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Environmental Noise Control Study

Proposed Commercial Buildings
2582 to 2626 Bank Street, Ottawa

Prepared For

Mr. Nabil Abdulla

September 1, 2021

Report: PG5546-1 Revision 1

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Mr. Nabil Abdulla to conduct an environmental noise control study for the proposed commercial buildings to be located at 2582 to 2626 Bank Street, in the City of Ottawa.

The objective of the current study is to:

- ❏ Determine the primary noise sources impacting the site and compare the projected sound levels to guidelines set out by the Ministry of Environment and Climate Change (MOECC) and the City of Ottawa.

- ❏ Review the projected noise levels and offer recommendations regarding warning classes, construction materials or alternative sound barriers.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes acoustical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

This study has been conducted according to City of Ottawa document - Engineering Noise Control Guidelines (ENCG), dated January 2016, and the Ontario Ministry of the Environment Guideline NPC-300.

2.0 Background

It is understood that the proposed development consists of three commercial buildings, with two (2) underground parking levels. All buildings (Building A, Building B, Building C) will have 3 storeys above-grade. Associated at-grade parking areas, access lanes and landscaped areas are further anticipated. No outdoor living areas are identified on the proposed site plan.

3.0 Methodology and Noise Assessment Criteria

The City of Ottawa outlines three (3) sources of environmental noise that must be analyzed separately:

- Surface Transportation Noise
- Stationary Noise
  - new noise-sensitive development applications (noise receptors) in proximity to existing or approved stationary sources of noise, and
  - new stationary sources of noise (noise generating) in proximity to existing or approved noise-sensitive developments
- Aircraft noise

Surface Transportation Noise

The City of Ottawa's Official Plan, in addition to the ENCG, dictate that the influence area must contain any of following conditions to classify as a surface transportation noise source for a subject site:

- Within 100 m of the right-of-way of an existing or proposed arterial, collector or major collector road; a light rail transit corridor; bus rapid transit, or transit priority corridor,
- Within 250 m of the right-of-way for an existing or proposed highway or secondary rail line,
- Within 300 m from the right of way of a proposed or existing rail corridor or a secondary main railway line,
- Within 500 m of an existing 400 series provincial highway, freeway or principle main railway line.

The NPC-300 outlines the limitations of the stationary and environmental noise levels in relation to the location of the receptors. These can be found in the following tables:

Table 1 - Sound Level Limits for Outdoor Living Areas

Time Period	Required $L_{eq(16)}$ (dBA)
16-hour, 7:00-23:00	55

- Standards taken from Table 2.2a; Sound Level Limit for Outdoor Living Areas - Road and Rail

Table 2 - Sound Level Limits for Indoor Living Area			
Type of Space	**Time Period**	**Required L_{eq} (dBA)**	
		Road	**Rail**
Living/Dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc	7:00-23:00	45	40
Theaters, place of worship, libraries, individual or semi-private offices, conference rooms, reading rooms	23:00-7:00	45	40
Sleeping quarters	7:00-23:00	45	40
	23:00-7:00	40	35
❑ Standards taken from Table 2.2b; Sound Level Limit for Indoor Living Areas - Road and Rail			

It is noted in the ENCG that the limits outlined in Table 2 are for the sound levels on the interior of the glass pane. The ENCG further goes on to state that the limit for the exterior of the pane of glass will be 55 dBA.

If the sound level limits are exceeded at the window panes for the indoor living areas, the following Warning Clauses may be referenced:

Table 3 - Warning Clauses for Sound Level Exceedances	
Warning Clause	**Description**
Warning Clause Type A	"Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally 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."
Warning Clause 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 (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."
Warning Clause Type C	"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments 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."
Warning Clause 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."
❑ Clauses taken from section C8 Warning Clauses; Environmental Noise Guidelines - NPC-300	

Stationary Noise

Stationary noise sources include sources or facilities that are fixed or mobile and can cause a combination of sound and vibration levels emitted beyond the property line. These sources may include commercial air conditioner units, generators and fans. Facilities that may contribute to stationary noise may include car washes, snow disposal sites, transit stations and manufacturing facilities.

The subject buildings are not in proximity to existing or approved stationary sources of noise. Therefore, a stationary noise analysis will not be required.

Aircraft/Airport Noise

The subject site is not located within the Airport Vicinity Development Zone. Therefore this project will not require an aircraft/airport noise analysis. No warning clauses regarding aircraft or airport noise will be required.

4.0 Analysis

Surface Transportation Noise

The subject buildings are bordered to the north by Bank Street followed by commercial buildings, to the east by commercial buildings, an institutional building and a memorial garden followed by Bank Street, to the west by a parking lot, commercial buildings and residential dwellings followed by Mesanges Drive, and to the south by protected area and residential dwellings. Bank Street and Mesanges Drive are identified within the 100 m radius of Building A and Building B. Only Mesanges Drive is identified within the 100 m radius of Building C.

Based on the City of Ottawa Official Plan, Schedule F, Bank Street is considered a 4 lane urban arterial divided road (4-UAD). Mesanges Drive is not classified as either an arterial, collector or major collector road, and is therefore not included in this study.

All noise sources are presented in Drawings PG5546-3, PG5546-4, PG5546-5 - Site Geometry located in Appendix 1.

The noise levels from road traffic are provided by the City of Ottawa, taking into consideration the right-of-way width and the implied roadway class. It is understood that these values represent the maximum allowable capacity of the proposed roadways. The parameters to be used for sound level predictions can be found below.

Table 4 - Traffic and Road Parameters

Road	Implied Roadway	AADT (Veh/day)	Posted Speed (km/h)	Day/Night Split %	Medium Truck %	Heavy Truck %
Bank Street	4-UAD	35000	60	92/8	7	5

❑ Data obtained from the City of Ottawa document ENCG

Two (2) levels of reception points were selected for this analysis. The following elevations were selected from the heights provided on the survey plan for subject buildings.

Table 5 - Elevation of Reception Points			
Floor Number	**Elevation at Centre of Window (m)**	**Floor Use**	**Daytime/Nighttime Analysis**
Ground Floor	1.5	Living Area/Bedroom	daytime/nighttime
Third Floor	7.5	Living Area/Bedroom	daytime/nighttime

For this analysis, a reception point was taken at the centre of each floor, at the ground floor and third floor. Reception points are detailed on Drawing PG5546-2 - Receptor Locations presented in Appendix 1.

All horizontal distances have been measured from the reception point to the edge of the right-of-way. The roadways were analyzed where they intersected the 100 m buffer zone, which is reflected in the local angles described in Paterson Drawings PG5546-3A to 3D and PG5546-4A to 4C - Site Geometry in Appendix 1.

Table 7 - Summary of Reception Points and Geometry, located in Appendix 1, provides a summary of the points of reception and their geometry with respect to the noise sources. The analysis is completed so that no effects of sound reflection off of the building facade are considered, as stipulated by the ENCG.

The subject site is at grade with the neighbouring roads within the 100 m radius.

The analysis was completed using STAMSON version 5.04, a computer program which uses the road and rail traffic noise prediction methods using ORNAMENT (Ontario Road Noise Analysis Method for Environment and Transportation) and STEAM (Sound from Trains Environment Analysis Method), publications from the Ontario Ministry of Environment and Energy.

5.0 Results

Surface Transportation

The primary descriptors are the 16-hour daytime and the 8-hour night time equivalent sound levels, $L_{eq(16)}$ and the $L_{eq(8)}$ for City roads.

The proposed traffic noise levels were analyzed at all reception points. The results of the STAMSON software can be located in Appendix 2, and the summary of the results can be noted in Table 6.

Table 6 - Proposed Noise Levels

Reception Point	Description	OLA (dBA)	Daytime at Facade $L_{EQ(16)}$ (dBA)	Nighttime at Facade $L_{eq(8)}$ (dBA)
REC 1-1	Building A, Western Elevation, 1st Floor	--	60.11	52.51
REC 1-3	Building A, Western Elevation, 3rd Floor	--	60.95	53.35
REC 2-1	Building A, Northern Elevation, 1st Floor	--	66.49	58.89
REC 2-3	Building A, Northern Elevation, 3rd Floor	--	67.26	59.66
REC 3-1	Building A, Northern Elevation, 1st Floor	--	68.52	60.92
REC 3-3	Building A, Northern Elevation, 3rd Floor	--	69.22	61.62
REC 4-1	Building A, Eastern Elevation, 1st Floor	--	55.53	47.93
REC 4-3	Building A, Eastern Elevation, 3rd Floor	--	63.36	55.77
REC 5-1	Building B, Western Elevation, 1st Floor	--	55.58	47.98
REC 5-3	Building B, Western Elevation, 3rd Floor	--	56.76	49.17
REC 6-1	Building B, Northern Elevation, 1st Floor	--	66.42	58.83
REC 6-3	Building B, Northern Elevation, 3rd Floor	--	67.19	59.60
REC 7-1	Building B, Eastern Elevation, 1st Floor	--	58.42	50.82
REC 7-3	Building B, Eastern Elevation, 3rd Floor	--	59.64	52.04

6.0 Discussion and Recommendations

6.1 Outdoor Living Areas

No outdoor living areas were identified for this development.

6.2 Indoor Living Areas and Ventilation

The results of the STAMSON modeling indicates that the $L_{eq(16)}$ ranges between 55.53 dBA and 69.22 dBA. The ENCG states that the limits for the exterior of the pane of glass is 55 dBA. This value was exceeded at the western, northern and eastern receptor points of Building A and Building B. Therefore, these dwellings should be supplied with a central air conditioning unit. Additionally, warning clause Type D, as outlined in Table 3, is also recommended for all units on the western, northern and eastern elevations of Building A and Building B.

The anticipated noise on the northern elevations of Building A and Building B do exceed the 65 dBA threshold. Therefore, a review of the building materials will be required.

Proposed Construction Specifications

It is understood that typical window and wall details are proposed for the commercial buildings. The effectiveness of the noise insulation can be expressed as the Acoustical Insulation Factor (AIF), calculated as follows:

$$AIF = L_{eq(16)(Exterior)} - L_{eq(16)(Interior)} + 10\log_{10}(N) + 2dBA$$

Where:

$L_{eq(16)(Exterior)}$ = Calculated value at the window pane
$L_{eq(16)(Interior)}$ = 45 dBA
N = number of components in the room

No floor plans or detailed design drawings were provided for this portion of the review. A conservative approach is to assume that there are 2 components per room. Therefore, the AIF would need to be at least 28 dBA.

A conversion from AIF to a Standard Transmission Class (STC) rating will require the knowledge of room dimensions in addition to the wall and window dimensions. However, a conservative approach would be to increase the AIF factor by 3. **Therefore, provided the building materials of either the windows and/or exterior walls have an STC rating of 31 or higher, this would be a sufficient noise attenuation device.**

A review of industry standards for construction material indicates that as long as the exterior cladding of the northern elevations at Building A and Building B consists of brick or concrete panels, and that all windows consist of double pane glass, these materials have an STC rating of greater than 31 and are considered acceptable. If alternative materials are to be utilized on the northern elevations of Building A and Building B, then a review will need to be completed once design details are finalized.

7.0 Summary of Findings

The subject site is located at 2582 to 2626 Bank Street. It is understood that the proposed development will consist of three 3-storey commercial buildings. The associated analysis identified one surface transportation noise source: Bank Street around Building A and Building B. Surface transportation noise source is not identified around Building C.

Several reception points were selected for the analysis at Building A and Building B, consisting of pane of glass reception points on both the first and top level. The western, northern and eastern elevations of Building A and Building B exceeded the 55 dBA guideline specified by the ENCG. Therefore, the installation of a central air conditioning unit will be required for these units, along with a warning clause Type D.

The results of the surface transportation noise indicates that the noise levels will be above 65 dBA on the northern elevations of Building A and Building B. Based on industry standards, the construction materials suitable for the proposed noise attenuation would be concrete panels or brick veneer, with windows being double pane. If alternative construction materials are proposed, a review will be required.

The following warning clause is to be included on all Offers of Purchase and Sale and/or lease agreements:

> "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."

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. Our recommendations should be reviewed when the project drawings and specifications are complete.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Mr. Nabil Abdulla or his agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Yolanda Tang, M.Sc.Eng.

September 1-2021

Stephanie A. Boisvenue, P.Eng.

Report Distribution:

- ❑ Mr. Nabil Abdulla (e-mail copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

TABLE 7 - SUMMARY OF RECEPTION POINTS AND GEOMETRY

DRAWING PG5546-2 - RECEPTOR LOCATION PLAN

DRAWING PG5546-3 - SITE GEOMETRY-BUILDING A

DRAWING PG5546-3A - SITE GEOMETRY (REC 1-1 and REC 1-3)

DRAWING PG5546-3B - SITE GEOMETRY (REC 2-1 and REC 2-3)

DRAWING PG5546-3C - SITE GEOMETRY (REC 3-1 and REC 3-3)

DRAWING PG5546-3D - SITE GEOMETRY (REC 4-1 and REC 4-3)

DRAWING PG5546-4 - SITE GEOMETRY-BUILDING B

DRAWING PG5546-4A - SITE GEOMETRY (REC 5-1 and REC 5-3)

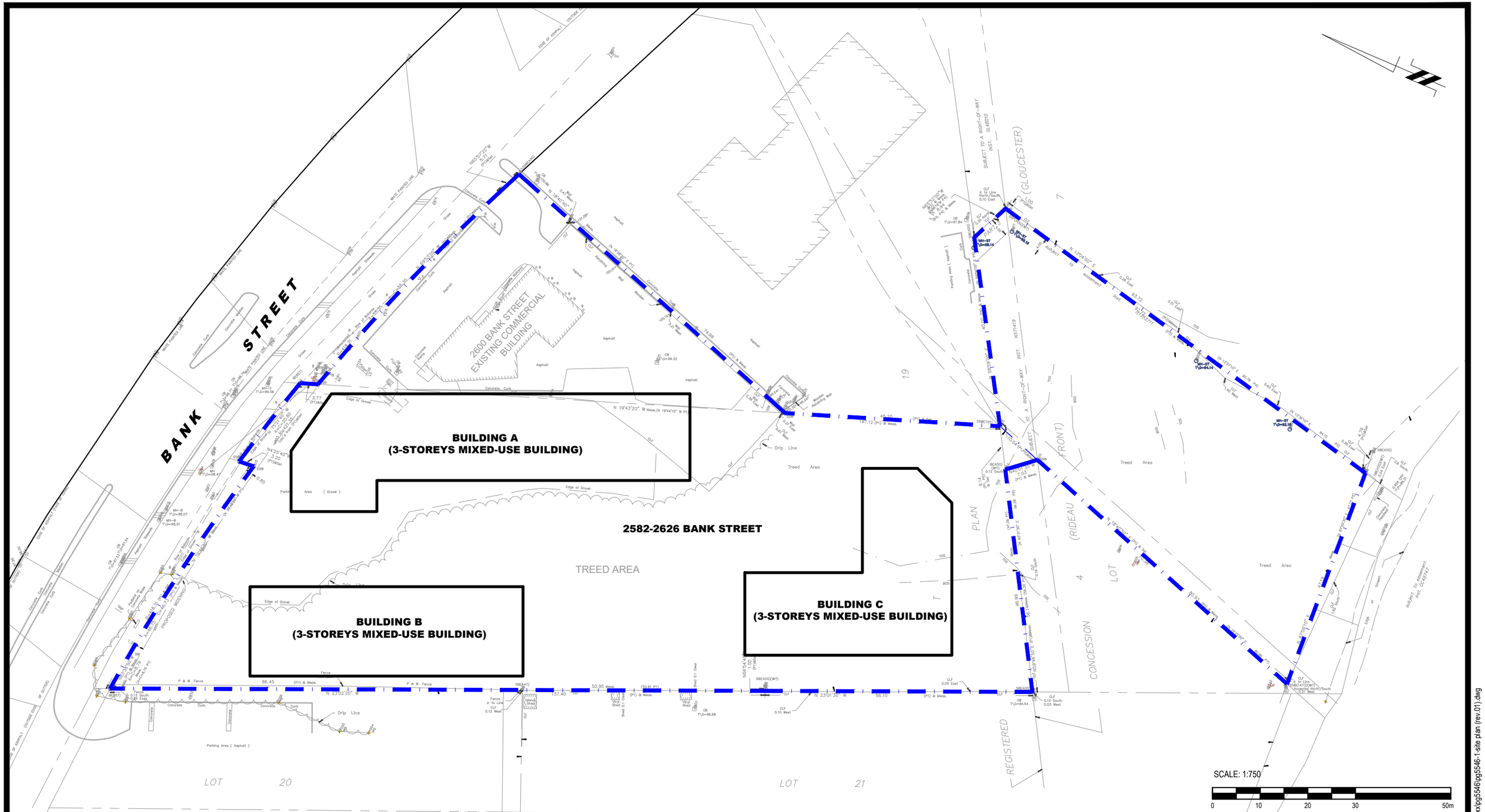
DRAWING PG5546-4B - SITE GEOMETRY (REC 6-1 and REC 6-3)

DRAWING PG5546-4C - SITE GEOMETRY (REC 7-1 and REC 7-3)

DRAWING PG5546-5 - SITE GEOMETRY-BUILDING C

Table 7 - Summary of Reception Points and Geometry
2582 to 2626 Bank Street

Point of Reception	Location	Leq Day (dBA)	Bank Street							
			Horizontal (m)	Vertical (m)	Total (m)	Local Angle (degree)	Number of Rows of Houses	Density (%)	Barrier Height (m)	Barrier Distance (m)
REC 1-1	Building A, Western Elevation, 1st Floor	60.11	40	1.5	40.03	-43, 0	n/a	n/a	n/a	n/a
REC 1-3	Building A, Western Elevation, 3rd Floor	60.95	40	7.5	40.7	-43, 0	n/a	n/a	n/a	n/a
REC 2-1	Building A, Northern Elevation, 1st Floor	66.49	30	1.5	30.04	-48, 90	n/a	n/a	n/a	n/a
REC 2-3	Building A, Northern Elevation, 3rd Floor	67.26	30	7.5	30.92	-48, 90	n/a	n/a	n/a	n/a
REC 3-1	Building A, Northern Elevation, 1st Floor	68.52	25	1.5	25.04	-85, 90	n/a	n/a	n/a	n/a
REC 3-3	Building A, Northern Elevation, 3rd Floor	69.22	25	7.5	26.1	-85, 90	n/a	n/a	n/a	n/a
REC 4-1	Building A, Eastern Elevation, 1st Floor	55.53	45	1.5	45.02	-90, 16	n/a	n/a	3	15
REC 4-3	Building A, Eastern Elevation, 3rd Floor	63.36	45	7.5	45.62	-90, 16	n/a	n/a	3	15
REC 5-1	Building B, Western Elevation, 1st Floor	55.58	65	1.5	65.02	-33, 0	n/a	n/a	n/a	n/a
REC 5-3	Building B, Western Elevation, 3rd Floor	56.76	65	7.5	65.43	-33, 0	n/a	n/a	n/a	n/a
REC 6-1	Building B, Northern Elevation, 1st Floor	66.42	30	1.5	30.04	-46, 90	n/a	n/a	n/a	n/a
REC 6-3	Building B, Northern Elevation, 3rd Floor	67.19	30	7.5	30.92	-46, 90	n/a	n/a	n/a	n/a
REC 7-1	Building B, Eastern Elevation, 1st Floor	58.42	50	1.5	50.02	-90, 10	1	50	n/a	n/a
REC 7-3	Building B, Eastern Elevation, 3rd Floor	59.64	50	7.5	50.56	-90, 10	1	50	n/a	n/a



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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

MR. NABIL ABDULLA

NOISE ATTENUATION STUDY

PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:750	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-1
Approved by: FA	Revision No.: 1

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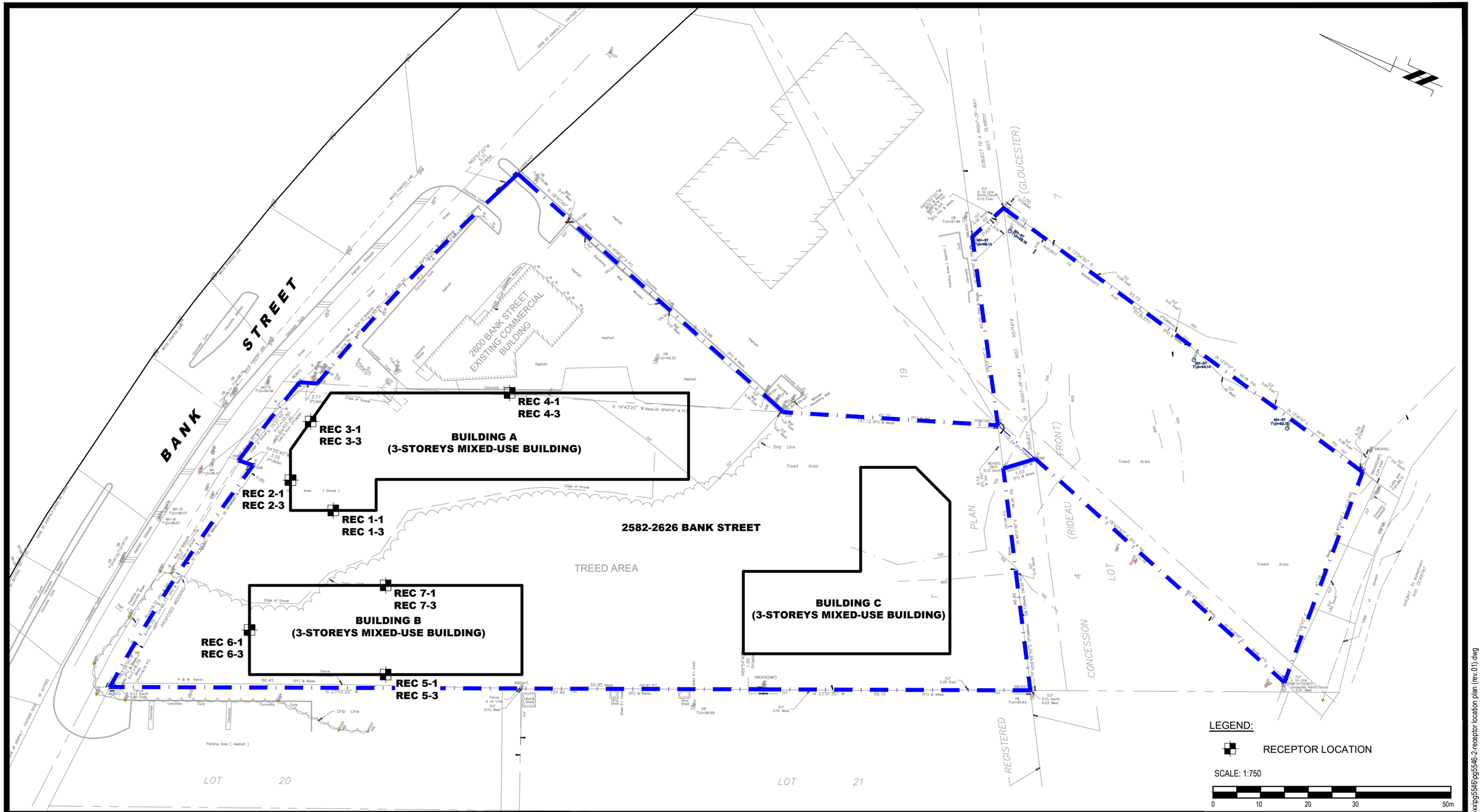

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OTTAWA, ONTARIO

Title:

RECEPTOR LOCATION PLAN

Scale: 1:750	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-2
Approved by: FA	Revision No.: 1

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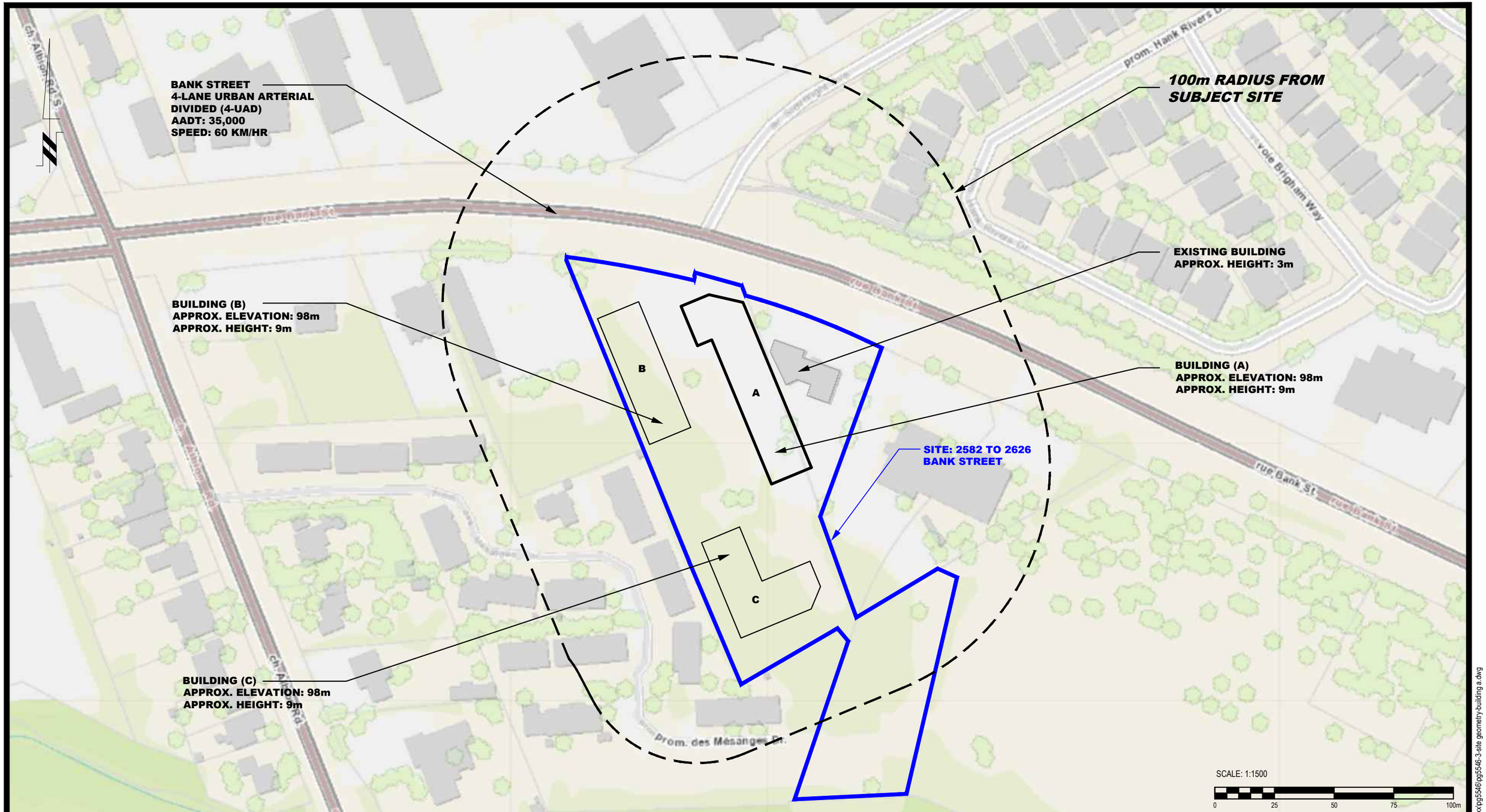

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NOISE ATTENUATION STUDY
PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - BUILDING A

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-3
Approved by: FA	Revision No.: 1

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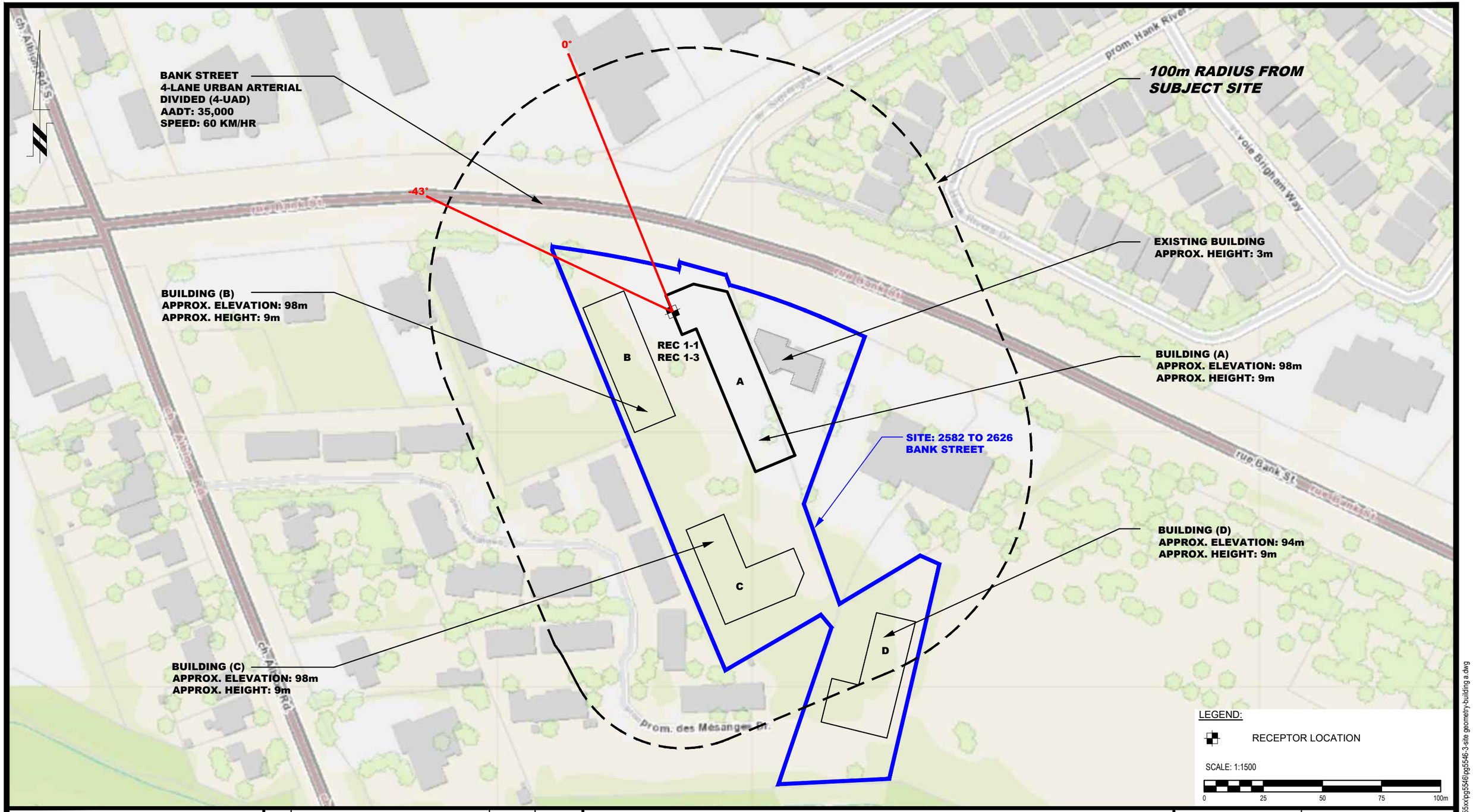

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OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 1-1 AND REC 1-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-3A
Approved by: FA	Revision No.:

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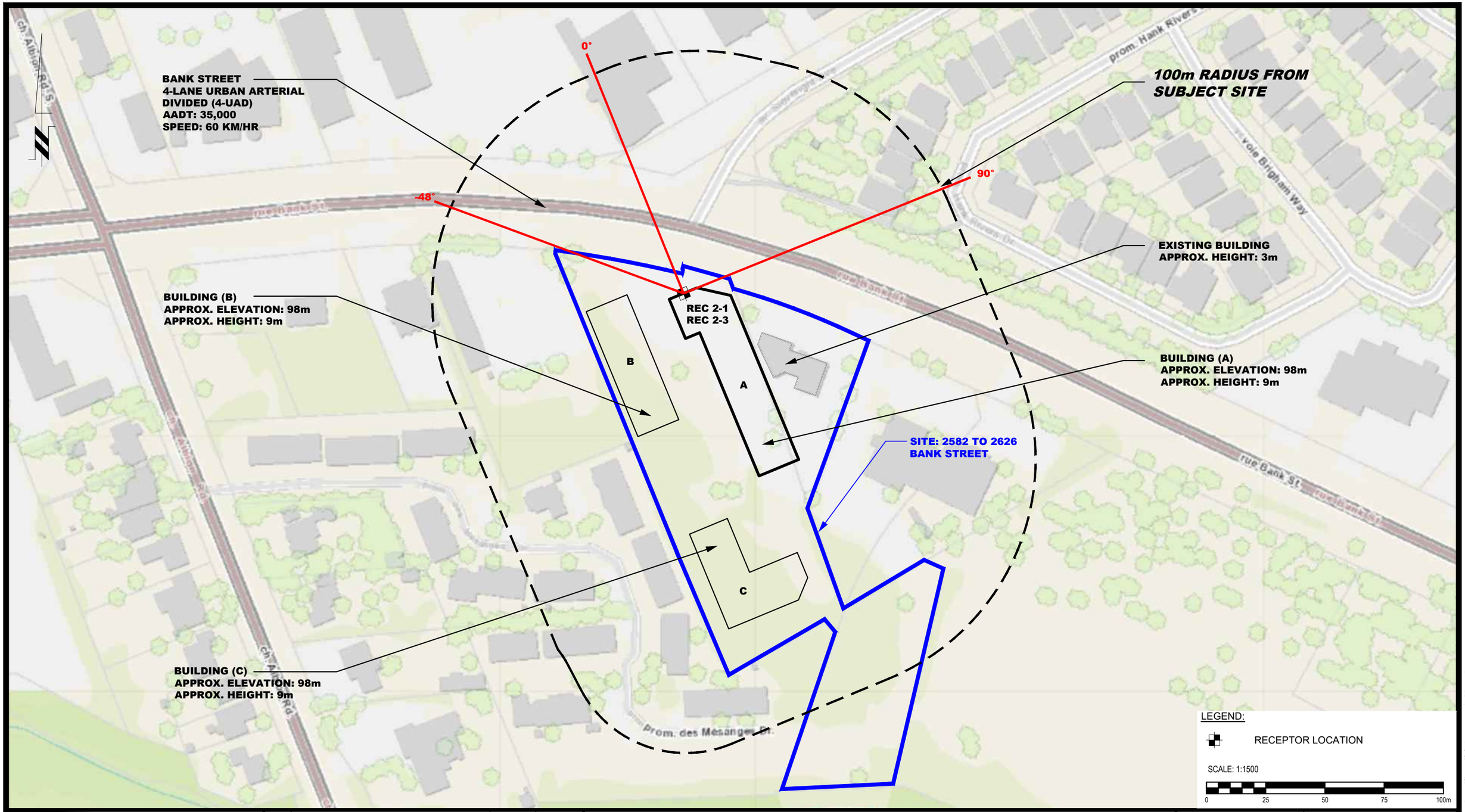

LEGEND:

RECEPTOR LOCATION

SCALE: 1:1500

0 25 50 75 100m

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OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 2-1 AND REC 2-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-3B
Approved by: FA	Revision No.: 1

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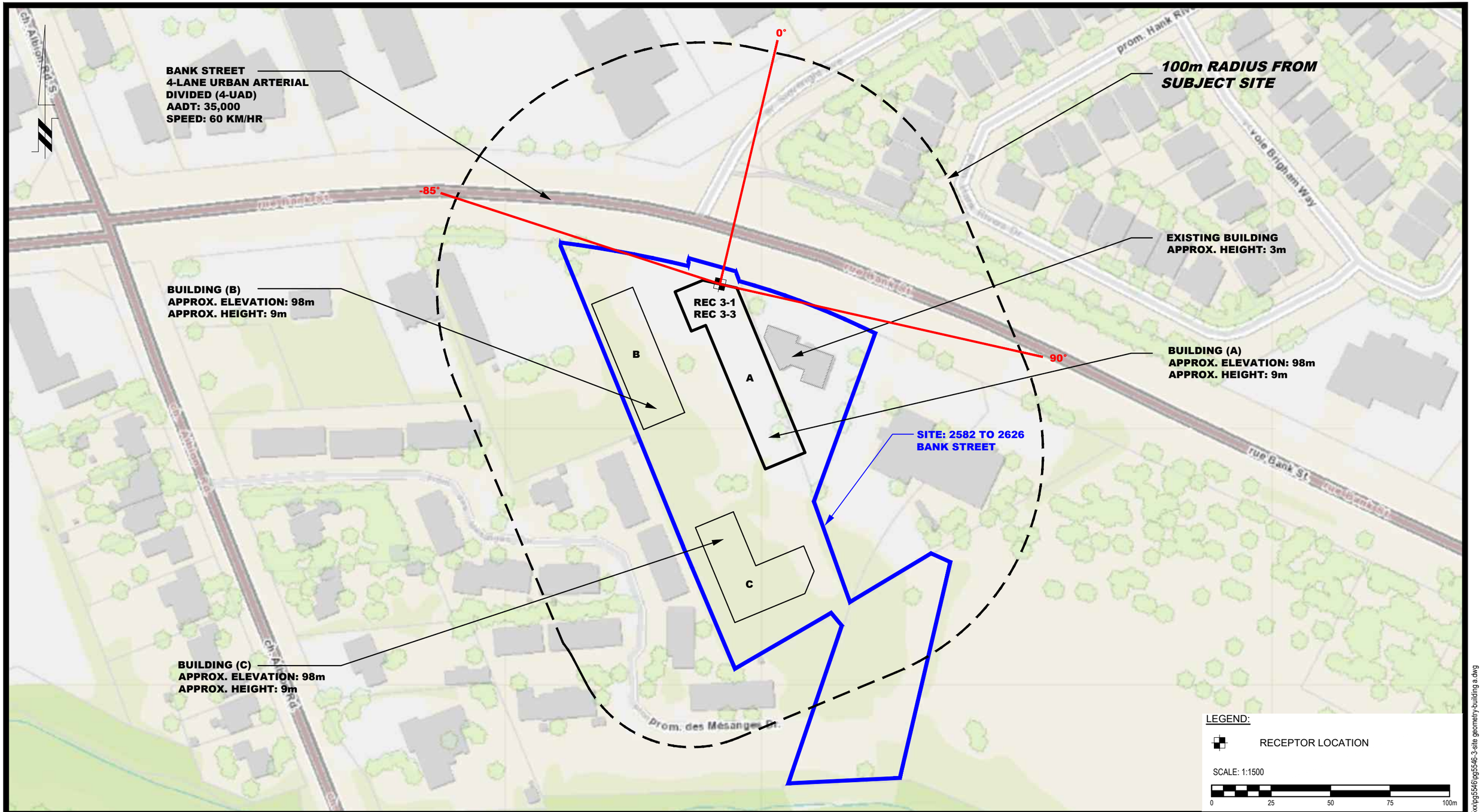

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OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 3-1 AND REC 3-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-3C
Approved by: FA	Revision No.: 1

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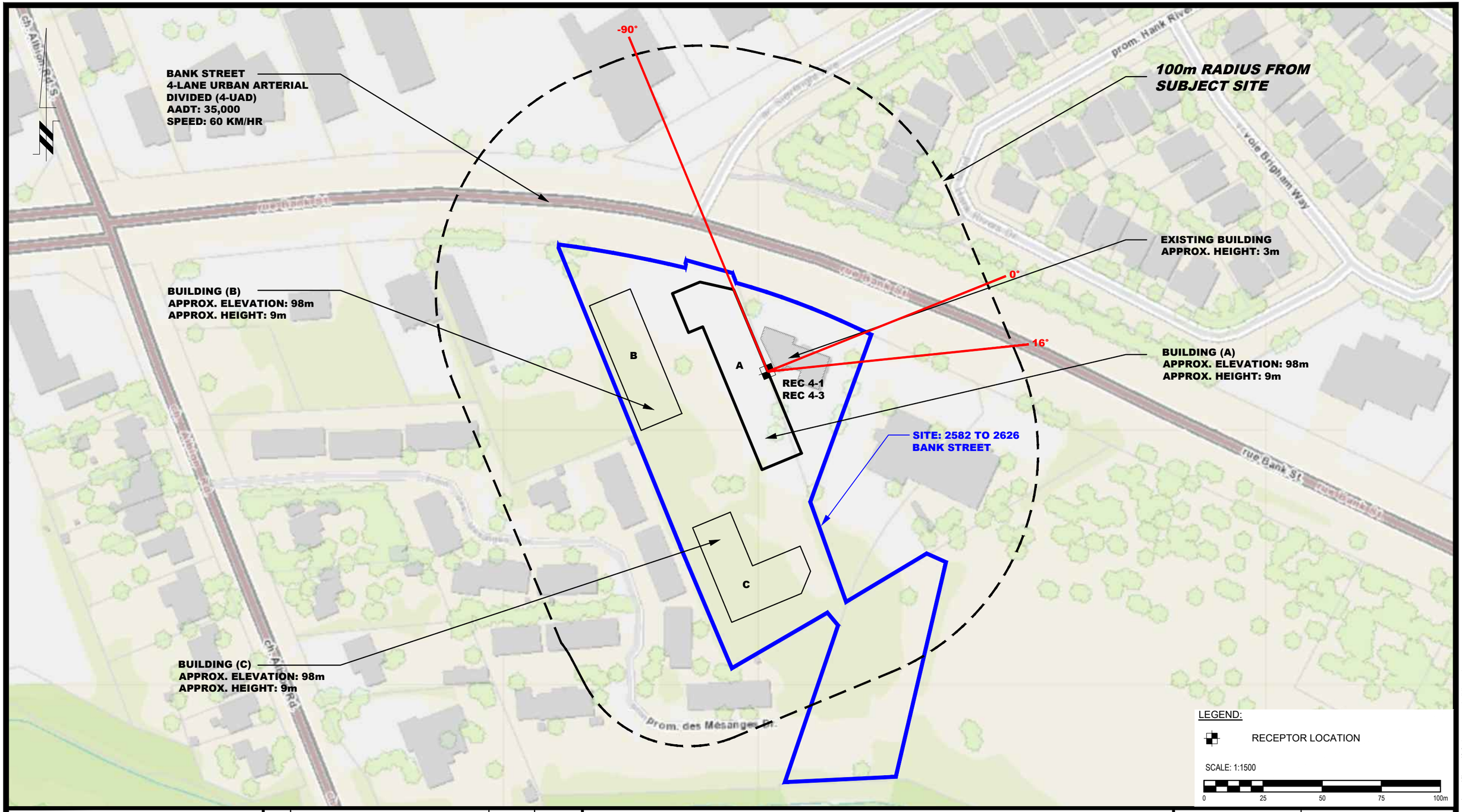

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OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 4-1 AND REC 4-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-3D
Approved by: FA	Revision No.: 1

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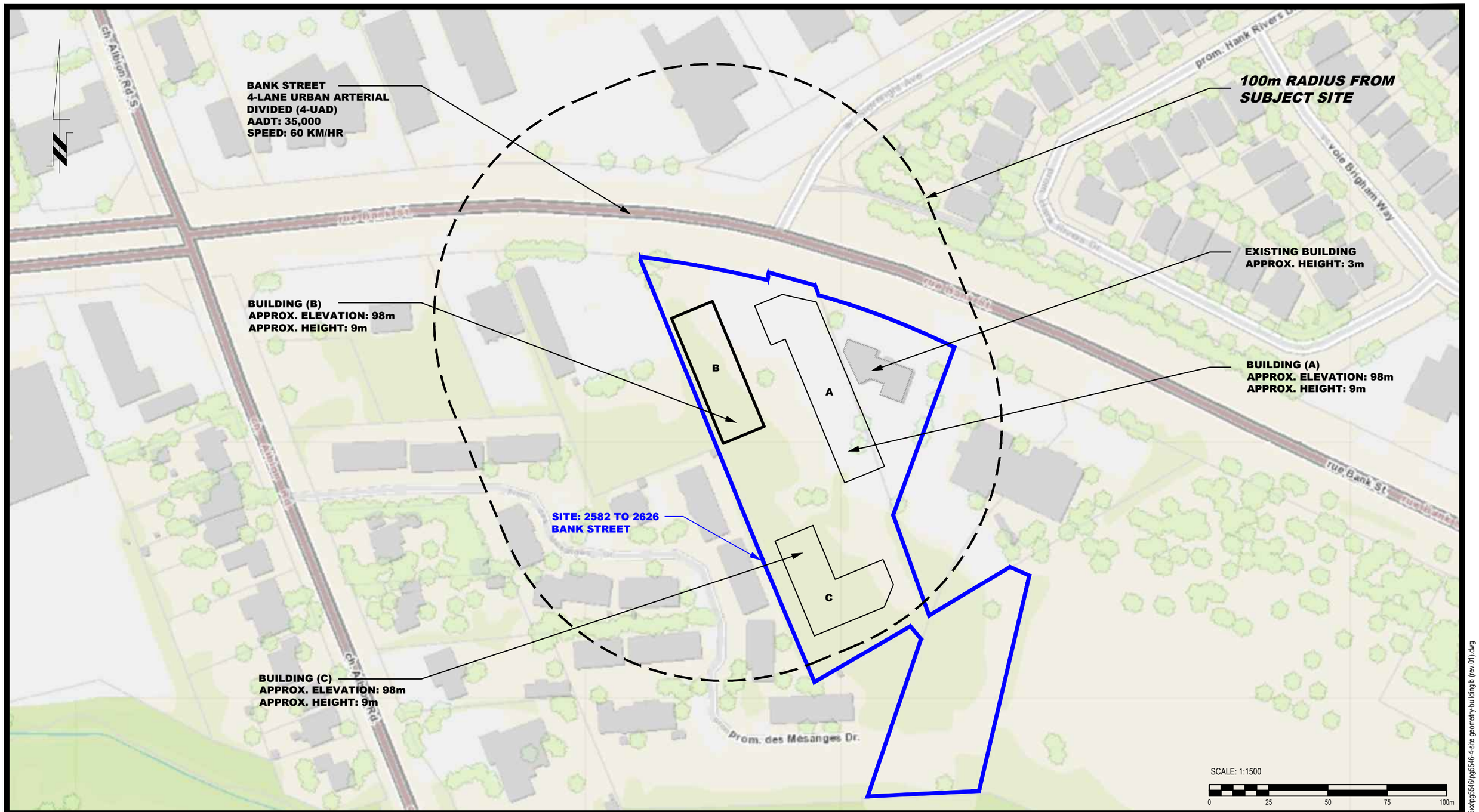

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

MR. NABIL ABDULLA
NOISE ATTENUATION STUDY
PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - BUILDING B

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-4
Approved by: FA	Revision No.: 1

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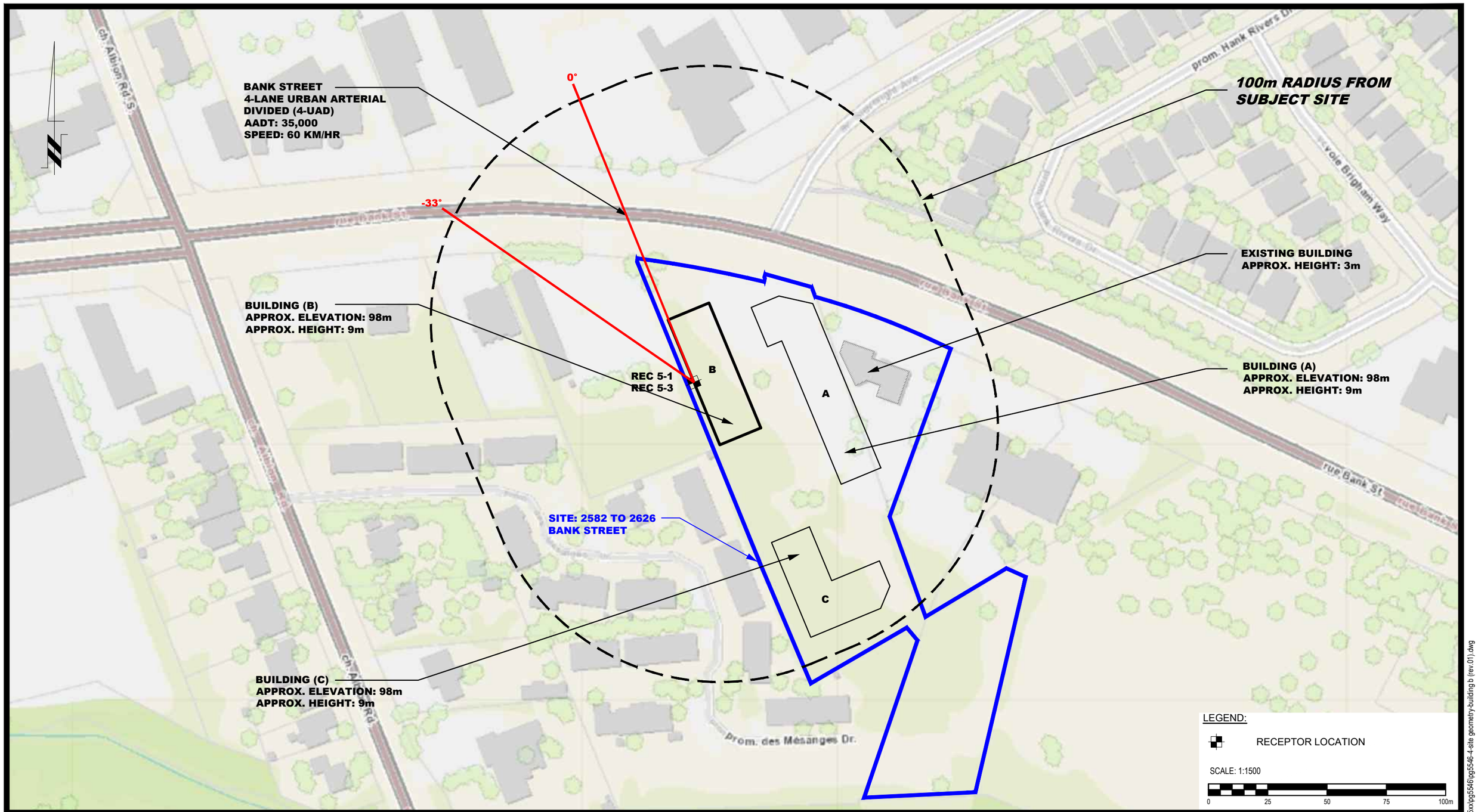

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

MR. NABIL ABDULLA
NOISE ATTENUATION STUDY
PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 5-1 AND REC 5-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-4A
Approved by: FA	Revision No.: 1

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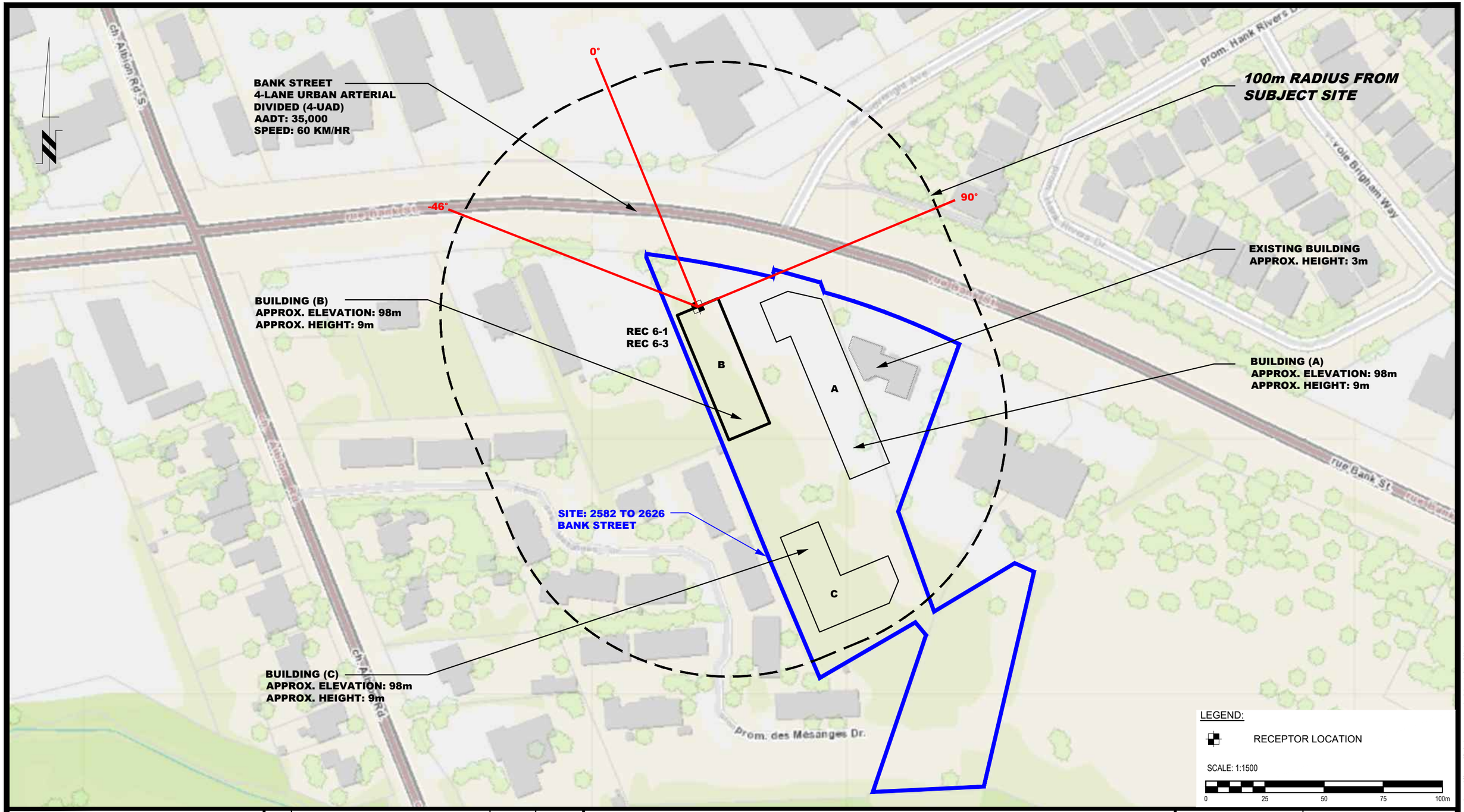

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

MR. NABIL ABDULLA
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PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 6-1 AND REC 6-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-4B
Approved by: FA	Revision No.: 1

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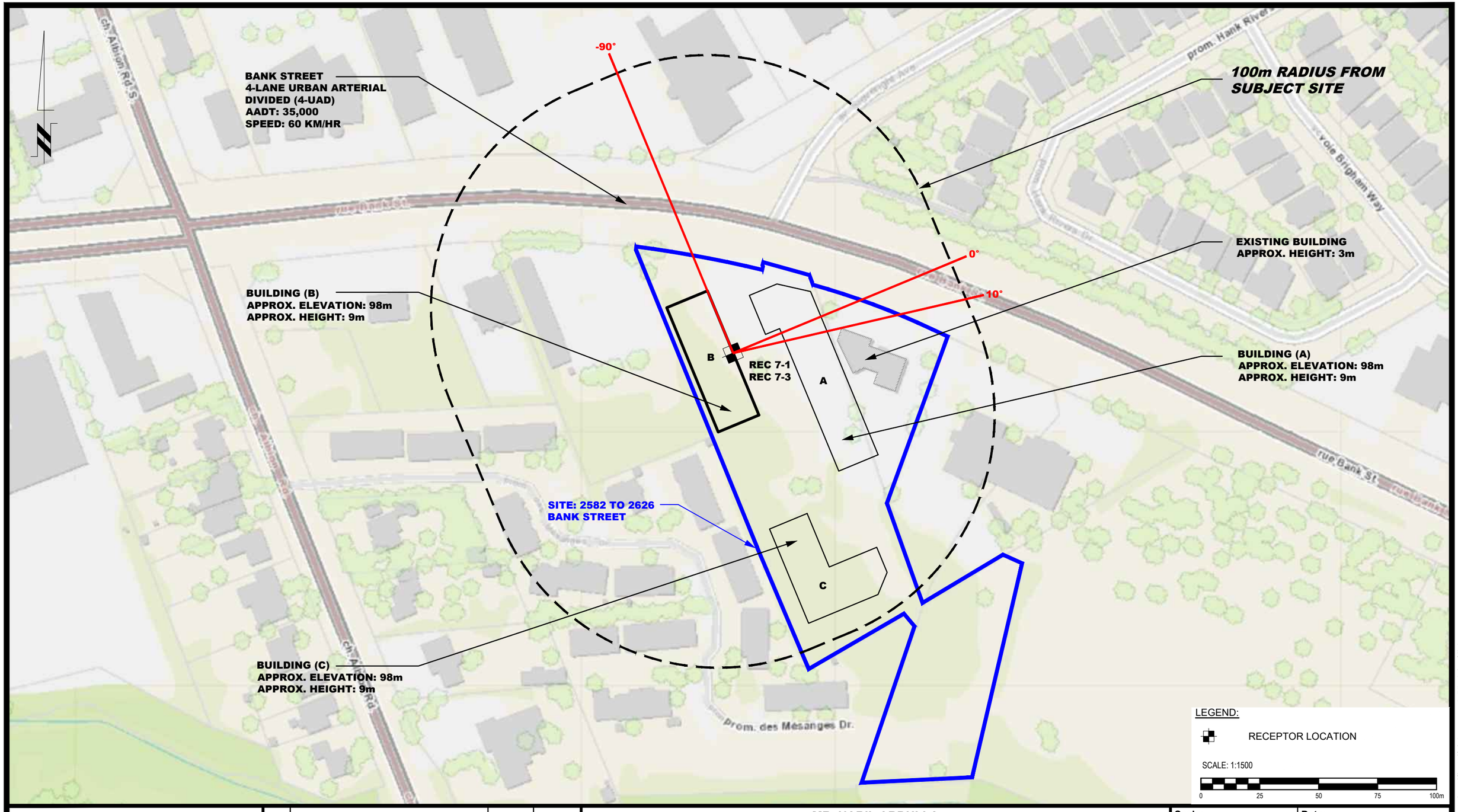

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

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PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - REC 7-1 AND REC 7-3

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-4C
Approved by: FA	Revision No.: 1

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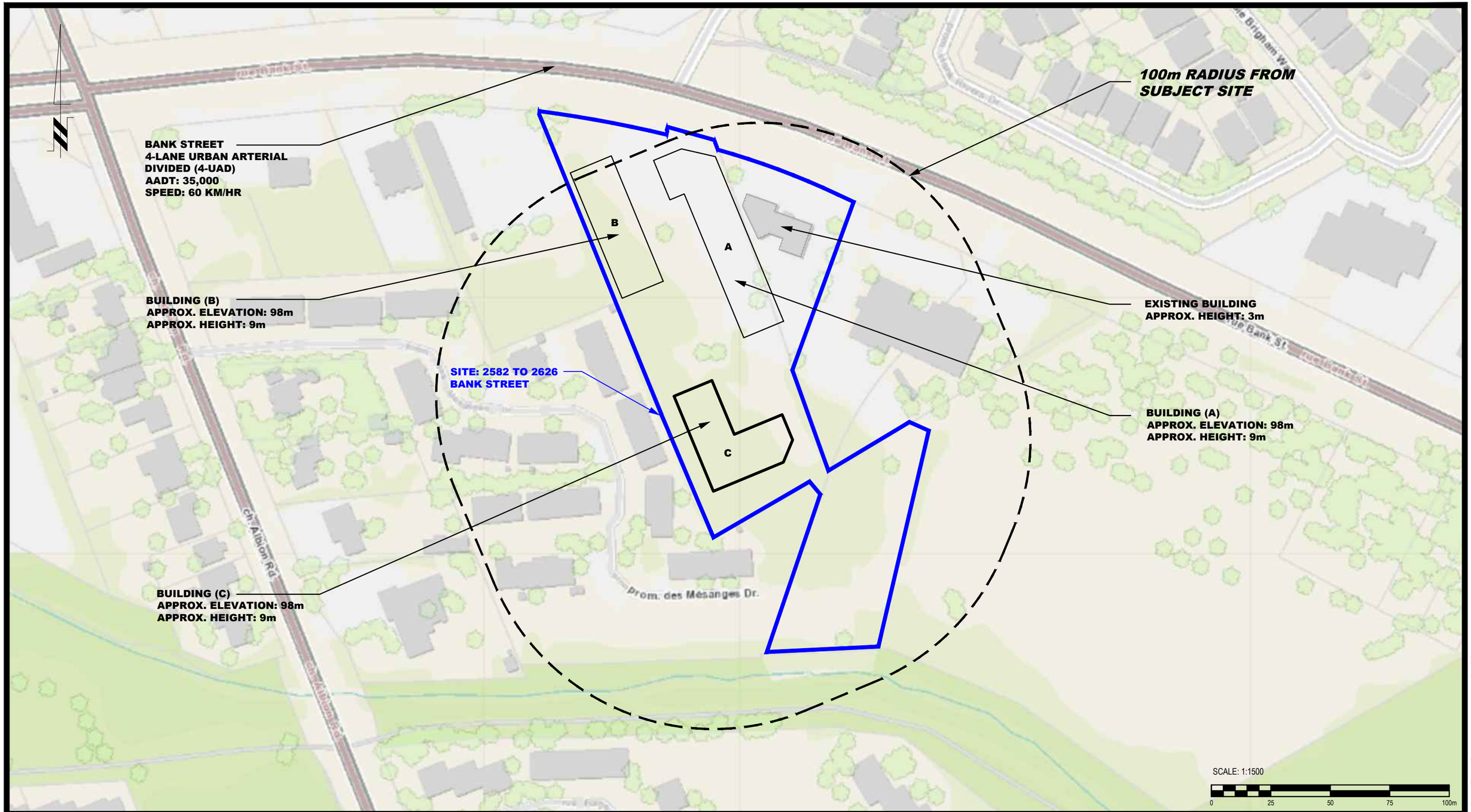

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	01/09/2021	YT

MR. NABIL ABDULLA
NOISE ATTENUATION STUDY
PROPOSED MULTI-STOREY BUILDINGS - 2582 TO 2626 BANK STREET
OTTAWA, ONTARIO

Title:
SITE GEOMETRY - BUILDING C

Scale: 1:1500	Date: 10/2020
Drawn by: YA	Report No.: PG5546-1
Checked by: SB	Dwg. No.: PG5546-5
Approved by: FA	Revision No.: 1

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APPENDIX 2

STAMSON RESULTS

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:42:17
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec11.te Time Period: Day/Night 16/8 hours
Description: Reception Point 1-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -43.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 60.11 + 0.00) = 60.11 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-43	0	0.66	73.68	0.00	-7.07	-6.50	0.00	0.00	0.00	60.11

Segment Leq : 60.11 dBA

Total Leq All Segments: 60.11 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 52.51 + 0.00) = 52.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-43	0	0.66	66.08	0.00	-7.07	-6.50	0.00	0.00	0.00	52.51

Segment Leq : 52.51 dBA

Total Leq All Segments: 52.51 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 60.11
(NIGHT): 52.51
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:43:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec13.te Time Period: Day/Night 16/8 hours
Description: Reception Point 1-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -43.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 60.95 + 0.00) = 60.95 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-43	0	0.48	73.68	0.00	-6.30	-6.42	0.00	0.00	0.00	60.95

Segment Leq : 60.95 dBA

Total Leq All Segments: 60.95 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 53.35 + 0.00) = 53.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-43	0	0.48	66.08	0.00	-6.30	-6.42	0.00	0.00	0.00	53.35

Segment Leq : 53.35 dBA

Total Leq All Segments: 53.35 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 60.95
(NIGHT): 53.35
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:45:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec21.te Time Period: Day/Night 16/8 hours
Description: Reception Point 2-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -48.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 30.00 / 30.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 66.49 + 0.00) = 66.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-48	90	0.66	73.68	0.00	-5.00	-2.19	0.00	0.00	0.00	66.49

Segment Leq : 66.49 dBA

Total Leq All Segments: 66.49 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 58.89 + 0.00) = 58.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-48	90	0.66	66.08	0.00	-5.00	-2.19	0.00	0.00	0.00	58.89

Segment Leq : 58.89 dBA

Total Leq All Segments: 58.89 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 66.49
(NIGHT): 58.89
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:46:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec23.te Time Period: Day/Night 16/8 hours
Description: Reception Point 2-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -48.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 30.00 / 30.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 67.26 + 0.00) = 67.26 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-48	90	0.48	73.68	0.00	-4.46	-1.96	0.00	0.00	0.00	67.26

Segment Leq : 67.26 dBA

Total Leq All Segments: 67.26 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 59.66 + 0.00) = 59.66 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-48	90	0.48	66.08	0.00	-4.46	-1.96	0.00	0.00	0.00	59.66

Segment Leq : 59.66 dBA

Total Leq All Segments: 59.66 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 67.26
(NIGHT): 59.66

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:49:26
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec31.te Time Period: Day/Night 16/8 hours
Description: Reception Point 3-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -85.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 25.00 / 25.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 68.52 + 0.00) = 68.52 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	90	0.66	73.68	0.00	-3.68	-1.48	0.00	0.00	0.00	68.52

Segment Leq : 68.52 dBA

Total Leq All Segments: 68.52 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 60.92 + 0.00) = 60.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	90	0.66	66.08	0.00	-3.68	-1.48	0.00	0.00	0.00	60.92

Segment Leq : 60.92 dBA

Total Leq All Segments: 60.92 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 68.52
(NIGHT): 60.92

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 11:50:47
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec33.te Time Period: Day/Night 16/8 hours
Description: Reception Point 3-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -85.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 25.00 / 25.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 69.22 + 0.00) = 69.22 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	90	0.48	73.68	0.00	-3.28	-1.17	0.00	0.00	0.00	69.22

Segment Leq : 69.22 dBA

Total Leq All Segments: 69.22 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 61.62 + 0.00) = 61.62 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	90	0.48	66.08	0.00	-3.28	-1.17	0.00	0.00	0.00	61.62

Segment Leq : 61.62 dBA

Total Leq All Segments: 61.62 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 69.22
(NIGHT): 61.62

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:25:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec41.te Time Period: Day/Night 16/8 hours
Description: Reception Point 4-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -90.00 deg 16.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive 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 : 16.00 deg
Barrier height : 3.00 m
Barrier receiver distance : 15.00 / 15.00 m
Source elevation : 78.00 m
Receiver elevation : 78.00 m
Barrier elevation : 78.00 m
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

Barrier height for grazing incidence

```
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !        79.50

ROAD (0.00 + 55.53 + 0.00) = 55.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     16   0.48  73.68   0.00  -7.06  -3.25   0.00   0.00  -7.83  55.53
-------------------------------------------------------------------------------

Segment Leq : 55.53 dBA

Total Leq All Segments: 55.53 dBA

↟
Results segment # 1: Bank Street (night)
----------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !        79.50

ROAD (0.00 + 47.93 + 0.00) = 47.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     16   0.48  66.08   0.00  -7.06  -3.25   0.00   0.00  -7.83  47.93
-------------------------------------------------------------------------------

Segment Leq : 47.93 dBA

Total Leq All Segments: 47.93 dBA

↟



TOTAL Leq FROM ALL SOURCES (DAY): 55.53
                           (NIGHT): 47.93
↟
↟
```

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:27:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec43.te Time Period: Day/Night 16/8 hours
Description: Reception Point 4-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -90.00 deg 16.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 45.00 / 45.00 m
Receiver height : 7.50 / 7.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 16.00 deg
Barrier height : 3.00 m
Barrier receiver distance : 15.00 / 15.00 m
Source elevation : 78.00 m
Receiver elevation : 78.00 m
Barrier elevation : 78.00 m
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

Barrier height for grazing incidence

```
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        7.50 !        5.50 !        83.50

ROAD (0.00 + 63.36 + 0.00) = 63.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     16   0.30  73.68   0.00  -6.20  -2.95   0.00   0.00  -0.24  64.29*
   -90     16   0.48  73.68   0.00  -7.06  -3.25   0.00   0.00   0.00  63.36
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 63.36 dBA

Total Leq All Segments: 63.36 dBA

↟
Results segment # 1: Bank Street (night)
----------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        7.50 !        5.50 !        83.50

ROAD (0.00 + 55.77 + 0.00) = 55.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     16   0.30  66.08   0.00  -6.20  -2.95   0.00   0.00  -0.24  56.69*
   -90     16   0.48  66.08   0.00  -7.06  -3.25   0.00   0.00   0.00  55.77
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 55.77 dBA

Total Leq All Segments: 55.77 dBA

↟



TOTAL Leq FROM ALL SOURCES (DAY): 63.36
                           (NIGHT): 55.77
```

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:28:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec51.te Time Period: Day/Night 16/8 hours
Description: Reception Point 5-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -33.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 65.00 / 65.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 55.58 + 0.00) = 55.58 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-33	0	0.66	73.68	0.00	-10.57	-7.53	0.00	0.00	0.00	55.58

Segment Leq : 55.58 dBA

Total Leq All Segments: 55.58 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 47.98 + 0.00) = 47.98 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-33	0	0.66	66.08	0.00	-10.57	-7.53	0.00	0.00	0.00	47.98

Segment Leq : 47.98 dBA

Total Leq All Segments: 47.98 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 55.58
(NIGHT): 47.98
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:32:43
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec53.te Time Period: Day/Night 16/8 hours
Description: Reception Point 5-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -33.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 65.00 / 65.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 56.76 + 0.00) = 56.76 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-33	0	0.48	73.68	0.00	-9.43	-7.49	0.00	0.00	0.00	56.76

Segment Leq : 56.76 dBA

Total Leq All Segments: 56.76 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 49.17 + 0.00) = 49.17 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-33	0	0.48	66.08	0.00	-9.43	-7.49	0.00	0.00	0.00	49.17

Segment Leq : 49.17 dBA

Total Leq All Segments: 49.17 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 56.76
(NIGHT): 49.17
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:35:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec61.te Time Period: Day/Night 16/8 hours
Description: Reception Point 6-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -46.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 30.00 / 30.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 66.42 + 0.00) = 66.42 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-46	90	0.66	73.68	0.00	-5.00	-2.26	0.00	0.00	0.00	66.42

Segment Leq : 66.42 dBA

Total Leq All Segments: 66.42 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 58.83 + 0.00) = 58.83 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-46	90	0.66	66.08	0.00	-5.00	-2.26	0.00	0.00	0.00	58.83

Segment Leq : 58.83 dBA

Total Leq All Segments: 58.83 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 66.42
(NIGHT): 58.83
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:37:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec63.te Time Period: Day/Night 16/8 hours
Description: Reception Point 6-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -46.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 30.00 / 30.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 67.19 + 0.00) = 67.19 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-46	90	0.48	73.68	0.00	-4.46	-2.03	0.00	0.00	0.00	67.19

Segment Leq : 67.19 dBA

Total Leq All Segments: 67.19 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 59.60 + 0.00) = 59.60 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-46	90	0.48	66.08	0.00	-4.46	-2.03	0.00	0.00	0.00	59.60

Segment Leq : 59.60 dBA

Total Leq All Segments: 59.60 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 67.19
(NIGHT): 59.60

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:42:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec71.te Time Period: Day/Night 16/8 hours
Description: Reception Point 7-1

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -90.00 deg 10.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 1
House density : 50 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 50.00 / 50.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 58.42 + 0.00) = 58.42 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	10	0.66	73.68	0.00	-8.68	-3.84	0.00	-2.73	0.00	58.42

Segment Leq : 58.42 dBA

Total Leq All Segments: 58.42 dBA

↟
Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 50.82 + 0.00) = 50.82 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	10	0.66	66.08	0.00	-8.68	-3.84	0.00	-2.73	0.00	50.82

Segment Leq : 50.82 dBA

Total Leq All Segments: 50.82 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 58.42
(NIGHT): 50.82
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 13-10-2020 12:44:35
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec73.te Time Period: Day/Night 16/8 hours
Description: Reception Point 7-3

Road data, segment # 1: Bank Street (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bank Street (day/night)

Angle1 Angle2 : -90.00 deg 10.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 1
House density : 50 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 50.00 / 50.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank Street (day)

Source height = 1.50 m

ROAD (0.00 + 59.64 + 0.00) = 59.64 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	10	0.48	73.68	0.00	-7.74	-3.56	0.00	-2.73	0.00	59.64

Segment Leq : 59.64 dBA

Total Leq All Segments: 59.64 dBA

↟

Results segment # 1: Bank Street (night)

Source height = 1.50 m

ROAD (0.00 + 52.04 + 0.00) = 52.04 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	10	0.48	66.08	0.00	-7.74	-3.56	0.00	-2.73	0.00	52.04

Segment Leq : 52.04 dBA

Total Leq All Segments: 52.04 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 59.64
(NIGHT): 52.04

↟

↟

APPENDIX 3

INDUSTRY STANDARDS

curved interior wall panels to distribute sound throughout the hall in a geometrically controlled fashion. They also serve as structural members. Some 200 curved, sandblasted panels, employing eight different radii, were created to meet all of the acoustical requirements. They were given a staining sealer for aesthetic effects.

Absorption of Sound

A sound wave always loses part of its energy as it is reflected by a surface. This loss of energy is called sound absorption. It appears as a decrease in sound pressure of the reflected wave. The sound absorption coefficient is the fraction of energy incident but not reflected per unit of surface area. Sound absorption can be specified at individual frequencies or as an average of absorption coefficients (NRC). A dense, non-porous concrete surface typically absorbs 1 to

Assembly	No. Description	STC[1] (OITC)
1	4 in. flat panel, 54 psf	49 (43)
2	5 in. flat panel, 60 psf	52[2]
3	6 in. flat panel, 75 psf	55 (46)
4	Assembly 2 with "Z" furring channels, 1 in. insulation and $^1/_2$ in. gypsum board, 75.5 psf	62
5	Assembly 2 with wood furring, $1^1/_2$ in. insulation and $^1/_2$ in. gypsum board, 73 psf	63
6	Assembly 2 with $^1/_2$ in. space, $1^5/_8$ in. metal stud row, $1^1/_2$ in. insulation and $^1/_2$ in. gypsum board	632
7	8 in. flat panel, 95 psf	58 (50)
8	10 in. flat panel, 120 psf	59[2]

1 The STC of sandwich panels is about the same as the STC of the thickness of the two concrete wythes (ignoring the insulation thickness).
2 Estimated values.

Table 1 Airborne Sound Transmission Class Ratings from Tests of Precast Concrete Assemblies.

Treatment	Increaesd Airborne STC
Wall furring, $^3/_4$ in. insulation and $^1/_2$ in. gypsum board attached to concrete wall	3
Separate metal stud system, $1^1/_2$ in. insulation in stud cavity and $^1/_2$ in. gypsum board attached to concrete wall	5 to 10
Plaster direct to concrete	0

Table 2 Typical Improvements for Wall Treatments Used with Precast Concrete Elements.

Sound Transmission Loss of Exterior Walls

Exterior finish	*Cavity Insulation*	*Resilient channel*	*STC*
Wood siding (1)	None	No	**37**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	**39**
	None	Yes	**43**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	**47**
Stucco (2)	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	**46**
	None	Yes	**49**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	**57**
Brick veneer (3)	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	**56**
	None	Yes	**54**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	**58**
Concrete block	None	No	**45**

Wall construction details

Wood siding (1)	Framing	2"x4" wood studs, (16" o.c.)
	Sheathing	1/2" wood fiberboard insulation nailed to studs
	Siding	5/8"x10" redwood nailed through sheathing into studs
	Interior	1/2" gypsum board screwed to studs or to metal resilient channels which were attached to the studs
Stucco (2)	Framing	2"x4" woods studs, (16" o.c.)
	Sheathing	None
	Stucco	No. 15 felt building and 1" wire mesh nailed to studs. Stucco Applied in 3 coats to 7/8" total thickness. Dry weight of Stucco 7.9 lb/sq ft
	Interior	1/2" gypsum board screwed to studs or resilient channel
Brick veneer (3)	Framing	2"x4" wood studs, (16" o.c.)
	Sheathing	3/4" wood fiberboard insulation
	Brick	standard face brick 3-1/2" wide, spaced 1/2" out from sheathing with metal ties nailed through sheathing into studs. Dry weight of brick and mortar 41 lb/sq ft .
	Interior	1/2" gypsum board screwed to studs or resilient channel

Taken from the U.S. Department of Commerce National Bureau of Standards Building Science Series 77.
* Information received in imperial units only

Insulating Glass (Table 2)

Glass Makeup			Frequency in Hertz (Hz)																	
			100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000	STC
			Sound Transmission Loss (dB)																		
Glass Ply	Air Space	Glass Ply																			
1/8" 3 mm	1/4" 6 mm	1/8" 3 mm	26	21	23	23	26	21	19	24	27	30	33	36	40	44	46	39	34	45	28
1/8" 3 mm	3/8" 9 mm	1/8" 3 mm	26	23	23	20	23	19	23	27	29	32	35	39	44	47	48	41	36	43	31
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	27	24	29	22	22	25	30	33	35	38	40	42	42	37	37	43	46	49	35
1/4" 6 mm	1/2" 13 mm	5/16" 8 mm	28	29	33	29	29	32	36	37	40	43	42	43	42	37	40	44	48	53	40
1/4" 6 mm	1/2" 13 mm	3/8" 10 mm	28	26	32	29	29	31	35	37	38	39	41	43	41	40	41	44	47	49	39
5/16" 8 mm	1/2" 13 mm	5/16" 8 mm	26	24	25	31	24	32	32	35	37	39	39	38	36	38	42	44	46	49	37
1/4" 6 mm	3/4" 19 mm	1/4" 6 mm	27	23	28	21	27	29	34	35	37	41	43	45	44	39	39	46	49	52	38
1/4" 6 mm	1" 25 mm	1/4" 6 mm	22	19	27	23	31	30	35	35	36	39	41	42	41	36	37	46	51	56	37

Laminated Insulating Glass (Table 3)

Glass Makeup					Frequency in Hertz (Hz)																	
					100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000	STC
					Sound Transmission Loss (dB)																		
Glass Ply	Air Space	Glass Ply	PVB*	Glass Ply																			
3/16" 5 mm	3/8" 9 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	27	27	26	24	22	28	32	35	38	38	39	40	42	43	41	45	52	57	37
3/16" 5 mm	1/2" 13 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	26	23	25	23	27	31	34	36	38	39	41	43	45	46	43	49	55	55	39
1/4" 6 mm	1/2" 13 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	28	20	29	24	26	30	34	36	39	42	43	44	44	41	40	47	52	56	39
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	.030" .76 mm	1/8" 3 mm	28	17	28	29	33	34	38	40	40	41	41	41	41	40	43	49	54	58	40
1/4" 6 mm	1/2" 13 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	30	29	31	28	31	34	37	39	41	42	44	46	45	44	47	52	55	60	42
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	.030" .76 mm	1/4" 6 mm	31	29	32	30	32	35	38	40	40	42	44	46	47	46	47	52	56	61	43
5/16" 8 mm	5/8" 16 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	28	28	34	36	33	40	41	42	43	43	42	40	40	43	49	53	57	61	43
1/4" 6 mm	3/4" 19 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	28	26	32	30	35	37	40	41	43	44	45	47	47	44	47	53	57	60	44
1/4" 6 mm	3/4" 19 mm	1/4" 6 mm	.060" 1.52 mm	1/4" 6 mm	28	29	36	32	34	39	41	41	41	43	44	45	45	46	47	52	56	61	44
3/8" 10 mm	3/4" 19 mm	1/4" 6 mm	.060" 1.52 mm	1/4" 6 mm	25	31	38	33	37	39	42	43	43	42	40	40	41	56	50	55	58	61	43

Data based on testing ~36" x 84" glass to ASTM E413-87 in an acoustical wall. Glass size and glazing system will affect STC rating.
*PVB (polyvinyl butyral) interlayer