REPORT

KANATA BOROUGHS

OTTAWA, ONTARIO

NOISE FEASIBILITY STUDY

RWDI #2100461

January 29, 2021

SUBMITTED TO

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VERSION HISTORY

Index	Date	Description	Prepared by	Reviewed by
1	January 29, 2020	Draft	Jacquie Kelton	Gillian Redman
2		Final		

EXECUTIVE SUMMARY

RWDI was retained to prepare a Noise and Vibration Impact Study (NVIS) for the proposed Kanata Boroughs development located at 8555 Campeau Drive in Ottawa, Ontario. The following noise control measures are recommended for the proposed development:

1. Suite bedroom window glazing with sound isolation performance up to STC 38.
2. Suite bedroom balcony doors with sound isolation performance up to STC 32.
3. Installation of central air-conditioning so that all suite windows can remain closed.
4. Construction of perimeter noise barriers along the outdoor amenity area.
5. The inclusion of noise warning clauses related to transportation sound levels at the outdoor amenity area and at the building façades.

At this stage in design the impact of the development on itself and its surroundings could not be quantitatively assessed. However, the impact on both the building itself and its surroundings is expected to be feasible to meet the applicable criteria. We recommend that the building design is evaluated prior to building permit to ensure that the acoustical design is adequately implemented in order to meet the applicable criteria.

Based on the results and recommendations included with this assessment; the proposed development is considered to be feasible from the noise and vibration impact aspect.

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1 INTRODUCTION

RWDI was retained to prepare a Noise and Vibration Impact Study (NVIS) for the proposed Kanata Boroughs development located at 8555 Campeau Drive in Ottawa, Ontario. The proposed development is located south of the Tanger Outlets and north of Highway 417, between Huntmar and Palladium Drive. This proposed development will consist of four 9-storey apartment buildings each with 106 units. There will also be one amenity building on-site. The context plan is shown in Figure 1.

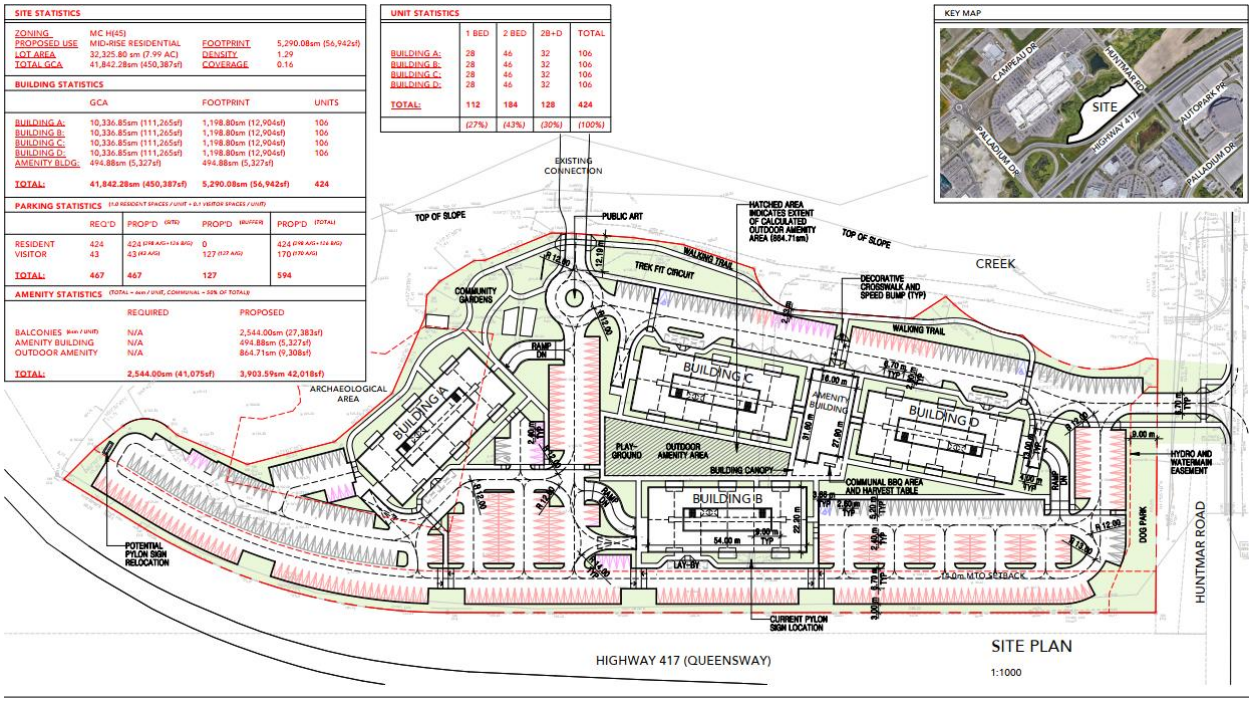

Figure 1: Context Plan

The site is exposed to noise from road traffic on: Highway 417 to the south, Huntmar Drive to the east, and Campeau Drive to the north. Palladium Drive to the west does not contribute significantly to road traffic noise due to set-back distances and the contribution of much busier Highway 417.

The site is exposed to noise from heating, cooling, and ventilation (HVAC) equipment at the outlet mall to the north.

This assessment was based on design drawings dated January 27th, 2021 which are included in Appendix A

2 APPLICABLE CRITERIA

Applicable criteria for transportation noise sources and stationary noise sources are described in this section. The City of Ottawa has its own environmental noise control guidelines for land use planning and they reference the Ontario Ministry of the Environment, Conservation and Parks (MECP) NPC-300 Environmental Noise Guideline. As such, NPC-300 was used with respect to transportation and stationary source impacts at the site.

2.1 Transportation Sources

NPC-300 was used to assess environmental noise generated by transportation-related sources. There are three aspects to consider, which include the following:

1. Transportation noise levels in indoor living areas (living rooms and sleeping quarters), which determines building façade elements (windows, exterior walls, doors) sound insulation design recommendations.
2. Transportation noise levels at the plane of the window, which determines air-conditioning and ventilation system recommendations and associated warning clauses which inform the future occupants that windows and doors must be closed in order to meet the indoor sound level criteria.
3. Transportation noise levels in Outdoor Living Areas (OLAs), which determines OLA noise mitigation and related warning clause recommendations.

OLAs would include outdoor areas intended and designed for the quiet enjoyment of the outdoor environment and are readily accessible from the building. OLAs may include any common outdoor amenity spaces associated with a multi-unit residential development (e.g. courtyards, roof-top terraces), and/or private backyards and terraces with a minimum depth of 4m provided they are the only outdoor living area for the occupant.

2.1.1 Road Noise

For assessing sound originating from transportation sources, NPC-300 defines sound level criteria as summarized in Table 1 for outdoor living areas (OLAs), and indoor areas of sensitive uses.

Table 1 – NPC-300 Sound Level Criteria for Road and Rail (Indoors)

Assessment Location	Time Period	NPC-300 Limit L_{EQ} (averaged over time period)		Comments
		Road	Rail	
Indoor Living Quarters	16 hr Daytime 0700-2300h	45 dBA	40 dBA	Building façade components should be specified to achieve the indicated indoor sound levels based on the assumption of a closed window.
	8 hr Nighttime 2300-0700h			
Indoor Sleeping Quarters	16 hr Daytime 0700-2300h	45 dBA	40 dBA	
	8 hr Nighttime 2300-0700h	40 dBA	35 dBA	
Outdoor Living Areas	16 hr Daytime 0700-2300h	55 dBA Combined Road & Rail		If technically and economically feasible, noise barriers should be used to achieve 55 dBA sound levels in OLAs. Otherwise a warning clause would be recommended for sound levels between 56-60 dBA.

Ventilation and warning clauses requirements for residential buildings are determined based on predicted levels of transportation noise at the exterior Plane of Window (POW) as summarized in Table 2 below.

Table 2 – Ventilation, Building Component, and Warning Clauses Recommendations for Road and Rail

Assessment Location	Transportation Noise Level		Recommendations
	Daytime Leq,16-hr	Nighttime Leq,8-hr	
Plane of Window (Road & Rail)	>65 dBA	>60 dBA	Air conditioning to allow windows to remained closed. The acoustical performance of building components should be designed to meet the indoor sound level limits. Warning clause "Type D" is recommended.
	Between 55 and 65 dBA	Between 50 and 60 dBA	Applicable for low and medium density: Forced-air ventilation system to allow for the installation of air-conditioning. Warning clause "Type C" is recommended. Applicable for high density: Air conditioning to allow windows to remained closed. Warning clause "Type D" is recommended.
Outdoor Living Area (Combined Road & Rail)	Between 55 and 60 dBA	Not Applicable	Noise controls (barriers) should be implemented to meet the 55 dBA criterion. If noise mitigation is not feasible to meet the 55 dBA criterion, a Warning Clause "Type A" or "Type B" would be recommended.
	> 60 dBA	Not applicable	Generally, not acceptable. Noise mitigation required to reduce sound levels to less than 60 dBA for areas designated for the quiet enjoyment of the outdoors.

The wording for any required warning clauses is included within Section 3.3.2. Warning clauses are recommended to be included in agreements of Offers of Purchase and Sale, lease/rental agreements and condominium declarations.

In addition to the ventilation and warning clauses; building facade components should be designed to meet the indoor sound level limits.

2.2 Stationary Sources

Noise from stationary sources are assessed to ensure the proposed development would not affect any environmental noise permits (Environmental Compliance Approvals or Environmental Activity Sector Registrations) of surrounding industrial or commercial properties and to ensure an adequate sound environment would be present for the future residents of the proposed development. Facilities such as residential towers, or retail buildings, are typically exempt from environmental noise permits but may have sources of noise such as mechanical equipment. Sound levels attributable to these types of facilities are assessed to ensure a comfortable sound environment at the proposed development for due diligence. Sound from facilities, such as industrial facilities, that could require an environmental noise permit are assessed strictly against MECP sound level limits to ensure that the proposed residential use is compatible with the existing industrial and commercial uses.

2.2.1 NPC-300 Criteria for Stationary Sources

Noise from stationary sources is treated differently from transportation sources and requires sound levels be assessed for the predictable worst-case 1-hour average sound level (L_{EQ}) for each period of the day. For assessing sound originating from stationary sources, NPC-300 defines sound level criteria for two types of Points of Reception (PORs): outdoor and façade.

The assessment criteria for all PORs is the higher of either the exclusion limit per NPC-300 or the minimum background sound level that occurs or is likely to occur at a POR. The applicable exclusion limit is determined based on the level of urbanization or "Class" of the area. This development is considered to be in a Class 1 (urban) area.

The NPC-300 exclusion limits for continuously operating stationary sources are summarized in Table 3. For the façade, the exclusion limits apply at the exterior plane of window; there are no indoor criteria for stationary sources.

Table 3 – NPC-300 Exclusion Limits - Continuous Stationary Sources

Time Period	Exclusion Limit, Class 1 (L_{EQ-1hr})	
	Outdoor	Façade
Daytime-Evening 0700-2300h	50 dBA	50 dBA
Nighttime 2300-0700h	--	45 dBA

3 IMPACT OF THE ENVIRONMENT ON THE PROPOSED DEVELOPMENT

Sources of sound identified as having the potential to affect the proposed development include the following:

Roadways: Highway 417 to the south, Huntmar Drive to the east, and Campeau Drive to the north; Palladium Drive to the west does not contribute significantly to road traffic noise due to set-back distances and the contribution of much busier Highway 417.

Stationary sources: Rooftop HVAC sources from the nearby Tanger Outlets mall.

The locations of these sources of sound in relation to the proposed development is shown in Figure 2.

Figure 2: Location of Proposed Development in Relation to Adjacent Significant Sources of Noise

3.1 Transportation Source Assessment

3.1.1 Road Traffic Volume Data

The road traffic volume data was taken from the Environmental Noise Control Guidelines set by the City of Ottawa. The information used for modelling is shown in Table 4.

Table 4 – Road Traffic Data Summary

Roadway	Ultimate (AADT)	% Day/ %Night	Post Speed Limit (km/hr)	% Medium Trucks Day	% Heavy Trucks Day
The Queensway (417)	18,333 vehicles per lane with 8 lanes = 146,664	92% / 8%	100	7	5
Huntmar Drive	12,000	92% / 8%	50	7	5
Campeau Drive	12,000	92% / 8%	50	7	5

3.1.2 Representative Receptors

The selection of receptors affected by transportation noise sources was based on the drawings reviewed for this assessment. Using ORNAMENT, a representative façade of each of the residential buildings was assessed. Additionally, daytime sound levels were assessed at one Outdoor Living Area (OLA), located between building B and building C. The OLA is illustrated in Figure 3. ORNAMENT calculations are included in Appendix B.

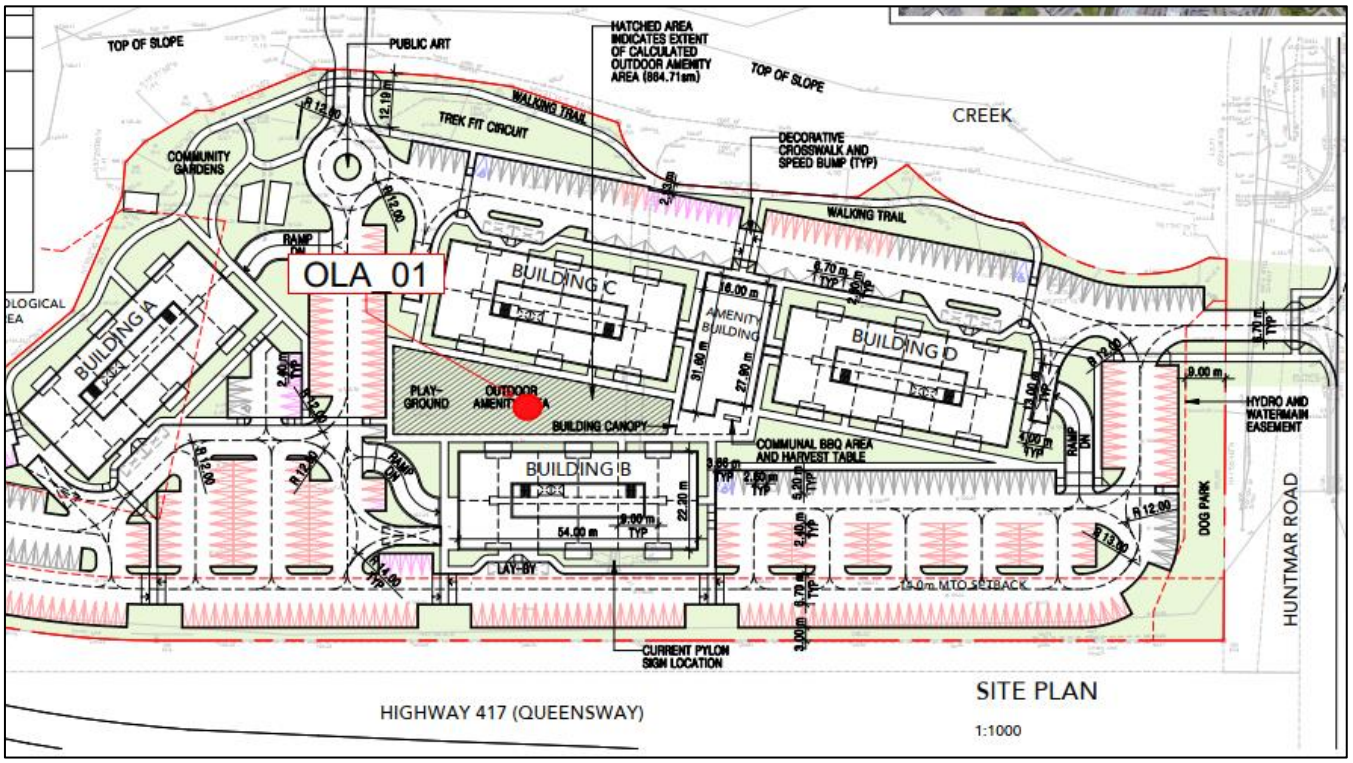

Figure 3: Location of OLA

3.1.3 Transportation Source Assessment - Analysis and Results

Sound levels due to the adjacent road traffic were predicted using ORNAMENT at six representative façades. To assess the impact of transportation noise on suites, the maximum sound level on each façade was determined with the results summarized in Table 5.

Table 5 – Predicted Road Levels of Transportation Noise on Facades

Building	Façade	Façade Sound Level (dBA)		Calculated/Proxy[3]	Recommendations for Warning Clause and/or Ventilation Requirements
		Road			
		Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr		
Building A	North	63	56	Proxy from A West	2
	East	73	65	Proxy from D South	2
	South	73	65	Proxy from D South	2
	West	63	56	Calculated	2
Building B	North	58	50	Proxy from D North	1
	East	74	67	Calculated	2
	South	77	69	Calculated	2

Building	Façade	Façade Sound Level (dBA)		Calculated/Proxy[3]	Recommendations for Warning Clause and/or Ventilation Requirements
		Road			
		Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr		
	West	74	67	Proxy from B East	2
Building C	North	55	47	Calculated	1
	East	73	65	Proxy from D East	2
	South	73	65	Proxy from D South	2
	West	73	65	Proxy from D East	2
Building D	North	58	50	Calculated	1
	East	73	65	Calculated	2
	South	73	65	Calculated	2
	West	73	65	Proxy from D East	2

Notes:

1. Applicable for low and medium density developments: Provision for future installation of air-conditioning, warning clause "Type C".
   Applicable for high density developments: Installation of air-conditioning to allow for windows and doors to remain closed, warning clause "Type D".
2. The acoustical performance of building components must be specified to meet the indoor sound level criteria. Installation of air conditioning to allow for windows and doors to remained closed, warning clause "Type D".
3. Proxy sound levels reference equivalent calculated sound levels from equivalent facades at the site.

To assess the impact of transportation noise on the OLA for the development, predicted sound level results are summarized Figure 4 below.

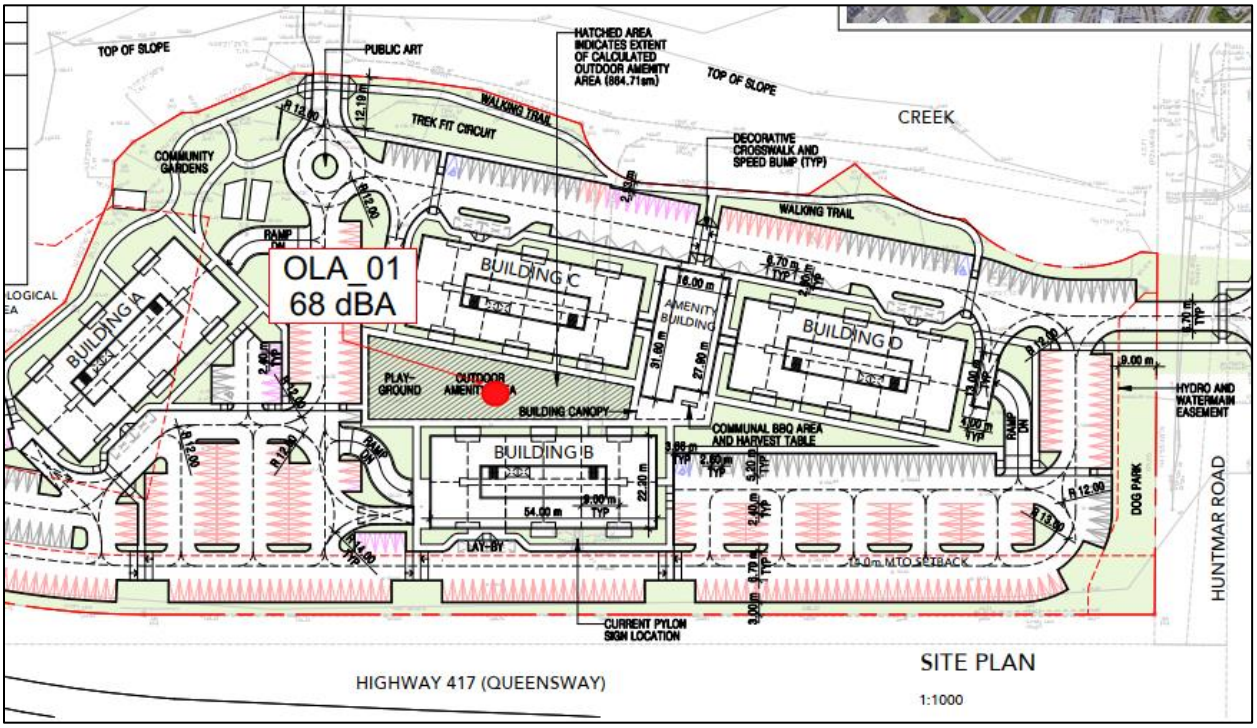

Figure 4: OLA Predicted Sound Levels

To reduce the level for this OLA to be within the maximum allowable 60 dBA level the use of localized barriers will be implemented.

3.2 Stationary Source Assessment

3.2.1 Assumed Sources and Sound Power Levels

Stationary sources with the potential to impact the development were identified as HVAC equipment on the roof-top of the nearby Tanger Outlet mall.

The assumed sound power levels of the sources included in the stationary source assessment are illustrated in Figure 6 with assumed sound power levels summarized in Table 6.

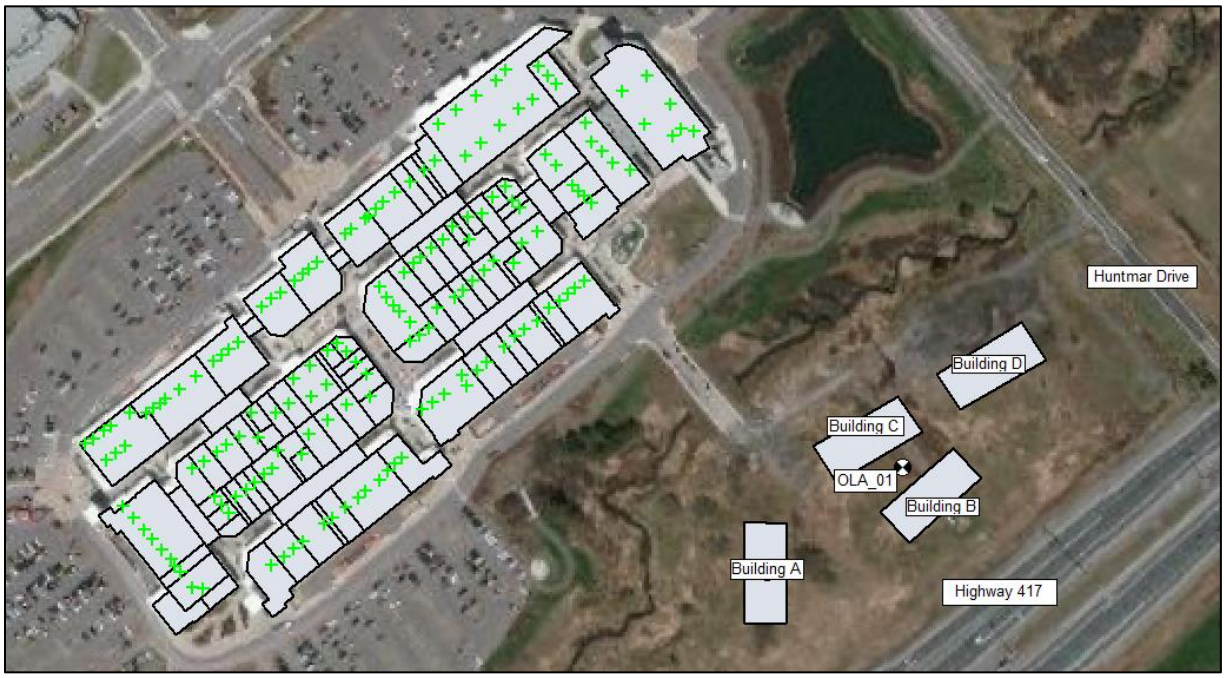

Figure 5: Sources Included in the Stationary Sources Noise Model

The assumed sound power level values for the stationary sources are based on RWDI proxy data. In the case of the Tanger Outlet Mall, it was assumed that the majority of HVAC equipment would not operate during nighttime (11pm to 7am) as the hours of the mall are 9am to 9pm.

Table 6 – Stationary Source Sound Power Level Assumptions

Source	Sound Power Level (dBA)	Duty Cycle	
		Daytime	Nighttime
HVAC – 1 Fan	85	Continuous	Off
HVAC – 2 Fans	88	Continuous	Off
HVAC – 4 Fans	91	Continuous	Off

3.2.2 Representative Receptors

The worst-case receptor locations were assessed to evaluate the potential stationary source noise impact. These were determined to be the north façade of Building C and OLA_01.

3.2.3 Stationary Source Assessment – Analysis and Results

Stationary source noise modelling was carried out using the Cadna/A software package, a commercially available implementation of the ISO 9613 (ISO, 1994 and ISO, 1996) algorithms. The predicted sound levels are assessed against the Class 1 Area limits as shown in Table 7.

Table 7 – Predicted Sound Levels at Worst-case Receptor Locations - Continuous Stationary Sources

Time Period	Receptor		Sound Level Criteria	Meets Class 1 Criteria?
	OLA_01 Outdoor $L_{EQ,1hr}$	Building C Plane of Window $L_{EQ,1hr}$	Class 1 L_{EQ-1hr}	
Daytime-Evening 0700-2300h	26 dBA	49 dBA	50 dBA	Yes

The predicted sound levels due to stationary sources are predicted to meet the Class 1 sound level criteria.

3.3 Recommendations

Based on an analysis of the predicted sound levels, the following recommendations and requirements were determined for the project due to transportation sources.

3.3.1 Transportation Sources

The following recommendations are provided to address transportation sources.

3.3.1.1 Building Façade Components

Due to the elevated transportation sound levels in the area, acoustical design of the façade components including spandrel, window glazing, and exterior doors, are recommended to be specified for the proposed development.

To assess the development's feasibility, preliminary window glazing, and exterior balcony door sound isolation requirements were determined. These were based on following assumptions:

- Estimates of window glazing and exterior door area relative to room floor area:
  - Residential Condominium & Rental (living rooms):
    - Glazing 60% of façade, Door: 20% of façade
    - 55% Façade to floor area Ratio
  - Residential Condominium & Rental (bedrooms):
    - Glazing 60% of façade, Door 20% of façade (where applicable)
    - 81% Façade to floor area Ratio
- Acoustical character of rooms
  - Intermediate absorption finishes/furniture
- Spandrel/façade wall assembly achieves minimum STC 45 rating
- Exterior doors meeting up to STC-32.

Based on the predicted façade sound levels and the assumptions listed above, the window glazing and exterior door sound insulation requirements for each facade were determined using the BPN-56 (NRCC, 1985) method. The reported results are in terms of Sound Transmission Class (STC) ratings as summarized in Table 8.

Table 8 – Façade Component Minimum Sound Insulation Requirements

Portion of Development	Façade	Window Glazing Requirements [1]	Exterior Door Restrictions	Exterior Door Glazing Requirements [2]
Building A	North	OBC	None	OBC
	East	STC-37	No Bedroom Exterior Door	STC-25
	South	STC-37	No Bedroom Exterior Door	STC-25
	West	OBC	None	OBC
Building B	North	OBC	None	OBC
	East	STC-35	No Bedroom Exterior Door	STC-28
	South	STC-38	No Bedroom Exterior Door	STC-32
	West	STC-35	No Bedroom Exterior Door	STC-28
Building C	North	OBC	None	OBC
	East	STC-37	No Bedroom Exterior Door	STC-25
	South	STC-37	No Bedroom Exterior Door	STC-25
	West	STC-37	No Bedroom Exterior Door	STC-25
Building D	North	OBC	None	OBC
	East	STC-37	No Bedroom Exterior Door	STC-25
	South	STC-37	No Bedroom Exterior Door	STC-25
	West	STC-37	No Bedroom Exterior Door	STC-25

Notes:

1. Typical windows/doors that meet the minimum requirements of the Ontario Building Code (e.g. for structural and thermal insulation requirements) would meet STC-28, and exterior balcony doors meet STC-25.
2. Exterior doors with STC-25 rating will be met with any standard OBC door, STC-28 rating can be met with upgraded glass door construction, STC-32 will require solid core door construction.

The maximum requirement for the window glazing was determined to be STC 38, which is considered feasible as this can be achieved by various double-glazed configurations of insulated glazing units.

Taking into account the assumptions used as a basis to determine the glazing requirements, the indoor transportation source sound level limits in Table 1 are predicted to be achieved.

We recommend that the façade construction is reviewed during detailed design to ensure that the indoor sound level limits will be met, and that the window/door supplier is requested to provide STC laboratory test reports as part of shop drawing submittal to confirm that the glazing/door components will meet the minimum STC requirements.

3.3.1.2 Ventilation Requirements

Due to the transportation sound levels at the plane of the façade, central air conditioning is a mandatory requirement for the proposed development. Further, prospective purchasers or tenants should be informed by a warning clause "Type D". The wording of the "Type D" warning clause is presented in Section 3.3.2.

3.3.1.3 Outdoor Living Areas

Due to exposure of noise from the nearby Highway 417 and Huntmar Drive, noise levels at the OLA are expected to be elevated. The daytime average sound levels are predicted to be 68 dBA. To reduce the levels for the OLA to the maximum allowable 60 dBA, noise barrier locations (in purple) and heights, shown in Figure 6, are required. Note that all noise barriers must be solid in construction (minimum surface weight of 20 kg/m^2) and free of gaps and cracks.

Barriers to meet the 55 dBA target were not feasible and as a result, prospective purchasers or tenants should be informed of transportation sound levels by a warning clause Type B. Since common OLAs are intended for the use by everyone in the building, every resident in the respective building should receive the warning clause. The wording of the "Type B" warning clauses are presented in Section 3.3.2.

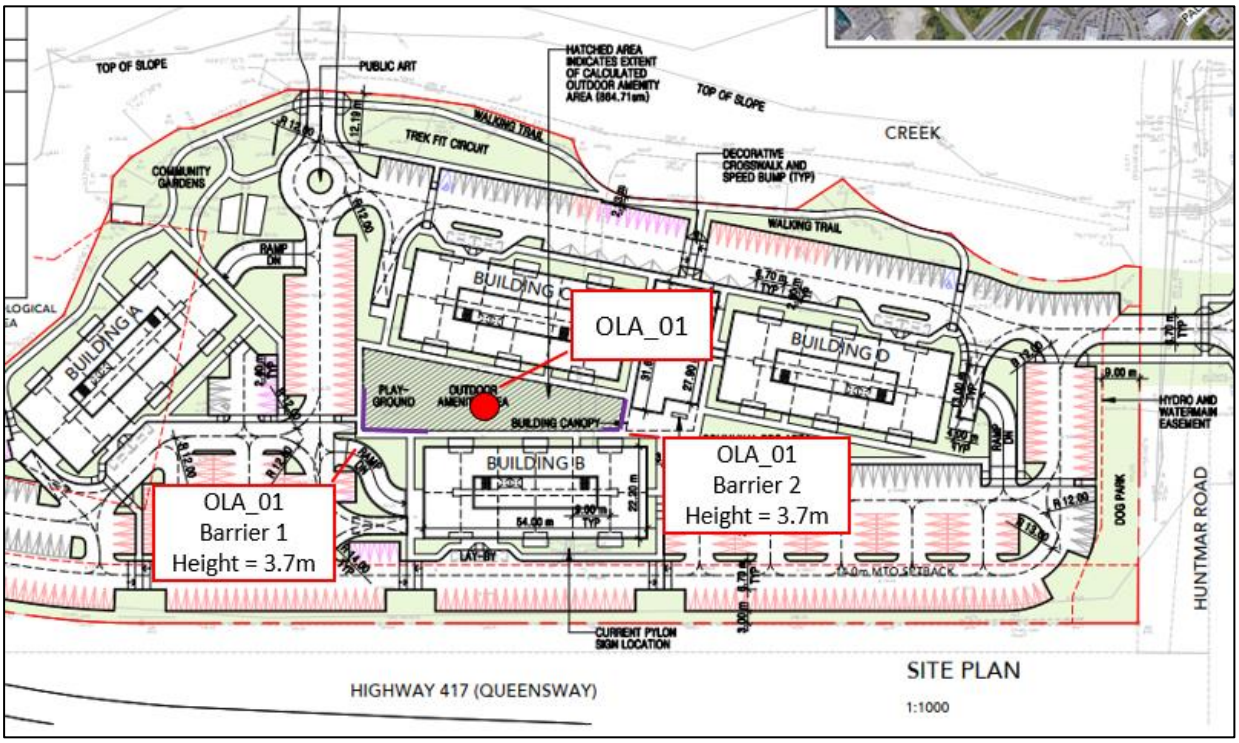

Figure 6: Required Perimeter Barriers to Meet the Maximum 60 dBA Limit

The location of the barriers shown in Figure 6 is one feasible configuration to reduce sound levels within an acceptable range. Other barrier configurations of the same height in a similar location that also break line of site between the OLA and Highway 417 would likely also be feasible. An acoustical engineer should review the final barrier design, if it differs from above, to ensure the OLA sound levels will be acceptable.

3.3.2 Warning Clauses

Warning clauses are recommended to be included on all development agreements, offers of purchase and agreements of purchase and sale or lease. Warning clauses may be used individually or in combination.

The following warning clauses are recommended; however, wording may be modified/customized during consultation with the planning authority to best suit the proposed development:

NPC-300 Type B: Recommended to address transportation noise in OLAs if the sound level is in the range of 56-60 dBA

"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 (rail traffic) (air traffic) may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."

NPC-300 Type D: Recommended to address transportation noise in indoor spaces

"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."

4 IMPACT OF THE PROPOSED DEVELOPMENT ON ITS SURROUNDINGS AND ON ITSELF

4.1 Applicable Criteria

The noise produced by stationary noise sources associated with the development itself would be evaluated based on the NPC-300 Environmental Noise Guideline. Although the development would not be required to obtain a permit for environmental noise, the potential effect of noise from the development are discussed here for due diligence.

4.2 Recommendations

On-site stationary sources for the development are expected to consist of HVAC related equipment in the roof-top mechanical penthouse as well as various exhaust fans. Further, consideration should be given to control airborne and structure-borne noise generated within the proposed development.

Within the development itself the main sources of noise that are likely to affect the uses of the building are the mechanical systems.

Provided that best practices for the acoustical design of the building are followed, noise from building services equipment associated with the development are expected to be feasible to meet the applicable sound level criteria due to the nature (residential) of the proposed development.

We recommend that the potential noise impact of the proposed development is reviewed during detailed design to ensure the applicable sound level criteria will be achieved.

5 CONCLUSIONS

RWDI was retained to prepare a Noise and Vibration Impact Study (NVIS) for the proposed Kanata Boroughs development located at 8555 Campeau Drive in Ottawa, Ontario. The following noise control measures are recommended for the proposed development:

1. Suite bedroom window glazing with sound isolation performance up to STC 38.
2. Suite bedroom balcony doors with sound isolation performance up to STC 32.
3. Installation of central air-conditioning so that all suite windows can remain closed.
4. Construction of perimeter noise barriers along the outdoor amenity area.

5. The inclusion of noise warning clauses related to transportation sound levels at the outdoor amenity area and at the building façades.

At this stage in design the impact of the development on itself and its surroundings could not be quantitatively assessed however, the impact on both the building itself and its surroundings is expected to be feasible to meet the applicable criteria. We recommend that the building design is evaluated prior to building permit to ensure that the acoustical design is adequately implemented in order to meet the applicable criteria.

Based on the results and recommendations included with this assessment; the proposed development is considered to be feasible from the noise and vibration impact aspect.

6 REFERENCES

1. Controlling Sound Transmission into Buildings (BPN-56), National Research Council Canada (NRCC, 1985).
2. City of Ottawa, 2016, Environmental Noise Control Guidelines.
3. International Organization for Standardization (ISO), 1994, International Standard ISO 9613-1:1994, Acoustics – Attenuation of Sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere.
4. International Organization for Standardization (ISO), 1996, International Standard ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
5. Ontario Ministry of the Environment, Conservation, and Parks (MECP), 1989, ORNAMENT Ontario Road Noise Analysis Method for Environment and Transportation, Technical Publication
6. Ontario Ministry of the Environment, Conservation, and Parks (MECP), August 2013, Publication NPC-300, Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning (NPC-300)

APPENDIX A

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.

APPENDIX B

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.09

Job No. 2100461 Scenario

Job Name 8555 Campeau Drive

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-BARRIER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	**Total Segment L_{eq} (dBA)**
			Autos	Medium	Heavy					θ_1	θ_2								
Huntmar Drive North	**Building "B" Day - South Façade**	16	4857.6	386.4	276	50	0	n	1	-90	3	144.0	Hard	A	1.5	0.0	8.0	0.0	51.90
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	-90	3	140.0	Hard	A	1.5	0.0	8.0	0.0	52.02
Highway 417 East		16	59370	4723	3373	100	0	n	1	-90	90	110.0	Hard	A	1.5	0.0	8.0	0.0	72.80
Highway 417 West		16	59370	4723	3373	100	0	n	1	-90	90	74.0	Hard	A	1.5	0.0	8.0	0.0	74.53
																			77
Huntmar Drive North	**Building "B" Night - South Façade**	8	422.4	33.6	24	50	0	n	1	-90	3	144.0	Hard	A	1.5	0.0	8.0	0.0	44.31
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	-90	3	140.0	Hard	A	1.5	0.0	8.0	0.0	44.43
Highway 417 East		8	5163	411	293	100	0	n	1	-90	90	110.0	Hard	A	1.5	0.0	8.0	0.0	65.21
Highway 417 West		8	5163	411	293	100	0	n	1	-90	90	74.0	Hard	A	1.5	0.0	8.0	0.0	66.93
																			69
Huntmar Drive North	**Building "D" Day - South Façade**	16	4857.6	386.4	276	50	0	n	1	-90	90	74.0	Hard	A	1.5	0.0	8.0	0.0	57.63
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	-90	90	70.0	Hard	A	1.5	0.0	8.0	0.0	57.87
Highway 417 East		16	59370	4723	3373	100	0	n	1	-7	90	144.0	Hard	A	1.5	0.0	8.0	0.0	68.91
Highway 417 West		16	59370	4723	3373	100	0	n	1	-7	90	103.0	Hard	A	1.5	0.0	8.0	0.0	70.37
																			73
Huntmar Drive North	**Building "D" Night - South Façade**	8	422.4	33.6	24	50	0	n	1	-90	90	74	Hard	A	1.5	0.0	8.0	0.0	50.03
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	-90	90	70	Hard	A	1.5	0.0	8.0	0.0	50.27
Highway 417 East		8	5163	411	293	100	0	n	1	-7	90	144	Hard	A	1.5	0.0	8.0	0.0	61.31
Highway 417 West		8	5163	411	293	100	0	n	1	-7	90	103	Hard	A	1.5	0.0	8.0	0.0	62.77
																			65
Huntmar Drive North	**Building "B" Day - East Façade**	16	4857.6	386.4	276	50	0	n	1	-10	90	131.0	Hard	A	1.5	0.0	8.0	0.0	52.64
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	-10	90	131.0	Hard	A	1.5	0.0	8.0	0.0	52.64
Highway 417 East		16	59370	4723	3373	100	0	n	1	0	90	109.0	Hard	A	1.5	0.0	8.0	0.0	69.89
Highway 417 West		16	59370	4723	3373	100	0	n	1	0	90	69.0	Hard	A	1.5	0.0	8.0	0.0	71.88
																			74
Huntmar Drive North	**Building "B" Night - East Façade**	8	422.4	33.6	24	50	0	n	1	-10	90	131.0	Hard	A	1.5	0.0	8.0	0.0	45.05
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	-10	90	131.0	Hard	A	1.5	0.0	8.0	0.0	45.05
Highway 417 East		8	5163	411	293	100	0	n	1	0	90	109.0	Hard	A	1.5	0.0	8.0	0.0	62.29
Highway 417 West		8	5163	411	293	100	0	n	1	0	90	69.0	Hard	A	1.5	0.0	8.0	0.0	64.28
Campeau Drive East		8	422.4	33.6	24	50	0	n	1	0	10	423.0	Hard	A	1.5	0.0	8.0	0.0	30.83
Campeau Drive West		8	422.4	33.6	24	50	0	n	1	0	10	423.0	Hard	A	1.5	0.0	8.0	0.0	30.83
																			66
Huntmar Drive North	**Building "D" Day - North Façade**	16	4857.6	386.4	276	50	0	n	1	20	90	75.0	Hard	A	1.5	0.0	8.0	0.0	53.56
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	20	90	75.0	Hard	A	1.5	0.0	8.0	0.0	53.56
Campeau Drive East		16	4857.6	386.4	276	50	0	n	1	-30	90	377.0	Hard	A	1.5	0.0	8.0	0.0	48.83
Campeau Drive West		16	4857.6	386.4	276	50	0	n	1	-30	90	377.0	Hard	A	1.5	0.0	8.0	0.0	48.83
																			57.8
Huntmar Drive North	**Building "D" Night - North Façade**	8	422.4	33.6	24	50	0	n	1	20	90	75.0	Hard	A	1.5	0.0	8.0	0.0	45.97
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	20	90	75.0	Hard	A	1.5	0.0	8.0	0.0	45.97
Campeau Drive East		8	422.4	33.6	24	50	0	n	1	-30	90	377.0	Hard	A	1.5	0.0	8.0	0.0	41.23
Campeau Drive West		8	422.4	33.6	24	50	0	n	1	-30	90	377.0	Hard	A	1.5	0.0	8.0	0.0	41.23
																			50.2
Huntmar Drive North	**Building "C" Day - North Façade**	16	4857.6	386.4	276	50	0	n	1	20	90	151.0	Hard	A	1.5	0.0	8.0	0.0	50.52
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	20	90	151.0	Hard	A	1.5	0.0	8.0	0.0	50.52
Campeau Drive East		16	4857.6	386.4	276	50	0	n	1	0	90	377.0	Hard	A	1.5	0.0	8.0	0.0	47.61
Campeau Drive West		16	4857.6	386.4	276	50	0	n	1	0	90	377.0	Hard	A	1.5	0.0	8.0	0.0	47.61
																			55.3
Huntmar Drive North	**Building "C" Night - North Façade**	8	422.4	33.6	24	50	0	n	1	20	90	151.0	Hard	A	1.5	0.0	8.0	0.0	42.93
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	20	90	151.0	Hard	A	1.5	0.0	8.0	0.0	42.93
Campeau Drive East		8	422.4	33.6	24	50	0	n	1	0	90	377.0	Hard	A	1.5	0.0	8.0	0.0	40.01
Campeau Drive West		8	422.4	33.6	24	50	0	n	1	0	90	377.0	Hard	A	1.5	0.0	8.0	0.0	40.01
																			47.7
Huntmar Drive North	**Building "A" Day - Northeast Façade**	16	4857.6	386.4	276	50	0	n	1	-45	10	241.0	Hard	A	1.5	0.0	8.0	0.0	47.49
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	-45	10	241.0	Hard	A	1.5	0.0	8.0	0.0	47.49
Highway 417 East		16	59370	4723	3373	100	0	n	1	80	90	138.0	Hard	A	1.5	0.0	8.0	0.0	60.18
Highway 417 West		16	59370	4723	3373	100	0	n	1	80	90	138.0	Hard	A	1.5	0.0	8.0	0.0	60.18
																			63.4
Huntmar Drive North	**Building "A" Night - Northeast Façade**	8	422.4	33.6	24	50	0	n	1	-45	10	241.0	Hard	A	1.5	0.0	8.0	0.0	39.89
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	-45	10	241.0	Hard	A	1.5	0.0	8.0	0.0	39.89
Highway 417 East		8	5163	411	293	100	0	n	1	80	90	138.0	Hard	A	1.5	0.0	8.0	0.0	52.58
Highway 417 West		8	5163	411	293	100	0	n	1	80	90	138.0	Hard	A	1.5	0.0	8.0	0.0	52.58
																			55.8
Huntmar Drive North	**Building "D" Day - East Façade**	16	4857.6	386.4	276	50	0	n	1	-90	90	65.5	Hard	A	1.5	0.0	8.0	0.0	58.16
Huntmar Drive South		16	4857.6	386.4	276	50	0	n	1	-90	90	69.5	Hard	A	1.5	0.0	8.0	0.0	57.90
Campeau Drive East		16	59370	4723	3373	100	0	n	1	-90	10	140.2	Hard	A	1.5	0.0	8.0	0.0	69.24
Campeau Drive West		16	59370	4723	3373	100	0	n	1	-90	10	101.3	Hard	A	1.5	0.0	8.0	0.0	70.66
																			73.3
Huntmar Drive North	**Building "D" Night - East Façade**	8	422.4	33.6	24	50	0	n	1	-90	90	65.5	Hard	A	1.5	0.0	8.0	0.0	50.56
Huntmar Drive South		8	422.4	33.6	24	50	0	n	1	-90	90	69.5	Hard	A	1.5	0.0	8.0	0.0	50.31
Campeau Drive East		8	5163	411	293	100	0	n	1	-90	10	140.2	Hard	A	1.5	0.0	8.0	0.0	61.65
Campeau Drive West		8	5163	411	293	100	0	n	1	-90	10	101.3	Hard	A	1.5	0.0	8.0	0.0	63.06
																			65.7