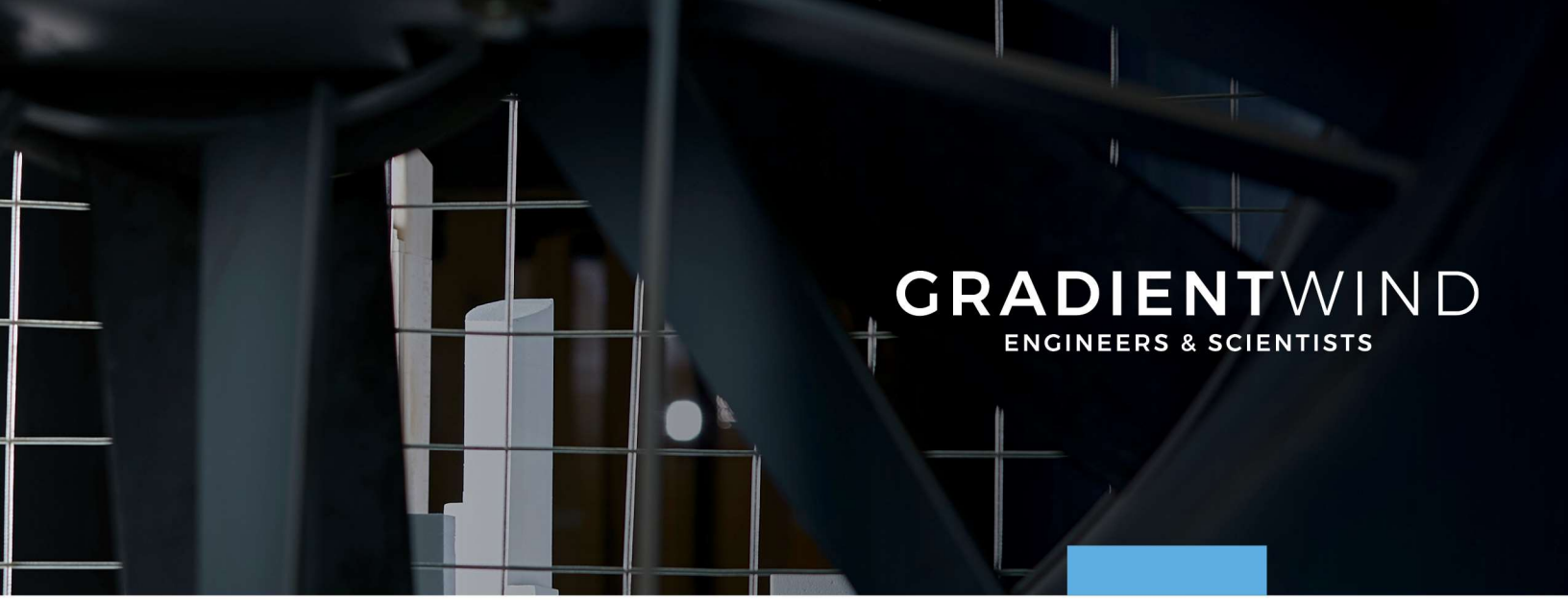

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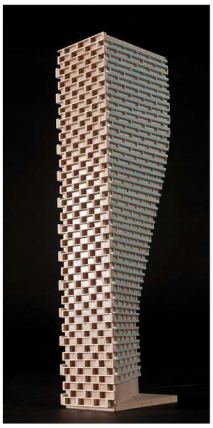
# ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT

1166 Gordon Street
Guelph, Ontario

REPORT: GW21-378-Traffic Noise Feasibility



February 4, 2022

PREPARED FOR
**GSD Development & Management Inc.**
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# EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment in support of a Zoning By-Law Amendment application (ZBA) for a proposed development located at 1166 Gordon Street in Guelph, Ontario. Throughout this report, the Gordon Street elevation is referred to as the west elevation. The development comprises two 6-storey apartment buildings to the west portion of the site, and four blocks of 3-storey townhouses to the east portion of the site. The major sources of roadway traffic noise are Gordon Street and Edinburgh Avenue South. Figure 1 illustrates the site plan and surrounding context.

This assessment is based on: (i) theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[1] guidelines; (ii) architectural drawings provided by Broadview Architect Inc. in December, 2021; and (iii) traffic volumes obtained from the City of Guelph.

The results of the current analysis indicate that noise levels will range between 52 and 69 dBA during the daytime period (07:00-23:00) and between 45 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level experienced by any façade of the buildings (i.e. 68 dBA) occurs along the West façade of the apartment buildings, which are nearest and most exposed to Gordon Street. Noise contours at 4.0 metres above grade are illustrated in Figures 3 and 4 for daytime and nighttime conditions, respectively.

The noise levels predicted due to roadway traffic exceed the criteria listed in NPC-300 for building components and upgraded building components will be required. Results also indicate that the apartment buildings in the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. The townhouse blocks of the development will require forced air heating with the provision for central air conditioning to be installed at the occupants' discretion. It is expected that all buildings within the development will be designed with central air conditioning, which meets these requirements. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.

Regarding Outdoor Living Areas (OLA), noise levels exceed the NPC-300 limit of 55 dBA at multiple points of reception, therefore noise control measures will be required. It is recommended that the amenity

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

spaces to the west of the apartment buildings (Receptors 4 and 8) not be programmed for quiet enjoyment of the outdoors. These spaces experience high noise levels due to their direct exposure to Gordon Street, and noise barriers are not considered feasible in these locations. Regarding the OLAs located on the north side of Apartment Building 1 and the central amenity (Receptors 3 and 5), noise barriers will be required to reduce the $L_{eq}$ to under 60 dBA and as close to 55 dBA as technically and administratively feasible. The specifications of noise barriers for these locations can be determined at a later point in the development process, typically at the time of site plan approval during a detailed traffic noise assessment.

With regards to stationary noise impacts from the surroundings on the site, Gradient Wind conducted a survey of the site using area maps and satellite view. No significant sources of stationary noise which will impact the development were identified. With regards to stationary noise impacts from the proposed development on its surroundings, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on the surrounding noise-sensitive areas and on the proposed buildings themselves. Typically, noise levels can be controlled by judicious selection and placement of the equipment and the introduction of silencers or noise screens where needed. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below NPC-300 limits.

A detailed roadway traffic noise study will be required at the time of Site Plan Control (SPC) approval to determine specific noise control measures for the development.

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# 1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by GSD Development & Management Inc. to undertake a roadway traffic noise feasibility assessment in support of a Zoning By-Law Amendment (ZBA) application for a proposed development located at 1166 Gordon Street in Guelph, 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 provided by Broadview Architect Inc. in December 2021, with future traffic volumes corresponding to roadway classification and theoretical capacity.

# 2. TERMS OF REFERENCE

The subject site is located at 1166 Gordon Street in Guelph, Ontario; bordered by Gordon Street to the southwest, Landsdown Drive to the northeast, existing residential buildings to the northwest, and existing residential buildings and Valley Road to the southeast. Throughout this report, the Gordon Street elevation is referred to as the west elevation.

*Rendering, South Perspective*
*(Courtesy of Broadview Architect Inc.)*

The proposed development comprises four three-storey rectangular townhouse blocks along the east of the site, hereinafter referred to as "Block 1, 2, 3, and 4" from north to south, respectively, and two six-storey apartment buildings, each topped with a mechanical penthouse, referred to as "Apartment Building 1 and 2", at the northwest and southwest of the subject site, respectively.

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

Above one below-grade parking level shared by Apartment Buildings 1 and 2, which includes an indoor amenity space at the northwest corner, the two apartment buildings share a common ground level. The ground level includes a central residential lobby with the main entrance to the east, indoor amenities to the north and south of the lobby, and residential units and shared support spaces throughout the remainder of the level. At grade, there is a central surface parking lot between the apartment buildings and the townhouses. Access to the central surface parking lot is provided from Landsdown Drive via a laneway between Block 1 and 2 and a laneway between Block 3 and 4. Access to underground parking is provided by a ramp to the south of Apartment Building 2. There are grade-level outdoor amenities along the north, east, and west elevations of the apartment buildings. At Level 2, the apartment buildings step back from the centre and rise with constant rectangular planforms to Level 6. Levels 2 through 6 are reserved for residential occupancy for both apartment buildings.

The major sources of roadway traffic noise are Gordon Street and Edinburgh Avenue South. Roadways located more than 100 m from the site are considered to be insignificant sources of roadway traffic noise, as per NPC-300. Balconies and terraces that extend less than 4 meters from the building façade are not considered as Outdoor Living Areas in this assessment, per NPC-300 guidelines. Figure 1 illustrates the site location 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) explore potential noise mitigation where required.

# 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 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 noise 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 45 and 40 dBA for 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 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) dictate the action required to achieve the recommended sound levels. 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].

For designated Outdoor Living Areas (OLAs), the sound level limit is 55 dBA during the daytime period. Where noise levels are in excess of the limit, noise control measures are required where feasible for technical, economic or administrative reasons. In all cases, noise levels should not exceed 60 dBA.

### 4.2.2 Theoretical Roadway Noise Predictions

The impact of transportation noise sources on the development was determined by computer modelling. Transportation noise source modelling is based on the software program *Predictor-Lima* which utilizes the United States Federal Highway Administration's Traffic Noise Model (TNM) to represent the roadway line sources. This computer program can represent three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. A set of comparative calculations were performed in the free field environment for comparisons to the current Ontario traffic noise prediction model STAMSON. The STAMSON model is however an older software and requires each receptor to be calculated separately. STAMSON also does not accurately account for building reflections and multiple screening elements, and curved road geometry. Noise levels were found to be within an imperceptible level of 0-3 dBA of those predicted in Predictor.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise, and by using existing building locations as noise barriers. 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, as per NPC-300 requirements for noise level predictions.

[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 day/night split for all streets was taken to be 90%/10%, respectively.
- Ground surfaces were modelled as absorptive where soft (landscaped) ground is present, and reflective where hard (paved) surfaces are present.
- Topography was assumed to be a flat/gentle slope surrounding the study site.
- Noise receptors were strategically placed at 11 locations around the study area (see Figure 2).

### 4.2.3 Roadway Traffic Volumes

NPC-300 dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on AADT data obtained from the City of Guelph. Volumes were then projected to 10 years in the future from the date of the project with a growth rate of 2% per year. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

**TABLE 2: ROADWAY TRAFFIC DATA**

| Segment | Roadway Traffic Data | Speed Limit (km/h) | 2019 Volume (AADT) | Projected 2032 Volume (AADT) |
|---|---|---|---|---|
| Gordon Street | 4-Lane Arterial | 60 | 24,118 | **31,200** |
| Edinburgh Avenue South | 2-Lane Collector | 50 | 10,846 | **14,030** |

# 5. ROADWAY TRAFFIC NOISE RESULTS

## 5.1 Roadway Traffic Noise Levels

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

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

| Receptor Number | Receptor height (m) | Receptor Location | Predictor Noise Level (dBA) | |
|---|---|---|---|---|
| | | | Day | Night |
| **Apartment Building 1** | | | | |
| 1 | 17.5 | POW / 6th Floor West Façade | 68 | 61 |
| 2 | 17.5 | POW / 6th Floor South Façade | 63 | 57 |
| 3 | 1.5 | OLA / 1st Floor North Side Amenity | 65 | N/A* |
| 4 | 1.5 | OLA / 1st Floor West Side Amenity | 69 | N/A* |
| 5 | 4.5 | OLA / 2nd Floor Central Amenity | 66 | N/A* |
| **Apartment Building 2** | | | | |
| 6 | 17.5 | POW / 6th Floor West Façade | 68 | 62 |
| 7 | 17.5 | POW / 6th Floor South Façade | 64 | 58 |
| 8 | 17.5 | OLA / 1st Floor West Side Amenity | 69 | N/A* |
| **Townhouse Blocks** | | | | |
| 9 | 4.5 | POW / 2nd Floor West Façade | 57 | 50 |
| 10 | 4.5 | POW / 2nd Floor West Façade | 52 | 45 |
| 11 | 4.5 | POW / 2nd Floor West Façade | 57 | 50 |

* Nighttime noise levels are not considered at OLA receptors, per NPC-300 guidelines

The results of the current analysis indicate that noise levels will range between 52 and 69 dBA during the daytime period (07:00-23:00) and between 45 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level experienced by any façade of the building (i.e. 68 dBA) occurs along the West façade of the apartment buildings, which are nearest and most exposed to Gordon Street. Noise contours at 4.0 metres above grade are illustrated in Figures 3 and 4 for daytime and nighttime conditions, respectively.

## 6. CONCLUSIONS AND RECOMMENDATIONS

The noise levels predicted due to roadway traffic exceed the criteria listed in NPC-300 for building components and upgraded building components will be required. Results also indicate that the apartment buildings in the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. The townhouse blocks of the development will require forced air heating with the provision for central air conditioning to be installed at the occupants' discretion. It is expected that all buildings within the development will be designed with central air conditioning, which meets these requirements. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.

Regarding Outdoor Living Areas (OLA), noise levels exceed the NPC-300 limit of 55 dBA at multiple points of reception, therefore noise control measures will be required. It is recommended that the amenity spaces to the west of the apartment buildings (Receptors 4 and 8) not be programmed for quiet enjoyment of the outdoors. These spaces experience high noise levels due to their direct exposure to Gordon Street, and noise barriers are not considered feasible in these locations. Regarding the OLAs located on the north side of Apartment Building 1 and the central amenity (Receptors 3 and 5), noise barriers will be required to reduce the $L_{eq}$ to under 60 dBA and as close to 55 dBA as technically and administratively feasible. The specifications of noise barriers for these locations can be determined at a later point in the development process, typically at the time of site plan approval during a detailed noise assessment.

With regards to stationary noise impacts from the surroundings on the site, Gradient Wind conducted a survey of the site using area maps and satellite view. No significant sources of stationary noise which will impact the development were identified. With regards to stationary noise impacts from the proposed development on its surroundings, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on the surrounding noise-sensitive areas and on the proposed buildings themselves. Typically, noise levels can be controlled by judicious selection and placement of the equipment and the introduction of silencers or noise screens where needed. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below NPC-300 limits.

A detailed roadway traffic noise study will be required at the time of Site Plan Control (SPC) approval to determine specific noise control measures for the development.

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.***

LICENSED PROFESSIONAL ENGINEER
J. R. FOSTER
100155055
Feb 4, 2022
PROVINCE OF ONTARIO

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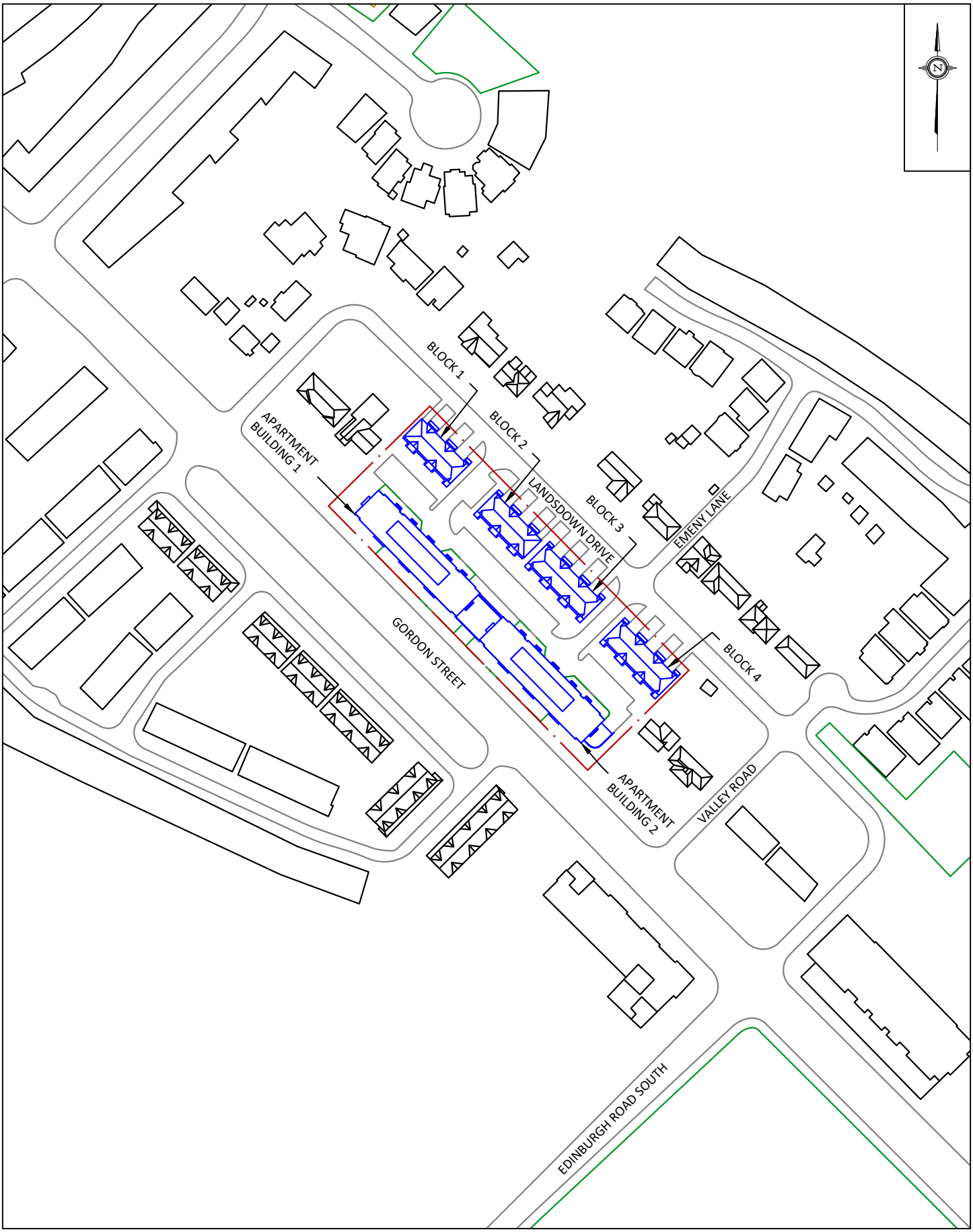
Lead Engineer

*Gradient Wind File #21-378 - Traffic Noise Feasibility*

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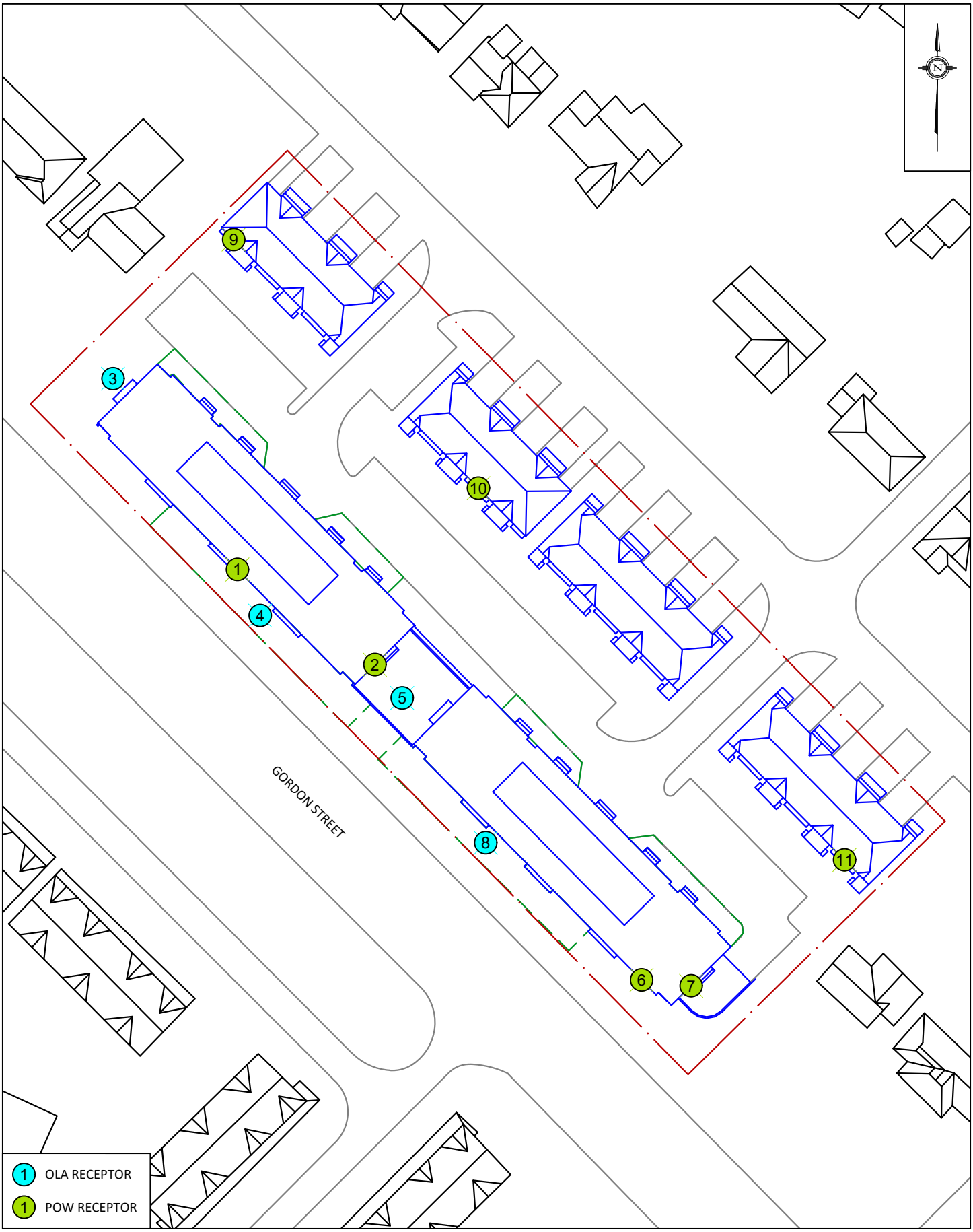
| | | |
|---|---|---|
| PROJECT | 1166 GORDON STREET, GUELPH<br>ROADWAY TRAFFIC NOISE ASSESSMENT | DESCRIPTION |
| SCALE 1:2500 (APPROX.) | DRAWING NO. GW21-378-T.NOISE-1 | FIGURE 1:<br>SITE PLAN AND SURROUNDING CONTEXT |
| DATE DECEMBER 21, 2021 | DRAWN BY T.M.F. | |

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| PROJECT | 1166 GORDON STREET, GUELPH<br>ROADWAY TRAFFIC NOISE ASSESSMENT | DESCRIPTION |
| SCALE 1:1000 (APPROX.) | DRAWING NO. GW21-378-T.NOISE-2 | FIGURE 2:<br>RECEPTOR LOCATIONS |
| DATE DECEMBER 21, 2021 | DRAWN BY T.M.F. | |

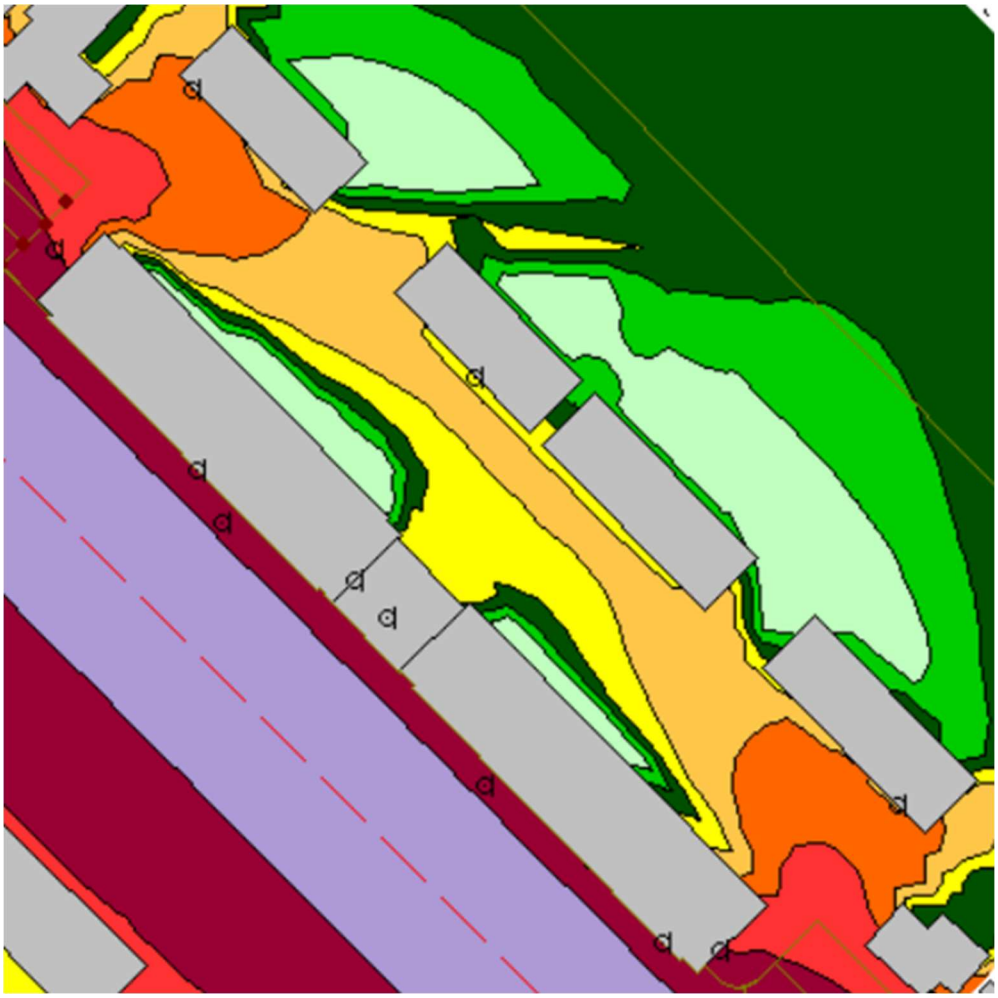

**FIGURE 3: DAYTIME TRAFFIC NOISE CONTOURS (4.0 METERS ABOVE GRADE)**

- *80 – 85 dB*
- *75 – 80 dB*
- *70 – 75 dB*
- *65 – 70 dB*
- *60 – 65 dB*
- *55 – 60 dB*
- *50 – 55 dB*
- *45 – 50 dB*
- *40 – 45 dB*
- *35 – 40 dB*
- *0 – 35 dB*

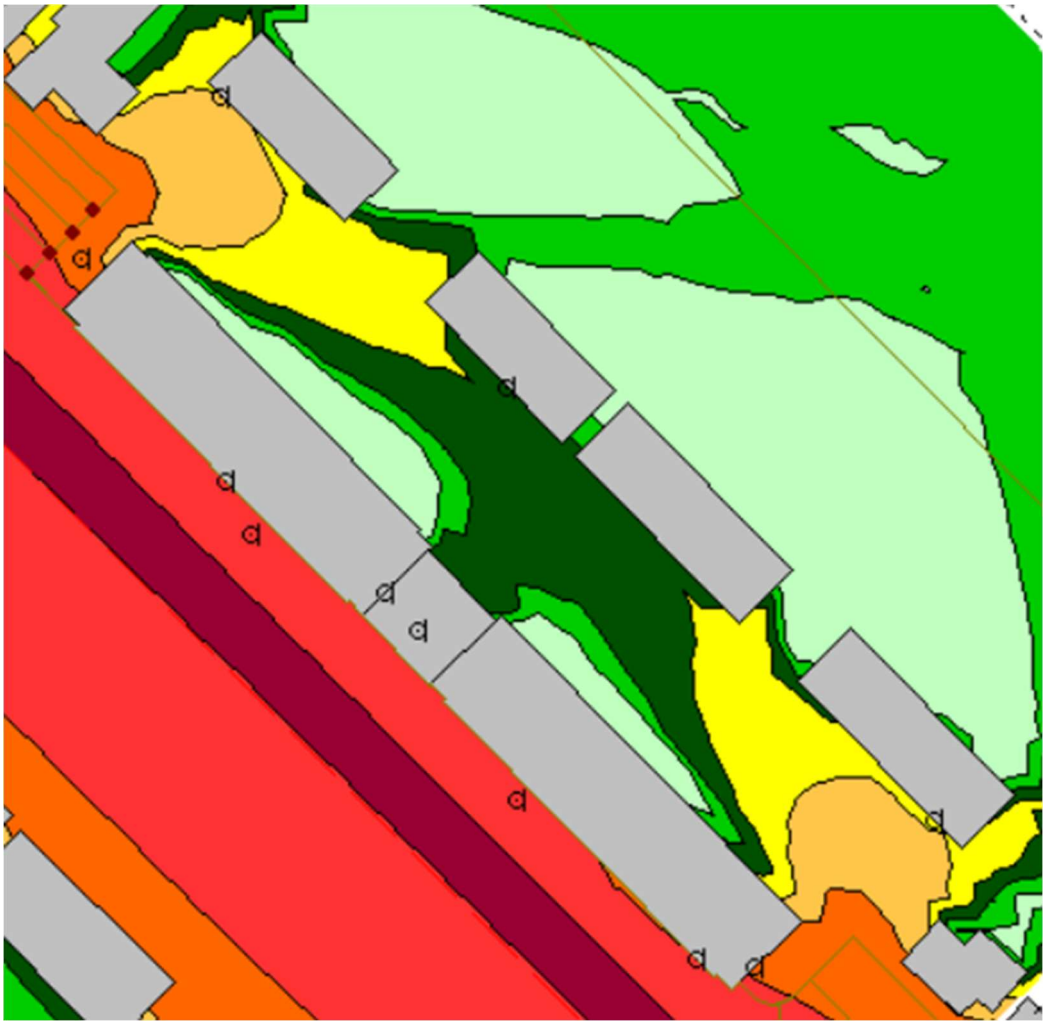

**FIGURE 4: NIGHTTIME TRAFFIC NOISE CONTOURS (4.0 METERS ABOVE GRADE)**

- *80 – 85 dB*
- *75 – 80 dB*
- *70 – 75 dB*
- *65 – 70 dB*
- *60 – 65 dB*
- *55 – 60 dB*
- *50 – 55 dB*
- *45 – 50 dB*
- *40 – 45 dB*
- *35 – 40 dB*
- *0 – 35 dB*