HGC ENGINEERING

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

Noise Feasibility Study
Proposed Retirement Facility, Phase 2
20 Cedarow Court
Stittsville, Ontario

Prepared for:

Nautical Lands Group
700 Finley Ave, Unit 4, Ajax
ON, L1S 3Z2

Prepared by

Harry Cai, EIT

Reviewed by

Sheeba Paul, MEng, PEng

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1 Introduction and Summary

HGC Engineering was retained by Nautical Lands Group to conduct a noise feasibility study for Phase 2 of a proposed retirement facility located at 20 Cedarow Court in Stittsville, Ottawa, Ontario. Lands surrounding the subject site are existing residential and commercial uses. The site will consist of a five storey residential development with a built-in restaurant and a shielded outdoor amenity courtyard. Phase I is currently under construction to the north-east and Phase III is to be built in the future. The study is required by the City of Ottawa as part of the planning and approvals process.

The primary source of noise was determined to be road traffic on Hazeldean Road. Ultimate road traffic data was obtained from the City of Ottawa and was used to predict future traffic sound levels at the proposed building façades and outdoor living areas. The predicted sound levels were compared to the guidelines of the Ministry of Environment, Conservation and Parks (MECP), and the City of Ottawa to develop noise control recommendations.

The results of the study indicate that future daytime and nighttime sound levels at the façades with exposure to Hazeldean Road will exceed the MECP guideline sound levels and will require noise control measures. Central air conditioning is required for all dwelling units in the building. Upgraded building construction will be required for the south façade facing Hazeldean Road to provide acoustical insulation for indoor spaces. Noise warning clauses are also required for affected units to inform future occupants and owners of the building of the traffic noise impact, to address sound level excesses, and the proximity to commercial facilities.

A preliminary investigation of the potential noise impact from the rooftop mechanical equipment of the proposed retirement development at existing residences was conducted. The analysis is based on mechanical drawings obtained from the Phase I development. The results indicate that the potential noise from the rooftop mechanical equipment will be within the MECP guidelines at the nearby residences. A detailed noise study should be conducted when equipment specifications are available to confirm that the applicable sound level guidelines are met at the nearby residences and provide any additional recommendations if they are required.

A preliminary investigation of the noise impact from existing commercial facilities on the proposed Phase II development was also conducted. Commercial facilities exist west of the site area. Activities

associated with Stittsville Car Wash, Auto Searchers Ltd, and other rooftop mechanical equipment on neighbouring buildings were included in a computer acoustic model to predict the sound levels at the closest façades of the proposed retirement facility. The results indicate that the sound emission of the existing commercial facilities, specifically the car wash, has the potential to exceed the applicable noise guideline limits of the MECP at the exposed ground level façade at the northwest corner of the proposed building facing the commercial facilities. Noise mitigation in the form of an acoustical barrier constructed along west property line is required to address these excesses. Due to high background sound levels from Hazeldean Road, the remaining facades or ground level areas are not expected to experience sound level excesses.

2 Site Description and Noise Sources

Figure 1 is a key plan indicating the location of the proposed site. The site is located on the north side of Hazeldean Road at 20 Cedarow Court, Stittsville, Ontario. The proposed development, designated as Phase II, is part of a large retirement living complex to be built along Hazeldean Road. The proposed Phase II development will consist of a five-storey residential development with a courtyard amenity area and a two-storey restaurant with a rooftop patio. Figures 2 and 2a show the preliminary site layout of Phase II, dated March 1st, 2019, and prediction locations.

HGC Engineering personnel visited the site on August 14th, 2019 to make observations of the acoustical environment. During the site visit, it was noted that the primary source of noise impacting the site was road traffic noise from Hazeldean Road. The site area is currently vacant. Phase I, situated east of the site area, is currently under construction. Areas around the site area are flat. West of the site are commercial facilities on Cedarow Court, which includes Stittsville Car Wash, a coin operated car washing facility with six wash bays and 2 vacuums that operate 24 hours a day, and Auto Searchers Ltd., a used car dealer with 4 auto repair bay doors operating during the daytime hours only. Rooftop HVAC units are also observed on adjacent commercial and industrial buildings. These have been included in the analysis in Section 8. Detached residential houses are present north and south of the site area.

3 Noise Level Criteria

3.1 Road Traffic Noise

Guidelines for acceptable levels of road traffic noise impacting residential developments are given in the MECP publication NPC-300, "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning", release date October 21, 2013, and are listed in Table I below. The values in Table I are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

Table I: MECP Road Traffic Noise Criteria (dBA)

Area	Daytime $L_{EQ\ (16\ hour)}$ Road	Nighttime $L_{EQ(8\ hour)}$ Road
Outdoor Living Area	55 dBA	--
Inside Living/Dining Rooms/Retirement Homes	45 dBA	45 dBA
Inside Bedrooms/Sleeping Quarters of Retirement Homes	45 dBA	40 dBA

Daytime refers to the period between 07:00 and 23:00. Nighttime refers to the time period between 23:00 and 07:00. The term "Outdoor Living Area" (OLA) is used in reference to an outdoor patio, a backyard, a terrace, or other area where passive recreation is expected to occur. Small balconies are not considered OLAs for the purposes of assessment. Terraces greater than 4 m in depth (measured perpendicular to the building façade) are considered to be OLAs.

The guidelines in the MECP publication allow the daytime sound levels in an Outdoor Living Area to be exceeded by up to 5 dBA, without mitigation, if warning clauses are placed in the purchase and rental agreements to the property. Where OLA sound levels exceed 60 dBA, physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically, and administratively practical. The minimum acceptable barrier wall height is 2.2 m for a flat grade case in the City of Ottawa, and the maximum acoustic fence height in the City of Ottawa is 2.5 m unless approved by the City, with a maximum combined berm and fence height of 4.5 m. In the case that the guideline criterion of 55 dBA cannot be met, it must be demonstrated to the City of Ottawa that it is not technically or economically feasible to meet the 55 dBA criterion

with a warning clause.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom or living/dining room windows exceed 60 dBA or daytime sound levels outside bedroom or living/dining room windows exceed 65 dBA. Forced-air ventilation with ducts sized to accommodate the future installation of air conditioning is required when nighttime sound levels at bedroom or living/dining room windows are in the range of 51 to 60 dBA or when daytime sound levels at bedroom or living/dining room windows are in the range of 56 to 65 dBA.

Building components such as walls, windows and doors must be designed to achieve indoor sound level criteria when the plane of window nighttime sound level is greater than 60 dBA or the daytime sound level is greater than 65 dBA due to road traffic noise.

Warning clauses to notify future residents of possible noise excesses are also required when nighttime sound levels exceed 50 dBA at the plane of the bedroom or living/dining room window and daytime sound levels exceed 55 dBA in the outdoor living area and at the plane of the bedroom or living/dining room window due to road traffic.

3.2 Criteria Governing Stationary Noise Sources

An industrial or commercial facility is classified in MECP guidelines as a stationary source of sound (as opposed to sources such as traffic or construction, for example) for noise assessment purposes. The proposed development is located in an urban acoustical environment classified as Class I according to MECP guidelines, which can be characterized by the background sound level being dominated by traffic and human activity.

The façade of a residence, or any associated usable outdoor area, is considered a sensitive point of reception. NPC-300 stipulates that the exclusionary minimum sound level limit for a stationary noise source in an urban Class 1 area is 50 dBA during daytime (07:00 to 19:00) and evening (19:00 to 23:00) hours, and 45 dBA during nighttime hours (23:00 to 07:00). If the background sound levels due to road traffic exceed the exclusionary minimum limits, then the background sound level becomes the criterion. The background sound level is defined as the sound level that is present when

the stationary source under consideration is not operating, and may include traffic noise and natural sounds.

Commercial activities such as the occasional movement of customer vehicles, occasional deliveries, and garbage collection are not of themselves considered to be significant noise sources in the MECP guidelines. Accordingly, these sources have not been considered in this study. Noise from safety equipment (e.g. back-up beepers) are also exempt from consideration. Frequent truck movements at a warehouse or busy shipping/receiving docks at an industry must generally be assessed. Trucking activities have not been included in this assessment since they will occur on an infrequent basis.

The MECP guidelines stipulate that the sound level impact during a "predicable worst case hour" be considered. This is defined to be an hour when a typically busy "planned and predictable mode of operation" occurs at the subject facility, coincident with a period of minimal background sound. Compliance with MECP criteria generally results in acceptable levels of sound at residential receptors although there may still be residual audibility during periods of low background sound.

4 Traffic Sound Level Assessment

4.1 Road Traffic Data

Ultimate traffic data was obtained from the City of Ottawa Environmental Noise Control Guidelines dated January 2016, along with ultimate commercial vehicle and day/night split percentages. The data from the guidelines is provided in Appendix A. Traffic data for Hazeldean Road was also obtained from the City of Ottawa in the form of hourly turning movement counts and AADT traffic values for comparison, and is provided in Appendix A. The higher and more conservative ultimate traffic volumes were used in the analysis. A posted speed limit of 60 km/h was used. A commercial vehicle percentage of 7 % for medium trucks and 5 % for heavy trucks was applied. A day/night split of 92/8 % was used. Table II summarizes the traffic volume data used in this study.

Table II: Ultimate Road Traffic Data

Road Name		Cars	Medium Trucks	Heavy Trucks	Total
Hazeldean Road	Daytime	28 336	2 254	1 610	32 200
	Nighttime	2 464	196	140	2 800
	Total	**30 800**	**2450**	**1 750**	**35 000**

4.2 Road Traffic Noise Predictions

To assess the levels of road traffic noise which will impact the study area in the future, sound level predictions were made using STAMSON version 5.04, a computer algorithm developed by the MECP. Sample STAMSON output is included in Appendix B.

Predictions of the traffic sound levels were chosen around the proposed retirement building to obtain an appropriate representation of future sound levels at various façades. Sound levels were predicted at the plane of the 5th storey bedroom and/or living/dining room windows during daytime and nighttime hours to investigate ventilation and façade construction requirements. Figures 2 and 2a show the concept plan of the site with prediction locations. The results of these predictions are summarized in Table III.

Table III: Predicted Road Traffic Sound Levels [dBA], Without Mitigation

Prediction Location	Description	Daytime – in the OLA $L_{EQ\text{-}16\ hr}$	Daytime – at the Façade $L_{EQ\text{-}16\ hr}$	Nighttime – at the Facade $L_{EQ\text{-}8\ hr}$
A	South Façade facing Hazeldean Road	--	72	64
B	West Façade facing Cedarow Court	--	68	60
C	East Façade facing Phase I	--	68	60
D	Courtyard Amenity Space	<55	--	--
E	Restaurant Patio^{+}	60	--	--

Note: + The City of Ottawa has requested a review of noise from vehicles.

5 Traffic Noise Recommendations

The sound level predictions indicate that the future traffic sound levels at façades with exposure to Hazeldean Road will exceed MECP guidelines. The following discussion outlines the recommendations for acoustic barrier requirements, ventilation requirements, upgraded building façade construction, and warning clauses to achieve the noise criteria stated in Table I.

5.1 Outdoor Living Areas

The site plan indicates an outdoor courtyard amenity space situated behind Phase II buildings and shielded from Hazeldean Road. This area has been analyzed as an outdoor living area (OLA) under MECP guidelines. The predicted daytime sound levels in the courtyard amenity space is less than the MECP's limit of 55 dBA, and physical mitigation is not required. The restaurant rooftop terrace and bistro patio are not considered as OLAs in the guidelines, and therefore are exempt from traffic noise assessment.

At the request of the City of Ottawa, a sound level prediction in the centre of the proposed restaurant rooftop terrace was investigated, with location of the terrace shown in Figure 2a. Typically, restaurant patios may include glass solid barriers. This barrier may be considered but is not required as per MECP guidelines.

5.2 Indoor Living Areas and Ventilation Requirements

Air Conditioning

The predicted future sound levels outside the 5th storey windows of Phase II façades with exposure to Hazeldean Road will be greater than 60 dBA during nighttime hours and/or 65 dBA during daytime hours. To address these excesses, these units need to be equipped with central air conditioning systems so that windows may remain closed. These units are show in Figure 3. Window or through-the-wall air conditioning units are not recommended because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall sound insulating properties of the envelope. Acceptable units are those housed in their own closet with an access door for maintenance. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with criteria of MECP publication NPC-300, as

applicable.

5.3 Building Façade Constructions

The predicted sound levels at the building façades with exposure to Hazeldean Road will exceed 65 dBA during daytime and/or 60 dBA during nighttime. MECP guidelines stipulate that in such cases, building components including windows, walls, and doors be designed so that the indoor sound levels comply with the noise criteria in Table I.

Calculations were performed to determine the acoustical insulation factors to maintain indoor sound levels within MECP guidelines. The calculation methods were developed by the National Research Council (NRC). They are based on the predicted future sound levels at the building facades, and the anticipated area ratios of the facade components (walls, windows and doors) and the floor area of the adjacent room.

Exterior Doors

There may be glazed exterior doors (sliding or swing) for entry onto the balconies from living/dining rooms and some bedrooms. The glazing areas of the doors should be counted as part of the total window glazing area. All exterior doors should include good weather seals to reduce air infiltration to the minimum achievable levels.

Exterior Walls

Exterior wall constructions meeting the requirements of the Ontario Building Code will provide sufficient sound insulation as long as the wall area to floor area ratios are less than 125%.

Acoustical Requirements for Glazing

A summary of the preliminary minimum STC requirements is given in Table IV, for the retirement building façades, based on the possibility of sound entering the building through windows. Detailed floor plans and building elevations were not available at the time of this report. A window to floor ratio of 50% (40% fixed, 10% operable) for living/dining room and 40% (30% fixed, 10% operable) for bedrooms were assumed to determine window STC ratings to mitigate road traffic noise levels.

Table IV: Minimum STC Requirements

Prediction Location	Description	Space	STC Glazing Requirements
A	Façade facing Hazeldean Road	Living/Dining	STC-33
		Bedroom	STC-30
B	Façade facing Cedarow Court	Living/Dining	OBC
		Bedroom	OBC
C	Façade facing Phase I	Living/Dining	OBC
		Bedroom	OBC

Notes: OBC – Ontario Building Code

The resulting STC ratings for the residential floors range from STC 33 and lower; however, in an urban environment such as this, it is not typically recommended to have window glazing less than STC-33. Note that this target applies to the entire assembly (including patio doors, awning windows, and mullions) and test data should be provided to verify, where available.

The glazing requirements can be met using fairly standard sealed units. Operable sections, including doors and operable windows, must be well-fitted and weather-stripped in order to achieve the upper range of target STC values. Acoustical criteria for different blocks and facades can be optimized as part of the detail design of the development, when floor plans and elevations for the buildings are available.

Further Analysis

When detailed floor plans and building elevations are available for the dwelling units, specifically those directly adjacent to Hazeldean Road, an acoustical consultant should review the floor plans and building elevations to refine the glazing construction based on actual window to floor area ratios.

6 Warning Clauses

The MECP guidelines recommend that warning clauses be included in the property and tenancy agreements and offers of purchase and sale for all dwelling units with anticipated traffic sound level excesses. The following noise warning clauses are required for specific dwellings as indicated in Table IX.

Suggested wording for future dwellings with sound level in excess of the MECP criteria has been provided is given below.

Type A:

> Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment, Conservation and Parks noise criteria.

Suggest wording for future dwellings which will have central air conditioning units to be installed is given below.

Type B:

> This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment, Conservation and Parks.

Suggested wording for future dwelling units in close proximity to institutional and commercial buildings is given below.

Type C:

> Purchasers are advised that due to the proximity of the existing commercial buildings, sound levels from the facilities may be at times be audible.

These sample clauses are provided by the MECP as examples, and can be modified by the Municipality as required.

7 Impact of the Proposed Building on Adjacent Sensitive Receptors

A preliminary noise impact assessment of stationary noise sources associated with the proposed retirement building and the impact at neighbouring existing noise sensitive receptors has been conducted. The proposed retirement facility will have rooftop mechanical equipment on the roof which are considered to be stationary noise sources. Phase I and Phase III developments, along with existing 2-storey residences close to the development, are considered to be noise sensitive receptors.

7.1 Sound Level Criteria at Sensitive Receptors

Minimum background sound levels can be determined through prediction of road traffic volumes at the hour of lowest volume where the background noise is dominated by traffic noise. Where it can be demonstrated that the hourly background sound levels are greater than the exclusionary limit, the criterion becomes the minimum predicted one-hour L_{EQ} sound level during each respective period of the day. At locations of the existing residences, since the background sound levels are low, the exclusionary limit of 50/45 will apply.

7.2 Stationary Source Noise Predictions

Predictive noise modelling was used to assess the sound impact of stationary noise sources of Phase II buildings at the most critically impacted façades of existing residential buildings in accordance to MECP guidelines. The noise prediction model was constructed based on a review of the proposed site plan, satellite photos, and estimates of sound emission levels of sources (taken from similar past HGC Engineering project files) from the rooftop mechanical equipment on the proposed Phase II building. The model and location of Phase II rooftop units were based on the HVAC Specification drawings for Phase I by M&E Engineering dated September 1st, 2016, provided by Nautical Lands Group.

MECP guidelines stipulate that an assessment to be representative of the predicable worst case scenario in any hour. HGC Engineering has observed and measured sound associated with similar mechanical units in the past, along with manufacturer's data. The source sound levels associated with the Phase II rooftop mechanic units are listed below in Table V.

Table V: Source Sound Power Levels [dB re 10-12 W]

Source	Octave Band Centre Frequency [Hz]							
	63	125	250	500	1k	2k	4k	8k
Kitchen Exhaust Fan	84	84	78	82	75	71	72	63
Lennox 15 Ton HVAC	57	92	88	87	83	78	72	67
Carrier 5 Ton HVAC	56	76	72	73	75	75	71	69

The above data were inputted into a predictive computer model using the software Cadna/A. The software used for this purpose (*Cadna-A version 2019, build: 173.4950*) is a computer implementation of ISO Standard 9613-2.2 "Acoustics - Attenuation of Sound During Propagation Outdoors." The ISO method accounts for reduction in sound level with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures such as barriers.

The following information and assumptions were used in the analysis. The noise sources are shown as green crosses on Figure 4a.

- A minimum 1.07 m solid parapet was assumed on the rooftop.
- The height of rooftop mechanical equipment was assumed to be 1.0 m.

In this impact assessment, we have considered typical worst-case (busiest hour) scenarios for each time period to be as follows:

Assumed day worst-case scenario:

- Rooftop mechanical equipment operated for 60 minutes in an hour.

Assumed night worst-case scenario:

- Rooftop mechanical equipment run for 30 minutes in an hour.

7.3 Results

The sound levels due to stationary noise sources associated with the proposed building and the impact at neighbouring sensitive receptors are summarized in Table VI, and presented graphically in Figures 4b and 4c.

Table VI: Predicted Sound Levels at Adjacent Residential Receptors [dBA]

Prediction Location	Description	Daytime (07:00 – 23:00)	Nighttime (23:00 – 07:00)	Criteria (Daytime / Nighttime)
R1	2nd Storey window of residence north-west of site area	<50	<45	50 / 45
R1_OLA	Outdoor living area of R1	<50	<45	
R2	2nd Storey window of residence south-east of site area	<50	<45	
R2_OLA	Outdoor living area of R2	<50	<45	
R3_OLA	Courtyard amenity space of Phase I	<50	<45	
R4	5th Storey Phase I façade facing Phase II	<50	<45	
R5	5th Storey Phase III façade facing Hazeldean Road	<50	<45	

Note: Sound Level Predictions include 1.07 m high roof parapet.

The results of the calculations indicate that the predicted sound levels due to the operation of the rooftop mechanical equipment of the proposed Phase II retirement building are within MECP limits at the façades and outdoor living areas of adjacent sensitive receptors during a worst case operational scenario. Mitigation strategies are not required.

8 Assessment of the Existing Stationary Noise Sources on Proposed Retirement Building

A preliminary noise impact assessment of stationary noise sources associated with the adjacent commercial uses (specifically the Stittsville Car Wash, a coin operated car wash, and Auto Searchers Ltd.) at the façades of the proposed retirement facility has been conducted. These facilities, along with rooftop equipment of other businesses, were analysed as stationary noise sources. Sensitive receptor locations associated with the proposed Phase II retirement facility façades facing the commercial uses on Cedarow Court and the courtyard amenity space were assessed.

8.1 Sound Level Criteria at Sensitive Receptors

Minimum background sound levels can be determined through prediction of road traffic volumes at the hour of lowest volume where the background noise is dominated by traffic noise. Where it can be demonstrated that the hourly background sound levels are greater than the exclusionary limit, the criterion becomes the minimum predicted one-hour L_{EQ} sound level during each respective period of the day. At locations where the background sound levels are low, the exclusionary limit of 50/45 will apply.

Because background sound in the vicinity of the proposed development is dominated by road traffic due to Hazeldean Road, it is appropriate to predict hourly background sound from road traffic volumes in order to determine applicable limits for impact of stationary noise sources.

Minimum background sound levels were calculated using the basic road element included in Cadna/A, which follows the German guideline RLS-90 for road traffic noise predictions. Hourly daytime traffic data was interpolated from available data obtained from the City of Ottawa. The minimum daytime traffic volume occurs at 7 am to 8 am. The minimum nighttime traffic was interpolated using the data provided by the City of Ottawa road traffic data and AADT traffic curve provided by the U.S. Federal Highway Administration, occurring at 4 am to 5 am. A commercial vehicle percentage of 7% medium trucks and 5% heavy trucks along with a posted speed limit of 60 km/h was applied. The minimum background sound levels due to Hazeldean Road were calculated at the proposed building façades using STAMSON 5.04, and the results were found to reasonably

match with the Cadna/A predictions. The results of the minimum hourly sound levels during the daytime and nighttime hours are provided in Figures 5h and 5i respectively.

8.2 Stationary Source Noise Predictions

Predictive noise modelling was used to assess the sound impact of existing commercial facilities at the most critically impacted façades of Phase II buildings in accordance to MECP guidelines. The noise prediction model was constructed based on a review of the proposed site plan, satellite photos, and estimates of sound emission levels of sources (taken from similar past HGC Engineering project files) coming from the adjacent commercial spaces to the west of the site, including a car wash, a auto-repair shop, and rooftop HVAC units of commercial facilities on Cedarow Court and the Phase I development. The model and location of rooftop HVAC units of Phase I were based on the HVAC Specification drawings by M&E Engineering dated September 1st, 2016.

Some types of sound have a special quality which may tend to increase their audibility and potential for disturbance or annoyance. For tonal sounds, the MECP guidelines stipulate that a penalty of 5 dBA is to be added to the measured source level. A tonal sound is defined as one which has a "pronounced audible tonal quality such as a whine, screech, buzz or hum". Some vacuum cleaners can produce such a hum. Therefore, a 5 dBA penalty has been applied to the vacuum sound sources associated with the car wash throughout this assessment.

MECP guidelines stipulate that an assessment to be representative of the predicable worst case scenario in any hour. All observable rooftop mechanical equipment, auto repair bays and car wash facilities are assumed to be operational. HGC Engineering has observed and measured sound associated with similar mechanical units, repair bays, and car wash facilities in the past. The source sound levels associated with the commercial facilities are listed below in Table VII.

Table VII: Source Sound Power Levels [dB re 10-12 W]

Source	Octave Band Centre Frequency [Hz]							
	63	125	250	500	1k	2k	4k	8k
Coin Operated Car Wash Bay Door+	85	76	75	77	76	79	81	83
Vacuum*	91	79	92	87	89	94	95	93
Auto Repair Bay	80	79	82	84	87	85	85	88
Air Chisel	77	81	83	86	88	91	94	91
Kitchen Exhaust Fan	84	84	78	82	75	71	72	63
Make Up Air Unit	91	92	89	86	86	84	81	79
Lennox 15 Ton HVAC	57	92	88	87	83	78	72	67
Carrier 5 Ton HVAC	56	76	72	73	75	75	71	69

* Includes a 5 dBA tonal penalty.
\+ Includes full cycle (soak, soap, jet spray, tire cleaner).

The above data were inputted into a predictive computer model using the software Cadna/A. The following information and assumptions were used in the analysis. The noise sources are shown as green crosses and lines on Figure 5a.

- A minimum 1.07 m solid parapet was assumed on rooftops of the proposed retirement buildings.
- The height of HVAC equipment on the roof was assumed to be 1.0 m.
- The height of the car wash vacuums was assumed to be 1.0 m.
- The height of the car wash bay was assumed to be 3.0 m.
- The height of the auto repair bay door was assumed to be 3.0 m.

In this impact assessment, we have considered typical worst-case (busiest hour) scenarios for each time period to be as follows:

Assumed day worst-case scenario:

- Rooftop mechanical equipment operates for 60 minutes out of an hour.
- All 6 car wash bays of the coin operated car wash include washing activities for 30 minutes each.
- Both vacuums operate for 15 minutes each.
- Sound from the automotive bay doors, including the use of an air tool, compressor and heater were assumed to operate for 10 minutes; and from an air chisel for 10 minutes.

Assumed night worst-case scenario:

- Rooftop mechanical equipment operate for 30 minutes;
- All 6 car wash bays include washing activities for 5 minutes each.
- Both vacuums operate for 5 minutes each.
- All auto repair bays are closed.

8.3 Results

The unmitigated daytime and nighttime sound levels due to stationary noise sources associated with the existing commercial facilities at the west façade of the proposed building are summarized in Table VIII, and presented graphically in Figures 5b and 5c. As per the MECP guidelines, the criteria for both OLA and façade sound levels used in the assessment is the background sound level when the stationary sources are not operating, since these are higher than the MECP minimum exclusionary limits.

Table VIII: Predicted Sound Levels from the Existing Commercial Sites on the Proposed Retirement Facility [dBA], Without Mitigation

Prediction Location	Façade facing Cedarow Court	Daytime (07:00 – 23:00)	Criteria (Daytime)	Nighttime (23:00 – 07:00)	Criteria (Nighttime)
B1	5th storey, windows closest to Hazeldean Rd	51	65	<45	56
B2	5th storey, windows closest to auto repair bays	56	61	<45	52
B3	1st storey, windows closest to auto repair bays	59	59	<45	49
B4	5th storey, windows closest to car wash bays	55	58	47	49
B5	1st storey, windows closest to car wash bays	56	53	48	45
B6	Courtyard amenity space	<50	50	<45	45

The results of the calculations indicate that the predicted sound levels due to the operation of the coin operated car wash during a worst-case scenario are likely to exceed the criteria at the ground level façade of the retirement building facing Cedarow Court. This area experiences low background sound levels due to shielding from road traffic noise by the adjacent commercial buildings and the proposed retirement building itself.

The impact of rooftop mechanical equipment of the Phase I building on the façade facing Phase I has also been analyzed. The predicted sound levels at the façade of the proposed Phase II are lower than the exclusionary limits, as shown in Figures 5d and 5e, and thus no mitigation strategies are required to address the impact of stationary sources on the façade facing Phase I.

8.4 Discussion and Recommendation with Regard to Stationary Noise Sources

Sound levels at the façade facing Cedarow Court may exceed the MECP criteria due to the operation of the existing commercial activities, specifically the coin operated car wash. Options for mitigation include property line barriers to protect the ground level windows and ground level patios, and/or architectural features to be incorporated into the design of individual units.

To address the sound level excesses at the ground floor windows of the façade facing Cedarow Court, an acoustic barrier 2.2 m in height is recommended along the west property line, shown in Figure 3. This acoustic barrier will reduce sound levels at the ground floor windows to levels acceptable to the MECP guidelines. Figures 5f and 5g shows the mitigated daytime and nighttime sound levels at the façade facing Cedarow Court.

Acoustic barriers can be any combination of an earth berm with an acoustic wall on top. All noise barriers must return back so that the rear yards are entirely shielded from the roadway or noise source. The minimum barrier height in the City of Ottawa is 2.2 m, and the maximum height is 2.5 m unless approved by the City. The wall component of the barrier should be of a solid construction with a surface density of no less than 20 kg/m^2. The walls may be constructed from a variety of materials such as wood, brick, pre-cast concrete or other concrete/wood composite systems provided that it is free of gaps or cracks within or below its extent.

The following warning clause should be provided to inform the tenants and building owners of the acoustic barrier.

Warning Clause Type D:

> That the acoustical berm and/or barrier as installed, shall be maintained, repaired or repaired by the owner. Any maintenance, repair or replacement shall be with the same material, or to the same standards, and having the same colour and appearance of the original.

This sample clause is provided by the MECP as an example and can be modified by the Municipality as required.

9 Summary and Recommendations

The following list and Table IX summarize the recommendations made in this report.

For transportation noise sources

1. Central air conditioning will be required for all Phase II dwelling units.

2. Upgraded building constructions are required for the façades with exposure to Hazeldean Road as noted in Table IV. When detailed floor plans and building elevations are available for the dwelling units with exposure to the roadways, window glazing construction should be refined on actual window to floor ratios.

3. The use of warning clauses in the property and tenancy agreements is recommended to inform future residents of traffic noise issues.

For stationary noise sources

4. An acoustic barrier 2.2 m in height is required along the west property line parallel to the façade facing Cedarow Court as shown in Figure 3.
5. An additional noise warning clause is required to inform future occupants of the presence of existing commercial facilities and the installation of the barrier.

Table IX: Summary of Noise Control Requirements and Noise Warning Clauses

Prediction Location	Description	Acoustic Barrier	Ventilation Requirements*	Type of Warning Clause	Upgraded Building Constructions
A	Façade facing Hazeldean Road	--	Central A/C	A, B, C	LR/DR: STC-33+ BR: STC-30
B	Façade facing Cedarow Court	✓	Central A/C	A, B, C, D	OBC
C	Façade facing Phase I	--	Central A/C	A, B, C	OBC
D	Courtyard amenity space	--	--	--	--

Notes:
* The location, installation and sound rating of the air conditioning condensers must be compliant with MECP Guideline NPC-300, as applicable.
+ When detailed floorplans and building elevations are available, Window STC requirements should be refined.
✓ Acoustic barrier required. See section 8.4 for barrier recommendations.
LR/DR : Living Room/Dining Room, BR: Bedroom
OBC – Ontario Building Code

9.1 Implementation

To ensure that the noise control recommendations outlined above are properly implemented, it is recommended that:

1. When grading information is available, the acoustic barrier heights should be refined.
2. Prior to the issuance of building permits for this development, the Municipality's building inspector or a Professional Engineer qualified to perform acoustical engineering services in the Province of Ontario should certify that the noise control measures have been properly incorporated, installed, and constructed.

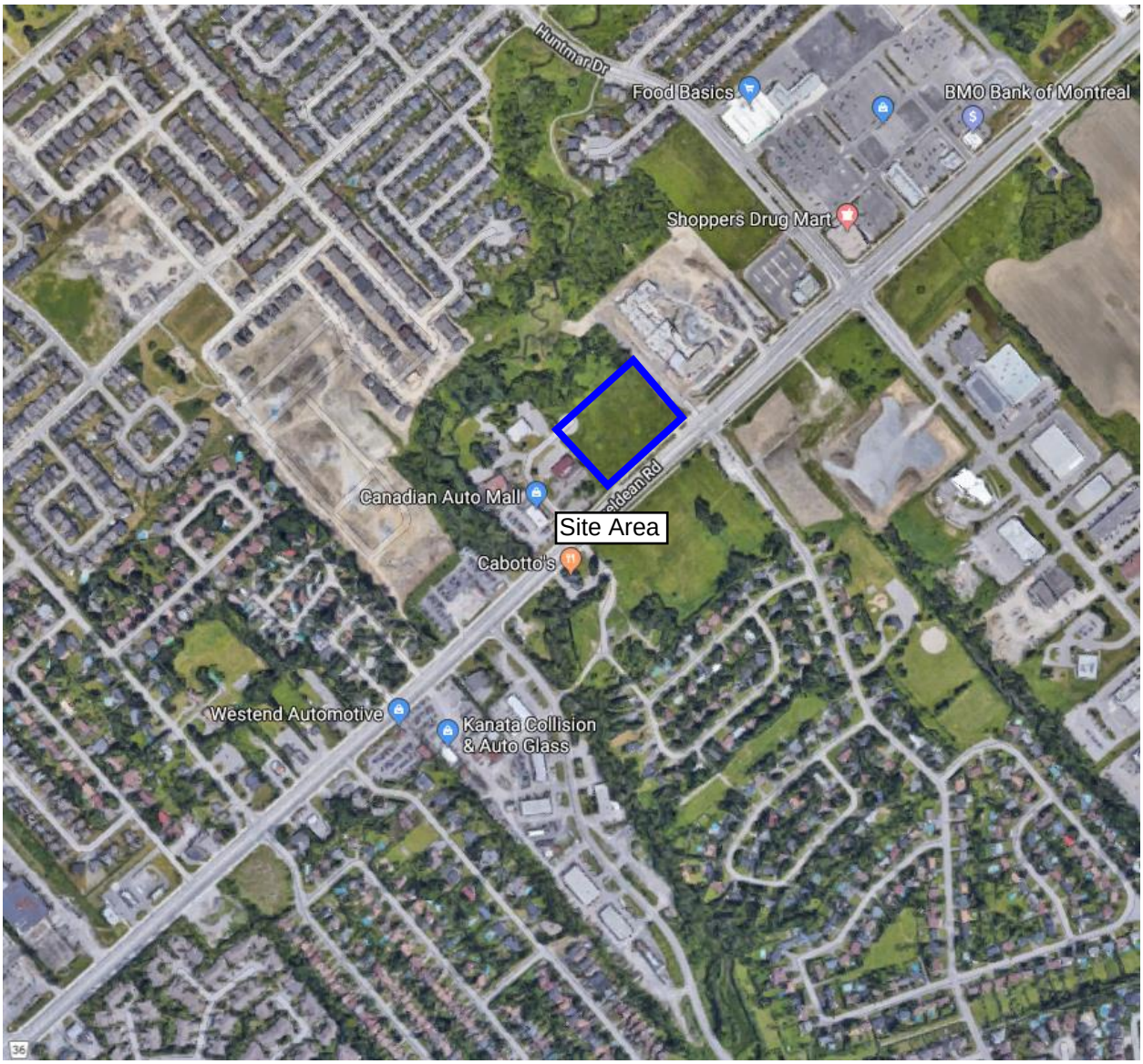
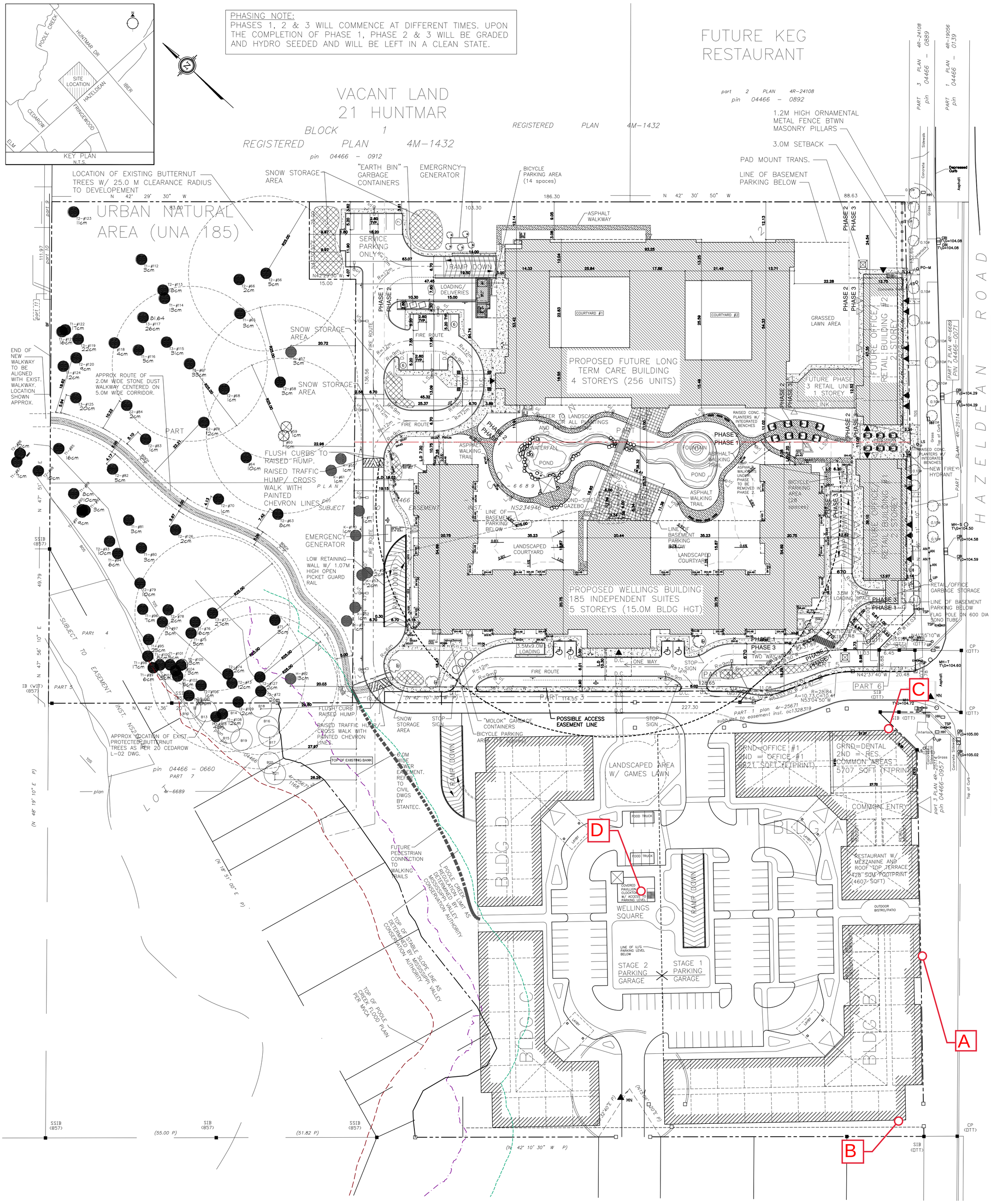


Figure 1: Key Plan



WELLINGS OF STITTSVILLE PHASE 2
PRELIMINARY SITE LAYOUT REV#5,
MAR1'19

Figure 2: Proposed Plan Showing Prediction Locations

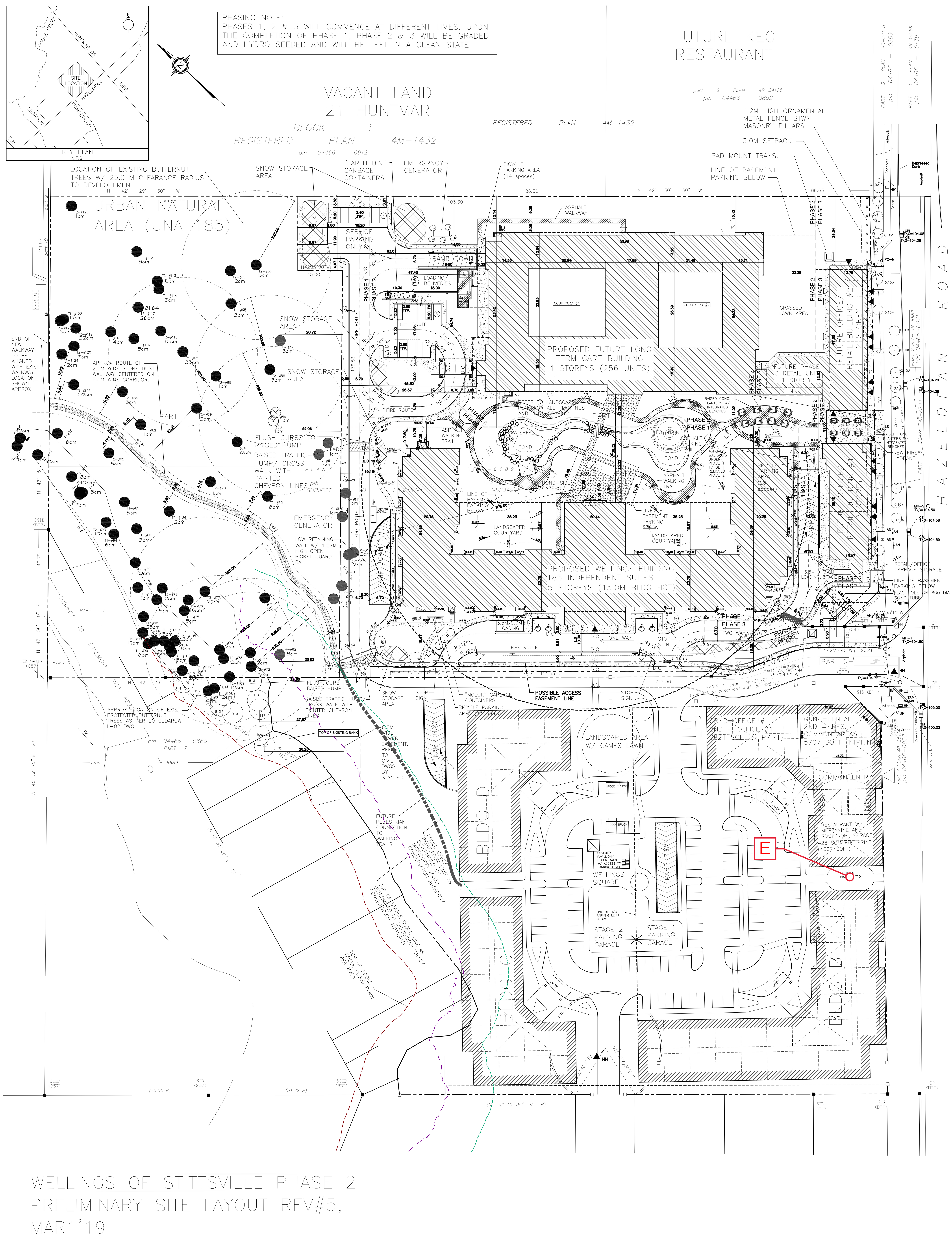
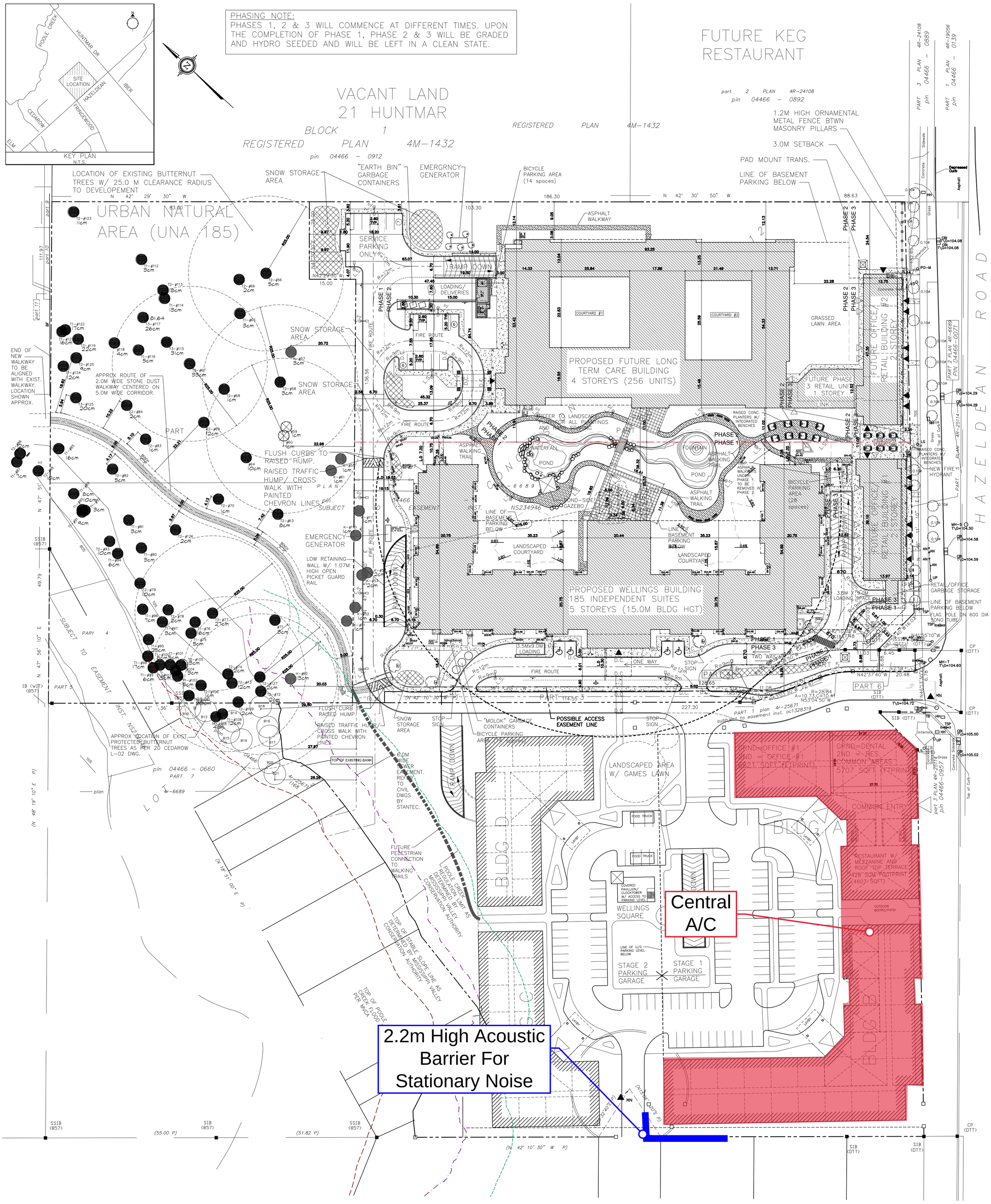


Figure 2a: Proposed Plan Showing Restaurant Terrace Location



WELLINGS OF STITTSVILLE PHASE 2
PRELIMINARY SITE LAYOUT REV#5, MAR1'19

Figure 3: Proposed Plan Showing Barrier and Ventilation Requirements

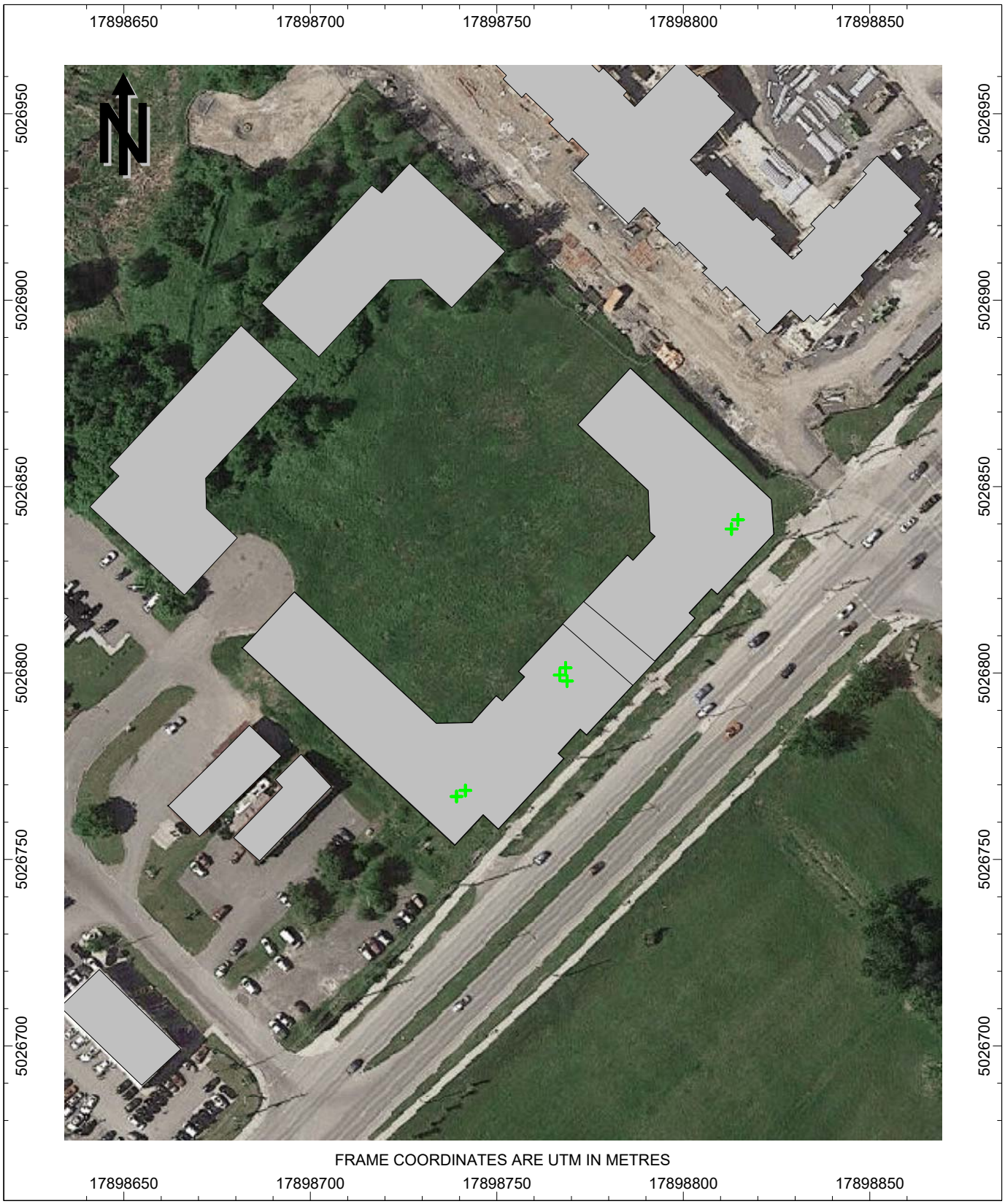


Figure 4a: Impact of Proposed Phase II on Adjacent Noise Sensitive Receptors
Assumed Noise Sources

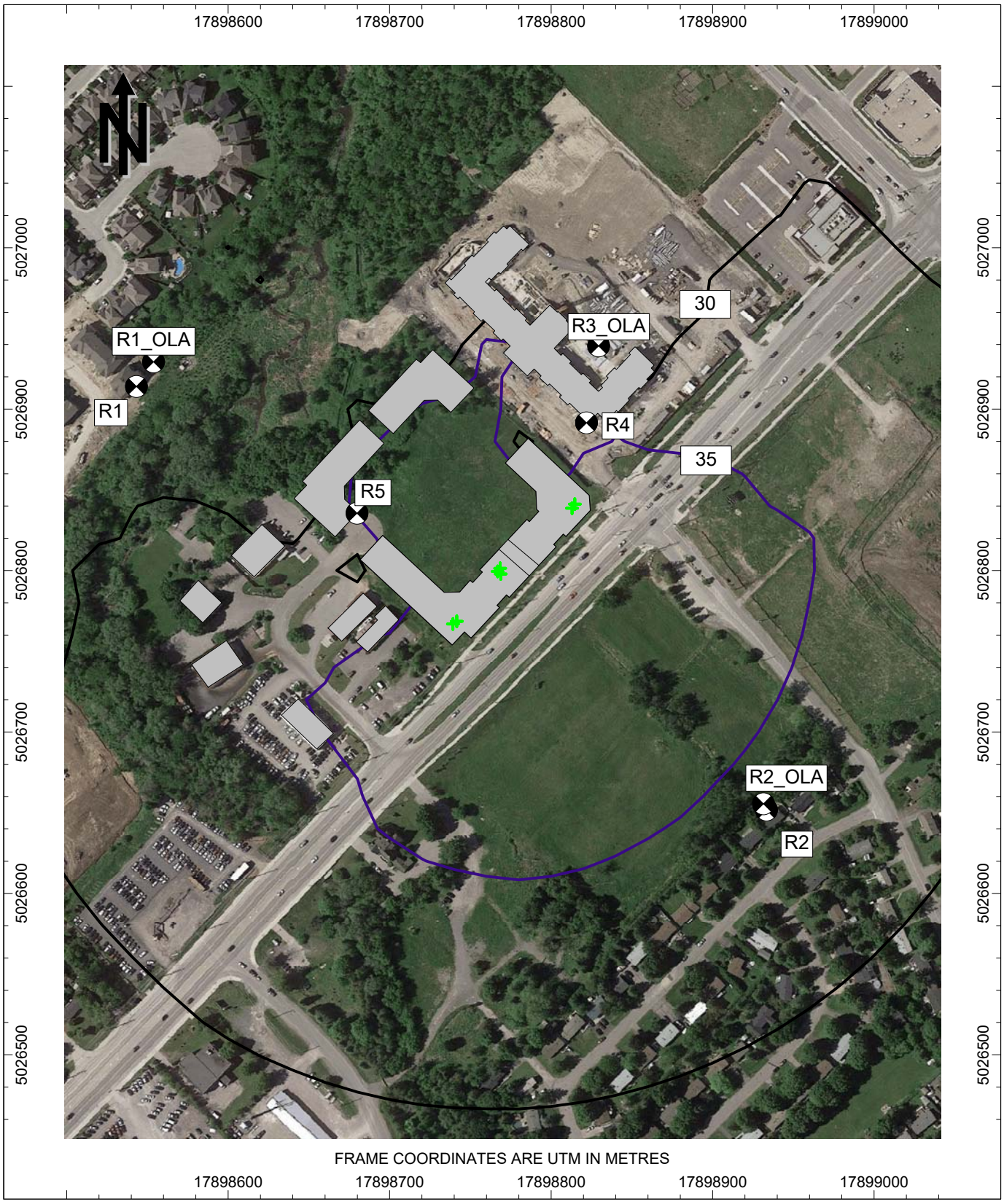


Figure 4b: Impact of Proposed Phase II on Adjacent Noise Sensitive Receptors
Daytime/Evening Sound Levels, Leq [dBA], 4.5 m Receptor Height

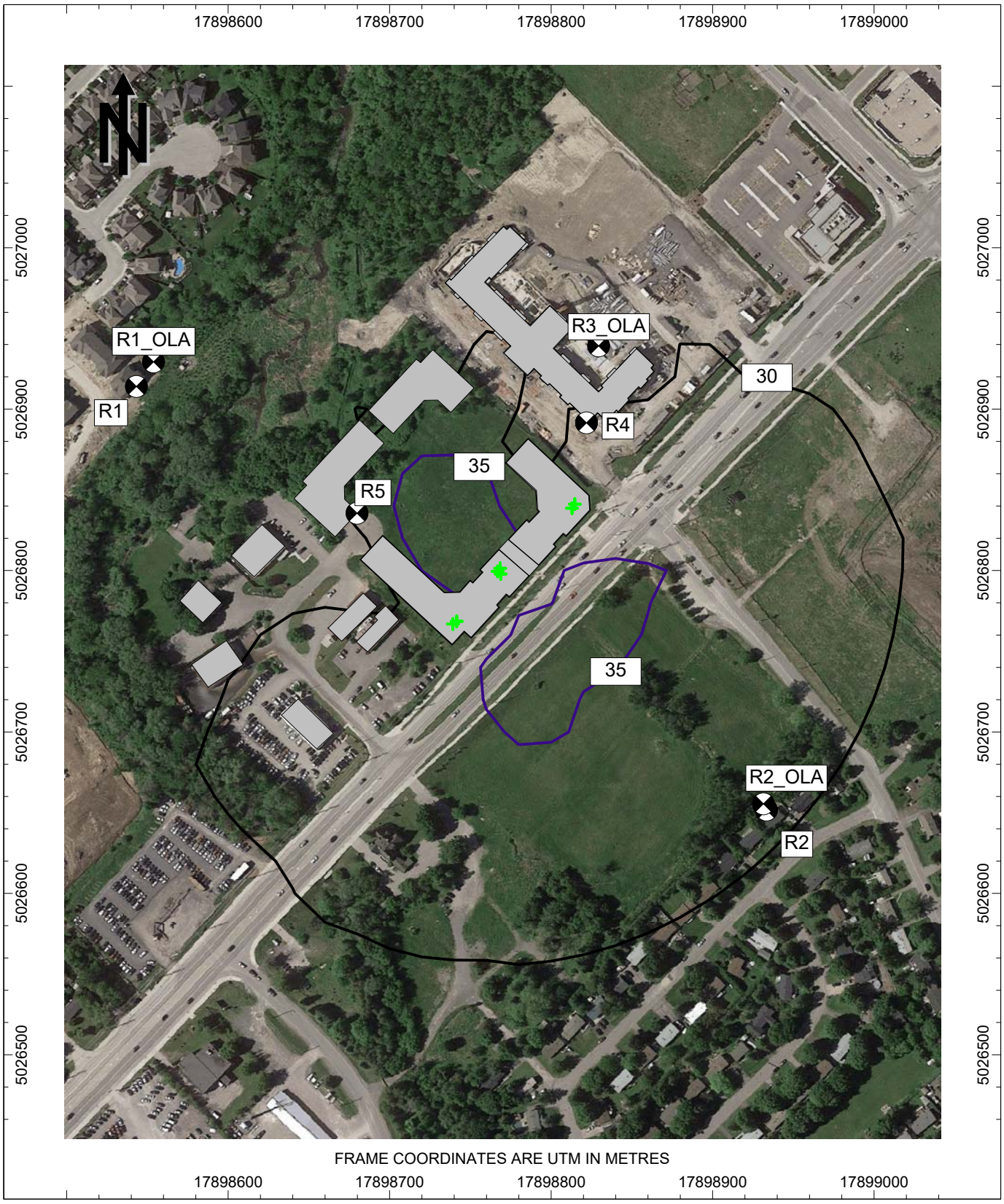


Figure 4c: Impact of Proposed Phase II on Adjacent Noise Sensitive Receptors
Nighttime Sound Levels, Leq [dBA], 4.5 m Receptor Height

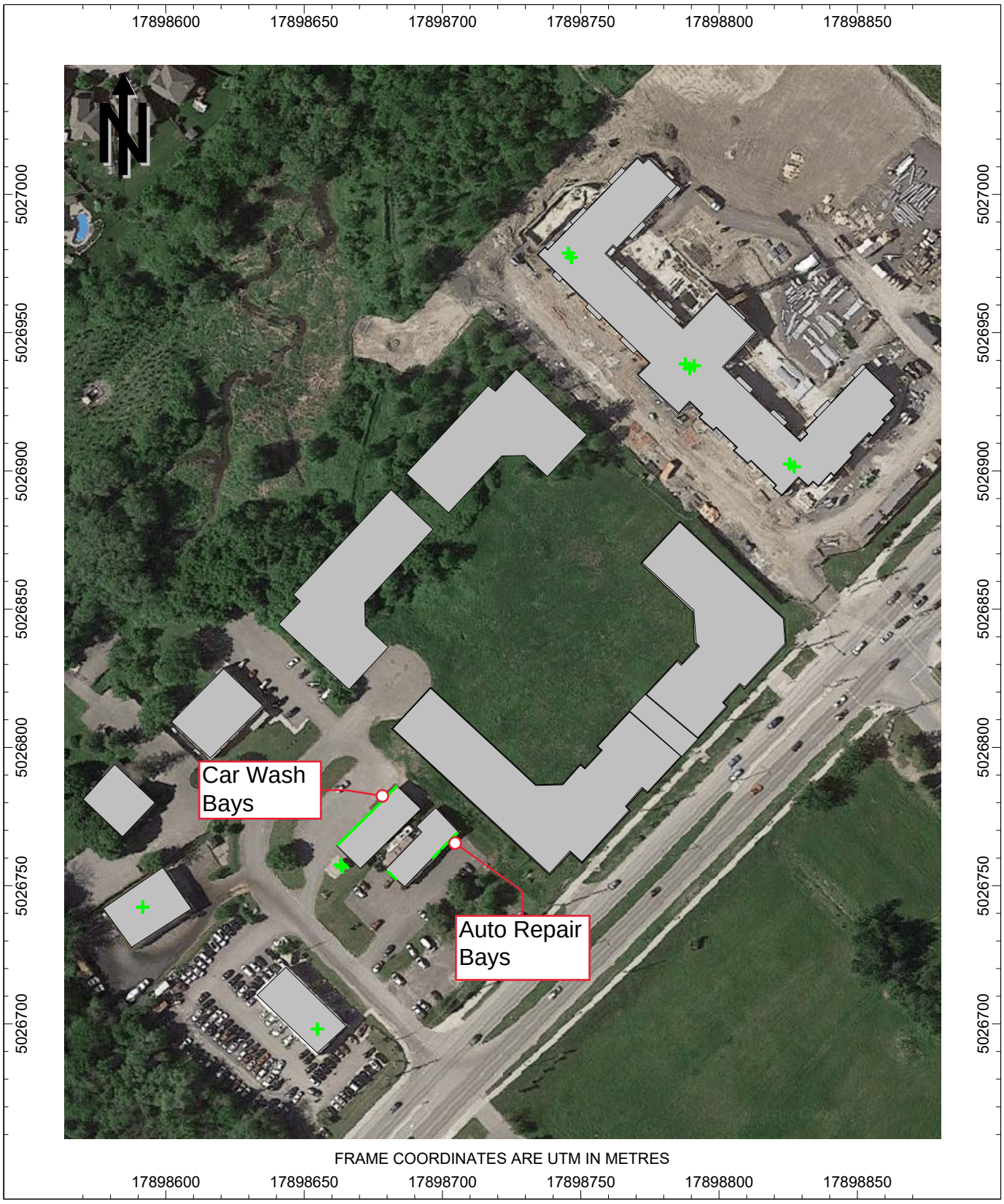


Figure 5a: Impact of Existing Stationary Noise Sources on Proposed Phase II Assumed Noise Sources

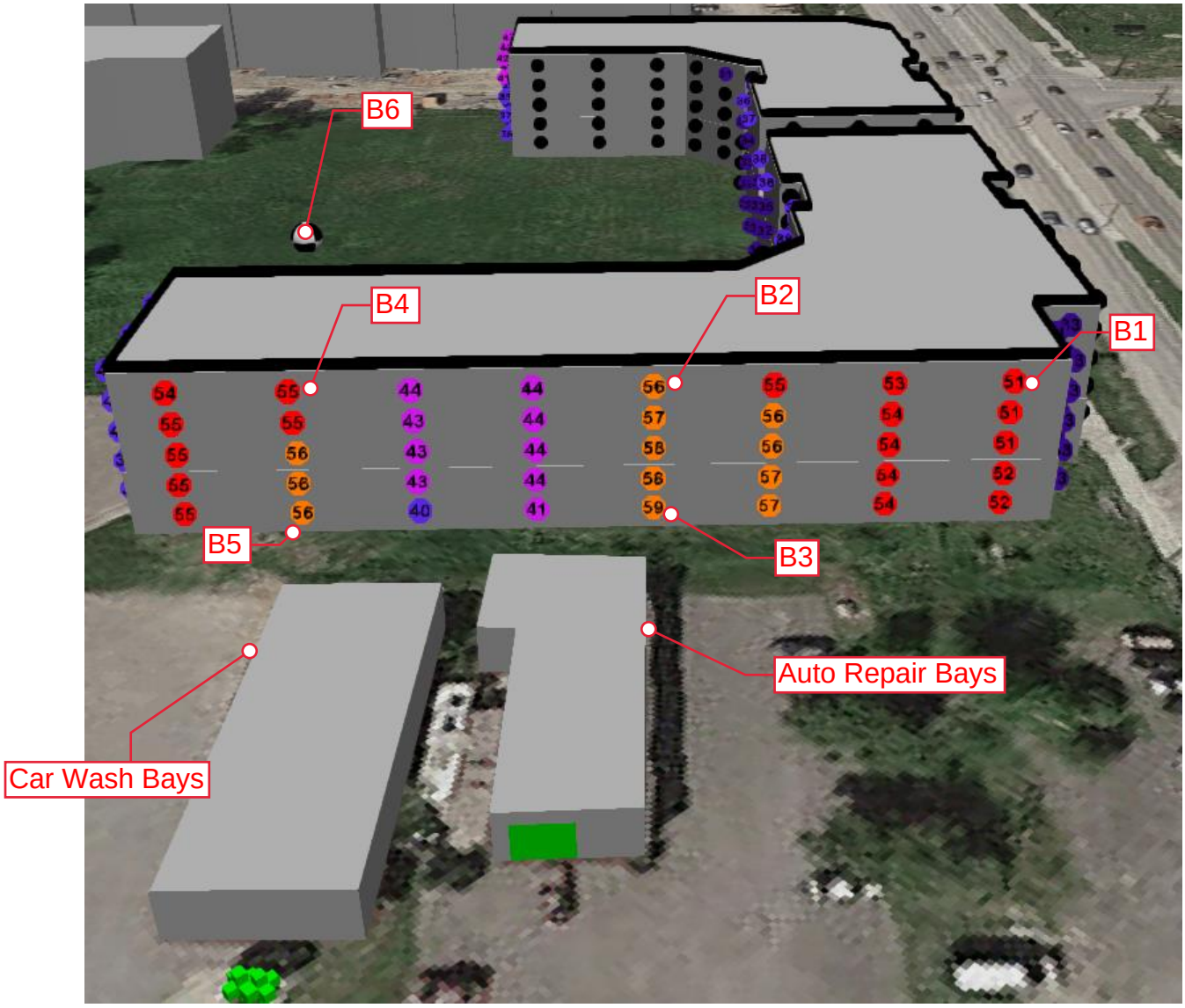


Figure 5b: Impact of Existing Stationary Noise Sources on Proposed Phase II

West Façade Facing Cedarow Court, Daytime/Evening Sound Levels, Leq [dBA], Unmitigated

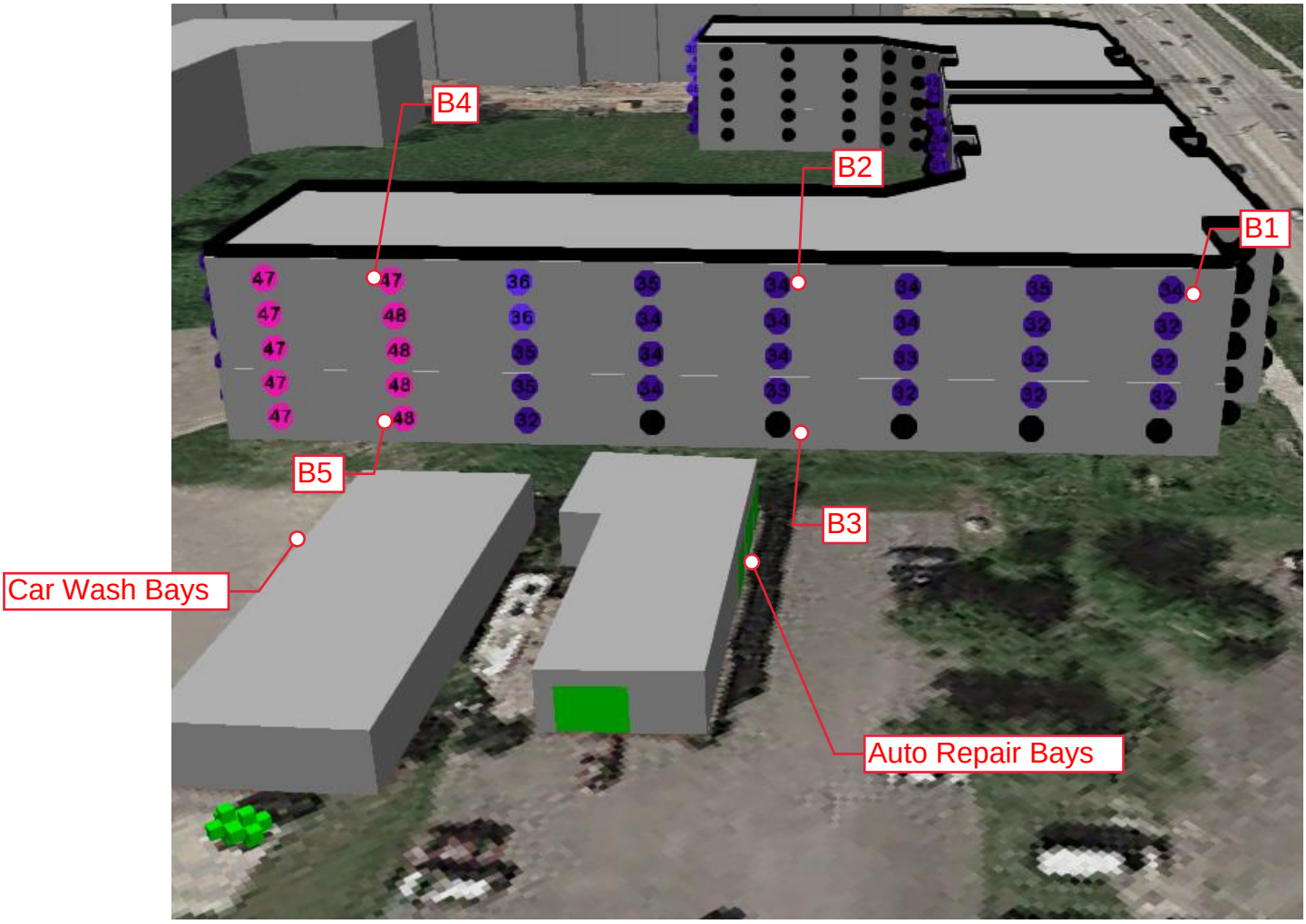


Figure 5c: Impact of Existing Stationary Noise Sources on Proposed Phase II

West Façade Facing Cedarow Court, Nighttime Sound Levels, Leq [dBA], Unmitigated

Figure 5d: Impact of Existing Stationary Noise Sources on Proposed Phase II East Façade Facing Phase I, Daytime/Evening Sound Levels, Leq [dBA], Unmitigated

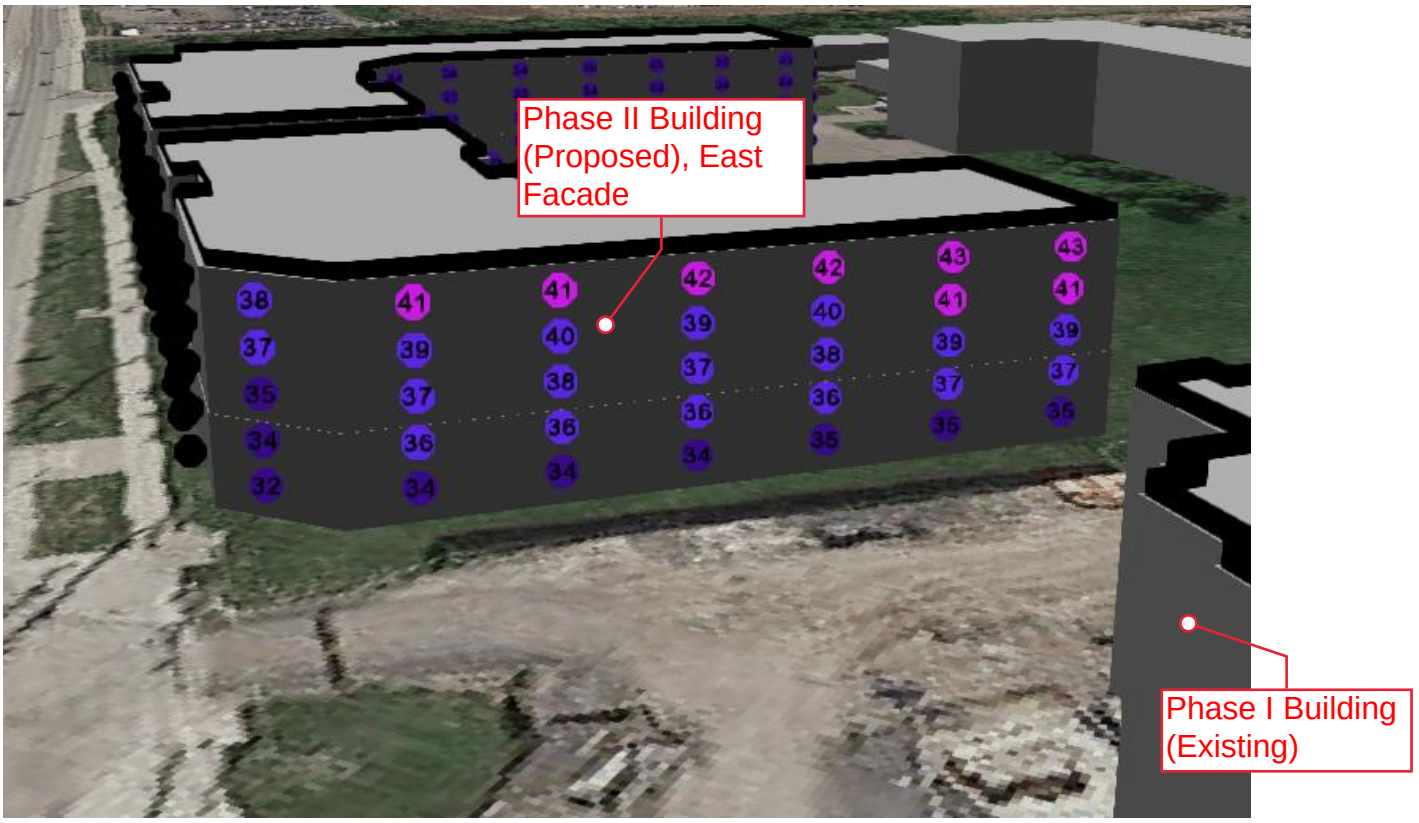


Figure 5e: Impact of Existing Stationary Noise Sources on Proposed Phase II

East Façade Facing Phase I, Nighttime Sound Levels, Leq [dBA], Unmitigated

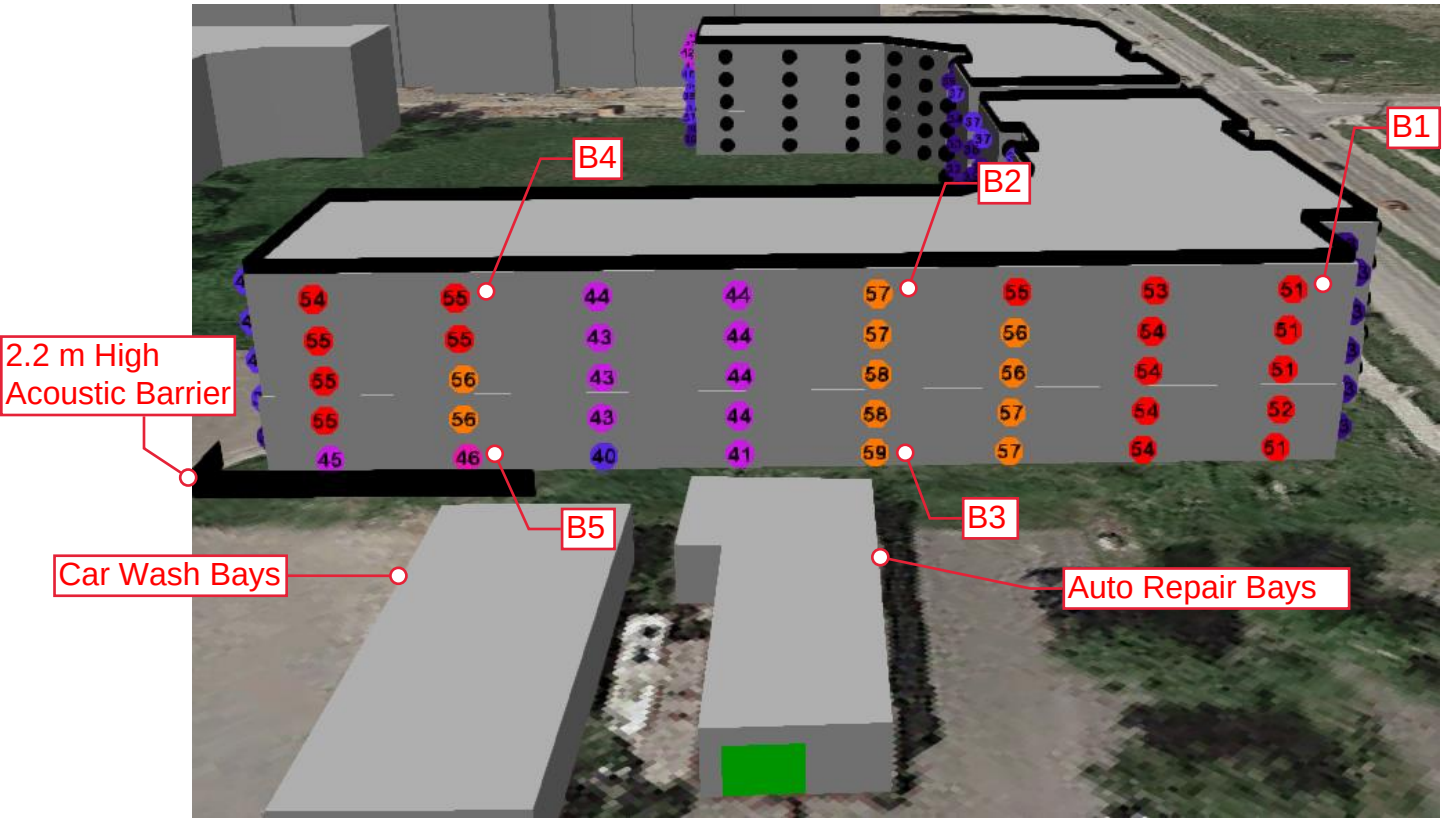


Figure 5f: Impact of Existing Stationary Noise Sources on Proposed Phase II

West Façade Facing Cedarow Court, Daytime/Evening Sound Levels, Leq [dBA], Mitigated

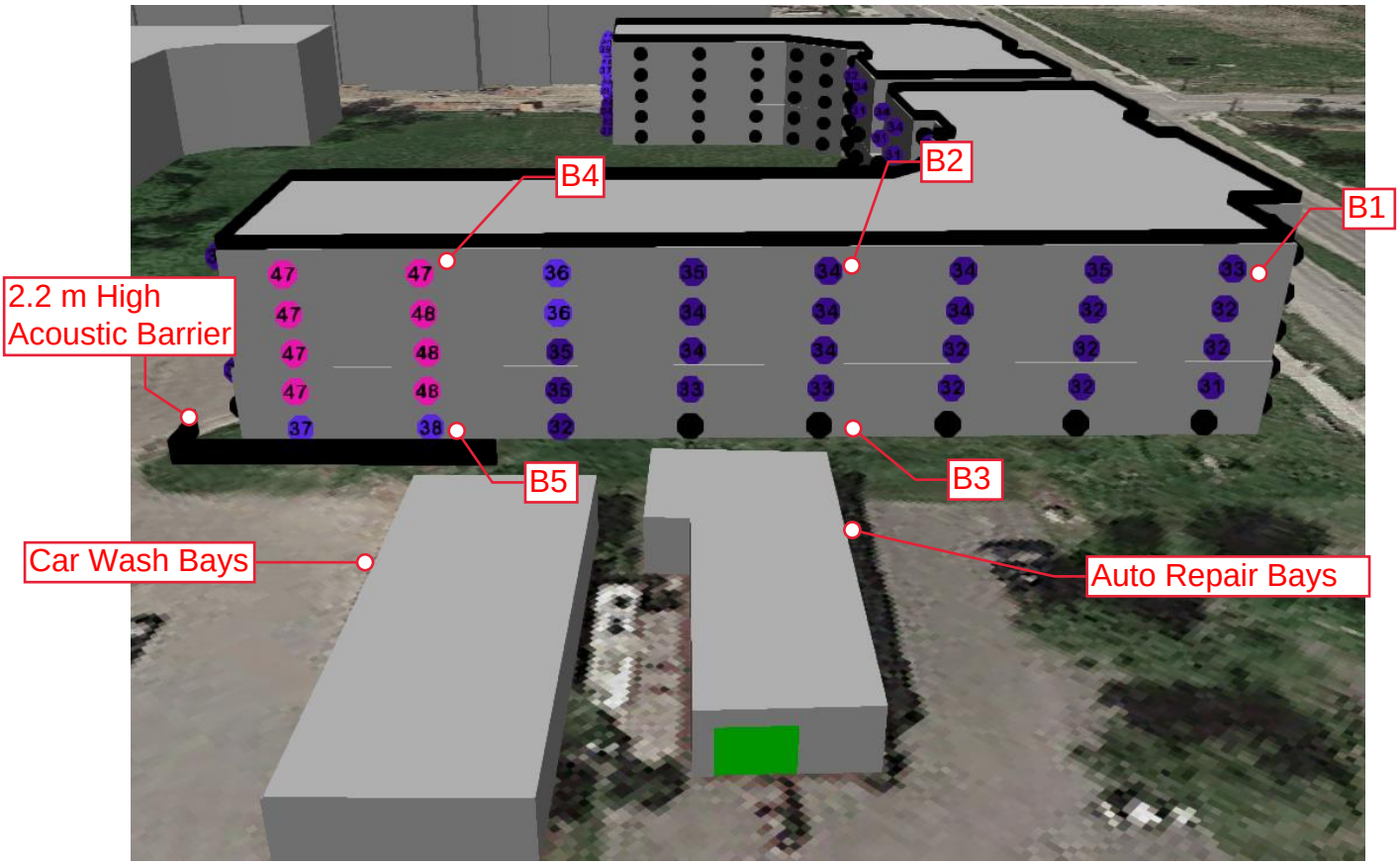


Figure 5g: Impact of Existing Stationary Noise Sources on Proposed Phase II

West Façade Facing Cedarow Court, Nighttime Sound Levels, Leq [dBA], Mitigated

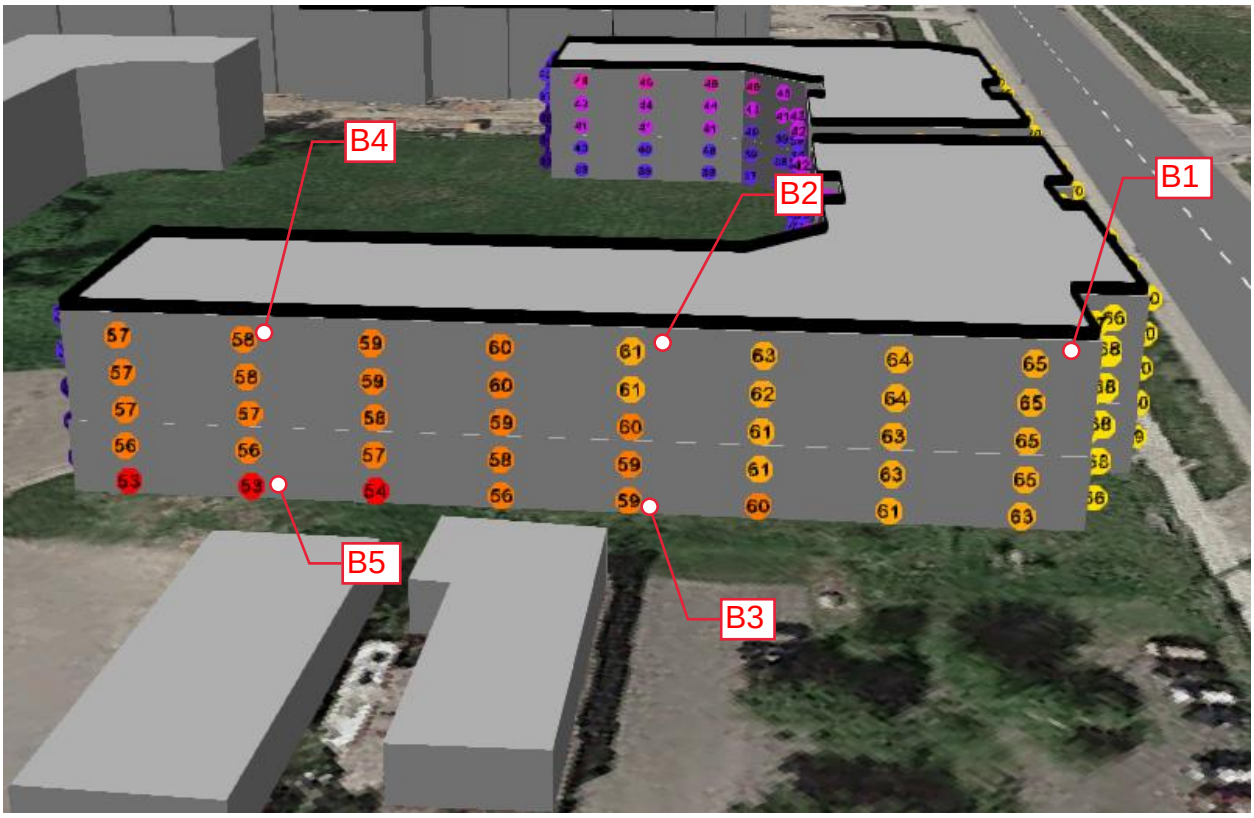


Figure 5h: West Façade - Minimum Daytime/Evening Background Sound Level, Led [dBA]

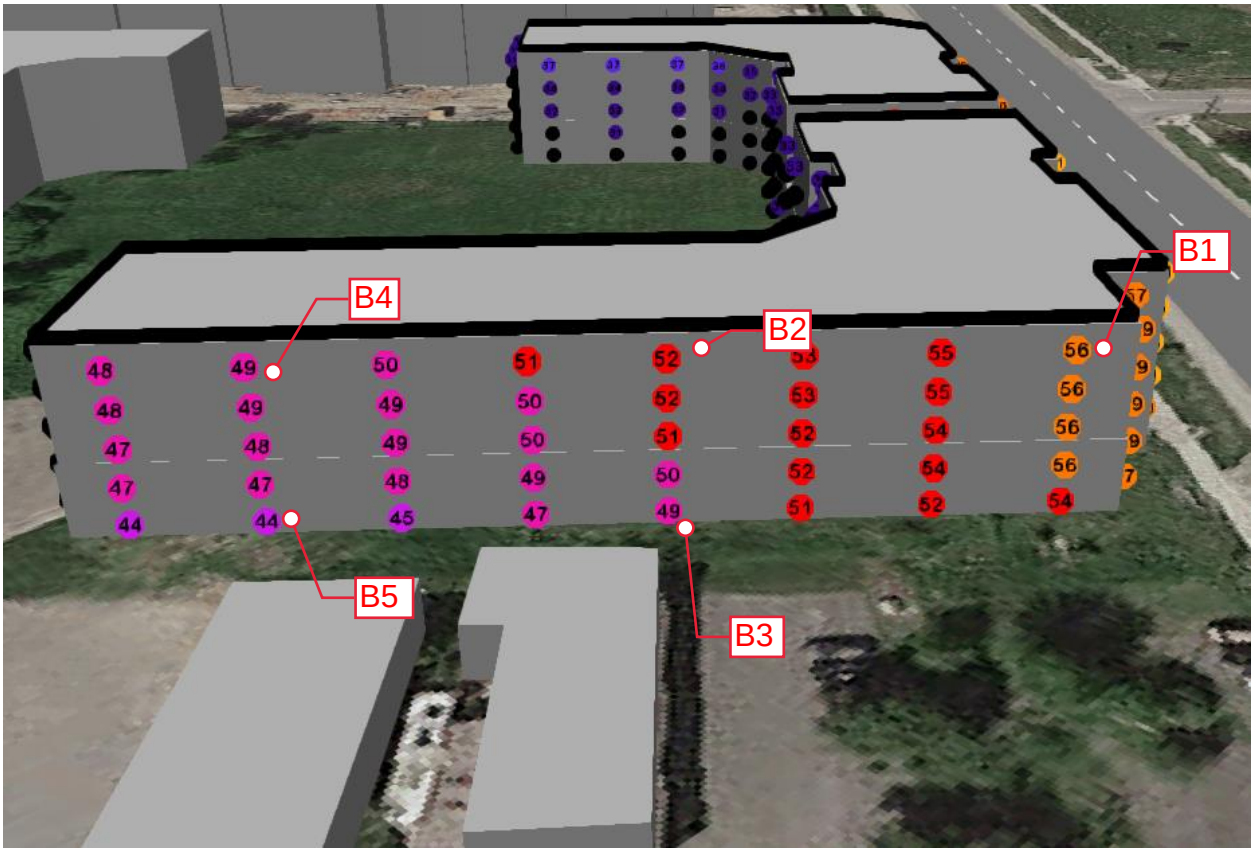


Figure 5i: West Façade - Minimum Nighttime Background Sound Level, Led [dBA]

Appendix A

Road Traffic Information

Appendix B: Table of Traffic and Road Parameters To Be Used For Sound Level Predictions

Table B1 Traffic And Road Parameters To Be Used For Sound Level Predictions

Row Width (m)	Implied Roadway Class	AADT Vehicles/Day	Posted Speed Km/Hr	Day/Night Split %	Medium Trucks %	Heavy Trucks % [1]
NA [2]	Freeway, Queensway, Highway	18,333 per lane	100	92/8	7	5
37.5-44.5	6-Lane Urban Arterial-Divided (6 UAD)	50,000	50-80	92/8	7	5
34-37.5	4-Lane Urban Arterial-Divided (4-UAD)	35,000	50-80	92/8	7	5
23-34	4-Lane Urban Arterial-Undivided (4-UAU)	30,000	50-80	92/8	7	5
23-34	4-Lane Major Collector (4-UMCU)	24,000	40-60	92/8	7	5
30-35.5	2-Lane Rural Arterial (2-RAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Urban Arterial (2-UAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Major Collector (2-UMCU)	12,000	40-60	92/8	7	5
30-35.5	2-Lane Outer Rural Arterial (near the extremities of the City) (2-RAU)	10,000	50-80	92/8	7	5
20-30	2-Lane Urban Collector (2-UCU)	8,000	40-50	92/8	7	5

[1] The MOE Vehicle Classification definitions should be used to estimate automobiles, medium trucks and heavy trucks.

[2] The number of lanes is determined by the future mature state of the roadway.

Transportation Services - Traffic Services

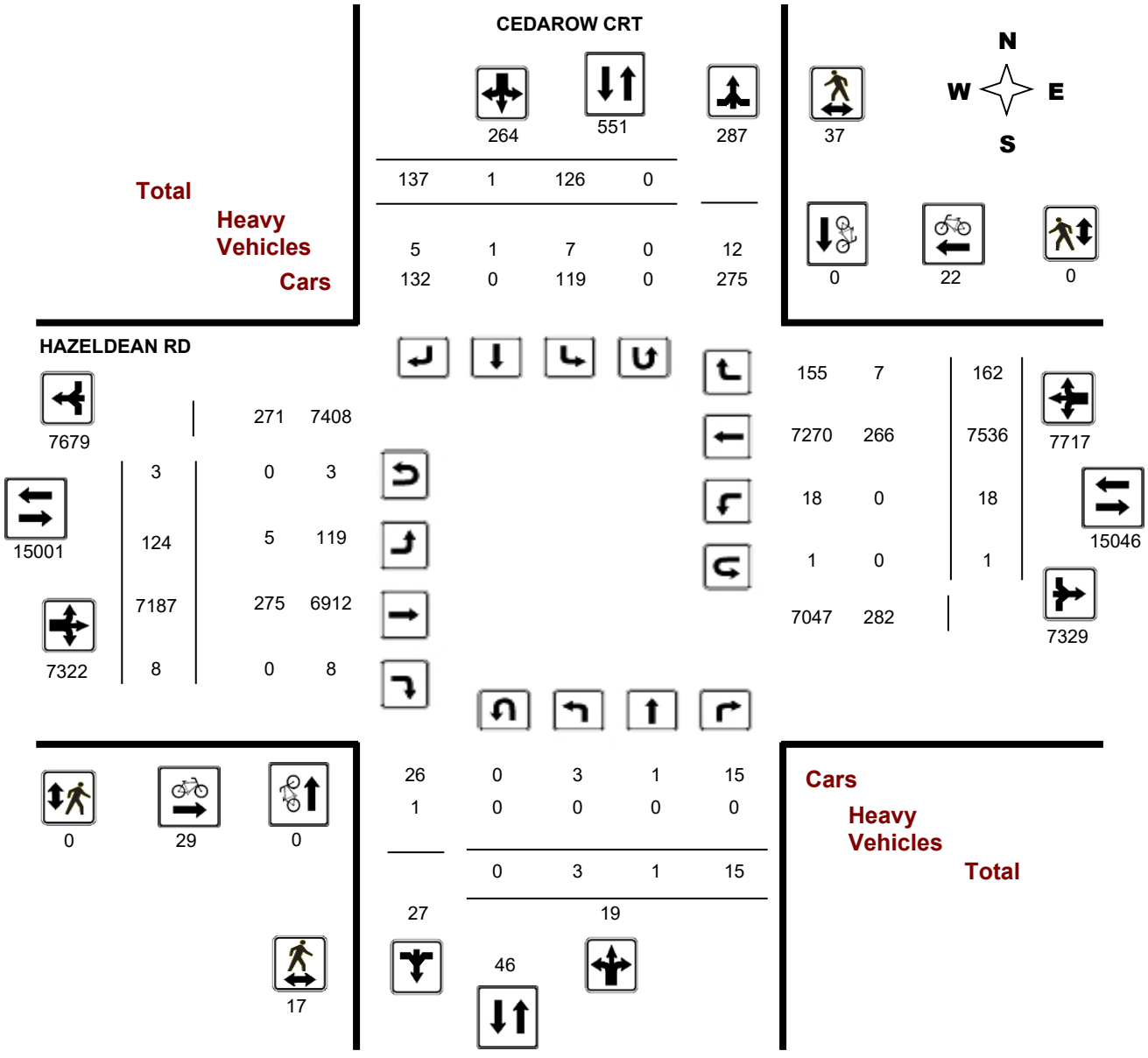
Turning Movement Count - Full Study Diagram

CEDAROW CRT @ HAZELDEAN RD

Survey Date: Thursday, August 01, 2019

WO#: 38616

Device: Miovision



Comments

Transportation Services - Traffic Services

Work Order 38616

Turning Movement Count - Full Study Summary Report

CEDAROW CRT @ HAZELDEAN RD

Survey Date: Thursday, August 01, 2019

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 3 Westbound: 1

AADT Factor .90

Full Study

	CEDAROW CRT									HAZELDEAN RD									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	**NB TOT**	LT	ST	RT	**SB TOT**	**STR TOT**	LT	ST	RT	**EB TOT**	LT	ST	RT	**WB TOT**	**STR TOT**	**Grand Total**
07:00 08:00	0	1	1	**2**	3	0	5	**8**	**10**	12	769	0	**781**	0	427	6	**433**	**1214**	**1224**
08:00 09:00	1	0	0	**1**	4	0	6	**10**	**11**	13	908	1	**922**	2	530	16	**548**	**1470**	**1481**
09:00 10:00	1	0	1	**2**	10	1	12	**23**	**25**	16	843	1	**860**	0	624	21	**645**	**1505**	**1530**
11:30 12:30	0	0	0	**0**	21	0	16	**37**	**37**	11	931	2	**944**	5	1045	31	**1081**	**2025**	**2062**
12:30 13:30	1	0	2	**3**	28	0	18	**46**	**49**	15	997	0	**1012**	1	990	24	**1015**	**2027**	**2076**
15:00 16:00	0	0	5	**5**	18	0	28	**46**	**51**	15	922	0	**937**	1	1190	29	**1220**	**2157**	**2208**
16:00 17:00	0	0	3	**3**	19	0	21	**40**	**43**	22	929	1	**952**	4	1438	14	**1456**	**2408**	**2451**
17:00 18:00	0	0	3	**3**	23	0	31	**54**	**57**	20	888	3	**911**	5	1292	21	**1318**	**2229**	**2286**
Sub Total	3	1	15	**19**	126	1	137	**264**	**283**	124	7187	8	**7319**	18	7536	162	**7716**	**15035**	**15318**
U Turns				**0**				**0**	**0**				**3**				**1**	**4**	**4**
Total	3	1	15	**19**	126	1	137	**264**	**283**	124	7187	8	**7322**	18	7536	162	**7717**	**15039**	**15322**
EQ 12Hr	4	1	21	**26**	175	1	190	**367**	**393**	172	9990	11	**10178**	25	10475	225	**10727**	**20905**	**21298**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	4	1	19	**24**	158	1	171	**330**	**354**	155	8991	10	**9160**	23	9428	203	**9654**	**18814**	**19168**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	5	2	25	**31**	206	2	225	**433**	**464**	203	11778	13	**11999**	29	12350	265	**12647**	**24646**	**25110**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Appendix B

Sample STAMSON 5.04 Output

STAMSON 5.0 NORMAL REPORT Date: 04-11-2019 15:57:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a.te Time Period: Day/Night 16/8 hours
Description: South Facade Facing Hazeldean Rd, Road Traffic Noise

Road data, segment # 1: Hazeldean Rd (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: Hazeldean Rd (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 23.00 / 23.00 m
Receiver height : 13.50 / 13.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Hazeldean Rd (day)

Source height = 1.50 m

ROAD (0.00 + 71.82 + 0.00) = 71.82 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	73.68	0.00	-1.86	0.00	0.00	0.00	0.00	71.82

Segment Leq : 71.82 dBA

Total Leq All Segments: 71.82 dBA

Results segment # 1: Hazeldean Rd (night)

Source height = 1.50 m

ROAD (0.00 + 64.22 + 0.00) = 64.22 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	66.08	0.00	-1.86	0.00	0.00	0.00	0.00	64.22

Segment Leq : 64.22 dBA

Total Leq All Segments: 64.22 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.82
(NIGHT): 64.22

STAMSON 5.0 NORMAL REPORT Date: 11-11-2019 09:26:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: d_ola.te Time Period: 16 hours
Description: D, Courtyard Amenity Space, Road Traffic Noise

Road data, segment # 1: Hazeldean Rd

Car traffic volume : 28336 veh/TimePeriod *
Medium truck volume : 2254 veh/TimePeriod *
Heavy truck volume : 1610 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Hazeldean Rd

Angle1 Angle2 : -5.00 deg 5.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 100.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00
Road data, segment # 2: Hazeldean Rd

Car traffic volume : 28336 veh/TimePeriod *
Medium truck volume : 2254 veh/TimePeriod *
Heavy truck volume : 1610 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: Hazeldean Rd

Angle1 Angle2 : -90.00 deg -5.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 100.00 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : -5.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 80.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Road data, segment # 3: Hazeldean Rd

Car traffic volume : 28336 veh/TimePeriod *
Medium truck volume : 2254 veh/TimePeriod *
Heavy truck volume : 1610 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 3: Hazeldean Rd

Angle1 Angle2 : 5.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 100.00 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 5.00 deg Angle2 : 90.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 80.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Hazeldean Rd

Source height = 1.50 m

ROAD (0.00 + 47.44 + 0.00) = 47.44 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	5	0.66	73.68	0.00	-13.68	-12.56	0.00	0.00	0.00	47.44

Segment Leq : 47.44 dBA

Results segment # 2: Hazeldean Rd

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	1.50	1.50

ROAD (0.00 + 44.32 + 0.00) = 44.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-5	0.00	73.68	0.00	-8.24	-3.26	0.00	0.00	-17.86	44.32

Segment Leq : 44.32 dBA

Results segment # 3: Hazeldean Rd

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	1.50	1.50

ROAD (0.00 + 44.32 + 0.00) = 44.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
5	90	0.00	73.68	0.00	-8.24	-3.26	0.00	0.00	-17.86	44.32

Segment Leq : 44.32 dBA

Total Leq All Segments: 50.40 dBA

TOTAL Leq FROM ALL SOURCES: 50.40