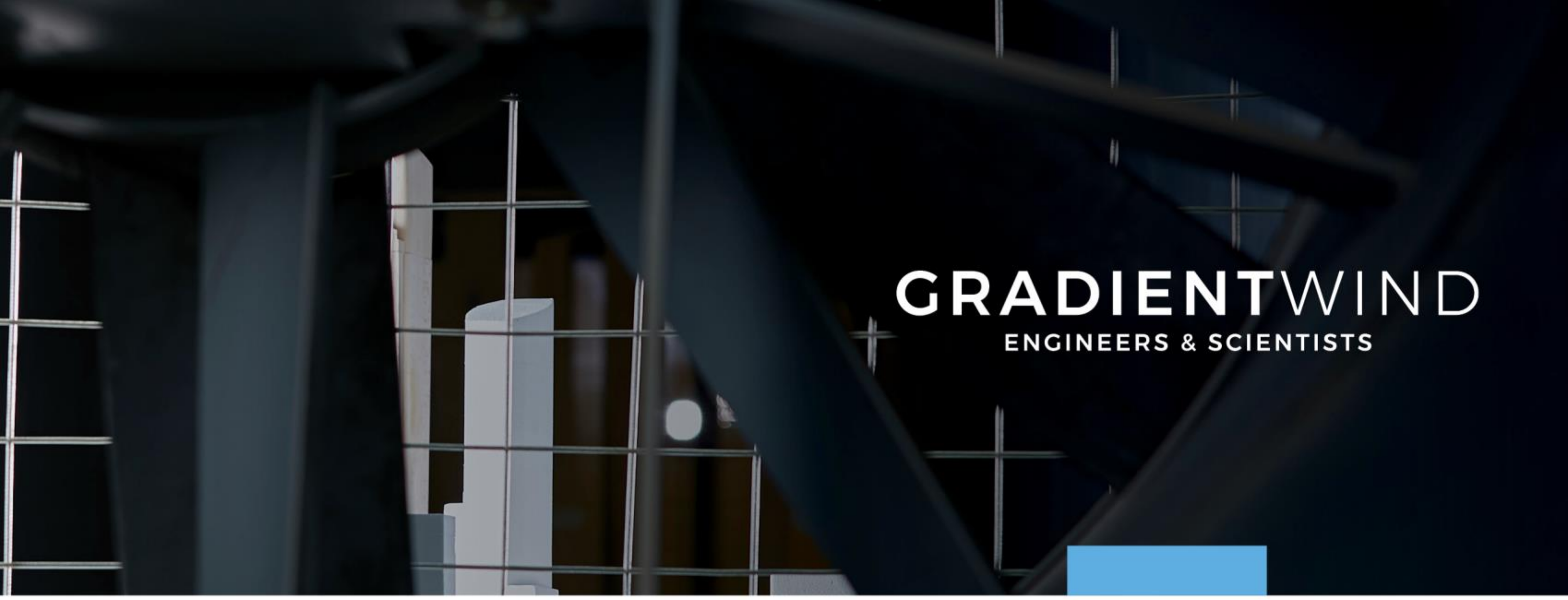
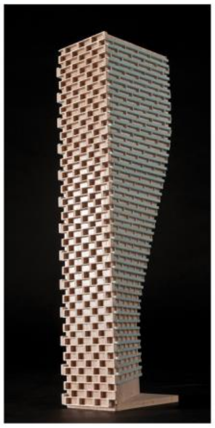


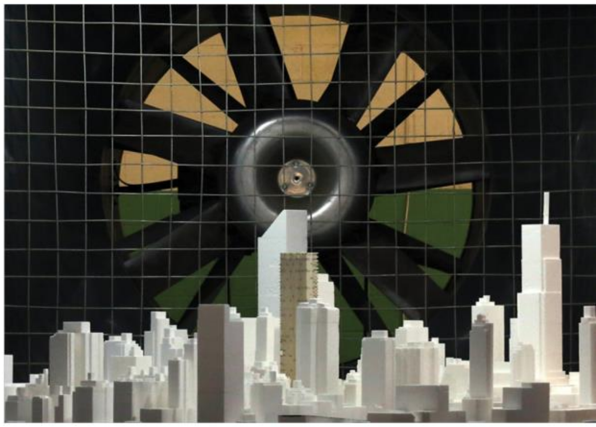
GRADIENTWIND
ENGINEERS & SCIENTISTS

STATIONARY NOISE ASSESSMENT

930 Carling Avenue & 520 Preston Street
The Ottawa Hospital
New Campus Development

REPORT: GW20 –049 – Stationary Noise





September 30, 2022

PREPARED FOR

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EXECUTIVE SUMMARY

This report describes a stationary noise assessment performed for the proposed New Campus Development serving The Ottawa Hospital (TOH) located at a portion of 930 Carling Avenue and 520 Preston Street in Ottawa, Ontario. The major sources of stationary noise are the air handling units, generators, cooling towers, laboratory and kitchen exhausts and the loading bay. While not considered a stationary noise source, noise from the helicopter landing pad was assessed to ensure that indoor noise levels are comfortable in noise sensitive areas such as patient rooms. Helicopter fly overs noise impacts are similar to other transient events such as sirens from ambulances and other emergency vehicles. Figure 1 illustrates a site plan with the surrounding context. Transportation noise impacts on the hospital are addressed in our report, "Environmental Noise & Vibration Assessment (GW 20-049 Noise & Vibration)", dated May 7, 2021.

The focus of this study is the exterior noise levels generated by stationary noise sources. The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) architectural drawings prepared by HDR Architects, provided September 2022; and (iv) mechanical drawings and data provided by Smith + Andersen, Chorley + Bisset Consulting Engineers, and Eequinox .

The results of the current study indicate that noise levels at nearby points of reception are expected to fall below the ENCG noise criteria provided that the assumptions outlined in Section 2.1 and the notes in Section 6 are followed. Additionally, the sound power levels of the stationary noise sources should not exceed the levels shown in Table 2. As such, the proposed development is expected to be compatible with the existing noise-sensitive land uses. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to the installation of the equipment.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by The Ottawa Hospital, through a sub-consultant agreement with Parsons Inc., to undertake a stationary noise assessment as part of the Site Plan planning process for the proposed New Campus Development located at a portion of 930 Carling Avenue and 520 Preston Street 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 the stationary noise sources onto the neighbouring residential properties, Dominion Observatory, and the hospital itself. 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, architectural drawings provided by HDR Architects, dated September 2022, and mechanical drawings and information provided by Smith + Andersen (Lab exhaust sound data, location of intake/exhaust louvers), Chorley + Bisset Consulting Engineers (Generator sound data), and Eequinox (Cooling towers).

2. TERMS OF REFERENCE

ARCHITECTURAL RENDERING, NORTH PERSPECTIVE
(COURTESY OF HDR ARCHITECTURE ASSOCIATES)

The New Campus Development for TOH is located between 930 Carling Avenue and 520 Preston Street in Ottawa; situated on a parcel of land bounded by Carling Avenue to the north, Preston Street to the east, Prince of Wales Drive to the southeast, Birch Drive to the southwest, and Maple Drive to the west. The New Campus Development main site plan includes a main hospital building and a Central Utility Plant (CUP), both of which form the focus of the present study,

[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

as well as a future research building to the north, a parking garage (previously approved Phase 2), and three future towers to be located at the northeast corner.

The main Hospital building comprises two nearly rectangular building components connected by a common podium. The building to the west is an eight-storey building, hereinafter referred to as “Tower A”, and the building to the east is a 13-storey building, hereinafter referred to as “Tower B”. Tower A includes terraces along the east and west elevations at Levels 5 and 6 and Tower B includes a helicopter pad on the roof. Entrances to the main hospital building are provided below-grade on the east elevation (public access to the emergency room) and west elevation (ambulance access), and grade-level access on the south (loading area) and north. Additionally, a pedestrian bridge at the northeast corner provides access between Level 1 of the main hospital building and the parking garage to the northeast. The covered emergency level includes short-term parking, and the main entrance level includes short-term parking and barrier-free parking surrounded by landscaping towards the northeast of the main entrance plaza. A wellness garden is located north on the main entrance plaza. The remain exterior of the building consist of curtain wall with large, glazed areas. The windows are fixed / non operable.

The CUP is a one-storey rectangular building located at the southwest corner of the subject site aligned with Maple Drive to the southwest. There is a fuelling and loading area located at the northeast corner, and a main entrance located at the northwest corner. The CUP is located below the level of Maple Drive and includes open areas and covered areas that will include surface parking. The CUP will include exhaust towers that extend above the surface of the CUP roof and parking area. Figure 1 illustrates the subject site and surrounding context, representing the proposed future massing.

The major sources of stationary noise are the air handling units, generators, cooling towers, kitchen/lab exhaust and loading bay. Figure 2 illustrates the location of noise sources included in this study.

Surrounding the site is the Central Experimental Farm and agricultural research facilities to the south and east, including the Dominion Observatory which is located to the north of the main hospital building. To the north of Carling Avenue is a mix of residential and commercial buildings. To the southeast is Dow's Lake and Rideau Canal and associated greenspace. The Dominion Observatory was contacted by Parsons Inc., where the facility manager advised that there is no particular sensitivity to noise and vibrations.

2.1 Assumptions

The sound power levels of the lab exhaust, cooling tower, and generators are based on manufacturer data provided by Smith + Andersen, Eequinox, and Chorley + Bisset Consulting Engineers, respectively. Locations of intake and exhaust louvers on the main hospital building were provided by Smith + Andersen. The sound power levels of other stationary sources are based on Gradient Wind's past experience. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to the installation of the equipment. It will be the responsibly of the design – build consultant to prepare an updated acoustic assessment.

The following assumptions have been made in the analysis:

(i) The sound power levels of the lab exhaust, cooling tower, and generators are based on manufacturer data provided by Smith + Andersen, Chorley + Bisset Consulting Engineers, and Eequinox.
(ii) The sound power levels of the Kitchen Exhaust are assumed to be equivalent to the sound power levels of the lab exhaust.
(iii) The sound power levels of the air handling units and the loading bay are assumed based on Gradient Wind's previous experience.
(iv) The cooling towers, and lab/kitchen exhausts are assumed to operate continuously at 100% over a 1-hour period during the daytime and nighttime periods.
(v) The air handling units were assumed to operate 100% and 50% during the daytime and nighttime, respectively.
(vi) The generator is assumed to be running continuously at 100% over a 1-hour period during the daytime period for testing and maintenance purposes.
(vii) The lab/kitchen exhausts and cooling towers were represented as point sources while noise from the air handling unit louvers was represented as emitting facades in the analysis.
(viii) The noise from the generators was represented as an emitting roof and an emitting façade on the Central Utility Plant (CUP).
(ix) A total of thirty-five (35) receptors were strategically placed on the closest buildings around the study site. The location noise sources and receptors can be seen in Figure 4.

(x) The ground region was modelled as absorptive ground due to the presence of grassland (soft ground).

(xi) The design of the hospital will incorporate fixed (inoperable) windows in all areas of the hospital building.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the neighbouring noise-sensitive buildings 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 noise-sensitive 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.

The noise impact from the helicopter onto the main hospital building was assessed by the computer modelling tool: Predictor-Lima; developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2. The flight path was provided by RGHeliservices Consulting and sound power data obtained from *Helicopter Noise Impacts on Hospital Development Design*[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

[3] A. James and L. Zoontjens, *"Helicopter Noise Impacts on Hospital Development Design",* Australian Acoustical Society, 2012

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" [4].

Noise associated with emergency activities, such as sirens from ambulances and helicopter air lifts, are not considered to be stationary noise sources as outlined in NPC-300:

> *Noise sources, equipment, activities or facilities connected with emergency measures undertaken for:*
>
> - *the immediate health, safety or welfare of inhabitants; and*
> - *the preservation or restoration of property; unless such noise is clearly of a longer duration or nature more disturbing than is reasonably necessary for the accomplishment of such emergency purpose.*

Notwithstanding, noise associated with the helicopter is included in this report to assist in design requirements for patrons in the hospital.

4.2 Stationary Noise Criteria

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.

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

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"[5]. 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 daycares. With regards to impacts on the hospital itself, NPC-300 does not define the following as points of reception:

The following are examples of locations that are not considered to be points of reception:

- *Outdoor locations associated with a noise sensitive institutional purpose or a noise sensitive commercial purpose.*
- *Inoperable (fixed or sealed) window as defined in Part A of this guideline;*

Because noise is dominated by manmade sources, the site is considered to be in a Class 1 area. The recommended maximum noise levels at a POR for a Class 1 area in an urban environment adjacent to arterial roadways are outlined in Table 1.

Additionally, when analysing standby power equipment such as emergency generators, NPC-300 specifies a noise level limit of 55 dBA for daytime testing. Generators are also investigated separately, without the combined effect of other equipment.

TABLE 1: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

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

4.3 Helicopter Air Lift Noise Criteria

As mentioned in Section 4.1. the helicopter air lift is not classified as a stationary source as it is associated with emergency activities. However, it remains a significant source of noise for hospital operations. As a result, noise impacts into the hospital building were studied in this report. According to *Helicopter Noise*

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

Impacts on Hospital Development Design[6]*,* a maximum level of no more than 65 dBA L_{Amax} is set for general hospital wards. If outdoor Plane of Window noise impacts exceed 65 dBA due to the helicopter, upgraded window components will be required for noise mitigation.

4.4 Determination of Noise Source Power Levels

The sound power levels of the cooling tower, generator, and lab exhaust are based on manufacturer data provided by Smith + Andersen, Chorley + Bisset Consulting Engineers, and Eequinox. Table 2 summarizes the sound power levels of each source used in the analysis.

TABLE 2: EQUIPMENT SOUND POWER LEVELS (DBA)

Source	Description	Height (m)	Correction Applied	Frequency (Hz)								
				63	125	250	500	1000	2000	4000	8000	Total
S1 – S5	Cooling Towers	1.5*	Unmitigated	79	84	87	90	90	86	83	75	**95**
			Maximum Permissible	74	79	82	85	85	81	78	70	**90**
S6-S7	Lab Exhaust	4.2*	Unmitigated	78	82	81	82	79	74	70	65	**88**
S7 – S9	Kitchen Exhaust	4.2*	Unmitigated	78	82	81	82	79	74	70	65	**88**
S10-S17	AHU Louvers	22.5**	Unmitigated	42	66	78	85	85	82	78	68	**90**
S18	Generator Radiator Intake/exhaust	2 **	Unmitigated	-	-	-	-	126	-	-	-	**126**
			Maximum Permissible	-	-	-	-	95	-	-	-	**95**
S19	Loading Dock	2.7***	Unmitigated	-	-	-	-	95	-	-	-	**95**
S20	Idling Trucks	2.7***	Unmitigated	-	-	-	-	95	-	-	-	**95**

*Height above CUP/Hospital roof.
** To the centerline of the louver above grade.
*** Above grade at loading dock.

[6] A. James and L. Zoontjens, *"Helicopter Noise Impacts on Hospital Development Design",* Australian Acoustical Society, 2012

4.4.1 Determination of Helicopter Air Lift Power Level

The sound power level of the Helicopter is based on *Helicopter Noise Impacts on Hospital Development Design*. In the model, the helicopter's path is represented as a moving source. It is assumed that one flight will take place over a one-hour period in the daytime/nighttime periods, respectively. Furthermore, the helicopter is assumed to idle for 5 minutes over the one-hour period during a patient delivery. Figure 3 shows the flight path and idle locations of the helicopter air lift. Table 3 summarizes the sound power level of the helicopter along its flight path and during idle.

TABLE 3: HELICOPTER AIR LIFT SOUND POWER LEVELS (DBA)

Description	Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	Total
Helicopter Arrival and Departure	-	-	-	-	137	-	-	-	**137**
Helicopter Idle on Helipad	-	-	-	-	127	-	-	-	**127**

4.5 Stationary Source Noise Predictions

The impact of stationary noise sources on nearby noise-sensitive 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 13 receptor locations were chosen on the surrounding buildings to measure the noise impact at off site plane of window (POW) receptors during the daytime/evening period (07:00 – 23:00), as well as during the nighttime period (23:00 – 07:00). An additional 22 receptors were placed onsite to capture noise impacts onto the hospital building (labelled IR14-IR35). Since the hospital will have fixed windows these internal receptors are not considered points of reception but will determine the required sound transmission class ratings for the glazing elements to control indoor noise levels. Receptor locations are described in Table 5 and illustrated in Figure 4 and the source locations can be seen in Figure 2 and Figure 3. 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 upon request.

TABLE 4: CALCULATION SETTINGS

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

TABLE 5: RECEPTOR LOCATIONS

Receptor ID	Receptor Location	Height Above Grade (m)
R1	2 Summershade Private – South Façade	4.5
R2	2 Summershade Private – East Façade	4.5
R3	327 Breezehill Avenue South – South Façade	22.5
R4	330 Loretta Avenue South – South Façade	22.5
R5	Dominion Observatory – South Facade	4.5
R6	Dominion Observatory – Southeast Façade	4.5
R7	Dominion Observatory – East Façade	4.5
R8	875 Carling Avenue – South Façade	38
R9	875 Carling Avenue – Southwest Façade	38
R10	875 Carling Avenue – East Façade	38
R11	875 Carling Avenue – West Façade	38
R12	330 Loretta Avenue South – East Façade	22.5
R13	327 Breezehill Avenue South – West Façade	22.5
IR14	Hospital Building – Tower A – Southeast Facade	34.5
IR15	Hospital Building – Tower A – Southeast Facade	34.5
IR16	Hospital Building – Tower A – Northwest Facade	34.5
IR17	Hospital Building – Tower B – East Façade	11.5
IR18	Hospital Building – Tower B – East Façade	29.7
IR 19	Hospital Building – Tower B – East Façade	29.7
IR 20	Hospital Building – Tower B – West Façade	29.7
IR 21	Hospital Building – Tower B – North Façade	29.7
IR 22	Hospital Building – Tower B – West Façade	61
IR 23	Hospital Building – Tower B – West Façade	61
IR24	Hospital Building – Tower B – East Façade	61
IR 25	Hospital Building – Tower A – East Facade	34.5
IR 26	Hospital Building – Tower A – North Facade	34.5
IR 27	Hospital Building – Tower A – South Facade	41.1
IR 28	Hospital Building – Tower B – South Facade	61

TABLE 6: RECEPTOR LOCATIONS (CONTINUED)

Receptor ID	Receptor Location	Height Above Grade (m)
IR 29	Hospital Building – Tower B – East Façade	61
IR 30	Hospital Building – Tower B – East Façade	61
IR 31	Hospital Building – Tower B – West Façade	61
IR 32	Hospital Building – Tower B– West Façade	61
IR 33	Hospital Building – Tower A – East Façade	41.1
IR 34	Hospital Building – Tower A – East Façade	41.1
IR 35	Hospital Building – Tower A – West Façade	41.1

5. RESULTS AND DISCUSSION

5.1 OFFSITE IMPACTS

Noise levels at nearby sensitive receptors are below ENCG criteria for stationary noise, as summarized in Tables 7 and 8 below. The sound levels listed in Table 7 and Table 8 are based on the assumptions outlined in Section 2.1. With consideration of Gradient Wind's recommendations and assumptions, the proposed development is expected to be compatible with the existing land uses. Figures 5-7 show the daytime and nighttime noise contours across the area.

TABLE 7: OFFSITE HVAC NOISE LEVELS

Receptor Number / Type	Location	Height Above Grade (m)	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 1 Criteria	
			Day	Night	Day	Night	Day	Night
R1	2 Summershade Private – South Façade	4.5	39	36	50	45	**Yes**	**Yes**
R2	2 Summershade Private – East Façade	4.5	39	36	50	45	**Yes**	**Yes**
R3	327 Breezehill Avenue South – South Façade	22.5	42	39	50	45	**Yes**	**Yes**
R4	330 Loretta Avenue South – South Façade	22.5	40	38	50	45	**Yes**	**Yes**
R5	Dominion Observatory – South Facade	4.5	40	40	50	45	**Yes**	**Yes**
R6	Dominion Observatory – Southeast Façade	4.5	40	40	50	45	**Yes**	**Yes**
R7	Dominion Observatory – East Façade	4.5	41	41	50	45	**Yes**	**Yes**
R8	875 Carling Avenue – South Façade	38	45	43	50	45	**Yes**	**Yes**
R9	875 Carling Avenue – Southwest Façade	38	46	44	50	45	**Yes**	**Yes**
R10	875 Carling Avenue – East Façade	38	44	42	50	45	**Yes**	**Yes**
R11	875 Carling Avenue – West Façade	38	44	42	50	45	**Yes**	**Yes**
R12	330 Loretta Avenue South – East Façade	22.5	37	35	50	45	**Yes**	**Yes**
R13	327 Breezehill Avenue South – West Façade	22.5	41	39	50	45	**Yes**	**Yes**

TABLE 8: OFFSITE GENERATOR NOISE LEVELS

Receptor Number / Type	Location	Height Above Grade (m)	Noise Level (dBA)	Sound Level Limits	Meets ENCG Class 1 Criteria
			Day	Day	Day
R1	2 Summershade Private – South Façade	4.5	24	55	**Yes**
R2	2 Summershade Private – East Façade	4.5	24	55	**Yes**
R3	327 Breezehill Avenue South – South Façade	22.5	33	55	**Yes**
R4	330 Loretta Avenue South – South Façade	22.5	26	55	**Yes**
R5	Dominion Observatory – South Facade	4.5	53	55	**Yes**
R6	Dominion Observatory – Southeast Façade	4.5	51	55	**Yes**
R7	Dominion Observatory – East Façade	4.5	54	55	**Yes**
R8	875 Carling Avenue – South Façade	38	25	55	**Yes**
R9	875 Carling Avenue – Southwest Façade	38	27	55	**Yes**
R10	875 Carling Avenue – East Façade	38	25	55	**Yes**
R11	875 Carling Avenue – West Façade	38	25	55	**Yes**
R12	330 Loretta Avenue South – East Façade	22.5	25	55	**Yes**
R13	327 Breezehill Avenue South – West Façade	22.5	33	55	**Yes**

5.2 ONSITE IMPACTS

The stationary noise impact onto the hospital building can be seen in Tables 9-12. As per Section 4.2 the plane of window and outdoor points of reception on the hospital site are not considered "points of reception" therefore the MECP sound level limits do not apply. In order to ensure acceptable indoor noise levels, the glazing will need to be designed to account of expected outdoor noise levels. As a practical limit, exterior noise levels at the plan of window of the hospital building should not exceed 65 dBA.

TABLE 9: ONSITE MECHANICAL EQUIPMENT NOISE IMPACT

Receptor Number / Type	Location	Height Above Grade (m)	HVAC Noise Level (dBA)		Generator Noise Level (dBA)
			Day	Night	Day
IR14	Hospital Building – Tower A – Southeast Facade	34.5	45	45	41
IR15	Hospital Building – Tower A – Southeast Facade	34.5	54	54	44
IR16	Hospital Building – Tower A – Northwest Facade	34.5	37	36	30
IR17	Hospital Building – Tower B – East Façade	11.5	58	57	32
IR18	Hospital Building – Tower B – East Façade	29.7	47	47	37
IR 19	Hospital Building – Tower B – East Façade	29.7	56	56	32
IR 20	Hospital Building – Tower B – West Façade	29.7	64	62	32
IR 21	Hospital Building – Tower B – North Façade	29.7	66	63	30
IR 22	Hospital Building – Tower B – West Façade	61	52	52	61
IR 23	Hospital Building – Tower B – West Façade	61	52	52	61
IR24	Hospital Building – Tower B – East Façade	61	51	51	33
IR 25	Hospital Building – Tower A – East Facade	34.5	55	53	35

TABLE 10: ONSITE MECHANICAL EQUIPMENT NOISE IMPACT (CONTINUED)

Receptor Number / Type	Location	Height Above Grade (m)	HVAC Noise Level (dBA)		Generator Noise Level (dBA)
			Day	Night	Day
IR 26	Hospital Building – Tower A – North Facade	34.5	58	55	29
IR 27	Hospital Building – Tower A – South Facade	41.1	55	53	64
IR 28	Hospital Building – Tower B – South Facade	61	49	47	63

The maximum noise impact from helicopter activity at the hospital will be 69 dBA at the facades under the helicopter pad. As per NPC-300 and ENCG guidelines indoor noise levels in hospitals should not exceed 40 dBA. Therefore, standard 25 mm insulated glazing units having a minimum STC of 35 will be sufficient to minimize helicopter noise inside the building.

TABLE 11: ONSITE HELICOPTER NOISE IMPACT

Receptor ID	Location	Height Above Grade (m)	HVAC Noise Level (dBA)	
			Day	Night
IR14	Hospital Building – Tower A – Southeast Facade	34.5	66	66
IR15	Hospital Building – Tower A – Southeast Facade	34.5	68	68
IR16	Hospital Building – Tower A – Northwest Facade	34.5	61	61
IR17	Hospital Building – Tower B – East Façade	11.5	59	59
IR18	Hospital Building – Tower B – East Façade	29.7	64	64
IR 19	Hospital Building – Tower B – East Façade	29.7	60	60
IR 20	Hospital Building – Tower B – West Façade	29.7	58	58
IR 21	Hospital Building – Tower B – North Façade	29.7	50	50
IR 22	Hospital Building – Tower B – West Façade	29.7	68	68
IR 23	Hospital Building – Tower B – West Façade	61	69	69
IR24	Hospital Building – Tower B – East Façade	61	64	64

TABLE 12: ONSITE HELICOPTER NOISE IMPACT (CONTINUED)

Receptor ID	Location	Height Above Grade (m)	HVAC Noise Level (dBA)	
			Day	Night
IR 25	Hospital Building – Tower A – East Facade	34.5	63	63
IR 26	Hospital Building – Tower A – North Facade	34.5	54	54
IR 27	Hospital Building – Tower A – South Facade	41.1	66	66
IR 28	Hospital Building – Tower B – South Facade	61	64	64
IR 29	Hospital Building – Tower B – East Façade	61	69	69
IR 30	Hospital Building – Tower B – East Façade	61	68	68
IR 31	Hospital Building – Tower B – West Façade	61	68	68
IR 32	Hospital Building – Tower B– West Façade	61	67	67
IR 33	Hospital Building – Tower A – East Façade	41.1	67	67
IR 34	Hospital Building – Tower A – East Façade	41.1	66	66
IR 35	Hospital Building – Tower A – West Façade	41.1	61	61

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 noise criteria provided that the assumptions outlined in Section 2.1 are followed, and the sound power levels of the mechanical equipment do not exceed the levels shown in Table 2. As such, the proposed development is expected to be compatible with the existing noise-sensitive land uses. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to the installation of the equipment.

On site noise levels from HVAC equipment approach 60 dBA at the plane of window of the hospital. Noise levels from helicopter arrivals and departures will approach 65 dBA (L_{eq}) at windows under the helicopter pad. As per NPC-300 guidelines where fixed windows are used, the outdoor noise criteria do not apply, but windows should have a minimum STC of 35 to ensure acceptable indoor sound levels can be achieved.

To ensure compliance with the ENCG, the following noise control measures are recorded:

- The hospital building will incorporate fixed / non-operable windows into the design of the building.
- The sound power levels of the stationary noise sources should not exceed the levels shown in Table 2.
- An acoustic louver or silencer bank will be required for the generator to reduce sound power levels to those shown in Table 2.

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.

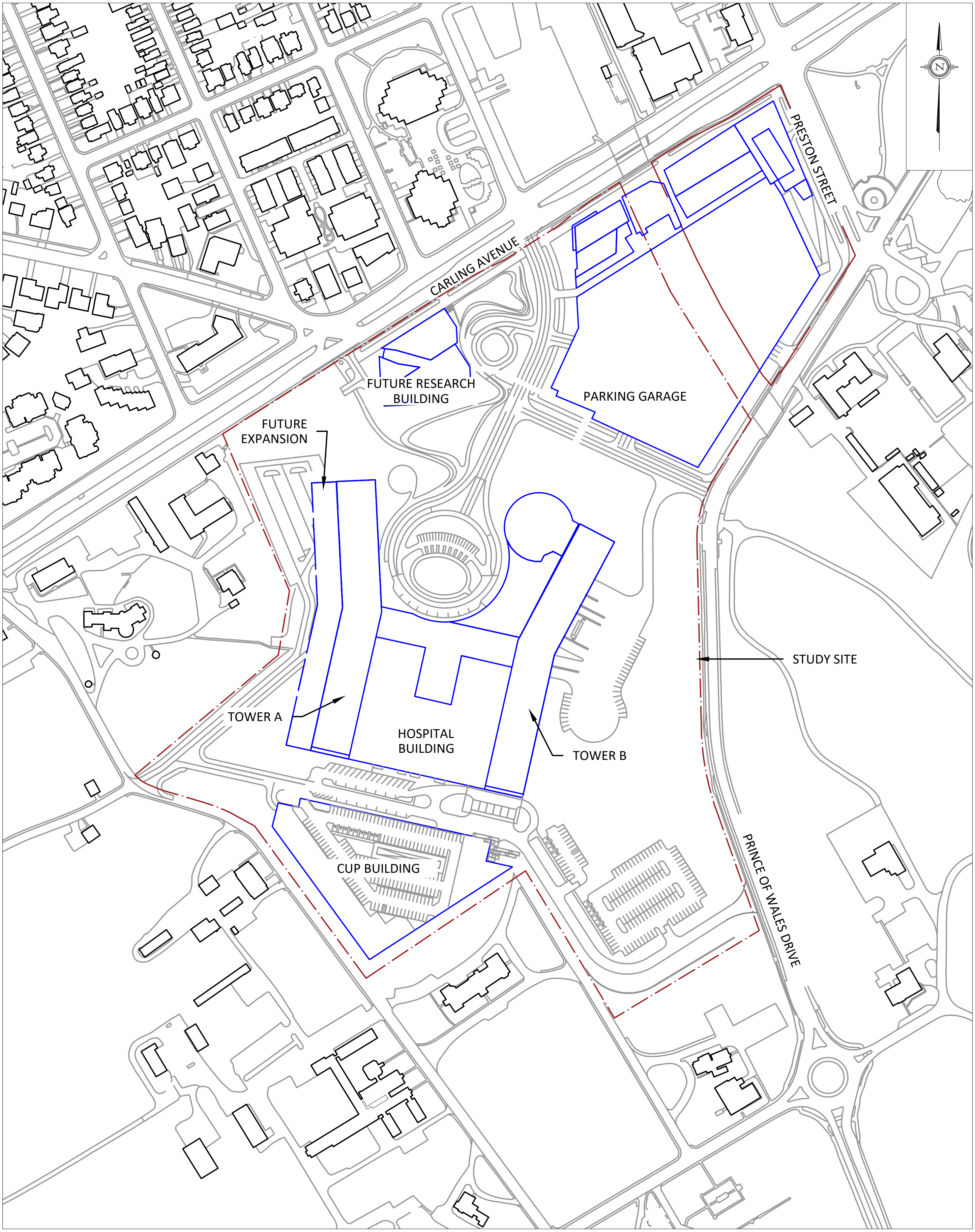
Sincerely,

Gradient Wind Engineering Inc.

Essraa Alqassab, BASc
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #20-049 – Stationary Noise



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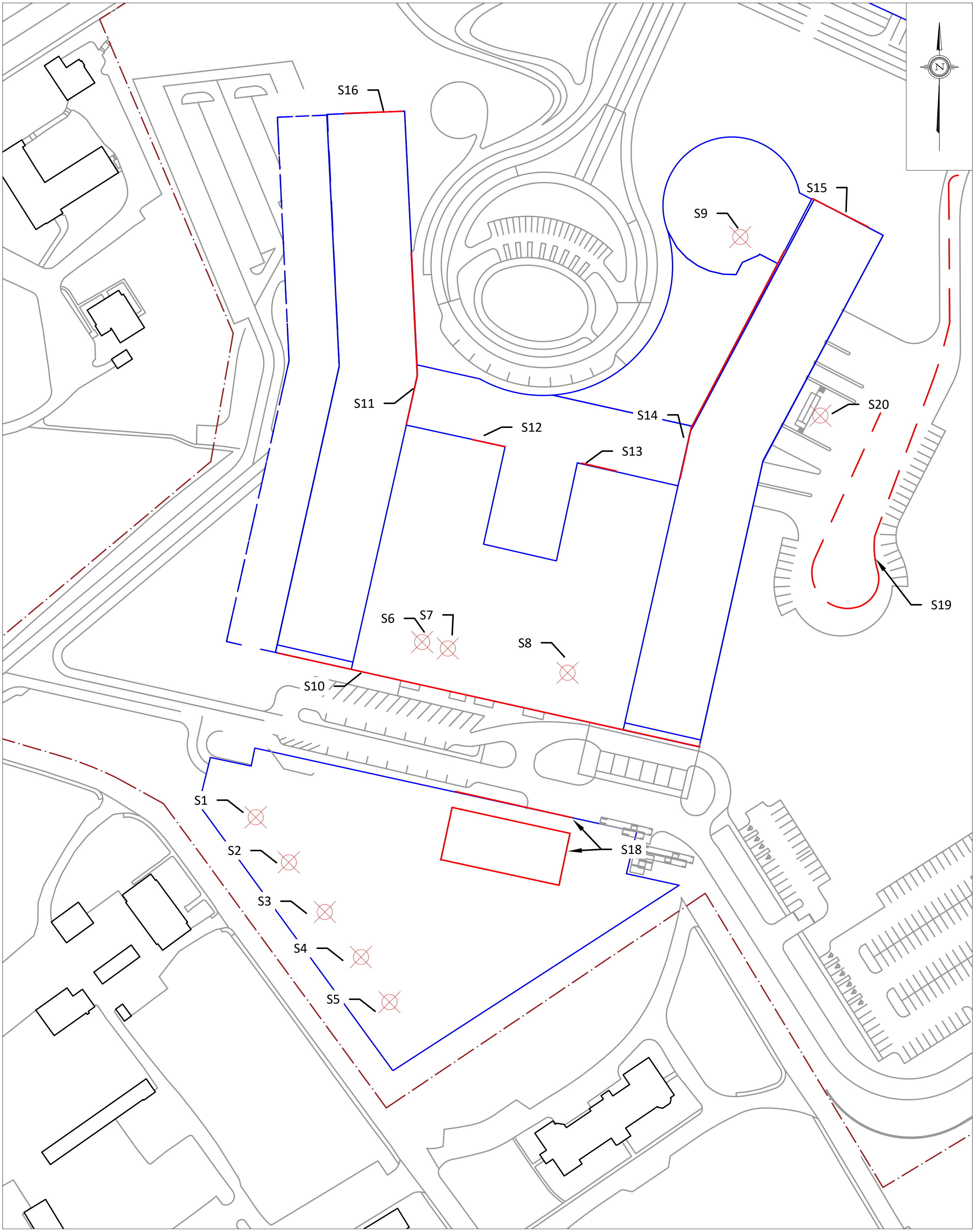
PROJECT	930 CARLING AVENUE AND 520 PRESTON STREET, OTTAWA STATIONARY NOISE ASSESSMENT		
SCALE	1:4000 (APPROX.)	DRAWING NO.	GW20-049-1
DATE	SEPTEMBER 27, 2022	DRAWN BY	E.A.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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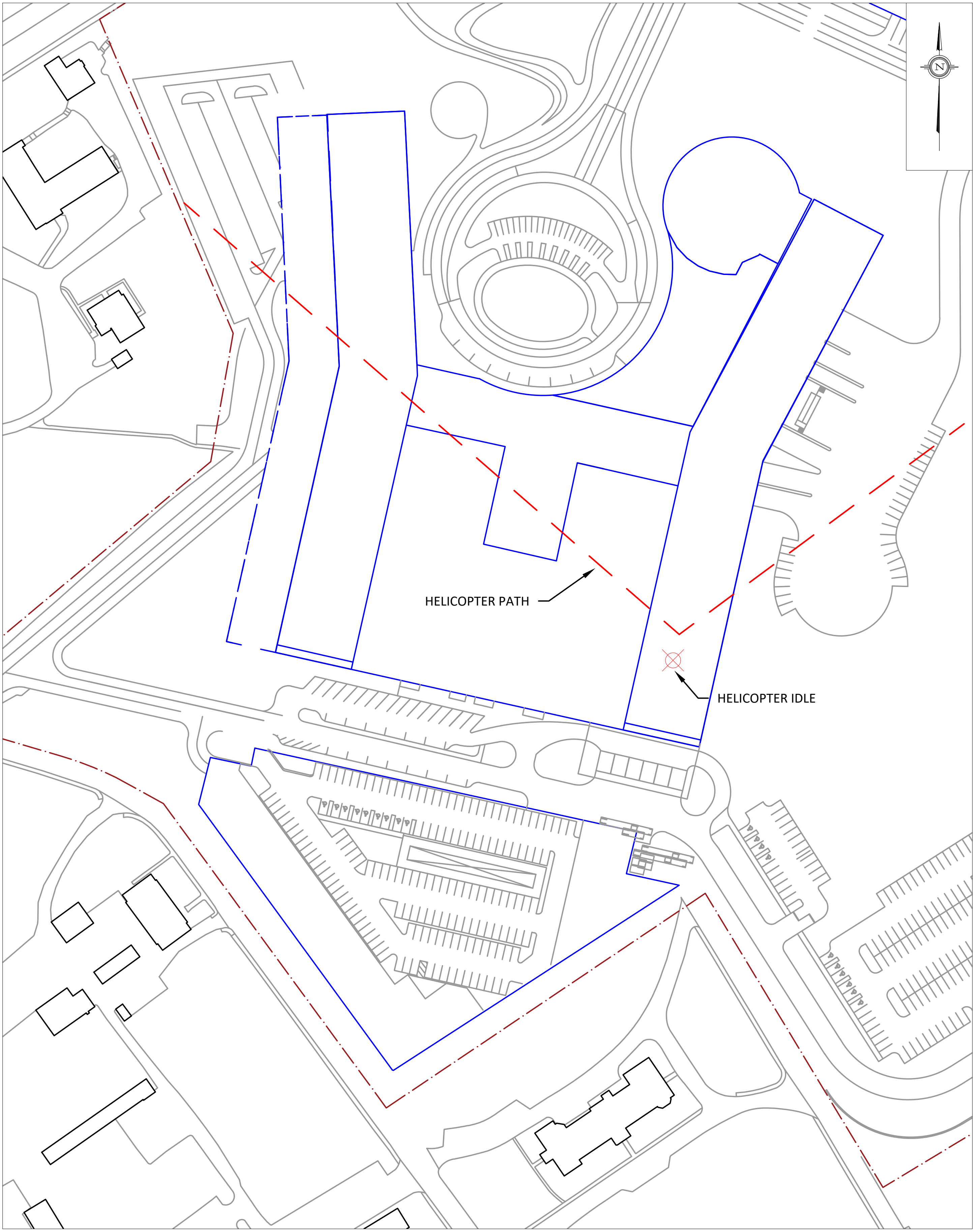
SCALE	1:200 (APPROX.)
DRAWING NO.	GW20-049-2
DATE	SEPTEMBER 27, 2022
DRAWN BY	E.A.
DESCRIPTION	FIGURE 2: SOURCE LOCATIONS



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PROJECT 930 CARLING AVENUE AND 520 PRESTON STREET, OTTAWA
STATIONARY NOISE ASSESSMENT

SCALE 1:200 (APPROX.)

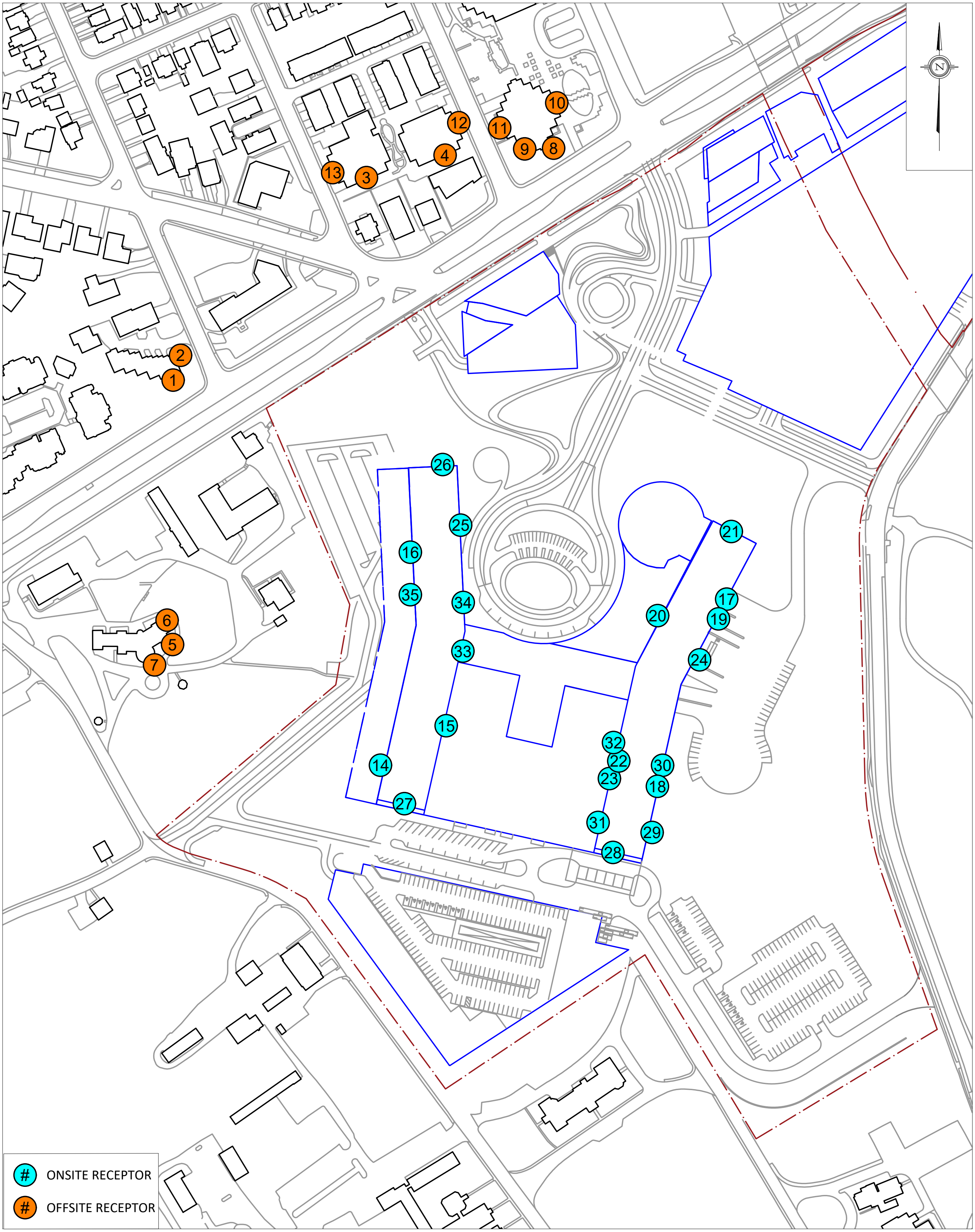
DRAWING NO. GW20-049-3

DATE SEPTEMBER 27, 2022

DRAWN BY E.A.

DESCRIPTION

FIGURE 3:
HELICOPTER AIR LIFT



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PROJECT 930 CARLING AVENUE AND 520 PRESTON STREET, OTTAWA STATIONARY NOISE ASSESSMENT		DESCRIPTION FIGURE 4: RECEPTOR LOCATIONS
SCALE 1:3000 (APPROX.)	DRAWING NO. GW20-049-4	
DATE SEPTEMBER 27, 2022	DRAWN BY E.A.	

FIGURE 5: HVAC DAYTIME NOISE CONTOURS (20 M 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 6: HVAC NIGHTTIME NOISE CONTOURS (20 M 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

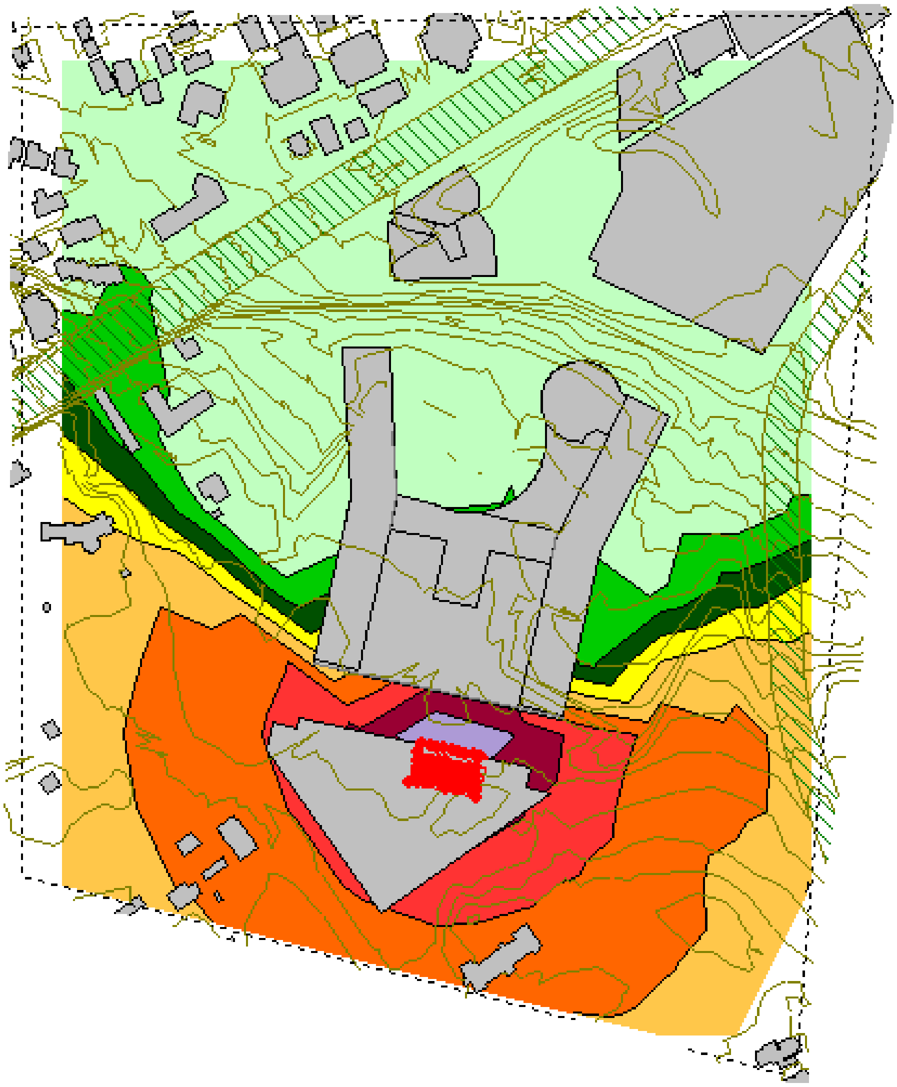

FIGURE 7: GENERATOR NOISE CONTOURS
(20 M ABOVE GRADE)

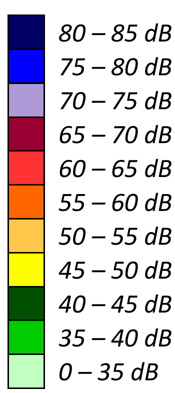

FIGURE 8: HELICOPTER DAYTIME NOISE CONTOURS (20 M ABOVE GRADE)

- *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: HELICOPTER NIGHTTIME NOISE CONTOURS
(20 M ABOVE GRADE)