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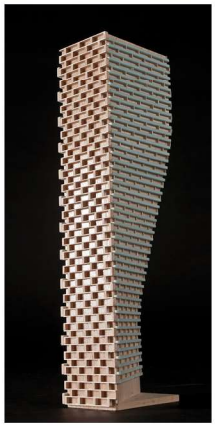
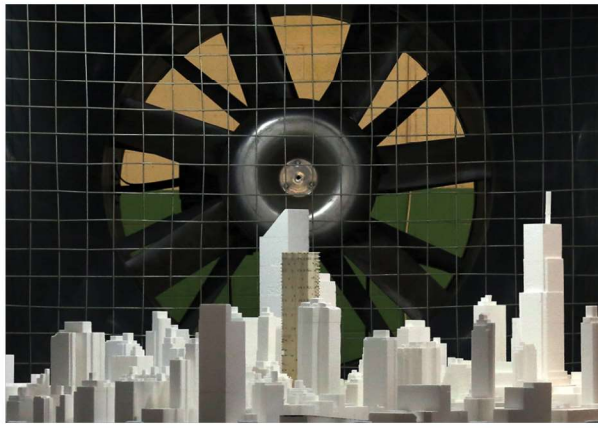
STATIONARY NOISE ASSESSMENT

6150 Thunder Road
Carlsbad Springs, Ontario

REPORT: 21-283 - Stationary Noise





September 14, 2021

PREPARED FOR

Avenue 31 Capital Inc.
401-222 Somerset Street West
Ottawa, ON | K2P 2G3

PREPARED BY

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Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a stationary noise assessment performed in support of a Site Plan Control application (SPA) for the proposed warehouse/industrial development located at 6150 Thunder Road in Carlsbad Springs, Ontario (hereinafter referred to as "subject site" or "proposed development"). For the purposes of this study, Boundary Road will be referred to as project east. The proposed development comprises five buildings, Building A to the northeast, Building B to the northwest, Building C to the southeast, Building D to the southwest, and Building E to the far southeast, east of Building C. Figure 1 illustrates a complete site plan and surrounding context.

The assessment was performed based on theoretical noise calculation methods conforming to (i) City of Ottawa Environmental Noise Control Guidelines (ENCG); (ii) Ministry of the Environment, Conservation and Parks (MECP) NPC-300 guidelines; (iii) Site plan drawings received from Avenue 31 Capital Inc. in July 2021; (iv) Assumed mechanical information based on Gradient Wind's experience with similar industrial developments; (v) Surrounding street layouts, and recent site imagery.

Mechanical information for the development was not yet available at the time of writing. As a result, Gradient Wind assumed the preliminary mechanical information for the development based on experience with similar industrial developments. Once the mechanical design progresses and equipment information becomes available, these should be forwarded to Gradient Wind for review.

The results of the current study indicate that without noise control measures, impulsive noise levels received at the adjacent residential dwelling of 5376 Boundary Road are expected to exceed the ENCG noise criteria. Specifically, impulsive noise levels at the plane of window (Receptor 3) are expected to approach 58 and 55 dBAI during the daytime and nighttime periods, exceeding the criteria by 8 and 10 dBAI respectively. Furthermore, the impulsive noise levels at the outdoor point of reception (Receptor 4) are expected to approach 61 dBAI during the daytime period, exceeding the criteria by 11 dBAI.

Noise control measures recommended in Section 5.3 shall ensure noise levels fall below the limits for impulsive noise received at 5376 Boundary Road. Calculations show that with the implementation of a 3.0-metre-tall noise barrier in the location specified by Figure 3, the resultant impulsive noise levels at the plane of window (Receptor 3) are reduced to 48 dBAI and 45 dBAI during the daytime and nighttime

periods respectively, and 48 dBAI at the outdoor point of reception (Receptor 4) during the daytime period. The barrier must be 3.0 metres-tall, have a minimum surface density of 20kg/m^2 and contain no gaps. The following information will be required by the City for review prior to installation of the barrier:

1. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
2. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
3. Layout plan, and wall elevations, showing proposed colours and patterns.

The proposed warehouse/industrial development is expected to be compatible with the existing noise-sensitive land, provided the assumptions in Section 2.1 and noise control measures in Section 5.3 are adhered to during detailed design process.

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 Avenue 31 Capital Inc. to undertake a stationary noise assessment in support of a Site Plan Control application (SPA) for the proposed warehouse/industrial development located at 6150 Thunder Road in Carlsbad Springs, 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 received at nearby noise-sensitive dwellings, generated by sources associated with the proposed warehouse/industrial development. Sources include rooftop air handling equipment, truck routes, idling trucks, and impulsive noise from loading dock operations. The assessment was performed based on theoretical noise calculation methods conforming to the City of Ottawa Environmental Noise Control Guidelines[1] (ENCG), Ministry of the Environment, Conservation and Parks (MECP) NPC-300[2] guidelines, site plan drawings received from Avenue 31 Capital Inc. in July 2021, assumed mechanical information based on Gradient Wind's experience with similar industrial developments, surrounding street layouts, and recent site imagery.

2. TERMS OF REFERENCE

The focus of this stationary noise assessment is the proposed warehouse/industrial development located 6150 Thunder Road in Carlsbad Springs, Ontario (hereinafter referred to as "subject site" or "proposed development"). For the purposes of this study, Boundary Road will be referred to as project east.

The proposed development comprises five buildings, Building A to the northeast, Building B to the northwest, Building C to the southeast, Building D to the southwest, and Building E to the far southeast, east of Building C. Building A, B, and C have an area of 8,920 square meters, Building D has an area of 10,405 square meters, and Building E has an area of 4,460 square meters. Building A, C, and E have a height of 6.1 meters, and Building B and D have a height of 7.3 meters.

[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

Internal roadways connect various access points of Buildings A-E to the roadways bordering the site, which are Boundary Road to the east, and Thunder Road to the northeast. There are 30 trailer parking spaces in between Building A and Building B, and another 30 spaces in between Building C and Building D. A total of 56 loading docks for semi-trailer transport trucks are positioned throughout the subject site. Buildings A, B, C have 12 loading docks each, while building D has 14. All loading docks for Buildings A to D are located in the central region of the site. Building E has 6 loading docks located on the south side of the building.

Surroundings to the proposed development are primarily open fields and wooded areas, with noise-sensitive dwellings located at 6140 Thunder Road, 5376 Boundary Road, and 5384 Boundary Road. Highway 417 lies approximately 400 metres to the north of the site, and a large distribution facility of approximately 100,000 square metres owned by Amazon.com, Inc. lies to the northeast across Boundary Road. Figure 1 illustrates the site plan and surrounding context.

The facility's mechanical equipment is expected to operate 24 hours a day with most of the operations taking place during the daytime period. However, certain sources are likely to have reduced operation during the nighttime period between 23:00 and 07:00. Sources of steady-state/varying stationary noise include rooftop air handling equipment, idling trucks, and a truck route. Regarding impulsive stationary noise (i.e., bangs), sources are expected at the central region of the site and to the northeast where the loading docks are localized. All impulsive sources are related to loading and unloading activities at the loading docks. Figure 2 illustrates the location of all noise sources and points of reception (POR) included in this study.

2.1 Assumptions

At the time of this study, mechanical information for the development was not yet available. As a result, Gradient Wind assumed the preliminary mechanical information for the development based on previous experience with similar industrial developments. Once the mechanical design progresses and equipment information becomes available, these should be forwarded to Gradient Wind for review. 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) The subject site is on industrial zoned lands where shipping, receiving, and loading operations are permitted throughout a 24-hour period.

(ii) The vehicle type primarily used at the facility is semi-trailer transport trucks.

(iii) As a worst-case scenario, twenty (20) truck movements occur during a peak hour of the daytime period (07:00 - 19:00), fifteen (15) occur during a peak hour of the evening period (19:00 - 23:00), and ten (10) occur during a peak hour of the nighttime period (23:00 - 07:00).

(iv) Truck movement routes were modelled as through traffic, arriving by Thunder Road and departing by Boundary Road.

(v) Trucks idle at the loading dock regions for a 25% of the one-hour period.

(vi) The locations, quantity and tonnage of rooftop units have been assumed based on Gradient Wind's experience with similar industrial developments.

(vii) Sound data for all noise sources for the development have been assumed based on Gradient Wind's experience with similar industrial developments.

(viii) The rooftop mechanical units were assumed to operate continuously over a 1-hour period during the daytime and evening periods, and at 50% operation during the nighttime period.

(ix) Ten (10) impulsive noise sources were positioned at loading docks of the site in the locations where their impact on the surrounding noise-sensitive properties is expected to be the greatest. During the nighttime period, loading dock activity is reduced by 50%.

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

(xi) The ground region was modelled as reflective for hard ground (pavement), and absorptive for soft ground (landscaped).

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the surrounding noise-sensitive dwellings 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. Six receptor locations were selected for the study site, as illustrated in Figure 2.

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 NPC-300 as "a source of sound or combination of sources of sound that are included and normally operated within the property lines of a facility and includes the premises of a person as one stationary source, unless the dominant source of sound on those premises is construction"[3]. Furthermore, NPC-300 indicates "back up beepers" of semi-trailer transport trucks are not considered as stationary sources.

[3] NPC – 300, page 16

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 NPC-300 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]. 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, campgrounds, and noise sensitive buildings such as schools and places of worship. The recommended maximum noise levels for a Class 1 at a POR are outlined in Table 1 below. The noise-sensitive dwellings are located on Thunder Road and Boundary Road which are classified as collector and arterial roads respectively, and in proximity to Highway 417. Therefore, ambient noise levels are expected to persist into the evening period. During the nighttime period (23:00 - 07:00) the acoustical environment is expected to be dominated by natural sounds.

TABLE 1: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

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

[4] NPC – 300, page 14

4.2.2 Determination of Steady-State / Varying Noise Source Power Levels

Mechanical information for the development was not yet available at the time of this study. As a result, Gradient Wind assumed the preliminary mechanical information for the development based on experience with similar industrial developments. Once the mechanical design progresses and equipment information becomes available, these should be forwarded to Gradient Wind for review. Table 2 summarizes the sound power of each steady-state/varying noise source used in the analysis.

TABLE 2: EQUIPMENT SOUND POWER LEVELS (dBA)

Source	Description	Height Above Grade/Roof (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1-S28	15 Ton RTU	1.5	66	77	80	84	85	81	77	68	**90**
S29	Truck Route	2	65	72	76	85	90	89	83	74	**94**
S30-S39	Idling Truck	2	65	72	76	85	90	89	83	74	**94**

4.2.3 Steady-State / Varying Stationary Source Noise Predictions

The impact of stationary noise sources on nearby residential areas was determined by computer modelling using the software program Predictor-Lima. 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 six receptor locations were chosen at nearby noise-sensitive dwellings 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 2. All units were represented as point sources in the Predictor model, with the exception of the truck route (S29) which was modelled as a moving source. 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 modelling data is available upon request.

TABLE 3: RECEPTOR LOCATIONS

Receptor Number	Receptor Location	Height Above Grade (m)
1	POW – 6140 Thunder Road – Southeast Façade	4.5
2	OPOR – 6140 Thunder Road – Southwest Yard	1.5
3	POW – 5376 Boundary Road – West Façade	1.5
4	OPOR – 5376 Boundary Road – West Yard	1.5
5	POW – 5384 Boundary Road – West Façade	1.5
6	OPOR – 5384 Boundary Road – West Yard	1.5

TABLE 4: CALCULATION SETTINGS

Parameter	Setting
Meteorological correction method	Single value for C0
Value C0	2.0
Ground attenuation factor for lawn areas	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

Impulsive noise events are expected to occur at the loading docks within the site. Loading and unloading activities of the semi-trailer transport trucks are potential sources of frequent impulsive noise. Based on Gradient Wind's experience with similar facilities, it is expected that the loading docks comprise of a concrete structure and metal loading ramps to allow pallet lift trucks to roll on and off the trailers. Impulsive noise is generated when the pallet truck moves over the metal ramp and is caused by the metal-on-metal or metal-on-concrete contact. Pallet lifts used to load and unload the transport trucks are expected to have standard hard plastic wheels.

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 the ENCG, the exclusion limit values for impulsive noise levels for Plane of Window and Outdoor Points of Reception are shown in Table 5 below.

TABLE 5: EXCLUSION LIMIT FOR IMPULSIVE SOUND LEVELS - CLASS 1 AREA

Time of Day	Actual Number of Impulses in Period of One-Hour	Class 1 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 Impulsive Noise Sound Power

Sound power levels for the impulsive noise due to the loading docks of the proposed development were based on Gradient Wind's previous experience with similar industrial developments. The Logarithmic Mean Impulse Sound Level (L_{LM}) of the impulsive noise at loading docks used in the assessment was 104 dBAI. Where impulsive noise sources are in close proximity, the L_{LM} was prorated to 101 dBAI. Impulsive noise sources are labelled S40-S49, with their locations identified in Figure 2.

4.3.3 Impulsive Noise Source Prediction Assessment

The logarithmic impulsive noise levels were examined at the various noise-sensitive points of reception in the *Predictor-Lima* model. As per Section 2.1, it was assumed that transport trailer loading or unloading occurs at ten (10) loading docks of the site during a peak 1-hour period. Locations were selected where the impact on the surrounding noise-sensitive properties is expected to be the greatest. During the nighttime period, loading dock activity is reduced by 50%. During the loading or unloading process, impulses are expected to occur more than 9 times within the process, requiring the most stringent impulse sound level limits. The impulsive noise sources were modeled as point sources at a height of 1.2 meters above grade for the deck-level of the trailer. Trailers were modeled at locations corresponding to the impulsive noise sources, as floating objects 1.0 metres off the ground, and 1.0 meters setback from the building façade. Trailer dimensions were taken as 2.5 metres wide x 8.2 metres long x 3.2 metres tall.

5. RESULTS AND DISCUSSION

5.1 Steady State / Varying Stationary Noise Results

Noise levels received at the surrounding noise-sensitive dwellings, produced by the mechanical equipment associated with the proposed industrial development are presented in Table 6. Noise levels are based on assumptions in Section 2.1. Noise contours at 1.5 metres above grade for all steady-state/varying stationary noise sources can be seen in Figures 4, 5, and 6 for daytime, nighttime, and evening conditions respectively. As Table 6 summarizes, steady-state/varying noise levels meet Class 1 criteria at all receptors.

TABLE 6: NOISE LEVELS FROM STEADY-STATE / VARYING STATIONARY SOURCES

Receptor Number	Receptor Location	Noise Level (dBA)			Sound Level Limits			Meets Class 1 Criteria		
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
1	POW – 6140 Thunder Road	38	38	35	50	50	45	**YES**	**YES**	**YES**
2	OPOR – 6140 Thunder Road	37	36	34	50	50	N/A*	**YES**	**YES**	**N/A***
3	POW – 5376 Boundary Road	48	47	45	50	50	45	**YES**	**YES**	**YES**
4	OPOR – 5376 Boundary Road	50	50	49	50	50	N/A*	**YES**	**YES**	**N/A***
5	POW – 5384 Boundary Road	44	44	41	50	50	45	**YES**	**YES**	**YES**
6	OPOR – 5384 Boundary Road	44	44	42	50	50	N/A*	**YES**	**YES**	**N/A***

*Nighttime noise levels are not considered at OPOR receptors as per NPC-300

5.2 Impulsive Noise Results

The impulse noise levels received at nearby noise-sensitive dwellings, generated from loading/unloading activities at the loading dock regions are summarized in Table 7. Impulsive noise contours at 1.5 metres above grade can be seen in Figures 7 and 8 for daytime and nighttime conditions, respectively.

The results of the analysis indicate that impulsive noise levels at 5376 Boundary Road exceed ENCG criteria at both the plane of window and outdoor point of reception (Receptors 3 and 4). The resultant mean logarithmic impulsive noise levels predicted at the plane of window of 5376 Boundary Road (Receptor 3) are 58 and 55 dBAI during the daytime and nighttime periods, respectively. The resultant impulsive noise level at the rear yard during the daytime period is 61 dBAI. Noise control measures are explored in Section 5.3 to address the exceedances.

TABLE 7: UNMITIGATED NOISE LEVELS FROM IMPULSIVE STATIONARY SOURCES

Receptor Number	Plane of Window Receptor Location	Noise Level (dBAI)		Meets Class 1 Criteria	
		Day	Night	Day (50 dBAI)	Night (45 dBAI)
1	POW – 6140 Thunder Road	47	45	**YES**	**YES**
2	OPOR – 6140 Thunder Road	46	44	**YES**	**N/A***
3	POW – 5376 Boundary Road	58	55	**NO**	**NO**
4	OPOR – 5376 Boundary Road	61	59	**NO**	**N/A***
5	POW – 5384 Boundary Road	50	45	**YES**	**YES**
6	OPOR – 5384 Boundary Road	48	45	**YES**	**N/A***

*Nighttime noise levels are not considered at OPOR receptors as per NPC-300

5.3 Noise Control Measures

The exceedances of ENCG objective limits for impulsive noise only occur at the noise-sensitive dwelling located southeast of the proposed development at 5376 Boundary Road. Specifically, impulsive noise levels at the plane of window (Receptor 3) are 58 and 55 dBAI respectively during the daytime and nighttime periods (50 and 45 dBAI limits), and 61 dBAI at the outdoor point of reception (Receptor 4) during the daytime period (50 dBAI limit).

Placement of a 3.0-metre-tall barrier at the southeast corner of the property as illustrated in Figure 3, will mitigate impulsive noise to acceptable levels. Calculations show that with the barrier, the resultant impulsive noise levels at the plane of window (Receptor 3) are reduced to 48 dBAI and 45 dBAI during the daytime and nighttime periods respectively, and 48 dBAI at the outdoor point of reception (Receptor 4) during the daytime period. Mitigated noise contours with the implemented barrier are illustrated for daytime and nighttime conditions in Figures 9 and 10. The barrier must be 3.0 metres-tall, have a minimum surface mass of 20kg/m^2 and contain no gaps.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that without noise control measures, impulsive noise levels received at the adjacent residential dwelling of 5376 Boundary Road are expected to exceed the ENCG noise criteria. Impulsive noise levels at the plane of window (Receptor 3) are expected to approach 58 and 55 dBAI during the daytime and nighttime periods, exceeding the criteria by 8 and 10 dBAI respectively. Furthermore, the impulsive noise levels at the outdoor point of reception (Receptor 4) are expected to approach 61 dBAI during the daytime period, exceeding the criteria by 11 dBAI.

Noise control measures recommended in Section 5.3 shall ensure noise levels fall below the limits for impulsive noise received at 5376 Boundary Road. Calculations show that with the implementation of a 3.0-metre-tall noise barrier in the location specified by Figure 3, the resultant impulsive noise levels at the plane of window (Receptor 3) are reduced to 48 dBAI and 45 dBAI during the daytime and nighttime periods respectively, and 48 dBAI at the outdoor point of reception (Receptor 4) during the daytime period. The barrier must be 3.0 metres-tall, have a minimum surface mass of 20kg/m^2 and contain no gaps. The following information will be required by the City for review prior to installation of the barrier:

1. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
2. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
3. Layout plan, and wall elevations, showing proposed colours and patterns.

The proposed warehouse/industrial development is expected to be compatible with the existing noise-sensitive land, provided the assumptions in Section 2.1 and noise control measures in Section 5.3 are adhered to during detailed design process.

Mechanical information for the development was not yet available at the time of writing. As a result, Gradient Wind assumed the preliminary mechanical information for the development based on experience with similar industrial developments. Once the mechanical design progresses and equipment

information becomes available, these should be forwarded to Gradient Wind for review. 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 stationary 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.

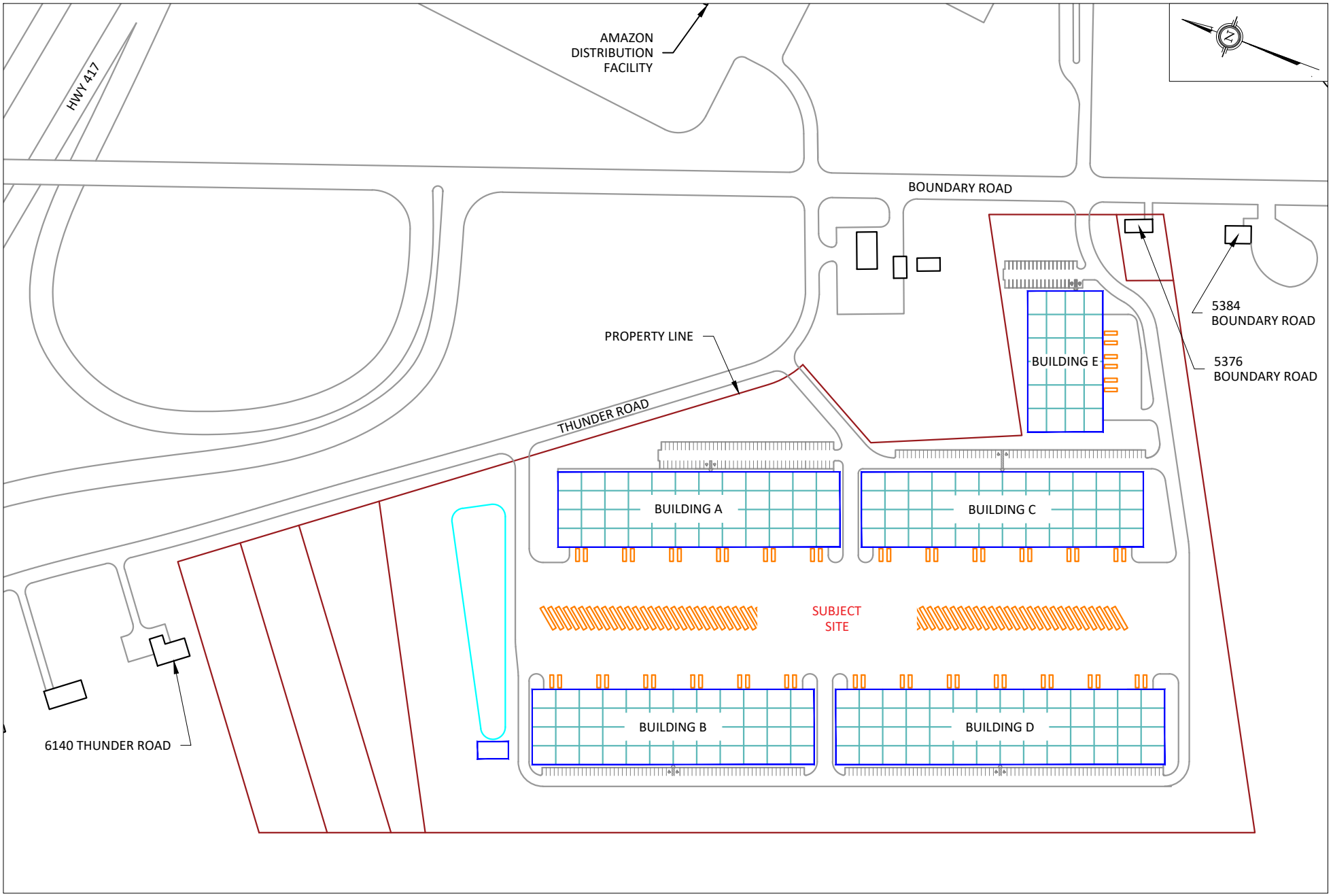
Sincerely,

Gradient Wind Engineering Inc.

Tanyon Matheson-Fitchett, B.Eng.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #21-283 – Stationary Noise



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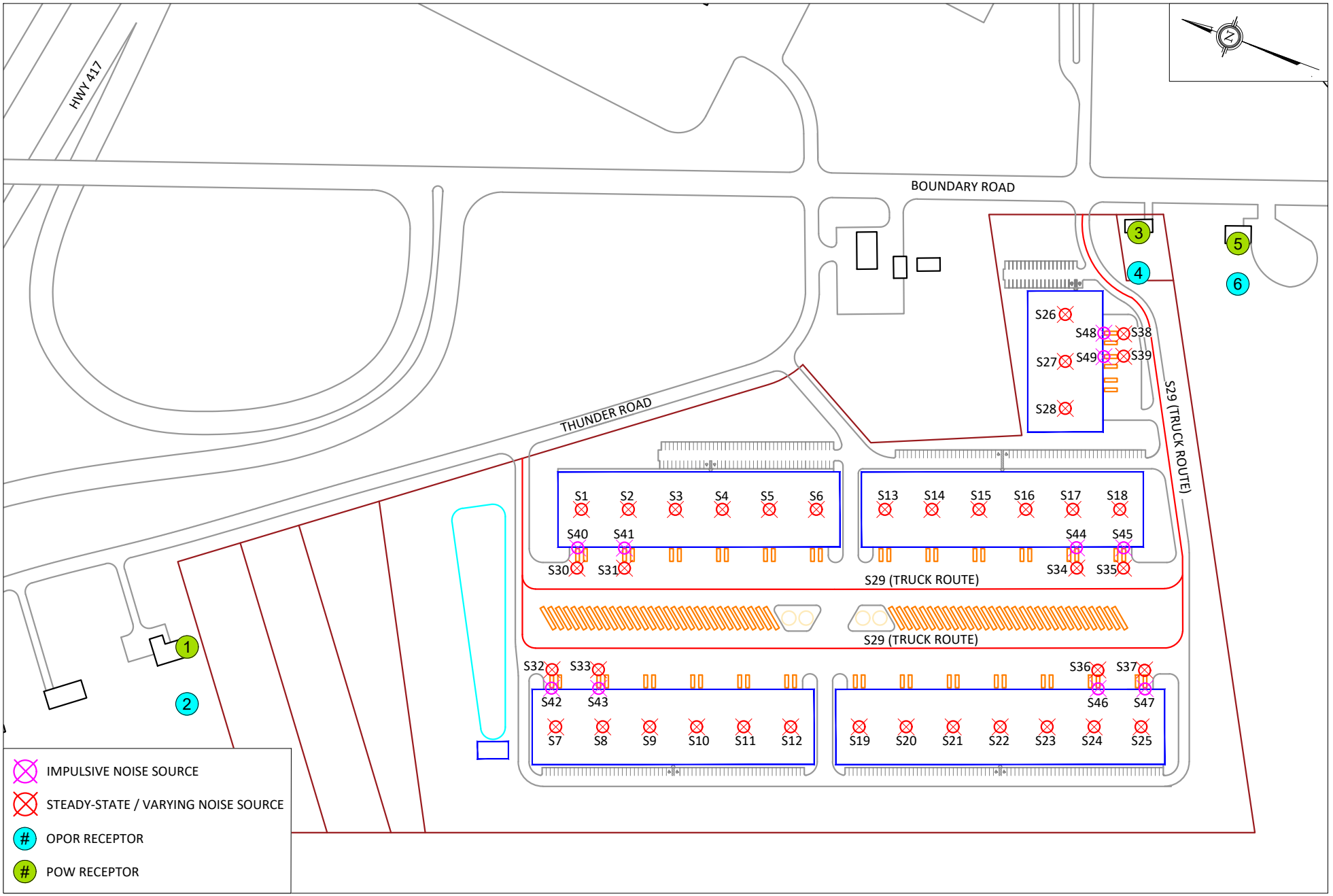
PROJECT	6150 THUNDER ROAD, CARLSBAD SPRINGS STATIONARY NOISE ASSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GW21-283-1
DATE	SEPTEMBER 3, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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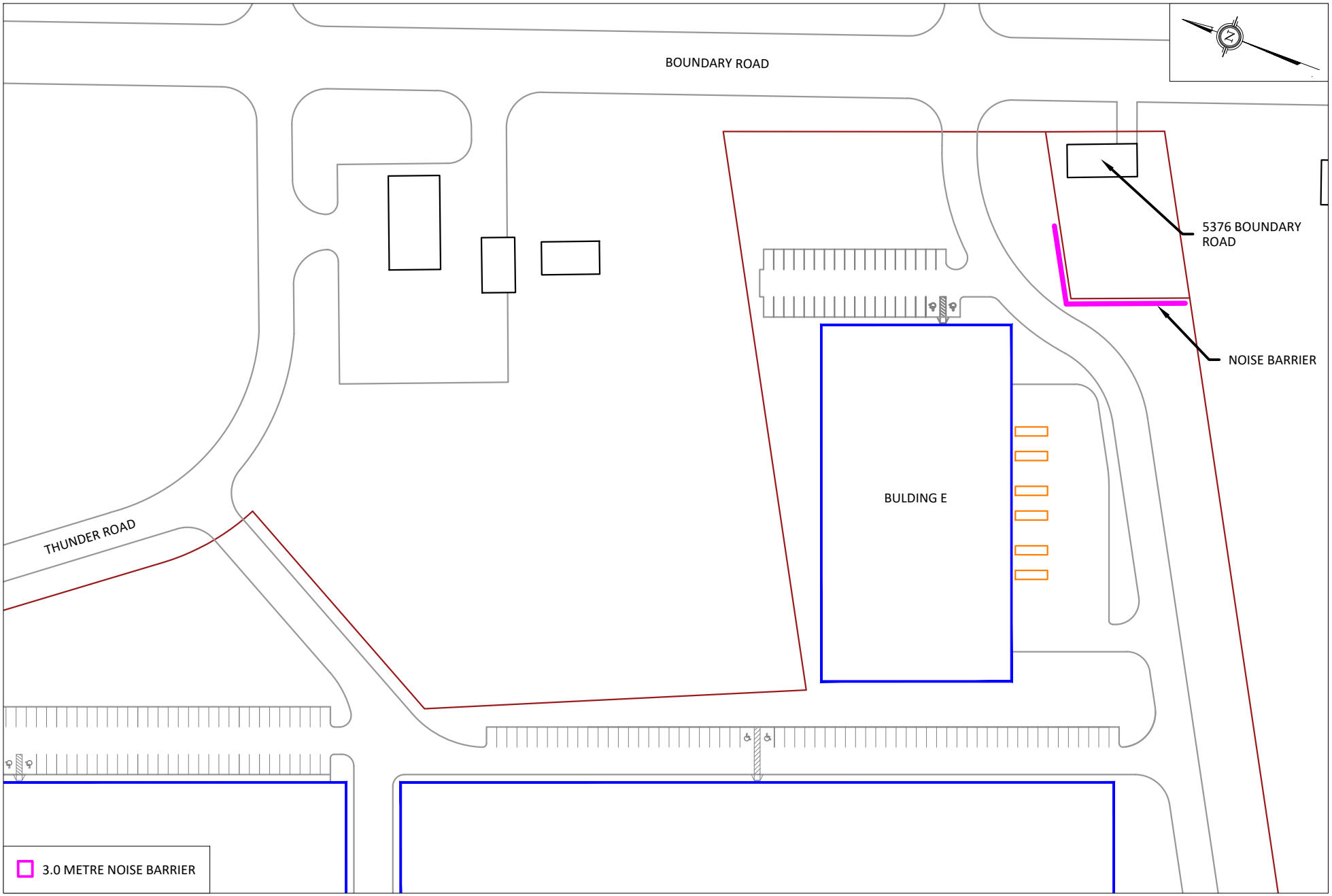
PROJECT	6150 THUNDER ROAD, CARLSBAD SPRINGS STATIONARY NOISE ASSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GW21-283-2
DATE	SEPTEMBER 3, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 2:
NOISE SOURCE AND RECEPTOR LOCATIONS



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PROJECT	6150 THUNDER ROAD, CARLSBAD SPRINGS STATIONARY NOISE ASSESSMENT		
SCALE	1:1500 (APPROX.)	DRAWING NO.	GW21-283-3
DATE	SEPTEMBER 7, 2021	DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 3:
RECOMMENDED 3.0 METRE NOISE BARRIER LOCATION

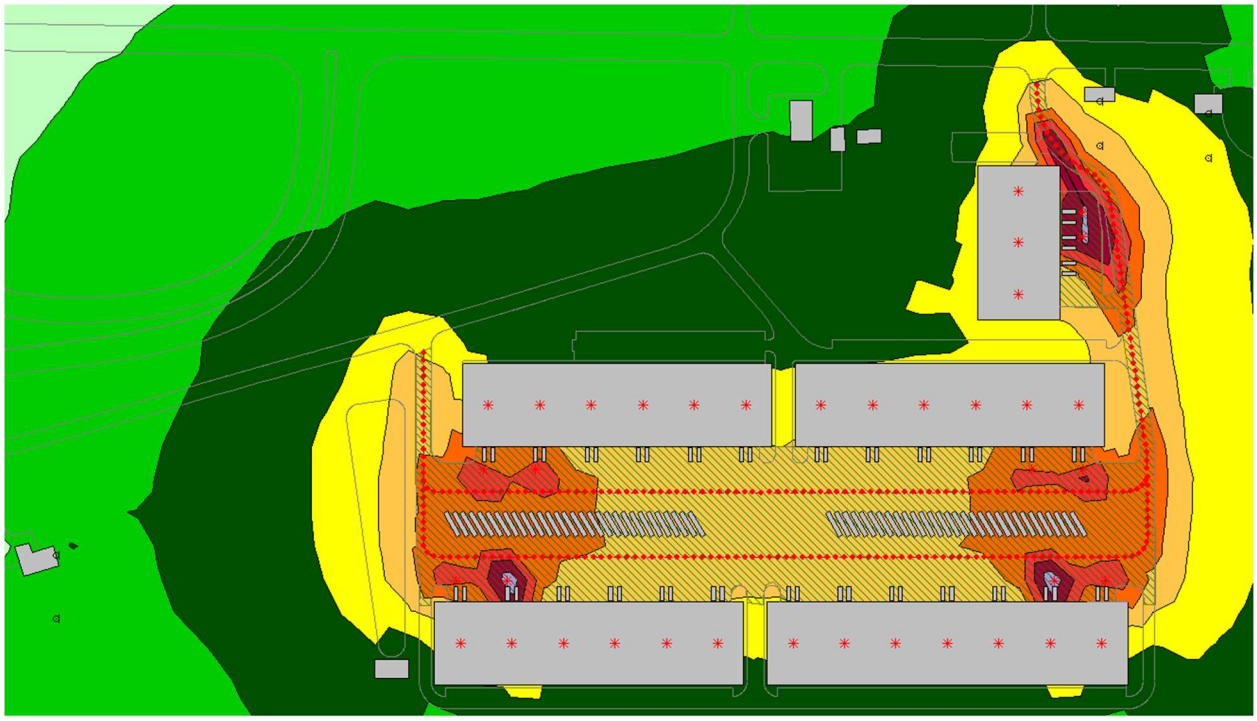


FIGURE 4: DAYTIME STEADY-STATE / VARYING STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)

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

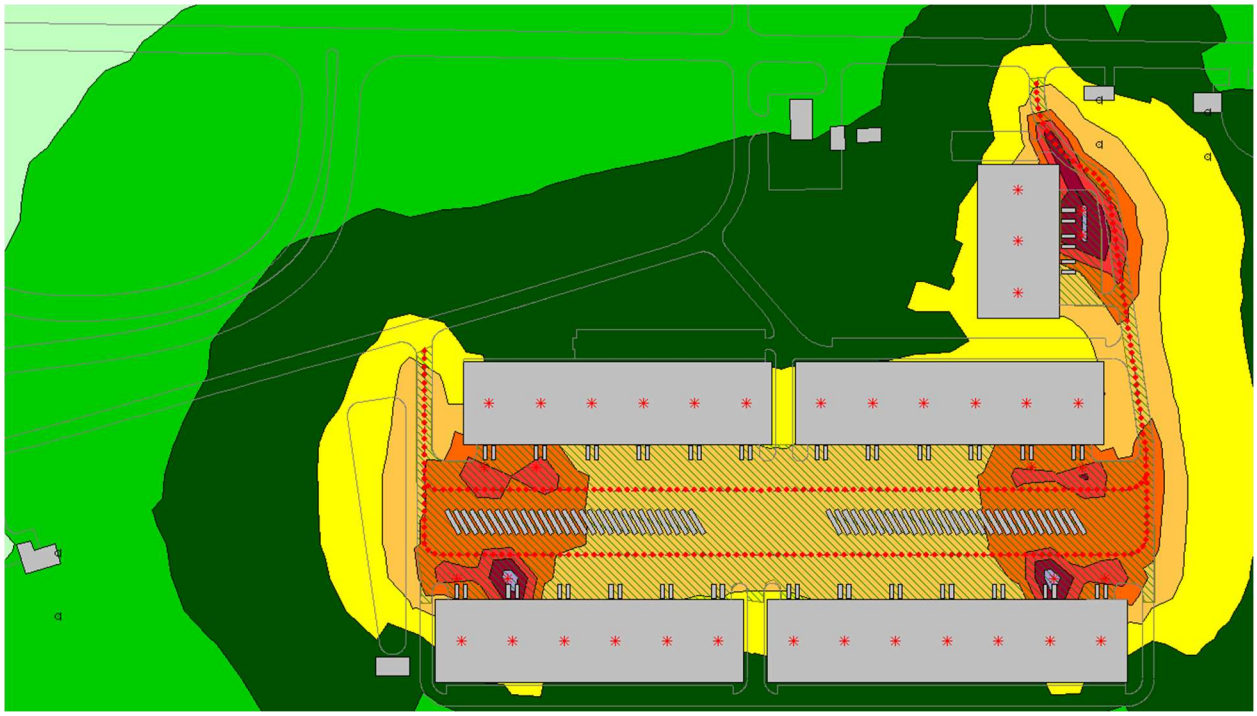
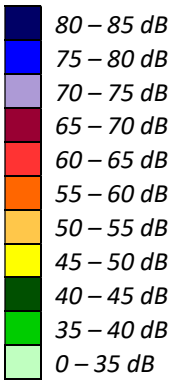


FIGURE 5: EVENING STEADY-STATE / VARYING STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)



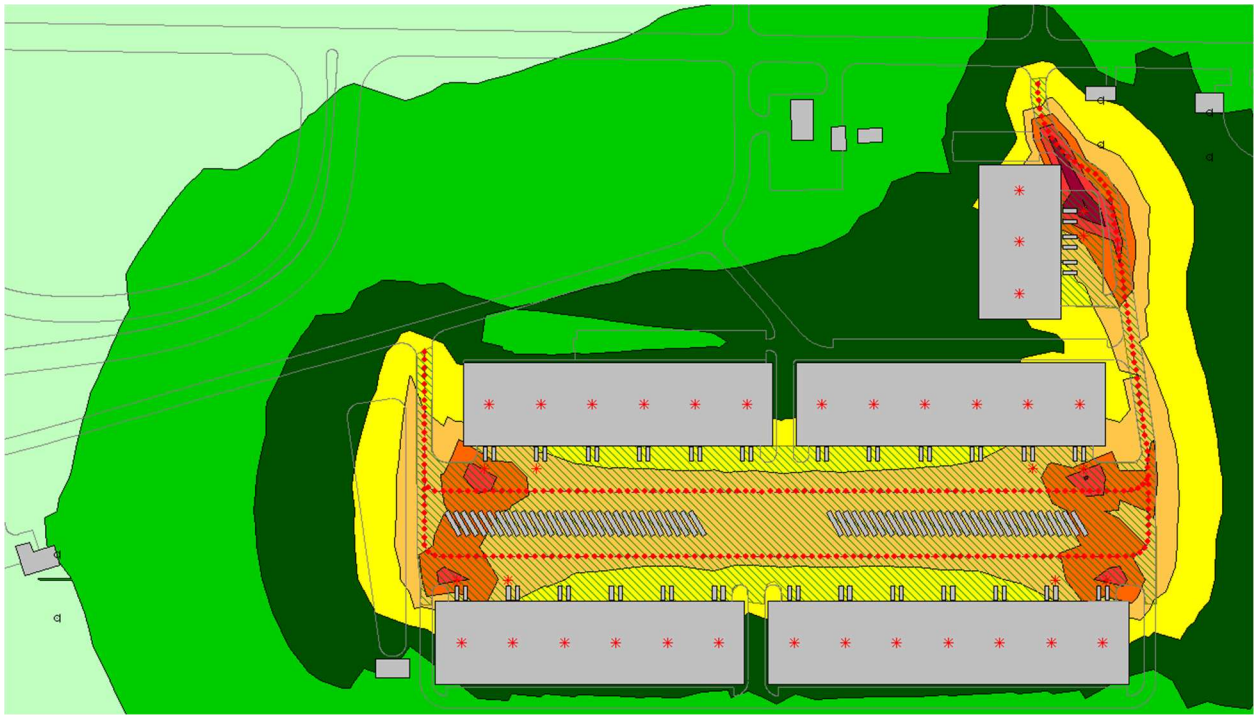


FIGURE 6: NIGHTTIME STEADY-STATE / VARYING STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)

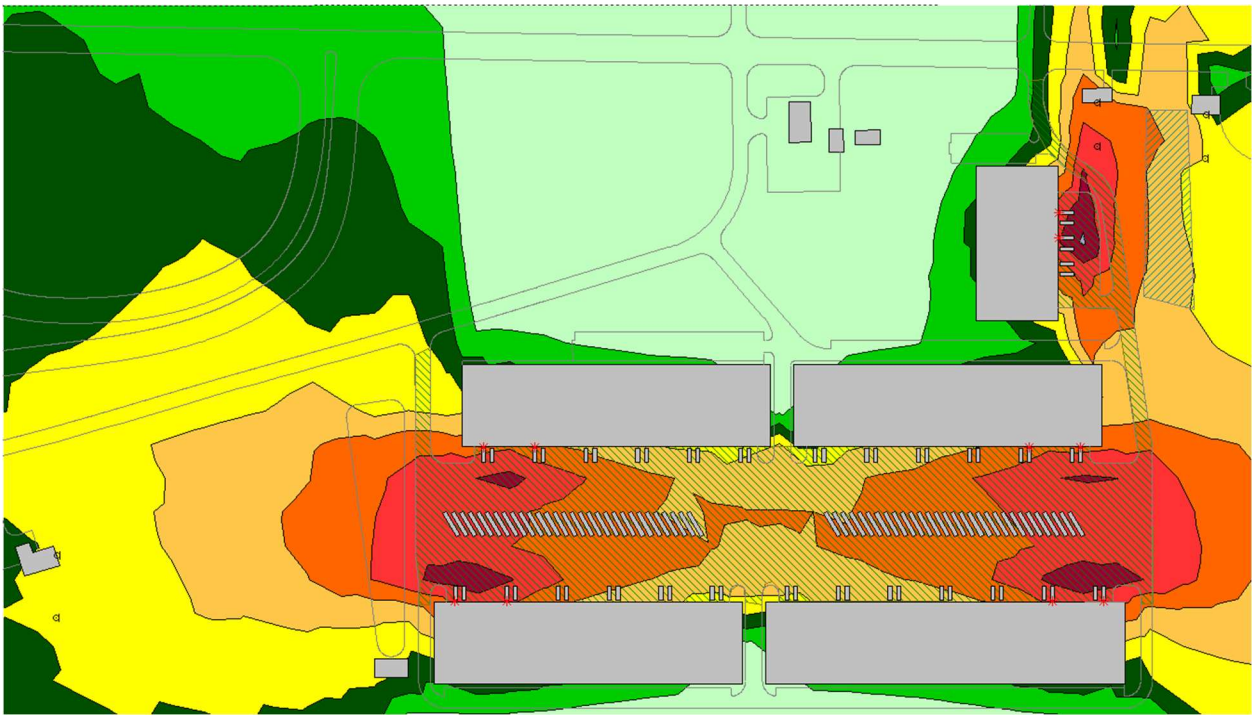
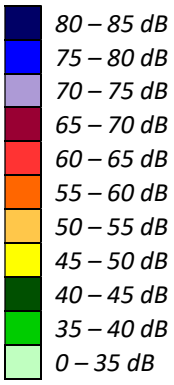


FIGURE 7: DAYTIME IMPULSIVE STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)



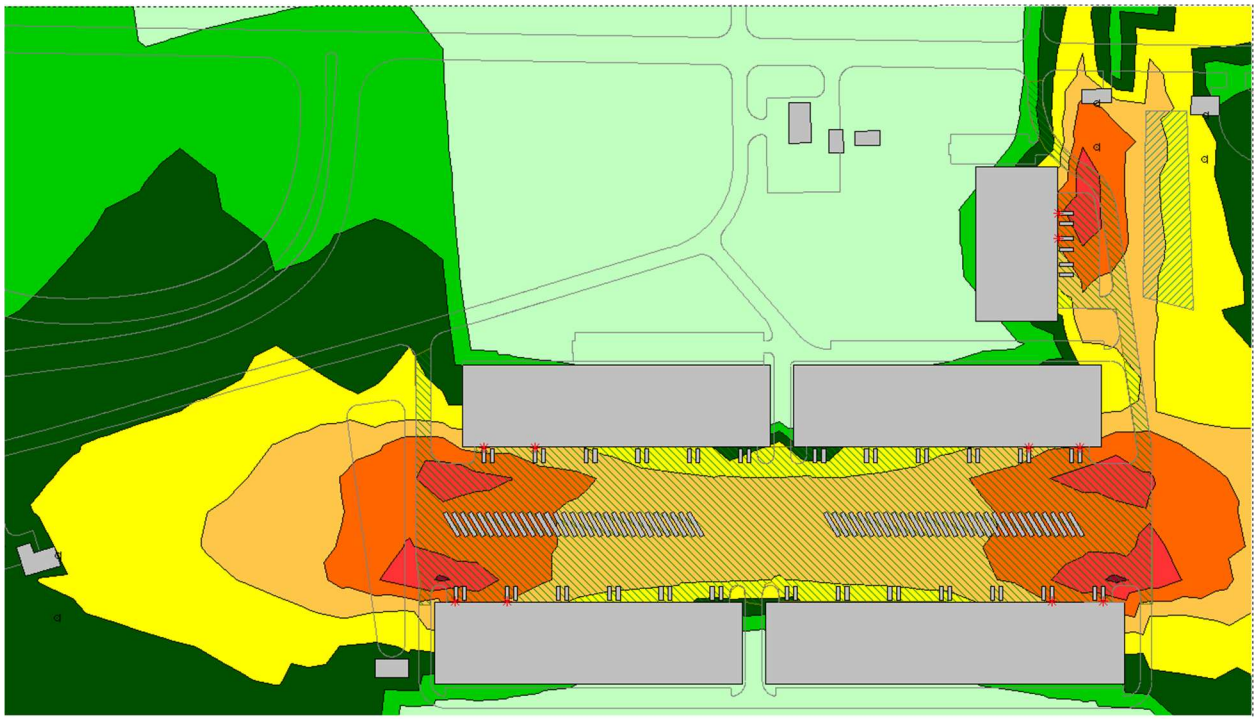


FIGURE 8: NIGHTTIME IMPULSIVE STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)

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

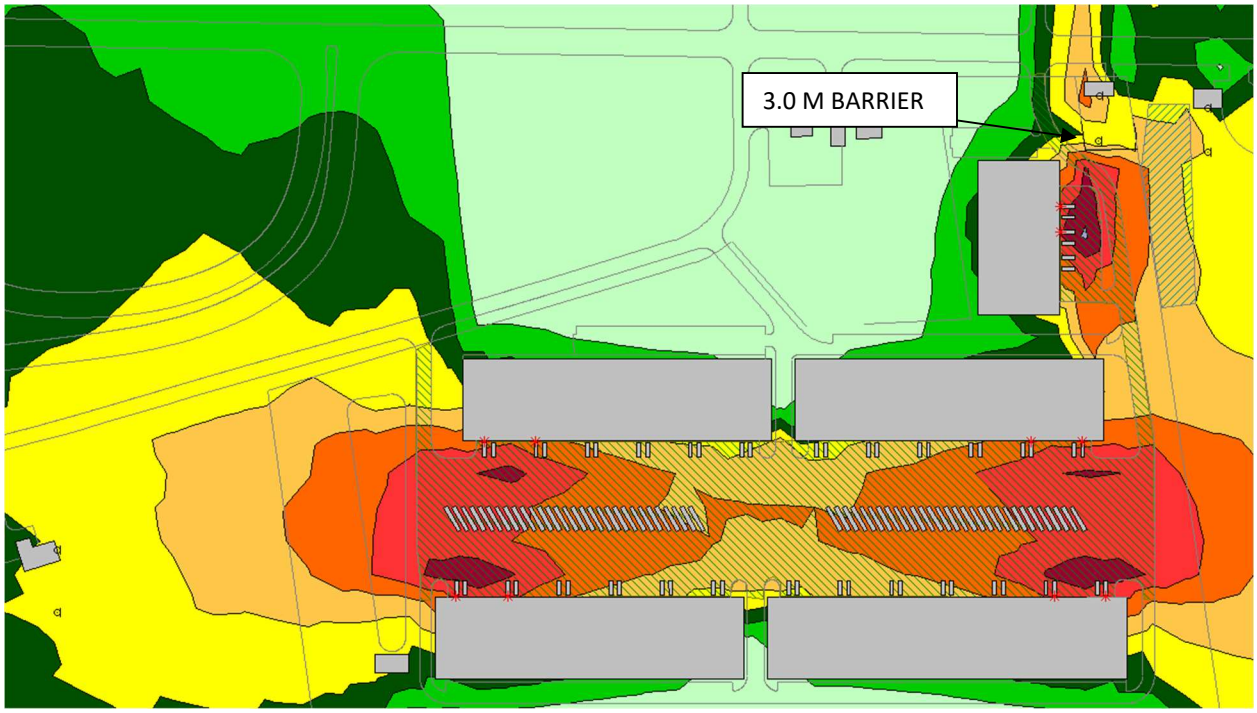


FIGURE 9: DAYTIME MITIGATED IMPULSIVE STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)

FIGURE 10: NIGHTTIME MITIGATED IMPULSIVE STATIONARY NOISE CONTOURS (1.5 METERS ABOVE GRADE)