Geotechnical Investigation
Proposed Walkley Centre Development
1820-1846 Bank Street, Ottawa, Ontario

Client:
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Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed re-development of the parcel of property referred to as Walkley Centre, located at 1822-1846 Bank Street, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: OTT-23002538-B0 dated August 1, 2023, and a subsequent proposal dated September 28, 2023. This report supersedes the final report submitted on August 28, 2024.

Based on the Hobin Architecture (Hobin) drawing, titled "Concept Site Plan Revision 3", dated September 18, 2024, the proposed development will consist of one (1) rental apartment building (Building 1) and three (3) mixed use rental buildings (Buildings 2 to 4). The building will range in height from twenty-four (24) storeys to thirty-nine (39) storeys and will have four (4) to five (5) storey podiums. Building 4 will also have an eight (8) storey podium. It is understood that three (3) levels of underground parking are proposed. The buildings will be located around the edges of the site in a U-shaped configuration with a park area in the center. An internal roadway named Bentall GreenOak Private is proposed and would encircle the park.

The lowest floor elevations of the proposed buildings and invert elevations of proposed utilities were not available at the time of this report. However, since the elevation of the current ground surface of the site is near the elevation of the adjacent roads and that the site is located in a well-established developed area of Ottawa, it is expected that the final site grades will generally match the existing grades and a minimum grade raise will be required at the site as part of the proposed development.

Drawing No. A0.00, titled "Row Comparison", dated November 13, 2023, by Hobin, showing existing elevations, was also provided to EXP and used as reference for this report.

The fieldwork for the geotechnical investigation was undertaken in three (3) stages. The first stage was completed between October 26 and November 3, 2023, and consisted of fifteen (15) boreholes (Borehole Nos. 1, 2 and 6 to 18) advanced to termination/auger refusal depths ranging from 2.1 m to 14.9 m below the existing grade. Borehole No. 5 was cancelled due to a potential underground utility conflict. The second stage was completed on December 14 and 15, 2023, and consisted of two (2) interior boreholes (Borehole Nos. 3 and 4) drilled to a termination depth of 5.4 m below existing grade within the existing building. The third stage was completed on June 16, 2024, and consisted of six (6) probeholes (Probehole Nos. 1 to 6), advanced without sampling to auger refusal depths of 1.7 m to 6.0 m below existing grade. The fieldwork for all the phases were supervised on a full-time basis by a representative from EXP.

The borehole information indicates the subsurface conditions at the site consist of asphaltic concrete, concrete and fill underlain by either glacial till or highly weathered (soil like) shale fragments. Auger refusal was met at 1.3 m to 6.0 m depths (Elevation 92.0 m to Elevation 86.2 m) in all the boreholes and probeholes. In Borehole Nos. 1 to 7 and 11 to 18 the boreholes were extended past the depth of refusal through rock coring. The presence of shale bedrock of the Carlsbad formation was confirmed at 1.3 m to 2.8 m depths (Elevation 92.0 m to Elevation 88.2 m). The coring terminated at 2.6 m to 14.9 m depths (Elevation 91.7 m to Elevation 76.2 m). The groundwater level in the glacial till and highly weathered shale were found to range from 0.6 m to 2.3 m (Elevation 91.9 m to Elevation 89.5 m) below the existing ground surface. The groundwater within the shale bedrock was found to range from 2.9 m to 14.1 m (Elevation 87.5 m to Elevation 77.5 m).

A multichannel Analysis of Surface Waves (MASW) was conducted at the site revealed an average seismic shear wave velocity is 1531.6 m/s for footings founded on the sound shale bedrock and this will result in a Class A site class for seismic site response in accordance with Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC), as amended January 1, 2022.

The site is underlain by shale bedrock of the Carlsbad Formation which is prone to swelling under certain conditions of heat and humidity. It is also prone to rapid deterioration especially for the portion of the shale bedrock below the groundwater table that is exposed to the elements. Therefore, the base and sides of the exposed shale bedrock in all footing and floor slab excavations should be cleaned of any soil or deleterious material, examined by a geotechnical engineer and the approved shale subgrade should be covered with 50 mm of concrete or gunnite within the same day of its first exposure. Similarly, the exposed shale bedrock surface along all excavation walls should be covered with shotcreted within the same day of exposure to protect the rock face from rapid deterioration due to exposure to the elements. Alternatively, the surface of the shale bedrock may be kept wet at all times.

Spread and strip footings founded on the sound shale bedrock, competent and free of soil filled seams may be designed for a factored geotechnical resistance at Ultimate Limit State (ULS) of 1,000 kPa. The factored ULS values includes a resistance factor of 0.5. The Serviceability Limit State (SLS) bearing pressure of the bedrock, required to produce 25 mm settlement of the structure will be much larger than the recommended value for factored geotechnical resistance at ULS. Therefore, the factored geotechnical resistance at ULS will govern the design. All footing beds should be examined by a geotechnical engineer to ensure that the founding material is capable of supporting the bearing pressure at SLS and that the footings have been properly prepared.

The lowest floor level for the parking garage is anticipated to be located below the groundwater level. Therefore, underfloor and perimeter drainage systems will be required for the proposed below grade parking garage. The lowest floor slab of the buildings will be founded on sound shale bedrock and may be constructed as a concrete slab-on-grade or as a paved surface.

Excavations within the soils and soil like highly weathered shale may be undertaken using heavy equipment capable of removing cobbles, boulders and possible large slabs of shale bedrock. All excavations must be undertaken in accordance with the Occupational Health and Safety Act (OHSA), Ontario Reg. 213/91.

It is anticipated that due to the significant depth of the excavation for the proposed buildings and the proximity of the excavation to existing infrastructure (roadways and underground municipal services), the excavations will need to be supported by a shoring system. This system may consist of steel H soldier pile and timber lagging system, interlocking sheeting system and/or secant pile shoring system. A hydrogeological assessment has been completed for the site and provides initial estimates to the quantity of water to be removed from the site for water taking permit requirements as well as to determine the potential impact on the neighboring properties from the dewatering activities. The hydrogeological assessment should be consulted in determining the appropriate shoring type and method of dewatering for the proposed excavation.

Excavations for the construction of the proposed buildings are expected to extend to 9.6 m below the existing ground surface. These excavations will extend through the fill, glacial till/highly weathered shale and into the sound shale bedrock. The excavations are anticipated to be significantly below the groundwater level. The excavation of the shale bedrock to extensive depths below the bedrock surface may require line drilling and blasting techniques. Contractors bidding on this project should decide on their own the most preferred rock removal method; hoe ramming or line drilling and blasting. The excavation side slopes in the sound shale bedrock may be undertaken with near vertical sides subject to examination by a geotechnical engineer. The exposed face of the bedrock in the excavation may require scaling and rock stabilization measures such a rock bolts and/or a wire mesh system. The need for stabilization measures will have to be assessed once excavation depths into the bedrock are finalized.

The invert depths of the underground services are not known at the time of this geotechnical investigation. It is anticipated that the subgrade for the proposed municipal services will be shale bedrock. The pipe bedding for the municipal services should be in accordance with City of Ottawa specifications, drawings and special provisions. The bedding and cover material should be compacted to a minimum of 98 percent standard Proctor maximum dry density (SPMDD).

The Hobin design concept plan indicate the new trees will be planted throughout the development. No sensitive clays were encountered and therefore there are no tree planting restrictions from a sensitive marine clay perspective for this project.

It is anticipated that the majority of the material required for backfilling purposes would have to be imported and should preferably conform to Ontario Provincial Standard Specification (OPSS) for Granular B Type II and OPSS Select Subgrade Material (SSM).

The pavement structure for surficial internal roadways should consist of 65 mm thick asphaltic concrete, 150 mm thick OPSS Granular A base and 300 mm thick OPSS Granular B Type II subbase. Pavement structure for heavy duty traffic areas should consist of 900 mm thick asphaltic concrete, 150 mm thick OPSS Granular A base and 450 mm thick OPSS Granular B Type II subbase.

The results of the resistivity tests indicate that the bedrock is mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be taken to protect the buried bare steel from corrosion.

The above and other related considerations are discussed in greater detail in the main body of the attached geotechnical report.

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed re-development of the parcel of property referred to as Walkley Centre, located at 1822-1846 Bank Street, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP Services Inc. (EXP) proposal number: OTT-23002538-B0 dated August 1, 2023, and a subsequent proposal dated September 28, 2023. This report supersedes the final report submitted on August 28, 2024.

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The geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at eighteen (18) boreholes and six (6) probeholes located on the site,

b) Classify the site for seismic site response in accordance with the requirements of the 2012 Ontario Building Code (as amended January 1, 2022) and assess the potential for liquefaction of the subsurface soils during a seismic event,

c) Comment on grade-raise restrictions and provide site grading requirements,

d) Make recommendations regarding the most suitable type of foundations, founding depth and bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) of the founding strata and comment on the anticipated total and differential settlements of the recommended foundation type,

e) Slab on grade construction,

f) Static and seismic earth forces on subsurface walls,

g) Comment on excavation conditions and de-watering requirements during construction,

h) Discuss backfilling requirements and suitability of on-site soils for backfilling purposes,

i) Recommend pavement structure thicknesses for access roads and parking lot,

j) Static and seismic earth forces on basement walls; and

k) Comment on the corrosion potential of subsurface soils buried concrete and steel structures/members;

The comments and recommendations given in this report are based on the assumption that the above-described design concepts 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 has the municipal addresses of 1822 to 1846 Bank Street in Ottawa, Ontario and is located on the northwest corner of the intersection of Bank Street and Walkley Road. The combined lots of the subject site have an irregular in shape with an approximate total area of 17,400 m^2.

The subject site is currently occupied on the west side by a single storey, slab on grade commercial building containing multiple units. The building has an approximately footprint of 3,925 m^2. The east side of the site is an asphaltic concrete parking lot.

The site is bound to the south by south by Walkley Road and to the east by Bank Street. Residential dwellings are to the west and to the north are further commercial spaces, the latter separated by a retaining wall. The Row Comparison drawing by Hobin indicates that the elevation of Walkley Road ranges from 90.36 m to 93.39 m, sloping upwards from East to West and the elevation of Bank Street ranges from 94.09 m to 94.94 m, sloping upwards from South to North at the site.

The elevations of the boreholes at the site range from Elevation 94.00 m to Elevation 90.35 m. The existing parking lot is approximately at the same elevation as Bank Street and Walkley Street.

3. Surficial Geology

3.1 Surficial Geology Map

The surficial geology was reviewed via the Google Earth applications published by the Ontario Ministry of Energy, Northern Development and Mines available le via www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/surficial-geology and was last modified on May 23, 2017. The map indicates the Site is underlain by fine-textured glaciomarine deposits consisting of silt and clay with minor sand and gravel. The surficial deposits are shown in Image 1 below.

Image 1 – Surficial Geology

3.2 Bedrock Geology Map

Based on a review of the bedrock geology map (Map P. 2716, Paleozoic Geology of the Ottawa Area, Southern Ontario 1984), the bedrock at the site consists of the Carlsbad formation that consists of a shale and limestone. The shale of the Carlsbad formation is an expansive type of shale. East of the site shale of the Billings formation is present which is also an expansive type of shale. Special procedures will have to be followed during the excavation of the Carlsbad shale. A fault line is noted approximately 230 m east of the site. The bedrock geology is show in Image 2 below.

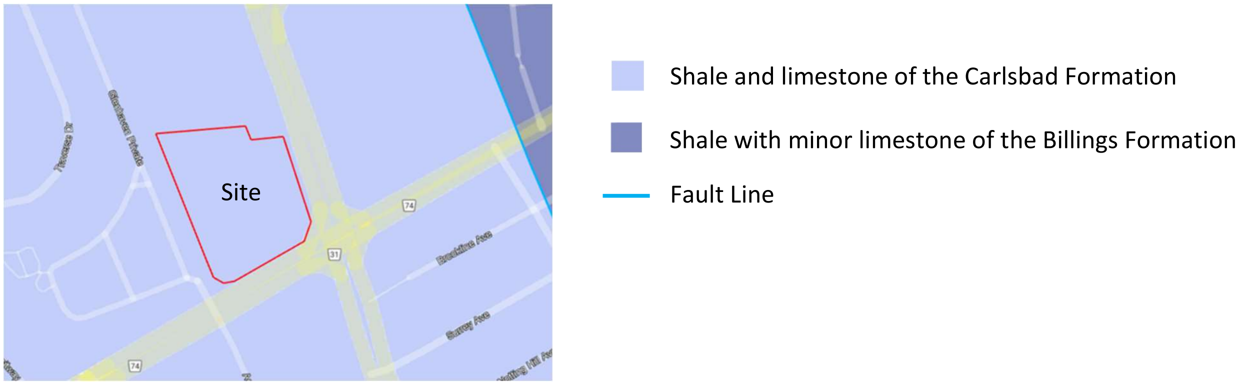


Image 2 – Bedrock Geology

4. Procedure

4.1 Fieldwork

The fieldwork for the geotechnical investigation was undertaken in three (3) stages. The first stage was completed between October 26 and November 3, 2023, and consisted of fifteen (15) boreholes (Borehole Nos. 1, 2 and 6 to 18) advanced to termination/auger refusal depths ranging from 2.1 m to 14.9 m below existing grade. Borehole No. 5 was cancelled due to a potential underground utility conflict. The second stage was completed on December 14 and 15, 2023 and consisted of two (2) interior boreholes (Borehole Nos. 3 and 4) drilled to a termination depth of 5.4 m below existing grade within the existing building. The third stage was completed on June 16, 2024, and consisted of six (6) probeholes (Probehole Nos. 1 to 6), advanced without sampling to auger refusal depths of 1.7 m to 6.0 m below existing grade. The fieldwork for all the phases were supervised on a full-time basis by a representative from EXP.

The locations and geodetic elevations of the boreholes were established on site by EXP and are shown on the Testhole Location Plan, Figure 2. The testhole (borehole and probehole) locations were cleared of private and public underground services, prior to the start of drilling operations.

The exterior boreholes and probeholes were drilled using a CME-55 truck-mounted drill rig equipped with continuous flight hollow-stem auger equipment and bedrock coring capabilities operated by a drilling contractor subcontracted to EXP. Standard penetration tests (SPTs) were performed in the boreholes at depth intervals of 0.6 m to 0.75 m with soil samples retrieved by the split-barrel sampler. Grab samples were collected between 0.1 m and 0.2 m depths in selected boreholes. The presence of the bedrock was proven in twelve (12) boreholes by conventional rock coring techniques using the N or H-size core barrels. A field record of wash water return, colour of wash water and any sudden drops of the core barrel were kept during rock coring operations. Photographs of the recovered rock core are included in Appendix A.

The interior boreholes were drilled using a Geoprobe model 450 using direct push sampling for the overburden soils. The bedrock was cored using a Hilti drill using an N-size core barrel. A field record of wash water return, colour of wash water and any sudden drops of the core barrel were kept during rock coring operations.

All soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified accordingly. Similarly, the rock cores were visually examined and the rock cores from the exterior boreholes were placed in core boxes, identified and logged. Due to the presence of the Carlsbad shale, the rock core was also immediately wrapped in plastic wrap to keep the rock core wet and thereby protecting from any deterioration resulting from exposure to oxygen.

Monitoring wells with diameters of thirty-two (32) mm, thirty-eight (38) mm or fifty (50) mm were installed in Borehole Nos. 1,2, 7 to 12 and 15 for long-term monitoring of the groundwater levels as well as groundwater sampling as part of the Phase Two ESA and the hydrogeological assessment. The wells were installed in accordance with EXP standard practice, and the installation configuration is documented on the respective borehole log. The boreholes were backfilled upon completion of drilling.

4.2 Laboratory Testing Program

On completion of the fieldwork, the soil samples and rock cores from the boreholes were transported to the EXP laboratory in Ottawa, Ontario where they were visually examined in the laboratory by a geotechnical engineer. All soil and rock samples were classified in accordance with the Unified Soil Classification System (USCS) and the modified Burmister System (2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM)).

The geotechnical engineer also assigned the laboratory testing program which is summarized in Table I.

Table I: Summary of Laboratory Testing Program

Type of Test	Number of Tests Completed
Soil Samples	
Moisture Content Determination	40
Unit Weight Determination	3
Grain Size Analysis	8
Atterberg Limits	5
Rock Samples	
Unconfined Compressive Strength and Unit Weight Determination	42
Corrosion Analysis (pH, sulphate, chloride and resistivity)	3

4.3 Multi-channel Analysis of Surface Waves (MASW) Survey

A seismic shear wave velocity sounding survey was conducted at the site on December 21,2023 by Geophysics GPR International Inc. (GPR). The survey was undertaken using the multi-channel analysis of surface waves (MASW), spatial auto correlation (SPAC) and seismic refraction methods. The seismic shear wave velocity sounding survey report dated January 8,2024 and prepared by GPR is shown in Appendix B.

5. Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions and groundwater levels from the boreholes are given on the attached Borehole and Probehole Logs, Figure Nos. 4 to 26. 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 also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

The boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical investigation. The Phase Two ESA should be consulted regarding the environmental conditions.

It should be noted that the soil and rock boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling operations. These boundaries 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 the 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 conditions with depth and groundwater level measurements.

5.1 Asphaltic Concrete Pavement

A 50 mm to 150 mm thick asphaltic concrete layer was contacted in all the exterior the testholes, with the exception of Borehole No. 16.

5.2 Concrete

A concrete slab was encountered at the surface of Borehole Nos. 3 and 4. The concrete slab was 165 mm and 200 mm thick in Borehole Nos. 3 and 4, respectively.

5.3 Fill

A layer of fill was contacted underlying the surface in Borehole No. 16 and underlying the asphaltic concrete or concrete in the remainder of the testholes. The fill extends to 0.3 m to 1.8 m depths (Elevation 92.8 m to Elevation 89.5 m). The fill generally consists of sand and gravel. The fill is in a loose to dense state based on standard penetration test (SPT) N-values ranging from 7 to 42. The moisture content of the fill ranged from 2 percent to 15 percent. The natural unit weight was 22.9 kN/m^3.

The results from the grain-size analysis conducted on three (3) samples of the fill are summarized in Table II. The grain-size distribution curves are shown in Figures 27 to 29.

Table II: Summary of Results from Grain-Size Analysis - Fill Samples

Borehole No. (BH)–Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)			
		Gravel	Sand	Fines	Soil Classification (USCS)
BH12-GS1	0.1 - 0.2	46	44	10	Well Graded Gravel with Silt and Sand (GW-GM)
BH17-GS1	0.1 - 0.2	54	38	8	Poorly Graded Gravel with Silt and Sand (GP-GM)
BH18-GS1	0.1 - 0.2	27	56	17	Silty sand with gravel (SM)

Based on a review of the results of the grain-size analysis, the fill ranged from well graded gravel with silt and sand (GW-GM) to poorly graded gravel with silt and sand (GP-GM) to silty sand with gravel (SM) in accordance with the USCS.

5.4 Glacial Till

A layer of glacial till was encountered underlying the fill at 0.3 m depth (Elevation 92.4 m) in Borehole No. 9. The glacial till contains varying amounts of gravel, sand, silt and clay within the soil matrix as well as cobbles and boulders. The SPT N-values of the glacial till was 17 indicating the glacial till is in a compact state. Higher N values with low sampler penetration such as N equal to 50 for 25 mm sampler penetration into the glacial till are likely a result of the split spoon sampler making contact with a cobble, boulder or a shale fragment.

The natural moisture content of the glacial till ranged from 6 percent to 12 percent.

5.5 Highly Weathered Shale Bedrock

A layer of highly weathered (soil like) shale bedrock was contacted underlying the fill or the glacial till at 0.7 m to 2.1 m depths (Elevation 92.3 m to Elevation 89.5 m) in all of the boreholes and probeholes except Boreholes No. 14 and 16 and Probehole Nos. 5 and 6. The highly weathered shale contains shale fragments which range in size from gravel to clay. Cobble and boulder sized shale fragments may be present. The SPT N-values of the highly weathered glacial till range from 7 to 57 indicating the highly weathered shale is in a loose to very dense state. Higher N values with low sampler penetration such as N equal to 50 for 100 mm sampler penetration into the highly weathered shale are likely a result of the split spoon sampler making contact with a cobble or boulder sized shale fragments.

The natural moisture content of the highly weathered shale ranged from 5 percent to 18 percent. The natural unit weight was 22.0 kN/m^3.

The results from the grain-size analysis conducted on five (5) samples of the highly weathered shale are summarized in Table III. The grain-size distribution curves are shown in Figures Nos. 30 to 34.

Table III: Summary of Results from Grain-Size and Atterberg Limit Analysis - Weathered Shale Samples

Borehole No. (BH)–Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)					
		Gravel	Sand	Silt	Clay	Plasticity Index	Soil Classification (USCS)
BH1-SS3	1.5 - 2.1	19	46	27	8	N.P.	Silty Sand and Gravel (SM)
BH10-SS3	1.5 - 2.1	20	52	21	7	N.P.	Silty Sand and Gravel (SM)
BH12-SS2	0.8 - 1.4	13	62	19	6	N.P.	Silty Sand (SM)
BH13-SS2	0.8 - 1.4	7	63	20	10	N.P.	Silty Sand (SM)
BH18-SS2	0.8 - 1.4	3	73	18	6	N.P.	Silty Sand (SM)

*N.P.= Non-plastic

Based on a review of the results of the grain-size analysis, the highly weathered shale may be classified as ranging from a silty sand (SM) to a silty sand and gravel (SM) in accordance with the USCS.

5.6 Auger Refusal and Shale Bedrock

Auger refusal was met at 1.3 m to 6.0 m depths (Elevation 92.0 m to Elevation 86.2 m) in all the boreholes and probeholes. In Borehole Nos. 1 to 7 and 11 to 18 the boreholes were extended past the depth of refusal through rock coring. The presence of shale bedrock of the Carlsbad formation was confirmed at 1.3 m to 2.8 m depths (Elevation 92.0 m to Elevation 88.2 m). The coring terminated at 2.6 m to 14.9 m depths (Elevation 91.7 m to Elevation 76.2 m). A summary of the depth where weathered bedrock was encountered, auger refusal depths as well as the depth of bedrock confirmed by coring is shown in Table IV.

Table IV: Summary of Inferred Bedrock, Auger Refusal and Cored Bedrock Depths (Elevations) in Boreholes

Borehole (BH) No.	Ground Surface Elevation (m)	Weathered Shale Bedrock Depth (Elevation), m	Depth (Elevation) of Cored Sound Bedrock (m)	Comment w.r.t. to Depth of Bedrock Surface
BH-1	91.67	1.4 (90.3)	2.7 (89.0)	Weathered shale encountered at 1.4 m depth. 3.2 m of bedrock cored below 2.7 m depth
BH-2	92.59	0.9 (91.7)	2.7 (89.9)	Weathered shale encountered at 0.9 m depth. 11.4 m of bedrock cored below 2.7 m depth
BH-3	92.06	1.3 (90.8)	2.1 (90.0)	Weathered shale encountered at 1.3 m depth. 3.3 m of bedrock cored below 2.1 m depth
BH-4	92.06	1.3 (90.8)	2.0 (90.1)	Weathered shale encountered at 1.3 m depth. 3.4 m of bedrock cored below 2.0 m depth
BH-6	92.02	0.9 (91.1)	1.3 (90.7)	Weathered shale encountered at 0.9 m depth. 1.3 m of bedrock cored below 1.3 m depth
BH-7	92.51	0.9 (91.6)	1.8 (90.7)	Weathered shale encountered at 0.9 m depth. 11.9 m of bedrock cored below 1.8 m depth
BH-8	92.50	1.4 (91.1)	--	Weathered shale encountered at 1.4 m depth. Auger refusal encountered at 2.1 m depth
BH-9	92.71	1.4 (91.3)	--	Weathered shale encountered at 1.4 m depth. Auger refusal encountered at 2.2 m depth
BH-10	91.66	0.7 (91.0)	--	Weathered shale encountered at 0.7 m depth. Auger refusal encountered at 2.5 m depth
BH-11	90.35	0.7 (89.7)	2.2 (88.2)	Weathered shale encountered at 0.7 m depth. 12.0 m of bedrock cored below 2.2 m depth
BH-12	91.53	0.7 (90.8)	2.8 (88.7)	Weathered shale encountered at 0.7 m depth. 11.2 m of bedrock cored below 2.8 m depth
BH-13	94.00	1.7 (92.3)	2.0 (92.0)	Weathered shale encountered at 1.7 m depth. 12.2 m of bedrock cored below 2.0 m depth
BH-14	92.58	--	1.3 (91.3)	Weathered shale was not encountered. 12.8 m of bedrock cored below 1.3 m depth
BH-15	92.18	0.7 (91.5)	1.4 (90.8)	Weathered shale encountered at 0.7 m depth. 12.3 m of bedrock cored below 1.4 m depth
BH-16	92.05	--	1.5 (90.6)	Weathered shale was not encountered. 13.4 m of bedrock cored below 1.5 m depth
BH-17	92.38	0.7 (91.7)	2.1 (90.3)	Weathered shale encountered at 0.7 m depth. 12.7 m of bedrock cored below 2.1 m depth
BH-18	91.30	1.8 (89.5)	1.9 (89.4)	Weathered shale encountered at 1.8 m depth. 12.8 m of bedrock cored below 1.9 m depth
PH-1	92.19	2.1 (90.1)	--	Weathered shale encountered at 2.1 m depth. Auger refusal encountered at 6.0 m depth
PH-2	93.59	2.1 (91.5)	--	Weathered shale encountered at 2.1 m depth. Auger refusal encountered at 3.8 m depth
PH-3	92.12	1.2 (90.9)	--	Weathered shale encountered at 1.2 m depth. Auger refusal encountered at 5.2 m depth
PH-4	92.47	1.5 (91.0)	--	Weathered shale encountered at 1.5 m depth. Auger refusal encountered at 4.9 m depth
PH-5	92.49	--	--	Weathered shale was not encountered Auger refusal encountered at 1.8 m depth
PH-6	92.26	--	--	Weathered shale was not encountered Auger refusal encountered at 1.7 m depth

A review of the initial coring runs in all the boreholes and as well as the second coring run in Borehole Nos. 14 and 15 indicates that from the depth of refusal to 2.5 m to 4.4 m depth (Elevation 91.4 m to Elevation 87.8 m) the total core recovery (TCR) ranges between 60 percent and 100 percent and the rock quality designation (RQD) ranges between 0 percent to 47 percent indicating the bedrock is of a very poor to poor quality.

Below 2.5 m to 4.4 m depths (Elevation 91.4 m to Elevation 87.8 m) the total core recovery (TCR) ranges between 73 percent and 100 percent and the rock quality designation (RQD) generally ranges between 50 and 100 indicating the bedrock is of a fair to excellent quality. In Borehole Nos. 14 and 17 the final run, 13.3 m to 14.1 m depth (Elevation 79.3 m to Elevation 78.5 m) and 13.3 m to 14.8 m depth (Elevation 79.1 m to Elevation 77.6 m) in Borehole Nos. 14 and 17, respectively, the RQD decreases to 48 percent and 27 percent indicating the bedrock is of a poor quality. Photographs of the bedrock cores are included in Appendix A.

Unit weight determination and unconfined compressive strength tests were conducted on forty-six (46) rock core sections. Three (3) of the samples were broken during the preparation process and were not tested. The test results are summarized in Table V.

Table V: Summary of Unconfined Compressive Strength Test Results – Bedrock Cores

Borehole (BH) No. – Run No.	Depth (m)	Unit Weight (kN/m^3)	Unconfined Compressive Strength (MPa)	Classification of Rock with respect to Strength
BH1 Run2	4.3 - 4.5	25.8	34.0	Medium Strong (R3)
BH1 Run3	5.6 - 5.8	26.0	34.6	Medium Strong (R3)
BH2 Run2	4.6 - 4.7	26.0	46.9	Medium Strong (R3)
BH2 Run4	7.5 - 7.6	26.7	48.2	Medium Strong (R3)
BH2 Run6	11.5 - 11.6	25.8	40.6	Medium Strong (R3)
BH7 Run2	2.7 - 2.9	25.3	17.4	Weak (R2)
BH7 Run4	6.1 - 6.3	25.9	36.1	Medium Strong (R3)
BH7 Run6	9.9 - 10.1	25.9	35.5	Medium Strong (R3)
BH7 Run8	12.8 - 13.0	25.6	31.5	Medium Strong (R3)
BH11 Run2	4.6 - 4.7	26.1	41.8	Medium Strong (R3)
BH11 Run4	7.5 - 7.6	26.0	42.9	Medium Strong (R3)
BH11 Run6	11.5 - 11.6	26.0	40.6	Medium Strong (R3)
BH11 Run8	13.5 - 13.6	26.0	50.4	Strong (R4)
BH12 Run2	3.0 - 3.2	25.9	34.9	Medium Strong (R3)
BH12 Run4	5.9 - 6.0	25.9	26.3	Medium Strong (R3)
BH12 Run6	9.8 - 10.0	25.8	41.2	Medium Strong (R3)
BH12 Run8	12.9 - 13.1	26.8	46.2	Medium Strong (R3)
BH13 Run3	4.3 - 4.5	25.9	36.0	Medium Strong (R3)
BH13 Run5	7.6 - 7.8	26.0	39.0	Medium Strong (R3)
BH13 Run7	11.5 - 11.6	26.0	29.2	Medium Strong (R3)
BH13 Run9	13.3 - 13.4	25.9	32.6	Medium Strong (R3)
BH14 Run2	3.9 - 4.0	26.2	42.9	Medium Strong (R3)
BH14 Run4	6.9 - 7.0	26.2	27.4	Medium Strong (R3)
BH14 Run6	9.1 - 10.1	26.1	10.8	Weak (R2)
BH14 Run8	13.1 - 13.3	26.0	34.2	Medium Strong (R3)
BH15 Run2	3.1 - 3.2	25.9	33.5	Medium Strong (R3)
BH15 Run4	7.0 - 7.2	26.0	45.8	Medium Strong (R3)
BH15 Run6	10.3 - 10.5	26.1	55.0	Strong (R4)
BH15 Run8	12.7 - 12.9	26.1	30.8	Medium Strong (R3)
BH16 Run2	3.5 - 3.7	25.6	32.1	Medium Strong (R3)
BH16 Run5	7.6 - 7.8	26.0	29.3	Medium Strong (R3)
BH16 Run7	10.8 - 10.9	25.7	27.4	Medium Strong (R3)
BH16 Run9	13.8 - 13.9	25.8	33.9	Medium Strong (R3)
BH17 Run2	3.0 - 3.1	25.9	35.0	Medium Strong (R3)
BH17 Run4	6.1 - 6.3	26.5	51.9	Strong (R4)
BH17 Run8	12.2 - 12.3	26.1	52.3	Strong (R4)
BH18 Run4	6.5 - 6.6	26.0	38.8	Medium Strong (R3)
BH18 Run6	10.1 - 10.2	26.1	43.4	Medium Strong (R3)
BH18 Run8	12.9 - 13.1	25.9	41.7	Medium Strong (R3)

A review of the test results in Table VI indicates the strength of the rock may be classified as weak (R2) to strong (R4) in accordance with the Canadian Foundation Engineering Manual (CFEM), Fourth Edition, 2006.

The bedrock at the site is shale bedrock of the Carlsbad formation which is a type of shale that is prone to deterioration when exposed to the elements. It also heaves due to a complex mechanism caused in part from the bio-oxidation of the sulphides in the rock, which then react with calcite seams to form expanding gypsum. This occurs when oxygen is permitted to enter the rock, usually by exposure or lowering of the water table and is accelerated by the presence of heat.

5.7 Groundwater Level Measurements

A summary of the groundwater level measurements taken in the monitoring wells are shown in Table VI.

Table VI: Groundwater Level Measurements

Borehole (BH)	Ground Surface Elevation (m)	Screened Material	Date of Measurement (Elapsed Time in Days from Date of Installation)	Groundwater Depth Below Ground Surface (Elevation), (m)
BH1	91.67	HIGHLY WEATHERED SHALE & SHALE BEDROCK	November 23, 2023 (28)	1.8 (89.9)
			December 6, 2023 (41)	2.2 (89.5)
			March 15, 2023 (140)	2.1 (89.6)
			June 19, 2024 (237)	2.1 (89.6)
BH2	92.59	SHALE BEDROCK	November 23, 2023 (24)	10.9 (81.7)
			December 6, 2023 (41)	8.9 (83.7)
			March 14, 2024 (136)	8.2 (84.4)
			--	--
BH3	92.06	HIGHLY WEATHERED SHALE & SHALE BEDROCK	December 21, 2023 (7)	2.3 (89.8)
			March 14, 2024 (91)	2.3 (89.8)
			June 14, 2024 (188)	2.3 (89.8)
BH4	92.06	HIGHLY WEATHERED SHALE & SHALE BEDROCK	December 21, 2023 (7)	1.8 (90.3)
			March 14, 2024 (91)	1.9 (90.2)
			June 14, 2024 (188)	2.0 (90.1)
BH7	92.51	SHALE BEDROCK	November 23, 2023 (28)	5.8 (86.7)
			December 3, 2023 (41)	8.6 (83.9)
			March 14, 2024 (140)	6.2 (86.3)
			June 19, 2024 (237)	5.5 (87.0)
BH8	92.5	HIGHLY WEATHERED SHALE	November 23, 2023 (28)	1.4 (91.1)
			December 6, 2023 (41)	1.3 (91.2)
			March 14, 2024 (140)	0.6 (91.9)
			June 19, 2024 (237)	1.2 (91.3)
BH9	92.71	GLACIAL TILL AND HIGHLY WEATHERED SHALE	November 23, 2023 (28)	1.4 (91.3)
			December 6, 2023 (33)	1.3 (91.4)
			March 14, 2024 (132)	1.1 (91.6)
			June 19, 2024 (229)	1.3 (91.4)
BH10	91.66	HIGHLY WEATHERED SHALE	November 23, 2023 (24)	1.5 (90.2)
			December 6, 2023 (37)	1.4 (90.3)
			March 14, 2024 (136)	1.3 (90.4)
			June 19, 2024 (233)	1.4 (90.3)

Table VI: Groundwater Level Measurements

Borehole (BH)	Ground Surface Elevation (m)	Screened Material	Date of Measurement (Elapsed Time in Days from Date of Installation)	Groundwater Depth Below Ground Surface (Elevation), (m)
BH11	90.35	SHALE BEDROCK	November 23, 2023 (22)	10.8 (79.6)
			December 6, 2023 (35)	10.2 (80.2)
			March 9, 2023 (134)	4.0 (86.4)
			June 19, 2024 (231)	2.9 (87.5)
BH12	91.6	SHALE BEDROCK	--	--
			December 6, 2023 (33)	11.6 (80.0)
			March 14, 2024 (132)	14.1 (77.5)
			June 19, 2024 (229)	13.7 (77.9)
BH15	92.2	SHALE BEDROCK	November 23, 2023 (21)	10.1 (82.1)
			December 6, 2023 (34)	6.9 (85.3)
			March 14, 2024 (133)	6.2 (86.0)
			June 19, 2024 (230)	6.1 (86.1)

The groundwater level in the glacial till and highly weathered shale were found to range from 0.6 m to 2.3 m (Elevation 91.9 m to Elevation 89.5 m) below the existing ground surface. The groundwater within the shale bedrock was found to range from 2.9 m to 14.1 m (Elevation 87.5 m to Elevation 77.5 m).

Water levels were determined in the boreholes and monitoring wells at the times and under the conditions noted above. 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.

6. Site Classification for Seismic Site Response and Liquefaction Potential of Soils

6.1 Site Classification for Seismic Site Response

A seismic shear wave velocity sounding survey was conducted at the site on December 21,2023 by Geophysics GPR International Inc. (GPR). The survey was undertaken using the multi-channel analysis of surface waves (MASW), spatial auto correlation (SPAC) and seismic refraction methods. The seismic shear wave velocity sounding survey report dated January 8,2024 and prepared by GPR is shown in Appendix B.

The results of the survey indicate that the average seismic shear wave velocity is 1531.6 m/s for footings founded on the sound shale bedrock will result in a Class A site class for seismic site response in accordance with Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC), as amended January 1, 2022.

6.2 Liquefaction Potential of Soils

Since the construction of the three (3) level underground parking garage below the proposed buildings would require the excavation and removal of all soils down to the bedrock, the presence of liquefiable soils at the site is not an issue for the proposed redevelopment.

7. Grade Raise Restrictions

The site is located in a well-established and developed area of the City of Ottawa and the current grades of the site are near those of the adjacent roadways. Therefore, a major grade raise is not anticipated to be required at the site as part of the proposed development. Since compressible cohesive soils were not encountered at the site, there are no restrictions to raising the grades at the site from a geotechnical point of view. However, for design purposes a grade raise of 1.0 m can be used at the site.

8. Site Grading

Site grading within the **proposed building footprint** area should consist of the removal of all existing fill and overburden soils down to the design depth of the footings or the base of the lowest floor slab within the sound shale bedrock surface. The native shale bedrock subgrade should be examined by a geotechnician. Any loose/soft or degraded areas identified during the subgrade examination should be excavated, removed and replaced with 20 MPa lean mix concrete to the underside of footing elevation or to strength specified by the structural engineer. As indicated in Section 3 of this report, the shale bedrock is prone to swelling under certain conditions of heat and humidity. It is also prone to rapid deterioration especially for the portion of the shale bedrock below the groundwater table that is exposed to the elements. The base and sides of the exposed shale bedrock in all footing or lowest floor slab excavations should be cleaned of any soil or deleterious material, examined by a geotechnical engineer and the approved shale subgrade should be covered with a skim coat of concrete or shotcrete within the same day of its first exposure. The exposed shale bedrock could also be sealed by spraying gunnite. Alternatively, the surface of the shale bedrock may be kept wet at all times.

In areas where the overburden soils are not removed, site grading for **local roadways** should consist of the removal of any soil containing organics or organic stained soils down to the approved fill or native overburden soil subgrade. The subgrade should be proofrolled in the presence of a geotechnician. Any loose/soft areas identified during the proofrolling process should be excavated, removed and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II or OPSS Select Subgrade Material (SSM) compacted to 95 percent standard Proctor maximum dry density (SPMDD). Alternatively, portions of the excavated and removed existing fill that is free of debris, cobbles, boulders and topsoil (organic soils), may be reused to raise the site grades to the design subgrade level. The suitability of re-using the existing fill to raise the grades will have to be further assessed at time of construction by examining the fill material and conducting additional tests on the material. For budgeting purposes, it should be assumed that all fill will require removal and disposal.

In place density tests should be performed on each lift of placed material to ensure that it has been compacted to the project specifications.

9. Foundation Considerations

For the proposed multi-storey buildings, it has understood that three (3) storeys of underground parking are proposed, and the lowest floor slab will be at approximately 9.0 m depth below existing grade. Footings are typically placed at 0.6 m below the lowest floor slab and therefore footings have been assumed to be founded at approximately 9.6 m below the existing grade. Based on the borehole information footings founded at 9.6 m will be founded on sound shale bedrock. It is considered feasible to support the proposed building by spread and strip footings founded on sound shale bedrock.

Spread and strip footings founded on the sound shale bedrock, competent and free of soil filled seams may be designed for a factored geotechnical resistance at Ultimate Limit State (ULS) of 1,000 kPa. The factored ULS values includes a resistance factor of 0.5. The Serviceability Limit State (SLS) bearing pressure of the bedrock, required to produce 25 mm settlement of the structure will be much larger than the recommended value for factored geotechnical resistance at ULS. Therefore, the factored geotechnical resistance at ULS will govern the design.

The factored sliding resistance at ULS between the underside of concrete and the top of the unweathered sound bedrock is 0.56 and includes a resistance factor of 0.8.

The shale bedrock subgrade should be examined by a geotechnician. Any loose/soft areas identified during the footing base evaluation should be excavated, removed and replaced with lean 20MPa lean mix concrete to the underside of footing elevation or to strength specified by the structural engineer.

As indicated in Section 8 of this report, the shale bedrock is prone to swelling under certain conditions of heat and humidity. It is also prone to rapid deterioration especially for the portion of the shale bedrock below the groundwater table that is exposed to the elements. For footings, the base and sides of the exposed shale bedrock in all footing excavations should be cleaned of any soil or deleterious material, examined by a geotechnical engineer and the approved shale subgrade of the footing and the sides of the footing trench should be covered with a skim coat of concrete within the same day of its first exposure. Alternatively, the shale bedrock exposed in the sides of the footing trenches may be sealed by spraying gunnite.

A minimum of 1.5 m of earth cover should be provided to the footings to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity. If snow will be removed from the vicinity of the unheated structures, the frost cover should be increased to 2.4 m. Rigid insulation thermally equivalent to the required soil cover may be used instead of the soil cover. Alternatively, a combination of rigid insulation and soil cover may be used to achieve the required frost protection for the footings.

The recommended factored geotechnical resistance at ULS and bearing pressure at SLS 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 boreholes when foundation construction is underway. The interpretation between 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.

10. Floor Slab and Drainage Requirements

It has understood that three (3) storeys of underground parking are proposed, and the lowest floor slab will be at approximately 9.0 m depth below existing grade depending on the number of underground parking levels. Based on the borehole information, bedrock was encountered at 1.3 m to 2.8 m (Elevation 92.0 m to Elevation 88.2 m) below the existing grade and lowest floor slab of the buildings will be founded on sound shale bedrock and may be constructed as a concrete slab-on-grade or as a paved surface. The concrete and asphalt pavement structures indicated below are for light duty traffic only (cars). EXP can provide concrete and asphalt pavement structures for heavy duty traffic (cars and trucks), if required.

The lowest floor level for the parking garage is anticipated to be located below the groundwater level. Therefore, underfloor and perimeter drainage systems will be required for the proposed below grade parking garage.

The underfloor drainage system may consist of 100 mm diameter perforated pipe or equivalent placed in parallel rows at 5 m to 6 m centres and at least 300 mm below the underside of the floor slab. The drains should be set on 150 mm thick bed of 19 mm sized clear stone covered on top and sides with 150 mm thick clear stone that is fully wrapped with an approved porous geotextile membrane, such as Terrafix 270R or equivalent. The perimeter drains may also consist of 100 mm diameter perforated pipe set on the footings and surrounded with 150 mm thick clear stone fully wrapped with a geotextile membrane. The perimeter and underfloor drains should be connected to separate sumps equipped with backup pumps and generators in case of mechanical failure and/or power outage, so that at least one system would be operational should the other fail.

For floor slabs founded on the shale bedrock, special procedures will be required during slab construction. The shale bedrock of the Carlsbad formation is known to heave due to a complex mechanism caused in part by the bio-oxidation of sulphides in the rock which then react with the calcite seams to form expanding gypsum. This occurs when oxygen is permitted to enter the rock, usually by lowering the water table. It is therefore recommended that the water table at the site should be maintained above the shale surface. The invert of the drains should be set at least 150 mm above the shale bedrock surface. In addition, a 50 mm thick concrete mud slab should be placed on the surface of the shale as a seal prior to placement of the granular fill. Weep holes should be provided in the concrete mud slab to facilitate drainage. Any granular fill to be placed under the floor slab should be compacted to at least 98 percent of the SPMDD. Any elevator pits and sumps should be constructed as water-tight structures instead of trying to locally depress the groundwater table around them which may result in dewatering of the shale.

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

10.1 Lowest Floor Level as a Concrete Surface

The subgrade is anticipated to be sound shale bedrock. The subgrade should be examined by a geotechnical engineer and any loose/soft zones of the bedrock should be excavated, removed and replaced with lean mix concrete. Upon approval, the bedrock subgrade should be prepared as noted above.

Following approval and preparation of the bedrock subgrade, the concrete slab for light duty traffic (cars only) may be constructed as follows:

- 150 mm thick concrete with 32 MPa compressive strength and air content of 5 percent to 8 percent; over
- 150 mm thick layer of OPSS 1010 Granular A compacted to 100 percent standard Proctor maximum dry density (SPMDD); over
- 300 mm minimum thick layer of OPSS 1010 Granular B Type II compacted to 100 percent SMPDD.

The concrete slab should be reinforced, and adequate saw cuts should be provided in the floor slab to control cracking. Additional recommendations can be provided once the final design of the lower floor level has been determined.

10.2 Lowest Floor Level as a Paved Surface

The subgrade is anticipated to be sound shale bedrock. The subgrade should be examined by a geotechnical engineer and any loose/soft zones of the bedrock should be excavated, removed and replaced with lean mix concrete. Upon approval, the bedrock subgrade should be prepared as noted above.

Following approval and preparation of the bedrock subgrade, the asphalt pavement structure for light duty traffic (cars only) may be constructed on the bedrock subgrade as follow:

- 65 mm thick layer of asphaltic concrete consisting of HL3/SP12.5 – The asphaltic concrete should be placed and compacted as per OPSS 310 and 313 and should be designed in accordance with OPSS 1150/1151; over
- 150 mm thick layer of OPSS Granular A compacted to 100 percent SPMDD; over
- 450 mm thick layer of OPSS Granular B Type II compacted to 100 percent SPMDD.

11. Lateral Earth Pressure Against Subsurface Walls

Subsurface basement walls for buildings with multiple levels of underground parking are typically designed not to support hydrostatic pressure behind the wall. In this case, the subsurface basement walls should be backfilled with free draining material, such as OPSS Granular B Type II compacted to 95 percent SPMDD 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. The expressions below assume free draining backfill material, a perimeter drainage system, level backfill surface behind the wall and vertical face on the back side of the wall.

Equation (i) will be applicable to the portion of the subsurface wall in the overburden (soil). Equation (ii) will be applicable to the portion of the subsurface wall in the bedrock where the earth pressure will be considerably reduced due to the narrow backfill between the subsurface wall and the rock face resulting in an arching effect (Spangler & Handy, 1984). The weight of the overburden (soil) and any surcharge applied at the ground surface should be considered as surcharge when computing lateral pressure using equation (ii).

Lateral static earth pressure, p, for subsurface basement wall in overburden soil:

$$p = k(\gamma h + q) \text{ ------------- (i)}$$

where:

k = lateral earth pressure coefficient for 'at rest' condition = 0.50

γ = unit weight of backfill = 22 kN/m^3

h = depth of interest below ground surface (m)

q = any surcharge acting at ground surface (kPa)

Lateral static earth pressure, σ_n , for subsurface basement wall in bedrock due to narrow earth backfill between subsurface wall and bedrock face:

$$\sigma_n = \frac{\gamma B}{2\tan\delta}\left(1 - e^{-2k\frac{z}{B}\tan\delta}\right) + kq \text{ -------------- (ii)}$$

where:

γ = unit weight of backfill = 22 kN/m^3

B = backfill width (m)

z = depth from top of wall (m)

δ = friction angle between the backfill and wall and backfill and rock (assumed to be equal) = 17 degrees

k = lateral earth pressure coefficient for 'at rest' condition = 0.50

q = surcharge pressure including pressures from overburden (soil), traffic at ground surface and foundations from existing adjacent buildings (kPa)

The lateral dynamic earth force (dynamic thrust) due to seismic loading may be computed from the equation given below:

Δ_{Pe} = $\gamma h^2 \frac{a_h}{g} F_b$ ------------------------------ (iii)

where Δ_{Pe} = dynamic thrust in kN/m of wall

h = height of basement wall against soil above the bedrock surface (m)

γ = unit weight of soil = 22 kN/m^3

$\frac{a_h}{g}$ = seismic coefficient = 0.36 (Earthquakes Canada value for Site)

F_b = thrust factor = 1.0

The dynamic thrust does not take into account the surcharge load. The resultant force acts approximately at 0.63H above the base of the wall.

For basement walls cast directly against bedrock, a vertical drainage membrane or board such as Terradrain 200 or equivalent should be installed on the face of the bedrock that leads to a solid discharge pipe connecting to a sump. The top of the drainage board should be covered with a fabric filter to prevent the loss of overlying soil into the drainage board.

All subsurface walls should be waterproofed.

12. Excavation and De-Watering Requirements

12.1 Excess Soil Management

Ontario Regulation 406/19 specifies protocols that are required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed and the requirements of the receiving site. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work.

Reference is made to the Phase II ESA completed by exp for management of any excess soils that will be generated from the site as part of the proposed development.

12.2 Excavation

Excavations for the construction of the proposed buildings are expected to extend to 9.6 m below the existing ground surface. These excavations will extend through the fill, glacial till/highly weathered shale and into the sound shale bedrock. The excavations are anticipated to be significantly below the groundwater level.

Overburden Soil

Excavations within the overburden soils may be undertaken using heavy equipment capable of removing cobbles, boulders and possible large slabs of shale bedrock.

All excavations in the overburden must be undertaken in accordance with the Occupational Health and Safety Act (OHSA), Ontario Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils and highly weathered bedrock on site are considered to be Type 3 and as such must be cut back at 1H:1V from the bottom of the excavation above the groundwater level. Within zones of persistent seepage and below the groundwater level, the excavation side slopes are expected to slough and eventually stabilize at a slope of 2H:1V to 3H:1V.

It is anticipated that due to the significant depth of the excavation for the proposed buildings and the proximity of the excavation to existing infrastructure (roadways and underground municipal services), the excavations side will have to be supported by shoring which may consist of steel H soldier pile and timber lagging system. If a secant pile shoring system is being considered, further recommendations can be provided.

A hydrogeological assessment has been completed to provide estimates to the quantity of water to be removed from the site for water taking permit requirements as well as to determine the potential impact on the neighboring properties from the dewatering activities. The hydrogeological assessment should be consulted in determining the appropriate shoring type and method of dewatering for the proposed excavation.

The type of shoring system required would depend on a number of factors including:

- Proximity of the excavation to existing structures and infrastructure,
- Type of foundations of the existing adjacent buildings and the difference in founding levels between the foundations of new buildings and existing adjacent buildings,
- Type and invert depth of existing underground municipal services (infrastructure); and
- The subsurface soil, bedrock and groundwater conditions.

The shoring system will require lateral restraint provided by tiebacks consisting of rock anchors. Due to the potential cobble and boulder size shale fragments pre-drilling may be required for the installation of the soldier piles. The presence of cobble and boulder size shale fragments in the subsurface soils should also be taken into consideration for other contemplated shoring systems.

The need for a shoring system, the most appropriate type of shoring system and the design and installation of the shoring system should be determined by the contractors bidding on this project. The design of the shoring system should be undertaken by a professional engineer experienced in shoring design and the installation of the shoring system should be undertaken by a contractor experienced in the installation of shoring systems. The shoring system should be designed and installed in accordance with latest edition of Ontario Regulation 213/91 under the OHSA and the 2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM). The shoring system as well as adjacent settlement sensitive structures (buildings) and infrastructure should be monitored for movement (deflection) on a periodic basis during construction operations.

A pre-construction condition survey of buildings and infrastructure within the influence zone of the construction should be undertaken prior to start of construction activities.

It is recommended that vibration monitoring be conducted at the site and at adjacent existing buildings and infrastructure during the installation of the shoring system and during construction of the new building addition to ensure the existing structures and infrastructure are not damaged as a result of the construction activities.

Soldier Pile and Timber Lagging System

A conventional steel H soldier pile and timber lagging shoring system must be designed to support the lateral earth pressure given by the expression below:

$$P = k(\gamma h + q)$$

where P = the pressure, at any depth, h, below the ground surface

k = applicable earth pressure coefficient; active lateral earth pressure coefficient = 0.33

‘at rest’ lateral earth pressure coefficient = 0.50

γ = unit weight of soil to be retained, estimated at 22 kN/m^3

h = the depth, in metres, at which pressure, P, is being computed

q = the equivalent surcharge acting on the ground surface adjacent to the shoring system

The pressure distribution assumes that drainage is permitted between the lagging boards and that no build-up of hydrostatic pressure may occur.

The shoring should be designed using appropriate ‘k’ values depending on the location of any settlement-sensitive infrastructure (roadways and underground services) and building structures. The traffic loads on the streets should be considered as surcharge. Soldier piles will need to extend into the sound rock below the soils. For guidance, if there is room to permit at least a 1.0 m of rock ledge around the perimeter of the excavation, the soldier piles could be toed into the upper levels of the rock provided that a rock bolt and plate arrangement is installed on the rock face to support the toe. The rock bolt should be designed to take the full toe pressure.

The shoring system as well as adjacent settlement sensitive structures and infrastructure should be monitored for movement (deflection) on a periodic basis during construction operations.

The shoring system should be evaluated for the need of lateral restraint by tiebacks in the form of grouted rock anchors.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

Rock Excavation

The excavations are anticipated to extend within the shale bedrock, to 9.6 m below the existing ground surface. The shale bedrock may be excavated using a hoe ram for removal of small quantities of the bedrock; however, this process is expected to be very slow. The excavation sideslopes in the upper depths of the weathered zones of the shale bedrock may be cut back at a 1H:1V gradient. The excavation side slopes in the sound shale bedrock may be undertaken with near vertical sides subject to examination by a geotechnical engineer.

The excavation of the shale bedrock to extensive depths below the bedrock surface may require line drilling and blasting techniques. Contractors bidding on this project should decide on their own the most preferred rock removal method; hoe ramming or line drilling and blasting.

The exposed shale bedrock surface along all excavation walls should be covered with shotcreted within the same day of exposure to protect the rock face from rapid deterioration due to exposure to the elements, as previously discussed.

Rock Support

The exposed face of the bedrock in the excavation may require scaling. The exposed bedrock face in the excavation may also require rock stabilization measures such a rock bolts and/or a wire mesh system to stabilize the walls of the rock excavation. The need for stabilization measures will have to be assessed once excavation depths into the bedrock are finalized.

Vibration Control

The vibration limits for blasting should be in accordance with City of Ottawa Special Provisions (SP No. 1201).

Vibration monitors should be installed in critical areas adjacent building and infrastructure located within the construction zone of influence to monitor the vibration levels and set up to provide automated “alert” and “stop work” notifications if the permissible vibration levels are exceeded.

It is recommended that a pre-construction condition survey of the adjacent building and infrastructure located within the construction zone of influence be undertaken prior to the start of any earth (soil) and rock excavation and construction operations. Should blasting be considered for the removal of the bedrock, then, additional vibration monitoring should also be undertaken during blasting operations. Prior to the commencement of blasting, a detailed blast methodology should be submitted by the Contractor.

12.3 Dewatering Requirements

A hydrogeological assessment has been carried out and submitted under a separate cover. This report should be consulted for recommendations on dewatering and management of the proposed excavations.

13. Pipe Bedding Requirements

The invert depths of the underground services are not known at the time of this geotechnical investigation. It is anticipated that the subgrade for the proposed municipal services will be the shale bedrock.

The pipe bedding for the municipal services should be in accordance with City of Ottawa specifications, drawings and special provisions. The bedding and cover material should be compacted to a minimum of 98 percent standard Proctor maximum dry density (SPMDD).

It is recommended that the pipe bedding be 150 mm thick and consist of OPSS Granular A. The bedding material should be placed along the sides and on top of the pipe to provide a minimum cover of 300 mm. The bedding should be compacted to at least 98 percent of the standard Proctor maximum dry density (SPMDD).

If the subgrade for the underground service pipes will be the expansive shale bedrock, special procedures for the installation of the underground services, as previously discussed for footing and slab-on-grade construction on the shale bedrock, may be required. EXP can provide additional comments and recommendations regarding the installation of the service pipes on the shale bedrock subgrade, once pipe invert elevations are known.

The municipal services should be installed in short open trench sections that are excavated and backfilled the same day.

14. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

It is anticipated that the majority of the material required for backfilling purposes for the proposed building and for roadway/parking lot backfill would have to be imported and should preferably conform to the following specifications:

- Engineered fill under the lowest floor slab - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent SPMDD, and
- Backfill material against foundation walls located outside the proposed building – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 95 percent SPMDD.

15. Tree Planting Restrictions

The Hobin design concept plan indicates the new trees will be planted throughout the development. No sensitive clays were encountered and therefore there are no tree planting restrictions from a sensitive marine clay perspective for this project.

16. Surface Parking and Access Roadways

The subgrade for the pavement structures for surface parking and access roadways is anticipated to consist of OPSS Granular B Type II material where the overburden soils have been removed and suitable fill, glacial till as well as OPSS Granular B Type II where the overburden has not been removed. Pavement structure thicknesses required for the access roads set on the anticipated approved subgrade materials were computed and are shown in Table VII. The pavement structures assume a functional design life of 15 to 20 years. The proposed functional design life represents the number of years to the first rehabilitation, assuming regular maintenance is carried out.

Table VII: Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Computed Pavement Structure	
		Light Duty Traffic (Cars Only)	Heavy Duty Traffic (Buses and Trucks)
Asphaltic Concrete	92 percent-97 percent MRD	65 mm HL3/SP12.5 mm/ Cat. B (PG 58-34)	40 mm HL3/SP12.5 Cat. B (PG 58-34) 50 mm HL8/SP 19 Cat. B (PG 58-34)
OPSS 1010 Granular A Base (crushed limestone)	100% percent SPMDD	150 mm	150 mm
OPSS 1010 Granular B Type II Sub-base	100% percent SPMDD	300 mm	450 mm

Notes:

1. SPMDD denotes standard Proctor maximum dry density, ASTM, D-698-12e2.
2. MRD denotes Maximum Relative Density, ASTM D2041.
3. The upper 300 mm of the subgrade fill must be compacted to 98 percent SPMDD.
4. The approved subgrade should be covered with a woven geotextile prior to placement of granular sub-base of the pavement structure.

The foregoing design assumes that construction is carried out during dry periods and that the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather and, heaving or rolling of the subgrade is experienced, additional thickness of granular material may be required in addition to the woven geotextile indicated in Table VII.

Additional comments on the construction of the parking lot and access roads are as follows:

1. In areas where the overburden soil has not been removed as part of the building excavation, the subgrade preparation for the areas to be paved, the proposed new pavement areas should be stripped of topsoil, organic stained soil and other obviously unsuitable material. The subgrade should be properly shaped, crowned, then proofrolled with a non-vibratory roller in the full-time presence of a representative of this office. Any soft or spongy subgrade areas detected should be sub excavated and properly replaced with suitable OPSS 1010 Granular B Type II compacted to 95 percent SPMDD (ASTM D698).
2. The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum cross fall of 2 percent) to provide effective surface drainage towards catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of paved areas.
3. The granular materials used for pavement construction should conform to OPSS 1010 for Granular A and Granular B Type II and should be compacted to 100 percent of the SPMDD (ASTM D698). The asphaltic concrete and its placement should meet OPSS requirements. It should be compacted to a minimum of 92 percent of the maximum relative density in accordance with ASTM D2041.

It is recommended that a geotechnical consultant be retained to review the final pavement structure design and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

17. Corrosion Potential

Chemical tests limited to pH, sulphate, chloride and resistivity were undertaken on three (3) shale bedrock samples. A summary of the results is shown in Table VIII. The laboratory certificate of analysis is shown in Appendix B.

Table VIII: Corrosion Test Results on Shale Bedrock Samples

Borehole – Sample No.	Depth (m)	Bedrock Type	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH 17 Run 2	3.9 – 4.0	Shale	9.75	0.001	0.001	3090
BH 12 Run 6	10.3 - 10.4	Shale	9.96	0.006	0.002	2520
BH 14 Run 4	6.1 - 6.2	Shale	9.92	0.001	0.001	3320

The results indicate the bedrock has a negligible sulphate and chloride attack on subsurface concrete. The concrete should be designed in accordance with CSA A.23.1-14.

The results of the resistivity tests indicate that the bedrock is mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be taken to protect the buried bare steel from corrosion.

18. Additional Comments

All earthwork activities from subgrade preparation to placement and compaction of engineered fill, placement and compaction of granular materials and asphaltic concrete, should be inspected by qualified geotechnicians to ensure that construction proceeds according to the project specifications.

All the footing beds should be examined by a geotechnical engineer to ensure that the founding surfaces are capable of supporting the design bearing pressure and that the footing beds have been properly prepared.

19. General Comments

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

The environmental aspects of the soils are discussed in the EXP Phase Two ESA report.

We trust that the information contained in this report will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Sincerely

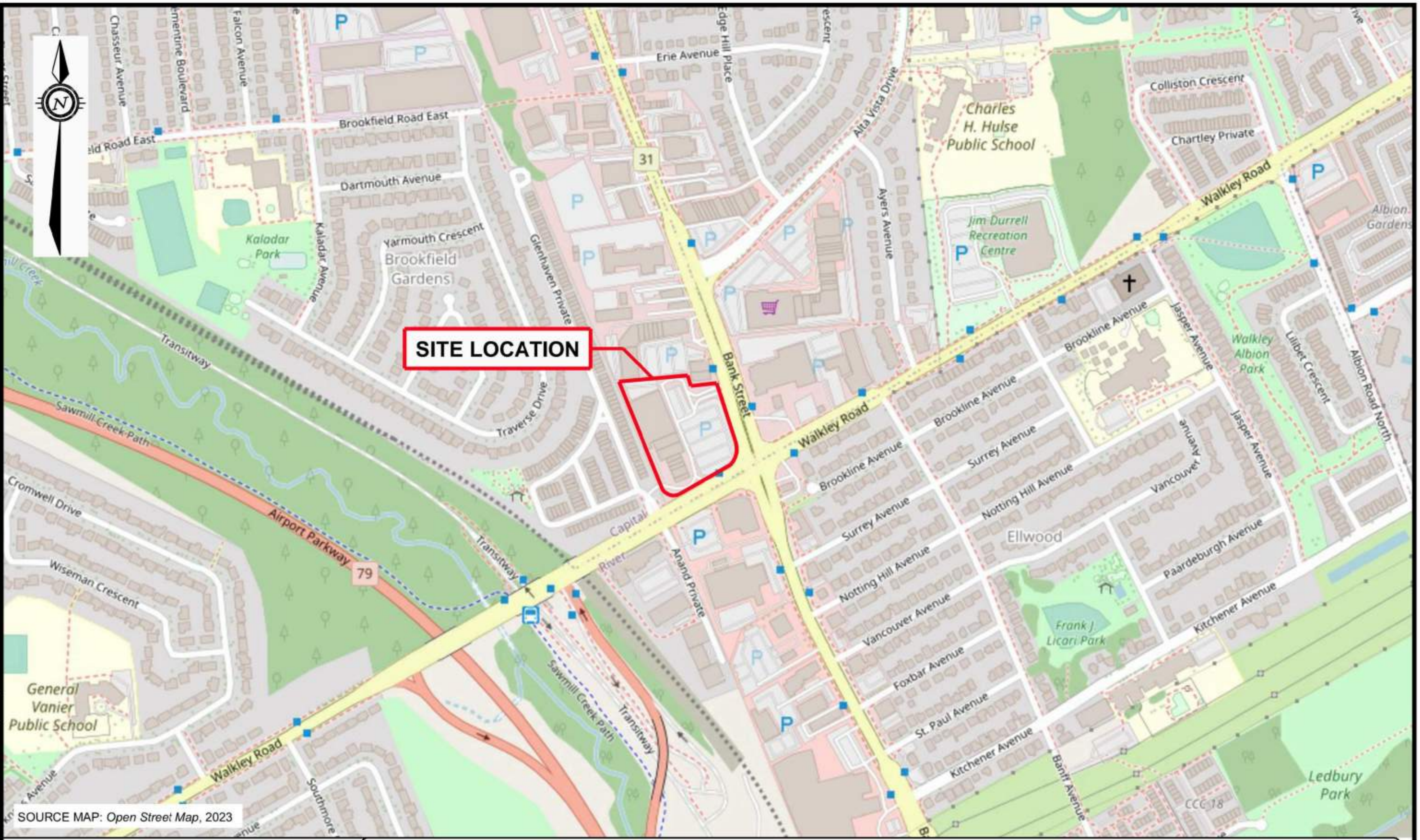
Daniel Wall

Daniel Wall, M. Eng., P.Eng.
Geotechnical Engineer
Earth & Environment

Ismail Taki, M. Eng., P.Eng.
Senior Manager, Eastern Region
Earth & Environment

LICENSED PROFESSIONAL ENGINEER
October 3, 2024
D C WALL
100159490
Daniel Wall
PROVINCE OF ONTARIO

Figures



SOURCE MAP: *Open Street Map*, 2023

0 50m 100m 300m

HORIZONTAL 1:7,500

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DATE		PROJECT:	project no.
SEPTEMBER 2023		GEOTECHNICAL INVESTIGATION	OTT-23002538-A0
DESIGN	CHECKED	CLIENT: BENTALL GREEN OAK	scale
CK / IT	IT	TITLE: SITE LOCATION PLAN	1:7,500
DRAWN BY		WALKLEY CENTRE RE-DEVELOPMENT (1820-1846 BANK ST.), OTTAWA, ONTARIO	FIG 1
AS			

Filename: E:\OTT\OTT-23002538-A0\60 Execution\65 Drawings\23002538-A0_Geo.dwg
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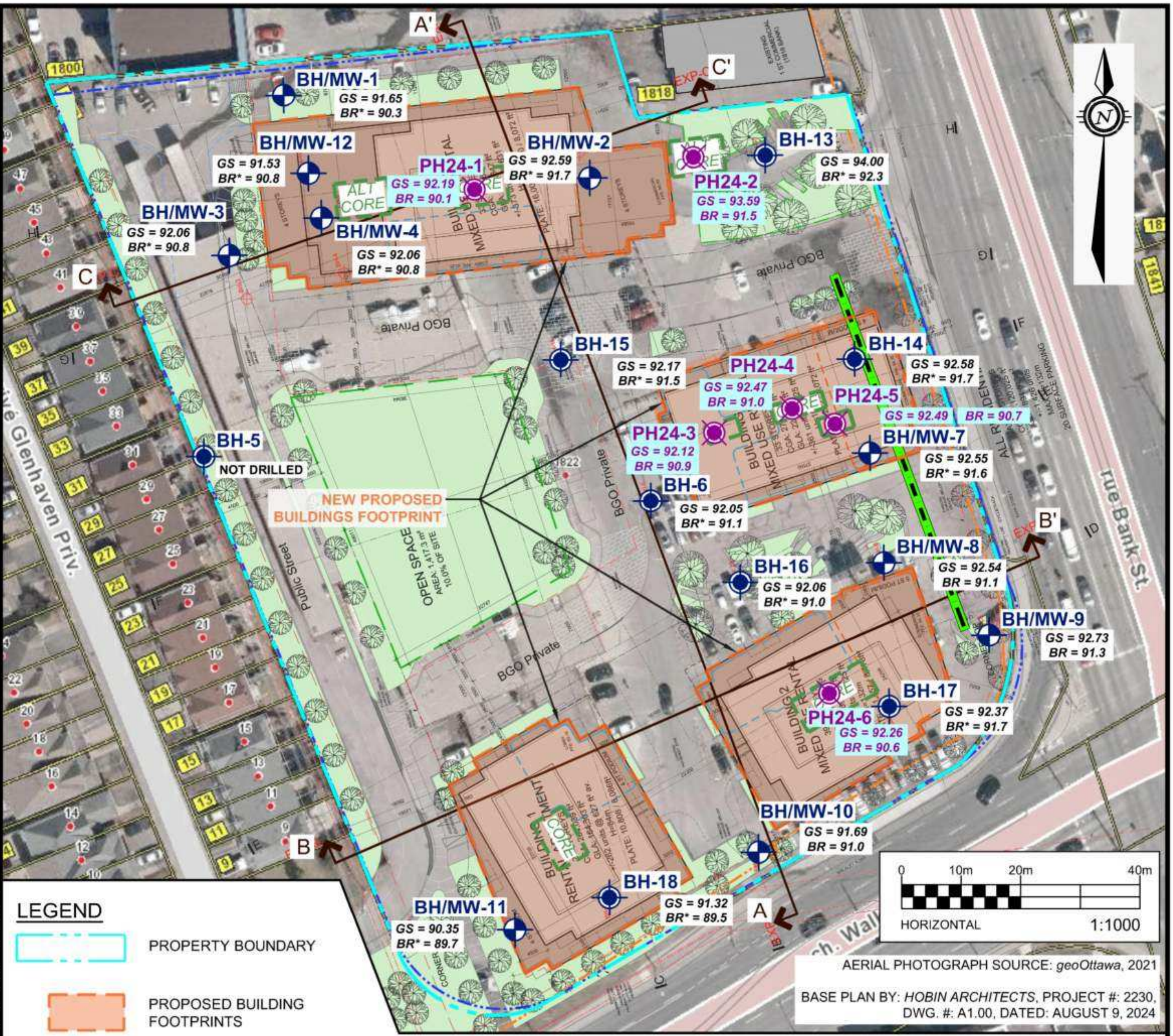

AERIAL PHOTOGRAPH SOURCE: *geoOttawa*, 2021

BASE PLAN BY: *HOBIN ARCHITECTS*, PROJECT #: 2230, DWG. #: A1.00, DATED: AUGUST 9, 2024

LEGEND

PROPERTY BOUNDARY

PROPOSED BUILDING FOOTPRINTS

A SECTION MARK

BH/MW-1 MONITORING WELL LOCATION

BH-6 BOREHOLE LOCATION

GS = 91.67 GROUND SURFACE LEVEL ELEVATION (m)

BR = 90.7 BEDROCK ELEVATION (m)

* BEDROCK CORED

PH24-1 PROBE HOLE LOCATION

GENERAL NOTES:

1. THE BOUNDARIES, SOIL AND ROCK TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES AND ROCK CORES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. ASPHALT QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLE LOCATIONS.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. THE PROPOSED SITE PLAN RECEIVED FROM: *HOBIN ARCHITECTS*, DATED: JULY 12, 2023

APPROXIMATE MASW STUDY AREA

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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE
AUGUST 2024
DESIGN CK / DW
CHECKED IT
DRAWN BY AS
CLIENT: BGO
PROJECT:
WALKLEY CENTRE RE-DEVELOPMENT
(1820-1846 BANK ST.), OTTAWA, ONTARIO
TITLE:
TEST HOLE LOCATION PLAN
project no.
OTT-23002538-B0
scale
1:1,000
FIG 2

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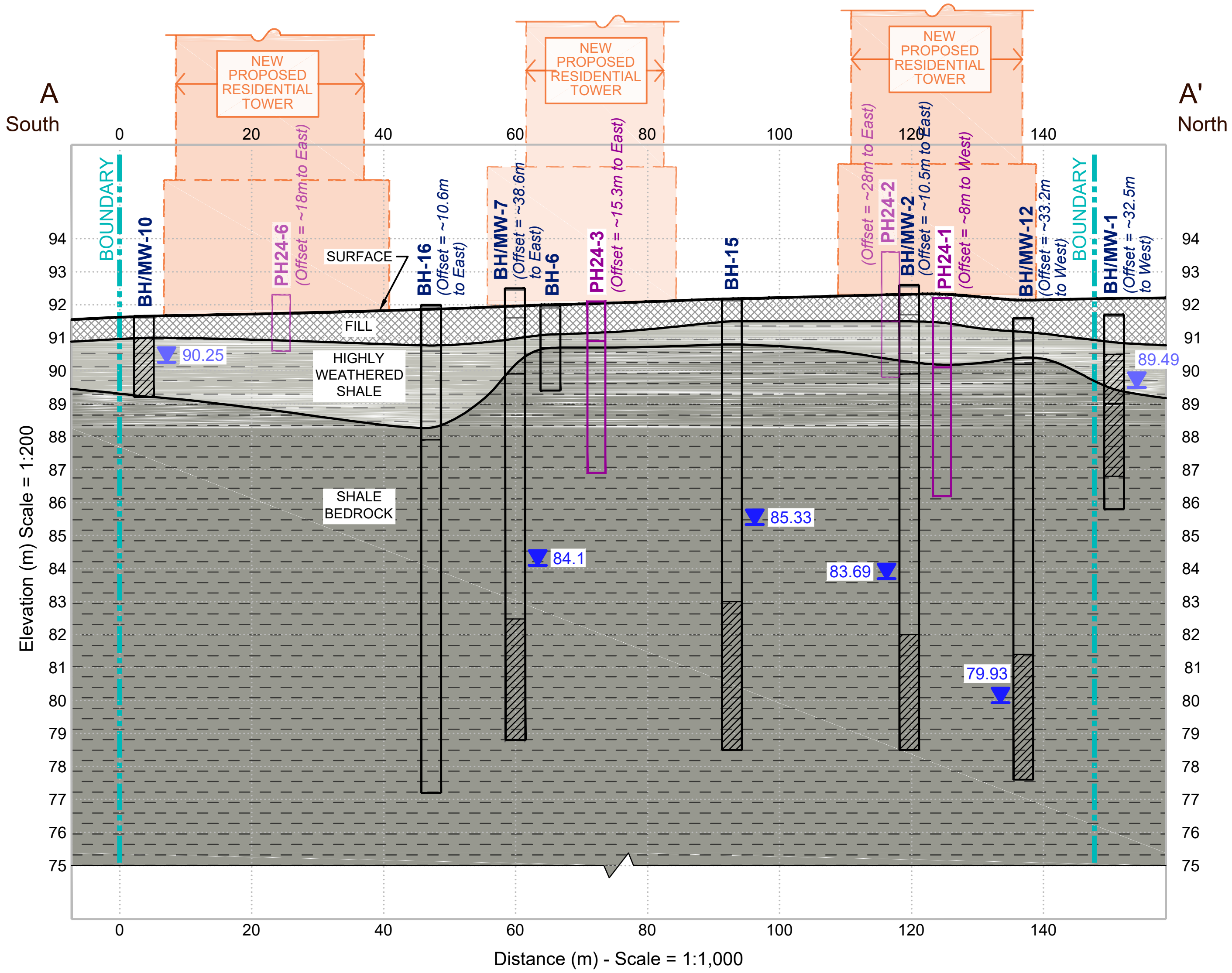


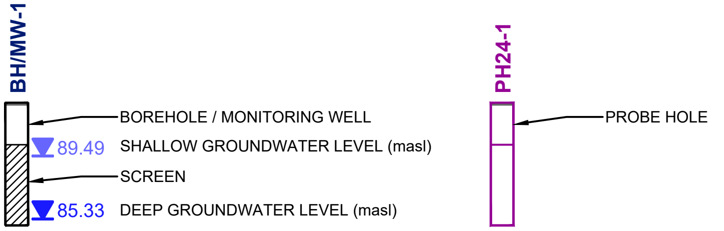
CROSS SECTION A-A'

LEGEND

▨ FILL: SAND, GRAVEL, Etc.

▤ HIGHLY WEATHERED SHALE

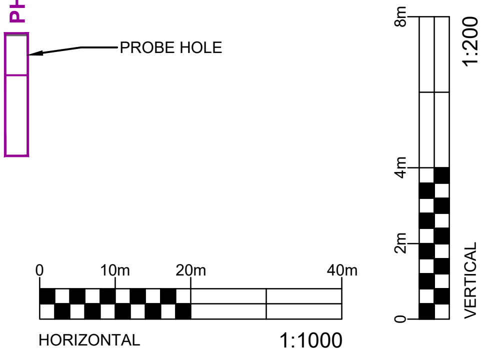
▦ SHALE BEDROCK



LEGEND (GENERAL)

PROPERTY BOUNDARY

NEW PROPOSED MIXED USE AND
RENTAL APARTMENTS TOWERS (24 - 40 STORIES)



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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

DATE JULY 2024	CLIENT: BGO	PROJECT: GEOTECHNICAL INVESTIGATION	project no. OTT-23002538-B0
DESIGN CK / DW	CHECKED IT	TITLE: CROSS SECTION A-A' WALKLEY CENTRE RE-DEVELOPMENT (1820-1846 BANK ST.), OTTAWA, ONTARIO	scale H = 1:1,000 | V = 1:200
DRAWN BY AS			FIG 3A

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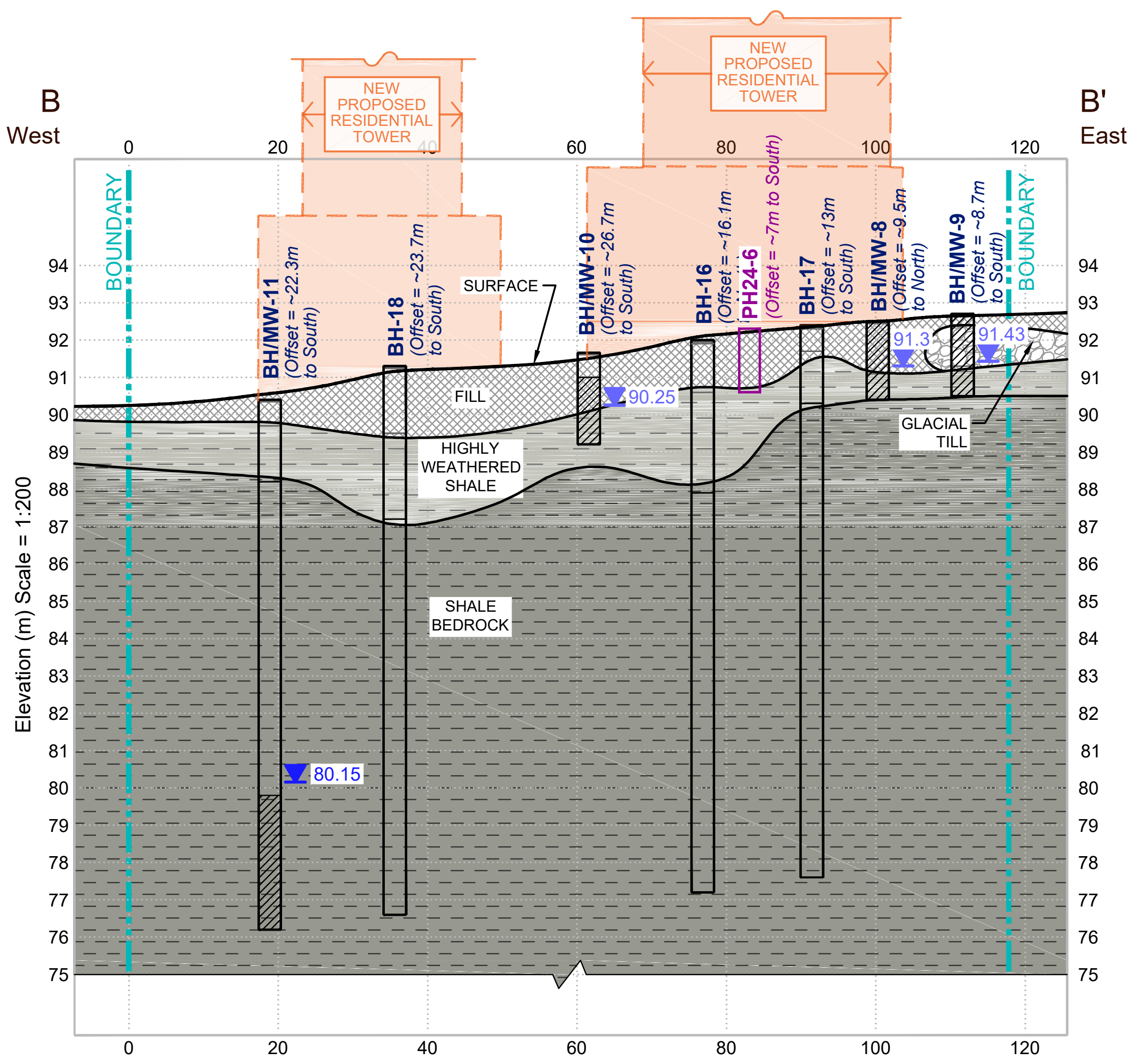
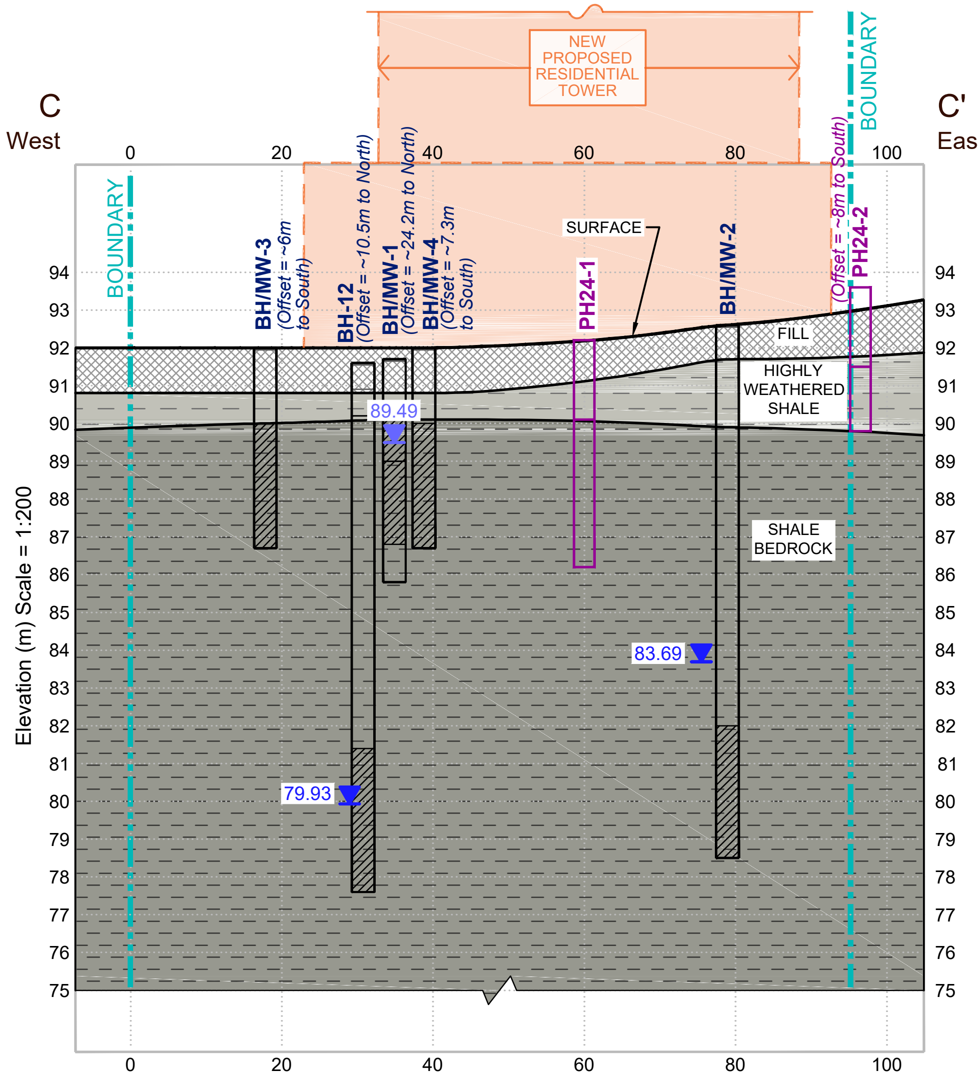


CROSS SECTION B-B'



CROSS SECTION C-C'

LEGEND

▨ FILL: SAND, GRAVEL, Etc.
▨ GLACIAL TILL
▨ HIGHLY WEATHERED SHALE
▨ SHALE BEDROCK

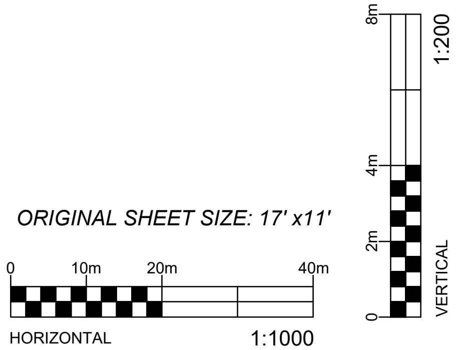
BH/MW-1
BOREHOLE / MONITORING WELL
▼ 89.49 SHALLOW GROUNDWATER LEVEL (masl)
SCREEN
▼ 85.33 DEEP GROUNDWATER LEVEL (masl)

PH24-1
PROBE HOLE

LEGEND (GENERAL)

— · — PROPERTY BOUNDARY
▨ NEW PROPOSED MIXED USE AND RENTAL APARTMENTS TOWERS (24 - 40 STORIES)

ORIGINAL SHEET SIZE: 17' x11'



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Ottawa, ON K2B 8H6, Canada

DATE JULY 2024	CLIENT: BGO	PROJECT: GEOTECHNICAL INVESTIGATION	project no. OTT-23002538-B0
DESIGN CK / DW — CHECKED IT	TITLE: CROSS SECTIONS B-B' & C-C' WALKLEY CENTRE RE-DEVELOPMENT (1820-1846 BANK ST.), OTTAWA, ONTARIO		scale H = 1:1,000 | V = 1:200
DRAWN BY AS			FIG 3B

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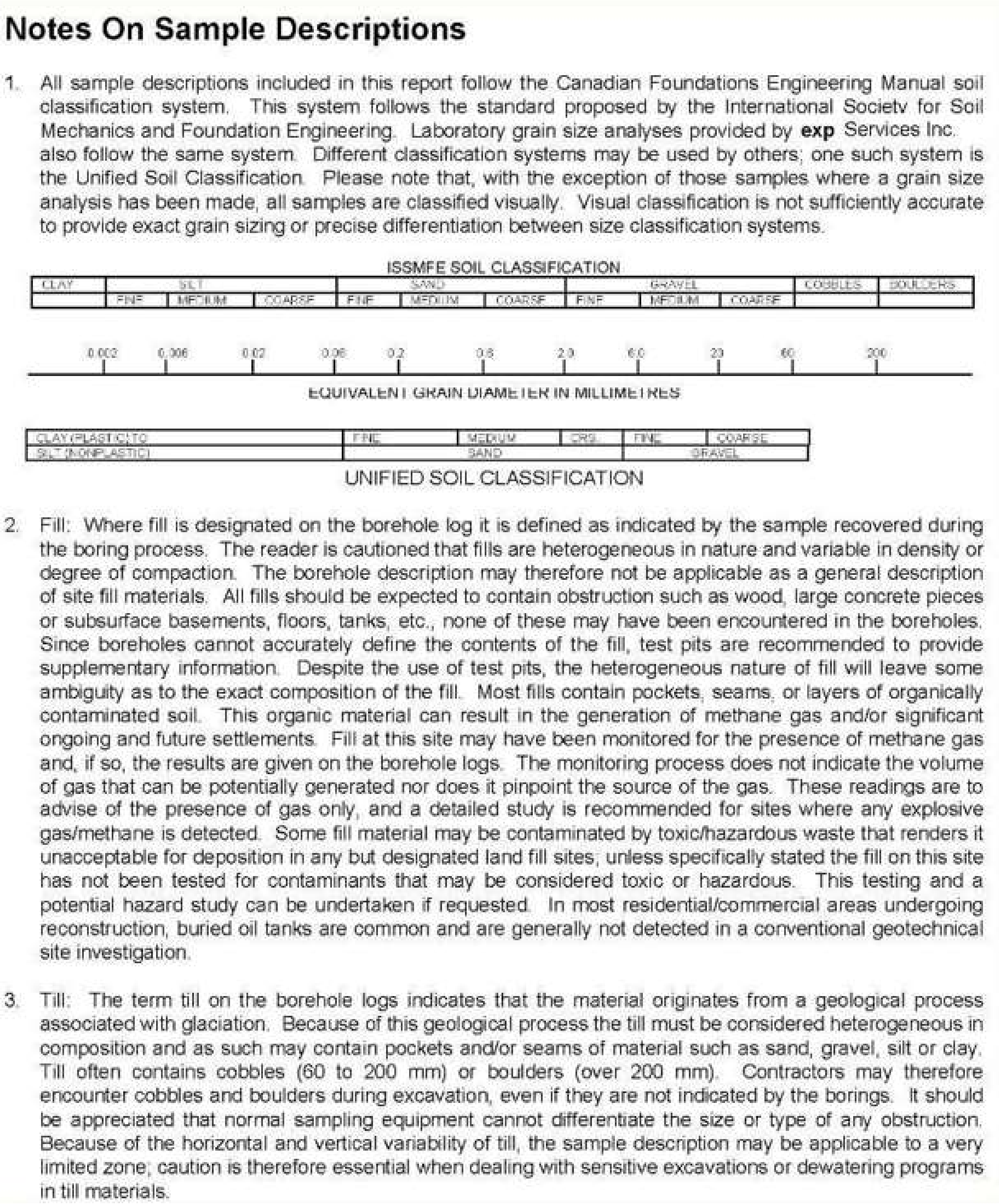


Notes On Sample Descriptions

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.

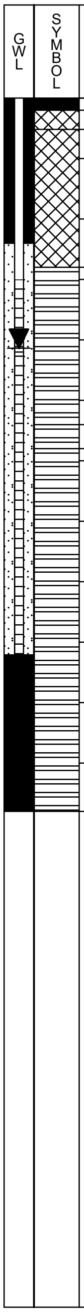
Log of Borehole BH-01

Project No: OTT-23008400-B0
Project: Geotechnical Investigation - Walkley Centre Development
Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 4
Page. 1 of 1

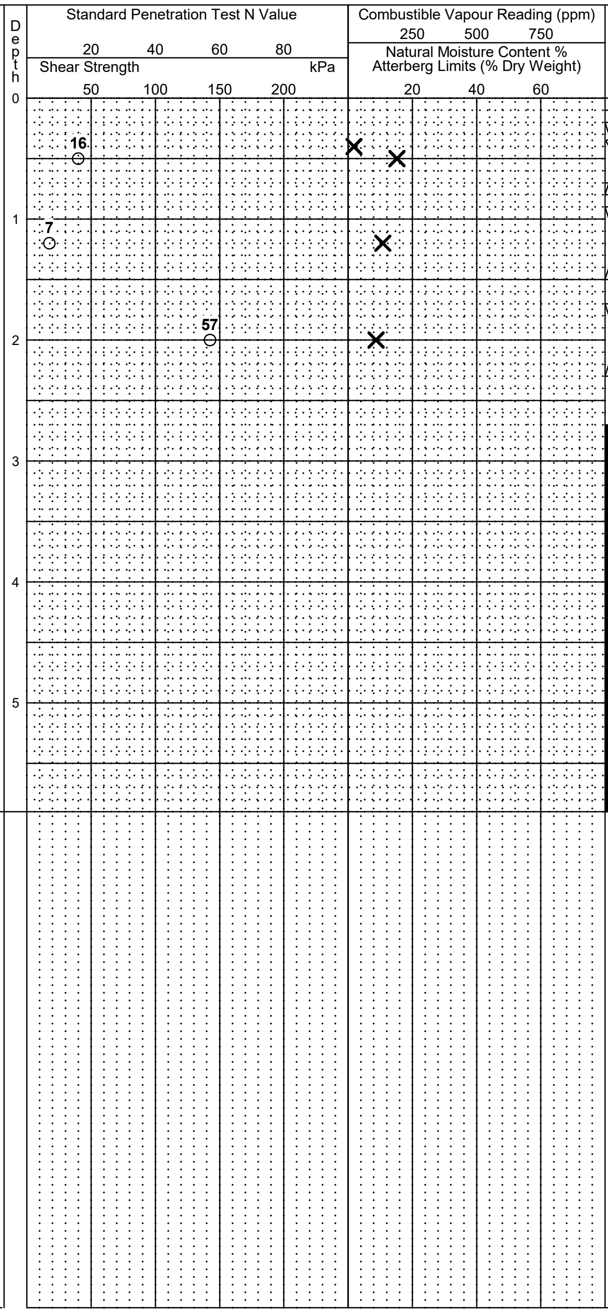
Date Drilled: 'October 26, 2023
Drill Type: CME-55 Truck-Mounted Drill Rig
Datum: Geodetic Elevation
Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲



SOIL DESCRIPTION	Geodetic Elevation m	Samples	Natural Unit Wt. kN/m³
	91.7		
ASPHALTIC CONCRETE ~ 100 mm thick	91.60		
GRANULAR FILL Sand and crushed gravel, grey, moist	91.44	GS1 SS1	
FILL Sand and gravel, brown, moist, (loose to compact)		SS2	
HIGHLY WEATHERED SHALE Silty sand and gravel, black, moist, (very dense)	90.30 89.6	SS3	
SHALE BEDROCK Black, Very Poor Rock Quality	89.00 88.80	CORE1	
SHALE BEDROCK Black, Fair to Good Rock Quality, Medium Strong		CORE2 CORE3	25.8 26.0
	85.80		

Borehole Terminated at 5.9 m Depth



NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 50 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	1.8	
12/06/2023	2.2	
3/14/2024	2.1	
6/19/2024	2.1	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.7 - 2.9	60	0
2	2.9 - 4.5	97	69
3	4.5 - 5.9	100	82

Log of Borehole BH-02

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 5

Page. 1 of 2

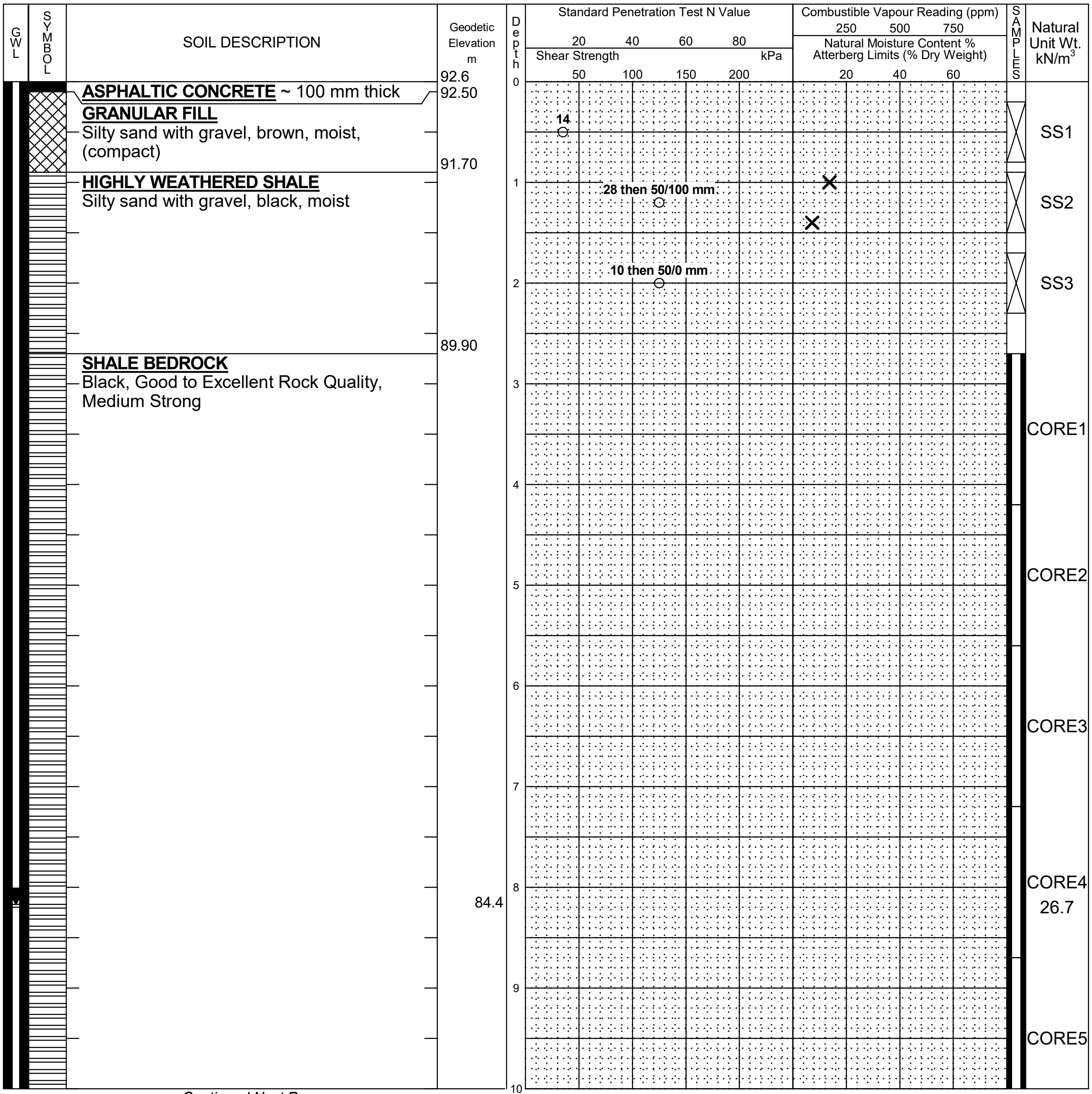
Date Drilled: 'October 30, 2023

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲



92.6

ASPHALTIC CONCRETE ~ 100 mm thick — 92.50

GRANULAR FILL
Silty sand with gravel, brown, moist, (compact)

91.70

HIGHLY WEATHERED SHALE
Silty sand with gravel, black, moist

89.90

SHALE BEDROCK
Black, Good to Excellent Rock Quality, Medium Strong

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.9	
3/14/2024	8.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.7 - 4.2	84	80
2	4.2 - 5.6	100	96
3	5.6 - 7.2	100	81
4	7.2 - 8.7	100	97
5	8.7 - 10.3	100	100
6	10.3 - 11.8	98	77
7	11.8 - 13.1	100	100
8	13.1 - 14.1	100	85

Log of Borehole BH-02

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 5

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong *(continued)*	82.6	10				
				11				CORE6 25.8
				12				CORE7
				13				CORE8
			78.50	14				
		Borehole Terminated at 14.1 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.9	
3/14/2024	8.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.7 - 4.2	84	80
2	4.2 - 5.6	100	96
3	5.6 - 7.2	100	81
4	7.2 - 8.7	100	97
5	8.7 - 10.3	100	100
6	10.3 - 11.8	98	77
7	11.8 - 13.1	100	100
8	13.1 - 14.1	100	85

Log of Borehole BH-03

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 6

Page. 1 of 1

Date Drilled: 12/14/23

Drill Type: Hilti / Geoprobe

Datum: Geodetic Elevation

Logged by: MR Checked by: LW

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	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		92.1	0				
	CONCRETE ~ 165 mm thick	91.94					
	FILL Sand, trace gravel, brown-grey, moist		1			☒	SS1
	HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist	90.80				☒	SS2
			2			■	CORE1
▼		89.8					
	SHALE BEDROCK Black, Poor to Fair Rock Quality	89.60	3			■	CORE2
			4			■	CORE3
		86.70	5			■	CORE4
	Borehole Terminated at 5.4 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 38mm PVC monitoring well was installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
12/21/2023	2.3	
3/14/2024	2.3	
6/19/2024	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.5 - 2.5	40	0
2	2.5 - 3.5	100	43
3	3.5 - 4.5	100	50
4	4.5 - 5.4	100	50

Log of Borehole BH-04

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 7

Page. 1 of 1

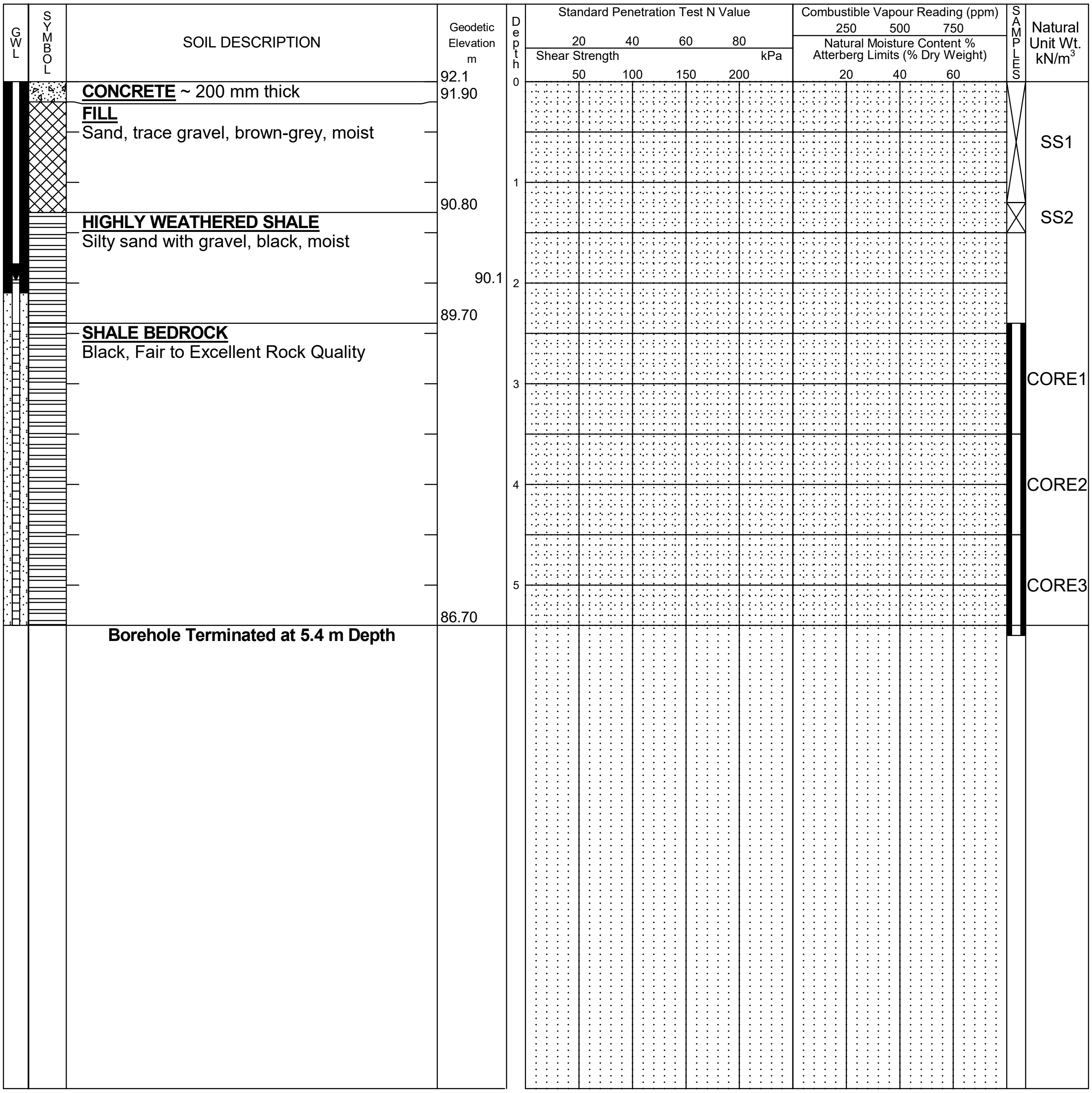
Date Drilled: 12/14/23

Drill Type: Hilti / Geoprobe

Datum: Geodetic Elevation

Logged by: MR Checked by: LW

Split Spoon Sample	⊠	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲



CONCRETE ~ 200 mm thick

FILL
Sand, trace gravel, brown-grey, moist

HIGHLY WEATHERED SHALE
Silty sand with gravel, black, moist

SHALE BEDROCK
Black, Fair to Excellent Rock Quality

Borehole Terminated at 5.4 m Depth

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 38mm PVC monitoring well was installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
12/21/2023	1.8	
3/14/2024	1.9	
6/19/2024	2.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.5 - 2.4	42	0
2	2.4 - 3.4	43	65
3	3.4 - 4.5	100	95
4	4.5 - 5.4	100	100

Log of Borehole BH-06

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 8

Page. 1 of 1

Date Drilled: 'October 27, 2023

Drill Type: CME-55 Truck-Mounted Drill Rig

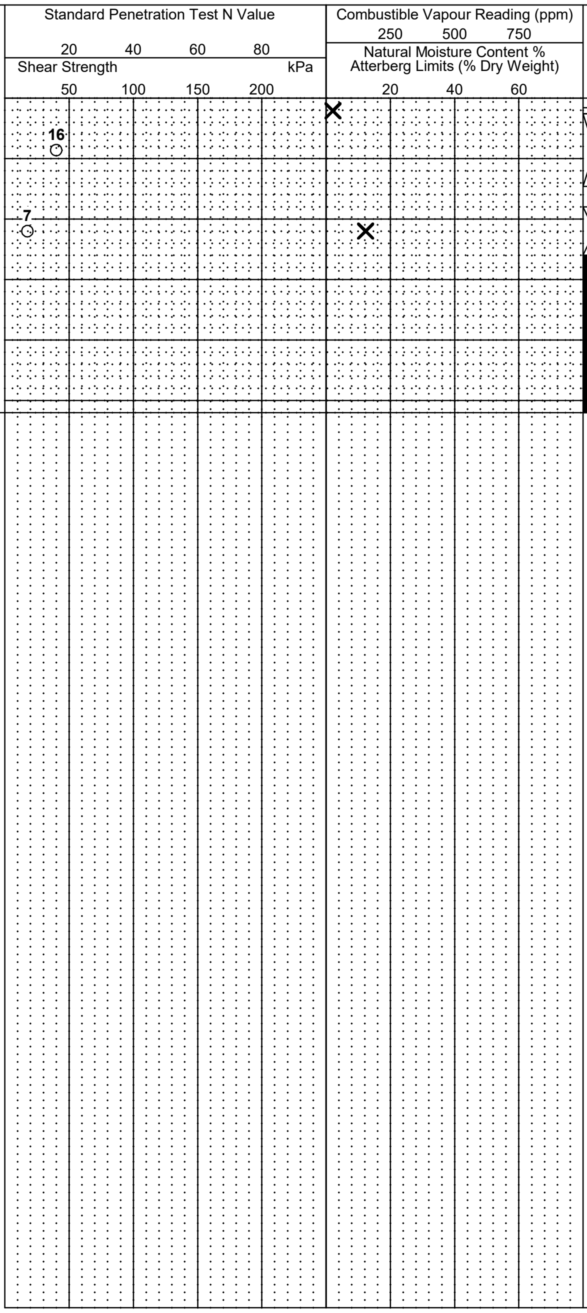
Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALTIC CONCRETE - 80 mm thick	92 91.92	0	GS1	
		FILL Silty sand with gravel, brown, moist, (compact)	91.10		SS1	
		HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist, (loose)	90.70	1	SS2	
		SHALE BEDROCK Black, Very Poor Rock Quality	89.40	2	CORE1	

Borehole Terminated at 2.6 m Depth



NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.3 - 2.6	100	0

Log of Borehole BH-07

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 9

Page. 1 of 2

Date Drilled: 'October 27, 2023

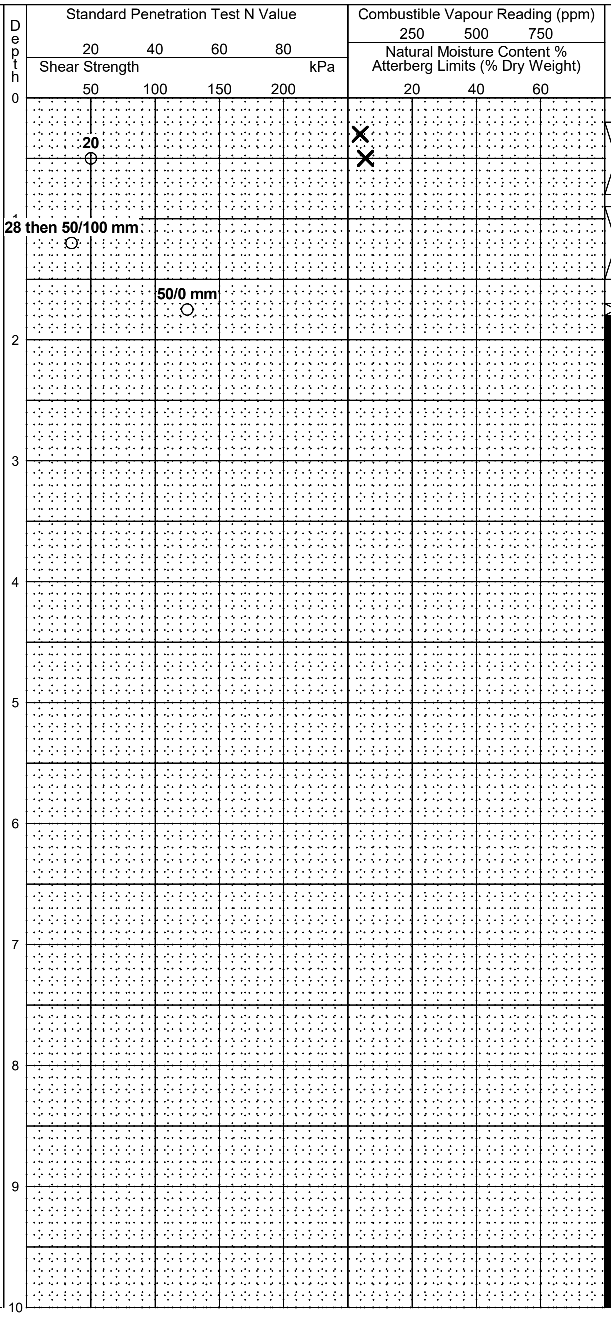
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	▥	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	──	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

Geodetic Elevation m	SOIL DESCRIPTION
92.5	
92.43	**ASPHALTIC CONCRETE** ~ 70 mm thick
92.35	**GRANULAR FILL** Sand and crushed gravel, grey, moist
91.60	**FILL** Silty sand with gravel, brown, moist, (compact)
90.70	**HIGHLY WEATHERED SHALE** Silty sand with gravel, black, moist, (very dense)
89.90	**SHALE BEDROCK** Black, Very Poor Rock Quality
	SHALE BEDROCK Black, Poor to Excellent Rock Quality, Weak to Medium Strong
87	



SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	
CORE1	
CORE2	25.3
CORE3	
CORE4	25.9
CORE5	
CORE6	25.9

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	5.8	
12/06/2023	8.6	
3/14/2024	6.2	
6/19/2024	5.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.8 - 2.7	76	47
2	2.7 - 4.2	100	78
3	4.2 - 5.7	100	100
4	5.7 - 7.2	100	58
5	7.2 - 8.8	100	80
6	8.8 - 10.3	100	85
7	10.3 - 11.8	100	71
8	11.8 - 13.4	100	71
9	13.4 - 13.7	100	92

Log of Borehole BH-07

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 9

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
		SHALE BEDROCK Black, Poor to Excellent Rock Quality, Weak to Medium Strong *(continued)*	82.5	10				
				11				CORE7
				12				
				13				CORE8 25.6
			78.80					CORE9
		Borehole Terminated at 13.7 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	5.8	
12/06/2023	8.6	
3/14/2024	6.2	
6/19/2024	5.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.8 - 2.7	76	47
2	2.7 - 4.2	100	78
3	4.2 - 5.7	100	100
4	5.7 - 7.2	100	58
5	7.2 - 8.8	100	80
6	8.8 - 10.3	100	85
7	10.3 - 11.8	100	71
8	11.8 - 13.4	100	71
9	13.4 - 13.7	100	92

Log of Borehole BH-08

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 10

Page. 1 of 1

Date Drilled: 'October 26, 2023

Drill Type: CME-55 Truck-Mounted Drill Rig

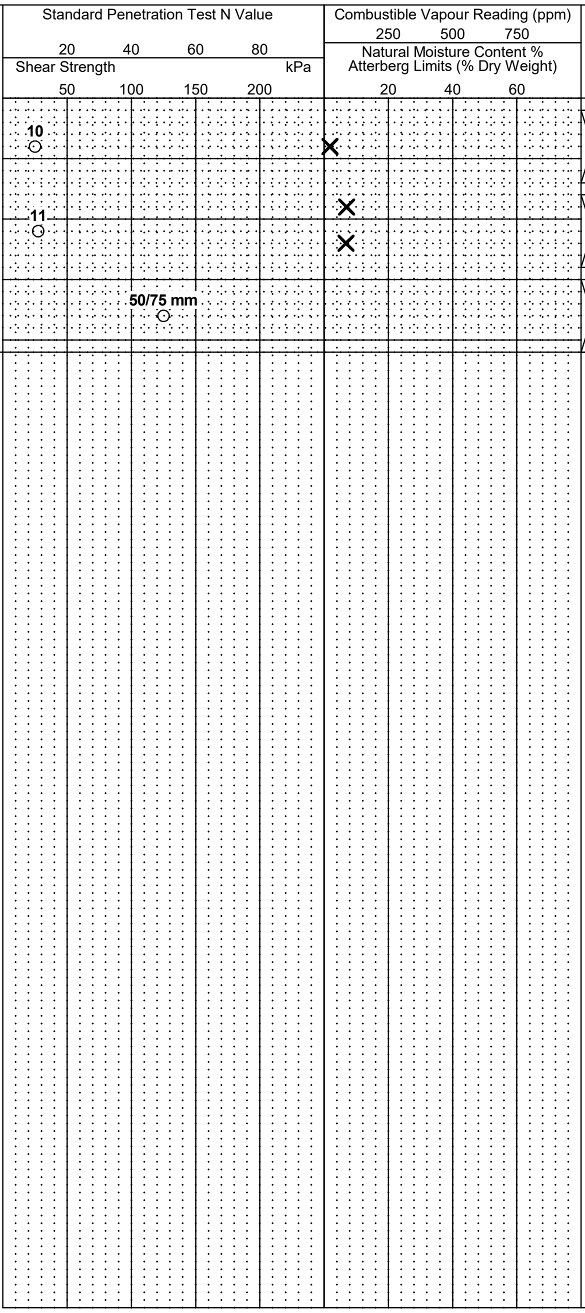
Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢⊖
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
			92.5	0		
		ASPHALTIC CONCRETE ~ 90 mm thick	92.41			
		FILL Sand with crushed gravel, with silt and asphaltic concrete debris, brown, moist, (compact)			SS1	
▼			91.3	1	SS2	
		HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist	91.10		SS3	
			90.40	2		

Auger Refusal at 2.1 m Depth



NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 50 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	1.4	
12/06/2023	1.3	
3/14/2024	0.6	
6/19/2024	1.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-09

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 11

Page. 1 of 1

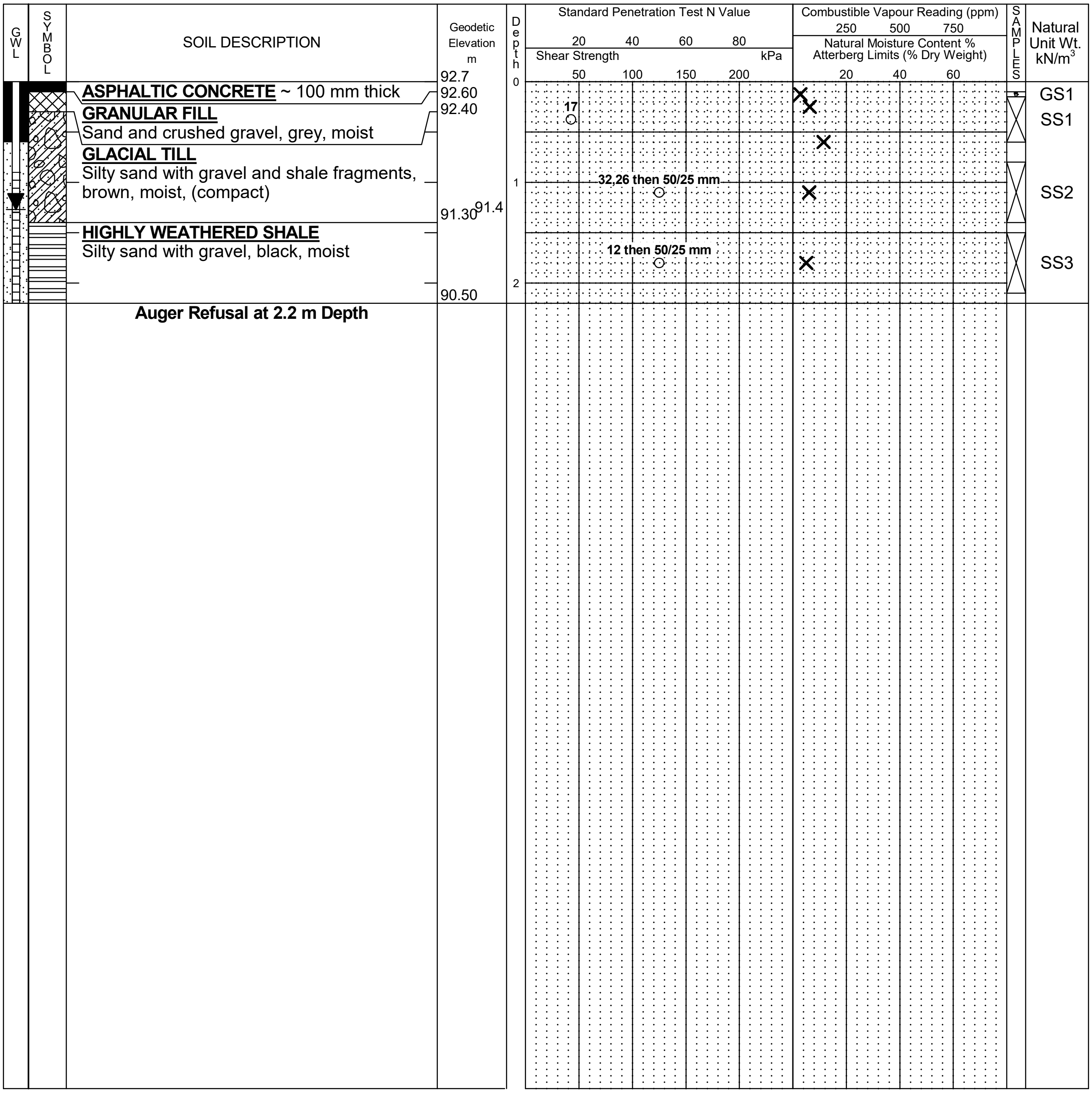
Date Drilled: 'October 26, 2023

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲



SOIL DESCRIPTION	Geodetic Elevation m
	92.7
ASPHALTIC CONCRETE ~ 100 mm thick	92.60
GRANULAR FILL Sand and crushed gravel, grey, moist	92.40
GLACIAL TILL Silty sand with gravel and shale fragments, brown, moist, (compact)	91.30
HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist	90.50

Auger Refusal at 2.2 m Depth

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 50 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	1.4	
12/06/2023	1.3	
3/14/2024	1.1	
6/19/2024	1.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-10

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 12

Page. 1 of 1

Date Drilled: 'October 26, 2023

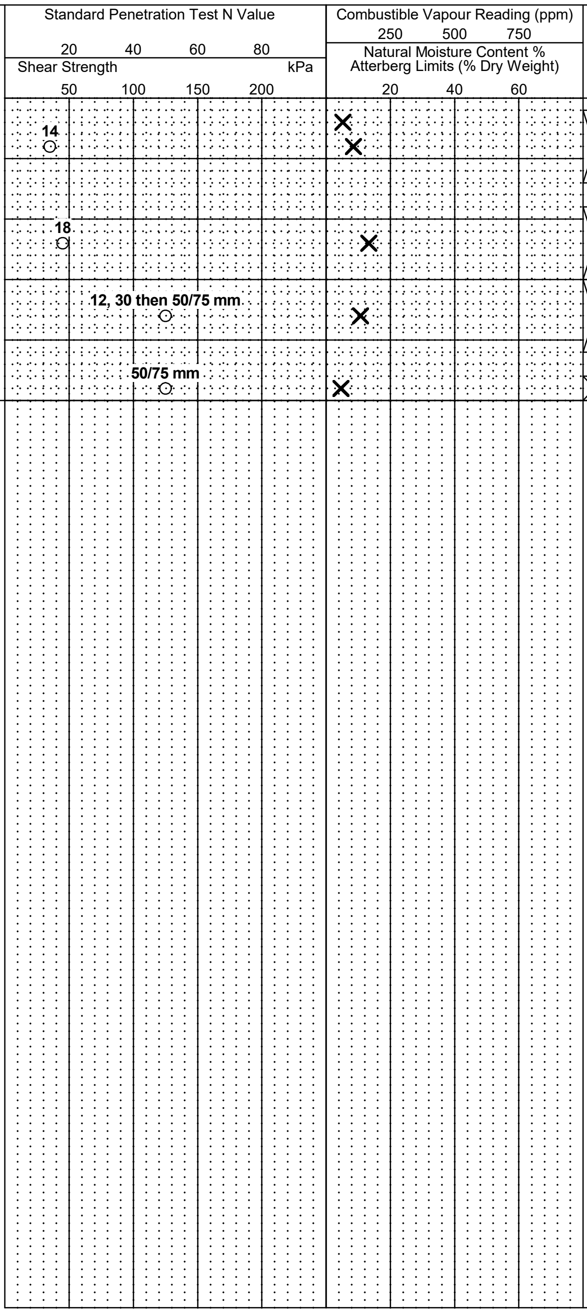
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
	91.7	0		
ASPHALTIC CONCRETE ~ 120 mm thick	91.58			
RECYCLED ASPHALTIC CONCRETE ~ 50 mm thick	91.53		SS1	
FILL Silty sand with gravel and asphalt fragments, brown, moist, (compact)	91.00	1	SS2	
HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist, (compact to very dense)	90.3		SS3	
	89.20	2	SS4	
Auger Refusal at 2.5 m Depth				



NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 50 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	1.5	
12/06/2023	1.4	
3/14/2024	1.3	
6/19/2024	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-11

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 13

Page. 1 of 2

Date Drilled: 'October 30, 2023

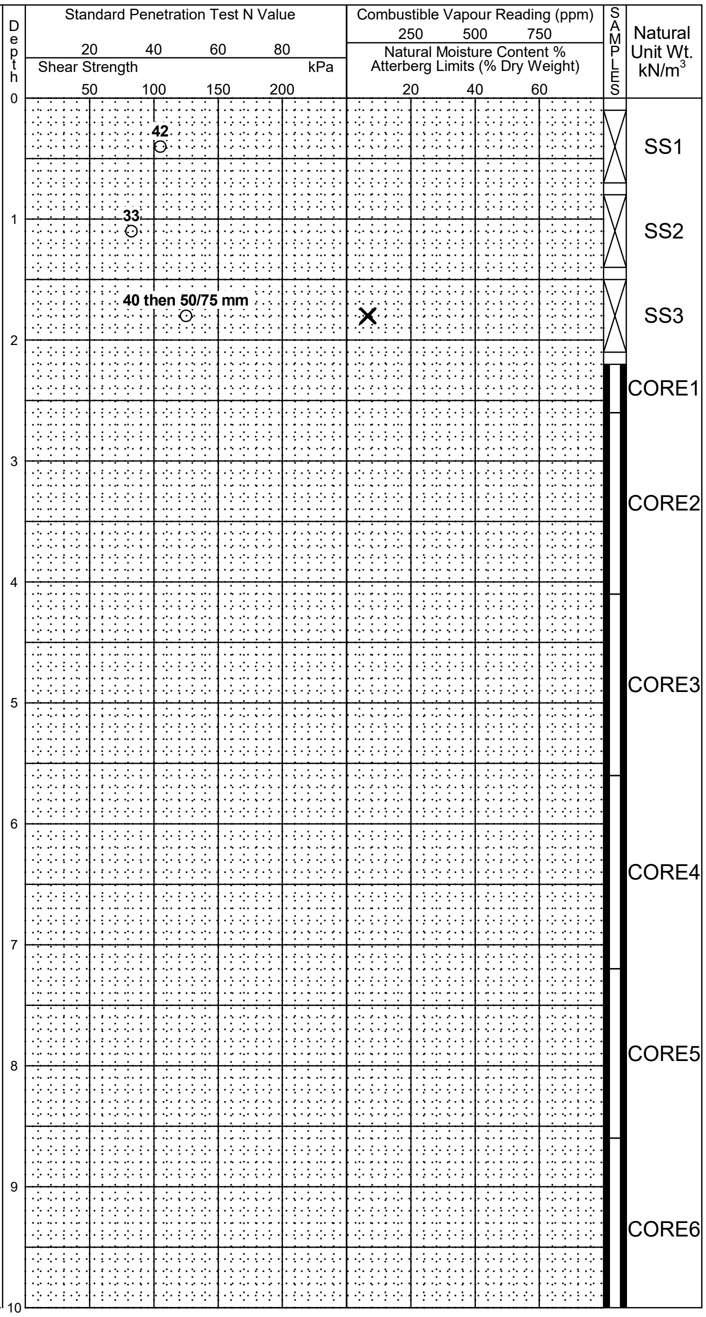
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

SOIL DESCRIPTION	Geodetic Elevation m
	90.4
ASPHALTIC CONCRETE ~ 90 mm thick	90.31
GRANULAR FILL Sand and crushed gravel, grey, moist	90.25 89.70
FILL Silty sand with gravel and shale fragments, brown, moist, (compact)	
HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist, (dense to very dense)	88.20
SHALE BEDROCK Black, Very Poor Rock Quality	87.80
SHALE BEDROCK Black, Fair to Excellent Rock Quality, Medium Strong to Strong	87.5



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NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.8	
12/06/2023	10.2	
3/14/2024	4.0	
6/19/2024	2.9	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.2 - 2.6	89	0
2	2.6 - 4.1	100	68
3	4.1 - 5.6	100	92
4	5.6 - 7.2	100	93
5	7.2 - 8.6	100	89
6	8.6 - 10.1	100	85
7	10.1 - 11.7	100	97
8	11.7 - 13.2	100	92
9	13.2 - 14.2	100	94

Log of Borehole BH-11

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 13

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation 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	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK Black, Fair to Excellent Rock Quality, Medium Strong to Strong *(continued)*	80.4	10				
				11				CORE7
				12				CORE8
				13				CORE9
			76.20	14				
		Borehole Terminated at 14.2 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.8	
12/06/2023	10.2	
3/14/2024	4.0	
6/19/2024	2.9	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.2 - 2.6	89	0
2	2.6 - 4.1	100	68
3	4.1 - 5.6	100	92
4	5.6 - 7.2	100	93
5	7.2 - 8.6	100	89
6	8.6 - 10.1	100	85
7	10.1 - 11.7	100	97
8	11.7 - 13.2	100	92
9	13.2 - 14.2	100	94

Log of Borehole BH-12

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 14

Page. 1 of 2

Date Drilled: 'November 1, 2023

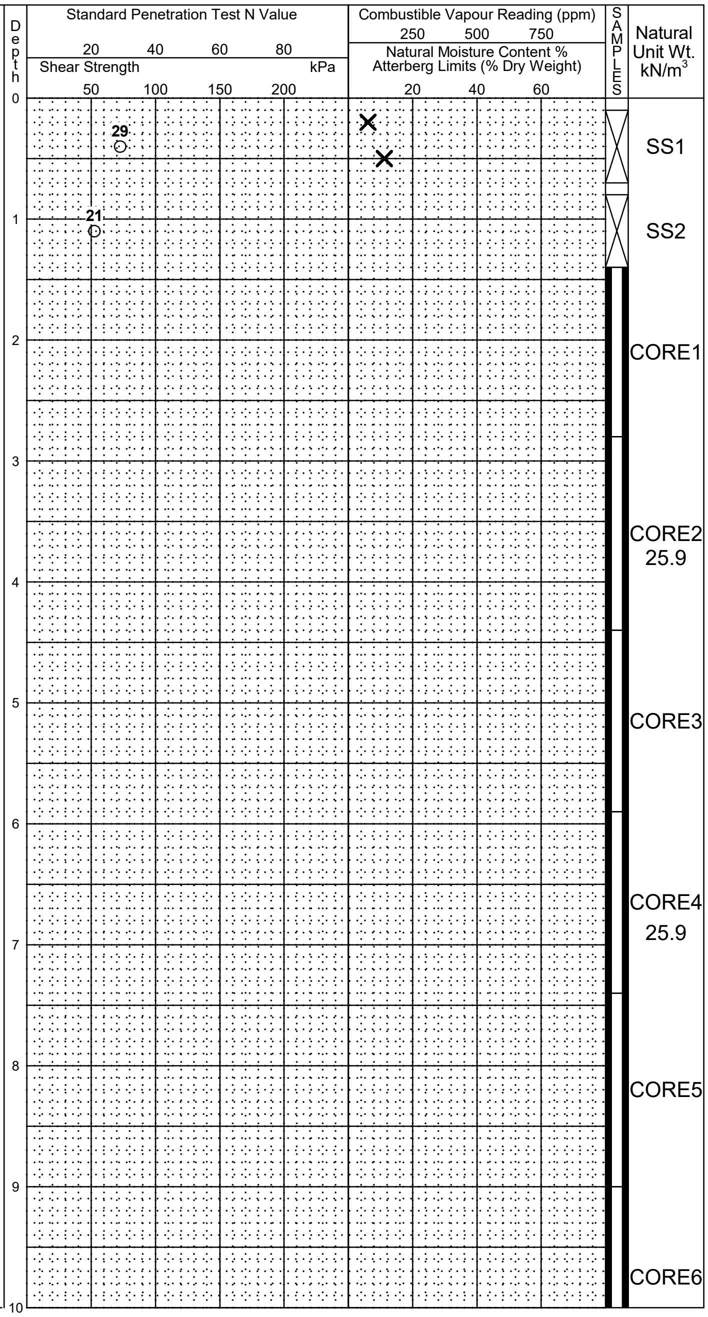
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

SOIL DESCRIPTION	Geodetic Elevation m
	91.6
ASPHALTIC CONCRETE - 90 mm thick	91.51
GRANULAR FILL Gravel with silt and sand, well graded, grey, moist	91.34
FILL Silty sand with gravel and shale fragments, brown, moist, (compact)	90.90
HIGHLY WEATHERED SHALE Silty sand and gravel, black, moist, (very dense)	90.20
SHALE BEDROCK Black, Very Poor Rock Quality	
SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong	88.80



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NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
12/06/2023	11.6	
3/14/2024	14.1	
6/19/2024	13.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.4 - 2.8	66	0
2	2.8 - 4.4	100	79
3	4.4 - 5.9	100	84
4	5.9 - 7.4	100	96
5	7.4 - 9	100	96
6	9 - 10.5	100	98
7	10.5 - 12	100	90
8	12 - 13.3	100	50
9	13.3 - 14	100	100

LOG OF BOREHOLE GINT LOGS 11.15.2023.GPJ TROW OTTAWA.GDT 9/10/24

Log of Borehole BH-12

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 14

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong *(continued)*	81.6	10				25.8
				11				CORE7
				12				CORE8 26.8
			77.9	13				CORE9
		Borehole Terminated at 14 m Depth	77.60	14				

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
12/06/2023	11.6	
3/14/2024	14.1	
6/19/2024	13.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.4 - 2.8	66	0
2	2.8 - 4.4	100	79
3	4.4 - 5.9	100	84
4	5.9 - 7.4	100	96
5	7.4 - 9	100	96
6	9 - 10.5	100	98
7	10.5 - 12	100	90
8	12 - 13.3	100	50
9	13.3 - 14	100	100

Log of Borehole BH-13

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 15

Page. 1 of 2

Date Drilled: 'November 3, 2023

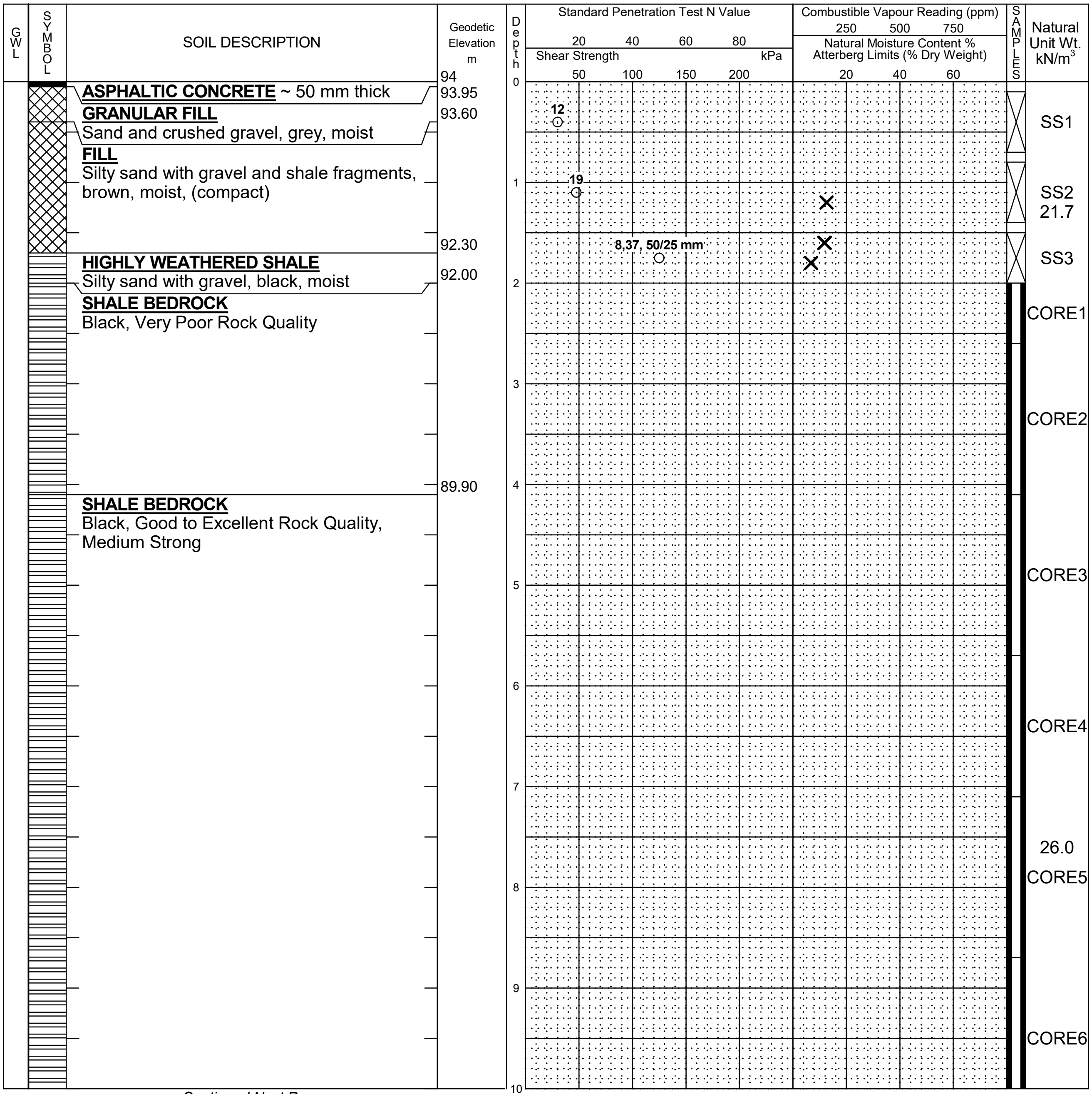
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

SOIL DESCRIPTION	Geodetic Elevation m
	94
ASPHALTIC CONCRETE ~ 50 mm thick	93.95
GRANULAR FILL Sand and crushed gravel, grey, moist	93.60
FILL Silty sand with gravel and shale fragments, brown, moist, (compact)	92.30
HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist	92.00
SHALE BEDROCK Black, Very Poor Rock Quality	89.90
SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong	



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NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2 - 2.6	77	0
2	2.6 - 4.1	100	7
3	4.1 - 5.7	100	95
4	5.7 - 7.1	100	95
5	7.1 - 8.7	100	100
6	8.7 - 10.3	100	91
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	90
9	13.3 - 14.2	100	101

Log of Borehole BH-13

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 15

Page. 2 of 2

G W L	S Y M B O L	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	S A M P L E S	Natural Unit Wt. kN/m³
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong *(continued)*	84	10				
				11				CORE7 26.0
				12				
				13				CORE8
				14				CORE9 25.9
			79.80					
		Borehole Terminated at 14.2 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2 - 2.6	77	0
2	2.6 - 4.1	100	7
3	4.1 - 5.7	100	95
4	5.7 - 7.1	100	95
5	7.1 - 8.7	100	100
6	8.7 - 10.3	100	91
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	90
9	13.3 - 14.2	100	101

Log of Borehole BH-14

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 16

Page. 1 of 2

Date Drilled: 'October 31, 2023

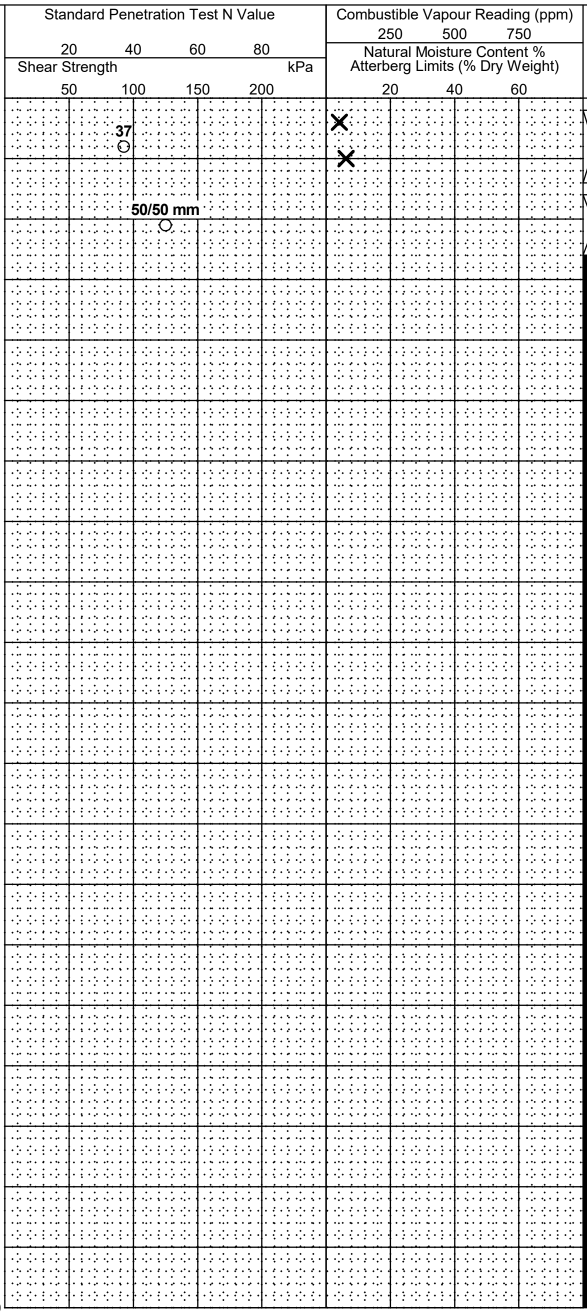
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m^3
			92.6	0		
		ASPHALTIC CONCRETE ~ 90 mm thick	92.51			
		GRANULAR FILL Sand and crushed gravel, grey, moist	92.23		SS1	
		FILL Silty sand with gravel and shale fragments and concrete fragments, brown, moist, (dense)	91.70	1	SS2	
		SHALE BEDROCK Black, Very Poor Rock Quality		2	CORE1	
		SHALE BEDROCK Black, Poor to Excellent Rock Quality, Weak to Medium Strong	90.00	3	CORE2	
				4		26.2
				5	CORE3	
				6	CORE4	26.2
				7		
				8	CORE5	
				9		
				10	CORE6	26.1



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NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.3 - 2.6	90	8
2	2.6 - 4.2	100	85
3	4.2 - 5.7	100	94
4	5.7 - 7.2	100	95
5	7.2 - 8.7	100	93
6	8.7 - 10.3	100	98
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	100
9	13.3 - 14.1	100	48

Log of Borehole BH-14

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 16

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
		SHALE BEDROCK Black, Poor to Excellent Rock Quality, Weak to Medium Strong *(continued)*	82.6	10				
				11				CORE7
				12				26.0 CORE8
				13				CORE9
			78.50	14				
		Borehole Terminated at 14.1 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.3 - 2.6	90	8
2	2.6 - 4.2	100	85
3	4.2 - 5.7	100	94
4	5.7 - 7.2	100	95
5	7.2 - 8.7	100	93
6	8.7 - 10.3	100	98
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	100
9	13.3 - 14.1	100	48

Log of Borehole BH-15

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 17

Page. 1 of 2

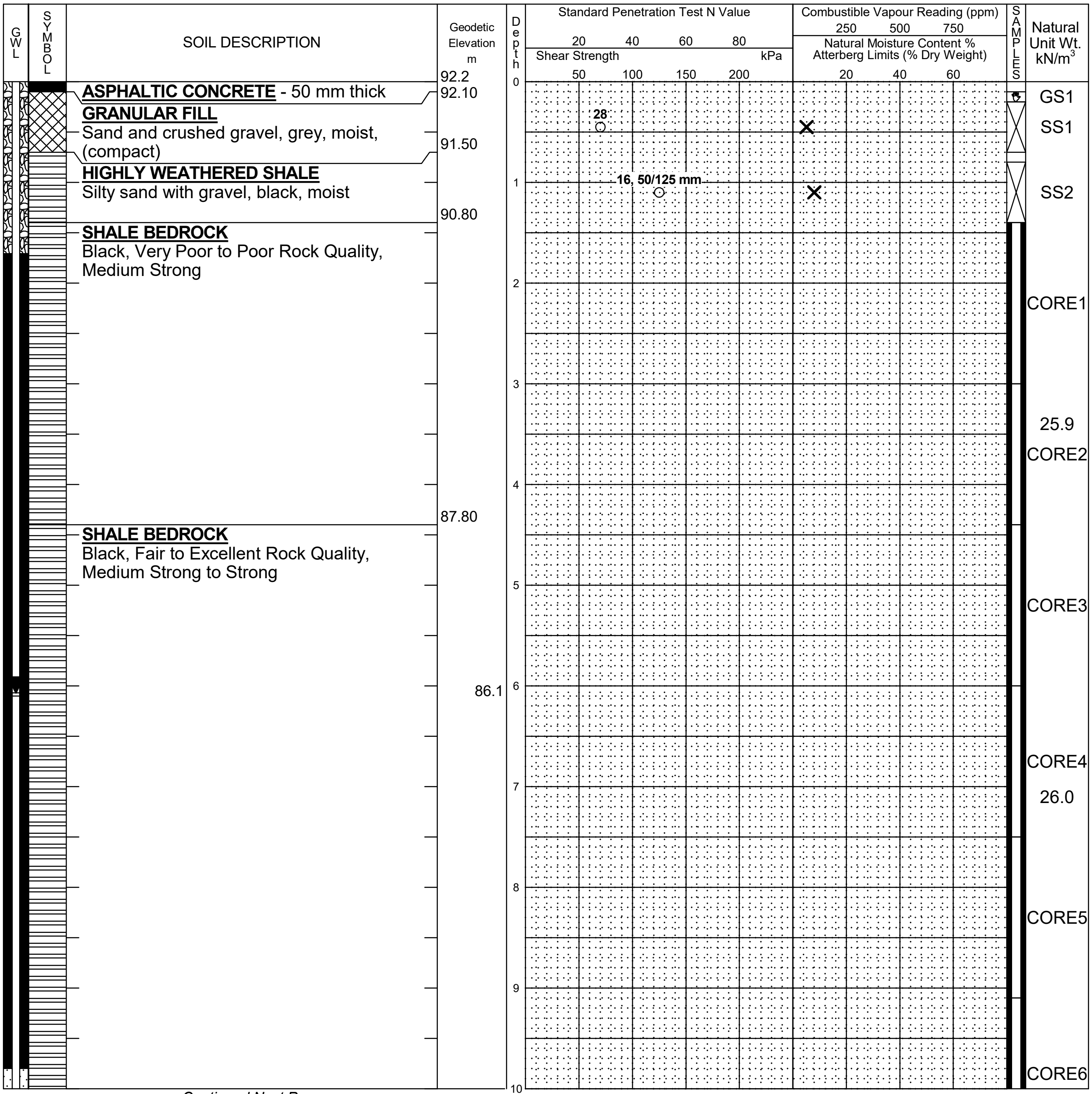
Date Drilled: 'November 1, 2023

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	──	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲



92.2

ASPHALTIC CONCRETE - 50 mm thick — 92.10

GRANULAR FILL
Sand and crushed gravel, grey, moist, (compact) — 91.50

HIGHLY WEATHERED SHALE
Silty sand with gravel, black, moist — 90.80

SHALE BEDROCK
Black, Very Poor to Poor Rock Quality, Medium Strong — 87.80

SHALE BEDROCK
Black, Fair to Excellent Rock Quality, Medium Strong to Strong

86.1

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.1	
12/06/2023	6.9	
3/14/2024	6.2	
6/19/2024	6.1	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.4 - 3	71	0
2	3 - 4.4	100	34
3	4.4 - 6	100	64
4	6 - 7.5	100	74
5	7.5 - 9.1	100	72
6	9.1 - 10.6	100	92
7	10.6 - 12.2	100	66
8	12.2 - 13.7	100	84

Log of Borehole BH-15

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 17

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation 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	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK Black, Fair to Excellent Rock Quality, Medium Strong to Strong *(continued)*	82.2	10				26.1
				11				CORE7
				12				
			78.50	13				26.1 CORE8
		Borehole Terminated at 13.7 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 31 mm monitoring well installed 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
11/23/2023	10.1	
12/06/2023	6.9	
3/14/2024	6.2	
6/19/2024	6.1	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.4 - 3	71	0
2	3 - 4.4	100	34
3	4.4 - 6	100	64
4	6 - 7.5	100	74
5	7.5 - 9.1	100	72
6	9.1 - 10.6	100	92
7	10.6 - 12.2	100	66
8	12.2 - 13.7	100	84

Log of Borehole BH-16

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 18

Page. 1 of 2

Date Drilled: 'November 2, 2023

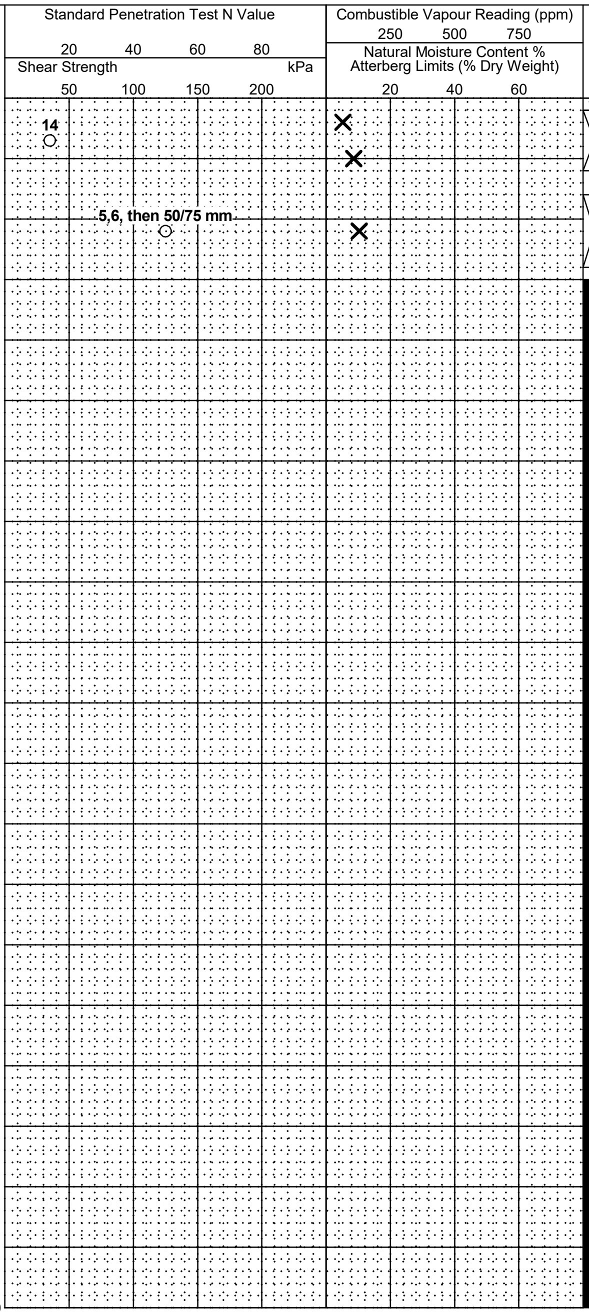
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	▥	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m³
			92.1	0		
		GRANULAR FILL Sand and crushed gravel, grey, moist	91.88		GS1	
		FILL Silty sand with gravel and wood/brick fragments, brown, moist, (compact)			SS1	22.9
		SHALE BEDROCK Black, Very Poor to Fair Rock Quality, Medium Strong	91.00	1	SS2	
				2	CORE1	
				3	CORE2	25.6
		SHALE BEDROCK Black, Excellent Rock Quality, Medium Strong	87.90	4		
				5	CORE3	
				6	CORE4	
				7		
				8	CORE5	26.0
				9		
				10	CORE6	



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NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.5 - 2.7	100	0
2	2.7 - 4.2	100	73
3	4.2 - 5.7	100	92
4	5.7 - 7.2	100	100
5	7.2 - 8.8	100	92
6	8.8 - 10.3	100	100
7	10.3 - 11.8	100	92
8	11.8 - 13.3	100	93
9	13.3 - 14.9	100	100

Log of Borehole BH-16

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 18

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK Black, Excellent Rock Quality, Medium Strong *(continued)*	82.1	10				
				11				CORE7 25.7
				12				CORE8
				13				
				14				CORE9 25.8
			77.20					

Borehole Terminated at 14.9 m Depth

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.5 - 2.7	100	0
2	2.7 - 4.2	100	73
3	4.2 - 5.7	100	92
4	5.7 - 7.2	100	100
5	7.2 - 8.8	100	92
6	8.8 - 10.3	100	100
7	10.3 - 11.8	100	92
8	11.8 - 13.3	100	93
9	13.3 - 14.9	100	100

Log of Borehole BH-17

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 19

Page. 1 of 2

Date Drilled: 'October 31, 2023

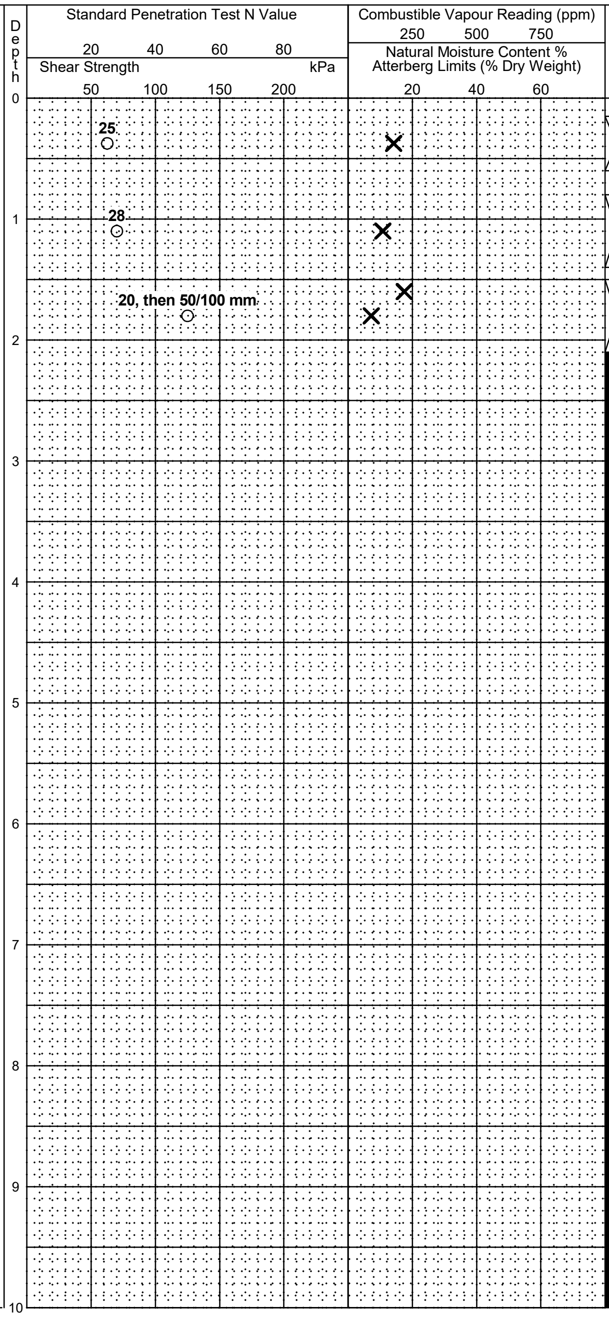
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	▥	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

Geodetic Elevation m	SOIL DESCRIPTION
92.4	
92.32	**ASPHALTIC CONCRETE** ~ 80 mm thick
92.04	**GRANULAR FILL** Gravel with silt and sand, poorly graded, grey, moist
91.70	**FILL** Silty sand with gravel, brown, moist
	HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist, (very dense)
90.30	**SHALE BEDROCK** Black, Very Poor to Fair Rock Quality, Medium Strong
88.20	**SHALE BEDROCK** Black, Good to Excellent Rock Quality, Strong



SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	22.0
CORE1	
CORE2	25.9
CORE3	
CORE4	26.5
CORE5	
CORE6	

Continued Next Page

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.1 - 2.6	81	0
2	2.6 - 4.2	100	73
3	4.2 - 5.7	100	93
4	5.7 - 7.2	100	100
5	7.2 - 8.7	100	83
6	8.7 - 10.3	100	100
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	95
9	13.3 - 14.8	100	27

Log of Borehole BH-17

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 19

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
			82.4	10				
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Strong *(continued)*		11 12 13				CORE7 CORE8 26.1
		SHALE BEDROCK Black, Poor Rock Quality	79.10	14				CORE9
		Borehole Terminated at 14.8 m Depth	77.60					

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	2.1 - 2.6	81	0
2	2.6 - 4.2	100	73
3	4.2 - 5.7	100	93
4	5.7 - 7.2	100	100
5	7.2 - 8.7	100	83
6	8.7 - 10.3	100	100
7	10.3 - 11.8	100	100
8	11.8 - 13.3	100	95
9	13.3 - 14.8	100	27

Log of Borehole BH-18

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 20

Page. 1 of 2

Date Drilled: 'November 2, 2023

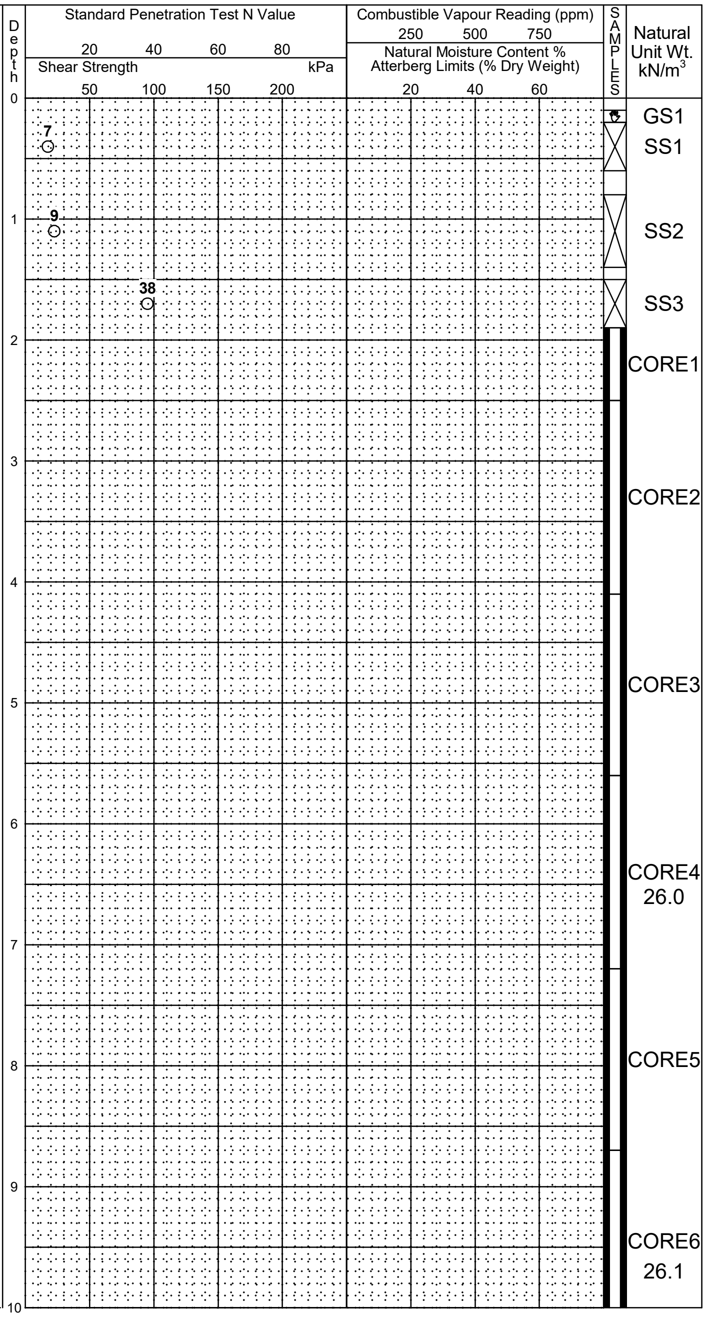
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample	☒	Combustible Vapour Reading	□
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m
			91.3
		ASPHALTIC CONCRETE - 100 mm thick	91.20
		GRANULAR FILL Sand with silt and gravel, well graded, grey, moist	90.94
		FILL Silty sand with gravel, brown, moist, (loose)	
			89.50
		HIGHLY WEATHERED SHALE Silty sand with gravel, black, moist, (very dense)	89.40
		SHALE BEDROCK Black, Very Poor to Fair Rock Quality	
			87.20
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong	



SAMPLES	Natural Unit Wt. kN/m^3
GS1	
SS1	
SS2	
SS3	
CORE1	
CORE2	
CORE3	
CORE4	26.0
CORE5	
CORE6	26.1

Continued Next Page

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.9 - 2.5	77	0
2	2.5 - 4.1	100	68
3	4.1 - 5.6	100	81
4	5.6 - 7.2	100	90
5	7.2 - 8.7	100	90
6	8.7 - 10.2	100	95
7	10.2 - 11.8	100	100
8	11.8 - 13.3	100	100
9	13.3 - 14.7	100	100

Log of Borehole BH-18

Project No: OTT-23008400-B0

Project: Geotechnical Investigation - Walkley Centre Development

Figure No. 20

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
		SHALE BEDROCK Black, Good to Excellent Rock Quality, Medium Strong *(continued)*	81.3	10				
				11				CORE7
				12				
				13				CORE8 25.9
				14				CORE9
		Borehole Terminated at 14.7 m Depth	76.60					

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled with soil cuttings 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-23008400-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.9 - 2.5	77	0
2	2.5 - 4.1	100	68
3	4.1 - 5.6	100	81
4	5.6 - 7.2	100	90
5	7.2 - 8.7	100	90
6	8.7 - 10.2	100	95
7	10.2 - 11.8	100	100
8	11.8 - 13.3	100	100
9	13.3 - 14.7	100	100

Log of Probehole PH-1

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 21

Page. 1 of 1

Date Drilled: 'June 17, 2024

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
	■	**ASPHALTIC CONCRETE** ~ 80 mm thick	92.19 92.1	0				
	▨	**GRANULAR FILL** Sand and crushed gravel, grey, moist	91.5					
	▨	**OVERBURDEN** Not Sampled	90.1	1 2				
	☰	**HIGHLY WEATHERED SHALE** Black	86.2	3 4 5 6				
		Auger Refusal at 6.0 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Probehole PH-2

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 22

Page. 1 of 1

Date Drilled: 'June 17, 2024

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◫	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
			93.59	0				
	■	**ASPHALTIC CONCRETE** ~ 150 mm thick	93.4					
	▨	**GRANULAR FILL** Sand and crushed gravel, grey, moist	92.8					
	▨	**OVERBURDEN** Not Sampled	91.5	1				
	☰	**HIGHLY WEATHERED SHALE** Black	89.8	2 3				
		Auger Refusal at 3.8 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Probehole PH-3

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 23

Page. 1 of 1

Date Drilled: 'June 17, 2024

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20, 40, 60, 80) Shear Strength kPa (50, 100, 150, 200)	Combustible Vapour Reading (ppm) (250, 500, 750) Natural Moisture Content % Atterberg Limits (% Dry Weight) (20, 40, 60)	SAMPLES	Natural Unit Wt. kN/m³
			92.12	0				
		ASPHALTIC CONCRETE ~ 120 mm thick	92.0					
		GRANULAR FILL Sand and crushed gravel, grey, moist	91.4					
		OVERBURDEN Not Sampled	90.9	1				
		HIGHLY WEATHERED SHALE Black	86.9	2 3 4 5				
		Auger Refusal at 5.2 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Probehole PH-4

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 24

Page. 1 of 1

Date Drilled: 'June 17, 2024

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◧	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
			92.47	0				
		ASPHALTIC CONCRETE ~ 90 mm thick	92.4					
		GRANULAR FILL Sand and crushed gravel, grey, moist	91.7					
		OVERBURDEN Not Sampled	91.0	1				
		HIGHLY WEATHERED SHALE Black	87.6	2 3 4				
		Auger Refusal at 4.9 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Probehole **PH-5**

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 25

Page. 1 of 1

Date Drilled: 'June 17, 2024

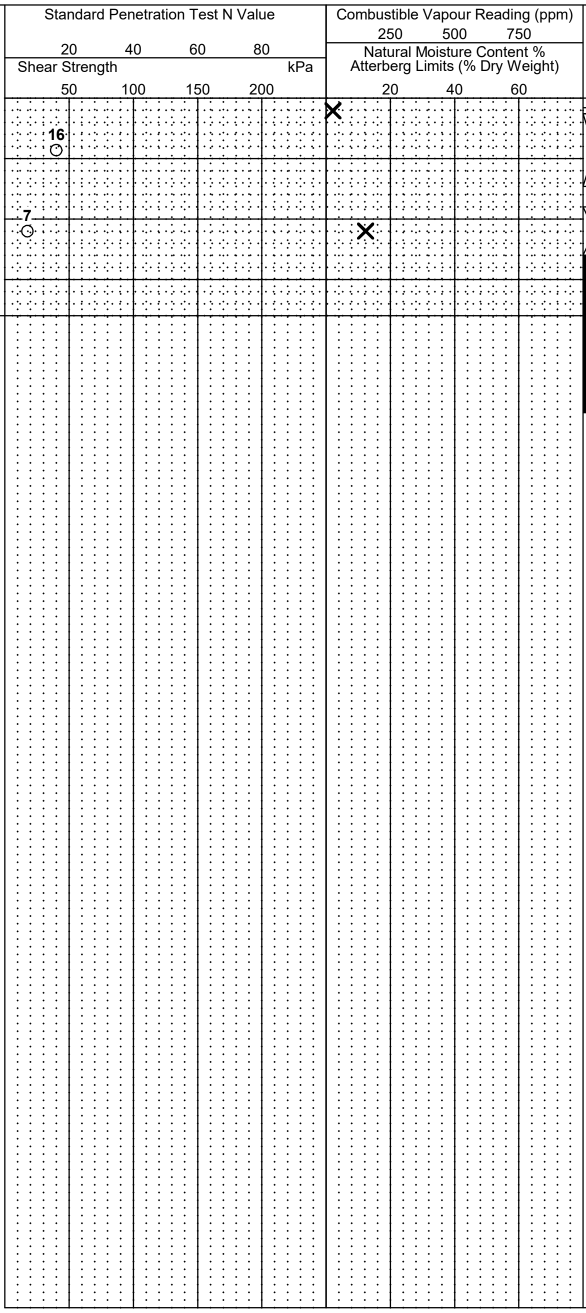
Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	SAMPLES	Natural Unit Wt. kN/m^3
			92.49	0		
		ASPHALTIC CONCRETE ~ 80 mm thick	92.4			GS1
		GRANULAR FILL Sand and crushed gravel, grey, moist	91.8		☒	SS1
		OVERBURDEN Not Sampled	90.7	1	☒	SS2
		Auger Refusal at 1.8 m Depth				CORE1



NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.3 - 2.6	100	0

Log of Probehole PH-6

Project No: OTT-23002538-B0

Project: Geotechnical Investigation - Walkley Centre Development

Location: 1822-1846 Bank Street, Ottawa, Ontario

Figure No. 26

Page. 1 of 1

Date Drilled: 'June 17, 2024

Drill Type: CME-55 Truck-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	✕
SPT (N) Value	○	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m^3
			92.26	0				
		ASPHALTIC CONCRETE ~ 90 mm thick	92.2					
		GRANULAR FILL Sand and crushed gravel, grey, moist	92.0					
		OVERBURDEN Not Sampled		1				
			90.6					
		Auger Refusal at 1.7 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled 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-23002538-B0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

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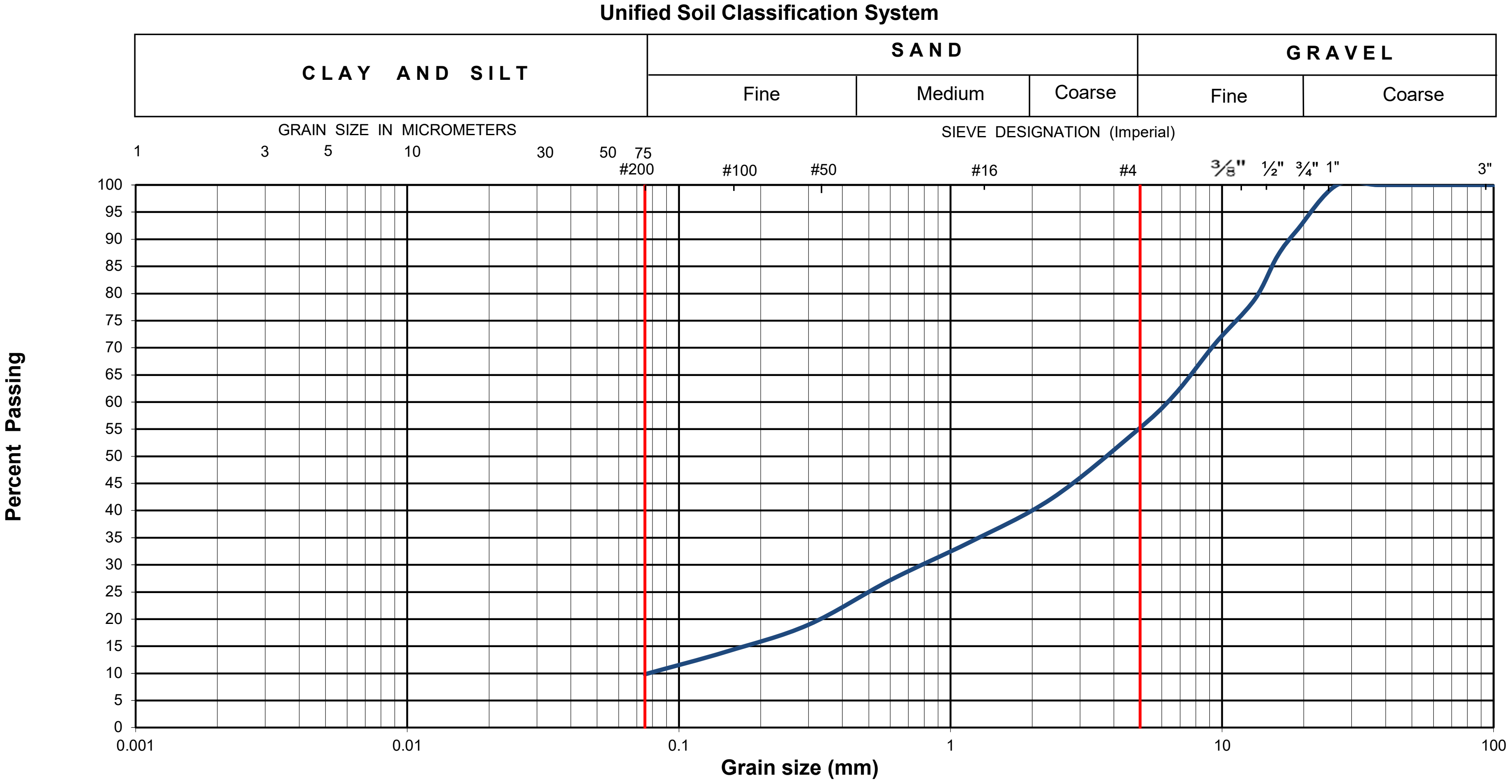
Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136



EXP Project No.:	**OTT-23002538-A0**	**Project Name :**	**Geotechnical Investigation - Walkey Centre Redevelopment**				
Client :	**Sun Life Assurance Company**	**Project Location :**	**1822-1846 Bank Street**				
Date Sampled :	**November 1, 2023**	**Borehole No:**	**BH12**	**Sample:**	**GS1**	**Depth (m) :**	**0.1-0.2**
Sample Composition :		**Gravel (%)**	**46**	**Sand (%)**	**44**	**Silt & Clay (%)**	**10**
Sample Description :	**FILL: Well Graded Gravel with Silt & Sand (GW-GM)**					**Figure :**	**27**

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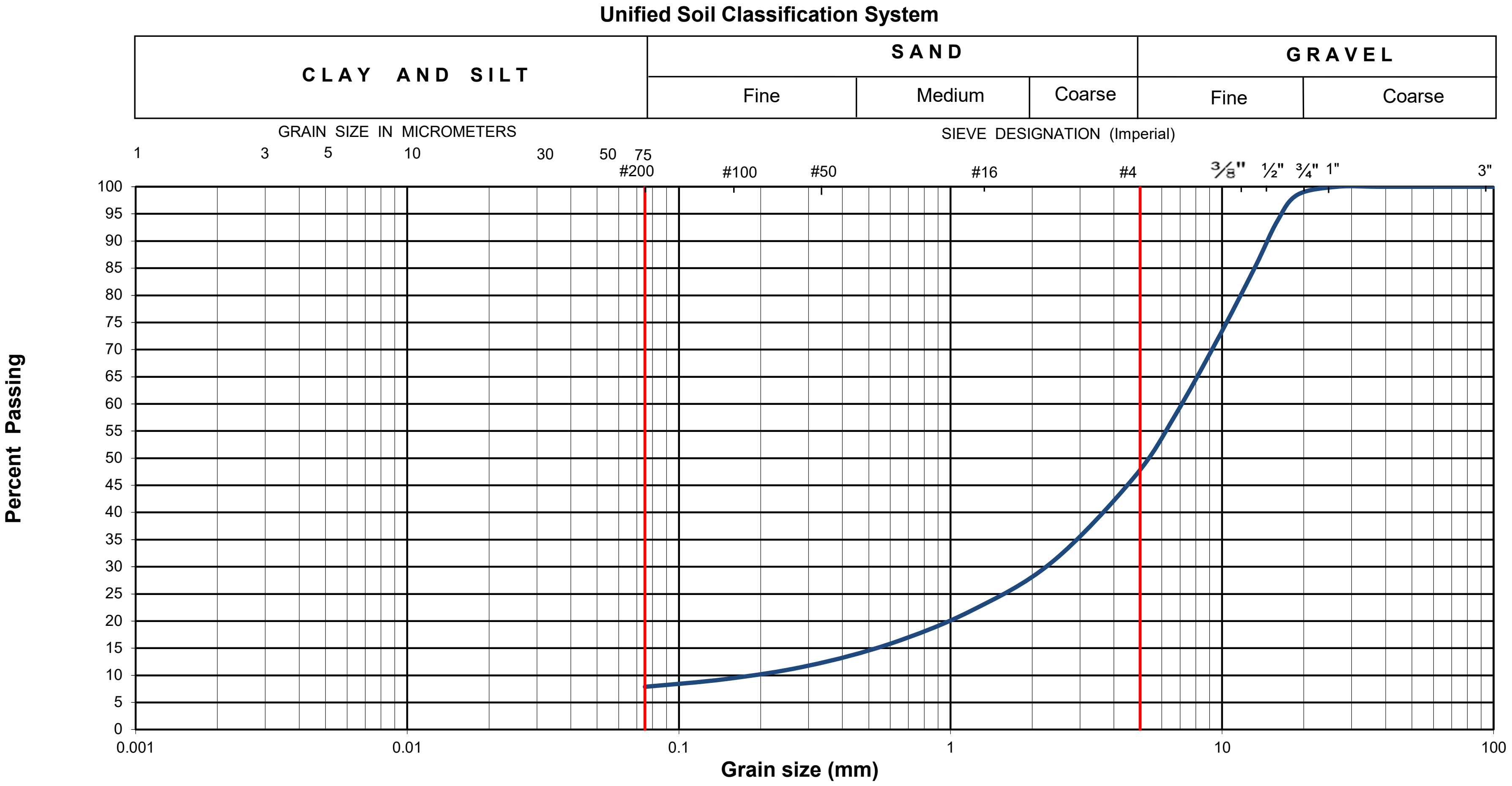
Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136



EXP Project No.:	OTT-23002538-A0	**Project Name :**	Geotechnical Investigation - Walkey Centre Redevelopment				
Client :	Sun Life Assurance Company	**Project Location :**	1822-1846 Bank Street				
Date Sampled :	October 31, 2023	**Borehole No:**	BH17	**Sample:**	GS1	**Depth (m) :**	0.1-0.2
Sample Composition :		**Gravel (%)** 54	**Sand (%)** 38	**Silt & Clay (%)** 8		**Figure :**	28
Sample Description :	FILL: Poorly Graded Gravel with Silt and Sand (GP-GM)						

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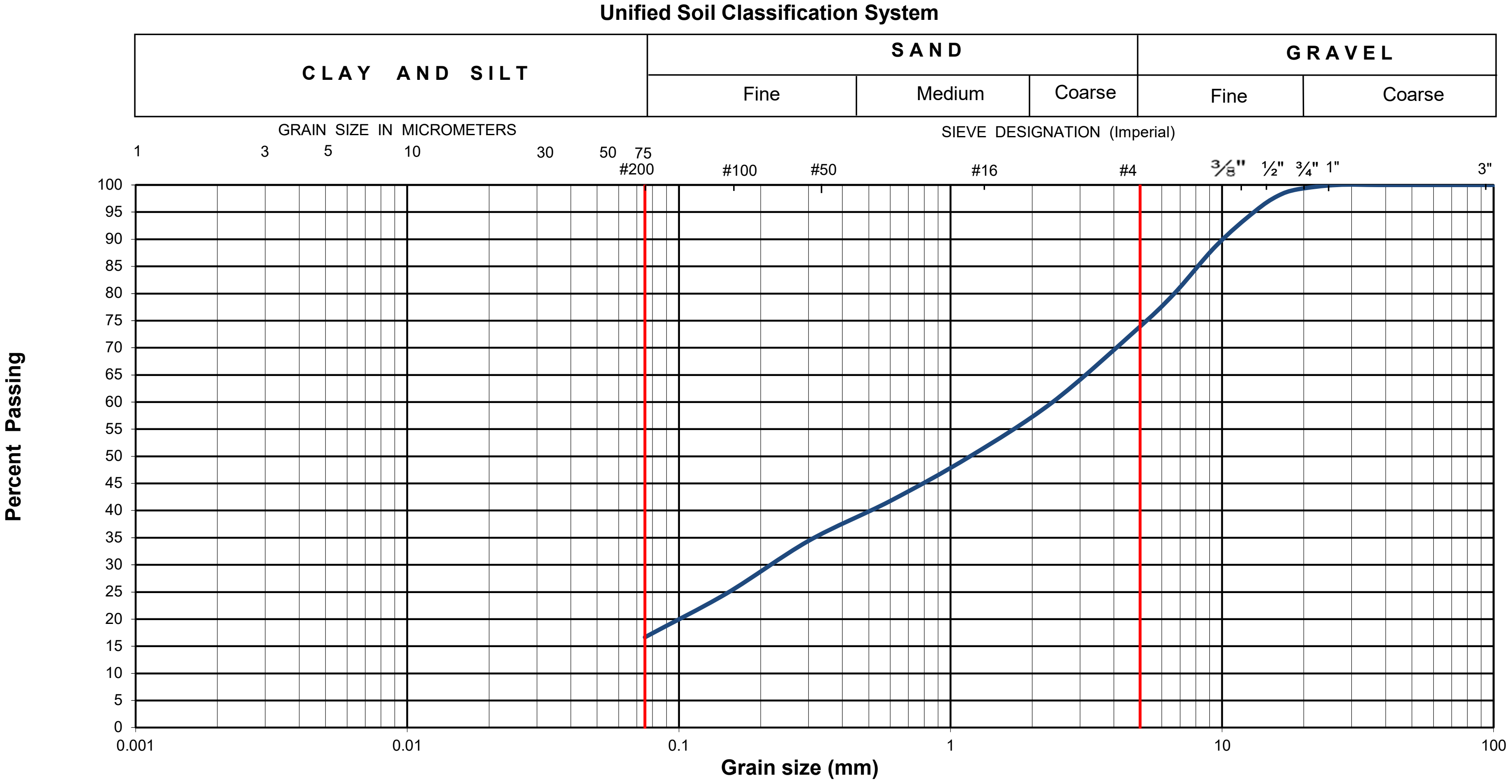
Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136



EXP Project No.:	**OTT-23002538-A0**	**Project Name :**	**Geotechnical Investigation - Walkey Centre Redevelopment**				
Client :	**Sun Life Assurance Company**	**Project Location :**	**1822-1846 Bank Street**				
Date Sampled :	**November 2, 2023**	**Borehole No:**	**BH18**	**Sample:**	**GS1**	**Depth (m) :**	**0.1-0.2**
Sample Composition :		**Gravel (%)**	**27**	**Sand (%)**	**56**	**Silt & Clay (%)**	**17**
Sample Description :	**FILL: Well Graded Sand with Silt and Gravel (GW-GM)**					**Figure :**	**29**

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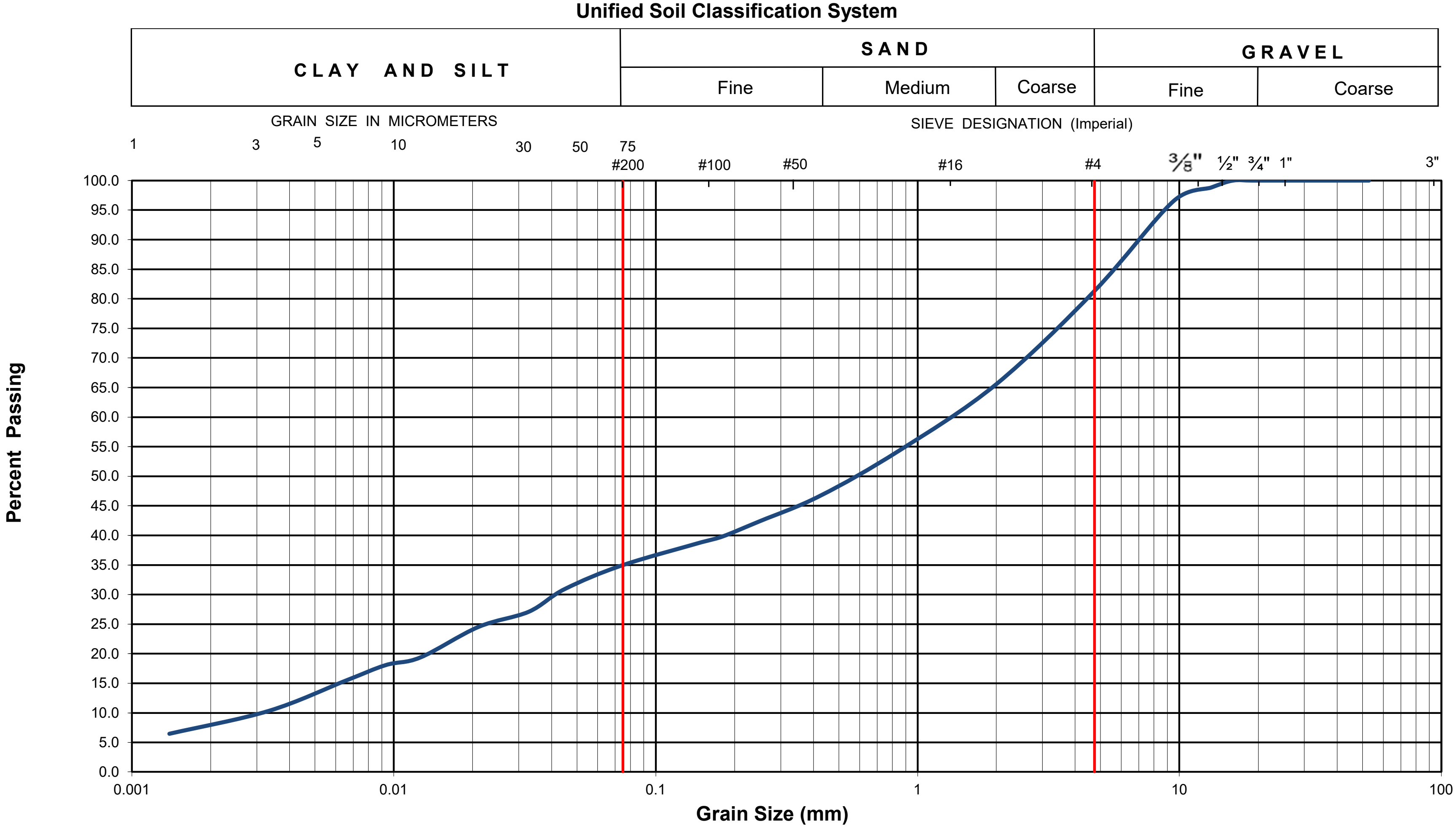
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	OTT-23002538-A0	**Project Name :**	Geotechnical Investigation - Walkley Centre Re-development					
Client :	Sun Life Assurance Company of Canada	**Project Location :**	1840-1846 Walkley Road, Ottawa					
Date Sampled :	October 26, 2023	**Borehole No:**	BH1	**Sample No.:**	SS3		**Depth (m) :**	1.5-2.1
Sample Description :		**% Silt and Clay**	35	**% Sand**	46	**% Gravel** 19	**Figure :**	30
Sample Description :	Silty Sand and Gravel (SM)							

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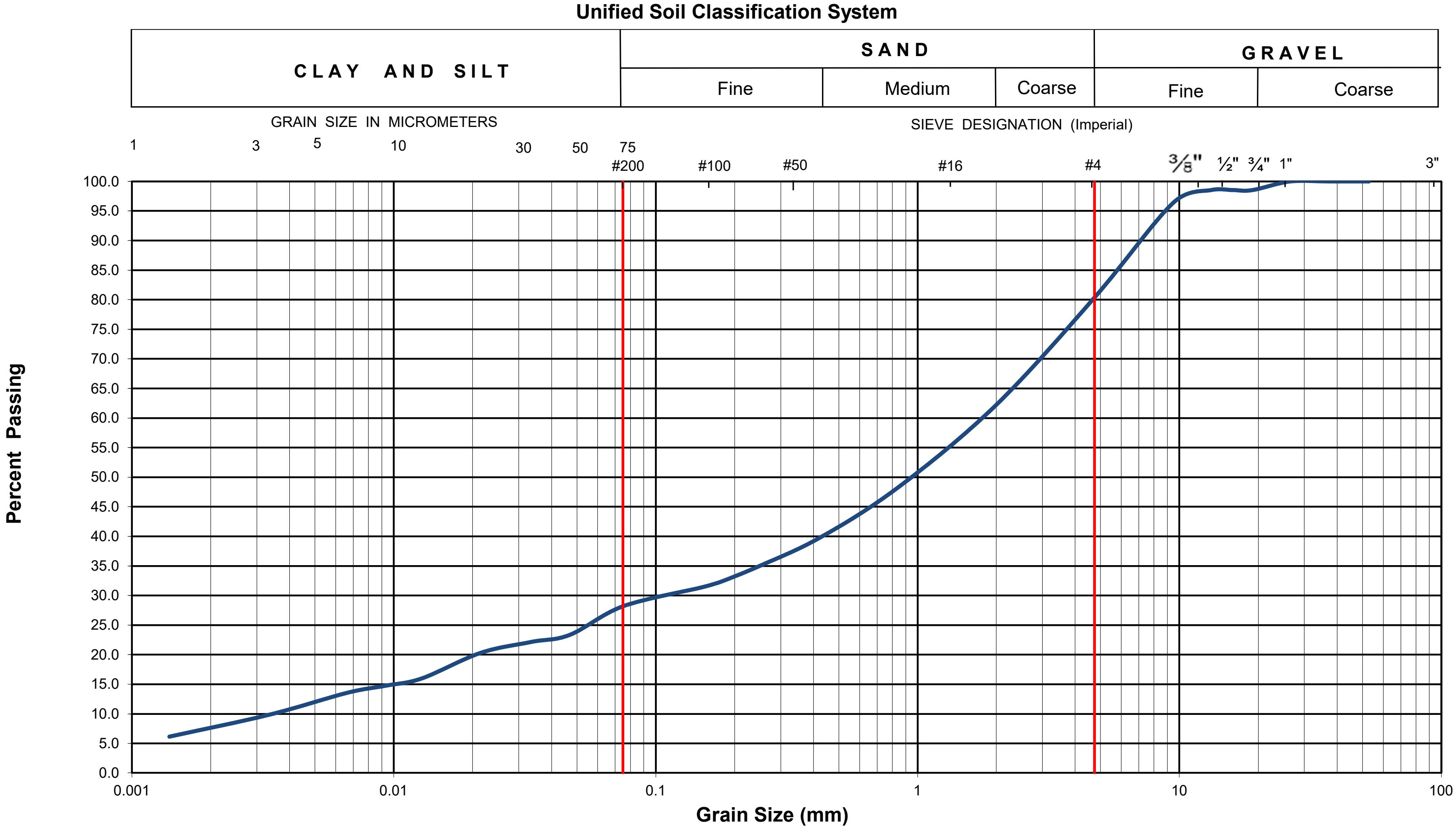
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.: OTT-23002538-A0	**Project Name :** Geotechnical Investigation - Walkley Centre Re-development					
Client : Sun Life Assurance Company of Canada	**Project Location :** 1840-1846 Walkley Road, Ottawa					
Date Sampled : October 26, 2023	**Borehole No:** BH10		**Sample No.:** SS3		**Depth (m) :** 1.5-2.1	
Sample Description :	**% Silt and Clay**	28	**% Sand**	52	**% Gravel** 20	**Figure :** 31
Sample Description : Silty Sand and Gravel (SM)						

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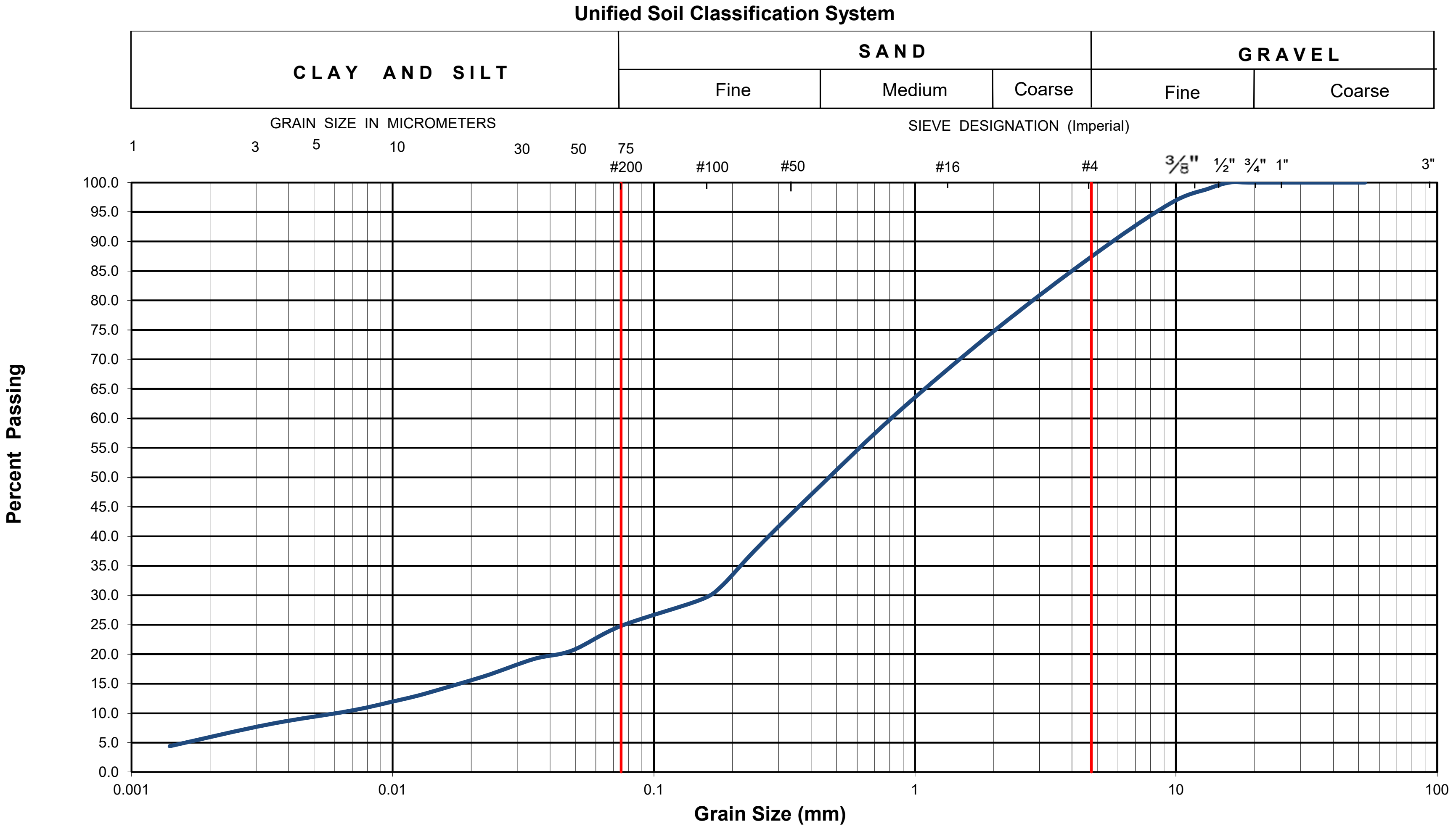
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	OTT-23002538-A0	**Project Name :**	Geotechnical Investigation - Walkley Centre Re-development				
Client :	Sun Life Assurance Company of Canada	**Project Location :**	1840-1846 Walkley Road, Ottawa				
Date Sampled :	November 1, 2023	**Borehole No:**	BH12	**Sample No.:**	SS2	**Depth (m) :**	0.8-1.4
Sample Description :		**% Silt and Clay** 25	**% Sand** 62	**% Gravel**	13	**Figure :**	32
Sample Description :	Silty Sand (SM)						

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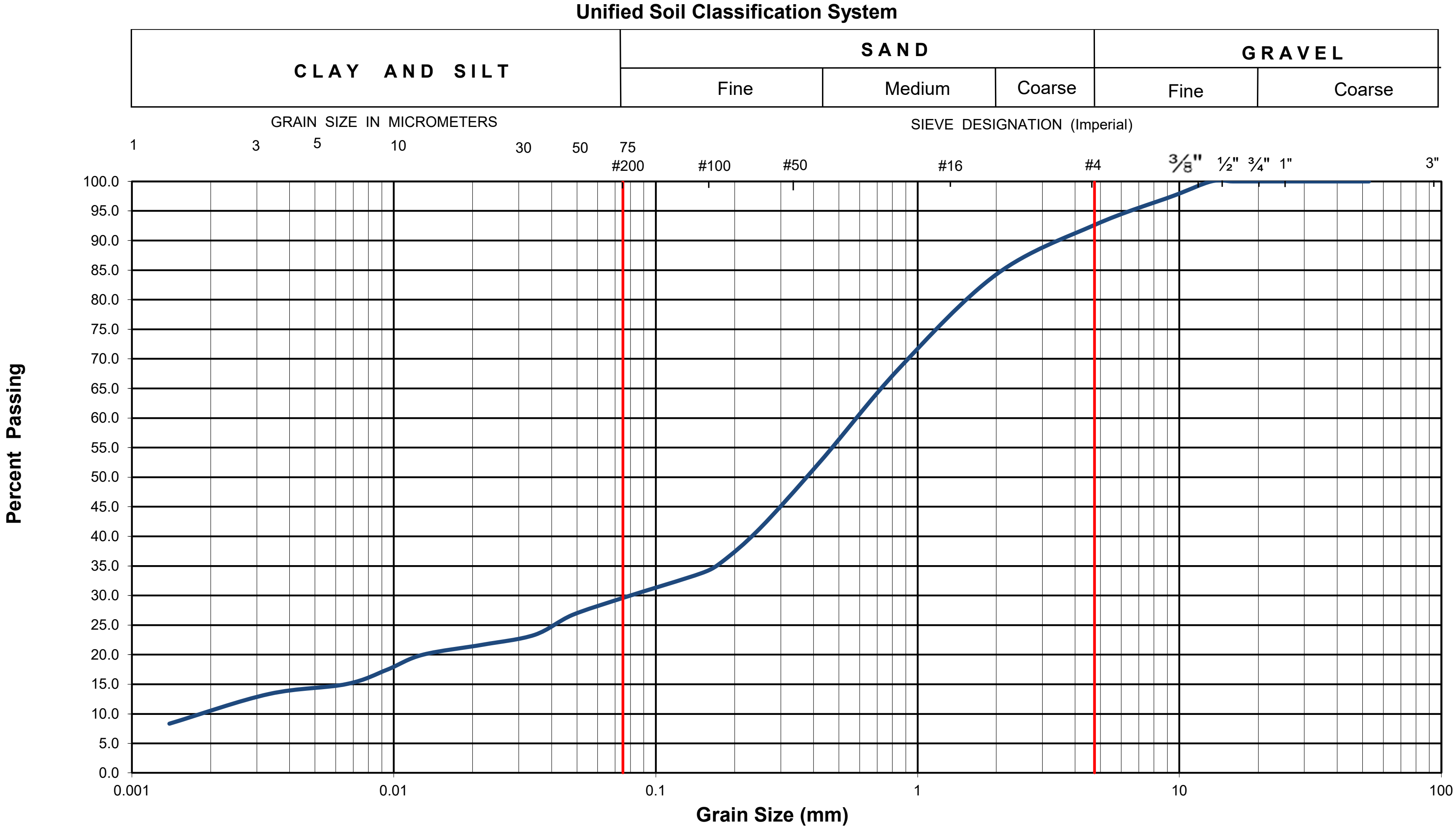
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	OTT-23002538-A0	**Project Name :**	Geotechnical Investigation - Walkley Centre Re-development				
Client :	Sun Life Assurance Company of Canada	**Project Location :**	1840-1846 Walkley Road, Ottawa				
Date Sampled :	November 3, 2023	**Borehole No:**	BH13	**Sample No.:**	SS2	**Depth (m) :**	0.8-1.4
Sample Description :		**% Silt and Clay**	30	**% Sand** 63	**% Gravel** 7	**Figure :**	33
Sample Description :	Silty Sand (SM)						

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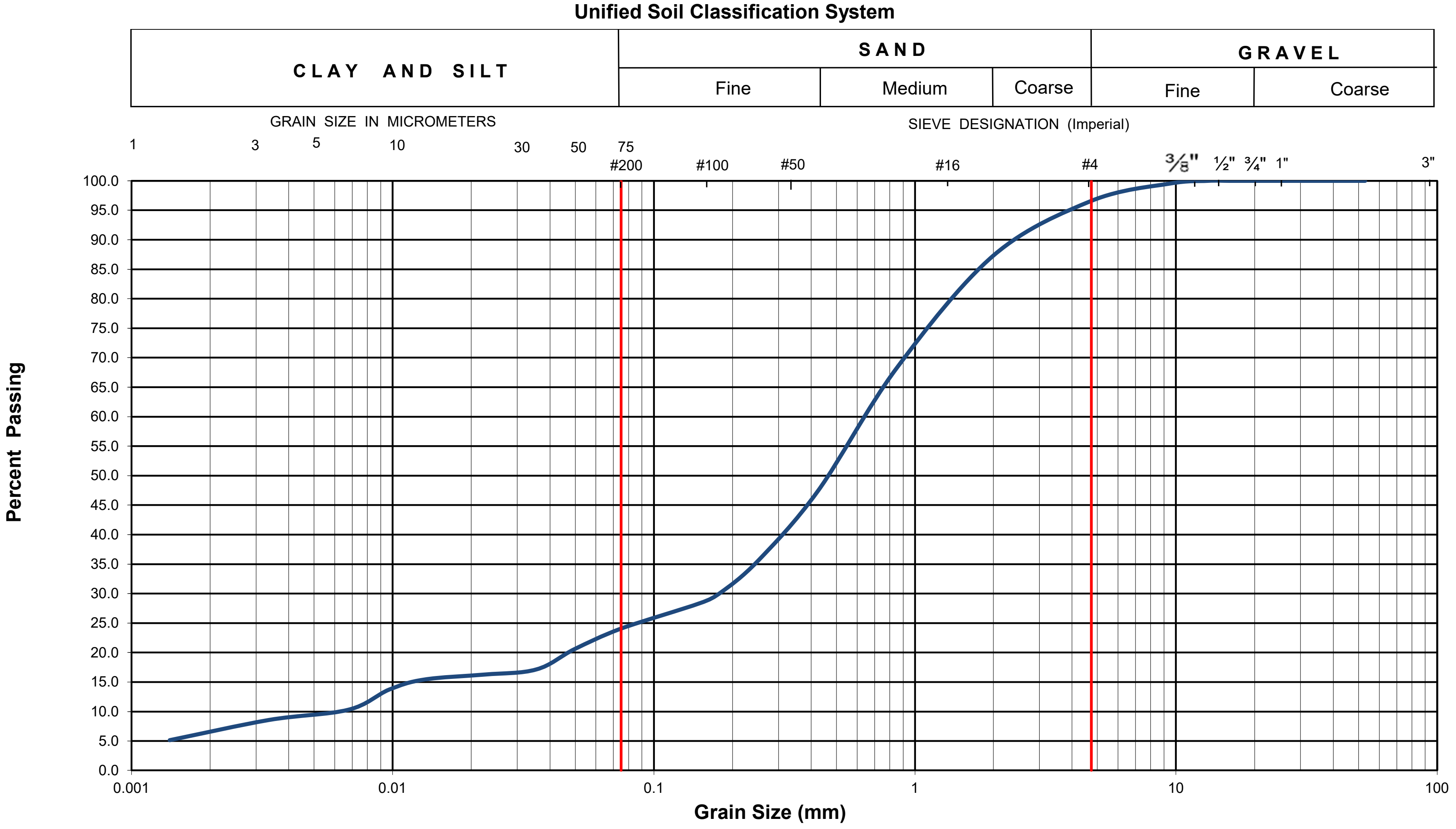
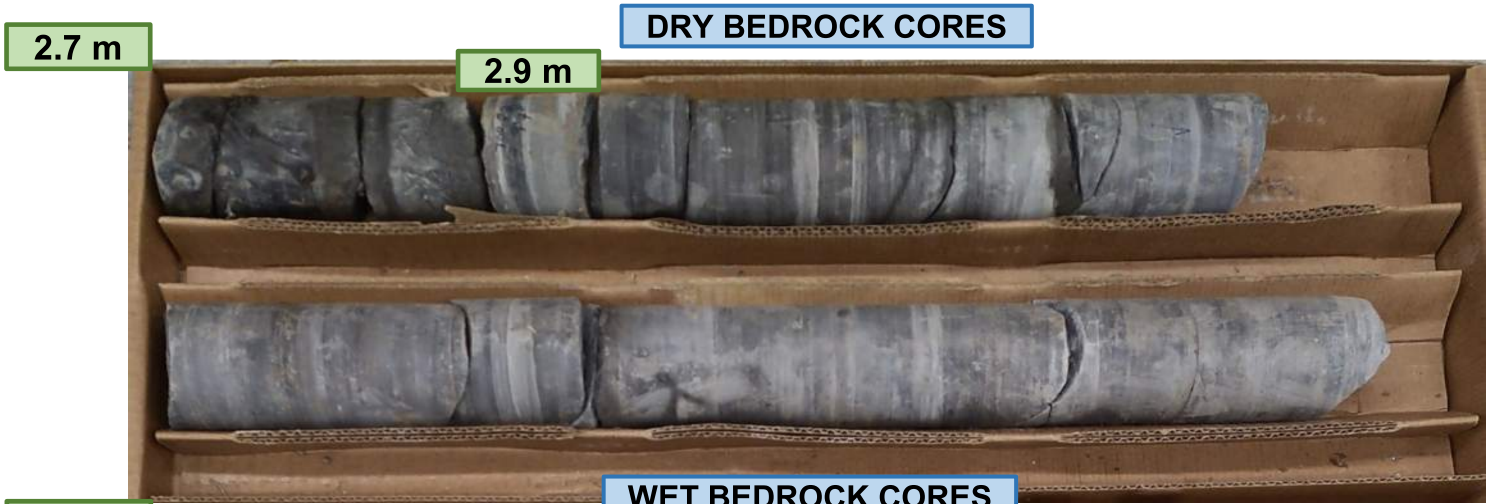
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-23002538-A0**	**Project Name :**	**Geotechnical Investigation - Walkley Centre Re-development**						
Client :	**Sun Life Assurance Company of Canada**	**Project Location :**	**1840-1846 Walkley Road, Ottawa**						
Date Sampled :	**November 2, 2023**	**Borehole No:**	**BH18**	**Sample No.:**	**SS2**			**Depth (m) :**	**0.8-1.4**
Sample Description :		**% Silt and Clay**	**24**	**% Sand**	**73**	**% Gravel**	**3**	**Figure :**	**34**
Sample Description :	**Silty Sand (SM)**								

Appendix A – Rock Core Photographs



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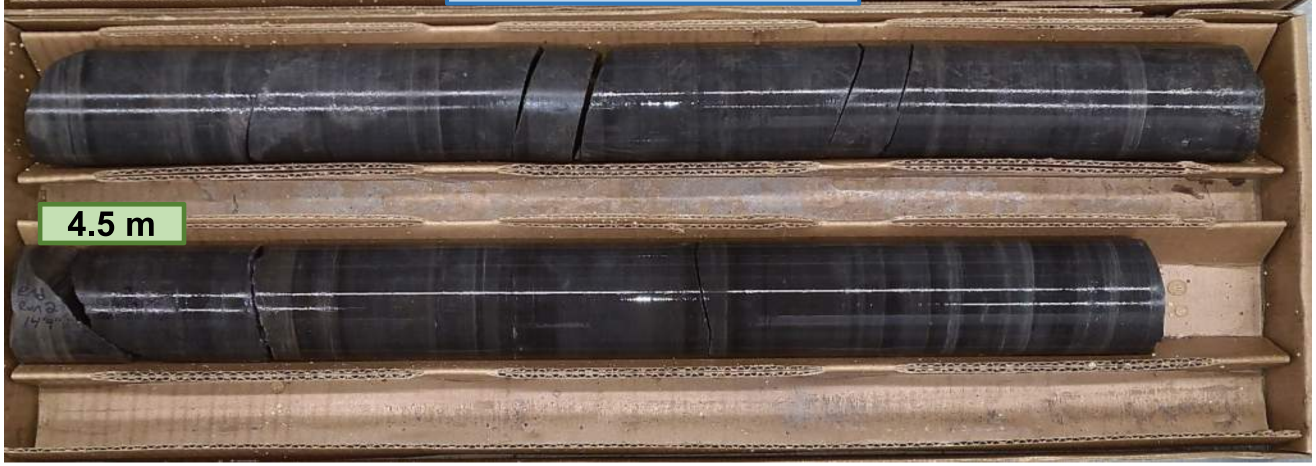
Borehole No: **BH01**	Core Runs Run 1: 2.7 m to 2.9 m Run 2: 2.9 m to 4.5 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/26/2023		Rock Core Photographs	A-1

DRY BEDROCK CORES

WET BEDROCK CORES



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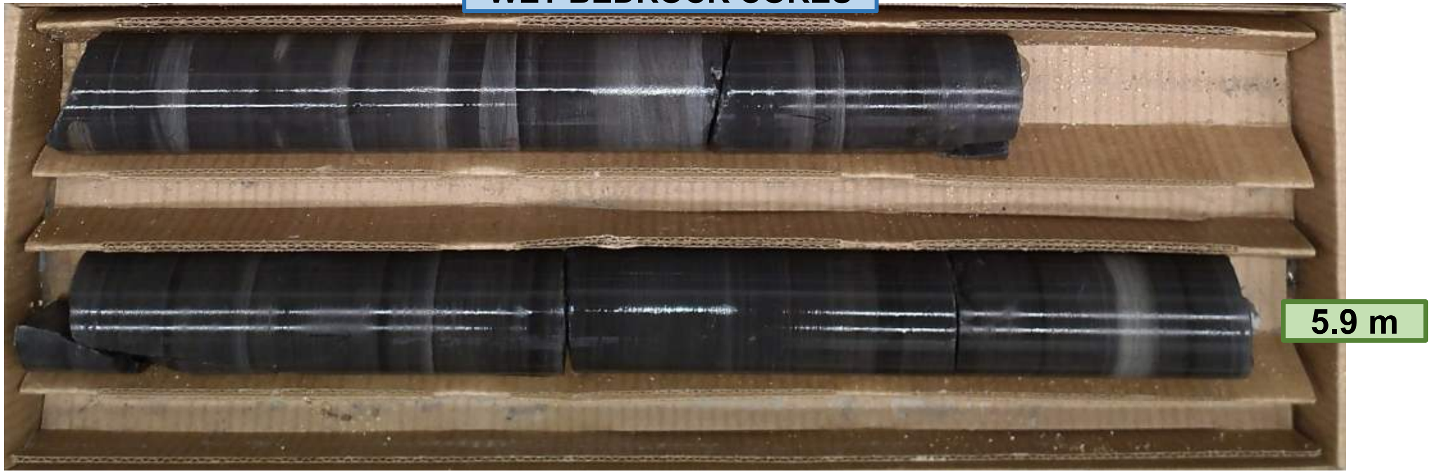
Borehole No: **BH01**	Core Runs Run 2: 2.9 m to 4.5 m Run 3: 4.5 m to 5.9 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/26/2023		Rock Core Photographs	A-2

DRY BEDROCK CORES

WET BEDROCK CORES



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Borehole No:
BH01

Core Runs
Run 2: 2.9 m to 4.5 m
Run 3: 4.5 m to 5.9 m

project
Geotechnical Investigation - Walkley Centre Development

Project N0:
OTT-23008400-A0

Date Cored
10/26/2023

Rock Core Photographs

A-3

DRY BEDROCK CORES

WET BEDROCK CORES

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Borehole No:
BH02

Core Runs
Run 1: 2.7 m to 4.2 m
Run 2: 4.2 m to 5.6 m

project
Geotechnical Investigation - Walkley Centre Development

Project N0:
OTT-23008400-A0

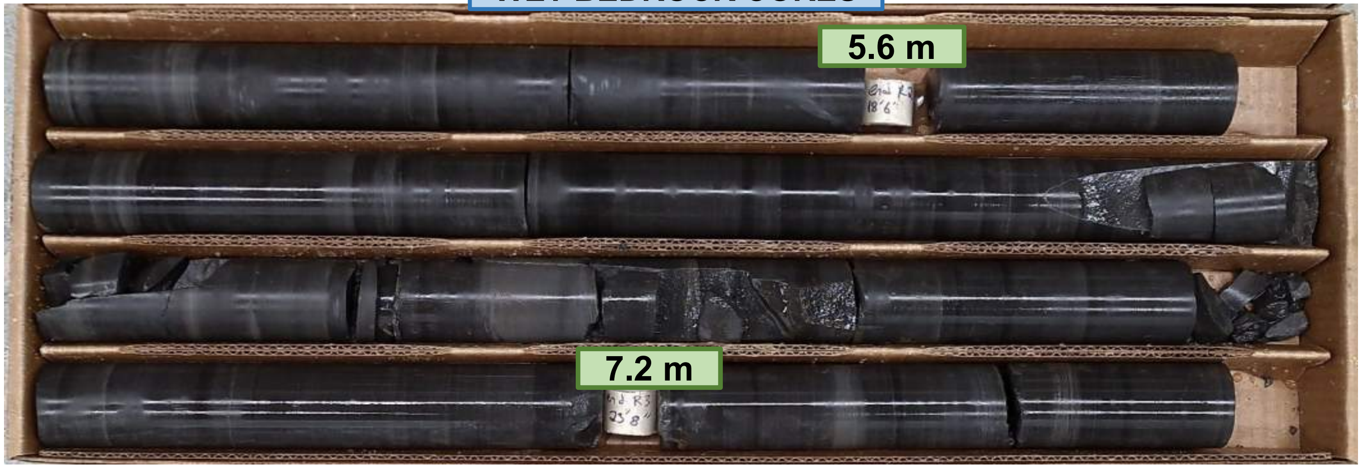
Date Cored
10/30/2023

Rock Core Photographs

A-4

DRY BEDROCK CORES

WET BEDROCK CORES



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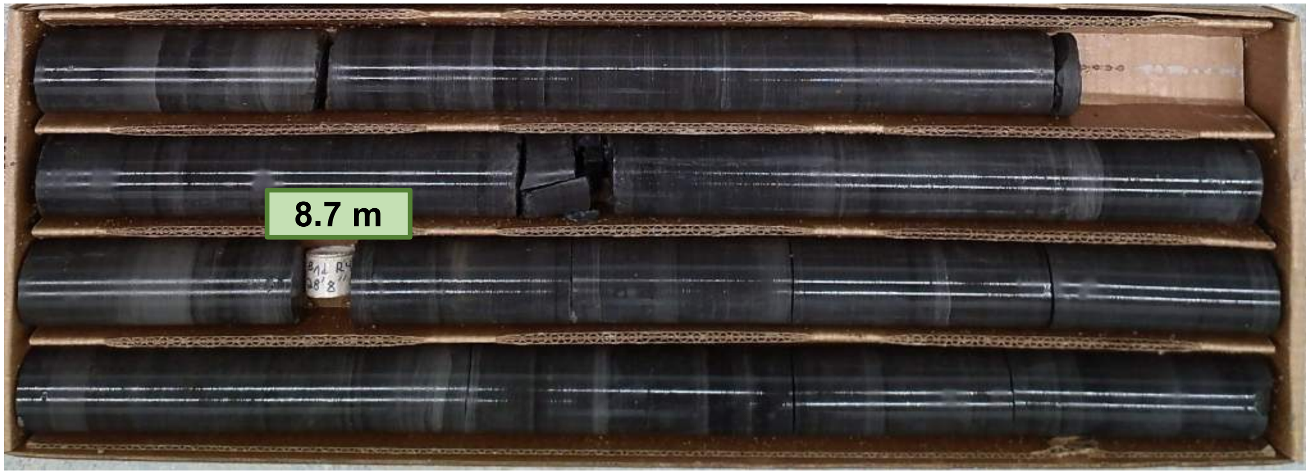
Ottawa, ON K2B 8H6, Canada

Borehole No: **BH02**	Core Runs Run 2: 4.2 m to 5.6 m Run 3: 5.6 m to 7.2 m Run 4: 7.2 m to 8.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-5

DRY BEDROCK CORES

WET BEDROCK CORES



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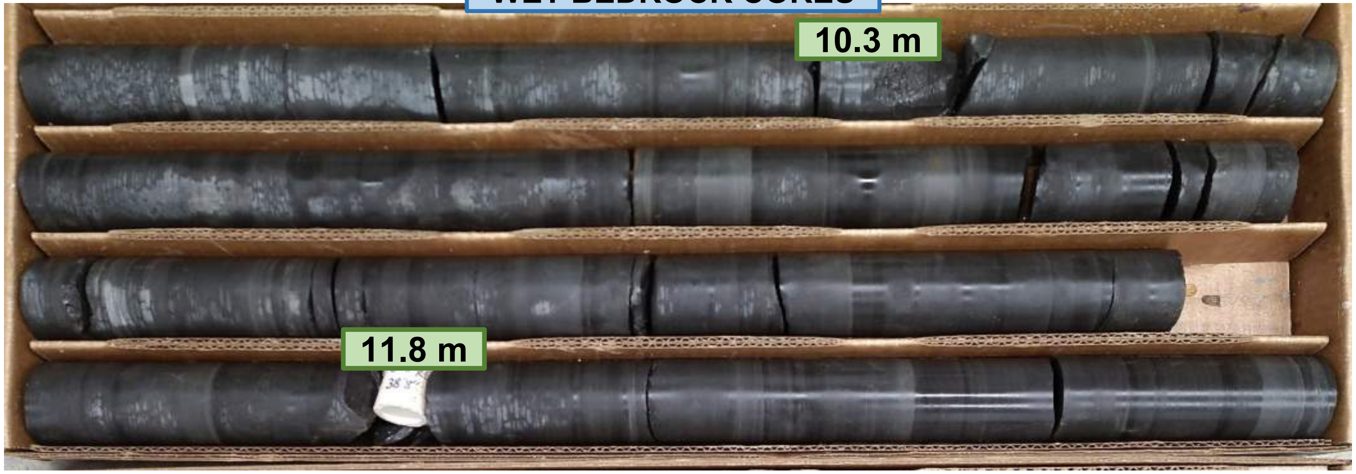
Ottawa, ON K2B 8H6, Canada

Borehole No:	Core Runs	project	Project N0:
BH02	Run 4: 7.2 m to 8.7 m Run 5: 8.7 m to 10.3 m	Geotechnical Investigation - Walkley Centre Development	OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-6

DRY BEDROCK CORES

WET BEDROCK CORES



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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

Borehole No: **BH02**	Core Runs Run 5: 8.7 m to 10.3 m Run 6: 10.3 m to 11.8 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-7

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Borehole No: **BH02**	Core Runs Run 7: 11.8 m to 13.1 m Run 8: 13.1 m to 14.1 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-8

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Borehole No: **BH06**	Core Runs Run 1: 1.3 m to 2.6 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-9

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Borehole No: **BH07**	Core Runs Run 1: 1.8 m to 2.7 m Run 2: 2.7 m to 4.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-10

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Borehole No: **BH07**	Core Runs Run 3: 4.2 m to 5.7 m Run 4: 5.7 m to 7.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-11

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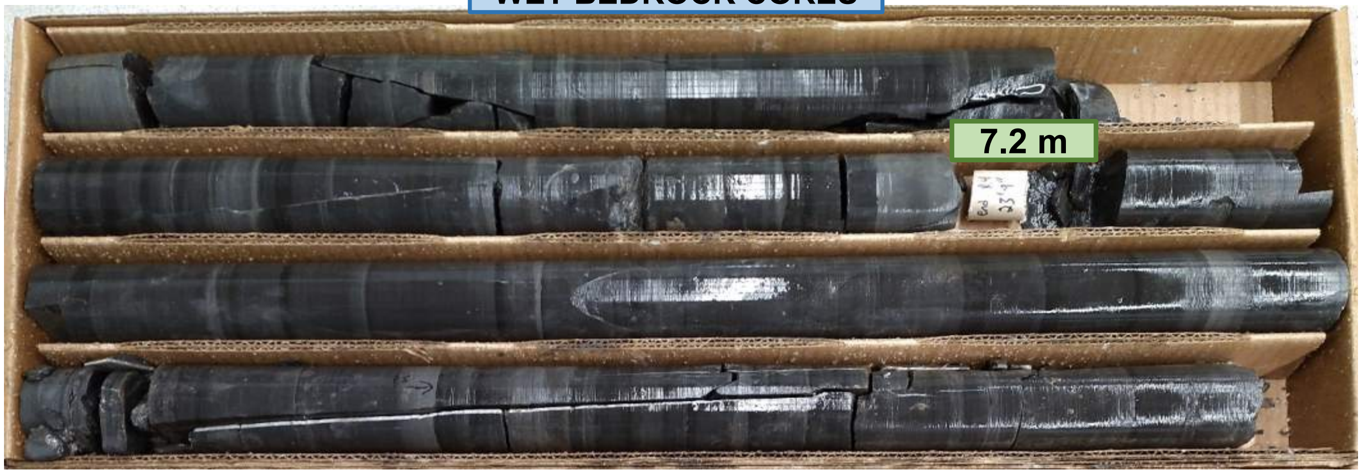

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2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6, Canada

Borehole No:
BH07

Core Runs
Run 4: 5.7 m to 7.2 m
Run 5: 7.2 m to 8.8 m

project
Geotechnical Investigation - Walkley Centre Development

Project N0:
OTT-23008400-A0

Date Cored
10/27/2023

Rock Core Photographs

A-12

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Borehole No: **BH07**	Core Runs Run 5: 7.2 m to 8.8 m Run 6: 8.8 m to 10.3 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-13

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Borehole No: **BH07**	Core Runs Run 7: 10.3 m to 11.8 m Run 8: 11.8 m to 13.4 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-14

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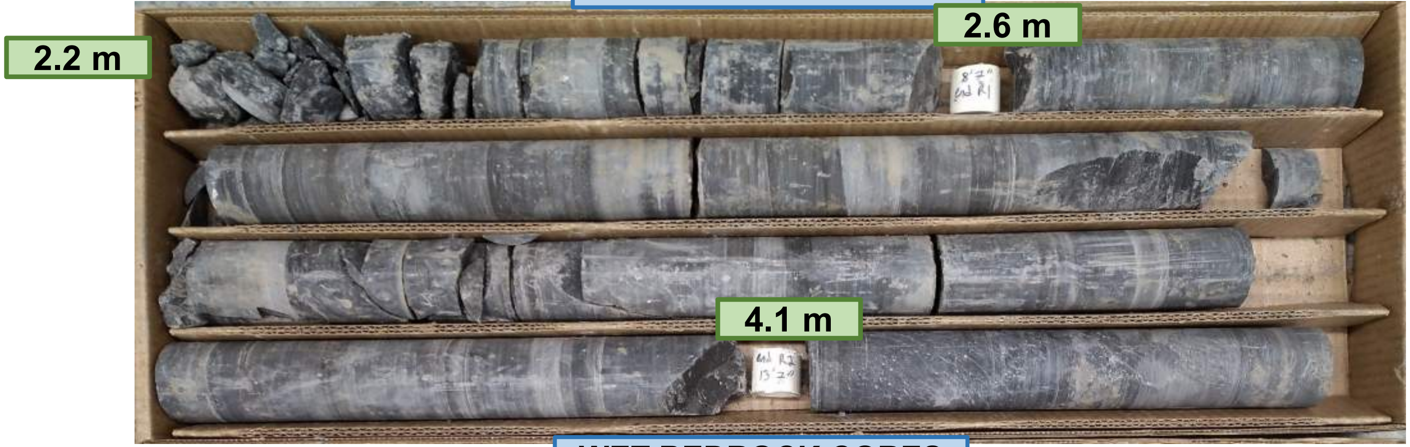
Borehole No: **BH07**	Core Runs Run 8: 11.8 m to 13.4 m Run 9: 13.4 m to 13.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/27/2023		Rock Core Photographs	A-15

DRY BEDROCK CORES



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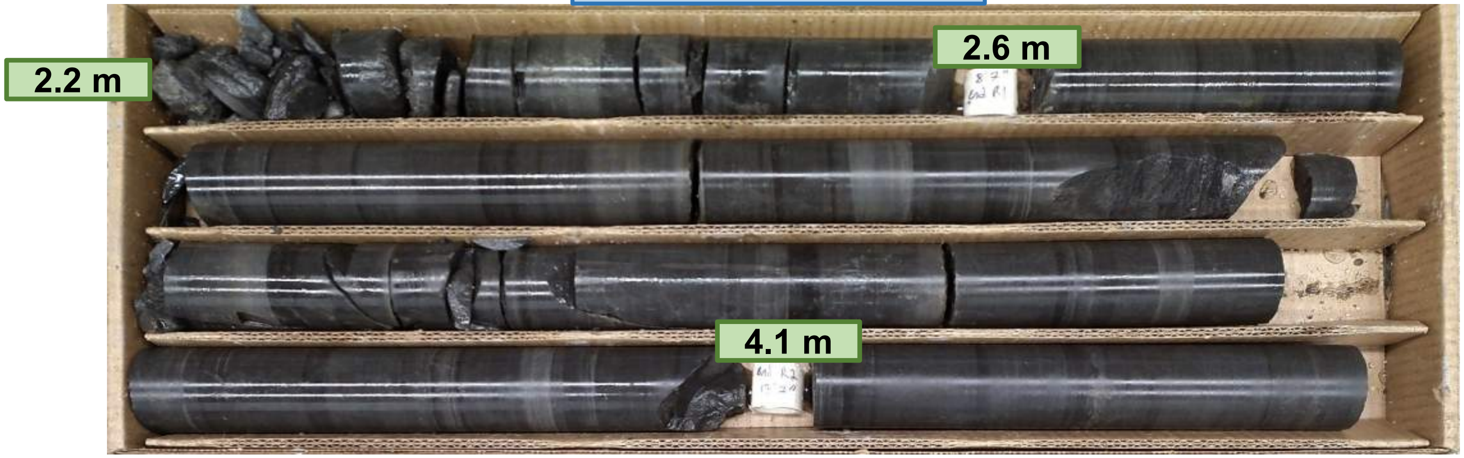

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Borehole No:	Core Runs	project	Project N0:
BH11	Run 1: 2.2 m to 2.6 m Run 2: 2.6 m to 4.1 m Run 3: 4.1 m to 5.6 m	Geotechnical Investigation - Walkley Centre Development	OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-16

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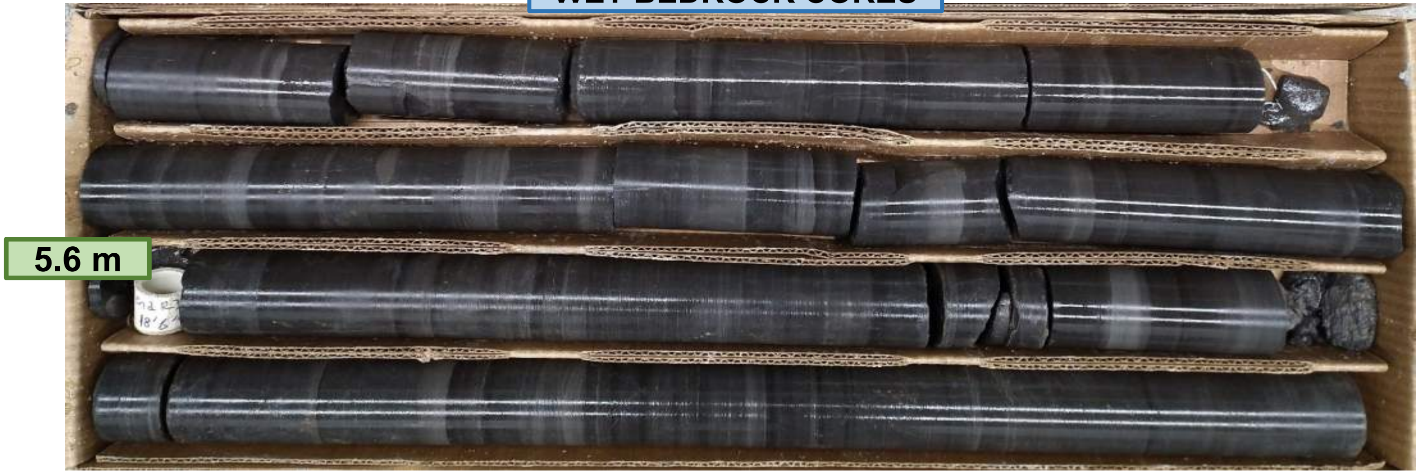

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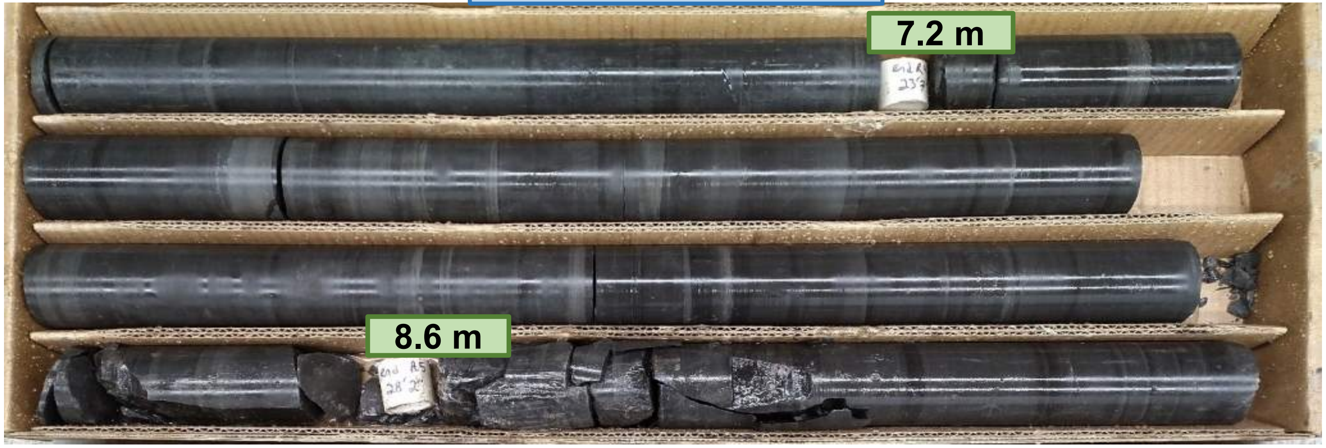
Borehole No: **BH11**	Core Runs Run 3: 4.1 m to 5.6 m Run 4: 5.6 m to 7.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-17

DRY BEDROCK CORES

WET BEDROCK CORES



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Borehole No:
BH11

Core Runs
Run 5: 7.2 m to 8.6 m
Run 6: 8.6 m to 10.1 m

project
Geotechnical Investigation - Walkley Centre Development

Project N0:
OTT-23008400-A0

Date Cored
10/30/2023

Rock Core Photographs

A-18

DRY BEDROCK CORES

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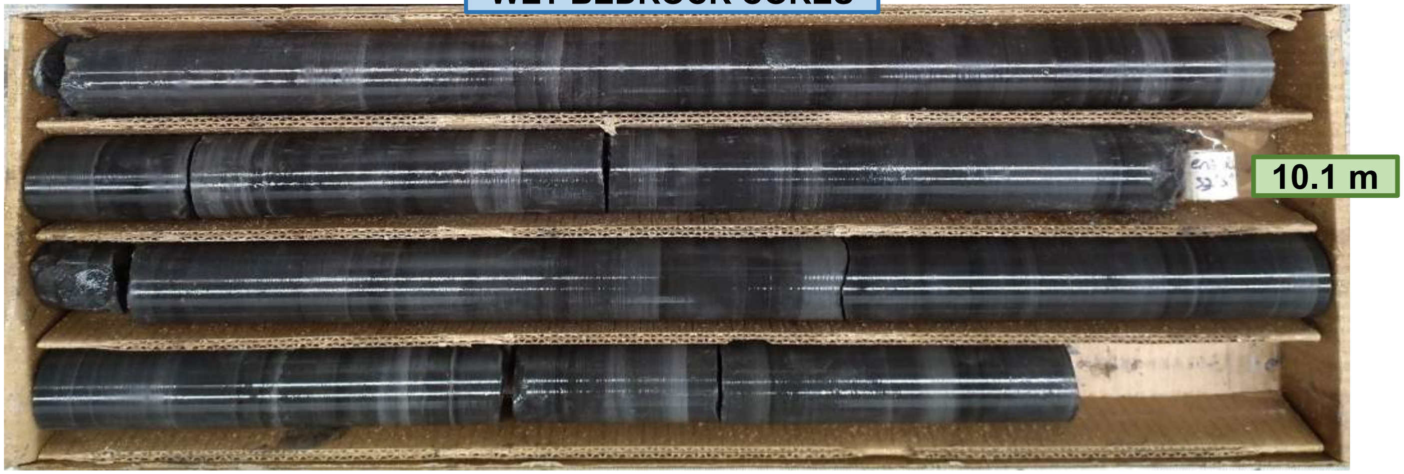

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Ottawa, ON K2B 8H6, Canada

Borehole No: **BH11**	Core Runs Run 6: 8.6 m to 10.1 m Run 7: 10.1 m to 11.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-19

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Borehole No: **BH11**	Core Runs Run 7: 10.1 m to 11.7 m Run 8: 11.7 m to 13.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/30/2023		Rock Core Photographs	A-20

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Borehole No:
BH11

Core Runs
Run 9: 13.2 m to 14.2 m

project
Geotechnical Investigation - Walkley Centre Development

Project N0:
OTT-23008400-A0

Date Cored
10/30/2023

Rock Core Photographs

A-21

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Borehole No: **BH12**

Date Cored: 11/1/2023

Core Runs
Run 1: 1.4 m to 2.8 m
Run 2: 2.8 m to 4.4 m
Run 3: 4.4 m to 5.9 m

project: Geotechnical Investigation - Walkley Centre Development

Rock Core Photographs

Project N0: OTT-23008400-A0

A-22

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Borehole No: **BH12**	Core Runs Run 4: 5.9 m to 7.4 m Run 5: 7.4 m to 9 m Run 6: 9 m to 10.5 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/1/2023		Rock Core Photographs	A-23

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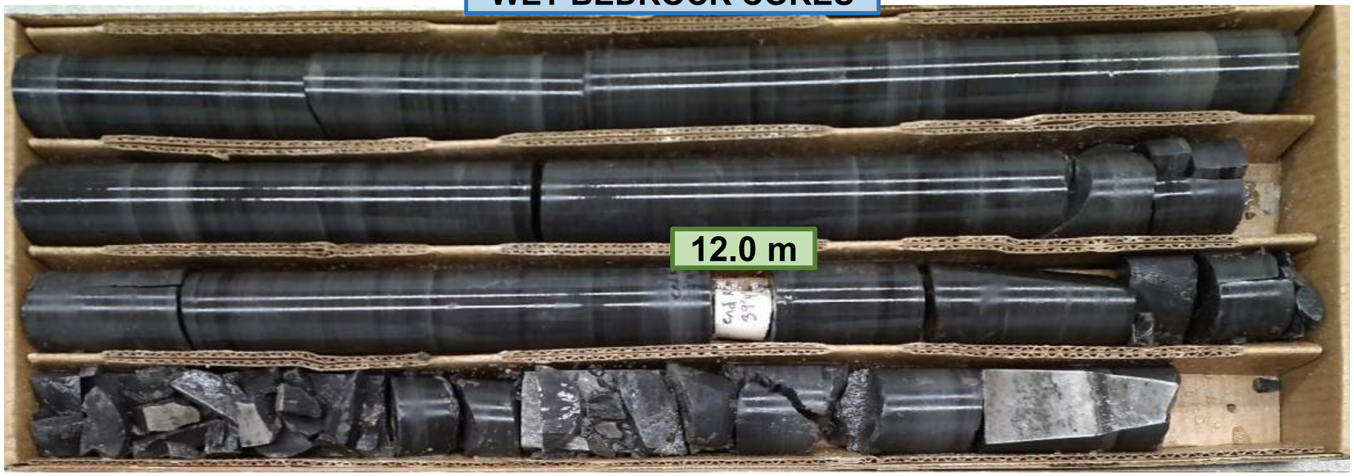

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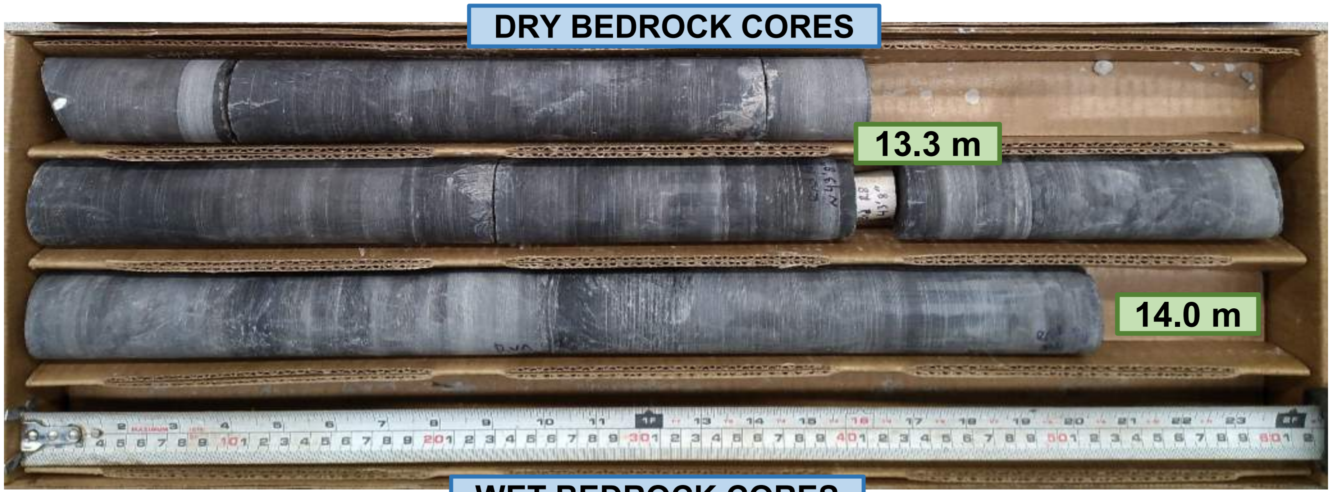
Borehole No: **BH12**	Core Runs Run 7: 10.5 m to 12.0 m Run 8: 12.0 m to 13.3 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/1/2023		Rock Core Photographs	A-24

DRY BEDROCK CORES



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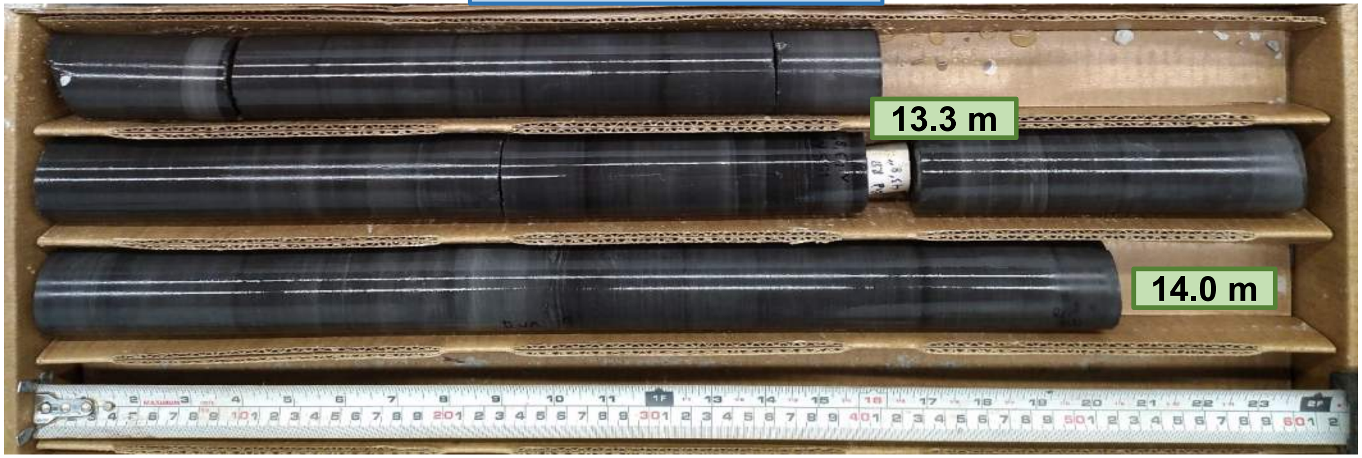

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Borehole No: BH12	Core Runs Run 8: 12 m to 13.3 m Run 9: 13.3 m to 14.0 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/1/2023		Rock Core Photographs	A-25

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Borehole No: **BH13**	Core Runs Run 7: 10.3 m to 11.8 m Run 8: 11.8 m to 13.3 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/3/2023		Rock Core Photographs	A-28

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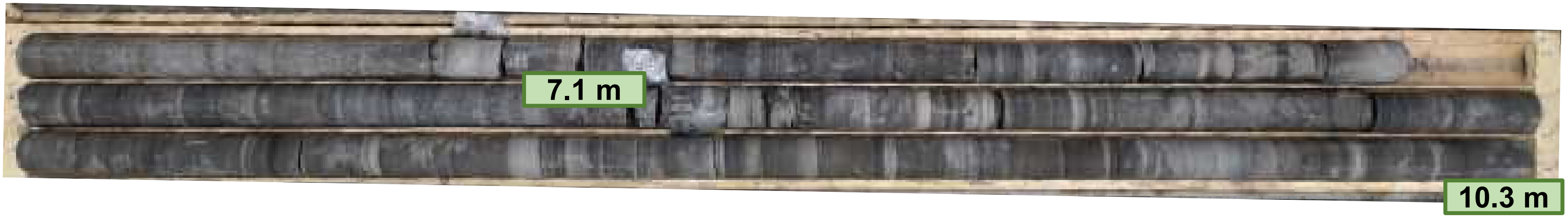
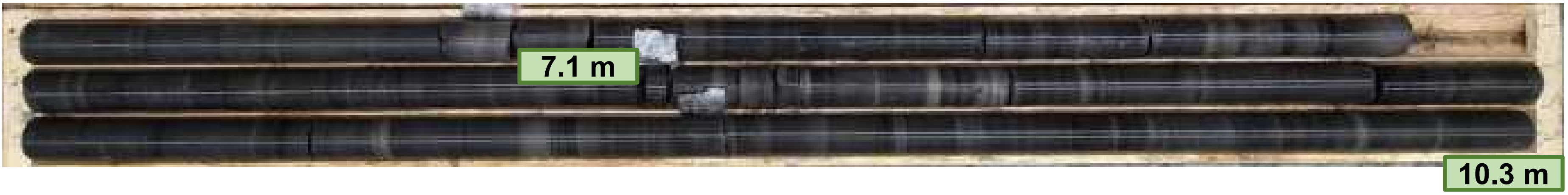
Borehole No: BH13	Core Runs Run 1: 2 m to 2.6 m Run 2: 2.6 m to 4.1 m Run 3: 4.1 m to 5.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/3/2023		Rock Core Photographs	A-26

DRY BEDROCK CORES



WET BEDROCK CORES



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Borehole No:	Core Runs	project	Project N0:
BH13	Run 4: 5.7 m to 7.1 m Run 5: 7.1 m to 8.7 m Run 6: 8.7 m to 10.3 m	Geotechnical Investigation - Walkley Centre Development	OTT-23008400-A0
Date Cored 11/3/2023		Rock Core Photographs	A-27

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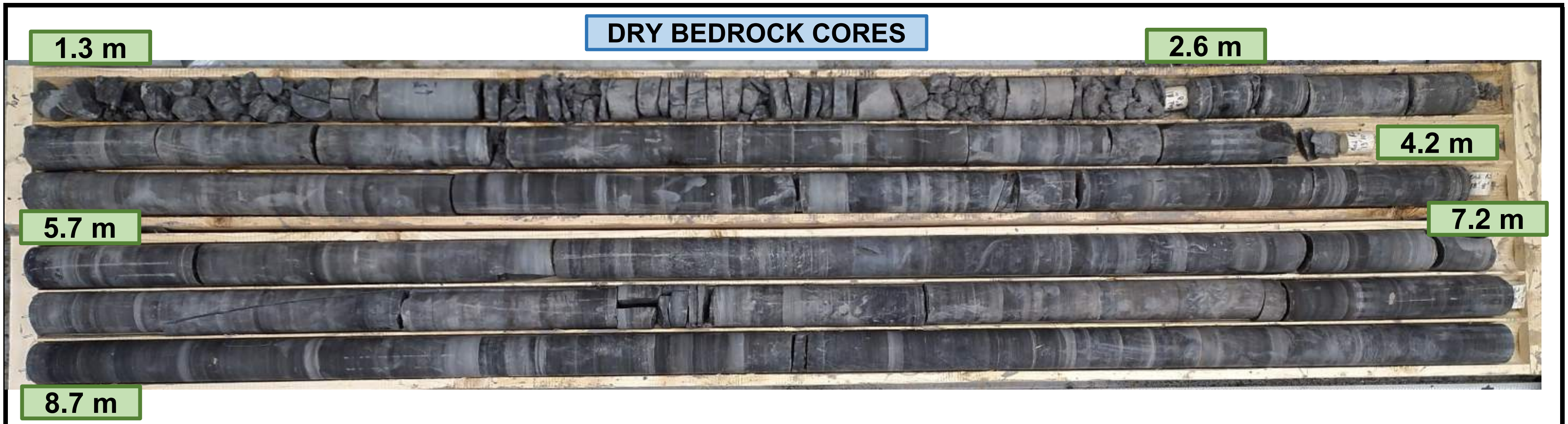
Borehole No: **BH13**	Core Runs Run 9: 13.3 m to 14.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/3/2023		Rock Core Photographs	A-29

DRY BEDROCK CORES



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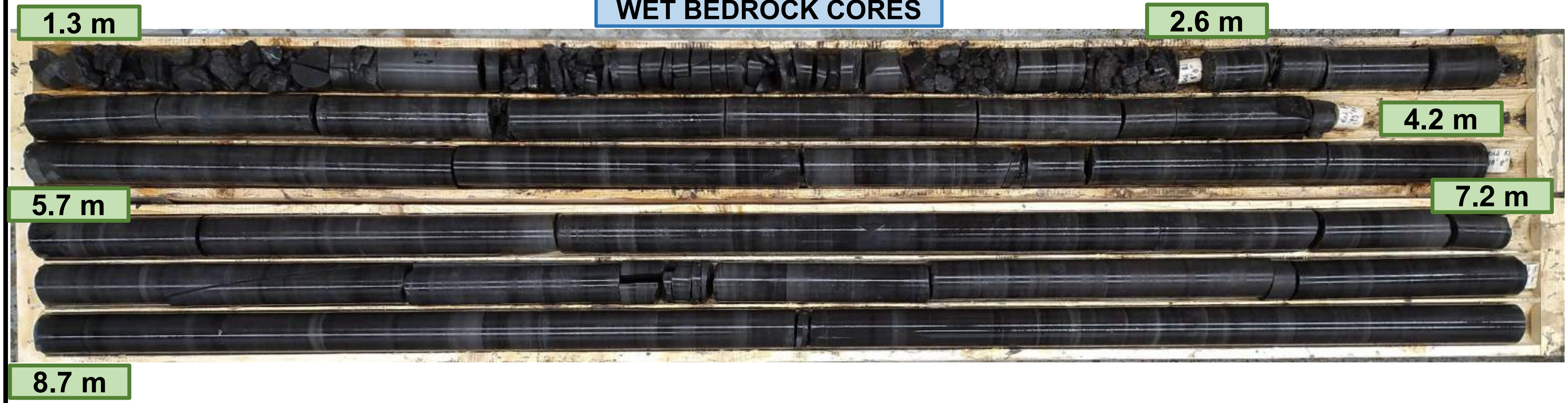

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Borehole No: **BH14**	Core Runs Run 1: 1.3 m to 2.6 m Run 2: 2.6 m to 4.2 m Run 3: 4.2 m to 5.7 m Run 4: 5.7 m to 7.2 m Run 5: 7.2 m to 8.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/31/2023		Rock Core Photographs	A-30

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Borehole No: **BH14**	Core Runs Run 6: 8.7 m to 10.3 m Run 7: 10.3 m to 11.8 m Run 8: 11.8 m to 13.3 m Run 9: 13.3 m to 14.1 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/31/2023		Rock Core Photographs	A-31

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Borehole No: **BH15**	Core Runs Run 1: 1.4 m to 3.0 m Run 2: 3.0 m to 4.4 m Run 3: 4.4 m to 6.0 m Run 4: 6.0 m to 7.5 m Run 5: 7.5 m to 9.1 m Run 6: 9.1 m to 10.6 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/1/2023		Rock Core Photographs	A-32

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Borehole No:	Core Runs	project	Project N0:
BH15	Run 7: 10.6 m to 12.2 m Run 8: 12.2 m to 13.7 m	Geotechnical Investigation - Walkley Centre Development	OTT-23008400-A0
Date Cored 11/1/2023		Rock Core Photographs	A-33

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Borehole No: **BH16**	Core Runs Run 1: 1.5 m to 2.7 m Run 2: 2.7 m to 4.2 m Run 3: 4.2 m to 5.7 m Run 4: 5.7 m to 7.2 m Run 5: 7.2 m to 8.8 m Run 6: 8.8 m to 10.3 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/2/2023		Rock Core Photographs	A-34

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Borehole No: **BH16**

Core Runs
Run 7: 10.3 m to 11.8 m
Run 8: 11.8 m to 13.3 m
Run 9: 13.3 m to 14.9 m

project: Geotechnical Investigation - Walkley Centre Development

Project N0: OTT-23008400-A0

Date Cored: 11/2/2023

Rock Core Photographs

A-35

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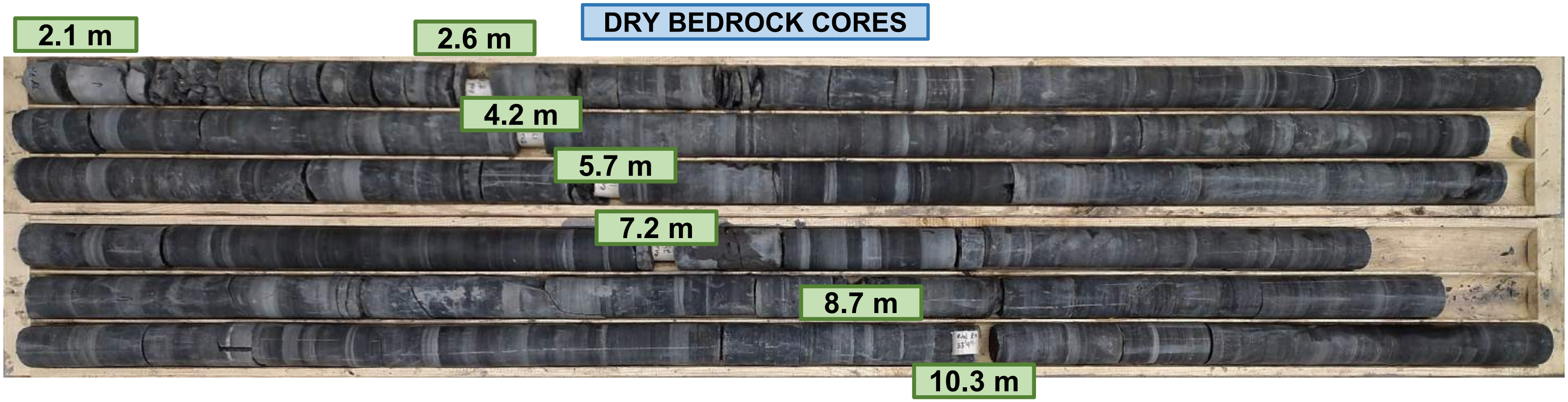
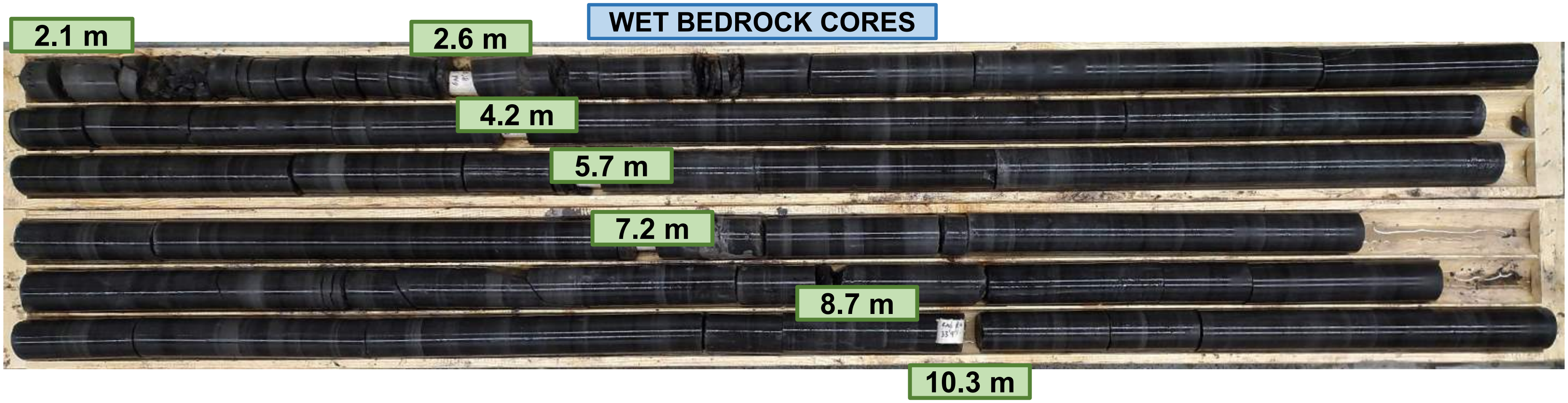


WET BEDROCK CORES



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Borehole No: **BH17**	Core Runs Run 1: 2.1 m to 2.6 m Run 2: 2.6 m to 4.2 m Run 3: 4.2 m to 5.7 m Run 4: 5.7 m to 7.2 m Run 5: 7.2 m to 8.7 m Run 6: 8.7 m to 10.3 m Run 7: 10.3 m to 11.8 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/31/2023		Rock Core Photographs	A-36

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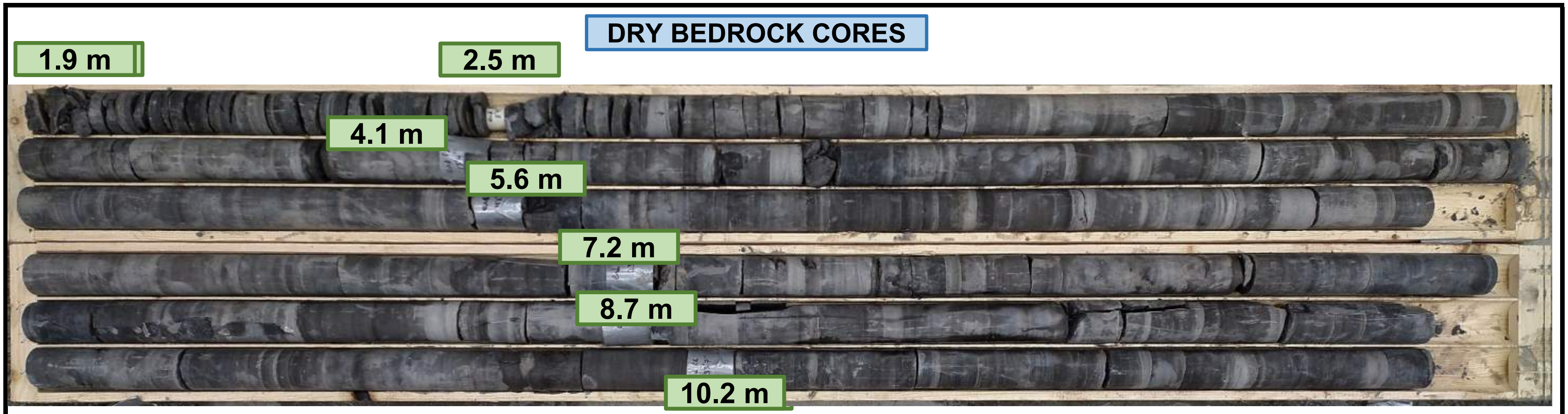
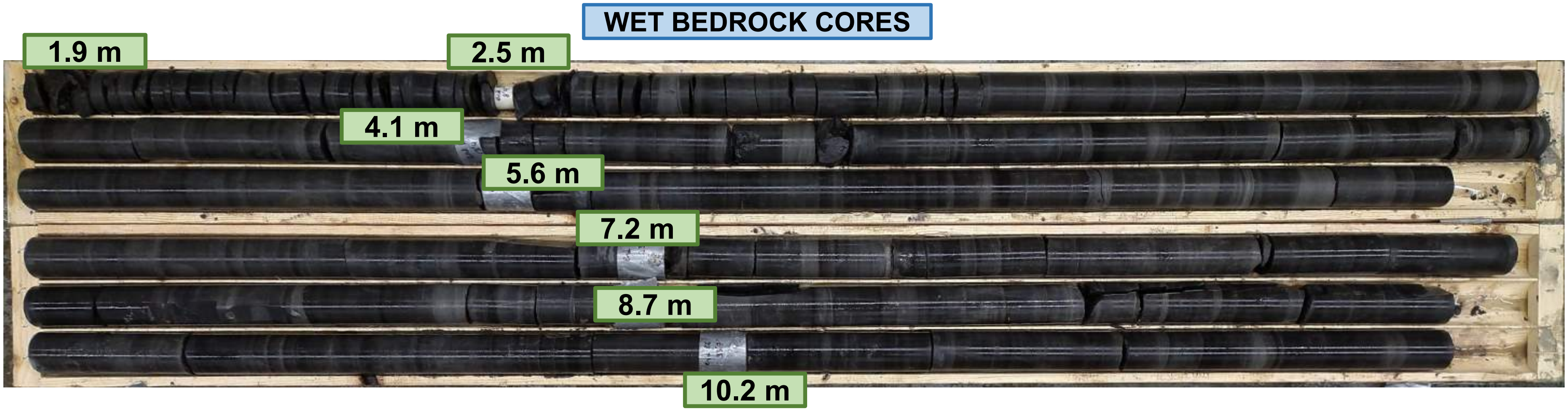
Borehole No: BH17	Core Runs Run 7: 10.3 m to 11.8 m Run 8: 11.8 m to 13.3 m Run 9: 13.3 m to 14.8 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 10/31/2023		Rock Core Photographs	A-37





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2650 Queensview Drive, Suite 100
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Borehole No: **BH18**	Core Runs Run 1: 1.9 m to 2.5 m Run 2: 2.5 m to 4.1 m Run 3: 4.1 m to 5.6 m Run 4: 5.6 m to 7.2 m Run 5: 7.2 m to 8.7 m Run 6: 8.7 m to 10.2 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/2/2023		Rock Core Photographs	A-38

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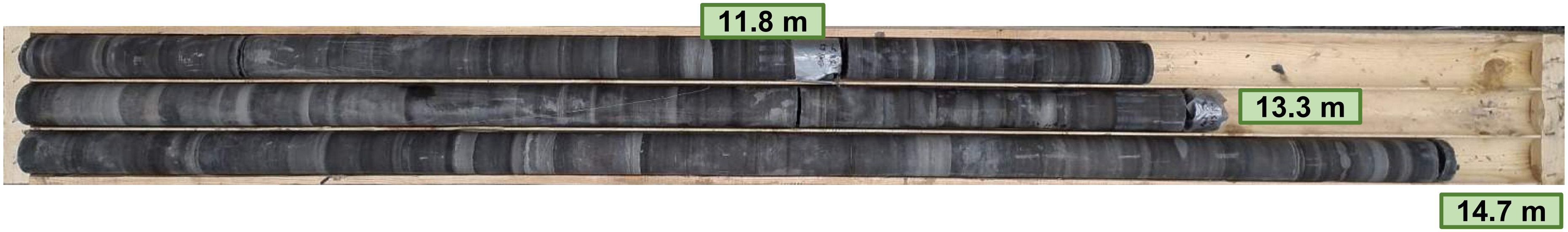
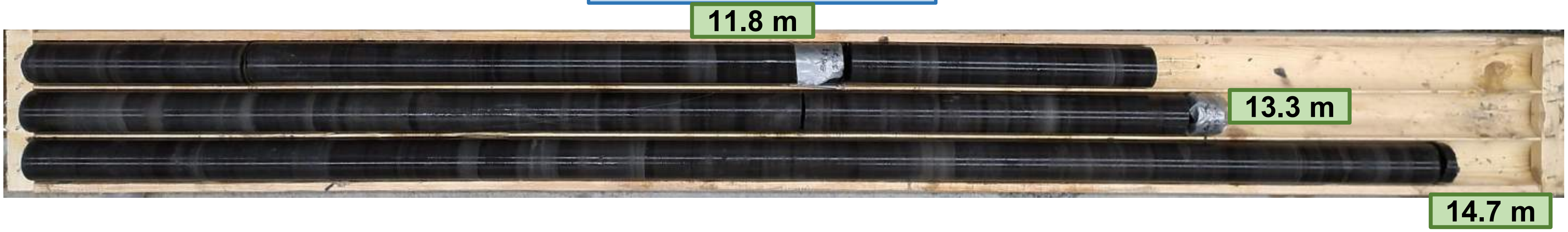


WET BEDROCK CORES



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Borehole No: **BH18**	Core Runs Run 7: 10.2 m to 11.8 m Run 8: 11.8 m to 13.3 m Run 9: 13.3 m to 14.7 m	project Geotechnical Investigation - Walkley Centre Development	Project N0: OTT-23008400-A0
Date Cored 11/2/2023		Rock Core Photographs	A-39

Appendix B – Shear Wave Velocity Sounding for the Site Class Determination

GEOPHYSICS GPR
INTERNATIONAL INC.

January 8th, 2023

Transmited by email: Daniel.Wall@exp.com
Our ref: GPR-23-05153

Mr. Daniel Wall, P.Eng.
Intermediate Geotechnical Engineer
EXP Services inc.
100 – 2650 Queensview Drive
Ottawa ON K2B 8H6

Subject: **Shear Wave Velocity Sounding for the Site Class Determination**
1822 Bank Street, Ottawa (ON)

Dear Mr. Wall,

Geophysics GPR International inc. has been mandated by EXP to carry out seismic surveys at 1822 Bank Street, in Ottawa (ON). The geophysical investigation used the Multi-channel Analysis of Surface Waves (MASW), the Spatial AutoCorrelation (SPAC), and the seismic refraction methods. From the subsequent results, the seismic shear wave velocity values were calculated for the soil and the rock, to determine the Site Class.

The surveys were conducted on December 21st, 2023, by Mr. Charles Trottier, M.Sc. phys. and Mrs. Karyne Faguy, graduate in geophysics. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic spreads. Both figures are presented in the Appendix.

The following paragraphs briefly describe the survey design, the principles of the testing methods, and the results presented in table and graph.

MASW PRINCIPLE

The *Multi-channel Analysis of Surface Waves* (MASW) and the *SPatial AutoCorrelation* (SPAC or MAM for *Microtremors Array Method*) are seismic methods used to evaluate the shear wave velocities of subsurface materials through the analysis of the dispersion properties of the Rayleigh surface wave. The MASW is considered an "active" method, as the seismic signal is induced at known location and time in the geophones' spread axis. Conversely, the SPAC is considered a "passive" method, using the low frequency "signals" produced far away. The method can also be used with "active" seismic source records. The SPAC method generally allows deeper Vs soundings. Its dispersion curve can then be merged with the one of higher frequency from the MASW to calculate a more complete inversion. The dispersion properties are expressed as a change of velocities with respect to frequencies. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. The inversion of the Rayleigh wave dispersion curve yields a shear wave (V_S) velocity depth profile (sounding).

Figure 3 schematically outlines the basic operating procedure for the MASW method. Figure 4 illustrates an example of one of the MASW/SPAC records, the corresponding spectrogram analysis and resulting 1D V_S model.

INTERPRETATION

The main processing sequence involved data inspection and edition when required; spectral analysis ("phase shift" for MASW, and "cross-correlation" for SPAC); picking the fundamental mode; and 1D inversion of the MASW and SPAC shot records using the SeisImagerSW™ software. The data inversions used a nonlinear least squares algorithm.

In theory, all the shot records for a given seismic spread should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation, local surface seismic velocities variations, and/or dipping of overburden layers or rock. In general, the precision of the calculated seismic shear wave velocities (V_S) is around 15% or better. More detailed descriptions of these methods are presented in *Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock*, Hunter, J.A., Crow, H.L., et al., Geological Surveys of Canada, General Information Product 110, 2015.

SURVEY DESIGN

The seismic spreads were installed in front of the building, parallel to Bank Street (Figure 2), near the boreholes BH-7, BH-8 and BH-9. The geophone spacing was 3.0 metres for the main spread, using 24 geophones. One shorter seismic spread, with geophone spacings of 1.0 metre, was dedicated to the near surface materials. The seismic records were produced with a seismograph Terraloc Pro (from ABEM Instrument), and the geophones were 4.5 Hz.

The seismic records counted 4096 data, sampled at 1000 µs for the MASW surveys, and at 40 µs for the seismic refraction. The records included a pre-trigged portion of 10 ms. An 8 kg sledgehammer was used as the energy source, with impacts being recorded off both ends of the seismic spreads. A stacking procedure was also used to improve the Signal / Noise ratio for the seismic records. The shear wave depth sounding can be considered as the average of the bulk area within the geophone spread, especially for its central half-length.

RESULTS

The MASW calculated V_S results are illustrated at Figure 5.

The $\overline{V}_{S30}$ value results from the harmonic mean of the shear wave velocities, from the surface to 30 metres deep. It is calculated by dividing the total depth of interest (30 metres) by the sum of the time spent in each velocity layer from the surface down to 30 metres, as:

$$\bar{V}_{S30} = \frac{\sum_{i=1}^{N} \mathrm{H}_i}{\sum_{i=1}^{N} {}^{H_i}/_{V_i}} \quad | \quad \sum_{i=1}^{N} \mathrm{H}_i = 30 \mathrm{~m}$$

(N: number of layers; H_i : thickness of layer "*i*" ; V_i : V_S of layer "*i*")

Thus, the $\overline{V}_{S30}$ value represents the seismic shear wave velocity of an equivalent homogeneous single layer response, between the surface and 30 metres deep.

The calculated $\overline{V}_{S30}$ value of the actual site is 1428.0 m/s (Table 1), corresponding to the Site Class "B". However, the Site Classes A and B are not to be used if there is 3 metres or more of soils between the rock and the bottom of the spread footing, pile cap or mat foundation. In the case the bottom of the foundation would be 1.2 metre or less from the rock, the $\overline{V}_{S30}$ * value would be greater than 1500 m/s, corresponding to the Site Class "A" (Table 2).

CONCLUSION

Geophysical surveys were carried out to identify the Site Class at 1822 Bank Street, in Ottawa (ON). The seismic surveys used the MASW and the SPAC analysis, and the seismic refraction to calculate the $\overline{V}_{S30}$ value. Its calculation is presented at Table 1.

The $\overline{V}_{S30}$ value of the actual site is 1428 m/s, corresponding to the Site Class "B" ($760 < \overline{V}_{S30} \leq 1500$ m/s), as determined through the MASW and SPAC methods, Table 4.1.8.4.-A of the NBC (2015), and the Building Code, O. Reg. 332/12. It must be noted that the Site Classes A and B are not to be used if there is 3 metres or more of soils between the rock and the bottom of the spread footing, pile cap or mat foundation.

In the case the bottom of the foundation would be 1.2 metre or less from the rock, the $\overline{V}_{S30}$* value would be greater than 1500 m/s, corresponding to the Site Class "A" ($\overline{V}_{S30} > 1500$ m/s).

It must also be noted that other geotechnical information gleaned on site; including the presence of liquefiable soils, very soft clays, high moisture content etc. (cf. Table 4.1.8.4.-A of the NBC 2015) can supersede the Site classification provided in this report based on the $\overline{V}_{S30}$ value.

The V_S values calculated are representative of the in situ materials and are not corrected for the total and effective stresses.

Hoping the whole to your satisfaction, we remain yours truly,

Karyne Faguy

Karyne Faguy, B.Sc. Geoph. .
Project Manager

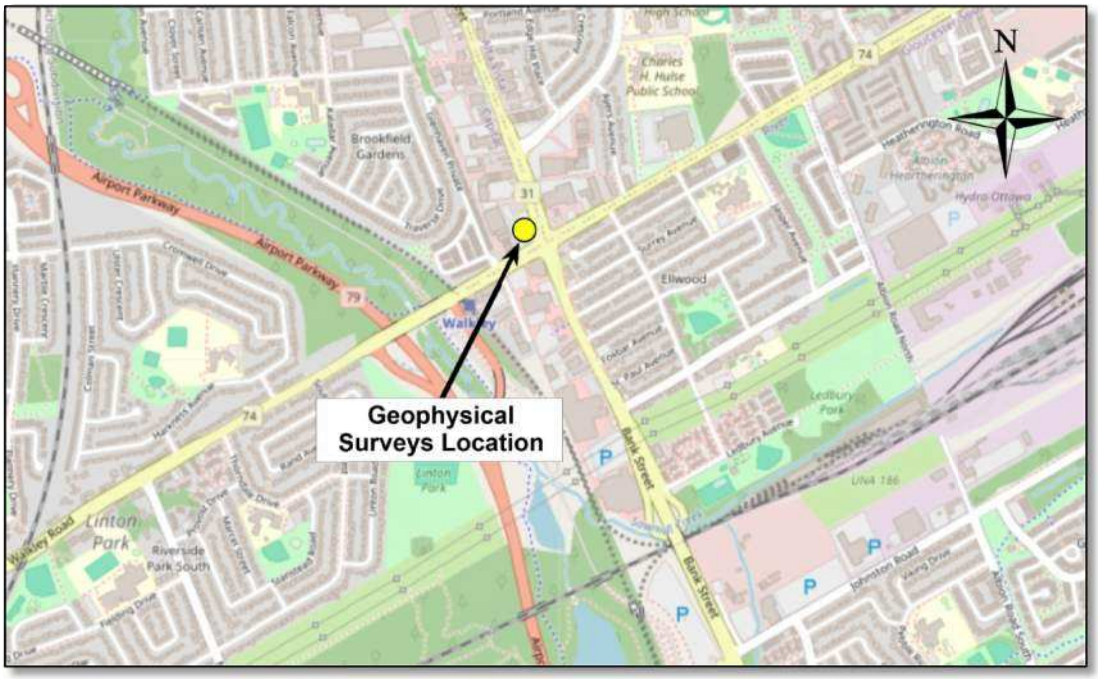

FIGURE 1

General Survey Location

(Source: OpenStreetMap©)

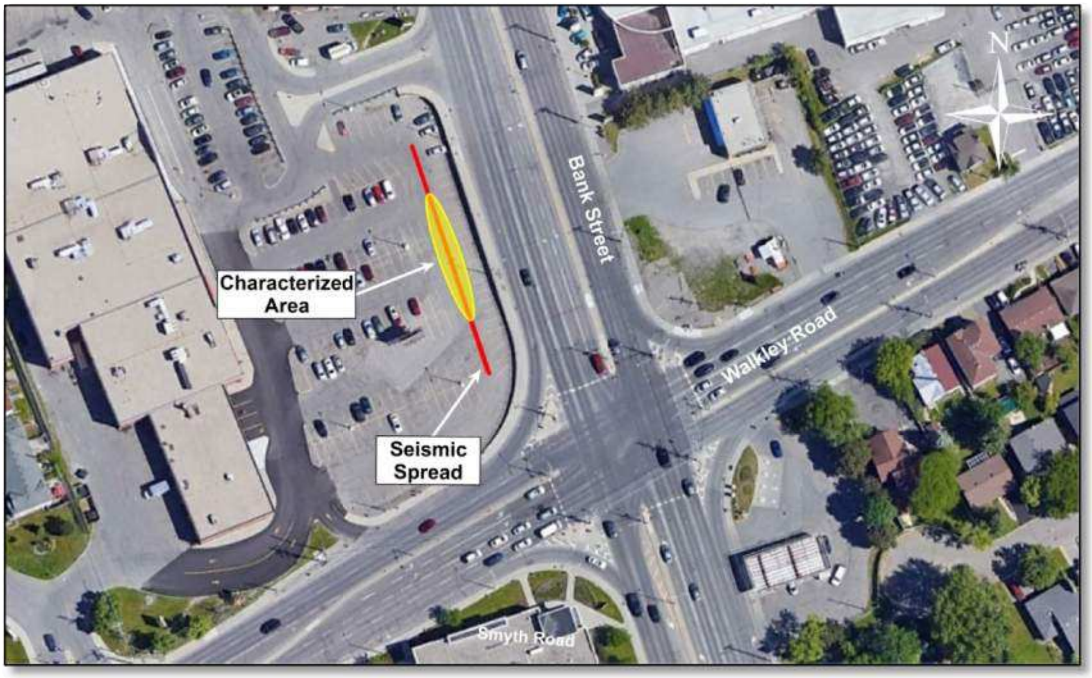

FIGURE 2

Location of borehole 23-01

(Source: Google Earth™)

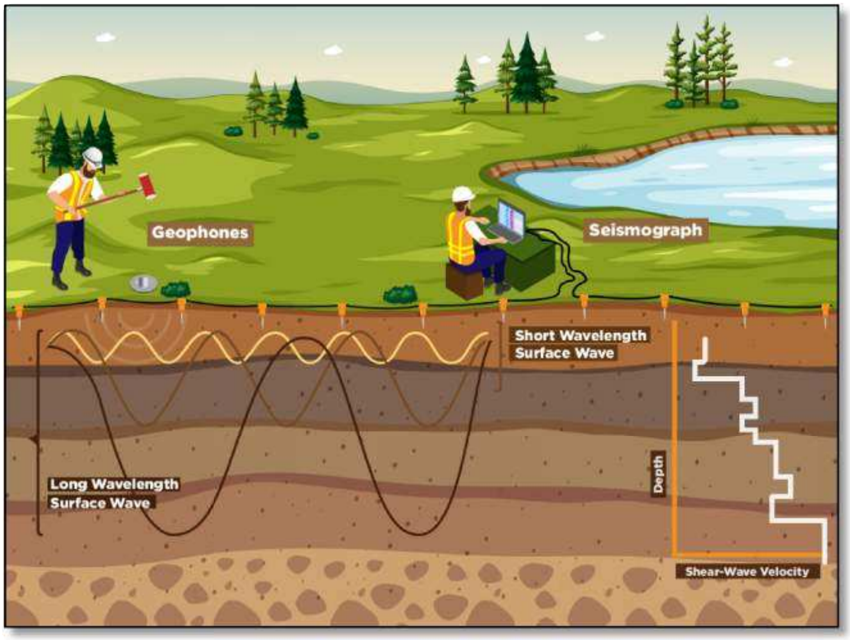

FIGURE 3
MASW Operating Principle

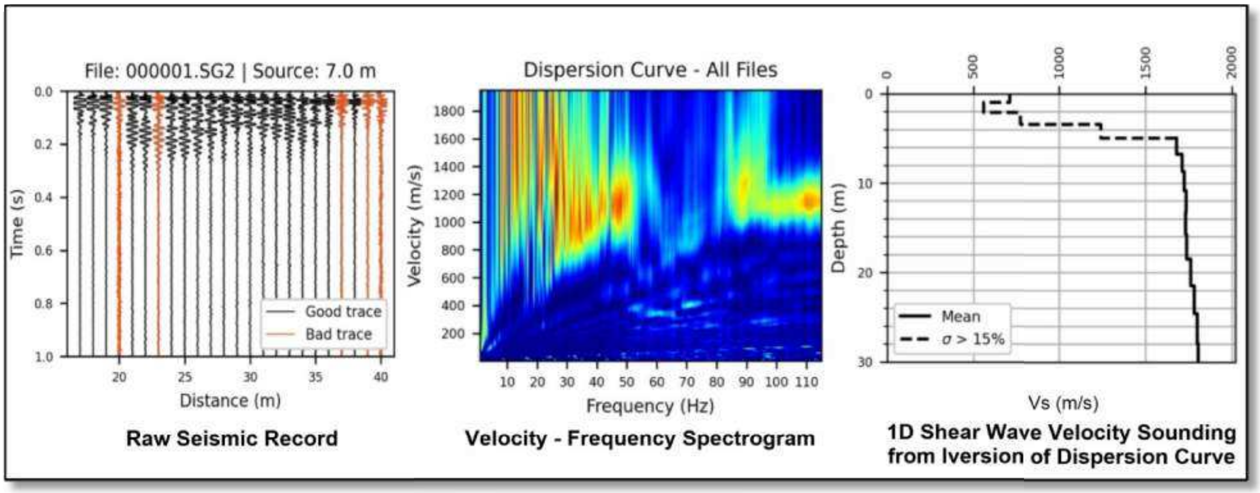

FIGURE 4
Example of a MASW/SPAC record, Phase Velocity - Frequency curve of the Rayleigh wave and resulting 1D Shear Wave Velocity Model

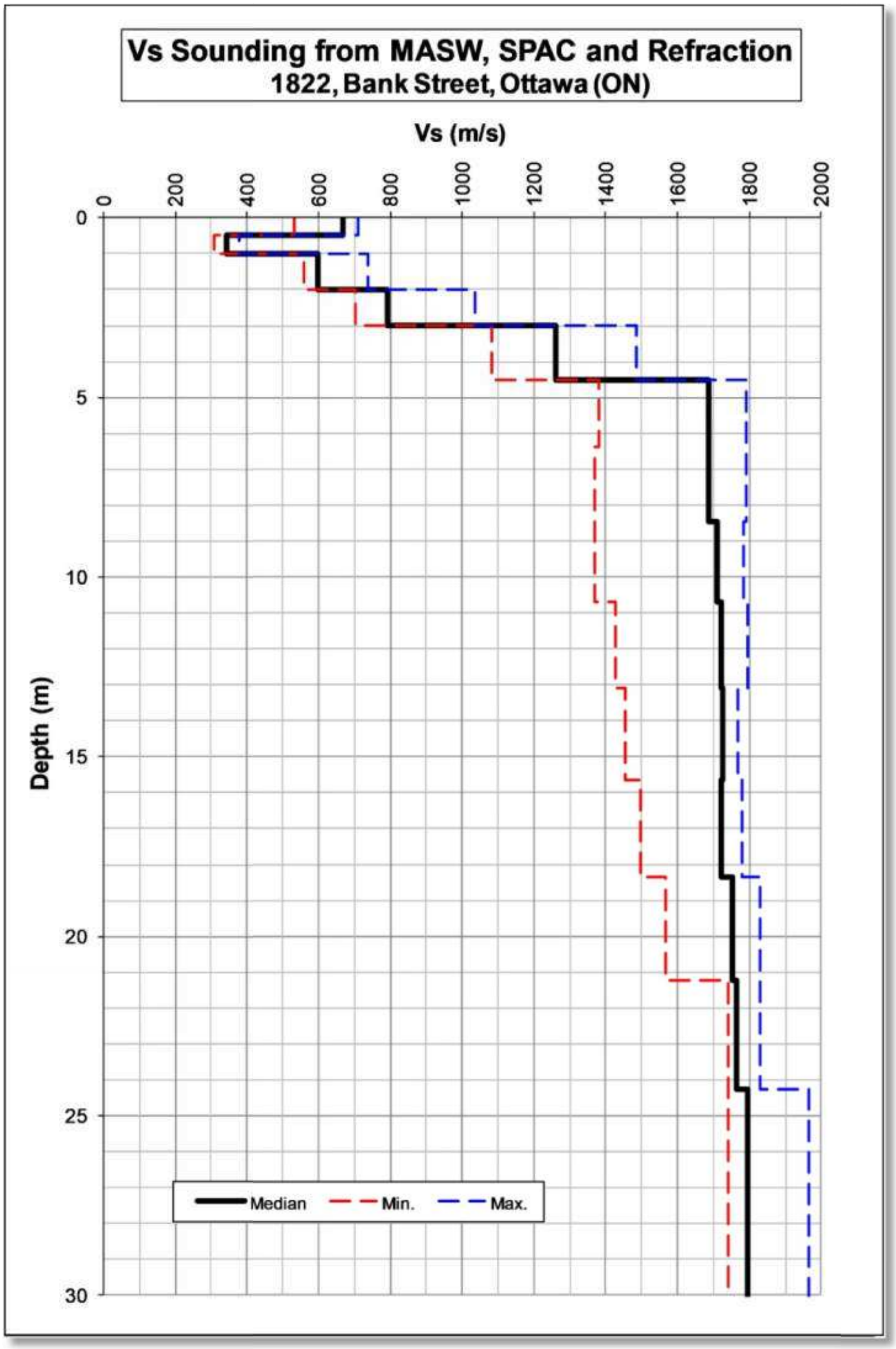

FIGURE 5

MASW Shear-Wave Velocity Sounding

TABLE 1

V_{S30} Calculation for the Site Class (actual site)

Depth	Vs			Thickness	Cumulative Thickness	Delay for med. Vs	Cumulative Delay	Vs at given Depth
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(s)	(m/s)
0	532.3	666.7	711.0	**Grade Level (December 21st, 2023)**				
0.50	306.8	342.6	378.4	0.50	0.50	0.000750	0.000750	666.7
1.00	559.2	596.7	738.4	0.50	1.00	0.001459	0.002209	452.6
2.00	703.2	790.6	1036.7	1.00	2.00	0.001676	0.003885	514.8
3.00	1080.9	1260.3	1483.8	1.00	3.00	0.001265	0.005150	582.5
4.50	1151.9	1680.0	1821.1	1.50	4.50	0.001190	0.006340	709.7
6.40	1184.1	1665.4	1825.4	1.90	6.40	0.001128	0.007469	856.3
8.46	1275.1	1696.3	1784.8	2.06	8.46	0.001237	0.008706	971.3
10.68	1386.5	1712.7	1794.6	2.23	10.68	0.001312	0.010018	1066.2
13.07	1454.5	1719.3	1767.2	2.39	13.07	0.001396	0.011413	1145.3
15.63	1496.5	1705.0	1778.3	2.55	15.63	0.001486	0.012899	1211.4
18.35	1567.7	1740.8	1829.5	2.72	18.35	0.001595	0.014494	1265.7
21.23	1706.6	1762.2	1829.5	2.88	21.23	0.001657	0.016152	1314.5
24.28	1740.8	1829.5	1967.2	3.05	24.28	0.001731	0.017882	1357.8
30				5.72	30.00	0.003126	0.021008	1428.0

V_{S30} (m/s)	**1428.0**
Class	**B**(1)

(1) The Site Classes A and B are not to be used if there is 3 metres or more of soils between the rock and the bottom of the spread footing, pile cap or mat foundation.

TABLE 2

Limit for the Site Class A

Depth	Vs			Thickness	Cumulative Thickness	Delay for med. Vs	Cumulative Delay	Vs at given Depth
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(s)	(m/s)
0.0	532.3	666.7	711.0	**Limit for the Site Class A (1.2 metres of soil)**				
0.8	306.8	342.6	378.4					
1.0	559.2	596.7	738.4	0.20	0.20	0.000584	0.000584	342.6
2.0	703.2	790.6	1036.7	1.00	1.20	0.001676	0.002260	531.1
3.0	1080.9	1260.3	1483.8	1.00	2.20	0.001265	0.003524	624.2
4.5	1151.9	1680.0	1821.1	1.50	3.70	0.001190	0.004715	784.8
6.4	1184.1	1665.4	1825.4	1.90	5.60	0.001128	0.005843	957.7
8.5	1275.1	1696.3	1784.8	2.06	7.66	0.001237	0.007080	1081.3
10.7	1386.5	1712.7	1794.6	2.23	9.88	0.001312	0.008392	1177.5
13.1	1454.5	1719.3	1767.2	2.39	12.27	0.001396	0.009788	1253.8
15.6	1496.5	1705.0	1778.3	2.55	14.83	0.001486	0.011274	1315.1
18.3	1567.7	1740.8	1829.5	2.72	17.55	0.001595	0.012869	1363.5
21.2	1706.6	1762.2	1829.5	2.88	20.43	0.001657	0.014526	1406.5
24.3	1740.8	1829.5	1967.2	3.05	23.48	0.001731	0.016256	1444.4
30.8				6.52	30.00	0.003564	0.019820	1513.6

V_{S30} (m/s)	**1513.6**
Class	**A**

Appendix C – Laboratory Certificate of Analysis Report

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **EXP SERVICES INC**
2650 QUEENSVIEW DRIVE, UNIT 100
OTTAWA, ON K2B8H6
(613) 688-1899
ATTENTION TO: **Daniel Wall**
PROJECT: **OTT-23002538-AO**
AGAT WORK ORDER: **23Z104773**
SOIL ANALYSIS REVIEWED BY: **Chuandi Zhang, Inorganic Supervisor**
DATE REPORTED: **Dec 22, 2023**
PAGES (INCLUDING COVER): **5**
VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

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Western Enviro-Agricultural Laboratory Association (WEALA)
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Certificate of Analysis

AGAT WORK ORDER: 23Z104773
PROJECT: OTT-23002538-AO

CLIENT NAME: EXP SERVICES INC
SAMPLING SITE:Bank Street

ATTENTION TO: Daniel Wall
SAMPLED BY:

(Soil) Inorganic Chemistry

DATE RECEIVED: 2023-12-15

DATE REPORTED: 2023-12-22

			SAMPLE DESCRIPTION:	BH 17 R2	BH 12 R6	BH 14 R4
			SAMPLE TYPE:	Soil	Soil	Soil
			DATE SAMPLED:	2023-10-31	2023-10-31	2023-10-31
Parameter	**Unit**	**G / S**	**RDL**	**5549286**	**5549287**	**5549288**
Chloride (2:1)	µg/g		2	11	20	11
Sulphate (2:1)	µg/g		2	13	55	13
pH (2:1)	pH Units		NA	9.75	9.96	9.92
Electrical Conductivity (2:1)	mS/cm		0.005	0.324	0.397	0.301
Resistivity (2:1) (Calculated)	ohm.cm		1	3090	2520	3320
Redox Potential 1	mV		NA	338	384	366
Redox Potential 2	mV		NA	346	389	369
Redox Potential 3	mV		NA	349	392	373

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

5549286-5549288 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.
Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Quality Assurance

CLIENT NAME: EXP SERVICES INC
PROJECT: OTT-23002538-AO
SAMPLING SITE:Bank Street

AGAT WORK ORDER: 23Z104773
ATTENTION TO: Daniel Wall
SAMPLED BY:

Soil Analysis

RPT Date: Dec 22, 2023			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
(Soil) Inorganic Chemistry															
Chloride (2:1)	5549286	5549286	11	10	11.6%	< 2	95%	70%	130%	99%	80%	120%	100%	70%	130%
Sulphate (2:1)	5549286	5549286	13	13	3.0%	< 2	94%	70%	130%	100%	80%	120%	100%	70%	130%
pH (2:1)	5549286	5549286	9.75	9.71	0.4%		93%	80%	120%						
Electrical Conductivity (2:1)	5549286	5549286	0.324	0.286	12.2%	< 0.005	90%	80%	120%						
Redox Potential 1	5549286		NA	NA	NA		100%	90%	110%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

Method Summary

CLIENT NAME: EXP SERVICES INC
PROJECT: OTT-23002538-AO
SAMPLING SITE:Bank Street

AGAT WORK ORDER: 23Z104773
ATTENTION TO: Daniel Wall
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	modified from G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	modified from G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	modified from G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

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5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 23Z104773

Cooler Quantity: n/a-

Arrival Temperatures: 19.8 | 19.7 | 19.6
6.6 | 6.4 | 6.2

Custody Seal Intact: ☐Yes ☐No ☒N/A

Notes: BAGGED ICE

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: EXP
Contact: DANIEL WALL
Address: 2650 QUEENSWAY DRIVE
Phone: Fax:
Reports to be sent to:
1. Email: DANIEL.WALL@EXP.COM
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table ___ *Indicate One*
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture *(Check One)*
☐Coarse
☐Fine

☐ Regulation 406
Table ___ *Indicate One*
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐Sanitary ☐Storm
Region
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): E.O.D. DEC 22/23

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: OTT-23002538-A0
Site Location: BANK STREET
Sampled By:
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a Record of Site Condition? ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

	Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153 Metals & Inorganics	Metals - ☐CrVI, ☐Hg, ☐HWSB	BTEX, F1-F4 PHCs	VOC	PAHs	PCBs	PCBs: Aroclors ☐	O. Reg 558 Landfill Disposal Characterization TCLP: TCLP: ☐M&I ☐VOCs ☐ABNs ☐B(a)P☐PCBs	O. Reg 406 Regulation 406 SPLP Rainwater Leach SPLP: ☐Metals ☐VOCs ☐SVOCs	Regulation 406 Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: ☐Moisture ☐ Sulphide	PH	CHLORIDES	SULPHIDES	RESISTIVITY			Potentially Hazardous or High Concentration (Y/N)
1.	BH 17 R2	OCT 31/23	AM PM		ROCK	13'-13'2"													✓	✓	✓	✓			
2.	BH 12 R6	↓	AM PM		↓	33'10"-34'2"													✓	✓	✓	✓			
3.	BH 14 R4		AM PM			20'1"-20'4"													✓	✓	✓	✓			
4.			AM PM																						
5.			AM PM																						
6.			AM PM																						
7.			AM PM																						
8.			AM PM																						
9.			AM PM																						
10.			AM PM																						
11.			AM PM																						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
DANIEL WALL	DEC 15	12 NOON		12/15/23	12h00
	12/15/23	18h30		12/16/23	10:15AM

Page ___ of ___

Nº: T-147993

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

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