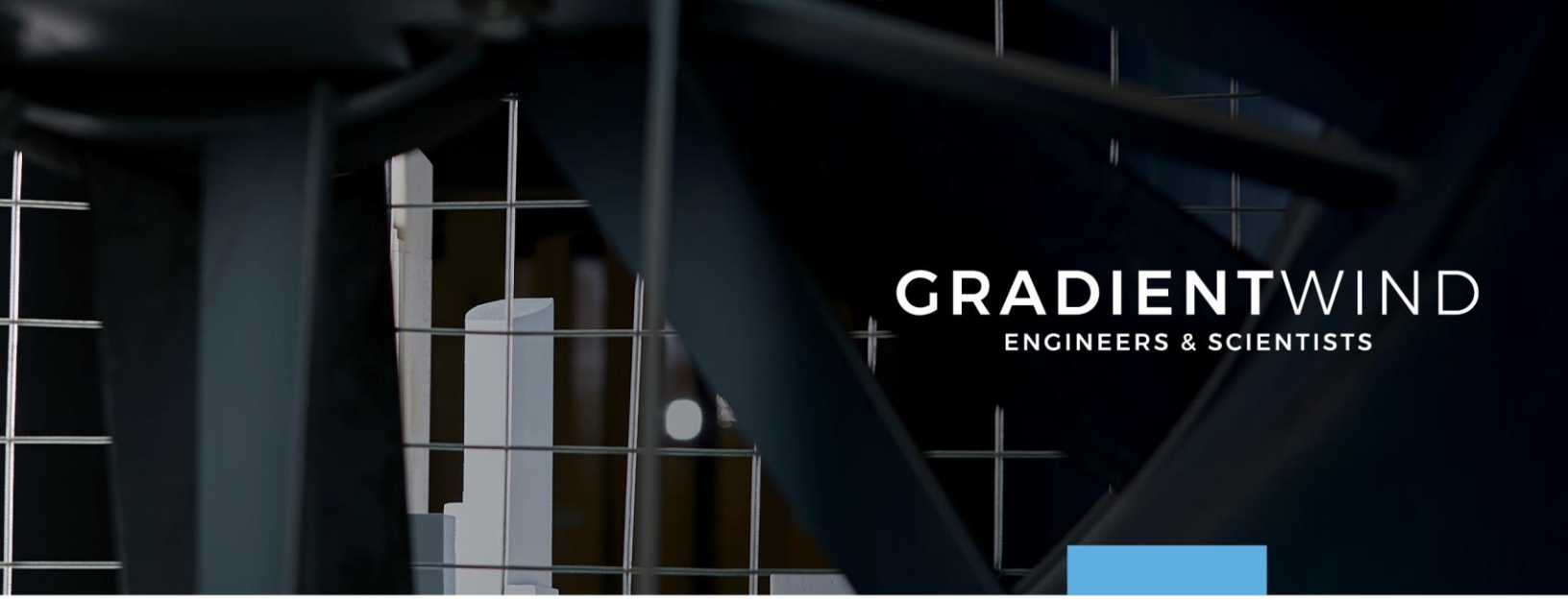

GRADIENTWIND
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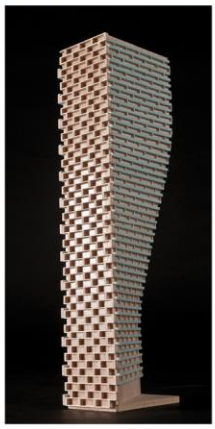
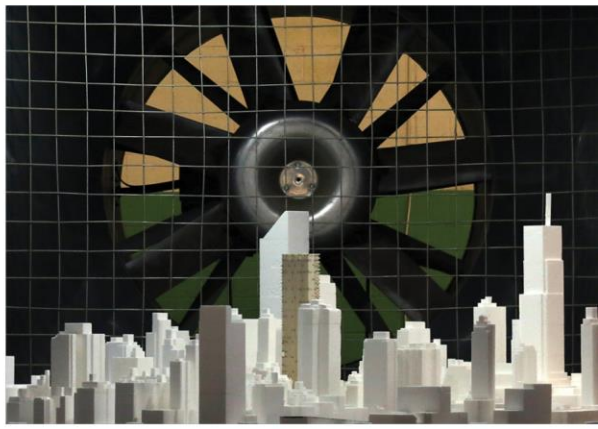
Roadway Traffic Noise Assessment

1083 Merivale Road
Ottawa, Ontario

Report: 22-335 Traffic Noise





November 29, 2022

PREPARED FOR

CSV Architects
190 O'Connor Street, Suite 100
Ottawa, ON K2P 2R3

PREPARED BY

Essraa Alqassab, BASc. Junior Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a traffic noise assessment for a proposed 6-storey development located at 1083 Merivale Road in Ottawa, Ontario. The primary source of roadway traffic noise is Merivale Road. This report also provides commentary on stationary noise impacts from existing surrounding buildings and impacts of the proposed mechanical systems on the surroundings and the development itself. Figure 1 illustrates the site location 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 provided by CSV Architects, dated October 2022.

The results of the current analysis indicate that noise levels will range between 67 and 72 dBA during the daytime period (07:00-23:00) and between 59 and 65 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the west façade which is nearest and most exposed to Merivale Road. Upgraded building components with a higher Sound Transmission Class (STC) will be required where exterior noise exceeds 65 dBA, as detailed in Table 4 and Figure 4.

Results of the calculations also indicate that the proposed development will require central air conditioning, or a similar mechanical system, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. A Type D Warning Clause[1] will also be required on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

With regards to on-site stationary noise impacts, Gradient Wind conducted a survey of the site using aerial imagery and no significant off-site sources of stationary noise were identified. The site is mainly surrounded by low -rise buildings or single-family homes, neither of which act as significant sources of stationary noise. The small rooftop units servicing 1390 Lepage Avenue will be sufficiently attenuated by the setback distances to the study site.

[1] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

In addition, the stationary noise impacts of the building on the surroundings would be considered at a future stage once the mechanical design has progressed and equipment has been selected. Stationary noise sources associated with the development could include rooftop air handling units, cooling towers or dry coolers, and emergency generators. Should noise levels from these units exceed the criteria established in NPC-300, noise from these sources can be controlled to acceptable limits by judicious selection of the equipment, locating the equipment on a high roof away from nearby residential receptors, and where necessary, installing silencers or noise screens.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by CSV Architects to undertake a traffic noise study in support of a Site Plan Control (SPC) application for the proposed 6-storey development located at 1083 Merivale Road in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic and provide commentary on stationary sources.

This assessment is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings provided by CSV Architects, dated October 2022, with future vehicular traffic volumes corresponding to roadway classifications, roadway traffic count data and theoretical roadway capacities.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed 6-storey residential development located at 1083 Merivale Road in Ottawa, Ontario. The study site is bounded by Merivale Road to the west, and low-rise residential buildings or single-family homes in all other directions. The relevant sources of roadway traffic noise considered in this study are Merivale Road and Kirkwood Avenue. Roadways located more than 100 m away from the site are also not considered, as per the ENCG.

The basement of the development includes various types of storage rooms (material storage, freezers, dry goods, etc.), and the electrical and mechanical rooms. Level 1 comprises a multipurpose room, kitchen/lounge area, a resident programs/laundry room, as well as the waste room, oriented west of the floorplan, and office rooms and resident lounge area to the east. Levels 2-6 include residential rooms along the perimeter of the floorplan, incorporating a series of standard rooms and barrier-free rooms.

With regards to on-site stationary noise impacts, Gradient Wind conducted a survey of the site using aerial imagery and no significant off-site sources of stationary noise were identified. The site is mainly surrounded by low-rise residential buildings and single-family dwellings, neither of which are significant

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

sources of stationary noise. The small rooftop equipment on 1390 Lepage Avenue will be sufficiently attenuated by the setback distance.

In addition, the stationary noise impacts of the building on the surroundings would be considered at a future stage once the mechanical design has progressed and equipment have been selected. Stationary noise sources associated with the development could include rooftop air handling units, cooling towers or dry coolers, and emergency generators. Should noise levels from these units exceed the criteria established in NPC-300, noise from these sources can be controlled to acceptable limits by judicious selection of the equipment, locating the equipment on a high roof away from nearby residential receptors, and where necessary, installing silencers or noise screens.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the Ministry of Environment, Conservation and Parks (MECP) NPC-300 guidelines, as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure 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 NPC-300 guidelines specify that the recommended indoor noise limit range (that is relevant to this study) is 40 dBA for sleeping quarters, as listed in Table 1. However, to account for deficiencies in building construction and to control peak noise, this level should be targeted toward 37 dBA.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [3]

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while

[3] Adapted from Table C-2, Part C, Section 3.2.3 of NPC-300

a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which 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[5].

4.2.2 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 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 Class	Speed Limit (km/h)	Traffic Volumes
Merivale Road	4-Lane Urban Arterial Divided (4-UAD)	50	**35,000**
Kirkwood Avenue	4-Lane Urban Arterial Divided (4-UAD)	50	**35,000**

4.2.3 Theoretical Roadway Traffic Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix A includes the STAMSON 5.04 input and output data.

[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[6] Ontario Ministry of Transportation provincial highways traffic volume sheet
[7] Toronto 24hr Traffic Volume Count

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

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks.
- The daytime and night volume split were assumed to be 92% daytime and 10% nighttime.
- The study site was treated as having gently sloping topography
- POW receptors were placed at a height of 16.5m for Level 6.
- Noise receptors were strategically placed at 3 locations around the study area, as illustrated in Figure 2.
- Exposure angles and distances can be seen in Figure 3.
- Due to the site's orientation and position relative to Kirkwood Avenue, the influence of this roadway was considered for Receptor 1 only. The exposure angle and distance to this roadway segment can be seen in Figure 3.

4.2.4 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, brick veneer walls can achieve STC 50 or more. Standard commercially sided exterior metal stud walls have around STC 45. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40, depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

As per Section 4.2, when daytime noise levels from road sources at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[6] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[7], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, which was prepared for site plan approval, detailed floor layouts and building elevations have not been finalized; therefore, detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

[6] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[7] CMHC, Road & Rail Noise: Effects on Housing

5. RESULTS

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. The results indicate that Plane of Window noise levels will range between 67 and 72 dBA during the daytime period (07:00-23:00) and between 59 and 65 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the west façade which is nearest and most exposed to Merivale Road.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Roadway Noise Level (dBA)	
			Day	Night
1	16.5	POW – Level 6 West Façade	72	65
2	16.5	POW – Level 6 North Façade	67	60
3	16.5	POW – Level 6 South Façade	67	59

5.1.1 Noise Control Measures

The noise levels predicted due to traffic noise exceeds the criteria listed in Section 4.2 for building components for the development. As discussed in Section 4.2, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels). As per NPC-300 and ENCG requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 4).

TABLE 4: NOISE CONTROL REQUIREMENTS

Façade	Window STC (Bedroom)	Exterior Wall Minimum STC
West	35	45
North	30	45
South	30	45

The results of the calculations also indicate that the development should be designed with central air conditioning or a similar system, which will allow occupants to keep windows closed and maintain a comfortable living environment. A Type D Warning Clause should be used in all Lease, Purchase and Sale Agreements of the building's units, as summarized in section 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the roadway traffic noise calculations indicate that Plane of Window noise levels will range between 67 and 72 dBA during the daytime period (07:00-23:00) and between 59 and 65 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the west façade which is nearest and most exposed to Merivale Road. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA. The STC requirements can be seen in Table 4 as well as in Figure 4.

Results of the calculations also indicate that the proposed building will require central air conditioning, or a similar mechanical system, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. The following Type D Warning Clause[8] will also be required on all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

> *"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*

With regards to on-site stationary noise impacts, Gradient Wind conducted a survey of the site using aerial imagery and no significant off-site sources of stationary noise were identified. The site is mainly surrounded by low-rise residential buildings and single-family homes, which are not recognized as significant sources of stationary noise. The small rooftop units servicing such buildings will be sufficiently attenuated by the setback distances to the study site.

[8] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

In addition, the stationary noise impacts of the building on the surroundings would be considered at a future stage once the mechanical design has progressed and equipment has been selected. Stationary noise sources associated with the development could include rooftop air handling units, cooling towers or dry coolers, and emergency generators. Should noise levels from these units exceed the criteria established in NPC-300, noise from these sources can be controlled to acceptable limits by judicious selection of the equipment, locating the equipment on a high roof away from nearby residential receptors, and where necessary, installing silencers or noise screens.

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.

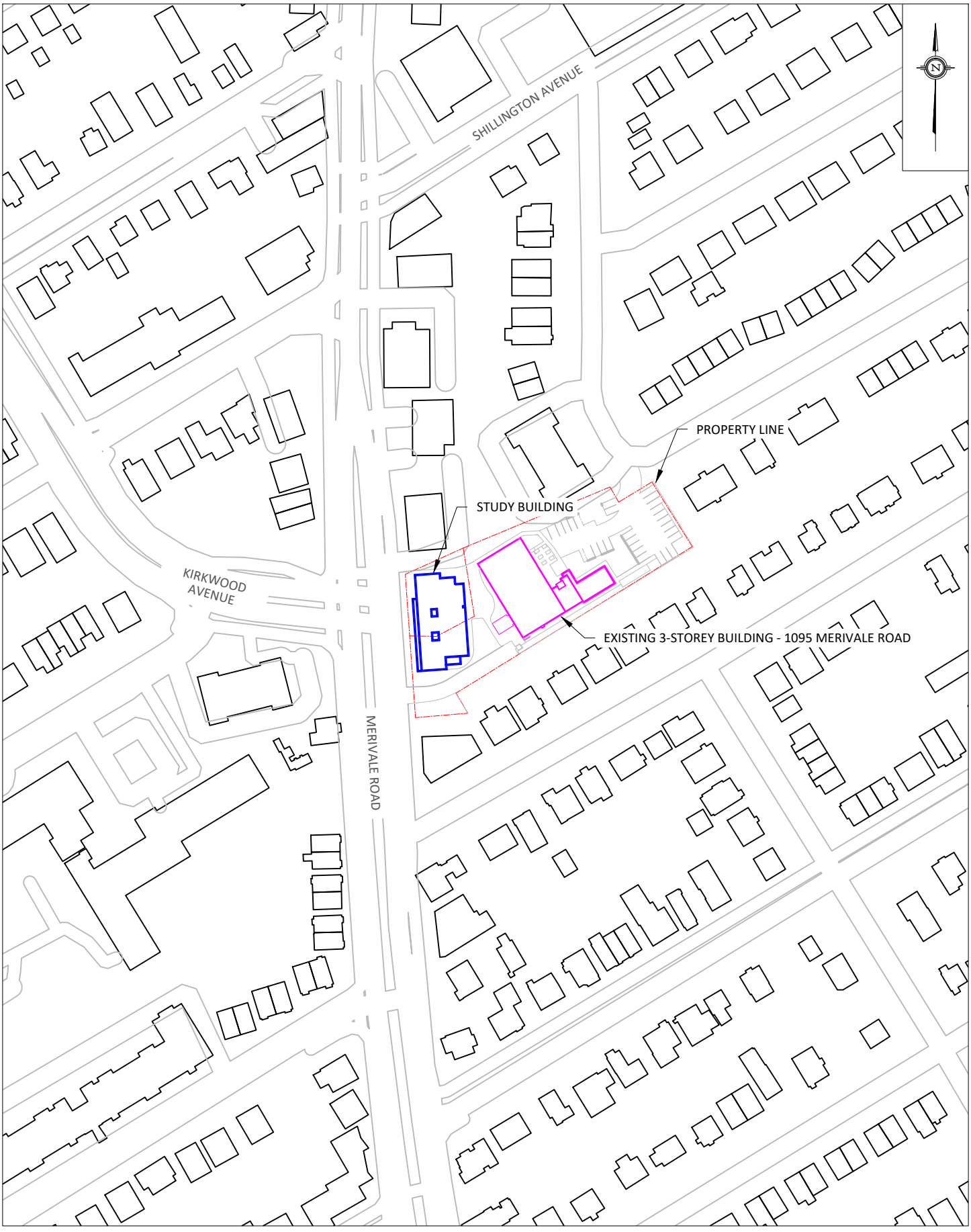
Sincerely,

Gradient Wind Engineering Inc.

Essraa Alqassab, BASc
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #22-335 – Traffic Noise



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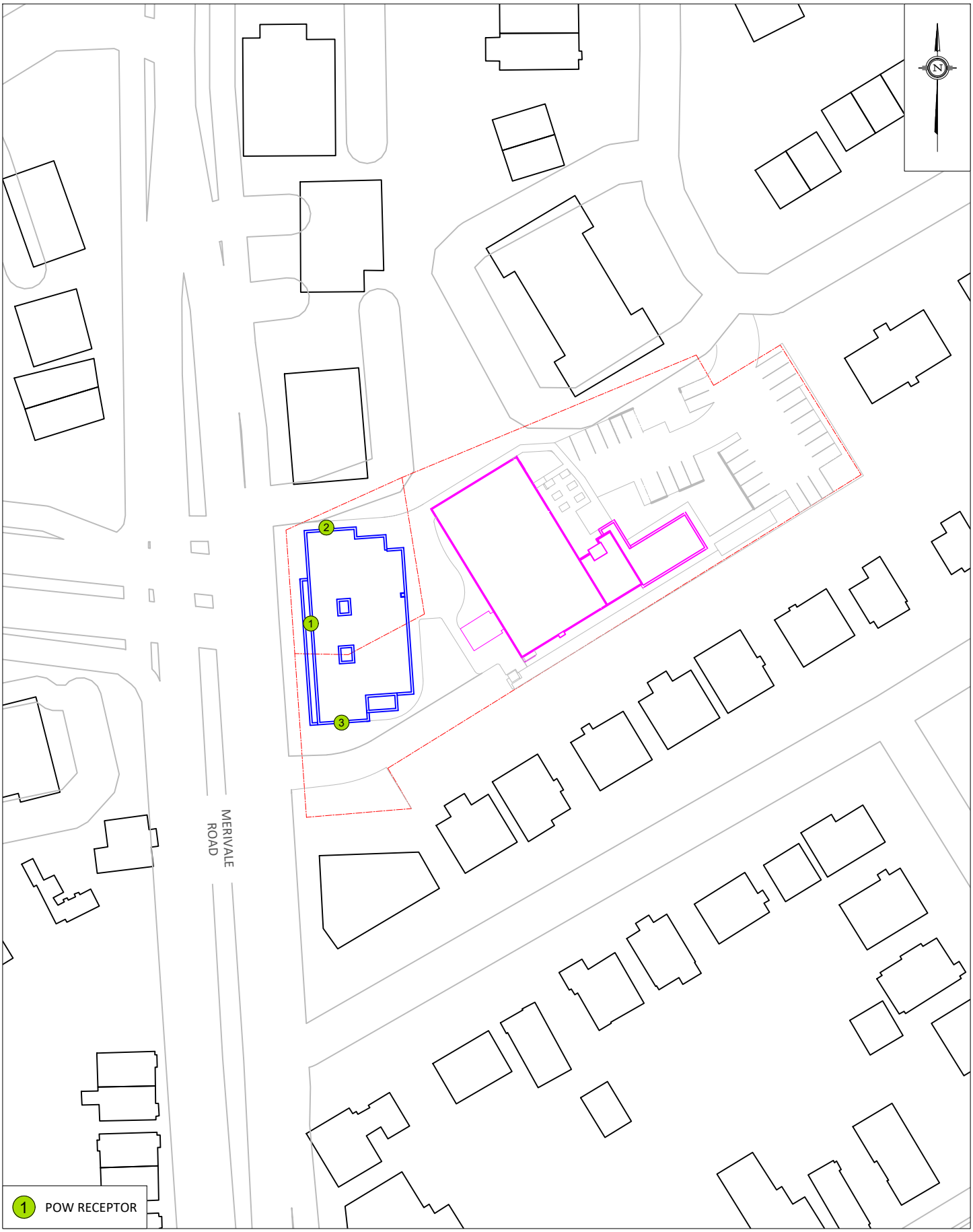
PROJECT	1083 MERIVALE ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW22-335-1
DATE	NOVEMBER 18, 2022
DRAWN BY	E.A.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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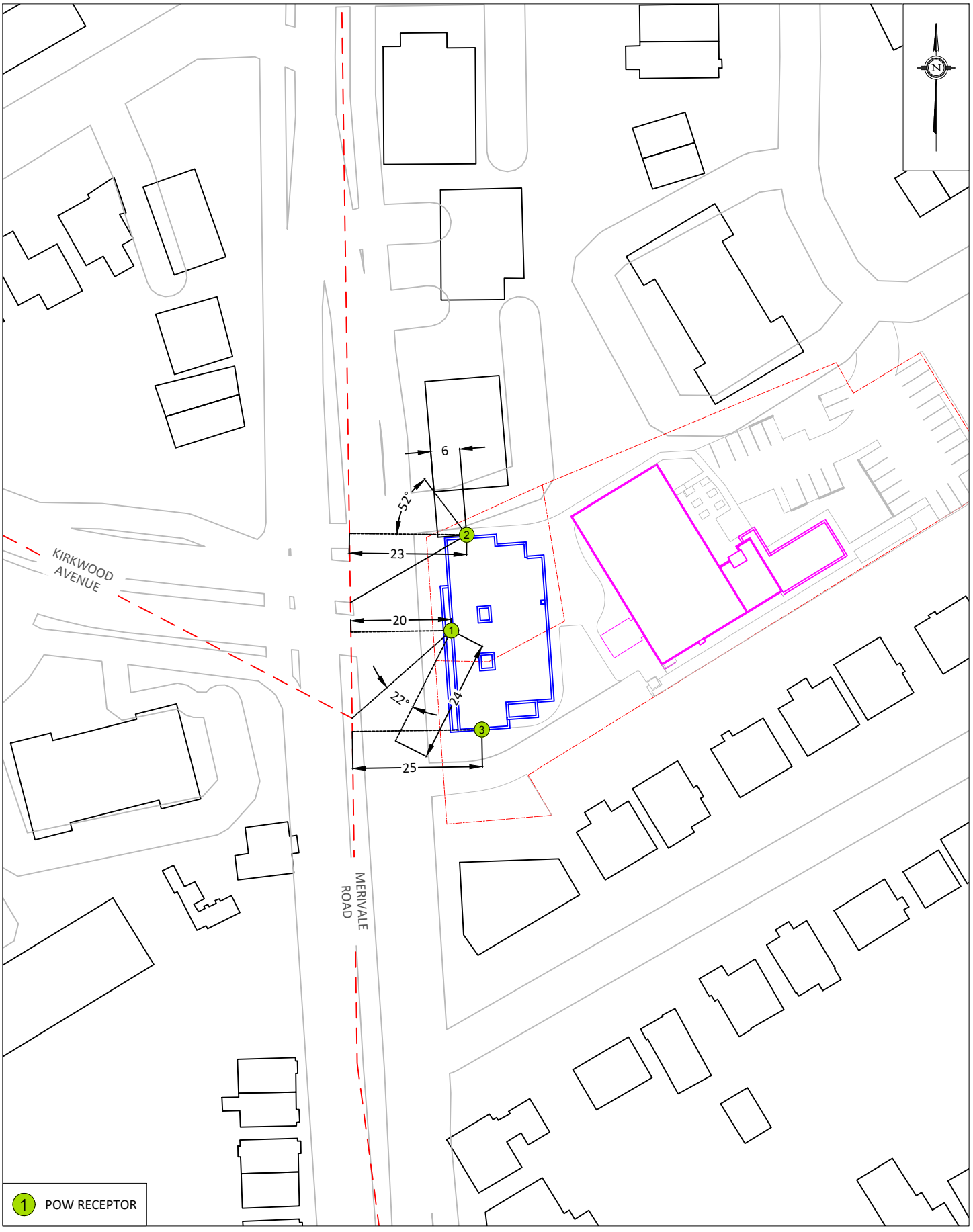
PROJECT	1083 MERIVALE ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW22-335-2
DATE	NOVEMBER 18, 2022
DRAWN BY	E.A.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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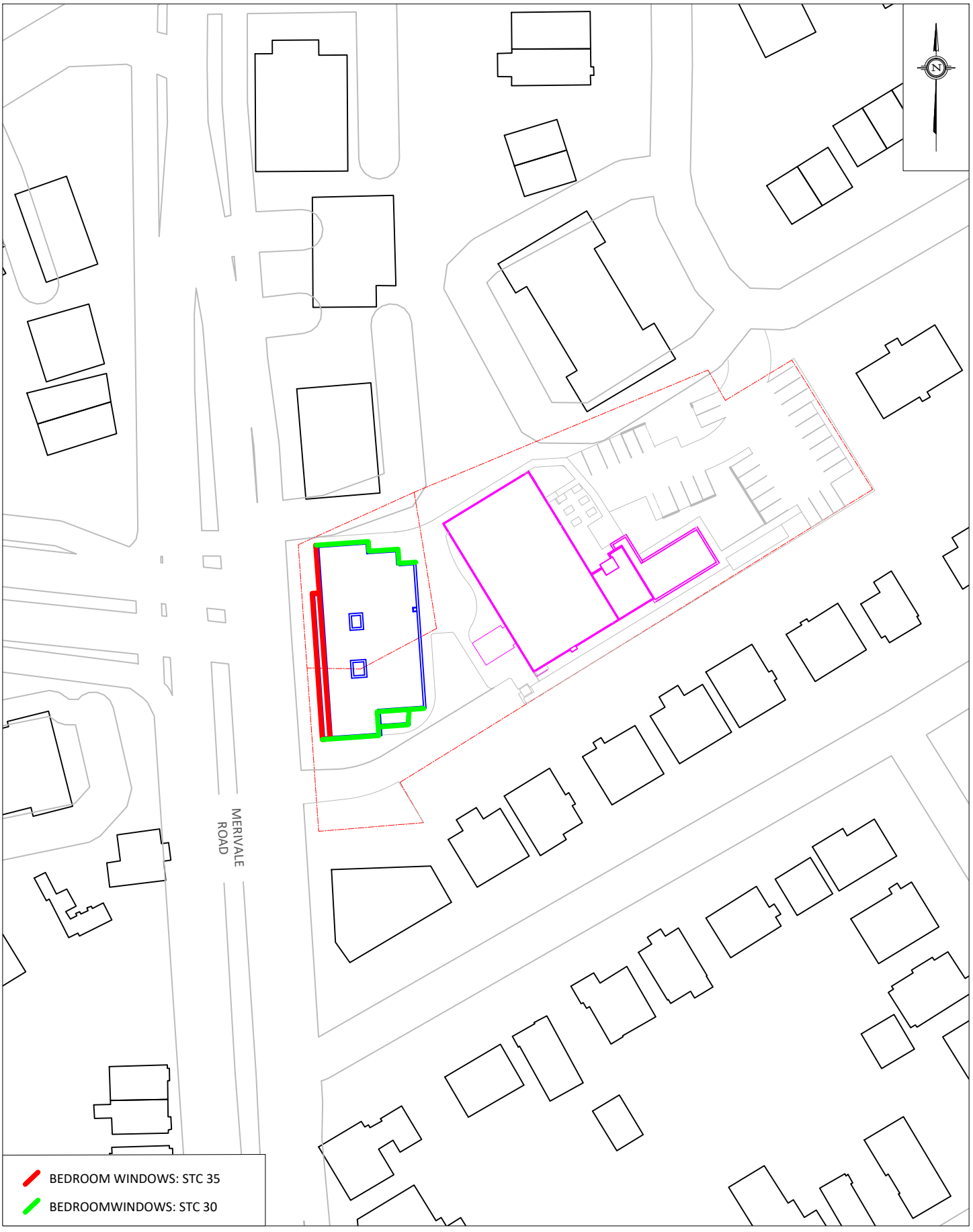
PROJECT	1083 MERIVALE ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW22-335-3
DATE	NOVEMBER 18, 2022
DRAWN BY	E.A.

DESCRIPTION

FIGURE 3:
STAMSON PARAMETERS



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PROJECT	1083 MERIVALE ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW22-335-4
DATE	NOVEMBER 18, 2022
DRAWN BY	E.A.

DESCRIPTION

FIGURE 4:
STC RECOMMENDATIONS

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: 22-11-2022 15:05:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Merivale (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   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):  35000
    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: Merivale (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           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Road data, segment # 2: Kirkwood (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   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):  35000
    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: Kirkwood (day/night)
------------------------------------------
Angle1   Angle2           :  22.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  24.00 / 24.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


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

Source height = 1.50 m

ROAD (0.00 + 70.91 + 0.00) = 70.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  72.16   0.00  -1.25   0.00   0.00   0.00   0.00
70.91
-------------------------------------------------------------------------
--

Segment Leq : 70.91 dBA
```

```
Results segment # 2: Kirkwood (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.89 + 0.00) = 65.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    22     90   0.00  72.16   0.00  -2.04  -4.23   0.00   0.00   0.00
65.89
-------------------------------------------------------------------------
--

Segment Leq : 65.89 dBA

Total Leq All Segments: 72.10 dBA


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

Source height = 1.50 m

ROAD (0.00 + 63.31 + 0.00) = 63.31 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  64.56   0.00  -1.25   0.00   0.00   0.00   0.00
63.31
-------------------------------------------------------------------------
--

Segment Leq : 63.31 dBA


Results segment # 2: Kirkwood (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.29 + 0.00) = 58.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    22     90   0.00  64.56   0.00  -2.04  -4.23   0.00   0.00   0.00
58.29
```

```
-------------------------------------------------------------------------------
--

Segment Leq : 58.29 dBA

Total Leq All Segments: 64.50 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 72.10
                           (NIGHT): 64.50
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-11-2022 16:42:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Merivale (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   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):  35000
    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: Merivale (day/night)
----------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  23.00 / 23.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  52.00 deg   Angle2 : 90.00 deg
Barrier height            :  11.00 m
Barrier receiver distance :   6.00 / 6.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Merivale (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 !       16.50 !       12.59 !        12.59

ROAD (64.91 + 63.55 + 0.00) = 67.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     52   0.00  72.16   0.00  -1.86  -5.39   0.00   0.00   0.00
64.91
-------------------------------------------------------------------------
--
    52     90   0.00  72.16   0.00  -1.86  -6.75   0.00   0.00  -1.50
62.04*
    52     90   0.00  72.16   0.00  -1.86  -6.75   0.00   0.00   0.00
63.55
-------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 67.29 dBA

Total Leq All Segments: 67.29 dBA


Results segment # 1: Merivale (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 !       16.50 !       12.59 !        12.59

ROAD (57.31 + 55.95 + 0.00) = 59.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     52   0.00  64.56   0.00  -1.86  -5.39   0.00   0.00   0.00
57.31
-------------------------------------------------------------------------
--
```

```
    52      90    0.00   64.56    0.00   -1.86   -6.75    0.00    0.00   -1.50
54.45*
    52      90    0.00   64.56    0.00   -1.86   -6.75    0.00    0.00    0.00
55.95
-------------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 59.70 dBA

Total Leq All Segments: 59.70 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 67.29
                           (NIGHT): 59.70
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-11-2022 16:37:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Merivale (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   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):  35000
    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: Merivale (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  25.00 / 25.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


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

Source height = 1.50 m

ROAD (0.00 + 66.93 + 0.00) = 66.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  72.16   0.00  -2.22  -3.01   0.00   0.00   0.00
66.93
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 66.93 dBA

Total Leq All Segments: 66.93 dBA


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

Source height = 1.50 m

ROAD (0.00 + 59.33 + 0.00) = 59.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  64.56   0.00  -2.22  -3.01   0.00   0.00   0.00
59.33
-------------------------------------------------------------------------------
--

Segment Leq : 59.33 dBA

Total Leq All Segments: 59.33 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 66.93
                           (NIGHT): 59.33
```