAs by houses, geometrical changes ("build" versus "no-build"), and proximity to roadways. These NSA and modelled receptor locations are shown in **Figure 2** to **Figure 5** and described in the following table.

Table 2: Representative NSAs Considered in Analysis

Receptor Location	Description	Distance to Huntington Rd. Centreline (m)	Distance to Major Mackenzie Dr. Centreline if Applicable (m)	Distance to Hwy 427 Centreline if Applicable (m)	Approximate # of NSAs Represented
POR1	Nashville Heights Sub-division – N of Mactier Dr.	120	NA	NA	1
POR2	Nashville Heights Sub-division – Adjacent to Cemetery	30	NA	NA	9
POR3	Huntington Rd N of Algoma Dr. –Single Family Residence	48	NA	NA	4
POR4	Nashville Heights Sub-division – Algoma Dr.	30	NA	NA	6
POR5	Nashville Heights Sub-division – Kincardine St.	60	766	734	15
POR6	Nashville Heights Sub-division – East's Corners Blvd.	33	660	624	2

Receptor Location	Description	Distance to Huntington Rd. Centreline (m)	Distance to Major Mackenzie Dr. Centreline if Applicable (m)	Distance to Hwy 427 Centreline if Applicable (m)	Approximate # of NSAs Represented
POR7	Nashville Heights Sub-division – NW corner of Moody Dr.	155	442	486	16
POR8	Nashville Heights Sub-division – Moody Dr.	245	368	484	16
POR9	Nashville Heights Sub-division – S corner of Moody Dr.	45	212	430	6
POR10	Nashville Heights Sub-division – SE corner of Moody Dr.	67	235	540	14
POR11	Major Mackenzie Dr. at Huntington Rd. – Single Family Residence	315	200	160	1
POR12	9711 Huntington Rd. – Single Rural Residence	95	NA	257	1
POR13	Huntington Rd. S of McGillivray Rd. – Single Family Residence	52	NA	320	1
POR14	9441 Huntington Rd. – Single Rural Residence	41	NA	474	1
POR15	6666 Rutherford Rd. – Single Rural Residence	247	NA	461	1
POR16	9151 Huntington Rd. – Single Rural Residence	294	NA	611	1
POR17	NE of Trade Valley Dr. at Huntington Rd. –Single Family Residence	75	NA	1039	1

The OLA may be situated on any side of the receptor, but is generally taken to be in the back yard. For assessment purposes, the OLA is taken as a point 3 m from the façade of the receptor, and 1.5 m (approximate head-height) above the ground surface to be consistent with MOECC policy. Where the actual position of the OLA is unknown, the side with worst-case (minimum) "build" versus "no-build" screening effects has been assumed. The locations of the points of reception used in the analysis are shown in **Figure 2** to **Figure 6**.

Receptor locations POR11 – POR16 were also included in the Highway 427 Transportation Corridor Environmental Assessment (EA) developed by McCormick Rankin Corporation (MRC) in January 2010. It should be noted that although a receptor was located northwest of the Huntington Rd and Major Mackenzie Dr. intersection in the 2010 EA, a transit route is proposed in this area according to the provided Highway 427 Extension Widening drawings provided by Parsons Corporation. Therefore, a receptor at this location was not included in this assessment.

2.3 Study Horizons

Under the Joint Protocol a "noise impact" is defined as the difference in projected noise levels at the start of construction and the projected noise levels 10 years after construction. The year 2015 was selected as the start of the construction year (defined as the existing "no-build" scenario) and a future year of 2034 was selected as the future "build" scenario, based on the best available future traffic year.

2.4 Study Scenarios

As mentioned above, the "noise impact" of the study area is defined as the difference in projected noise levels at the start of construction and the projected noise levels in the future. It should be noted that the future road improvements identified in **Section 1.2** and their corresponding projected traffic volumes are included in both the "no-build" and the "build" scenarios as these improvements have been approved by the applicable agencies and will be implemented regardless of outcome of the proposed Huntington Road improvements addressed in this assessment.

2.5 Road Traffic Data

Traffic volumes for the 2015 "no-build" and 2034 "build" scenarios for multiple sections along Huntington Road were provided by Parsons Corporation and are provided in **Table** 3 and **Table 4**, respectively. Traffic data was provided in the form of Annual Average Daily Traffic (AADT) for sections along Huntington Road for both "no-build" and "build" traffic volumes. The percentage of commercial trucks was also provided for sections along Huntington Rd. A Medium / Heavy truck split of 60/40 was assumed as per City of Vaughan policy.

Traffic volumes associated with the Highway 427 Expansion was obtained from the Ministry of Transportation Ontario's Noise Review Report: Highway 427 Expansion from Highway 7 to Major Mackenzie Drive (July, 2016). Seeing as approval has been given to the Highway 427 Expansion, Highway 427 and Major Mackenzie Drive traffic volumes were applied to both the "no-build" and "build" scenarios for this noise assessment.

Traffic data with respect to the Highway 427 Extension Widening was provided in the form of Summer Average Daily Traffic (SADT) data for future volumes and is presented in **Table 5**. Medium / Heavy truck split data and speed limits with respect to the Highway 427 Expansion were also provided and applied in this assessment. Note that a Medium / Heavy truck split of 60/40 was applied to Highway 427 and Major Mackenzie Drive in the Highway 27 Expansion Noise Review Report, similar to the truck split applied to Huntington Road in this assessment. Raw traffic data and typical distributions can be found in **Appendix C**.

Table 3: "No-Build" Year 2015 Traffic Data along Huntington Rd.

Road	2015 AADT	Day / Night Split [1]	Overall % Commercial Vehicles	Medium / Heavy Truck Split [2], [3]	Posted Speed Limit (km/h)
Nashville Rd – Major Mackenzie Dr.	1,210	85/15	11	6.6/4.4	80
Major Mackenzie Dr. – Rutherford Rd.	835	85/15	16	9.6/6.4	80
Rutherford Rd. – Trade Valley Dr./Street. A	4,440	85/15	16	9.6/6.4	80
Trade Valley Dr./Street A – Langstaff Rd.	7,590	85/15	8	4.8/3.2	80

Notes: [1] XX / YY is the percentage of vehicle traffic in the 16 hour daytime and 8 hour night-time respectively.
[2] MM / HH is the percentage of medium trucks and heavy trucks used in the analysis, respectively.
[3] Medium / Heavy Truck Split of 60/40 was assumed as per City of Vaughan policy.

Table 4: "Build" Year 2034 Traffic Data along Huntington Rd.

Road	2034 AADT	Day / Night Split [1]	Overall % Commercial Vehicles	Medium / Heavy Truck Split [2], [3]	Posted Speed Limit (km/h)
Nashville Rd. – Major Mackenzie Dr.	5,745	85/15	11	6.6/4.4	80
McGillivray Rd. – Rutherford Rd.	1,160	85/15	8	4.8/3.2	80
Rutherford Rd. – Trade Valley Dr./Street A	11,215	85/15	16	9.6/6.4	80
Trade Valley Dr./Street A – Langstaff Rd.	14,445	85/15	8	4.8/3.2	80

Notes: [1] XX / YY is the percentage of vehicle traffic in the 16 hour daytime and 8 hour night-time respectively.
[2] MM / HH is the percentage of medium trucks and heavy trucks used in the analysis, respectively.
[3] Medium / Heavy Truck Split of 60/40 was assumed as per City of Vaughan policy.

Table 5: "No-build" and "Build" Traffic Data – Hwy 427 Extension Widening

Road	2034 SADT	Day / Night Split [1]	Overall % Commercial Vehicles	Medium / Heavy Truck Split [2]	Posted Speed Limit (km/h)
Hwy 427 – Major Mackenzie Dr. to Rutherford Rd.	72,300	66/33	12	7/5	100
Hwy 427 – Rutherford Rd. to Langstaff Rd.	98,600	66/33	12	7/5	100
Major Mackenzie Dr. – East of 427	35,600	85/15	8	5.6/2.4	60
Major Mackenzie Dr. S-EW Ramp	21,000	85/15	8	5.6/2.4	60
Major Mackenzie Dr. S-W Ramp	17,100	85/15	8	5.6/2.4	60

Notes: [1] XX / YY is the percentage of vehicle traffic in the 16 hour daytime and 8 hour night-time respectively.
[2] MM / HH is the percentage of heavy trucks and medium trucks used in the analysis, respectively.

2.6 Noise Barriers

As per the provided site plan drawings "3748-BP", "3921-BP", "3922-BP", "4284-BP", received on June 9, 2016, noise barriers are to be installed in designated locations of Block 61 – Nashville Heights to mitigate daytime sound exposure. The location of each noise barrier

(1.8 m high above grade) to be installed is shown in **Figure 2** to **Figure 6**. Note that the noise barriers at POR2 and southeast of POR4 shown in **Figure 3** are to be 1.8 m high, installed above a 1.4 m berm. Although, other noise barriers were included in the provided site plan drawings, the location of the noise barriers are not relevant to the receptors assessed in the current study and have therefore not been included. Also note that the Block 61 residential development north of and including POR1 (shown in **Figure 2**) was not addressed in the site plan drawings provided on June 9, 2016 nor in the provided Nashville Heights – Block 61 Environmental Noise Assessment Reports prepared by Valcoustics Canada Ltd. Therefore, noise barriers in the residential development area described above were not included in the current assessment.

It is our understanding that no additional mitigation (i.e. noise barriers) are to be included in the Highway 427 Extension, as per the MTO's Noise Review Report: Highway 427 Expansion from Highway 7 to Major Mackenzie Drive (July, 2016). Thus, noise barriers pertaining to the Highway 427 Extension were not included in this assessment.

2.7 Noise Model Used

Road traffic noise levels were modelled using a computerized spreadsheet implementation of the "Ontario Road Noise Analysis Method for Environmental Transportation (ORNAMENT)" algorithms (MOECC 1989). The algorithms in this spreadsheet form the basis of the STAMSON v5.04 computer program produced by the MOECC (MOECC 2000). Results from the ORNAMENT calculations and STAMSON are equivalent. Sound levels were predicted using the computerized spreadsheet for both the future "no-build" and future "build" cases. The ORNAMENT model was selected as road-receiver geometries and intervening terrain within the Area of Investigation are relatively simple, and the potential for impacts (sound level increases greater than 5 dBA) to result from the proposed undertaking is small.

The following factors were taken into account in the analysis:

- Horizontal and vertical road-receiver geometry;
- Intervening terrain types (ground absorption);
- Traffic volumes and percentage of trucks;
- Vehicle speeds;
- Screening provided by terrain, houses and existing sound barriers.

Distances, roadway heights, and receptor locations were obtained from aerial photography and site plan drawings supplied by Parsons Corporation.

2.8 Detailed Modelling

Table 6 presents a comparison of future "build" versus existing "no-build" sound levels at receptors requiring detailed modelling. Sample calculations can be found in **Appendix D**.

Table 6: Noise Levels With and Without the Undertaking

Receptor Location	Number of NSAs Represented	Future "Build" L_{eq} (16h)	Existing "No-Build" L_{eq} (16h)	Change ("Build" minus "No-Build")
POR1	1	50[1]	50[1]	0
POR2	9	51	50[1]	1
POR3	4	55	50[1]	5[2]
POR4	6	51	50[1]	1
POR5	15	50[1]	50[1]	0
POR6	2	50[1]	50[1]	0
POR7	16	50[1]	50[1]	0
POR8	16	50[1]	50[1]	0
POR9	6	56	53	3
POR10	14	50[1]	50[1]	0
POR11	1	53	53	0
POR12	1	58	58	0
POR13	1	57	57	0
POR14	1	55	55	0
POR15	1	54	54	0
POR16	1	54	53	1
POR17	1	57	54	3

Notes: All sound levels are in dBA
Apparent arithmetic discrepancies are due to rounding
[1] Actual predicted background L_{eq} is less than 50 dBA, however the receptor is classified as Class 2 Area: Urban for which background L_{eq} is assumed to be 50dBA based on the MOECC Publication NPC-300
[2] Actual sound level is slightly in excess of 5 dBA

Impacts are also ranked in terms of increasing future "build" sound levels (in **Table 7**), and increasing change in sound level (in **Table 8**).

Table 7: Ranking of Absolute Future Noise Levels

Future "Build" L_{eq} (16h)	Number of Receptors in this Category	Number of NSAs Represented
45 to < 50 dBA	0	0
50 to < 55 dBA	11[1]	82
55 to < 60 dBA	6	14
60 to < 65 dBA	0	0
65 to < 70 dBA	0	0
70 dBA or greater	0	0

[1] Number of receptors in this category is based on an assumed background L_{eq} of 50 dBA for Class 2 Area: Urban receptors

Table 8: Ranking of Change in Sound Levels

Future "Build" L_{eq} (16h)		Number of Receptors in this Category	Number of NSAs Represented
Increase in Sound Level	> 15 dBA	0	0
	> 10 to 15 dBA	0	0
	> 5 to 10 dBA	1	4
	0 to 5 dBA	16	92
Decrease in Sound Level	-5 to < 0 dBA	0	0
	-10 to < -5 dBA	0	0
	-15 to < -10 dBA	0	0
	< -15 dBA	0	0

Note: The information provided in this table is based on an assumed background L_{eq} of 50 dBA for Class 2 Area: Urban receptors

2.9 Investigation of Noise Mitigation

The results show that changes in sound exposures resulting from the proposed project are expected to be slightly in excess of 5 dB at Receptor POR3 (rounded to 5 dB in **Table 6**). This receptor is representative of four NSAs which are all single residences that front Huntington Rd. (Part B). It is recognized that noise impacts from the proposed project exist at these NSAs. Placement of noise barriers on the driveway / right of way might be technically feasible to provide a greater than 5 dB noise reduction however they are not considered to be economically feasible.

Based on the projected sound levels at the remaining receptor locations (POR1, POR2, POR4 – POR17), changes in sound exposure levels are not expected to be 5 dB or greater. As a result, further investigation of mitigation measures is not required under the Joint Protocol.

3.0 CONSTRUCTION NOISE IMPACTS

Construction noise impacts are temporary in nature, and largely unavoidable. Although for some periods and types of work, construction noise will be noticeable, with adequate controls, impacts can be minimized. This section of the report provides an evaluation of noise impacts from construction, and recommends a Code of Practice to minimize impacts.

3.1 Construction Noise Guidelines

3.1.1 Local Noise Control Bylaws

The proposed project lies within the local jurisdiction of the City of Vaughan. Bylaws restricting noise from construction activity exist within this jurisdiction. The applicable bylaw

requirements are summarized below in **Table 9**. Copies of the bylaw can be found in **Appendix E**.

Table 9: Applicable Local Noise Control Bylaws

Jurisdiction	Bylaw Number	Bylaw Provision
City of Vaughan	By-law 96-2006	**Section 10 – Construction** **Subsection (1)** No person shall, between 1900 hours of one day and 0700 hours of the next day operate or cause to be operated, any construction vehicle or construction equipment in connection with the construction of any building or structure, highway, motor car, steam boiler or other engine or machine; **Subsection (2)** Despite subsection (1), no person shall operate or cause to be operated any construction vehicle or construction equipment before 0700 hours and no later than 1900 hours on any Saturday and not at all on Sunday or statutory holidays

If work is required outside of the allowable time periods listed above, the Contractor should seek in advance any required exemptions and permits directly from the affected jurisdiction. If an exemption cannot be obtained, then construction should proceed in accordance with the Bylaw requirements.

3.1.2 MOECC Model Municipal Noise Control Bylaw

The MOECC stipulates limits on noise emissions from individual items of equipment, rather than for overall construction noise. In the presence of persistent noise complaints, sound emission standards for the various types of construction equipment used on the project should be checked to ensure that they meet the specified limits contained in MOE Publication NPC-115 – "Construction Equipment", as follows (MOECC 1977):

Table 10: NPC-115 Maximum Noise Emission Levels for Typical Construction Equipment

Type of Unit	Maximum Sound Level [1] (dBA)	Distance (m)	Power Rating (kW)
Excavation Equipment [2]	83	15	< 75
	85	15	> 75
Pneumatic Equipment [3]	85	7	-
Portable Compressors	76	7	-

Notes: [1] Maximum permissible sound levels presented here are for equipment manufactured after Jan. 1, 1981.
[2] Excavation equipment includes bulldozers, backhoes, front end loaders, graders, excavators, steam rollers and other equipment capable of being used for similar applications.
[3] Pneumatic equipment includes pavement breakers.

3.2 Anticipated Construction Activities

The following construction activities are anticipated as part of this project:

- Removing existing surface pavements
- Construction and rehabilitation of the base course
- Paving (and repaving) of the roadway surface
- Construction of new roadway (Future Rd) and the widening of existing roadways including removal of overburden

3.3 Anticipated Construction Noise Levels

Construction noise levels at a given receptor location will vary over time as different activities take place as those activities change location within the right-of-way.

At this time, detailed construction plans are not available. An analysis of potential worst-case construction noise levels has been conducted based on generic data (equipment types and activities) and assumed construction configurations (equipment types and activity schedules). The analysis, including anticipated construction sound levels, is described in **Appendix F**. A summary of the results is shown in **Table 11**.

Note that the results represent the "worst-case" sound levels that would be experienced in a worst-case hour. Construction activity and noise levels will vary in space as well as in time as project proceeds and equipment is moved within the project area. Sound levels will generally be much less than those shown in the table.

Table 11: Anticipated Construction Sound Levels

Construction Activity	Receptor	L_{eq} (1hr)	L_{10}	L_{dn}
Roadway Construction including: Removal of overburden, compaction of subgrade, base course, compaction of base course, surface course	POR1	68	71	64
	POR2	80	83	77
	POR3	75	78	72
	POR4	80	83	76
	POR5	74	77	70
	POR6	79	82	75
	POR7	66	69	62
	POR8	62	65	59
	POR9	76	79	73
	POR10	73	76	69
	POR11	60	63	57
	POR12	70	73	66
	POR13	75	78	71
	POR14	77	80	73
	POR15	62	65	59
	POR16	61	64	57
	POR17	72	75	68

Notes: All sound levels are in dBA

3.4 Construction Code of Practice Requirements (Mitigation)

To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor, as outlined below:

- Construction should be limited to the time periods allowed by the locally applicable bylaws. If construction activities are required outside of these hours, the Contractor must seek permits / exemptions directly from the City of Vaughan in advance.
- There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract and local noise by-laws. Enforcement of noise control by-laws is the responsibility of the Municipality for all work done by Contractors.
- All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
- The Contract documents should contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to are in effect.
- In the presence of persistent noise complaints, all construction equipment should be verified to comply with MOECC NPC-115 guidelines, as outlined in Section 3.
- In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measured may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration

should be given to the technical, administrative and economic feasibility of the various alternatives.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The potential environmental noise impacts of the proposed Huntington Road Improvements have been assessed. Both operational and construction noise impacts have been considered. The following conclusions and recommendations result:

- Changes of 5 dBA resulting from the project are predicted for receptor POR3, which is representative of four NSAs single residence NSAs that front Huntington Road (Part B). However, the implementation of noise barriers at these four NSAs is not considered to be economically feasible.

- Changes of 5 dBA or greater resulting from the project are not expected for any of the remaining noise sensitive receptors (POR1, POR2, POR4 – POR17). Thus, noise mitigation is not recommended for this project.

- Construction noise impacts are temporary in nature but will be noticeable at times at residential NSAs. Methods to minimize construction noise impacts should be included in the Construction Code of Practice, as outlined above.

5.0 REFERENCES

Ontario Ministry of the Environment and Climate Change (MOECC), 1977b, *Model Municipal Noise Control Bylaw,* which includes Publication NPC-115 – Construction Equipment

Ontario Ministry of the Environment and Climate Change (MOECC), 1977c, *Model Municipal Noise Control Bylaw,* which includes Publication NPC-119 – Noise From Blasting

Ontario Ministry of the Environment and Climate Change (MOECC) / Ontario Ministry of Transportation (MTO), 1986, "Joint Protocol", A Protocol for Dealing with Noise Concerns During the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments

Ontario Ministry of the Environment and Climate Change (MOECC), 2013, *Environmental Noise Guideline*: *Stationary and Transportation Sources – Approval and Planning, Publication NPC-300*

Ontario Ministry of the Environment and Climate Change (MOE), 1989, Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT)

Ontario Ministry of the Environment and Climate Change (MOE), 2000, STAMSON v5.04: Road, Rail and Rapid Transit Noise Prediction Model

Ontario Ministry of Transportation (MTO), 1992a, Quality and Standards Directive QST-A1, *Noise Policy and Acoustic Standards for Provincial Highways*

Ontario Ministry of Transportation (MTO), 2013, *Environmental Reference for Highway Design*

Ontario Ministry of Transportation (MTO), 2003, Ontario Provincial Standard Specification OPSS 120: *General Specification for the Use of Explosives*

Ontario Ministry of Transportation (MTO), Revised 2008, *Environmental Guide for Noise (2006).*

Figures

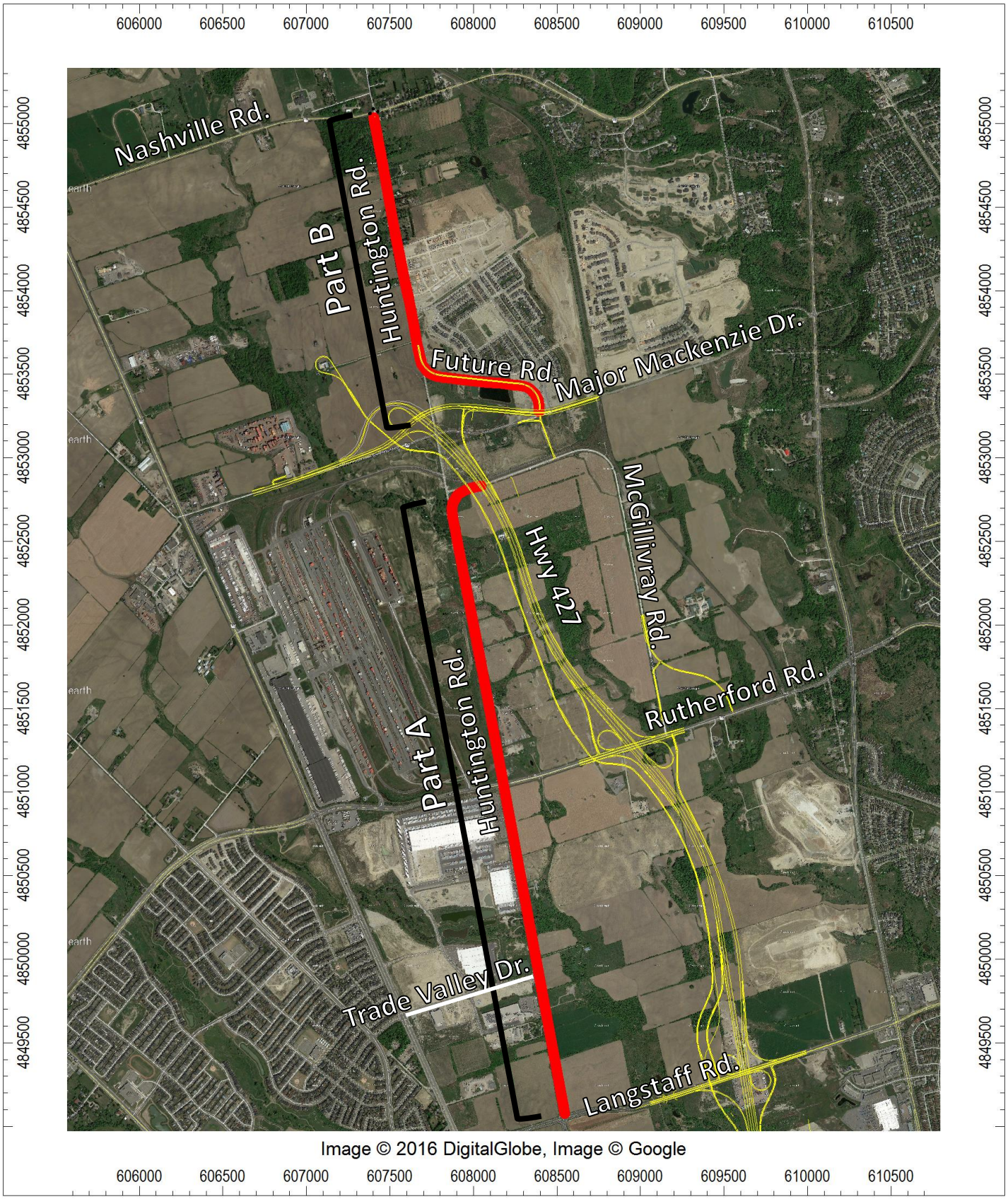


Figure No. **1**

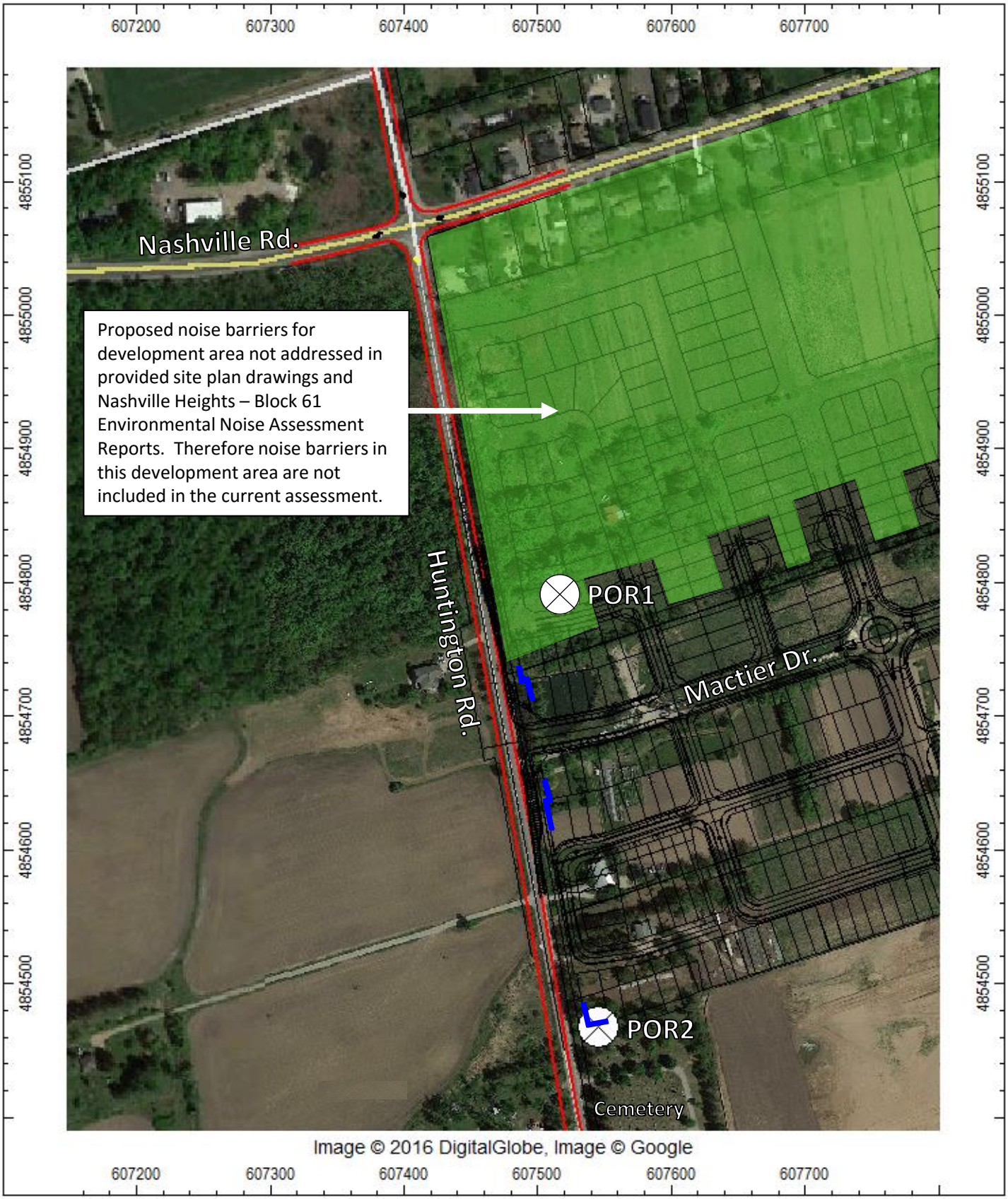
Project Limits

Huntington Road Improvements
Vaughan, Ontario

True North

Scale: 1: 32,000
Date: 16/08/09
File No.: 13-0253
Drawn By: SS

novus ENVIRONMENTAL



Noise Barrier – 1.8 m above grade
(as proposed by developer)

Figure No. **2**

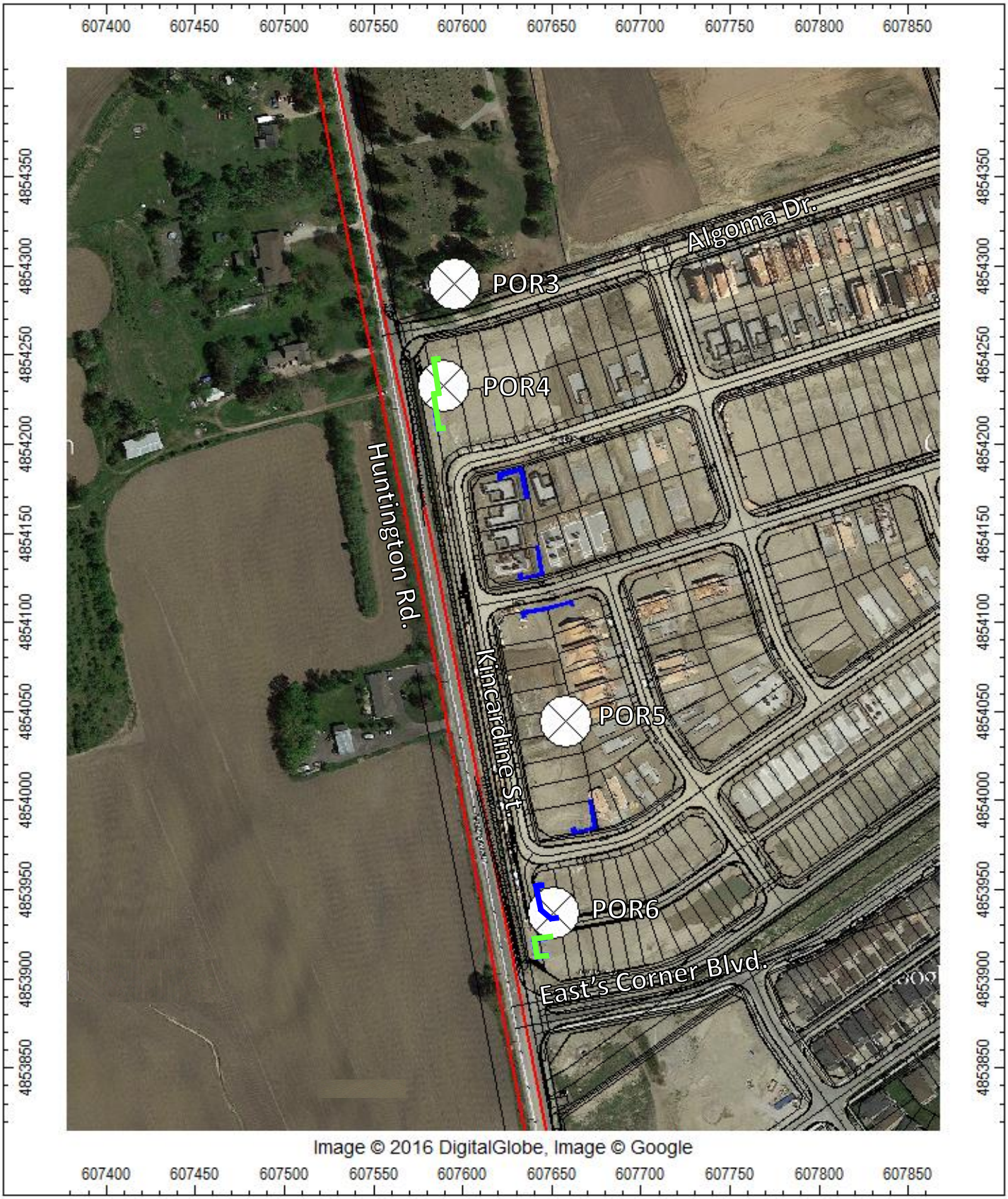
Modelled Receptors and Noise Sensitive Areas
Part B - North Section

Huntington Road Improvements
Vaughan, Ontario

True North

Scale:	1: 4,000
Date:	16/08/09
File No.:	13-0253
Drawn By:	SS

novus ENVIRONMENTAL



Noise Barrier – 1.8 m above grade (as proposed by developer)

Noise Barrier – 1.8 m above 1.4 m berm (as proposed by developer)

Figure No. **3**

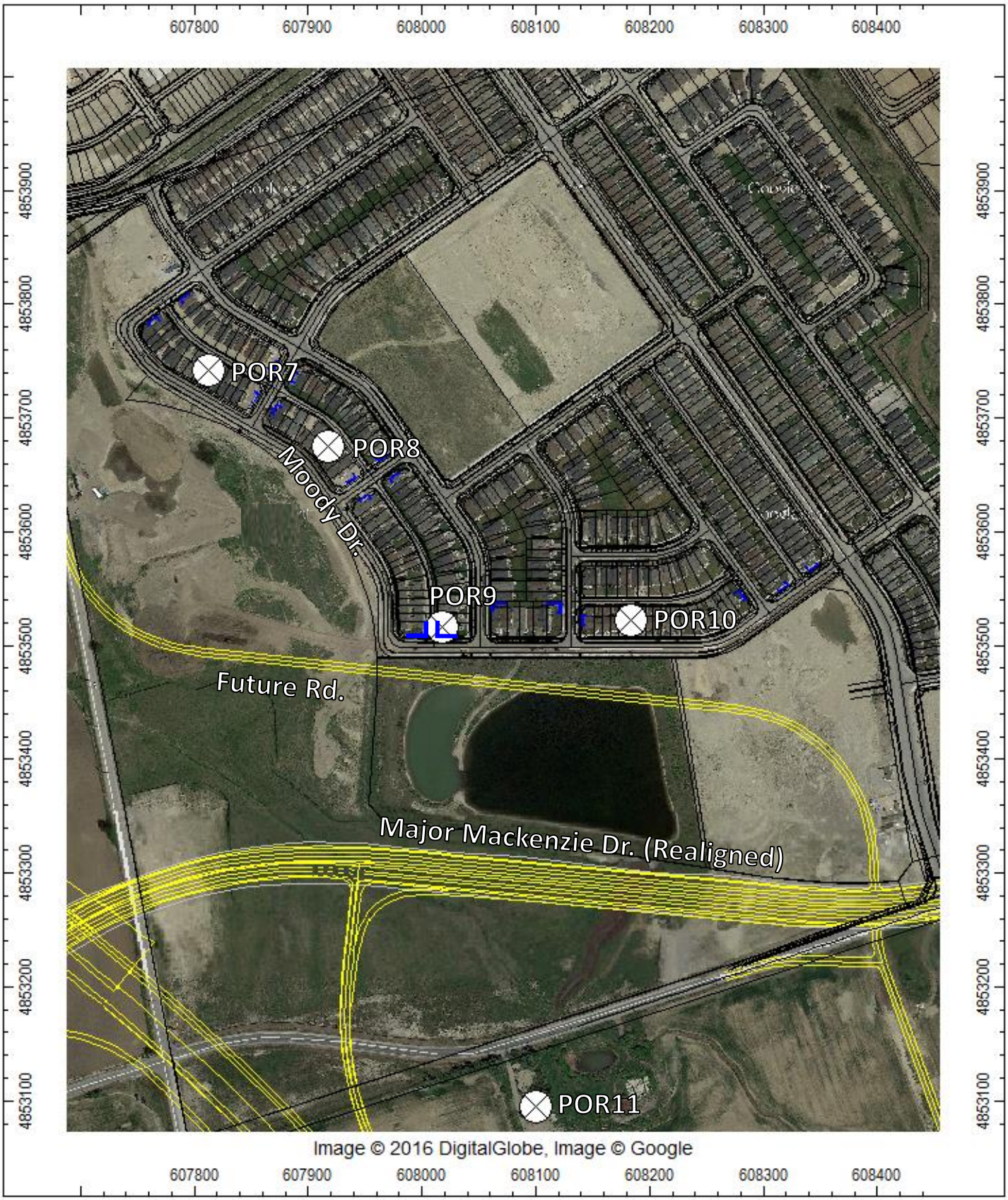
Modelled Receptors and Noise Sensitive Areas
Part B – Central Section

Huntington Road Improvements
Vaughan, Ontario

True North

Scale: 1: 3,000
Date: 16/08/09
File No.: 13-0253
Drawn By: SS

novus ENVIRONMENTAL



Noise Barrier – 1.8 m above grade
(as proposed by developer)

Figure No. **4**

Modelled Receptors and Noise Sensitive Areas
Part B – South Section

Huntington Road Improvements
Vaughan, Ontario

True North

Scale: 1: 4,000
Date: 16/08/09
File No.: 13-0253
Drawn By: SS

novus ENVIRONMENTAL

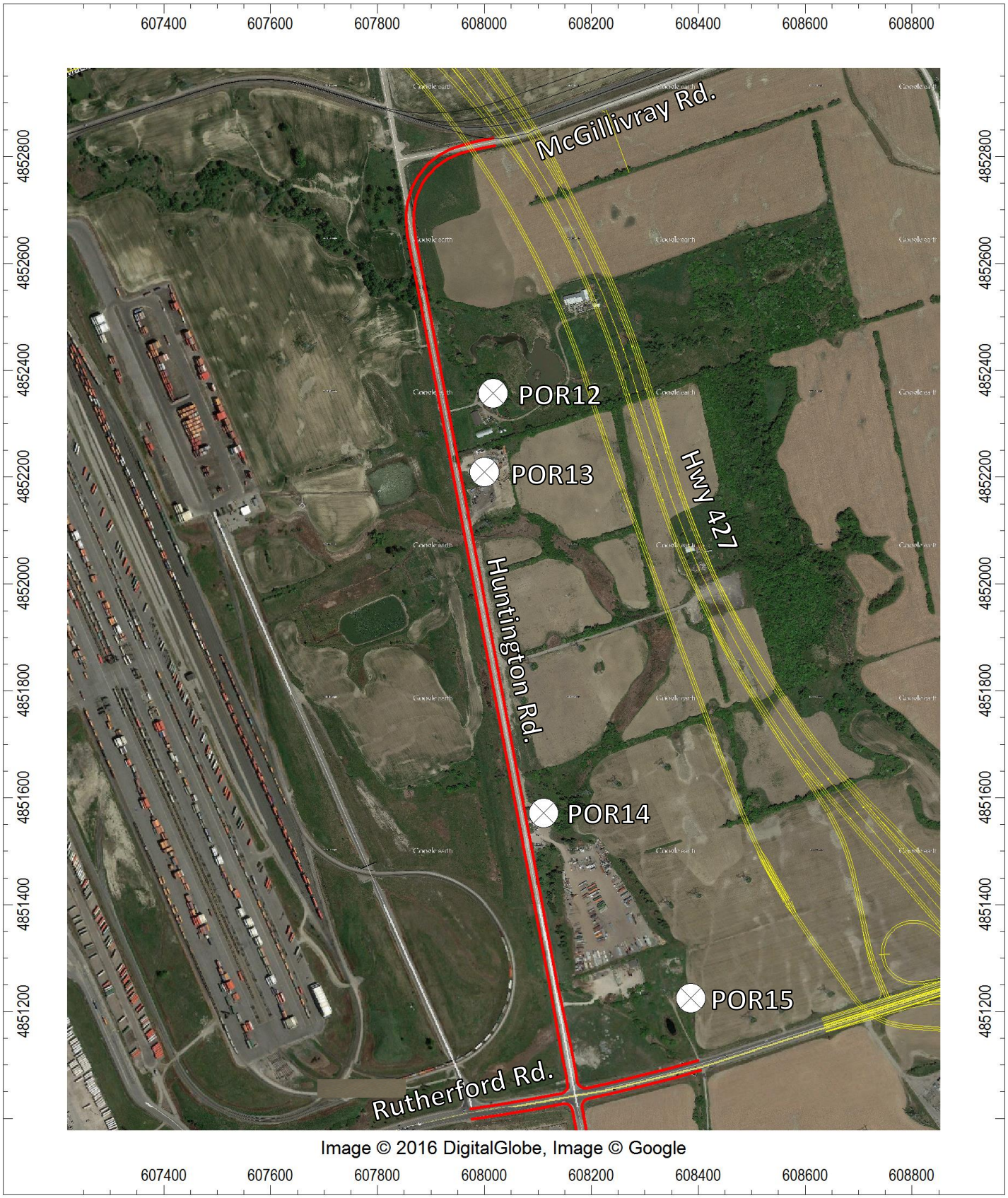


Figure No. **5**

Modelled Receptors and Noise Sensitive Areas
Part A – North Section

Huntington Road Improvements
Vaughan, Ontario

True North

Scale: 1: 10,000
Date: 16/08/09
File No.: 13-0253
Drawn By: SS

novus ENVIRONMENTAL

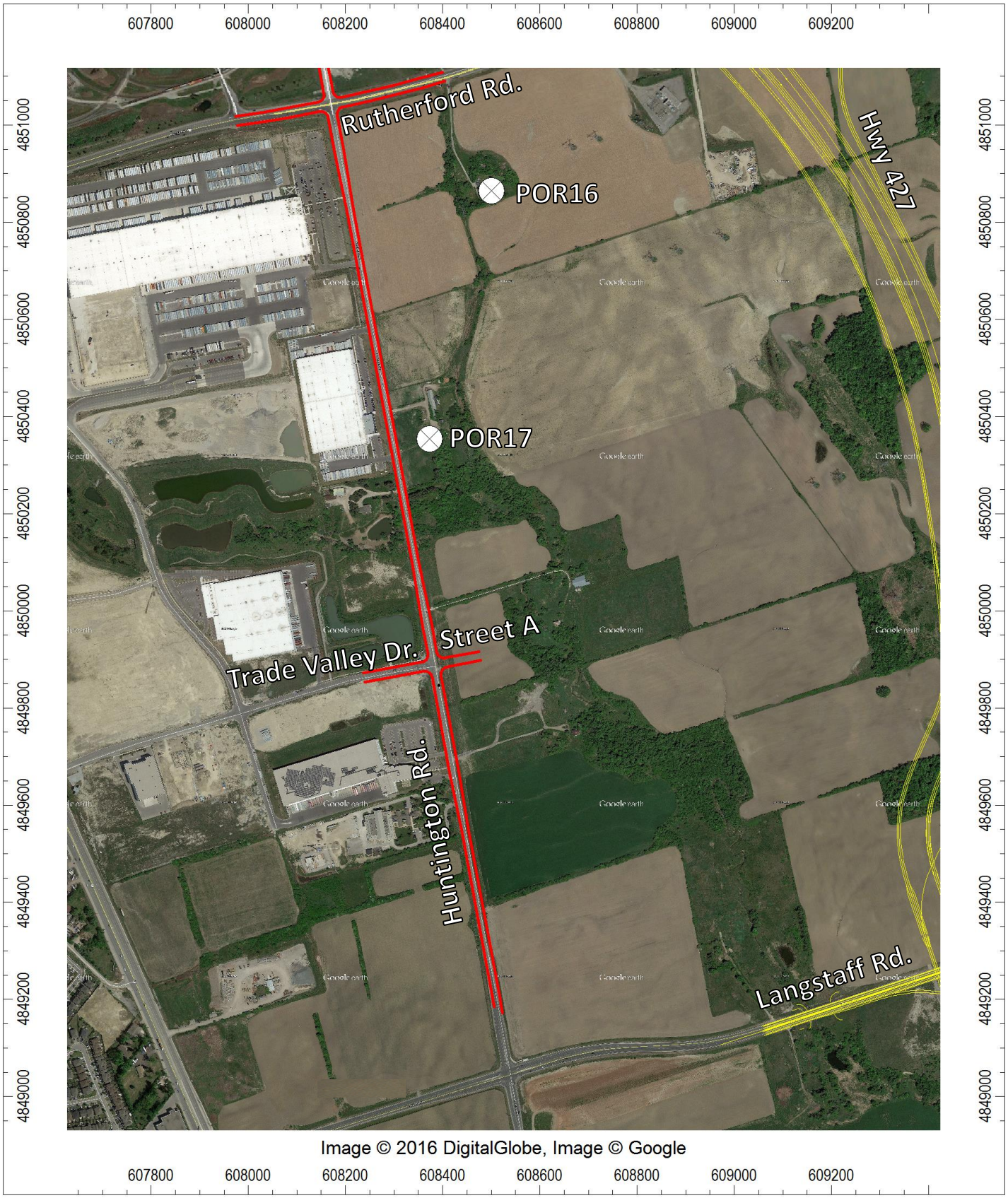


Figure No. **6**

Modelled Receptors and Noise Sensitive Areas
Part A – South Section

Huntington Road Improvements
Vaughan, Ontario

True North

Scale:	1: 11,000
Date:	16/08/09
File No.:	13-0253
Drawn By:	SS

novus ENVIRONMENTAL

Appendix A

Glossary of Commonly Used Noise Terminology

Airborne Sound*: Sound that reaches the point of interest by propagation through air.

Ambient or Background Noise: The ambient noise from all sources other than the sound of interest (i.e. sound other than that being measured). Under most MOE guidelines, aircraft overflights and train noise, due to their transient nature, are normally excluded from measurements of background noise.

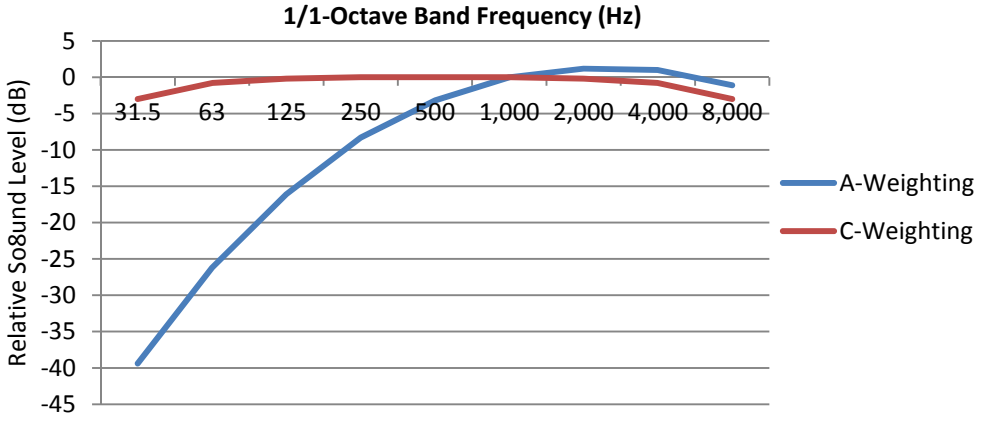
Articulation Index (AI)*: A numerically calculated measure of the intelligibility of transmitted or processed speech. It takes into account the limitations of the transmission path and the background noise. The articulation index can range in magnitude between 0 and 1.0. If the AI is less than 0.1, speech intelligibility is generally low. If it is above 0.6, speech intelligibility is generally high.

Attenuation*: The reduction of sound intensity by various means (e.g., air, humidity, porous materials, etc.).

dB -Decibel: The logarithmic units associated with sound pressure level, sound power level, or acceleration level. See sound pressure level, for example.

dBA -Decibel, A-Weighted: The logarithmic units associated with a sound pressure level, where the sound pressure signal has been filtered using a frequency weighting that mimics the response of the human ear to quiet sound levels. The resultant sound pressure level is therefore representative of the subjective response of the human ear. A-weighted sound pressure levels are denoted by the suffix 'A' (ie. dBA), and the term pressure is normally omitted from the description (i.e., sound level or noise level).

dBC -Decibel, C-Weighted: The logarithmic units associated with a sound pressure level, where the sound pressure signal has been filtered using a frequency weighting that mimics the response of the human ear to loud sound levels. C-weighted sound pressure levels are denoted by the suffix 'C' (ie dBC). C-weighted levels are often used in low-frequency noise analysis, as the filtering effect is nearly flat at lower frequencies.



dBL or dBLin -Decibel, Linear: The logarithmic units associated with a sound pressure level, where the sound pressure signal is unfiltered, and represents the full spectrum of incoming noise.

Calibrator (Acoustical)*: A device which produces a known sound pressure on the microphone of a sound level measurement system, and is used to adjust the system to standard specifications.

Definitions with a "*" marker originally from "Noise Control Terms Made Somewhat Easier", by David Kelso (Minnesota Pollution Control Agency), and Al Perez (Northern Sound), Minneapolis, Minnesota May, 1983, as modified on the Noise Pollution Clearinghouse website www.nonoise.org.

Directivity Factor (Q) (also, **Directional** or **Directionality Factor):** A factor mathematically related to Directivity Index, used in calculating propagated sound levels to account for the effect of reflecting surfaces near to the source. For example, for a source in free space where the sound is radiating spherically, Q = 1. For a source located on or very near to a surface (such as the ground, a wall, rooftop, etc.), where the sound is radiating hemispherically, Q = 2. This accounts for the additional sound energy reflecting off the surface, and translates into a +3 dB add.

Directivity Index*: In a given direction from a sound source, the difference in decibels between (a) the sound pressure level produced by the source in that direction, and (b) the space-average sound pressure level of that source, measured at the same distance.

Energy Equivalent Sound Level (L_{eq}): An energy-average sound level taken over a specified period of time. It represents the average sound pressure encountered for the period. The time period is often added as a suffix to the label (i.e., Leq(24) for the 24-hour equivalent sound level). Leq is usually A-weighted. An Leq value expressed in dBA is a good, single value descriptor of the annoyance of noise.

Exceedance Noise Level (L_N): The noise level exceeded N% of the time. It is a statistical measure of the noise level. For highly varying sounds, the L90 represents the background noise level, L50 represents the median or typical noise level, and L10 represents the short term peak noise levels, such as those due to occasional traffic or a barking dog.

Far Field*: Describes a region in free space where the sound pressure level from a source obeys the inverse-square law (the sound pressure level decreases 6 dB with each doubling of distance from the source). Also, in this region the sound particle velocity is in phase with the sound pressure. Closer to the source where these two conditions do not hold constitutes the "near field" region.

Free Sound Field (Free Field)*: A sound field in which the effects of obstacles or boundaries on sound propagated in that field are negligible.

Frequency*: The number of times per second that the sine wave of sound or of a vibrating object repeats itself. Now expressed in hertz (Hz), formerly in cycles per second (cps).

Hertz (Hz)*: Unit of measurement of frequency, numerically equal to cycles per second.

Human Perception of Sound: The human perception of noise impact is an important consideration in qualifying the noise effects caused by projects. The following table presents a general guideline.

Subjective Human Perception of Changes in Sound Levels

Change in Broadband Sound Level (dB)	Human Perception of Change
<3	Imperceptible change
3	Just-perceptible change
4 to 5	Clearly noticeable change
6 to 9	Substantial change
>10 and more	Very substantial change (half or twice as loud)
>20 and more	Very substantial change (much quieter or louder)

Notes:
Adapted from Bies and Hansen, p53, and MOE Noise Guidelines for Landfill Sites, 1998. Applies to changes in broadband noise sources only (i.e., increases or decreases in the same noise or same type of noise only). Changes in frequency content or the addition of tonal or temporal changes would affect the perception of the change.

Impact Insulation Class (IC)*: A single-figure rating that compares the impact sound insulating capabilities of floor-ceiling assemblies to a reference contour.

Impact Sound*: The sound produced by the collision of two solid objects, e.g., footsteps, dropped objects, etc., on an interior surface (wall, floor, or ceiling) of a building. Typical industrial sources include punch presses, forging hammers, etc.

Impulsive Noise*: a) Single or multiple sound pressure peak(s) (with either a rise time less than 200 milliseconds or total duration less than 200 milliseconds) spaced at least by 500 millisecond pauses, b) A sharp sound pressure peak occurring in a short interval of time.

Infrasonic*: Sounds of a frequency lower than 20 hertz.

Insertion Loss (IL): The arithmetic difference between the sound level from a source before and after the installation of a noise mitigation measure, at the same location. Insertion loss is typically presented as a positive number, i.e., the post-mitigation sound level is lower than the pre-mitigation level. Insertion loss is expressed in dB and is usually specified per 1/1 octave band, per 1/3 octave band, or overall.

Intensity*: The sound energy flow through a unit area in a unit time.

Low Frequency Noise (LFN): Noise in the low frequency range, from infrasonic sounds (<20 Hz) up to 100 Hz.

Masking*: a) The process by which the threshold of audibility for a sound is raised by the presence of another (masking) sound, or b) The amount by which the threshold of audibility of a sound is raised by the presence of another (masking) sound.

Near Field*: The sound field very near to a source, where sound pressure does not obey the inverse-square law and the particle velocity is not in phase with the sound pressure.

Noise: Unwanted sound.

Noise Criteria (NC) Curves: A single number rating for noise in 1/1-octave frequency bands which is sensitive to the relative loudness and speech interference properties of a given sound spectrum. The method consists of a family of criteria curves extending from 63 Hz to 8000 Hz, and a tangency rating procedure. Oringinally proposed by Bernanek in 1957. While other more modern criteria curve rating schemes exist (NCB, RC, RC Mark II, RNC, etc.), NC curves are still widely used in determining acceptability of noise levels within spaces. Level of NC 25 to NC 35 are usually considered acceptable for residences, private offices, and schools.

Noise Isolation Class (NIC)*: A single number rating derived in a prescribed manner from the measured values of noise reduction between two areas or rooms. It provides an evaluation of the sound isolation between two enclosed spaces that are acoustically connected by one or more paths.

Noise Reduction (NR)*: The numerical difference, in decibels, of the average sound pressure levels in two areas or rooms. A measurement of "noise reduction" combines the effect of the sound transmission loss performance of structures separating the two areas or rooms, plus the effect of acoustic absorption present in the receiving room.

Noise Reduction Coefficient (NRC)*: A measure of the acoustical absorption performance of a material, calculated by averaging its sound absorption coefficients at 250, 500, 1000 and 2000 Hz, expressed to the nearest multiple of 0.05.

Noise Level: Same as Sound Level, except applied to unwanted sounds.

Noise Exposure Forecast (NEF): A calculated measure of aircraft noise based on the type of aircraft in use, the take-off and landing patterns of the aircraft, and times of operation. It represents the noise exposure over a typical 24 hour period. A penalty is applied to nighttime operation.

Peak Sound Pressure Level: Same as Sound Pressure Level except that peak (not peak-to-peak) sound pressure values are used in place of RMS pressures.

Quasi-Steady Impulsive Noise: Noise composed of a series of short, discrete events, characterized by rapid rise times, but with less than 0.5 seconds elapsing between events.

RMS Sound Pressure: The square-root of the mean-squared pressure of a sound (usually the result of an RMS detector on a microphone signal).

Reverberant Field*: The region in a room where the reflected sound dominates, as opposed to the region close to the noise source where the direct sound dominates.

Reverberation*: The persistence of sound in an enclosed space, as a result of multiple reflections, after the sound source has stopped.

Reverberation Time (RT)*: The reverberation time of a room is the time taken for the sound pressure level to decrease 60 dB from its steady-state value when the source of sound energy is suddenly interrupted. It is a measure of the persistence of an impulsive sound in a room as well as of the amount of acoustical absorption present inside the room. Rooms with long reverberation times are called live rooms.

Sabin*: A measure of the sound absorption of a surface; it is the equivalent of one square metre of a perfectly absorptive surface (or one square foot in imperial units).

Sound: a dynamic (fluctuating) pressure.

Sound Exposure Level (SEL): An L_{eq} referenced to a one second duration. Also known as the Single Event Level. It is a measure of the cumulative noise exposure for a single event. It provides a measure of the accumulation of sound energy over the duration of the event.

Sound Level (SL): The A-weighted Sound Pressure Level expressed in dBA.

Sound Level Meter*: An instrument comprised of a microphone, amplifier, output meter, and frequency-weighting networks which is used for the measurement of noise and sound levels.

Sound Pressure Level (SPL): The logarithmic ratio of the RMS sound pressure to the sound pressure at the threshold of hearing. The sound pressure level is defined by equation (1) where P is the RMS pressure due to a sound and P0 is the reference pressure. P0 is usually taken as 2.0×10^{-6} Pascals.

$$\textbf{(1)}\ \text{SPL (dB)} = 20 \log(P_{RMS}/P_0)$$

Sound Power Level (PWL): The logarithmic ratio of the instantaneous sound power (energy) of a noise source to that of an international standard reference power. The sound power level is defined by equation (2) where W is the sound power of the source in watts, and W0 is the reference power of 10^{-12} watts.

$$\textbf{(2)}\ \text{PWL (dB)} = 10 \log(W/W_0)$$

Interrelationships between sound pressure level (SPL) and sound power level (PWL) depend on the location and type of source.

Sound Transmission Class (STC)*: The preferred single figure rating system designed to give an estimate of the sound insulation properties of a structure or a rank ordering of a series of structures.

Sound Transmission Loss (STL)*: A measure of sound insulation provided by a structural configuration. Expressed in decibels, it is 10 times the logarithm to the base 10 of the reciprocal of the sound transmission coefficient of the configuration.

Spectrum*: The description of a sound wave's resolution into its components of frequency and amplitude.

Speech Interference Level (SIL)*: A calculated quantity providing a guide to the interference of a noise with the reception of speech. The speech-interference level is the arithmetic average of the octave band levels of the interfering noise in the most important part of the speech frequency range. The levels in octave bands centered at 500, 1000, and 2000 Hz are commonly averaged to determine the speech-interference level.

Speed (Velocity) of Sound in Air*: 344 m/s (1128 ft/s) at 70°F (21°C) in air at sea level.

Threshold of Audibility (Threshold of Detectability)*: The minimum sound pressure level at which a person can hear a specified frequency of sound over a specified number of trials.

Transmission Loss: A measure of the reduction in sound energy resulting from incident sound waves striking a wall, partition or enclosure, and radiating through to the other side. Mathematically, the transmission coefficient t is the ratio of transmitted acoustic power to the incident acoustic power, and in decibels, the Transmission Loss (TL) of the wall is:

$$\textbf{(3)}\ TL = 10\log(1 / t)$$

The TL of a wall varies by frequency. The associated noise reduction (NR) due to the TL of the wall is a function of the TL and the acoustical parameters of the receiving space. For noise radiating from an enclosure into the outdoors, NR = (TL + 6).

TRANSPORTATION SOUND BASICS

Sound Levels

Sound is, in its simplest form, a dynamic, fluctuating pressure, in a fluid medium. That medium can be air, other gases, or liquids such as water. These fluctuations are transmitted by pressure waves through the medium from the source to the receiver. For the majority of transportation engineering purposes, the primary interest is with sound waves in air, with human beings as the receptor. Noise is defined as unwanted sound. The standard practice within the acoustical industry is to use these two terms interchangeably.

Decibels

A decibel (dB) is a logarithmic ratio of a value to a reference level. The general mathematical format is:

$$\text{Level in dB} = 10 \log (\text{Value} / \text{Reference})$$

Any value can be expressed in decibels. Decibels are very, very useful in performing comparisons where there are huge ranges in levels. For example, an acoustical engineer can expect to deal with acoustical energy values ranging from 0.00001 W to 100 W (sound power), and pressures ranging from 0.002 Pa to 200 Pa (sound pressure).1[1] For completeness, decibels should always be stated with their reference level (e.g., 20 dB re: 20 µPa). However, in practice the reference level is often left out.

Sound Pressure Level

Sound pressure level is what humans experience as sound. Sound waves create small fluctuations around the normal atmospheric pressure. These pressure fluctuations come into contact with eardrums and create the sensation of sound. Sound pressure is measured in decibels, according to the following equation:

$$\text{Sound Pressure Level, dB} = 10 \log (p^2/p_0^2))$$

Where: p = root mean square (r.m.s.) sound pressure, in Pa po = reference sound pressure, 20 µPa

The reference pressure represents the faintest sound that a "typical" human being can hear. The typical abbreviation for sound pressure level is SPL, although Lp is also often used in equations. "Sound level" or "noise level" are also sometimes used.

Octave Bands

Sounds are composed of varying frequencies or pitches. Human sensitivity to noise varies by frequency, with a greater sensitivity to higher frequency sounds. The propagation of sound also varies by frequency. The unit of frequency is Hertz (Hz), which refers the number of cycles per second (number of wave peaks per second of the propagating sound wave). The typical human hearing response runs from 20 Hz to 20,000 Hz. Frequencies below 20 Hz are generally inaudible, although response is variable, and some individuals may be able to hear or perceive them.

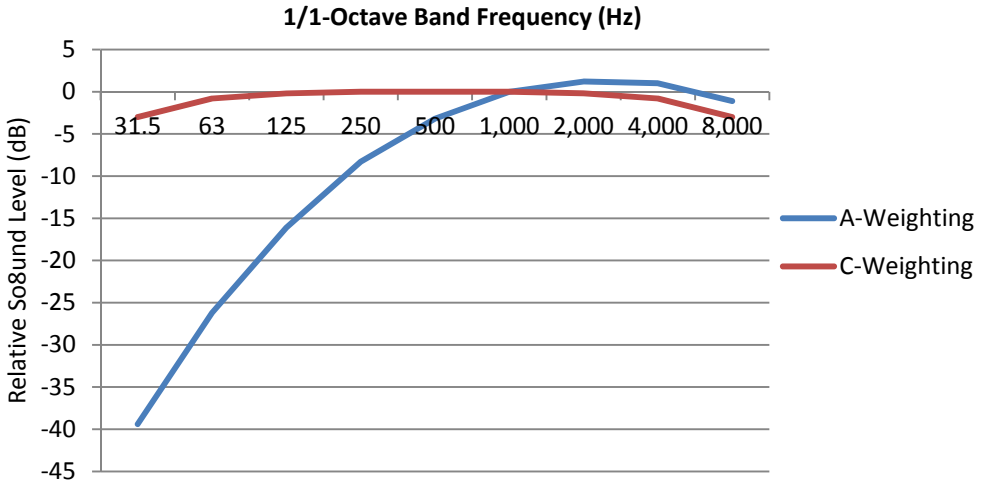
[1] Equivalent to Sound Power Levels ranging from 70 to 140 dB and Sound Pressure Levels ranging from 20 dB to 140 dB

Sound is typically analysed in octave bands or 1/3-octave bands. An octave band is defined as a band or range of sound frequencies where the frequency range doubles for succeeding octave (alternately, the highest frequency in the range is twice the value of the lowest frequency).

A-Weighting

When the overall sound pressure level is expressed as a single value (i.e., not expressed in frequency band levels) the variation in human frequency response must be accounted for. People do not hear low frequency noise as well as noise in mid or high frequencies. To account for this, frequency-weighting networks have been developed to better account for human hearing response. The most frequently used networks are the A-Weighting and C-Weighting.

The A-Weighting network was developed to correspond to how humans hear low to medium levels of noise. The A-Weighting is the most frequently used scheme, and the majority of noise guidelines are expressed in A-Weighted decibel values, denoted as "dBA" levels. C-Weighted "dBC" values are sometimes used in assessing low-frequency noise impacts, which are generally not of concern in transportation noise impact assessment. The A-Weighting and C-Weighting values are shown in the following figure.



A-Weighting and C-Weighting Networks

Ranges of Sound Levels

People experience a wide range of sound levels in their daily activities. The table below presents a graphical comparison of "typical" noise levels which might be encountered, and the general human perception of the level. Sound levels from 40 to 65 dBA are in the faint to moderate range. The vast majority of the outdoor noise environment, even within the busiest city cores, will lie within this area. Sound levels from 65 to 90 are perceived as loud. This area includes very noisy commercial and industrial spaces. Sound levels greater than 90 dB are very loud to deafening, and may result in hearing damage.

Ranges of Sound Levels

Sound Levels		Sources of Noise
Human Perception	**SPL in dBA**	
Deafening	125	Sonic booms
	120	Threshold of Feeling / Pain
	115	Maximum level, hard rock band concert
	110	Accelerating Motorcycle at a few feet away
Very Loud	105	Loud auto horn at 3 m (10 ft) away
	100	Dance club / maximum human vocal output at 1 m (3 ft) distance
	95	Jack hammer at 15 m (50 ft) distance
	90	Indoors in a noisy factory
Loud	85	Heavy truck pass-by at 15 m (50 ft) distance
	80	School cafeteria / noisy bar; Vacuum cleaner at 1.5 m (5 ft)
	75	Near edge of major highway
	70	Inside automobile at 60 km/h
	65	Normal human speech (unraised voice) at 1 m (3 ft) distance
Moderate	60	Typical background noise levels in a large department store
	55	General objective for outdoor sound levels; typical urban sound level (24h)
	50	Typical suburban / semi-rural sound level (24h)
	45	Typical noise levels in an office due to HVAC; typical rural levels (24h)
Faint	40	Typical background noise levels in a library
	35	
	30	Broadcast Studio
	25	Average whisper
Very Faint	20	Deep woods on a very calm day
	15	
	10	
	5	Human breathing
	0	Quietest sound that can be heard

Transportation noise events, which vary with time, can also be considered in terms of their maximum noise level (L_{max}) during a vehicle pass-by, as shown in the following table:

Typical Pass-By Noise Level at 15 m from Noise Source

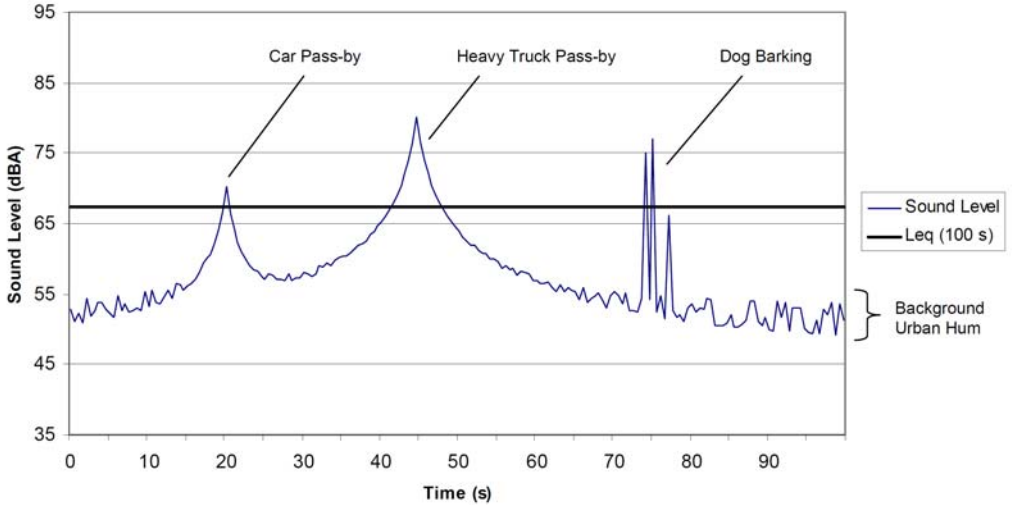
Event	Range of Noise Levels (dBA) at 15 m
Semi-Trailer Trucks	75 - 85
Aircraft	69 - 85 [1]
Conventional Light Rapid Transit (Streetcars)	72 - 80 [2]
Large Trucks	71 - 78
Street Motorcycle	76
Diesel or Natural Gas Bus	70 - 78
Trolley Bus	69 - 73
Small Motorcycle	67
General Busy Auto Traffic	66 – 70
Individual Automobiles	63 - 69

Notes: Source: BKL Consultants Ltd.
[1] Aircraft flyover not at 15 m distance
[2] Based on data provided for the Calgary, Edmonton and Portland LRT systems.

Noise Descriptors – L_{eq} Values

At this time, the best available research indicates that long-term human responses to noise are best evaluated using energy equivalent sound exposure levels (Leq values), in A-Weighted decibels (L_{eq} values in dBA)[2,3] including adjustments to account for particularly annoying characteristics of the sounds being analyzed.

Sound levels in the ambient environment vary each instant. In a downtown urban environment, the background noise is formed by an "urban hum", composed of noise from distant road traffic and from commercial sources. As traffic passes near a noise receptor, the instantaneous sound level may increase as a vehicle approaches, and then decrease as it passes and travels farther away. The energy equivalent sound exposure level L_{eq} is the average sound level over the same period of time with same acoustical energy as the actual environment (i.e., it is the average of the sound energy measured over a time period T). As a time-average, all L_{eq} values must have a time period associated with them. This is typically placed in brackets beside the L_{eq} tag. For example, a thirty-minute Leq measurement would be reported as an L_{eq} (30 min) value. The L_{eq} concept is illustrated in Figure 3, showing noise levels beside a small roadway, over a 100 second time period, with two vehicle pass-bys:



The L_{eq} Concept

In this example, the background "urban hum" is between 47 and 53 dBA. A car passes by at 20 seconds. As it approaches, the noise level increases to a maximum, and then decreases as it speeds away. At 45 seconds, a heavy truck passes by. Near 75 seconds, a dog barks three times. The maximum sound level (Lmax) over the period is 80 dBA and the minimum is 47 dBA. For almost 50 % of the time, the sound level is lower than 55 dBA.

The L_{eq} (100s) for the example is 67 dBA, which is much higher than the statistical mean sound level of 55 dBA. This illustrates that the Leq value is very sensitive to loud noise events, which contain much more sound energy (as sound is ranked on a logarithmic scale) than the normal background. It is also sensitive to the number of events during the time period, and the duration of those events. If only the truck had passed by during the measurement (no car and no dog barks), the L_{eq} (100s) would be 66 dBA. If only the car and dog barks had occurred, the L_{eq} (100s) would be 61 dBA. This shows that the truck pass-by is the dominant event in our example, due to its level and duration.

[2] Berglund and Lindvall, Community Noise, 1995.

[3] ISO 1996:2003(E), Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures.

The ability of the L_{eq} metric to account for the three factors of level, duration and frequency of events makes it a robust predictor of human response to noise. It is for this reason that the vast majority of noise standards are based on L_{eq} values.

Typical Durations for L_{eq} Analyses

For transportation noise impact analyses, the following durations are typically used:

L_{eq} (24h)	–	The sound exposure level over then entire 24-hour day
L_{eq} Day	–	Either: Leq (15h), from 7am to 10 pm; or Leq (16h), from 7am to 11 am
L_{eq} Night	–	Either: Leq (9h), from 10 pm to 7 am; or Leq (8h), from 11 pm to 7 am
L_{dn}	–	A special Leq (24h) value with a 10 dB night-time penalty applied to overnight sound levels (10pm to 7am)
L_{eq} (1-h)	–	The sound exposure over a 1-hour time period

L_{eq} (24h) values are appropriate for examining impacts of transportation noise sources with small changes in sound exposure levels over the 24-hour day. For example, freeway noise levels are generally consistent over the 24-hour day. Therefore, for freeways, there is little difference between L_{eq} (24h) values and the corresponding L_{eq} Day and L_{eq} Night values.

L_{eq} Day values, covering off the AM-peak and PM-peak travel periods, are generally appropriate for examining the impacts of non-freeway highways and municipal arterial roadways. The vast majority of noise associated with these sources is concentrated in the daytime hours, where typically, 85% to 90% of the daily road traffic will occur.[4] Thus, if reasonable sound levels occur during the daytime (and appropriate guideline limits are met), they will also occur (and be met) at night.

To account for increased annoyance with noise overnight in a single value, the U.S. Environmental Protection Agency (U.S. EPA) developed the L_{dn} metric (also known as DNL). It is a special form of the L_{eq} (24h) with a +10 dB night-time penalty. L_{dn} values and a related metric, the day-evening-night level (Lden) are also used in some European guidelines. L_{dn} values are not used in Canadian Provincial jurisdictions in evaluating transportation noise. Instead, guideline limits for separate Leq Day and Leq Night periods are generally used.

L_{eq} (1-h) values are the average sound levels over a one-hour time period. These tend to fluctuate more over the day, as traffic levels can fluctuate significantly hour to hour. L_{eq} (1-h) values are useful in assessing the impact of transportation sources which also vary hourly, and which may vary in a different manner than the background traffic. These values are often used to assess haul route noise impacts, for example.

[4] Based on research conducted by Ontario Ministry of Transportation, and provided in the *MTO Environmental Office Manual Technical Areas – Noise.* Daytime refers to a 16 hour day from 7am to 11 pm.

Some transportation noise sources may have significant traffic levels occurring overnight. For example, freight rail traffic in heavily used corridors can be shifted to over-night periods, with daytime track use being reserved for freight switcher traffic and passenger traffic. In situations such as this, an assessment of both daytime and night-time noise impacts may be appropriate.

Decibel Addition

Decibels are logarithmic numbers, and therefore have special properties of addition. Decibel values must be added logarithmically. If two sources, each emitting the same amount of sound energy, are placed side-by-side, then the total increase in sound level will only be 3 dB. If the difference in sound energy emitted is greater than 10 dB, then effectively the sound level will be the same as for the loudest unit (i.e., the increase in noise will be less than a decibel).

Decibel Addition Chart

dB Difference Of	dB Value to Add to Highest Number
0	3.0
1	2.5
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4

This affects transportation noise from projects, as noise emission is logarithmically related to traffic volume. Doubling the traffic volume (essentially the same as adding a source with the same sound emission) will only result in a 3 dB increase over the original levels. The decibel increase in noise due to the increase in traffic volume, assuming all other factors remain the same, can be estimated by:

$$\text{dB increase} = 10 \log (\text{new volume} / \text{original volume}).$$

Human Response to Changes in Sound Levels

The human ear does not interpret changes in sound level in a linear manner. The general subjective human perception of changes in sound level is shown in the following table.

Subjective Human Perception of Changes in Sound Levels[5,6]

Change in Broadband Sound Level (dB)	Human Perception of Change
<3	Imperceptible change
3	Just-perceptible change
4 to 5	Clearly noticeable change
6 to 9	Substantial change
>10 and more	Very substantial change (half or twice as loud)
>20 and more	Very substantial change (much quieter or louder)

Notes:

Adapted from Bies and Hansen, p53, and MOE Noise Guidelines for Landfill Sites, 1998. Applies to changes in broadband noise sources only (i.e., increases or decreases in the same noise or same type of noise only). Changes in frequency content or the addition of tonal or temporal changes would affect the perception of the change.

The above table is directly applicable to changes in sound level where the noise sources are of the same general character. For example, existing road traffic noise levels can be directly compared to future road traffic noise levels, using the above relationships. In comparing road traffic noise to road plus rail traffic noise, the different frequency and temporal nature of the noise means that the rail noise may be more noticeable. Adjustments for the nature of the new sound can be applied to better account for temporal and frequency differences.

For transportation noise sources, research conducted by the U.S. Environmental Protection Agency indicates that a 5 dB change in sound levels is required to trigger a change in large-scale community response to noise. This correlates to a clearly noticeable increase in noise levels.

Decay of Noise with Distance

Noise levels decrease with increasing distance from a source of noise. The rate of decay is partially dependent on the nature of the ground between the source: whether it is hard (acoustically reflective) or soft (acoustically absorptive). Transportation noise sources in general act as *line sources* of sound. For line sources, the rate of decay is approximately:

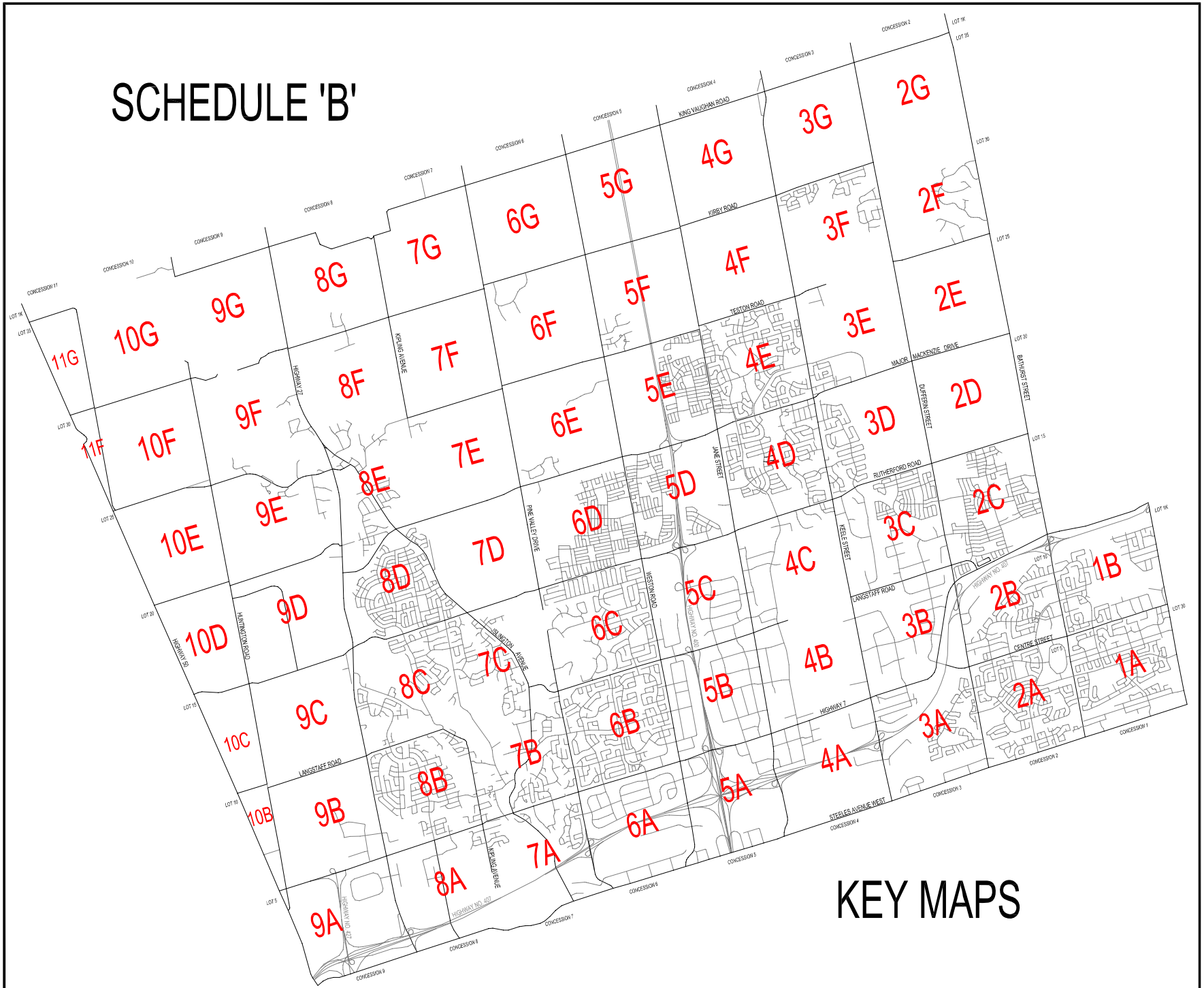
- Hard ground: 3 dB for each doubling of distance from the source
- Soft ground: 5 dB for each doubling of distance from the source

[5] Bies, D.A., and C.H Hansen 1988. Engineering Noise – Theory and Practice, 2nd Ed. E & E & FN Spon, London, p 53.

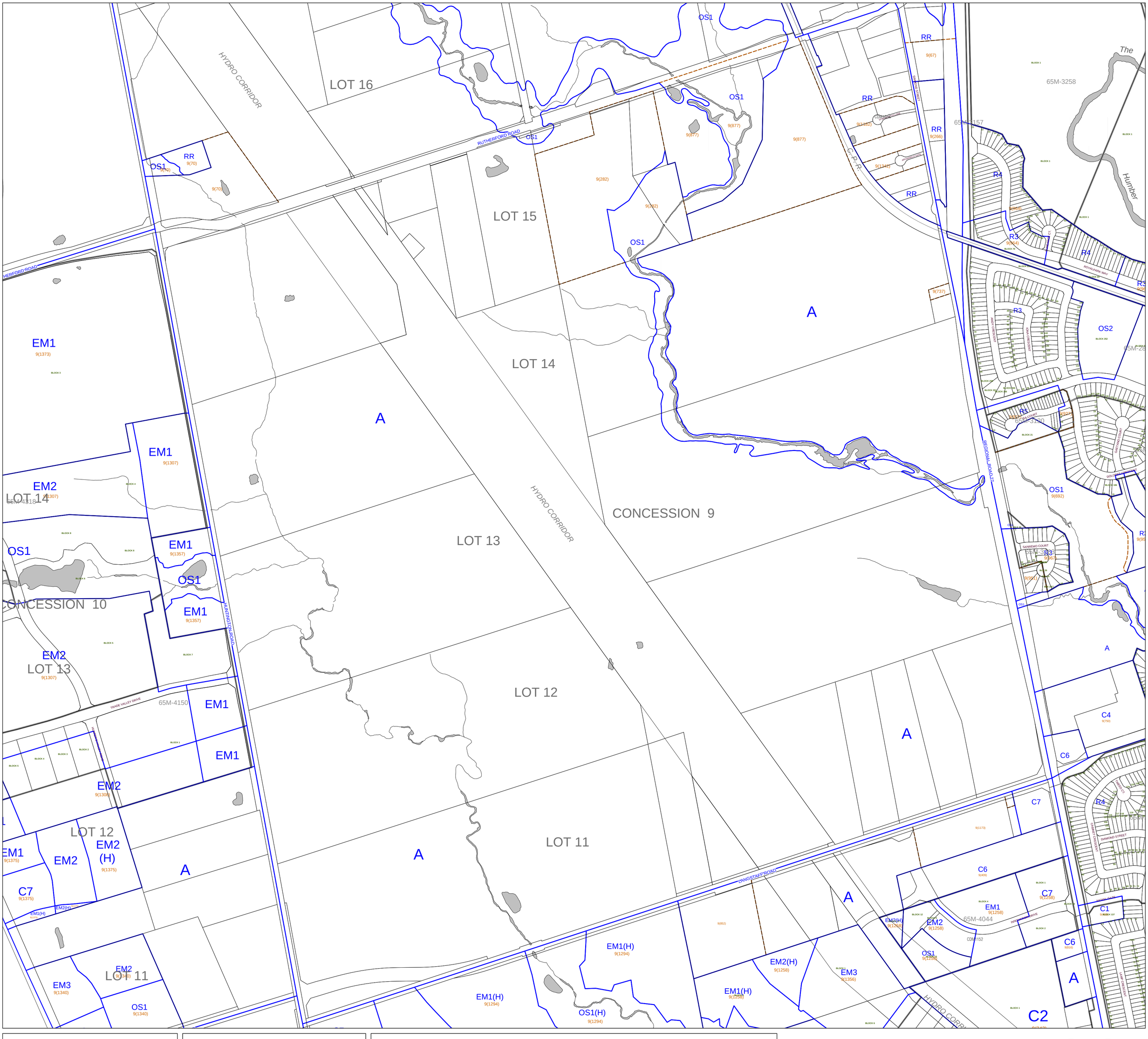
[6] Ontario Ministry of the Environment 1998. Noise Guidelines for Landfill Sites. Queen's Printer for Ontario.

Appendix B

SCHEDULE 'B'



KEY MAPS



VAUGHAN

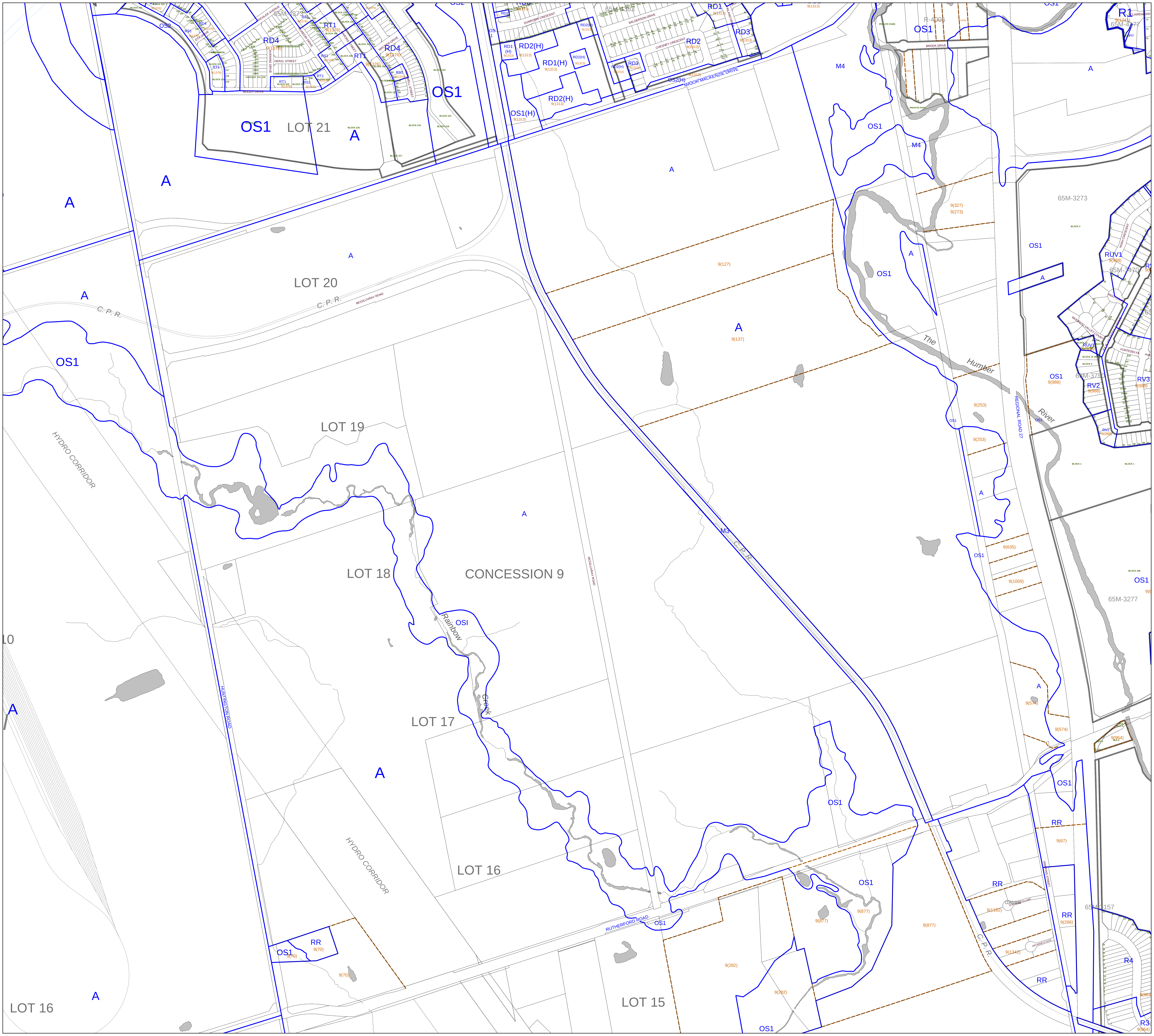
0 200 600 1000m

SCALE

KEY MAP 9C

TO BYLAW 1-88

REVISED JANUARY 2014



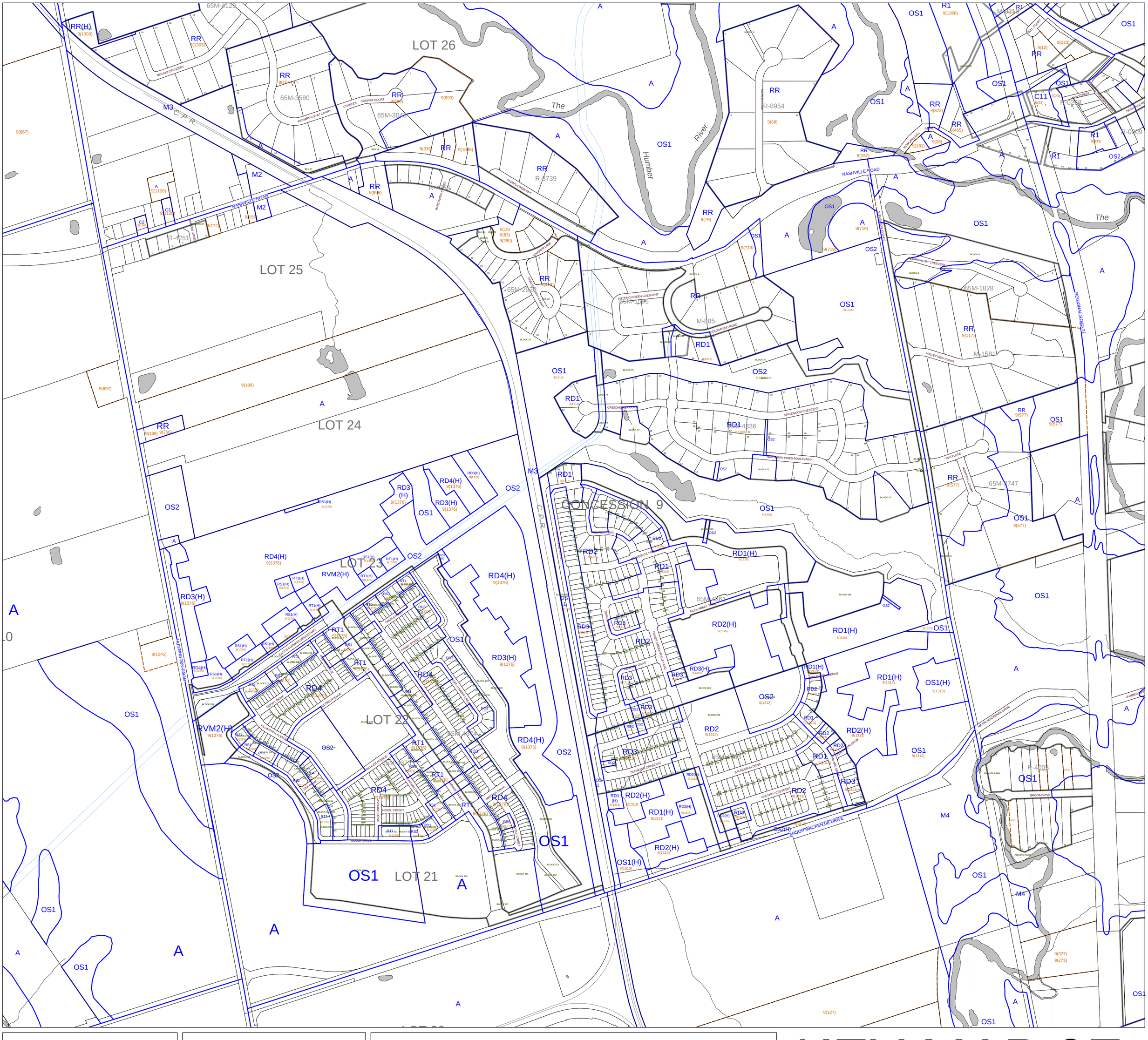
0 200 600 1000m

SCALE

KEY MAP 9D

TO BYLAW 1-88

REVISED JANUARY 2014



VAUGHAN

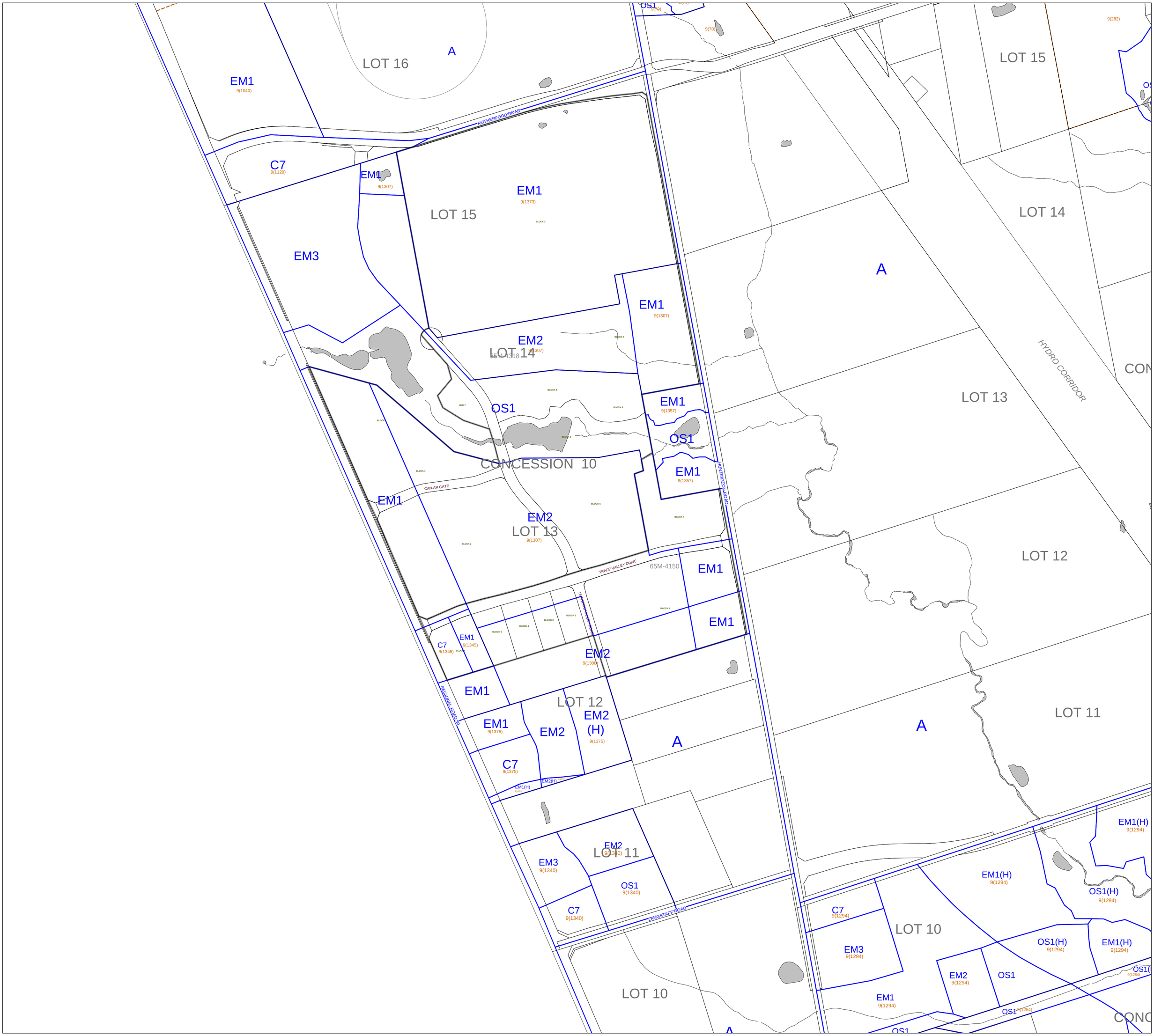
0 200 600 1000m

SCALE

KEY MAP 9E

TO BYLAW 1-88

REVISED JANUARY 2014



VAUGHAN

0 200 600 1000m

SCALE

KEY MAP 10C

TO BYLAW 1-88

REVISED JANUARY 2014

KEY MAP 10D

TO BYLAW 1-88

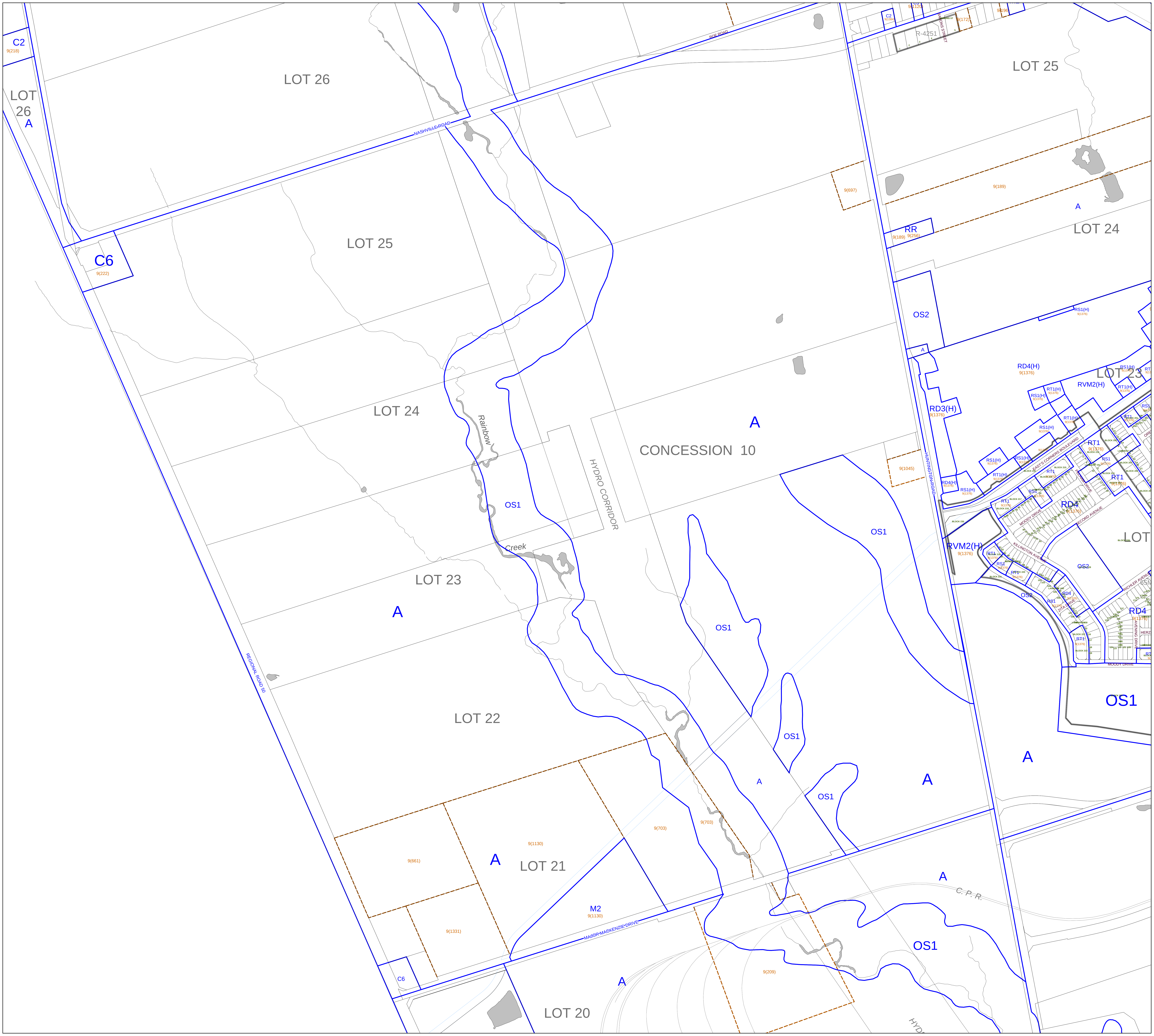
REVISED JANUARY 2014

VAUGHAN

0 200 600 1000m

SCALE

LOT 21
LOT 20
LOT 19
LOT 18
LOT 17
LOT 16
LOT 15
CONCESSION 10
CONCESS
CPR Intermodal Terminal
HYDRO CORRIDOR
HYDRO CORRIDOR
C.P.R.
C.P.R.
MAJOR MACKENZIE DRIVE
MCGILLIVRAY ROAD
FRONTENAC ROAD
REGIONAL ROAD 50
RUTHERFORD ROAD
Rainbow Creek
A
M2 9(1130)
EM1 9(1040)
EM1 9(1307)
EM1 9(1373)
EM3
C6
C7 9(1129)
OS1
OS1
OSI
RR 9(70)
9(661)
9(1130)
9(1331)
9(703)
9(703)
9(209)
9(100)
9(70)
9(70)



0 200 600 1000m

SCALE

VAUGHAN

KEY MAP 10E

TO BYLAW 1-88

REVISED JANUARY 2014

Appendix C

Traffic Volumes on Huntington Road, Part A and Part B – "Build"

Route	Section	AADT Data		% Growth Rate	Commercial %
		Corresponding Year	AADT		
Huntington Road	Nashville Rd to Major Mackenzie Dr. (Part B)	2021	5,305	0.62	11
		2034	5,745		
	McGillivray Rd. to Rutherford Rd. (Part A)	2021	460	Unknown	8
		2034	1,160	Unknown	
	Rutherford Rd. to Street A (Part A)	2021	6,105	4.8	16
		2034	11,215	4.8	
	Street A to Langstaff Rd. (Part A)	2021	10,850	2.23	8
		2034	14,445	2.23	

Traffic Volumes on Huntington Road, Part A and Part B – "No-Build"

Route	Section	AADT Data		Commercial %
		Corresponding Year	AADT	
Huntington Road	Nashville Rd to Major Mackenzie Dr. (Part B)	2015	1,210	11
		2021	1,410	11
		2034	1,950	11
	Major Mackenzie Dr. to Rutherford Rd. (Part A)	2015	835	16
		2021	-	-
		2034	-	-
	Rutherford Rd. to Street A (Part A)	2015	4,440	16
		2021	4,580	16
		2034	8,000	16
	Street A to Langstaff Rd. (Part A)	2015	7,590	8
		2021	8,625	8
		2034	12,680	8

Table 4: Traffic Data[3]

Source		No Project				With Project				General Characteristics		
		SADT	%M.T.	%H.T.	Speed Limit (kph)	SADT	%M.T.	%H.T.	Speed Limit (kph)	Grade %	Pavement Type	Day/Night Split
427 - Major Mackenzie to Rutherford		Not Applicable in No Project				72,300	7	5	100	Varies	PCC	66/33
427 - Rutherford to Langstaff		Not Applicable in No Project				98,600	7	5	100	Varies	PCC	66/33
427 - Langstaff to Hwy 7		Not Applicable in No Project				122,800	7	5	100	Varies	PCC	66/33
Major Mackenzie Drive – west of 427		41,000	5.6	2.4	80	53,100	5.6	2.4	60	Varies	DGAC	85/15
Major Mackenzie Drive – east of 427						35,600	5.6	2.4	60	Varies	DGAC	85/15
Rutherford Road – west of 427		76,000	5.6	2.4	80	30,100	5.6	2.4	60	Varies	DGAC	85/15
Rutherford Road – east of 427						32,700	5.6	2.4	60	Varies	DGAC	85/15
Langstaff Road – west of 427		25,000	5.6	2.4	80	35,900	5.6	2.4	60	Varies	DGAC	85/15
Langstaff Road – east of 427						24,000	5.6	2.4	60	Varies	DGAC	85/15
Highway 7 – west of 427		No data available				67,000	5.6	2.4	60	Varies	DGAC	85/15
Highway 7 – east of 427						50,200	5.6	2.4	60	Varies	DGAC	85/15
Langstaff Ramps	N-EW	Not Applicable in No Project				5,300	5.6	2.4	60	Varies	DGAC	85/15
	E-S					6,000	5.6	2.4	60	Varies	DGAC	85/15
	W-S					11,800	5.6	2.4	60	Varies	DGAC	85/15
	W-N					2,000	5.6	2.4	60	Varies	DGAC	85/15
	E-N					2,000	5.6	2.4	60	Varies	DGAC	85/15
	S-EW					15,600	5.6	2.4	60	Varies	DGAC	85/15
Rutherford Ramps	N-EW	Not Applicable in No Project				3,400	5.6	2.4	60	Varies	DGAC	85/15
	E-S					9,800	5.6	2.4	60	Varies	DGAC	85/15
	W-S					7,300	5.6	2.4	60	Varies	DGAC	85/15
	W-N					2,100	5.6	2.4	60	Varies	DGAC	85/15
	E-N					1,600	5.6	2.4	60	Varies	DGAC	85/15
	S-EW					16,200	5.6	2.4	60	Varies	DGAC	85/15
Major Mackenzie Ramps	S-EW	Not Applicable in No Project				21,000	5.6	2.4	60	Varies	DGAC	85/15
	E-S					15,000	5.6	2.4	60	Varies	DGAC	85/15
	W-S					19,100	5.6	2.4	60	Varies	DGAC	85/15
	S-W					17,100	5.6	2.4	60	Varies	DGAC	85/15

4.3 Results

Table 5 shows the predicted future "No Project" and "With Project" noise levels, as well as the resulting noise impact due to the proposed road improvements. Also shown in Table 5 is the perception of the noise impact and the requirement for noise mitigation investigation.

[3] *SADT – Summer Average Daily Traffic*
%M.T. – Medium Truck Percentage
%H.T. – Heavy Truck Percentage

Appendix D

ORNAMENT

Ontario Road Noise Analysis Method for Environment and Transportation

Road Segment ID	Roadway Name	Link Description	Speed (kph)	Period (h)	Auto	Med	Heavy
	Hwy 427 and Major Mack Extension						
427_Rutherford_Langstaff	Hwy 427 - Rutherford to Langstaff	2015/2034	100	16	57,267	4,555	3,254
427_Rutherford_Major Mackenzie	Hwy 427 - Rutherford to Major Mack	2015/2034	100	16	41,992	3,340	2,386
MajMack_East of 427	Major Mack - East of 427	2015/2034	60	16	27,839	1,695	726
MajMack_S-EW Ramp	Major Mack - S-EW Ramp	2015/2034	60	16	16,422	1,000	428
MajMack_S-W Ramp	Major Mack - S-W Ramp	2015/2034	60	16	13,372	814	349
	No Build - Existing						
NV_MajMack_ex	Nashville to Major Mackenzie	2015	80	16	915	68	45
MajMack_Rutherford_ex	Major Mackenzie to Rutherford	2015	80	16	596	68	45
Rutherford_Street A_ex	Rutherford to Street A	2015	80	16	3,170	362	242
StreetA_Langstaff_ex	Street A to Langstaff	2015	80	16	5,935	310	206
	Build						
NV_MajMack_fut	Nashville to Major Mackenzie	2034	80	16	4,346	322	215
McGill_Rutherford_fut	McGillivray to Rutherford	2034	80	16	907	47	32
Rutherford_Street A_fut	Rutherford to Street A	2034	80	16	8,008	915	610
StreetA_Langstaff_fut	Street A to Langstaff	2034	80	16	11,296	589	393

Road Segment ID	Type of Pavement Surface	Description	Road Elev (m)	Dist to Centreline (m)	Φ1	Φ2	Ground Type	Topography	Elevation Change (m)	Road Gradient (%)	Receiver Elev (m)	Receiver Height (m)	Barrier Receiver Distance (m)	Barrier Elev (m)	Barrier Height (m)	Θ1	Θ2	Depth of Woods (m)	Rows of Intervening Houses	Density of Houses (%)	Road L_{eq} (dBA)	Bright Zone?
		POR1 - Nashville Heights Sub-division – N of Mactier Dr. - No Build Existing																			**41.7**	
NV_MajMack_ex	Typical asphalt or concrete	open to road	0	119.5	-90	0	Absorptive	Gentle Slope	0		0	1.5									41.5	Bright Zone
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	119.5	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				29.0	-
		POR1 - Nashville Heights Sub-division – N of Mactier Dr. - Build																			**48.5**	
NV_MajMack_fut	Typical asphalt or concrete	open to road	0	119.5	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.2	Bright Zone
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	119.5	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				35.7	-
		POR 2- Nashville Heights Sub-division – Adjacent to Cemetery - No Build Existing																			**44.4**	
NV_MajMack_ex	Typical asphalt or concrete	screen by noise barrier	0	27.9	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3	1.4	1.8	-90	90				44.4	-
		POR 2- Nashville Heights Sub-division – Adjacent to Cemetery - Build																			**51.1**	
NV_MajMack_fut	Typical asphalt or concrete	screen by noise barrier	0	27.9	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3	1.4	1.8	-90	90				51.1	-
		POR3 - Huntington Rd N of Algoma Dr. –Single Family Residence - No Build Existing																			**48.2**	
NV_MajMack_ex	Typical asphalt or concrete	open to road	0	47.8	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.1	Bright Zone
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	47.8	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				34.0	-
		POR3 - Huntington Rd N of Algoma Dr. –Single Family Residence - Build																			**55.0**	
NV_MajMack_fut	Typical asphalt or concrete	open to road	0	47.8	-90	0	Absorptive	Gentle Slope	0		0	1.5									54.8	Bright Zone
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	47.8	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				40.8	-
		POR4 - Nashville Heights Sub-division – Algoma Dr. - No Build Existing																			**44.0**	
NV_MajMack_ex	Typical asphalt or concrete	screen by noise barrier	0	29.7	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3	1.4	1.8	-90	90				44.0	-
		POR4 - Nashville Heights Sub-division – Algoma Dr. - Build																			**50.8**	
NV_MajMack_fut	Typical asphalt or concrete	screen by noise barrier	0	29.7	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3	1.4	1.8	-90	90				50.8	-
		POR5 - Nashville Heights Sub-division – Kincardine St. - No Build Existing																			**42.4**	
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	60	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				35.8	-
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	766	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				32.2	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	734	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				40.8	-
		POR5 - Nashville Heights Sub-division – Kincardine St. - No Build Existing																			**45.0**	
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	60	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				42.5	-
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	766	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				32.2	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	734	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				40.8	-
		POR6- Nashville Heights Sub-division – East's Corners Blvd. - No Build Existing																			**48.6**	
NV_MajMack_ex	Typical asphalt or concrete	screen by house/noise barrier	0	33	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				48.8	-
MajMack_East of 427	Typical asphalt or concrete	screen by house/noise barrier	0	660	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				39.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house/noise barrier	0	621	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				48.0	-
		POR6- Nashville Heights Sub-division – East's Corners Blvd. - Build																			**48.6**	
NV_MajMack_fut	Typical asphalt or concrete	screen by house/noise barrier	0	33	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				55.5	-
MajMack_East of 427	Typical asphalt or concrete	screen by house/noise barrier	0	660	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				39.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house/noise barrier	0	621	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				48.0	-
		POR7- Nashville Heights Sub-division – NW corner of Moody Dr. - No Build Existing																			**44.1**	
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	245	-90	60	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	60				26.3	-
NV_MajMack_ex	Typical asphalt or concrete	open to road	0	245	60	90	Absorptive	Gentle Slope	0		0	1.5									28.9	Bright Zone
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	368	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				36.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	484	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				43.2	-
		POR7- Nashville Heights Sub-division – NW corner of Moody Dr. - Build																			**44.6**	
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	245	-90	60	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	60				33.1	-
NV_MajMack_fut	Typical asphalt or concrete	open to road	0	245	60	90	Absorptive	Gentle Slope	0		0	1.5									35.6	Bright Zone
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	368	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				36.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	484	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				43.2	-
		POR8- Nashville Heights Sub-division – Moody Dr. - No Build Existing																			**44.1**	
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	155	-90	60	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	60				28.9	-
NV_MajMack_ex	Typical asphalt or concrete	open to road	0	155	60	90	Absorptive	Gentle Slope	0		0	1.5									32.2	Bright Zone
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	442	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				35.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	486	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				43.1	-
		POR8- Nashville Heights Sub-division – Moody Dr. - Build																			**45.0**	
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	155	-90	60	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	60				35.6	-
NV_MajMack_fut	Typical asphalt or concrete	open to road	0	155	60	90	Absorptive	Gentle Slope	0		0	1.5									38.9	Bright Zone
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	442	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				35.3	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	486	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-90	90				43.1	-

Road Segment ID	Type of Pavement Surface	Description	Road Elev (m)	Dist to Centreline (m)	Φ1	Φ2	Ground Type	Topography	Elevation Change (m)	Road Gradient (%)	Receiver Elev (m)	Receiver Height (m)	Barrier Receiver Distance (m)	Barrier Elev (m)	Barrier Height (m)	Θ1	Θ2	Depth of Woods (m)	Rows of Intervening Houses	Density of Houses (%)	Road L_{eq} (dBA)	Bright Zone?
		POR9- Nashville Heights Sub-division – S corner of Moody Dr.- No Build Existing																			**53.2**	
NV_MajMack_ex	Typical asphalt or concrete	screen by noise barrier	0	45	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				46.7	-
MajMack_East of 427	Typical asphalt or concrete	screen by noise barrier	0	212	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				46.9	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	430	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				50.5	-
		POR9- Nashville Heights Sub-division – S corner of Moody Dr. - Build																			**55.8**	
NV_MajMack_fut	Typical asphalt or concrete	screen by noise barrier	0	45	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				53.5	-
MajMack_East of 427	Typical asphalt or concrete	screen by noise barrier	0	212	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				46.9	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by noise barrier	0	430	-90	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		1.8	-90	90				50.5	-
		POR10- Nashville Heights Sub-division – SE corner of Moody Dr. - No Build Existing																			**39.0**	
NV_MajMack_ex	Typical asphalt or concrete	screen by house	0	67	-45	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-45	90				33.3	-
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	235	-55	55	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-55	55				33.7	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	539	-40	30	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-40	30				35.5	-
		POR10- Nashville Heights Sub-division – SE corner of Moody Dr. - Build																			**42.0**	
NV_MajMack_fut	Typical asphalt or concrete	screen by house	0	67	-45	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-45	90				40.0	-
MajMack_East of 427	Typical asphalt or concrete	screen by house	0	235	-55	55	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-55	55				33.7	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	screen by house	0	539	-40	30	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	-40	30				35.5	-
		POR11 - Major Mackenzie Dr. at Huntington Rd. – Single Family Residence - No Build Existing																			**53.2**	
MajMack_Rutherford_ex	Typical asphalt or concrete	open to road	0	315	-90	0	Absorptive	Gentle Slope	0		0	1.5									34.1	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	315	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				23.2	-
MajMack_East of 427	Typical asphalt or concrete	open to road	0	201	-30	90	Absorptive	Gentle Slope	0		0	1.5									50.1	Bright Zone
MajMack_S-EW Ramp	Typical asphalt or concrete	open to road	0	160	-90	50	Absorptive	Gentle Slope	0		0	1.5									50.2	Bright Zone
		POR11 - Major Mackenzie Dr. at Huntington Rd. – Single Family Residence - Build																			**53.1**	
MajMack_East of 427	Typical asphalt or concrete	open to road	0	201	-30	90	Absorptive	Gentle Slope	0		0	1.5									50.1	Bright Zone
MajMack_S-EW Ramp	Typical asphalt or concrete	open to road	0	160	-90	50	Absorptive	Gentle Slope	0		0	1.5									50.2	Bright Zone
		Didn`t include Huntington since no road here in "future build"																				
		POR12- 9711 Huntington Rd. – Single Rural Residence - No Build Existing																			**57.9**	
MajMack_Rutherford_ex	Typical asphalt or concrete	open to road	0	95	-90	0	Absorptive	Gentle Slope	0		0	1.5									42.7	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	95	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				29.8	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	257	-90	69	Absorptive	Gentle Slope	0		0	1.5									57.7	Bright Zone
		POR12 - 9711 Huntington Rd. – Single Rural Residence - Build																			**57.9**	
McGill_Rutherford_fut	Typical asphalt or concrete	open to road	0	95	-90	0	Absorptive	Gentle Slope	0		0	1.5									42.0	Bright Zone
McGill_Rutherford_fut	Typical asphalt or concrete	screen by house	0	95	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				29.1	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	257	-90	69	Absorptive	Gentle Slope	0		0	1.5									57.7	Bright Zone
		POR13 - Huntington Rd. S of McGillivray Rd. – Single Family Residence - No Build Existing																			**56.6**	
MajMack_Rutherford_ex	Typical asphalt or concrete	open to road	0	52	-90	0	Absorptive	Gentle Slope	0		0	1.5									47.0	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	52	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				33.2	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	320	-90	63	Absorptive	Gentle Slope	0		0	1.5									56.0	Bright Zone
		POR13 - Huntington Rd. S of McGillivray Rd. – Single Family Residence - Build																			**56.5**	
McGill_Rutherford_fut	Typical asphalt or concrete	open to road	0	52	-90	0	Absorptive	Gentle Slope	0		0	1.5									46.4	Bright Zone
McGill_Rutherford_fut	Typical asphalt or concrete	screen by house	0	52	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				32.4	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	320	-90	63	Absorptive	Gentle Slope	0		0	1.5									56.0	Bright Zone
		POR14 - 9441 Huntington Rd. – Single Rural Residence - No Build Existing																			**54.6**	
MajMack_Rutherford_ex	Typical asphalt or concrete	open to road	0	41	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.8	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	41	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				34.4	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	474	-70	80	Absorptive	Gentle Slope	0		0	1.5									53.3	Bright Zone
		POR14 - 9441 Huntington Rd. – Single Rural Residence- Build																			**54.5**	
McGill_Rutherford_fut	Typical asphalt or concrete	open to road	0	41	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.1	Bright Zone
McGill_Rutherford_fut	Typical asphalt or concrete	screen by house	0	41	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				33.7	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	474	-70	80	Absorptive	Gentle Slope	0		0	1.5									53.3	Bright Zone
		POR15 - 6666 Rutherford Rd. – Single Rural Residence - No Build Existing																			**54.1**	
MajMack_Rutherford_ex	Typical asphalt or concrete	open to road	0	247	-90	0	Absorptive	Gentle Slope	0		0	1.5									35.8	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	247	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				24.5	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	461	-75	30	Absorptive	Gentle Slope	0		0	1.5									52.2	Bright Zone
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	461	30	90	Absorptive	Gentle Slope	0		0	1.5									49.5	Bright Zone
		POR15 - 6666 Rutherford Rd. – Single Rural Residence - Build																			**54.1**	
McGill_Rutherford_fut	Typical asphalt or concrete	open to road	0	247	-90	0	Absorptive	Gentle Slope	0		0	1.5									35.2	Bright Zone
MajMack_Rutherford_ex	Typical asphalt or concrete	screen by house	0	247	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				24.5	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	461	-75	30	Absorptive	Gentle Slope	0		0	1.5									52.2	Bright Zone
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	461	30	90	Absorptive	Gentle Slope	0		0	1.5									49.5	Bright Zone
		POR16 - 9151 Huntington Rd. – Single Rural Residence - No Build Existing																			**52.8**	
Rutherford_Street A_ex	Typical asphalt or concrete	open to road	0	294	-90	0	Absorptive	Gentle Slope	0		0	1.5									41.8	Bright Zone
Rutherford_Street A_ex	Typical asphalt or concrete	screen by house	0	294	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				30.8	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	611	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.7	Bright Zone
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	611	0	90	Absorptive	Gentle Slope	0		0	1.5									50.0	Bright Zone
		POR16 - 9151 Huntington Rd. – Single Rural Residence - Build																			**53.4**	
Rutherford_Street A_fut	Typical asphalt or concrete	open to road	0	294	-90	0	Absorptive	Gentle Slope	0		0	1.5									45.9	Bright Zone
Rutherford_Street A_fut	Typical asphalt or concrete	screen by house	0	294	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				34.8	-
427_Rutherford_Major Mackenzie	Typical asphalt or concrete	open to road	0	611	-90	0	Absorptive	Gentle Slope	0		0	1.5									48.7	Bright Zone
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	611	0	90	Absorptive	Gentle Slope	0		0	1.5									50.0	Bright Zone
		POR 17 - NE of Trade Valley Dr. at Huntington Rd. –Single Family Residence - No Build Existing																			**53.7**	
Rutherford_Street A_ex	Typical asphalt or concrete	open to road	0	75	-90	0	Absorptive	Gentle Slope	0		0	1.5									51.7	Bright Zone
Rutherford_Street A_ex	Typical asphalt or concrete	screen by house	0	75	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				38.4	-
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	1039	-80	80	Absorptive	Gentle Slope	0		0	1.5									49.1	Bright Zone
		POR 17 - NE of Trade Valley Dr. at Huntington Rd. –Single Family Residence - Build																			**56.7**	
Rutherford_Street A_fut	Typical asphalt or concrete	open to road	0	75	-90	0	Absorptive	Gentle Slope	0		0	1.5									55.7	Bright Zone
Rutherford_Street A_fut	Typical asphalt or concrete	screen by house	0	75	0	90	Absorptive	Gentle Slope With Barrier	0		0	1.5	3		6	0	90				42.4	-
427_Rutherford_Langstaff	Typical asphalt or concrete	open to road	0	1039	-80	80	Absorptive	Gentle Slope	0		0	1.5									49.1	Bright Zone

Appendix E

THE CITY OF VAUGHAN

BY-LAW

BY-LAW NUMBER 96-2006

A By-law to regulate noise.

WHEREAS the Municipal Act, R.S.O. 2001, Section 129. (1) Paragraphs 1, 2 and 3 authorize municipalities to pass by-laws to prohibit and regulate noise;

AND WHEREAS a recognized body of scientific and technological knowledge exists by which sound and vibration may be substantially reduced;

AND WHEREAS it is in the public interest to reduce the noise level in the City of Vaughan, so as to preserve, protect, and promote public health, safety, welfare, and the peace and quiet of the inhabitants of the City;

AND WHEREAS it is the policy of the Council of The Corporation of City of Vaughan to regulate such sound or vibration, or nuisance;

NOW THEREFORE the Council of The Corporation of City of Vaughan enacts as follows:

1. TITLE

   This By-law shall be referred to as "The Noise Control By-Law".

2. TECHNICAL TERMS

   In this By-Law all words and definitions that are of technical nature and are related to sound and vibration shall have the meanings specified for them in Schedule 3 - Publication NPC-101.

3. DEFINITIONS

   In this By-Law,

   "APPLICABLE PUBLICATION" means any Publication referred to in the Provisions of this By-Law including a Schedule hereto;

   “APPLICANT” includes any person or persons seeking in writing from the Department Head of Enforcement Services, an exemption of either a temporary or permanent nature from the provisions and requirements of this By-law;

   "CERTIFICATE" means a certificate of Competency in Environmental Acoustics, Technology of a specified class issued by an accredited program of an Ontario Community College or other approved consulting agency;

   "CITY" means the municipal corporation of the City of Vaughan or the geographic area of the City of Vaughan as the context requires;

   "CONSTRUCTION" includes erection, alteration, repair, dismantling, demolition, structural maintenance, painting, moving, land clearing, earth moving, grading, excavating, the laying of

pipe and conduit whether above or below ground level, street and highway building, concreting, equipment installation and alteration and the structural installation of construction components and materials in any form or for any purpose, and includes any work in connection therewith;

"CONSTRUCTION EQUIPMENT" means any equipment or device designed and intended for use in construction, or material handling, including but not limited to, air compressors, pile drivers, pneumatic or hydraulic tools, bulldozers, tractors, excavators, trenchers, cranes, derricks, loaders, scrapers, pavers, generators, off highway haulers or trucks, ditchers, compactors and rollers, pumps, concrete mixers, graders, or other material handling equipment;

"CONSTRUCTION SITE" means the area or portion of land used for construction or any other area used for any purpose related to the construction or for any related purpose;

"CONVEYANCE" includes a vehicle and any other device used to transport a person or persons or goods from place to place but does not include any vehicle or device operated only within the premises of a person;

"COUNCIL" means the council of City of Vaughan;

"dBA" means the sound level in decibels obtained when using a sound level meter with the A-weighting;

"DEPARTMENT HEAD OF ENFORCEMENT SERVICES" means the person occupying the position of the Department Head of Enforcement Services of the City of Vaughan or authorized representative.

“EFFECTIVE MUFFLER” means a muffler in good working order and in constant operation to prevent excessive or unusual noise or excessive smoke but it does not a cut-out muffler, straight exhaust gutted muffler, Hollywood mffler, by-pass or similar device.

"ENFORCEMENT OFFICER" means a person appointed by the Council of he City of Vaughan as a Municipal Law Enforcement Officer to enforce the provisions of this By-law or a sworn member of York Regional Police, Ontario Provincial Police, Royal Canadian Mounted Police, or any other person so authorized;

"HIGHWAY" includes a common and public highway, as defined under the Highway Traffic Act R.S.O. 1990 and includes any bridge, trestle, viaduct, or other structure forming part of the highway designed and intended for or used by, the general public for the passage of vehicles.

"MINISTRY" means the Ministry of the Environment;

"MOTOR VEHICLE" means any motorized conveyance and includes any automobile, motorcycle and any other vehicle propelled or driven otherwise than by muscular power, but does not include the cars of electric or steam railways, or other motor vehicle running only upon rails, or a motorized snow vehicle, traction engine, farm tractor, self-propelled implement of husbandry or road building machine;

"MOTORIZED CONVEYANCE" means a conveyance propelled or driven otherwise than by muscular, gravitational or wind power;

"MUNICIPALITY" means the land within the geographic limit of City of Vaughan;

"NOISE" means unwanted sound;

“PERMIT” means and includes any permit or written authorization of a temporary or permanent nature, issued by the Department Head of Enforcement Services of City of Vaughan, which provides an exemption(s) to the terms and conditions of this By-law;

"POINT OF RECEPTION" means any point on a premises or a location of an equivalent distance where sound or vibration originating from other than those locations are received;

"NPC PUBLICATION" means a specified publication of the Noise Pollution Control Section of the Pollution Control Branch of the Ministry of the Environment named in Schedule 4 of this By-Law;

"QUIET ZONE" means all lands located within a distance of 250 meters of all exterior walls of a hospital, nursing home, or seniors retirement facility;

"REFUSE COMPACTING EQUIPMENT" means a vehicle fitted in order to compact and transport refuse;

"RESIDENTIAL AREA" means an area of the municipality designated as residential area in City of Vaughan Zoning By-Laws;

"RESIDENTIAL RENOVATIONS" means construction that does not require any building permits and such renovations are constructed without the operation of any heavy equipment;

"SOUND AMPLIFYING SYSTEM" means any system of loudspeakers, amplifiers, microphones or reproducers or any combination of such equipment, including electronic devices or electro-mechanical transducers, used in the reproduction or amplification of music, speech or other sounds;

"SOUND REPRODUCTION DEVICE" means a device intended primarily for the production or reproduction of sound, including, but not limited to, any musical instrument, radio receiver, television receiver, tape recorder, phonograph or sound amplifying system;

"SOURCE" or "SOURCE OF SOUND OR VIBRATION" means an activity, matter, thing, or tangible personal property or real property, from which sound or vibration is emitted;

"SOUND" is an oscillation in pressure, stress, particle displacement or particle velocity, in a medium with internal forces (e.g. elastic, viscous), or the superposition of such propagated oscillations, which may cause an auditory sensation;

"SPECIAL EVENT" includes but not limited to demonstrations, parades, sports events, festivals, carnivals, street dances, residential block parties, and any other functioned deemed to be a “Special Event” by the Department Head of Enforcement Services of City of Vaughan;

"STATIONARY SOURCE" means a source of sound, which does not normally move from place to place and includes the premises of a person as one stationary source unless the dominant source on the premises is construction equipment or a conveyance;

"VEHICLE" includes a motor vehicle, trailer, traction engine, farm tractor, road-building machine, motorcycle, bicycle and any vehicle drawn, propelled or driven by any kind of power, including muscular power, but does not include a motorized snow vehicle or the cars of electric or steam railways running only upon rails.

4. PROHIBITIONS

No person shall emit or cause to permit the emission of sound resulting:

(1) From a stationary source such that the level of resultant sound at a point of reception located in a residential area, or quiet zone which exceeds the applicable sound level limit prescribed in Schedule 3, Publication NPC-205 - Stationary Sources;

(2) From an act listed in Schedule 1 - General Prohibitions, and which sound is clearly audible at a point of reception;

(3) From any act listed in Schedule 2 - Prohibitions by Time and Place, if clearly audible at a point of reception.

5. PRE-EMPTION

Where section 1 (1) or (2) applies to a source of sound, the less restrictive provision shall prevail.

6. UNUSUAL NOISE, NOISE LIKELY TO DISTURB

No person in a residential area shall make any unusual noise or noise likely to disturb the inhabitants of the City.

7. BELLS, HORNS, SHOUTING

No person shall ring any bell, sound any horn, or shout in a manner likely to disturb the inhabitants of the City provided that nothing herein contained shall prevent,

a. the ringing of bells, or electronic reproduction of the sound of bells, in connection with any church, chapel, meeting house or religious service;

b. the ringing of fire bells or fire alarms or the making of any other noise for the purpose of giving notice of fire or any other danger or any unlawful act for a continuous period of time of twenty (20) minutes or less.

8. AIR CONDITIONERS, HEAT PUMPS, AND SIMILAR DEVICES

No person shall use or operate or cause to be used or operated any residential air conditioner, heat pump, or similar device, the noise from which has a level greater than 61 dBA when measured at the point of reception.

9. PUMP OR FILTRATION SYSTEMS

No person shall use or operate or cause to be used or operated any pump, filtration system or similar device for an outdoor swimming pool, hot tub, spa fountain or water feature, the noise from which has a level greater than 55 dBA when measured at the point of reception or in compliance with NPC-205, Stationary Sources.

10. CONSTRUCTION

(1) No person shall, between 1900 hours of one day and 0700 hours of the next day operate or cause to be operated, any construction vehicle or construction equipment in connection with the construction of any building or structure, highway, motor car, steam boiler or other engine or machine;

(2) Despite subsection (1), no person shall operate or cause to be operated any construction vehicle or construction equipment before 0700 hours and no later than 1900 hours on any Saturday and not at all on Sunday or statutory holidays.

11. LOADING AND UNLOADING

No person shall load or unload any transport truck, commercial vehicle, or any other vehicle used to transport goods between 2300 hours of one day and 0700 hours of the next day so as to make or cause noises that disturb, or tend to disturb the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood in a residential area.

12. MUFFLERS

No person shall discharge into the open air, on any property other than a highway, the exhaust of any motor vehicle except through a muffler or other device, which effectively prevents loud or explosive noises.

13. MOTOR SPORTS

(1) No person shall operate or permit the operation of racing competitions between motor vehicles on a property other than a highway within the City, whether or not an admission fee is charged, unless,

a. the competitions are held at a permanent facility;

b. all motor vehicles are properly equipped with effective mufflers, and

c. such competitions are not carried out between 2300 hours of one day and 1000 hours of the next day.

(2) Subsection (1) shall not apply to permanent go-kart operations on a property other than a highway.

14. GO-KART ACTIVITIES

No person shall operate or permit the operation of go-kart activities on a property other than a highway within the City, whether or not an admission fee is charged, unless,

(1) the activities are held at a permanent go-kart facility;

(2) all go-karts are equipped with effective mufflers, and

(3) such activities are not carried out between 2300 hours of one day and 0700 hours of the next day.

15. UNNECESSARY MOTOR VEHICLE NOISE

No person shall cause or permit unnecessary motor vehicle noise such as the sounding of the horn, or revving of engine, or the squealing of tires of any motor vehicle on any property other than a highway.

16. SOUND REPRODUCTION OR AMPLIFICATION DEVICES

(1) No person in a residential area shall operate or use or cause to be operated or use any sound reproduction device during any time of day so as to disturb the peace and comfort of,

a. any person in any dwelling house, or other type of residence.

(2) Assessment of noise complaints may be undertaken at the point of reception of the noise for the purposes of confirming a violation. Assessment may be conducted by noise monitoring as required pursuant to NPC-205, Stationary Sources.

. (3) No person shall operate or use or cause to be operated or used any sound reproduction device on any highway or other public place.

(4) No person shall operate or use or cause to be operated or used any sound reproduction device originating from or in connection with the operation of any commercial establishment at any time. The noise from which sound reproduction device when measured in any dwelling house, apartment house, or any other type of residence in a residential area has an equivalent sound level (Leq) the noise criteria established in NPC-205, Stationary Source.

(5) Subsections (1) and (2) do not apply to prevent,

a. the use of sound reproduction devices in the City's parks provided that the user has a permit from or the written permission of the City to do so and the user otherwise complies with the provisions of this By-law, including the noise level maximum herein provided,

b. the amplification of the sound of the ringing of bells or the playing of chimes in connection with,

i. any church, chapel, meeting house or religious service, or

ii. the City Hall between 0900 hours and 2100 hours of the same day,

c. the use of musical instruments by street musicians on the highway or other public place, provided that the use is not liable to disturb the peace, enjoyment and comfort or convenience of individuals or the public.

17. EXEMPTIONS

(1) The provisions of this By-law shall not apply to the City of Vaughan or Regional Municipality of York, the Province of Ontario, the Government of Canada or any of their agents when the emission of sound is in connection with work undertaken for the immediate health, safety or welfare of the inhabitants of the City.

(2) The provisions of this By-law shall not apply to preclude musicians or performers providing outdoor entertainment involving sound reproduction devices during special events sanctioned by the City.

(3) The provisions of this By-law shall not apply to agricultural operations and agricultural processing activities.

(4) The provisions of this By-law shall not apply to snow removal activities conducted by the City, Region of York, or the Province of Ontario.

(5) Nothing in this By-law shall prevent the clearing of snow from designated fire routes.

18. SOUND REPRODUCTION DEVICES USED IN A SPECIAL EVENT AND OUTDOOR EXHIBITIONS

(1) The Department Head of Enforcement Services is delegated the authority to grant an exemption for an event subject to the following conditions:

a. The event relates to live or recorded music or involves the use of a sound amplifying system or sound reproduction device operated in a reasonable manner in the context of the special event;

b. The event shall not create noise to exceed 55 dBA when measured at the point of reception;

c. Any activity that is lawfully carried out pursuant to a Special Event Permit issued by the City is subject to any conditions imposed on the Special Event Permit. Where there is a conflict between a condition imposed on the Special Event Permit and this By-law, the requirements of this By-law shall prevail;

d. The breach of any conditions imposed by this Section shall nullify the Special Event Permit and enforcement procedures could be considered;

e. An Enforcement Officer may monitor the activity at the special event, the cost of which will be born by the Special Event Permit holder at a rate of remuneration established under the City of Vaughan Fee By-law.

19. EXEMPTION - CONSTRUCTION EQUIPMENT

(1) The Department Head of Enforcement Services is delegated the authority to grant an exemption to subsection 7(1) for construction equipment utilized during prohibited hours subject to the following conditions:

a. the use of construction equipment shall not exceed the established noise levels of NPC-115, Construction Equipment;

b. the duration of the exemption requested shall not exceed eleven (11) calendar days in length.

(2) An application for exemption from the provisions of the noise by-law for construction equipment shall be made in writing to the Department Head of Enforcement Services at least sixty (60) days prior to the commencement of the use of the construction equipment for which the exemption is sought and shall include the following:

a. the name and address of the applicant;

b. the name and address of the business represented by the applicant, if applicable;

c. the source of the sound or vibration in respect of which the exemption is sought;

d. the provision of this By-law from which the exemption is sought;

e. the date and time of commencement of the construction, for which the exemption is sought;

f. the time of conclusion for each day for the use of the construction equipment for which the exemption is sought;

g. the duration of the use of the construction equipment, for which the exemption is sought;

h. the location of the construction for which the exemption is sought;

i. rationale for granting an exemption;

j. the name of the contact person or persons who will be supervising the use of the construction equipment, and

k. payment of the application fee as described in the City of Vaughan Fee By-law.

(3) The Department Head of Enforcement Services may require the applicant to provide documentation confirming that notification of the use of construction equipment has been given to the affected parties including but not limited to community associations, business improvement areas and adjacent residents and businesses.

(4) Where the Department Head of Enforcement Services requires monitoring of sound levels resulting from the construction, the monitoring shall be conducted at the applicant's expense as outlined in the City of Vaughan Fee By-law.

20. EXEMPTION - TEMPORARY MOTOR RACING COMPETITIONS

(1) The Department Head of Enforcement Services is delegated the authority to grant an exemption for motor racing competitions at temporary venues subject to the following conditions:

a. the competition does not exceed three (3) days in length;

b. the event shall not create noise to exceed 65 dBA at any point of reception.

(2) An application for exemption from the provisions of the Noise By-law for motor racing competitions at temporary venues shall be made in writing to the Department Head of Enforcement Services at least sixty (60) days prior to the commencement of the temporary motor competition for which the exemption is sought and shall include the following:

a. the name and address of the applicant;

b. the name and address of the business represented by the applicant, if applicable;

c. the provision of this By-law from which the exemption is sought;

d. the date and time of commencement of the competition for which the exemption is sought;

e. the time of conclusion for each day of the competition;

f. the duration of the competition for which the exemption is sought;

g. the location of the competition for which the exemption is sought;

h. rationale for granting an exemption;

i. the name of the contact person or persons who will be supervising the competition, and

j. payment of the application fee as described in the City of Vaughan Fee By-law.

(3) The Department Head of Enforcement Services may require the applicant to provide documentation confirming that notification of the motor racing competition at a temporary venue has been given to the affected parties including but not limited to community associations, business improvement areas and adjacent residents and businesses.

(4) Where the Department Head of Enforcement Services requires monitoring of sound levels resulting from the event or activity, the monitoring shall be conducted at the applicant's expense as outlined in the City's Fee By-law.

21. ENFORCEMENT

This By-law shall be enforced by any Enforcement Officer or person duly authorized by the City.

22. OFFENCE AND PENALTIES

(1) Every person who contravenes any of the provisions of this By-law is guilty of an offence.

(2) Every person who is convicted of an offence under this By-law is liable to a fine as provided for in the Provincial Offences Act, RS.O. 1990, Chap. P.33

(3) When a person has been convicted of an offence under this by-law,

a. the Ontario Court (Provincial Division) of the City of Vaughan, or

b. any court of competent jurisdiction thereafter may, in addition to any other penalty imposed on the person convicted, issue an order prohibiting the continuation or repetition of the offence or the doing of any act or thing by the person convicted directed toward the continuation or repetition of the offence.

23. INTERPRETATION

(1) It is declared that if any section, subsection or part or parts thereof be declared by any Court of Law to be bad, illegal or ultra vires, such section, subsection or part or parts shall be deemed to be severable and all parts hereof are declared to be separate and independent and enacted as such.

(2) In this by-law, a word interpreted in the singular number has a corresponding meaning when used in the plural.

(3) Schedules "1", "2", "A" and "B" and any Publications NPC annexed hereto are hereby

declared to form part of this By-law.

24. REPEAL

a. By-law 158-73, By-law 270-81 and amending By-laws 253-85 and 244-99 are hereby repealed.

25. EFFECTIVE DATE

This By-law shall come into effect on the 10th day of April, 2006.

READ a FIRST, SECOND and THIRD time and finally passed this 10th day of April, 2006.

Michael Di Biase, Mayor

J. D. Leach, City Clerk

Schedule 1

GENERAL PROHIBITIONS

1. Racing of any motorized conveyance other than in a racing event regulated by law.
2. The operation of a motor vehicle in such a way that the tires squeal.
3. The operation of any combustion engine shall not discharge into the open air, on any property other than a highway, the exhaust of any motor vehicle except through a proper muffler or legal device which effectively prevents loud or explosive noises.
4. The operation of a vehicle or a vehicle with a trailer resulting in banging, clanking, squealing or other like sounds due to improperly secured load or equipment;
5. The operation of an engine or motor in, or on, any motor vehicle or item of attached auxiliary equipment for a continuous period exceeding five minutes, while such vehicle is stationary in a Residential Area or, unless,
   (a) The vehicle is in an enclosed structure constructed so as to effectively prevent excessive noise emission; or,
   (b) The original equipment manufacturer specifically recommends a longer idling period for normal and efficient operation of the motor vehicle in which case such recommended period shall not be exceeded;
   (c) Operation of such engine or motor is essential to a basic function of the vehicle or equipment, including but not limited to, operation of ready mixed concrete trucks, lift platforms or refuse compactors and heat exchange systems; or,
   (d) Weather conditions justify the use of heating or refrigerating systems powered by the motor or engine for the safety and welfare of the operator, passengers or animals, or preservation of perishable cargo; or,
   (e) Prevailing low temperatures make longer idling periods necessary, immediately after starting the motor or engine; or,
   (f) The idling is for the purpose of cleaning and flushing the radiator and associated circulation system for seasonal change or antifreeze, cleaning of the fuel system, carburetor or the like, when such work is performed other than for profit.
6. The operation of a motor vehicle horn or other warning device except where required or authorized by law in accordance with good safety practices.
7. The operation of any item of construction equipment shall not discharge into the open air, on any property other than a highway the exhaust except through a proper muffler or legal device, which effectively prevents loud or explosive noises.

Schedule 2

TIME AND PLACE PROHIBITED PERIODS

1. The operation of any auditory signaling device, including but not limited to the ringing of bells or gongs and the blowing of horns or sirens or whistles, or the production, reproduction or amplification of any similar sounds by-law or in accordance with good safety practices.

Quiet Zone	Residential Area
At Any Time	B

2. The operation of any electronic device or group of connected electronic devices incorporating one or more loudspeakers or other electro mechanical transducers, and intended for the production, reproduction or amplification of sound.

Quiet Zone	Residential Area
At Any Time	A

3. Loading, unloading, delivering, packing, unpacking, or otherwise handling any containers, produce, materials, or refuse whatsoever, unless necessary for the maintenance of essential services.

Quiet Zone	Residential Area
B	B & D

4. The operation of any construction equipment in connection with construction.

Quiet Zone	Residential Area
E & D	F & D

5. The detonation of fireworks or explosive devices

Quiet Zone	Residential Area
At Any Time	A

6. The operation of a combustion engine which,

(i) is, or

(ii) is used in, or

(iii) is intended for use in,

A toy or a model or replica of a larger device, which model or replica has no function other than amusement and which is not a conveyance.

Quiet Zone	Residential Area
At Any Time	B

7. The operation of any powered rail car including but not limited to refrigeration cars, locomotives or self-propelled passenger cars, while stationary on property not owned or controlled by a railway governed by The Canada Railway Act.

Quiet Zone	Residential Area
At Any Time	A

8. The operation of any motorized conveyance other than on a highway or other place intended for its operation.

Quiet Zone	Residential Area
At Any Time	B

9. The venting, release or pressure relief of air, steam or other gaseous material, product or compound from any autoclave, boiler, pressure vessel, pipe, valve, machine, device or system.

Quiet Zone	Residential Area
At Any Time	A

10. Persistent barking, calling or whining or other similar persistent noise making by any domestic pet.

Quiet Zone	Residential Area
At Any Time	At Any Time

11. The operation of any powered or non-powered tool for domestic purposes other than snow removal.

Quiet Zone	Residential Area
C	G

12. The operation of solid waste bulk lifts or refuse compacting equipment.

Quiet Zone	Residential Area
C	B

13. The operation of commercial car wash with air-drying equipment.

Quiet Zone	Residential Area
C	H

14. The operation of a power assisted hang glider or Para foil.

Quiet Zone	Residential Area
At Any Time	At Any Time

15. The operation of any item of snow making equipment.

Quiet Zone	Residential Area
At Any Time	At Any Time

16. The operation of a sound emitting pest control device

Quiet Zone	Residential Area
At Any Time	At Any Time

17. The discharge of firearms

Quiet Zone	Residential Area
At Any Time	At Any Time

Note: For the purpose of this Schedule, "motorized conveyance" includes, but is not limited to;

(a) Snowmobiles;

(b) Mopeds;

(c) Go-carts;

(d) Track bikes;

(e) Trail bikes

Restricted Times:

a) 23:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

b) 19:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

c) 17:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

d) All day Sundays and Statutory Holidays

e) 17:00 hrs. of one day to 07:00 hrs. next day

f) 19:00 hrs. of one day to 07:00 hrs. next day

g) 21:00 hrs. of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

h) 22:00 hrs of one day to 07:00 hrs. next day (09:00 hrs. Sundays)

Index of Publications NPC

Publication NPC-101	Technical Definitions Publication
Publication NPC-102	Instrumentation
Publication NPC-103	Procedures
Publication NPC-104	Sound Level Adjustments
Publication NPC-205	***Stationary Source***

Publication NPC-206	***Road Traffic***
Publication NPC-115	Construction Equipment
Publication NPC-117	Domestic Outdoor Power Tools
Publication NPC-118	Motorized Conveyances
Publication NPC-119	Blasting

Appendix F

Roadway Construction Noise Assessment - Roadway Construction

Project Name: Huntington Road Improvements
Project Reference #: 13-0253

1. Removal of Overburden

Equipment	# of pieces	Activity PWL[1]	Max SPL[2]
Excavator (> 75 kW)	1	109	81
Haul Truck (typical 3-axle)	3	108	76
Dozer (> 75 kW)	1	110	82
Scraper	1	112	84
Total / Max		117	84

2. Compaction of Subgrade

Equipment	# of pieces	Activity PWL[1]	Max SPL[2]
Compactor (ground)	2	108	83
Total / Max		111	83

3. Base Course

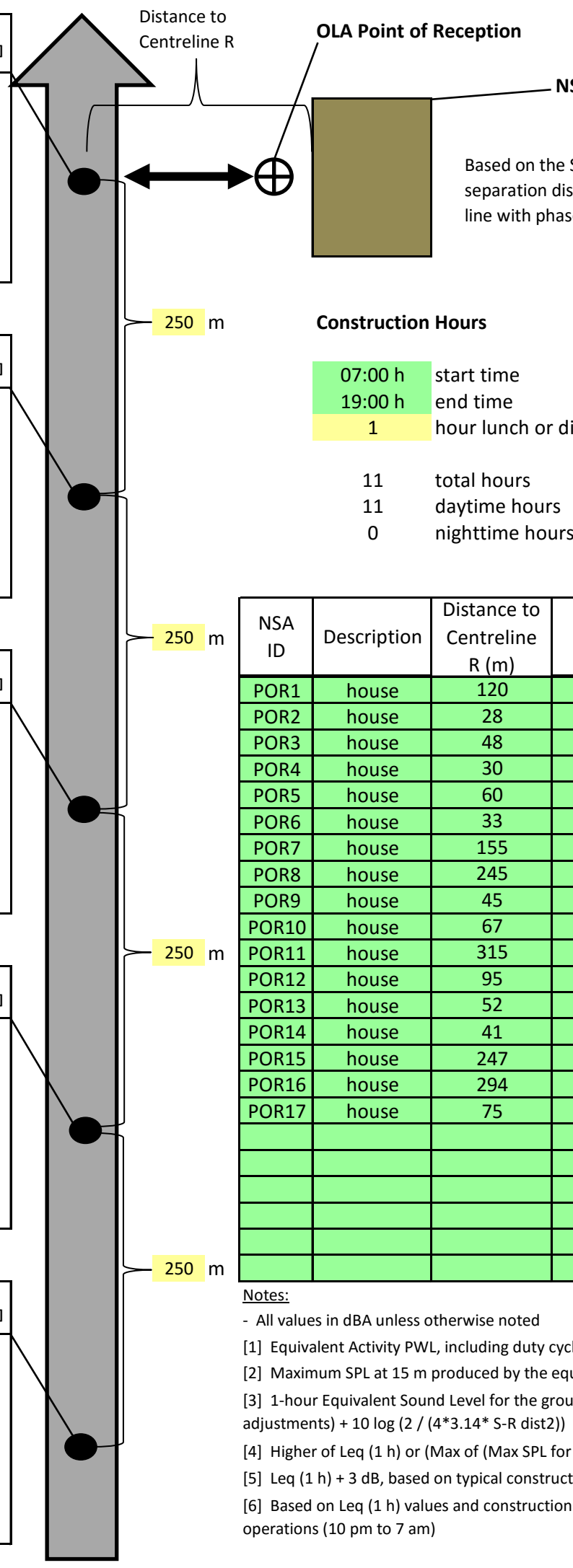
Equipment	# of pieces	Activity PWL[1]	Max SPL[2]
Front End Loader (> 75 kW)	2	107	79
Dozer (> 75 kW)	1	110	82
Haul Truck (typical 3-axle)	4	108	76
Total / Max		116	82

4. Compaction of Base Course

Equipment	# of pieces	Activity PWL[1]	Max SPL[2]
Compactor (ground)	1	108	83
Grader	1	113	85
Total / Max		114	85

5. Surface Course

Equipment	# of pieces	Activity PWL[1]	Max SPL[2]
Backhoe (> 75 kW)	2	106	78
Haul Truck (typical 3-axle)	3	108	76
Paver	1	106	77
Roller	1	105	80
Total / Max		115	80



Based on the SPL and PWL data used, as well as assumed separation distances, worst-case impacts are expected while in line with phase 1, Removal of Overburden.

Construction Hours

07:00 h	start time
19:00 h	end time
1	hour lunch or dinner breaks
11	total hours
11	daytime hours
0	nighttime hours

NSA ID	Description	Distance to Centreline R (m)	Approx Screening (dB)	$L_{eq}(1)$[3]	L_{max}[4]	L_{10}[5]	L_{dn}[6]
POR1	house	120	0	68	68	71	64
POR2	house	28	0	80	80	83	77
POR3	house	48	0	75	75	78	72
POR4	house	30	0	80	80	83	76
POR5	house	60	0	74	74	77	70
POR6	house	33	0	79	79	82	75
POR7	house	155	0	66	66	69	62
POR8	house	245	0	62	62	65	59
POR9	house	45	0	76	76	79	73
POR10	house	67	0	73	73	76	69
POR11	house	315	0	60	60	63	57
POR12	house	95	0	70	70	73	66
POR13	house	52	0	75	75	78	71
POR14	house	41	0	77	77	80	73
POR15	house	247	0	62	62	65	59
POR16	house	294	0	61	61	64	57
POR17	house	75	0	72	72	75	68

Notes:

- All values in dBA unless otherwise noted

[1] Equivalent Activity PWL, including duty cycle and penalty adjustments

[2] Maximum SPL at 15 m produced by the equipment

[3] 1-hour Equivalent Sound Level for the group (includes duty cycle, penalties and no of vehicle adjustments) + 10 log (2 / (4*3.14* S-R dist2))

[4] Higher of Leq (1 h) or (Max of (Max SPL for each group + 20 log (15 / SR- dist))

[5] Leq (1 h) + 3 dB, based on typical construction sites, per RCNM

[6] Based on Leq (1 h) values and construction hours, includes a 10 dB penalty for night-time operations (10 pm to 7 am)