FINAL REPORT

263 GREENSWAY

OTTAWA, ONTARIO

NOISE FEASIBILITY ASSESSMENT

RWDI #1802859

May 17, 2018

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained by Manor Park Management to conduct a traffic noise feasibility study as part of the Site Plan Approval (SPA) for the proposed development, to be located at the northwest corner of Vanier Parkway and Montreal Road in Ottawa, Ontario. The purpose of this assessment was to predict noise levels from road traffic affecting the proposed development using the applicable guidelines and to determine the overall feasibility of the project.

This study assessed sound impacts due to road-traffic noise only. The sound levels modelled for the road-traffic noise were assessed using the City of Ottawa guidelines, and supplemented where applicable by Ministry of the Environment and Climate Change Publication NPC-300.

The sound levels due to road-traffic sources are predicted to exceed the Ottawa City Guidelines and NPC-300 sound level limits at the proposed development. For road-traffic sources, the development can meet the requirements with:

- The implementation of central air conditioning;
- Windows on the east side of the building with a minimum STC rating of 32;
- Windows on the south side of the building with a minimum STC rating of 30;
- Warning clauses in purchase or lease/rental agreements;
- Installation of ground level barriers to protect the OLAs as follows:
    - Installation of one of the two ground-level barrier options presented to protect the ground level amenity area if located in the northeast corner of the site;
    - Installation of the proposed barrier to protect the ground level amenity area if located in the southwest corner of the site; and
- A 1.2 m solid parapet surrounding the podium level amenity area.

The feasibility study is based on assumptions regarding the currently-available building configuration and construction information and therefore the resulting recommendations are broad. As such, the recommendations must be refined by a detailed design study prior to the construction of the building to ensure that appropriate noise control measures have been incorporated into the final design.

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1 INTRODUCTION

RWDI was retained by Manor Park Management to conduct a traffic noise feasibility study as part of the Site Plan Approval (SPA) for the proposed development, to be located at the northwest corner of Vanier Parkway and Montreal Road in Ottawa, Ontario. The purpose of this assessment was to predict noise levels from road traffic affecting the proposed development using the applicable guidelines and to determine the overall feasibility of the project. This assessment is based on the design drawings dated February 13th, 2018.

The scope of this study did not include evaluation of noise from stationary sources surrounding the development or proposed as part of the development itself.

2 DESCRIPTION OF PROJECT AND SITE

The proposed development site will be located at the northwest corner of Vanier Parkway and Montreal Road in Ottawa, Ontario (see Figure 1). The apartment building includes a 3-storey podium level and a 6-storey tower. Outdoor amenity spaces are included on the north side of the building on the 3rd floor terrace and at ground level. Drawings of the development are included in Appendix A.

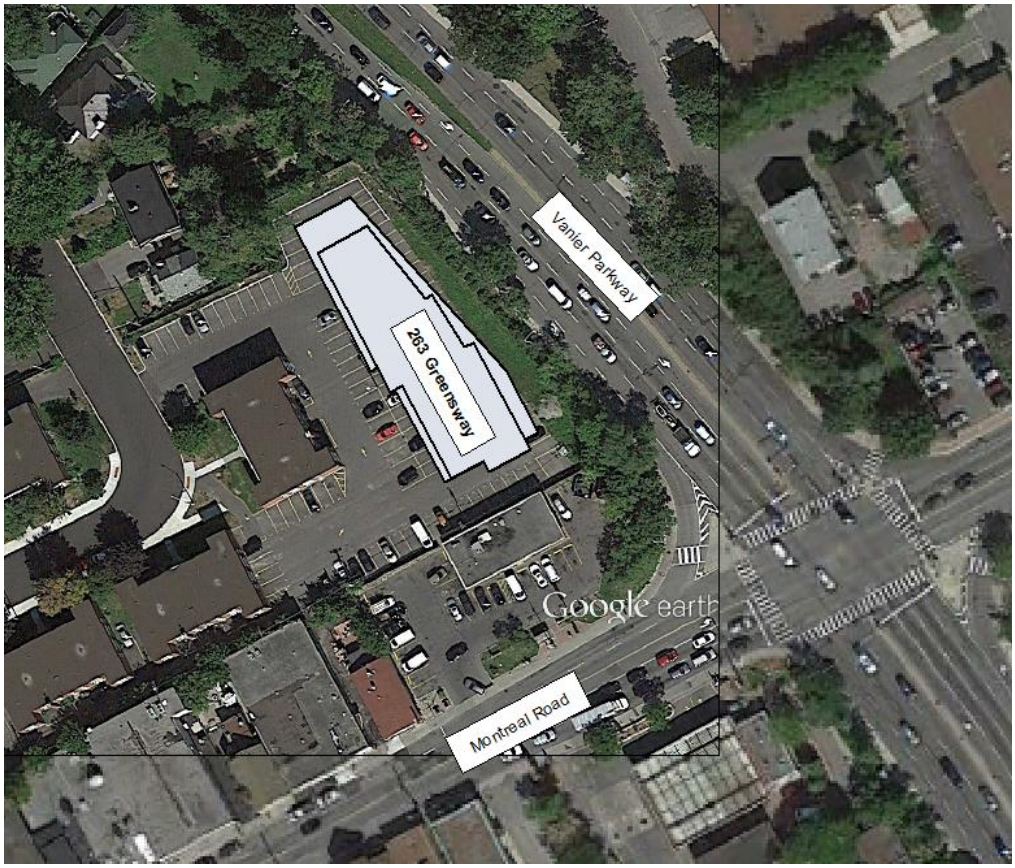

Figure 1: Proposed Development Location

Vanier Parkway and Montreal Road are the nearest sources of road traffic noise. Noise from the next nearest road, Greensway Avenue, is not expected to be significant at the proposed development. There are no other transportation-related noise sources, such as rail lines, in close proximity to the development.

The detailed evaluation of transportation-related and stationary sources affecting the development were assessed using the MOECC NPC-300 Guidelines (MOECC, 2013) and the City of Ottawa Environmental Noise Control Guidelines (City of Ottawa, 2016). The relevant section of NPC-300 is Part C – Land Use Planning. The relevant sections of Ottawa City Guidelines are Part 1 – Environmental Noise Control Guidelines for Land Use Planning and Part 4 – Technical Requirements for Environmental Noise Control Studies and Implementation.

3 ROAD-TRAFFIC NOISE ASSESSMENT

3.1 Assessment Criteria

For assessing sound originating from road-traffic sources, both Ottawa City Guidelines and NPC-300 define sound level criteria for two classes of locations: outdoor living areas (OLAs) and indoor areas of sensitive uses.

An OLA is defined as an outdoor area easily accessible from the building and designed for the quiet enjoyment of the outdoor environment. Courtyards, terraces and balconies (with a depth of more than 4 m) are considered noise-sensitive OLAs. The daytime sound level limit for OLAs is an equivalent sound level (L_{EQ}) of 55 dBA averaged over the daytime hours (07:00 to 23:00h). Neither Ottawa City Guidelines nor NPC-300 define a nighttime sound level limit for OLAs.

Indoor spaces are limited by daytime and nighttime sound level restrictions based on the type of usage, such as living/dining rooms or bedrooms. Indoor living areas within the proposed developments include dining/living rooms and bedrooms. The sound level criteria are based on all windows and doors being closed to the environment. The daytime sound level limit for indoor spaces is an L_{EQ} of 45 dBA averaged over 07:00 to 23:00h. The nighttime sound level limits for indoor spaces are L_{EQ}s of 45 and 40 dBA averaged over 23:00 to 07:00h, for an indoor living area and sleeping quarters, respectively. As no details regarding the specific layouts of the residential units was available at the time of the assessment, the more conservative 40 dBA limit was used for all indoor spaces evaluated.

The Ottawa City Guidelines and NPC-300 sound level criteria for road traffic sources are summarized in Table 1.

Table 1: Ottawa City Guidelines and NPC-300 Road-Traffic Source Sound Level Criteria for Sensitive Land Uses

Assessment Location	Time of Day	Time Period	Sound Level Limit[1]
Outdoor Living Area	Daytime	07:00-23:00h	55 dBA
Indoor Living Area	Daytime	07:00-23:00h	45 dBA
	Nighttime	23:00-07:00h	45 dBA
Sleeping Quarters	Daytime	07:00-23:00h	45 dBA
	Nighttime	23:00-07:00h	40 dBA

1. The average sound level over the time period at the assessment location must not exceed the sound level limit.

3.2 Traffic Data

At the proposed location, two roadways were evaluated: Vanier Parkway and Montreal Road. Greensway Avenue is expected to have an insignificant impact at the proposed development. The location of the proposed development in relation to these roadways is shown in Figure 1.

As per Schedule E of the City of Ottawa Official Plan, and in conjunction with Appendix B of Part 4 of Ottawa City Guidelines, Vanier Parkway was identified as a 4-Lane Urban Arterial-Divided Roadway, while Montreal Road was classified as a 4-Lane Urban Arterial-Undivided. The corresponding ultimate annual average daily traffic (AADT), vehicle type breakdown, and daytime-nighttime split data values provided by Appendix B are summarized in Table 2, along with respective road traffic speeds.

Table 2: Road Traffic Data

Roadway Link	Ultimate AADT[1]	Daytime / Nighttime Split (%Day / %Night)	%Light	%Medium	%Heavy	Speed (km/hr)
Vanier Parkway	35000	92 / 8	88	7	5	60
Montreal Road	30000		88	7	5	50

1. AADT – Annual Average Daily Traffic.

3.3 Representative Receptors for Transportation Sources

The selection of receptors is based on drawings dated February 13th, 2018, which show the proposed building and locations of outdoor living areas. Representative receptors were chosen to evaluate the worst-case impacts on the proposed development. The locations of the representative receptors in relation to the roadways and the development site plan are shown in Figure 2.

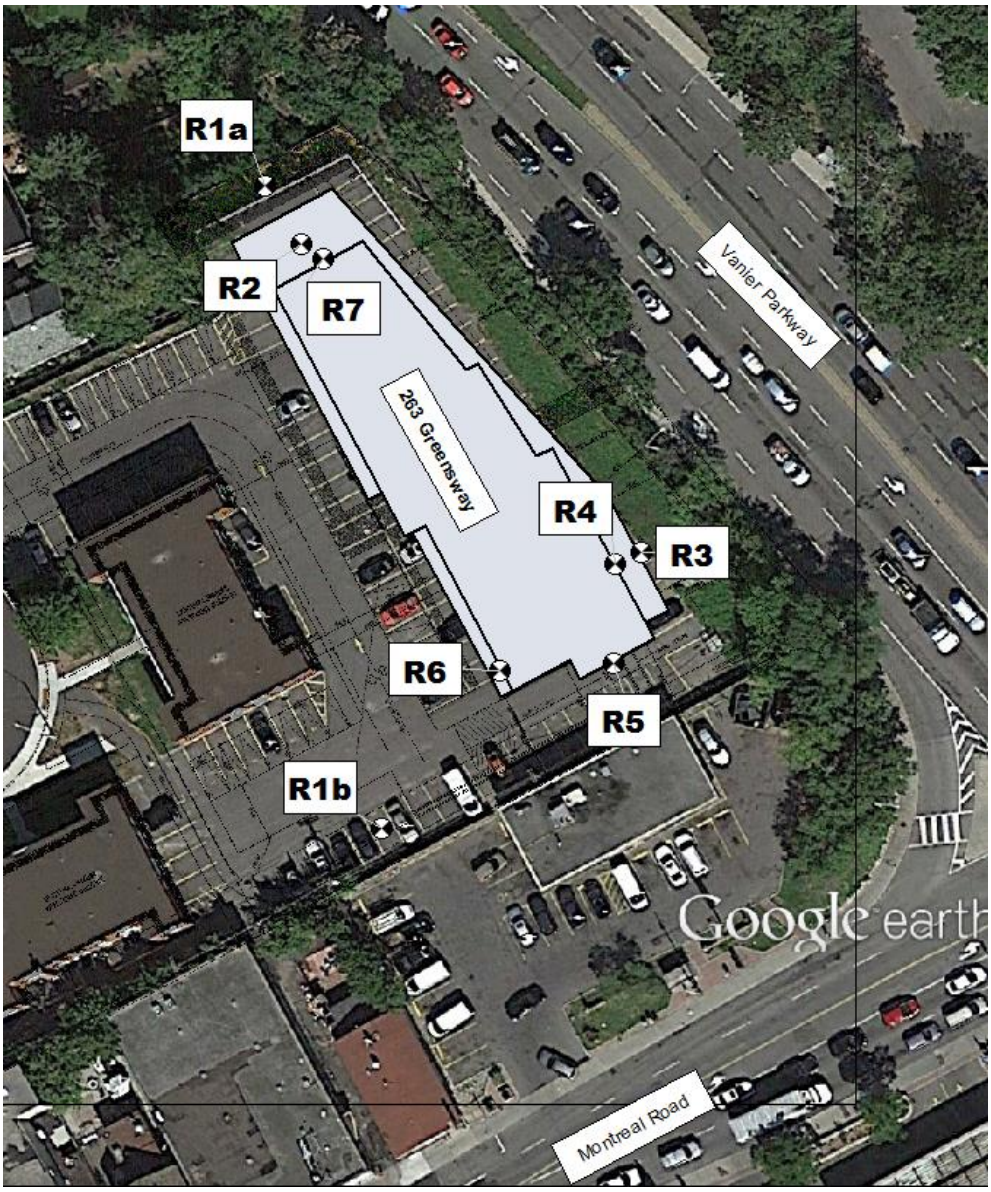

Figure 2: Representative Receptors for Traffic Modelling

Seven worst-case outdoor receptors were selected for modelling:

- R1a – OLA – Ground Level
- R1b – OLA – Ground Level
- R2 – OLA – Podium Level
- R3 – Podium – East Façade
- R4 – Tower – East Façade
- R5 – Tower – South Façade
- R6 – Tower – West Façade
- R7 – Tower – North Façade

Facade receptor locations represent the exterior plane of window into indoor sensitive areas such as sleeping or living rooms.

No private balconies on the towers or the podium have a depth of more than four meters, and were not assessed. Therefore, only common amenity areas – on the podium, at the north of the property at ground level, and at the southwest of the property at ground level – were considered as OLAs. It should be noted that either OLA R1a or OLA R1b will be included in the final design. Barriers and analysis were included for both options.

3.4 Noise Modelling Results

Sound levels due to road traffic were predicted using ORNAMENT. The sound level calculations are provided in Appendix B with results summarized in Table 3. The predicted facade sound levels represent the sound levels at the exterior plane of the window. Indoor sound levels were calculated from the predicted plane of window levels by accounting for a 28 dB loss through a minimum Ontario Building Code construction window, consistent with industry standard practice.

OLA nighttime calculations were not necessary, as Ottawa City Guidelines and NPC-300 do not specify a nighttime limit.

Table 3: Results of ORNAMENT Modelling

Receptor	Predicted Outdoor Road-Traffic Sound Exposures (dBA)		Predicted Indoor Road-Traffic Sound Exposures (dBA) [1]		Sound Level Limit (dBA) [2]		Complies with Criteria? (Yes/No)
	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	
R1a	68	-	-	-	55	-	No
R1b	63	-	-	-	55	-	No
R2	60	-	-	-	55	-	No
R3	71	63	43	35	40	35	No
R4	71	63	43	35	40	35	No
R5	69	61	41	33	40	35	No
R6	63	56	35	28	40	35	Yes
R7	66	59	35	38	40	35	Yes

1. Predicted indoor sound levels include a 28 dB reduction in sound level due to loss through a minimum Ontario Building Code construction window.
2. Sound level limits are indoors for Façade locations and outdoors for OLA locations.

Sound levels from road traffic was found to exceed the City of Ottawa and MOECC sound level limits at 5 of the 7 representative receptors. Noise control measures are required and recommendations are presented in the following section.

3.5 Addressing Excess Sound

3.5.1 Outdoor Living Areas (OLAs)

In addition to the rooftop amenity area, two potential ground level OLA locations were outlined, only one of which will be the final ground level OLA location. The analysis results for each ground level OLA and the single rooftop OLA are presented in this section.

3.5.1.1 Potential OLA at R1a

For the first potential ground level amenity area (receptor R1a), a ground level barrier adjacent to the amenity area on the north and east sides is recommended to reduce the sound levels to 60 dBA. Two options for this barrier are presented to allow some flexibility for the existing residence whose property line this barrier will abut. In both cases, the barrier will be absorptive on the side facing the existing residence so as not to increase sound levels for the existing residence. Both barrier options presented will be constructed of a solid, continuous material with a minimum face density of 20 kg/m^2. The two proposed locations of the barrier are presented in Figures 3a and 3b.

- **Option 1:** A 24 m barrier, with a height of 3 m
- **Option 2:** A 27m barrier, with the portion along Vanier Parkway 12 m in length and 3 m in height, and the portion abutting the existing residence 15 m in length and 2 m in height.

For OLA receptors where the sound level at the OLA is greater than 55 dBA, but less than or equal to 60 dBA, warning clause "Type B" must be included.

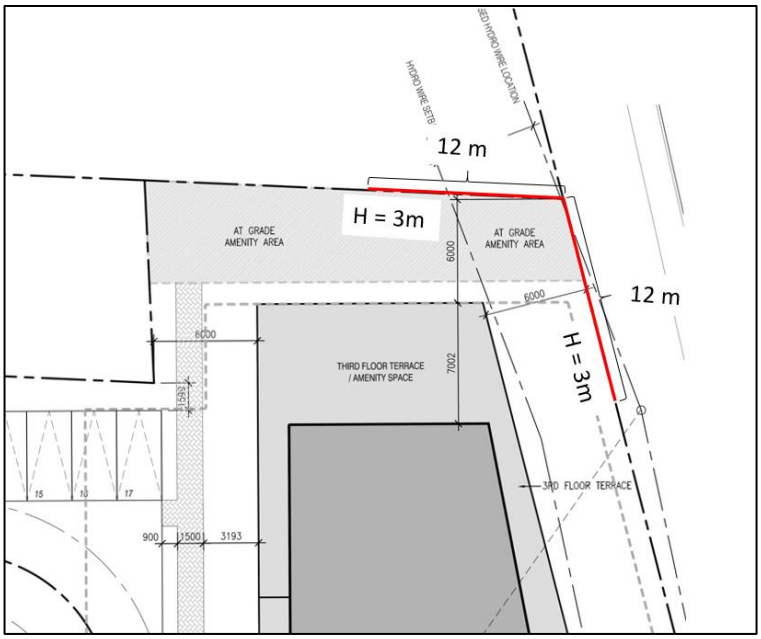

Figure 3a: Location of At-Grade Amenity Area Barrier for OLA R1a – Option 1

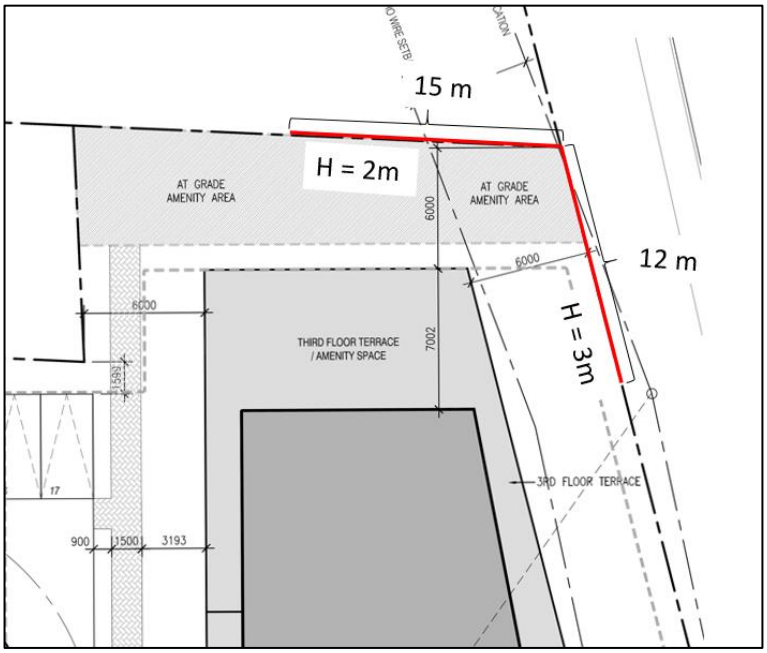

Figure 3b: Location of At-Grade Amenity Area Barrier for OLA R1a – Option 2

3.5.1.2 Potential OLA at R1b

For the second potential ground level amenity area (receptor R1b), a ground level barrier adjacent to the amenity area on the south side is recommended to reduce the sound levels to 60 dBA. It is recommended that the fence along the south side of the OLA be upgraded to a barrier, as shown in Figure 4.

The barrier will be absorptive on the side facing the existing residence so as not to increase sound levels for the existing residence, and will be constructed of a solid, continuous material with a minimum face density of 20 kg/m^2. The barrier will be a minimum of 1.8 m in height.

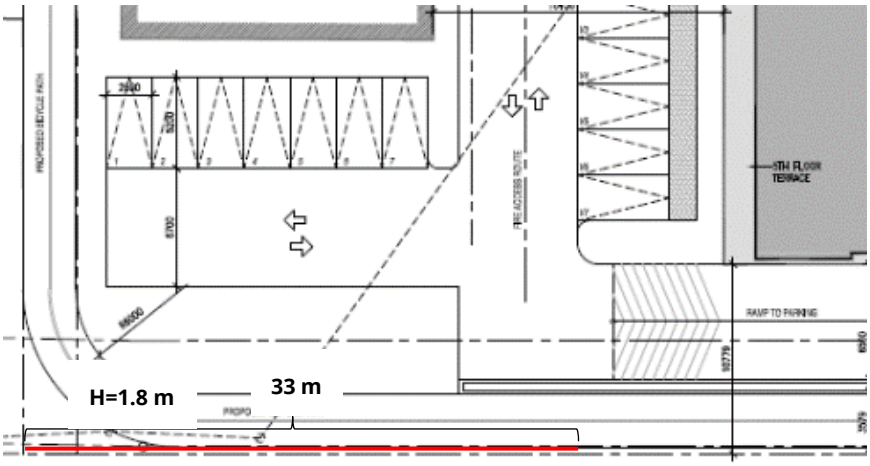

Figure 4: Location of At-Grade Amenity Area Barrier for OLA R1b

For OLA receptors where the sound level at the OLA is greater than 55 dBA, but less than or equal to 60 dBA, warning clause "Type B" must be included.

3.5.1.3 Rooftop OLA

For the rooftop amenity area (receptor R2) it is recommended that the proposed safety railing or parapet surrounding the rooftop amenity area be upgraded to act as a noise barrier. A minimum height of 1.2 m is required, and the barrier must be constructed of a solid, continuous material with a minimum face density of 20 kg/m^2. For OLA receptors where the sound level at the OLA is greater than 55 dBA, but less than or equal to 60 dBA, warning clause "Type B" must be included.

3.5.2 Indoor Sound Levels

For facade receptors where the sound level at the window is greater than 65 dBA during the daytime, and/or 60 dBA during the nighttime, which includes R3, R4, R5, and R7, both the City of Ottawa and the MOECC require that the residential unit includes the installation of central air conditioning. NPC-300 also requires a warning clause "Type D" included. For facade receptors where the sound level at the window is greater than 55 dBA during the daytime, and/or 50 dBA during the nighttime, which includes receptor R6, warning clause "Type C" must be included, which requires the dwelling to be designed to allow for installation of air conditioning. If the proposed development will be built with central air conditioning for all units, Warning clause "Type D" is appropriate for all units.

The wording of the "Type D" warning clause is presented in Section 4 of this report. In addition to NPC-300 warning clause requirements, Ottawa City Guidelines require standard City wording to be included in any warning clause, examples of which can be found in the City of Ottawa guidelines. This city-mandated warning clause requirement should be revisited during the detailed design stage, after design and building components have been confirmed. Final wording of any warning clause must be approved by the City of Ottawa.

To ensure the indoor sound levels are met, windows above and beyond minimum Ontario Building Code standard will be required for the east and south facades (R3, R4, and R5). Detailed calculations were completed the determine the minimum STC ratings for the east and south facades, and are presented in Table 4. Sample construction presented in table 4 is provided as a general reference for a window construction that is likely to meet the minimum STC rating. Any construction meeting this STC requirement is sufficient. Note that STC calculations were performed assuming typical wall to window ratios, room finishes, and room sizes. These calculations must be revisited when final construction details are known. Detailed calculations are included in Appendix C.

Table 4: Minimum Required STC ratings for Windows

Façade	Receptor	Minimum Window STC Rating	Sample Construction
East	R3, R4	32	4mm Pane – 12mm Air Space – 4mm Pane
South	R5	30	3mm Pane – 12mm Air Space – 3mm Pane

In addition to the required warning clauses, building components including walls and doors need to be designed to ensure the indoor sound levels comply with the limits detailed in Table 3.

4 WARNING CLAUSES

Type B: *"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 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 and Climate Change."*

Type D: *"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 and Climate Change."*

5 CONCLUSION

RWDI completed a traffic noise feasibility study as part of the Site Plan Approval (SPA) for the proposed development, to be located at the northwest corner of Vanier Parkway and Montreal Road in Ottawa, Ontario. The purpose of this assessment was to predict noise levels from road traffic affecting the proposed development using the applicable guidelines and to determine the overall feasibility of the project.

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- The implementation of central air conditioning;
- Windows on the east side of the building with a minimum STC rating of 32;
- Windows on the south side of the building with a minimum STC rating of 30;
- Warning clauses in purchase or lease/rental agreements;
- Installation of ground level barriers to protect the OLAs as follows:
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- A 1.2 m solid parapet surrounding the podium level amenity area.

The feasibility study is based on assumptions regarding the currently-available building configuration and construction information and therefore the resulting recommendations are broad. As such, the recommendations must be refined by a detailed design study prior to the construction of the building to ensure that appropriate noise control measures have been incorporated into the final design.

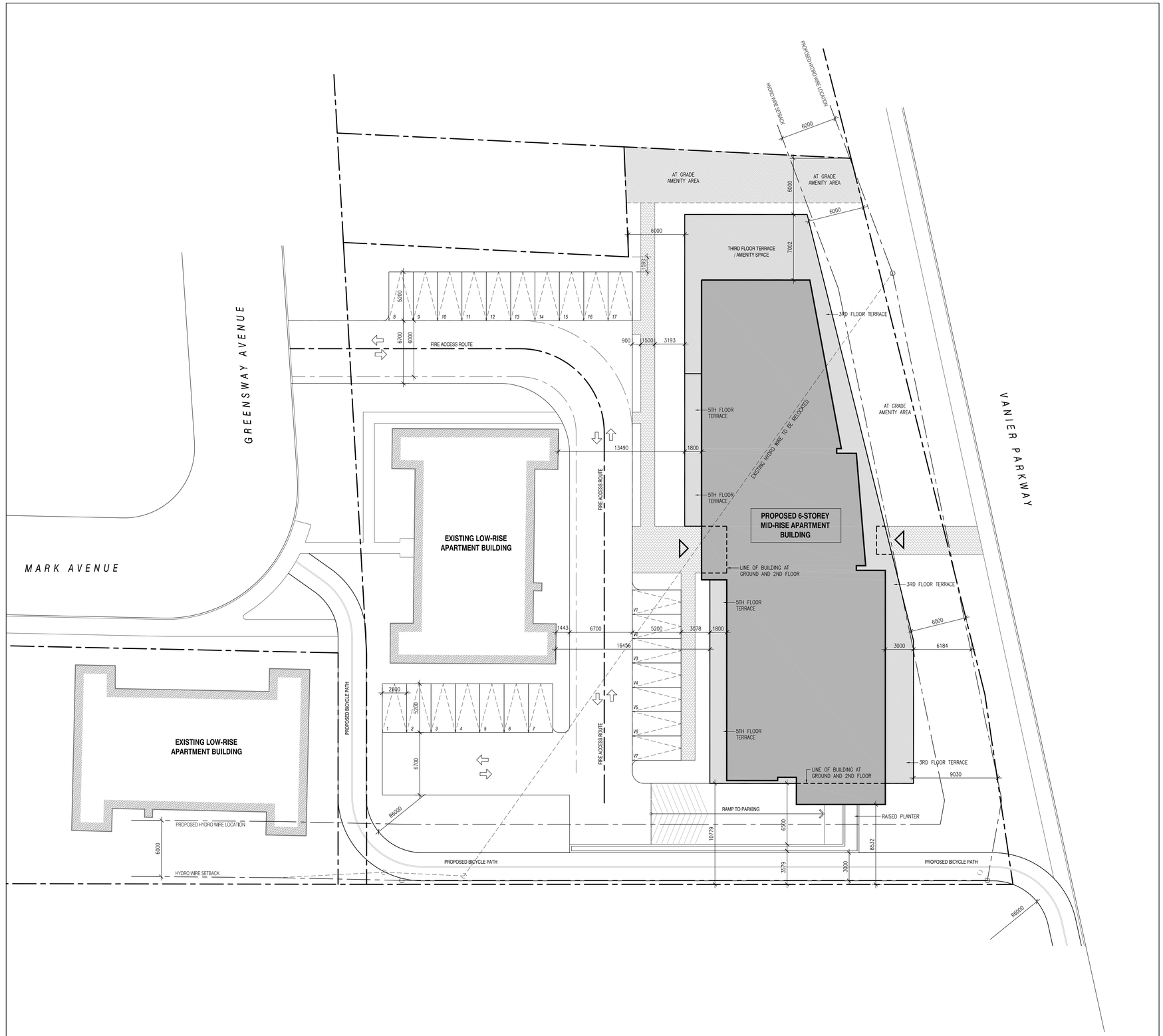
6 REFERENCES

1. Ontario Ministry of the Environment and Climate Change (MOECC), August 2013, Publication NPC-300, *Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning*

2. Ontario Ministry of the Environment and Climate Change (MOECC), 1989, ORNAMENT Ontario Road Noise Analysis Method for Environment and Transportation, Technical Publication

3. City of Ottawa, 2016, *Environmental Noise Control Guidelines.*

APPENDIX A



6 SP-01 SITE PLAN
SCALE: 1:75

1 SP-01 LOCATION PLAN
SCALE: NTS

2 SP-01 SURVEY INFO
SCALE: NTS

3 SP-01 SYMBOLS LEGEND
SCALE: NTS

4 SP-01 KEYNOTES
SCALE: NTS

ZONING
SCALE: NTS

SITE & PROJECT STATISTICS

GENERAL INFORMATION

Zoning:	-
Min. Lot Area:	-
Max. Building Height:	-
Min. Front Yard:	-
Min. Rear Yard:	-
Min. Int. Side Yard:	-

PROJECT STATISTICS

Lot Area:	4,535m2
Building Height:	20m
Front Yard:	-
Rear Yard:	6m
Int. Side Yard:	6m
Total Number of Units:	77 units

PARKING CALCULATION
As per Section 101

Required Parking:	33 spaces
0 spaces for first 12 units - Section 101(3)	
0.5 spaces/ unit for 125 units - Table 101	
Resident Parking Provided:	129 spaces

VISITOR PARKING CALCULATION
As per Section 102

Required Visitor Parking:	7 spaces
0 spaces for first 12 units - Section 102(2)	
0.1 spaces/unit for 125 units - Table 102	
Visitor Parking Provided:	7 spaces
Total Parking Provided:	136 spaces

BICYCLE PARKING CALCULATION
As per Table 111A

Required Parking:	39 spaces
0.5spUnit for 87 units[111A(b)(i)]	
Total Parking Provided:	40 spaces

AMENITY AREA CALCULATION
As per Table 137

Totall Amenity Area Req'd:	462 m2
6m2/unit	
Communal Amenity Req'd:	231 m2
Min of 50% of Total Amenity Area	
Amenity Area Provided:	**531 m2**
Level 01:	*91m2*
Level 02:	*63 m2*
Level 03:	*211 m2*
Level 04:	*58 m2*
Level 05:	*54 m2*
Level 06:	*54 m2*
Communal Amenity Provided:	270 m2
At Grade Parkspace:	*130 m2*
Level 03 Lounge:	*74 m2*
Level 03 Terrace:	*66 m2*
Total Amenity Area Provided:	801 m2

GENERAL ARCHITECTURAL NOTES:
1. This drawing is the property of the Architect and may not be reproduced or used without the expressed consent of the Architect.
2. Drawings are not to be scaled. The Contractor is responsible for checking and verifying all levels and dimensions and shall report all discrepancies to the Architect and obtain clarification prior to commencing work.
3. Upon notice in writing, the Architect will provide written/graphic clarification or supplementary information regarding the intent of the Contract Documents.
4. The Architectural drawings are to be read in conjuction with all other Contract Documents including Project Manuals and the Structural, Mechanical and Electrical Drawings.
5. Positions of exposed or finished Mechanical or Electrical devices, fittings and fixtures are indicated on the Architectural Drawings. Locations shown on the Architectural Drawings shall govern over Mechanical and Electrical Drawings. Mechanical and Electrical items not clearly located will be located as directed by the Architect.
6. These documents are not to be used for construction unless specifically noted for such purpose.

REVISION RECORD

ISSUE RECORD

ISSUED FOR COORDINATION	2018-02-13
ISSUED FOR COORDINATION	2017-12-11
ISSUED FOR COORDINATION	2017-11-24
ISSUED FOR COORDINATION	2017-11-02

project1 studio
Project1 Studio Incorporated
| 613.235.3636 | mail@project1studio.ca

263 GREENSWAY

263 Greensway Avenue
Ottawa, ON

PROJ	SCALE	DRAWN	REVIEWED
1722.1	SP-01	LB	RMK

SITE PLAN & STATISTICS

SP-01

APPENDIX B

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.09

Job No. 1802859
Job Name 263 Greensway

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

Receptor	Roadway 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)	Topo-graphy Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Ground Elevation Change (m)			Barrier Height (m)	Barrier Elevation (m asl)	Barrier-Reciever Distance (m)	Barrier Viewable Angle		No. of Rows of Houses	Density of Houses (% Houses)	Depth of Woods	Adjustment (dB)	Reason For Adjustment	**Total Segment L_{eq} (dBA)**
			Autos	Medium	Heavy					Θ_1	Θ_2								Elevation Change e (m)	Hor. Dist a (m)	Hor. Dist b (m)				Θ_1	Θ_2						
R1a - Ground Level OLA	Vanier Parkway Southbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	30.0	Soft	A	1.5		1.5															59.2
	Vanier Parkway Nouthbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	45.0	Hard	A	1.5		1.5															61.6
	Vanier Parkway Southbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	26.0	Soft	A	1.5		1.5															62.8
	Vanier Parkway Nouthbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	41.0	Hard	A	1.5		1.5															62.6
															-																R1a_Day_Total	**68**
R1a - Ground Level OLA with Barrier - Option 2	Vanier Parkway Southbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	30.0	Soft	A	1.5		1.5					2.0		10.0	-90	-25						54.4
	Vanier Parkway Nouthbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	45.0	Hard	A	1.5		1.5					2.0		10.0	-90	-25						56.2
	Vanier Parkway Southbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	26.0	Soft	A	1.5		1.5					3.0		10.0	-37	40						52.9
	Vanier Parkway Nouthbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	41.0	Hard	A	1.5		1.5					3.0		10.0	-37	40						52.9
															-																R1a_Day_Total_Barr	**60**
R1a - Ground Level OLA with Barrier - Option 1	Vanier Parkway Southbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	30.0	Soft	A	1.5		1.5					3.0		10.0	-80	-25						52.9
	Vanier Parkway Nouthbound - north segment	16	14168	1127	805	60	0	n	1	-90	-25	45.0	Hard	A	1.5		1.5					3.0		10.0	-80	-25						56.7
	Vanier Parkway Southbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	26.0	Soft	A	1.5		1.5					3.0		10.0	-37	40						52.9
	Vanier Parkway Nouthbound - south segment	16	14168	1127	805	60	0	n	1	-37	40	41.0	Hard	A	1.5		1.5					3.0		10.0	-37	40						52.9
																															R1a_Day_Total_Barr	**60**
R1b - Ground Level OLA	Vanier Parkway Southbound	16	14168	1127	805	60	0	n	1	6	20	62.0	Hard	A	1.5		1.5															53.7
	Vanier Parkway Northbound	16	14168	1127	805	60	0	n	1	6	20	79.0	Hard	A	1.5		1.5															52.7
	Montreal Road	16	24288	1932	1380	50	0	n	1	-40	13	43.0	Hard	A	1.5		1.5															61.8
															-																R1b_Day_Total	**63**
R1b - Ground Level OLA with Barrier	Vanier Parkway Southbound	16	14168	1127	805	60	0	n	1	6	20	62.0	Hard	A	1.5		1.5															53.7
	Vanier Parkway Northbound	16	14168	1127	805	60	0	n	1	6	20	79.0	Hard	A	1.5		1.5															52.7
	Montreal Road	16	24288	1932	1380	50	0	n	1	-40	13	43.0	Hard	A	1.5		1.5					1.8		4.0	-40	13						56.3
															-																R1b_Day_Total_Barr	**59**
R2 - Terrace OLA	Vanier Parkway Southbound - north segment	16	14168	1127	805	60	0	n	1	-90	-32	32.0	Soft	A	1.5		1.5	6.0				1.2	6.0	7.0	-90	-32						51.6
	Vanier Parkway Northbound - north segment	16	14168	1127	805	60	0	n	1	-90	-32	47.0	Hard	A	1.5		1.5	6.0				1.2	6.0	7.0	-90	-32						55.2
	Vanier Parkway Southbound - south segment	16	14168	1127	805	60	0	n	1	-46	35	27.0	Soft	A	1.5		1.5	6.0				1.2	6.0	7.0	-46	35						53.5
	Vanier Parkway Northbound - south segment	16	14168	1127	805	60	0	n	1	-46	35	42.0	Hard	A	1.5		1.5	6.0				1.2	6.0	7.0	-46	35						56.2
															-																R2_Day_Total	**60**
R3 - East Façade Podium, Day	Vanier Parkway Southbound	16	14168	1127	805	60	0	n	1	-90	90	20.0	Soft	A	1.5		1.5															67.1
	Vanier Parkway Northbound	16	14168	1127	805	60	0	n	1	-90	90	35.0	Hard	A	1.5		1.5															67.0
	Montreal Road	16	24288	1932	1380	50	0	n	1	-90	0	57.0	Hard	A	1.5		1.5															62.8
															-																R3_Day_Total	**71**
R3 - East Façade Podium, Night	Vanier Parkway Southbound	8	1232	98	70	60	0	n	1	-90	90	20.0	Soft	A	1.5		1.5															59.5
	Vanier Parkway Northbound	8	1232	98	70	60	0	n	1	-90	90	35.0	Hard	A	1.5		1.5															59.4
	Montreal Road	8	2112	168	120	50	0	n	1	-90	0	57.0	Hard	A	1.5		1.5															55.2
																															R3_Night_Total	**63**
R4 - East Façade Tower, Day	Vanier Parkway Southbound	16	14168	1127	805	60	0	n	1	-90	90	23.0	Soft	A	1.5		7.5															66.8
	Vanier Parkway Northbound	16	14168	1127	805	60	0	n	1	-90	90	38.0	Hard	A	1.5		7.5															66.7
	Montreal Road	16	24288	1932	1380	50	0	n	1	-90	0	57.0	Hard	A	1.5		7.5															62.8
															-																R4_Day_Total	**71**
R4 - East Façade Tower, Night	Vanier Parkway Southbound	8	1232	98	70	60	0	n	1	-90	90	23.0	Soft	A	1.5		7.5															59.2
	Vanier Parkway Northbound	8	1232	98	70	60	0	n	1	-90	90	38.0	Hard	A	1.5		7.5															59.1
	Montreal Road	8	2112	168	120	50	0	n	1	-90	0	57.0	Hard	A	1.5		7.5															55.2
																															R4_Night_Total	**63**
R5 - South Façade, Day	Vanier Parkway Southbound	16	14168	1127	805	60	0	n	1	0	90	30.0	Soft	A	1.5		1.5															61.3
	Vanier Parkway Northbound	16	14168	1127	805	60	0	n	1	0	90	45.0	Hard	A	1.5		1.5															63.0
	Montreal Road	16	24288	1932	1380	50	0	n	1	-90	90	47.0	Hard	A	1.5		1.5															66.6
															-																R5_Day_Total	**69**
R5 - South Façade, Night	Vanier Parkway Southbound	8	1232	98	70	60	0	n	1	0	90	30.0	Soft	A	1.5		1.5															53.7
	Vanier Parkway Northbound	8	1232	98	70	60	0	n	1	0	90	45.0	Hard	A	1.5		1.5															55.4
	Montreal Road	8	2112	168	120	50	0	n	1	-90	90	47.0	Hard	A	1.5		1.5															59.0
																															R5_Night_Total	**61**
R6 - West Façade, Day	Montreal Road	16	24288	1932	1380	50	0	n	1	0	90	53.0	Hard	A	1.5		1.5															63.1
															-																R6_Day_Total	**63**

Receptor	Roadway 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)	Topo-graphy Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Ground Elevation Change (m)			Barrier Height (m)	Barrier Elevation (m asl)	Barrier-Reciever Distance (m)	Barrier Viewable Angle		No. of Rows of Houses	Density of Houses (% Houses)	Depth of Woods	Adjustment (dB)	Reason For Adjustment	**Total Segment L_{eq} (dBA)**
			Autos	Medium	Heavy					Θ_1	Θ_2								Elevation Change e (m)	Hor. Dist a (m)	Hor. Dist b (m)				Θ_1	Θ_2						
R6 - West Façade, Night	Montreal Road	8	2112	168	120	50	0	n	1	0	90	53.0	Hard	A	1.5		1.5														55.5
																														R6_Night_Total	**56**
R7 - North Façade, Day	Vanier Parkway Southbound - north segment	16	14168	1127	805	60	0	n	1	-90	-35	32.0	Soft	A	1.5		1.5														57.7
	Vanier Parkway Nouthbound - north segment	16	14168	1127	805	60	0	n	1	-90	-35	47.0	Hard	A	1.5		1.5														60.7
	Vanier Parkway Southbound - south segment	16	14168	1127	805	60	0	n	1	-50	5	26.0	Soft	A	1.5		1.5														61.4
	Vanier Parkway Nouthbound - south segment	16	14168	1127	805	60	0	n	1	-50	4	41.0	Hard	A	1.5		1.5														61.1
															-															R7_Day_Total	**66**
R7 - North Façade, Night	Vanier Parkway Southbound - north segment	8	1232	98	70	60	0	n	1	-90	-35	32.0	Soft	A	1.5		7.5														51.2
	Vanier Parkway Nouthbound - north segment	8	1232	98	70	60	0	n	1	-90	-35	47.0	Hard	A	1.5		7.5														53.2
	Vanier Parkway Southbound - south segment	8	1232	98	70	60	0	n	1	-50	5	26.0	Soft	A	1.5		7.5														54.3
	Vanier Parkway Nouthbound - south segment	8	1232	98	70	60	0	n	1	-50	4	41.0	Hard	A	1.5		7.5														53.6
															-															R7_Night_Total	**59**

APPENDIX C

Job Name: 263 Greensway **Job Number:** 1802859

Room Name: East Façade - Bedroom

Room Dimensions

Length	4.0	m	Floor Area	16.0	m^2	Volume	51.2	m^3
Width	4.0	m	Ceiling Area	16.0	m^2			
Height	3.2	m	Wall Area	51.2	m^2			
			Total Area	83.2	m^2			

Room Effect Calculations

Surface	Finish	Description	Area (m^2)		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Floor	2	Perfect Reflection	16.0	Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceiling	7	Plaster Ceiling	16.0	Alpha (α)	0.1	0.14	0.1	0.06	0.05	0.04	0.03	0.05
				S·α	1.6	2.2	1.6	1.0	0.8	0.6	0.5	0.8
Wall	8	1/2" Gypsum wall board	43.2	Alpha (α)	0.29	0.29	0.1	0.05	0.04	0.07	0.09	0.07
				S·α	12.5	12.5	4.3	2.2	1.7	3.0	3.9	3.0
Window	17	Window, std. glass	8	Alpha (α)	0.2	0.35	0.25	0.18	0.12	0.07	0.04	0.02
				S·α	1.6	2.8	2.0	1.4	1.0	0.6	0.3	0.2
	2	Perfect Reflection		Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	Perfect Reflection		Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Area for use in calculation =			83.2	m^2								

	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Total S·α	15.7	17.6	7.9	4.6	3.5	4.2	4.7	4.0
Average α	0.19	0.21	0.10	0.05	0.04	0.05	0.06	0.05
Reverberation Time RT_{60} (sec.)	0.52	0.47	1.04	1.81	2.36	1.95	1.76	2.07
Room Constant R (m^2)	19.4	22.3	8.8	4.8	3.6	4.4	5.0	4.2

Sound Levels Within Room

Assumes receiver is within near-field of the window source. Window Area 8 m^2

Assumes window is dominant source of sound from building envelope

SPL within room is therefore: $SPL_2 = SPL_1 - TL + NR$

$SPL_2 = SPL_1 - TL + 10 \log (1/4 + S/R)$, where S is area of window

			Unit	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Total	
SPL1 (in plane of window)			(dB)	64.5	64.0	60.5	61.0	69.3	63.2	54.7	51.5	72.7	<< Exterior SPL
			(dBA)	38.3	47.9	51.9	57.8	69.3	64.4	55.7	50.4	71.0	
TL	347	SAFLEX: Nonlaminate {4[12AS]4}	(dB)	14.6	25.7	19.1	28.7	36.7	39.0	36.1	36.1	n/a	<< STC 32
Noise Reduction (10 log (1/4 + S/R))			(dB)	-1.8	-2.2	0.7	2.8	3.9	3.1	2.7	3.3	n/a	
Total SPL in Hotel Room (SPL_2)			(dB)	**48.2**	**36.1**	**42.0**	**35.1**	**36.5**	**27.3**	**21.3**	**18.8**	49.7	
			(dBA)	22.0	20.0	33.4	31.9	36.5	28.5	22.3	17.7	39.7	**40** dBA TARGET

Job Name: 263 Greensway **Job Number:** 1802859

Room Name: South Façade - Bedroom

Room Dimensions

Length	4.0	m	Floor Area	16.0	m^2	Volume	51.2	m^3
Width	4.0	m	Ceiling Area	16.0	m^2			
Height	3.2	m	Wall Area	51.2	m^2			
			Total Area	83.2	m^2			

Room Effect Calculations

Surface	Finish	Description	Area (m^2)		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Floor	2	Perfect Reflection	16.0	Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ceiling	7	Plaster Ceiling	16.0	Alpha (α)	0.1	0.14	0.1	0.06	0.05	0.04	0.03	0.05
				S·α	1.6	2.2	1.6	1.0	0.8	0.6	0.5	0.8
Wall	8	1/2" Gypsum wall board	43.2	Alpha (α)	0.29	0.29	0.1	0.05	0.04	0.07	0.09	0.07
				S·α	12.5	12.5	4.3	2.2	1.7	3.0	3.9	3.0
Window	17	Window, std. glass	8	Alpha (α)	0.2	0.35	0.25	0.18	0.12	0.07	0.04	0.02
				S·α	1.6	2.8	2.0	1.4	1.0	0.6	0.3	0.2
	2	Perfect Reflection		Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	Perfect Reflection		Alpha (α)	0	0	0	0	0	0	0	0
				S·α	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Area for use in calculation =			83.2	m^2								

	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Total S·α	15.7	17.6	7.9	4.6	3.5	4.2	4.7	4.0
Average α	0.19	0.21	0.10	0.05	0.04	0.05	0.06	0.05
Reverberation Time RT_{60} (sec.)	0.52	0.47	1.04	1.81	2.36	1.95	1.76	2.07
Room Constant R (m^2)	19.4	22.3	8.8	4.8	3.6	4.4	5.0	4.2

Sound Levels Within Room

Assumes receiver is within near-field of the window source.

Assumes window is dominant source of sound from building envelope

SPL within room is therefore: $SPL_2 = SPL_1 - TL + NR$

$SPL_2 = SPL_1 - TL + 10 \log (1/4 + S/R)$, where S is area of window

Window Area 8 m^2

			Unit	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Total	
SPL1 (in plane of window)			(dB)	62.5	62.0	58.5	59.0	67.3	61.2	52.7	49.5	70.7	<< Exterior SPL
			(dBA)	36.3	45.9	49.9	55.8	67.3	62.4	53.7	48.4	69.0	
TL	346	SAFLEX: Nonlaminate {3[12AS]3}	(dB)	10.6	24.8	17.8	24.5	34.3	42.5	34.0	34.0	n/a	<< STC 30
Noise Reduction (10 log (1/4 + S/R))			(dB)	-1.8	-2.2	0.7	2.8	3.9	3.1	2.7	3.3	n/a	
Total SPL in Hotel Room (SPL_2)			(dB)	**50.2**	**35.0**	**41.4**	**37.3**	**36.9**	**21.8**	**21.4**	**18.9**	51.2	
			(dBA)	24.0	18.9	32.8	34.1	36.9	23.0	22.4	17.8	40.0	**40** dBA TARGET