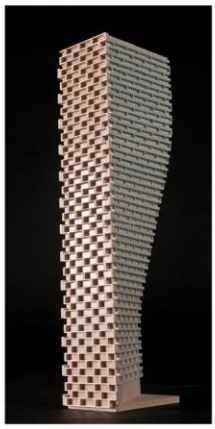
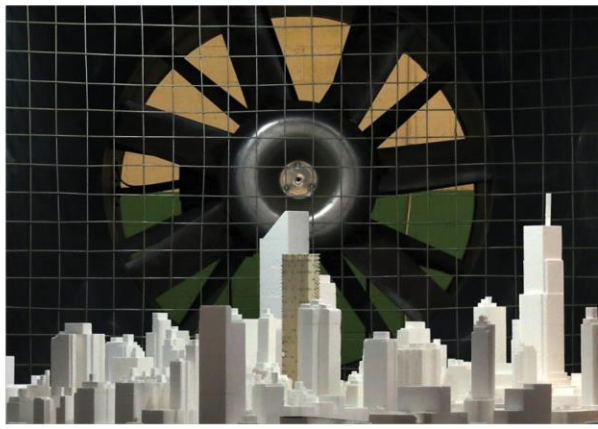
GRADIENTWIND
ENGINEERS & SCIENTISTS

TRAFFIC NOISE FEASIBILITY ASSESSMENT

Kanata North Development
936 March Road
Kanata, Ontario

REPORT: 18-149 – Traffic Noise Feasibility R3





April 17, 2020

PREPARED FOR

Minto Communities – Canada
Attn: Beth Henderson
Senior Land Development Manager
200-180 Kent Street
Ottawa, Ontario
K1P 0B6

PREPARED BY

Giuseppe Garro, MASc., Junior Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This document describes a roadway traffic noise feasibility assessment performed in support of Zoning By-Law Amendment (ZBA) and Draft Plan of Subdivision Approval (DPA) applications for a proposed residential subdivision development located at 936 March Road in Kanata, Ontario. The study site is situated near the northeast corner of March Road and Maxwell Bridge Road in Kanata, Ontario. The assessment analyzes road traffic noise impacts on the development to ensure that future occupants are afforded comfortable use of the outdoor and indoor living spaces, as directed by the City of Ottawa's Environmental Noise Control Guidelines (ENCG).

The proposed development is near a segment of March Road north of Maxwell Bridge Road. The site is bordered by future commercial development (by others) to the west, future proposed residential land to the north, an abandoned railway corridor to the east, and existing residential land to the south. The development will be comprised of single-family homes, townhomes, and a school site. The development will include creation of new residential streets and a collector feeding into the subdivision from March Road. Features of the community also include parks as well as a storm water retention pond and woodlot east of the abandoned rail corridor. The major sources of roadway noise affecting the development are the internal minor collectors, Street No. 1 and No. 2, which are identified on Schedule E of the City of Ottawa's Official Plan (OP).

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 ENCG; (iii) future vehicular traffic volumes based on the City of Ottawa's OP roadway classifications; and (iv) a draft plan of subdivision drawing provided by Minto Communities in April of 2020. As the site plan may be subject to change, the approach undertaken in this feasibility study is to establish noise contours around the site without the consideration of site massing. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control would be required for various areas on site.

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 48 and 63 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Street No. 1 and Street No. 2.

Results of the roadway traffic noise calculations also indicate that outdoor living areas bordering and having direct exposure to Street No. 1 and Street No. 2 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. The results also indicate that dwellings bordering the collector will possibly require internal ventilation such as forced air heating with provisions for central air conditioning. A detailed roadway traffic noise study will be required at the time of subdivision registration to determine specific noise control measures for the development. Anticipated locations for barriers are identified in Figures 4 and 5.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Minto Communities - Canada to undertake a roadway traffic noise feasibility assessment of the proposed Kanata residential subdivision located at 936 March Road in Kanata, Ontario. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment and was prepared in consideration of the client's draft plan of subdivision application. Gradient Wind's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic. The report also quantitatively addresses any potential noise impact mitigation measures. 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] (MECP) guidelines. Noise calculations were based on a draft plan of subdivision drawing provided by Minto Communities, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is a proposed subdivision located at 936 March Road, in proximity to where the roadway intersects with Maxwell Bridge Road and Halton Terrace in Kanata, Ontario. The site is bordered by future commercial development (by others) to the west, future potential residential land to the north, an abandoned railway corridor to the east, and existing residential land to the south. The development will comprise of single family homes, townhomes, and a school site. The development will include creation of new residential streets and a collector feeding into the subdivision from March Road. The community will also include communal parks and a storm water retention pond and woodlot east of the abandoned rail corridor.

The major sources of roadway noise affecting the development are the internal minor collectors, Street No. 1 and No. 2, as identified on Schedule E of the City of Ottawa's OP. March Road (an arterial roadway) is located along the west perimeter of the site. Since March Road is situated more than 100 metres (m) from the site, it is considered an insignificant source of traffic noise. As per the community design plan, the

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

abandoned rail corridor will be converted into a recreation pathway and is not considered to be a significant source of noise. Figure 1 illustrates the site location with surrounding context.

Due to the current state of the development, the final site configuration is uncertain and may be subject to change. Therefore, the approach undertaken in this feasibility assessment was to establish noise contours around the site as per the current plans, however site massing was not considered.

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 were based on a draft plan of subdivision drawing provided by Minto Communities, with future traffic volumes corresponding to the City of Ottawa's 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 vehicle 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 Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. As per the ENCG, OLAs do not need to be considered during the nighttime period.

Predicted noise levels at the outdoor living area 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 detailed noise study.

4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs: Predictor-Lima and STAMSON 5.04. 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. Although this program outputs noise contours, it is not the approved model for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the MECP computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as shown in Figures 2 and 3. Receptor distances and exposure angles are also illustrated in Figures 2 and 3. 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, 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.
- Absorptive ground surface between sources and receivers.
- The study site was treated as having flat or gently sloping topography.
- No massing considered as potential noise screening elements.
- Six receptors were strategically placed throughout the study area.

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 OP and Transportation Master Plan[3] (TMP) which provides 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 1 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 1: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Street No. 1	2-Lane Urban Collector (2-UCU)	40	**8,000**
Street No. 2	2-Lane Urban Collector (2-UCU)	40	**8,000**

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 5. 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

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

5.04, as shown in Figures 2 and 3, and summarized in Table 2 below. Receptors 1-3 and 6 are located in the central section of the site, Receptor 4 toward the north, and Receptor 5 toward the west. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROAD 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 – Lot 207	60	60
2	1.5	OLA – Grade Level – Block 495	61	61
3	1.5	OLA – Grade Level – Block 506	63	62
4	1.5	OLA – Grade Level – Lot 107	59	59
5	1.5	OLA – Grade Level – Communal Park	49	52
6	1.5	OLA – Grade Level – Communal Park	48	52

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 of less than 3 dBA. As stated in Section 4.3.1, no massing of proposed buildings was considered as potential screening elements. Results of the roadway traffic noise calculations also indicate that outdoor living areas (Receptors 1-4) on lots/blocks adjacent to and having direct exposure to the proposed minor collector (Street No. 1 and 2) will likely require noise control measures.

According to Table 2, the lots orientated east/west toward the west of the site, and lots oriented north/south toward the north of the site will likely require noise barriers along the edge of the rear yards which border the proposed minor collectors. The potential locations of the noise barriers for the affected lots/blocks are presented in Figures 4 and 5. Massing elements (houses / townhomes) along the edge of the minor collectors are expected block direct line of sight of the roadways at a majority of OLA and act as noise barriers, reducing the sound experienced at the lots situated further away.

Furthermore, due to the proposed minor collectors travelling through the development, dwellings bordering the collectors will possibly require internal ventilation such as forced air heating with provisions for central air conditioning. A summary of possible mitigation measures are described in Section 5.2, with the aim to reduce the L_{eq} at the OLA 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.

5.2 Noise Control Measures

The OLA 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. 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

Examining the noise control measures listed above, these conclusions consider the possibility that not all of the proposed buildings will be oriented to provide screening elements for their OLA against roadway traffic sources. Distance setback, insertion of non-noise sensitive land uses, and building orientation to provide sheltered zones in rear yards may not be feasible due to the requirements of the Community Development Plan. It is also not feasible to have shared outdoor amenity areas for this development with respect to rear yards, as this would have a significant impact on marketability. Therefore, the most feasible measures are insertion of earth berms or acoustic wall barriers between the sensitive rear yards and sources of noise, as mentioned in Section 5.1. By siding lots along the collector roadway, the extent of barriers are minimized. The use of earth berms or acoustic barriers will depend on the grading plan when it becomes available. Both options have the ability to reduce OLA noise levels to below 55 dBA.

Regarding Figure 6, the area(s) with noise levels under 55 dBA (yellow and light orange) have no mitigation requirements. The area(s) with noise levels between 55 and 60 dBA (orange) may require forced air heating with provision for central air conditioning.

6. CONCLUSIONS AND RECOMMENDATIONS

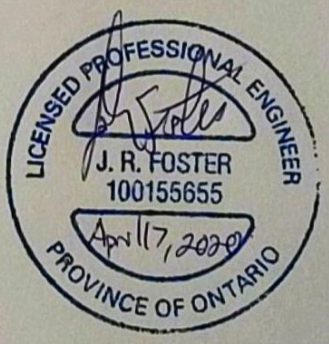
The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 48 and 63 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Street No. 1 and Street No. 2.

Results of the roadway traffic noise calculations also indicate that outdoor living areas bordering and having direct exposure to minor collector (Street No. 1 and Street No. 2) 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. The results also indicate that dwellings bordering the collectors will possibly require internal ventilation such as forced air heating with provisions for central air conditioning. 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 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,

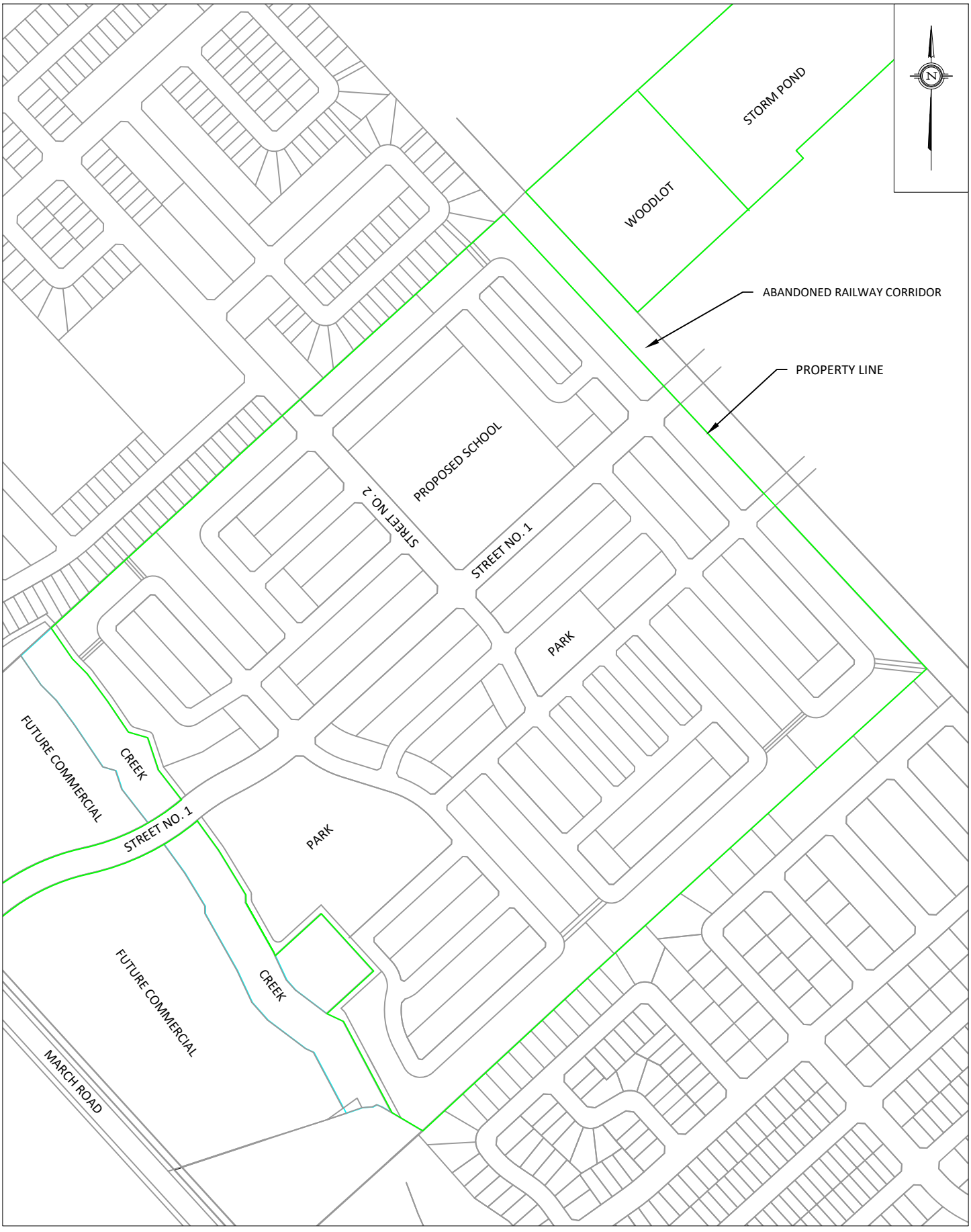
Gradient Wind Engineering Inc.



Giuseppe Garro, MASc.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #18-149 – Traffic Noise Feasibility R3

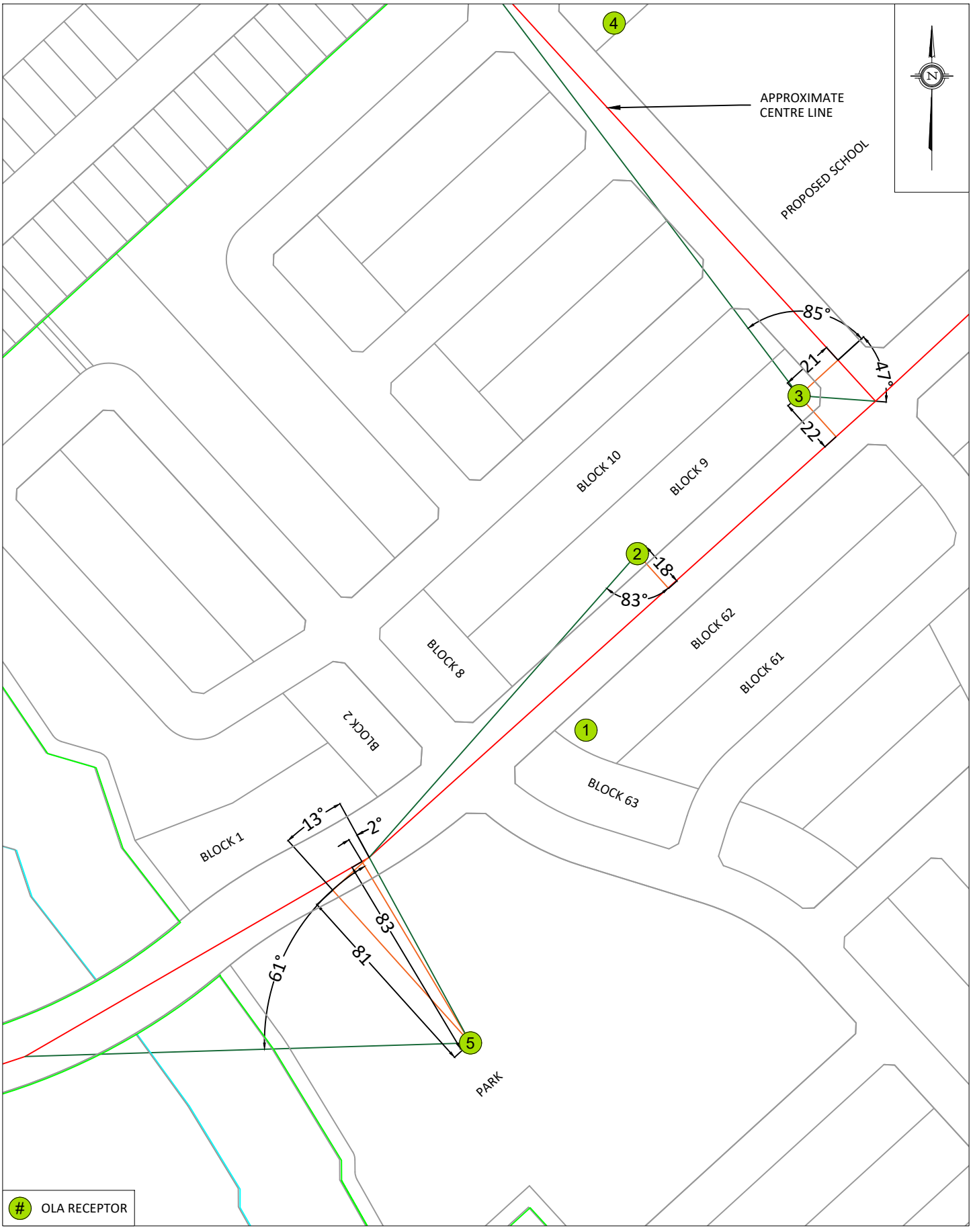


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	936 MARCH ROAD - TRAFFIC NOISE FEASIBILITY STUDY
SCALE	1: 5000 (APPROX.)
DRAWING NO.	GW18-149-1
DATE	APRIL 16, 2020
DRAWN BY	G.G.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

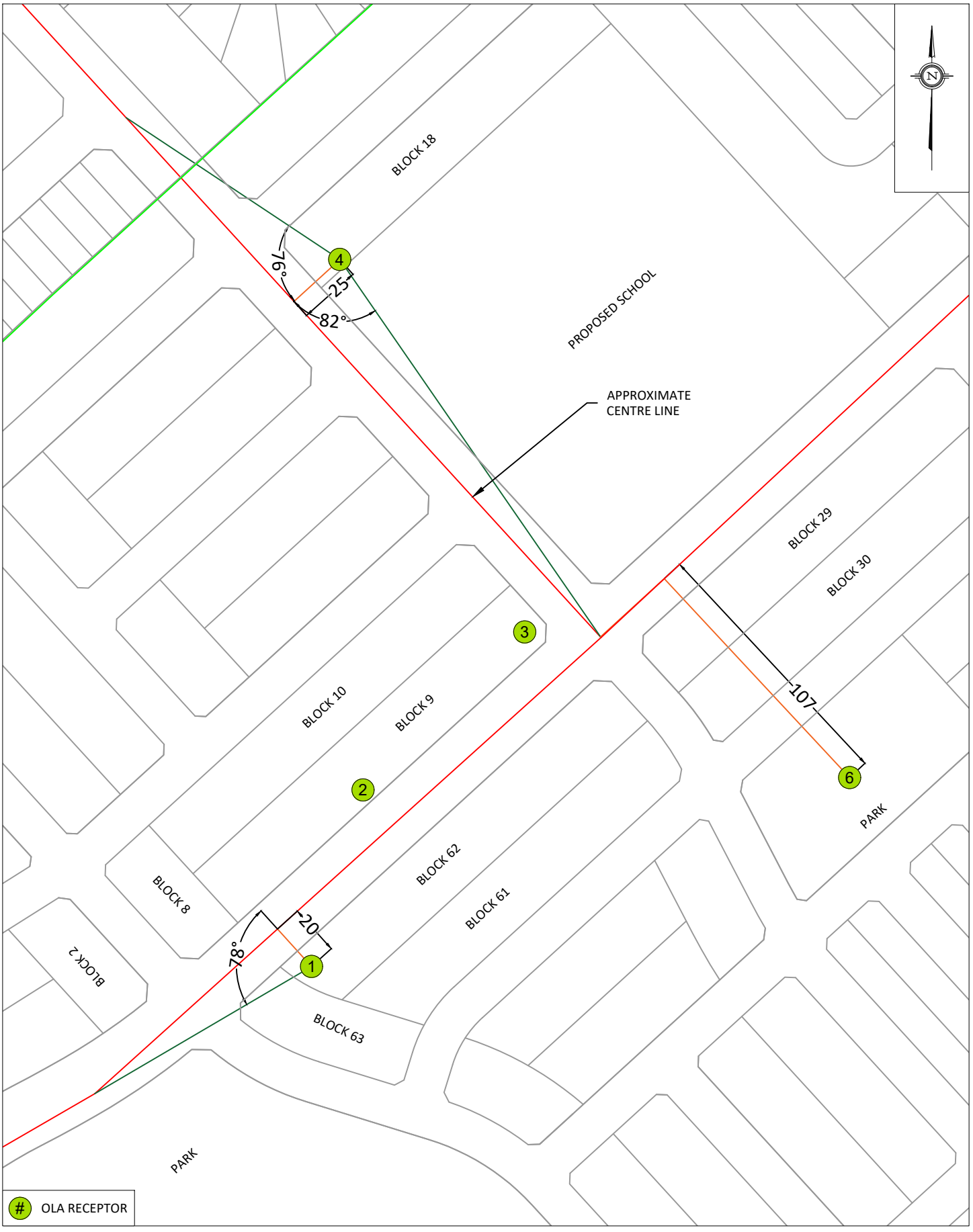


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	936 MARCH ROAD- TRAFFIC NOISE FEASIBILITY STUDY		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW18-149-2
DATE	APRIL 16, 2020	DRAWN BY	G.G.

DESCRIPTION

FIGURE 2:
RECEPTOR 2, 3 AND 5 STAMSON INPUT PARAMETERS

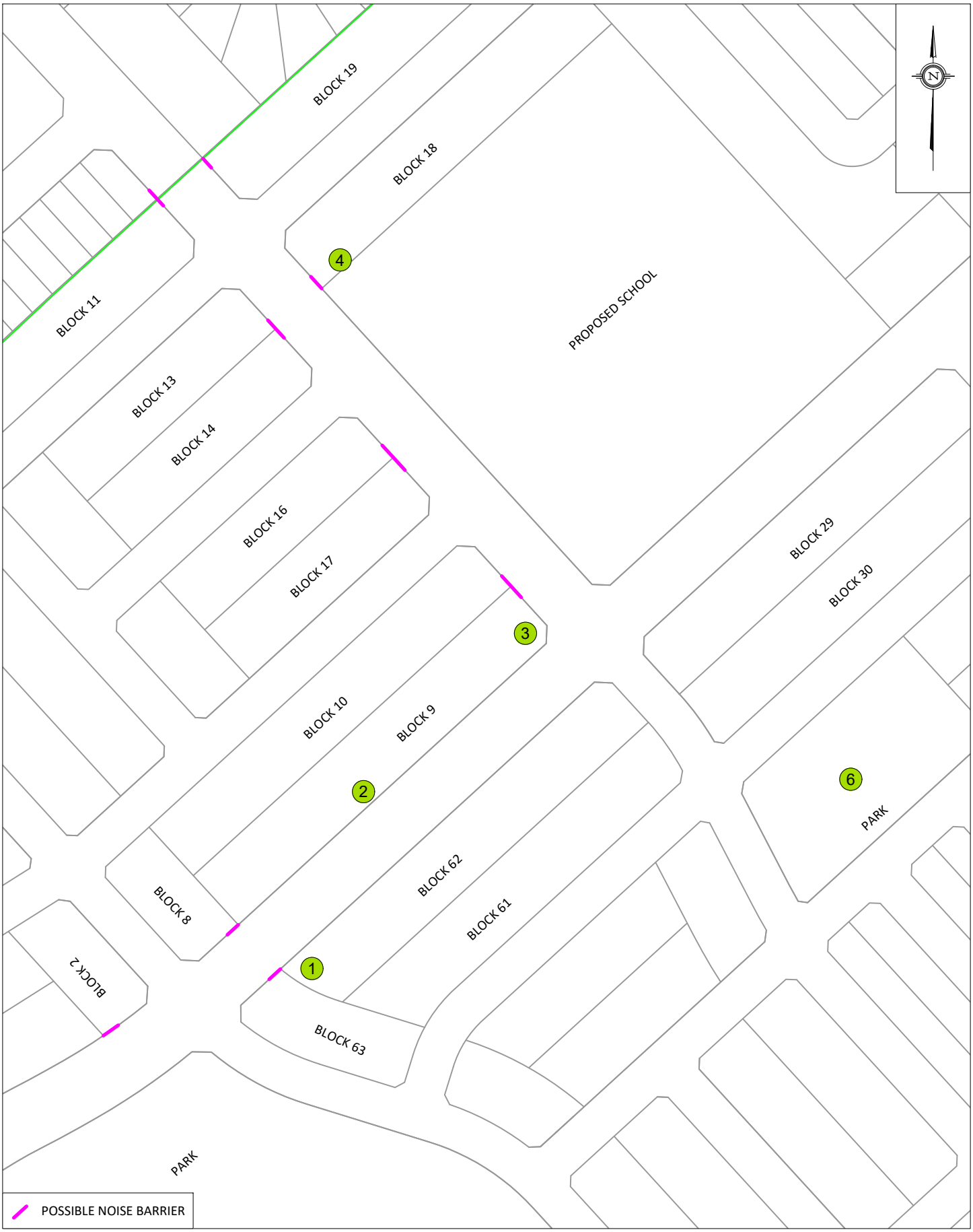


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	936 MARCH ROAD- TRAFFIC NOISE FEASIBILITY STUDY		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW18-149-3
DATE	APRIL 16, 2020	DRAWN BY	G.G.

DESCRIPTION

FIGURE 3:
RECEPTOR 1, 4 AND 6 STAMSON INPUT PARAMETERS



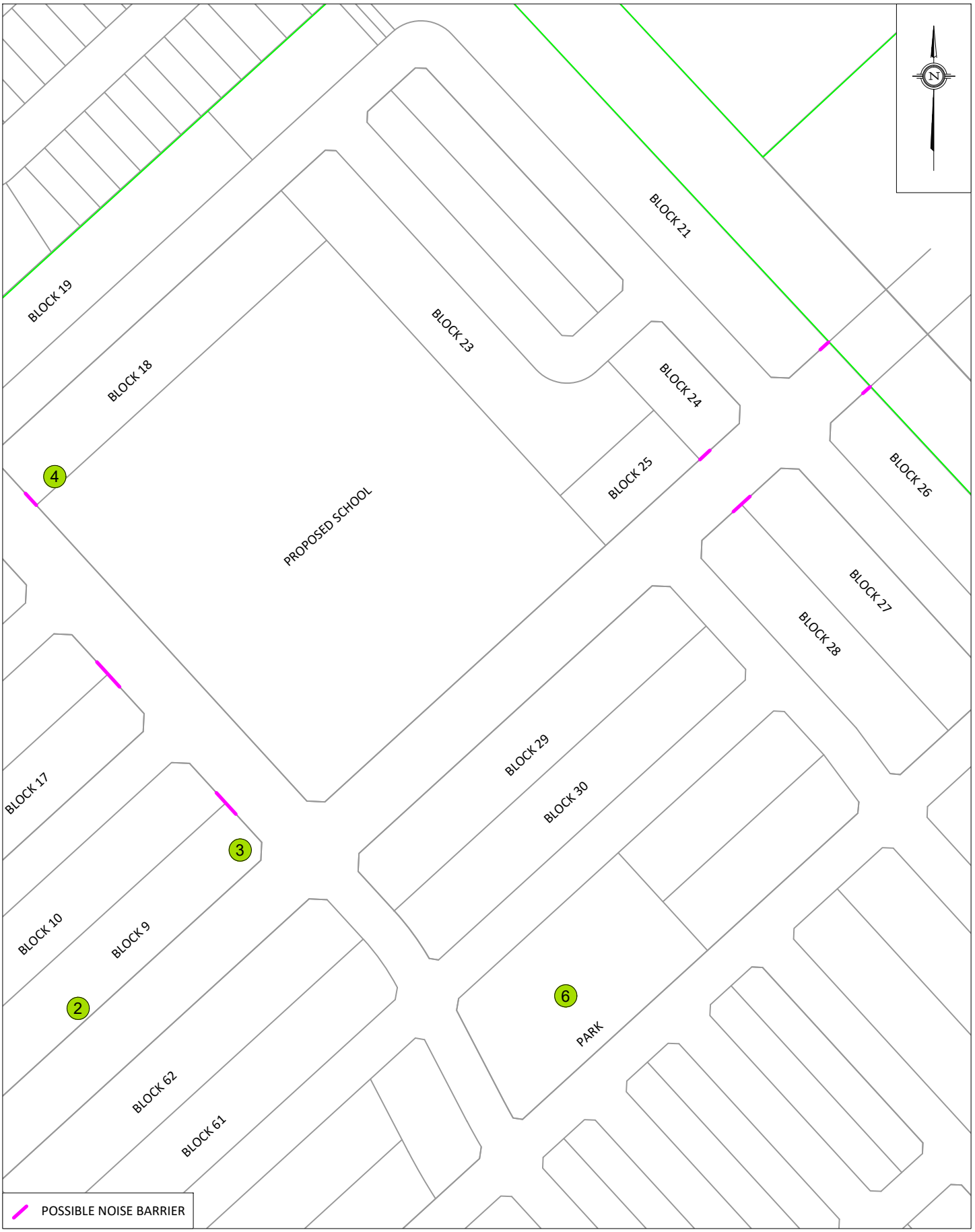
GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	936 MARCH ROAD- TRAFFIC NOISE FEASIBILITY STUDY		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW18-149-4
DATE	APRIL 16, 2020	DRAWN BY	G.G.

DESCRIPTION

FIGURE 4:
POSSIBLE NOISE BARRIER LOCATIONS



GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	936 MARCH ROAD- TRAFFIC NOISE FEASIBILITY STUDY		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW18-149-5
DATE	APRIL 16, 2020	DRAWN BY	G.G.

DESCRIPTION

FIGURE 5:
POSSIBLE NOISE BARRIER LOCATIONS

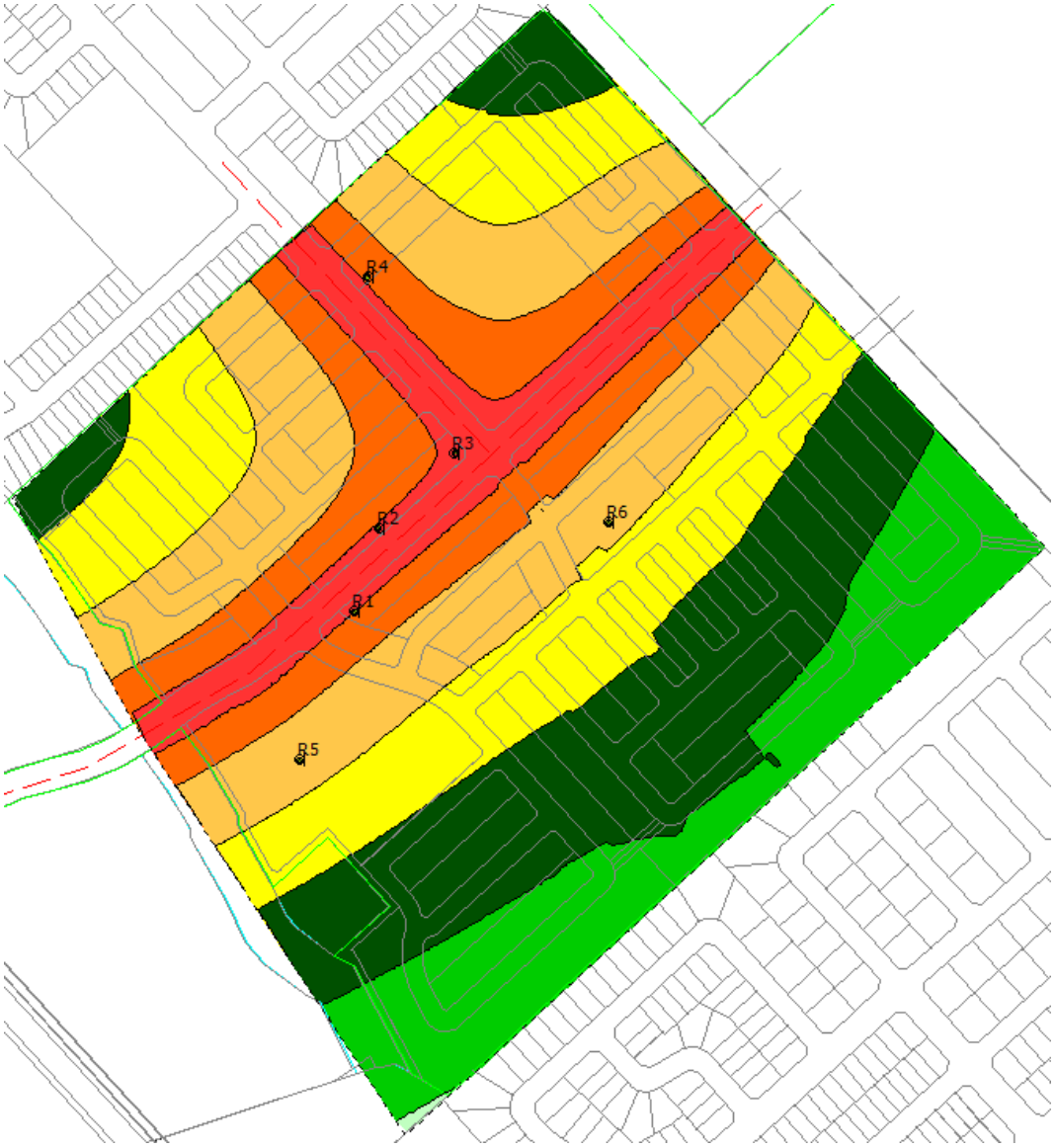


FIGURE 6: GROUND LEVEL NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD)

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: 16-04-2020 12:31:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 1 (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  :    40 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: St No 1 (day/night)
-----------------------------------------
Angle1   Angle2           : -78.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  20.00 / 20.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.34 + 0.00) = 60.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -78     90    0.66  63.96   0.00  -2.07  -1.54   0.00   0.00   0.00
60.34
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 60.34 dBA

Total Leq All Segments: 60.34 dBA

Results segment # 1: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.74 + 0.00) = 52.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -78     90   0.66  56.36   0.00  -2.07  -1.54   0.00   0.00   0.00
52.74
-------------------------------------------------------------------------
--

Segment Leq : 52.74 dBA

Total Leq All Segments: 52.74 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.34
                           (NIGHT): 52.74
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-04-2020 12:31:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 1 (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  :    40 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: St No 1 (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   83.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  18.00 / 18.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.15 + 0.00) = 61.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     83    0.66  63.96   0.00  -1.31  -1.49   0.00   0.00   0.00
61.15
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 61.15 dBA

Total Leq All Segments: 61.15 dBA

Results segment # 1: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.56 + 0.00) = 53.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     83   0.66  56.36   0.00  -1.31  -1.49   0.00   0.00   0.00
53.56
-------------------------------------------------------------------------
--

Segment Leq : 53.56 dBA

Total Leq All Segments: 53.56 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 61.15
                           (NIGHT): 53.56
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-04-2020 12:31:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 1 (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  :    40 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: St No 1 (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

Road data, segment # 2: St No 2 (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  :    40 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 # 2: St No 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -85.00 deg   47.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  21.00 / 21.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.74 + 0.00) = 59.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.66  63.96   0.00  -2.76  -1.46   0.00   0.00   0.00
59.74
-------------------------------------------------------------------------------
--

Segment Leq : 59.74 dBA

Results segment # 2: St No 2 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.28 + 0.00) = 59.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -85     47   0.66  63.96   0.00  -2.43  -2.25   0.00   0.00   0.00
59.28
-------------------------------------------------------------------------------
--

Segment Leq : 59.28 dBA

Total Leq All Segments: 62.53 dBA
```

```
Results segment # 1: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.14 + 0.00) = 52.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  56.36   0.00  -2.76  -1.46   0.00   0.00   0.00
52.14
-------------------------------------------------------------------------
--

Segment Leq : 52.14 dBA

Results segment # 2: St No 2 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.69 + 0.00) = 51.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -85     47   0.66  56.36   0.00  -2.43  -2.25   0.00   0.00   0.00
51.69
-------------------------------------------------------------------------
--

Segment Leq : 51.69 dBA

Total Leq All Segments: 54.93 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 62.53
                           (NIGHT): 54.93
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2019 10:19:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 2 (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  :    40 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: St No 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -82.00 deg   76.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  25.00 / 25.00  m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 2 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.66 + 0.00) = 58.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -82     76   0.66  63.96   0.00  -3.68  -1.62   0.00   0.00   0.00
58.66
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 58.66 dBA

Total Leq All Segments: 58.66 dBA

Results segment # 1: St No 2 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.39 + 0.00) = 51.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -82     76   0.57  56.36   0.00  -3.48  -1.49   0.00   0.00   0.00
51.39
-------------------------------------------------------------------------
--

Segment Leq : 51.39 dBA

Total Leq All Segments: 51.39 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.66
                           (NIGHT): 51.39
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-04-2020 12:32:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 1 (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  :    40 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: St No 1 (day/night)
----------------------------------------
Angle1   Angle2           : -61.00 deg   2.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  81.00 / 81.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: St No 1 (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  :    40 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 # 2: St No 1 (day/night)
-----------------------------------------
Angle1   Angle2           :  13.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  83.00 / 83.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.68 + 0.00) = 46.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -61      2   0.66  63.96   0.00 -12.16  -5.12   0.00   0.00   0.00
46.68
-------------------------------------------------------------------------------
--

Segment Leq : 46.68 dBA

Results segment # 2: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.18 + 0.00) = 46.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    13     90   0.66  63.96   0.00 -12.33  -5.44   0.00   0.00   0.00
46.18
-------------------------------------------------------------------------------
--

Segment Leq : 46.18 dBA

Total Leq All Segments: 49.45 dBA
```

```
Results segment # 1: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 39.08 + 0.00) = 39.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -61      2   0.66  56.36   0.00 -12.16  -5.12   0.00   0.00   0.00
39.08
-------------------------------------------------------------------------
--

Segment Leq : 39.08 dBA

Results segment # 2: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 38.59 + 0.00) = 38.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    13     90   0.66  56.36   0.00 -12.33  -5.44   0.00   0.00   0.00
38.59
-------------------------------------------------------------------------
--

Segment Leq : 38.59 dBA

Total Leq All Segments: 41.85 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 49.45
                           (NIGHT): 41.85
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-04-2020 12:32:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: St No 1 (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  :    40 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: St No 1 (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  : 107.00 / 107.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: St No 1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 48.33 + 0.00) = 48.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.66  63.96   0.00 -14.16  -1.46   0.00   0.00   0.00
48.33
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 48.33 dBA

Total Leq All Segments: 48.33 dBA

Results segment # 1: St No 1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 40.74 + 0.00) = 40.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  56.36   0.00 -14.16  -1.46   0.00   0.00   0.00
40.74
-------------------------------------------------------------------------
--

Segment Leq : 40.74 dBA

Total Leq All Segments: 40.74 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.33
                           (NIGHT): 40.74
```