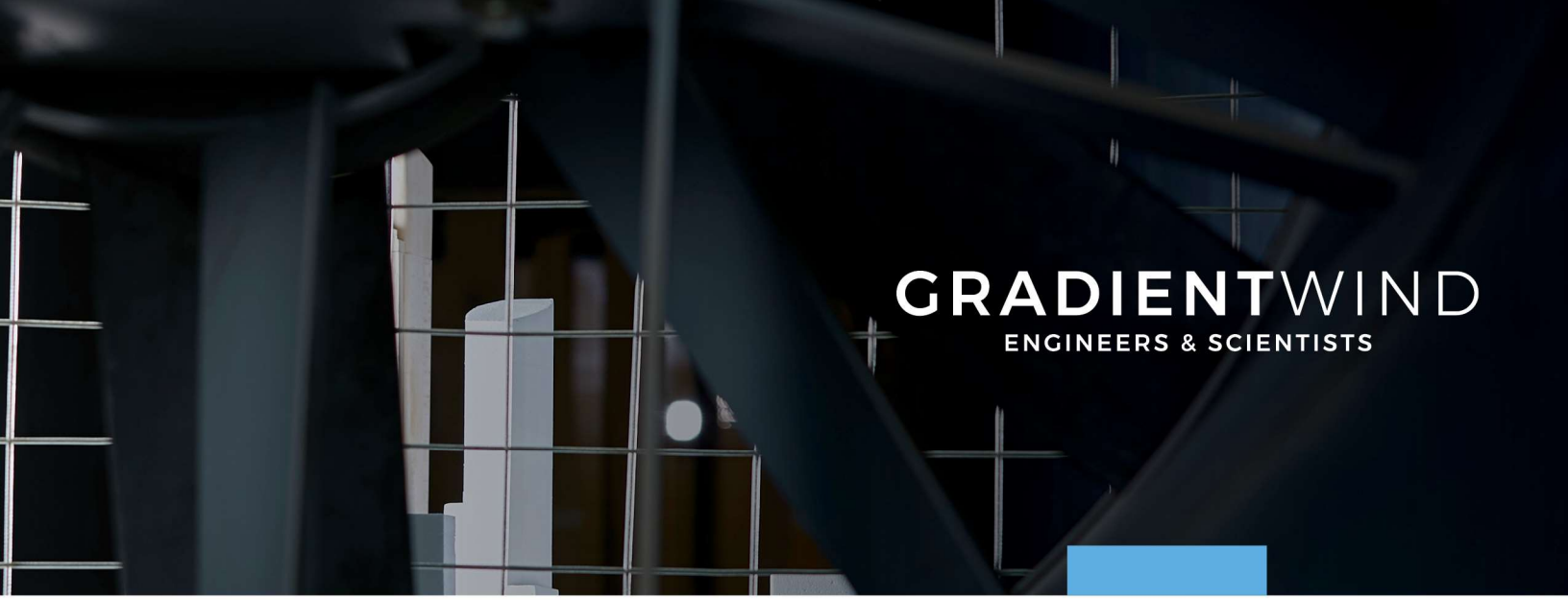

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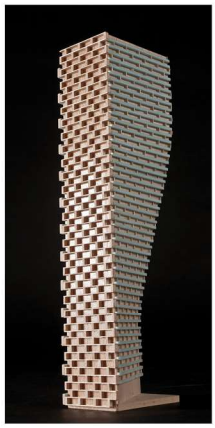
# DETAILED ROADWAY TRAFFIC NOISE ASSESSMENT

51, 53, 55 &75 Bradford St. and
20 Checkley St., Barrie, Ontario – Phase 1

REPORT: 19-214 – Phase 1-Traffic Noise



August 13, 2020

PREPARED FOR

**Barrie Lakeshore Developments**
3200 Highway 7
Vaughan, ON L4K 5Z5


PREPARED BY

Efser Kara, MSc, LEED GA, Acoustic Scientist
Joshua Foster, P.Eng., Principal

# EXECUTIVE SUMMARY

This report describes a traffic noise assessment performed to satisfy Site Plan Application (SPA) for a proposed mixed-use building featuring residential and hotel services. The overall site development consists of three high-rise residential towers, referred to as Tower 2, 3 and 4, and a mixed-use building referred to as Tower 1. Tower 1 is the focus of this detailed traffic noise assessment which outlines the specific noise control measures for Phase 1. The building comprises 25 storeys and was part of a larger rezoning application Gradient Wind prepared a Traffic Noise Feasibility Assessment (refer to project 19-124), dated December 17, 2019.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP); (ii) noise level criteria as specified by the MECP NPC-300 guidelines; (iii) vehicular traffic volumes corresponding to roadway classification and roadway traffic counts obtained from the City of Barrie's webpage[1]; and (iv) architectural drawings prepared by Turner Fleischer Architects Inc. dated July 31, 2020.

The results of the current analysis indicate that noise levels will range between 45 and 63 dBA during the daytime period (07:00-23:00) and between 38 and 55 dBA during the nighttime period (23:00-07:00). The highest noise level occurs along the development's east-facing façades. Especially, Tower 1's east-facing façade, which is the nearest and most exposed to Lakeshore Drive.

The noise levels predicted due to roadway traffic don't exceed the criteria listed in NPC-300 for building components. Therefore, building components that comply with the Ontario Building Code are expected to be sufficient to attenuate the indoor noise levels to acceptable levels. The results of the study also indicate the buildings will require ventilation systems that incorporate provisions for central air conditioning. If installed at the owners' discretion central air conditioning will allow windows to remain closed thereby providing a quiet and comfortable environment for building occupants. A Warning Clause will be required in all Lease, Purchase and Sale Agreements for residential units facing east as summarized in Section 6.

[1] Barrie – Traffic Count: https://discover.barrie.ca/datasets/traffic-count/data?geometry=-79.713%2C44.382%2C-79.672%2C44.387

The noise levels at the podium of Tower 1, at areas set back from the edge of the building, were found to be less than 55 dBA during the daytime period, which is below the NPC-300 criteria. Therefore no migration is required for the outdoor amenity space.

With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. The study will determine noise impacts from rooftop mechanical equipment and garage or mechanical room exhaust fans on the surroundings and the development itself. The study will include recommendations for any noise control measures that may be necessary to ensure compliance with NPC-300 sound level limits. As a general strategy, large pieces of mechanical equipment such as cooling towers, condensers, and generators should be located in the mechanical penthouse or nearby roof area to shield surrounding noise-sensitive areas from line of sight to the equipment.

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# 1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Barrie Lakeshore Developments, to undertake a detailed roadway traffic noise assessment for Tower 1, a 25-storey mixed-use building, in the proposed development referred to as Barrie Waterfront, located at 51, 53, 55 & 75 Bradford Street and 20 Checkley Street in Barrie, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic.

This assessment is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by Turner Fleischer Architects Inc. dated July 31, 2020, with traffic volumes corresponding to roadway traffic counts obtained from the City of Barrie webpage.

# 2. TERMS OF REFERENCE

Barrie Waterfront located between Bradford Street and Lakeshore Drive in Barrie, Ontario. The focus of this study is the proposed mixed-use tower, Tower 1. The development features the following characteristics:

Tower 1 rises above a 6-storey podium. The first floor comprises the hotel lobby area to the south and the residential lobby to the north. The breakfast area and the restaurant of the hotel also located on Level 1. The hotel rooms are located on the west and south sides of the upper podium floors. The remaining area of these floors is reserved mostly for parking. The podium features an outdoor amenity space on its roof. Level 8 is reserved as an amenity floor. Residential floors comprising 1, 2, and 3-bedroom units rise above level 8.

Gradient Wind completed a previous noise feasibility study of the overall development site which also included, three future phase residential towers, referred to as Tower 2, 3 and 4, comprising 39, 46 and 36-storeys, respectively. The future phase towers are located to the west of the study building and aligned north to south along Bradford Street and Tower 1 overlooks Lakeshore Drive at the east side of the site. Also, a 6-storey parkade is located to the north of the site.

Tower 1 rises above a 6-storey podium. The floorplate sets back on the east side of the tower, at Levels 16, 18, 20, 22 and 24. The tower also comprises a mechanical penthouse.

[2] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

The major source of roadway traffic noise is Lakeshore Drive along the east perimeter of the site. The roads surrounding the site, Bradford Street and Simcoe Street, have also been included in the analysis. Roadways located more than 100 m from the site are considered to be insignificant sources of roadway traffic noise. Figure 1 illustrates the site plan with the surrounding context.

# 3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the Ministry of the Environment, Conservation and Parks (MECP) guidelines as outlined in Section 4.2 of this report.

# 4. METHODOLOGY

## 4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure level at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard sound pressure level ($2\times10^{-5}$ Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

## 4.2 Roadway Traffic Noise

### 4.2.1 Criteria for Roadway Traffic Noise

For vehicular traffic, the equivalent sound energy level, $L_{eq}$, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time-varying noise level over a period of time. For roadways and LRT, the $L_{eq}$ is commonly calculated on the basis of a 16-hour ($L_{eq16}$) daytime (07:00-23:00) / 8-hour ($L_{eq8}$) nighttime (23:00-07:00) split to assess its impact on residential buildings. NPC-300 specifies that the recommended

indoor noise limit ranges (that are relevant to this study) are 50, 45 and 40 dBA for retail, living rooms and sleeping quarters, respectively, as listed in Table 1. Based on Gradient Wind's experience, more comfortable indoor noise levels should be targeted, towards 47, 42, and 37 dBA, respectively, to control peak noise and deficiencies in building envelope construction.

**TABLE 1: INDOOR SOUND LEVEL CRITERIA**

| Type of Space | Time Period | Leq (dBA) |
|---|---|---|
| General offices, reception areas, **retail** stores, etc. | 07:00 – 23:00 | 50 |
| Living/dining/den areas of **residences**, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc. | 07:00 – 23:00 | 45 |
| Sleeping quarters of hotels/motels | 23:00 – 07:00 | 45 |
| Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc. | 23:00 – 07:00 | 40 |

Predicted noise levels at the "plane of window" (POW) determines the action required to achieve the recommended sound levels. NPC-300 dictates if the nighttime sound level outside the bedroom or living/dining room windows exceeds 60 dBA or the daytime sound level outside the bedroom or living/dining area windows exceeds 65 dBA, building components including windows, walls and doors should be designed to comply with the sound level limits in Table 1.

An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[3]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[4]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, building components will require higher levels of sound attenuation[5].

[3] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[4] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

The sound level criterion for outdoor living areas (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

### 4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs. Predictor-LimA (TNM calculation) was employed to provide a general sense of noise across the site. The software incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. It is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid with 5 × 5 m spacing was placed across the study site, along with a number of individual receptors at key sensitive areas.

Roadway traffic noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks
- The day/night split was taken to be 92% / 8% respectively for all streets
- Receptor heights were taken to be at different heights on the facades
- Reflective ground surface between source and receivers
- The study site was treated as having flat or gently sloping topography
- Building massing has been considered as potential noise screening elements in the Predictor LimA model.
- 6 (six) receptors were strategically placed throughout the study area (see Figure 2).

### 4.2.3 Roadway Traffic Volumes

The Average Annual Daily Traffic (AADT) volumes used in the calculations are based on the traffic counts provided online by the City of Barrie. NPC-300 dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature stage of development. Therefore, a 2% growth rate was applied to the traffic volumes every year for 10 years period. Table 2 summarizes the AADT values used for each roadway included in this assessment.

**TABLE 2: ROADWAY TRAFFIC DATA**

| Segment | Roadway Type | Speed Limit (km/h) | Traffic Volumes |
|---|---|---|---|
| Toronto Street | 2-Lane Urban Arterial | 50 | **23,060** |
| Lakeshore Drive | 2-Lane Urban Arterial | 50 | **27,978** |
| Simcoe Street | 2-Lane Urban Collector | 50 | **8,194** |
| Bradford Street | 4- Lane Major Collector | 50 | **13,193** |

# 5. ROADWAY TRAFFIC NOISE RESULTS

## 5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3.

**TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES**

| Receptor Number | Receptor Location | PREDICTOR-LIMA Noise Level (dBA) | |
|---|---|---|---|
| | | Day | Night |
| 1 | Tower 1-West Façade | 45 | 38 |
| 2 | Tower 1-North Façade | 55 | 48 |
| 3 | Tower 1-South Façade | 57 | 49 |
| 4 | Tower 1-East Façade | 63 | 55 |
| 5 | The Podium of Tower 1-South Side | 51 | N/A |

The results of the current analysis indicate that noise levels will range between 45 and 63 dBA during the daytime period (07:00-23:00) and between 38 and 55 dBA during the nighttime period (23:00-07:00). The highest noise level occurs along the development's east-facing façades. Especially, Tower 1's east-facing façade, which is the nearest and most exposed to Lakeshore Drive.

The noise contour lines can be seen in Figures 2 and 3 for the daytime and nighttime noise levels, respectively.

## 6. CONCLUSIONS AND RECOMMENDATIONS

The noise levels predicted due to roadway traffic don't exceed the criteria listed in NPC-300 for building components. Therefore, building components that comply with the Ontario Building Code are expected to be sufficient to attenuate the indoor noise levels to acceptable levels. The results of the study also indicate the buildings will require ventilation systems that incorporate provisions for central air conditioning. If installed at the owners' discretion central air conditioning will allow windows to remain closed thereby providing a quiet and comfortable environment for building occupants. A Warning Clause will be required in all Lease, Purchase and Sale Agreements for the residential units facing east:

> *"This dwelling unit has been designed with the provision for adding central air conditioning (or similar mechanical system) at the occupant's discretion. Installation of central air conditioning by the occupant in high-density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*

The noise levels at the podium of Tower 1, at areas set back from the edge of the building, were found to be less than 55 dBA during the daytime period, which is below the NPC-300 criteria.

With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. The study will determine noise impacts from rooftop mechanical equipment and garage or mechanical room exhaust fans on the surroundings and the development itself. The study will include recommendations for any noise control measures that may be necessary to ensure compliance with NPC-300 sound level limits. As a general strategy, large pieces of mechanical equipment such as cooling towers, condensers, and generators should be located in the mechanical penthouse or nearby roof area to shield surrounding noise-sensitive areas from line of sight to the equipment.

This concludes our traffic noise assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

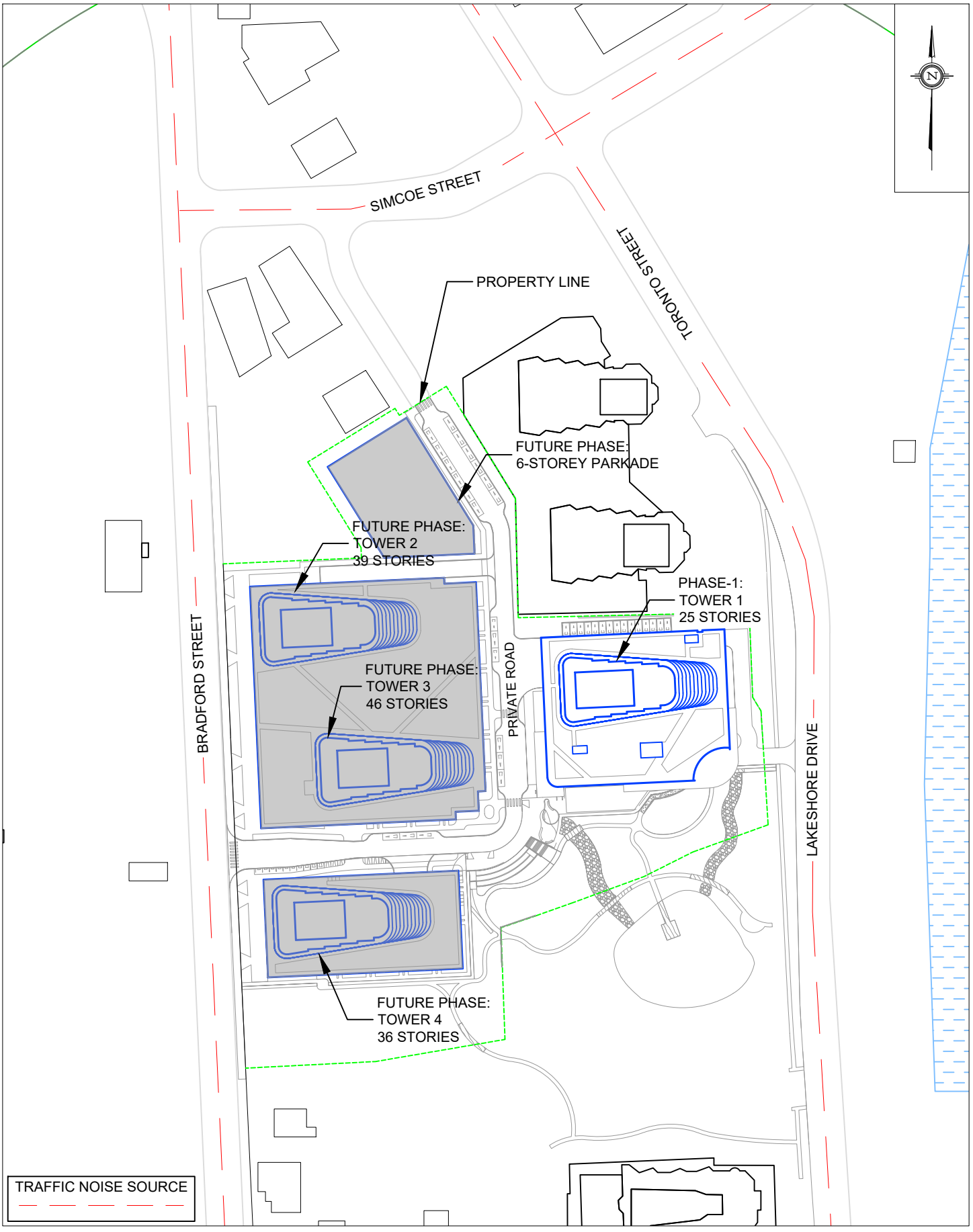
Sincerely,

***Gradient Wind Engineering Inc.***


Efser Kara, MSc, LEED GA
Acoustic Scientist

Joshua Foster, P.Eng.
Principal

*Gradient Wind File #19-214 – Phase 1-Traffic Noise*

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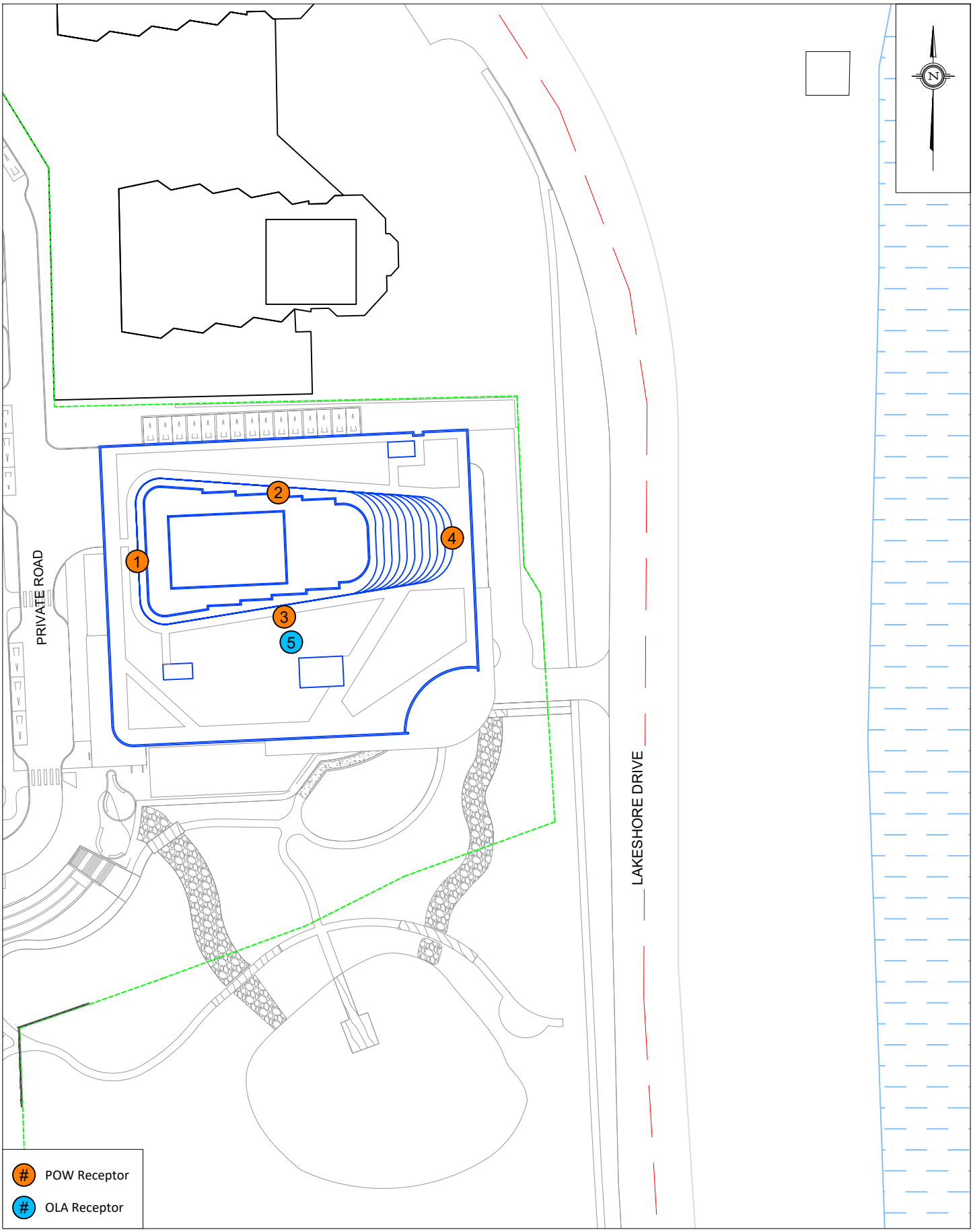
| | | | |
|---|---|---|---|
| PROJECT | BARRIE WATERFRONT<br>ROADWAY TRAFFIC NOISE ASSESSMENT | | |
| SCALE | 1:2000 (APPROX.) | DRAWING NO. | GW19-214-1 |
| DATE | AUGUST 7, 2020 | DRAWN BY | E.K. |

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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| SCALE | 1:1000 (APPROX.) | DRAWING NO. | GW19-214-2 |
| DATE | AUGUST 7, 2020 | DRAWN BY | E.K. |

FIGURE 2:
RECEPTOR LOCATIONS

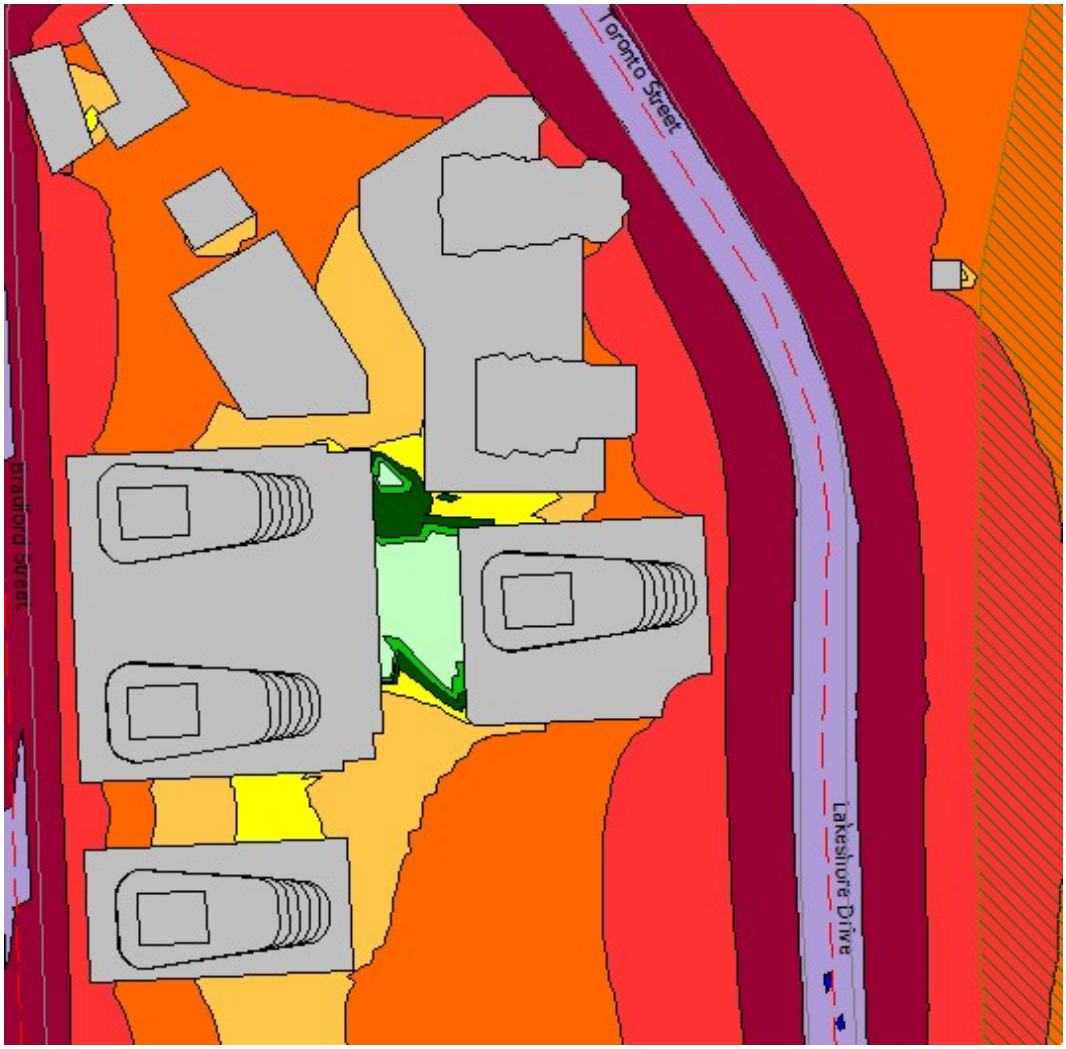
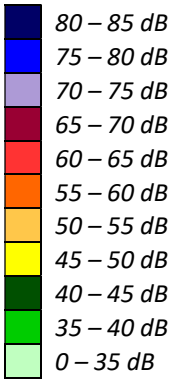



**FIGURE 3: DAYTIME NOISE CONTOURS (4 M ABOVE GRADE)**



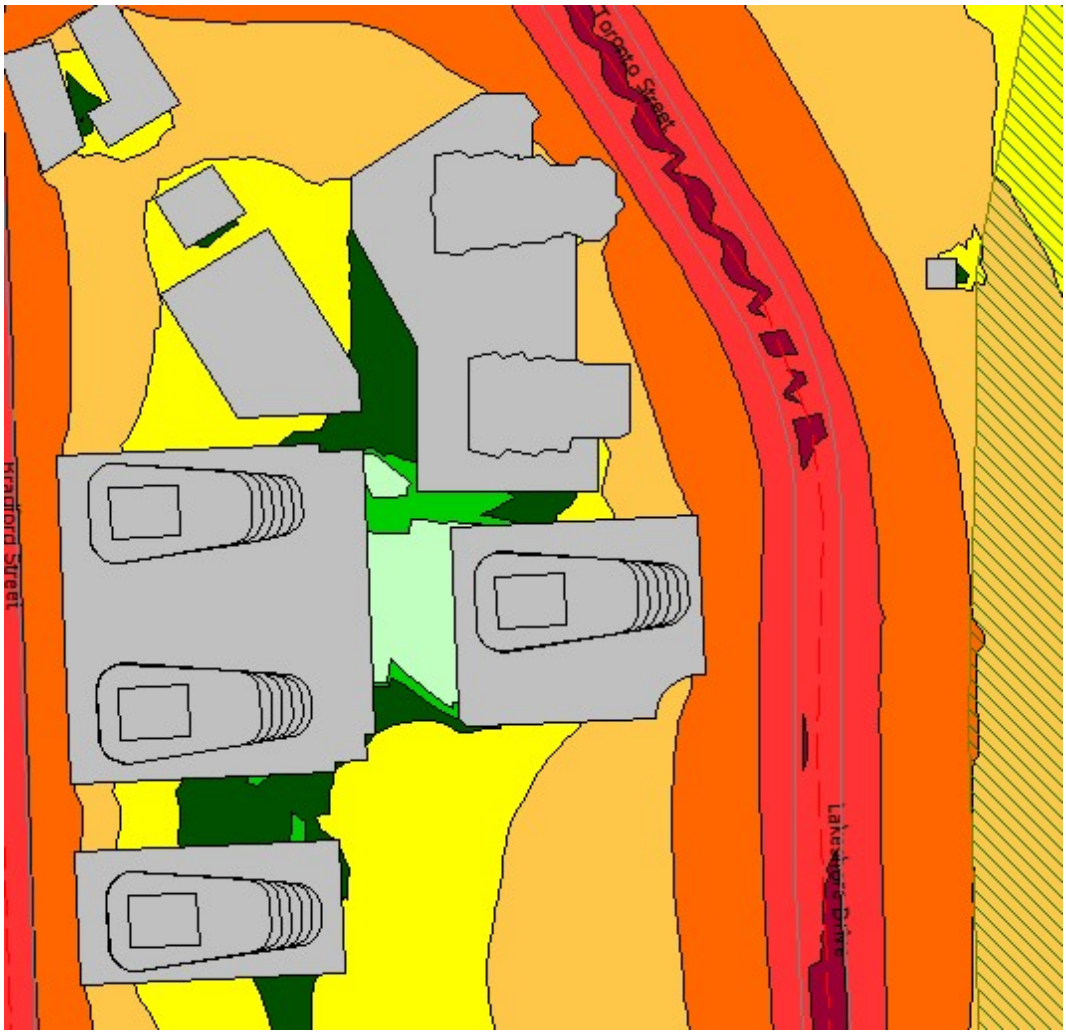



**FIGURE 4: NIGHTTIME NOISE CONTOURS (4 M ABOVE GRADE)**