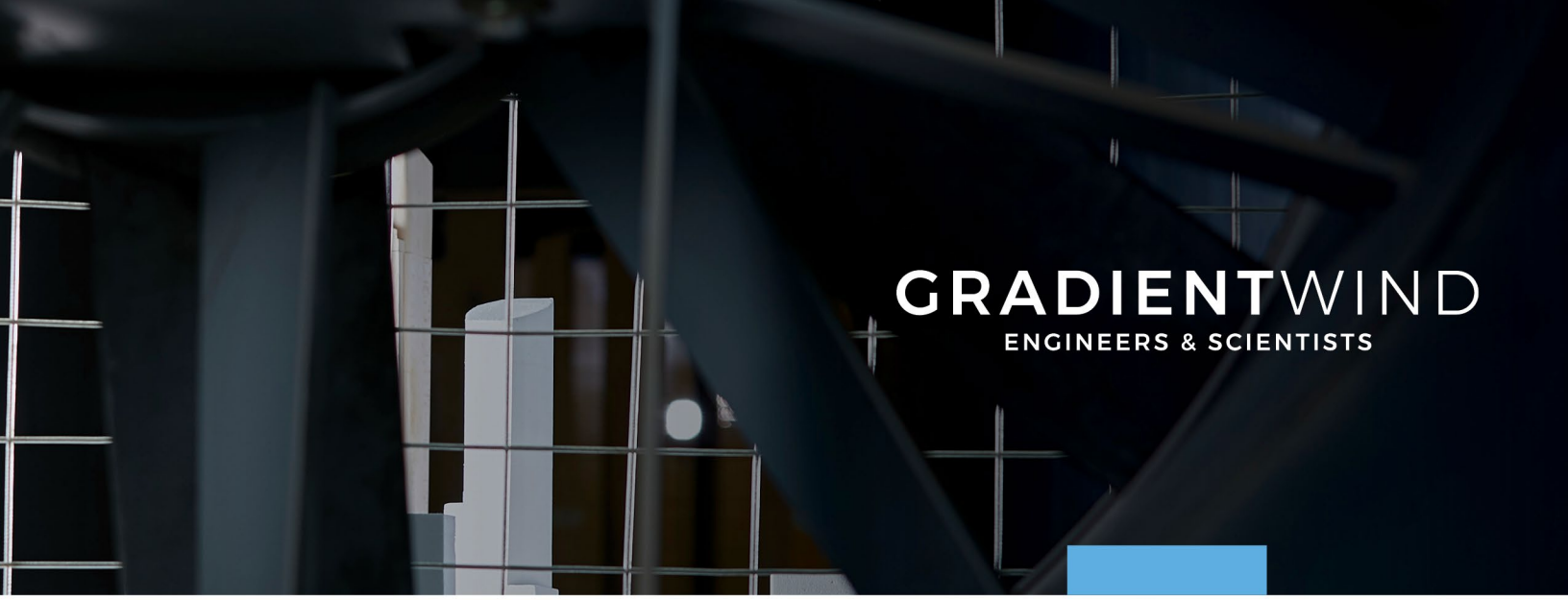

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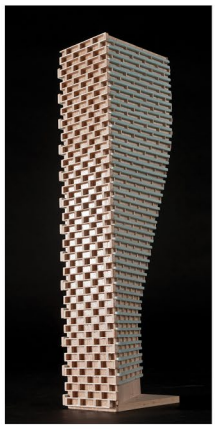
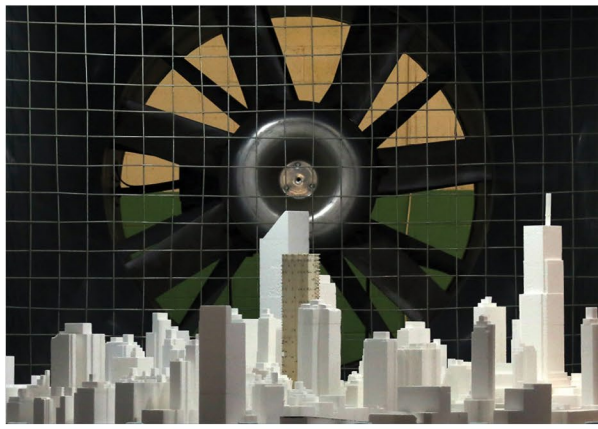
TRAFFIC NOISE FEASIBILITY ASSESSMENT

Barrhaven Conservancy Subdivision
(Phase 5)
Ottawa, Ontario

REPORT: GWE17-151 – Traffic Noise Feasibility





December 6, 2022

PREPARED FOR

Caivan Communities
2934 Baseline Road, Suite 302
Ottawa, Ontario
K2H 1B2

PREPARED BY

Giuseppe Garro, MASc., Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment in support of a rezoning and a revision draft plan application for a proposed residential subdivision, referred to as Barrhaven Conservancy Subdivision, located at 3288 Borrisokane Road in Ottawa, Ontario. The study site is situated in the southwest area of Barrhaven in Ottawa, Ontario. This report provides an analysis focused on the Phase 5 draft plan which incorporates a portion of the lands immediately west of Borrisokane Road. The initial concept plan being considered for application comprises residential developments (single and town homes), several communal parks, as well as open space along Jock River to the south.

The major sources of roadway noise affecting the development are roadway traffic along the proposed minor collector to the north and center passing through the development running east-west, Borrisokane Road, and a proposed Bus Rapid Transit (BRT) line with a dedicated transitway to the north. However, the road network and arrangement of land uses may be subject to change through the development approval process.

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) site plan concept drawings provided by Caivan Communities in December 2022. As the site plan may be subject to change, GWE took the approach to establish noise contours around the site. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control for various areas on site would likely be required.

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 63 and 69 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to the intersection of Borrisokane Road and the proposed minor collector. Results of the roadway traffic noise calculations also indicate that outdoor living areas siding and/or fronting onto Borrisokane Road, the proposed minor collector, or the BRT corridor may require noise control measures. Mitigation measures are described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. A detailed roadway traffic

noise study will be required at the time of subdivision registration to determine specific noise control measures for the development.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Caivan Communities to undertake a roadway traffic noise feasibility assessment in support of a rezoning and a revision draft plan application for a proposed residential subdivision. The subdivision, referred to as Barrhaven Conservancy Subdivision, is located at 3288 Borrisokane Road in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment. Gradient Wind's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic.

The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation, and Parks[2] guidelines. Noise calculations were based on site plan concept drawings provided by Caivan Communities in December 2022, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications, and Bus Rapid Transit (BRT) volumes based on correspondence with a senior reviewer at the City of Ottawa.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is Phase 5 of the proposed subdivision located in Ottawa, Ontario. The study site is situated in the southwest area of Barrhaven in Ottawa, Ontario. The draft plan incorporates a portion of the lands immediately west of Borrisokane Road. The initial concept plan being considered for application comprises residential developments (single and town homes), several communal parks, as well as open space along Jock River to the south. The townhouse units proposed include rear lane and traditional front lane townhomes. The rear lane townhomes are located adjacent to the west side of Borrisokane Road. A lot dedicated to mixed-use land is located at the northwest corner of the Borrisokane Road and BRT intersection. The remaining space is dedicated to single detached homes and traditional townhomes. The development is expected to contain outdoor living areas in the rear yards of each single detached dwelling unit.

The major sources of roadway noise affecting the development are roadway traffic along the proposed minor collector to the north and center passing through the development running east-west, Borrisokane

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Publication NPC-300

Road, and a proposed Bus Rapid Transit (BRT) line with a dedicated transitway to the north. Other sources of transportation noise near the site include Strandherd Drive to the north. This source is beyond 100 m from the nearest development boundary line and are considered insignificant sources of transportation noise. Therefore, these sources were omitted from the assessment. It should be noted that Highway 416 is greater than 500 m from the site and was also considered an insignificant source of transportation noise.

The site is surrounded by vacant land designated with residential developments to the north and west, and open space along Jock River to the south of the development. Due to the current state of development, the final site configuration is uncertain and may be subject to change. Therefore, Gradient Wind took the approach to establish noise contours around the site ignoring the proposed site massing. The contours were combined with the City of Ottawa noise criteria, to determine what level of noise control for various areas on site would be required. Figure 1 illustrates the site plan and surrounding context.

3. OBJECTIVES

The principal objective of this work is to calculate the future noise levels on the study site produced by local roadway traffic and explore potential for noise mitigation where required. Noise calculations are based on site plan concept drawings provided by Caivan Communities in December 2022, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

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 (2×10^{-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 surface roadway traffic noise, 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 Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. OLA do not need to be considered during the nighttime period.

Predicted noise levels at the OLA dictate the action required to achieve the recommended sound levels. According to the ENCG, if an area is to be used as an OLA, noise control measures are required to reduce the L_{eq} to 55 dBA. This is typically done with noise control measures outlined in Section 5.2. When noise levels at these areas exceed the criteria, specific Warning Clause requirements may apply. As this is a preliminary assessment, noise control recommendations are of a general nature. Specific mitigation requirements would be the work of a future study.

4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs. To provide a general sense of noise across the site, the employed software program was Predictor-Lima (TNM calculation), which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program 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 discrete receptors at key sensitive areas.

The results were confirmed by performing discrete noise calculations with the Ministry of the Environment, Conservations and Parks (MECP) computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as shown in Figure 2. Receptor

distances and exposure angles are depicted in Figure 3-5. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 1 below, 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 was taken to be 92% / 8% respectively for all streets.
- Receptor heights taken to be 1.5 m above grade.
- The study site was treated as having flat or gently sloping topography.
- No massing considered as potential noise screening elements.
- Receptor distances and exposure angles illustrated in Figure 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[3] 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. As for the BRT, volumes were used based on Gradient Wind's experience with similar developments. Table 1 (below) summarizes the AADT values used for each roadway included in this assessment.

[3] City of Ottawa Transportation Master Plan, November 2013

TABLE 1: ROADWAY TRAFFIC DATA

Roadway	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Proposed Minor Collector	2-Lane Urban Collector (2-UCU)	50	**8,000**
Borrisokane Road	2-Lane Urban Arterial (2-UAU)	80	**15,000**
Bus Rapid Transit	BRT	80	**191/67***

* Daytime and nighttime volumes based on correspondence with the City of Ottawa

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations for the daytime period, covering the entire study site, are shown in Figure 8. Discrete receptors were also placed at ground level at key locations throughout the site. The noise contours were generated using TNM and verified with discrete receptors using STAMSON 5.04, as shown in Figure 2, and summarized in Table 2 below. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	Predictor-Lima Noise Level (dBA)
			Day	Day
1	1.5	OLA – Grade Level – Rear Lane Townhouse	67	68
2	1.5	OLA – Grade Level – Rear Lane Townhouse	69	69
3	1.5	OLA – Grade Level – Side of Single Home	64	65
4	1.5	OLA – Grade Level – Rear Lane Townhouse	63	64
5	1.5	OLA – Grade Level – Back-To-Back Townhouse	63	63
6	1.5	OLA – Grade Level – Rear Lane Townhouse	67	68

As shown above, the results calculated from TNM have good correlation with calculations performed in STAMSON 5.04. A tolerance of 3 dBA between models is generally considered acceptable given human hearing cannot detect a change in sound level less than 3 dBA. As stated in Section 4.2.2, massing elements, such as buildings, were conservatively ignored as potential screening elements. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources and are within approximately 45 meters, may require noise control measures. These measures are briefly described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

According to Table 2, it is possible homes fronting the proposed minor collector will require noise control measures as outlined in Section 5.2. Lots with rear yards siding/fronting onto the minor collector/BRT corridor may require mitigation in the form of a noise barrier as outlined in Figure 7. Massing elements along the edge of the development are expected block direct line of sight of the roadways and act as sound barriers, reducing the sound experienced at the inner bocks within the subdivision. With regard to the rear lane townhomes, these homes are expected to front or side onto Borrisokane Road, which would fully or partially shelter the proposed second storey terrace. For select blocks, mitigation at the terrace may be required should the final design exceed 4 meters in depth and exceed the OLA noise criterion of 55 dBA. A detailed roadway traffic noise study will be required at the time of subdivision registration to determine specific noise control measures for the development.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic, at a number of receptors, exceed the criteria listed in the ENCG for outdoor living areas, as discussed in Section 4.2.3. Therefore, noise control measures as described below, subscribing to Table 2.3a in the ENCG and listed in order of preference, will be required to reduce the L_{eq} to 55 dBA:

- Distance setback with soft ground
- Insertion of noise insensitive land uses between the source and sensitive points of reception
- Orientation of buildings to provide sheltered zones in rear yards
- Shared outdoor amenity areas
- Earth berms (sound barriers)
- Acoustic barriers

Based on expected noise levels, blocks in the dark red to dark purple regions in Figure 8 will likely require upgraded building components and central air conditioning. These blocks are outlined in Figure 6 by the red hatched area. Blocks in the dark orange and red regions in Figure 8 will require forced air heating with provisions for central air conditioning. These blocks are highlighted in Figure 6 by the green hatched area. Warning Clauses will also be required on purchase, sale, and lease agreements. Specific mitigation will be determined during the detailed design assessment.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 63 and 69 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to the intersection of Borrisokane Road and the proposed minor collector. Results of the roadway traffic noise calculations also indicate that outdoor living areas siding and/or fronting onto Borrisokane Road, the proposed minor collector, or the BRT corridor may require noise control measures. Mitigation measures are described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically, and administratively feasible. A detailed roadway traffic noise study will be required at the time of subdivision registration 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.

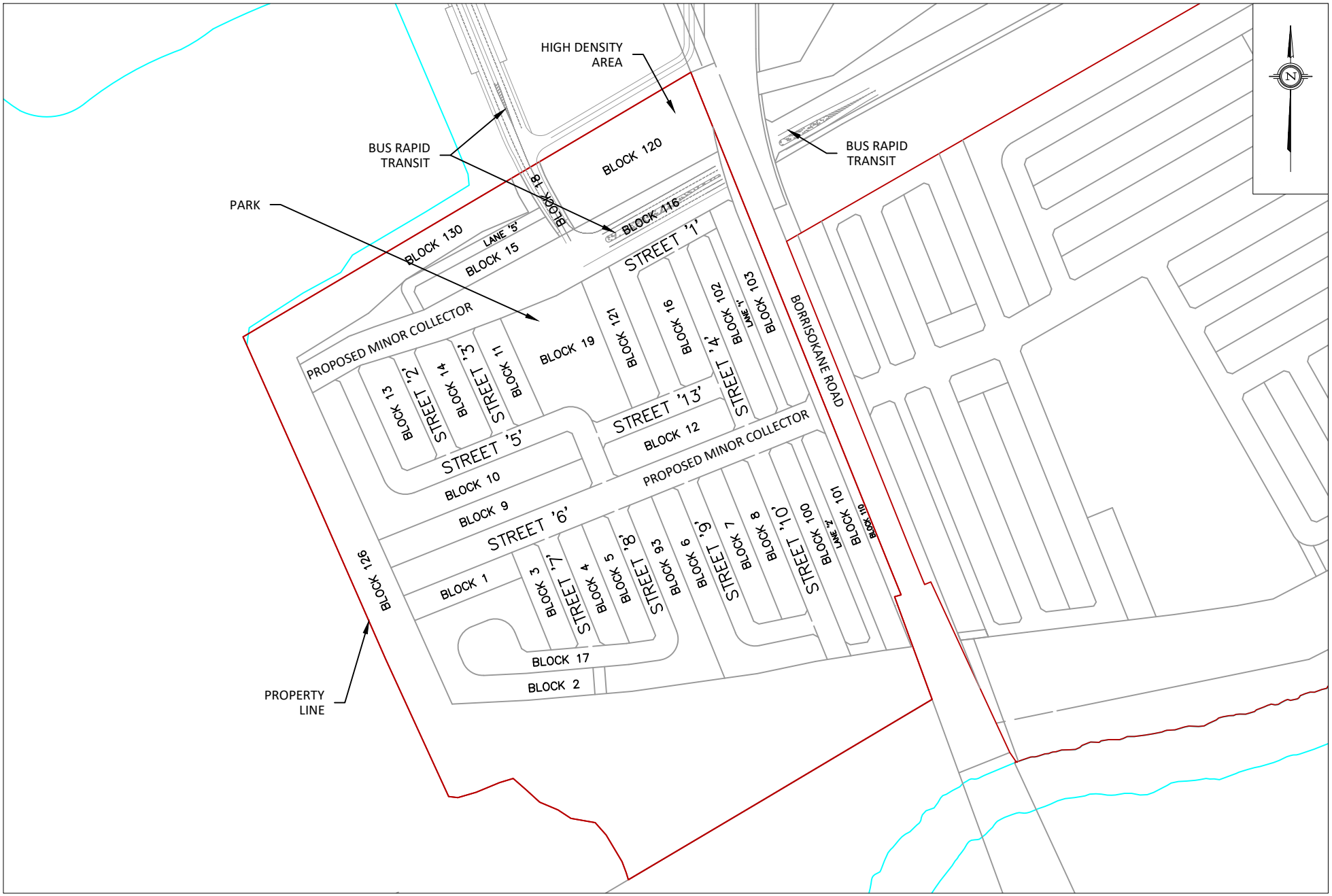
Sincerely,

Gradient Wind Engineering Inc.

Giuseppe Garro, MASc.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #17-151



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PROJECT	BARRHAVEN CONSERVANCY SUBDIVISION, OTTAWA TRAFFIC FEASIBILITY NOISE STUDY
SCALE	1:4000 (APPROX.)
DRAWING NO.	GWE17-151-1
DATE	DECEMBER 6, 2022
DRAWN BY	G.G.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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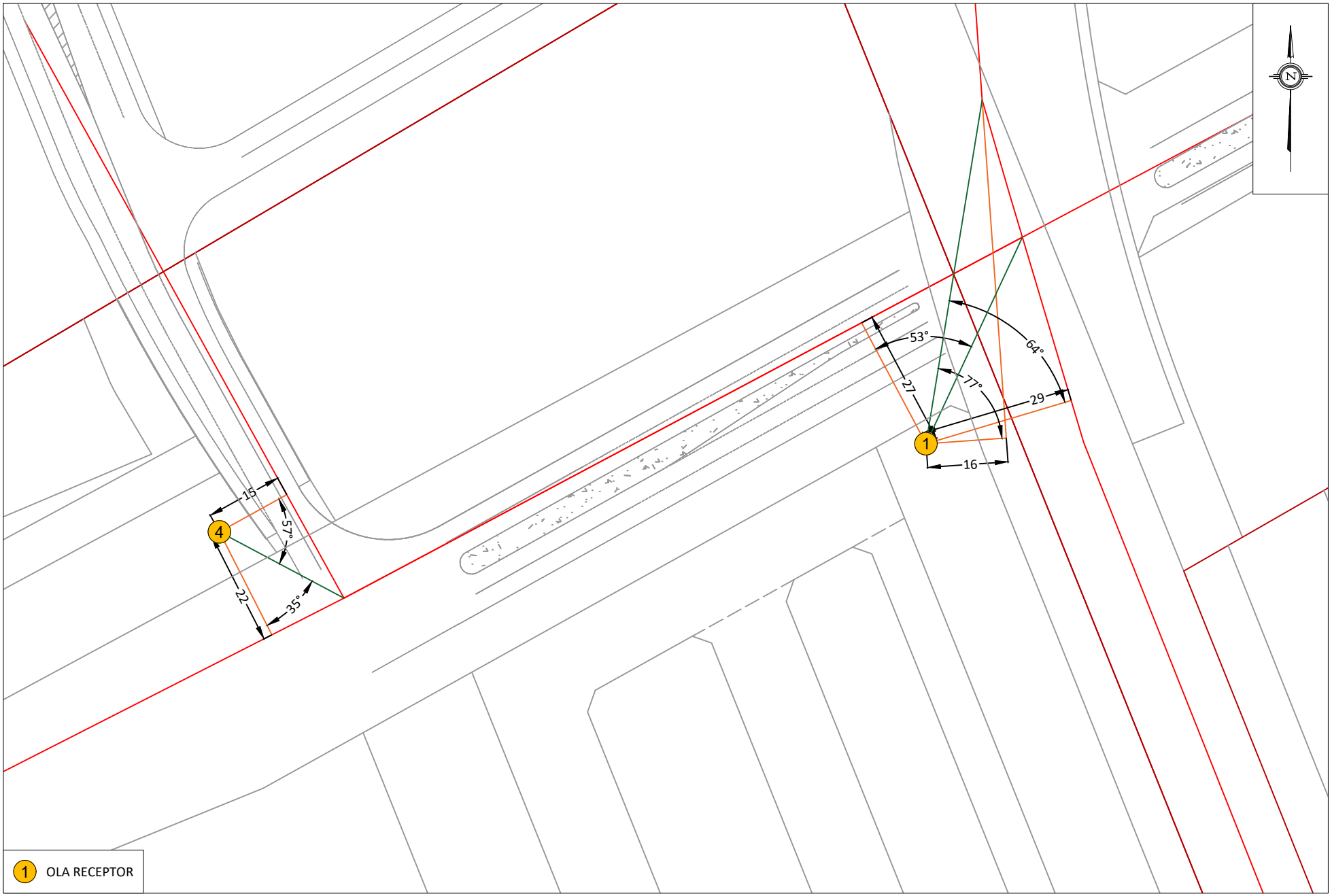
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE17-151-2
DATE	DECEMBER 6, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE17-151-3
DATE	DECEMBER 6, 2022
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FIGURE 3:
STAMSON INPUT PARAMETERS

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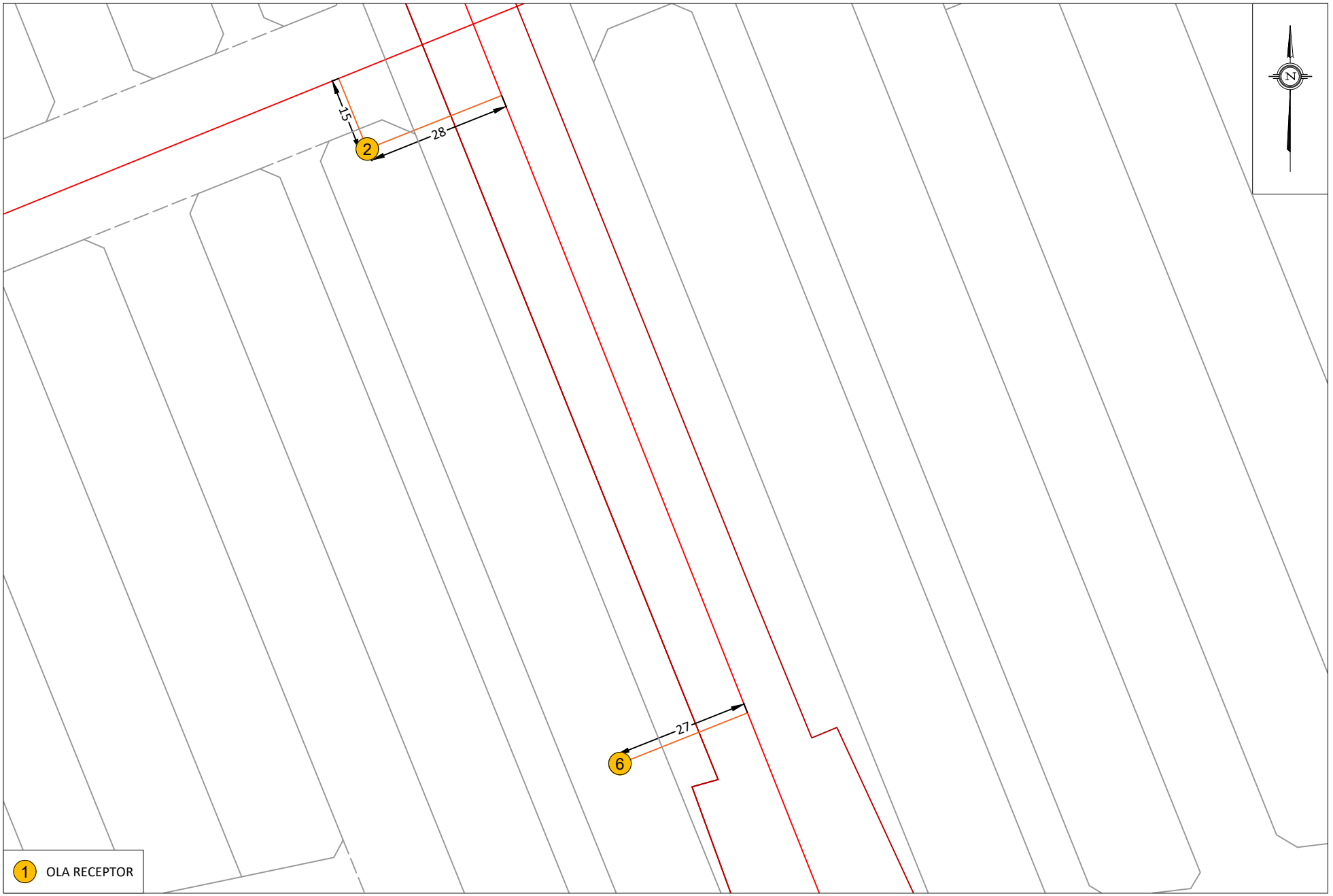
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE17-151-4
DATE	DECEMBER 6, 2022
DRAWN BY	G.G.

DESCRIPTION

FIGURE 4:
STAMSON INPUT PARAMETERS



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PROJECT	BARRHAVEN CONSERVANCY SUBDIVISION, OTTAWA TRAFFIC FEASIBILITY NOISE STUDY		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE17-151-5
DATE	DECEMBER 6, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 5:
STAMSON INPUT PARAMETERS

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SCALE	1:3000 (APPROX.)
DRAWING NO.	GW17-151-6
DATE	DECEMBER 6, 2022
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DESCRIPTION

FIGURE 6:
POTENTIAL VENTILATION REQUIREMENTS

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SCALE	1:3000 (APPROX.)	DRAWING NO.	GW17-151-7
DATE	DECEMBER 6, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 7:
POTENTIAL NOISE BARRIER LOCATIONS

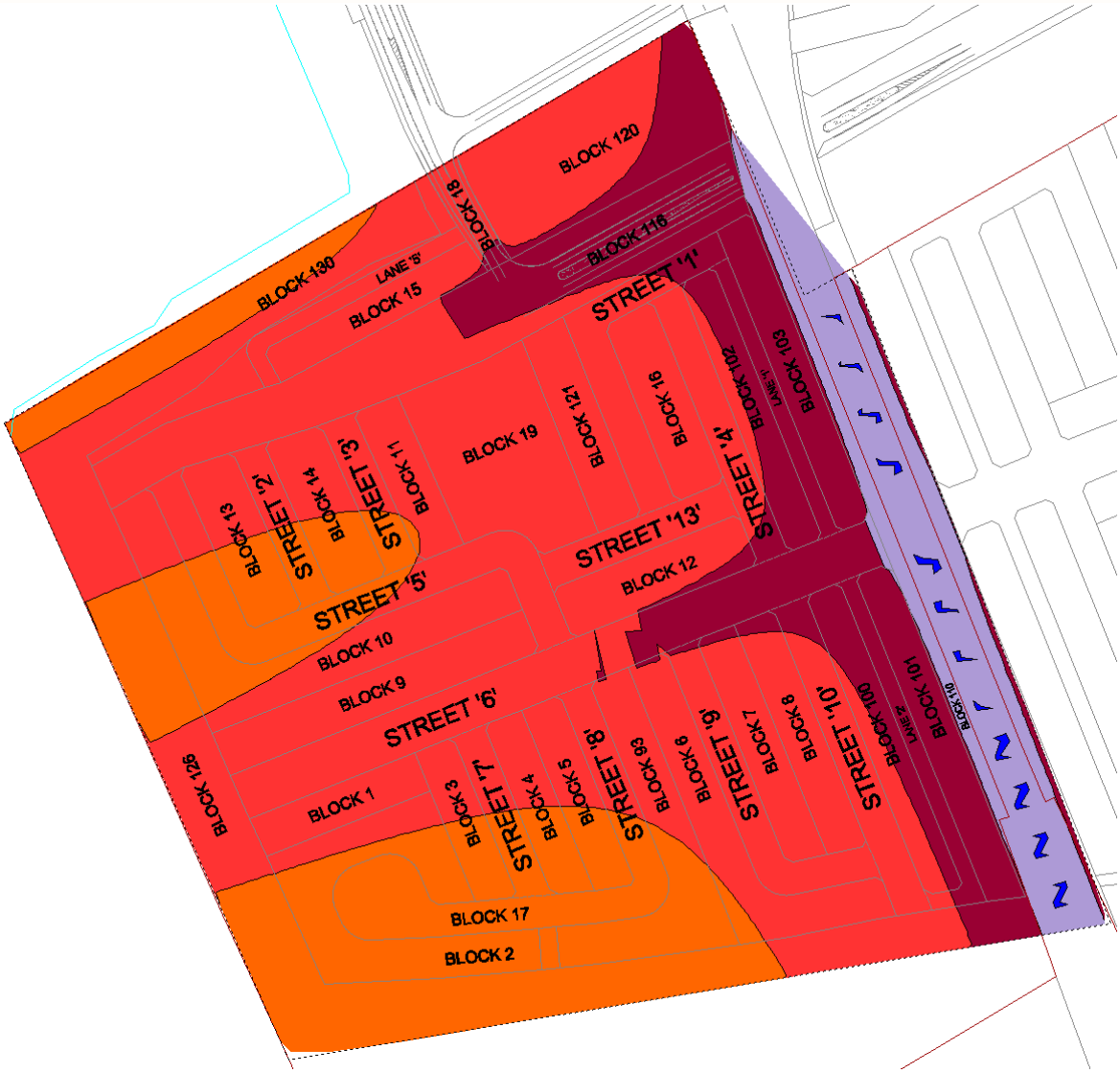
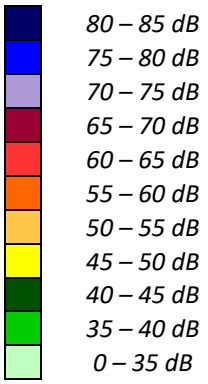
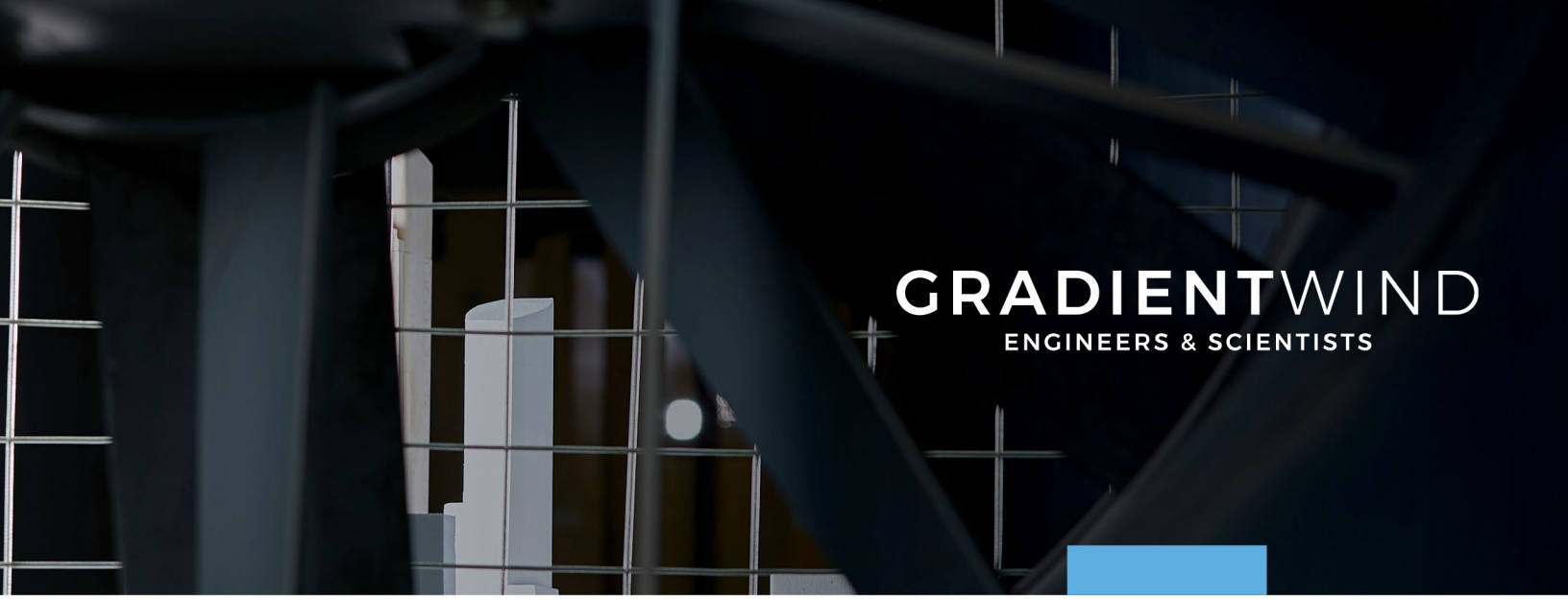


FIGURE 8: GROUND LEVEL NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD)





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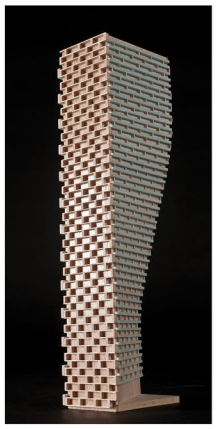

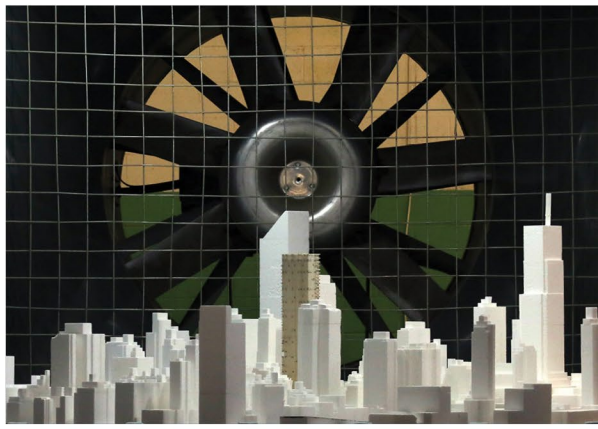

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

```
STAMSON 5.0         NORMAL REPORT         Date: 17-10-2022 16:38:30
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Borris Rd1 (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  :    80 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: Borris Rd1 (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   -77.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  16.00 / 16.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Borris Rd2 (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  :    80 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: Borris Rd2 (day/night)
---------------------------------------------
Angle1   Angle2           : -64.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  29.00 / 29.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Road data, segment # 3: PC (day/night)
--------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    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):   8000
    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 # 3: PC (day/night)
------------------------------------
Angle1   Angle2           : -90.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  27.00 / 27.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Borris Rd1 (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.14 + 0.00) = 54.14 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -77   0.66  72.49   0.00  -0.47 -17.88   0.00   0.00   0.00
54.14
-------------------------------------------------------------------------
--

Segment Leq : 54.14 dBA


Results segment # 2: Borris Rd2 (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.96 + 0.00) = 65.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64     90   0.66  72.49   0.00  -4.75  -1.78   0.00   0.00   0.00
65.96
-------------------------------------------------------------------------
--

Segment Leq : 65.96 dBA


Results segment # 3: PC (day)
-----------------------------

Source height = 1.50 m

ROAD (0.00 + 59.47 + 0.00) = 59.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     53   0.66  65.75   0.00  -4.24  -2.05   0.00   0.00   0.00
59.47
-------------------------------------------------------------------------
--

Segment Leq : 59.47 dBA

Total Leq All Segments: 67.07 dBA
```

```
Results segment # 1: Borris Rd1 (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.55 + 0.00) = 46.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -77   0.66  64.89   0.00  -0.47 -17.88   0.00   0.00   0.00
46.55
-------------------------------------------------------------------------

Segment Leq : 46.55 dBA

Results segment # 2: Borris Rd2 (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.36 + 0.00) = 58.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64     90   0.66  64.89   0.00  -4.75  -1.78   0.00   0.00   0.00
58.36
-------------------------------------------------------------------------
--

Segment Leq : 58.36 dBA

Results segment # 3: PC (night)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.87 + 0.00) = 51.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     53   0.66  58.16   0.00  -4.24  -2.05   0.00   0.00   0.00
51.87
-------------------------------------------------------------------------
--

Segment Leq : 51.87 dBA

Total Leq All Segments: 59.47 dBA
```

```
RT/Custom data, segment # 1: BRT EW (day/night)
-----------------------------------------------
1 - Bus:
Traffic volume    :   191/67    veh/TimePeriod
Speed             :    80 km/h

Data for Segment # 1: BRT EW (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  27.00 / 27.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: BRT EW (day)
---------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 53.72 + 0.00) = 53.72 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.66  59.41  -4.24  -1.46   0.00   0.00   0.00  53.72
-------------------------------------------------------------------------

Segment Leq : 53.72 dBA

Total Leq All Segments: 53.72 dBA


Results segment # 1: BRT EW (night)
-----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 52.18 + 0.00) = 52.18 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.66  57.87  -4.24  -1.46   0.00   0.00   0.00  52.18
-------------------------------------------------------------------------

Segment Leq : 52.18 dBA

Total Leq All Segments: 52.18 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.26
                           (NIGHT): 60.21
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-10-2022 16:38:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Prop Min Col (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    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):   8000
    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: Prop Min Col (day/night)
-----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Road data, segment # 2: Borris Rd (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  :    80 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: Borris Rd (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  28.00 / 28.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Prop Min Col (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.29 + 0.00) = 64.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.66  65.75   0.00   0.00  -1.46   0.00   0.00   0.00
64.29
-------------------------------------------------------------------------------
--

Segment Leq : 64.29 dBA


Results segment # 2: Borris Rd (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 66.53 + 0.00) = 66.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.66  72.49   0.00  -4.50  -1.46   0.00   0.00   0.00
66.53
-------------------------------------------------------------------------------
--

Segment Leq : 66.53 dBA
```

```
Total Leq All Segments: 68.56 dBA

Results segment # 1: Prop Min Col (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.70 + 0.00) = 56.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  58.16   0.00   0.00  -1.46   0.00   0.00   0.00
56.70
-------------------------------------------------------------------------
--

Segment Leq : 56.70 dBA


Results segment # 2: Borris Rd (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.93 + 0.00) = 58.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  64.89   0.00  -4.50  -1.46   0.00   0.00   0.00
58.93
-------------------------------------------------------------------------
--

Segment Leq : 58.93 dBA

Total Leq All Segments: 60.97 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 68.56
                           (NIGHT): 60.97
```

```
STAMSON 5.0         NORMAL REPORT         Date: 17-10-2022 16:38:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Prop Min Col (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    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):   8000
    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: Prop Min Col (day/night)
-----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Prop Min Col (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.29 + 0.00) = 64.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.66  65.75   0.00   0.00  -1.46   0.00   0.00   0.00
64.29
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 64.29 dBA

Total Leq All Segments: 64.29 dBA

Results segment # 1: Prop Min Col (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.70 + 0.00) = 56.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  58.16   0.00   0.00  -1.46   0.00   0.00   0.00
56.70
-------------------------------------------------------------------------
--

Segment Leq : 56.70 dBA

Total Leq All Segments: 56.70 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 64.29
                           (NIGHT): 56.70
```

```
STAMSON 5.0         NORMAL REPORT         Date: 17-10-2022 16:38:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Prop Min Col (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    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):   8000
    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: Prop Min Col (day/night)
-----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  22.00 / 22.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Prop Min Col (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.53 + 0.00) = 61.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.66  65.75   0.00  -2.76  -1.46   0.00   0.00   0.00
61.53
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 61.53 dBA

Total Leq All Segments: 61.53 dBA

Results segment # 1: Prop Min Col (night)
------------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.94 + 0.00) = 53.94 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.66  58.16   0.00  -2.76  -1.46   0.00   0.00   0.00
53.94
-------------------------------------------------------------------------------
--

Segment Leq : 53.94 dBA

Total Leq All Segments: 53.94 dBA

RT/Custom data, segment # 1: BRT1 (day/night)
-----------------------------------------------
1 - Bus:
Traffic volume    :   191/67    veh/TimePeriod
Speed             :    80 km/h

Data for Segment # 1: BRT1 (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   57.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

RT/Custom data, segment # 2: BRT2 (day/night)
-----------------------------------------------
1 - Bus:
Traffic volume    :   191/67    veh/TimePeriod
Speed             :    80 km/h

Data for Segment # 2: BRT2 (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   -35.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  22.00 / 22.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00
```

Results segment # 1: BRT1 (day)

Source height = 0.50 m

RT/Custom (0.00 + 57.47 + 0.00) = 57.47 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	57	0.66	59.41	0.00	-1.94	0.00	0.00	0.00	57.47

Segment Leq : 57.47 dBA

Results segment # 2: BRT2 (day)

Source height = 0.50 m

RT/Custom (0.00 + 48.98 + 0.00) = 48.98 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-35	0.66	59.41	-2.76	-7.67	0.00	0.00	0.00	48.98

Segment Leq : 48.98 dBA

Total Leq All Segments: 58.05 dBA

Results segment # 1: BRT1 (night)

Source height = 0.50 m

RT/Custom (0.00 + 55.93 + 0.00) = 55.93 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	57	0.66	57.87	0.00	-1.94	0.00	0.00	0.00	55.93

Segment Leq : 55.93 dBA

```
Results segment # 2: BRT2 (night)
---------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 47.44 + 0.00) = 47.44 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90    -35   0.66  57.87  -2.76  -7.67   0.00   0.00   0.00  47.44
-------------------------------------------------------------------------

Segment Leq : 47.44 dBA

Total Leq All Segments: 56.51 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 63.14
                           (NIGHT): 58.42
```

```
STAMSON 5.0         NORMAL REPORT         Date: 17-10-2022 16:38:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Prop Min Col (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    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):   8000
    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: Prop Min Col (day/night)
-----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  19.00 / 19.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Prop Min Col (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.59 + 0.00) = 62.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.66  65.75   0.00  -1.70  -1.46   0.00   0.00   0.00
62.59
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 62.59 dBA

Total Leq All Segments: 62.59 dBA

Results segment # 1: Prop Min Col (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.00 + 0.00) = 55.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  58.16   0.00  -1.70  -1.46   0.00   0.00   0.00
55.00
-------------------------------------------------------------------------
--

Segment Leq : 55.00 dBA

Total Leq All Segments: 55.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 62.59
                           (NIGHT): 55.00
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-10-2022 16:39:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Borris Rd (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  :    80 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: Borris Rd (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  27.00 / 27.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Borris Rd (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 66.79 + 0.00) = 66.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.66  72.49   0.00  -4.24  -1.46   0.00   0.00   0.00
66.79
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 66.79 dBA

Total Leq All Segments: 66.79 dBA

Results segment # 1: Borris Rd (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.20 + 0.00) = 59.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  64.89   0.00  -4.24  -1.46   0.00   0.00   0.00
59.20
-------------------------------------------------------------------------
--

Segment Leq : 59.20 dBA

Total Leq All Segments: 59.20 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 66.79
                           (NIGHT): 59.20
```