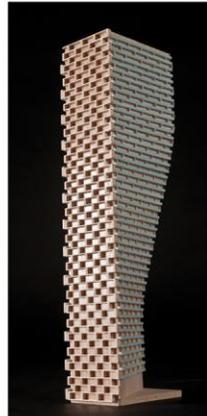


**TRAFFIC NOISE  
FEASIBILITY ASSESSMENT**

78-90 Beechwood Avenue &  
69-93 Barrette Street  
Ottawa, Ontario

Report: 20-069-Traffic Noise



July 29, 2020

PREPARED FOR  
Minto Communities - Canada  
200-180 Kent Street  
Ottawa, ON K1P 0B6

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

## EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment to satisfy the City of Ottawa requirements for a zoning by-law amendment application (ZBA) submission, for the proposed development located at 78-90 Beechwood Avenue and 77-93 Barrette Street in Ottawa, Ontario. The development is a 9-storey mixed-use building with a C-shaped planform, aligned in the east-west direction. The major source of roadway traffic noise is Beechwood Avenue that lies to the north of the development site. In addition to Beechwood Avenue to the north, the development site is bounded by Barrette Street to the south and existing buildings to the east and west. The site is surrounded by low-rise residential and commercial buildings and high and mid-rise planned developments. Figure 1 illustrates the site plan with the surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings prepared by RAW Design.

The results of the current analysis indicate that noise levels will range between 64 and 69 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 57 and 61 dBA during the nighttime period (23:00-07:00).

The noise levels predicted due to roadway traffic exceed the criteria required by ENCG for building components, therefore upgraded building components will be required. Due to the limited information available at the time of the study, which was prepared for a ZBA submission, detailed STC calculations could not be performed at this time. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building.

Results of the calculations also indicate that 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. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.



The noise levels at the majority of the outdoor communal amenity areas do not exceed the 55 dBA criterion except Receptor 7, which is nearest and most exposed to Beechwood Avenue. A barrier investigation that was conducted in STAMSON indicated that a 1.2 m high solid barrier without any gaps, which can be built as a solid guard rail, can provide the required noise levels at the terrace. More specific details will be outlined in the detailed roadway traffic noise report that will be prepared for the site plan control application (SPA) submission.

With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess (i) stationary noise impacts on the study building from neighbouring rooftop mechanical units, and (ii) impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits.

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## 1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Minto Communities – Canada to undertake a roadway traffic noise feasibility assessment for the proposed mixed-use development located at 78-90 Beechwood Avenue and 77-93 Barrette Street in Ottawa, 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 City of Ottawa<sup>1</sup> and the Ministry of the Environment, Conservation and Parks (MECP)<sup>2</sup> guidelines. Noise calculations were based on architectural drawings prepared by RAW Design with future traffic volumes corresponding to the City of Ottawa’s Official Plan (OP) roadway classifications.

## 2. TERMS OF REFERENCE

The subject site is located at 78-90 Beechwood Avenue and 69-93 Barrette Street in Ottawa on a rectangular parcel of land bounded by Beechwood Avenue to the northwest, St. Charles Street to the northeast, Barrette Street to the southeast, and Loyer Street to the southwest.



*Architectural Rendering, Northwest Perspective  
(Courtesy of RAW Design)*

The subject site comprises a 9-storey building with a C-shaped planform, open to the west. The south wing of the building is 7 storeys tall. It is recessed from all elevations on the 7<sup>th</sup> floor providing an outdoor amenity space. At the northeast end of the building, the building steps back from the southeast elevation at Level 9. Level 10 (the Mechanical Penthouse Level) features private terraces and mechanical and electrical equipment.

---

<sup>1</sup> City of Ottawa Environmental Noise Control Guidelines, January 2016

<sup>2</sup> Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013



The ground floor comprises residential units and retail space along the north elevation, fronting Beechwood Avenue, as well lobby, leasing office, and building services space. The primary building entrance is located at the east elevation, while retail entrances are located along the north elevation. Ground floor units also feature private entrances. Levels 2 and above comprise residential units.

Outdoor amenity space is provided at grade, within the inner courtyard. Balconies and terraces with a minimum depth of 4 metres are considered as outdoor living areas (OLA) as indicated in the ENCG. Provided that, the terrace areas with less than 4 metres depth aren't included in the study. The OLAs that were included in the study other than the communal outdoor amenity yard at grade are the private terraces at the north extension rooftop, the 7<sup>th</sup>-floor rooftop communal outdoor amenity terrace, and the 9<sup>th</sup> floor terrace at the south side.

The major source of roadway traffic noise is Beechwood Avenue, which is situated along the north side of the development site. The site is surrounded by low-rise residential and commercial buildings. 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) 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 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 ( $2 \times 10^{-5}$  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, 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. The City of Ottawa’s Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 45 and 40 dBA for living rooms and sleeping quarters respectively for roadway, as listed in Table 1. Based on Gradient Wind’s experience, more comfortable indoor noise levels should be targeted, towards 42 and 37, 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        |
| <b>Living/dining/den areas of residences</b> , 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        |
| <b>Sleeping quarters of residences</b> , 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<sup>3</sup>. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment<sup>4</sup>. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation

<sup>3</sup> Burberry, P.B. (2014). Mitchell’s Environment and Services. Routledge, Page 125

<sup>4</sup> MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8



for the building should consider the need for having windows and doors closed, which triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation<sup>5</sup>.

The sound level criterion for outdoor living areas 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. If these measures are not provided, prospective purchasers or tenants should be informed of potential excess noise levels by a warning clause.

#### **4.2.2 Theoretical Roadway Noise Predictions**

Noise predictions were performed with the aid of the Ministry of the Environment, Conservations and Parks' (MECP) computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix A includes the STAMSON 5.04 input and output data.

Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise. Roadways that are more than a hundred metres away than the development site are not included in the calculations. 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 ENCG requirements for noise level predictions.
- The day/night split for all roads was taken to be 92% / 8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- The proposed development and the surrounding existing buildings were considered as barriers in the calculations.

---

<sup>5</sup> MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

- A total of nine (9) receptor locations were chosen around the study site; four (4) of them at the façades of the building as Plane of Window (POW) receptors and five (5) are at the outdoor amenity areas including terraces as Outdoor Living Area (OLA) receptors.
- Receptor 1 was taken at the centre of the 5<sup>th</sup>-floor window on the protruding north façade and Receptors 2-4 were taken on the highest residential floor (Level 9) of the building at the centre of the window.
- Receptor 5 was taken 1.5 metres above the ground and Receptors 6-9 was taken 1.5 metres above the rooftop terraces.
- The receptor distances to roadway traffic and exposure angles are illustrated in Figures 3-5.

### 4.2.3 Roadway Traffic Volumes

The ENCG 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 the roadway classifications outlined in the City of Ottawa’s Official Plan (OP) and Transportation Master Plan<sup>6</sup> which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. 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) | Traffic Volumes |
|------------------|-------------------------------|--------------------|-----------------|
| Beechwood Avenue | 2 Lane Urban Arterial (2-UAU) | 50                 | <b>15,000</b>   |

## 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. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

<sup>6</sup> City of Ottawa Transportation Master Plan, November 2013



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

| Receptor Number | Receptor Height Above Grade (m) | Receptor Location                      | STAMSON 5.04 Noise Level (dBA) |       |
|-----------------|---------------------------------|--|--------------------------------|-------|
|                 |                                 |  | Day                            | Night |
| 1               | 15.15                           | POW North Façade – Level 5             | 69                             | 61    |
| 2               | 28.40                           | POW North Façade – Level 9             | 68                             | 60    |
| 3               | 28.40                           | POW West Façade – Level 7              | 64                             | 57    |
| 4               | 28.40                           | POW East Façade – Level 9              | 64                             | 57    |
| 5               | 1.50                            | OLA – Communal Outdoor Amenity Yard    | 49                             | N/A*  |
| 6               | 21.35                           | OLA – Communal Outdoor Amenity Terrace | 48                             | N/A*  |
| 7               | 31.10                           | OLA – North Private Terrace            | 57                             | N/A*  |
| 8               | 31.10                           | OLA – West Private Terrace             | 49                             | N/A*  |
| 9               | 27.55                           | OLA- Level 9 South terrace             | 42                             | N/A*  |

\* OLA noise levels during the nighttime are not considered as per the ENCG

The results of the current analysis indicate that noise levels will range between 64 and 69 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 57 and 61 dBA during the nighttime period (23:00-07:00).

The highest noise levels occur along the north façade, which is nearest and most exposed to Beechwood Avenue. The noise levels at the majority of the outdoor communal amenity areas do not exceed the 55 dBA criterion except Receptor 7, which is nearest and most exposed to Beechwood Avenue. A barrier investigation that was conducted in STAMSON indicated that a 1.2 m high solid barrier without any gaps, which can be built as a solid guard rail, can provide the required noise levels at the private rooftop terrace.

## 6. CONCLUSIONS AND RECOMMENDATIONS

The noise levels predicted due to roadway traffic exceed the criteria required by ENCG for building components, therefore upgraded building components will be required. Due to the limited information available at the time of the study, which was prepared for a zoning by-law amendment application (ZBA) submission, detailed STC calculations could not be performed at this time. A detailed review of the



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window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building.

Results of the calculations also indicate that 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. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.

The noise levels at the majority of the outdoor communal amenity areas do not exceed the 55 dBA criterion except Receptor 7, which is nearest and most exposed to Beechwood Avenue. A barrier investigation that was conducted in STAMSON indicated that a 1.2 m high solid barrier without any gaps, which can be built as a solid guard rail, can provide the required noise levels at the terrace. More specific details, including details regarding the noise barrier at the rooftop private terrace, will be outlined in the detailed roadway traffic noise report that will be prepared for the site plan control application (SPA) submission.

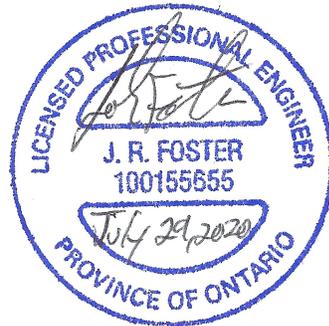
This concludes our roadway traffic noise feasibility assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

Sincerely,

**Gradient Wind Engineering Inc.**



Efsar Kara, MSc, LEED GA  
Acoustic Scientist



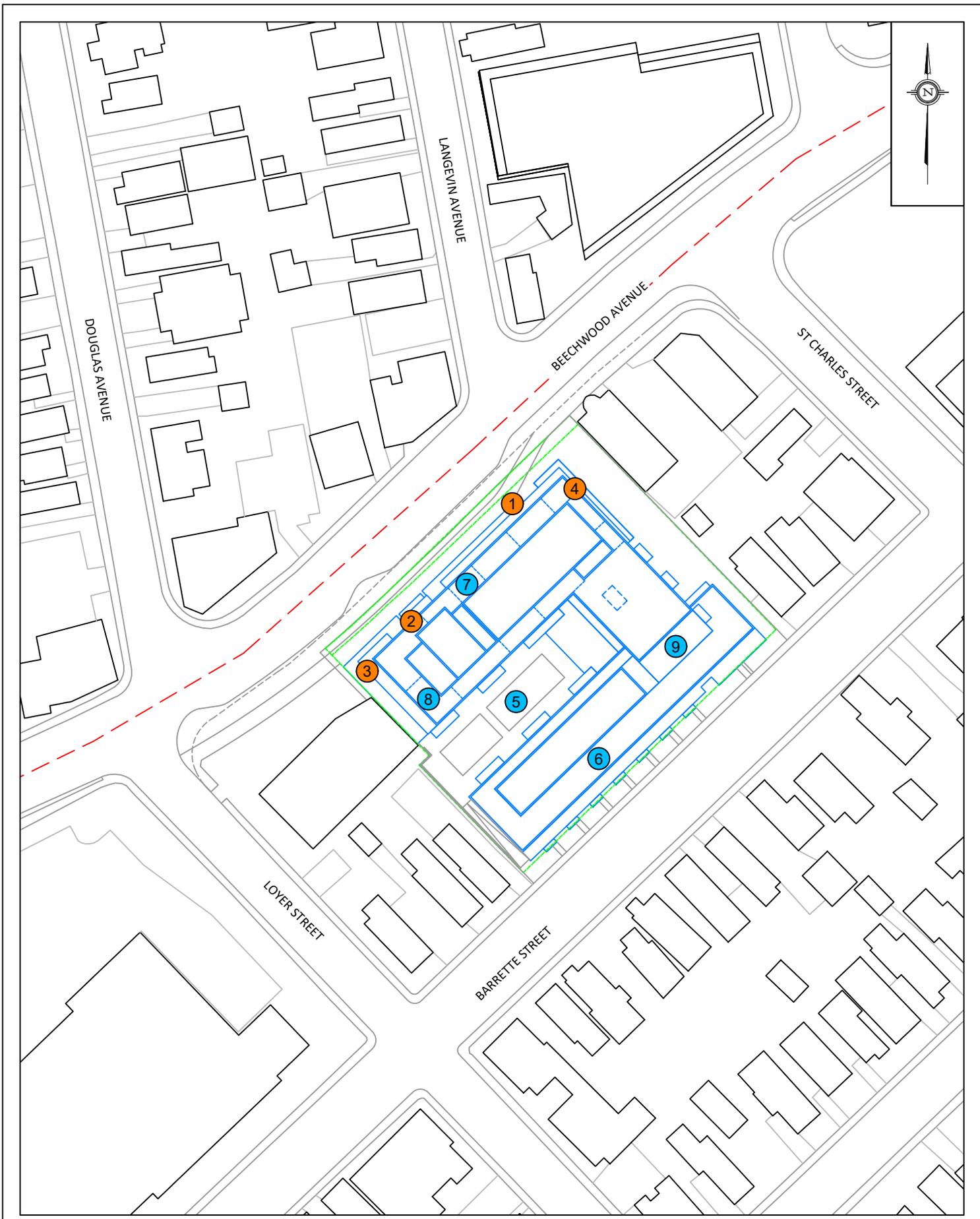
Joshua Foster, P.Eng.  
Principal

*Gradient Wind File #20-069-Traffic Noise*

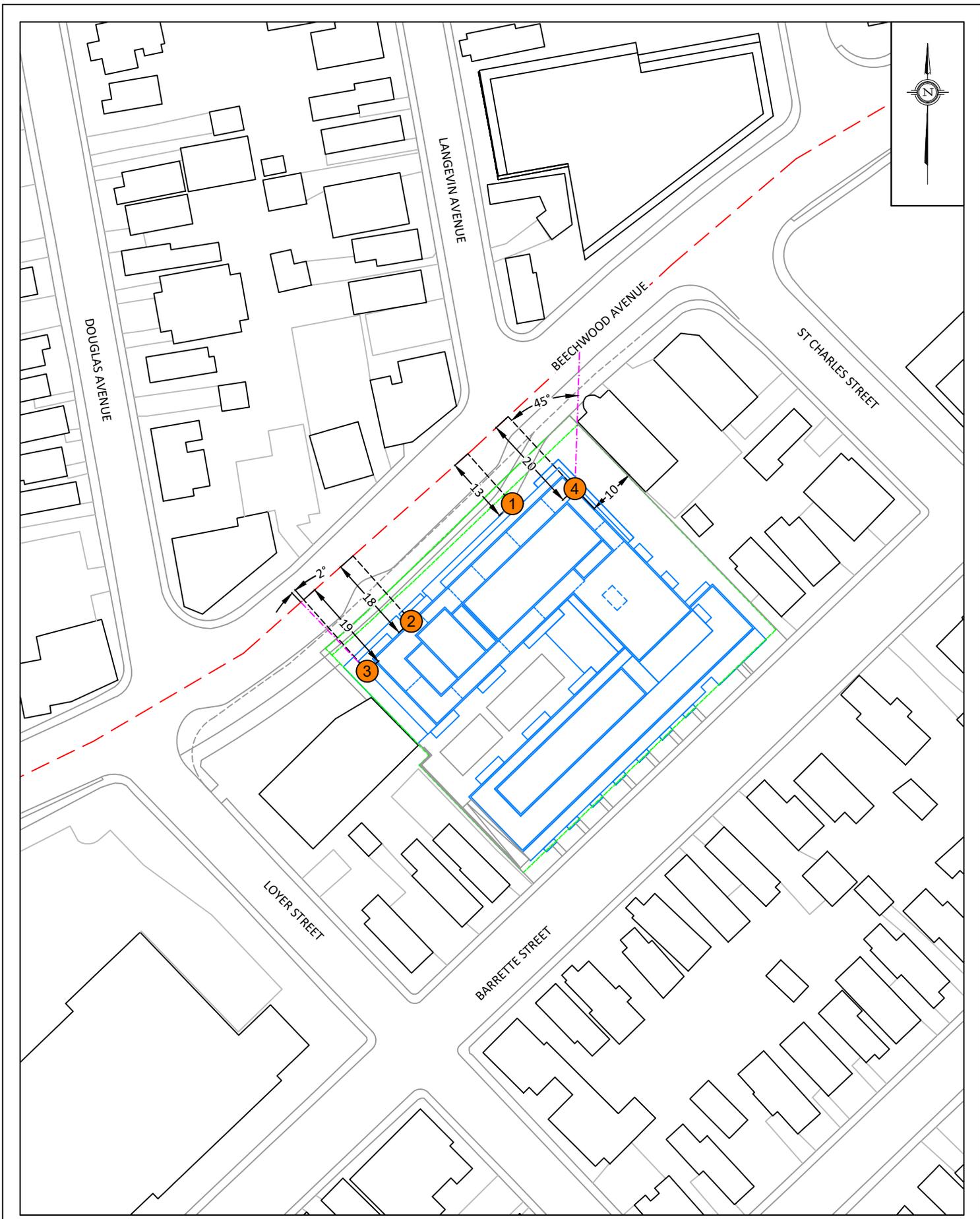




|         |   |                           |
|---------|---|---------------------------|
| PROJECT | 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA<br>ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT |                           |
| SCALE   | 1:2000 (APPROX.)  | DRAWING NO.<br>GW20-069-1 |
| DATE    | JULY 28, 2020   | DRAWN BY<br>E.K.          |



|         |   |                           |
|---------|---|---------------------------|
| PROJECT | 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA<br>ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT |                           |
| SCALE   | 1:1000 (APPROX.)  | DRAWING NO.<br>GW20-069-2 |
| DATE    | JULY 28, 2020   | DRAWN BY<br>E.K.          |



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PROJECT 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA  
ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT

SCALE 1:1000 (APPROX.)

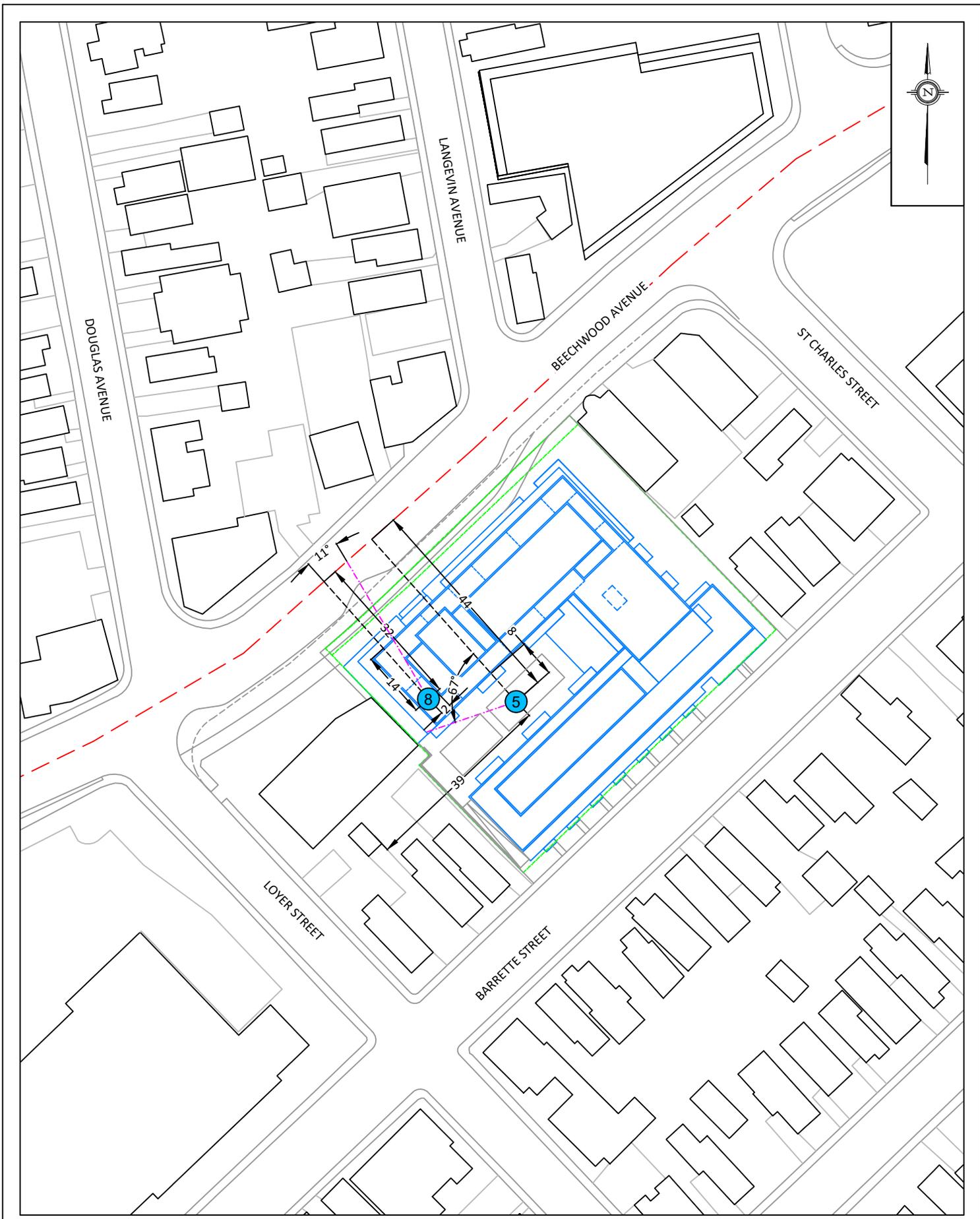
DATE JULY 28, 2020

DRAWING NO. GW20-069-3

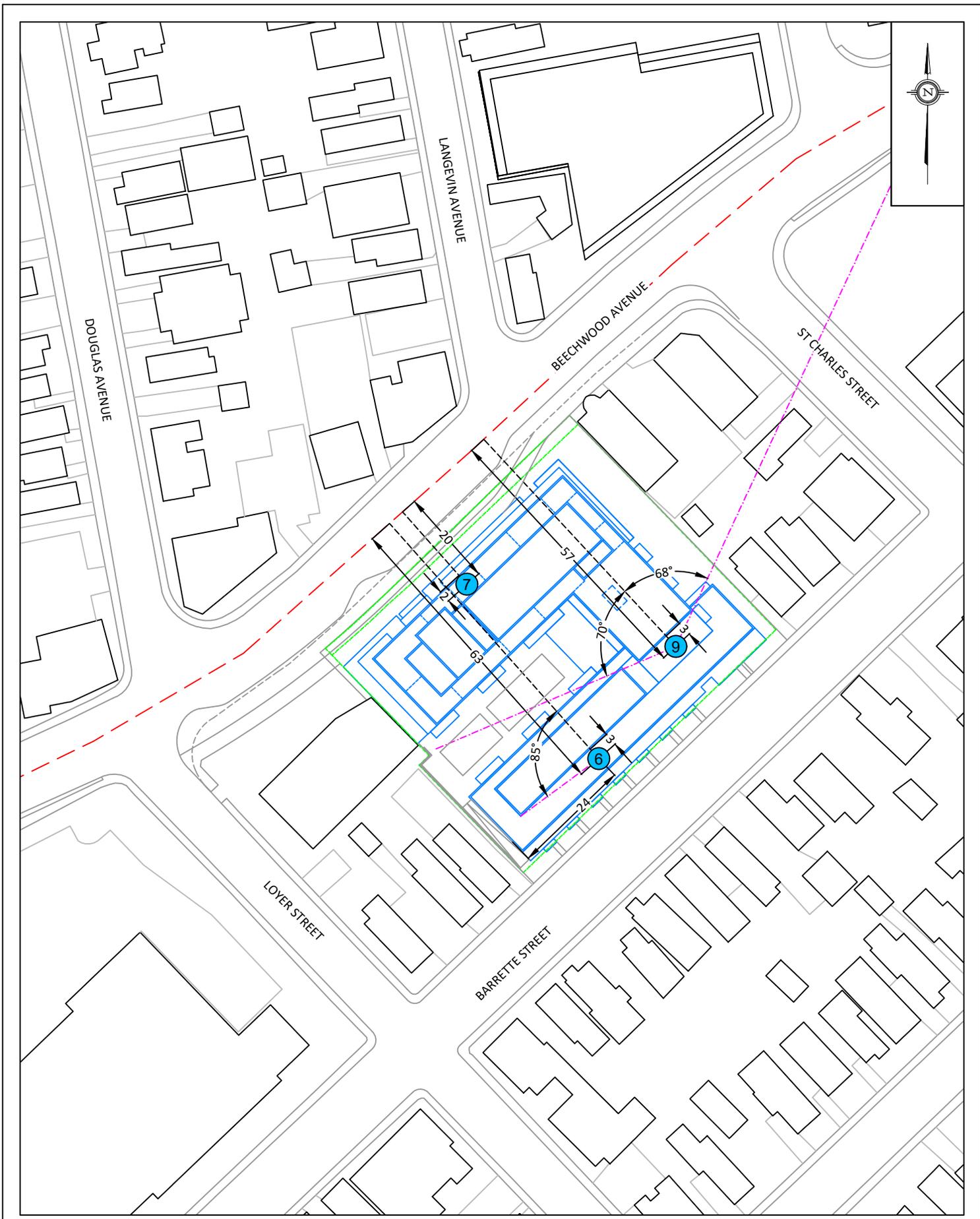
DRAWN BY E.K.

DESCRIPTION

FIGURE 3:  
STAMSON INPUT DATA  
FOR RECEPTORS 1, 2, 3 & 4

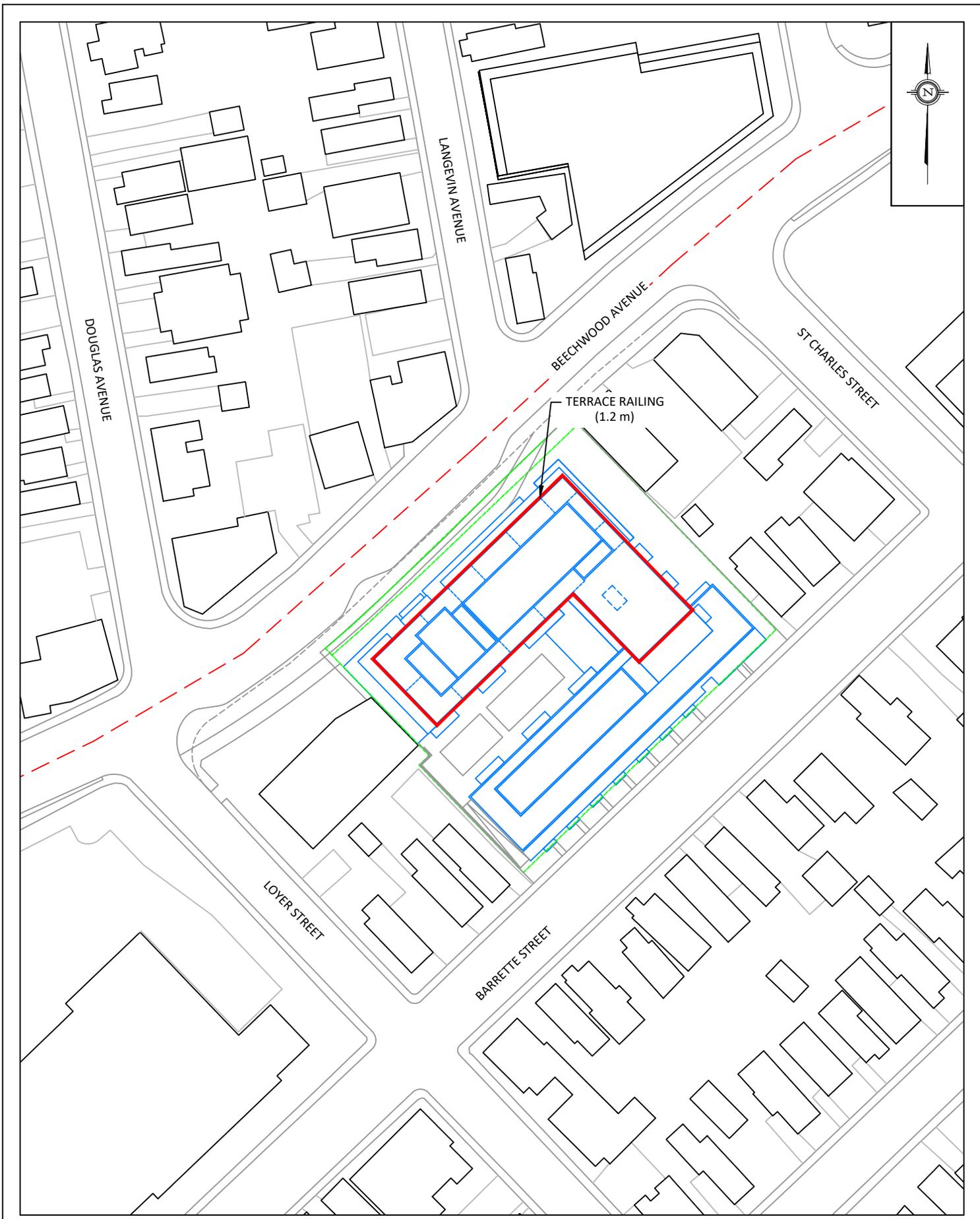


|         |   |                           |
|---------|---|---------------------------|
| PROJECT | 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA<br>ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT |                           |
| SCALE   | 1:1000 (APPROX.)  | DRAWING NO.<br>GW20-069-4 |
| DATE    | JULY 28, 2020   | DRAWN BY<br>E.K.          |



|   |   |                        |
|---|---|------------------------|
| <b>GRADIENTWIND</b><br>ENGINEERS & SCIENTISTS<br>127 WALGREEN ROAD, OTTAWA, ON<br>613 836 0934 • GRADIENTWIND.COM | PROJECT 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA<br>ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT | DESCRIPTION            |
|   | SCALE 1:1000 (APPROX.)  | DRAWING NO. GW20-069-5 |
|   | DATE JULY 28, 2020  | DRAWN BY E.K.          |

FIGURE 5:  
STAMSON INPUT DATA  
FOR RECEPTOR 6, 7 & 9



|   |   |                        |
|---|---|------------------------|
| <b>GRADIENTWIND</b><br>ENGINEERS & SCIENTISTS<br>127 WALGREEN ROAD, OTTAWA, ON<br>613 836 0934 • GRADIENTWIND.COM | PROJECT 78-90 BEECHWOOD AVENUE & 77-93 BARETTE STREET, OTTAWA<br>ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT | DESCRIPTION            |
|   | SCALE 1:1000 (APPROX.)  | DRAWING NO. GW20-069-6 |
|   | DATE JULY 28, 2020  | DRAWN BY E.K.          |

FIGURE 6:  
BARRIER LOCATION

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## APPENDIX A

### STAMSON INPUT-OUTPUT DATA

**STAMSON 5.0    NORMAL REPORT    Date: 29-06-2020 09:56:27**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r1.te            Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood (day/night)

-----  
Angle1 Angle2 : -90.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 15.00 / 15.00 m  
Receiver height : 15.15 / 15.15 m  
Topography : 1 (Flat/gentle slope; no barrier)  
Reference angle : 0.00



Results segment # 1: Beechwood (day)  
-----

Source height = 1.50 m

ROAD (0.00 + 68.48 + 0.00) = 68.48 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| -90    | 90     | 0.00  | 68.48  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 68.48  |

-----  
-90 90 0.00 68.48 0.00 0.00 0.00 0.00 0.00 0.00 68.48  
-----

Segment Leq : 68.48 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Beechwood (night)  
-----

Source height = 1.50 m

ROAD (0.00 + 60.88 + 0.00) = 60.88 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| -90    | 90     | 0.00  | 60.88  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 60.88  |

-----  
-90 90 0.00 60.88 0.00 0.00 0.00 0.00 0.00 0.00 60.88  
-----

Segment Leq : 60.88 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.48

(NIGHT): 60.88



**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 14:26:52**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r2.te            Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood (day/night)

-----  
Angle1 Angle2 : -90.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 18.00 / 18.00 m  
Receiver height : 27.55 / 27.55 m  
Topography : 1 (Flat/gentle slope; no barrier)  
Reference angle : 0.00



Results segment # 1: Beechwood (day)  
-----

Source height = 1.50 m

ROAD (0.00 + 67.69 + 0.00) = 67.69 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| -90    | 90     | 0.00  | 68.48  | 0.00  | -0.79 | 0.00  | 0.00  | 0.00  | 0.00  | 67.69  |

-----  
-90 90 0.00 68.48 0.00 -0.79 0.00 0.00 0.00 0.00 67.69  
-----

Segment Leq : 67.69 dBA

Total Leq All Segments: 67.69 dBA

Results segment # 1: Beechwood (night)  
-----

Source height = 1.50 m

ROAD (0.00 + 60.09 + 0.00) = 60.09 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| -90    | 90     | 0.00  | 60.88  | 0.00  | -0.79 | 0.00  | 0.00  | 0.00  | 0.00  | 60.09  |

-----  
-90 90 0.00 60.88 0.00 -0.79 0.00 0.00 0.00 0.00 60.09  
-----

Segment Leq : 60.09 dBA

Total Leq All Segments: 60.09 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.69  
(NIGHT): 60.09

**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 14:30:42**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r3.te                    Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood (day/night)

-----  
Angle1 Angle2 : -90.00 deg -2.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 19.00 / 19.00 m  
Receiver height : 21.35 / 21.35 m  
Topography : 1 (Flat/gentle slope; no barrier)  
Reference angle : 0.00



Results segment # 1: Beechwood (day)

-----

Source height = 1.50 m

ROAD (0.00 + 64.35 + 0.00) = 64.35 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|     |    |      |       |      |       |       |      |      |      |       |
|-----|----|------|-------|------|-------|-------|------|------|------|-------|
| -90 | -2 | 0.00 | 68.48 | 0.00 | -1.03 | -3.11 | 0.00 | 0.00 | 0.00 | 64.35 |
|-----|----|------|-------|------|-------|-------|------|------|------|-------|

-----

Segment Leq : 64.35 dBA

Total Leq All Segments: 64.35 dBA

Results segment # 1: Beechwood (night)

-----

Source height = 1.50 m

ROAD (0.00 + 56.75 + 0.00) = 56.75 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|     |    |      |       |      |       |       |      |      |      |       |
|-----|----|------|-------|------|-------|-------|------|------|------|-------|
| -90 | -2 | 0.00 | 60.88 | 0.00 | -1.03 | -3.11 | 0.00 | 0.00 | 0.00 | 56.75 |
|-----|----|------|-------|------|-------|-------|------|------|------|-------|

-----

Segment Leq : 56.75 dBA

Total Leq All Segments: 56.75 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.35

(NIGHT): 56.75



**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 14:41:02**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r4.te            Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood 1 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood 1 (day/night)

-----  
Angle1 Angle2 : 0.00 deg 45.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 20.00 / 20.00 m  
Receiver height : 27.55 / 27.55 m  
Topography : 1 (Flat/gentle slope; no barrier)  
Reference angle : 0.00

Road data, segment # 2: Beechwood 2 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Beechwood 2 (day/night)

-----  
Angle1 Angle2 : 45.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 20.00 / 20.00 m  
Receiver height : 28.40 / 28.40 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : 45.00 deg Angle2 : 90.00 deg  
Barrier height : 9.00 m  
Barrier receiver distance : 10.00 / 10.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Results segment # 1: Beechwood 1 (day)

Source height = 1.50 m

ROAD (0.00 + 61.21 + 0.00) = 61.21 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

0 45 0.00 68.48 0.00 -1.25 -6.02 0.00 0.00 0.00 61.21

Segment Leq : 61.21 dBA

Results segment # 2: Beechwood 2 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of  
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

1.50 ! 28.40 ! 14.95 ! 14.95

ROAD (0.00 + 61.21 + 0.00) = 61.21 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

45 90 0.00 68.48 0.00 -1.25 -6.02 0.00 0.00 -0.21 61.00\*  
45 90 0.00 68.48 0.00 -1.25 -6.02 0.00 0.00 0.00 61.21

\* Bright Zone !

Segment Leq : 61.21 dBA

Total Leq All Segments: 64.22 dBA

Results segment # 1: Beechwood 1 (night)

Source height = 1.50 m

ROAD (0.00 + 53.61 + 0.00) = 53.61 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

0 45 0.00 60.88 0.00 -1.25 -6.02 0.00 0.00 0.00 53.61

Segment Leq : 53.61 dBA

Results segment # 2: Beechwood 2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of  
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

1.50 ! 28.40 ! 14.95 ! 14.95

ROAD (0.00 + 53.61 + 0.00) = 53.61 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

45 90 0.00 60.88 0.00 -1.25 -6.02 0.00 0.00 -0.21 53.41\*  
45 90 0.00 60.88 0.00 -1.25 -6.02 0.00 0.00 0.00 53.61

\* Bright Zone !

Segment Leq : 53.61 dBA

Total Leq All Segments: 56.62 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.22  
(NIGHT): 56.62

**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 14:50:56**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r5.te                    Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood 1 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood 1 (day/night)

-----  
Angle1 Angle2 : -90.00 deg -67.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 44.00 / 44.00 m  
Receiver height : 1.50 / 1.50 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -90.00 deg Angle2 : -67.00 deg  
Barrier height : 3.00 m  
Barrier receiver distance : 39.00 / 39.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Road data, segment # 2: Beechwood 2 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Beechwood 2 (day/night)

-----  
Angle1 Angle2 : -67.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 44.00 / 44.00 m  
Receiver height : 1.50 / 1.50 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -67.00 deg Angle2 : 90.00 deg  
Barrier height : 30.20 m  
Barrier receiver distance : 8.00 / 8.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Results segment # 1: Beechwood 1 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of  
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

-----+-----+-----+-----  
1.50 ! 1.50 ! 1.50 ! 1.50

ROAD (0.00 + 47.92 + 0.00) = 47.92 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-----  
-90 -67 0.00 68.48 0.00 -4.67 -8.94 0.00 0.00 -6.95 47.92  
-----

Segment Leq : 47.92 dBA

Results segment # 2: Beechwood 2 (day)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
|------------|--------------|--------------|-------------------|
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

|                           |
|---------------------------|
| -----+-----+-----+-----   |
| 1.50 ! 1.50 ! 1.50 ! 1.50 |

ROAD (0.00 + 43.45 + 0.00) = 43.45 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|   |
|---|
| -----   |
| -67 90 0.00 68.48 0.00 -4.67 -0.59 0.00 0.00 -19.76 43.45 |
| -----   |

Segment Leq : 43.45 dBA

Total Leq All Segments: 49.25 dBA

Results segment # 1: Beechwood 1 (night)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
|------------|--------------|--------------|-------------------|
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

|                           |
|---------------------------|
| -----+-----+-----+-----   |
| 1.50 ! 1.50 ! 1.50 ! 1.50 |

ROAD (0.00 + 40.32 + 0.00) = 40.32 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|   |
|---|
| -----   |
| -90 -67 0.00 60.88 0.00 -4.67 -8.94 0.00 0.00 -6.95 40.32 |
| -----   |

Segment Leq : 40.32 dBA



Results segment # 2: Beechwood 2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source<br>Height (m) | ! Receiver<br>Height (m) | ! Barrier<br>Height (m) | ! Elevation of<br>Barrier Top (m) |
|----------------------|--------------------------|-------------------------|-----------------------------------|
|----------------------|--------------------------|-------------------------|-----------------------------------|

|      |   |      |   |      |   |      |
|------|---|------|---|------|---|------|
| 1.50 | ! | 1.50 | ! | 1.50 | ! | 1.50 |
|------|---|------|---|------|---|------|

ROAD (0.00 + 35.86 + 0.00) = 35.86 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|     |    |      |       |      |       |       |      |      |        |       |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|
| -67 | 90 | 0.00 | 60.88 | 0.00 | -4.67 | -0.59 | 0.00 | 0.00 | -19.76 | 35.86 |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|

Segment Leq : 35.86 dBA

Total Leq All Segments: 41.65 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 49.25  
(NIGHT): 41.65



**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 16:36:16**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r6.te                    Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood 1 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood 1 (day/night)

-----  
Angle1 Angle2 : -90.00 deg -85.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 63.00 / 63.00 m  
Receiver height : 21.35 / 21.35 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -90.00 deg Angle2 : -85.00 deg  
Barrier height : 19.85 m  
Barrier receiver distance : 24.00 / 24.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Road data, segment # 2: Beechwood 2 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Beechwood 2 (day/night)

-----  
Angle1 Angle2 : -85.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 63.00 / 63.00 m  
Receiver height : 21.35 / 21.35 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -85.00 deg Angle2 : 90.00 deg  
Barrier height : 23.06 m  
Barrier receiver distance : 3.00 / 3.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Results segment # 1: Beechwood 1 (day)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
|------------|--------------|--------------|-------------------|
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

-----+-----+-----+-----

|        |         |         |       |
|--------|---------|---------|-------|
| 1.50 ! | 21.35 ! | 13.79 ! | 13.79 |
|--------|---------|---------|-------|

ROAD (0.00 + 39.79 + 0.00) = 39.79 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|     |     |      |       |      |       |        |      |      |       |       |
|-----|-----|------|-------|------|-------|--------|------|------|-------|-------|
| -90 | -85 | 0.00 | 68.48 | 0.00 | -6.23 | -15.56 | 0.00 | 0.00 | -6.90 | 39.79 |
|-----|-----|------|-------|------|-------|--------|------|------|-------|-------|

-----

Segment Leq : 39.79 dBA

Results segment # 2: Beechwood 2 (day)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
|------------|--------------|--------------|-------------------|
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

-----+-----+-----+-----

|        |         |         |       |
|--------|---------|---------|-------|
| 1.50 ! | 21.35 ! | 20.40 ! | 20.40 |
|--------|---------|---------|-------|

ROAD (0.00 + 47.53 + 0.00) = 47.53 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|     |    |      |       |      |       |       |      |      |        |       |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|
| -85 | 90 | 0.00 | 68.48 | 0.00 | -6.23 | -0.12 | 0.00 | 0.00 | -14.60 | 47.53 |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|

-----

Segment Leq : 47.53 dBA

Total Leq All Segments: 48.21 dBA



Results segment # 1: Beechwood 1 (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source Height (m) | Receiver Height (m) | Barrier Height (m) | Elevation of Barrier Top (m) |
|-------------------|---------------------|--------------------|------------------------------|
| 1.50              | 21.35               | 13.79              | 13.79                        |

ROAD (0.00 + 32.19 + 0.00) = 32.19 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj  | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|--------|-------|-------|-------|--------|
| -90    | -85    | 0.00  | 60.88  | 0.00  | -6.23 | -15.56 | 0.00  | 0.00  | -6.90 | 32.19  |

-90 -85 0.00 60.88 0.00 -6.23 -15.56 0.00 0.00 -6.90 32.19

Segment Leq : 32.19 dBA

Results segment # 2: Beechwood 2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source Height (m) | Receiver Height (m) | Barrier Height (m) | Elevation of Barrier Top (m) |
|-------------------|---------------------|--------------------|------------------------------|
| 1.50              | 21.35               | 20.40              | 20.40                        |

ROAD (0.00 + 39.93 + 0.00) = 39.93 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj  | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|--------|--------|
| -85    | 90     | 0.00  | 60.88  | 0.00  | -6.23 | -0.12 | 0.00  | 0.00  | -14.60 | 39.93  |

Segment Leq : 39.93 dBA

Total Leq All Segments: 40.61 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.21  
(NIGHT): 40.61



**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 15:44:53**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r7.te            Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood (day/night)

-----  
Angle1 Angle2 : -90.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 20.00 / 20.00 m  
Receiver height : 31.10 / 31.10 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg  
Barrier height : 30.20 m  
Barrier receiver distance : 2.00 / 2.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00

Results segment # 1: Beechwood (day)

Source height = 1.50 m

Barrier height for grazing incidence

| Source<br>Height (m) | Receiver<br>Height (m) | Barrier<br>Height (m) | Elevation of<br>Barrier Top (m) |
|----------------------|------------------------|-----------------------|---------------------------------|
|----------------------|------------------------|-----------------------|---------------------------------|

|      |       |       |       |
|------|-------|-------|-------|
| 1.50 | 31.10 | 28.14 | 28.14 |
|------|-------|-------|-------|

ROAD (0.00 + 56.90 + 0.00) = 56.90 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|     |    |      |       |      |       |      |      |      |        |       |
|-----|----|------|-------|------|-------|------|------|------|--------|-------|
| -90 | 90 | 0.00 | 68.48 | 0.00 | -1.25 | 0.00 | 0.00 | 0.00 | -10.33 | 56.90 |
|-----|----|------|-------|------|-------|------|------|------|--------|-------|

Segment Leq : 56.90 dBA

Total Leq All Segments: 56.90 dBA



Results segment # 1: Beechwood (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source<br>Height (m) | Receiver<br>Height (m) | Barrier<br>Height (m) | Elevation of<br>Barrier Top (m) |
|----------------------|------------------------|-----------------------|---------------------------------|
|----------------------|------------------------|-----------------------|---------------------------------|

|      |       |       |       |
|------|-------|-------|-------|
| 1.50 | 31.10 | 28.14 | 28.14 |
|------|-------|-------|-------|

ROAD (0.00 + 49.31 + 0.00) = 49.31 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|     |    |      |       |      |       |      |      |      |        |       |
|-----|----|------|-------|------|-------|------|------|------|--------|-------|
| -90 | 90 | 0.00 | 60.88 | 0.00 | -1.25 | 0.00 | 0.00 | 0.00 | -10.33 | 49.31 |
|-----|----|------|-------|------|-------|------|------|------|--------|-------|

Segment Leq : 49.31 dBA

Total Leq All Segments: 49.31 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.90  
(NIGHT): 49.31



**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 15:54:05**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r8.te            Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood 1 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood 1 (day/night)

-----  
Angle1 Angle2 : -90.00 deg 11.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 32.00 / 32.00 m  
Receiver height : 31.10 / 31.10 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -90.00 deg Angle2 : 11.00 deg  
Barrier height : 30.20 m  
Barrier receiver distance : 14.00 / 14.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Road data, segment # 2: Beechwood 2 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Beechwood 2 (day/night)

-----  
Angle1 Angle2 : 11.00 deg 90.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 28.00 / 28.00 m  
Receiver height : 31.10 / 31.10 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : 11.00 deg Angle2 : 90.00 deg  
Barrier height : 32.50 m  
Barrier receiver distance : 2.00 / 2.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Results segment # 1: Beechwood 1 (day)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

|            |              |              |                   |
|------------|--------------|--------------|-------------------|
| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

-----+-----+-----+-----

|        |         |         |       |
|--------|---------|---------|-------|
| 1.50 ! | 31.10 ! | 18.15 ! | 18.15 |
|--------|---------|---------|-------|

ROAD (0.00 + 44.87 + 0.00) = 44.87 dBA

|        |        |       |        |       |       |       |       |       |       |        |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|     |    |      |       |      |       |       |      |      |        |       |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|
| -90 | 11 | 0.00 | 68.48 | 0.00 | -3.29 | -2.51 | 0.00 | 0.00 | -17.81 | 44.87 |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|

-----

Segment Leq : 44.87 dBA

Results segment # 2: Beechwood 2 (day)

-----

Source height = 1.50 m

Barrier height for grazing incidence

-----

|            |              |              |                   |
|------------|--------------|--------------|-------------------|
| Source     | ! Receiver   | ! Barrier    | ! Elevation of    |
| Height (m) | ! Height (m) | ! Height (m) | ! Barrier Top (m) |

-----+-----+-----+-----

|        |         |         |       |
|--------|---------|---------|-------|
| 1.50 ! | 31.10 ! | 28.99 ! | 28.99 |
|--------|---------|---------|-------|

ROAD (0.00 + 46.51 + 0.00) = 46.51 dBA

|        |        |       |        |       |       |       |       |       |       |        |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

-----

|    |    |      |       |      |       |       |      |      |        |       |
|----|----|------|-------|------|-------|-------|------|------|--------|-------|
| 11 | 90 | 0.00 | 68.48 | 0.00 | -2.71 | -3.58 | 0.00 | 0.00 | -15.69 | 46.51 |
|----|----|------|-------|------|-------|-------|------|------|--------|-------|

-----

Segment Leq : 46.51 dBA

Total Leq All Segments: 48.78 dBA



Results segment # 1: Beechwood 1 (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source Height (m) | Receiver Height (m) | Barrier Height (m) | Elevation of Barrier Top (m) |
|-------------------|---------------------|--------------------|------------------------------|
| 1.50              | 31.10               | 18.15              | 18.15                        |

ROAD (0.00 + 37.27 + 0.00) = 37.27 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj  | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|--------|--------|
| -90    | 11     | 0.00  | 60.88  | 0.00  | -3.29 | -2.51 | 0.00  | 0.00  | -17.81 | 37.27  |

-90 11 0.00 60.88 0.00 -3.29 -2.51 0.00 0.00 -17.81 37.27

Segment Leq : 37.27 dBA



Results segment # 2: Beechwood 2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of  
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

-----+-----+-----+-----  
1.50 ! 31.10 ! 28.99 ! 28.99

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-----  
11 90 0.00 60.88 0.00 -2.71 -3.58 0.00 0.00 -15.69 38.91  
-----

Segment Leq : 38.91 dBA

Total Leq All Segments: 41.18 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.78  
(NIGHT): 41.18

**STAMSON 5.0    NORMAL REPORT    Date: 28-07-2020 15:56:53**  
**MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT**

**Filename: r9.te                    Time Period: Day/Night 16/8 hours**  
**Description:**

Road data, segment # 1: Beechwood 1 (day/night)

-----  
Car traffic volume : 12144/1056 veh/TimePeriod \*  
Medium truck volume : 966/84 veh/TimePeriod \*  
Heavy truck volume : 690/60 veh/TimePeriod \*  
Posted speed limit : 50 km/h  
Road gradient : 0 %  
Road pavement : 1 (Typical asphalt or concrete)

\* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 15000  
Percentage of Annual Growth : 0.00  
Number of Years of Growth : 0.00  
Medium Truck % of Total Volume : 7.00  
Heavy Truck % of Total Volume : 5.00  
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Beechwood 1 (day/night)

-----  
Angle1 Angle2 : -70.00 deg 68.00 deg  
Wood depth : 0 (No woods.)  
No of house rows : 0 / 0  
Surface : 2 (Reflective ground surface)  
Receiver source distance : 57.00 / 57.00 m  
Receiver height : 27.55 / 27.55 m  
Topography : 2 (Flat/gentle slope; with barrier)  
Barrier angle1 : -70.00 deg Angle2 : 68.00 deg  
Barrier height : 30.20 m  
Barrier receiver distance : 3.00 / 3.00 m  
Source elevation : 0.00 m  
Receiver elevation : 0.00 m  
Barrier elevation : 0.00 m  
Reference angle : 0.00



Results segment # 1: Beechwood 1 (day)

Source height = 1.50 m

Barrier height for grazing incidence

| Source Height (m) | Receiver Height (m) | Barrier Height (m) | Elevation of Barrier Top (m) |
|-------------------|---------------------|--------------------|------------------------------|
| 1.50              | 27.55               | 26.18              | 26.18                        |

ROAD (0.00 + 42.01 + 0.00) = 42.01 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj  | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|--------|--------|
| -70    | 68     | 0.00  | 68.48  | 0.00  | -5.80 | -1.15 | 0.00  | 0.00  | -19.52 | 42.01  |

Segment Leq : 42.01 dBA

Total Leq All Segments: 42.01 dBA

Results segment # 1: Beechwood 1 (night)

Source height = 1.50 m

Barrier height for grazing incidence

| Source<br>Height (m) | Receiver<br>Height (m) | Barrier<br>Height (m) | Elevation of<br>Barrier Top (m) |
|----------------------|------------------------|-----------------------|---------------------------------|
|----------------------|------------------------|-----------------------|---------------------------------|

|      |       |       |       |
|------|-------|-------|-------|
| 1.50 | 27.55 | 26.18 | 26.18 |
|------|-------|-------|-------|

ROAD (0.00 + 34.41 + 0.00) = 34.41 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|
|--------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|

|     |    |      |       |      |       |       |      |      |        |       |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|
| -70 | 68 | 0.00 | 60.88 | 0.00 | -5.80 | -1.15 | 0.00 | 0.00 | -19.52 | 34.41 |
|-----|----|------|-------|------|-------|-------|------|------|--------|-------|

Segment Leq : 34.41 dBA

Total Leq All Segments: 34.41 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 42.01  
(NIGHT): 34.41

