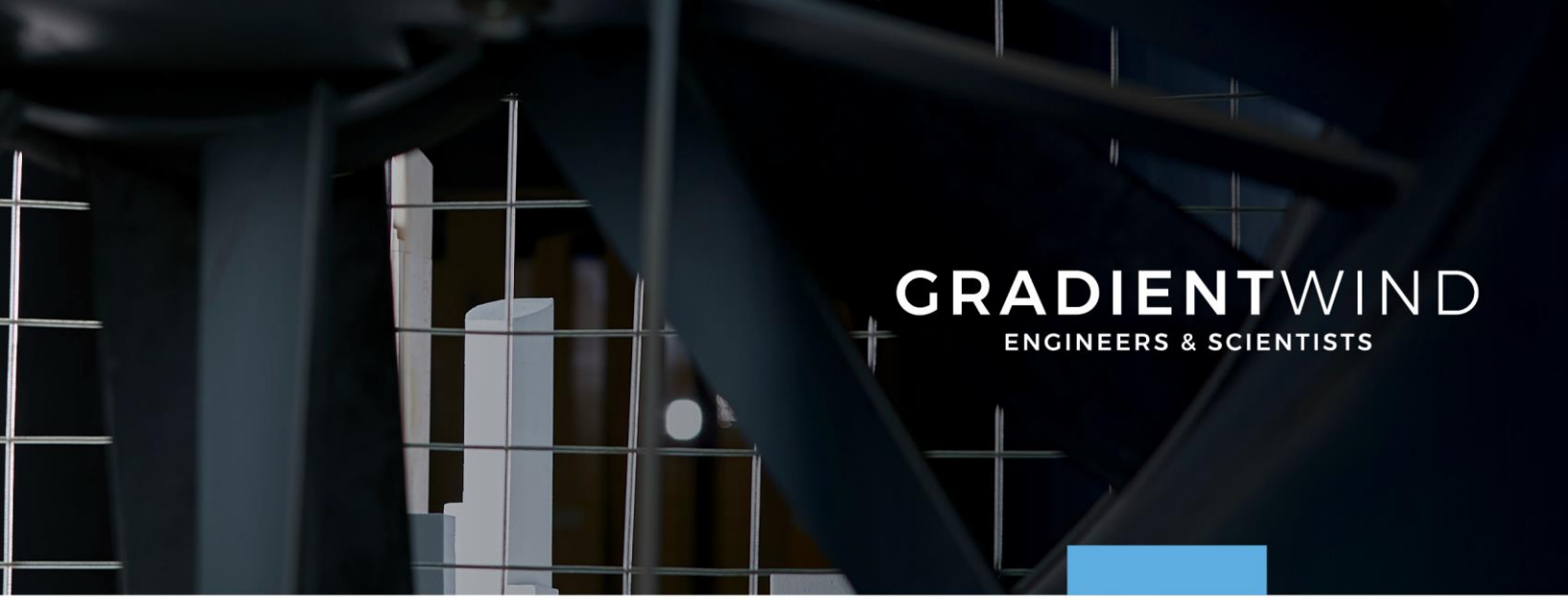
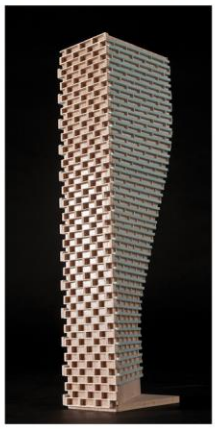


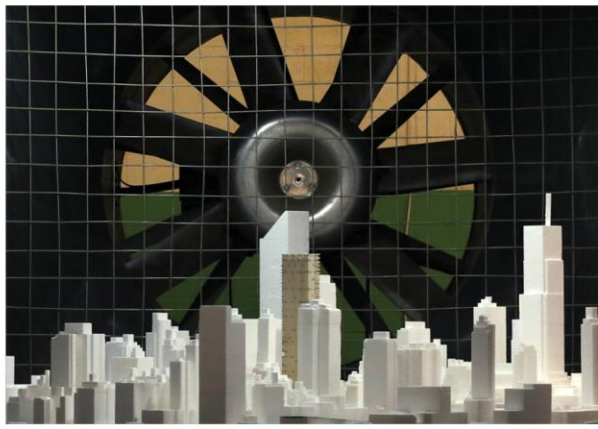
GRADIENTWIND
ENGINEERS & SCIENTISTS

TRAFFIC NOISE ASSESSMENT

800 Palladium Drive
Ottawa, Ontario

REPORT: GWE19-017 – Traffic Noise





March 7, 2019

PREPARED FOR
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EXECUTIVE SUMMARY

This report describes a traffic noise assessment undertaken in support of site plan application for a proposed mixed-use development located at 800 Palladium Drive in Ottawa, Ontario. The proposed development is a five (5) storey, rectangular planform office building with commercial space at grade. The major sources of traffic noise are Highway 417, Palladium Drive, and a future major collector roadway. Figure 1 illustrates a complete site plan with surrounding context.

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

The results of the current analysis indicate that noise levels will range between 66 and 72 dBA during the daytime period (07:00-23:00) and between 58 and 64 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the south façade, which is nearest and most exposed to Palladium Drive. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 3.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Cominar to undertake a traffic noise assessment for a proposed mixed-use development at 800 Palladium Avenue in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by STGM Architectes, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The proposed development is a five (5) storey, rectangular planform office building, located at northeast corner of the intersection of Palladium Drive and Cyclone Taylor Boulevard. The ground floor features two (2) commercial units and a restaurant, overlooking Palladium Drive. Entrances are found at the west, south and east elevations. A terrace is found at the south side, serving the restaurant and a public amenity space is found at the southwest corner extending along the west side. A parking lot comprising 319 spaces surrounds the building at the east and north side.

The site is surrounded by low-rise office buildings to the north and east, and a paved lot to the south and west. The major sources of traffic noise are Highway 417, Palladium Drive, and a future major collector roadway. Figure 1 illustrates a complete site plan with surrounding context.

Because the proposed office is more then 100 m from existing or planned noise sensitive residential neighbourhoods, stationary noise impacts are not expected to be of concern. The surrounding office buildings are not considered noise-sensitive and do not have operable windows. Because of this, as well as

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

the separation distance between the development and the surrounding offices, a detailed stationary noise analysis of the developments mechanical equipment will not be necessary.

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 City of Ottawa's Environmental Noise Control 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 surface roadway traffic noise, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range

(that is relevant to this study) is 50 and 45 dBA for retail/open office and private office/conference rooms respectively, as listed in Table 1.

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

Type of Space	Time Period	Leq (dBA)
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
Sleeping quarters of hotels/motels	23:00 – 07:00	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 a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. 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[6].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.2 Theoretical Roadway 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.

Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources 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, as per ENCG requirements for noise level predictions.
- The day/night split for all streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Receptor height was taken to be 17.5 metres at Level 5 for the centre of the window (height to 5th floor slab + 1.5 metres) for Receptors 1-4.
- The low-rise building at 770 Palladium Drive to the north was considered as a noise barrier with a height of 15-metres.
- Noise receptors were strategically placed at 4 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figures 4-5.

4.2.1 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[7] 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.

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Highway 417	8 Lane Freeway	100	**110,000**
Palladium Drive	4-Lane Urban Arterial (2-UAU)	60	**35,000**
North-south Major Collector	2-Lane Major Collector (2-UMCU)	60	**12,000**

4.3 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 roadway traffic 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[8] 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

[8] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

Based on published research[9], 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).

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

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

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
1	17.5	POW – 5th Floor – North Façade	66	58
2	17.5	POW – 5th Floor – East Façade	68	60
3	17.5	POW – 5th Floor – South Façade	72	64
4	17.5	POW – 5th Floor – West Façade	69	62

The results of the current analysis indicate that noise levels will range between 66 and 72 dBA during the daytime period (07:00-23:00) and between 58 and 64 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the south façade, which is nearest and most exposed to Palladium Drive.

[9] CMHC, Road & Rail Noise: Effects on Housing

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3, 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 city of Ottawa 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 7):

- **Retail/Office Windows**

(i) Retail/open office windows facing north, east south, and west will require a minimum STC of 30

- **Exterior Walls**

(i) Exterior wall components will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[10]

The STC requirements apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a window/wall system is used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however several manufacturers and various combinations of window components, such as those proposed, will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors.

[10] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 66 and 72 dBA during the daytime period (07:00-23:00) and between 58 and 64 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the south façade, which is nearest and most exposed to Palladium Drive. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 3.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause[11] will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building, sound levels due to increasing roadway traffic may, on occasion, interfere with some activities of the office, as the sound levels exceed the sound level limits of the City and the Ministry of the Environment and Climate Change. To help address the need for sound attenuation, this development includes:*
>
> - *STC rated multi-pane glazing elements and spandrel panels*
> - *North, east, south, and west façade retail and office: STC 30*
> - *STC rated exterior walls*
> - *North, east, south and west façade: STC 45*
>
> *This dwelling unit has also been designed with air conditioning. Air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound*

[11] City of Ottawa Environmental Noise Control Guidelines, January 2016

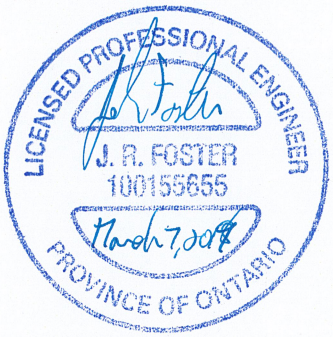
levels are within the sound level limits of the City and the Ministry of the Environment and Climate Change.

To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features."

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.



Michael Lafortune, C.E.T.
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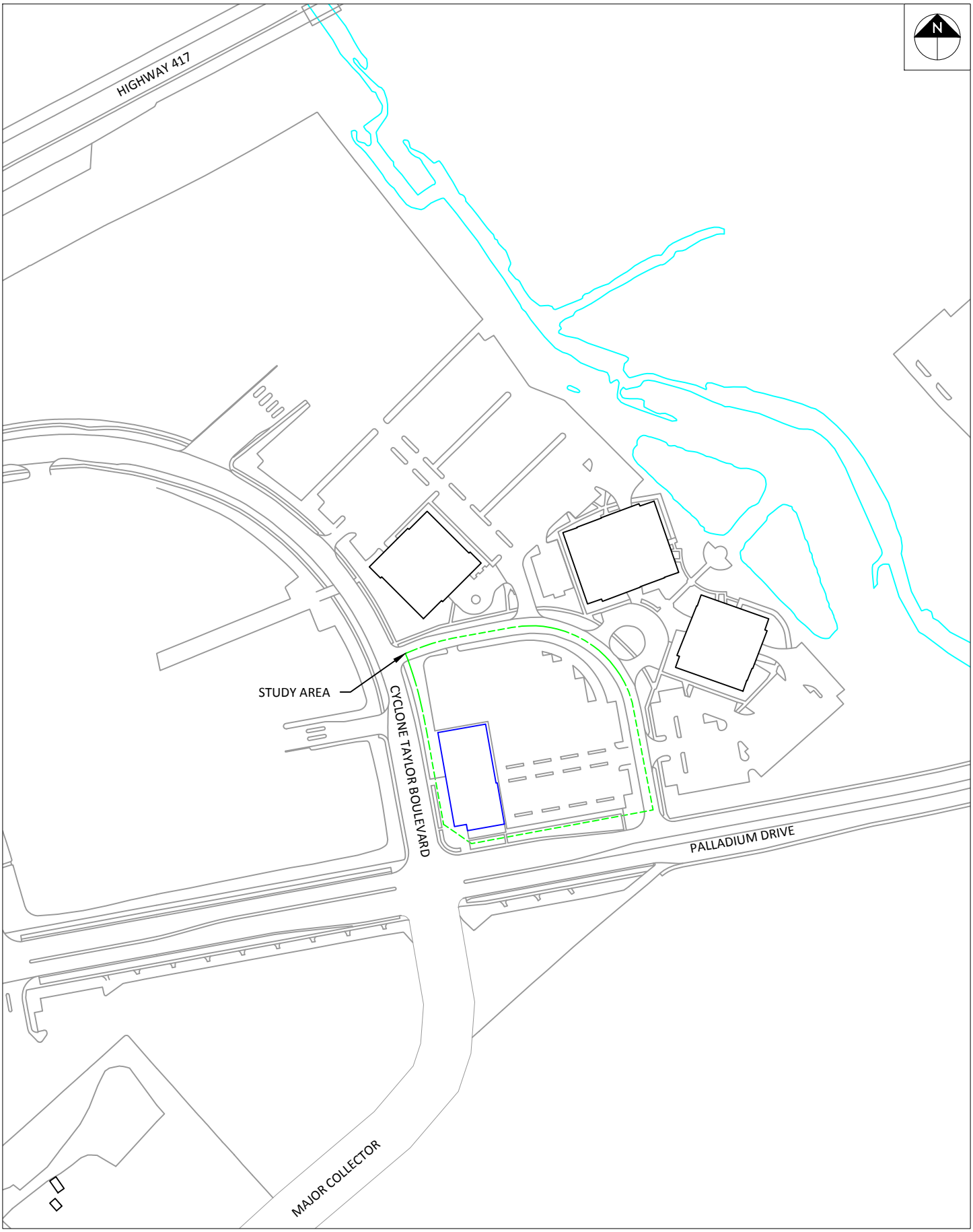
Principal



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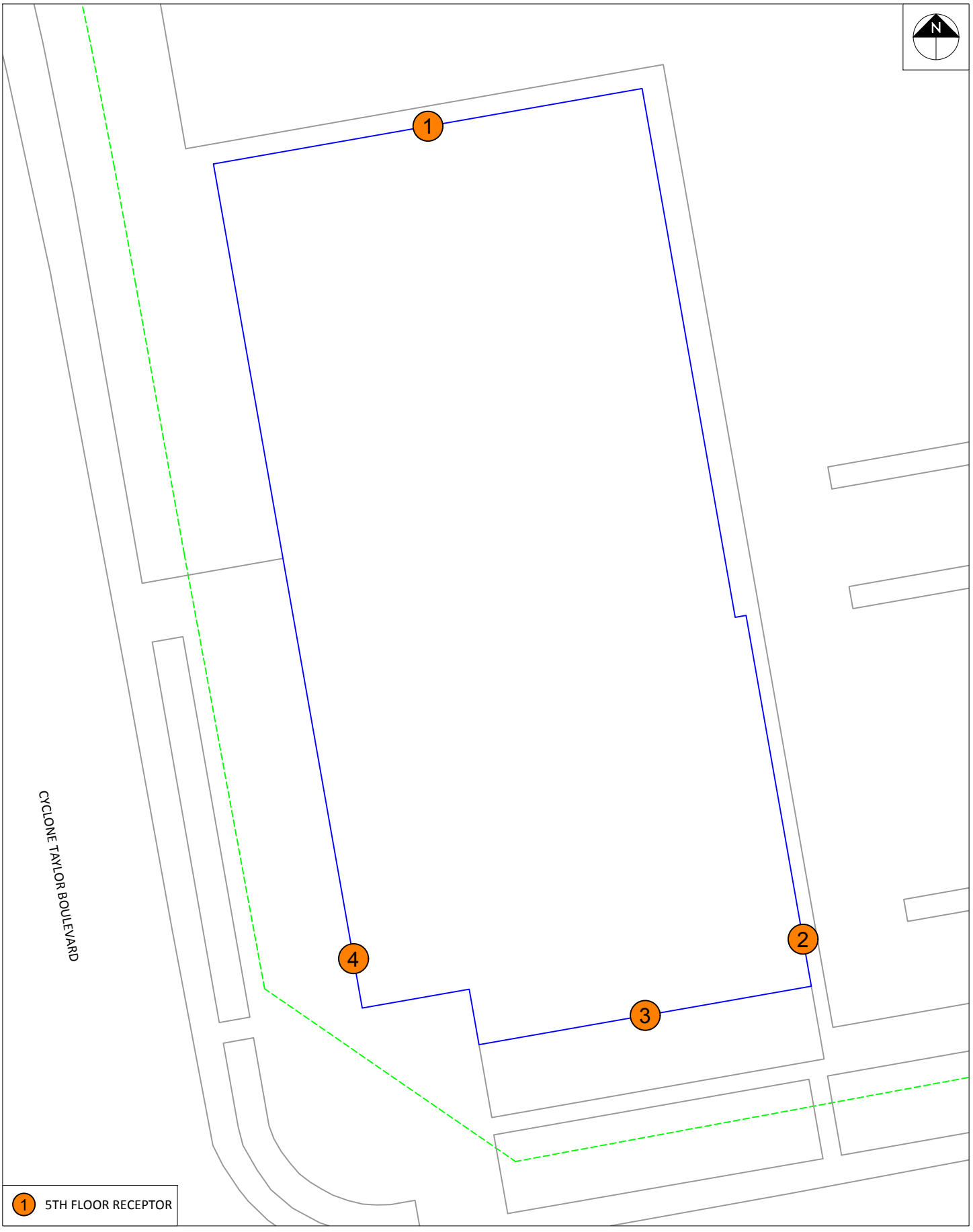
PROJECT	800 PALLADIUM DRIVE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:3000 (APPROX.)	DRAWING NO.	GWE19-017-1
DATE	FEBRUARY 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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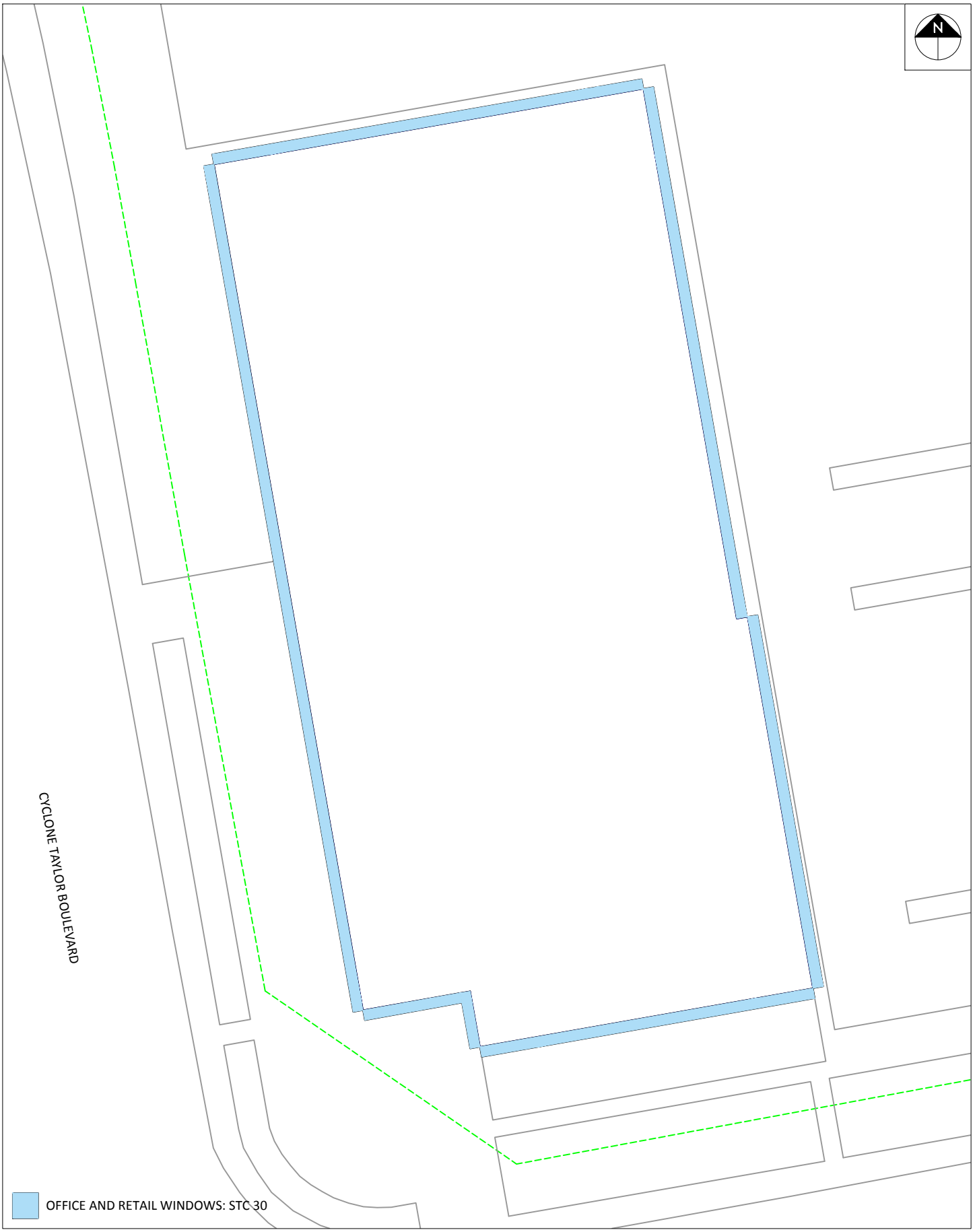
PROJECT	800 PALLADIUM DRIVE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:300 (APPROX.)	DRAWING NO.	GWE19-017-2
DATE	FEBRUARY 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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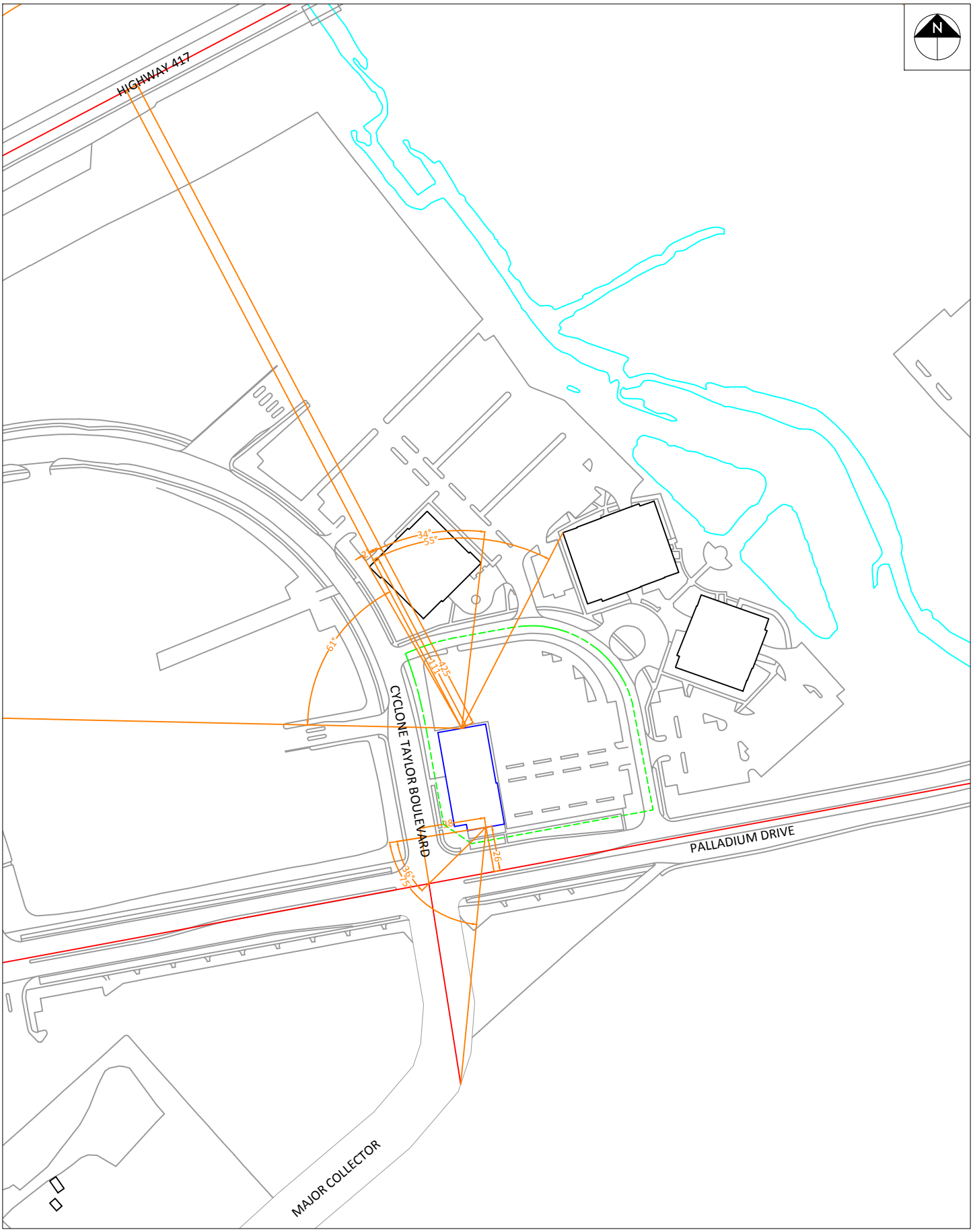
PROJECT	800 PALLADIUM DRIVE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:300 (APPROX.)	DRAWING NO.	GWE19-017-3
DATE	FEBRUARY 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 3:
WINDOW STC REQUIREMENTS



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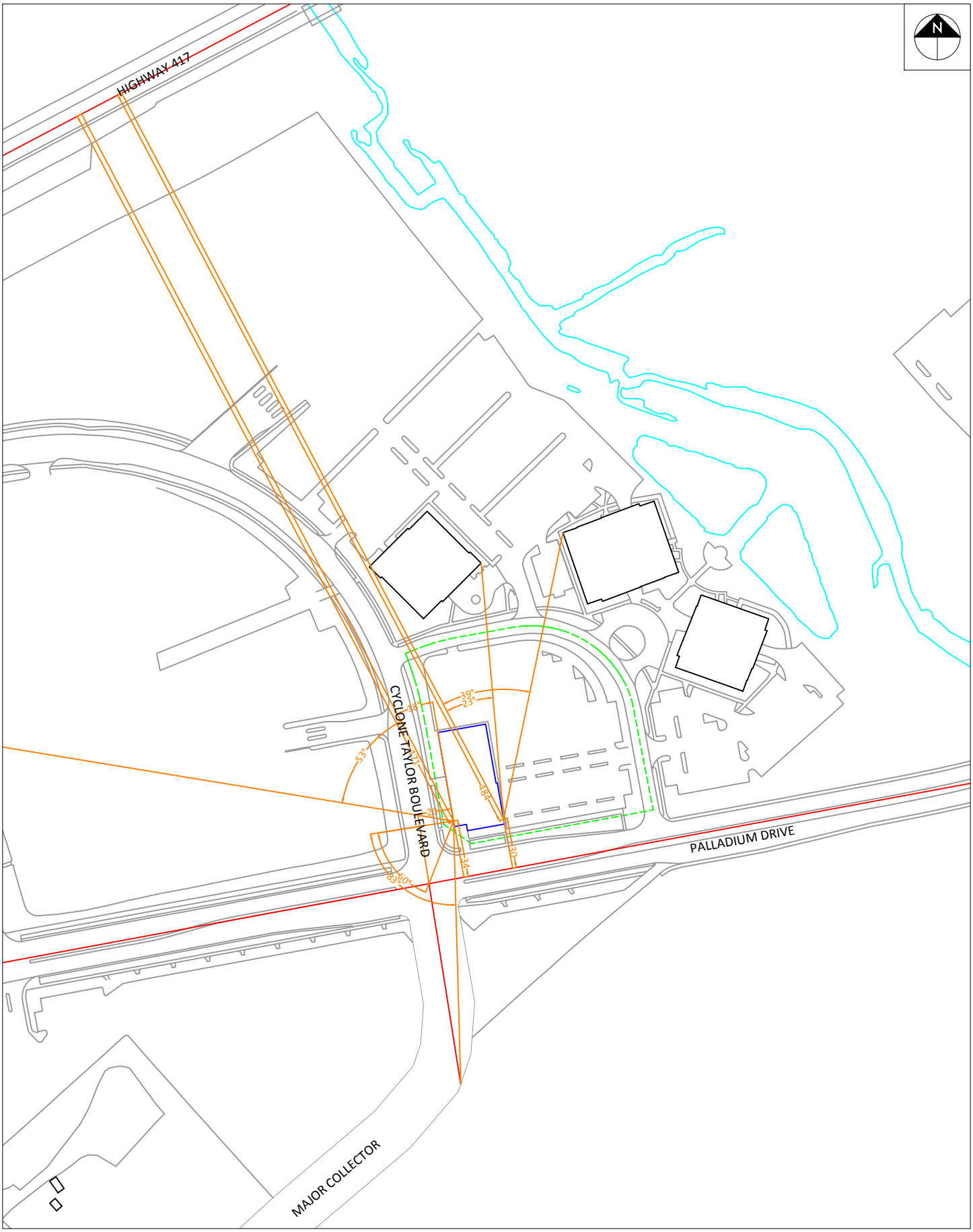
PROJECT	800 PALLADIUM DRIVE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GWE19-017-4
DATE	FEBRUARY 22, 2019
DRAWN BY	M.L.

DESCRIPTION

FIGURE 4:
STAMSON INPUT PARAMETERS - RECEPTOR 1,3



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PROJECT	800 PALLADIUM DRIVE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:3000 (APPROX.)	DRAWING NO.	GWE19-017-4
DATE	FEBRUARY 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 4:
STAMSON INPUT PARAMETERS - RECEPTOR 2,4

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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```
STAMSON 5.0        NORMAL REPORT        Date: 21-02-2019 33:36:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway 417 (day/night)
-----------------------------------------------
Car traffic volume  : 89056/7744  veh/TimePeriod  *
Medium truck volume :  7084/616   veh/TimePeriod  *
Heavy truck volume  :  5060/440   veh/TimePeriod  *
Posted speed limit  :   100 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): 110000
    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: Highway 417 (day/night)
---------------------------------------------
Angle1   Angle2           : -61.00 deg   55.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 425.00 / 425.00 m
Receiver height           :  17.50 / 17.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  -2.00 deg   Angle2 : 34.00 deg
Barrier height            :  15.00 m
Barrier receiver distance : 111.00 / 111.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Highway 417 (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 !       17.50 !       13.32 !        13.32

ROAD (63.79 + 55.84 + 59.30) = 65.60 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -61     -2   0.00  83.16   0.00 -14.52  -4.84   0.00   0.00   0.00
63.79
-------------------------------------------------------------------------------
--
    -2     34   0.00  83.16   0.00 -14.52  -6.99   0.00   0.00  -5.81
55.84
-------------------------------------------------------------------------------
--
    34     55   0.00  83.16   0.00 -14.52  -9.33   0.00   0.00   0.00
59.30
-------------------------------------------------------------------------------
--

Segment Leq : 65.60 dBA

Total Leq All Segments: 65.60 dBA
```

```
Results segment # 1: Highway 417 (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 !       17.50 !       13.32 !        13.32

ROAD (56.19 + 48.24 + 51.71) = 58.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -61     -2   0.00  75.56   0.00 -14.52  -4.84   0.00   0.00   0.00
56.19
-------------------------------------------------------------------------------
--
    -2     34   0.00  75.56   0.00 -14.52  -6.99   0.00   0.00  -5.81
48.24
-------------------------------------------------------------------------------
--
    34     55   0.00  75.56   0.00 -14.52  -9.33   0.00   0.00   0.00
51.71
-------------------------------------------------------------------------------
--

Segment Leq : 58.00 dBA

Total Leq All Segments: 58.00 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 65.60
                           (NIGHT): 58.00
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-02-2019 33:36:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway 417 (day/night)
-----------------------------------------------
Car traffic volume  : 89056/7744  veh/TimePeriod  *
Medium truck volume :  7084/616   veh/TimePeriod  *
Heavy truck volume  :  5060/440   veh/TimePeriod  *
Posted speed limit  :   100 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): 110000
    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: Highway 417 (day/night)
---------------------------------------------
Angle1   Angle2           :  23.00 deg   39.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 484.00 / 484.00 m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Palladium (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  :    60 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: Palladium (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  :  30.00 / 30.00  m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Highway 417 (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.56 + 0.00) = 57.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    23     39   0.00  83.16   0.00 -15.09 -10.51   0.00   0.00   0.00
57.56
-------------------------------------------------------------------------
--

Segment Leq : 57.56 dBA


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

Source height = 1.50 m

ROAD (0.00 + 67.66 + 0.00) = 67.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  73.68   0.00  -3.01  -3.01   0.00   0.00   0.00
67.66
-------------------------------------------------------------------------
--

Segment Leq : 67.66 dBA

Total Leq All Segments: 68.06 dBA
```

```
Results segment # 1: Highway 417 (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.96 + 0.00) = 49.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    23     39   0.00  75.56   0.00 -15.09 -10.51   0.00   0.00   0.00
49.96
-------------------------------------------------------------------------------
--

Segment Leq : 49.96 dBA


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

Source height = 1.50 m

ROAD (0.00 + 60.06 + 0.00) = 60.06 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  66.08   0.00  -3.01  -3.01   0.00   0.00   0.00
60.06
-------------------------------------------------------------------------------
--

Segment Leq : 60.06 dBA

Total Leq All Segments: 60.46 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 68.06
                           (NIGHT): 60.46
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-02-2019 33:37:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Palladium (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  :    60 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: Palladium (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  :  26.00 / 26.00  m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: MajorCol (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: MajorCol (day/night)
-------------------------------------------
Angle1   Angle2           : -75.00 deg   -36.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  38.00 / 38.00  m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 71.29 + 0.00) = 71.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  73.68   0.00  -2.39   0.00   0.00   0.00   0.00
71.29
-------------------------------------------------------------------------
--

Segment Leq : 71.29 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.35 + 0.00) = 58.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -75    -36   0.00  69.03   0.00  -4.04  -6.64   0.00   0.00   0.00
58.35
-------------------------------------------------------------------------
--

Segment Leq : 58.35 dBA

Total Leq All Segments: 71.51 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 63.69 + 0.00) = 63.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -2.39   0.00   0.00   0.00   0.00
63.69
-------------------------------------------------------------------------------
--

Segment Leq : 63.69 dBA


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

Source height = 1.50 m

ROAD (0.00 + 50.75 + 0.00) = 50.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -75    -36   0.00  61.43   0.00  -4.04  -6.64   0.00   0.00   0.00
50.75
-------------------------------------------------------------------------------
--

Segment Leq : 50.75 dBA

Total Leq All Segments: 63.91 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 71.51
                           (NIGHT): 63.91
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-02-2019 33:36:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway 417 (day/night)
-----------------------------------------------
Car traffic volume  : 89056/7744  veh/TimePeriod  *
Medium truck volume :  7084/616   veh/TimePeriod  *
Heavy truck volume  :  5060/440   veh/TimePeriod  *
Posted speed limit  :   100 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): 110000
    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: Highway 417 (day/night)
---------------------------------------------
Angle1   Angle2           : -53.00 deg   18.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 471.00 / 471.00 m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Palladium (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  :    60 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: Palladium (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  :  34.00 / 34.00  m
Receiver height           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: MajorCol (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 3: MajorCol (day/night)
-------------------------------------------
Angle1   Angle2           : -83.00 deg   -60.00 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           :  17.50 / 17.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Highway 417 (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.15 + 0.00) = 64.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -53     18   0.00  83.16   0.00 -14.97  -4.04   0.00   0.00   0.00
64.15
-------------------------------------------------------------------------------
--

Segment Leq : 64.15 dBA


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

Source height = 1.50 m

ROAD (0.00 + 67.11 + 0.00) = 67.11 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90   0.00  73.68   0.00  -3.55  -3.01   0.00   0.00   0.00
67.11
-------------------------------------------------------------------------------
--

Segment Leq : 67.11 dBA
```

```
Results segment # 3: MajorCol (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.84 + 0.00) = 58.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83    -60   0.00  69.03   0.00  -1.25  -8.94   0.00   0.00   0.00
58.84
-------------------------------------------------------------------------
--

Segment Leq : 58.84 dBA

Total Leq All Segments: 69.30 dBA


Results segment # 1: Highway 417 (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.55 + 0.00) = 56.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -53     18   0.00  75.56   0.00 -14.97  -4.04   0.00   0.00   0.00
56.55
-------------------------------------------------------------------------
--

Segment Leq : 56.55 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 59.52 + 0.00) = 59.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  66.08   0.00  -3.55  -3.01   0.00   0.00   0.00
59.52
-------------------------------------------------------------------------
--

Segment Leq : 59.52 dBA


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

Source height = 1.50 m

ROAD (0.00 + 51.24 + 0.00) = 51.24 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83    -60   0.00  61.43   0.00  -1.25  -8.94   0.00   0.00   0.00
51.24
-------------------------------------------------------------------------
--

Segment Leq : 51.24 dBA

Total Leq All Segments: 61.70 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 69.30
                           (NIGHT): 61.70
```