PATERSON GROUP

LRT Confederation Line Level 2 Proximity Study

Proposed High-Rise Development

335 Roosevelt Avenue
Ottawa, Ontario

Prepared for
Uniform Urban Developments

Report PG2178-2 Revision 5
Dated July 10, 2025

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Uniform Urban Developments to conduct an LRT Confederation Line – Level 2 Proximity Study for the proposed development to be located at 335 Roosevelt Avenue in the City of Ottawa, Ontario.

The objectives of the current study were to:

- ❑ Review all current information available from the City of Ottawa with regards to the infrastructure of the Confederation Rail Line (O-Train Rail).
- ❑ Liaison between the City of Ottawa and Uniform Urban Developments consultant team involved with the aforementioned project.

This report has been prepared specifically and solely for the aforementioned project which is described herein. It contains a collaboration of architectural, civil, structural, and geotechnical information as they pertain to the aforementioned project.

2.0 Development Details

Based on current plans, it is understood that the proposed development consists of 2 high-rise buildings. The west building will have 3 underground parking levels, while the east building will have 4 underground parking levels, which will extend to the vicinity of the property lines at subject site.

The existing average ground surface elevation at the subject site is at an approximate geodetic elevation of 66.4 m. The proposed building's design underside of footing (USF) is expected to be around geodetic elevation 50 m, and will be supported by clean, surface sounded bedrock.

The following is known about the Confederation Line and Dominion Station in the vicinity of the subject site:

- ❑ The Confederation Line is proposed to be located to the north of the subject site, within the existing recessed transitway structure.
- ❑ The proposed Confederation Line rails are anticipated to be located at the base of the existing transitway at approximate geodetic elevation 61 m.
- ❑ Based on the subsurface profile encountered at the borehole locations at 335 Roosevelt Avenue and our experience in the general area, bedrock is expected at approximate depths of 0.6 to 1.2 m below the existing ground

surface at the subject site, which corresponds to approximate geodetic elevation 65 to 66 m.

Temporary BRT Detour

It is also understood that the OC Transpo bus route, which previously operated in the existing transitway located north of the subject site, will be detoured within the multi-use path which is located immediately to the north of the subject site. This detour will be in place for the duration of the Stage 2 LRT construction.

3.0 Construction Methodology and Impact Review

Paterson has prepared a construction methodology summary along with possible impacts on the adjacent segment of the proposed Confederation Line and temporary BRT detour, based on the current building design details. The Construction Methodology and Impact Review is provided in Appendix A and presents the anticipated construction items, impact review and mitigation program recommended for the proposed Confederation Line, Dominion Station, and temporary BRT detour.

The primary issue will be vibrations associated with the bedrock blasting removal program. It is recommended that a vibration monitoring program be implemented to ensure vibration levels remain below recommended tolerances. Details of the recommended vibration monitoring program are presented below.

3.1 Vibration Monitoring and Control Program

Proposed Vibration Limits

Due to the proposed Confederation Line alignment and Dominion Station located in the vicinity of the subject site, the contractor should take extra precaution to minimize vibrations. The monitoring program will be required for the full duration of the shoring installation (if required) and blasting operations. The purpose of the vibration monitoring and control program (VMCP) is to provide a description of the measures to be implemented by the contractor to manage excavation operations and any other vibration sources during the construction for the proposed development. The VMCP will also provide a guideline for assessing results against the relevant vibration impact assessment criteria and recommendations to meet the required limits.

The monitoring program will incorporate real time results at the proposed Confederation Line, Dominion Station, and temporary BRT detour located in the vicinity of the subject site. The monitoring equipment will consist of a tri-axial

seismograph, capable of measuring vibration intensities up to 254 mm/s at a frequency response of 2 to 250 Hz.

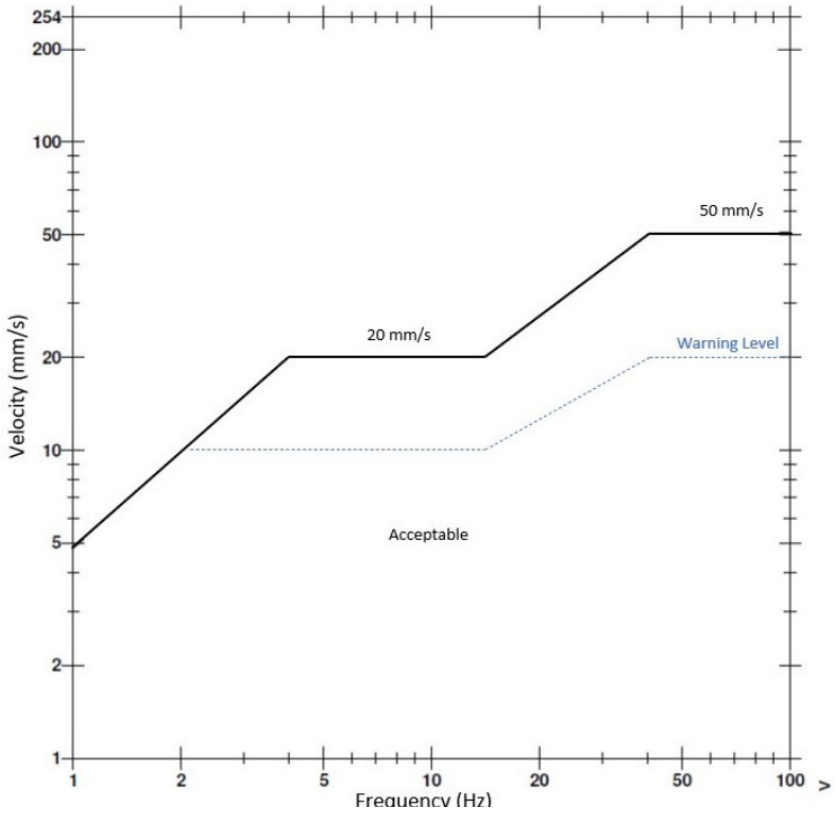
The locations of the seismographs should be reviewed periodically throughout construction to ensure that the monitoring equipment remains along the alignment of the proposed Confederation Line and temporary BRT detour at the closest radius to the construction activities. The seismograph locations should be approved by the project manager prior to installation.

During construction, the vibration monitor will be relocated for the 'worst case' location for each construction activity. When an event is triggered, Paterson will review the results and provide any necessary feedback. Otherwise, the vibration results will be summarized in the weekly

Proposed Vibration Limits

The excavation operations should be planned and conducted under the supervision of a licensed professional engineer who is an experienced bedrock excavation consultant. The following figure outlines the vibration limits for the proposed Confederation Line, Dominion Station, and temporary BRT detour:

Figure 1 - Proposed Vibration Limits at the Confederation Line



Monitoring Data

The monitoring protocol should include the following information:

Warning Level Event (indicated by the blue line on Figure 1)

- ❑ Paterson will review all vibrations over the established warning level, and
- ❑ Paterson will notify the contractor if any vibrations occur due to construction activities and are close to exceedance level.

Exceedance Level Event (indicated by the black line on Figure 1)

- ❑ Paterson will notify all the relevant stakeholders via email
- ❑ Ensure monitors are functioning
- ❑ Issue the vibration exceedance result

The data collected will include the following:

- ❑ Measured vibration levels
- ❑ Distance from the construction activity to monitoring location
- ❑ Vibration type

Monitoring should be in compliance with all related regulations.

3.2 Incident/Exceedance Reporting

In case an exceedance occurs from construction activities, the Senior Project Management and any relevant personnel should be notified immediately. A report should be completed which contains the following:

- ❑ Identify the location of vibration exceedance
- ❑ The date, time and nature of the exceedance
- ❑ Purpose of the exceeded monitor and current vibration criteria
- ❑ Identify the likely cause of the exceedance
- ❑ Describe the response action that has been completed to date
- ❑ Describe the proposed measures to address the exceedance.

The contractor should implement mitigation measures for future excavation or any construction activities as necessary and provide updates on the effectiveness of the improvement. Response actions should be pre-determined prior to excavation, depending on the approach provided to protect elements. Processes and procedures should be in-place prior to completing any vibrations to identify issues and react in a quick manner in the event of an exceedance.

4.0 Proximity Study Requirement Responses

Based on the O-Train System Proximity Study Guidelines dated 2024, a Level 2 Confederation Line Proximity Study is considered to be required for the proposed development. A Level 2 Proximity Study is required where the proposed development is located within the City of Ottawa's Development Zone of Influence. The following Table 1, below, lists the applicable requirements for a Level 1 and Level 2 proximity study and our associated responses.

Table 1: List of Level 1 and Level 2 Proximity Study Requirements

Level 1 Projects	Response
A site plan of the development with the centreline or reference line of the Confederation Line structure and/or right-of-way located and the relevant distances between the Confederation Line and developer's structure shown clearly;	See Confederation Line Proximity Plan (Drawing No. PG2178-3) presented in Appendix A.
Plan and cross-sections of the development locating the Confederation Line structure/right-of-way and founding elevations relative to the development, including any underground storage tanks and associated piping;	See the LRT Proximity Section A-A (Drawing No. PG2178-4) presented in Appendix A.
A geotechnical investigation report showing up-to-date geotechnical conditions at the site of the development. The geotechnical investigation shall be prepared in accordance with the Geotechnical Investigation and Reporting Guidelines for Development Applications in the City;	Refer to the Geotechnical Investigation: Paterson Group Report PG2178-1 Revision 5 dated July 10, 2025 presented in Appendix B.
Structural, foundation, excavation and shoring drawings;	Structural, foundation, excavation, and shoring drawings will be provided once available for the proposed project.

Acknowledgment that the potential for noise, vibration, electro-magnetic interference and stray current from Confederation Line operations have been considered in the design of the project, and appropriate mitigation measures applied.	The potential for noise, vibration, electro-magnetic interference and stray current from Confederation Line operations have been considered in the design of the project and appropriate mitigation measures have been applied. The Transportation Noise & Ground Vibrations Impact Study dated June 25, 2020 and prepared by Gradient Wind Engineers & Scientists for this project is attached in Appendix C.

Level 2 Projects	Response
A structural analysis or calculations of the effects of loadings, including construction loading, on the Confederation Line structure, and demonstrating that the Confederation Line will not be adversely affected by the development, including solutions to mitigate any impact on the Confederation Line structure	No building loads will be imposed on the subject alignment of the Confederation Line due to the presence of sound bedrock at founding levels of the proposed buildings, and the setback of the proposed Confederation Line, which is located a minimum of 16 m, away from the building foundation. Refer to Cross-Section A-A' (Drawing No. PG2178-4) and the Proximity Assessment Letter PG2178-LET.01 Revision 5 dated July 10, 2025 presented in Appendix D.
Documentation showing that the excavation support system and permanent structure adjacent to the Confederation Line property are designated for at-rest earth pressures.	A temporary shoring system, if required for the proposed development, will be designed for at-rest earth pressures, as stated in the site Geotechnical Investigation Report (Paterson Group Report PG2178-1 Revision 5 dated July 10, 2025). Temporary shoring drawings, if required, will be provided once available.
Structural drawings, including foundation plans, sections and details, floor plans, column and wall schedules and loads on foundation for the development. The relationship of the development to the Confederation Line structure should be depicted in both plan and section;	Structural drawings will be provided once available. Refer to the Confederation Line Proximity Plan (Drawing No. PG2178-3) and Cross-Section A-A' (Drawing No. PG2178-4), which illustrate the relative depth and location of the proposed buildings to the proposed Confederation Line alignment.

Shoring design criteria and description of excavation and shoring method;	A temporary shoring system for the proposed development, if required, is anticipated to consist of soldier piles and lagging. Additional shoring design criteria are provided in the aforementioned Geotechnical Investigation Report prepared by Paterson. The temporary shoring drawings, if required, will be submitted once they are finalized. A temporary shoring design if required, will also take into consideration the presence of the temporary BRT detour.
Groundwater control plan, including the determination of the short-term (during construction) and long-term effects of dewatering on the Confederation Line structure, and provision of assurances that the influences of dewatering will have no impact on the Confederation Line structure;	Due to the relatively shallow bedrock depth in the vicinity of the subject site, it is anticipated that the proposed rail line will be bearing on sound bedrock. Therefore, should groundwater lowering occur, no negative impacts are expected for the Confederation Line or temporary BRT detour. Refer to Proximity Assessment Report PG2178-LET.01 Revision 5 dated July 10, 2025 presented in Appendix D.
Proposal to replace/repair waterproofing system of the affected Confederation Line structure, including the Confederation Line expansion joint;	There will be at least a 16 m offset between the proposed Stage 2 LRT rail line and the proposed buildings. Therefore, the replace/repair of the waterproofing system is not applicable.
Identification of utility installations proposed through or adjacent to Confederation Line property.	Utility plans will be forwarded once they are completed. Based on the distance of 16 m between the proposed buildings and the proposed Confederation Line rail alignment, no negative impacts to the Confederation Line are anticipated due to utilities associated with the proposed development.

Identification of the exhaust air quality and relationship of air in-take/discharge to the Confederation Line at-grade vent shaft openings and station entrance openings.	Detailed mechanical plans will be forwarded once they are completed. Based on the distance of 16 m between the proposed buildings and the proposed Confederation Line rail alignment, no negative impacts to the Confederation Line are anticipated due to utilities associated with the proposed development.
Proposal for a pre-construction condition survey of the Confederation Line structure, including a survey to confirm locations of existing walls and foundations;	A thorough pre-construction condition survey of the Confederation Line, temporary BRT detour, and associated infrastructure will be completed prior to the start of construction at 335 Roosevelt Avenue.
Monitoring plan for movement of the shoring and Confederation Line structure prior to and during construction of the development, including an Action Protocol.	A monitoring plan for the movement of the temporary shoring system, if required adjacent of the Confederation Line, will be completed prior to construction and will be included with the temporary shoring drawing submission.

We trust that this information satisfies your immediate request.

Best Regards,

Paterson Group Inc.

Deepak k Rajendran, E.I.T.

Scott S. Dennis, P.Eng.

APPENDIX A

Site Plan

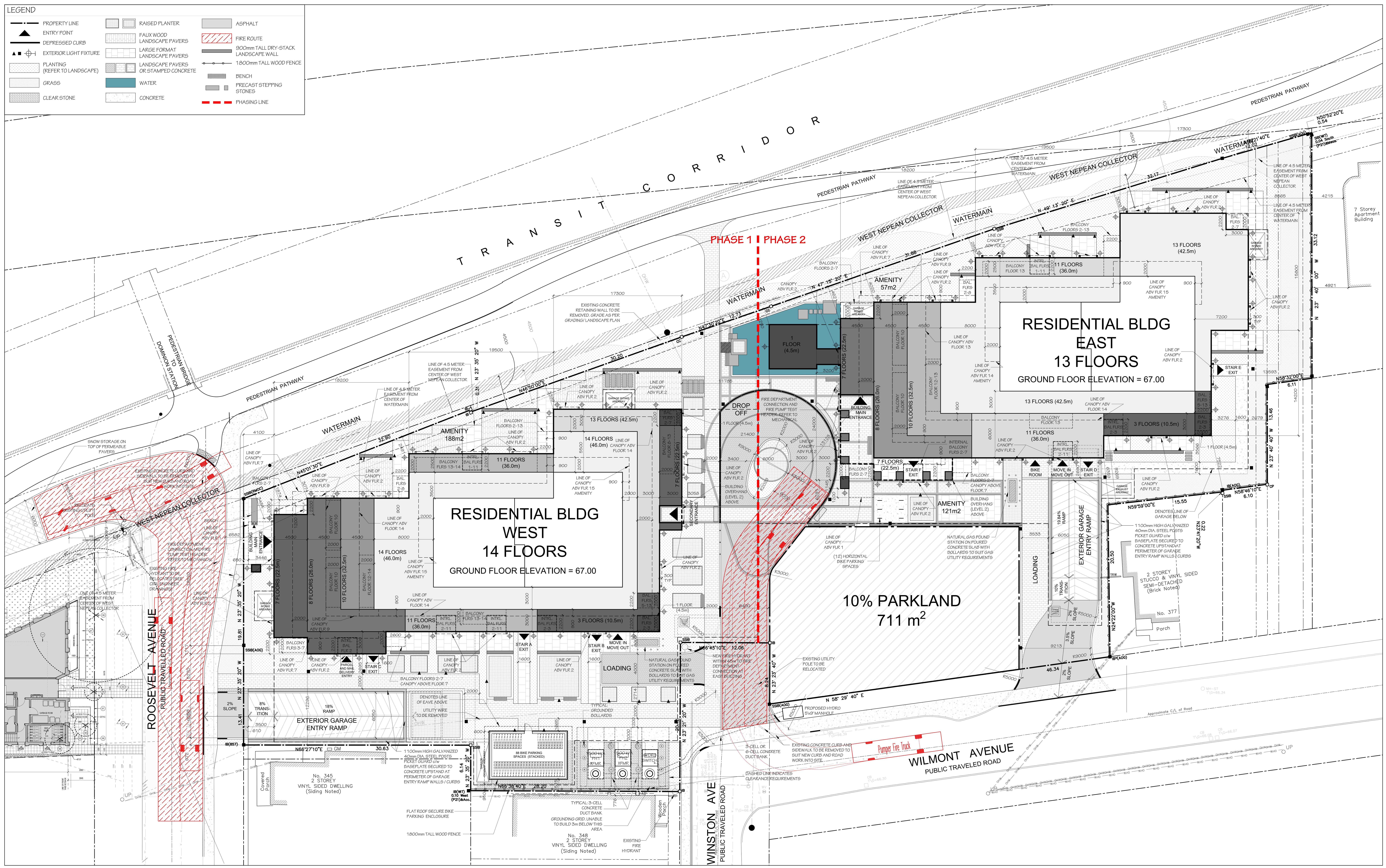
Confederation Line Proximity Plan

Confederation Line Cross Section A-A'

Topographic Plan of Survey

Temporary BRT Detour Plans

Construction Methodology and Impact Review



SURVEY INFORMATION TAKEN FROM:

TOPOGRAPHIC PLAN OF SURVEY OF
LOT 38, REGISTERED PLAN 114, LOTS 14 AND 15 (West Winston Avenue)
LOTS 21 & 22 AND PART OF LOT 20 (East Winston Avenue),
LOTS 17 AND 18 (West Moira Avenue),
PART OF WINSTON AVENUE (Closed by By-Law 44-79 Inst. NS45831),
PART OF MOIRA AVENUE (Closed By Judge's Order Inst. NS150801)
REGISTERED PLAN 179
CITY OF OTTAWA

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

SITE SUMMARY:

ZONING: R5B [2772] S454
* REFER TO BY-LAW NUMBER 2024-490

PROPOSED USE:
- RESIDENTIAL RENTAL APARTMENT BUILDINGS
- PHASE 1 WEST BUILDING = 14 RESIDENTIAL FLOORS
- PHASE 2 EAST BUILDING = 13 RESIDENTIAL FLOORS
- 3 LEVELS UNDERGROUND PARKING GARAGE BELOW PHASE 1 BUILDING AND 4 BELOW PHASE 2 BUILDING
- ROOF TOP AMENITY PHASE 1 AND PHASE 2 BUILDINGS

SITE AREA: 7,112 m²
\- 711 m² (10% PARKLAND)

TOTAL = 6,401 m² (PHASE 1 AND PHASE 2)

BUILDING FOOTPRINT AND COVERAGE PHASE 1 & 2: (VALUES ABOVE GRADE)

	PROPOSED
TOTAL SITE COVERAGE - PHASE 1 AND PHASE 2 =	40.9%
BUILDING FOOTPRINT - PHASE 1 WEST BUILDING :	1,284 m²
BUILDING FOOTPRINT - PHASE 2 EAST BUILDING :	1,336 m²
TOTAL FOOTPRINT - PHASE 1 AND PHASE 2 =	2,620 m²

LANDSCAPE OPEN SPACE PHASE 1 & 2:

	PROPOSED
SOFT LANDSCAPING :	1,318 m² (20.6 %)
HARD LANDSCAPING :	1,284 m² (20.1 %)
ARCHITECTURAL ELEMENTS :	293 m² (4.6 %)
TOTAL LANDSCAPE OPEN SPACE =	2,895 m² (45.3%)

BUILDING GFA ZONING: PHASE 1 & 2

	PROPOSED
GFA PHASE 1 WEST BUILDING =	15,446 m²
GFA PHASE 2 EAST BUILDING =	15,814 m²
TOTAL GFA PHASE 1 AND PHASE 2 =	31,260 m²

RESIDENTIAL UNITS: PHASE 1 & 2

	PROPOSED
PHASE 1 WEST BUILDING =	152 UNITS
PHASE 2 EAST BUILDING =	160 UNITS
TOTAL PHASE 1 AND PHASE 2 =	312 UNITS

BUILDING HEIGHTS: PHASE 1 & 2

MAXIMUM BUILDING HEIGHTS AS PER URBAN EXCEPTIONS AND ZONING SCHEDULE

A ROOFTOP INDOOR AMENITY SPACE IS PERMITTED TO PROJECT ABOVE THE MAXIMUM BUILDING HEIGHT FOR A MAXIMUM OF 4.5 M

REQUIRED SETBACKS: PHASE 1 & 2

MINIMUM SETBACKS AS PER URBAN EXCEPTIONS AND ZONING SCHEDULE

PHASE 1 WEST BUILDING: PARKING AND AMENITY AREA SUMMARY:

VEHICLE PARKING	REQUIRED	PROVIDED
RESIDENTIAL PARKING = 152 UNITS (- 12 UNITS) (X 0.5)	70	134
VISITOR PARKING = 152 UNITS (- 12 UNITS) (X 0.1)	14	14
TOTAL PHASE 1 =	84	148

VEHICLE PARKING DISTRIBUTION:
PARKING LEVEL P1 = 44
PARKING LEVEL P2 = 51
PARKING LEVEL P3 = 53

BICYCLE PARKING	REQUIRED	PROVIDED
BICYCLE PARKING = MINIMUM BICYCLE PARKING RATE: ONE PER DWELLING UNIT.	152	181

BICYCLE PARKING DISTRIBUTION:
INTERIOR = 93
EXTERIOR = 88

AMENITY AREA	REQUIRED	PROVIDED
TOTAL AMENITY AREA = 152 UNITS X 6 m² / UNIT	912 m²	2,335 m²
COMMUNAL AMENITY AREA = MIN. 50% OF REQ'D TOTAL AMENITY AREA	456 m²	1,176 m²

URBAN EXCEPTIONS 2772
ROOFTOP INDOOR AMENITY SPACE IS PERMITTED TO A MAXIMUM AREA OF 150 m²

PHASE 2 EAST BUILDING: PARKING AND AMENITY AREA SUMMARY:

VEHICLE PARKING	REQUIRED	PROVIDED
RESIDENTIAL PARKING = 160 UNITS (- 12 UNITS) (X 0.5)	74	116
VISITOR PARKING = 160 UNITS (- 12 UNITS) (X 0.1)	15	15
TOTAL PHASE 2 =	89	131

VEHICLE PARKING DISTRIBUTION:
PARKING LEVEL P1 = 26
PARKING LEVEL P2 = 37
PARKING LEVEL P3 = 38
PARKING LEVEL P4 = 30

BICYCLE PARKING	REQUIRED	PROVIDED
BICYCLE PARKING = MINIMUM BICYCLE PARKING RATE: ONE PER DWELLING UNIT.	160	262

BICYCLE PARKING DISTRIBUTION:
INTERIOR = 250
EXTERIOR = 12

AMENITY AREA	REQUIRED	PROVIDED
TOTAL AMENITY AREA = 160 UNITS X 6 m² / UNIT	960 m²	1,828 m²
COMMUNAL AMENITY AREA = MIN. 50% OF REQ'D TOTAL AMENITY AREA	480 m²	792 m²

URBAN EXCEPTIONS 2772
ROOFTOP INDOOR AMENITY SPACE IS PERMITTED TO A MAXIMUM AREA OF 150 m²

PHASE 1 WEST BUILDING SUMMARY:

LEVEL	GROSS AREA	NET AREA
UPPER MECHANICAL	212 m²	0 m²
MECHANICAL & ROOF AMENITY	338 m²	0 m²
LEVEL 14	702 m²	598 m²
LEVEL 13	811 m²	702 m²
LEVEL 12	811 m²	702 m²
LEVEL 11	896 m²	777 m²
LEVEL 10	963 m²	845 m²
LEVEL 9	963 m²	845 m²
LEVEL 8	1,070 m²	919 m²
LEVEL 7	1,219 m²	1,062 m²
LEVEL 6	1,219 m²	1,062 m²
LEVEL 5	1,219 m²	1,062 m²
LEVEL 4	1,219 m²	1,062 m²
LEVEL 3	1,263 m²	1,106 m²
LEVEL 2	1,257 m²	1,058 m²
LEVEL 1 GROUND	1,284 m²	223 m²
TOTAL ABOVE GRADE =	15,446 m²	12,022 m²
PARKING LEVEL P1	2,533 m²	0 m²
PARKING LEVEL P2	2,533 m²	0 m²
PARKING LEVEL P3	2,533 m²	0 m²
TOTAL BELOW GRADE =	7,599 m²	0 m²
TOTAL ABOVE AND BELOW GRADE =	23,045 m²	12,022 m²

PHASE 2 EAST BUILDING SUMMARY:

LEVEL	GROSS AREA	NET AREA
UPPER MECHANICAL	212 m²	0 m²
MECHANICAL & ROOF AMENITY	338 m²	0 m²
LEVEL 13	836 m²	728 m²
LEVEL 12	836 m²	728 m²
LEVEL 11	980 m²	854 m²
LEVEL 10	1,074 m²	947 m²
LEVEL 9	1,074 m²	947 m²
LEVEL 8	1,195 m²	1,021 m²
LEVEL 7	1,311 m²	1,137 m²
LEVEL 6	1,311 m²	1,137 m²
LEVEL 5	1,311 m²	1,137 m²
LEVEL 4	1,311 m²	1,137 m²
LEVEL 3	1,343 m²	1,168 m²
LEVEL 2	1,343 m²	1,168 m²
LEVEL 1 GROUND	1,336 m²	586 m²
TOTAL ABOVE GRADE =	15,814 m²	12,694 m²
PARKING LEVEL P1	2,245 m²	0 m²
PARKING LEVEL P2	2,245 m²	0 m²
PARKING LEVEL P3	2,245 m²	0 m²
PARKING LEVEL P4	1,841 m²	0 m²
TOTAL BELOW GRADE =	8,576 m²	0 m²
TOTAL ABOVE AND BELOW GRADE =	24,390 m²	12,694 m²

PROJECT CONSULTANTS:

ARCHITECT
HOBIN ARCHITECTURE INC.
63 PAMILLA STREET,
OTTAWA, ON K1S 3K7

CONTACT:
RHEAL LABELLE
TEL. 613-236-7200 X112

DEVELOPER
UNIFORM URBAN DEVELOPMENTS
117 CENTREPOINTE DR. #300
OTTAWA, ON K2G 5X3

CONTACT:
RYAN MACDOUGALL
TEL. xxx xxx-xxxx EXT. xxx

SITE SERVICES & GRADING
NOVATECH
240 MICHAEL COWPLAND DR.
OTTAWA, ON K2M 1P6

CONTACT:
MARK BISSET
TEL. 613 xxx-xxxx EXT. xxx

GEOTECHNICAL
PATERSON GROUP
613-226-7381,
OTTAWA, ON K2E 7T9

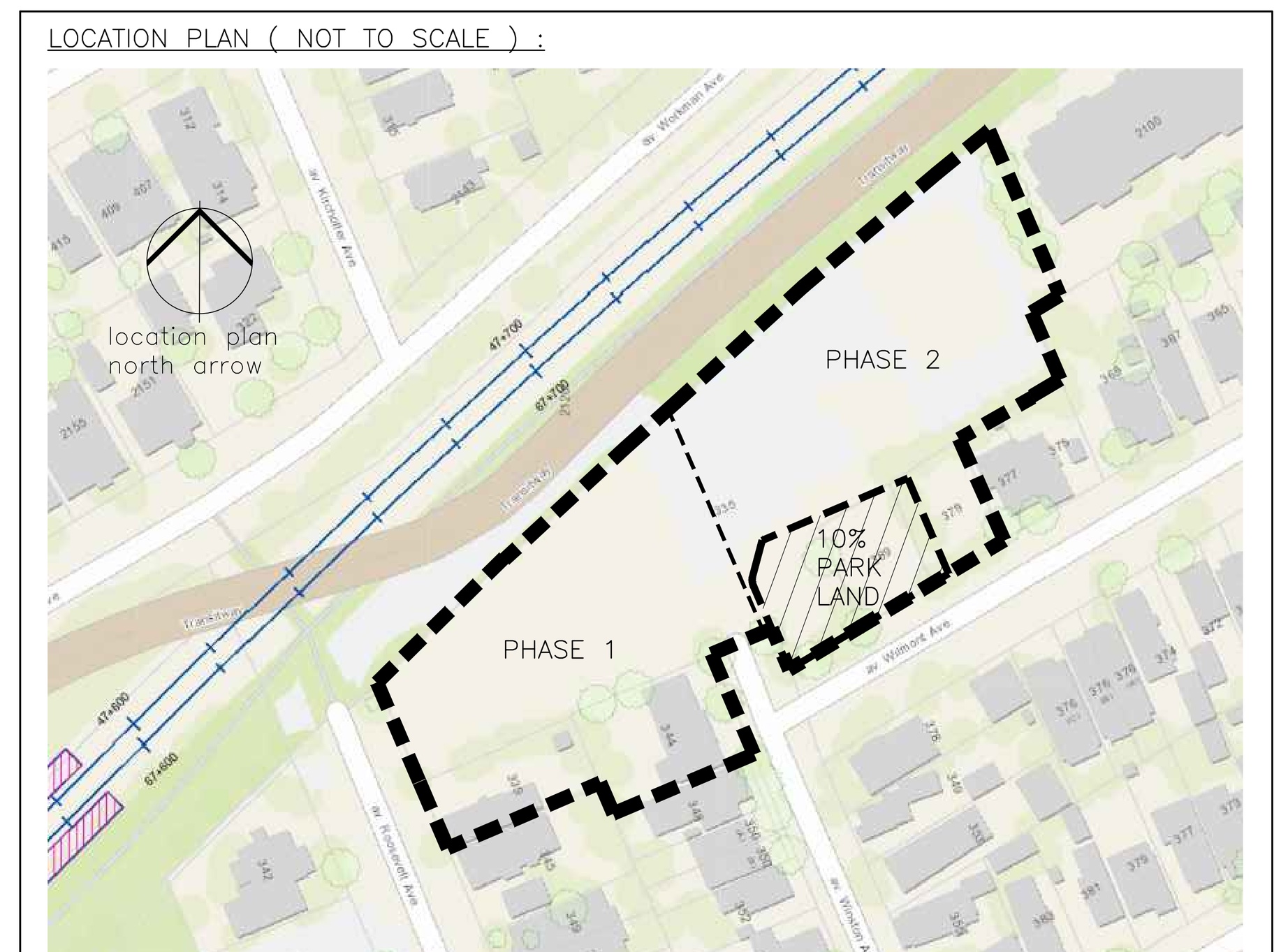
CONTACT:
DAVID GILBERT
TEL. 613 XXX XXXX EXT. XXX

LANDSCAPE ARCHITECT
NOVATECH
240 MICHAEL COWPLAND DR.,
OTTAWA, ON K2M 1P6

CONTACT:
SCOTT COVELL
613 254-9643 EXT. 303

GRAPHIC SCALE
0m 5m 10m 20m

LOCATION PLAN (NOT TO SCALE) :



no.	date	revision
7	2025-06-27	ISSUED FOR SPA
6	2025-06-27	ISSUED FOR COORDINATION
5	2025-06-20	ISSUED FOR REVIEW
4	2025-06-04	ISSUED FOR COORDINATION
3	2025-06-03	HYDRO COORDINATION
2	2025-05-08	ISSUED FOR COORDINATION
1	2025-02-21	ISSUED FOR COORDINATION

It is the responsibility of the appropriate contractor to check and verify all dimensions on site and report all errors and/or omissions to the architect.

All contractors must comply with all pertinent codes and by-laws.

Do not scale drawings.

This drawing may not be used for construction until signed.

ONTARIO ASSOCIATION OF ARCHITECTS
BARRY J. HOBIN
LICENCE 3049

uniform
URBAN DEVELOPMENTS
#300, 117 CENTREPOINTE DR, NEPEAN, ON, K2G 5X3

Hobin Architecture Incorporated
63 Pamilla Street
Ottawa, Ontario
Canada K1S 3K7
T: 613-238-7200
F: 613-235-2005
E: mail@hobinarc.com
hobinarc.com

HOBIN ARCHITECTURE

PROJECT/LOCATION:
335 ROOSEVELT
HIGHRISE RENTAL APARTMENTS
335 ROOSEVELT AVE, OTTAWA, ONTARIO

DRAWING TITLE:
SITE PLAN
PHASE 1 WEST BUILDING & PHASE 2 EAST BUILDING

DRAWN BY:	DATE:	SCALE:
JD	SEP. 4, 2024	1:200

north arrow

PROJECT: 2315

DRAWING NO.: A-1.01

REVISION NO.:

#XX XXX

File No: PC2024-0041

None
None

PROPOSED CONFEDERATION LINE ALIGNMENT

MULTI - USE PATHWAY

APPROXIMATE DISTANCE FROM EDGE OF DEVELOPMENT TO PROPOSED CONFEDERATION LINE ALIGNMENT

17.0m

APPROXIMATE DISTANCE FROM EDGE OF DEVELOPMENT TO PROPOSED CONFEDERATION LINE ALIGNMENT

16.0m

335 ROOSEVELT AVENUE

RESIDENTIAL BLDG WEST
14 FLOORS
GROUND FLOOR ELEVATION = 66.910

RESIDENTIAL BLDG EAST
13 FLOORS
GROUND FLOOR ELEVATION = 66.910

BH 1
66.39
[65.65]

BH 2
66.37
[65.68]

BH 3
66.43
[65.46]

BH 4
66.64
[65.47]

BH 5
66.50
[65.51]

TP 1
{0.91}

TP 2
{0.81}

TP 3
{0.71}

3-STOREY UNDERGROUND PARKING FOOTPRINT

10% PARKLAND

ROOSEVELT AVENUE

WILMONT AVENUE

WINSTON AVENUE

LEGEND:

- BOREHOLE LOCATION, 2020
- TEST PIT LOCATION, 2020
- GEOPHONE LOCATION
- 20 GEOPHONE NUMBER
- -10.5 SHOT LOCATIONS
- A A CROSS SECTION LOCATION
- 66.39 GROUND SURFACE ELEVATION (m)
- [65.65] BEDROCK SURFACE ELEVATION (m)
- {0.91} BEDROCK DEPTH (m)

CONCEPTUAL PLAN PROVIDED HOBIN ARCHITECTURE

SCALE: 1:500

0 5 10 15 20 25 30m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DD/MM/YYYY	INITIAL
3	UPDATED TO NEW CONCEPTUAL PLAN	26/02/2025	PB
2	UPDATED TO NEW CONCEPTUAL PLAN	29/10/2021	SD
1	UPDATED TO NEW CONCEPTUAL PLAN	07/09/2020	DP

UNIFORM URBAN DEVELOPMENTS
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
335 ROOSEVELT AVENUE
OTTAWA, ONTARIO

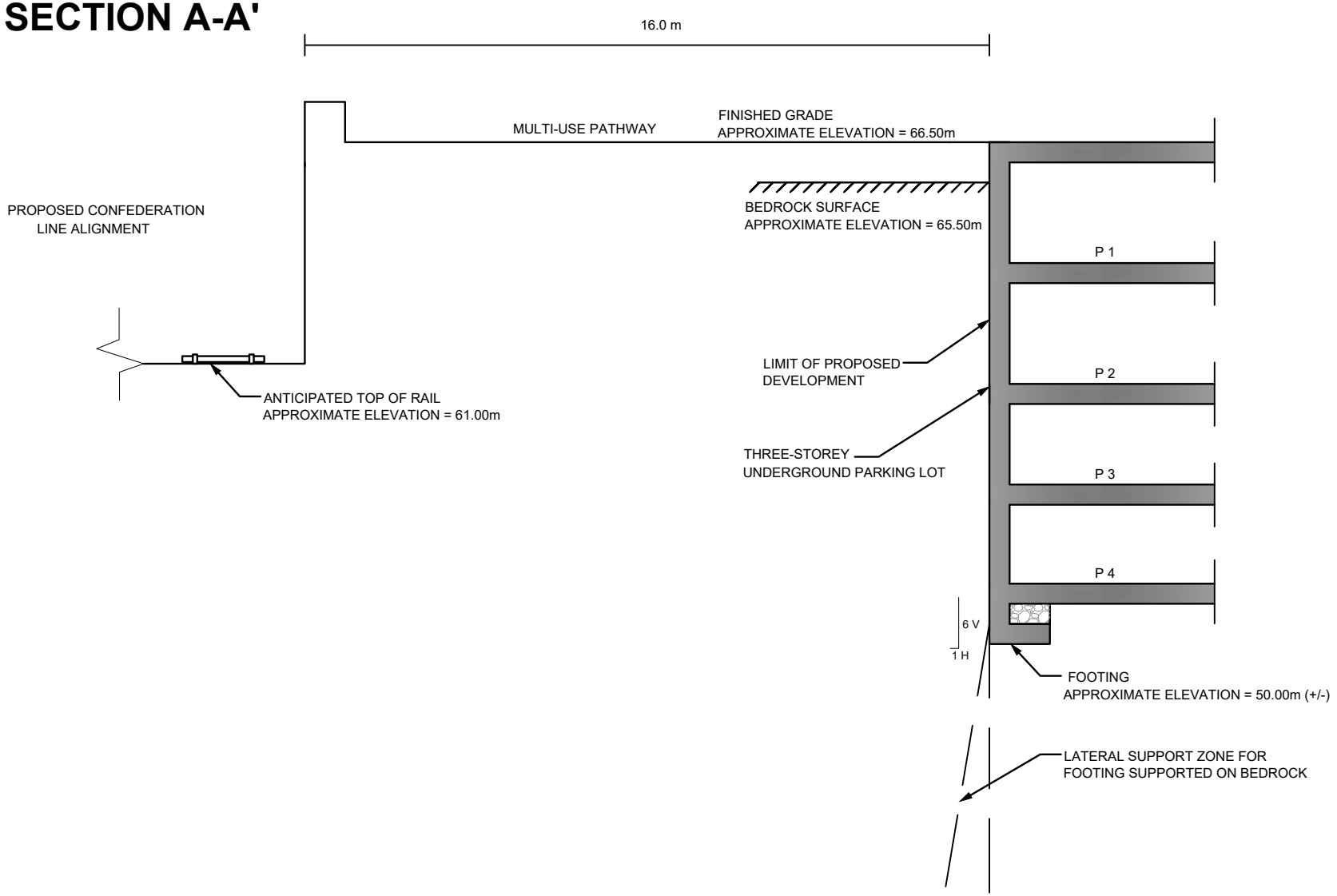
Title:
CONFEDERATION LINE PROXIMITY PLAN

Scale: 1:500	Date: 06/2020
Drawn by: YA	Report No.: PG2178-1
Checked by: PB	Dwg. No.: PG2178-3
Approved by: SD	Revision No.: 3

11x17

p:\autocad drawings\geotechnical\pg2178\pg2178-1-test hole location plan (rev.02).dwg

CROSS SECTION A-A'



PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

UNIFORM URBAN DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
335 ROOSEVELT AVENUE

OTTAWA, **ONTARIO**

Title:

CROSS SECTION A-A'

Scale: 1:150	**Date:** 07/2025
Drawn by: YA	**Report No.:** PG2178-1
Checked by: PB	**Drawing No.:** PG2178-4
Approved by: SD	**Revision No.:**

p:\autocad drawings\geotechnical\pg21xx\pg2178\pg2178-4-cross section a-a' dwg

8-1/2x11

TOPOGRAPHICAL PLAN OF SURVEY OF

LOT 38
REGISTERED PLAN 114
LOTS 14 AND 15 (West Winston Avenue)
LOTS 21 & 22 AND PART OF LOT 20
(East Winston Avenue)
LOTS 17 AND 18 (West Moira Avenue)
PART OF WINSTON AVENUE
(Closed by By-Law 44-79 Inst. NS45831)
PART OF MOIRA AVENUE
(Closed By Judge's Order Inst. NS150801)REGISTERED PLAN 179
CITY OF OTTAWA

Surveyed by
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

Scale 1 : 300

12 9 6 3 0 6 12 Metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

Surveyor's Certificate

I CERTIFY THAT:
1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The survey was completed on January 11, 2006.

JAN. 13, 2006
Date

E. H. HERWEYER
ONTARIO LAND SURVEYOR

UNDERGROUND SERVICE & INVERT INFORMATION ADDED SEPTEMBER 18, 2006.

ADDITIONAL TREE INFORMATION ADDED AUGUST 18, 2010.

ELEVATION OF TOP AND LOCATION OF NORTH EDGE OF 1.22ø WATERMAIN ADDED AUGUST 18, 2010.

ELEVATION OF TOP AND LOCATION OF SOUTH EDGE OF 1.22ø WATERMAIN AT (A) AND (B) ADDED OCTOBER 18, 2010.

ADDITIONAL CURBS AT WINSTON AND WILMONT AND LOCATION OF FIRE HYDRANT ADDED AUGUST 10, 2011.

ASSOCIATION OF ONTARIO LAND SURVEYORS PLAN SUBMISSION FORM 1585529

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR

As per O.Reg. 826, Regulation 42(8), Section 29(3).

Notes & Legend

©	Denotes	LIGHT STANDARD
●	"	UTILITY POLE
	"	GUY WIRE
	"	DECIDUOUS TREE
	"	CONIFEROUS TREE
MH	"	MAINTENANCE HOLE (STORM SEWER)
MH	"	MAINTENANCE HOLE (SANITARY)
MH	"	MAINTENANCE HOLE (WATER VALVE)
	"	MAINTENANCE HOLE (UNIDENTIFIED)
	"	BOLLARD
	"	CATCHBASIN
	"	FIRE HYDRANT
x 65.00	"	LOCATION OF ELEVATIONS
x Inv=65.00* x Top=65.00*	"	ELEVATIONS OBTAINED FROM CITY OF OTTAWA AS-BUILT DRAWINGS (SEE UTILITY NOTES)
*	"	LOCATION OF ELEVATIONS ADDED AUG 18, 2010.
*	"	LOCATION OF ELEVATIONS ADDED AUG 10, 2011.
	"	PROPERTY LINE
— G —	"	UNDERGROUND GAS
— ST —	"	STORM SEWER
— S —	"	SANITARY SEWER
— W —	"	WATERMAIN
T/L	"	TOP OF LID/GRATE
Inv	"	INVERT
C/L	"	CENTRELINE
	"	SURVEY MONUMENT PLANTED
	"	SURVEY MONUMENT FOUND
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
SSIB*	"	SHORT STANDARD IRON BAR (0.3m LONG)
IB	"	IRON BAR
CRIB	"	CORRUGATED ROUND IRON BAR
CC	"	CUT CROSS
S/W	"	SPIKE AND WASHER
WIT	"	WITNESS
(P1)	"	REGISTERED PLAN 114
(P2)	"	REGISTERED PLAN 179
(P3)	"	PLAN 4R-2731
(P4)	"	PLAN 5R-3875
(P5)	"	PLAN 5R-3958
(P6)	"	PLAN 5R-6341
(P7)	"	PLAN 4R-10545
(P8)	"	PLAN 5R-14473
(P9)	"	PLAN 4R-19763
(P10)	"	PLAN BY (AOG) OCTOBER 29, 1991
(P11)	"	PLAN BY (AOG) SEPTEMBER 29, 1983
(P12)	"	PLAN BY (857) JULY 30, 1997
(P13)	"	PLAN BY (857) MARCH 30, 1966
(P14)	"	PLAN BY (1287) AUGUST 28, 1992
(AOG)	"	ANNIS, O'SULLIVAN, VOLLEBEKK
CLF	"	CHAIN LINK FENCE
BF	"	BOARD FENCE
CRW	"	CONCRETE RETAINING WALL
OHW	"	OVERHEAD WIRES
EOG	"	EDGE OF GRAVEL
TOC	"	TOP OF CONCRETE CURB
Fin.	"	FINISHED
Bldg	"	BUILDING

BEARINGS ARE ASTRONOMIC DERIVED FROM THE WESTERLY LIMIT OF WINSTON AVENUE SHOWN TO BE N23°38'10"W ON PLAN 5R-3875.

SITE AREA = 5508 Square Metres
BOUNDARY INFORMATION COMPILED FROM EXISTING SURVEY PLANS

ELEVATIONS NOTES

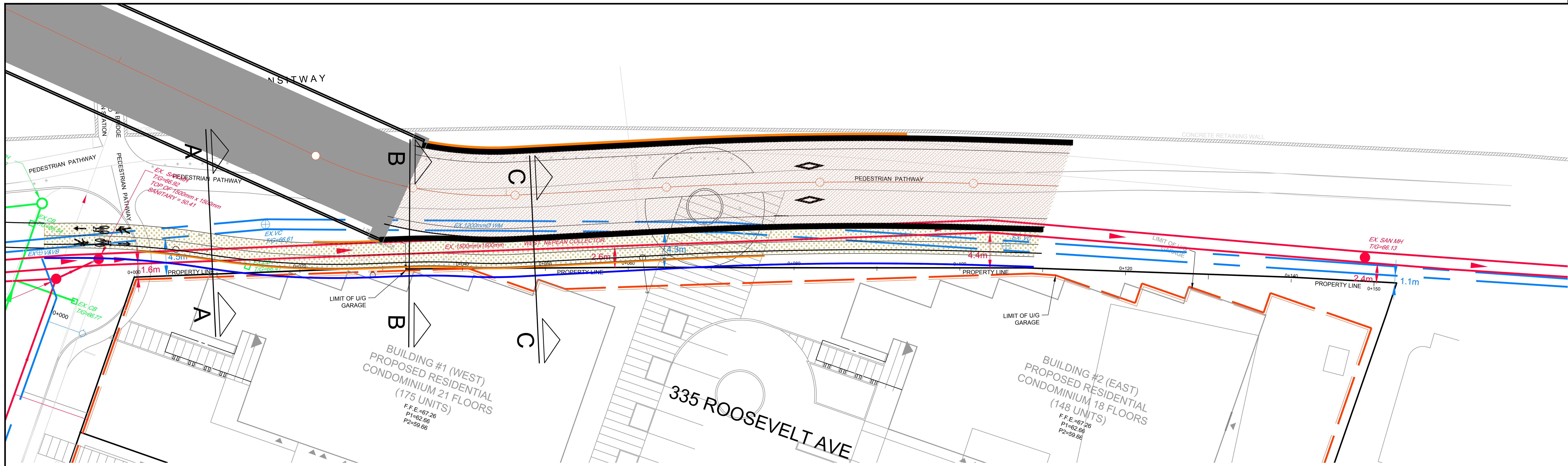
1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM.
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATIONS AND DESCRIPTIONS AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

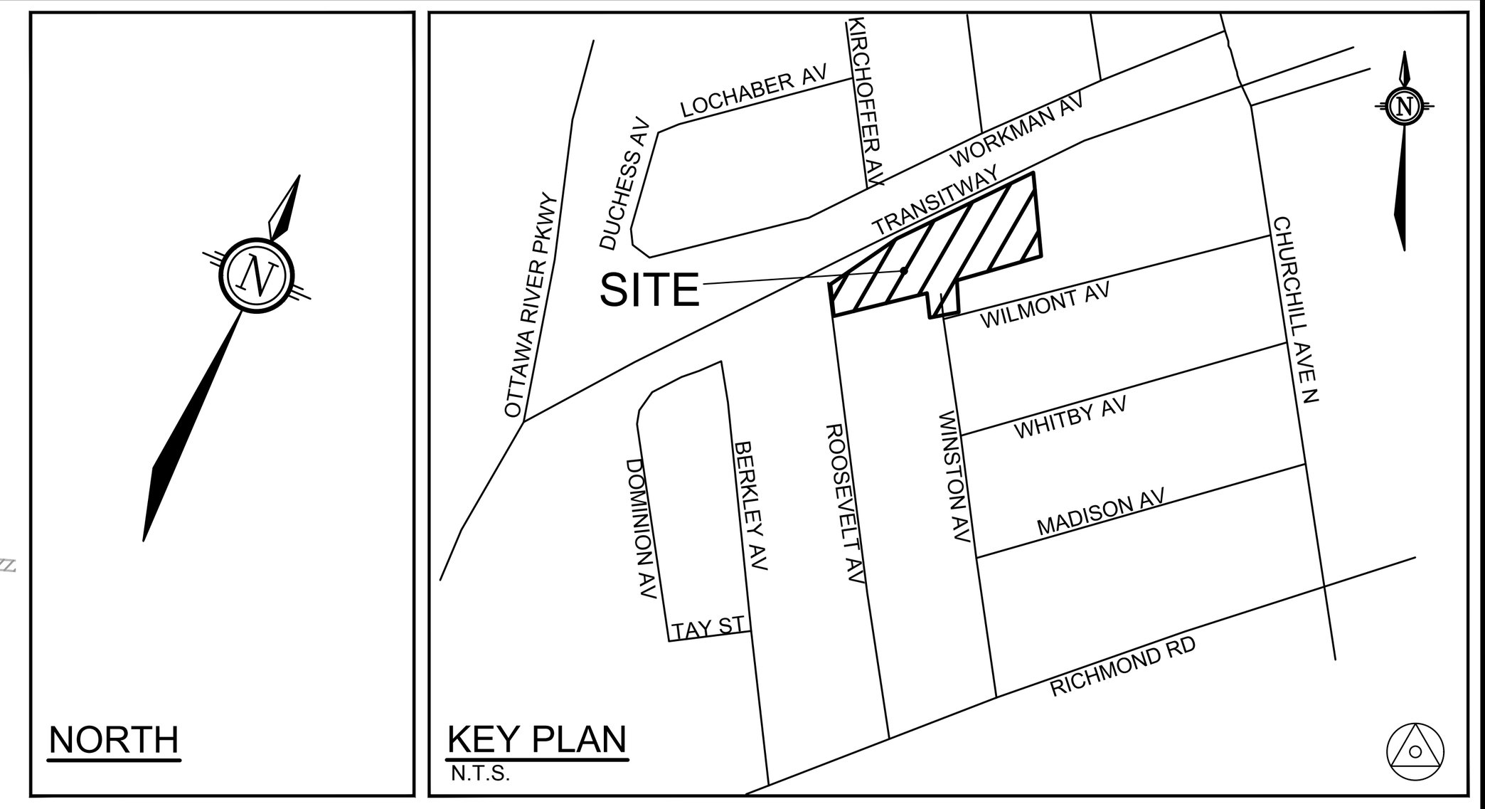
UTILITY NOTES

1. UNDERGROUND UTILITY INFORMATION DERIVED FROM CITY OF OTTAWA PLAN 2179, DATED SEPT 27, 1988 AND CITY OF OTTAWA PLAN 2183, DATED JUNE 4, 1989.
2. THIS SURVEY COMPLETED UNDER WINTER/SNOW CONDITIONS. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ALL OF THE UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION.
3. A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY BEFORE ANY WORK INVOLVING BREAKING GROUND, PROBING, EXCAVATING ETC.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

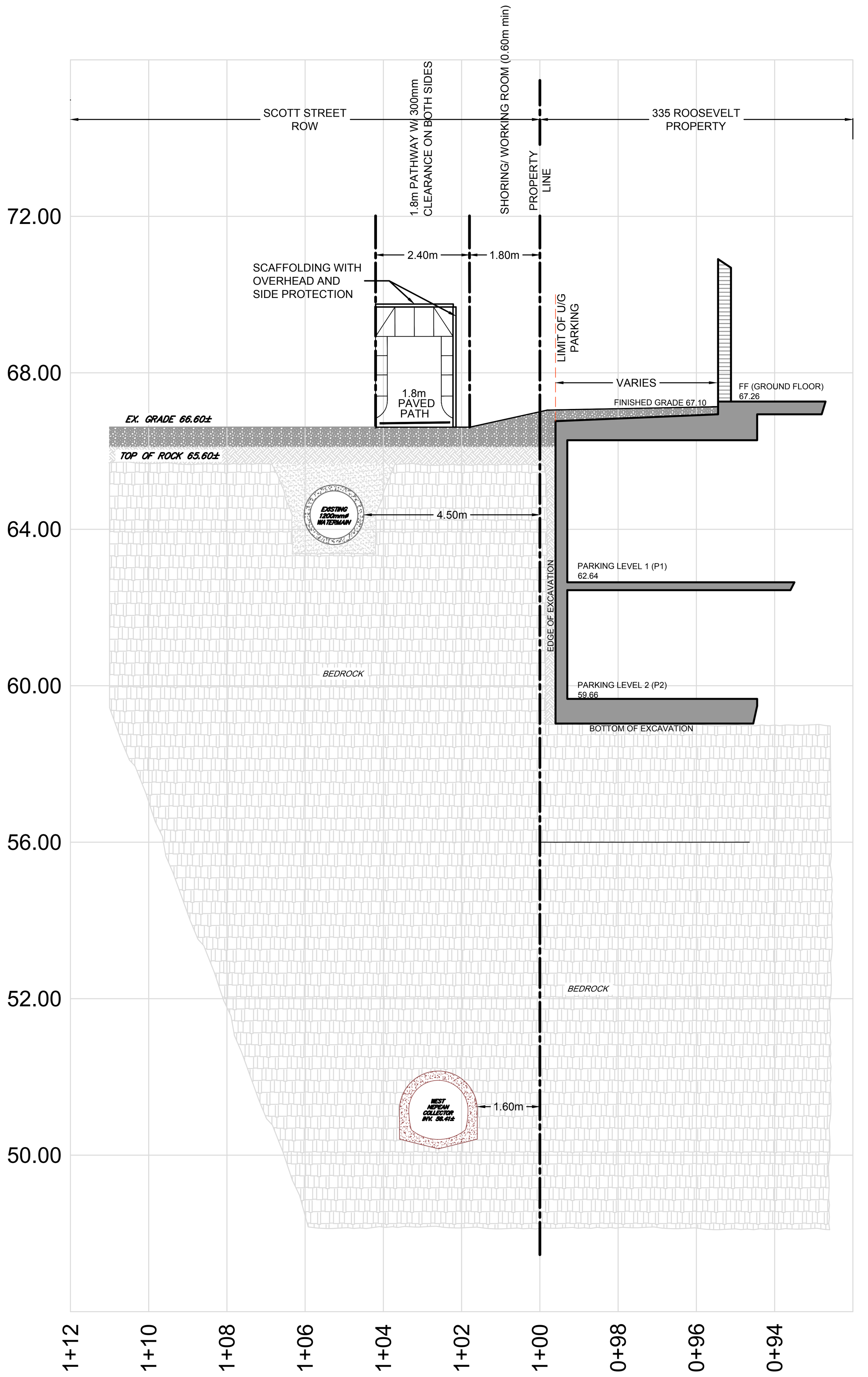
Job No. 11093-10 TOPO Lt 38 Pl 114 Its in Pt 179 Ottawa D2 AUG 10-2011 | CRO



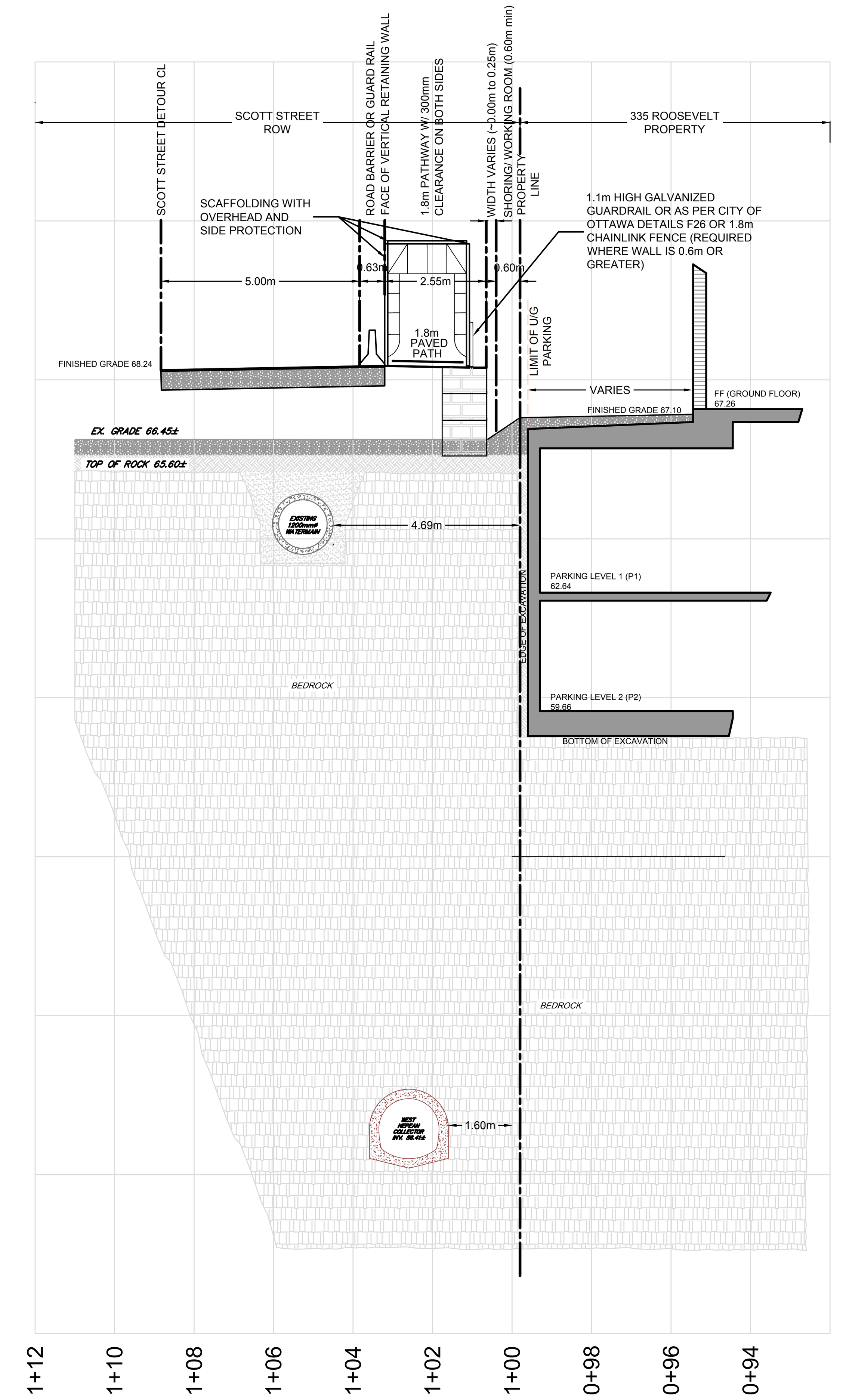


LEGEND

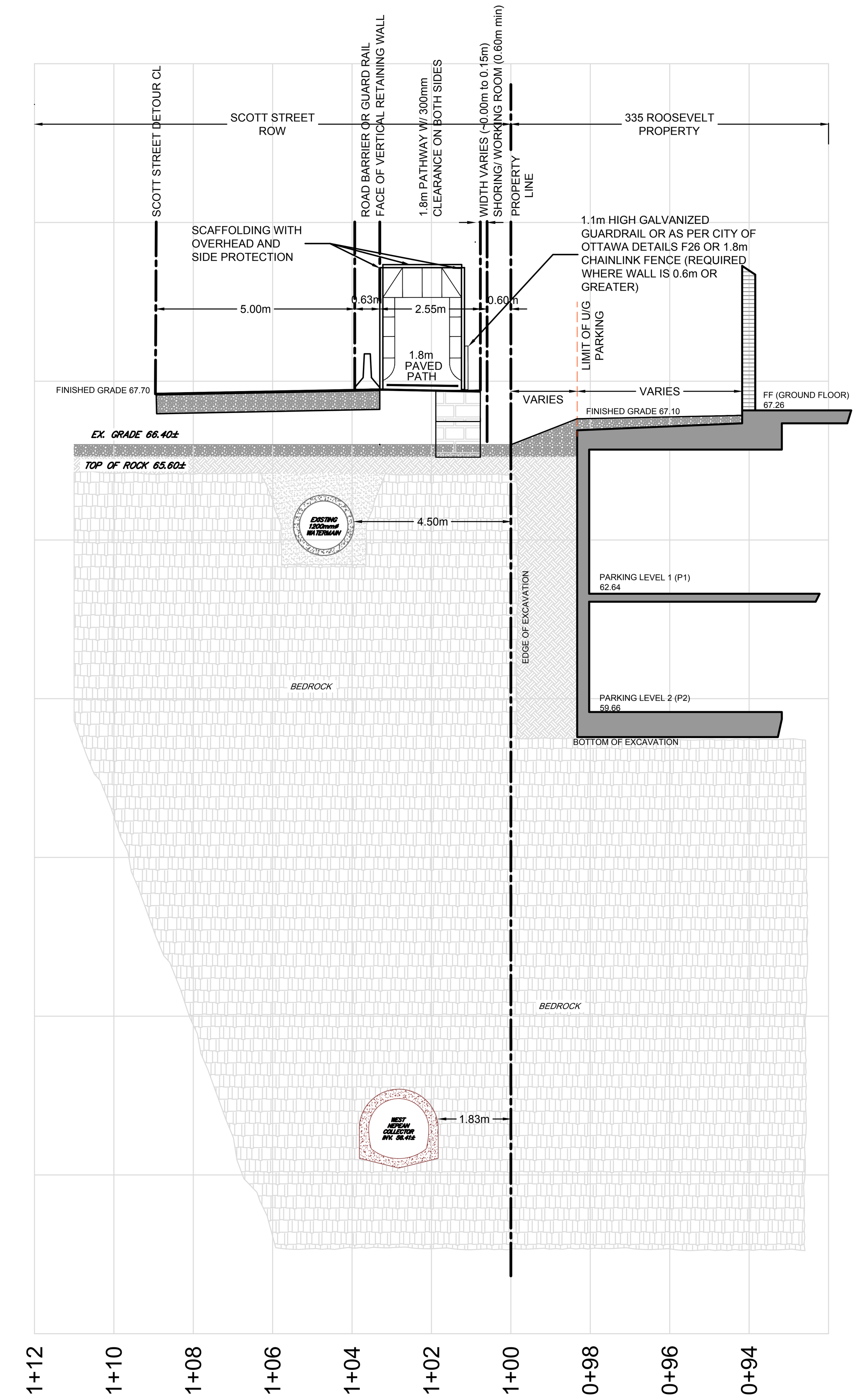
PROPERTY LINE



CROSS SECTION (A-A)
STATION 0+009
1:100



CROSS SECTION (B-B)
STATION 0+033
1:100



CROSS SECTION (C-C)
STATION 0+047
1:100

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR INFORMATION	NOV 20	BHB

SCALE 1:100

DESIGN BHB
CHECKED BHB
DRAWN BHB
CHECKED BHB
APPROVED BHB

FOR REVIEW ONLY

NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

LOCATION
CITY OF OTTAWA
335 ROOSEVELT AVENUE

uniform

DRAWING NAME
CROSS SECTION
PROPOSED SCOTT STREET
DETOUR AND MUP

PROJECT No. 110098-00
REV # 1
DRAWING No. 110098-XS2

M:\2010\110098\CAD\Design\110098-XS2.dwg, 110098-XS, Dec 01, 2020 - 10:43am, bneed

Construction Methodology and Impact Review		
Construction Item	**Potential Impact**	**Mitigation Program**
Item A - Installation of Temporary Shoring System - Where adequate space is not available for the overburden to be sloped, the overburden along the perimeter of the proposed building footprint will need to be shored in order to complete the construction of the underground parking levels. The shoring system is anticipated to consist of a soldier pile and lagging system.	Vibration issues during shoring system installation	Design of the temporary shoring system, in particular vibrations during installation, will take into consideration the presence of the proposed Confederation Line alignment and Dominion Station structure. Installation of the shoring system is not anticipated to have an adverse impact on the Confederation Line and Blair Station, nonetheless, a series of vibration monitoring devices are recommended to be installed to monitor vibrations. The vibration monitors would be remotely connected to permit real time monitoring and a vibration monitoring program would be implemented as detailed in Subsection 3.1 - Vibration Monitoring Program of Paterson Group Report PG2178-2 Revision 2 dated October 29, 2021.
Item B - Bedrock Blasting and Removal Program - Blasting of the bedrock will be required for the proposed buildings and parking garage structure construction. It is expected that up to approximately 6 to 7 m of bedrock removal is required based on the current design concepts for the proposed development.	Structural damage of Confederation Line and Dominion Station due to vibrations from blasting program.	Structural damage to the Confederation Line and Dominion Station during bedrock blasting and removal is not anticipated, nonetheless, a series of vibration monitoring devices are recommended to be installed along the LRT alignment to monitor vibrations. The vibration monitors would be remotely connected to permit real time monitoring and a vibration monitoring program would be implemented as detailed in Subsection 3.1 - Vibration Monitoring Program of Paterson Group Report PG2178-2 Revision 2 dated October 29, 2021.
Item C - Construction of Footings and Foundation Walls - The proposed building will include 2 levels of underground parking. Therefore, the footings will be placed over a clean, surface sounded limestone bedrock bearing surface.	Building footing loading on adjacent Confederation Line and Dominion Station structure, and excavation within the lateral support zone of the Confederation Line and Dominion Station structure.	Due to the distance between the proposed building and the Confederation Line and Dominion Station, the zone of influence from the proposed footings will not intersect the LRT structures. Further, although the underground parking levels for the proposed building will extend approximately 6 to 7 m below existing ground surface, due to the approximate 16 m distance between the proposed building and LRT structures, the building excavation will not impact the lateral support zone of the Confederation Line or Dominion Station structure.

APPENDIX B

Geotechnical Investigation:

Paterson Group Report PG2178-1 Revision 5 dated July 10, 2025

PATERSON GROUP

Geotechnical Investigation

Proposed High-Rise Development

335 Roosevelt Avenue
Ottawa, Ontario

Prepared for Uniform Urban Developments

Report PG2178-1 Revision 5 dated July 10, 2025

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Uniform Urban Developments to conduct a geotechnical investigation for the proposed development to be located at 335 Roosevelt Avenue in the City of Ottawa, Ontario (refer to Figure 1 – Key Plan in Appendix 2 for the general site location).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes, and to
- Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development at the subject will consist of 2 high-rise buildings. The west building will have 3 underground parking levels, while the east building will have 4 underground parking levels.

At finished grades, the proposed buildings will be surrounded by asphalt-paved walkways and parking areas with paver walkways and landscaped margins. It is also expected that the proposed buildings will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was carried out on April 1 and 4, 2025. At that time, 6 boreholes and 14 test pits were advanced to maximum depths of 15.1 and 3.0 m below the existing ground surface, respectively. A previous geotechnical investigation conducted at subject site by Paterson in November 2010 included 5 boreholes advanced to a maximum depth of 9.5 m below the existing ground surface.

The borehole locations were distributed in a manner to provide general coverage of the subject site. The locations of the boreholes are shown on Drawing PG2178-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a truck-mounted auger drill rig operated by a two-person crew and test pits were completed by a hydraulic excavator. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations, sampling and testing the overburden. In addition, bedrock was cored at each borehole location using diamond drilling procedures.

Sampling and In Situ Testing

Soil samples were collected from the boreholes either by sampling directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. Rock cores (RC) were obtained using 47.6 mm inside diameter coring equipment. Grab samples (G) from the test pits were recovered from the side walls of the open excavation. The depths at which the auger, split-spoon, rock core and grab samples were recovered from the test holes are shown as AU, SS, RC and G, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

All samples were visually inspected and initially classified on site. The grab, auger and split-spoon samples were placed in sealed plastic bags, and rock core samples were placed in cardboard boxes. All samples were transported to our laboratory for further examination and classification.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Diamond drilling was carried out at borehole BH 1-25 through BH 6-25 to assess the bedrock depth and quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown on the Soil Profile and Test Data Sheets in Appendix 1.

The recovery value is the ratio shown, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

A groundwater monitoring well was installed in all boreholes to permit the monitoring of the groundwater level subsequent to the completion of the sampling program. The groundwater observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data sheets in Appendix 1.

3.2 Field Survey

The test hole locations, and the ground surface elevation at each test hole location for the current investigation, were surveyed by Paterson using a handheld GPS unit with respect to a geodetic datum. The ground surface elevation at each borehole locations for the previous investigation was referenced to a temporary benchmark (TBM), consisting of a magnetic nail in a utility pole. A geodetic elevation of 67.30 m has been provided for the TBM by Annis O'Sullivan Vollebekk Ltd. The location of the TBM and boreholes, as well as the ground surface elevation at each borehole, are presented on Drawing PG2178-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil and bedrock samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. All samples from the current investigation will be stored in the laboratory for 1 month after this report is completed. They will then be discarded unless we are otherwise directed.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

At the time of the field program, two existing residential buildings were located along the southwest boundary of the subject site. The remainder of the site was surfaced with gravel and fill.

The site is bordered to the north by the transitway, to the west by Roosevelt Avenue, to the south by Winston Avenue and Wilmont Avenue, and to the east by a 7-storey residential building. The western-most building was noted to be approximately 0.6 m below Roosevelt Avenue.

A sewer (West Nepean Collector) and watermain are located just to the north of the subject site, with inverts at approximate elevations of 50 m and 63 m, respectively. Additionally, the transit-way located north of the subject site was noted to be approximately 6 m below the elevation of 335 Roosevelt Avenue. The subject site is relatively flat.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the borehole locations consists of either asphaltic concrete or fill overlying native silty sand or silty clay. Bedrock was encountered at depths between about 0.5 and 3 m.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each borehole location.

Bedrock

Based on the results of the bedrock coring, the bedrock consists of limestone with layers of black shale which is generally poor to fair in quality in the upper 2 m, becoming to good to excellent in quality with depth.

Available geological mapping indicates that the subject site is located in an area where the bedrock consists of interbedded limestone and dolomite of the Gull River formation, with drift thicknesses varying between 1 and 2 m.

4.3 Groundwater

Groundwater levels (GWL) were measured in all boreholes on November 16, 2010. The measured GWL readings are presented in Table 1 below. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 1 – Summary of Groundwater Levels

Test hole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1	66.39	4.88	61.51	November 16, 2010
BH 2	66.37	6.53	59.84	
BH 3	66.43	Dry	--	
BH 4	66.64	3.84	62.80	
BH 5	66.50	4.97	61.53	
BH 1-25	66.26	3.57	62.69	April 11, 2025
BH 2-25	66.29	3.90	62.39	
BH 3-25	66.36	4.46	61.9	
BH 4-25	66.63	4.13	62.5	
BH 5-25	66.25	4.28	61.97	
BH 6-25	66.13	3.10	63.03	

Note:
-The ground surface elevation at each test hole location was surveyed using a high precision GPS and are referenced to a geodetic datum.

Based on these observations, the long-term groundwater level is expected to range between approximately 4 to 5 m below ground surface.

However, it should be noted that groundwater levels are subject to seasonal fluctuations, therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. The proposed buildings are recommended to be founded on conventional spread footings placed on clean, surface sounded bedrock.

Considering that the site is underlain by shallow bedrock (within about 1 m below the surface), shoring may not be necessary if the excavation of the overburden soils can be stepped back from the bedrock excavation face.

Bedrock removal will be required to complete the 3 levels of underground parking. Temporary rock bolts may be required to stabilize the walls of the excavation through bedrock.

A sewer (West Nepean Collector) and watermain run along the north property boundary, in close proximity to the subject site. It is expected that the adjacent sewer and watermain could be subjected to potential vibrations associated with the bedrock blasting program. To ensure that no detrimental vibrations cause damage to the adjacent sewer and watermain, a vibration monitoring and control program is recommended to be undertaken during the blasting and excavation work required for the proposed building excavation.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures. However, due to the depth of bedrock and the anticipated founding level for the proposed buildings, it is anticipated that all existing overburden material will be excavated from within the proposed building footprints.

Bedrock Removal

Based on the bedrock encountered in the area, it is expected that line-drilling in conjunction with hoe-ramming or controlled blasting will be required to remove the

bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

An existing watermain alignment is located approximately 2.5 m north of the subject site's north property line. Blasting can be used for most of the bedrock removal up to a minimum horizontal distance of 2 m from the northern property line, along the existing watermain. Blasting operations will be reviewed and the 2 m minimum distance from the watermain may be increased if vibrations from the blasting operation are questionable.

Vibration monitors should be installed to measure the vibrations and to ensure that the vibration levels stay below 25 and 15 mm/s at the property boundary and watermain, respectively.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s

between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz).

It should be noted that these guidelines are for today's construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed building.

Vibration Monitoring and Control Plan

Due to the presence of the existing sewer and watermain near the northern property boundary, a vibration monitoring and control plan (VMCP) is recommended during the excavation program. The purpose of the vibration monitoring and control plan is to provide measures to be implemented by the contractor to manage excavation operations and any other vibration sources during the construction for the proposed development. The VMCP will also provide a guideline for assessing results against the relevant vibration impact assessment criteria and recommendations to meet the required limits.

The monitoring program will incorporate real time results at the existing sewer and watermain segment adjacent to the subject site. The monitoring equipment should consist of a tri-axial seismograph, capable of measuring vibration intensities up to 254 mm/s at a frequency response of 2 to 250 Hz. At least two vibration monitoring devices should be placed adjacent to the existing watermain.

It is recommended that the vibration monitoring devices be installed at obvert level of the existing watermain, and be periodically inspected during the construction program.

This report, which includes the VMCP, should be provided to all parties involved with the construction for review. A meeting between Paterson and site contractor should be conducted prior to any excavation or construction of the subject site to review the following:

- ❑ The pre-condition/pre-construction survey.
- ❑ Control measures (i.e vibrations, noise).
- ❑ Monitoring locations.
- ❑ Tracking and reporting of excavation progress, and.
- ❑ Procedure for exceedances (i.e vibrations, noise), complaints, evaluation and corrective measures.

When an event is triggered, Paterson will review the results and provide any necessary feedback. Otherwise, the vibration results will be summarized in the weekly report. The following table outlines the vibration limits for the adjacent watermain segment.

Table 2 - Structure Vibration Limits for adjacent Watermain Segment

Dominant Frequency Range (Hz)	Peak Particle Velocity (mm/s)	Event	Description of Event
<10	all	none	no action required
<40	>10	trigger level	Warning e-mail sent to contractor.
<40	≥15	exceedance level	Exceedance e-mail and phone call to the contractor. All operations are ceased to review on-site activities.
>40	>15	trigger level	Warning e-mail sent to contractor.
>40	≥20	exceedance level	Exceedance e-mail and phone call to the contractor. All operations are ceased to review on-site activities.

The monitoring protocol should include the following information:

Trigger Level Event

- ❑ Paterson will review all vibrations over the established warning level, and
- ❑ Paterson will notify the contractor if any vibrations occur due to construction activities and are close to exceedance levels.

Exceedance Level Event

- ❑ Paterson will notify all the relevant stakeholders via email,
- ❑ Ensure monitors are functioning, and
- ❑ Isse the vibration exceedance results.

Fill Placement

Engineered fill placed for grading beneath the proposed buildings, where required, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

If excavated bedrock is to be used as fill, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 300 mm. Where this fill material is open-graded, a woven geotextile may be required to prevent adjacent finer materials from migrating into the voids, with associated loss of ground and settlements. This can be assessed at the time of construction.

Lean Concrete Filled Trenches

Where rock overbreak occurs at the underside of footing (USF) elevation, lean concrete (minimum **17 MPa** 28-day compressive strength) can be used to reinstate the subgrade from the bedrock surface to the USF elevation. Typically, the excavation side walls will be used as the form to support the concrete. The lean concrete placement should be at least 150 mm wider than all sides of the footing (strip and pad footings) at the base of the excavation. The additional width of the concrete poured will suffice in providing a direct transfer of the footing load to the underlying bedrock.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on the clean, surface sounded bedrock surface can be designed using a bearing resistance value at serviceability limit states (SLS) and ultimate

limit states (ULS) of **5,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the above-noted bearing resistance value at SLS and ULS.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Footings supported on clean, surface sounded bedrock, and designed for the bearing resistance values provided herein, will be subjected to negligible post-construction total and differential settlements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

5.4 Design for Earthquakes

The Seismic shear wave velocity testing was completed within the subject site to accurately determine the applicable seismic site designation for the proposed buildings in accordance with Ontario Building Code (OBC) 2024. The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided on Figures 2 and 3 in Appendix 2 of the present report.

Field Program

The seismic array was located within the proposed mid-rise building footprint at the subject site and as presented in Drawing PG2178-1 – Test Hole Location Plan attached to the present report. Paterson field personnel placed 24 horizontal 4.5 Hz geophones mounted to the surface by means of two 75 mm ground spike attached to the geophone land case. The geophones were spaced at 1 m intervals and were connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a laptop computer and a hammer trigger switch attached to a 12-pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between 4 to 8 times at each shot location to improve signal to noise ratio.

The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were 1, 2 and 10.5 m away from the first and last geophone, and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation of the shear wave velocity results was completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct, reflected and refracted waves.

The interpretation is repeated at each shot location to provide an average shear wave velocity, Vs_{30}, of the upper 30 m profile, immediately below the proposed foundation of the buildings. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location.

The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

It is understood that the footings of the proposed building are to be founded directly on the bedrock surface. From the testing results, the average bedrock shear wave velocity is **2,220 m/s**.

The V_{s30} was calculated using the standard equation for average shear wave velocity provided in OBC 2024 and as presented below:

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{S_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{S_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{30\ m}{2{,}220\ m/s}\right)}$$

$$V_{s30=} 2{,}220\ m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity V_{s30} for the proposed buildings founded on bedrock is **2,220 m/s**. Therefore, as per the OBC 2024, a **Seismic Site Designation X_{2220}** is applicable for the design of proposed buildings. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill from within the footprints of the proposed buildings, the bedrock will be considered an acceptable subgrade on which to commence backfilling for floor slab construction.

It is anticipated that the underground levels for the proposed buildings will be mostly parking, and the recommended pavement structures noted in Section 5.8 will be applicable. However, if storage or other uses of the lower level will involve the construction of a concrete floor slab, the upper 300 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

In consideration of the anticipated groundwater conditions, an underslab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided under the lowest level slab of the proposed building. This is discussed further in Section 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the proposed building. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a drained unit weight of 20 kN/m^3 (effective unit weight 13 kN/m^3).

However, the lower portion of the basement walls are to be poured against a composite drainage blanket which will be placed against the exposed bedrock

face. A nominal coefficient of at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 23.5 kN/m^3 (effective 15.2 kN/m^3) where this condition occurs. Further, a seismic earth pressure component will not be applicable for the foundation wall which is poured against the bedrock face. It is expected that the seismic earth pressure will be transferred to the underground floor slabs, which should be designed to accommodate these pressures. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a \cdot H^2/g$ where:

$a_c = (1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H= height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.303g according to OBC 2024. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o \cdot \gamma \cdot H^2$, where K = 0.5 for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2024.

5.7 Rock Anchor Design

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or a 60 to 90 degree pullout of rock cone with the apex of the cone near the middle of the bonded length of the anchor. Interaction may develop between the failure cones of anchors that are relatively close to one another resulting in a total group capacity smaller than the sum of the load capacity of each individual anchor.

A third failure mode of shear failure along the grout/steel interface should be reviewed by the structural engineer to ensure all typical failure modes have been reviewed. The anchor should be provided with a bonded length at the base of the anchor which will provide the anchor capacity, as well an unbonded length between the rock surface and the top of the bonded length.

Permanent anchors should be provided with corrosion protection. As a minimum, the entire drill hole should be filled with cementious grout. The free anchor length is provided by installing a plastic sleeve to act as a bond break, with the sleeve filled with grout or a corrosion inhibiting mastic. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems or Williams Form Engineering Corp. Recognizing the importance of the anchors for the long-term performance of the foundation of the proposed building, any permanent rock anchors for this project are recommended to be provided with double corrosion protection.

Grout to Rock Bond

The Canadian Foundation Engineering Manual recommends a maximum allowable grout to rock bond stress (for sound rock) of 1/30 of the unconfined

compressive strength (UCS) of either the grout or rock (but less than 1.3 MPa) for an anchor of minimum length (depth) of 3 m. Generally, the UCS of sound limestone bedrock ranges between about 60 and 120 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, can be calculated. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

As discussed previously, the geotechnical capacity of the rock anchors depends on the dimensions of the rock anchors and the configuration of the anchorage system. Based on existing bedrock information, a **Rock Mass Rating (RMR) of 69** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.575 and 0.00293**, respectively.

Recommended Rock Anchor Lengths

Parameters used to calculate rock anchor lengths are provided in Table 3 below:

Table 3 – Parameters used in Rock Anchor Review

Grout to Rock Bond Strength – Factored at ULS	1.0 MPa
Compressive Strength – Grout	40 MPa
Rock Mass Rating (RMR) – Good Quality Limestone Hoek and Brown Parameters	69 m=0.575 and s=0.00293
Unconfined Compressive Strength – Shale Bedrock	60 MPa
Unit weight – Submerged Bedrock	15 kN/m^3
Apex Angle of Failure Cone	60°
Apex of Failure Cone	Mid-point of fixed anchor length

The fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths for a 125 mm diameter hole are provided in Table 4 below. The factored tensile resistance values given in Table 4 are based on a single anchor with no group influence effects.

A detailed analysis of the anchorage system, including potential group influence effects, could be provided once the details of the loading for the proposed building are determined.

Table 4 – Recommended Rock Anchor Lengths – Grouted Rock Anchor				
Diameter of Drill Hole (mm)	**Anchor Lengths (m)**			**Factored Tensile Resistance (kN)**
	Bonded Length	**Unbonded Length**	**Total Length**	
125	1.1	0.5	1.6	300
	1.5	0.7	2.2	500
	2.6	1	3.6	1000

Other Considerations

The anchor drill holes should be within 1.5 to 2 times the rock anchor tendon diameter and should be flushed clean prior to grouting under inspection from geotechnical personnel. A tremie tube is recommended to place grout from the bottom of the anchor holes. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day that grout is prepared.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request.

5.8 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the lower underground parking level of the proposed building consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 5 below.

Table 5 - Recommended Rigid Pavement Structure - Lower Parking Level	
Thickness (mm)	**Material Description**
125	**Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment)
300	**BASE** - OPSS Granular A Crushed Stone
SUBGRADE - Existing imported fill, or OPSS Granular B Type I or II material placed over in situ soil or bedrock.	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hours after the concrete has been poured during warm temperatures, and up to 12 hours during cooler temperatures.

Pavement Structure Over Podium Deck

The pavement structures presented in Tables 6 and 7 should be used for car only parking areas, at grade access lanes and heavy loading parking areas over the top of the podium structure.

Table 6 - Recommended Pavement Structure - Car Only Parking Areas Over Podium

Thickness (mm)	Material Description
50	**Wear Course** – HL-3 or Superpave 12.5 Asphaltic Concrete
200*	**BASE** - OPSS Granular A Crushed Stone
See below**	**Thermal Break** ** - Rigid Insulation (See Following Paragraph)
n/a	**Waterproofing Membrane and IKO Protection Board**
SUBGRADE – Reinforced concrete podium deck	

* Thickness of base course is dependent on grade of insulation as noted in proceeding paragraph
** If specified by others, not required from a geotechnical perspective

Table 7 - Recommended Pavement Structure – Access Lanes, Fire Truck Lane, Ramp, and Loading Areas Over Podium

Thickness (mm)	Material Description
40	**Wear Course** – HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** – HL-8 or Superpave 19.0 Asphaltic Concrete
300*	**BASE** - OPSS Granular A Crushed Stone
See below**	**Thermal Break** ** - Rigid Insulation (See Following Paragraph)
n/a	**Waterproofing Membrane and IKO Protection Board**
SUBGRADE – Reinforced concrete podium deck	

* Thickness of base course is dependent on grade of insulation as noted in proceeding paragraph
** If specified by others, not required from a geotechnical perspective

The transition between the pavement structure over the podium deck subgrade and soil subgrade beyond the footprint of the podium deck is recommended to be transitioned to match the existing pavement structures. For this transition, a 5H:1V is recommended between the two subgrade surfaces.

Further, the base layer thickness should be increased to a minimum thickness of 500 mm below the top of the podium slab a minimum of 1.5 m from the face of the foundation wall prior to providing the recommended taper.

Should the proposed podium deck be specified to be provided a thermal break by the use of a layer of rigid insulation below the pavement structure, its placement within the pavement structure is recommended to be as per the above-noted tables. The layer of rigid insulation is recommended to consist of a DOW Chemical High-Load 100 (HI-100), High-Load 60 (HI-60), or High-Load 40 (HI-40). The base layer thickness will be dependent on the grade of insulation considered for this project and should be reassessed by the geotechnical consultant once pertinent design details have been prepared.

The higher grades of insulation have more resistance to deformation under wheel-loading and require less granular cover to avoid being crushing by vehicular loading. It should be noted that SM (Styrofoam) rigid insulation is **not** considered suitable for this application.

Pavement Structure on Overburden Soils

The following pavement structures may be considered for at-grade car only parking and heavy traffic areas, should they be required. The proposed pavement structures are shown in Tables 8 and 9.

Table 8 - Recommended Pavement Structure - Car-Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils, bedrock or OPSS Granular B Type I or II material placed over in situ soil or bedrock	

Table 9 - Recommended Pavement Structure - Heavy-Truck Traffic and Loading Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils, bedrock or OPSS Granular B Type I or II material placed over in situ soil or bedrock	

Other Considerations

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that the proposed building foundation walls be blind-poured and placed against a composite drainage board which is fastened to the vertical bedrock face.

For the installation of the composite drainage board against the vertical bedrock face, the following is recommended:

- ❑ Line drill the excavation perimeter (usually at 150 to 200 mm spacing).
- ❑ Mechanically remove bedrock along the foundation walls, up to approximately 150 mm from the finished vertical excavation face.
- ❑ Grind the bedrock surface up to the outer face of the line drilled holes to create a satisfactory surface for the composite drainage board.
- ❑ If bedrock overbreaks occur, shotcrete these areas to fill in cavities and to smooth out angular features of the bedrock surface, as required based on site inspection by Paterson.
- ❑ Place a composite drainage board, such as Delta Drain 6000 or equivalent, against the prepared vertical bedrock surface. The composite drainage layer should extend from finished grade to underside of footing level. A waterproofing membrane should then be installed over the composite drainage board.
- ❑ Pour foundation wall against the composite drainage board and waterproofing membrane.

It is recommended that 100 mm diameter sleeves at 3 m centres be cast at the foundation wall/footing interface to allow for the infiltration of water from the composite drainage board to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to sump pit(s) within the lower basement area.

Elevators and any other pits located below the underslab drainage system should be waterproofed. This is illustrated on the attached Figure 6 – Waterproofing System for Elevator and Sump Pit.

Perimeter and Underslab Drainage System

The perimeter and underslab drainage system is recommended to control water infiltration below the underground parking level slab and to re-direct water from the building's foundation drainage system to the building's sump pit(s). For preliminary design purposes, it is recommended that 100 mm diameter perforated pipes be placed at approximate 6 m centres underlying the lowest level slab. The underslab drainage pipes should also be provided with a geosock and surrounded on all sides by a minimum 100 mm thick layer of 19 mm clear crushed stone.

The perimeter drainage system should be mechanically connected to the 100 mm drainage sleeves and gravity connected to the underslab drainage system, which in turn is connected to the building's sump pit(s).

The spacing of the underslab drainage system should be confirmed by the geotechnical consultant at the time of completing the excavation when water infiltration can be better assessed.

Elevator (and Sump) Pit Waterproofing

All elevator shaft exterior foundation walls and floor slabs should be waterproofed to avoid any infiltration into the elevator pit. The underside of the elevator pit slab should be waterproofed using a membrane such as Colphene BSW H for horizontal applications (or approved equivalent). It is recommended that a waterproofing membrane, such as Colphene Torch'n Stick (or approved equivalent), is applied to the exterior of the elevator shaft foundation wall. The membrane should extend to the top of the footing in accordance with the manufacturer's specifications.

A continuous PVC waterstop, such as Southern Waterstop 14RCB (or approved equivalent), should be installed within the interface between the concrete base slab below the elevator pit sidewalls. An outlet for any trapped water should be installed through the elevator pit wall with a gravity connection to the underfloor drainage system or directly to the sump pit.

A protection board should be placed over the waterproofing membrane to protect the membrane from damage during the backfilling operations.

Consideration should also be given to waterproofing the sump pit(s). If chosen, the above-noted waterproofing methodology will also be applicable to sump pit waterproofing.

Foundation Backfill

Above the bedrock surface, backfill against the exterior sides of the foundation walls should consist of free draining, non-frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent thickness of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure and require additional protection, such as soil cover of 2.1 m, or an equivalent combination of soil cover and foundation insulation.

However, footings are generally not expected to require protection against frost action due to the founding depth. Unheated structures such as the access ramp may require insulation for protection against the deleterious effects of frost action.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is anticipated that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations).

Unsupported Side Slopes

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level.

The subsurface soil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavation side slopes carried out for the building footprint are recommended to be provided with surface protection from erosion by rain and surface water runoff, where shoring is not anticipated to be implemented. This can be accomplished by covering the entire surface of the excavation side slopes with tarps secured between the top and bottom of the overburden excavation, and approved by Paterson personnel at the time of construction. It is further recommended to maintain a relatively dry surface along the bottom of the excavation footprint to mitigate the potential for sloughing of the side slopes.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations, where insufficient room is available for open cut methods. The shoring requirements, designed by a structural engineer specializing in those works, will depend on the depth of the excavation, the proximity of the adjacent structures and the elevation of the adjacent building foundations and underground services. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team.

Inspections and approval of the temporary system will also be the responsibility of the designer. The geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should consider the impact of a significant precipitation event and designate design measures to ensure that precipitation will not negatively impact the shoring system or soils supported by the system.

Any changes to the approved shoring design system should be reported immediately to the owner's structural designer prior to implementation.

The temporary shoring system could consist of a soldier pile and lagging system. Any additional loading due to street traffic, neighbouring buildings, construction equipment, adjacent structures and facilities, etc., should be included in the earth pressures described below.

The earth pressures acting on the temporary shoring system may be calculated with the parameters presented in Table 10, presented below.

Table 10 – Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Dry Unit Weight (γ), kN/m^3	20
Effective Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level. The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil should be calculated to full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

Bedrock Stabilization

Excavation side slopes in sound bedrock can be carried out using vertical side walls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system.

Horizontal rock anchors may be required at specific locations to prevent pop-outs of the bedrock, especially in areas where bedrock fractures are conducive to the failure of the bedrock surface.

The requirement for temporary chainlink fencing, shotcrete, and/or rock bolts should be evaluated during the excavation operations and should be discussed with the structural engineer during the design stage of the project. It is anticipated that such measures will be required, at a minimum, for the upper, weathered limestone bedrock.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material for areas over a soil subgrade. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD. The bedding material should extend at a minimum to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A crushed stone, should extend from the spring line of the pipe to a minimum of 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of its SPMDD.

Wet sub-excavated soil should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used. All stones greater than 300 mm in their greatest dimension should be removed prior to reuse of site-generated glacial till.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should consist of the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be relatively low to moderate, and controllable using open sumps.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Persons as stipulated under O.Reg. 63/16.

Adverse Effects of Dewatering on Adjacent Properties

Given the shallow bedrock present at, and in the vicinity of, the subject site, the neighbouring structures are expected to be founded on the bedrock surface. Therefore, no issues are expected with respect to groundwater lowering that would cause damage to adjacent structures surrounding the proposed development.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures using straw, propane heaters and tarpaulins or other suitable means.

In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost into the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions.

6.7 Protection of Existing Watermain

During the bedrock removal for the proposed development, the existing watermain located just beyond the north property boundary of the subject site will require monitoring.

Bedrock Condition

Based on our existing information, the bedrock is expected at approximate elevation +/-65.5 m. The upper portion of the bedrock is weathered and the bedrock quality improves with depth. The bedrock quality is generally fair to good based on the rock quality designation (RQD) findings below upper 1 to 2 m of weathered bedrock.

Paterson undertook a test pit excavation program on the subject property along the northern boundary on September 13, 2010. Three test pits were excavated using a rubber-tired backhoe and our findings can be summarized as follows:

Subsurface Conditions	Test Pit 1	Test Pit 2	Test Pit 3
Pavement structure overlying sandy silt deposit thickness	810 mm	810 mm	710 mm
Weathered bedrock thickness	100 mm	none	none
South bedrock depth	910 mm	810 mm	710 mm

The approximate locations of the test pits are shown on Drawing PG2178-1 - Test Hole Location Plan in Appendix 2.

Bedrock Removal along the Northern Boundary

The bedrock removal for the subject site will be carried out using a combination of blasting and hoe-ramming techniques, especially along the northern boundary where the existing watermain is located. The bedrock removal along the northern boundary will be carried out as follows:

- Blasting can be used for most of the bedrock removal up to a minimum horizontal distance of 2 m from the northern property line. A minimum line drilling spacing of 300 mm c/c will be required at the 2 m blasting boundary.

- The blasting contractor will control the blasting operation to keep peak particle velocities below 25 mm/s at the property boundary. It is expected that the blasting contractor will commence the blasting operation at the opposite end of the site so that blasting patterns and vibrations can be monitored and verified prior to attempting any blasting along the northern boundary adjacent to the existing watermain. This approach will allow the blasting contractor to adjust and control the blasting operation.

- Blasting operations will be reviewed and the 2 m minimum distance from the watermain may be increased if vibrations from the blasting operation are questionable.

- Within the minimum 2 m distance from the watermain, the bedrock will be removed using hoe-ramming or grinding techniques. Blasting will not be permitted. Line drilling spacing will be decreased to 200 mm c/c along the proposed excavation boundary. Similar to the blasting operations, hoe-ramming or grinding operations will be governed by the vibrations they produce along the property boundary adjacent to the watermain.

Monitoring and Reporting

- Two seismographs will be installed directly on the bedrock along the northern property line to monitor vibrations. Each blasting event will be reviewed and reported to the blasting contractor and the site superintendent.

- A weekly summary report will be issued presenting our findings and observations. Any concerns identified during the monitoring will be immediately reported, as discussed in Section 5.2, and the rock removal operations in the immediate area will be temporarily halted to address the concern.

6.8 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a slightly to moderately aggressive corrosive environment.

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and future details of the proposed development have been prepared:

- ❑ Review preliminary and detailed grading, servicing and landscaping plans, from a geotechnical perspective.
- ❑ Review of the geotechnical aspects of the foundation drainage systems prior to construction, if applicable.
- ❑ Review of the geotechnical aspects of the excavation contractor's shoring design, if not designed by Paterson, prior to construction, if applicable.

It is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- ❑ Review and inspection of the installation of the foundation drainage and waterproofing systems.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling and follow-up field density tests to determine the level of compaction achieved.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant. All excess soil must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

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 Uniform Urban Developments, or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Deepak K Rajendran, E.I.T.

Scott S. Dennis, P.Eng.

Report Distribution:

- ❑ Uniform Urban Development
- ❑ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362959.59 **NORTHING:** 5028485.36 **ELEVATION:** 66.26

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

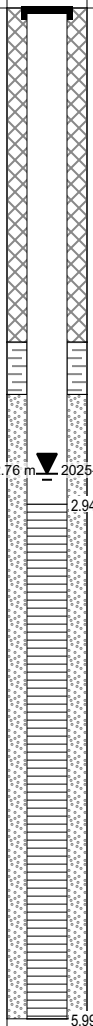
REMARKS:

DATE: April 1, 2025

FILE NO. : PG2178

HOLE NO. : BH 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, brown silty sand and gravel, with crushed stone, trace clay			AU 1						66
0.64m [65.62m]			AU 2						
BEDROCK: Poor quality bedrock, limestone and dolomite interbedded		1	RC 1	100	RQD 47				65
		2	RC 2	97	RQD 47				64
- Good to excellent quality bedrock below 3.0 m depth		3							63
		4	RC 3	100	RQD 83				62
		5	RC 4	100	RQD 100				61
5.99m [60.27m]		6							60
End of Borehole		7							59
(GWL at 2.76 m depth - April 11, 2025)		8							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362948.36 **NORTHING:** 5028436.56 **ELEVATION:** 66.29

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: April 1, 2025

FILE NO. : PG2178

HOLE NO. : BH 2-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, brown silty sand and gravel, with crushed stone, topsoil			AU 1						
0.76m [65.53m]									
BEDROCK: Fair to excellent quality bedrock, limestone and dolomite interbedded		1	RC 1	100	RQD 62				
		2	RC 2	100	RQD 66				
		3	RC 3	100	RQD 100			2.97 m – 2025-04-11	
		4							
		5	RC 4	100	RQD 100				
5.99m [60.30m]		6						5.99m	
End of Borehole									
(GWL at 2.97 m depth - April 11, 2025)		7							
		8							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362970.93 **NORTHING:** 5028470.25 **ELEVATION:** 66.36

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

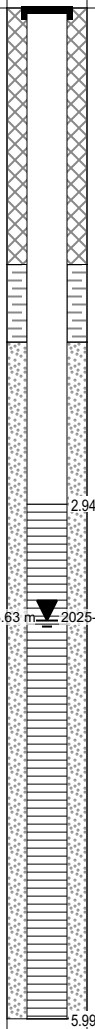
REMARKS:

DATE: April 1, 2025

FILE NO. : PG2178

HOLE NO. : BH 3-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, brown silty sand and gravel, with crushed stone, trace clay			AU 1						
0.86m [65.50m]									
BEDROCK: Fair to excellent quality bedrock, limestone and dolomite interbedded		1	RC 1	84	RQD 56				
		2	RC 2	100	RQD 66				
		3	RC 3	100	RQD 100				
		4	RC 4	100	RQD 90				
5.99m [60.37m]		6							
End of Borehole									
(GWL at 3.63 m depth - April 11, 2025)		8							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362955.80 **NORTHING:** 5028427.53 **ELEVATION:** 66.63

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: April 2, 2025

FILE NO. : PG2178

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact to dense, brown silty sand and gravel, with crushed stone, rock fragments		1	AU 1						66
			SS 2	57	16-19-21-15 40				
		2	RC 3	33	7-32-10-5 42				65
2.59m [64.04m]			RC 1	91	12-50-/-/ 50/0.1				
BEDROCK: Fair to excellent quality bedrock, limestone and dolomite interbedded		3	RC 2	100	RQD 55				64
		4	RC 3	100	RQD 89			2.82m 3.35 m 2025-04-11	63
		5	RC 4	100	RQD 95				62
5.56m [61.07m]								5.56m	61
End of Borehole (GWL at 3.35 m depth - April 11, 2025)		6							60
		7							59
		8							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362891.67 **NORTHING:** 5028416.89 **ELEVATION:** 66.25

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: April 2, 2025

FILE NO. : PG2178

HOLE NO. : BH 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											66
FILL: Compact to dense, brown silty sand and gravel, with crushed stone, topsoil			AU 1								
0.30m [65.95m]			AU 2								
Compact, brown **SILTY SAND** with gravel											65
0.66m [65.59m]											
BEDROCK: Fair to excellent quality bedrock, limestone and dolomite interbedded		1	RC 1	100	RQD 50						
		2	RC 2	100	RQD 85						64
										2.46m	
		3	RC 3	100	RQD 92						63
										3.60 m 2025-04-11	
		4									62
		5	RC 4	100	RQD 85						61
										5.51m	
		6	RC 5	100	RQD 97						60
		7									59
		8	RC 6								

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362891.67 **NORTHING:** 5028416.89 **ELEVATION:** 66.25

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: April 2, 2025

FILE NO. : PG2178

HOLE NO. : BH 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
		8	RC 6	100	RQD 95				58
		9							57
		10	RC 7	100	RQD 98				56
		11	RC 8	100	RQD 100				55
		12							54
		13	RC 9	100	RQD 100				53
		14							52
		15	RC 10	100	RQD 98				51
15.06m [51.19m] End of Borehole (GWL at 3.60 m depth - April 11, 2025)		16							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362907.01 **NORTHING:** 5028402.46 **ELEVATION:** 66.13

PROJECT:

ADVANCED BY: CME-55 Low Clearance Drill

REMARKS:

DATE: April 2, 2025

FILE NO. : PG2178

HOLE NO. : BH 6-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL: with organics									66
0.18m [65.95m]									
Compact, brown **SILTY SAND** with gravel			AU 1						
0.56m [65.57m]									
BEDROCK: Fair to excellent quality bedrock, limestone and dolomite interbedded		1	RC 1	100	RQD 56				65
		2	RC 2	97	RQD 85			2.47 m 2025-04-11	64
- Vertical fracture from 3.1 to 3.51 m depth		3	RC 3	95	RQD 75			2.54m	63
		4							62
		5	RC 4	100	RQD 87				61
5.59m [60.54m]								5.59m	
End of Borehole		6							60
(GWL at 2.47 m depth - April 11, 2025)		7							59
		8							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362969.22 **NORTHING:** 5028491.31 **ELEVATION:** 66.42

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.32m]			G 1						
FILL: Compact, brown fine to medium sand and clay with some gravel 0.30m [66.12m]			G 2						
FILL: Compact, dark brown, fine to medium sand with clay, trace topsoil, organics 0.45m [65.97m]									
FILL: Compact, brown, silty fine sand with some gravel, trace clay 0.85m [65.57m]			G 3						
End of Test Pit Practical refusal on bedrock at 0.85 m depth		1 2 3 4							66 65 64 63

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362957.73 **NORTHING:** 5028475.73 **ELEVATION:** 66.21

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 2-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Loose to compact, crushed stone			G 1								
0.10m [66.11m]											66
FILL: Compact, brown medium sand with silt and gravel, crushed stone											
0.60m [65.61m]			G 2								
FILL: Compact, light brown, fine silty sand with gravel, cobbles											
0.74m [65.47m]											65
End of Test Pit		1									
Practical refusal on bedrock at 0.74 m depth											64
		2									
		3									63
		4									

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362960.01 **NORTHING:** 5028455.22 **ELEVATION:** 66.27

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 3-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.17m]			G 1						
FILL: Compact, brown medium to coarse sand with gravel, crushed stone and occasional cobbles 0.25m [66.02m]			G 2						66
FILL: Compact, dark brown, fine to medium sand with silt, gravel and crushed stone, trace topsoil 0.65m [65.62m]			G 3						
Compact, light brown **SILTY SAND** with gravel and cobbles 0.82m [65.45m]									65
End of Test Pit		1							
Practical refusal on bedrock at 0.82 m depth		2							64
		3							63
		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362964.39 **NORTHING:** 5028431.66 **ELEVATION:** 66.78

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 4-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.24m [66.54m]									
FILL: Compact, dark brown medium sand with some gravel, crushed stone 0.95m [65.83m]			G 1 G 2						66
End of Test Pit Practical refusal on bedrock at 0.95 m depth		1 2 3 4							65 64 63

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362958.70 **NORTHING:** 5028422.84 **ELEVATION:** 66.68

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.58m]			G 1						
FILL: Compact, blasted rock with dark brown silty fine to medium sand, gravel, cobbles and crushed stone 0.25m [66.43m]									
FILL: Compact, crushed stone 0.50m [66.18m]			G 2						66
FILL: Compact, blasted rock with dark brown silty fine to medium sand, gravel, cobbles and crushed stone, trace clay		1	G 3						65
		2	G 4						64
3.00m [63.68m]		3	G 5						63
End of Test Pit Test pit terminated at 3.0m depth due to water infiltration and side walls collapsing into test pit		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362946.53 **NORTHING:** 5028427.77 **ELEVATION:** 66.36

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 6-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.26m]			G 1						
FILL: Compact, brown medium sand with some gravel and cobbles 0.55m [65.81m]									66
FILL: Compact, light brown, silty fine sand with some gravel and cobbles 0.90m [65.46m]			G 2						
End of Test Pit Practical refusal on bedrock at 0.9 m depth		1 2 3 4							65 64 63

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362931.86 **NORTHING:** 5028422.09 **ELEVATION:** 66.33

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 7-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.23m]									
FILL: Compact, dark brown medium sand with some silt and gravel 0.60m [65.73m]			G 1						
Compact, light brown **SILTY** fine **SAND** with gravel and cobbles 0.90m [65.43m]			G 2						
End of Test Pit Practical refusal on bedrock at 0.9 m depth		1 2 3 4							66 65 64 63

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362936.14 **NORTHING:** 5028459.77 **ELEVATION:** 66.18

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 8-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.15m [66.03m]			G 1						66
FILL: Compact, topsoil, some gravel and crushed stone 0.30m [65.88m]			G 2						
Compact, light brown **SILTY** fine **SAND** with some cobbles and gravel 0.65m [65.53m]		1							65
End of Test Pit Practical refusal on bedrock at 0.65 m depth		2							64
		3							63
		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362944.77 **NORTHING:** 5028445.96 **ELEVATION:** 66.25

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP 9-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) ▲ UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											66
FILL: Loose to compact, crushed stone			G 1								
0.15m [66.10m]											
FILL: Compact, brown silty fine to medium sand, gravel, trace clay			G 2								
0.45m [65.80m]											
TOPSOIL: trace gravel and clay 0.55m [65.70m]			G 3								
FILL: Compact, light brown silty fine to medium sand, gravel, cobbles and crushed stone, trace clay											65
0.85m [65.41m]											
End of Test Pit		1									
Practical refusal on bedrock at 0.85 m depth											64
		2									
		3									63
		4									

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362918.26 **NORTHING:** 5028443.88 **ELEVATION:** 66.18

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP10-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.08m]									66
FILL: Compact, dark brown silty clay with topsoil, sand, gravel, crushed stone 0.30m [65.88m]			G 1						
Compact, light brown **SILTY** fine **SAND** with gravel 0.60m [65.58m]			G 2						
End of Test Pit Practical refusal on bedrock at 0.6 m depth		1							65
		2							64
		3							63
		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362906.53 **NORTHING:** 5028428.17 **ELEVATION:** 66.11

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP11-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.05m [66.06m]			G 1						66
FILL: Compact, dark brown silty clay with topsoil, sand, gravel, crushed stone 0.15m [65.95m]			G 2						
Compact, light brown **SILTY** fine **SAND** with gravel 0.45m [65.66m]									
End of Test Pit									
Practical refusal on bedrock at 0.45 m depth		1							65
		2							64
		3							63
		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362875.60 **NORTHING:** 5028398.22 **ELEVATION:** 66.24

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP12-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
0.05m [66.19m]											
FILL: Compact, dark brown silty clay with topsoil, sand, gravel, crushed stone			G 1								
0.15m [66.09m]											
Compact, light brown **SILTY** fine **SAND** with gravel			G 2								
0.45m [65.79m]											
End of Test Pit											
Practical refusal on bedrock at 0.45 m depth											
		1									66
											65
		2									64
		3									63
		4									

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362953.45 **NORTHING:** 5028436.33 **ELEVATION:** 66.42

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP13-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Compact, crushed stone 0.10m [66.32m]			G 1						
FILL: Compact, dark brown silty fine sand with some blast rock, gravel, trace topsoil and clay 0.75m [65.67m]			G 2						66
Compact, light brown **SILTY** fine **SAND** with gravel, cobbles, trace clay 1.05m [65.37m]		1	G 3						65
End of Test Pit Practical refusal on bedrock at 1.05 m depth		2							64
		3							63
		4							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

335 Roosevelt Avenue, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 362976.95 **NORTHING:** 5028462.62 **ELEVATION:** 66.41

PROJECT:

ADVANCED BY: Back Hoe

REMARKS:

DATE: April 4, 2025

FILE NO. : PG2178

HOLE NO. : TP14-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Loose to compact, crushed stone									
0.20m [66.21m]									
FILL: Compact, dark brown silt, medium sand, gravel, cobbles and crushed stone, trace clay			G 1						
0.45m [65.96m]									
Compact, light brown **SILTY** fine **SAND** with gravel, trace clay			G 2						
1.00m [65.41m]		1							
End of Test Pit									
Practical refusal on bedrock at 1.05 m depth		2							64
		3							63
		4							

patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-335 Roosevelt Ave.
Ottawa, Ontario

DATUM TBM - Mag nail in utility pole, along southeast property line. Geodetic elevation = 67.30m.

FILE NO. PG2178

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 9 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.39
Asphaltic concrete 0.05		AU	1				
FILL: Dark brown silty sand, some gravel 0.46		SS	2		50+		
0.74		RC	1	94	22	1	65.39
Grey-brown **SILTY CLAY,** some sand		RC	2	100	51	2	64.39
BEDROCK: Grey limestone						3	63.39
- black shaley limestone from 1.5 to 2.5m depth		RC	3	100	78	4	62.39
		RC	4	100	84	5	61.39
		RC	5	100	35	6	60.39
		RC	6	100	96	7	59.39
		RC	7	100	100	8	58.39
9.47						9	57.39
End of Borehole							
(GWL @ 4.88m-Nov. 16/10)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-335 Roosevelt Ave.
Ottawa, Ontario

DATUM TBM - Mag nail in utility pole, along southeast property line. Geodetic elevation = 67.30m.

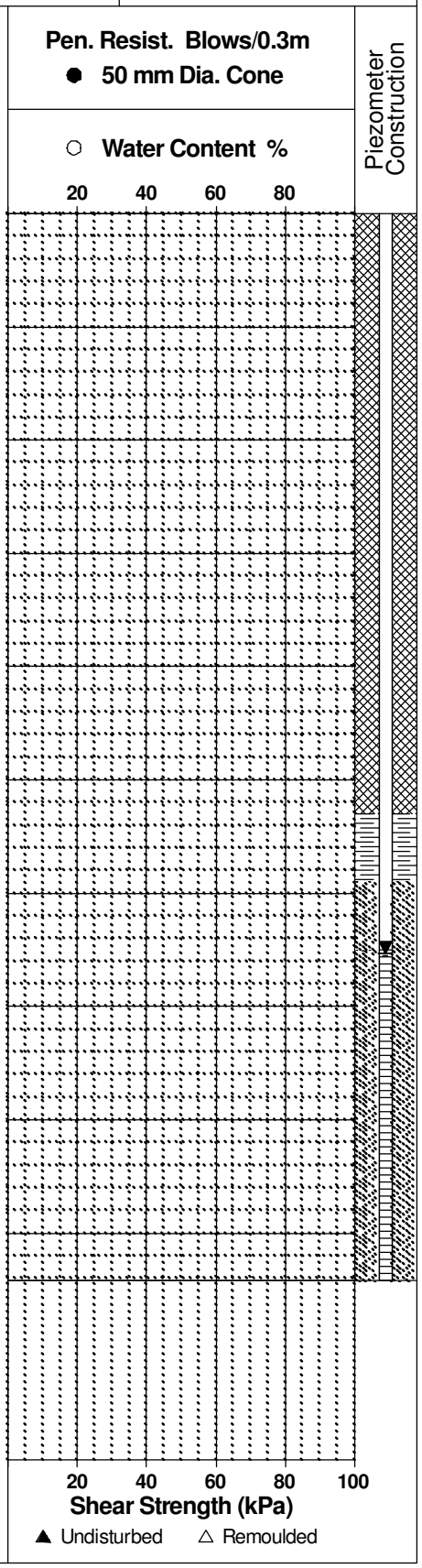
FILE NO. PG2178

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 9 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.37
Asphaltic concrete 0.05							
FILL: Dark brown silty sand, some gravel 0.46		AU	1				
Grey-brown **SILTY CLAY** 0.60		SS	2	0	50+		
		RC	1	84	58	1	65.37
		RC	2	100	57	2	64.37
BEDROCK: Grey limestone						3	63.37
- black shaley limestone from 1.6m to 2.5m depth		RC	3	98	83	4	62.37
		RC	4	100	92	5	61.37
		RC	5	98	98	6	60.37
		RC	6	100	93	7	59.37
		SS	7	100	100	8	58.37
9.42						9	57.37
End of Borehole							
(GWL @ 6.53m-Nov. 16/10)							



patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-335 Roosevelt Ave.
Ottawa, Ontario

DATUM TBM - Mag nail in utility pole, along southeast property line. Geodetic elevation = 67.30m.

FILE NO. PG2178

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 9 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.43
Asphaltic concrete 0.05		AU	1				
FILL; Brown silty sand with gravel 0.60							
FILL: Light brown silty sand, some gravel, trace clay 0.97		SS	2	0	50+		
		RC	1	88	63	1	65.43
		RC	2	97	35	2	64.43
BEDROCK: Grey limestone						3	63.43
- black shaley limestone from 1.5m to 1.7m depth		RC	3	100	75	4	62.43
		RC	4	98	87	5	61.43
						6	60.43
		RC	5	98	85	7	59.43
		RC	6	100	89	8	58.43
		RC	7	96	96	9	57.43
9.40 End of Borehole							
(BH dry - Nov. 16/10)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-335 Roosevelt Ave.
Ottawa, Ontario

DATUM TBM - Mag nail in utility pole, along southeast property line. Geodetic elevation = 67.30m.

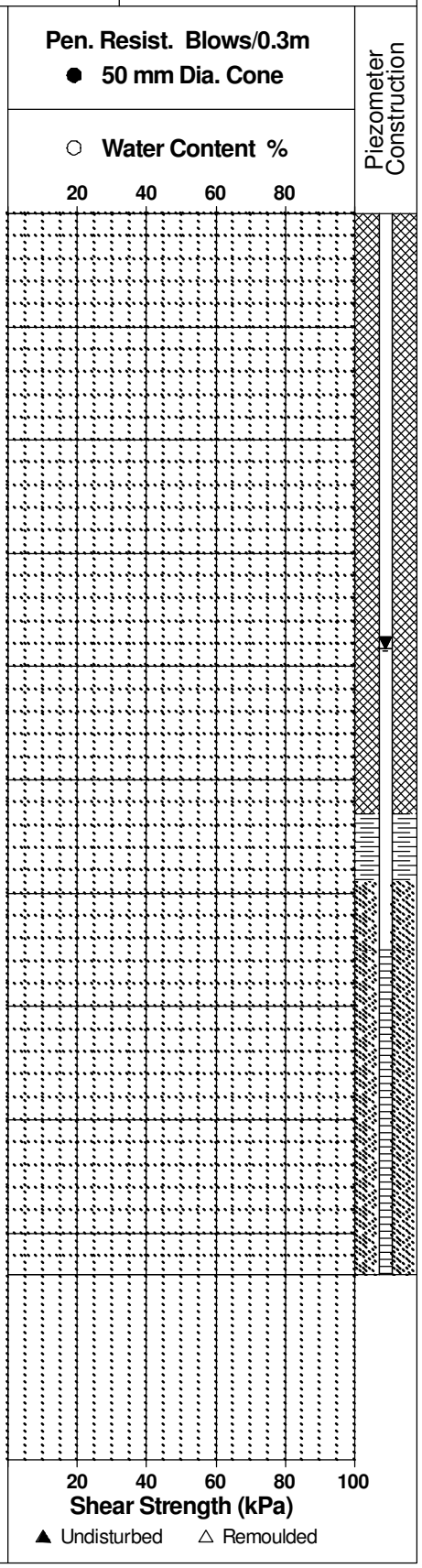
REMARKS

FILE NO. PG2178

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** 10 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.64
Asphaltic concrete 0.04		AU	1				
Crushed stone 0.15							
FILL: Brown silty sand, some gravel 0.91		SS	2	90	10	1	65.64
Grey-brown **SILT** 1.17							
BEDROCK: Shaley limestone		RC	1	92	36	2	64.64
3.00						3	63.64
		RC	2	100	55	4	62.64
		RC	3	100	60	5	61.64
BEDROCK: Grey limestone						6	60.64
		RC	4	100	93	7	59.64
		RC	5	100	92	8	58.64
		RC	6	100	100	9	57.64
9.37							
End of Borehole							
(GWL @ 3.84m-Nov. 16/10)							



patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-335 Roosevelt Ave.
Ottawa, Ontario

DATUM TBM - Mag nail in utility pole, along southeast property line. Geodetic elevation = 67.30m.

FILE NO. PG2178

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 10 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.50
FILL: Dark brown silty sand with gravel, trace metals, brick and asphalt		SS	1	50	8		
0.76							
FILL: Black silty sand		SS	2	78	50+	1	65.50
0.94							
Light brown **SILT**		RC	1	86	0		
0.99							
		RC	2	97	45	2	64.50
						3	63.50
		RC	3	98	85		
BEDROCK: Grey limestone						4	62.50
- shaley limestone from 1.9m to 2.0m depth		RC	4	100	77	5	61.50
						6	60.50
		RC	5	100	95		
						7	59.50
		RC	6	100	82	8	58.50
		RC	7	100	83	9	57.50
9.40							
End of Borehole							
(GWL @ 4.97m-Nov. 16/10)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

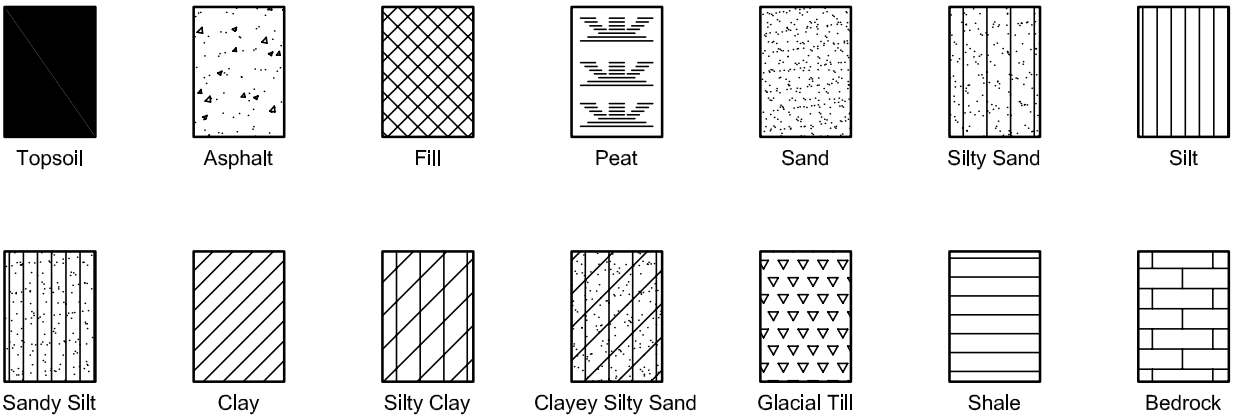
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

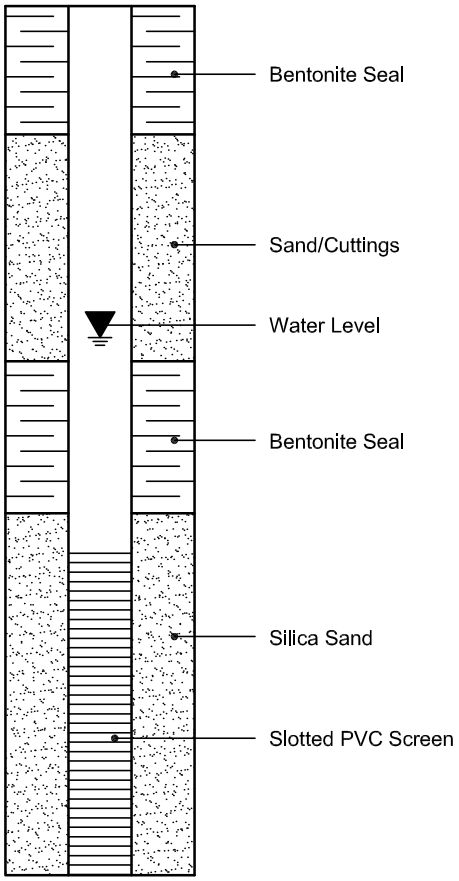
SYMBOLS AND TERMS (continued)

STRATA PLOT

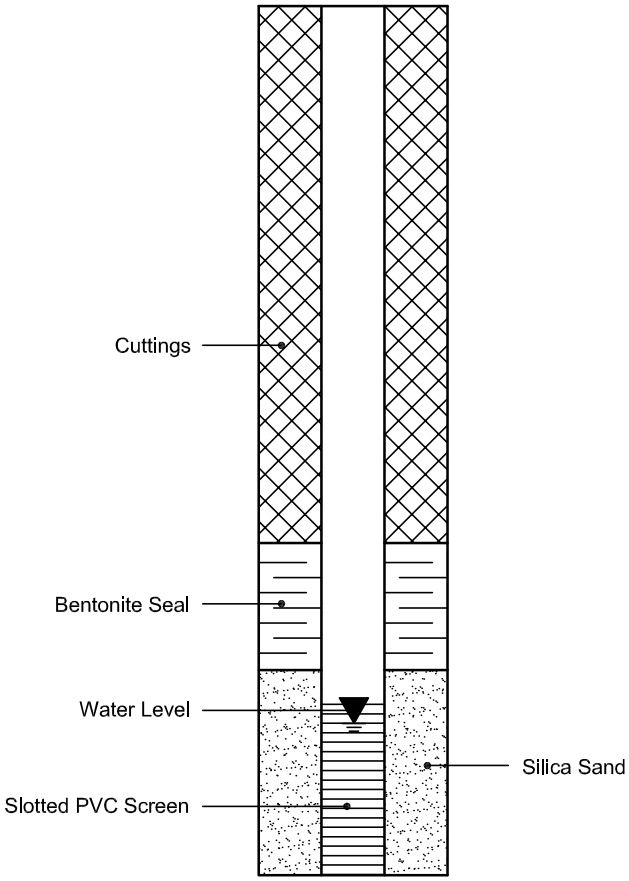


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



	Client ID:	TP13-25 G3	-	-	-		
	Sample Date:	04-Apr-25 09:00	-	-	-	-	-
	Sample ID:	2515330-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	83.2	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.58	-	-	-	-	-
Resistivity	0.1 Ohm.m	51.2	-	-	-	-	-
Anions							
Chloride	10 ug/g	10	-	-	-	-	-
Sulphate	10 ug/g	28	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURES 2 & 3 – SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG2178-1 – TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

PATERSON GROUP

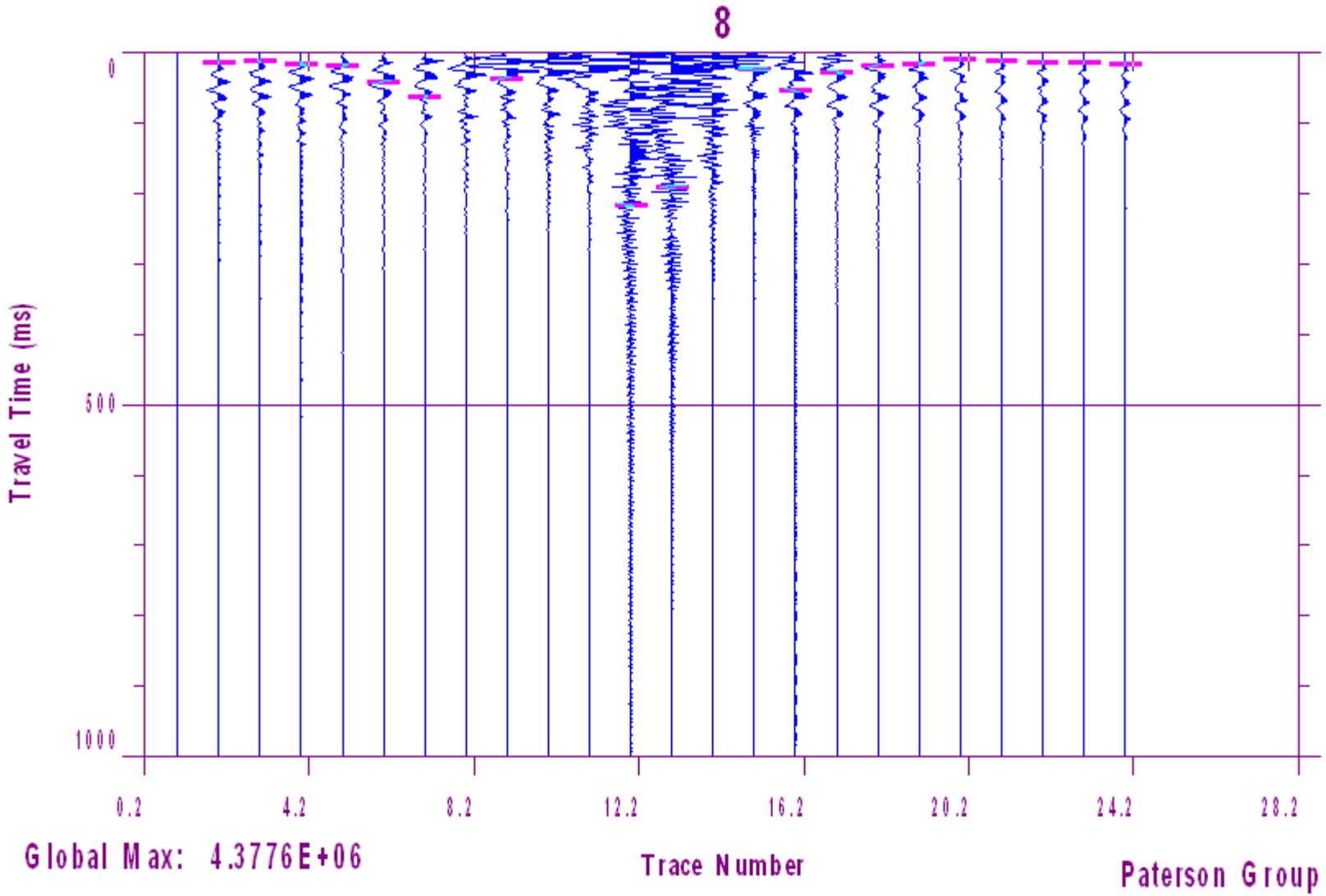


Figure 2 – Shear Wave Velocity Profile at Shot Location 11.5 m

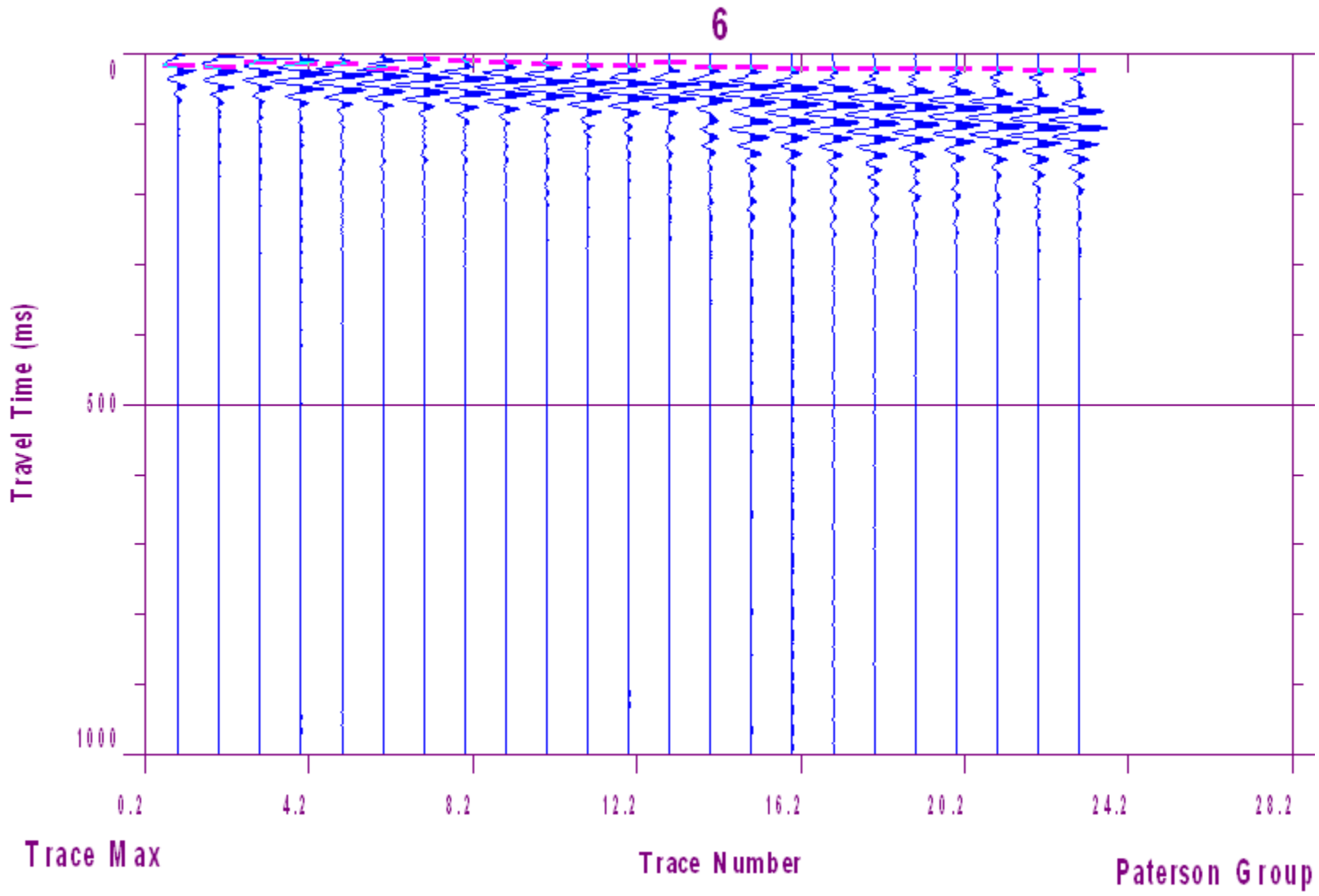
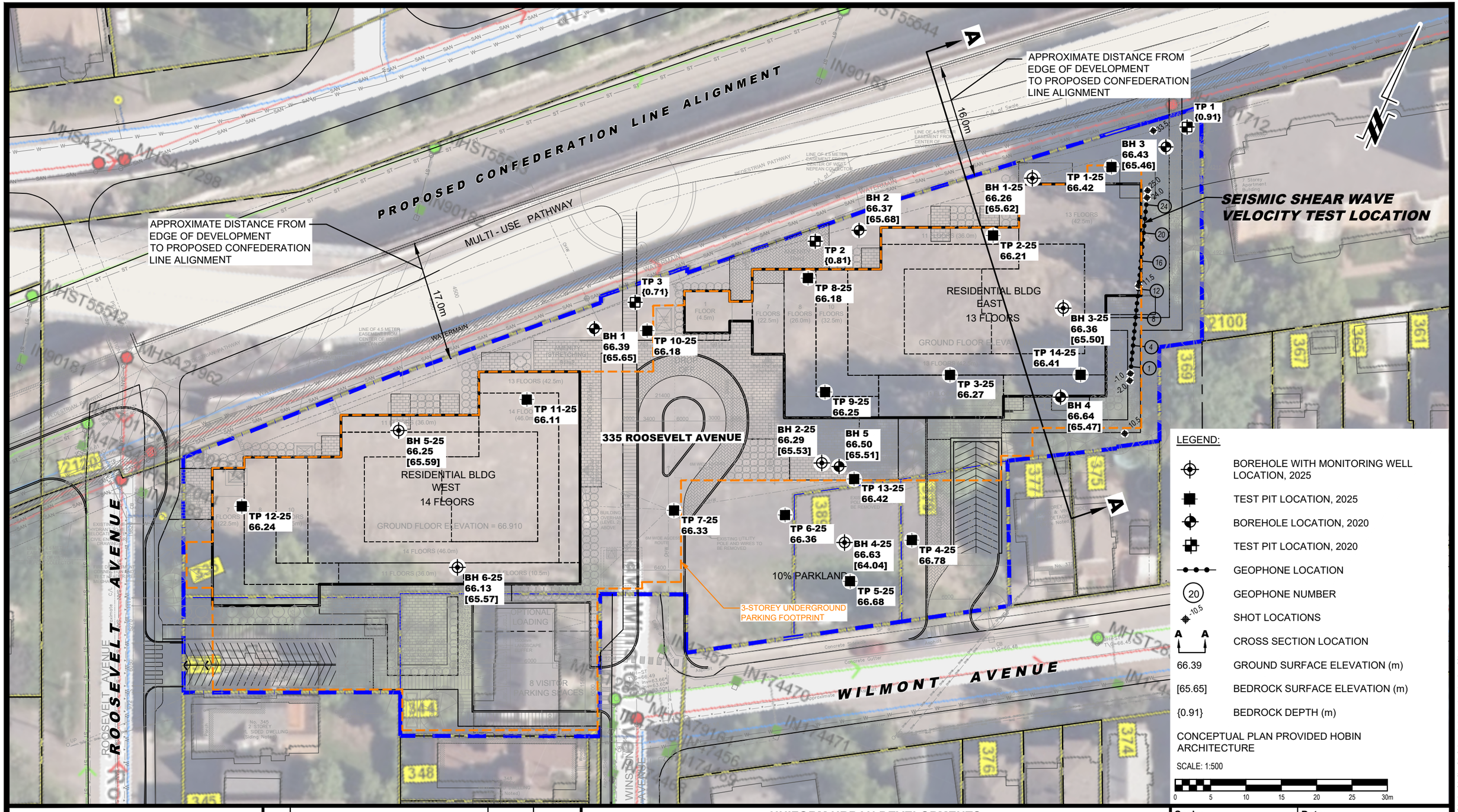


Figure 3 – Shear Wave Velocity Profile at Shot Location -1 m



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION, 2025
- TEST PIT LOCATION, 2025
- BOREHOLE LOCATION, 2020
- TEST PIT LOCATION, 2020
- GEOPHONE LOCATION
- 20 GEOPHONE NUMBER
- -10.5 SHOT LOCATIONS
- A A CROSS SECTION LOCATION
- 66.39 GROUND SURFACE ELEVATION (m)
- [65.65] BEDROCK SURFACE ELEVATION (m)
- {0.91} BEDROCK DEPTH (m)

CONCEPTUAL PLAN PROVIDED HOBIN ARCHITECTURE

SCALE: 1:500

0 5 10 15 20 25 30m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DD/MM/YYYY	INITIAL
3	ADDED 2025 BOREHOLES AND TEST PIT LOCATION	10/04/2025	DR
2	UPDATED TO NEW CONCEPTUAL PLAN	26/02/2025	PB
1	UPDATED TO NEW CONCEPTUAL PLAN	07/09/2020	DP

UNIFORM URBAN DEVELOPMENTS
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
335 ROOSEVELT AVENUE
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 06/2020
Drawn by: YA	Report No.: PG2178-1
Checked by: PB	Dwg. No.: PG2178-1
Approved by: SD	Revision No.: 3

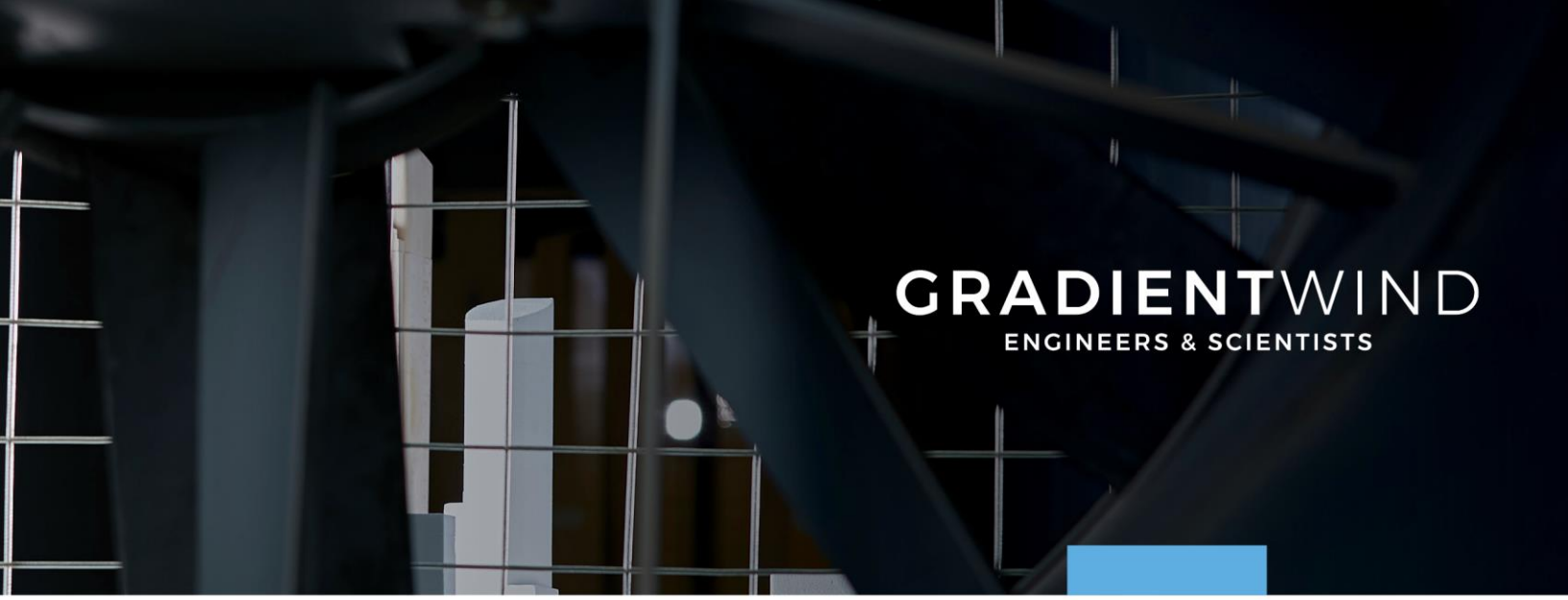
p:\autocad drawings\geotechnical\pg21xx\pg2178\pg2178-1-test hole location plan (rev03).dwg

11x17

APPENDIX C

Transportation Noise & Ground Vibrations Impact Study

prepared by Gradient Wind Engineers & Scientists dated June 25, 2020

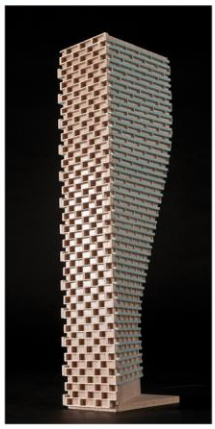


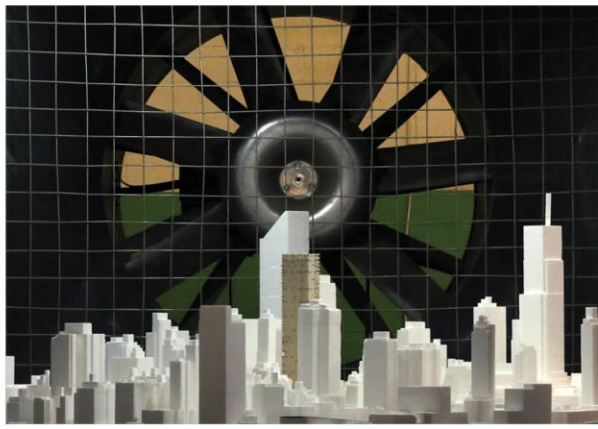
GRADIENTWIND
ENGINEERS & SCIENTISTS

TRANSPORTATION NOISE & GROUND VIBRATIONS IMPACT STUDY

335 Roosevelt Avenue
Ottawa, Ontario

REPORT #20-091-Transportation Noise & Vibration





June 25, 2020

DRAFT

PREPARED FOR

Uniform Urban Developments
117 Centerpointe Drive, Suite 300
Ottawa, ON K2G 5X3

Attn: Dan Tomka, P.Eng., Vice President, High-Rise
dtomka@uniformdevelopments.com

PREPARED BY

Efser Kara, MSc, LEED GA, Acoustic Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a transportation noise and ground vibration assessment undertaken for a proposed residential development located at 335 Roosevelt Avenue in Ottawa, Ontario to examine the impact of light rail transit corridor (proposed future LRT) traffic on the development to ensure that future occupants are afforded comfortable use of indoor and outdoor living spaces, as directed by the City of Ottawa's Environmental Noise Control Guidelines (ENCG).

The proposed residential development is located at 335 Roosevelt Avenu in Ottawa just at the intersection of Roosevelt and Winston Avenues. The development features two residential buildings; one lies between Roosevelt and Winston Avenues on the west side and the other on the east side of Winston Avenue. The west building comprises 21 and the east building comprises 18 storeys. The development features 125-car underground parking serving both buildings. Each building has 5th-floor amenity terraces located on the west side and Both east and west buildings have residential terraces on 17th and 20th floors, respectively.

The study site is not within a 100 metres of any existing or planned collector or arterial roadway. However, a light rail transit corridor, which is planned to be built on the north side of the study site, is the major source of noise and ground vibrations. Figure 1 illustrates a complete site plan with the surrounding context.

The Western LRT is the westerly extension of the City's Confederation Line. This report describes the assessment, methodology and results for existing and future environmental noise and vibration impacts influenced by the project undertaking, and provides recommendations for mitigation where required.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) (ii) ground-borne vibration prediction and assessment methodology as specified by the Federal Transit Authority (FTA) Protocol; (iii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iv) future rail traffic volumes based on the ultimate buildout LRT volumes were used which were established in the Confederation Line West Extension Environmental Assessment Study; and (v) drawings prepared by Hobin Architecture, dated June 2020.

The results of the current analysis indicate that noise levels will range between 34 and 60 dBA during the daytime period (07:00-23:00) and between 27 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 60 dBA) occurs at the north façades of the East and West Buildings, which are nearest and most exposed to the LRT line. Outdoor Living Area (OLA) noise levels at building terraces and outdoor amenity areas are well below the 55 dBA ENCG criteria. Therefore no barriers will be required.

The results of the calculations also indicate that the dwellings should be designed with forced air heating and provisions for the installation of central air conditioning.

Warning clauses will be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

The results of the vibration calculations indicated that the ground vibration levels will be approximately 0.11 mm/s, marginally above the threshold level of human perception to vibrations and the criterion of 0.10 mm/s. The ground-borne noise is estimated to be at 38 dBA. The exceedance is deemed to be trivial, therefore, mitigation for ground-borne vibrations and noise is not required. Details of the vibration calculations are presented in Appendix B.

With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess the impacts of stationary sources, such as rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG and NPC-300 limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Generally, loader pieces of equipment such as cooling towers, generators and large make-up air units, should be placed in the mechanical penthouse or the high roof. Where necessary noise screens and silencers can be placed into the design.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Uniform Urban Developments to undertake a transportation noise and vibration assessment for a proposed residential development located at 335 Roosevelt Avenue in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise & vibration levels generated by local transportation sources.

Our work is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[1] guidelines, City of Ottawa[2], and vibration assessment conforming to Federal Transit Authority (FTA) Protocol. Calculations were based on architectural drawings prepared by Hobin Architecture, dated June, 2020, with the ultimate buildout LRT volumes were used which were established in the Confederation Line West Extension Environmental Assessment Study.

2. TERMS OF REFERENCE

The focus of this study is the proposed residential development is located at 335 Roosevelt Avenu in Ottawa just at the intersection of Roosevelt and Winston Avenues. The development features two residential high-rise buildings; one lies between Roosevelt and Winston Avenues on the west side and the other on the east side of Winston Avenue; and four low-rise blocks (Block A, B, C, and D). The west building comprises 21 storeys and the east building comprises 18 storeys. Blocks A, B, C, and D comprise 3 storeys each. The West and East Buildings feature 125-car underground parking serving both buildings. Each building has 5th-floor amenity terraces located on the west side and Both east and west buildings have residential terraces on 17th and 20th floors, respectively. A linear park is located on the north side of the development which acts as a buffer between the development and the LRT corridor.

The major source of noise and ground vibrations impacting the site is a planned light rail transit corridor north of the site. At the time of writing of the report, construction has started on the line which is converting

[1] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[2] City of Ottawa Environmental Noise Control Guidelines, January 2016

an existing bus rapid transit network to LRT. There are no other major roadways within a 100 metres of the site. Figure 1 illustrates a complete site plan with the surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on development produced by local transportation sources, (ii) measure the vibration levels on the study building produced from passing trains, (iii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the ENCG as outlined in Section 4.2.1 of this report, and (v) ensure vibration levels to not exceed the allowable limits specified by industry guidelines, such as the United States Federal Transit Authority (FTA).

4. METHODOLOGY

4.1 Noise Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Transportation Noise

4.2.1 Criteria for Transportation Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level that has the same energy as a time-varying noise level over a period of time. For road and railways including LRT, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8})

nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range for roadway and LRT noise is 45 (during daytime) and 40 (during nighttime) for residences, as listed in Table 1. However, to account for deficiencies in building construction and control peak noise, these levels should be targeted toward 42, 37 for living areas during the daytime and sleeping quarters during the nighttime respectively.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (LRT)[3]

Type of Space	Time Period	Leq (dBA)
		LRT
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50
Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters	07:00 – 23:00	45
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning (or similar systems). Where noise levels exceed 65 dBA daytime and 60 dBA nighttime building components will require higher levels of sound attenuation[5].

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

Noise levels at outdoor living areas should be limited to 55 dBA where technically and administratively feasible. The City of Ottawa preferences for noise control prescribe the following hierarchy:

(i) Increased distance setback with absorptive ground cover (vegetation)
(ii) Relocation of noise-sensitive areas away from roadways and light rail transit corridors
(iii) Earth berms
(iv) Acoustic barriers

4.2.2 Theoretical LRT Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for transportation noise analysis. Appendix A includes the STAMSON 5.04 input and output data.

The LRT lines were treated as single line sources of noise which use, where appropriate, existing building locations and the study building as noise barriers partially or fully obstructing exposure to the source. In addition to the LRT volumes summarized in Table 2 below, theoretical noise predictions were also based on the following parameters:

(i) Noise receptors were strategically placed at seventeen (17) locations around the study area (see Figure 2).
(ii) Ground surfaces were taken as reflective where hard ground (pavement and concrete areas) present and absorptive where soft ground (grass, foliage, trees) present.
(iii) Topography was assumed to be a flat/gentle slope with a barrier for receptors influenced by the LRT which is located 5.5 metres below the grade level of the study site.
(iv) Plane of window (POW) receptor heights were taken to be at the centre of the highest storey window for both West and East Buildings, and Block A and Block C which are partially exposed to light rail transit corridor (see Table 3).
(v) The Outdoor living areas (OLA) are located at the terraces of both buildings. The 5th storey terrace receptors were taken at 14.75 m high. For the terrace on the 20th storey of the West Building, the receptor height was taken as 59.70 metes and for the 17th storey terrace of the East Building, the receptor height was 50.70 m. In addition to terrace OLA receptors, two receptors were used at grade level outdoor amenity spaces.

(vi) Receptor distance and exposure angles outlined in Figures 3-7.

4.2.1 Light Rail Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on the mature state of development of the roadway or transit system. Therefore, the ultimate buildout LRT volumes were used which were established in the Confederation Line West Extension Environmental Assessment Study. Table 2 below summarizes the light rail traffic volumes considered in the assessment.

TABLE 2: LIGHT RAIL TRAFFIC DATA

Railway	Railway Traffic Data		Speed Limit (km/h)	Traffic Volumes
	Existing (2020)	Projected (2035)		
Confederation Line LRT (Phase 2)	N/A	540/60*	70	N/A

* Daytime/nighttime volumes

4.3 Ground Vibration and Ground-borne Noise

Rail systems and heavy vehicles on roadways can produce perceptible levels of ground vibrations, especially when they are in close proximity to residential neighbourhoods or vibration-sensitive buildings. Similar to sound waves in air, vibrations in solids are generated at a source, propagated through a medium, and intercepted by a receiver. In the case of ground vibrations, the medium can be uniform, or more often, a complex layering of soils and rock strata. Also, similar to sound waves in air, ground vibrations produce perceptible motions and regenerated noise known as 'ground-borne noise' when the vibrations encounter a hollow structure such as a building. Ground-borne noise and vibrations are generated when there is an excitation of the ground, such as from a train. The repetitive motion of the wheels on the track or rubber tires passing over an uneven surface causes vibrations to propagate through the soil. When they encounter a building, vibrations pass along the structure of the building beginning at the foundation and propagating to all floors. Air inside the building excited by the vibrating walls and floors represents regenerated airborne noise. Characteristics of the soil and the building are imparted to the noise, thereby creating a unique noise signature.

Human response to ground vibrations is dependent on the magnitude of the vibrations, which is measured by the root mean square (RMS) of the movement of a particle on a surface. Typical units of ground

vibration measures are millimetres per second (mm/s), or inch per second (in/s). Since vibrations can vary over a wide range, it is also convenient to represent them in decibel units, or dBV. In North America, it is common practice to use the reference value of one micro-inch per second (µin/s) to represent vibration levels for this purpose. The threshold level of human perception to vibrations is about 0.10 mm/s RMS or about 72 dBV. Although somewhat variable, the threshold of annoyance for continuous vibrations is 0.5 mm/s RMS (or 85 dBV), five times higher than the perception threshold, whereas the threshold for significant structural damage is 10 mm/s RMS (or 112 dBV), at least one hundred times higher than the perception threshold level.

4.3.1 Criteria for Ground Vibration and Ground-borne Noise

In the United States, the Federal Transportation Authority (FTA) has set vibration criteria for sensitive land uses next to transit corridors. Similar standards have been developed by the MECP. These standards indicate that the appropriate criterion for residences is 0.10 mm/s RMS for vibrations. For mainline railways, a document titled *Guidelines for New Development in Proximity to Railway Operations*[6], indicates that vibration conditions should not exceed 0.14 mm/s RMS averaged over a one-second time-period at the first floor and above of the proposed building. The Federal Transportation Authority (FTA) criterion was adopted as the appropriate standard for this study. As the main vibration source is due to the light rail line which has frequent events, the 0.10 mm/s RMS (72 dBV) vibration criteria and 35 dBA ground-borne noise criteria were adopted for this study.

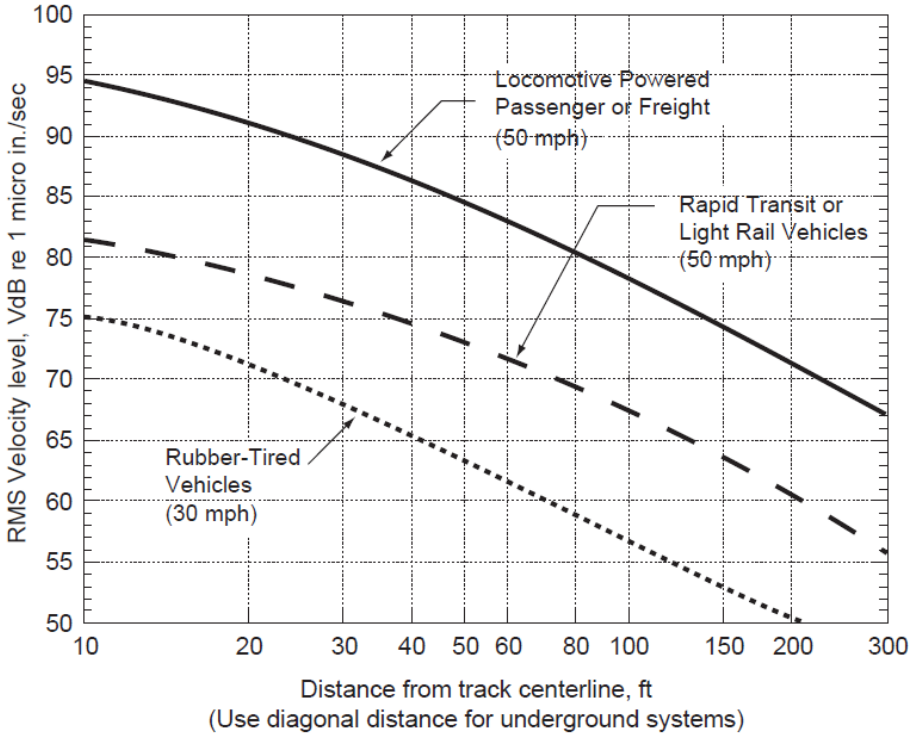
4.3.2 Theoretical Ground Vibration Prediction Procedure

Potential vibration impacts of trains were predicted using the FTA's *Transit Noise and Vibration Impact Assessment*[7] protocol. The FTA general vibration assessment is based on an upper bound generic set of curves that show vibration level attenuation with distance. These curves, illustrated in the figure below, are based on ground vibration measurements at various transit systems throughout North America. Vibration levels at points of reception are adjusted by various factors to incorporate known characteristics of the system being analyzed, such as operating speed of vehicle, conditions of the track, construction of

[6] Dialog and J.E. Coulter Associates Limited, prepared for The Federation of Canadian Municipalities and The Railway Association of Canada, May 2013
[7] C. E. Hanson; D. A. Towers; and L. D. Meister, Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

the track and/or tunnel; depth and geology; as well as the structural type of the impacted building structures. The vibration impact on the building was determined using a set of curves for LRT at a speed of 70 km/h. Adjustment factors were considered based on the following information:

- The maximum operating speed of the LRT near the study area is 70 km/h (43 mph)
- The distance between the development and the closest track is 20 m
- The vehicles are assumed to have soft primary suspensions
- Tracks are not welded though in otherwise good condition
- Soil conditions do not efficiently propagate vibrations
- The building's foundation is large masonry on piles



FTA GENERALIZED CURVES OF VIBRATION LEVELS VERSUS DISTANCE (ADOPTED FROM FIGURE 10-1, FTA TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT)

5. RESULTS AND DISCUSSION

5.1 LRT Noise Levels

The results of the railway noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Type / Building	Receptor Locations	Receptor Height (m)	LRT Noise Levels (dBA)	
				Day	Night
1	POW / West Building	21st Floor – West Façade POW	62.70 m	58	52
2	POW / West Building	21st Floor – North Façade POW	62.70 m	59	53
3	POW / West Building	21st Floor – North Façade POW	62.70 m	60	53
4	POW / West Building	21st Floor – East Façade POW	62.70 m	48	42
5	POW / West Building	21st Floor – South Façade POW	62.70 m	49	42
6	POW / East Building	18th Floor – West Façade POW	53.70 m	58	51
7	POW / East Building	18th Floor – North Façade POW	53.70 m	59	53
8	POW / East Building	18th Floor – North Façade POW	53.70 m	60	53
9	POW / East Building	18th Floor – East Façade POW	53.70 m	54	47
10	OLA / West Building	5th Floor Terrace – West Façade OLA	14.75 m	47	N/A*
11	OLA / West Building	20th Floor Terrace – West Façade OLA	59.70 m	43	N/A*
12	OLA / East Building	5th Floor Terrace – West Façade OLA	14.75 m	46	N/A*
13	OLA / East Building	17th Floor Terrace – West Façade OLA	50.70 m	41	N/A*
14	OLA	Outdoor Amenity Area West	1.50 m	37	N/A*
15	OLA	Outdoor Amenity Area East	1.50 m	35	N/A*
16	POW / Block A	3rd Floor – North Facade	8.10 m	38	31
17	POW / Block C	3rd Floor – North Facade	7.75 m	34	27

* OLA noise levels during the nighttime are not considered as per the ENCG

Results of the current analysis indicate that noise levels at POW receptors will range between 34 and 60 dBA during the daytime period (07:00-23:00) and between 27 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 60 dBA) occurs at the north façades of the East and West Buildings, which are nearest and most exposed to the LRT line. Outdoor Living Area (OLA) noise levels at building terraces and outdoor amenity areas are well below the 55 dBA ENCG criteria.

5.2 Noise Control Measures for LRT Traffic

As the results indicate, the noise levels at Plane of Window receptors do not exceed 65 dBA during daytime and 60 dBA during nighttime, therefore, upgraded building components will not be required. Building components compliant with the Ontario Building Code will be sufficient.

The results of the calculations also indicate that the buildings should be designed with forced air heating and provisions for the installation of central air conditioning. In addition to ventilation requirements, warning clauses will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

5.3 Vibration Impacts

The results of the vibration calculations indicated that the ground vibration levels will be approximately 0.11 mm/s, marginally above the threshold level of human perception to vibrations and the criterion of 0.10 mm/s. The ground-borne noise is estimated to be at 38 dBA. The exceedance is deemed to be trivial, therefore, mitigation for ground-borne vibrations and noise is not required. Details of the vibration calculations are presented in Appendix B.

6. CONCLUSIONS AND RECOMMENDATIONS

Results of the current analysis indicate that noise levels will range between 34 and 60 dBA during the daytime period (07:00-23:00) and between 27 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 60 dBA) occurs at the north façades of the East and West Buildings, which are nearest and most exposed to the LRT line. Outdoor Living Area (OLA) noise levels at building terraces and outdoor amenity areas are well below the 55 dBA ENCG criteria.

The results of the calculations also indicate that the dwellings should be designed with forced air heating and provisions for the installation of central air conditioning. If installed at the occupants' discretion, air conditioning will allow windows and doors to remain close providing a quiet and comfortable indoor environment. Warning clauses will be required to be placed on all Lease, Purchase and Sale Agreements, as summarized below:

"Purchasers/tenants are advised that sound levels due to increasing Light Rail 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.

This dwelling unit has also been designed with the provision for adding central air conditioning at the occupant's discretion and forced air heating. Installation of central air conditioning will allow windows and exterior doors 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."

In addition, the Rail Construction Program Office recommends that the warning clause identified below to be included in all agreements of purchase and sale and lease agreements for the proposed development including those prepared prior to the registration of the Site Plan Agreement:

"The Owner hereby acknowledges and agrees:

i) The proximity of the proposed development of the lands described in Schedule "A" hereto (the "Lands") to the City's existing and future transit operations, may result in noise, vibration, electromagnetic interferences, stray current transmissions, smoke and particulate matter (collectively referred to as "Interferences") to the development;

ii) It has been advised by the City to apply reasonable attenuation measures with respect to the level of the Interferences on and within the Lands and the proposed development; and

iii) The Owner acknowledges and agrees all agreements of purchase and sale and lease agreements, and all information on all plans and documents used for marketing purposes, for the whole or any part of the subject lands, shall contain the following clauses which shall also be incorporated in all transfer/deeds and leases from the Owner so that the clauses shall be covenants running with the lands for the benefit of the owner of the adjacent road:

'The Transferee/Lessee for himself, his heirs, executors, administrators, successors and assigns acknowledges being advised that a public transit light-rail rapid transit system (LRT) is proposed to be located in proximity to the subject lands, and the construction, operation and maintenance of the LRT may result in environmental impacts including, but not limited to noise, vibration, electromagnetic interferences, stray current transmissions, smoke and particulate matter (collectively referred to as the Interferences) to the subject lands. The Transferee/Lessee acknowledges and agrees that despite the inclusion of noise control features within the subject lands, Interferences may continue to be of concern, occasionally interfering with some activities of the occupants on the subject lands.

The Transferee covenants with the Transferor and the Lessee covenants with the Lessor that the above clauses verbatim shall be included in all subsequent lease agreements, agreements of purchase and sale and deeds conveying the lands described herein, which covenants shall run with the lands and are for the benefit of the owner of the adjacent road.'"

The results of the vibration calculations indicated that the ground vibration levels will be approximately 0.11 mm/s, marginally above the threshold level of human perception to vibrations and the criterion of 0.10 mm/s. The ground-borne noise is estimated to be at 38 dBA. The exceedance is deemed to be trivial, therefore, mitigation for ground-borne vibrations and noise is not required. Details of the vibration calculations are presented in Appendix B.

This concludes our assessment and report. If you have any questions or wish to discuss our findings please advise us. In the interim, we thank you for the opportunity to be of service.

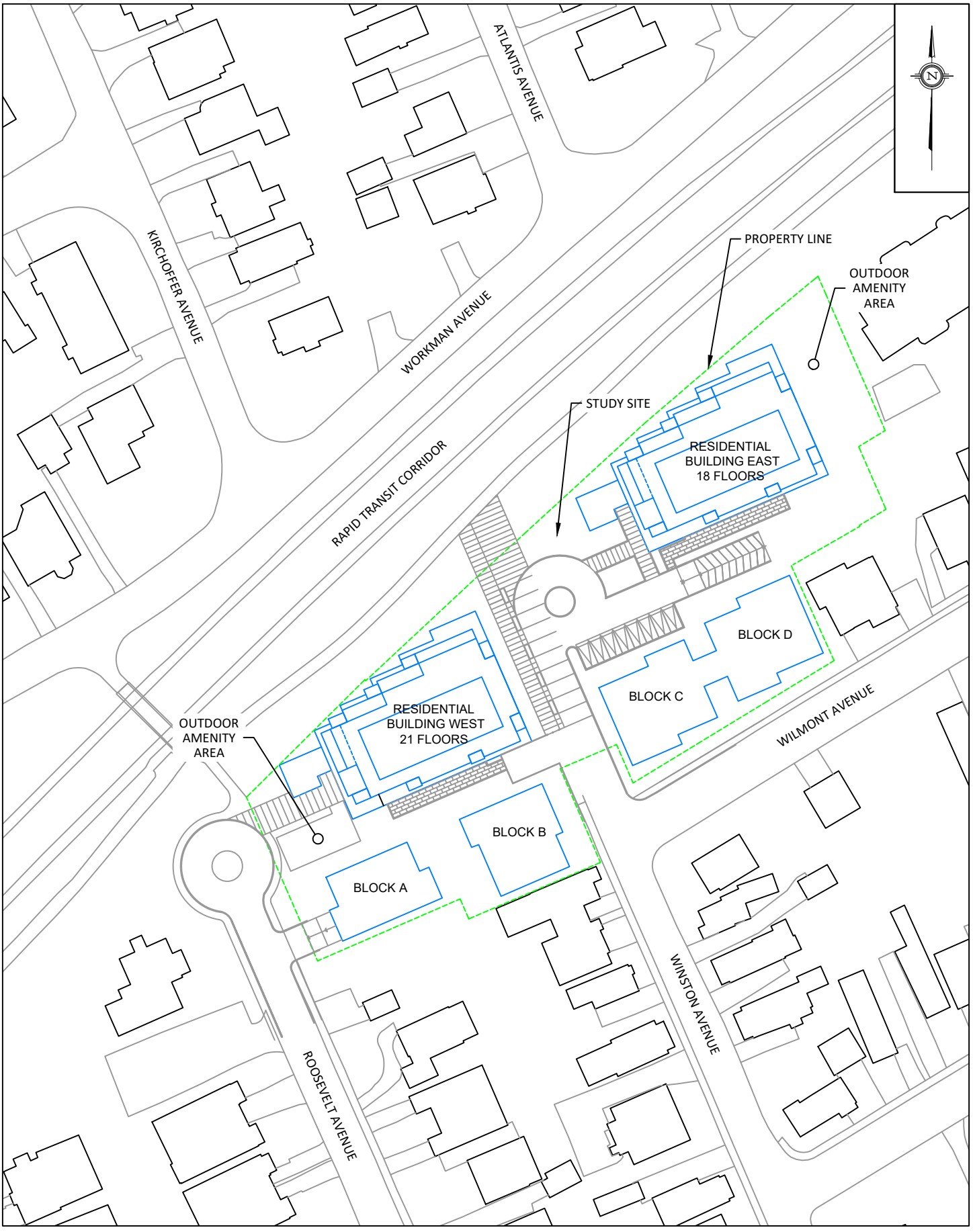
Sincerely,

Gradient Wind Engineering Inc.

Efser Kara, MSc, LEED GA
Acoustic Scientist

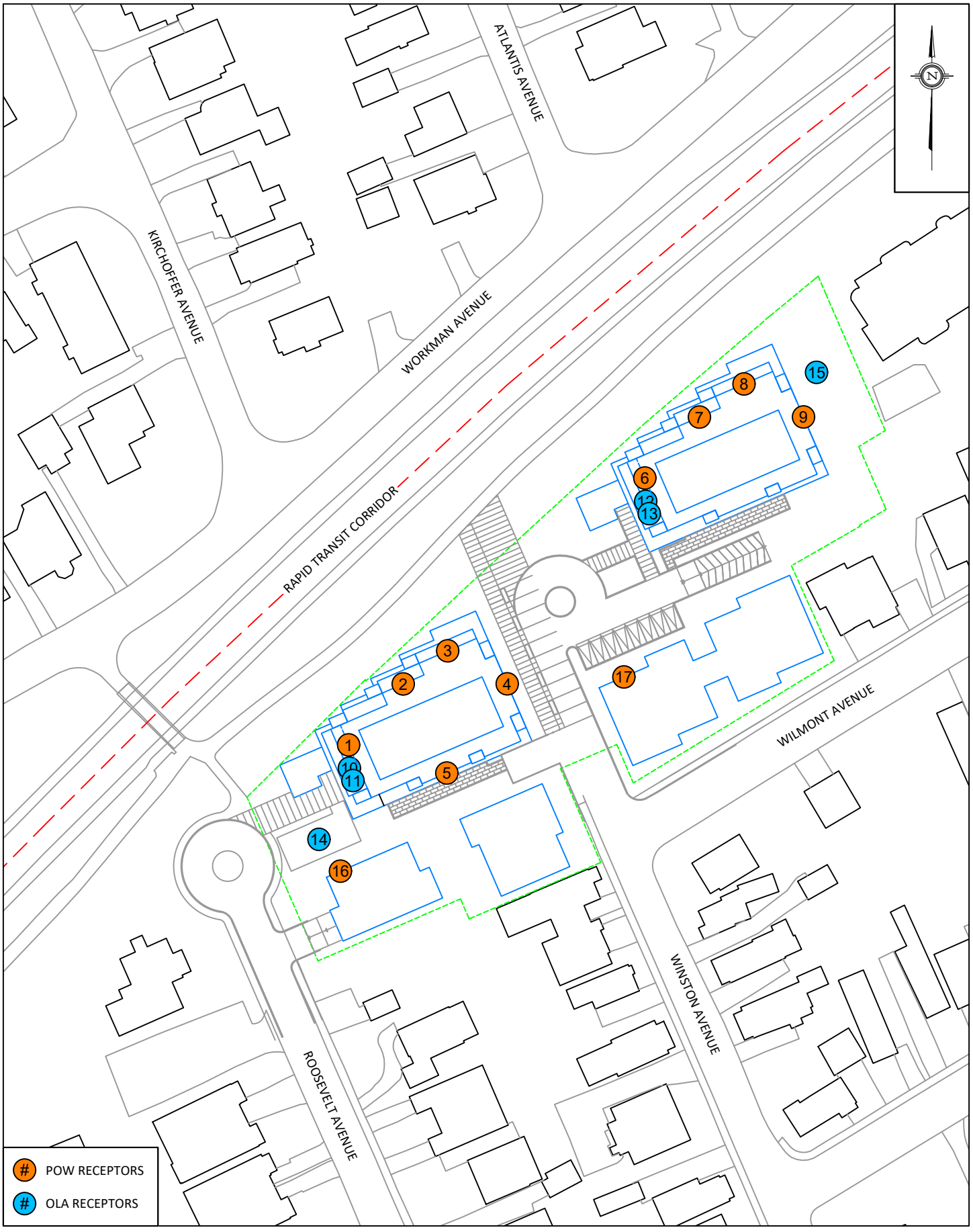
Joshua Foster, P.Eng.
Principal

Gradient Wind File#20-091 – Transportation Noise & Vibration



GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-091-1
DATE	JUNE 19, 2020
DRAWN BY	E.K.
DESCRIPTION	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT

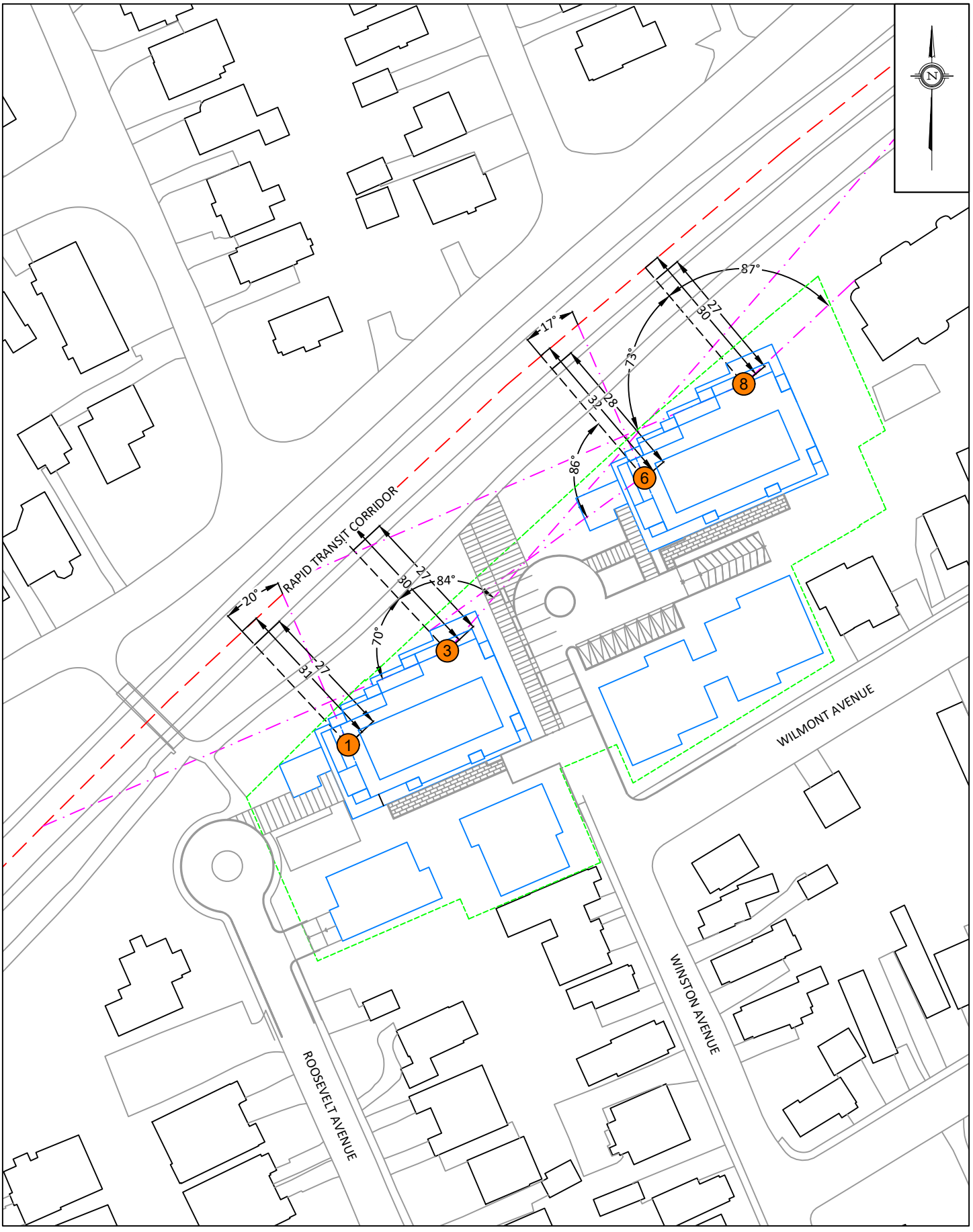


GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-091-2
DATE	JUNE 19, 2020	DRAWN BY	E.K.

FIGURE 2:
RECEPTOR LOCATIONS



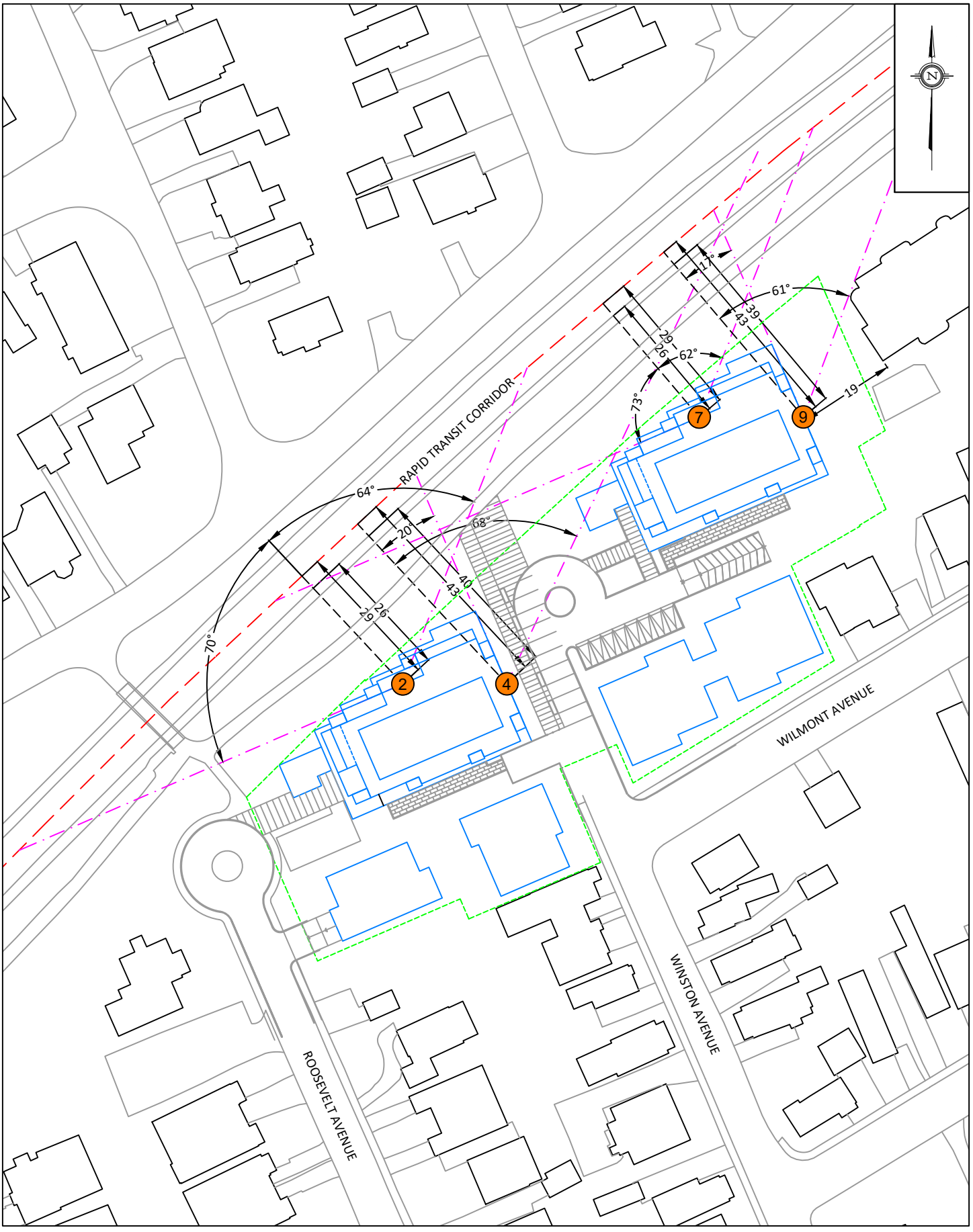
GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-091-3
DATE	JUNE 19, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 3:
STAMSON INPUT DATA
FOR RECEPTORS 1, 3, 6 AND 8

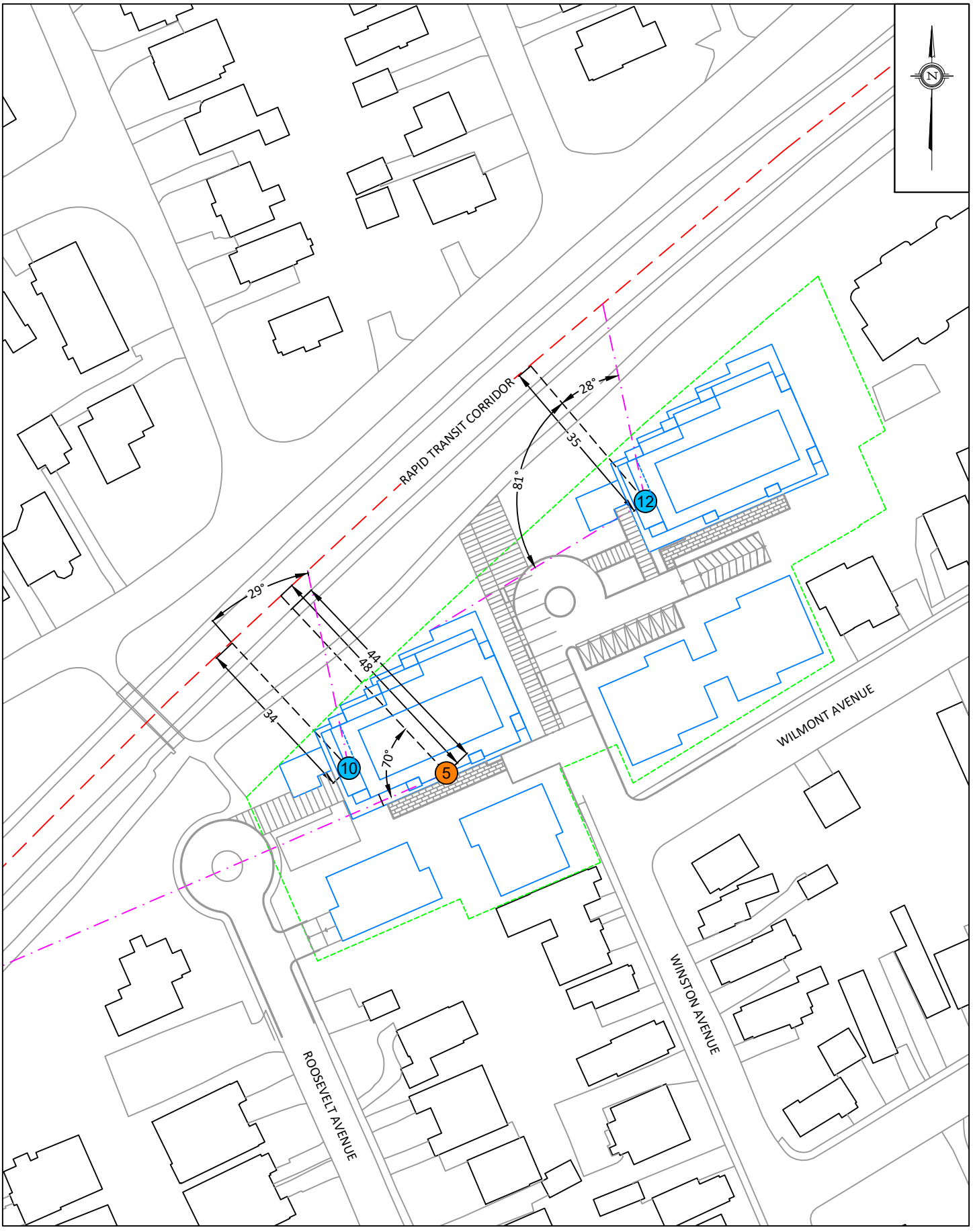


GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-091-4
DATE	JUNE 19, 2020	DRAWN BY	E.K.

FIGURE 4:
STAMSON INPUT DATA
FOR RECEPTORS 2, 4, 7 AND 9



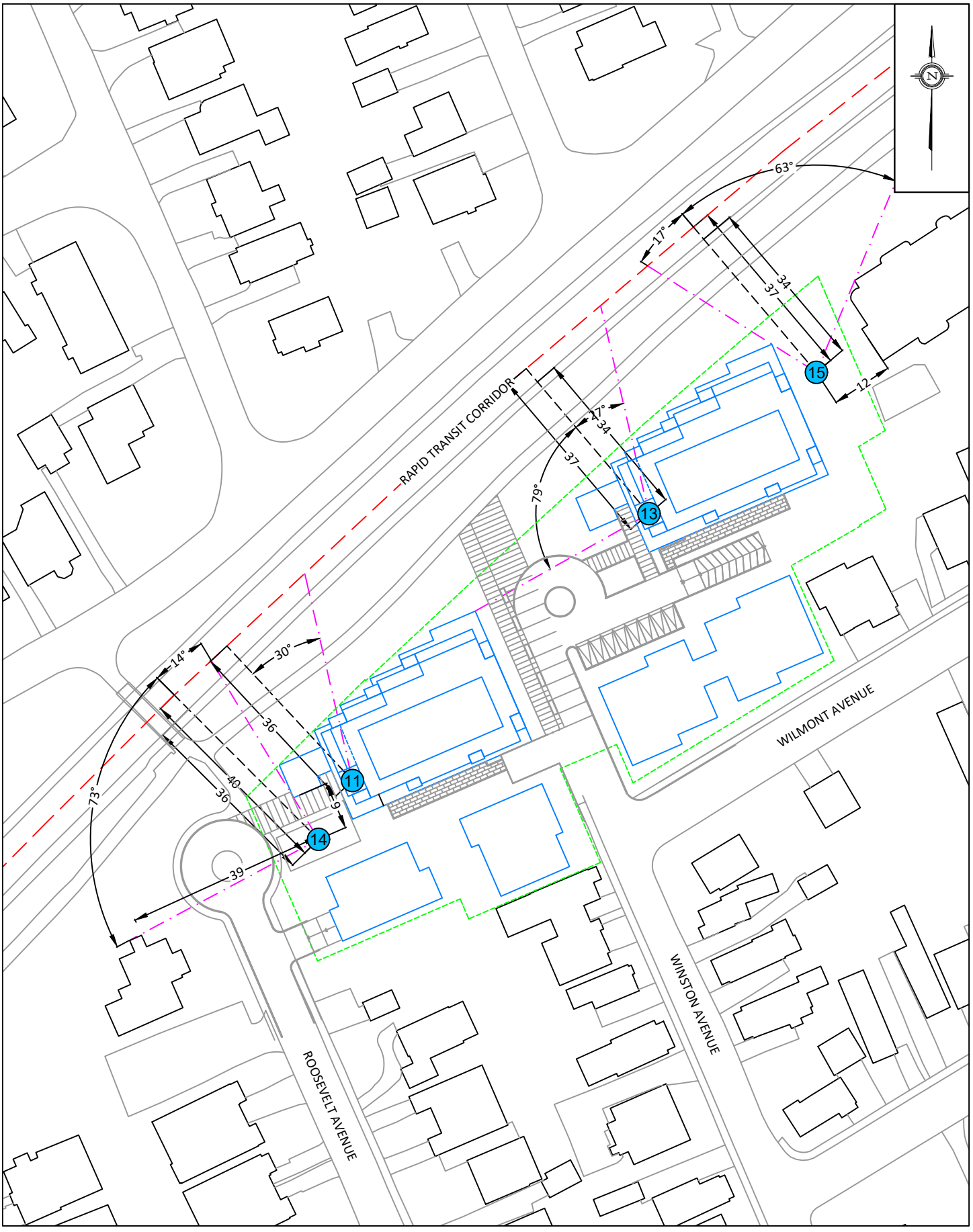
GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-091-5
DATE	JUNE 19, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 5:
STAMSON INPUT DATA
FOR RECEPTORS 5, 10, AND 12



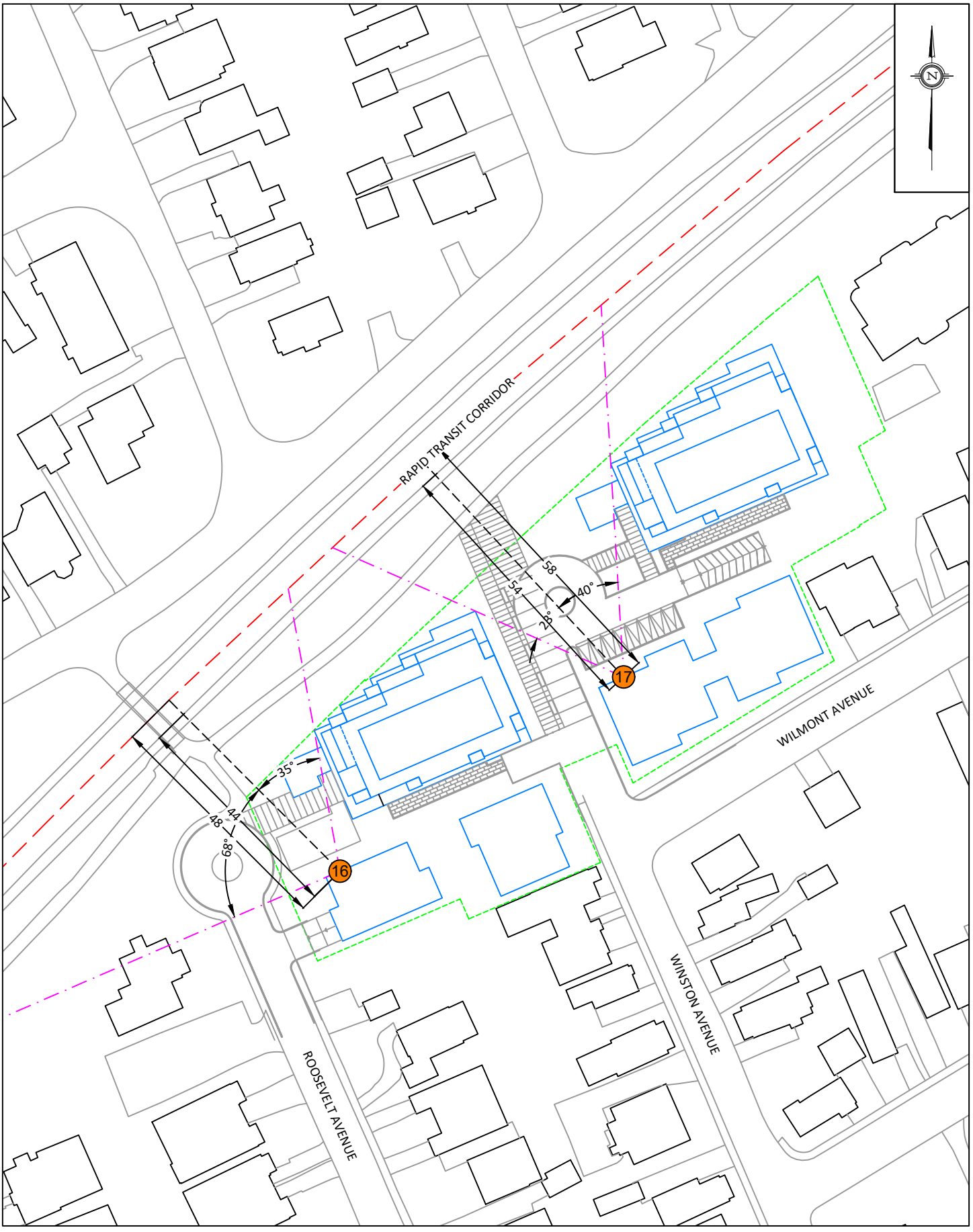
GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-091-6
DATE	JUNE 19, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 6:
STAMSON INPUT DATA
FOR RECEPTORS 11, 13, 14, AND 15



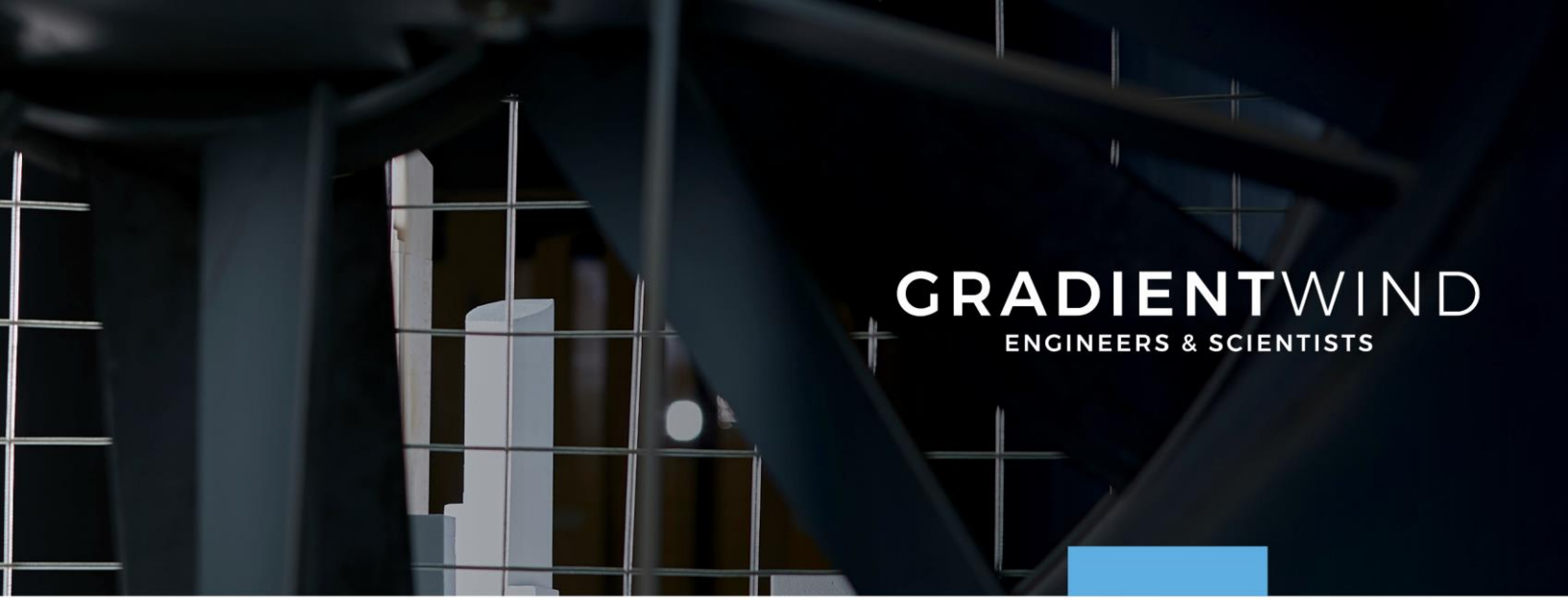
GRADIENTWIND
ENGINEERS & SCIENTISTS

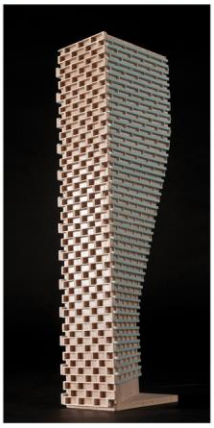
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

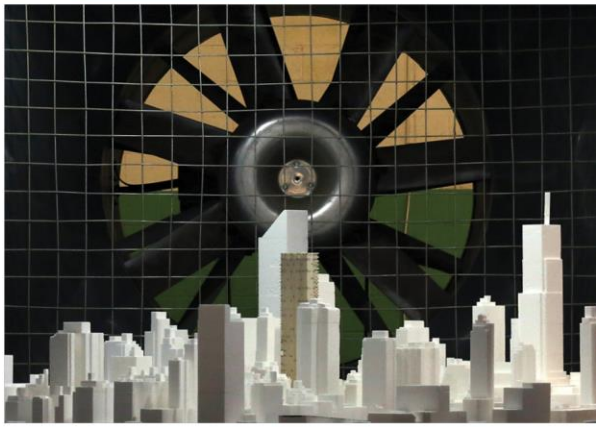
PROJECT	335 ROOSEVELT AVENUE RAILWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-091-7
DATE	JUNE 19, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 7:
STAMSON INPUT DATA
FOR RECEPTORS 16 AND 17







APPENDIX A

STAMSON INPUT-OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 12:21:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -90.00 deg 20.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 31.00 / 31.00 m
Receiver height : 62.70 / 62.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 20.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 27.00 / 27.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 3.74 ! 3.74

RT/Custom (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 20 0.00 63.44 -3.15 -2.14 0.00 0.00 -0.33 57.81*
-90 20 0.00 63.44 -3.15 -2.14 0.00 0.00 0.00 58.15
---

* Bright Zone !

Segment Leq : 58.15 dBA

Total Leq All Segments: 58.15 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 3.74 ! 3.74

RT/Custom (0.00 + 51.61 + 0.00) = 51.61 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 20 0.00 56.91 -3.15 -2.14 0.00 0.00 -0.33 51.28*
-90 20 0.00 56.91 -3.15 -2.14 0.00 0.00 0.00 51.61
---

* Bright Zone !

Segment Leq : 51.61 dBA

Total Leq All Segments: 51.61 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.15
(NIGHT): 51.61

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 15:39:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -70.00 deg 64.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 29.00 / 29.00 m
Receiver height : 62.70 / 62.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -70.00 deg Angle2 : 64.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 26.00 / 26.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 2.00 ! 2.00

RT/Custom (0.00 + 59.29 + 0.00) = 59.29 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-70 64 0.00 63.44 -2.86 -1.28 0.00 0.00 -1.80 57.49*
-70 64 0.00 63.44 -2.86 -1.28 0.00 0.00 0.00 59.29
---

* Bright Zone !

Segment Leq : 59.29 dBA

Total Leq All Segments: 59.29 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 2.00 ! 2.00

RT/Custom (0.00 + 52.76 + 0.00) = 52.76 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-70 64 0.00 56.91 -2.86 -1.28 0.00 0.00 -1.80 50.96*
-70 64 0.00 56.91 -2.86 -1.28 0.00 0.00 0.00 52.76
---

* Bright Zone !

Segment Leq : 52.76 dBA

Total Leq All Segments: 52.76 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.29
(NIGHT): 52.76

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 15:40:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -70.00 deg 84.00 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 : 62.70 / 62.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -70.00 deg Angle2 : 84.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 27.00 / 27.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 1.77 ! 1.77

RT/Custom (0.00 + 59.75 + 0.00) = 59.75 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-70 84 0.00 63.44 -3.01 -0.68 0.00 0.00 -2.70 57.05*
-70 84 0.00 63.44 -3.01 -0.68 0.00 0.00 0.00 59.75
---

* Bright Zone !

Segment Leq : 59.75 dBA

Total Leq All Segments: 59.75 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 1.77 ! 1.77

RT/Custom (0.00 + 53.22 + 0.00) = 53.22 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-70 84 0.00 56.91 -3.01 -0.68 0.00 0.00 -2.70 50.52*
-70 84 0.00 56.91 -3.01 -0.68 0.00 0.00 0.00 53.22
---

* Bright Zone !

Segment Leq : 53.22 dBA

Total Leq All Segments: 53.22 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.75
(NIGHT): 53.22

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 15:44:27
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : 20.00 deg 68.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 43.00 / 43.00 m
Receiver height : 62.70 / 62.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 20.00 deg Angle2 : 68.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 40.00 / 40.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! -0.28 ! -0.28

RT/Custom (0.00 + 48.05 + 0.00) = 48.05 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
20 68 0.00 63.44 -4.57 -5.74 0.00 0.00 -5.07 48.05

Segment Leq : 48.05 dBA

Total Leq All Segments: 48.05 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! -0.28 ! -0.28

RT/Custom (0.00 + 41.52 + 0.00) = 41.52 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
20 68 0.00 56.91 -4.57 -5.74 0.00 0.00 -5.07 41.52

Segment Leq : 41.52 dBA

Total Leq All Segments: 41.52 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.05
(NIGHT): 41.52

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 15:45:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -90.00 deg -70.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 48.00 / 48.00 m
Receiver height : 62.70 / 62.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : -70.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 44.00 / 44.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 0.64 ! 0.64

RT/Custom (0.00 + 48.84 + 0.00) = 48.84 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -70 0.00 63.44 -5.05 -9.54 0.00 0.00 -4.89 43.95*
-90 -70 0.00 63.44 -5.05 -9.54 0.00 0.00 0.00 48.84
---

* Bright Zone !

Segment Leq : 48.84 dBA

Total Leq All Segments: 48.84 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 62.70 ! 0.64 ! 0.64

RT/Custom (0.00 + 42.31 + 0.00) = 42.31 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -70 0.00 56.91 -5.05 -9.54 0.00 0.00 -4.89 37.42*
-90 -70 0.00 56.91 -5.05 -9.54 0.00 0.00 0.00 42.31
---

* Bright Zone !

Segment Leq : 42.31 dBA

Total Leq All Segments: 42.31 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.84
(NIGHT): 42.31

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 15:46:11
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -86.00 deg 17.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 / 32.00 m
Receiver height : 53.70 / 53.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -86.00 deg Angle2 : 17.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 28.00 / 28.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 2.34 ! 2.34

RT/Custom (0.00 + 57.72 + 0.00) = 57.72 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-86 17 0.00 63.44 -3.29 -2.42 0.00 0.00 -0.61 57.11*
-86 17 0.00 63.44 -3.29 -2.42 0.00 0.00 0.00 57.72
---

* Bright Zone !

Segment Leq : 57.72 dBA

Total Leq All Segments: 57.72 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 2.34 ! 2.34

RT/Custom (0.00 + 51.19 + 0.00) = 51.19 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-86 17 0.00 56.91 -3.29 -2.42 0.00 0.00 -0.61 50.58*
-86 17 0.00 56.91 -3.29 -2.42 0.00 0.00 0.00 51.19
---

* Bright Zone !

Segment Leq : 51.19 dBA

Total Leq All Segments: 51.19 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.72
(NIGHT): 51.19

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 16:15:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -73.00 deg 62.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 29.00 / 29.00 m
Receiver height : 53.70 / 53.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -73.00 deg Angle2 : 62.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 26.00 / 26.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 1.07 ! 1.07

RT/Custom (0.00 + 59.32 + 0.00) = 59.32 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 62 0.00 63.44 -2.86 -1.25 0.00 0.00 -4.04 55.29*
-73 62 0.00 63.44 -2.86 -1.25 0.00 0.00 0.00 59.32
---

* Bright Zone !

Segment Leq : 59.32 dBA

Total Leq All Segments: 59.32 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 1.07 ! 1.07

RT/Custom (0.00 + 52.79 + 0.00) = 52.79 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 62 0.00 56.91 -2.86 -1.25 0.00 0.00 -4.04 48.75*
-73 62 0.00 56.91 -2.86 -1.25 0.00 0.00 0.00 52.79
---

* Bright Zone !

Segment Leq : 52.79 dBA

Total Leq All Segments: 52.79 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.32
(NIGHT): 52.79

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 16:15:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r8.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -73.00 deg 87.00 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 : 53.70 / 53.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -73.00 deg Angle2 : 87.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 27.00 / 27.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 0.87 ! 0.87

RT/Custom (0.00 + 59.92 + 0.00) = 59.92 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 87 0.00 63.44 -3.01 -0.51 0.00 0.00 -4.42 55.50*
-73 87 0.00 63.44 -3.01 -0.51 0.00 0.00 0.00 59.92
---

* Bright Zone !

Segment Leq : 59.92 dBA

Total Leq All Segments: 59.92 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 0.87 ! 0.87

RT/Custom (0.00 + 53.38 + 0.00) = 53.38 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 87 0.00 56.91 -3.01 -0.51 0.00 0.00 -4.42 48.97*
-73 87 0.00 56.91 -3.01 -0.51 0.00 0.00 0.00 53.38
---

* Bright Zone !

Segment Leq : 53.38 dBA

Total Leq All Segments: 53.38 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.92
(NIGHT): 53.38

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 16:19:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r9.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : 17.00 deg 61.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 43.00 / 43.00 m
Receiver height : 53.70 / 53.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 17.00 deg Angle2 : 61.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 39.00 / 39.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

RT/Custom data, segment # 2: Conf.LinePh2 (day/night)
---
1 - Bus:
Traffic volume : 540/60 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 2: Conf.LinePh2 (day/night)

Angle1 Angle2 : 61.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 43.00 / 43.00 m
Receiver height : 53.70 / 53.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 61.00 deg Angle2 : 90.00 deg
Barrier height : 19.00 m
Barrier receiver distance : 19.00 / 19.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 0.46 ! 0.46

RT/Custom (0.00 + 52.75 + 0.00) = 52.75 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
17 61 0.00 63.44 -4.57 -6.12 0.00 0.00 -4.74 48.01*
17 61 0.00 63.44 -4.57 -6.12 0.00 0.00 0.00 52.75
---

* Bright Zone !

Segment Leq : 52.75 dBA

Results segment # 2: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

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

0.50 ! 53.70 ! 27.76 ! 27.76

RT/Custom (0.00 + 46.55 + 0.00) = 46.55 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
61 90 0.00 59.05 -4.57 -7.93 0.00 0.00 -0.36 46.19*
61 90 0.00 59.05 -4.57 -7.93 0.00 0.00 0.00 46.55
---

* Bright Zone !

Segment Leq : 46.55 dBA

Total Leq All Segments: 53.68 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 0.46 ! 0.46

RT/Custom (0.00 + 46.21 + 0.00) = 46.21 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
17 61 0.00 56.91 -4.57 -6.12 0.00 0.00 -4.74 41.47*
17 61 0.00 56.91 -4.57 -6.12 0.00 0.00 0.00 46.21
---

* Bright Zone !

Segment Leq : 46.21 dBA

Results segment # 2: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 53.70 ! 27.76 ! 27.76

RT/Custom (0.00 + 40.01 + 0.00) = 40.01 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
61 90 0.00 52.52 -4.57 -7.93 0.00 0.00 -0.36 39.66*
61 90 0.00 52.52 -4.57 -7.93 0.00 0.00 0.00 40.01
---

* Bright Zone !

Segment Leq : 40.01 dBA

Total Leq All Segments: 47.14 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.68
(NIGHT): 47.14

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 15:14:59
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r10.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -90.00 deg 29.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 34.00 / 34.00 m
Receiver height : 14.75 / 14.75 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 29.00 deg
Barrier height : 14.75 m
Barrier receiver distance : 2.50 / 2.50 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 14.75 ! 13.30 ! 13.30

RT/Custom (0.00 + 47.15 + 0.00) = 47.15 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 29 0.00 63.44 -3.55 -1.80 0.00 0.00 -10.94 47.15

Segment Leq : 47.15 dBA

Total Leq All Segments: 47.15 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 14.75 ! 13.30 ! 13.30

RT/Custom (0.00 + 40.61 + 0.00) = 40.61 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 29 0.00 56.91 -3.55 -1.80 0.00 0.00 -10.94 40.61

Segment Leq : 40.61 dBA

Total Leq All Segments: 40.61 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 47.15
(NIGHT): 40.61

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 15:15:50
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r11.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -90.00 deg 30.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 36.00 / 36.00 m
Receiver height : 59.70 / 59.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 30.00 deg
Barrier height : 59.70 m
Barrier receiver distance : 2.50 / 2.50 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 59.70 ! 55.21 ! 55.21

RT/Custom (0.00 + 42.67 + 0.00) = 42.67 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 30 0.00 63.44 -3.80 -1.76 0.00 0.00 -15.21 42.67

Segment Leq : 42.67 dBA

Total Leq All Segments: 42.67 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 59.70 ! 55.21 ! 55.21

RT/Custom (0.00 + 36.14 + 0.00) = 36.14 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 30 0.00 56.91 -3.80 -1.76 0.00 0.00 -15.21 36.14

Segment Leq : 36.14 dBA

Total Leq All Segments: 36.14 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 42.67
(NIGHT): 36.14

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 15:17:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r12.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -81.00 deg 28.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 / 35.00 m
Receiver height : 14.75 / 14.75 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -81.00 deg Angle2 : 28.00 deg
Barrier height : 14.75 m
Barrier receiver distance : 2.50 / 2.50 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 14.75 ! 13.34 ! 13.34

RT/Custom (0.00 + 46.06 + 0.00) = 46.06 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-81 28 0.00 63.44 -3.68 -2.18 0.00 0.00 -11.52 46.06

Segment Leq : 46.06 dBA

Total Leq All Segments: 46.06 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 14.75 ! 13.34 ! 13.34

RT/Custom (0.00 + 39.53 + 0.00) = 39.53 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-81 28 0.00 56.91 -3.68 -2.18 0.00 0.00 -11.52 39.53

Segment Leq : 39.53 dBA

Total Leq All Segments: 39.53 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 46.06
(NIGHT): 39.53

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 15:18:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r13.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -79.00 deg 27.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 37.00 / 37.00 m
Receiver height : 50.70 / 50.70 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -79.00 deg Angle2 : 27.00 deg
Barrier height : 50.70 m
Barrier receiver distance : 2.50 / 2.50 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 50.70 ! 46.94 ! 46.94

RT/Custom (0.00 + 40.78 + 0.00) = 40.78 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-79 27 0.00 63.44 -3.92 -2.30 0.00 0.00 -16.44 40.78

Segment Leq : 40.78 dBA

Total Leq All Segments: 40.78 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 50.70 ! 46.94 ! 46.94

RT/Custom (0.00 + 34.25 + 0.00) = 34.25 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-79 27 0.00 56.91 -3.92 -2.30 0.00 0.00 -16.44 34.25

Segment Leq : 34.25 dBA

Total Leq All Segments: 34.25 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 40.78
(NIGHT): 34.25

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 14:30:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r14.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh1 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh1 (day/night)

Angle1 Angle2 : -90.00 deg -73.00 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 : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : -73.00 deg
Barrier height : 6.00 m
Barrier receiver distance : 39.00 / 39.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

RT/Custom data, segment # 2: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 2: Conf.LinePh2 (day/night)

Angle1 Angle2 : -73.00 deg 14.00 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 : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -73.00 deg Angle2 : 14.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 36.00 / 36.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

RT/Custom data, segment # 3: Conf-LinePh3 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 3: Conf-LinePh3 (day/night)

Angle1 Angle2 : 14.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 48.00 / 48.00 m
Receiver height : 1.50 / 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 14.00 deg Angle2 : 90.00 deg
Barrier height : 5.20 m
Barrier receiver distance : 9.00 / 9.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh1 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.84 ! -4.84

RT/Custom (0.00 + 28.86 + 0.00) = 28.86 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -73 0.33 63.44 -5.67 -13.24 0.00 0.00 -15.67 28.86

Segment Leq : 28.86 dBA

Results segment # 2: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.35 ! -4.35

RT/Custom (0.00 + 30.74 + 0.00) = 30.74 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 14 0.66 60.51 -7.07 -3.88 0.00 0.00 -18.83 30.74

Segment Leq : 30.74 dBA

Results segment # 3: Conf-LinePh3 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! 0.28 ! 0.28

RT/Custom (0.00 + 34.04 + 0.00) = 34.04 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
14 90 0.38 60.51 -6.96 -4.87 0.00 0.00 -14.64 34.04

Segment Leq : 34.04 dBA

Total Leq All Segments: 36.52 dBA

Results segment # 1: Conf.LinePh1 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.84 ! -4.84

RT/Custom (0.00 + 22.33 + 0.00) = 22.33 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -73 0.33 56.91 -5.67 -13.24 0.00 0.00 -15.67 22.33

Segment Leq : 22.33 dBA

Results segment # 2: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.35 ! -4.35

RT/Custom (0.00 + 24.21 + 0.00) = 24.21 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-73 14 0.66 53.98 -7.07 -3.88 0.00 0.00 -18.83 24.21

Segment Leq : 24.21 dBA

Results segment # 3: Conf-LinePh3 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! 0.28 ! 0.28

RT/Custom (0.00 + 27.51 + 0.00) = 27.51 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
14 90 0.38 53.98 -6.96 -4.87 0.00 0.00 -14.64 27.51

Segment Leq : 27.51 dBA

Total Leq All Segments: 29.99 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 36.52
(NIGHT): 29.99

STAMSON 5.0 NORMAL REPORT Date: 19-06-2020 14:32:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r15.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh1 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh1 (day/night)

Angle1 Angle2 : -17.00 deg 63.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 37.00 / 37.00 m
Receiver height : 1.50 / 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -17.00 deg Angle2 : 63.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 34.00 / 34.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

RT/Custom data, segment # 2: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 2: Conf.LinePh2 (day/night)

Angle1 Angle2 : 63.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 37.00 / 37.00 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 : 19.00 m
Barrier receiver distance : 12.00 / 12.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh1 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.47 ! -4.47

RT/Custom (0.00 + 33.21 + 0.00) = 33.21 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-17 63 0.66 63.44 -6.51 -4.02 0.00 0.00 -19.71 33.21

Segment Leq : 33.21 dBA

Results segment # 2: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -0.61 ! -0.61

RT/Custom (0.00 + 30.33 + 0.00) = 30.33 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
63 90 0.00 60.51 -3.92 -8.24 0.00 0.00 -18.03 30.33

Segment Leq : 30.33 dBA

Total Leq All Segments: 35.01 dBA

Results segment # 1: Conf.LinePh1 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -4.47 ! -4.47

RT/Custom (0.00 + 26.67 + 0.00) = 26.67 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-17 63 0.66 56.91 -6.51 -4.02 0.00 0.00 -19.71 26.67

Segment Leq : 26.67 dBA

Results segment # 2: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 1.50 ! -0.61 ! -0.61

RT/Custom (0.00 + 23.79 + 0.00) = 23.79 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
63 90 0.00 53.98 -3.92 -8.24 0.00 0.00 -18.03 23.79

Segment Leq : 23.79 dBA

Total Leq All Segments: 28.47 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 35.01
(NIGHT): 28.47

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 16:24:43
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r16.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -68.00 deg 35.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 48.00 / 48.00 m
Receiver height : 8.10 / 8.10 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -68.00 deg Angle2 : 35.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 44.00 / 44.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 8.10 ! -3.91 ! -3.91

RT/Custom (0.00 + 37.96 + 0.00) = 37.96 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-68 35 0.00 63.44 -5.05 -2.42 0.00 0.00 -18.00 37.96

Segment Leq : 37.96 dBA

Total Leq All Segments: 37.96 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 8.10 ! -3.91 ! -3.91

RT/Custom (0.00 + 31.43 + 0.00) = 31.43 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-68 35 0.00 56.91 -5.05 -2.42 0.00 0.00 -18.00 31.43

Segment Leq : 31.43 dBA

Total Leq All Segments: 31.43 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 37.96
(NIGHT): 31.43

STAMSON 5.0 NORMAL REPORT Date: 18-06-2020 16:25:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r17.te Time Period: Day/Night 16/8 hours
Description:

RT/Custom data, segment # 1: Conf.LinePh2 (day/night)
---
1 - 4-car SRT:
Traffic volume : 540/60 veh/TimePeriod
Speed : 70 km/h

Data for Segment # 1: Conf.LinePh2 (day/night)

Angle1 Angle2 : -23.00 deg 40.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 58.00 / 58.00 m
Receiver height : 7.75 / 7.75 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -23.00 deg Angle2 : 40.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 54.00 / 54.00 m
Source elevation : -5.50 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Conf.LinePh2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 7.75 ! -4.12 ! -4.12

RT/Custom (0.00 + 33.70 + 0.00) = 33.70 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-23 40 0.00 63.44 -5.87 -4.56 0.00 0.00 -19.30 33.70

Segment Leq : 33.70 dBA

Total Leq All Segments: 33.70 dBA

Results segment # 1: Conf.LinePh2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

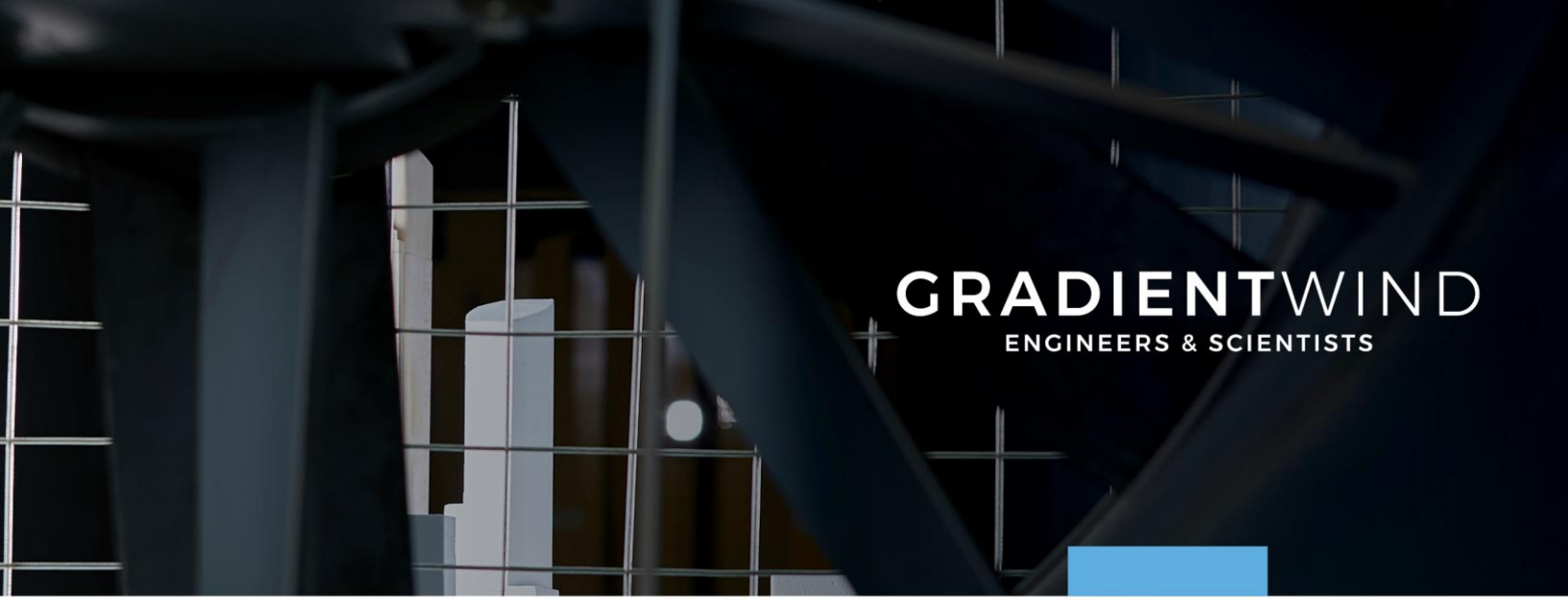
Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---+---+---+---
0.50 ! 7.75 ! -4.12 ! -4.12

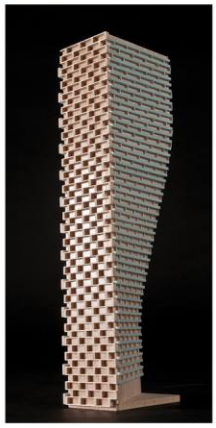
RT/Custom (0.00 + 27.17 + 0.00) = 27.17 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-23 40 0.00 56.91 -5.87 -4.56 0.00 0.00 -19.30 27.17

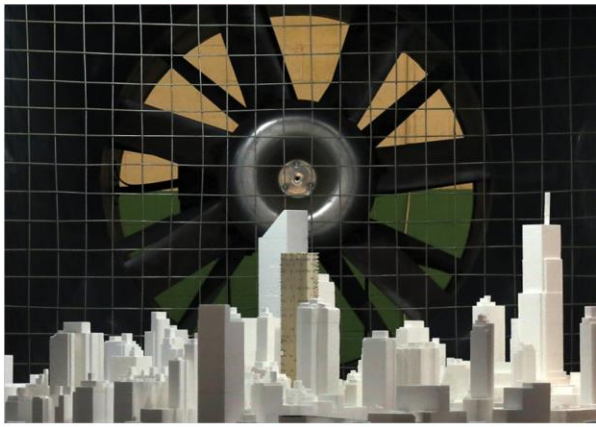
Segment Leq : 27.17 dBA

Total Leq All Segments: 27.17 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 33.70
(NIGHT): 27.17







APPENDIX B

FTA VIBRATION CALCULATIONS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

GW20-091

Possible Vibration Impacts on
335 Roosevelt Avenue
Perdicted using FTA General Assesment

Train Speed 70 km/h 43 mph

	Distance from C/L	
	(m)	(ft)
LRT	17.0	55.8

Vibration

From FTA Manual Fig 10-1

Vibration Levels at distance from track	72	dBV re 1 micro in/sec	

Adjustment Factors FTA Table 10-1

Speed reference 50 mph	-1	Operating Speed 43 mph	
Vehicle Parameters	0	Assume Soft primary suspension, Wheels run true	
Track Condition	0	Good condition	
Track Treatments	0	none	
Type of Transit Structure	0	Open cut	
Efficient vibration Propagation	2	Propagation through rock	
Vibration Levels at Fdn	73		0.111
Coupling to Building Foundation	0	Fondation on Bedrock	
Floor to Floor Attenuation	-4.0	Second Floor Ocupied	
Amplification of Floor and Walls	4		
Total Vibration Level	72.79	dBV or	0.111 mm/s
Noise Level in dBA	37.79	dBA	

APPENDIX D

Proximity Assessment Report

PG2178-LET.02 Revision 5 dated July 10, 2025

PATERSON GROUP

Consulting Engineers
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
Tel: (613) 226-7381

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Materials Testing
Building Science
Rural Development Design
Temporary Shoring Design
Retaining Wall Design
Noise and Vibration Studies

patersongroup.ca

July 10, 2025
File: PG2178-LET.02 Revision 5

Uniform Urban Developments
117 Centrepointe Drive, Suite 300
Ottawa, Ontario
K2G 5X3

Subject: Proximity Assessment
Proposed High-Rise Buildings
335 Roosevelt Avenue – Ottawa

Dear Sir/Madam,

Further to your request and authorization, Paterson Group (Paterson) prepared the current letter to summarize construction issues which could occur due to the proximity of the proposed development with respect to the proposed alignment of the Confederation Line and temporary BRT detour. The following letter should be read in conjunction with the LRT Confederation Line – Level 2 Proximity Study (Paterson Report PG2178-2 Revision 5 dated July 10, 2025).

1. Background Information

Based on current plans, it is understood that the proposed development will consist of 2 high-rise buildings. The west building will have 3 levels of underground parking, while the east building will have 4 levels of underground parking.

The following sections summarize our existing soils information and construction precautions for the proposed development, which may impact the proposed alignment of the Confederation Line, Dominion Station, and temporary BRT detour.

It should be noted that the information submitted as part of the current Proximity Study will be supplemented with construction plans issued for construction, once available.

2. Subsurface Conditions

Based on existing geotechnical information, the subsurface conditions in the immediate area of the subject site and adjacent Confederation Line alignment consist of the following:

- Existing surface grade is at an elevation of approximately 66.5 m.
- The overburden thickness is approximately 0.6 to 1.2 m.
- Bedrock surface elevation is at approximately 65.5 to 65.7 m.
- The bedrock at the subject site generally consists of approximately 2 m of poor quality limestone bedrock, while the underlying bedrock was observed to be of fair to excellent quality.

LRT and Station Location

It is anticipated that the proposed Confederation Line alignment will be located approximately 16 to 17 m north of the subject site. A multi-use pathway is located between the subject site and the proposed Confederation Line alignment, where a temporary BRT detour will be located for the duration of the Stage 2 LRT construction. The ground surface at the LRT alignment is located at approximate geodetic elevation 61 m, while the deepest underside of footing (USF) elevation for the proposed building is anticipated to be around geodetic elevation 50 m.

The proposed Dominion Station is to be located approximately 45 m to the northwest of the subject site

3. Construction Precautions and Recommendations

Influence of Proposed Development on Confederation Line

Based on existing subsurface information and building design details, the footings of the proposed buildings will be founded on sound bedrock. Lateral loads due to the building footings will be transferred directly into the bedrock well within a conservative 6V:1H zone of influence from the outside face of footing. Therefore, due to the depth of the proposed buildings, and the distance between the proposed buildings and the Confederation Line alignment, the proposed buildings will not apply additional loading to the Confederation Line or Dominion Station structures.

Further, although the underground parking levels for the proposed buildings will extend approximately 13 m below existing ground surface, due to the approximate 16 m distance between the proposed buildings and LRT structures, the building excavation will not impact the lateral support zone of the Confederation Line, Dominion Station, or temporary BRT detour structures, which are also anticipated to be founded on bedrock.

Excavation and Temporary Shoring

The overburden along the perimeter of the proposed building footprints will need to be sloped adequately or shored in order to complete the construction of the underground parking structure for the proposed development. Bedrock removal is also anticipated, which will be completed by line drilling, blasting and/or hoe ramming. The blasting and hoe ramming will be carried out by a contractor specializing in bedrock removal.

There are no adverse effects to the Confederation Line, Dominion Station, or temporary BRT detour with the approach being considered for the building excavation along this alignment. Also, there will be no disturbance to the bedrock mass between the buildings and the Confederation Line.

Where required, it is anticipated that the temporary shoring system will consist of a soldier pile and lagging system designed for at-rest earth pressures, using a pressure coefficient of $K_0 = 0.5$.

The geotechnical engineer will review the stability of the rock face underlying the overburden during excavation. Following the review of the rock face, the geotechnical engineer will determine if rock reinforcement is required, and if so, the extent to which rock reinforcement is required. This determination will include consideration for the Confederation Line, Dominion Station structure, and temporary BRT detour.

A seismograph would be installed near the northern boundary of the subject site to monitor vibrations during the bedrock removal program. A program detailing trigger levels and action levels is provided in Section 3.1 of the LRT Confederation Line – Level 2 Proximity Study (Paterson Report PG2178-2 Revision 5 dated July 10, 2025).

Pre-Construction Survey

Due to the anticipated construction activities for the proposed buildings, a pre-construction survey will be required for the Confederation Line, Dominion Station, and temporary BRT detour structures.

Any existing structures in the immediate area of the proposed buildings will also undergo a pre-construction survey as per standard construction practices, where bedrock blasting will be required. Plans for construction of underground utilities and air exchange systems for the underground parking lot will be assessed as part of the pre-construction survey. At the time of preparation of this report, the civil and mechanical drawings are not currently available. The civil and mechanical plans will be forwarded once they are completed.

Groundwater Control

Groundwater observations during the geotechnical investigation indicated groundwater levels at approximately 4 to 6 m below the existing ground surface. Due to the presence of shallow bedrock at the site and in the general area, adverse effects related to ground surface settlement due to dewatering are expected to be negligible. The current groundwater level is fully within the bedrock unit, therefore, any depressurization of the groundwater table within the bedrock, will have no adverse effects to surrounding structures including the Confederation Line, Dominion Station structure, or temporary BRT detour.

4. Conclusions and Recommendations

Based on the currently available information for the subject alignment and the existing subsurface information, the proposed buildings will not negatively impact the existing Confederation Line, Dominion Station, or temporary BRT detour structures. It should be noted that the information submitted as part of the current Proximity Study will be supplemented with drawings issued for construction and a field monitoring program as described in the application conditions.

We trust that this information is to your satisfaction.

Best Regards,

Paterson Group Inc.

Puneet Bandi, M.Eng.

Scott S. Dennis, P.Eng.