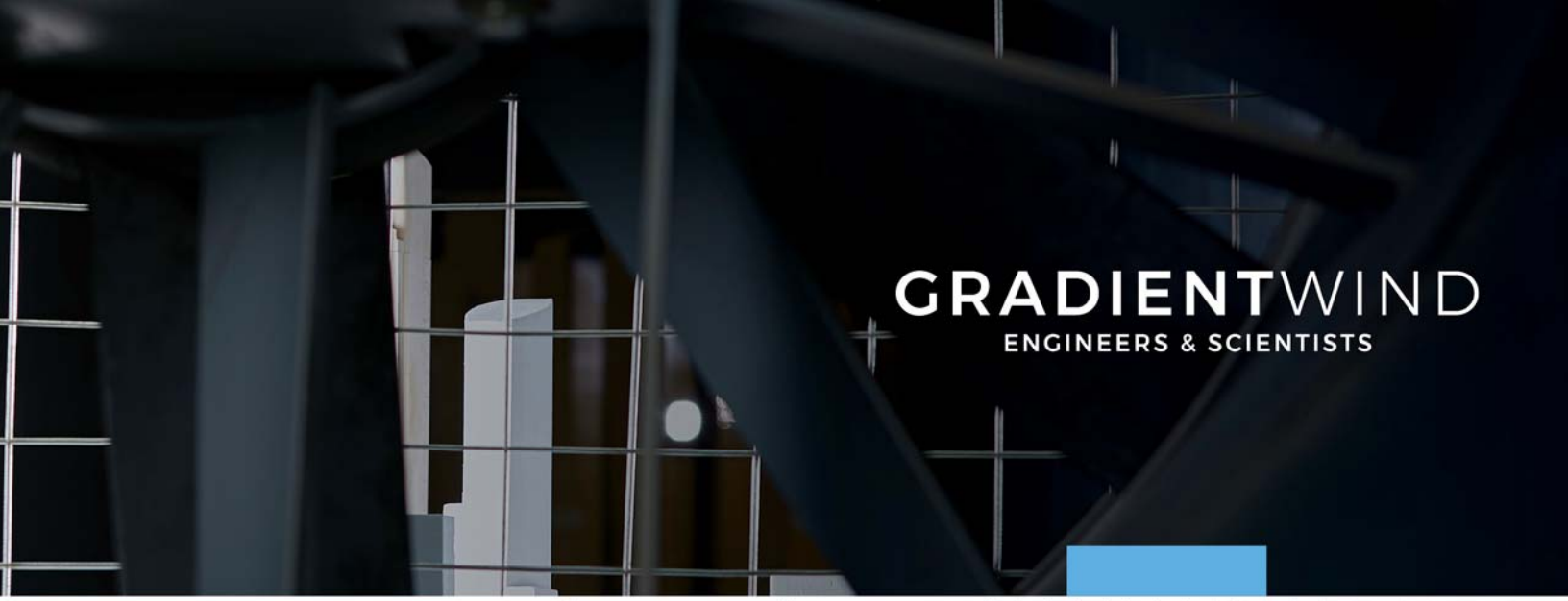
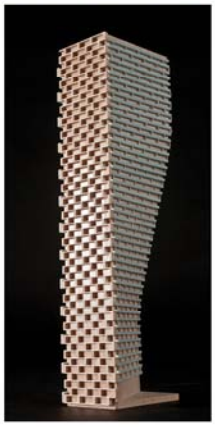


GRADIENTWIND
ENGINEERS & SCIENTISTS

ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT

3194 Jockvale Road
Ottawa, Ontario

REPORT: GWE18-192 – Environmental Noise Feasibility



December 20, 2018

PREPARED FOR

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PREPARED BY

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EXECUTIVE SUMMARY

This report describes an environmental noise feasibility assessment performed for the proposed Richcraft Subdivision development at 3194 Jockvale Road in Ottawa, Ontario. The property is divided into three large blocks and four smaller blocks. Residential use is planned for Block 1 and commercial use planned for Blocks 2, 3, 4,5 and 6. A park is planned for Block 7. The site is surrounded by retail land to the north, and vacant land to the east and south. To the west is a storm water management pond. The site is bordered by Greenbank Road to the east. Based on the City of Ottawa's Official Plan Schedule E, the major sources of roadway noise are Greenbank Road, Standherd Drive, Marketplace Avenue, as well as new collector and major collector roadways within and immediately beyond the site. Figure 1 illustrates the 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 (MOECP) 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) draft plan of subdivision prepared by Annis, O'Sullivan, Vollebekk Ltd.

The results of the current study indicate that noise levels due to roadway traffic at Block 1(proposed residential use) will range between approximately 45 and 65 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to new collector (realigned Jockvale Road) roadway and Greenbank Road.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 40 metres of the proposed collector, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. Noise levels from existing stationary sources across Block 1 were found to be below 45 dBA during the nighttime period, for the vast majority of Block 1.

From a noise perspective the proposed land uses are compatible with existing land uses; however, detailed roadway traffic and stationary noise studies should be undertaken during site plan approval to determine specific noise control measures for the development.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by JMurray Consulting to undertake an environmental noise feasibility assessment for the proposed Richcraft Subdivision development at 3194 Jockvale Road in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to an environmental noise feasibility assessment and was prepared in consideration of the client's draft plan of subdivision application. Gradient Wind's scope of work involved assessing noise levels throughout the site, generated by local roadway traffic and existing stationary sources. The report also quantitatively addresses any potential noise impacts. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MOECP)[2] guidelines. Noise calculations were based on an initial draft plan of subdivision prepared by Annis, O'Sullivan, Vollebekk Ltd., with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications, as well as satellite imagery of the site and Gradient Wind's past experience with stationary noise.

2. TERMS OF REFERENCE

The focus of this environmental noise feasibility assessment is a proposed draft plan of subdivision, which is expected to comprise of single homes and townhouse units on western portion and commercial elsewhere. The development is expected to contain outdoor living areas in the rear yards of each unit. The property is divided into three large blocks and four smaller blocks. Residential use is planned for Block 1 and commercial use planned for Blocks 2, 3, 4,5 and 6. A park is planned for Block 7. The site is surrounded by retail land to the north, and vacant land to the east and south. To the west is a storm water management pond. The site is bordered by Greenbank Road to the east. Based on the City of Ottawa's Official Plan Schedule E, the major sources of roadway noise are Greenbank Road, Standherd Drive, Marketplace Avenue, as well as new collector (realigned Jockvale Road) and major collector roadways within and immediately beyond the site. Figure 1 illustrates the site location with surrounding context.

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

Due to the current state of the development, the final site configuration is uncertain and may be subject to change. Therefore, GWE took the approach to establish noise contours around the site as per the current plans. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control would be required for various areas on site.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the site produced by local transportation and stationary sources, (ii) ensure that noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4 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 Transportation Noise

4.2.1 Criteria for Transportation Noise

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

Control Guidelines (ENCG) specifies that the recommended Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. OLA do not need to be considered during the nighttime period.

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

4.2.2 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[3] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 1 (below) summarizes the AADT values used for each roadway and LRT line included in this assessment.

TABLE 1: ROADWAY AND RAILWAY TRAFFIC DATA

Segment	Roadway Type	Speed Limit (km/h)	Traffic Volumes
Greenbank Road	4-UAD	60	35,000
Strandherd Drive	4-UAD	60	35,000
Marketplace Avenue	2-UCU	50	8,000
New Collector	2-UCU	50	8,000
New Major Collector	2-UMCU	50	12,000

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

4.2.3 Theoretical Transportation Noise Predictions

Noise predictions were determined by computer modelling using two programs. To provide a general sense of noise across the site, the software program *Predictor-Lima*, which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid with 5 × 5 m spacing was placed across the study site, along with a number of discrete receptors at key sensitive areas. This program outputs noise contours, however, is not the approved model for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the Ministry of the Environment and Climate Change's (MOECC) computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as shown in Figure 2. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 1, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions
- The day/night split was taken to be 92% / 8% respectively for all streets
- Reflective ground surface between source and receivers.
- The study site was treated as having flat or gently sloping topography
- No massing considered as potential noise screening elements

Receptor distances and exposure angles illustrated in Figure 2.

4.3 Stationary Noise

4.3.1 Criteria for Stationary Noise

For stationary sources, the L_{eq} is commonly calculated on an hourly interval, while for roadways, the L_{eq} is calculated on the basis of a 16-hour daytime/8-hour nighttime split as previously mentioned in Section 4.2.1.

Noise criteria taken from the ENCG apply to outdoor points of reception (POR). A POR is defined under NPC-300 as "any location on a noise sensitive land use where noise from a stationary source is received"[4]. This applies to the plane of window and outdoor amenity spaces serving the development. The surrounding area of the development would be defined as a Class 2 (Suburban) environment, as background noise levels are dominated by human activities such as roadway and transit sources.

The exclusionary sound level limits for Class 2 areas are summarized in Table 3 below. The applicable sound level limit is the higher of either the values in Table 2 or background noise levels due to sources such as transportation.

TABLE 2: EXCLUSIONARY LIMITS FOR CLASS 2 AREA

Time of Day	Class 2	
	Outdoor Points of Reception	Plane of Window
07:00 – 19:00	50	50
19:00 – 23:00	50	45
23:00 – 07:00	N/A	45

[4] NPC – 300, page 14

4.3.2 Assumptions

The nearest existing commercial facility to the development is the commercial plaza located at 3777 and 3779 Strandherd Drive, directly north of the development. The following assumptions have been included in the analysis:

(i) The quantity, location and sound power of rooftop equipment has been assumed based on satellite imagery and experience on similar projects.

(ii) The rooftop equipment is assumed to operate continuously over a 1-hour period during the daytime period, and at 50% operation during the nighttime period. This is to account for the decreased occupancy loads in the buildings overnight.

(iii) Chillers were assumed to operate continuously during a typical 24-hour period.

(iv) Screening effects of parapets have been conservatively excluded in the modelling.

4.3.3 Determination of Noise Source Power Levels

Sound power data for the rooftop equipment were assumed based on Gradient Wind's experience with similar types of equipment that are present on the surrounding commercial facilities. Table 3 summarizes the sound power assumed for each source used in the analysis, which are illustrated in Figure 3.

TABLE 3: EQUIPMENT SOUND POWER LEVELS (dBA)

Source ID	Description	Height Above Roof (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1-19	17.5 Ton RTU	2	-	71	78	81	81	76	71	63	86
S20-60	6.5 Ton RTU	2	-	72	74	78	78	74	70	61	83
S61-66	Chiller	2	-	-	-	-	89	-	-	-	89

4.3.4 Stationary Source Noise Predictions

The impact of the surrounding stationary noise sources on the development was determined by computer modelling. Stationary noise source modelling is based on the software program *Predictor-Lima* developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2. This computer program is capable of representing three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. The methodology has been used on numerous assignments and has been accepted by the MOECP as part of Environmental Compliance Approvals applications.

A receptor grid, with a receptor spacing of 5X5 m has been placed within the property lines in the *Predictor-Lima* model to measure the noise impact across the site during the daytime (07:00 – 19:00) and nighttime (19:00 – 07:00) periods. All mechanical equipment was represented as point sources in the model. Air temperature, pressure and humidity were set to 10°C, 101.3 kPA and 70%, respectively. Ground absorption over the study area was determined based on topographical features (such as water, concrete, grassland, etc.). A coefficient of 0 was used for hard surfaces, such as concrete and paved areas, and 1 for soft surfaces, such as grass and vegetative areas. Existing and proposed buildings were added to the model to account for screening and reflection effects from building façades. Modelling files and outputs are available upon request.

5. RESULTS AND DISCUSSION

5.1 Transportation Noise Levels

The results of the roadway traffic noise calculations for the daytime and nighttime period are shown in Figures 4 and 5 respectively, which cover the entire study site. Discrete receptors were also placed at ground level at key locations throughout the site. The noise contours were generated using *Predictor-Lima* and verified with discrete receptors using STAMSON 5.04 as shown in Figure 2 and summarized in Table 4 below. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

TABLE 4: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Plane of Window Receptor Location	STAMSON 5.04 Noise Level (dBA)		Predictor Noise Level (dBA)	
		Day	Night	Day	Night
1	Block 3	59	51	60	52
2	Block 2	54	46	53	45
3	Block 2	59	51	59	51
4	Block 1	52	44	53	45

As shown above, the results calculated from *Predictor-Lima* generally have good correlation with calculations performed in STAMSON 5.04. A tolerance of 3 dBA between models is generally considered acceptable given human hearing cannot detect a change in sound level of less than 3 dBA. As stated in Section 4.3.1, no massing of proposed buildings considered as potential screening elements. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 40 metres of the proposed collectors, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

5.2 Stationary Noise Levels

Noise levels from existing stationary sources were found to be below 45 dBA during the nighttime period, for the vast majority of Block 1. These levels largely fall below the Class 2 criteria. It is noted that these levels are likely to be conservative given the low likelihood of all units running concurrently. The anticipated sound levels across the development are illustrated in Figure 6 and 7 for daytime and nighttime conditions, respectively. The main contributor of noise at proposed resdential parcel is the rooftop mechanical equipment of the adjacent Home Depot store. The most impacted area of the development is the upper level windows.

5.3 Noise Control Measures

The OLA noise levels predicted due to roadway traffic, at a number of areas, exceed the criteria listed in the ENCG for outdoor living areas, as discussed in Section 4.2. Therefore, noise control measures as described below from Table 2.3a in the ENCG, in order of preference, will be required to reduce the L_{eq} to 55 dBA:

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

Regarding Figure 4 and 5, the area(s) with noise levels under 55 dBA (yellow and light orange) have no ventilation or mitigation requirements. The area(s) with noise levels between 55 and 65 dBA (orange and red) require forced air heating with provision for central air conditioning with an applicable generic Warning Clause. Finally, the area(s) that represent noise levels above 65 dBA (maroon) require central air conditioning with an applicable extensive mitigation Warning Clause. If the daytime/ nighttime noise levels in the plane of window for a bedroom or living room is greater than 65 dBA/ 60 dBA, respectively, building components including windows, walls and doors, where applicable, should be designed so that the indoor noise levels comply with the noise levels stated in Section 4.2.

6. CONCLUSIONS AND RECOMMENDATIONS

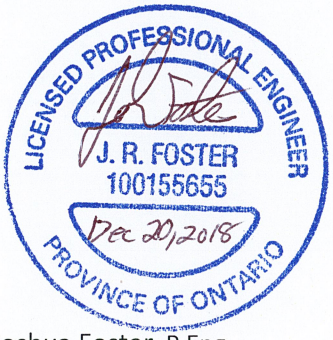
The results of the current study indicate that noise levels due to roadway traffic at Block 1 will range between approximately 45 and 65 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to new collector roadway and Greenbank Road.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 40 metres of the proposed collector, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. Noise levels from existing stationary sources across Block 1 were found to be below 45 dBA during the nighttime period, for the vast majority of Block 1.

A detailed roadway traffic noise and stationary noise study will be required at the time of site plan approval to determine specific noise control measures for the development. 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
GWE18-192

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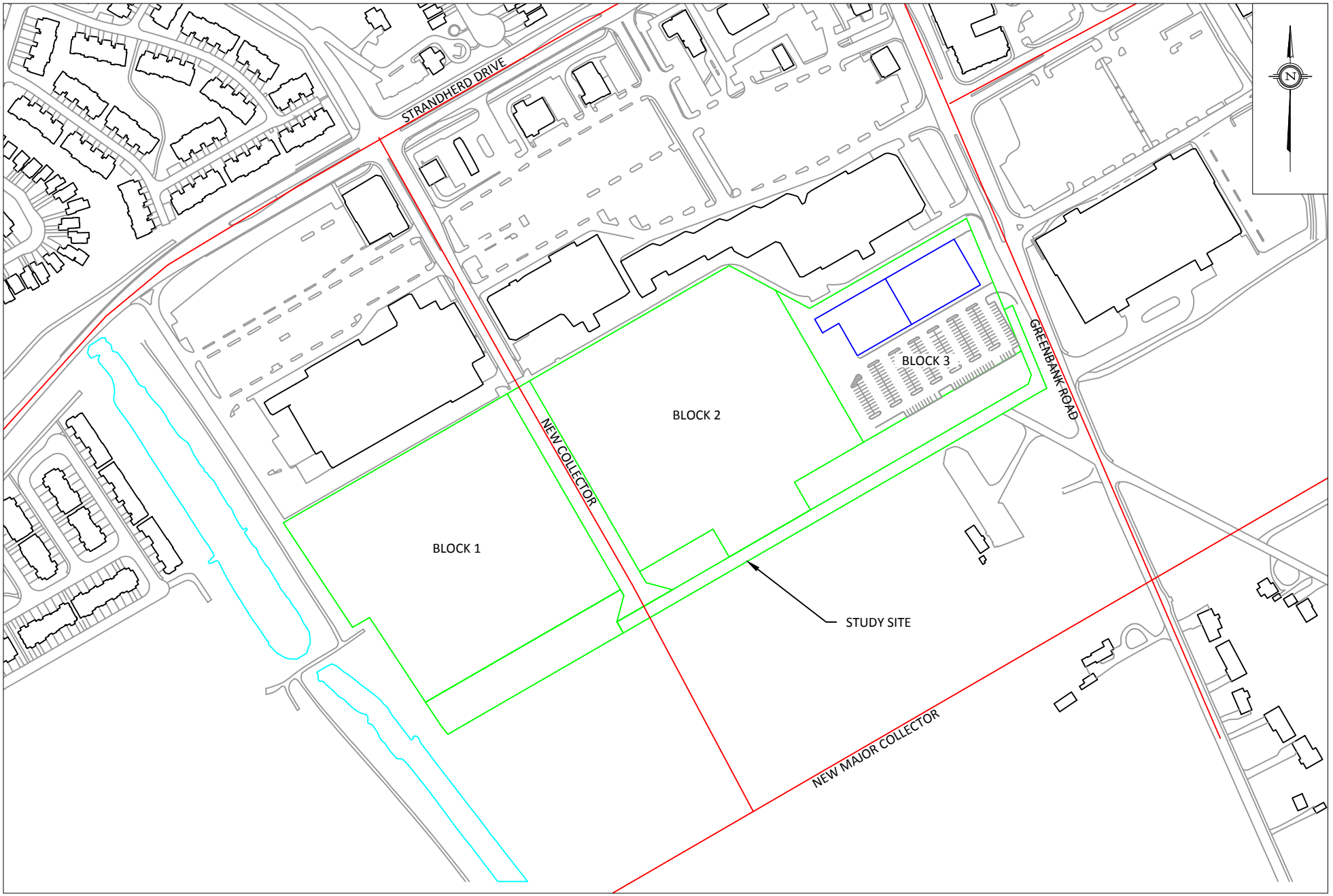
Principal



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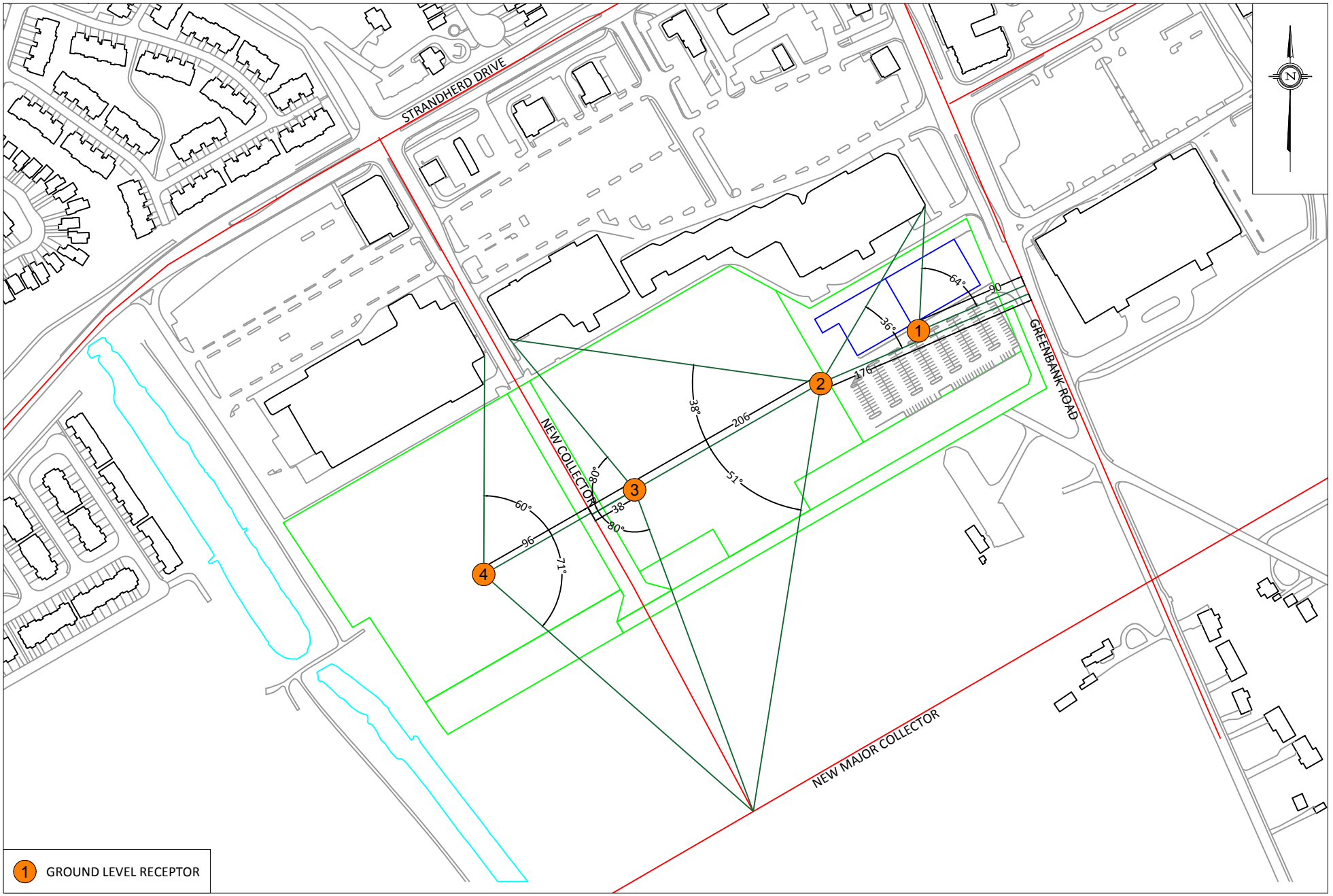
PROJECT	3194 JOCKVALE ROAD ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT
SCALE	1:4000 (APPROX.)
DRAWING NO.	GWE18-192-1
DATE	DECEMBER 14, 2018
DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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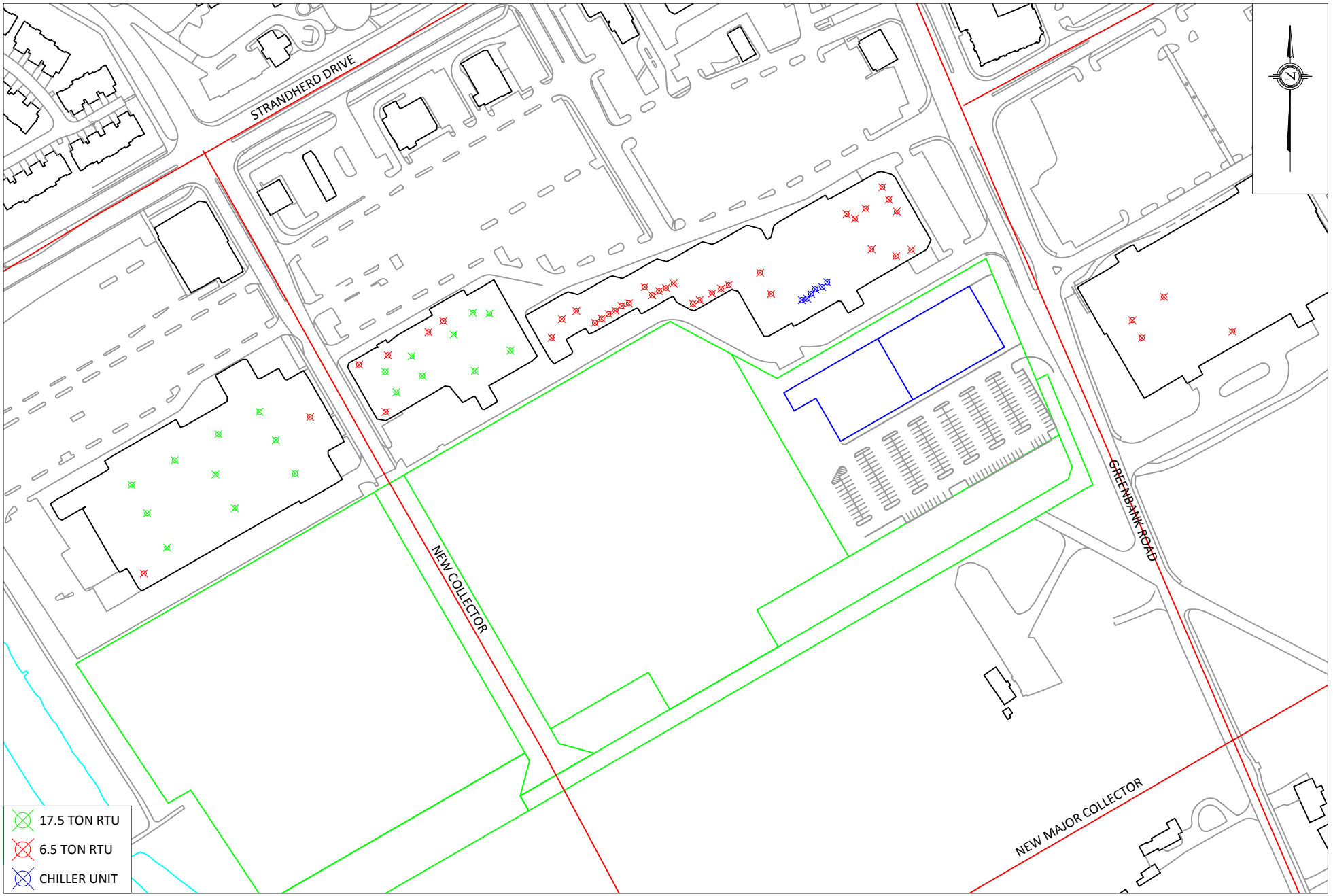
PROJECT	3194 JOCKVALE ROAD ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT
SCALE	1:4000 (APPROX.)
DRAWING NO.	GWE18-192-2
DATE	DECEMBER 14, 2018
DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS AND STAMSON INPUT DATA



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PROJECT	3194 JOCKVALE ROAD ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE18-192-3
DATE	DECEMBER 14, 2018	DRAWN BY	M.L.

DESCRIPTION

FIGURE 3:
STATIONARY NOISE SOURCE LOCATIONS

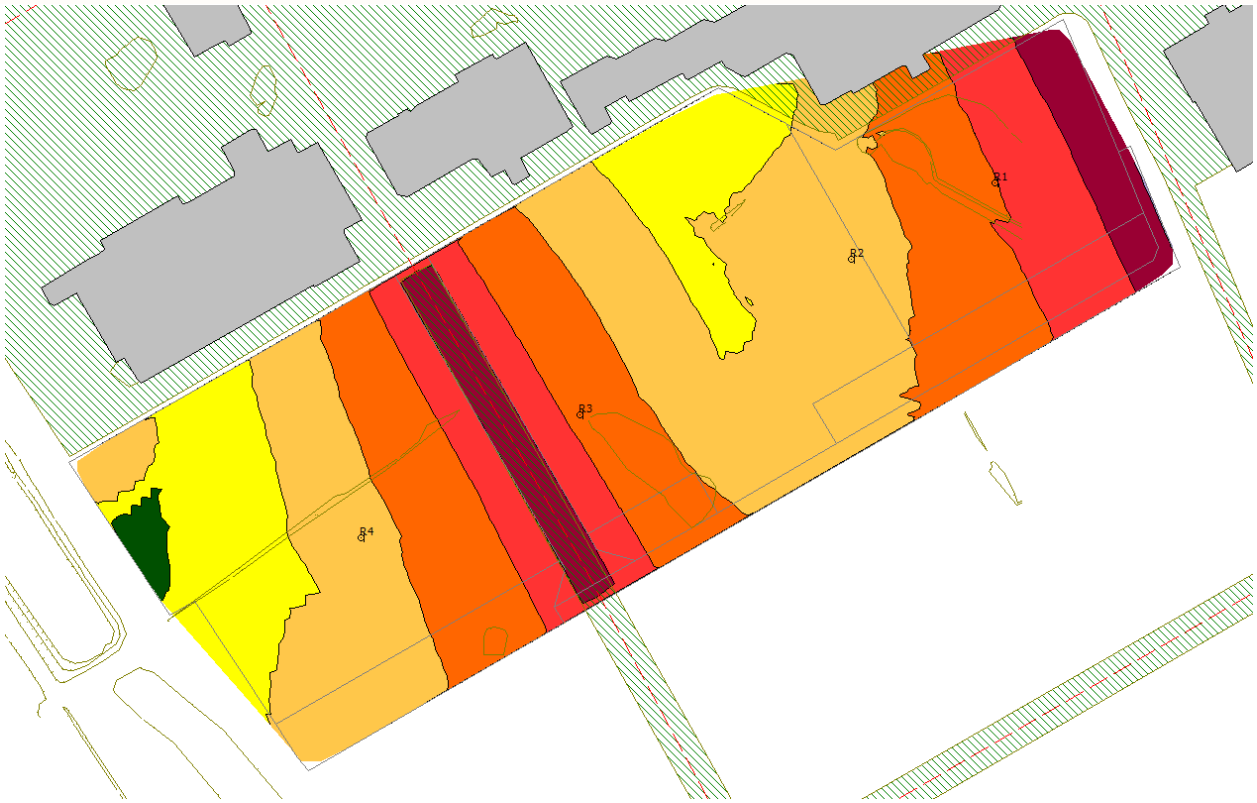

FIGURE 4: ROADWAY NOISE GROUND LEVEL NOISE CONTOURS (DAYTIME PERIOD)

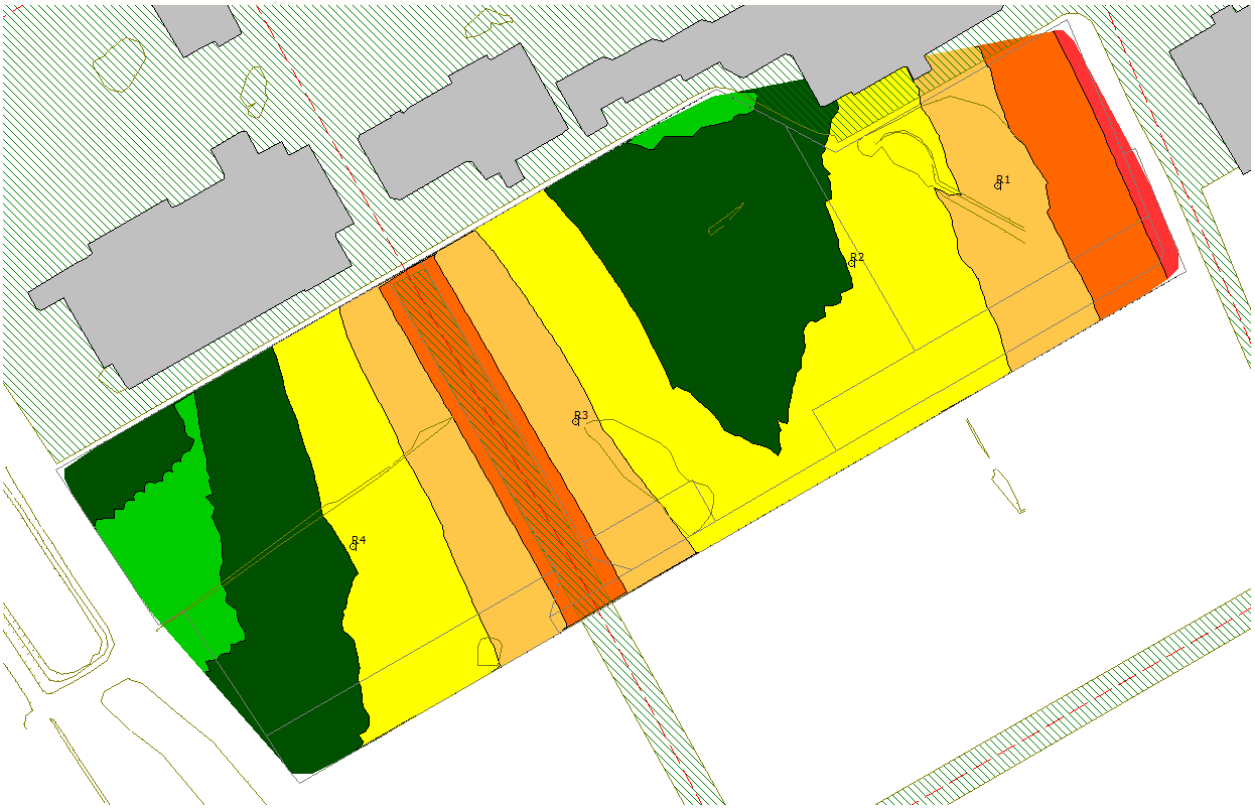

FIGURE 5: ROADWAY NOISE GROUND LEVEL NOISE CONTOURS (NIGHTTIME PERIOD)

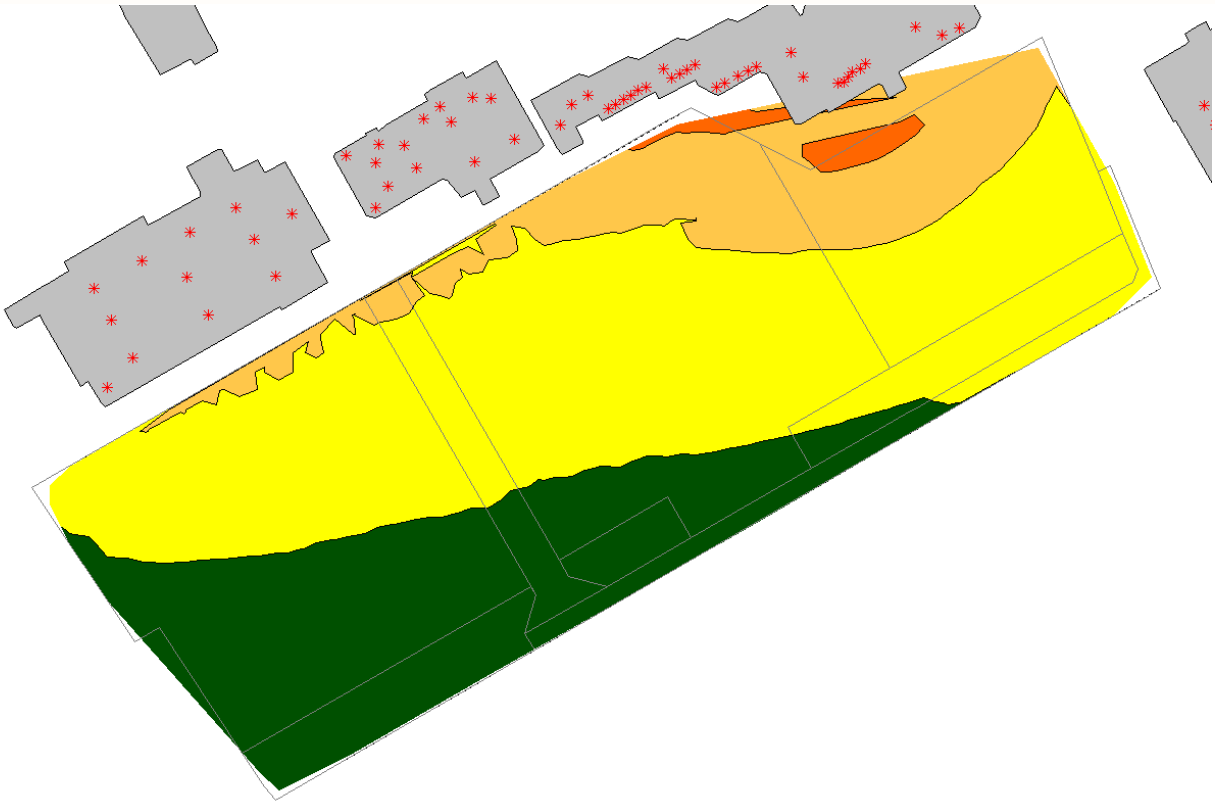

FIGURE 6: STATIONARY NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD) – 7.5 M

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: 14-12-2018 16:06:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


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

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

Source height = 1.50 m

ROAD (0.00 + 58.98 + 0.00) = 58.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64     90   0.66  73.68   0.00 -12.92  -1.78   0.00   0.00   0.00
58.98
-------------------------------------------------------------------------
--

Segment Leq : 58.98 dBA

Total Leq All Segments: 58.98 dBA


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

Source height = 1.50 m

ROAD (0.00 + 51.38 + 0.00) = 51.38 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64     90   0.66  66.08   0.00 -12.92  -1.78   0.00   0.00   0.00
51.38
-------------------------------------------------------------------------
--

Segment Leq : 51.38 dBA

Total Leq All Segments: 51.38 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 58.98
                           (NIGHT): 51.38
```

```
STAMSON 5.0         NORMAL REPORT         Date: 14-12-2018 16:06:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Greenbank (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: Greenbank (day/night)
--------------------------------------------
Angle1   Angle2           : -36.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 176.00 / 176.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Collector (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Collector (day/night)
-------------------------------------------
Angle1   Angle2           : -51.00 deg   38.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 206.00 / 206.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 53.32 + 0.00) = 53.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -36     90   0.66  73.68   0.00 -17.75  -2.61   0.00   0.00   0.00
53.32
-------------------------------------------------------------------------
--

Segment Leq : 53.32 dBA


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

Source height = 1.50 m

ROAD (0.00 + 43.48 + 0.00) = 43.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -51     38   0.66  65.75   0.00 -18.89  -3.38   0.00   0.00   0.00
43.48
-------------------------------------------------------------------------
--

Segment Leq : 43.48 dBA

Total Leq All Segments: 53.75 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 45.72 + 0.00) = 45.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -36     90   0.66  66.08   0.00 -17.75  -2.61   0.00   0.00   0.00
45.72
-------------------------------------------------------------------------------
--

Segment Leq : 45.72 dBA


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

Source height = 1.50 m

ROAD (0.00 + 35.89 + 0.00) = 35.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -51     38   0.66  58.16   0.00 -18.89  -3.38   0.00   0.00   0.00
35.89
-------------------------------------------------------------------------------
--

Segment Leq : 35.89 dBA

Total Leq All Segments: 46.15 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 53.75
                           (NIGHT): 46.15
```

```
STAMSON 5.0         NORMAL REPORT         Date: 14-12-2018 16:07:02
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Collector (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Collector (day/night)
-------------------------------------------
Angle1   Angle2           : -80.00 deg   80.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  38.00 / 38.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 58.98 + 0.00) = 58.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -80     80   0.66  67.27   0.00  -6.70  -1.59   0.00   0.00   0.00
58.98
-------------------------------------------------------------------------
--

Segment Leq : 58.98 dBA

Total Leq All Segments: 58.98 dBA


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

Source height = 1.50 m

ROAD (0.00 + 51.38 + 0.00) = 51.38 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -80     80   0.66  59.67   0.00  -6.70  -1.59   0.00   0.00   0.00
51.38
-------------------------------------------------------------------------
--

Segment Leq : 51.38 dBA

Total Leq All Segments: 51.38 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 58.98
                           (NIGHT): 51.38
```

```
STAMSON 5.0        NORMAL REPORT        Date: 14-12-2018 16:07:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Collector (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Collector (day/night)
--------------------------------------------
Angle1   Angle2           : -60.00 deg   71.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  96.00 / 96.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 51.81 + 0.00) = 51.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -60     71   0.66  67.27   0.00 -13.38  -2.08   0.00   0.00   0.00
51.81
-------------------------------------------------------------------------
--

Segment Leq : 51.81 dBA

Total Leq All Segments: 51.81 dBA


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

Source height = 1.50 m

ROAD (0.00 + 44.21 + 0.00) = 44.21 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -60     71   0.66  59.67   0.00 -13.38  -2.08   0.00   0.00   0.00
44.21
-------------------------------------------------------------------------
--

Segment Leq : 44.21 dBA

Total Leq All Segments: 44.21 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 51.81
                           (NIGHT): 44.21
```

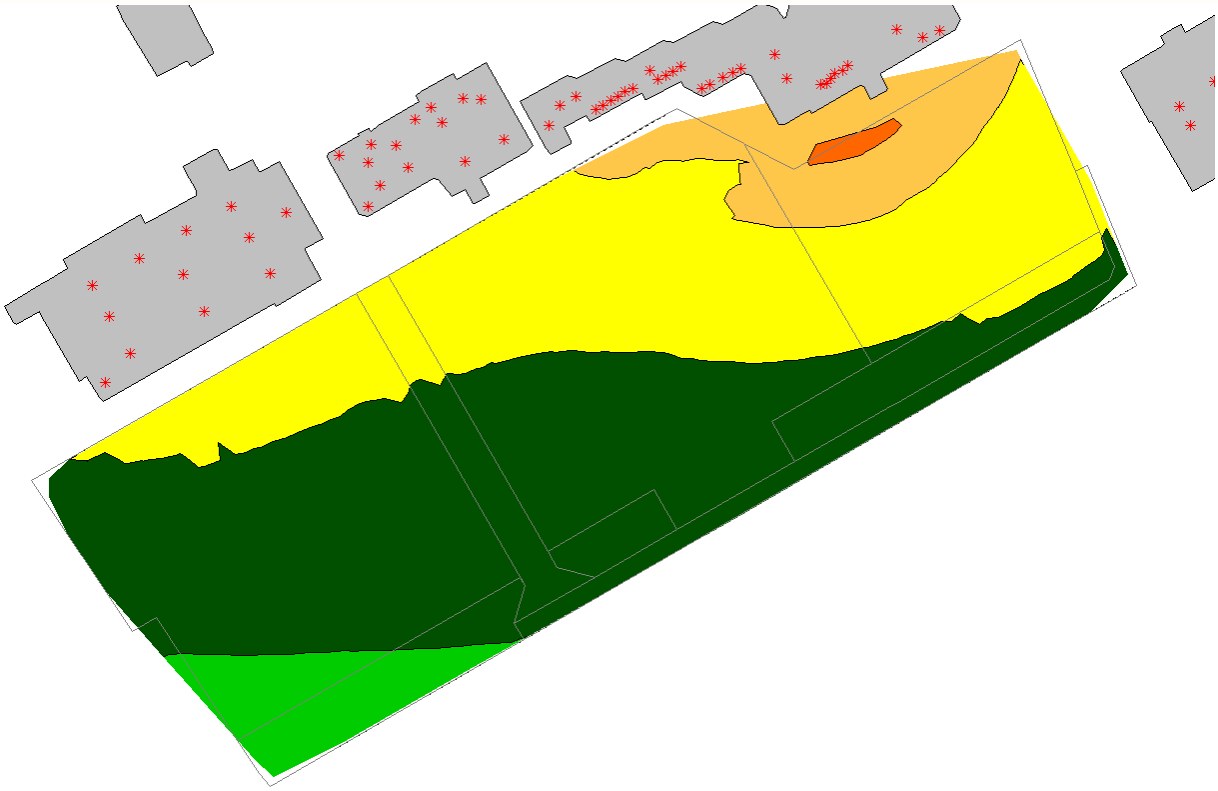

FIGURE 7: STATIONARY NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD) – 7.5 M