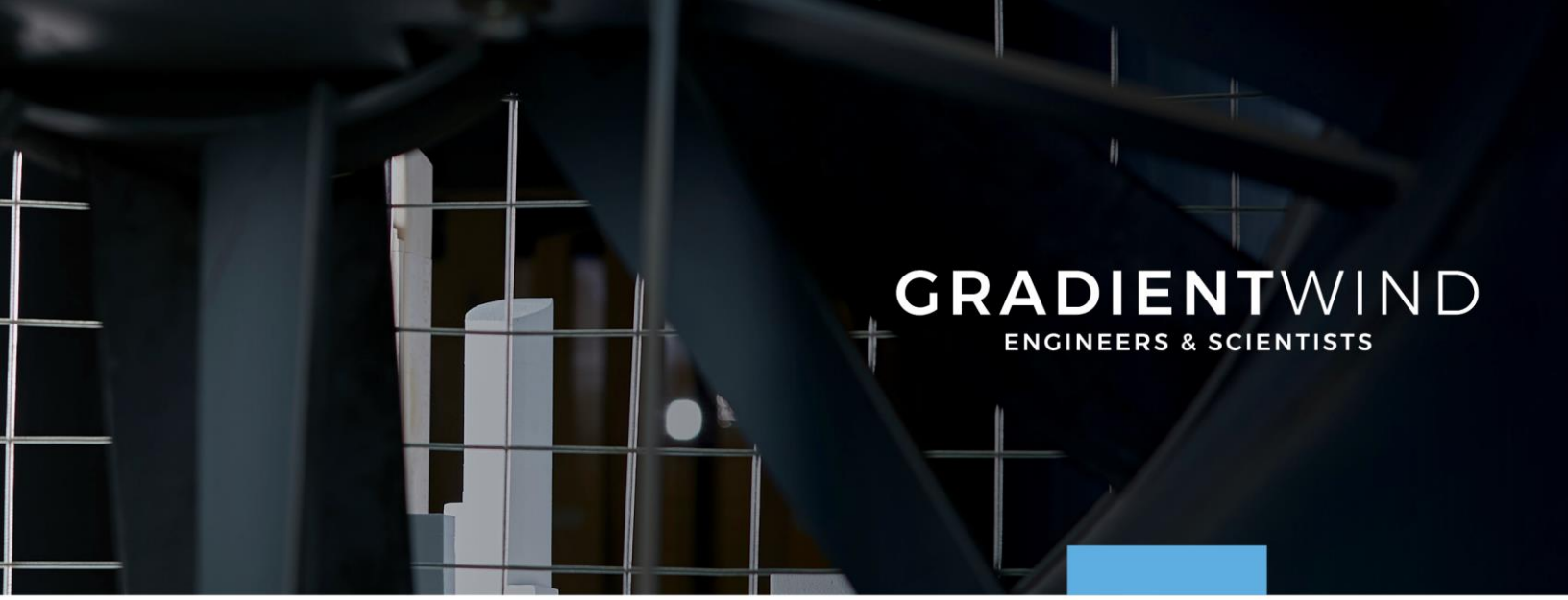
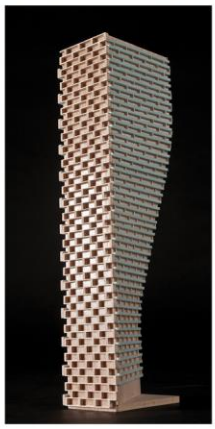


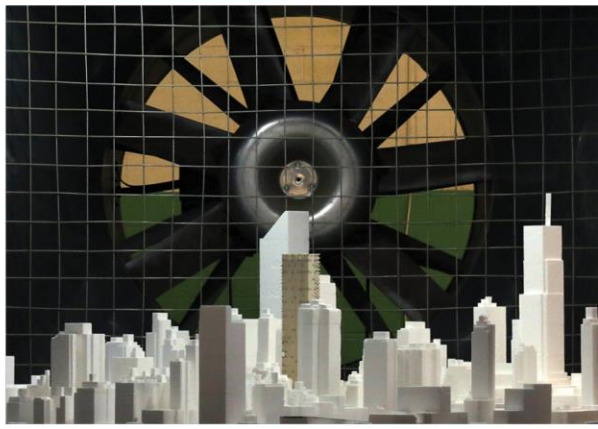
GRADIENTWIND
ENGINEERS & SCIENTISTS

STATIOANRY NOISE ASSESSMENT

3713 Borrisokane Road
Ottawa, Ontario

REPORT: GWE19-228 – Stationary Noise R1





December 16, 2019

PREPARED FOR
Hugo Lalonde
Director, Land Development
Caivan Greenbank North Inc.
2934 Baseline Road, Suite 302
Ottawa, ON
K2H 1B2

PREPARED BY
Michael Lafortune, C.E.T., Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a stationary noise assessment performed for the proposed industrial development at 3713 Borrisokane Road in Ottawa, Ontario. The proposed industrial facility contains a plant located on the east side of the site and two storeys of office space located to the west. The facility is expected to operate during daytime hours only. Sources of stationary noise include rooftop air handling equipment, and trucking/loading activities. Moving trucks and forklifts are a source of steady-state noise, while loading of trucks and movement of materials in the storage yard can be a source of impulsive noise. There are also two emergency generators located at grade to the south of the building. Figure 1 illustrates a 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), and; (iii) drawings prepared by Figurr/Nak Design Strategies.

The results of the current study indicate that noise levels at nearby points of reception are expected to fall below the ENCG and NPC-300 noise criteria, provided that the assumptions outlined in Section 2.1 are followed during the detailed design process. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses and will satisfy all site plan conditions. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Caivan Greenbank North Inc. to undertake a stationary noise assessment for the proposed industrial development at 3713 Borrisokane Road in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a stationary noise assessment.

The present scope of work involves assessing exterior noise levels generated by rooftop air handling equipment and manufacturing processes such as truck movements. The assessment was performed based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[2] guidelines, drawings prepared by Figurr/Nak Design Strategies, mechanical information provided by the applicant, surrounding street layouts obtained from the City of Ottawa, and recent site imagery.

2. TERMS OF REFERENCE

The focus of this stationary noise assessment is the proposed development at 3713 Borrisokane Road in Ottawa, Ontario. The proposed industrial facility is a manufacturing assembly line and contains an assembly plant located on the east side of the site and two storeys of office space located to the west. An internal driveway is located to the south and to the west to access a drop-off area near the main entrance. Entry/exit to the loading areas for the trucks are provided at the northwest and at the southeast corner of the site. Outdoor vehicular parking is provided to the northwest of the building within the site. The development includes a berm along the east side of the development site. The site is bound by Borrisokane Road to the west, a future roadway to the south, future residential subdivision to the east and a storm water management pond to the north. Figure 1 illustrates the site plan and surrounding context.

The facility is expected to operate during daytime hours only. Sources of stationary noise include rooftop air handling equipment, trucking and loading activities. Moving trucks and forklifts are considered sources

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

of steady-state noise, while loading of trucks and movement of materials in the storage yard can be sources of impulsive sound. There are also two emergency generators located at grade to the south of the building. Figure 2 illustrates the location of all noise sources included in this study.

2.1 Assumptions

Gradient Wind has received mechanical information the applicant. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment. The following assumptions have been made in the analysis:

(i) Nine truck movements occur per hour during the daytime period (07:00 – 23:00).

(ii) More than 8 impulsive noise events per hour may be generated at the loading docks or outdoor storage areas.

(iii) The locations, quantity and tonnage of rooftop units has been based on mechanical information provided by the applicant.

(iv) Sound data for rooftop units are based on manufacturer's data.

(v) Sound data for truck movements, loading activities and impulse noise is based on Gradient Wind's past experience with similar properties.

(vi) The rooftop mechanical units are assumed to operate continuously over a 1-hour period during the daytime and at 50% operation during the nighttime period.

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

(viii) Locations of generators is based on information provided by the applicant.

(ix) A 3.5 m earth berm surrounds the storage yard on the east side (see Figure 1), as per the December 2019 grading plan.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the surrounding properties produced by stationary sources and (ii) ensure that exterior noise levels do not exceed the allowable limits specified by the ENCG, as outlined in Section 4 of this report.

4. METHODOLOGY

The impact of the external stationary noise sources on the nearby residential areas 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 simulates three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. This methodology has been used on numerous assignments and has been accepted by the MECP as part of Environmental Compliance Approvals applications. Three receptor locations were selected for the study site, as illustrated in Figure 3.

4.1 Perception of Noise

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 source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Its measurement 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 represents the noise perceived by the human ear. With this scale, a doubling of sound power at the source results in a 3 dBA increase in measured noise levels at the receiver and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

Stationary sources are defined in the ENCG as "all sources of sound and vibration, whether fixed or mobile, that exist or operate on a premises, property or facility, the combined sound and vibration levels of which are emitted beyond the property boundary of the premises, property or facility, unless the source(s) is (are) due to construction" [3].

[3] City of Ottawa Environmental Noise Control Guidelines, page 10

4.2 Steady-State/Varying Stationary Noise

4.2.1 Criteria for Steady-State/Varying Stationary Noise

The equivalent sound energy level, L_{eq}, provides a weighted 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 selected period of time. 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.

Noise criteria taken from the ENCG and NPC-300 apply to points of reception (POR). A POR is defined under the ENCG as "any location on a noise sensitive land use where noise from a stationary source is received"[4]. A POR can be located on an existing or zoned for future use premises of permanent or seasonal residences, hotels/motels, nursing/retirement homes, rental residences, hospitals, camp grounds, and noise sensitive buildings such as schools and places of worship. The study site is located adjacent to an arterial roadway, and the surrounding lands are slated for suburban developments. The recommended maximum noise levels for a Class 2 area in a suburban environment adjacent to arterial roadways at a POR are outlined in Table 1 below.

TABLE 1: EXCLUSIONARY LIMITS FOR CLASS 2 AREA

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

4.2.2 Determination of Noise Source Power Levels

Mechanical information for the development has been based on mechanical information provided by the applicant, as well as Gradient Wind's experience with similar properties. S23-26 account for the steady-state noise component of loading activities, which may include short-term idling of vehicles. Table 2 summarizes the sound power of each source used in the analysis.

[4] City of Ottawa Environmental Noise Guidelines, page 9

TABLE 2: EQUIPMENT SOUND POWER LEVELS (dBA) (UNMITIGATED)

Source ID	Description	Height Above Grade (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1-6	5 TON RTU	1.3					84				**84**
S7-9	6 TON RTU	1.5					85				**85**
S10	7 TON RTU	1.5					85				**85**
S11-13	10 TON RTU	1.5					91				**91**
S14	12 TON RTU	1.5					85				**85**
S15-20	MUA	1.2	78	80	76	82	82	81	79	69	**89**
S21-22	Truck Movement	1.5	65	72	76	85	90	89	83	74	**94**
S23-26	Loading Activity	2	79	82	84	84	81	78	75	72	**90**
S27-28	Generator	2					95				**95**

4.2.3 Steady-State Noise Predictions

The impact of stationary noise sources on nearby residential areas was determined by computer modelling using the software program Predictor-Lima. This program was developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2 and 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 Ministry of the Environment, Conservation and Parks (MECP) as part of Environmental Compliance Approval applications.

A total of 8 receptor locations were chosen around the site to measure the noise impact at points of reception (POR) during the daytime/evening period (07:00 – 23:00), as well as during the nighttime period (23:00 – 07:00). POR locations include outdoor points of reception (OPOR) and the plane of windows (POW) of the adjacent residential properties. Sensor locations are described in Table 3 and illustrated in Figure 3. All units were represented as point sources in the Predictor model. Table 4 below contains Predictor-Lima calculation settings. These are typical settings that have been based on ISO 9613 standards and guidance from the MECP.

Ground absorption over the study area was determined based on topographical features (such as water, concrete, grassland, etc.). An absorption value of 0 is representative of hard ground, while a value of 1 represents grass and similar soft surface conditions. Existing and proposed buildings were added to the model to account for screening and reflection effects from building façades. A Predictor-Lima sample output is available in Appendix A. Further modelling data is available upon request.

TABLE 3: RECEPTOR LOCATIONS

Receptor Number	Receptor Location	Height Above Grade (m)
R1	POW – Future Dwelling 2nd Floor West Façade	4.5
R2	OPOR – Future Dwelling Rear Yard	1.5
R3	POW – Future Dwelling 2nd Floor West Façade	4.5
R4	OPOR – Future Dwelling Rear Yard	1.5
R5	POW – Future Dwelling 2nd Floor West Façade	4.5
R6	OPOR – Future Dwelling Rear Yard	1.5
R7	POW – Future Dwelling 2nd Floor West Façade	4.5
R8	OPOR – Future Dwelling Rear Yard	1.5

TABLE 4: CALCULATION SETTINGS

Parameter	Setting
Meteorological correction method	Single value for C0
Value C0	2.0
Default ground attenuation factor	1
Ground attenuation factor for roadways and paved areas	0
Temperature (K)	283.15
Pressure (kPa)	101.33
Air humidity (%)	70

4.3 Impulsive Stationary Noise

According to NPC-300, certain noise sources are not considered as stationary sources. In this case, such sources include "'back up beepers' on construction equipment or other vehicles", as well as "occasional movement of vehicles on the property such as a delivery of goods to and the removal of goods from convenience stores, fast food restaurants, and similar commercial facilities"[5]. Because the proposed facility will have multiple deliveries/removal of goods per week, this is included within the analysis. Eight impulsive sources were assumed to be located at the loading docks as well as in the storage yard where the movement of materials can be a source of impulsive sound (see Figure 2). Impulsive noise from loading docks is generated when the pallet truck moves over the metal ramp and is caused by the metal-on-metal or metal-on-concrete contact. In the storage area impulses can be generated when heavy materials are lowered into place from a forklift.

4.3.1 Criteria for Impulsive Stationary Noise

Impulse noise, such as bangs and firearm discharges, are expressed in terms of the Logarithmic Mean Impulse Sound Level (L_{LM}). The L_{LM} is the average of the individual sound pressure levels generated by each impulse event. According to NPC-300, the exclusion limit values for impulsive sound levels for Plane of Window and Outdoor Points of Reception are shown in Table 5 below.

[5] NPC – 300, page 20

TABLE 5: EXCLUSION LIMIT FOR IMPULSIVE SOUND LEVELS - CLASS 2 AREA[6]

Time of Day	Actual Number of Impulses in Period of One-Hour	Class 2 L_{LM} (dBAI) Limit	
		POW Points of Reception	OPOR Points of Reception
07:00 – 23:00/ 23:00-07:00	9 or more	50/45	50/-
07:00 – 23:00/ 23:00-07:00	7 to 8	55/50	55/-
07:00 – 23:00/ 23:00-07:00	5 to 6	60/55	60/-
07:00 – 23:00/ 23:00-07:00	4	65/60	65/-
07:00 – 23:00/ 23:00-07:00	3	70/65	70/-
07:00 – 23:00/ 23:00-07:00	2	75/70	75/-
07:00 – 23:00/ 23:00-07:00	1	80/75	80/-

4.3.2 Determination of Impulse Noise Sound Power

Sound power levels for the impulse noise due to the loading bays and storage activities were based on Gradient Wind's past experience on similar developments. Based on the information provided by the applicant, it was assumed that impulse events may occur more than 8 times within an hour at each location. The Logarithmic Mean Impulse Sound Level (L_{LM}) of the loading docks and storage yard used in the assessment was 104 dBA. To account for the random nature of these impulse events, in terms of location, the source has been split into 8 individual sources, each with a sound power level of 95 dBA for input in the *Predictor-Lima* model.

4.3.3 Impulse Source Noise Prediction Assessment

The logarithmic impulse noise levels were examined at the various noise sensitive points of reception in the *Predictor-Lima* model. The impulse sources were modeled as point sources at a height of 1.2 meters above grade for loading dock activities (deck level), and 0.01 m above grade for storage yard activities which are primarily generated by materials being placed on the ground. These sources are positioned at key locations, such as the loading docks and throughout the storage yard.

[6] *Ministry of Environment and Climate Change (MOECC). Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300). August 2013.*

5. RESULTS AND DISCUSSION

5.1 Steady-State/Varying Stationary Noise Results

Noise levels at nearby sensitive receptors fall below NPC-300 and ENCG criteria for stationary noise, as summarized in Table 6 and 7 below. The sound levels listed in Table 6 and 7 are based on the assumptions outlined in Section 2.1.

TABLE 6: NOISE LEVELS FROM STEADY-STATE SOURCES

Receptor Number	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 2 Criteria	
	Day	Night	Day	Night	Day	Night
R1	37	32	50	45	Yes	Yes
R2	35	29	50	45	Yes	Yes
R3	39	30	50	45	Yes	Yes
R4	37	31	50	45	Yes	Yes
R5	41	32	50	45	Yes	Yes
R6	37	31	50	45	Yes	Yes
R7	40	30	50	45	Yes	Yes
R8	35	30	50	45	Yes	Yes

TABLE 7: NOISE LEVELS FROM EMERGENCY EQUIPMENT

Receptor Number	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 2 Criteria	
	Day	Night	Day	Night	Day	Night
R1	13	N/A	55	N/A	Yes	Yes
R2	14	N/A	55	N/A	Yes	Yes
R3	17	N/A	55	N/A	Yes	Yes
R4	17	N/A	55	N/A	Yes	Yes
R5	28	N/A	55	N/A	Yes	Yes
R6	17	N/A	55	N/A	Yes	Yes
R7	41	N/A	55	N/A	Yes	Yes
R8	38	N/A	55	N/A	Yes	Yes

As Table 6 and 7 summarize, noise levels fall below NPC-300 and ENCG criteria at all receptors. Criteria for emergency equipment is 5 dB higher than the exclusionary limits, as shown in Table 6. Noise contours at 4.5 m above grade can be seen in Figure 4 and 5 for daytime and nighttime conditions for HVAC noise, respectively. Figure 6 illustrates noise contours at 4.5 m above grade for generator noise. The loudest rooftop equipment should be located toward the centre of the rooftop, avoiding direct line of sight with sensitive areas if possible. With consideration of Gradient Wind's recommendations, the proposed development is expected to be compatible with the existing land uses.

5.2 Impulsive Noise Levels

The impulse noise levels from deliveries/removal of goods from site, as well as various storage activities in the storage yard are summarized in Table 8. The results of the analysis indicate the resultant highest mean logarithmic impulsive sound level at the development is 55 dBAI during the daytime period. No unloading/loading activities are expected to occur during the evening or nighttime periods. This falls below the NPC-300 criteria provided the assumptions in Section 2.1 and 4.3 are followed. Noise contours for the development at 4.5 m above grade can be seen in Figure 7 for daytime conditions.

TABLE 8: NOISE LEVELS FROM IMPULSIVE STATIONARY SOURCES

Receptor Number	Noise Level (dBAI)		Meets Class 2 Criteria	
	Day	Night	Day (50 dBAI)	Night (45 dBAI)
R1	44	44	Yes	Yes
R2	45	45	Yes	Yes
R3	49	49	Yes	Yes
R4	44	44	Yes	Yes
R5	50	50	Yes	Yes
R6	44	44	Yes	Yes
R7	49	49	Yes	Yes
R8	42	42	Yes	Yes

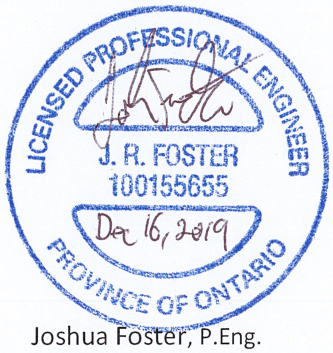
6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels at nearby points of reception are expected to fall below the ENCG and NPC-300 noise criteria, provided that the assumptions outlined in Section 2.1 are adhered to during the detailed design process. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses and will satisfy all site plan conditions. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment.

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,

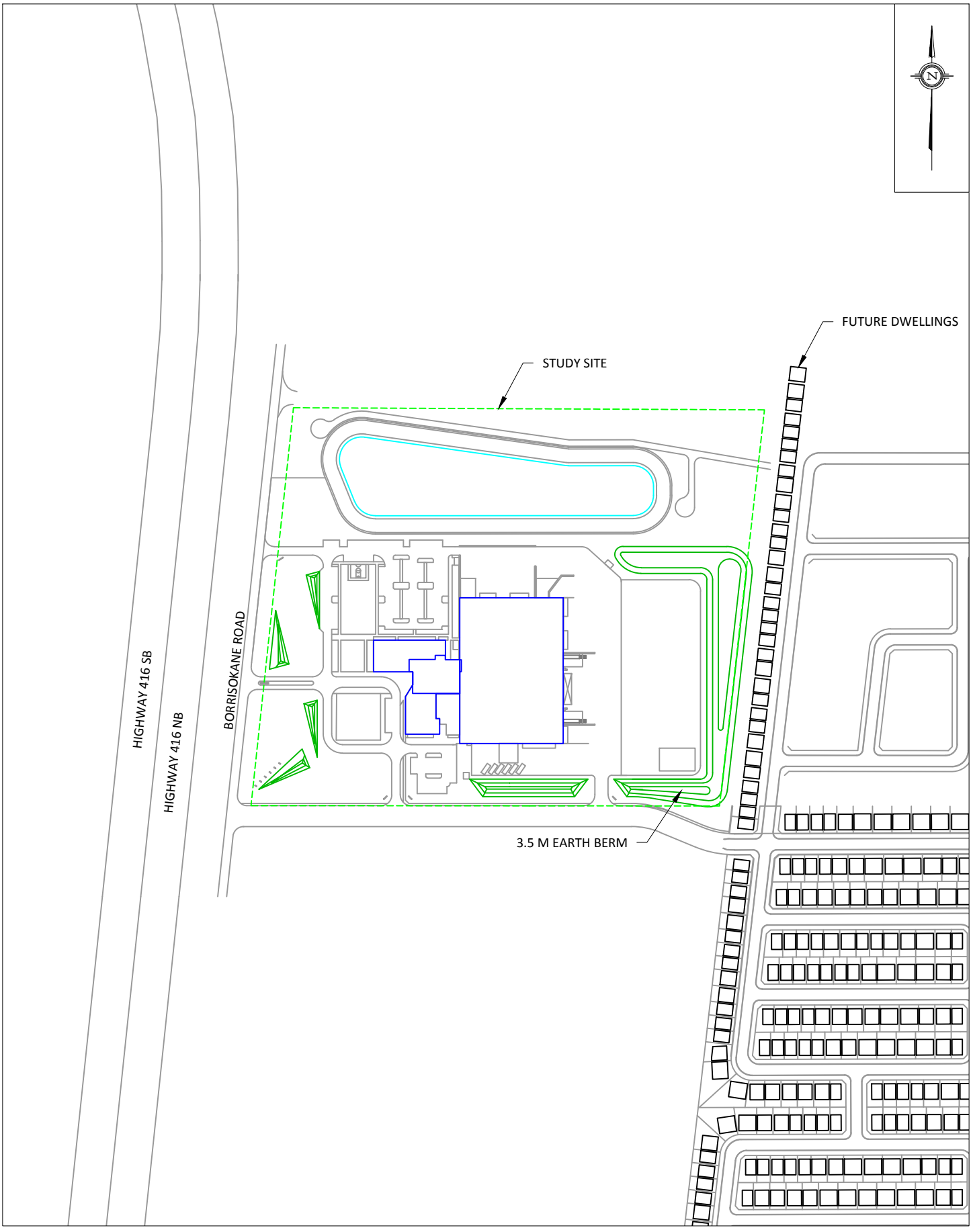
Gradient Wind Engineering Inc.



Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #19-228 – Stationary Noise R1



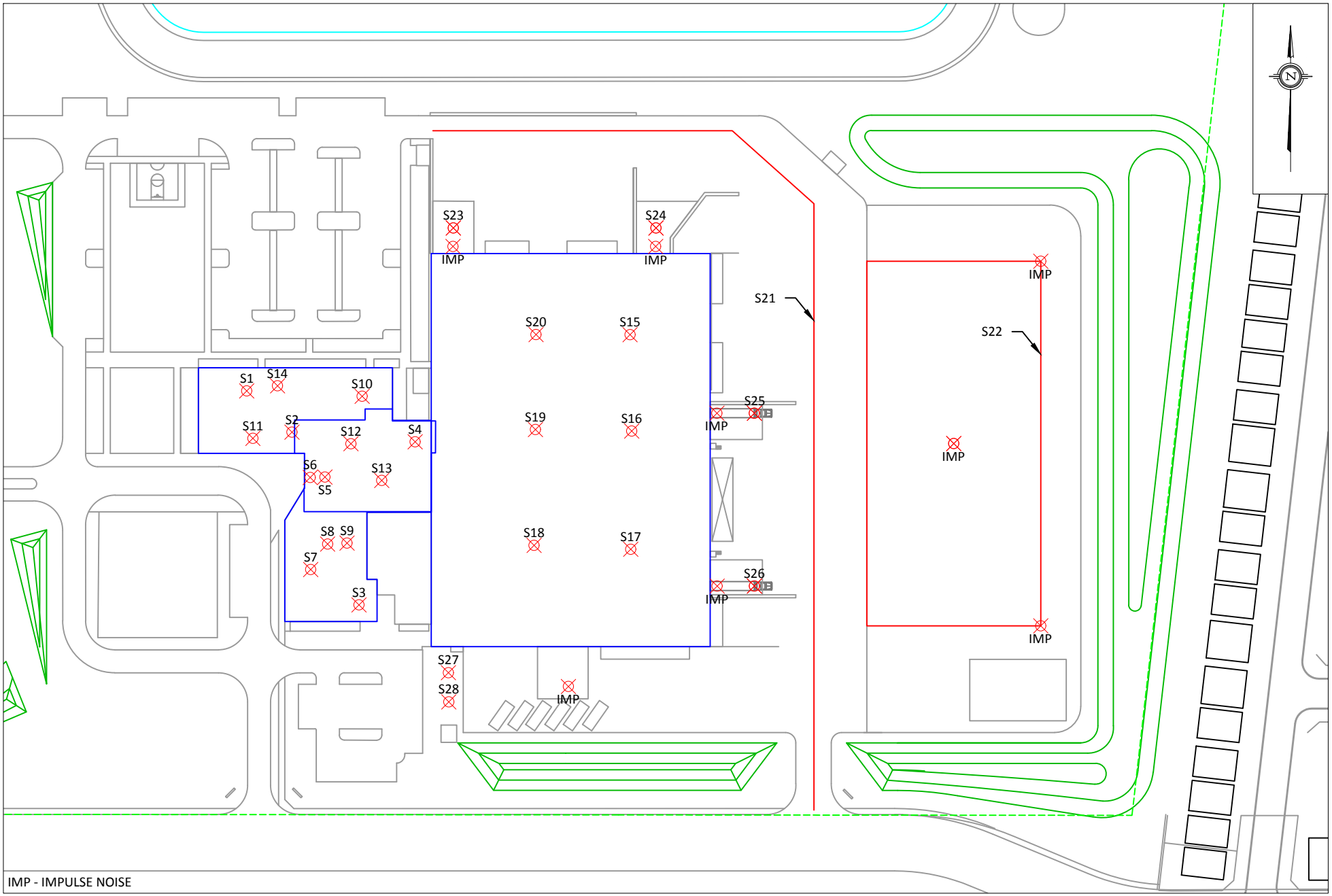
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3713 BORRISOKANE ROAD, OTTAWA STATIONARY NOISE ANALYSIS		
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE19-228-1
DATE	NOVEMBER 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



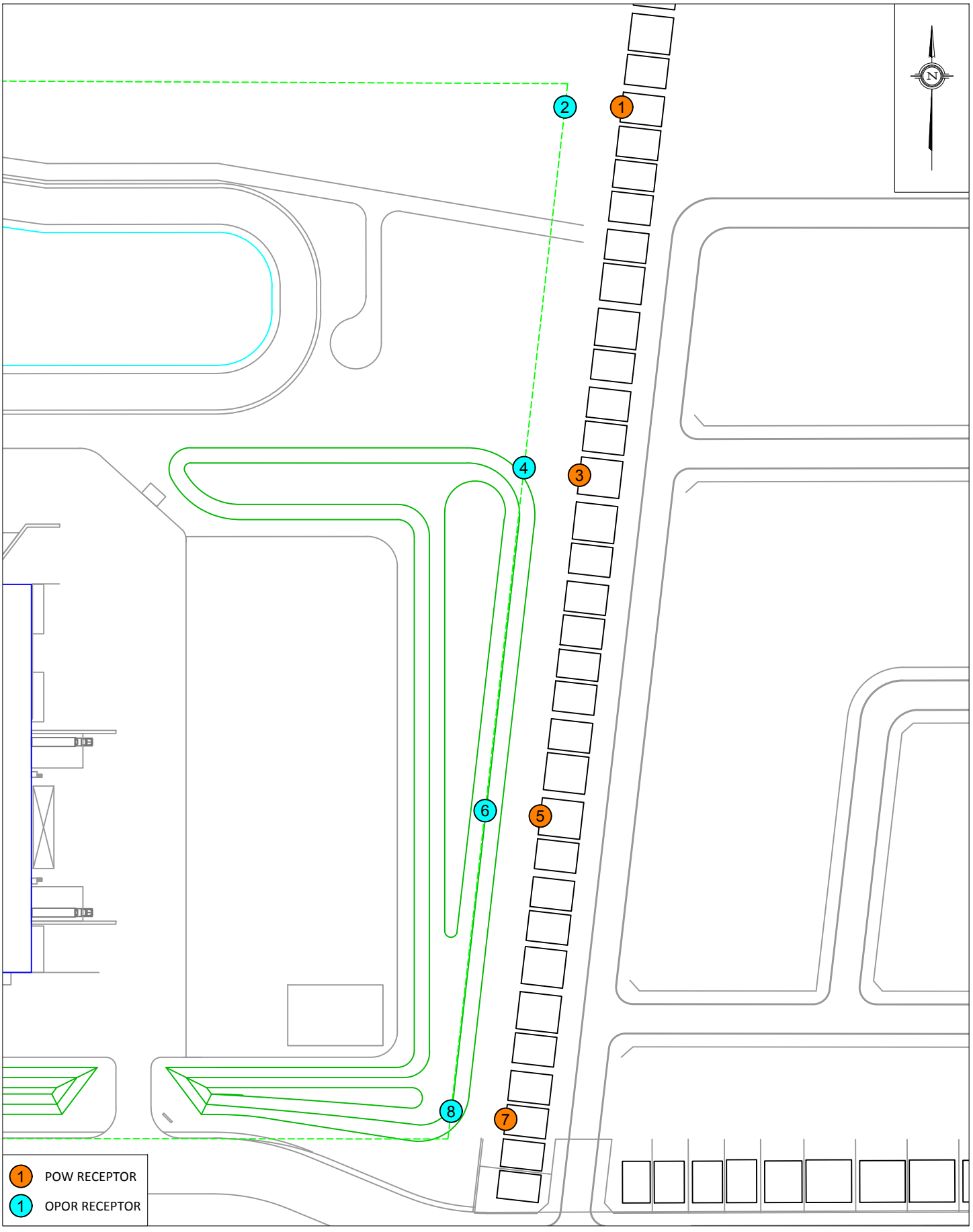
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3713 BORRISOKANE ROAD, OTTAWA STATIONARY NOISE ANALYSIS		
SCALE	1:1500 (APPROX.)	DRAWING NO.	GWE19-228-2
DATE	NOVEMBER 22, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
STATIONARY NOISE SOURCE LOCATIONS



GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3713 BORRISOKANE ROAD, OTTAWA STATIONARY NOISE ANALYSIS		DESCRIPTION
SCALE	1:1500 (APPROX.)	DRAWING NO.	GWE19-228-3
DATE	NOVEMBER 22, 2019	DRAWN BY	M.L.

FIGURE 3:
RECEPTOR LOCATIONS

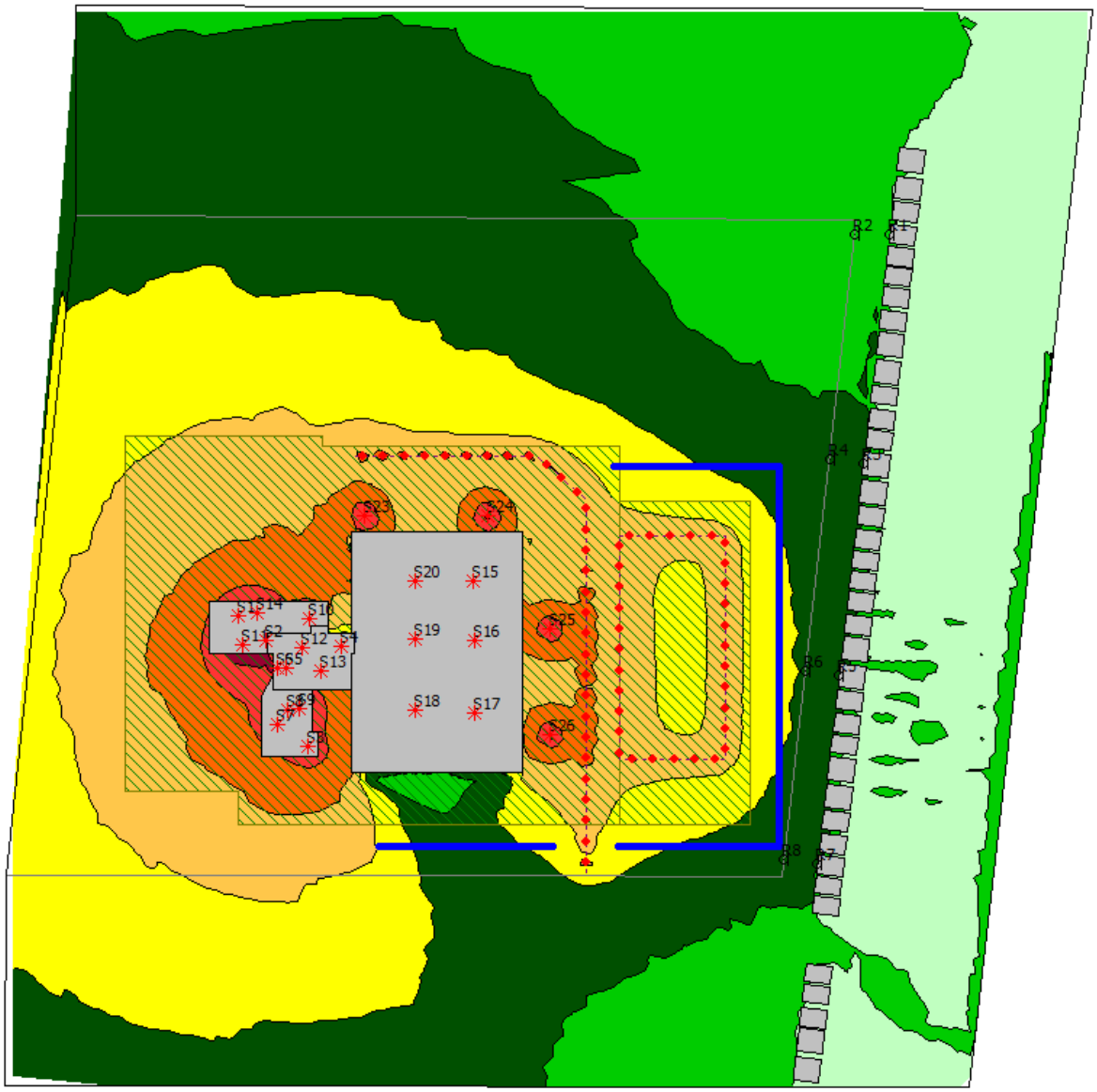


FIGURE 4: STEADY-STATE NOISE CONTOURS 4.5M ABOVE GRADE (DAYTIME PERIOD), HVAC

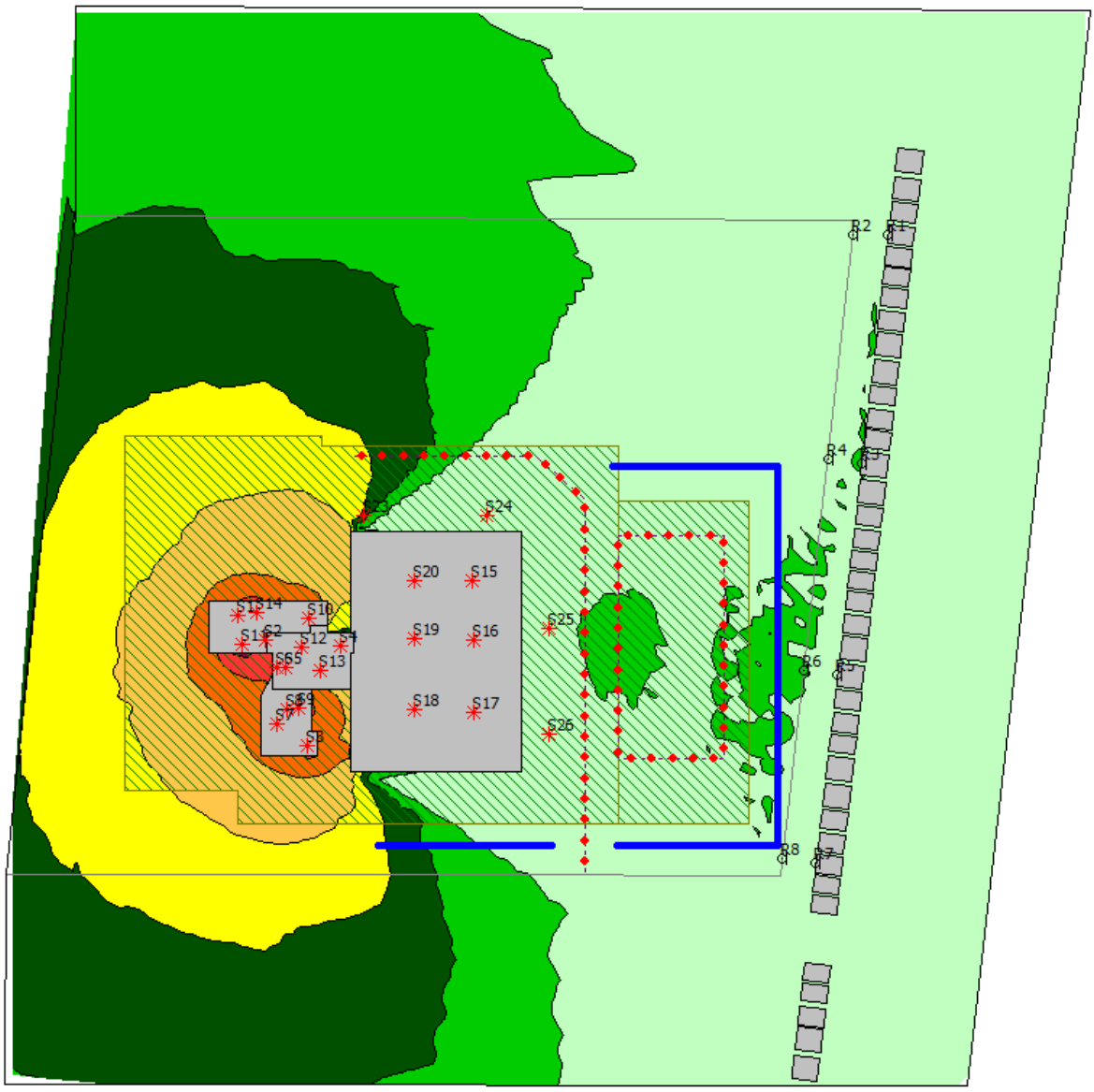


FIGURE 5: STEADY-STATE NOISE CONTOURS 4.5M ABOVE GRADE (NIGHTTIME PERIOD), HVAC

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

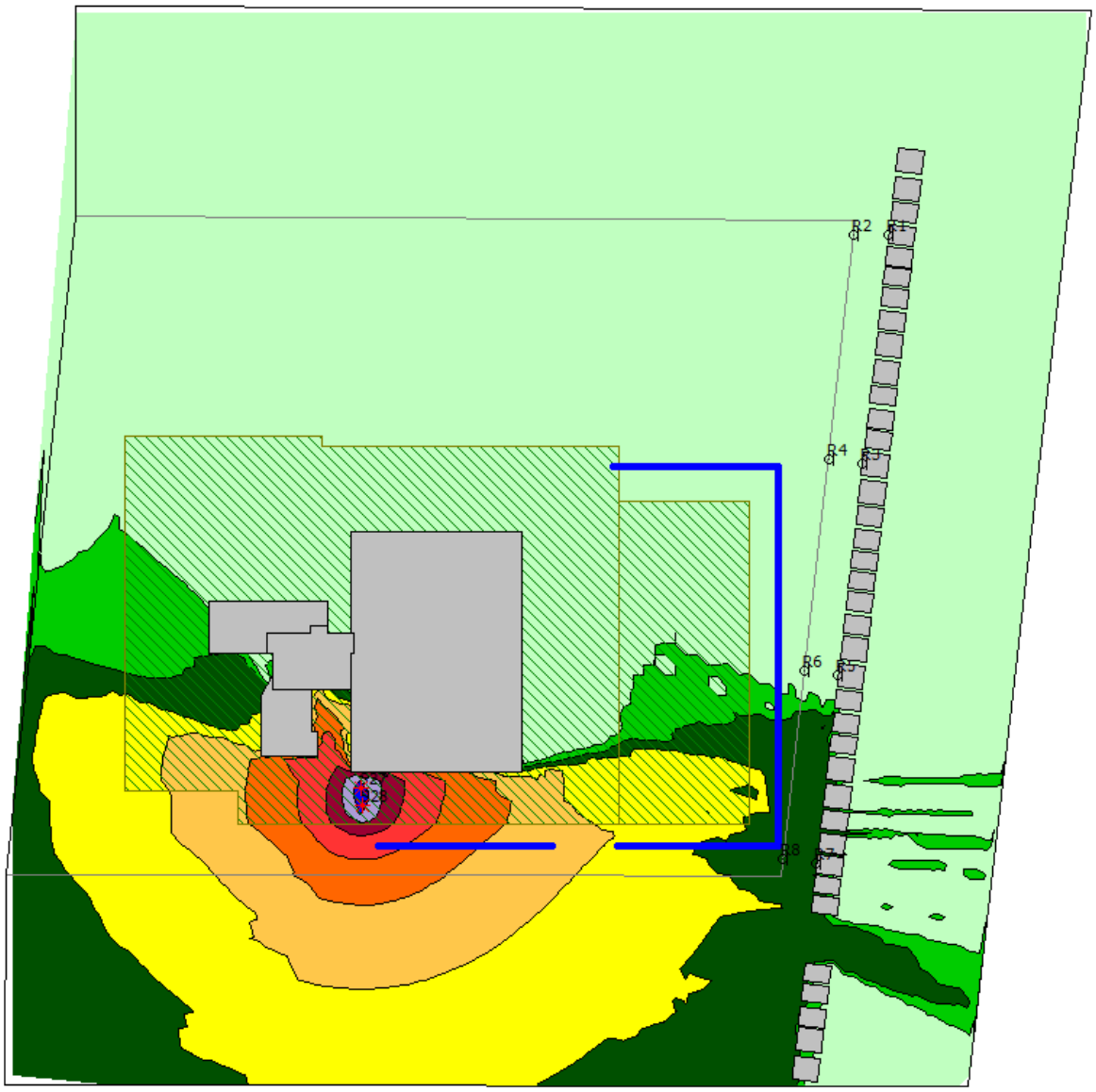


FIGURE 6: STEADY-STATE NOISE CONTOURS 4.5M ABOVE GRADE (DAYTIME PERIOD), GENERATOR

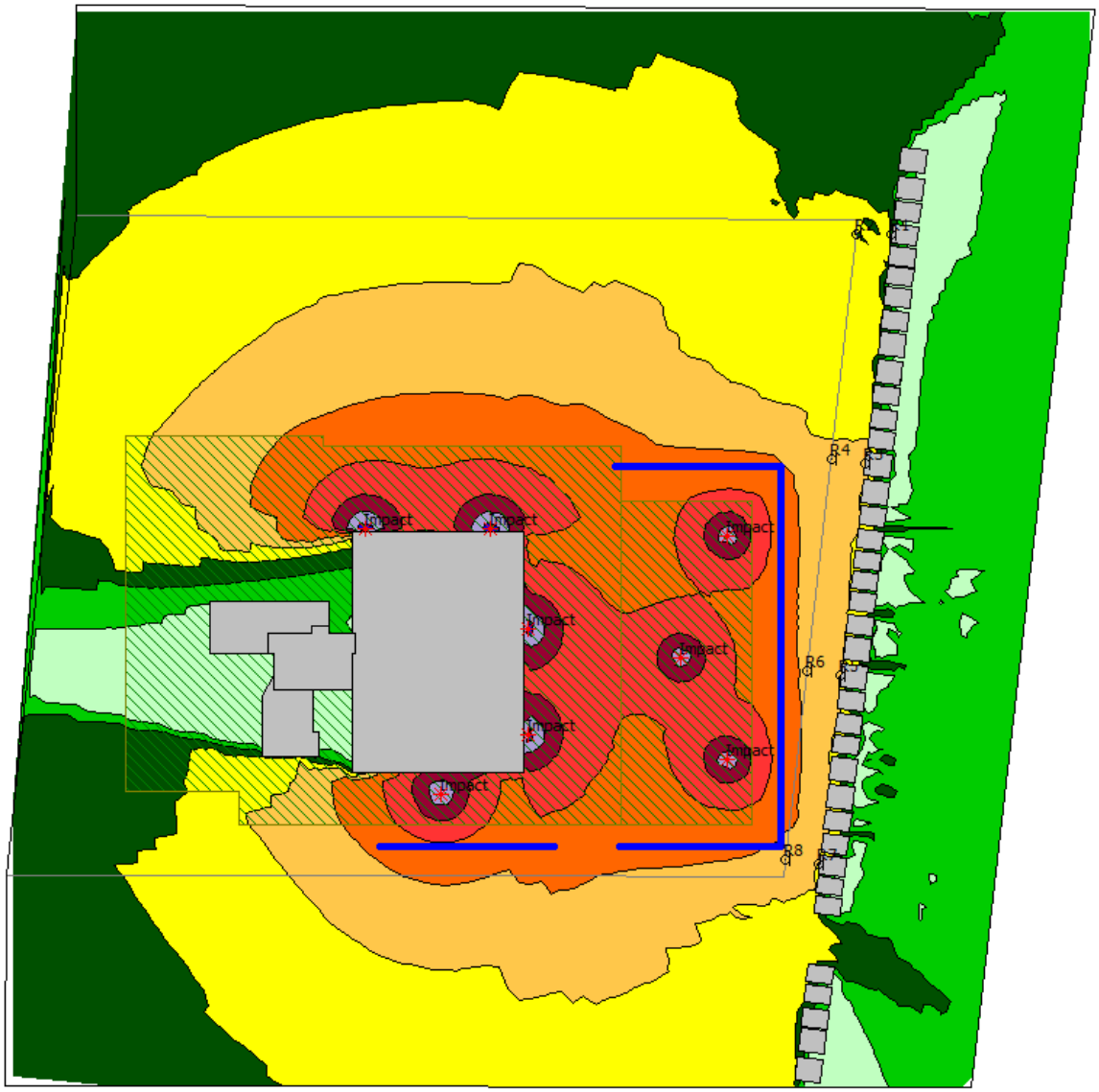


FIGURE 7: IMPULSE NOISE CONTOURS 4.5 M ABOVE GRADE (DAYTIME PERIOD)