October 12, 2022

Azure Urban Developments
463 Golden Avenue,
Ottawa, ON K2A 2E4

Attn: John Thomas
Jthomas@azureurban.com

Re: Roadway Traffic Noise Brief
377-381 Winona Avenue, Ottawa, ON
GWE File No.: 22-293– Roadway Traffic Noise

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Azure Urban Developments to undertake a roadway traffic noise brief for the proposed six-storey mixed-use development located at 377-381 Winona Avenue in Ottawa, Ontario, to ensure that future residents are afforded comfortable usage of the indoor space. The study was requested by the City of Ottawa, as the subject property is within 100 meters (m) of two urban arterial roadways, Richmond Road and Churchill Avenue North. This roadway traffic noise brief summarizes the methodology, results and recommendations related to a roadway traffic noise assessment. Gradient Wind's scope of work involved assessing exterior noise levels generated by local roadway traffic to ensure that the development does not require a detailed analysis for noise control measures and mitigation. The roadway traffic noise 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 (MECP)[2] guidelines. Our study was based on a basement floor plan drawing prepared by CSV Architects in September 2022, future traffic volumes corresponding to the City of Ottawa's Official Plan (OP), and CAD mapping obtained through the City of Ottawa.

[1] City of Ottawa – Environmental Noise Control Guidelines, January 2016
[2] Ministry of the Environment and Climate Change (MOECC) – Environmental Noise Guideline, Publication NPC-300, August 2013

2. TERMS OF REFERENCE

The focus of this roadway traffic noise brief is a proposed six storey mixed-use building located at 377-381 Winona Avenue in Ottawa, Ontario. The study building is bounded by Winona Avenue to the west and Pickton Avenue to the north. The main sources of roadway traffic noise in the area are Richmond Road to the south and Churchill Avenue North to the west. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The main goals of this work are to: (i) calculate the future noise levels on the study buildings produced by local roadway traffic and (ii) ensure that exterior noise levels do not exceed the ENCG objective limit, as specified in Section 4.2.1 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 mixed-use and residential buildings.

Predicted noise levels at the plane of window (POW) and outdoor living area (OLA) dictate the action required to achieve the recommended indoor and OLA sound levels, as specified in the ENCG. When noise levels at these areas meet or exceed the ENCG objective limit of 55 dBA, specific outdoor, ventilation and Warning Clause requirements may apply. In addition, where noise levels exceed 65 dBA, upgraded building components must be designed to ensure indoor sound level limits can be met.

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[3] 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 the roadway included in this assessment.

TABLE 1: ROADWAY TRAFFIC DATA

Roadway	Roadway Class	Speed Limit (km/h)	Official Plan AADT
Richmond Road	2-Lane Urban Arterial (2-UAU)	40	**15,000**
Churchill Avenue North	2-Lane Urban Arterial (2-UAU)	40	**15,000**

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.

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

Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise, and by using existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 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
- Reflective intermediate ground surfaces are used
- The study site was treated as having flat or gently sloping topography
- Two noise receptors were strategically placed throughout the development (Figure 2)
- STAMSON input parameters are illustrated in Figure 3.

5. RESULTS AND CONCLUSIONS

The results of the roadway traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Location	Noise Level (dBA)	
		Day	Night
1	POW – South Façade	61	59
2	POW – West Façade	60	59

The results of the current study indicate that noise levels will range between 60 and 61 dBA during the daytime period (07:00-23:00) and around 59 dBA during the nighttime period (23:00-07:00). The highest noise levels occur along the south façade which is nearest and most exposed to Richmond Road. Since noise levels do not exceed the ENCG plane of window limit of 65 dBA and 60 dBA during the daytime and nighttime periods, respectively, standard building components will be sufficient. The development will require forced air heating with provisions for central air conditioning, however given the nature of the development air condition is expected to be provided. A Type D Warning Clause will be required on all Lease, Purchase and Sale Agreements. Draft language is provided below:

"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, Conservation and Parks."

This concludes our 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.

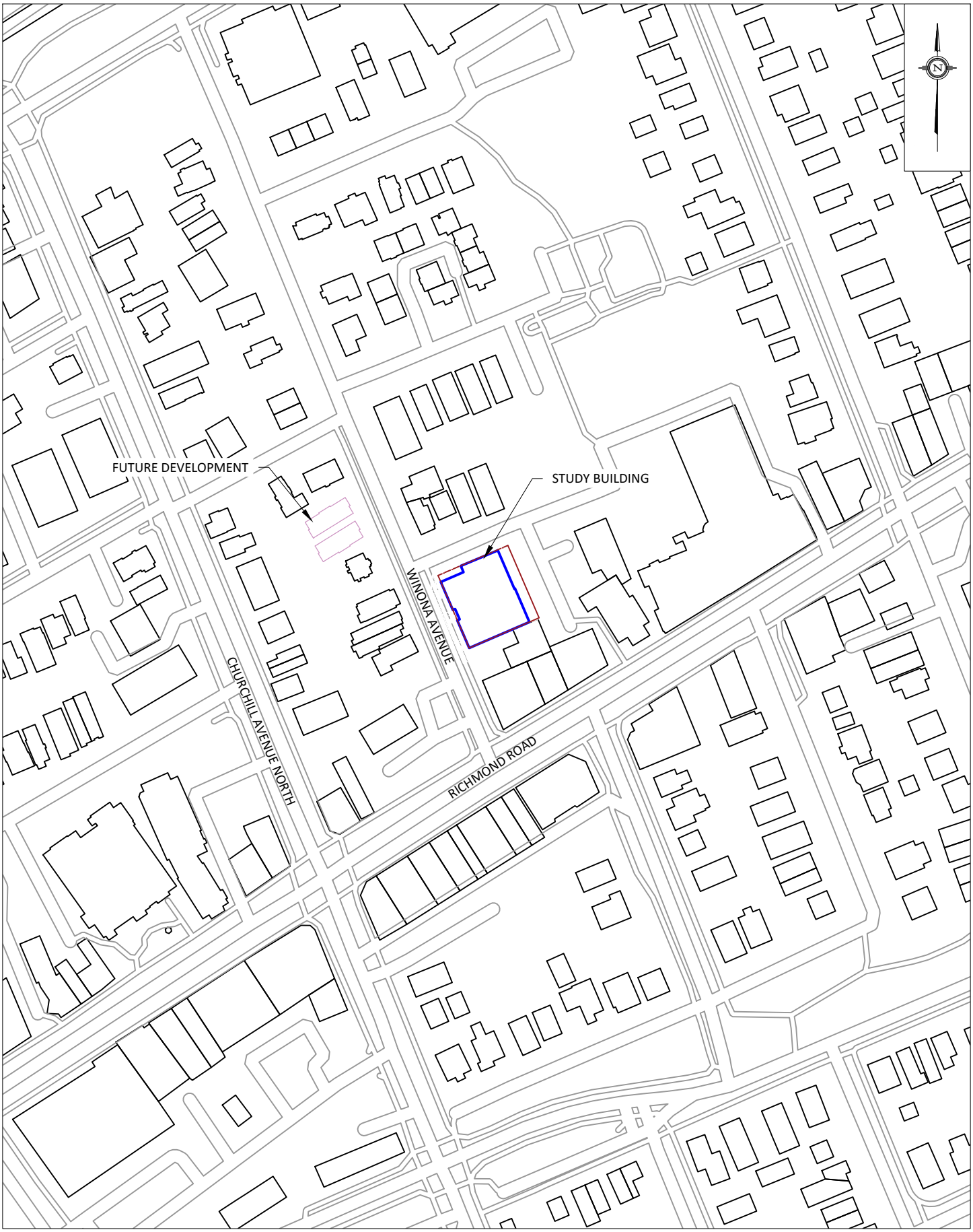
Sincerely,

Gradient Wind Engineering Inc.

Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #22-293-Roadway Traffic Noise Brief



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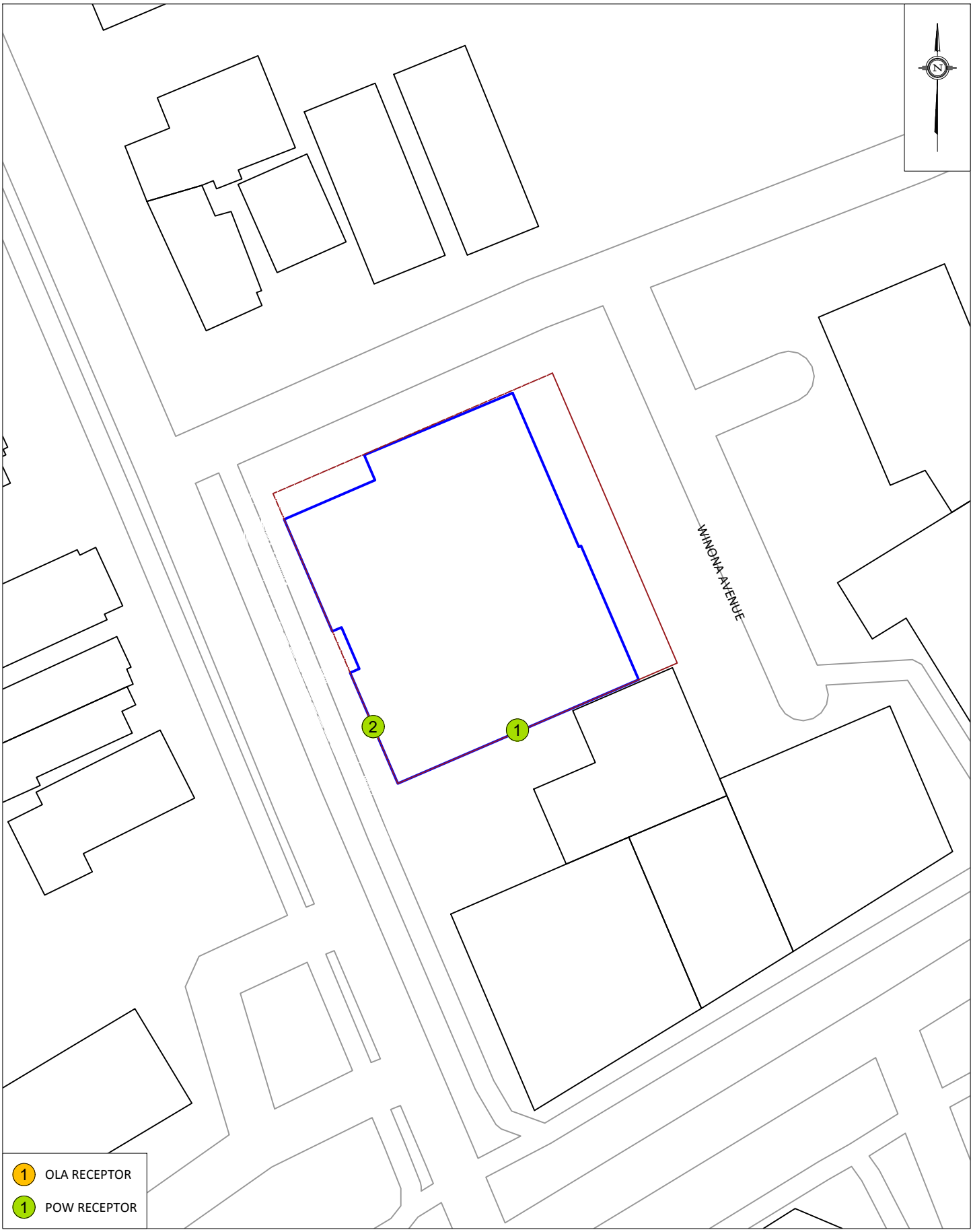
PROJECT	377-381 WINONA AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW22-293-1
DATE	OCTOBER 5, 2022	DRAWN BY	J.F.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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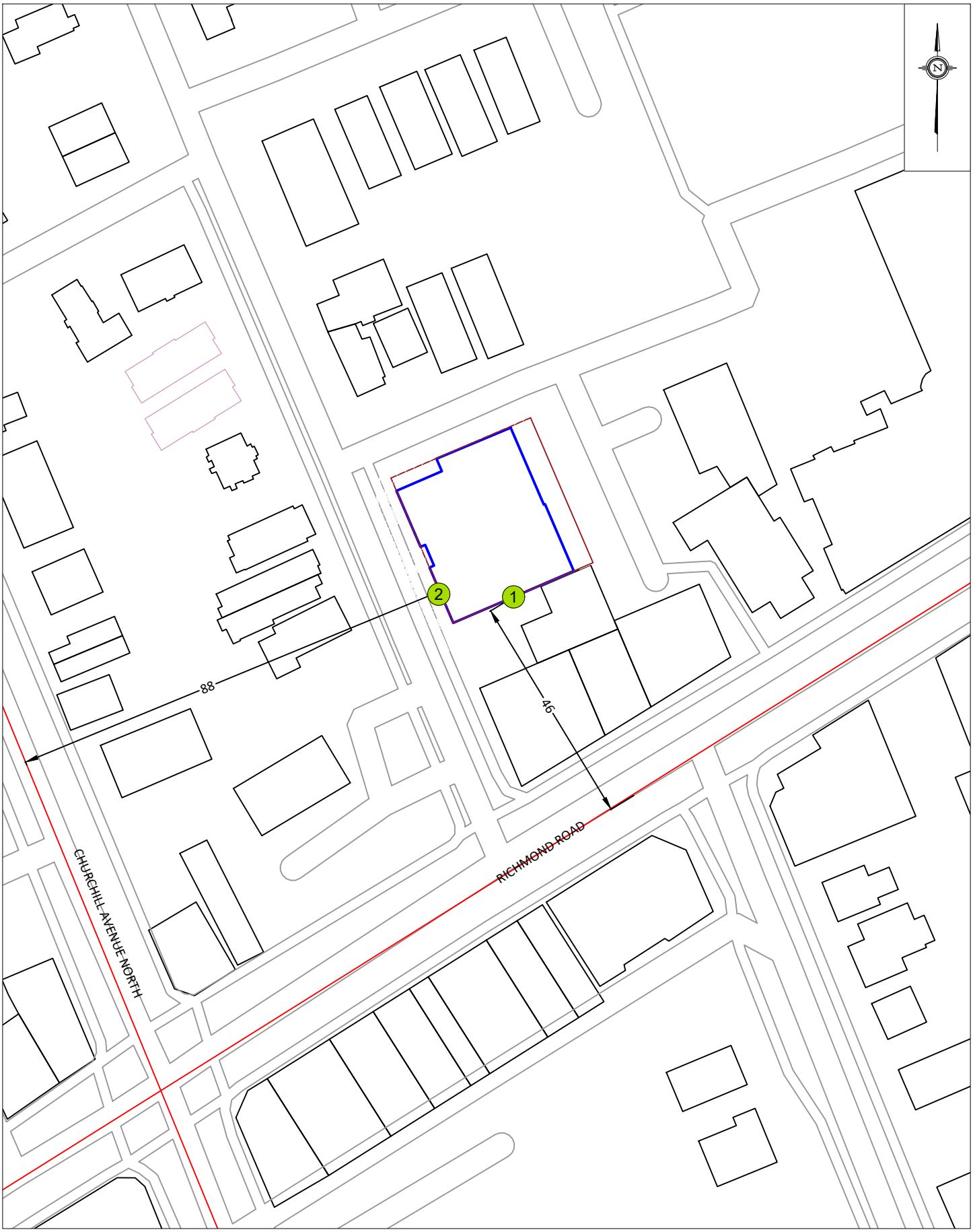
PROJECT	377-381 WINONA AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:500 (APPROX.)
DRAWING NO.	GW22-293-2
DATE	OCTOBER 5, 2022
DRAWN BY	J.F.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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PROJECT	377-381 WINONA AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-293-3
DATE	OCTOBER 5, 2022	DRAWN BY	J.F.

FIGURE 3:
STAMSON INPUT PARAMETERS

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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```
STAMSON 5.0        NORMAL REPORT        Date: 05-10-2022 14:02:25
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1.te                Time Period: Day/Night 16/8 hours
Description: POR 1: South Facade


Road data, segment # 1: Richmond (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  :    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):  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: Richmond (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  :  46.00 / 15.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Churchill (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  :    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):  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: Churchill (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  88.00 / 88.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.23 + 0.00) = 60.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.21  66.69   0.00  -5.89  -0.56   0.00   0.00   0.00
60.23
-------------------------------------------------------------------------
--

Segment Leq : 60.23 dBA


Results segment # 2: Churchill (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.81 + 0.00) = 53.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.21  66.69   0.00  -9.30  -3.57   0.00   0.00   0.00
53.81
-------------------------------------------------------------------------
--

Segment Leq : 53.81 dBA

Total Leq All Segments: 61.12 dBA
```

```
Results segment # 1: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.53 + 0.00) = 58.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.21  59.09   0.00   0.00  -0.56   0.00   0.00   0.00
58.53
-------------------------------------------------------------------------
--

Segment Leq : 58.53 dBA


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

Source height = 1.50 m

ROAD (0.00 + 46.22 + 0.00) = 46.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.21  59.09   0.00  -9.30  -3.57   0.00   0.00   0.00
46.22
-------------------------------------------------------------------------
--

Segment Leq : 46.22 dBA

Total Leq All Segments: 58.78 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 61.12
                           (NIGHT): 58.78
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-10-2022 14:03:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te                Time Period: Day/Night 16/8 hours
Description: POR 2: West Facade


Road data, segment # 1: Richmond (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  :    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):  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: Richmond (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Churchill (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  :    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):  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: Churchill (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  :  88.00 / 15.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.22 + 0.00) = 57.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.21  66.69   0.00  -5.89  -3.57   0.00   0.00   0.00
57.22
-------------------------------------------------------------------------
--

Segment Leq : 57.22 dBA


Results segment # 2: Churchill (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.83 + 0.00) = 56.83 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.21  66.69   0.00  -9.30  -0.56   0.00   0.00   0.00
56.83
-------------------------------------------------------------------------
--

Segment Leq : 56.83 dBA

Total Leq All Segments: 60.04 dBA
```

```
Results segment # 1: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.63 + 0.00) = 49.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.21  59.09   0.00  -5.89  -3.57   0.00   0.00   0.00
49.63
-------------------------------------------------------------------------
--

Segment Leq : 49.63 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.53 + 0.00) = 58.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.21  59.09   0.00   0.00  -0.56   0.00   0.00   0.00
58.53
-------------------------------------------------------------------------
--

Segment Leq : 58.53 dBA

Total Leq All Segments: 59.06 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 60.04
                           (NIGHT): 59.06
```