Integral dx
ENGINEERING LTD.

NOISE IMPACT ASSESSMENT STUDY

Development Address:
765 Montreal Road
Ottawa, Ontario

City of Ottawa File Number: D07-12-18-0059

Client:
Shepherds of Good Hope

c/o:
CSV Architects
402-1066 Somerset Street West
Ottawa, ON

Attention: Rick Kellner, M.Arch, OAA

Prepared by:
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10 May 2018

NOISE IMPACT ASSESSMENT STUDY

Shepherds of Good Hope Residential Development and Community Centre
765 Montreal Road
Ottawa, Ontario

City of Ottawa File Number: D07-12-18-0059

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EXECUTIVE SUMMARY

In accordance with the City of Ottawa's Environmental Noise Control Guidelines (ENCG), this report and associated study present an assessment of the environmental noise impacting on the property identified as the Shepherds of Good Hope Residential Development and Community Centre, located at 765 Montreal Road in Ottawa, Ontario. This development proposal is made by CSV Architects on behalf of Shepherds of Good Hope.

With respect to the residential intention of the development, the assessment indicates that indoor noise level limits for some units will only be met when windows are closed. Therefore, central air conditioning needs to be provided for these units. This also requires that Notices-on-Title be incorporated into all Agreements of Lease or Purchase and Sale, and incorporated into the Development Agreements which are registered on the property title.

An assessment of noise transmission via building envelope components (windows, doors, and exterior walls) is also included, in order to confirm minimum construction requirements for façade elements which ensure that indoor noise level requirements will be met.

The assessment also indicates that outdoor sound level limits will be met at the outdoor amenity area identified as the North Patio. An additional outdoor amenity area, identified as the North Yard, will be subject to noise levels within a 5 dB tolerance above the applicable sound level limit. However, because of the nature of the site and local grade, there are no practical solutions to mitigate noise levels in that area.

The results indicate that the noise emissions for the site will, with respect to background levels of noise, comply with City of Ottawa Environmental Noise Control Guidelines and therefore, do not constrain the proposed property development.

1.0 INTRODUCTION / BACKGROUND INFORMATION

In accordance with the City of Ottawa's Environmental Noise Guidelines (ENCG), this report provides a detailed study of the environmental noise impact upon the development proposed by CSV Architects and located at 765 Montreal Road in Ottawa, Ontario.

The proposed development is a four storey mixed-use building. A community centre on the ground floor will include a shared kitchen and dining room, along with office spaces and other indoor amenity spaces. The upper floors will include a total of 42 studio apartments. Two outdoor amenity space or Outdoor Living Areas (OLAs) will be provided on the north side of the property: a patio immediately north of the proposed building (“North Patio”), and an elevated, landscaped lawn north of the parking lot (“North Yard”). A retaining wall will be built between the parking lot and the North Yard, accommodating a grade change of approximately 3.5 metres.

In accordance with City and Provincial Guidelines, ambient noise levels due to significant sources of road traffic are assessed and compared with applicable sound level limits. Noise levels are calculated for the community centre spaces and studio apartments with significant exposure to Montreal Road, as well as at the identified outdoor amenity areas.

Site plans are provided in Appendix A, with the assessment locations marked.

1.1 REFERENCES

This study is based on information presented in the following documents specific to the project:

- Drawings A100, A200, A201, A300, and A301, received via email on 27 April 2018
- Project Outline Specification 01, dated 2017-09-05

Reference is made to the following documents:

1) Ontario Ministry of the Environment and Climate Change (MOECC) Environmental Noise Guideline publication NPC-300: Stationary and Transportation Sources - Approval and Planning, dated August 2013
2) City of Ottawa Environmental Noise Control Guidelines, updated January 2016 (ENCG)

3) Ontario Ministry of the Environment and Climate Change (MOECC) modelling tool STAMSON, version 5.02

4) DBR/NRC Building Research Note BRN148: Acoustic Insulation Factor, dated June, 1980.

In this report:

- Unless otherwise indicated, noise levels are reported in terms of sound pressure levels ("SPL") in decibels, referenced to $2x10^{-5}$ pascals.

1.2 PURPOSE

The purpose of this report is to demonstrate that the Shepherds of Good Hope Residential Development and Community Centre can be developed in a manner that meets all applicable requirements with respect to environmental noise.

1.3 SCOPE

This Noise Impact Assessment Study presents a detailed study of the issues, as defined by the ENCG. No further study is required or proposed.

The scope of this report is limited to the issues described above, and makes no claim as to the validity of the noise level criteria or their ability to satisfy the expectations of all persons.

2.0 SOUND LEVEL CRITERIA

2.1 TRANSPORTATION NOISE

This property is categorized as Class 1, with an acoustical environment typical of a major population centre, and the land use is classified as “noise sensitive” (ref. NPC-300). The applicable outdoor and indoor sound level limits due to road noise per the ENCG and NPC-300 are summarized in Table 1 and Table 2. Supplementary, good-practice design objectives for other types of indoor spaces are provided in Table 3, per the ENCG. There are no significant sources of rail or aircraft noise in the vicinity of the project.

Table 1: Sound Level Limit for Outdoor Living Areas

Time Period	L_{eq}(16) dBA
16 hours betwee 07:00-23:00	55*

*Where it can be demonstrated to the satisfaction of the City of Ottawa that achieving the outdoor 55 dBA L_{eq} is not technically or economically feasible, a tolerance of not more than 5 dB above the stated limit may be acceptable.

Table 2: Sound Level Limits for Indoor Living Areas

Type of Space	Time Period	Road L_{eq} dBA
Living/dining/den areas of residences	16 hours between 07:00-23:00	45
	8 hours between 23:00-07:00	45
Sleeping quarters	16 hours between 07:00-23:00	45
	8 hours between 23:00-07:00	40

Table 3: Supplementary Sound Level Limits for Indoor Spaces

Type of Space	Time Period	Road L_{eq} dBA
General offices, reception areas, retail stores, etc.	16 hours between 07:00-23:00	50
Theatres, places of worship, libraries, individual or semi- private offices, conference rooms, reading rooms, etc.	16 hours between 07:00-23:00	45

The indoor sound level analysis is based on sound levels calculated at the façades or Planes Of Windows (POW) to noise-sensitive indoor spaces. Depending on POW noise levels, noise control measures affecting ventilation systems for residential units (to allow windows to remain closed), and/or an analysis to identify minimum façade constructions to reduce sound transmission to indoor spaces, may be required to ensure indoor noise limits are met. The requirements are summarized in Table 4 and Table 5, per NPC-300.

Table 4: Noise Control Measures (Daytime – Road Noise)

Assessment Location	Sound Level (dBA L_{eq} 16hr)	Ventilation Requirements	Building Component Requirements
Plane of a bedroom or living/dining room window	Less than or equal to 55	None	Per the Ontario Building Code
	Greater than 55 and less than or equal to 65	Provision for the installation of central air conditioning in the future, at occupant's discretion	
	Greater than 65 dBA	Central air conditioning	Building components must be designed to ensure indoor criteria are met*

* Per the ENCG (Section 5.2, page 14), the preferred assessment method is the Acoustic Insulation Factor (AIF) method.

Table 5: Noise Control Measures (Nighttime – Road Noise)

Assessment Location	Sound Level (dBA Leq 8hr)	Ventilation Requirements	Building Component Requirements
Plane of a bedroom or living/dining room window	Less than or equal to 50	None	Per the Ontario Building Code
	Greater than 50 and less than or equal to 60	Provision for the installation of central air conditioning in the future, at occupant's discretion	
	Greater than 60 dBA	Central air conditioning	Building components must be designed to ensure indoor criteria are met*

* Per the ENCG (Section 5.2, page 14), the preferred assessment method is the Acoustic Insulation Factor (AIF) method.

2.2 STATIONARY SOURCE NOISE

In the following table, sound level exclusion limits for noise due to stationary sources are extracted from the MOECC Guideline.

Table 6: Stationary Noise Exclusion Limits for Class 1 Area

Receiver Area (Class #)	Time Period	Exclusion Limit Value, 1-hour L_{eq}, dBA	
		Outdoor Point of Reception	*Plane of Window of Noise Sensitive Space*
Class 1 (Ref: MOECC NPC-300)	07:00 – 19:00	50	50
	19:00 - 23:00	50	50
	23:00 - 07:00	(n/a)	45

Per NPC-300, unless it can be demonstrated that background sound levels consistently exceed the exclusion limits in a given time period, the exclusion limits set the sound level limit for noise from a stationary source.

3.0 TRANSPORTATION NOISE ASSESSMENT

3.1 ROADWAY TRAFFIC INFORMATION

The City of Ottawa Transportation Master Plan has been used to identify significant roadways within the vicinity of the project that must be included in noise level calculations. The significant roadways are Montreal Road (divided into eastbound and westbound segments), and Den Haag Drive (see the Area Plan, Figure 2). Average Annual Daily Traffic (AADT) volumes have been assigned and divided by time-of-day and vehicle categories per ENCG requirements (ENCG, Appendix B). The traffic data used for noise level calculations are summarized in Table 7.

Table 7: Roadway Traffic Flow Data

Roadway Segment	Roadway Class	Speed Limit	Total AADT	AADT by Vehicle Type and Time of Day (Daytime / Nighttime)		
				Cars	Medium Trucks	Heavy Trucks
Montreal Road, Westbound	4-Lane Urban Arterial Divided	60 km/h	35000	14168/1232	1127/98	805/70
Montreal Road, Eastbound				14168/1232	1127/98	805/70
Den Haag Drive	2-Lane Urban Collector Undivided	40 km/h	8000	6477/563	515/45	368/32

Traffic flow was presumed to be at the centre of each roadway segment, as is normal practice.

3.2 POINTS OF ASSESSMENT

The following Points of Assessment (POA) form part of this Noise Study. These locations have been selected due to their potential to be worst-case locations in terms of noise levels or building component requirements. The assessment locations are shown on the Site Plan included in Appendix A.

- POA 'A' is located on the south façade of the building closest to Den Haag Drive, with full exposure to Montreal Road. The assessment height is 2.0 m

above ground, corresponding to the approximate centre height of the ground floor. The calculated sound level also corresponds to sound levels for the upper floors.

- POA 'B' is located on the angled south-west corner of the building. The assessment height is 5.6 m, corresponding to the approximate centre height of the second floor. The calculated sound level also corresponds to sound levels for the upper floors.
- POA 'C' is located at approximately the centre of the outdoor amenity space identified as the North Yard. The POA is located 1.5 metres above grade.
- POA 'D' is located at approximately the centre of the outdoor amenity space identified as the North Patio. The POA is located 1.5 metres above grade.

Our calculations assume a flat topography for POA 'A', POA 'B', and POA 'D'. A height difference of 4.5 metres between the roadways and the OLA grade has been accounted for at POA 'C'.

3.3 TRAFFIC NOISE CALCULATION DETAILS AND RESULTS

Noise level calculations were made at each POA using the MOECC tool STAMSON, version 5.02. Table 8 summarizes distances and angles used for calculations at each POA. The detailed calculation results are included as Appendix B, and the results are summarized in Table 9.

Table 8: STAMSON Calculation Details

POA			Roadway Segments				Barriers				
ID	Height (m)	Gnd Elev (m)	Name	Angles (deg)	D to POA (m)	Gnd Elev (m)	Description	Angles (deg)	D to POA (m)	Height (m)	Gnd Elev (m)
A	2	0.0	MontrealW	-90 to 90	15.0	0.0	(none)				
			MontrealE	-90 to 90	25.6	0.0	(none)				
			DenHaag	60 to 90	16.8	0.0	(none)				
B	5.6	0.0	MontrealW	-45 to 90	16.9	0.0	(none)				
			MontrealE	-45 to 90	27.7	0.0	(none)				
			DenHaag	60 to 90	16.8	0.0	(none)				
C	1.5	94.0	DenHaag	67 to 90	28.0	89.5	Proposed Building	67 to 90	15.8	13.6	90.8
			MTL-1W	-90 to 53	49.9	89.5	Proposed Building	-49 to 47	17.0	13.6	90.8
			MTL-1E	-90 to 53	60.8	89.5	Proposed Building	-49 to 47	17.0	13.6	90.8
			MTL-2W	53 to 90	49.9	89.5	Rexall Building	53 to 90	31.9	7.0	89.5
			MTL-2E	53 to 90	60.8	89.5	Rexall Building	53 to 90	31.9	7.0	89.5
D	1.5	0.0	MontrealW	-90 to 90	33.9	0.0	Proposed Building	-90 to 90	2.0	13.6	0.0
			MontrealE	-90 to 90	45.0	0.0	Proposed Building	-90 to 90	2.0	13.6	0.0
			DenHaag	63 to 90	28.0	0.0	Proposed Building	63 to 90	15.8	13.6	0.0

Table 9: Summary of Traffic Noise Level Calculation Results

Location	Predicted Noise Level Daytime (OLA or plane of window)	Predicted Noise Level Nighttime (plane of bedroom window)
POA 'A' South façade, all levels	73 dBA L_{eq}	65 dBA L_{eq}
POA 'B' SW corner, all levels	71 dBA L_{eq}	64 dBA L_{eq}
POA 'C' OLA: North Yard	58 dBA L_{eq}	N/A
POA 'D' OLA: North Patio	51 dBA L_{eq}	N/A

3.4 INDOOR NOISE CONTROL MEASURES: STUDIO APARTMENTS

The calculation results at POA 'A' and POA 'B' indicate that noise control measures are required for studio apartments along the south façade to ensure indoor noise level limits are met. Central air conditioning must be provided for these units, so that windows can remain closed. An evaluation of noise transmission via the building envelope is also required to confirm that the indoor criteria will be met for the south units (see Section 3.7 and Appendix C).

In addition to the above-noted noise control measures, Notices-on-Title are required with respect to noise for the units along the south façade. Recommended wording is included in Appendix D. There are no noise control requirements for the studio apartments located along the north façade.

3.5 INDOOR NOISE CONTROL MEASURES: COMMUNITY CENTRE

An evaluation of noise transmission via the building envelope was completed in order to determine window constructions that will allow the supplemental indoor sound level limits to be met in the community centre rooms along the south façade of the building (see Section 3.7 and Appendix C).

3.6 NOISE CONTROL MEASURES: OUTDOOR AMENITY AREAS

The noise level calculation at POA 'C' exceeds the 55 dBA limit for transportation noise. As a result of the local grade, there are no practical noise mitigation measures to reduce noise at the North Yard. It is worth noting that occupants will have access to the North Patio, which complies with the MOECC and ENCG

outdoor sound level limit. The North Yard is also within the 5 dB tolerance noted in the ENCG.

No noise control measures are recommended for the North Yard. A Notice-on-Title is recommended to alert purchasers of the potential for disturbance. Recommended wording is included in Appendix D.

3.7 ACOUSTIC INSULATION FACTOR ANALYSIS

An Acoustic Insulation Factor analysis was performed according to DBR/NRC Building Research Note BRN148 in order to confirm façade component construction requirements that will ensure indoor sound level limits are met within studio apartments and the ground floor community centre spaces. The façade components include the exterior wall, windows that are fixed and sealed to the frame, and operable windows. The glass entry door to the Meeting Room on the ground floor was treated as an operable window. With reference to Table 3, the best-practice indoor sound level limit for the noise-sensitive community centre spaces along the south façade (Meeting Room, TV Room, Games Room, and Micro Winery) was set at 45 dBA.

Intermediate calculation results for the Acoustic Insulation Factor analysis are provided in Appendix C.

3.7.1 Exterior Wall Construction

The project Outline Specification includes the following description for exterior wall constructions:

- 16mm type “X” gypsum board
- 6mil poly vapour barrier
- 152mm load-bearing wood framing at 600mm o/c
- 140mm mineral wool insulation in wall cavity
- 11mm OSB sheathing
- Vapour permeable self-adhesive air barrier
- 32mm high density rigid mineral fibre insulation
- 25mm air space
- Cladding:
  - 25% masonry brick veneer
  - 25% 19 x 64mm wood strapping 406mm o/c under pre-finished metal siding
  - 50% 19 x 64mm wood strapping 40mm o/c under cement board panels

No upgrades to the proposed exterior wall constructions are required to meet indoor noise level limits. In order to determine window construction requirements, the exterior wall performance was set as equivalent to NRC exterior wall type EW3 (ref: BRN148) in our analysis. The construction proposed above will achieve superior performance with all cladding options.

3.7.2 Fixed and Operable Windows

Table 10 describes the minimum window construction requirements in order to meet indoor sound level limits for the noise-sensitive areas of the building. The noise isolation requirements can be met with single- or double-glazed units at all locations. However, the project Outline Specification lists triple-glazing for exterior windows, which are expected to achieve superior performance.

The window requirements are determined based on the floor area of the indoor space and the total area of each type of its associated façade components. Therefore, any change to floor plans and/or the size or composition of façade components may change these requirements. Window units which include thicker glass panes and/or greater interpane space(s) than indicated in Table 10 will also meet noise isolation requirements.

Table 10: Minimum Window Requirements

Indoor Location	Fixed Window	Operable Windows
Studio apartments, south façade, all floors	Single pane 2mm thick, or Double glazing, 2-6-2*, or Triple glazing	Single pane 2mm thick, or Double glazing, 2-6-2*, or Triple glazing
Studio apartments, north façade, all floors	Per OBC	Per OBC
Meeting Room 111	Double glazing, 3-13-6*, or Triple glazing, 3-6-3-6-6**	Entry door: Single pane 2mm thick, or Double glazing, 2-6-2*, or Triple glazing
Ground floor amenity spaces: TV Room, Games Room, and Micro Winery	Single pane 4mm thick, or Double glazing, 3-13-3*, or Triple glazing, 3-6-3-6-3**	(no operable windows shown)
Other ground floor amenity spaces	Per OBC	Per OBC

*Double glazing entries are in the format “a-b-c” where:
a is the thickness of the first pane of glass, in mm
b is the interpane thickness, in mm, and
c is the thickness of the second pane of glass, in mm

**Triple glazing entries use the same format as double glazing, with additional numbers representing the additional interpane and glass thicknesses.

4.0 STATIONARY NOISE IMPACT ASSESSMENT

4.1 ON-SITE STATIONARY NOISE SOURCE EMISSIONS

With reference to the ENCG and NPC-300, operation of the Shepherds of Good Hope Residential Development and Community Centre, in its entirety, is considered a “Stationary Source”. All individual noise sources (e.g. rooftop mechanical equipment) for this site must therefore be designed to comply with City of Ottawa and MOECC requirements for noise emissions from a stationary source.

Therefore, as part of the mechanical design, any new exterior equipment serving common areas of the building must be selected to comply with City of Ottawa noise limits at adjacent noise-sensitive land uses.

4.2 OFF-SITE STATIONARY NOISE SOURCE EMISSIONS

A site visit was conducted on 27 April 2018 to review the site and its surroundings. The nearest potentially significant stationary noise sources are located on the rooftop of the Rexall pharmacy just west of the site across Lang's Road. Based on available satellite imagery, the nearest rooftop units are approximately 35 metres from the west façade of the proposed development. The rooftop units were inaudible from various positions on the ground at the time of our visit. It is further noted that there are no windows to noise-sensitive indoor areas on the west façade of the proposed development, further reducing the potential for disturbance. The roof edge of the pharmacy building provides significant obstruction of line-of-sight to the OLAs, therefore reducing noise level from the equipment for ground-level receivers.

No other potentially significant stationary noise sources were identified in the vicinity of the proposed development. We therefore conclude that there are no concerns regarding the impact of existing off-site stationary noise sources upon the proposed development.

5.0 RECOMMENDATIONS

The following noise control measures are recommended for the control of noise from transportation sources:

- South-facing studio apartment windows (including at southwest corner units) with minimum specifications as follows:
  - Double glazing: 2mm glass, 6mm interpane spacing, and 2mm glass; or
  - Triple glazing.
- South-facing community centre amenity room windows with minimum specifications as follows (additional options are included in Table 10):
  - Double glazing: 3mm glass, 13mm interpane spacing, and 6mm glass; or
  - Triple glazing: 3mm glass, 6mm interpane spacing, 3mm glass, 6mm interpane spacing, and 6mm glass.
- Central air conditioning for all studio apartments along the south façade.
- Notices-on-Title respecting noise (see recommended wording in Appendix D).

In addition to the above, any new on-site mechanical equipment for the proposed development shall be designed to meet ENCG and NPC-300 requirements for noise emissions from a stationary source.

We conclude that the project can be developed such that all environmental noise requirements are met.

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Pier-Gui Lalonde, P.Eng., ing.

Checked by:

Patrick Trahan, M.A.Sc., EIT

Approved by:

Gregory E. Clunis, P.Eng.

10 May 2018

This Noise Impact Assessment Study was prepared by Integral DX Engineering for the account of Shepherds of Good Hope. The material in it reflects Integral DX Engineering's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibilities of such third parties. Integral DX Engineering accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Attachments:

Appendix A: Site Plans

Appendix B: Stamson 5.02 outputs dated 9 May 2018

Appendix C: Results of AIF Analysis

Appendix D: Recommended wording for Notices-on-Title

APPENDIX A: SITE PLANS

(attachment to Integral DX Engineering Ltd. report dated 10 May 2018)

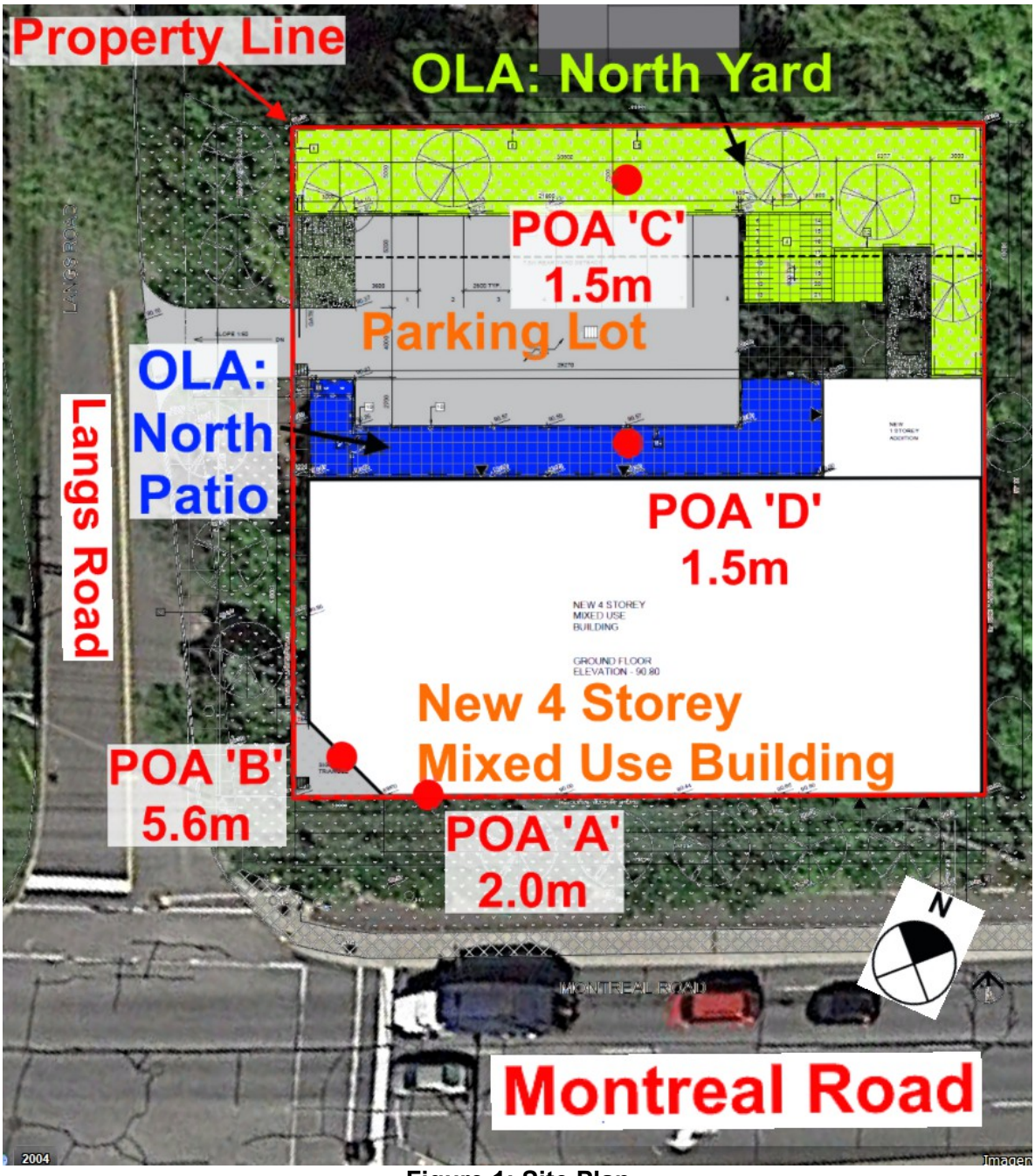

Figure 1: Site Plan

Included in Figure 1: property line, location of the proposed building, POA heights, OLAs.

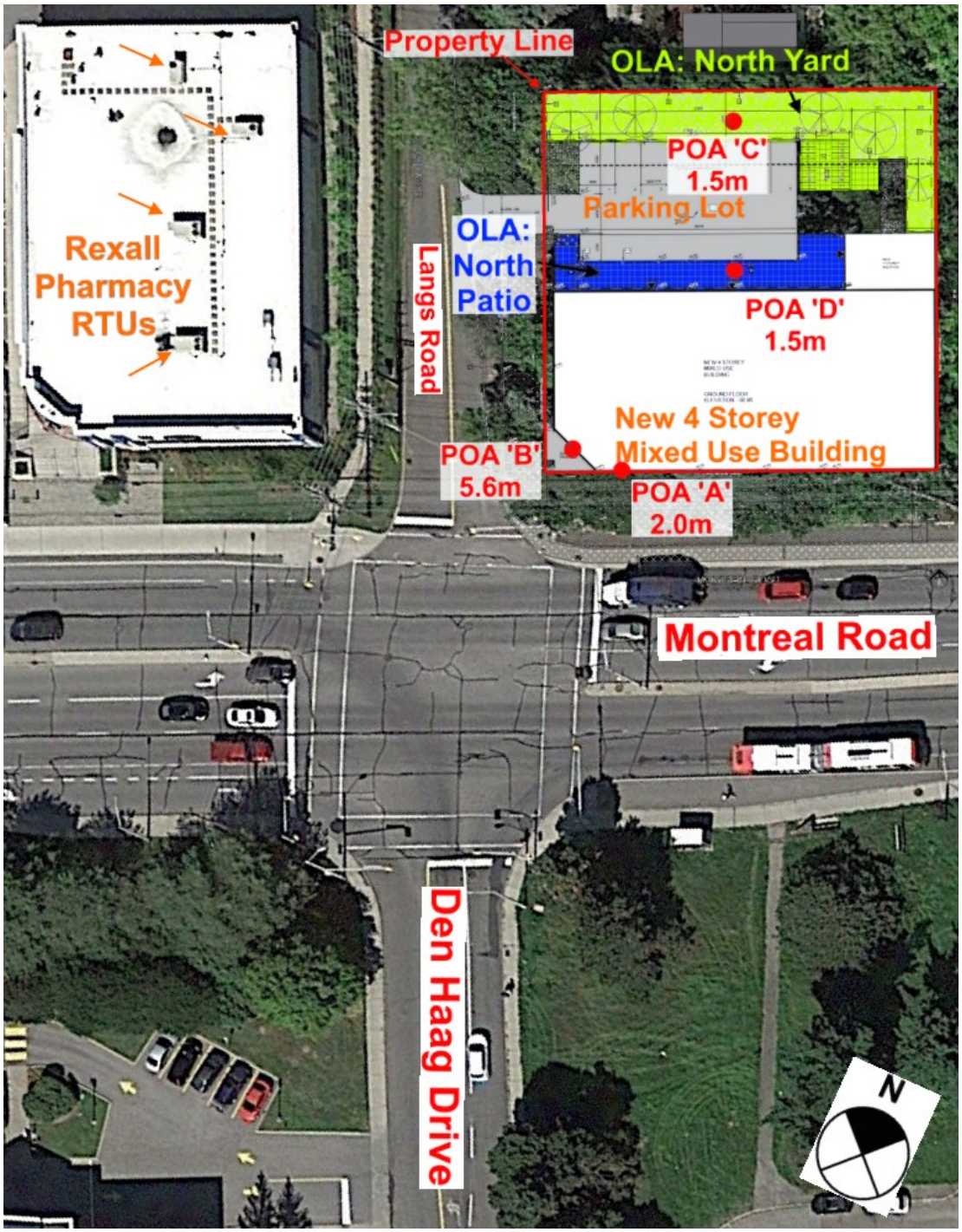

Figure 2: Area Plan

Included in Figure 2: significant roadways, Lang's Road (insignificant roadway), location of Rexall pharmacy and associated rooftop equipment.

APPENDIX B: STAMSON 5.02 OUTPUTS DATED 9 MAY 2018

(attachment to Integral DX Engineering Ltd. report dated 10 May 2018)

```
STAMSON 5.0        SUMMARY REPORT        Date: 09-05-2018 15:36:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: POA_A.te             Time Period: Day/Night 16/8 hours
Description: 765 Montreal Road, S facade near SW corner.


Road data, segment # 1: MontrealW (day/night)
----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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: MontrealW (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  :  15.00 / 15.00  m
Receiver height           :   2.00 / 2.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Road data, segment # 2: MontrealE (day/night)
----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 2: MontrealE (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  :  25.60 / 25.60  m
Receiver height           :   2.00 / 2.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00



Road data, segment # 3: DenHaag (day/night)
-------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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 # 3: DenHaag (day/night)
-----------------------------------------
Angle1   Angle2           :  60.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.80 / 16.80  m
Receiver height           :   2.00 / 2.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

Result summary (day)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.MontrealW	1.50	70.67	70.67
2.MontrealE	1.50	68.34	68.34
3.DenHaag	1.50	55.68	55.68
Total			72.76 dBA

Result summary (night)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.MontrealW	1.50	63.07	63.07
2.MontrealE	1.50	60.75	60.75
3.DenHaag	1.50	48.09	48.09
Total			65.16 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 72.76
(NIGHT): 65.16

```
STAMSON 5.0        SUMMARY REPORT        Date: 09-05-2018 15:36:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: POA_B.te             Time Period: Day/Night 16/8 hours
Description: 765 Montreal Road, SW corner angled facade.


Road data, segment # 1: MontrealW (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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: MontrealW (day/night)
-------------------------------------------
Angle1   Angle2           : -45.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.90 / 16.90  m
Receiver height           :   5.60 / 5.60   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00



Road data, segment # 2: MontrealE (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 2: MontrealE (day/night)
-------------------------------------------
Angle1   Angle2           : -45.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  27.70 / 27.70  m
Receiver height           :   5.60 / 5.60   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00



Road data, segment # 3: DenHaag (day/night)
-------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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 # 3: DenHaag (day/night)
-----------------------------------------
Angle1   Angle2           :  60.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.80 / 16.80  m
Receiver height           :   5.60 / 5.60   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00



Result summary (day)
--------------------

                  !  source  !   Road   !  Total
                  !  height  !   Leq    !   Leq
                  !   (m)    !  (dBA)   !  (dBA)
```

1.MontrealW	1.50	68.90	68.90
2.MontrealE	1.50	66.75	66.75
3.DenHaag	1.50	55.68	55.68
Total			71.09 dBA

Result summary (night)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.MontrealW	1.50	61.30	61.30
2.MontrealE	1.50	59.16	59.16
3.DenHaag	1.50	48.09	48.09
Total			63.50 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.09
(NIGHT): 63.50

```
STAMSON 5.0        SUMMARY REPORT        Date: 09-05-2018 15:36:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: POA_C.te             Time Period: Day/Night 16/8 hours
Description: 765 MTL Road, OLA centre north yard.


Road data, segment # 1: DenHaag (day/night)
-------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: DenHaag (day/night)
-----------------------------------------
Angle1   Angle2           :  67.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  28.00 / 28.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  67.00 deg   Angle2 : 90.00 deg
Barrier height            :  13.60 m
Elevation                 :   4.50 m
Barrier receiver distance :  15.80 / 15.80  m
Source elevation          :  89.50 m
Receiver elevation        :  94.00 m
Barrier elevation         :  90.80 m
Reference angle           :   0.00


Road data, segment # 2: MTL-1W (day/night)
------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 2: MTL-1W (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  49.90 / 49.90  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -49.00 deg   Angle2 : 47.00 deg
Barrier height            :  13.60 m
Elevation                 :   4.50 m
Barrier receiver distance :  17.00 / 17.00  m
Source elevation          :  89.50 m
Receiver elevation        :  94.00 m
Barrier elevation         :  90.80 m
Reference angle           :   0.00



Road data, segment # 3: MTL-1E (day/night)
------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 3: MTL-1E (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                    :      1        (Absorptive ground surface)
Receiver source distance   :  60.80 / 60.80  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      4        (Elevated; with barrier)
Barrier angle1             : -49.00 deg   Angle2 : 47.00 deg
Barrier height             :  13.60 m
Elevation                  :   4.50 m
Barrier receiver distance  :  17.00 / 17.00  m
Source elevation           :  89.50 m
Receiver elevation         :  94.00 m
Barrier elevation          :  90.80 m
Reference angle            :   0.00


Road data, segment # 4: MTL-2W (day/night)
------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 4: MTL-2W (day/night)
----------------------------------------
Angle1   Angle2            :  53.00 deg   90.00 deg
Wood depth                 :      0        (No woods.)
No of house rows           :      0 / 0
Surface                    :      2        (Reflective ground surface)
Receiver source distance   :  49.90 / 49.90  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      4        (Elevated; with barrier)
Barrier angle1             :  53.00 deg   Angle2 : 90.00 deg
Barrier height             :   7.00 m
Elevation                  :   4.50 m
Barrier receiver distance  :  31.90 / 31.90  m
Source elevation           :  89.50 m
Receiver elevation         :  94.00 m
Barrier elevation          :  89.50 m
Reference angle            :   0.00
```

```
Road data, segment # 5: MTL-2E (day/night)
------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 5: MTL-2E (day/night)
----------------------------------------
Angle1   Angle2           :  53.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  60.80 / 60.80  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  53.00 deg   Angle2 : 90.00 deg
Barrier height            :   7.00 m
Elevation                 :   4.50 m
Barrier receiver distance :  31.90 / 31.90  m
Source elevation          :  89.50 m
Receiver elevation        :  94.00 m
Barrier elevation         :  89.50 m
Reference angle           :   0.00



Result summary (day)
--------------------

                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+----------+----------+----------
 1.DenHaag          !     1.50 !    36.40 !    36.40
 2.MTL-1W           !     1.50 !    54.73 !    54.73
 3.MTL-1E           !     1.50 !    53.45 !    53.45
 4.MTL-2W           !     1.50 !    48.74 !    48.74
 5.MTL-2E           !     1.50 !    49.20 !    49.20
--------------------+----------+----------+----------
                      Total                  58.33 dBA
```

Result summary (night)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.DenHaag	1.50	28.81	28.81
2.MTL-1W	1.50	47.13	47.13
3.MTL-1E	1.50	45.85	45.85
4.MTL-2W	1.50	41.14	41.14
5.MTL-2E	1.50	41.60	41.60
Total			50.73 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.33
(NIGHT): 50.73

```
STAMSON 5.0        SUMMARY REPORT        Date: 09-05-2018 15:36:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: POA_D.te             Time Period: Day/Night 16/8 hours
Description: 765 MTL Road, OLA centre north patio.


Road data, segment # 1: MontrealW (day/night)
----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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: MontrealW (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  :  33.90 / 33.90  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with
barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  13.60 m
Barrier receiver distance :   2.00 / 2.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Road data, segment # 2: MontrealE (day/night)
----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 2: MontrealE (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  :  45.00 / 45.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with
barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  13.60 m
Barrier receiver distance :   2.00 / 2.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00



Road data, segment # 3: DenHaag (day/night)
-------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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 # 3: DenHaag (day/night)
-----------------------------------------
Angle1   Angle2           :  63.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  28.00 / 28.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      2       (Flat/gentle slope; with
barrier)
Barrier angle1             :  63.00 deg   Angle2 : 90.00 deg
Barrier height             :  13.60 m
Barrier receiver distance  :  15.80 / 15.80  m
Source elevation           :   0.00 m
Receiver elevation         :   0.00 m
Barrier elevation          :   0.00 m
Reference angle            :   0.00
```

Result summary (day)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.MontrealW	1.50	48.10	48.10
2.MontrealE	1.50	46.91	46.91
3.DenHaag	1.50	36.35	36.35
Total			50.72 dBA

Result summary (night)

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.MontrealW	1.50	40.51	40.51
2.MontrealE	1.50	39.32	39.32
3.DenHaag	1.50	28.75	28.75
Total			43.13 dBA

```
TOTAL Leq FROM ALL SOURCES (DAY): 50.72
                           (NIGHT): 43.13
```

APPENDIX C: RESULTS OF AIF ANALYSIS

(attachment to Integral DX Engineering Ltd. report dated 10 May 2018)

The table below shows intermediate calculation results for the AIF analysis. The calculations were completed per BRN148. Worst-case noise sensitive indoor locations were considered, factoring in façade noise levels, indoor noise level limits, floor areas, façade component areas, and the number of façade components.

Table C.1: AIF Calculation Results

Indoor Location	Road Noise				N (1)	Average AIF Needed	Floor Area (m^2)	Components				
	Indoor Limit		Facade Level					Type (2)	Area (m^2)	AR (3)	Actual Performance	
	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)							AIF	▲PWL (4)
Studio 213	45	40	73	65	3	35	25.8	EW	12.9	50.1	40	-27
								OP-W	1.0	3.9	35	-30
								F-W	1.6	6.2	36	-30
											Total	*-87*
Studio 316 (corner unit)	45	40	71	64	3	33	21.5	EW	25.6	118.9	36	-23
								OP-W	1.0	4.7	34	-7
								F-W	1.6	7.4	35	-12
											Total	*-42*
Meeting Room	45	n/a	73	65	3	35	67.9	EW	8.5	12.5	45	-30
								OP-W	2.6	3.8	35	0
								F-W	24.9	36.7	33	20
											Total	*-10*
TV Room	45	n/a	73	65	2	33	19.4	EW	11.8	60.9	39	-42
								F-W	7.6	39.2	31	29
											Total	*-13*

Notes:
(1) N refers to the number of different types of façade components.
(2) Component Types:
EW = Exterior Wall
OP-W = Operable Window
F-W = Fixed Window
(3) AR refers to the ratio of the component area and floor area, expressed as a percentage value.
(4) ▲PWL refers to the change in transmitted sound power for the specified component, compared to a component with an AIF rating equal to the average required level. The room total value is provided, and must be less than or equal to 0 to meet the indoor sound level limit.

APPENDIX D: RECOMMENDED WORDING FOR NOTICES-ON-TITLE

(attachment to Integral DX Engineering Ltd. report dated 10 May 2018)

> “Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment and Climate Change.
>
> To help address the need for sound attenuation, this development includes multi-pane glass. To ensure that provincial sound level limits are not exceeded, it is important to maintain this sound attenuation feature.
>
> South-facing dwelling units have been supplied with a central air conditioning system and other measures which will allow windows to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment and Climate Change.
>
> The Transferee covenants with the Transferor that the above clauses, verbatim, shall be included in all subsequent Agreements of Purchase and Sale and Deeds conveying the lands described herein, which covenant shall run with the said lands and is for the benefit of the subsequent owners of the said lands and the owner of the adjacent road."