Geotechnical Investigation
Proposed Residential Development
349 Danforth Avenue, Ottawa, Ontario

Client:
Mr. Fernando Matos
337 Sunnyside Avenue, Suite 101
Ottawa, Ontario K1S 0R9
fernando@ottawacarletonconstruction.com

Type of Document:
Final

Project Number:
OTT-00259161-A0

Prepared By:
Athir Nader, M.A.Sc., P.Eng.
Senior Project Manager/Geotechnical Engineer

Reviewed / Approved By:
Ismail M. Taki, M.Eng. P.Eng.
Manager, Geotechnical Services

Date Submitted:
September 14, 2020

100 - 2650 Queensview Drive, Ottawa, Ontario K2B 8H6
T: +1.613.688.1899 • F: +1.613.225.7337 • www.exp.com

Table of Contents:

Figures:

List of Tables:

Executive Summary

A geotechnical investigation was undertaken at the site of the proposed three (3) storey with basement commercial/residential building to be located at 349 Danforth Avenue, City of Ottawa, Ontario. Terms and conditions of the assignment were outlined in EXP's Proposal dated March 12, 2020.

This report was concurrently completed with a Phase I/II Environmental Site Assessment which are presented under separate covers.

The fieldwork for the geotechnical investigation was completed on June 29 to 30, 2020 and comprised the drilling of three (3) boreholes, i.e., Borehole Nos. 1 to 3, to depths ranging between 9.5 m and 10.2 m below the existing ground surface. The boreholes were drilled using truck-mounted drill-rig equipment operated by a drilling specialist subcontracted to EXP and was supervised on a full-time basis by a representative of EXP.

The investigation has revealed that the subsurface conditions comprise of very loose to loose fill underlain by bedrock encountered at depths ranging from 0.6 m and 0.8 m below ground surface. Wash boring and core drilling used to advance all boreholes into bedrock to depths ranging from 9.5 m to 10.2 m below ground surface.

Water level measurements were made in the monitoring wells installed in all boreholes upon and after installation. The measurements revealed that the groundwater table to be at a depth ranging between 5.0 m and 6.0 m below the existing ground surface or elevations 95.4 m to 93.8 m.

A significant grade raise is not expected at the site. However, for design purposes, a maximum grade raise of 1 m is permissible at the site from a geotechnical point of view.

Based on the results of the investigation, the proposed building may be founded on the limestone bedrock below any weathered or fractured zones and designed for a bearing pressure at Ultimate Limit State (ULS) of 1000 kPa.

All the footing beds should be examined by a senior geotechnician to ensure that they are prepared properly, and they are able to support the ULS bearing pressure.

The basement slab of the proposed building may be set on a bed of 300 mm of clear stone set over bedrock or engineered fill. Perimeter drainage systems is recommended for the proposed building with one basement level.

Excavations at the site in the overburden may be undertaken as open-cut provided they are cut back at a slope of 1H to 1V. Excavation of the bedrock would require the use of hoe-ramming and/or line drilling and may be undertaken with near vertical sides. Vibrations should be monitored during construction to prevent damage to adjacent structures and services. A pre-condition survey of all the structures and services situated within proximity of the site will be required prior to commencement of construction and

during the excavation of the bedrock. Care must be undertaken to ensure that the footings of the neighbouring properties are not undermined or damaged during construction.

Seepage of surface water into the excavations should be anticipated. It should be possible to collect the water entering the excavation in perimeter ditches and to remove it by pumping from sumps.

The subject site has been classified as Class C for seismic site response in relation to Section 4.1.8.4 of the 2012 Ontario Building Code (OBC 2012). A higher site class for the site may be obtained if a shear-wave measurement is completed at the site.

The above and other related considerations are discussed in greater detail in the report

1 Introduction

A geotechnical investigation was undertaken at the site of the proposed three (3) storey with basement commercial/residential building at 349 Danforth Avenue, City of Ottawa, Ontario (Figure 1). Terms and conditions of the assignment were outlined in EXP's Proposal dated March 12, 2020.

Design site grades as well design ground floor/basement elevations were not available at the time of preparation of the report. The building currently existing on-site will be demolished to allow the new construction.

This report was concurrently completed with a Phase I/II Environmental Site Assessment which are presented under separate covers.

The geotechnical investigation was undertaken to:

a) Establish the subsurface soil, bedrock and groundwater conditions at the location of the boreholes drilled at the site;

b) Comment on grade-raise restrictions for the site;

c) Make recommendations on the most suitable type of foundations, founding depth and Serviceability Limit State (SLS) bearing pressures and Ultimate Limit State (ULS) factored geotechnical resistances for the proposed addition as well as anticipated total and differential settlements;

d) Provide lateral earth pressure parameters for subsurface basement wall design;

e) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes;

f) Discuss excavation conditions and dewatering requirements during construction; and

g) Provide classification of the site for seismic design in accordance with requirements of the 2012 Ontario Building Code (OBC) and assess the liquefication potential of the on-site soils in a seismic event.

The comments and recommendations given in this report assume that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2 Site Description

The subject site is a narrow rectangular parcel of land roughly 10 m wide by 30 m long, occupied by an existing two storey residential building (Figure 2). It is understood that the existing building will be demolished prior to the construction of the proposed building. The site is bounded by Danforth Avenue to the southeast and by industrial buildings and parking lots on all other sides. The site is generally flat.

3 Procedure

The fieldwork for the geotechnical investigation was completed on June 29 and 30, 2020 and comprised the drilling of three (3) boreholes, i.e., Borehole Nos. 1 to 3, to depths ranging between 9.5 m and 10.2 m below the existing ground surface. The boreholes were drilled using truck-mounted drill-rig equipment operated by a drilling specialist subcontracted to EXP and was supervised on a full-time basis by a representative of EXP.

The locations of the boreholes were established in the field by EXP and are shown on Figure 2. Their elevations were established using a temporary benchmark being the top of storm sewer manhole adjacent to front of the property at Danforth Avenue with an assumed elevation of 100.00 m. Therefore, convergence to geodetic elevations will be required once available.

Prior to the fieldwork, the locations of the boreholes were cleared of any public and private underground services. Standard penetration tests were performed in all the boreholes at continuous depth intervals and soil samples retrieved by split-barrel sampler in accordance with ASTM 1586. Wash-boring and core-drilling techniques were used to advance all boreholes beyond the refusal depth.

Long-term groundwater monitoring installations consisting of 32 mm diameter polyvinyl chloride (PVC) monitoring wells were installed in all boreholes in accordance with EXP standard practice. The installation configuration is documented on the respective borehole log.

All the soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified. Similarly, all the rock cores were visually examined, placed in core boxes, identified and logged. On completion of the fieldwork, all the soil and rock samples were transported to the EXP laboratory in the City of Ottawa, Ontario, where they were visually examined by a geotechnical engineer, and borehole logs prepared. The engineer also assigned the laboratory testing which consisted of performing the following tests on soil and rock samples:

Natural Moisture Content	4 tests
Unit Weight and Unconfined Compressive Strength Tests on Rock Cores	3 tests

4 Subsurface Soil and Groundwater Conditions

A detailed description of the geotechnical conditions encountered in the boreholes is given on the borehole logs, Figures 3 to 5 inclusive. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time may also result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

It should be noted that the soil and rock boundaries indicated on the borehole logs are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Descriptions" preceding borehole logs form an integral part of this report and should be read in conjunction with this report.

A review of the borehole logs indicates the following subsurface soil and groundwater conditions with depth.

4.1 Fill

Fill was encountered from the ground surface in all boreholes and extended to bedrock surface at 0.6 m to 0.8 m below ground surface.

The fill is very loose to loose, heterogeneous in nature and consists of a 100 mm to 150 mm layer of crushed stone type, i.e. sand and gravel, underlain by silty sand with gravel.

4.2 Bedrock

The shallow deposit of fill is underlain by bedrock which was investigated to depths of 9.5 m to 10.2 m below ground surface, i.e Elevation 90.2 m to 89.6 m.

A review of the recovered bedrock cores and published geology maps indicate that the bedrock underlying the site comprises of limestone and shale of the Billings Formation of the Upper Ordovician Period.

A Total Core Recovery (TCR) and Rock Quality Designation (RQD) of 98 to 100 percent and 28 to 95 percent respectively were obtained from the recovered bedrock cores. On this basis, the bedrock quality within the depth investigated may be classified as poor to excellent quality.

A total of three (3) rock core samples were selected for unconfined compressive strength testing and the test results are presented in Table I. A review of the test results indicates a bedrock with compressive strength ranging between 105 MPa and 161 MPa. Based on these values, the rock can be classified with respect to intact strength as "very strong", (Canadian Foundation engineering manual, 4th edition, 2006). The unit weight of the bedrock ranged between 2707 kg/m^3 and 2714 kg/m^3.

Table 1: Results of Unconfined Compression Tests on Rock Core Samples			
Borehole No. Run No.	**Depth (m)**	**Compressive Strength (MPa)**	**Unit Weight of Bedrock (Kg/m3)**
BH/MW1 – Run 1	1.3 – 1.4	133.2	2673
BH/MW2 – Run 1	0.8 – 0.9	87.1	2651
BH/MW3 – Run 1	0.8 – 0.9	234.4	2386

Photographs of the bedrock core recovered are presented in Figure 6 to 8.

4.3 Groundwater

Water level measurements were made in the monitoring wells installed in all boreholes upon installation, one (1) day after installation, seven (7) days after installation, and eleven (11) days after installation. The measurements revealed that the groundwater table to be at a depth ranging between 5.0 m and 6.0 m below the existing ground surface or elevations 95.4 m to 93.8 m.

Water levels were determined in the boreholes at the times and under the conditions stated in the scope of services. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

5 Grade Raise

The investigation has revealed the site to be underlain by a shallow deposit of overburden (less than 1.0 m) overlying limestone with shale partings to shale bedrock.

Based on the geotechnical findings a grade raise of up to 1 m is considered acceptable from a geotechnical point of view. However, significant grade raise is not expected at the site as the results of the proposed building.

6 Foundation Considerations

Floor Plans call for the construction of the proposed three (3) storey with basement residential building. It is understood that the existing building will be demolished prior to the construction of the proposed building.

Based on the results of the investigation, the proposed building may be founded on the limestone bedrock below any weathered or fractured zones and designed for a bearing pressure at Ultimate Limit State (ULS) of 1000 kPa. Since the footings will be founded on sound bedrock, factored geotechnical resistance at ULS will govern the design. Settlement for footings founded on sound bedrock is expected to be minimal.

All footing beds should be examined by a geotechnical engineer to ensure that the founding surfaces can support the design bearing pressure and that the footing beds have been properly prepared as described above. A minimum of 1.2 m of earth cover should be provided to the footings of a heated structure founded on bedrock to protect them from damage due to frost penetration. The frost cover should be increased to 1.5 m for unheated structures.

The recommended bearing pressures have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between the boreholes when foundation construction is underway. The interpretation between the boreholes and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

7 Floor Slab and Drainage Requirements

The lowest basement floor slab of the proposed building may be constructed provided they are set on beds of well-compacted 19 mm clear stone at least 300 mm thick placed on bedrock or on well-compacted engineered fill. The clear stone would prevent the capillary rise of moisture to the floor slab. Adequate saw cuts should be provided in the floor slab to control cracking.

It is anticipated that perimeter drainage system would be required for the proposed building with basement. The perimeter drainage system may consist of 100 mm diameter perforated pipe wrapped with filter cloth (sock) and set on the footings and surrounded with 150 mm of 19 mm clear stone and properly connected to an outflow. The subsurface walls should be adequately damp proofed.

The finished exterior grade should be sloped away from the buildings to prevent surface ponding of water close to the exterior walls.

8 Pipe Bedding Requirement

It is recommended that the bedding for the underground services including material specification, thickness of cover material and compaction requirements conform to the local requirements of the municipality and/or Ontario provincial Standard Specification and Drawings (OPSS and OPSD).

For guidance, the pipe bedding may consist of 150 mm of OPSS 1010 Granular A for services founded on bedrock. The bedding material should be also placed along the sides and on top of the pipes to provide a minimum cover of 300 mm. The bedding, spring line and cover should be compacted to at least 98 percent the Standard Proctor Maximum Dry Density (SPMDD).

9 Lateral Earth Pressure against Basement Walls

The subsurface wall should be backfilled with free draining material, such as OPSS 1010 for Granular B, Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The walls will be subjected to lateral static and dynamic (seismic) earth forces.

For design purposes, the lateral static earth thrust against the subsurface walls may be computed from the following equation:

$$P = K_0 H (q + \tfrac{1}{2} \gamma H)$$

where P = lateral earth thrust acting on the subsurface wall; kN/m

K_0 = lateral earth pressure coefficient for 'at rest' condition for Granular B Type II backfill material = 0.5

γ = unit weight of free draining granular backfill; Granular B = 22 kN/m^3

H = Height of backfill adjacent to foundation wall, m

q = surcharge load, kPa

The lateral seismic thrust may be computed from the equation given below:

$$\Delta P_E = 0.32 \gamma H^2$$

where ΔP_E = resultant thrust due to seismic activity; kN/m

γ = unit weight of free draining granular backfill; Granular B Type II = 22 kN/m^3

H = height of backfill behind wall, (m)

The ΔPE value does not take into account the surcharge load. The resultant load should be assumed to act at 0.6 H from the bottom of the wall.

10 Excavations and De-Watering Requirements

Excavations for the construction of the proposed building and underground services will likely be undertaken through the shallow fill and into bedrock to a maximum depth of 1.0 m below ground surface and are expected to be above the prevailing groundwater table.

Excavations at the site must comply with the latest version of Ontario Occupational Health and Safety Act, Ontario Regulations 213/91 (January 11, 2014).

Excavations at the site in the overburden may be undertaken as open-cut provided they are cut back at a slope of 1H to 1V. Excavation of the bedrock would require the use of hoe-ramming and/or line drilling and may be undertaken with near vertical sides. Vibrations should be monitored during construction to prevent damage to adjacent structures and services. A pre-condition survey of all the structures and services situated within the proximity of the site will be required prior to the commencement of construction and during the excavation of the bedrock. Care must be undertaken to ensure that the footings of the neighbouring properties are not undermined or damaged during construction.

Surface water inflow into the excavation should be expected. However, it should be possible to adequately handle this inflow by collecting the water in perimeter ditches and pumping from properly filtered sumps.

11 Seismic Site Classification

11.1 Liquefaction Potential

The investigation has revealed that the proposed building will be founded on bedrock.

Based on the results of the investigation, there is no liquefaction potential of the subsurface soil during a seismic event.

11.2 Seismic Classification

Based on the subsurface conditions, the site is classified as **Class C for seismic site response** in accordance with Section 4.1.8.4 of the 2012 Ontario Building Code (ONBC 2012).

A higher site class will likely be obtained if a shear-wave velocity testing is completed at the site.

12 Backfilling Requirements and Suitability of on-Site Soils for Backfilling Purposes

The material to be excavated from the site will be comprised of heterogenous fill of limited quantity and bedrock.

It is anticipated that all the material required for backfilling purposes will need to be imported and should preferably conform to OPSS 1010 Granular B Type II.

The on-site fill may be used for grading purposes provided it is free of organics and foreign debris. Excavated bedrock is not suitable for backfilling and should be discarded.

13 Legal Notification

This report was prepared by EXP Services Inc. (EXP) for the account of Mr. Fernando Matos.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project

14 General Comments

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions, especially bedrock elevations between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretation of the factual borehole and test pit results to draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report is not intended to reflect on environmental aspects of the soils and groundwater. Should specific information be required, including for example, the presence of pollutants, contaminants or other hazards in the soil, refer to the Phase I and II reports prepared by EXP for this project and presented under separate covers.

15 Signatures

We trust that this information is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely

Athir Nader, P.Eng
Senior Geotechnical Engineer
Earth and Environment

Ismail Taki, M.Eng, P.Eng
Manager, Geotechnical Division
Earth and Environment

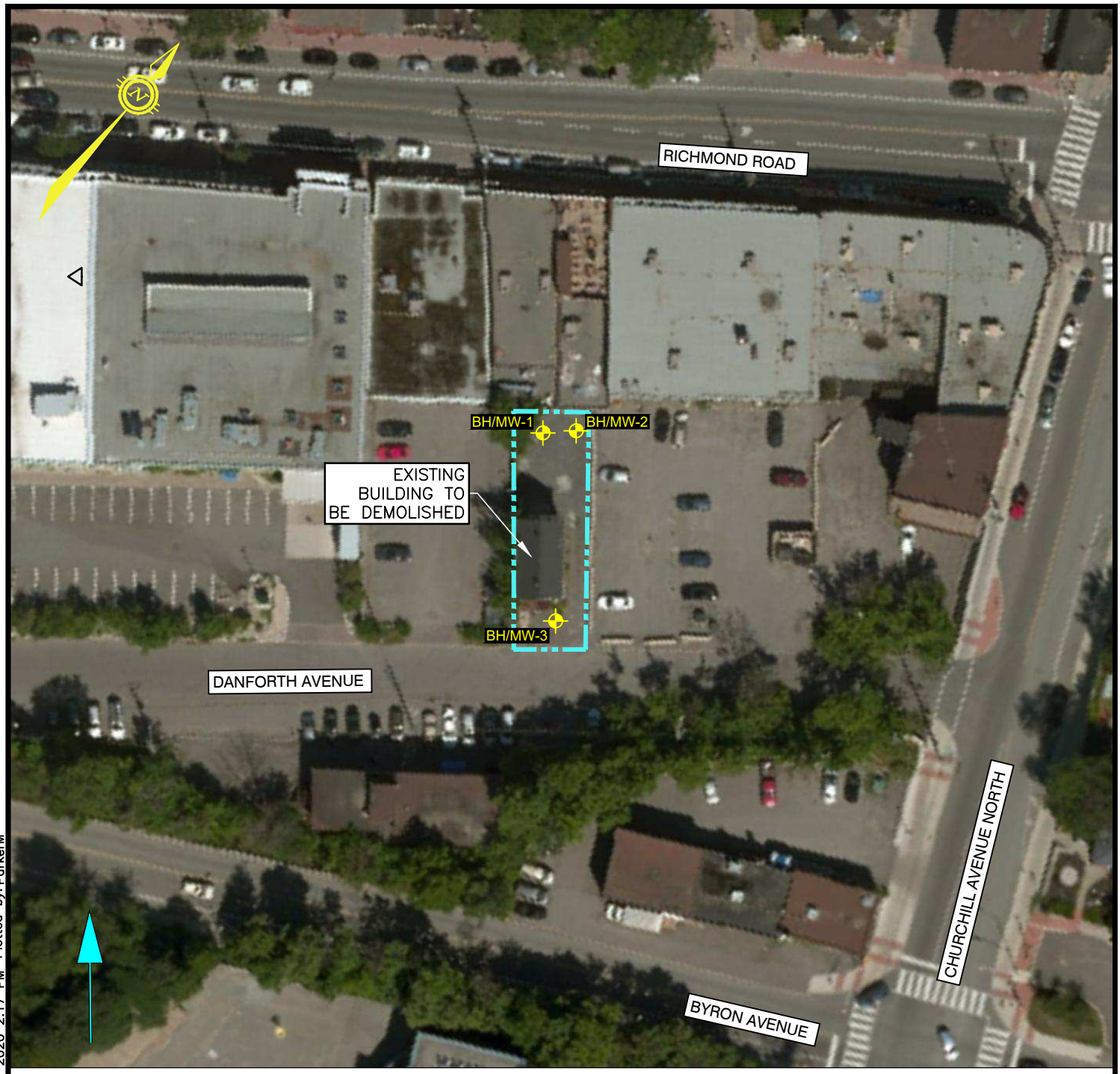
Figures

0 100m 200m 400m

HORIZONTAL 1:10,000

EXP Services Inc. www.exp.com
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: JULY 2020	CLIENT: OTTAWA CARLETON CONSTRUCTION GROUP LTD.	project no. OTT-00259161-A0
DESIGN: O.V. / CHECKED: P.S.		scale: 1:10,000
DRAWN BY: M.P.	TITLE: SITE LOCATION PLAN 349 DANFORTH AVENUE, OTTAWA, ON	FIG 1



LEGEND

PROPERTY BOUNDARY

BH/MW-2 — BOREHOLE/MONITORING WELL LOCATION & NUMBER

0 5m 10m 30m

HORIZONTAL 1:750

EXP Services Inc. www.exp.com
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE: AUGUST 2020	CLIENT: OTTAWA CARLETON CONSTRUCTION GROUP LTD.	project no. OTT-00259161-A0
DESIGN: A.N. / CHECKED: P.S.		scale: 1:750
DRAWN BY: M.P.	TITLE: GEOTECHNICAL INVESTIGATION 349 DANFORTH AVENUE, OTTAWA, ON	FIG 2

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH/MW1

Project No: OTT-00259161-A0

Project: Geotechnical Investigation - Proposed Residential Development

Location: 349 Danforth Avenue, Ottawa, Ontario

Figure No. 3

Page. 1 of 1

Date Drilled: June 29th, 2020

Drill Type: CME 55 (truck mount)

Datum: Assumed

Logged by: MD Checked by: PS/IT

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Assumed m	Depth	Standard Penetration Test N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			99.8					
		CRUSHED STONE TYPE FILL ~ 150 mm Sand and gravel, grey, moist, no odour or staining.	99.6	0	2	5	SS1	
			99.2					
		FILL Silty sand with gravel, dark brown and grey, moist, no odour or staining, (very loose).		1				
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, highly to slightly weathered, grey, weak to strong, (poor to excellent quality)		2			RUN1	
				3			RUN2	
				4				
			94.7	5			RUN3	
		SHALE BEDROCK fine to medium grained, slightly weathered, black, medium strong, (good quality)	94.15	6			RUN4	
			93.3					
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, slightly weathered, grey, medium strong to strong, (good to excellent quality)		7				
				8			RUN5	
				9				
				10			RUN6	
			89.6					
		Borehole Terminated at 10.2 m Depth						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

LOG OF BOREHOLE LOGS OF BOREHOLES - 349 DANFORTH.GPJ TROW OTTAWA.GDT 9/14/20

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 32 mm monitoring well with flushmount was installed in the borehole upon completion.
3. Field work was supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00259161-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
completion	1.0	-
1 day	6.0	-
7 days	6.0	-
11 days	5.7	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	0.92 - 2.54	100	49
2	2.54 - 4.04	100	78
3	4.04 - 5.56	100	94
4	5.56 - 7.09	99	88
5	7.09 - 8.66	100	91
6	8.66 - 10.16	100	95

Log of Borehole BH/MW2

Project No: OTT-00259161-A0

Project: Geotechnical Investigation - Proposed Residential Development

Location: 349 Danforth Avenue, Ottawa, Ontario

Figure No. 4

Page. 1 of 1

Date Drilled: June 29th, 2020

Drill Type: CME 55 (truck mount)

Datum: Assumed

Logged by: MD Checked by: PS/IT

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Assumed m	Depth	Standard Penetration Test N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CRUSHED STONE TYPE FILL ~ 100 mm Sand and gravel, grey, moist, no odour or staining.	99.7 / 99.6	0	5	10	SS1	
		FILL Silty sand with gravel, dark brown and grey, moist, no odour or staining, (loose).	99.0	1			RUN1	
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, highly to slightly weathered, grey, weak to strong, (poor to excellent quality)		2			RUN2	
				3			RUN3	
				4			RUN4	
		SHALE BEDROCK fine to medium grained, slightly weathered, black, medium strong, (excellent quality)	94.67 / 94.5	5			RUN5	
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, slightly weathered, grey, medium strong to strong, (fair to good quality)	93.2	6			RUN6	
				7				
				8			RUN7	
			90.2	9				
		Borehole Terminated at 9.5 m Depth						

LOG OF BOREHOLE LOGS OF BOREHOLES - 349 DANFORTH.GPJ TROW OTTAWA.GDT 9/14/20

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 32 mm monitoring well with flushmount was installed in the borehole upon completion.
3. Field work was supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00259161-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
1 day	1.9	-
7 days	5.6	-
11 days	5.0	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	0.71 - 1.09	100	28
2	1.09 - 2.64	100	51
3	2.64 - 3.97	100	91
4	3.97 - 5.46	100	92
5	5.46 - 6.93	100	82
6	6.93 - 8.54	100	81
7	8.54 - 9.47	100	60

Log of Borehole BH/MW3

Project No: OTT-00259161-A0

Project: Geotechnical Investigation - Proposed Residential Development

Location: 349 Danforth Avenue, Ottawa, Ontario

Figure No. 5

Page. 1 of 1

Date Drilled: June 30th, 2020

Drill Type: CME 55 (truck mount)

Datum: Assumed

Logged by: MD Checked by: PS/IT

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test ——— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○⊣ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Assumed m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			100		20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		CRUSHED STONE TYPE FILL ~ 150 mm Sand and gravel, grey, moist, no odour or staining.	99.8	0	7	5	SS1	
		FILL Silty sand with gravel, dark brown and grey, moist, no odour or staining, (loose).	99.2	1	66 / 250 mm	0	SS2	
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, highly to slightly weathered, grey, weak to strong, (fair to good quality)		2			RUN1	
				3			RUN2	
				4			RUN3	
			95.44	5			RUN4	
		SHALE BEDROCK fine to medium grained, slightly weathered, black, medium strong, (fair quality)	94.5	6			RUN5	
		LIMESTONE BEDROCK Limestone with shale partings, fine to medium grained, slightly weathered, grey, medium strong to strong, (fair to good quality)	93.3	7			RUN6	
				8				
				9			RUN7	
		Borehole Terminated at 10.0 m Depth	90.0	10				

LOG OF BOREHOLE LOGS OF BOREHOLES - 349 DANFORTH.GPJ TROW OTTAWA.GDT 9/14/20

NOTES:

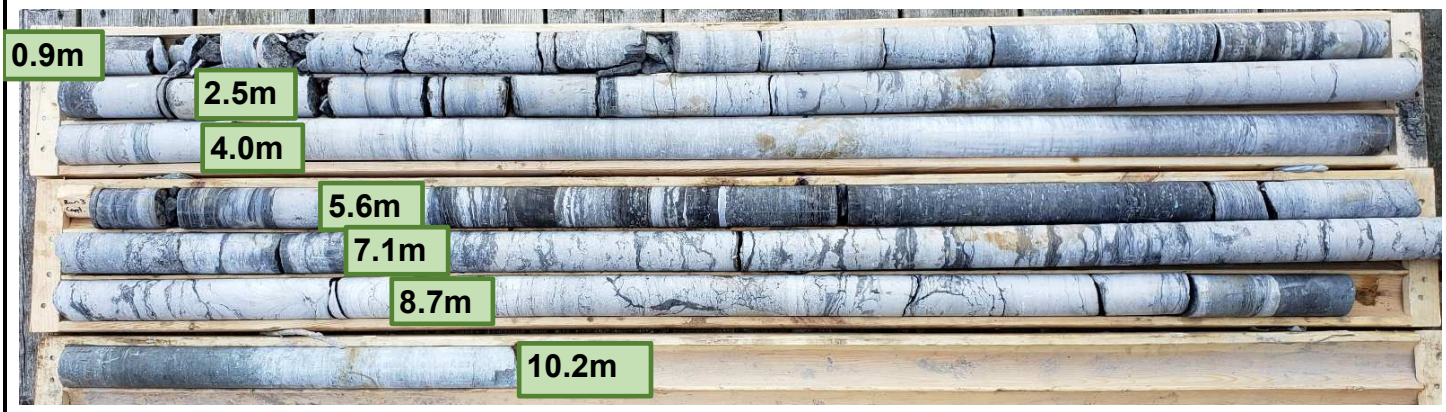
1. Borehole data requires interpretation by EXP before use by others
2. A 32 mm monitoring well with flushmount was installed in the borehole upon completion.
3. Field work was supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-00259161-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
completion	1.7	-
6 days	5.5	-
10 days	4.6	-

CORE DRILLING RECORD

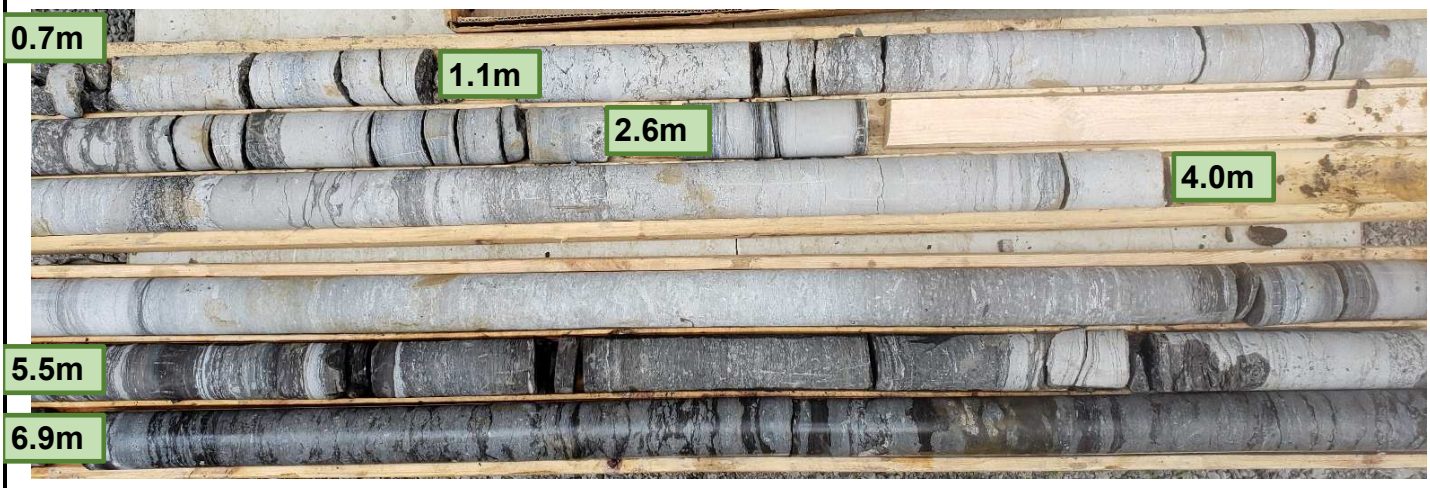
Run No.	Depth (m)	% Rec.	RQD %
1	0.79 - 1.12	100	77
2	1.12 - 2.59	98	61
3	2.59 - 4.17	100	65
4	4.17 - 5.61	98	58
5	5.61 - 7.04	100	78
6	7.04 - 8.48	98	88
7	8.48 - 10.03	100	77



exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

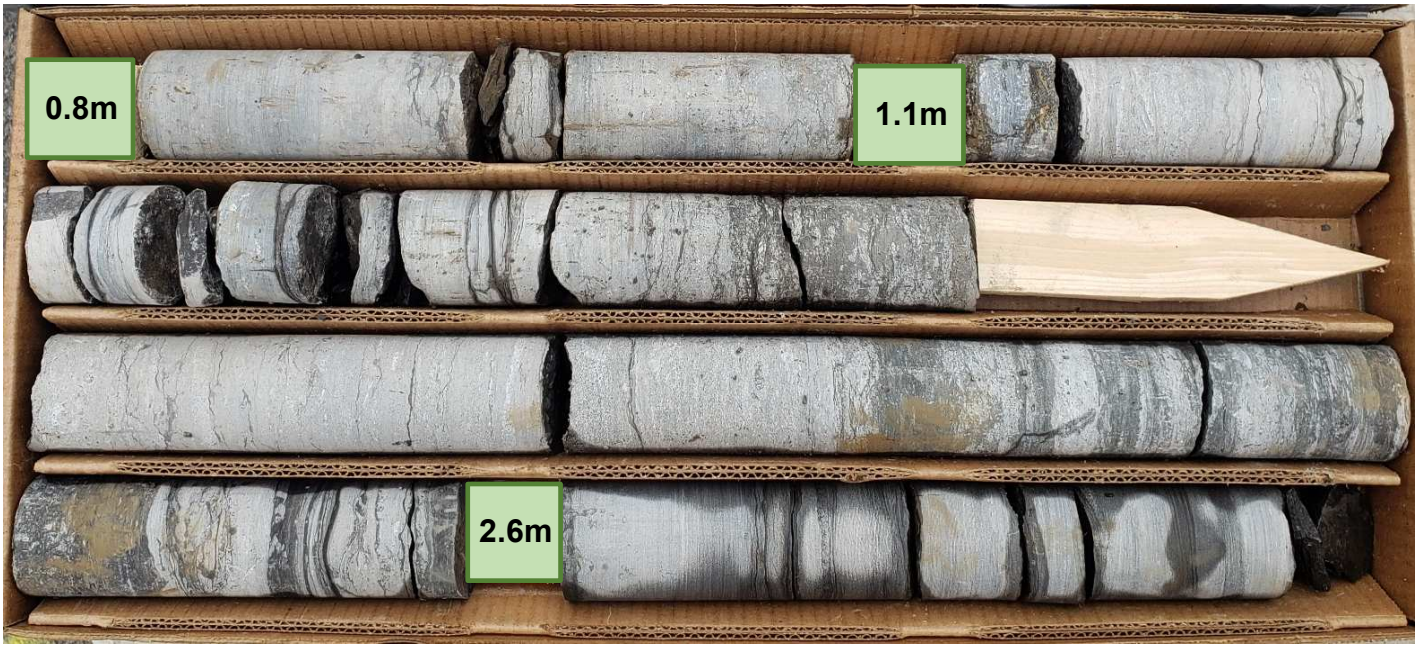
borehole no.	core runs	PROJECT	project no.
MW1	Run 1: 0.9m-2.5m Run 2: 2.5m-4.0m Run 3: 4.0m-5.6m Run 4: 5.6m-7.1m Run 5: 7.1m-8.7m Run 6: 8.7m-10.2m	PIIESA and Geotechnical Investigation 349 Danforth Avenue, Ottawa, Ontario	OTT-00259161-A0
date cored Jun 29, 2020		ROCK CORE PHOTOGRAPHS	FIG. 6

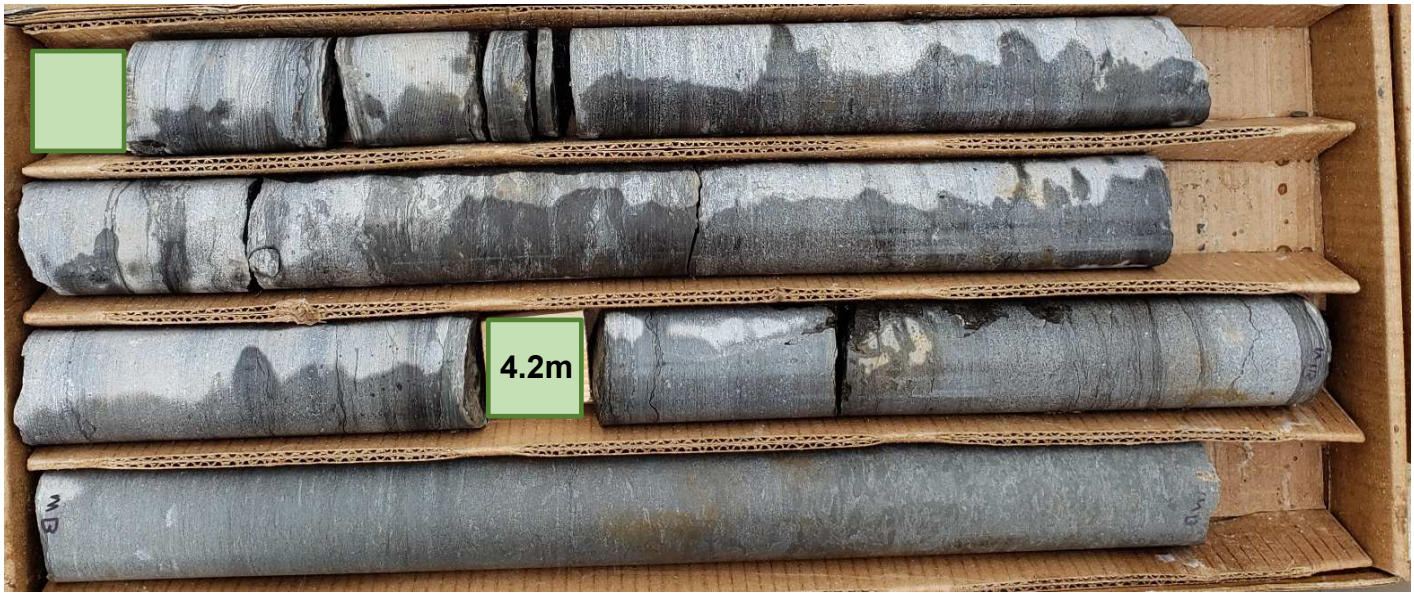


exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

borehole no.	core runs	PROJECT	project no.
MW2	Run 1: 0.7m-1.1m Run 2: 1.1m-2.6m Run 3: 2.6m-4.0m Run 4: 4.0m-5.5m Run 5: 5.5m-6.9m Run 6: 6.9m-8.5m Run 7: 8.5m-9.5m	PIIESA and Geotechnical Investigation 349 Danforth Avenue, Ottawa, Ontario	OTT-00259161-A0
date cored Jun 29, 2020		ROCK CORE PHOTOGRAPHS	FIG. 7

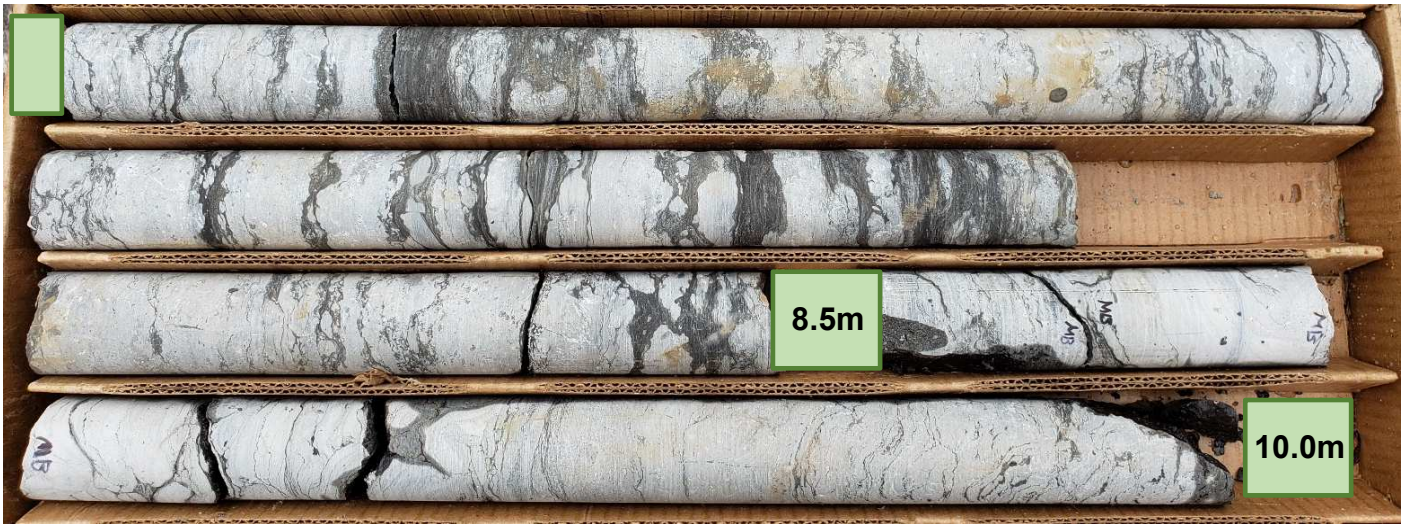




exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

borehole no.	core runs	PROJECT	project no.
MW3	Run 1: 0.8m-1.1m Run 2: 1.1m-2.6m Run 3: 2.6m-4.2m Run 4: 4.2m-5.6m	PIIESA and Geotechnical Investigation 349 Danforth Avenue, Ottawa, Ontario	OTT-00259161-A0
date cored Jun 30, 2020		ROCK CORE PHOTOGRAPHS	FIG. 8A



exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

borehole no.	core runs	PROJECT	project no.
MW3	Run 4: 4.2m-5.6m Run 5: 5.6m-7.0m Run 6: 7.0m-8.5m Run 7: 8.5m-10.0m	PIIESA and Geotechnical Investigation 349 Danforth Avenue, Ottawa, Ontario	OTT-00259161-A0
date cored Jun 30, 2020		ROCK CORE PHOTOGRAPHS	FIG. 8B