Montfort Hospital

c/o ZW Project Management Inc.

Detailed Geotechnical Investigation

Type of Document
FINAL (supersedes August 15, 2017 report)

Project Name
Geotechnical Investigation,
Proposed Orleans Family Health Hub (OFHH)
2225 Mer Bleue Road
Ottawa (formerly Orleans), Ontario

Project Number
OTT-000240904-A0

Prepared By: Susan M. Potyondy, P.Eng.

Reviewed By: Ismail M. Taki, M.Eng., P.Eng.

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

Date Submitted:
March 14, 2018

Montfort Hospital

c/o ZW Project Management Inc.

150 Richmond Road
Ottawa, Ontario K1Z 6W2

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Prepared By:
EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada
T: 613-688-1899
F: 613-225-7337
www.exp.com

Susan M. Potyondy, P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environment

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

Date Submitted:
March 14, 2018

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Executive Summary

A geotechnical investigation was undertaken at the site of the proposed Orleans Family Health Hub (OFHH) to be located at 2225 Mer Bleue Road in the City of Ottawa (formerly Orleans), Ontario. The investigation was completed in general conformance with the technical requirements document titled, "AFP – Geotechnical, Hydrogeology, Environmental Due Diligence Technical Requirements" dated June 8, 2012 and prepared by Infrastructure Ontario.

The project under consideration comprises the construction of a new one- to two-storey 8,310 m^2 healthcare facility with associated access roads, surface parking facility and outdoor landscaped areas. The building will not have a basement and will be serviced by municipal infrastructure via an east-west service easement connecting to the east side of the building. A loading dock will be located on the east side of the building and will have retaining walls with a height of 1.35 m above final grade tapering to 0.15 m above final grade.

Based on the preliminary site grading plan (Drawing No. C-002) prepared by EXP Services Inc. (EXP) and dated February 16, 2018 and prepared by EXP, the proposed maximum site grade raise in the building area will be 1.73 m and up to 1.4 m in the remaining area of the site.

The fieldwork for this investigation was completed between June 20 and July 5, 2017 and comprised the drilling of 46 boreholes to termination/auger refusal depths of 3.2 m to 15.8 m below the existing ground surface; i.e. Elevation 74.0 to 71.9 m. In addition, a dynamic cone penetration test (DCPT) was conducted in select boreholes to cone refusal depths of 13.4 to 14.3 m; i.e. Elevation 74.1 to 73.5 m. The fieldwork was supervised on a full-time basis by geotechnical personnel from EXP.

The investigation has revealed the subsurface conditions at the site comprise of surficial topsoil layer and fill underlain by firm to hard silty clay stratum extending to depths of 11.9 to 14.1 m; i.e. Elevation 76.0 to 73.7 m, overlying a glacial till which extends to depths of 13.9 to 15.9 m; i.e. Elevation 74.0 to 71.9 m, mantling limestone bedrock. The groundwater table measurements range from ground surface to 1.4 m depth; i.e. Elevation 88.0 to 86.4 m.

The investigation has revealed the site is underlain by a deep deposit of clay, which is slightly over-consolidated. As a result, settlements of any structure founded on spread and strip footings in conjunction with the proposed site grade raise will exceed the normally tolerated limits of 25 mm total and 19 mm differential movements. Therefore, footings to support the proposed building is considered not feasible. Caissons are also not considered feasible due to the high groundwater level (de-watering) and costs. Therefore, it is recommended that the proposed building be supported by pile foundation.

The restriction for site grade raise using conventional soil fill is 0.50 m. Based on the proposed grades, it is recommended that floor slab of the proposed building should be constructed as a structural slab supported by the pile foundation and the grades raised beneath the interior of the building using conventional fill. The slab should be equipped with perimeter and underfloor drains.

At entrances to the building, a combination of soil fill and LWF should be used to minimize differential settlement between the floor and sidewalk entranceways. For guidance, the site grade raise should consist of a combination of 0.5 m of soil fill and LWF placed over a horizontal distance of 2.4 m from the exterior side of the building. This could also be applied to planter areas, if settlement cannot be tolerated.

For the parking lot and access road areas, the total site grade raise may be raised by the placement of soil fill. Some consolidation settlement of the clay should be expected over time requiring future maintenance of the pavement structures.

The estimated total settlement of the underground services from the placement of the site grade raise using soil fill is anticipated to be within the limiting total settlement for service connections of 50 to 135 mm as indicated in the 2006 Canadian Foundation Engineering Manual (4th Edition). Therefore, provided this range of total settlement can be tolerated by the underground services, no special measures are required for the pipes.

Excavations for the construction of the proposed building and installation of underground services must be undertaken in accordance with the current Occupational Health and Safety Act. Seepage of surface and subsurface water into the excavations may be handled by collecting the water at low points and conventional pumping techniques. High capacity pumps may be required in zones of more permeable soils.

The soils to be excavated from the site are anticipated to be fill and silty clay. The fill is not considered suitable for reuse as backfill material. The brown and grey silty clay above and below the groundwater level are considered too wet and not suitable for reuse as backfill material. The fill, brown and grey silty clay may be used in landscaped areas. It is anticipated the majority of backfill material required for this project will have to be imported and should consist of materials recommended in this report.

The site has been classified as Class D for seismic site response in accordance with Table 4.1.8.4.A of the 2012 Ontario Building Code. The subsurface soils are considered not to be liquefiable.

The pavement structure for access roads and heavy-duty parking areas may consist of 90 mm of asphaltic concrete underlain by 150 mm of OPSS 1010 Granular A base and 600 mm of OPSS 1010 Granular B Type II sub-base. The pavement structure for light duty parking areas may consist of 65 mm of asphaltic concrete underlain by 150 mm of OPSS 1010 Granular A base and 450 mm of OPSS 1010 Granular B sub-base. Extra care should be taken during the preparation of the subgrade to ensure that it is not overworked or disturbed by the construction traffic due to the sensitive nature of the clay subgrade. The approved subgrade should be covered with a woven geotextile.

Normal Portland cement may be used in the sub-surface concrete at this site. The subsurface soils are considered to be mildly to severely corrosive to buried steel members/structures. A corrosion expert should be retained to provide corrosion protection recommendations.

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

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1 Introduction

A geotechnical investigation was undertaken at the site of the proposed Orleans Family Health Hub (OFHH) to be located at 2225 Mer Bleue Road in the City of Ottawa (formerly Orleans), Ontario. Written authorization to proceed with the original geotechnical investigation and additional geotechnical engineering services was authorized by Ms. Chantal Potvin of Montfort Hospital via Purchase Order No. 00184636 Rev.1. The investigation was completed in general conformance with the technical requirements document titled, "AFP – Geotechnical, Hydrogeology, Environmental Due Diligence Technical Requirements" dated June 8, 2012 and prepared by Infrastructure Ontario.

The project under consideration comprises the construction of a new one- to two-storey 8,310 m^2 healthcare facility with associated access roads, surface parking facility and outdoor landscaped areas. The building will not have a basement and will be serviced by municipal infrastructure via an east-west service easement connecting to the east side of the building. A loading dock will be located on the east side of the building and will have retaining walls with a height of 1.35 m tapering to 0.15 m above final grade.

Based on the preliminary site grading plan (Drawing No. C-002) prepared by EXP and dated February 16, 2018, the proposed maximum site grade raise in the building area will be 1.73 m, 0.92 m maximum site grade raise in the parking lot, 1.41 m maximum site grade raise along the north-south access road on the west side of the building and 0.80 maximum site grade raise along the north-south access road along the east side of the building. Based on the preliminary site servicing plan (Drawing No. C-001) prepared by EXP and dated February 16, 2018, the proposed east-west municipal service easement at the east side of the building will have a site grade raise of 1.73 m that gradually tapers or decreases in the east direction to approximately 165 m east of the building, where the final grade matches the existing grade and the new underground services tie into the existing services that originate from Gerry Lalonde Drive.

The investigation was undertaken to:

a) Establish the subsurface soil, bedrock and groundwater conditions at the borehole locations;

b) Classify the site for seismic site response in accordance with the requirements of the 2012 Ontario Building Code (OBC) and assess the potential for liquefaction of the subsurface soils during a seismic event;

c) Comment on grade-raise restrictions;

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) Discuss the feasibility of constructing the lowest floor slab as a slab-on-grade and provide comments regarding perimeter and underfloor drainage systems;

f) Provide pipe bedding requirements for municipal underground services;

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 thickness for access roads and parking areas;

j) Comment on subsurface concrete requirements and corrosion potential of subsurface soils to buried metal structures/members; and

k) Discuss tree planting.

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

Phase I and II Environmental Site Assessments (ESAs) and a hydrogeological investigation (including water balance) were undertaken concurrently with the geotechnical investigation by EXP with the results reported under separate covers.

2 Background Information

A geotechnical investigation was undertaken in 2010 at the subject site for the proposed Orleans Family Health Hub and was reported under Trow Associates Inc. [now EXP Services Inc. (EXP)], Project No. OTGE-00020336A dated January 22, 2010. The investigation comprised the drilling of nine (9) boreholes advanced to auger or dynamic cone refusal/termination depths between 1.8 and 16.0 m. The investigation revealed the subsurface soil conditions, below the surficial topsoil layer, comprised of an extensive silty clay deposit underlain by a thin silty sand till layer overlying boulders or bedrock. The groundwater levels ranged from 0.5 to 1.2 m depth below existing ground surface at the time of the investigation. The borehole locations from the 2010 geotechnical investigation are shown in Figure 2 and the borehole logs are shown in Appendix A. Significant findings and recommendations from the 2010 geotechnical investigation were as follows:

- The site is underlain by deep deposit of 12 to 16 m of silty clay overlain by thin layer of glacial till mantling bedrock contacted at inferred depths of 12.5 to 16 m. The groundwater table was established at depths of 0.5 to 1.5 m below the existing ground surface;
- A zero and 0.5 m grade raise were considered permissible at the site within the building envelope and parking areas respectively;
- The proposed building should be founded on deep foundation, i.e. driven piles; and
- A site Class E was selected for this site for seismic design in accordance with the 2006 Ontario Building Code (OBC).

3 Site Description

The subject site is located in the northeast quadrant of the intersection of Brian Coburn Boulevard and Mer Bleue Road in the Orleans suburb of the City of Ottawa, Ontario. The site location plan is shown on Figure 1. The site is approximately 9.2 hectares in size and is currently vacant. At the time of the geotechnical investigation, the site was covered with high grass and scrub brush. Trees are present along the north property limit and in the southwest portion of the site.

The topographic plan tilted, "Topographic Plan Survey of Part of Lot 2, Concession 11 (Geographic Township of Cumberland), City of Ottawa", dated April 2017 and prepared by Stantec Geomatics Ltd. was reviewed for this geotechnical investigation.

The site is occupied by soil stockpiles in the northwest and southeast corners of the site and in the west portion of the property. The topographic plan indicates the stockpiles range in height from approximately 0.7 to 2.2 m. Debris in the form of concrete and brick pieces and automobile tires were scattered over the ground surface along the western edge of the site in the vicinity of former buildings (refer to Phase I ESA).

Major drainage ditches run along the north property line, west property line parallel with Mer Bleue Road and the west section of the south property line parallel with Brian Coburn Boulevard. A major ditch in the southern section of the site runs partway across the site in an east-west direction from the ditch along Mer Bleue Road. It appears that this ditch runs through the proposed location of the building. The topographic plan indicates the depth of this ditch ranges from 200 to 660 mm below existing grade. Areas of poor drainage ('swampy' areas) are present in the southwest section, eastern and localized area along the north property line of the site and are covered with high grass and cattails (bulrushes). At the time of the borehole drilling for the geotechnical investigation, the drainage ditches and 'swampy' areas were covered with ponded water up to 900 mm deep. In addition, localized areas of significant ponded water are scattered throughout the site.

Based on borehole elevations and the topographic plan, the topography of the site is relatively flat with ground surface elevations at the borehole locations ranging from Elevation 88.05 m to 87.47 m with typical elevations across the site in the order of 87.7 to 87.9 m.

4 Procedure

The fieldwork for the geotechnical investigation was undertaken between June 20 and July 5, 2017. The original scope of work consisted of 47 boreholes (Borehole Nos. 1 to 47). However, Borehole No. 46 could not be drilled, since the borehole location could not be accessed by the drill rig due to excessive water ponding and the presence of drainage ditches. Therefore, a total of 46 boreholes were drilled for the geotechnical investigation. The borehole drilling program was undertaken in general conformance with our proposal, and a summary of the completed borehole drilling program for each type of proposed structure is shown in Table I. The fieldwork was supervised on a full-time basis by a representative of EXP.

Table I: Summary of Borehole Drilling Program

Borehole Numbers	Borehole Termination Depths
1-18 and 34	3.2 m and 4.7 m
21, 23, 24-28 28,30,32,33,35-38 and 42-44	6.3 m
19,22,31,41 and 47	To Bedrock at 13.9 m to 15.8 m Depths and Cored 3 m to 4 m of the Bedrock; Termination Depths Ranging from 17.6 to 19.0 m.
20, 29, 39, 40 and 45	To 6.3 m Depth and Advanced Dynamic Cone from 6.3 m Depth to Cone Refusal Depths Ranging from 13.4 to 14.3 m.

The borehole locations were established on site by EXP and based on the proposed locations of the access road, parking lot and building shown in the AutoCAD drawing provided by ZW Project Management Inc. Boreholes within the proposed building footprint were spaced on an approximate 20 m grid and on an approximate 40 m grid for the proposed underground services, access road and parking areas. The geodetic ground surface elevations of the boreholes were determined on site by EXP. The borehole locations from the current and 2010 geotechnical investigations and from the Phase II ESA are shown on the Borehole Location Plan, Figure 2.

Prior to the commencement of the fieldwork, the borehole locations were cleared of any underground services by USL-1 Cable Locates.

The boreholes were drilled with a track-mounted CME- 850-J drill rig equipped with continuous flight hollow-stem auger equipment and rock coring capabilities. Standard penetration tests (ASTM 1586) were performed in all the boreholes at 0.75 and 1.5 m depth intervals and soil samples retrieved by split-barrel sampler. In addition, relatively undisturbed thin wall tube samples were obtained from selected depths in some of the boreholes. The undrained shear strength of the silty clay was determined using in-situ field vane tests (ASTM 273) and the pocket penetrometer. The bedrock in Borehole Nos. 19, 22, 31, 41 and 47 was proven by core-drilling techniques using NQ-size core bit. During core drilling of the bedrock, a record of wash water return, colour of wash and any sudden drop of the drill rods were kept. Borehole Nos. 20, 29, 39, 40 and 45 were advanced, unsampled below a 6.0 m depth by conducting dynamic cone penetration

test (DCPT) to cone refusal depths. All the soil samples were visually examined in the field, logged, placed in plastic bags and identified. The rock cores were logged, placed in core boxes and identified. Methane readings were undertaken in the boreholes using an RKI-GX four (4) gas reader.

Groundwater levels were measured in the open boreholes upon completion of drilling. In addition, 19 mm diameter slotted standpipe and 50 mm diameter monitoring wells (from the Phase II ESA) were installed in Borehole Nos. 1, 5, 7, 13, 16, 18, 19, 26, 28, 35, 45 and 47 for long-term monitoring and sampling of the groundwater table. The standpipe piezometers and monitoring wells were installed in accordance with EXP standard practice and their installation configuration is documented on the respective borehole log.

On completion of each phase of the fieldwork, all the soil samples and rock cores were transported to the EXP laboratory located in the City of Ottawa. All the soil samples and rock cores were visually examined in the laboratory by a senior geotechnical engineer for textural classification (ASTM D2487) and borehole and borehole logs prepared. The engineer also assigned the laboratory testing, which consisted of performing the following tests:

Natural Moisture Content of Soil (ASTM D2216-10) ..... 319 tests

Unit Weight of Soil (ASTM D7263-09)..... 91 tests

Grain-Size Analysis of Soil (ASTM C136 and D422) ..... 5 tests

Atterberg Limits (ASTM D4318) ..... 5 tests

Consolidation Test of Soil (ASTM D2435)..... 2 tests

Unconfined Compressive Strength Tests on Bedrock Cores……. 5 tests

pH, Sulphate, Chlorides, Resistivity Analyses of Soil..... 10 tests

5 Subsurface Soil and Groundwater Conditions

A detailed description of the geotechnical conditions encountered in the 46 boreholes is given on the borehole logs, Figures 3 to 48 inclusive. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. 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 soil stratigraphy and bedrock conditions with depth and groundwater level measurements in the areas of the proposed building, underground service, access road and parking lot.

5.1 Proposed Parking Lot and Access Road Areas

5.1.1 *Topsoil*

A surficial 50 to 355 mm thick topsoil layer was contacted in all boreholes except Borehole No. 15.

5.1.2 *Fill*

Fill was encountered at ground surface in Borehole No. 15 and below the topsoil in Borehole No. 12. The fill extends to depths of 0.6 and 0.8 m; i.e. Elevation 87.3 and 87.6 m respectively. The fill consists of sand and gravel mixed with construction debris (concrete and brick pieces) in Borehole No. 15. Based on the N-values of 4 and 5 from the standard penetration test (SPT), the fill is in a loose state. The natural moisture content of the fill is 20 and 25 percent.

5.1.3 *Silty Clay (Desiccated Crust)*

The topsoil and fill in all boreholes are underlain by a native silty clay comprising of an upper desiccated brown to greyish brown silty clay crust underlain by grey silty clay. The upper crust extends to an approximate 2.2 m depth; i.e. Elevation 86.4 to 85.5 m. The silty clay crust is approximately 1.6 to 2.1 m thick. The undrained shear strength of the crust is 120 to 216 kPa indicating a very stiff to hard consistency. The natural moisture content and unit weight of the crust are 25 to 53 percent and 16.6 to 19.7 kN/m^3 respectively. Grain-size analysis was undertaken on one (1) sample of the silty clay crust and the grain-size distribution curve is shown in Figure 49. The results of the grain-size analysis indicate a soil composition of 74 percent clay, 23 percent silt, and 3 percent sand. The crust may be classified as a silty clay with trace of sand.

5.1.4 *Silty Clay*

In all of the boreholes, the brown to greyish brown silty clay crust is underlain by the grey silty clay. All boreholes terminated within the grey silty clay at 3.2 to 4.7 m depths; i.e. Elevation 85.0 to 83.0 m. The undrained shear strength of the silty clay ranges from 106 to 34 kPa with depth, indicating a very stiff to firm consistency. Lower undrained shear strength measurements of 24 and 29 kPa are present at 3.7 m depth (Elevation 84.3 m), and 4.6 m depth (Elevation 83.1 m) in Borehole Nos. 34 and 18 respectively. These lower undrained shear strength values suggest a localized firm to soft zone at the noted depths within the silty clay. Based on sensitivity values of 4 to 8, the silty clay may be described as sensitive. A higher sensitivity value of 12 indicating an extra-sensitive zone is noted in Borehole No. 2 at a 3.1 m depth; i.e. Elevation 84.9 m. The silty clay has a moisture content of 48 to 91 percent with one (1) sample having a moisture content of 36 percent. Based on one (1) sample, the natural unit weight of the silty clay is 16.4 kN/m^3.

5.2 Proposed Building Area

5.2.1 *Topsoil*

A surficial 75 to 405 mm thick topsoil layer was contacted in all boreholes except Borehole No. 23.

5.2.2 *Fill*

Fill was encountered at ground surface in Borehole No. 23 and below the topsoil in Borehole Nos. 29 and 47. The fill extends to depths ranging from 0.6 to 0.9 m; i.e. Elevation 87.4 and 86.6 m respectively. The fill consists of sand and gravel, sandy gravel and gravel mixed with construction debris (concrete and brick pieces) and wood chips. Based on the N-values of 3 to 27 from the standard penetration test (SPT), the fill is in a very loose to compact state. The natural moisture content of the fill is 17 to 37 percent.

5.2.3 *Silty Clay (Desiccated Crust)*

The topsoil and fill in all boreholes are underlain by a native silty clay comprising of an upper desiccated brown to greyish brown silty clay crust underlain by grey silty clay. The upper crust extends to approximate depths of 1.4 to 3.0 m; i.e. Elevation 86.4 to 85.0 m. The silty clay crust is approximately 0.8 to 2.6 m thick. The undrained shear strength of the crust is 106 to 216 kPa indicating a very stiff to hard consistency. The single sensitivity value of 4.4 indicates the silty clay crust is sensitive. The natural moisture content of the crust is 33 to 58 percent with two (2) high values of 61 and 66 percent. The natural unit weight of the silty clay crust ranges from 16.4 to 19.0 kN/m^3.

An Atterberg limit test performed on one (1) sample of the silty clay crust indicates a liquid limit of 61 percent and plastic limit of 27 percent resulting in a plasticity index of 34 percent and liquidity index of 0.5. Based on the Atterberg limit result, the silty clay crust may be classified as a silty clay of high plasticity.

One-dimensional oedometer test was performed on one (1) sample of the brown to greyish brown silty clay crust. The test results are summarized in Table II. The test results are shown in Appendix B.

Table II: One-Dimensional Oedometer Test Results on Brown to Greyish Brown Silty Clay Sample

BH No.-Sample No.	Elevation (Depth) (m)	σ'_{v0} (kPa)	w_c (%)	γ (kN/m^3)	σ'_p (kPa)	e_o	c_r	c_c	OC (kPa)
BH19 -TW3	86.1 – 86.0 (1.8-1.9)	28	47	17.3	450	1.281	0.042	0.57	422

σ'_{v0} = effective overburden pressure (kPa); Wc: water content (%), γ: estimated natural unit weight σ'_p = pre-consolidation pressure (kPa), e_o = initial void ratio, ; c_r = re-compression index; c_c = compression index; OC= over-consolidation pressure (kPa);

Note: σ'_{v0} calculated using July 21, 2017 groundwater level measurements.

The test results indicate that the pre-consolidation pressure of the brown to greyish brown silty clay is 450 kPa and its effective overburden pressure is 28 kPa. Therefore, the silty clay is over consolidated by 422 kPa. The compression and recompression indices of the silty clay are 0.57 and 0.042 respectively.

5.2.4 *Silty Clay*

The brown to greyish brown silty clay crust is underlain by the grey silty clay in all the boreholes. The silty clay extends to depths ranging from 11.9 to 14.1 m; i.e. Elevation 76.0 to 73.7 m in Borehole Nos. 19, 22, 31, 41 and 47. Based on dynamic cone penetration test (DCPT) results, the silty clay was inferred below the 6.3 m depth; i.e. Elevation 81.5 to 81.2 m to cone refusal depths of 13.4 to 14.3 m depth, i.e. Elevation 74.1 to 73.5 m in Borehole Nos. 20, 29, 39, 40 and 45. Borehole Nos. 21, 23 to 28, 30, 32, 33, 35 to 38 and 42 to 44 terminated within the grey silty clay at 6.3 m depth; i.e. Elevation 81.8 to 81.3 m. The undrained shear strength of the silty clay ranges from 96 to 34 kPa with depth, indicating a stiff to firm consistency. Localized high shear strength value of 103 kPa (very stiff consistency), was measured in Borehole No. 36 at 2.2 m depth; i.e. Elevation 85.6 m near the interface between the brown silty clay crust and grey silty clay. Localized firm zones of the silty clay were identified by low shear strength measurements of 29 and 31 kPa in Borehole Nos. 41 and 47 at 3.7 to 5.3 m depths; i.e. Elevation 84.1 to 82.5 m. The sensitivity values of the silty clay range from 2.4 to 9.0 indicating the silty clay is of a medium sensitivity to extra-sensitive. The natural moisture content of the silty clay ranges from 50 to 96 percent. Based on two (2) samples, the natural unit weight of the silty clay is 15.0 and 16.9 kN/m^3.

Grain-size analyses were conducted on two (2) samples of the grey silty clay and the results are summarized in Table III. The grain-size distribution curves are shown in Figures 50 and 51.

Table III: Summary of Results from Grain Size Analysis – Grey Silty Clay Samples					
Borehole No. - Sample No.	Depth (m)	Grain Size Analysis (%)			
		Clay	Silt	Sand	Gravel
BH 19-SS 9	7.6 – 8.2	77	21	2	0
BH 22-SS 11	10.7 – 11.3	65	32	3	0

Based on a review of the results from the grain-size analyses, the soil may be classified as a silty clay with trace of sand.

Atterberg limit determination was conducted on four (4) samples of the grey silty clay and the results are presented in Table IV.

Table IV: Summary of Atterberg Limit Results – Grey Silty Clay Samples							
Borehole No. - Sample No.	Depth (m)	Atterberg Limit Results					
		w_n (%)	LL (%)	PL (%)	PI (%)	LI	Soil Classification [(1)]
BH22 – SS8	6.1 – 6.7	88	56	30	26	2.2	CH
BH31 – SS7	4.6 – 5.2	89	60	26	34	1.9	CH
BH41-SS12	12.2 – 12.8	61	52	24	28	1.3	CH
BH47-TW11	10.7 – 11.3	88	50	25	25	2.5	CL
W_n: Water Content, **LL**: Limit Liquid; **PL:** Plastic Limit; **PI**: Plasticity Index; **LI**: Liquidity Index; [(1)]: Refer to Casagrande Plasticity Chart (1932).							

Based on a review of the Atterberg limit values, the grey silty clay may be classified as a silty clay of low to medium plasticity (CL) to high plasticity (CH).

One-dimensional oedometer test was performed on one (1) sample (Borehole No. 47) of the grey silty clay. The test results are shown in Table V along with the one-dimensional oedometer test results from two (2) samples (Borehole Nos. 1 and 9) of the grey silty clay from the 2010 geotechnical investigation. The test results from the current investigation are shown in Appendix B.

Table V: One-Dimensional Oedometer Test Results on Grey Silty Clay Samples									
BH No.- Sample No.	**Elevation (Depth) (m)**	**σ'_{v0} (kPa)**	**w_c (%)**	**γ (kN/m^3)**	**σ'_p (kPa)**	**e_o**	**c_r**	**c_c**	**OC (kPa)**
BH47-TW11	76.8 – 76.7 (11.0-11.1)	78	83	15.0	110	2.289	0.032	1.95	32
BH1-TW8	81.7-81.1 (6.1-6.7)	64	84	15.2	120	2.318	0.064	1.80	56
BH9-TW6	84.0-83.4 (3.8-4.4)	45	86	14.7	96	2.382	0.075	2.41	51

σ'_{v0} = effective overburden pressure (kPa); Wc: water content (%), γ: estimated moist unit weight σ'_p = pre-consolidation pressure (kPa), e_o = initial void ratio, ; c_r = re-compression index; c_c = compression index; OC= over-consolidation pressure (kPa);

σ'_{v0} calculated using July 21, 2017 groundwater level measurements.

The test results indicate that the pre-consolidation pressure of the brown to grey silty clay ranges from 96 to 120 kPa and its effective overburden pressure is 45 to 7 kPa. Therefore, the silty clay is over consolidated by 32 to 56 kPa. The compression and recompression indices of the silty clay range from 1.80 to 2.41 and 0.032 to 0.075 respectively.

5.2.5 *Glacial Till*

The grey silty clay in Borehole Nos. 19, 22, 31, 41 and 47 is underlain by glacial till at 11.9 to 14.1 m; Elevation 76.0 to 73.7 m and extends to depths ranging from 13.9 to 15.9 m; i.e. Elevation 74.0 to 71.9 m. The till is approximately 0.5 to 1.8 m thick. The glacial till consists of silty clay with some sand and trace to some gravel to clayey, sandy, gravelly silt to clayey, silty gravelly sand. The till contains cobbles and boulders. Based on the N values from the standard penetration test (SPT), the till is in a very dense state. The natural moisture content of the till is 22 and 24 percent.

The results from grain-size analyses of two (2) samples of the glacial till are summarized in Table VI. The grain-size distribution curves are shown in Figures 52 and 53.

Table VI: Summary of Results from Grain Size Analysis – Glacial Till Samples					
Borehole No. - Sample No.	**Depth (m)**	**Grain Size Analysis (%)**			
		Clay	**Silt**	**Sand**	**Gravel**
BH41-SS13	13.7-14.3	49	27	14	10
BH47-SS13	13.7-14.3	54	33	10	3

Based on a review of the results from the grain-size analyses, the glacial till in Borehole Nos. 41 and 41 may be described as a silty clay till with some sand and trace to some gravel.

5.2.6 *Cone Refusal*

Cone refusal from the dynamic cone penetration test (DCPT) was met in Borehole Nos. 20, 29, 39, 40 and 45 at 13.4 to 14.3 m depths; i.e. Elevation 74.1 to 73.5 m. Cone refusal may have been met on inferred cobbles, boulders or bedrock.

5.2.7 *Bedrock*

Beneath the glacial till in Borehole Nos. 19, 22, 31, 41 and 47, limestone bedrock was encountered at 13.9 to 15.8 m depths; i.e. Elevation 74.0 to 71.9 m. Review of published geology maps indicates the site is underlain by limestone bedrock of the Ottawa Formation.

Review of the recovered bedrock cores indicates the total core recovery (TCR) ranges from 98 to 100 percent. The rock quality designation (RQD) value ranges from 24 to 98 percent indicating the bedrock ranges from very poor to excellent in quality. The results of the unconfined compressive strength test completed on five (5) rock cores indicates the unconfined compressive strength of the rock cores ranges from 98 to 168 MPa. Based on the Canadian Foundation Engineering Manual (CFEM), 4th Edition, 2006, the rock may be classified as ‘strong’ to ‘very strong’ rock. The unit weight of the bedrock ranges from 2,673 to 2,700 kg/m$^{3.}$ Photographs of the bedrock cores are shown in Appendix C.

5.3 Groundwater

Water level observations were made in the boreholes during drilling and in standpipe piezometers and monitoring wells installed in boreholes subsequent to completion of drilling. The groundwater observations made in the boreholes are shown in Table VII.

Table VII: Summary of Groundwater Levels in Boreholes					
Borehole No.	**Ground Surface Elevation (m)**	**Drill Date**	**Date of Groundwater Level Measurement (Number of Days After Drilling)**	**Depth (m)**	**Elevation (m)**
Proposed Parking Lot and Access Road Areas					
BH-1	88.55	June 21, 2017	July 21, 2017 (30 days)	0.6	88.0
BH-5	87.82	June 20, 2017	July 21, 2017 (31 days)	0.1	87.7
BH-7	87.94	June 20, 2017	July 21, 2017 (31 days)	0.2	87.7
BH-13	87.78	June 20, 2017	July 21, 2017 (14 days)	0.0 (ground surface)	87.8
BH-16	87.82	June 30, 2017	July 21, 2017 (21 days)	0.3	87.5
BH-18	87.74	June 27, 2017	July 21, 2017 (24 days)	0.1	87.6
Proposed Building Area					
BH-19	87.86	June 21, 2017	July 21, 2017 (30 days)	1.4	86.5
BH-28	87.87	June 28, 2017	July 21, 2017 (23 days)	0.6	87.3
BH-35	87.74	July 4, 2017	July 21, 2017 (17 days)	0.0 (ground surface)	87.7
BH-45	87.76	June 27, 2017	July 21, 2017 (24 days)	0.2	87.6
BH-47	87.84	June 23, 2017	July 21, 2017 (28 days)	1.4	86.4

A review of Table VII indicates the groundwater table at the site was measured at depths ranging from ground surface to 1.4 m depth; i.e. Elevation 88.0 to 86.4 m.

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

5.4 Methane Readings

The methane readings in each borehole are 0 percent, indicating no presence of methane gas.

6 Site Classification for Seismic Site Response and Potential for Liquefaction

The geotechnical investigation revealed that the subsurface soil conditions at the site consist of topsoil and fill underlain by native silty clay extending to depths ranging from 11.9 to 14.1 m, i.e. Elevation 76.0 to 73.7 m overlying a glacial till to depths of 13.9 to 15.9 m; i.e. Elevation 74.0 to 71.9 m underlain by limestone bedrock.

6.1 Liquefaction Potential

As indicated in Section 4 of this report, the liquid and plastic limits of the brown and grey silty clay vary from 50 to 61 percent and 24 to 30 percent respectively. The natural moisture content of silty clay ranges from 45 to 89 percent. Based on these results, the silty clay deposit is considered not to be susceptible to liquefaction as per Bray et al. (2004) criteria for fine-grained soils as shown in Figure 54.

6.2 Seismic Site Classification

At the specific proposed location of the building and using the information from the boreholes located within the proposed building footprint, the shear-wave velocity was estimated using the undrained shear strength values obtained in the silty clay, the N-values obtained in the till and an assumed shear-wave velocity of the bedrock as follows:

The shear-wave velocity value of the silty clay deposit was correlated to the undrained shear strength values (Su) using the Dickenson, S.E. (1994)[1] formula:

$$Vs(m/s) = 23.Su^{0.475}$$

The shear-wave velocity value of the glacial till was correlated to the standard penetration test values using Imai and Tonouchi[2] (1982) formula. A conservative SPT N-value of 50 was used in estimating the shear wave velocity of the till.

$$Vs(m/s) = 91.7\ N^{0.26}$$

The shear wave velocity of the bedrock was assumed at a conservative value of 360 m/s.

The average shear-wave velocity to 30 m depth was estimated at 278 m/s. Therefore, in comparing the results from the shear-wave velocity survey and the building specific borehole information, it is concluded

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[1] Dickenson, S.E. (1994), "Dynamic Response of Soft and Deep Cohesive Soils during the Loma Prieta Earthquake".
2 Imai, T, and K Tonouchi (1982). Correlation of N value with S-wave velocity and shear modulus, Proc., 2nd European Symp. on Penetration Testing, Amsterdam, pp. 67–72.

that the site can be classified as **Class D** for seismic site response in accordance with Table 4.1.8.4 A of the 2012 Ontario Building Code (OBC).

In addition, a shear wave velocity survey was undertaken at the site on January 25, 2018 by Geophysics GPR International Inc. The survey was undertaken using the Multi-channel Analysis of Surface Waves(MASW), the Extended SPatial AutoCorrelation (ESPAC) and seismic refraction methods. The results are reported in the letter dated February 5, 2018 shown in Appendix D. The MASW yielded an average shear wave velocity of 246 m/s in the upper 30 m, confirming a site classification of **Class D** for seismic site response.

7 Grade Raise Restrictions

The investigation has revealed that the deep deposit of the grey silty clay at the site is slightly over-consolidated. Consequently, large settlements of the silty clay will result if it is loaded beyond its pre-consolidation pressure. To maintain the settlements within normally tolerated limit of 25 mm total, the site grade raise is restricted to 0.50 m.

The proposed site grade raise of up to 1.7 m inside the building using conventional soil fill will result in total and differential settlements exceeding 25 mm and 19 mm, respectively. Therefore, it is recommended that the floor slab for the building be designed as a structural slab supported by pile foundation and the grades within the building raised by the placement of conventional soil fill.

It is our understanding that the design of the structural slab currently calls for the construction of a 'sandwich type' system consisting of 150 mm thick floor slab on grade underlain by 300 mm thick compacted granular fill overlying a 355 mm thick structural slab supported by the pile foundation.

At entrances to the building, a combination of soil fill and LWF should be used to minimize differential settlement between the floor and sidewalk entranceways. For guidance, the site grade raise should consist of a combination of 0.5 m of soil fill and LWF placed over a horizontal distance of 2.4 m from the exterior side of the building. This could also be applied to planter areas, if settlement cannot be tolerated.

For the parking lot and access road areas, the total site grade raise may be raised by the placement of soil fill. Some consolidation settlement of the clay should be expected over time requiring future maintenance of the pavement structures.

The estimated total settlement of the underground services from the placement of the site grade raise using soil fill is anticipated to be within the limiting total settlement for service connections of 50 to 135 mm as indicated in the 2006 Canadian Foundation Engineering Manual (4th Edition). Therefore, provided this range of total settlement can be tolerated by the underground services, no special measures are required for the pipes.

The LWF may consist of extended polystyrene (EPS) blocks conforming to ASTM C578 specification with a normal density of 21.6 kg/m^3, a compressive strength of 103 – 145 kPa at 10 percent strain, water absorption of 1.0 to 3.5 percent and tolerances within 0.5 percent for thickness, flatness and squareness. The LWF blocks should be tightly fitted to the walls of the excavation without voids. The LWF blocks should be fixed on all sides to the adjacent blocks with Building Grip PL300 construction adhesive. If another layer of light weight blocks is required, it should be installed at right angles to the previous layer with blocks fitting tightly leaving no voids. The LWF should be covered with geotextile (such as Terrafix 270R or equivalent) prior to placement of soil or granular fill.

The final grading plan should be reviewed by EXP to confirm that the grade raise is in accordance with the recommendations of this report.

8 Site Grading

Site grading within the footprint of the proposed building, parking lot and access road areas should consist of the excavation and removal of all topsoil, organic stained soil (including fully saturated organic soils from the drainage ditches) and fill from the site as well as any soil stockpiles.

The exposed subgrade in all areas should be proofrolled in the presence of a geotechnical engineer prior to backfilling operations. Any soft areas identified should be excavated and replaced with OPSS (MUNI.OPSS 1010) Granular B Type II and compacted to 98 percent of standard Proctor maximum dry density (SPMDD) as per ASTM D-698-12e2 inside the building and to 95 percent SPMDD elsewhere.

9 Foundation Considerations

The investigation has revealed the site to be underlain by deep deposits of clay, which is lightly over-consolidated. As a result, settlements of any structure founded on spread and strip footings in conjunction with the proposed site grade raise will exceed the normally tolerated limits of 25 mm total and 19 mm differential movements. Caisson foundation is also not feasible to support the proposed building due to the high groundwater level (de-watering) and that caissons will likely be more expensive than pile foundations. Therefore, it is recommended that the proposed building be founded on pile foundations.

It is our understanding the retaining walls may consist of armourstone or a modular block type system and will extend 1.35 m above the final grade and taper to 0.15 m above final grade. Based on a review of the preliminary grading plan, the site grade raise in the vicinity of the retaining walls will be approximately 1.4 m. The retaining wall may be supported by a strip footing design founded on top of the native brown clay provided settlement can be tolerated by the wall. Alternatively, the retaining wall may be supported by pile foundation.

9.1 Retaining Wall

Retaining walls having a maximum width of 1.5 m, designed as a strip footing and set on top of the undisturbed native brown clay contacted at Elevation 87.9 to 87.3 m may be designed for a bearing pressure at serviceability limit state (SLS) of 65 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 100 kPa. The factored ULS includes a geotechnical resistance factor of 0.5.

The total settlement of the retaining wall designed for the above SLS value and 1.4 m site grade raise using soil backfill is estimated at 125 mm. The retaining walls may be backfilled with LWF in which case the total settlement of the wall is estimated at 40 mm. If total settlements between 40 and 125 mm can be tolerated by the wall, the backfill may consist of a combination of soil fill and LWF. EXP can provide additional comment in this regard, if required. The retaining walls should be designed as separate structural members from the proposed building structure. If the total settlements noted above cannot be tolerated by the retaining wall, the wall should be supported on pile foundation.

For the unheated retaining walls, frost protection may be provided by 2.4 m earth cover or a combination of rigid insulation and earth cover equivalent to the 2.4 m earth cover in areas where the snow will be removed and an equivalent 2.1 m of earth cover in areas where the snow will not be removed. LWF may provide additional thermal protection to the base of the wall.

The subgrade for the retaining walls should be examined by a geotechnical engineer to ensure that the founding surfaces are capable of supporting the design bearing pressure and that the subgrade has been properly prepared. Depending on the prevailing weather conditions at the time of construction, it may be necessary to protect the surface of the native soil following excavation by the placement of a concrete mud slab.

Sliding resistance may be provided by the unfactored ULS friction coefficient between concrete and native clay of 0.35. A geotechnical resistance factor of 0.80 should be applied to the ULS value when calculating the factored ULS resistance to sliding.

9.2 Building Foundation

Closed-end pipe filled with concrete or steel H piles are considered to be the most suitable type of foundation for the support of the building foundation. However, closed end concrete filled pipe piles are expected to be more economical. Within the proposed building location, the piles are expected to meet practical refusal on bedrock at approximate depths ranging between 14.5 and 16.5 m below the existing ground surface, i.e. Elevation 73.5 to 71.1 m. Since the piles are expected to meet refusal in the bedrock, the factored geotechnical resistance at ULS will govern the design. The factored geotechnical resistance at ULS includes a resistance factor of 0.40. The factored geotechnical resistance at ULS has been given on Table VIII.

The increase in the site grades will result cause consolidation settlement of the clay. This will result in down-drag forces on the piles which will have to be taken into consideration in the design of the piles. The unfactored down-drag forces on the piles have been estimated and are shown in Table VIII.

Table VIII: Factored Geotechnical Resistance at Ultimate Limit State (ULS) and Unfactored Down-Drag Forces of Steel Pipe and H Piles

Type of Pile	Size	Factored Geotechnical Resistance at ULS (kN)	Unfactored Down-Drag Forces (kN)
Steel Pipe	245 mm O.D. by 10 mm wall thickness	1,275	315
	245 mm O.D. by 12 mm wall thickness	1,445	315
	324 mm O.D. by 12 mm wall thickness	2,120	420
Steel H	HP 310 x 79	1,260	500
	HP 310 x 110	1,775	510
	HP 310 x 125	2,000	512

The above factored geotechnical resistance at ULS was based on steel piles with a yield strength of 350 MPa and concrete compressive strength of 35 MPa.

Settlements induced by the above recommended pile loads are expected to be less than normally tolerated limits of 25 mm total and 19 mm differential movements.

In accordance with the 2006 Canadian Foundation Engineering Manual (CFEM), down-drag forces and transient live loads should not be combined. Two (2) separate loading conditions must be considered in design; permanent load plus drag load but no transient live load and permanent load and transient live load but no drag load.

To achieve the capacity given previously, the pile driving hammer must seat the pile into bedrock without overstressing the pile material. For guidance purposes, it is estimated that a hammer with rated energy of 54 kJ to 70 kJ (40,000 to 52,000 ft. lbs.) per blow would be required to drive the piles to practical refusal in the bedrock. Practical refusal is considered to have been achieved at a set of 5 blows for 6 mm or less of pile penetration. However, the driving criteria for a particular hammer-pile system must be established at the beginning of the project. This may be achieved with a Pile Driving Analyzer.

The till is expected to contain cobbles and boulders. It is therefore recommended that the pile tips should be reinforced with a 25-mm thick steel plate and equipped with a driving shoe in accordance with Ontario Provincial Standard Drawing (OPSD) 3001.100, Type II, dated November 2010 and shown in Appendix E.

The steel pipe and H piles may have to be spliced because of the length of pile required. However, the number of splices should be limited to a maximum of 1 splice per pile.

A number of test piles (5 percent of the total number of piles) should be monitored with the Pile Driving Analyzer (PDA) during the initial driving and re-striking at the beginning of the project and 3 percent of the piles tested should be subjected to CAPWAP analysis. This monitoring will allow for the evaluation of transferred energy into the pile from the hammer, determination of driving criteria and an evaluation of the geotechnical resistance at ULS of the piles. Depending on the results of the pile driving analysis, the pile capacity may have to be proven by at least one pile load test for each pile type before production piling begins. If necessary, the pile load test should be performed in accordance with ASTM D 1143.

Closed-end pipe piles tend to displace a relatively large volume of soil. When driven in a cluster or group, they may tend to jack up the adjacent piles in the group. Consequently, the elevation of the top of each pile in a group should be monitored immediately after driving and after all the piles in the group have been driven. This is to ensure that the piles are not heaving. Any piles found to heave more than 3 mm should be re-tapped.

Piles driven at the site may be subject to relaxation, i.e. loss of load carrying capacity with time. Therefore, it is recommended that the piles should be re-struck, minimum of 24 hours after initial driving to determine if the piles have relaxed. If relaxation is observed, this procedure should be repeated every 24 hours until it can be proven that relaxation is no longer a problem.

The installation of the piles at the site should be monitored on a full-time basis by a geotechnician working under the direction and supervision of a qualified geotechnical engineer to verify that the piles are driven in accordance with the project specifications.

The concrete grade beams and pile caps for heated structures should be protected from frost action by providing the beams and caps with 1.5 m of earth cover. For non-heated structures, the pile caps and beams should be provided with 2.4 m of earth cover in areas where the snow will be removed and 2.1 m of cover in areas where the snow will not be removed. Alternatively, frost protection may be provided by rigid insulation or a combination of earth cover and rigid insulation.

A granular mat at least 600 mm thick will be required to provide access to the pile driving rig following the removal of the topsoil. The thickness of the required granular mat would have to be established by the piling contractor based on the type of piling rig that will be used on-site.

The recommended factored geotechnical resistances at ULS 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.

9.2.1 *Uplift Capacity of Piles*

The computed factored ULS geotechnical uplift resistance of the piles are given in Table IX. The factored ULS geotechnical uplift resistance is based on an embedment length in the clay of 11.2 m and includes a factored geotechnical resistance of 0.30. The uplift capacities listed on Table IX do not include the dead weight of the piles.

Table IX: Factored Ultimate Limit State (ULS) Uplift Resistance of Steel Pipe and H Piles

Type of Pile	Size	Factored Geotechnical Uplift Resistance at ULS (kN)
Steel Pipe	245 mm OD x 10 mm wall thickness	95
	245 mm OD x 12 mm wall thickness	95
	324 mm OD x 12 mm wall thickness	125
Steel H	HP 310 x 79	150
	HP 310 x 110	155
	HP310 x 125	155

9.2.2 *Lateral Resistance of Piles*

The ultimate lateral resistance (capacity), H_u, and deflection, y_g, at ground level of the piles may be determined using the charts provided by Broms' (1964) shown below for short and long piles and for free head and restrained head conditions.

The pile is determined to be long or short in cohesive soil by the following criteria:

$$\beta h = \beta = \left(\frac{kb}{4EI}\right)^{1/4}$$

$\beta h\ D$ > 2.25 (long pile)

$\beta h\ D$ < 2.25 (short pile)

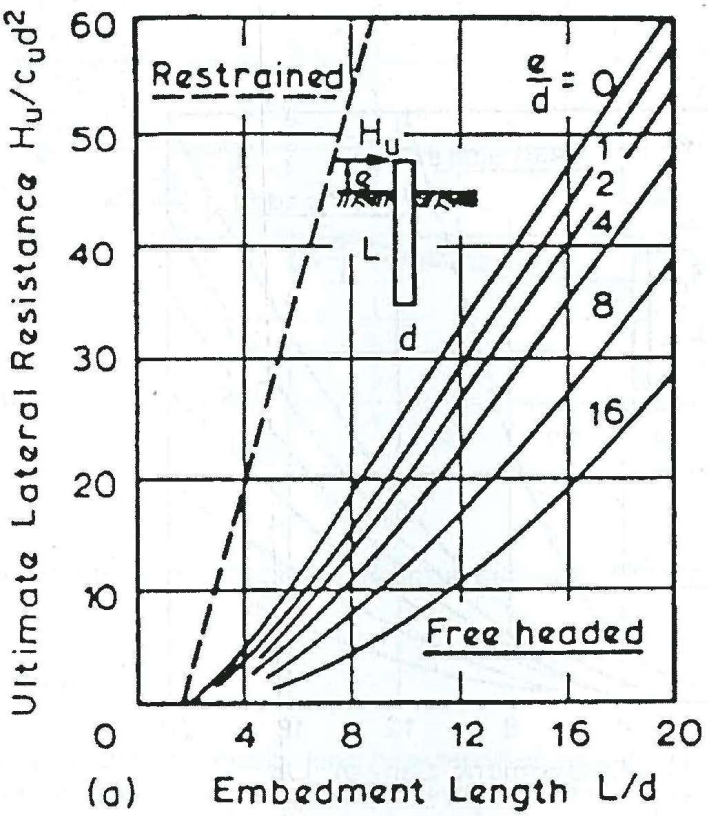
Where: b = diameter or width of the pile, m
D= embedment depth of the pile, m
E = modulus of elasticity of pile, MPa
I = moment of inertia of pile, m^4
k = k_h = coefficient of horizontal subgrade reaction = 2995/b where b is in metres and k_h is in kPa /m^3

The following geotechnical parameters may be used in determining the lateral resistance:

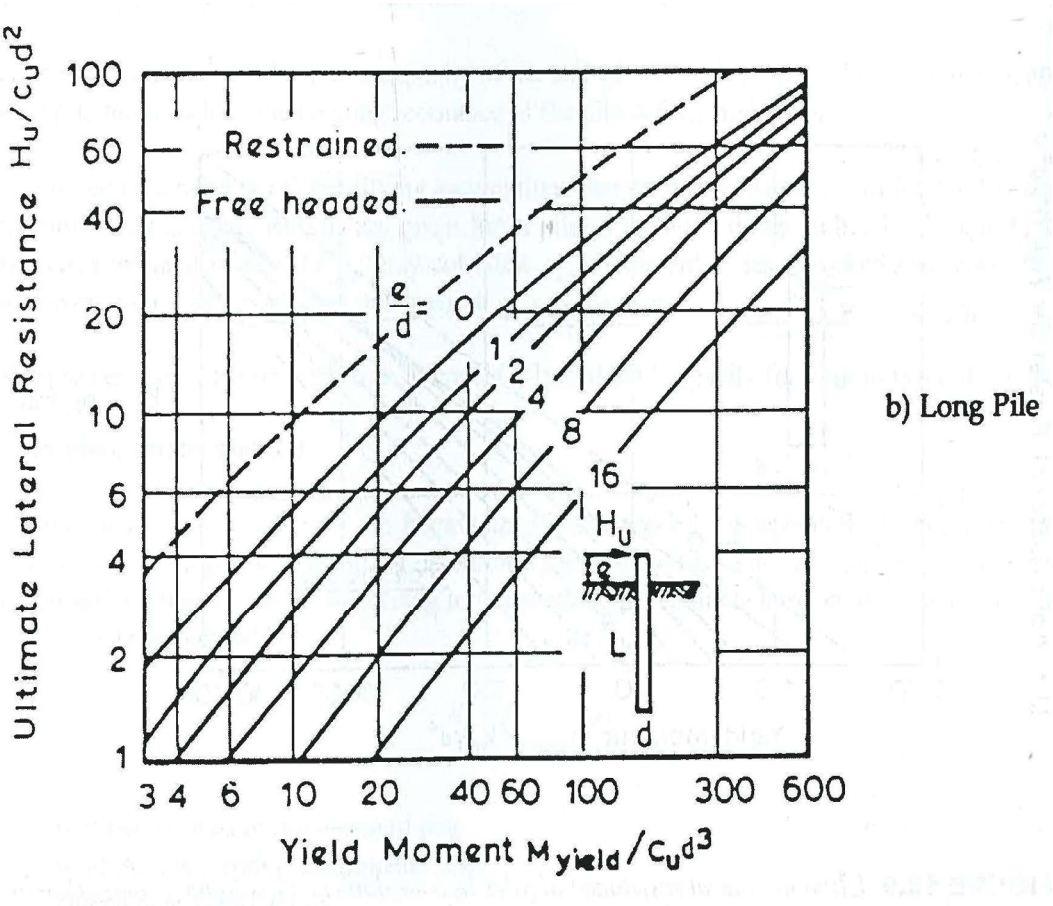
H_u	=	Lateral load capacity of pile
C_u	=	Clay Cohesion = 50 kPa
d	=	Diameter or width of pile, m
L	=	Embedded length, m
γ	=	unit weight of soil = 16 kN/m^3
M yield	=	Yield moment of pile
e	=	Height of lateral load above ground surface

The computed resistance should be multiplied by a geotechnical resistance factor of 0.5.

For βhD values between 2.0 and 2.5, both long and short pile criteria should be considered and the smaller value used in design.

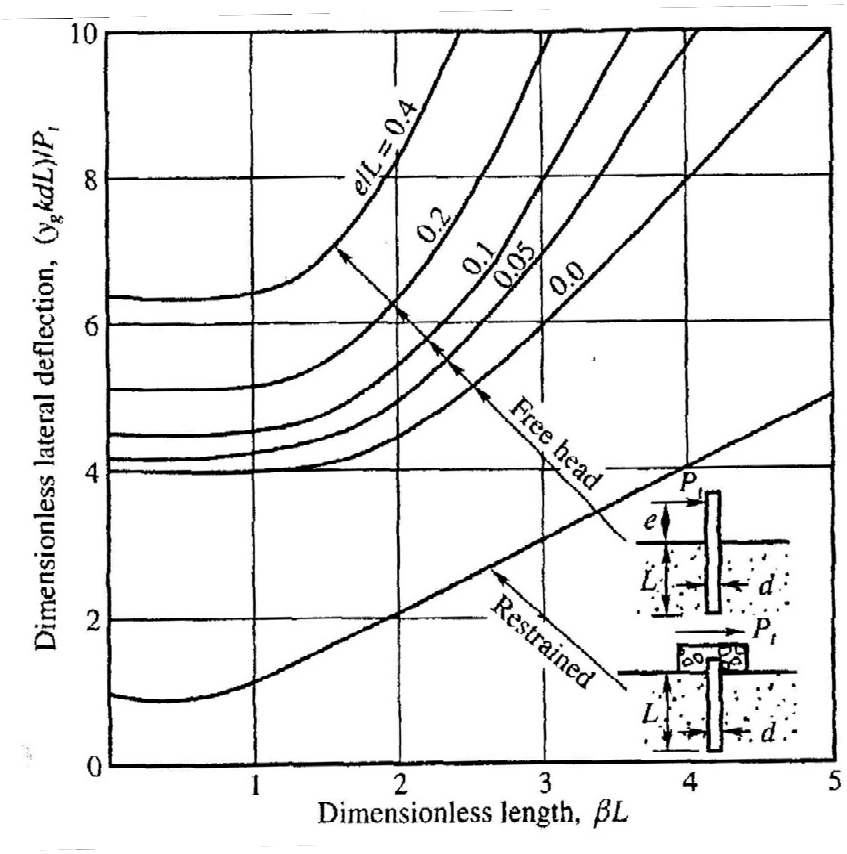

Ultimate Lateral Resistance $H_u/c_u d^2$
60
50
40
30
20
10
0
Restrained
H_u
e
L
d
$\frac{e}{d} = 0$
1
2
4
8
16
Free headed
4
8
12
16
20
(a) Embedment Length L/d

a) Short Pile



Ultimate lateral resistance of piles in cohesive soils (after Broms, 1964a)

The deflection, y_g, at ground surface of the pile maybe calculated from the following graph:



Lateral Deflection at the Ground Surface of Horizontally Loaded Pile in Cohesive Soil (Broms, 1964 a)

Where:

$$\beta h = \beta$$

P_t = Lateral load applied at or above the ground level

The lateral capacity of a single pile may also be computed by using computer software such as L-pile.

10 Floor Slab and Drainage Requirements

As indicated in Section 7 of this report, it is recommended that the floor slab of the proposed building should be designed as a structural slab supported by pile foundation. Current design calls for the construction of a 'sandwich type' system consisting of 150 mm thick floor slab underlain by 300 mm thick compacted granular fill overlying a 355 mm thick structural slab.

The area between the two slabs should be backfilled with 300 mm thick Ontario Provincial Standard Specification (OPSS 1010) Granular A compacted to 98 percent standard Proctor maximum dry density (SPMDD).

The lower floor slab should be set on a 300-mm thick OPSS 1010 Granular A pad compacted to 98 percent SPMDD.

In view of the high groundwater level, perimeter and underfloor drains will be required for the building. The underfloor drainage system may consist of 100 mm diameter perforated pipe or equivalent placed in parallel rows at 5 to 6 m centre spacing and at least 300 mm below the underside of the lower slab. The drains should be set on 100 mm thick pea gravel and covered top and sides with 150 mm of pea gravel. The pea gravel should be surrounded with a minimum of 300 mm CSA Fine Concrete Aggregate to act as filter material. The CSA fine concrete aggregate may be replaced by an approved geotextile membrane, such as Terrafix 270R or equivalent. The perimeter drains may also consist of 100 mm diameter perforated pipe set at the base of the grade beam on a 100 mm thick pea gavel surrounded with 150 mm pea gravel and the fine concrete aggregate. The perimeter and underfloor drains should be connected to separate sumps so that at least one (1) system would be operational should the other fail.

The exterior walls of the sandwiched slab should be dampproofed.

The modulus of subgrade reaction is estimated at 5 MPa/m^3 for a minimum 300 mm thick bed of Ontario Provincial Standard Specification (OPSS) Granular A compacted to 98 percent standard Proctor maximum dry density (SPMDD) constructed on the native silty clay.

The finished exterior grade should be sloped away from the building at an inclination of 2 percent to prevent surface ponding of water close to the exterior walls.

11 Lateral Earth Pressure for Retaining Walls

It is our understanding that the retaining walls of the loading dock will extend 1.35 m above the final grade and taper to 0.15 m above final grade.

Depending on the tolerable settlement of the walls, the soil backfill behind the walls may consist of free-draining material such as OPSS Granular B Type II or LWF. The walls should be equipped with a drainage system or weep holes to prevent the build up of hydrostatic pressure behind the walls. Depending on the type of wall system selected, the vertical back face of the wall may need to be covered by a geotextile.

The retaining walls may be designed to resist the static lateral earth pressure as well as the dynamic earth pressure generated during a seismic event. The dynamic earth pressure induced during a seismic event is an inverted triangular pressure distribution with maximum pressure at the top of the wall and minimum pressure at the bottom of the wall. The total static and seismic pressure distribution may be computed from the following equation. The expression assumes the water level behind the wall will be maintained at the base of the wall by providing subsurface drains or weep holes and the backfill material behind the wall consists of free-draining OPSS Granular B Type II material or LWF. The expression below also assumes the surface of the backfill behind the wall is level with the top of the retaining wall and the back face of the retaining wall is vertical.

$$P_{PA} = K_a \gamma h + (K_{AE} - K_a) \gamma (H - h) + q$$

where

P_{PA} = combined active lateral earth pressure at depth h below top of wall (kPa)

K_a = active earth pressure coefficient = 0.27

K_{AE} = is the seismic earth pressure coefficient = 0.37; based on PGA = 0.32g for Ottawa area; k_h = 0.5 times PGA for yielding walls with displacements up to 80 mm (250PGA in mm)

γ = is the unit weight of the soil backfill = 22 kN/m^3 , unit weight of LWF = 0.21 kN/m^3

h = depth, m, below top of wall where pressure is being computed

H = total height of wall (m)

q = surcharge that may be acting close to the subsurface walls, kPa

The static lateral earth pressure acts at 0.3H from the base of the wall. The dynamic component acts at 0.6H from the base of the wall.

For pile foundation, the passive resistance may be provided by the lateral capacity of the piles discussed in Section 9.

12 Pipe Bedding Requirements

It is recommended that the bedding for the underground services including material specifications, thickness of cover material and compaction requirements conform to City of Ottawa requirements and/or Ontario Provincial Standard Specification and Drawings (OPSS and OPSD).

Due to the presence of the silty clay and high groundwater level, it is recommended the pipe bedding consist of 300 mm thick OPSS 1010 Granular B Type II sub-bedding material overlain by 150 mm thick OPSS 1010 Granular A bedding material. The bedding materials should be compacted to at least 95 percent SPMDD.

The bedding thickness may be further increased in areas where the silty clay subgrade becomes disturbed. Trench base stabilization techniques, such as removal of loose/soft material, placement of crushed stone sub-bedding (Granular B Type II), completely wrapped in a non-woven geotextile, may also be used if trench base disturbance becomes a problem in wet or soft areas.

The service pipes should be equipped with flexible joints and/or backfilled with LWF if the service pipes cannot tolerate the limiting total settlement of 50 to 135 mm, as indicated in Section 7.

If the backfill for the service trenches will consist of granular fill, clay seals should be installed in the service trenches at select intervals as per City of Ottawa Drawing No. S8. The seals should be 1 m wide, extend over the entire trench width and from the bottom of the trench to the underside of the pavement structure. The clay should be compacted to 95% SPMDD. The purpose of the clay seals is to prevent the permanent lowering of the groundwater level.

13 Excavations

13.1 Excavations

Excavations for construction of the proposed building and installation of any underground services at the site are expected to extend to a maximum depth of approximately 3 m below the existing ground surface. These excavations will terminate within silty clay stratum and will likely be below the groundwater level.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing possible debris within the existing on-site fill. All excavation work should be completed in accordance with the Occupational Health and Safety Act, Ontario, Reg. 213/91. Excavations may be undertaken as open cut provided that the excavation walls are sloped back at 1H:1V from the bottom of the excavation. For excavations that extend below the groundwater level, the side slopes should be cut back at 3H:1V from the bottom of the excavation. If space restrictions prevent open-cut excavations (such as for underground service trenches), the excavations may be undertaken within the confines of a prefabricated support system (trench box) designed and installed in accordance with the above noted regulation.

Excavations up to a 3 m depth below existing grade are not expected to experience ‘base heave’ type failure. Deeper excavations may be susceptible to ‘base heave’ type failure and EXP should be contacted to review and provide comment regarding the potential for ‘base heave’ failure.

The silty clay stratum at the site is susceptible to disturbance due to the movement of construction equipment, and personnel on its surface. It is therefore recommended that the excavation at the site should be undertaken by equipment that does not travel on the excavated surface, such as a gradall or mechanical shovel. It is anticipated that temporary granular roads (600 mm thick granular base) may be required to gain access to the site by construction equipment and the pile driving rig. The exposed subgrade for the temporary construction roads should be inspected by a geotechnical engineer prior to placement of the granular roads.

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.

13.2 De-Watering Requirements

Seepage of the surface and subsurface water into these excavations is anticipated. However, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated. Therefore, the need of high capacity pumps to keep the excavation dry should not be ignored. Drainage of ponded surface water in low lying and swampy areas will also be required and can be accomplished by perimeter ditching and pumping from sumps.

It has been assumed that the maximum excavation depth at the site will be approximately 3 m and would necessitate groundwater removal from the site. It is noteworthy to mention that new legislation came into force in Ontario on March 29, 2016 to regulate groundwater takings for construction dewatering purposes. Prior to March 29, 2016, a Category 2 Permit to Take Water (PTTW) was required from the Ontario Ministry of the Environment and Climate Change (MOECC) for groundwater takings related to construction dewatering, where taking volumes in excess of 50 m^3/day, but less than 400 m^3/day, and the taking duration was no more than 30 consecutive days. The new legislation replaces the Category 2 PTTW for construction dewatering with a new process under the Environmental Activity and Sector Registry (EASR). The EASR is an on-line registry, which allows persons engaged in prescribed activities, such as water takings, to register with the MOECC instead of applying for a PTTW.

To be eligible for the new EASR process, the construction dewatering taking must be less than 400 m^3/day under normal conditions. The water taking can be groundwater, storm water, or a combination of both. It should be noted that the 30-consecutive day limit on the water taking under the old Category 2 PTTW process has been removed in the new EASR process. Also, it should be noted that the EASR process requires two technical studies be prepared by a Qualified Person, prior to any water taking. These studies include a Water Taking Report, which provides assurance that the taking will not cause any unacceptable impacts, and a Discharge Plan, which provides assurance that the discharge will not result in any adverse impacts to the environment. A significant advantage of the new EASR process over the former Category 2 PTTW process, is that the groundwater taking may begin immediately after completing the on-line registration of the taking and paying the applicable fee, assuming the accompanying technical studies have been completed. The former PTTW process typically took more than 90 days, which had the potential to impact construction schedules. EXP can provide assistance during the EASR/PTTW process, if required.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to adequately engineer construction dewatering systems.

14 Backfilling Requirements and Suitability of On-site Soils for Backfilling Purposes

The on-site soils to be excavated are anticipated to consist of sand and gravel, sandy gravel and gravel fill, brown silty clay (desiccated crust) and grey silty clay. The fill, brown and grey silty clay above and below the groundwater level are not considered suitable for reuse as backfill material. These soils may be used for general grading purposes in landscaped areas, provided the moisture content of these soils is lowered by air-drying in the sun.

It is anticipated that the majority of the material required for backfilling purposes and for subgrade preparation would have to be imported and should preferably conform to the following specifications:

- Backfill in services trenches inside the building – OPSS 1010 Granular A placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD;
- Trench backfill and subgrade fill in parking area and access roadways – OPSS 1010 Granular B Type II and Select Subgrade Material (SSM) below and above the groundwater table respectively, placed in 300 mm thick lifts and each lift compacted to 95 percent of the SPMDD. To minimize settlement of the pavement structure over services trenches, the trench backfill material within the frost zone should match the existing material along the trench walls to minimize differential frost heaving of the subgrade soil, provided this material is compactible. Otherwise, frost tapers may be required.

If the backfill for the service trenches will consist of granular fill, clay seals should be installed in the service trenches at select intervals as per City of Ottawa Drawing No. S8. The seals should be 1 m wide, extend over the entire trench width and from the bottom of the trench to the underside of the pavement structure. The clay should be compacted to 95% SPMDD. The purpose of the clay seals is to prevent the permanent lowering of the groundwater level.

15 Access Roads and Parking Areas

The subgrade at the site is anticipated to primarily consist of imported granular fill such as OPSS Granular B Type II and Select Subgrade Material (SSM) used to raise the grades at the site. Pavement structure thicknesses required for the access roads and parking areas set on the imported fill were computed and are shown on Table X. The pavement structure thicknesses are based upon an estimate of the soil properties of the imported fill and functional design life of twelve to fifteen years. The proposed functional design life represents the number of years to the first rehabilitation, assuming regular maintenance is carried out.

Table X: Recommended Pavement Structure Thicknesses

Pavement Layer	Compaction Requirements	Light Duty Parking Areas	Heavy Duty Parking Areas and Access Roads
Asphaltic Concrete (PG 58-34)	92 to 97 % MRD	65 mm – SP12.5 Cat B or HL3	40 mm – 12.5 Cat B/HL3 50 mm – 19 Cat B/HL8
Granular A Base (OPSS1010) (crushed limestone)	100% SPMDD	150 mm	150 mm
Granular B Sub-base, Type II (OPSS 1010)	100% SPMDD	450 mm	600 mm
SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698-12e2 MRD denotes Maximum Relative Density, ASTM D2041			

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 and/or geotextile may be required.

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

1. As part of the subgrade preparation for the areas to be paved, the proposed parking and access roadway should be stripped of topsoil and other obviously unsuitable material. The subgrade should be properly shaped, crowned, then proofrolled with a heavy 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% SPMDD (ASTM D698). To prevent overstressing the clay subgrade, coarser material may be

required in the lower 400 mm of the subgrade fill such as OPSS 1010 Granular B Type II or well graded blast-shattered bedrock.

2. The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. The need for adequate drainage cannot be over-emphasized. Subdrains should be installed on both sides of the access road(s). Subdrains must be installed in the proposed parking area at low points and should be continuous between catchbasins to intercept excess surface and subsurface moisture and to prevent subgrade softening. This will ensure no water collects in the granular course, which could result in pavement failure during the spring thaw. The location and extent of sub drainage required within the paved areas should be reviewed by this office in conjunction with the proposed site grading.

3. To minimize the problems of differential movement between the pavement and catchbasins/ manhole due to frost action, the backfill around the structures should consist of free-draining granular preferably conforming to OPSS 1010 Granular B, Type II material. Weep holes should be provided in the catchbasins/manholes to facilitate drainage of any water that may accumulate in the granular fill.

4. The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, temporary construction roadways, etc., may be required, especially if construction is carried out during unfavorable weather.

5. 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.

6. Relatively weaker subgrade may develop over service trenches at subgrade level. These areas may require the use of thicker/coarser sub-base material and the use of a geotextile at the subgrade level. if this is the case, it is recommended that additional 150 mm of granular sub-base Granular B should be provided in these areas in addition to the use of a geotextile at the subgrade level. On-site excavated soils should not be used as backfill of the service trenches.

7. 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 used and its placement should meet OPSS requirements. It should be compacted to 92 to 97 percent of the maximum relative density in accordance with ASTM D2041.

It is recommended that EXP 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.

16 Corrosion Potential

Chemical tests limited to pH, chloride, sulphate and electrical resistivity were performed on ten (10) selected soil samples. The certificate of the laboratory test results is attached in Appendix F and the results are summarized in Table XI below.

Table XI: Results of pH, Chloride, Sulphate and Electrical Resistivity Tests on Soil Samples

Borehole No. (Sample No.)	Soil	Depth (m)	pH	Sulphate (%)	Chloride (%)	Electrical Resistivity (ohm.cm)
Threshold Values			**<5**	**>0.1**	**>0.04**	**<1500 ohm.cm High corrosion potential**
BH1-SS3	Brown Silty Clay	1.5-2.1	7.33	0.0034	0.0009	8,770
BH5-SS3	Brown Silty Clay	1.5-2.1	7.66	0.0097	0.0068	2,720
BH7-SS3	Brown Silty Clay	1.5-2.1	7.64	0.0029	0.0004	7,140
BH15-SS3	Brown Silty Clay	1.5-2.1	7.60	0.0180	0.0016	3,460
BH18-SS3	Brown Silty Clay	1.5-2.1	7.51	0.0029	0.0006	8,470
BH19-SS3	Brown Silty Clay	1.5-2.1	7.33	0.0224	0.0030	2,770
BH22-SS7	Grey Silty Clay	4.6-5.2	8.50	0.0072	0.0051	2,790
BH31-SS9	Grey Silty Clay	7.6-8.2	8.39	0.0039	0.0012	4,030
BH41-SS11	Grey Silty Clay	10.7-11.3	8.41	0.0127	0.0033	2,230
BH47-SS12	Grey Silty Clay	12.2-12.8	8.52	0.0255	0.0034	1,820

The results indicate a soil with a sulphate and chloride content of less than 0.1 percent and 0.04 percent respectively. These concentrations of sulphate and chloride in the soil would have a negligible potential of sulphate and chloride attack on subsurface concrete. The concrete should be designed in accordance with Table Nos. 3 and 6 of CSA A.23.1-14. However, the concrete should be dense, well compacted and cured.

The results of the electrical resistivity tests indicate that the soil is moderately corrosive to subsurface steel. Based on this condition, the loss of thickness of the steel piles due to corrosion, over a period of 75 years is estimated at 1.9 mm. It is recommended that the structural design steel thickness of the piles should be increased by the anticipated steel thickness loss due to corrosion for the design service life of the structure.

17 Tree Planting

The clay in the Ottawa area is prone to shrinkage on drying. This process is largely not reversible. Therefore, settlement and cracking of the structures can result if trees are planted too close to the residences. During dry seasons, the tree roots draw moisture from the clay thereby resulting in the clay drying and shrinking.

City of Ottawa guidelines indicate that fast growing, high-water demand trees must not be planted closer to a building than a distance equal to their height at maturity. Only one of the small-sized trees listed below can be placed a minimum distance of 7.5 m away from any buildings, including when planting along road allowances (refer to Table XII below). In addition, new planted trees must be a minimum of 2.5 m from the curb and have a small-sized canopy at maturity to allow sufficient space for snow and ice control purposes.

Table XII: List of Trees that can be Planted 7.5 m from Structures

Species	Water Demand
Amur Maple (Acer ginnala)	Moderate
Serviceberry (Amelanchier canadensis)	Low
Crabapple (Malus spp.)	Moderate
Japanese Lilac (Syringa reticulate)	Moderate
Green Colorado Spruce or any conifer species (Picea pungens)	Low

For further information, an arborist should be consulted.

18 Additional Comments

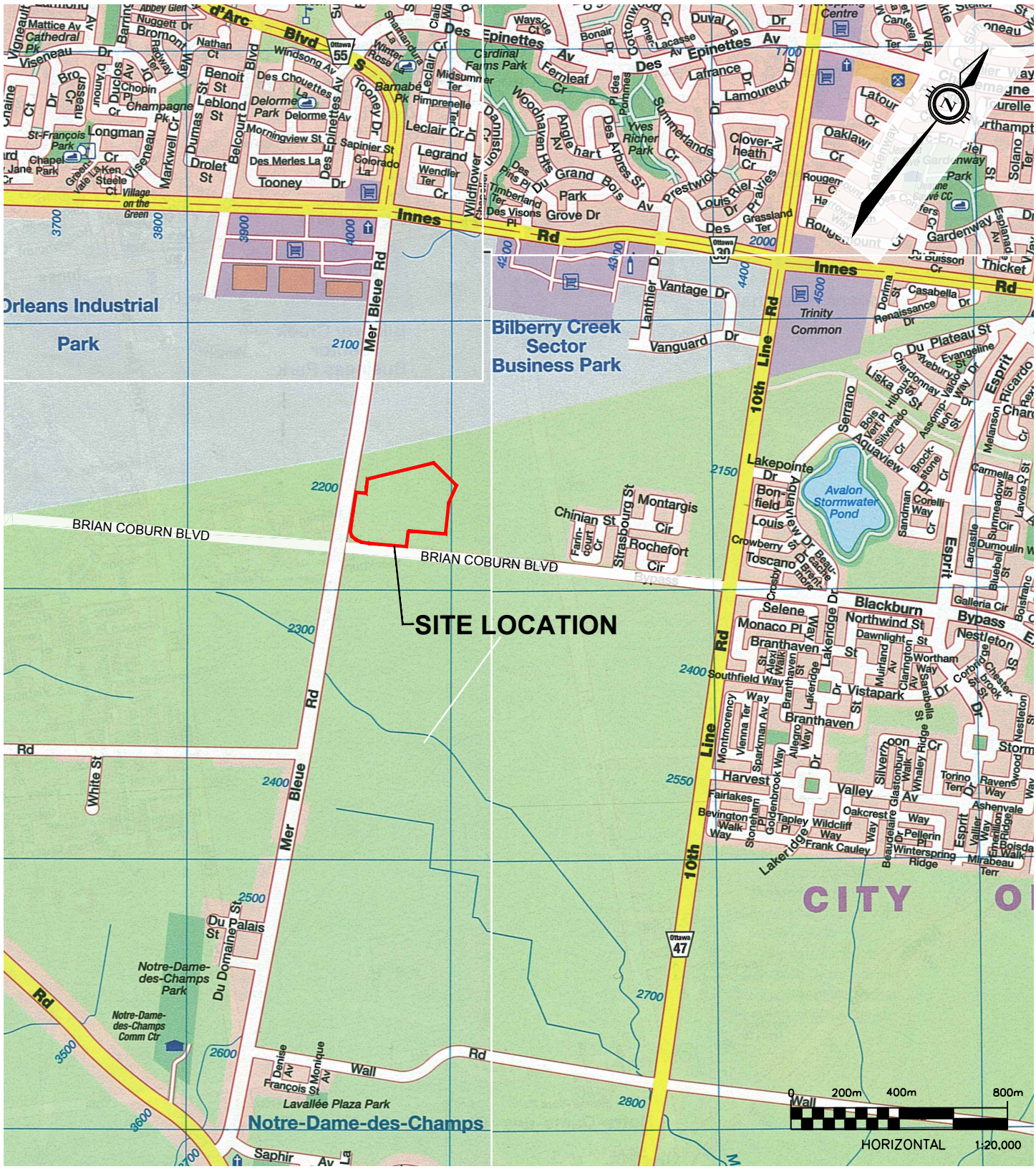
All earthwork activities from placement and compaction of fill in the service trenches to subgrade preparation, placement and compaction of granular materials and asphaltic concrete should be inspected by qualified geotechnicians to ensure that construction of the sewers and pavement proceeds according to the specifications. Driving of the piles should be completed under the full-time supervision of a geotechnician working under the direction of a geotechnical engineer.

19 General Closure

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 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.

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.

FIGURES



exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
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scale 1:20,000	CLIENT: MONTFORT HOSPITAL C/O ZW PROJECT MANAGEMENT INC. PROPOSED ORLEANS FAMILY HEALTH HUB	project no. OTT-00240904-A0
date JULY 2017	TITLE: SITE LOCATION PLAN 2225 MER BLEUE ROAD, OTTAWA, ON	FIG 1
drawn by J.R.		

Filename: r:\240000\240000\240904-a0 geo inv mer bleu - from 239983\240904ge-p1.dwg
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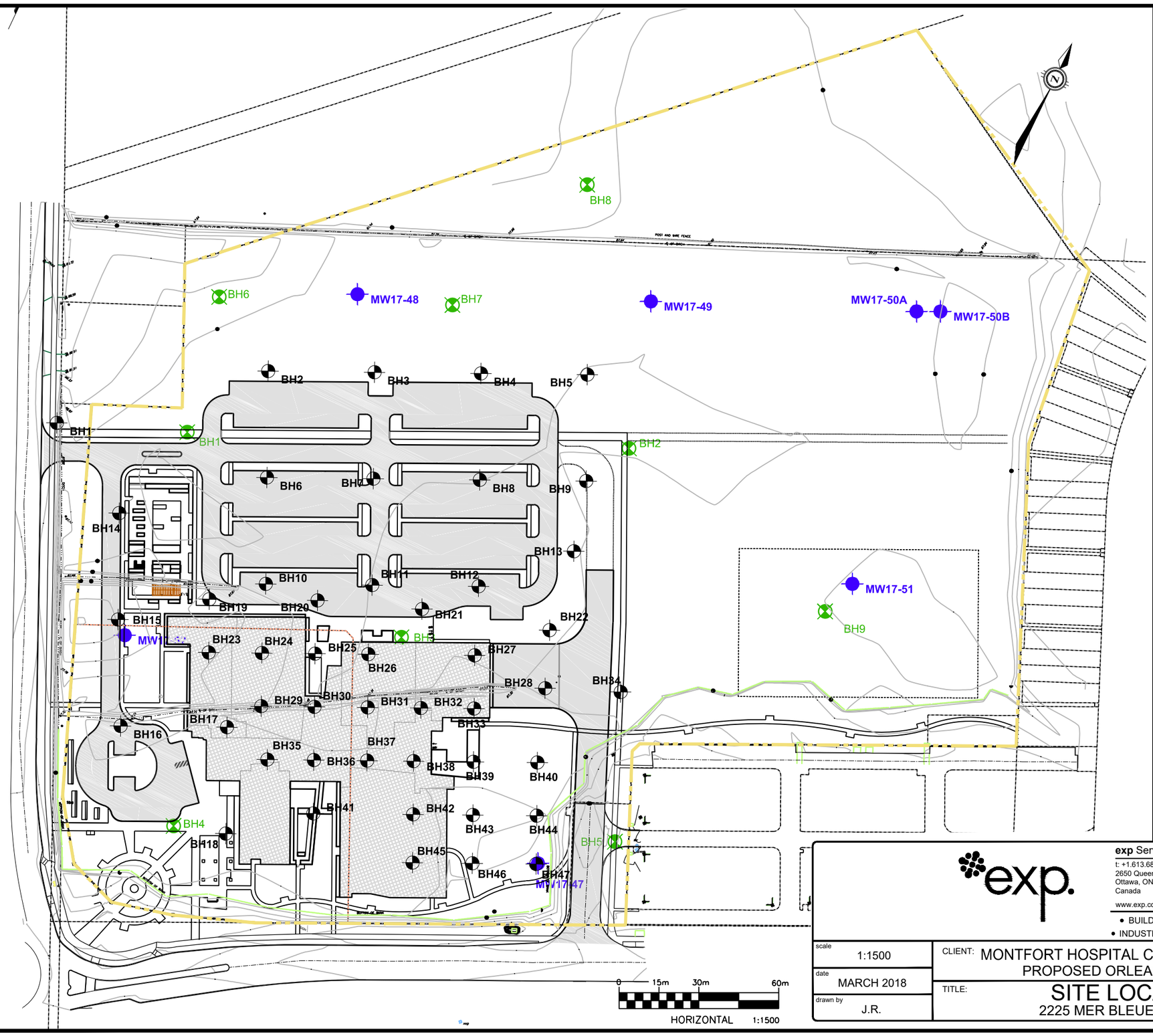

LEGEND

BH1	BOREHOLE NUMBER AND LOCATION FROM 2017 GEOTECHNICAL INVESTIGATION PREPARED BY **EXP**
MW17-51	BOREHOLE NUMBER AND LOCATION FROM 2017 PHASE II INVESTIGATION PREPARED BY **EXP**
BH1	BOREHOLE NUMBER AND LOCATION FROM 2010 GEOTECHNICAL INVESTIGATION PREPARED BY **EXP** (FORMERLY TROW ASSOCIATES INC.)

NOTES:

1. THE BOUNDARIES AND SOIL 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 WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TOPSOIL 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. BASE PLAN OBTAINED FROM ZW GROUP INC, AND STANTEC GEOMATICS, LTD

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scale 1:1500	CLIENT: MONTFORT HOSPITAL C/O ZW PROJECT MANAGEMENT INC.	project no. OTT-00240904-A0
date MARCH 2018	PROPOSED ORLEANS FAMILY HEALTH HUB	
drawn by J.R.	TITLE: **SITE LOCATION PLAN** 2225 MER BLEUE ROAD, OTTAWA, ON	FIG 2

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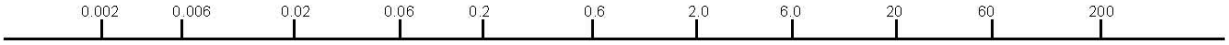
Notes On Sample Descriptions

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		



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-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'June 21, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~180 mm	88.55	0				
		SILTY CLAY (DESICCATED CRUST)	88.4					
		Brown to greyish brown, moist, (hard)	87.95		6, 216			
				1	12, 216			18.3
					6			17.2
			86.4	2	100, S = 4.4			
		SILTY CLAY			H.W.			
		Grey, sensitive to medium sensitivity, wet, (stiff to firm)		3	65, S = 4.9			
					H.W.			
					38, S = 6.4			
					H.W.	84		
					34, S = 3.5			
			83.9					

Borehole Terminated at 4.7 m Depth

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	7.6
30 days	0.6	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 02

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm	87.99	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.9		4 ○, 144 ▲	×		
▼				1	12 ○, 192 ▲	×		18.6
			86.49					
				2	6 ○	×		19.7
		SILTY CLAY Grey, sensitive to extra sensitive, wet, (stiff)	85.8		70 +, S = 4.0; H.W. ○	×		
				3	58 +, S = 12.0	×		
			84.8					
		Borehole Terminated at 3.2 m Depth						
		Note: 1) Methane Reading: 0%						

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	1.5	2.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 03

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 75 mm	87.92	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.8		5 ○, 144 ▲	×		17.9
				1	11 ○, 168 ▲	×		18.4
▼					4 ○	×		
			85.7	2	86 +, S = 4.0			
		SILTY CLAY Grey, sensitive, wet, (stiff)	85.82		H.W. ○	×		
				3	62 +, S = 5.2			
			84.7					
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.1	2.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 04

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			87.89	0				
		TOPSOIL ~125 mm	87.7					
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)		1	2; 168			
					10; 168			18.1
				2	4			17.1
			85.7		86; S = 4.8			
		SILTY CLAY Grey, sensitive to extra sensitive, wet, (stiff)			H.W.			
				3	53; S = 8.8			
			84.7					
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	2.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 05

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 7

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm	87.82	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.72		2 ○, 168 ▲	×		
				1	10 ○, 192 ▲	×		18.5
					4 ○	×		17.5
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.6	2	82 +S, S = 4.5			
					H.W. ○	×		
			84.6	3	48 +S, S = 8.0			
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	3.0
31 days	0.1	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 06

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 8

Page. 1 of 1

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~280 mm	87.9	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.7		4, 168			
				1	9, 192			19.3
					4			17.3
			85.7	2	77, S = 6.4			
▼		**SILTY CLAY** Grey, sensitive, wet, (stiff to firm)	85.5		H.W.			
				3	62, S = 5.0			
					H.W.		82	
					38, S = 4.0			
					H.W.		86	
					38, S = 4.6			
			83.2					
		Borehole Terminated at 4.7 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	3.8

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 07

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 9

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~180 mm	87.94	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, sensitive, moist to wet, (hard)	87.74		4 ○	×		
				1	12 ○ 216 ▲	×		18.5
					6 ○	×		17.3
			85.7	2	100 + S = 5.7			
		SILTY CLAY Grey, sensitive, wet, (stiff)			H.W. ○	×		
				3	62 + S = 6.5			
			84.7					
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	3.0
31 days	0.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 08

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 10

Page. 1 of 1

Date Drilled: 'June 21, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.84	0				
		SILTY CLAY (DESICCATED CRUST) Trace sand, brown to greyish brown, moist, (very stiff)	87.6		3, 168			17.3
				1	10, 192			
					3			17.3
			85.6	2	77, S = 6.4			
▼		**SILTY CLAY** Grey, sensitive, wet, (stiff to firm)	85.44		H.W.			
				3	38, S = 8.0			
					H.W.		81	
					34, S = 7.0			
					H.W.		88	
			83.1		34, S = 7.0			
		Borehole Terminated at 4.7 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	3.8

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 09

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 11

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			87.84	0				
		TOPSOIL ~ 200 mm	87.6					
		SILTY CLAY (DESICCATED CRUST)	87.84					
		Brown to greyish brown, moist to wet, (very stiff)			4 ○, 168 ▲	×		18.0
				1	9 ○, 168 ▲	×		18.0
					4 ○	×		
			85.6	2	91 +S, S = 4.8			
		SILTY CLAY			H.W. ○	×		
		Grey, sensitive, wet, (stiff to firm)		3	48 +S, S = 5.7			
			84.6					
		Borehole Terminated at 3.2 m Depth						
		Note: 1) Methane Reading: 0%						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.0	2.4

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 10

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 12

Page. 1 of 1

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 300 mm	87.93	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6		2 ○, 120 ▲	×		
				1	9 ○, 192 ▲	×		18.4
▼					5 ○	×		17.6
			85.7 85.83	2	106 +, S = 4.4			
		SILTY CLAY Grey, sensitive, wet, (very stiff to stiff)			H.W. ○	×		
			84.7	3	77 +, S = 6.4			
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.1	2.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 11

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 13

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 100 mm	87.95	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (hard to very stiff)	87.9		7 ○ 216 ▲	×		
				1	11 ○ 192 ▲	×		17.5
▼					4 ○	×		18.8
			85.8	2	70 + S = 7.0			
		SILTY CLAY Grey, sensitive, wet, (stiff)	85.85		5 ○	×		
				3	53 + S = 5.5			
			84.8					
		Borehole Terminated at 3.2 m Depth						
		Note: 1) Methane Reading: 0%						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.1	2.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 12

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 14

Page. 1 of 1

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~ 50 mm	87.92	0
		FILL	87.9	
		Sand and gravel, brown, moist, (loose)	87.3	
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (hard)		1
▼			85.7	2
		SILTY CLAY Grey, sensitive, wet, (stiff)	85.62	
			84.7	3
		Borehole Terminated at 3.2 m Depth		

Note:
1) Methane Reading: 0%

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

5 ○ ×
10 ○ 216 ▲ ×
4 ○ ×
77 +S = 5.3
H.W. ○ ×
58 +S = 6.0

Natural Unit Wt. kN/m³: 18.3, 17.1

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.3	2.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 13

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 15

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 150 mm	87.78	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6 87.78		1 ○ 168 ▲	×		
				1	8 ○ 192 ▲	×		17.4
				2	3 ○	×		18.3
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff to firm)	85.6		82 + S = 3.4			
					H.W. ○	×		
			84.6	3	43 + S = 5.1			

Borehole Terminated at 3.2 m Depth

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.0	3.0
31 days	0.0	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 14

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 16

Page. 1 of 1

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 125 mm	87.99	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.9		6 ○, 192 ▲	×		
				1	9 ○, 168 ▲	×		18.2
					4 ○	×		17.8
			85.8	2	77 +S = 4.6			
		SILTY CLAY Grey, sensitive, wet, (stiff)			H.W. ○	×		
				3	58 +S = 5.3			
			84.8					
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	2.9

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 15

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 17

Page. 1 of 1

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
▼		**FILL** Sand and gravel, construction debris (concrete and brick pieces), brown, moist, (loose)	88.41 87.81	0	4	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.6	1	13 192	×		
				2	6 101 S = 4.2	×		18.2
		SILTY CLAY Grey, sensitive, wet, (very stiff to firm)	86.2		H.W.	×		16.4
				3	62 S = 5.2			
					H.W.	×		
					43 S = 4.5			
					H.W.		88	
					34 S = 4.7			
		Borehole Terminated at 4.7 m Depth	83.7					

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.6	3.9

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 16

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 18

Page. 1 of 1

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~300 mm	87.82	0	4 ○, 168 ▲	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.52	1	8 ○, 192 ▲	×		18.5
				2	4 ○	×		17.5
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.6		86 +S, S = 4.5			
				3	H.W. ○	×		
					58 +S, S = 4.8			
					H.W. ○	×		
					38 +S, S = 5.3			
					H.W. ○	×		
			83.1		38 +S, S = 4.0			

Borehole Terminated at 4.7 m Depth

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	
21 days	0.3	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 17

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 19

Page. 1 of 1

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~ 300 mm	88.2	0	3			
		SILTY CLAY (DESSICATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.9		144			
▼				1	7			18.9
			86.7		192			
				2	5			17.5
			86.0		67			
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff)			S = 3.5			
					H.W.			
				3	53			
			85.0		S = 5.5			
		Borehole Terminated at 3.2 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	1.5	3.9

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 18

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 20

Page. 1 of 1

Date Drilled: 'June 27, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~280 mm	87.74	0				
			87.64					
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.4		3			
				1	7, 192			16.6
					3			17.5
			85.5	2	86, S = 4.5			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.			
				3	38, S = 5.3			
					H.W.			
					34, S = 4.7			
					H.W.			86
			83.0		29, S = 6.0			
		Borehole Terminated at 4.7 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	4.5
24 days	0.1	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 19

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 21

Page. 1 of 2

Date Drilled: 'June 21, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.86	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, high plasticity, moist to wet, (hard)	87.7					
			86.46	1	5, 10, 216, 216			18.1
				2	5, 72, S = 5.0			
		SILTY CLAY Trace sand, medium sensitivity to sensitive, grey, wet, (stiff to firm)	85.7	3	2, 53, S = 4.4			
				H.W.				
				H.W.	34, S = 7.0		88	
				H.W.	43, S = 5.1		86	
				5	53, S = 4.4			
				6				
				H.W.				
				7	48, S = 6.7			
				H.W.				
				8	46, S = 3.8			
				9				
				10	43, S = 6.0			

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 50 mm monitoring well with screened section installed upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.6	12.2
30 days	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.6 - 16.1	100	81
2	16.1 - 17.6	100	98

Log of Borehole BH 19

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 21

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		SILTY CLAY Trace sand, medium sensitivity to sensitive, grey, wet, (stiff to firm) *(continued)*	77.86	10
				11
			76.0	12
		GLACIAL TILL Sand, silty, clayey, gravelly, cobbles and boulders, grey, wet, (very dense) -borehole advanced through cobbles and boulders by coring technique from 12.5 m to 14.6 m depths.		13
				14
			73.3	15
		LIMESTONE BEDROCK Grey, (fair to excellent quality)		16
				17
			70.3	
		Borehole Terminated at 17.6 m Depth Note: 1) Methane Reading: 0%		

Standard Penetration Test N Value
20 40 60 80
Shear Strength kPa
50 100 150 200

1
48
S = 5.0
50 for 125 mm

Combustible Vapour Reading (ppm)
250 500 750
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
20 40 60

SAMPLES

Natural Unit Wt. kN/m³

Run 1

Run 2

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 50 mm monitoring well with screened section installed upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.6	12.2
30 days	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.6 - 16.1	100	81
2	16.1 - 17.6	100	98

Log of Borehole BH 20

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 22

Page. 1 of 2

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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 m	Depth	Standard Penetration Test N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Wt. kN/m³
	TOPSOIL ~150 mm	87.79	0			
	SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.6		4		
			1	10; 192		17.8
			2	3; 72		16.8
		85.6				
▼	**SILTY CLAY** Grey, medium sensitivity to sensitive, wet, (stiff to firm)	85.09		H.W.		
			3	53; S = 5.5		
				H.W.		81
				43; S = 5.1		
				H.W.		
				38; S = 4.0		
			5	H.W.		87
				38; S = 2.9		
				H.W.		85
			6	43; S = 3.6		
	INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.1 m depth.	81.5				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 20

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 22

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 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
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.1 m depth. *(continued)*	77.79	10				
				11				
				12				
				13				
			73.7	14				
		Refusal of Cone Penetration Test at 14.1 m Depth Note: 1) Methane Reading: 0%						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 21

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 23

Page. 1 of 1

Date Drilled: 'June 29, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~200 mm	87.78	0
		SILTY CLAY (DESICCATED CRUST)	87.6	
		Brown to greyish brown, moist, (very stiff)		1
				2
			85.6	
		SILTY CLAY		
▼		Grey, sensitive, wet, (stiff to firm)		3
			84.48	
				4
				5
				6
			81.5	
		Borehole Terminated at 6.3 m Depth		
		Note: 1) Methane Reading: 0%		

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

Depth	Shear Strength	Natural Moisture Content %	Combustible Vapour Reading (ppm)
0	4 ○		
	144 ▲		
1	8 ○		
	192 ▲		
2	3 ○		
	72 +S = 4.3		
	H.W. ○		
3	48 +S = 6.7		
	H.W. ○		
	43 +S = 4.5		
	H.W. ○		88 ×
	38 +S = 5.3		
	H.W. ○		92 ×
5	38 +S = 5.3		
	H.W. ○		87 ×
6	43 +S = 6.0		

SAMPLES	Natural Unit Wt. kN/m³
	18.6
	16.4

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.3	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 22

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 24

Page. 1 of 2

Date Drilled: 'June 20, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~280 mm	87.75	0
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (hard)	87.5	
▼		**SILTY CLAY** Trace sand, sensitive to extra sensitive, high plasticity, grey, wet, (firm to stiff)	85.6	2
			85.45	

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

Depth	Standard Penetration Test N Value	Shear Strength (kPa)	Combustible Vapour Reading (ppm)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
0	3	216		×		
1	11	216		×		18.2
2	3			×		17.4
	91	S = 4.8				
H.W.				×		
3	48	S = 6.7				
H.W.				×		
	36	S = 7.5				
H.W.					90	
	38	S = 8.0				
H.W.					91	
5	43	S = 9.0				
6						
H.W.					88	
	50	S = 4.2				
7						
H.W.						
8	58	S = 4.8				
9						
H.W.				×		
10	62	S = 4.7				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.3	17.5

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.6 - 16.2	98	81
2	16.2 - 17.6	98	83

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 22

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 24

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 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
		SILTY CLAY Trace sand, sensitive to extra sensitive, high plasticity, grey, wet, (firm to stiff) *(continued)*	77.75	10				
				11	H.W.			
					62 S = 5.2			
				12				
					H.W.			
				13	77 S = 4.6			
					H.W.			
		GLACIAL TILL Silt, clayey, sandy, gravelly, cobbles and boulders, grey, wet	73.7	14				
		LIMESTONE BEDROCK Grey, fractures, clay seams, (good to excellent quality)	73.2	15				Run 1
				16				
				17				Run 2
		Borehole Terminated at 17.6 m Depth	70.2					

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.3	17.5

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.6 - 16.2	98	81
2	16.2 - 17.6	98	83

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 23

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 25

Page. 1 of 1

Location: 2225 Mer Bleue Road, Ottawa, ON

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Sandy gravel, construction debris (concrete and brick pieces), brown, moist, (loose)	88.1	0	7	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.4	1	14; 168	×		
				2	11; 144	×		17.3
				3	3; 62; S = 4.0; H.W.	×		16.9
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff to firm)	85.1	4	48; S = 5.0; H.W.	×		
▼			83.1	5	38; S = 4.0; H.W.	83		
				6	38; S = 5.3; H.W.	89		
		Borehole Terminated at 6.3 m Depth	81.8		38; S = 3.2			

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	5.0	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 24

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 26

Page. 1 of 1

Date Drilled: 'June 29, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~405 mm	88.05	0	2 ○ 144 ▲	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, medium sensitivity, moist to wet, (very stiff)	87.7	1	8 ○ 192 ▲	×		18.1
				2	5 ○	×		17.6
▼			85.1	2	115 + S = 3.7			
				3	H.W. ○ 72 + S = 6.0	×		
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.05		H.W. ○ 38 + S = 8.0	×		
				4	H.W. ○ 38 + S = 4.0	93 ×		
				5	H.W. ○ 43 + S = 4.0	×		
				6	H.W. ○ 43 + S = 5.1	83 ×		
			81.8					
		Borehole Terminated at 6.3 m Depth						
		Note: 1) Methane Reading: 0%						

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	5.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 25

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 27

Page. 1 of 1

Date Drilled: 'June 29, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~380 mm	87.69	0	2	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.3	1	6, 168	×		18.1
				2	4	×		17.5
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.5	2	74, S = 4.4			
					H.W.	×		
				3	58, S = 4.8			
					H.W.	×		
▼			83.99		48, S = 5.0			
					H.W.	×		
					43, S = 4.5			
				5	H.W.	×		
					43, S = 4.5			
					H.W.	84 ×		
			81.4	6	48, S = 5.0			
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 26

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 28

Page. 1 of 1

Date Drilled: 'June 29, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.83	0				
		SILTY CLAY (DESICCATED CRUST)	87.6					
		Brown to greyish brown, moist to wet, (very stiff)	87.43		3 ○ 168 ▲	×		
				1	8 ○ 192 ▲	×		17.8
					4 ○	×		17.9
			85.6	2	91 + S = 3.8			
		SILTY CLAY			H.W. ○	×		
		Grey, medium sensitivity to sensitive, wet, (stiff to firm)		3	43 + S = 4.5			
					H.W. ○	×		
					38 + S = 4.6			
					H.W. ○	×		
					43 + S = 4.5			
					H.W. ○	×	87	
				5	43 + S = 6.0			
					H.W. ○	×	83	
				6	48 + S = 4.4			
			81.5					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	6.0
22 days	0.4	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 27

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 29

Page. 1 of 1

Date Drilled: 'June 29, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.68	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff to hard)	87.5		3 ○, 168 ▲	×		
				1	10 ○, 216 ▲	×		18.3
				2	5 ○, >120 +	×		18.0
			85.2					
▼		**SILTY CLAY** Grey, sensitive, wet, (stiff to firm)			H.W. ○	×		
				3	62 +S, S = 5.2			
					H.W. ○	×		
					38 +S, S = 4.0			
					H.W. ○	×		84
					38 +S, S = 5.3			
				5	H.W. ○	×		87
					38 +S, S = 5.3			
					H.W. ○	×		94
				6	38 +S, S = 4.0			
			84.68					
			81.4					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	5.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 28

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 30

Page. 1 of 1

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~405 mm	87.87	0				
			87.5					
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.27		3	81		
				1	9 / 192			18.3
					4			18.3
			85.7	2	77 S = 4.6			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.			
				3	53 S = 5.5			
					H.W.			
					43 S = 6.0			
					H.W.	96		
					38 S = 5.3			
				5	H.W.	81		
					38 S = 5.3			
					H.W.	87		
				6	43 S = 4.5			
			81.6					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3
23 days	0.6	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 29

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 31

Page. 1 of 2

Date Drilled: 'June 28, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~355 mm	87.47	0	3			
		FILL	87.1					
		Sand and gravel, concrete pieces, brown, moist, (very loose to loose)	86.6	1	10; 216			17.9
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (hard to very stiff)		2	9; 168			18.3
			85.0		H.W.			
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff to firm)		3	58; S = 4.8; H.W.			
▼			83.77		38; S = 5.3; H.W.			
				4	43; S = 3.6; H.W.			
				5	43; S = 4.5; H.W.			
				6	48; S = 4.0			
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 13.4 m depth.	81.2	7				
				8				
				9				
				10				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 29

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 31

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 13.4 m depth. *(continued)*	77.47	10	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				11				
				12				
				13				
		Refusal of Cone Penetration Test at 13.4 m Depth	74.1					

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 30

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 32

Page. 1 of 1

Date Drilled: 'July 4, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~330 mm	87.68	0	5	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, sensitive, moist to wet, (very stiff)	87.4	1	9; 192	×		18.2
				2	4; 106; S = 4.4	×		18.5
		SILTY CLAY Grey, sensitive, wet, (firm)	85.2	3	H.W.; 48; S = 4.0	×		
▼			83.98	4	H.W.; 43; S = 6.0	×	88	
				5	H.W.; 38; S = 5.3	×	90	
				6	H.W.; 38; S = 5.3	×	86	
			81.4		43; S = 4.5			
		Borehole Terminated at 6.3 m Depth						
		Note: 1) Methane Reading: 0%						

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3

CORE DRILLING RECORD

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

Log of Borehole BH 31

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 33

Page. 1 of 2

Location: 2225 Mer Bleue Road, Ottawa, ON

Date Drilled: 'June 22, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~250 mm	87.93	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.7		3			
				1	9; 168			
				2	6; 90; S = 4.5			18.3
		SILTY CLAY Grey, medium sensitivity to sensitive, high plasticity, wet, (stiff to firm)	85.7		1			
▼				3	62; S = 7.0			
			84.13		34; S = 4.3			
				H.W.			93	
					34; S = 6.0			
				H.W.			89	
				5	43; S = 4.0			
				6				
				H.W.				
				7	48; S = 4.0			
				H.W.			85	
				8	53; S = 4.9			
				9				
				H.W.			82	
				10	58; S = 4.2			

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.8	17.8

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	13.8 - 14.7	100	79
2	14.7 - 16.2	98	32
3	16.2 - 17.7	100	65

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 31

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 33

Page. 2 of 2

SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
SILTY CLAY Grey, medium sensitivity to sensitive, high plasticity, wet, (stiff to firm) *(continued)*	77.93	10	Shear Strength: 20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		11	58 S = 2.4			
		12				
		13	53 S = 3.1			
	74.5					
GLACIAL TILL Sand, clayey, silty, gravelly, cobbles and boulders, grey, wet, (very dense)	74.0	14	50 for 25 mm	×		
LIMESTONE BEDROCK Grey, horizontal and vertical fractures, (poor to fair quality)		15				Run 1
		16				Run 2
		17				Run 3
	70.2					
Borehole Terminated at 17.7 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.8	17.8

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	13.8 - 14.7	100	79
2	14.7 - 16.2	98	32
3	16.2 - 17.7	100	65

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 32

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 34

Page. 1 of 1

Date Drilled: 'July 4, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~280 mm	88.09	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (very stiff)	87.8		3	×		
				1	6, 168	×		18.2
					3	×		18.0
			85.9	2	67, S = 4.0			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.	×		
▼			85.09	3	43, S = 6.0			
					H.W.	×		
					38, S = 8.0			
					H.W.	×		
					38, S = 5.3			
				5	H.W.	91		
					43, S = 6.0			
					H.W.	87		
			81.8	6	43, S = 6.0			
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 33

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 35

Page. 1 of 1

Date Drilled: 'July 4, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~170 mm	88.03	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.9		2			
				1	7, 216			18.9
					4			17.9
			85.8	2	96, S = 5.0			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.			
				3	53, S = 5.5			
▼			84.33		H.W., 38, S = 5.3			
					H.W., 38, S = 5.3			
				5	H.W., 43, S = 6.0			
					H.W.		85	
				6	43, S = 4.5			
			81.7					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 34

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 36

Page. 1 of 1

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~355 mm	87.99	0	3 ○ 144 ▲	×		
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6	1	6 ○ 192 ▲	×		18.2
				2	2 ○	×		16.9
		SILTY CLAY Grey, sensitive, wet, (firm to soft)	85.8	2	43 + S = 6.0 H.W. ○	×		
▼			85.29	3	34 + S = 5.6 H.W. ○	×	81	
					24 + S = 4.0 H.W. ○	×	91	
			83.3		38 + S = 4.3			
		Borehole Terminated at 4.7 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	3.9

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 35

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 37

Page. 1 of 1

Date Drilled: 'July 4, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~150 mm	87.74	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6 87.74		3 ○ 144 ▲	×		
				1	6 ○ 192 ▲	×		18.4
					2 ○	×		17.3
			85.5	2	72 + S = 6.0			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W. ○	×		
				3	43 + S = 4.5			
					H.W. ○		82 ×	
					38 + S = 5.3			
					H.W. ○	×		
					38 + S = 5.3			
					H.W. ○	×		
				5	43 + S = 6.0			
					H.W. ○		90 ×	
				6	43 + S = 4.5			
			81.4					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.7	5.3
17 days	0.0	

CORE DRILLING RECORD

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

Log of Borehole BH 36

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 38

Page. 1 of 1

Date Drilled: 'July 4, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.76	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6		4, 144			
				1	8, 192			19.0
					4			18.1
			85.6	2	103, S = 4.3			
		SILTY CLAY Grey, sensitive, wet, (very stiff to firm)			H.W.			
▼			84.76	3	48, S = 5.0			
					H.W.			
					38, S = 5.3			
					H.W.			
					38, S = 5.3			
					H.W.			
				5	43, S = 6.0			
					H.W.			
				6	43, S = 5.1			
			81.5					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.0	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 37

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 39

Page. 1 of 1

Date Drilled: 'July 5, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~250 mm	87.75	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff to hard)	87.5		3 (○), 192 (▲)	×		
				1	8 (○), 216 (▲)	×		18.4
				2	5 (○)	×		17.7
			85.6		91 (+S), S = 4.2			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W. (○)	×		
				3	53 (+S), S = 5.5			
					H.W. (○)	×		
					43 (+S), S = 5.3			
					H.W. (○)	×		
					38 (+S), S = 5.3			
				5	H.W. (○)	×		
					38 (+S), S = 5.3			
					H.W. (○)	×		
				6	38 (+S), S = 5.3			
			81.5					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.0	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 38

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 40

Page. 1 of 1

Date Drilled: 'July 5, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.79	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6		5, 144			
				1	6, 168			18.2
					2			17.5
			85.6	2	77, S = 4.0			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.			
				3	43, S = 6.0			
					H.W.		92	
					38, S = 5.3			
					H.W.		85	
▼			83.39		38, S = 5.3			
				5	H.W.		89	
					43, S = 6.0			
					H.W.		86	
				6	43, S = 6.0			
			81.5					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	4.4	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 39

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 41

Page. 1 of 2

Date Drilled: 'July 5, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~200 mm	87.59	0
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff to hard)	87.4	
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.1	
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.0 m depth.	81.3	

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

Depth	Standard Penetration Test N Value	Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Wt. kN/m³
0	4	144		
1	9	216		18.4
2	4	115 S = 4.8		18.1
H.W.				
3	53	S = 5.5		
H.W.				
	43	S = 6.0		
H.W.				
	38	S = 5.3		
H.W.				
5	38	S = 5.3		
H.W.				
6	43	S = 4.5	91	
7				
8				
9				
10				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.0	6.2

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 39

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 41

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.0 m depth. *(continued)*	77.59	10	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				11				
				12				
				13				
		Refusal of Cone Penetration Test at 14.0 m Depth Note: 1) Methane Reading: 0%	73.6	14				

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	0.0	6.2

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 40

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 42

Page. 1 of 2

Date Drilled: 'July 5, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~300 mm	87.57	0
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.3	
			85.4	2
▼		**SILTY CLAY** Grey, sensitive, wet, (stiff to firm)	84.87	
			81.3	6
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 13.7 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

Depth	Standard Penetration Test N Value	Shear Strength (kPa)	Combustible Vapour Reading (ppm)	Natural Moisture Content %	SAMPLES	Natural Unit Wt. kN/m³
0	3					
1	7	144				
		192				18.6
2	3					17.5
		82 S = 5.7				
H.W.						
3		53 S = 5.7				
H.W.						
		43 S = 6.0				
H.W.					85	
		38 S = 6.0				
H.W.					88	
5		38 S = 5.3				
H.W.					83	
6		43 S = 6.0				
7						
8						
9						
10						

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 40

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 42

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 13.7 m depth. *(continued)*	77.57	10 11 12 13	20 40 60 80 Shear Strength kPa 50 100 150 200	250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60		
		Refusal of Cone Penetration Test at 13.7 m Depth Note: 1) Methane Reading: 0%	73.9					

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.7	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 41

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 43

Page. 1 of 2

Date Drilled: 'June 26, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~250 mm	87.77	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.5		4 ○ 168 ▲	×		
				1	7 ○ 180 ▲	×		
					3 ○	×		16.7
▼			85.6	2	86 + S = 4.5			
		SILTY CLAY Grey, medium sensitivity to sensitive, high plasticity, wet, (firm to stiff)	85.47		H.W. ○	×		
				3	34 + S = 7.0			
					H.W. ○	×	84	
					31 + S = 4.3			
					H.W. ○	×	86	
					29 + S = 6.0			
					H.W. ○	×	84	
				5	38 + S = 4.0			
				6	H.W. ○	×	82	
					43 + S = 4.0			
				7	H.W. ○	×	83	
					43 + S = 4.9			
				9	H.W. ○	×	81	
				10	60 + S = 4.2			

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.3	12.0

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.7 - 15.8		
2	15.8 - 17.4	98	80
3	17.4 - 19	100	95

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 41

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 43

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		SILTY CLAY Grey, medium sensitivity to sensitive, high plasticity, wet, (firm to stiff) *(continued)*	77.77	10	Shear Strength 20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
				11 H.W.				
					58 S = 2.4			
				12				
				H.W.				
				13	67 S = 3.1			
				H.W. 14				
		GLACIAL TILL Clay, silty, some sand and gravel, cobbles and boulders, grey, wet -coring through cobbles and boulders from 14.7 to 15.8 m depths	73.7	15				Run 1
			71.9	16				Run 2
		LIMESTONE BEDROCK Grey, (good to excellent quality)		17				
				18				Run 3
			68.8	19				
		Borehole Terminated at 19.0 m Depth Note: 1) Methane Reading: 0%						

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.3	12.0

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.7 - 15.8		
2	15.8 - 17.4	98	80
3	17.4 - 19	100	95

Log of Borehole BH 42

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 44

Page. 1 of 1

Date Drilled: 'July 5, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.76	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.6		4 ○, 144 ▲	×		
				1	7 ○, 192 ▲	×		18.1
				2	3 ○	×		17.5
			85.6		72 +S, S = 6.0			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W. ○	×		
				3	48 +S, S = 5.0			
					H.W. ○	×		
					43 +S, S = 6.0			
▼					H.W. ○			
			83.36			× 87		
					38 +S, S = 5.3			
				5	H.W. ○	× 85		
					38 +S, S = 5.3			
					H.W. ○	× 89		
				6	43 +S, S = 4.5			
			81.5					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	4.4	5.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 43

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 45

Page. 1 of 1

Location: 2225 Mer Bleue Road, Ottawa, ON

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	87.72	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.5		1 ○, 168 ▲	×		
				1	7 ○, 192 ▲	×		18.1
				2	4 ○	×		17.3
▼			85.5		77 +, S = 5.3			
		SILTY CLAY Grey, sensitive, wet (stiff to firm).	85.32		H.W. ○	×		
				3	67 +, S = 4.0			
					H.W. ○	×		
					38 +, S = 5.3			
					H.W. ○	×		
					34 +, S = 4.7			
				5	H.W. ○	×		
					38 +, S = 5.3			
					H.W. ○	×		
				6	38 +, S = 6.4			
			81.4					
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	5.3

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH 44

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 46

Page. 1 of 1

Date Drilled: 'June 30, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~75 mm	87.64	0				
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.5		5; 144			
				1	7; 192			18.6
					2			17.3
			85.4	2	86; S = 5.1			
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)			H.W.			
				3	53; S = 5.5			
					H.W.			
					43; S = 6.0			
▼			83.24		H.W.			
					38; S = 5.3			
				5	H.W.			
					38; S = 5.3			
					H.W.			
			81.3	6	43; S = 4.5			
		Borehole Terminated at 6.3 m Depth						

Note:
1) Methane Reading: 0%

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with cuttings upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	4.4	5.3

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 45

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 47

Page. 1 of 2

Date Drilled: 'June 27, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~200 mm	87.76	0
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very stiff)	87.56	
		SILTY CLAY Grey, sensitive, wet, (stiff to firm)	85.6	2
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.3 m depth.	81.5	6

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

Depth	Standard Penetration Test N Value	Shear Strength	Combustible Vapour Reading (ppm)	Natural Moisture Content % Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
0	5	168				
1	7	192				18.1
2	2					17.1
2		96 S = 5.0				
H.W.						
3		43 S = 6.0				
H.W.						
		34 S = 5.6				
H.W.					85	
		34 S = 4.7				
H.W.						
5		34 S = 4.0				
H.W.					90	
6		43				
7						
8						
9						
10						

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	5.3
24 days	0.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 45

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 47

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		INFERRED SILTY CLAY Sampled portion of borehole terminated at 6.0 m depth. Dynamic Cone Penetration Test (DCPT) advanced from 6.3 m to cone refusal at 14.3 m depth. *(continued)*	77.76	10 11 12 13 14	20 40 60 80 Shear Strength kPa 50 100 150 200	250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60		
		Refusal of Cone Penetration Test at 14.3 m Depth Note: 1) Methane Reading: 0%	73.5					

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	5.3
24 days	0.2	

CORE DRILLING RECORD

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

Log of Borehole BH 47

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Location: 2225 Mer Bleue Road, Ottawa, ON

Figure No. 48

Page. 1 of 2

Date Drilled: 'June 23, 2017

Drill Type: CME-55

Datum: Geodetic

Logged by: A.N. Checked by: S.P.

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL~200 mm	87.84	0				
		FILL	87.6					
		Gravel fill mixed with wood chips, moist, (compact)	87.2					
		SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (hard)	86.4	1	27, 7, 216			18.4
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff to firm)	86.44	2	4, 62 S = 5.2			16.9
				3	H.W., 53 S = 4.4			
				4	H.W., 58 S = 5.3		93	
				5	H.W., 41 S = 4.9		87	
				6	H.W., 29 S = 4.8			
				7	H.W., 38 S = 4.0		88	
				8	48 S = 4.0			
				9	H.W., 53 S = 3.7		84	

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 50 mm monitoring well with screened section installed upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	14.3
28 days	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.8 - 16.1	100	24
2	16.1 - 17.2	100	44
3	17.2 - 18.8	100	63

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

Log of Borehole BH 47

Project No: OTT-00240904-A0

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)

Figure No. 48

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff to firm) *(continued)* low to medium plasticity from 10.7-11.3 m depth	77.84	10
				11
				12
				13
			73.8	14
		GLACIAL TILL Clay, silty, some sand, trace gravel, cobbles and boulders, grey, wet	73.0	
		LIMESTONE BEDROCK Grey, horizontal and vertical fractures, horizontal seams, (_____quality)		15
				16
				17
				18
			69.0	
		Borehole Terminated at 18.8 m Depth Note: 1) Methane Reading: 0%		

Standard Penetration Test N Value
20 40 60 80
Shear Strength kPa
50 100 150 200

58
S = 4.8

58
S = 4.4

H.W.

Combustible Vapour Reading (ppm)
250 500 750
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
20 40 60

SAMPLES

88

Natural Unit Wt. kN/m³

Run 1

Run 2

Run 3

LOG OF BOREHOLE LOGS OF BOREHOLES -00240904.GPJ TROW OTTAWA.GDT 8/4/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 50 mm monitoring well with screened section installed upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	2.4	14.3
28 days	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.8 - 16.1	100	24
2	16.1 - 17.2	100	44
3	17.2 - 18.8	100	63

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100-2650 Queensview Drive
Ottawa, ON K2B 8H6

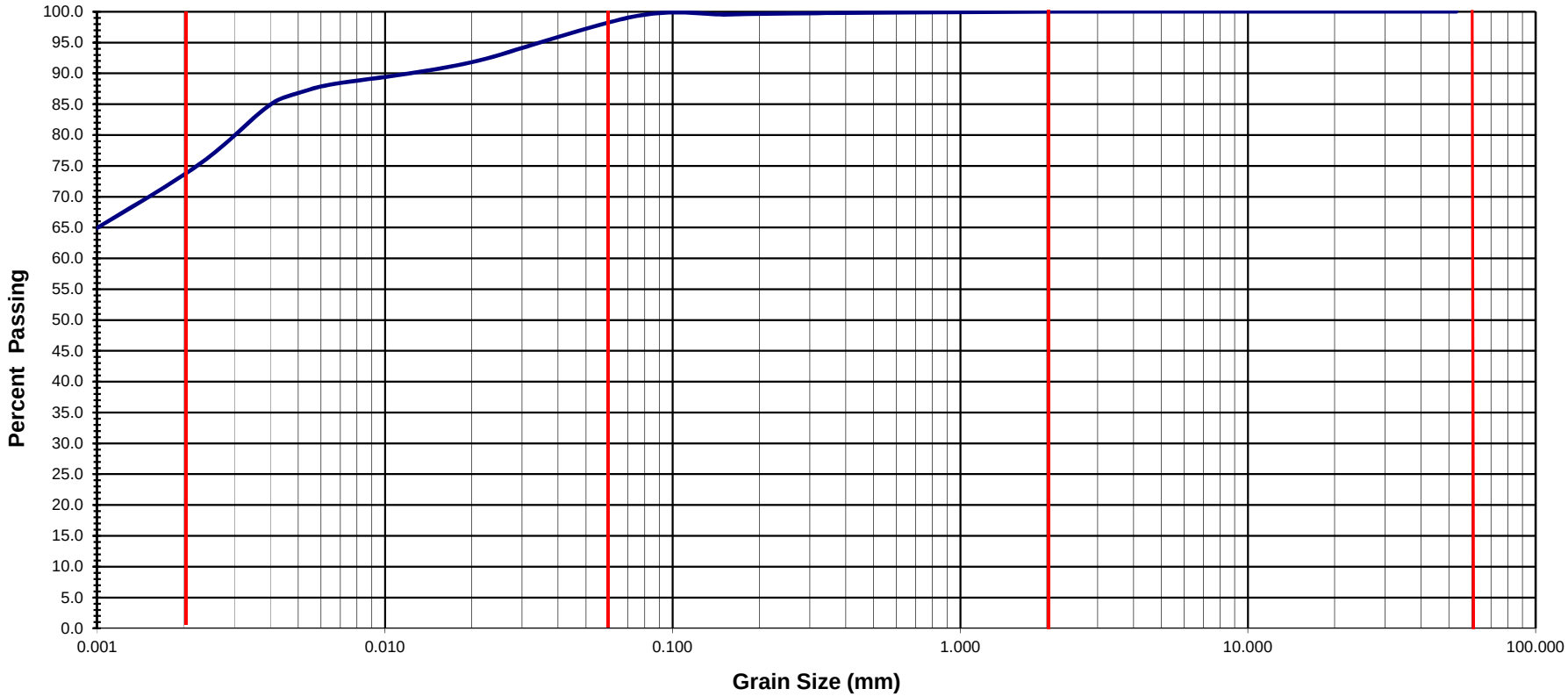
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

ASTM D-422

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00240904-AO**	**Project Name :**	**Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)**		
Client :	**Montfort Hospital. c/o ZW Group**	**Project Location :**	**2225 Mer Bleue Road, Ottawa**		
Date Sampled :	**June 21, 2017**	**Borehole No.:**	**8**	**Sample No.:** **SS2**	**Depth (m) :** **0.8-1.4**
Sample Description :	**Silty Clay, trace Sand**				**Figure :** **49**

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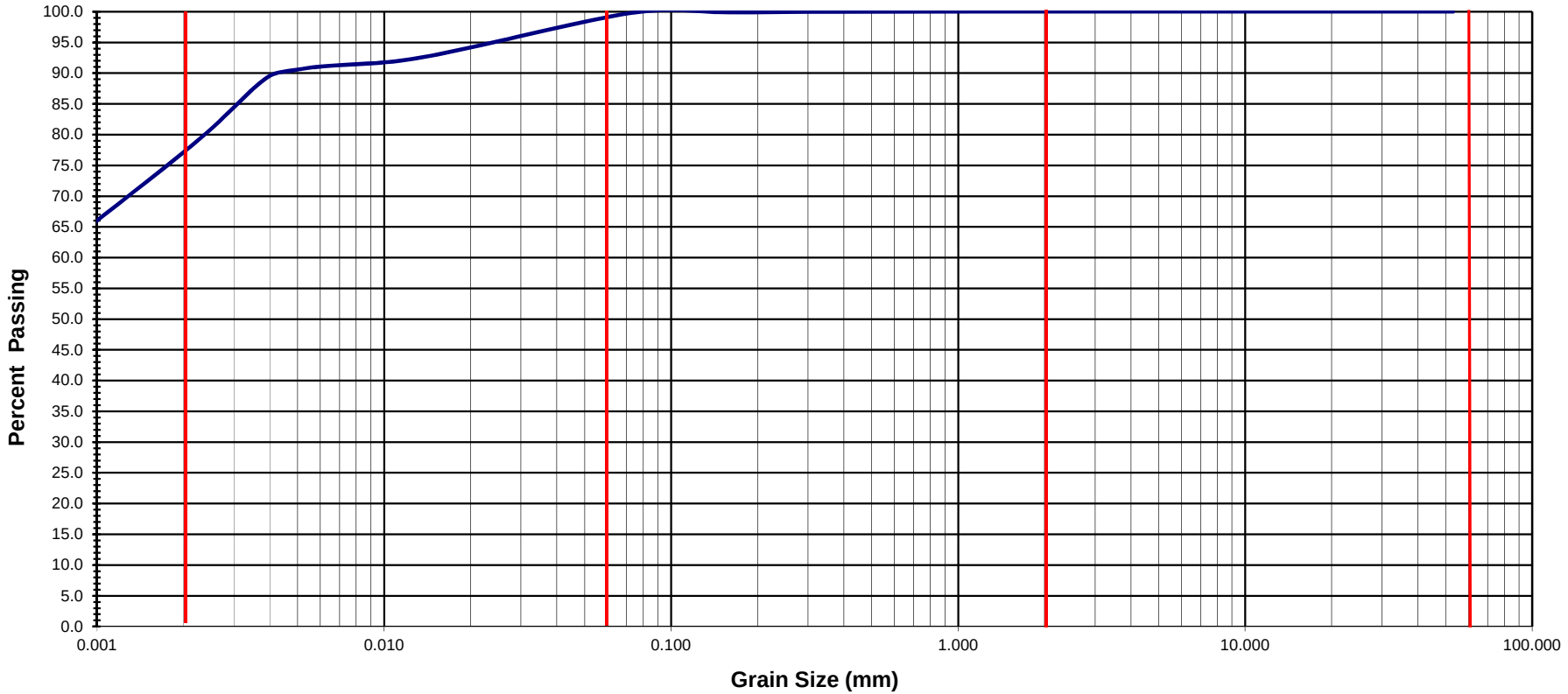
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

ASTM D-422

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00240904-AO**	**Project Name :**	**Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)**		
Client :	**Montfort Hospital. c/o ZW Group**	**Project Location :**	**2225 Mer Bleue Road, Ottawa, ON.**		
Date Sampled :	**June 21, 2017**	**Borehole No.:**	**19**	**Sample No.:** **SS9**	**Depth (m) :** **7.6-8.2**
Sample Description :	**Silty Clay, trace Sand**				**Figure :** **50**

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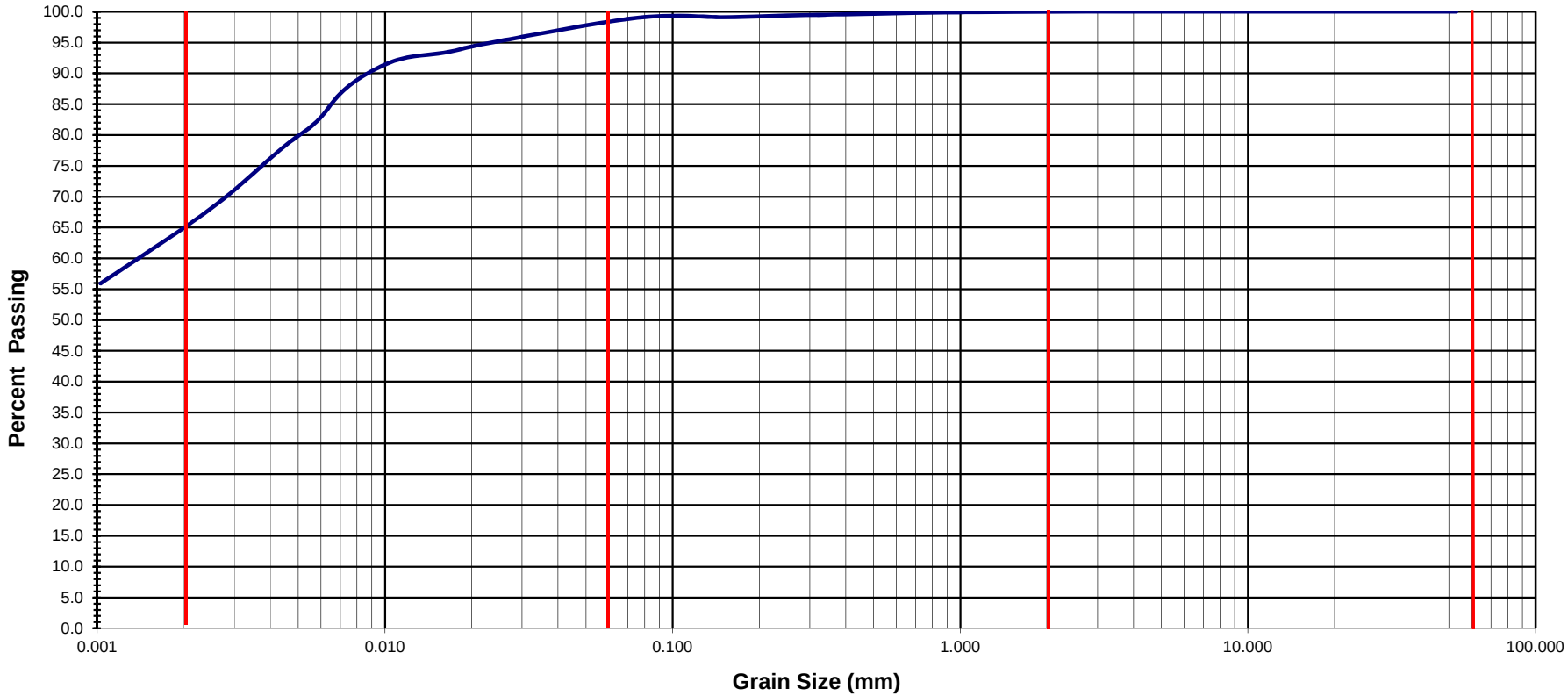
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

ASTM D-422

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00240904-AO**	**Project Name :**	**Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)**		
Client :	**Montfort Hospital, c/o ZW Group**	**Project Location :**	**2225 Mer Bleue Road, Ottawa, ON**		
Date Sampled :	**June 27, 2017**	**Borehole No.:**	**22**	**Sample No.:** **SS11**	**Depth (m) :** **10.7-11.3**
Sample Description :	**Silty Clay, trace Sand**				**Figure :** **51**

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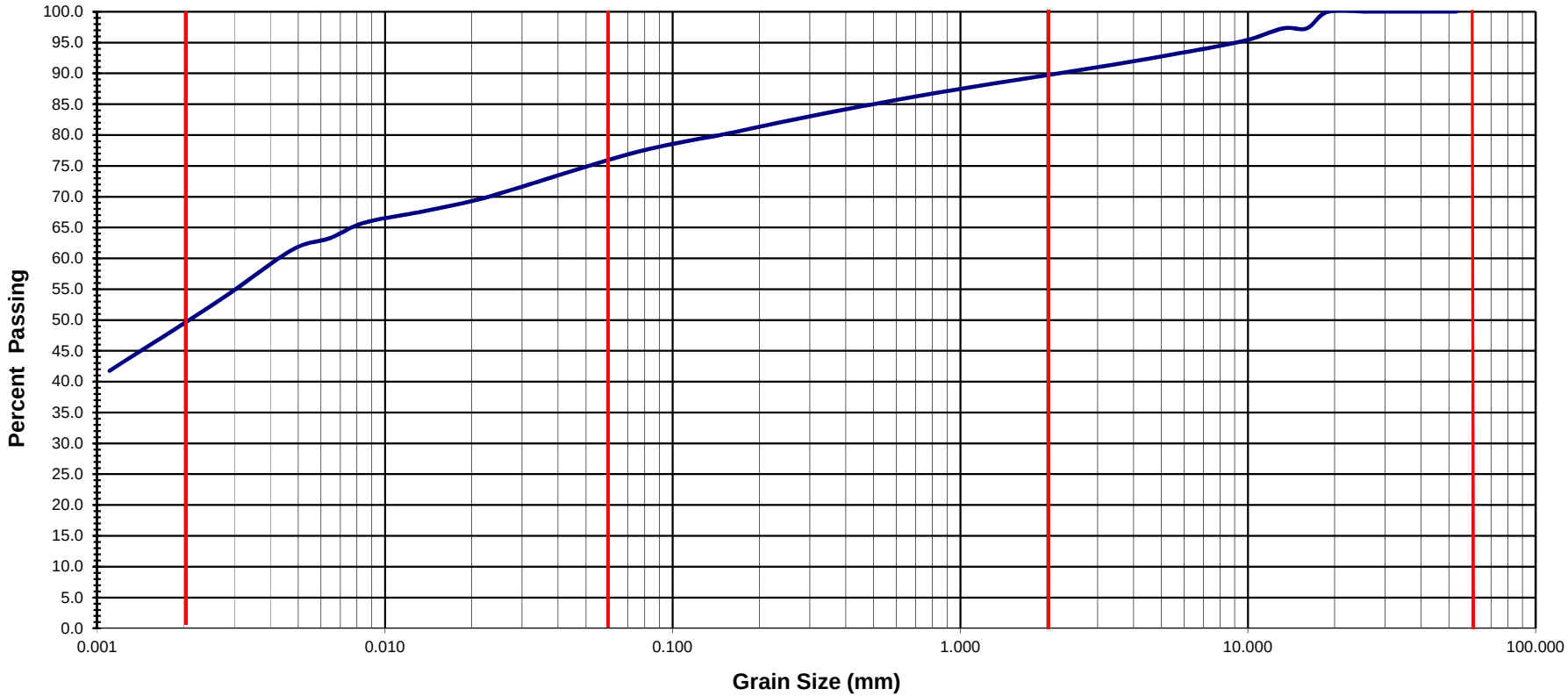
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

ASTM D-422

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00240904-AO**	**Project Name :**	**Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)**		
Client :	**Montfort Hospital. C/O ZW Group**	**Project Location :**	**2225 Mer Bleue Road, Ottawa, ON**		
Date Sampled :	**June 26, 2017**	**Borehole No.:**	**41**	**Sample No.:** **SS13**	**Depth (m) :** **13.7-14.3**
Sample Description :		**Silty Clay, some Sand and Gravel**			**Figure :** **52**

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100-2650 Queensview Drive
Ottawa, ON K2B 8H6

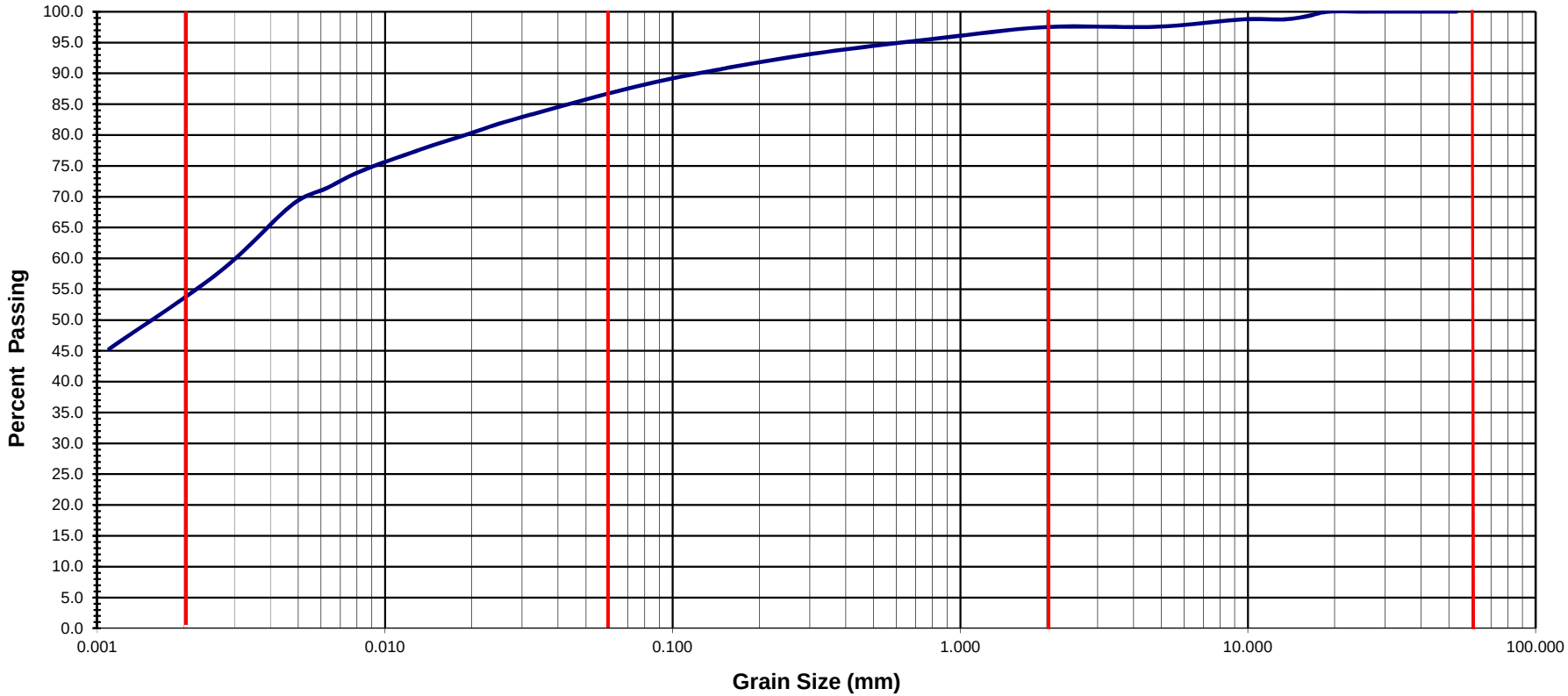
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

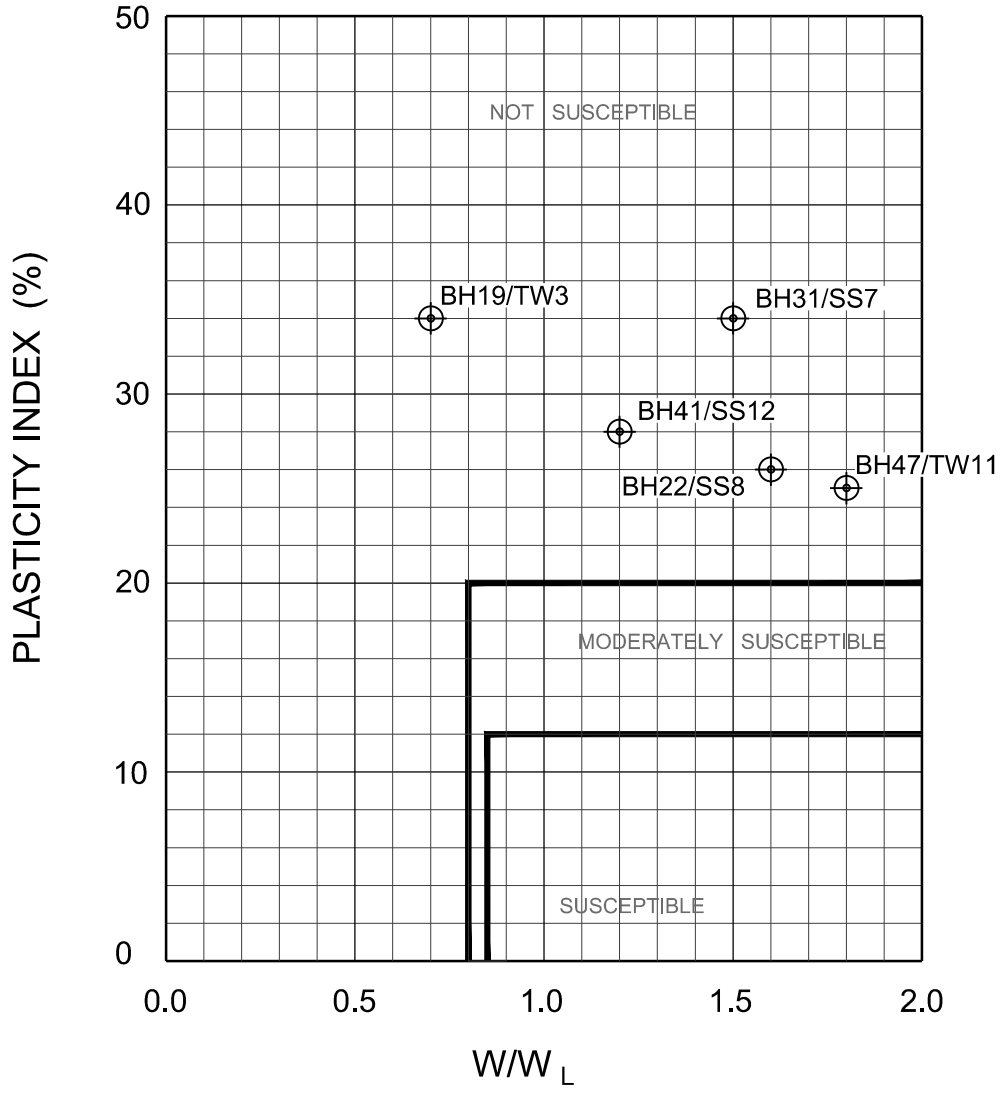
ASTM D-422

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00240904-AO**	**Project Name :**	**Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)**		
Client :	**Montfort Hospital. c/o ZW Group**	**Project Location :**	**2225 Mer Bleue Road, Ottawa, ON**		
Date Sampled :	**June 23, 2017**	**Borehole No.:**	**47**	**Sample No.:**	**SS13**	**Depth (m) :**	**13.7-14.3**
Sample Description :	**Silty Clay, some Sand, trace Gravel**					**Figure :**	**53**



BRAY ET AL. (2004) CRITERIA FOR LIQUEFACTION ASSESSMENT OF FINE-GRAINED SOILS

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t: +1.613.688.1899 | f: +1.613.225.7337
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scale: N.T.S.	CLIENT: MONTFORT HOSPITAL C/O ZW PROJECT MANAGEMENT INC. PROPOSED ORLEANS FAMILY HEALTH HUB	project no.: OTT-00240904-A0
date: JULY 2017	TITLE: LIQUEFACTION ASSESSMENT CHART 2225 MER BLEUE ROAD, OTTAWA, ON	FIG 54
drawn by: M.N.		

APPENDIX A: Borehole Logs from 2010 Geotechnical Investigation

Log of Borehole 1

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 2

Page. 1 of 1

Date Drilled: 'December 22, 2009

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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
		TOPSOIL ~100mm	87.8	0
		SILTY CLAY	87.7	
		Brown to grey, moist to wet (very stiff to stiff)	87.17	
		SILTY CLAY TO CLAY	85.7	2
		Grey, wet (firm)		
		Terminated @ 8.5 m depth	79.3	8

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

Depth	Standard Penetration Test N Value	Shear Strength (kPa)	Combustible Vapour Reading (ppm)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
0	3					
1	6	168				17.9
2	4	96				15.7
		118 s=12				
	/HW					
3		70 s=29				
	/HW					
		44 s=18				
	/HW				84	
		44 s=18				
	/HW					
5		44 s=18				
6	/Push				83	15.2
7		44 s=29				
	/HW				83	
8		46 s=19				

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 50 monitoring well was installed in the borehole upon completion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.3	
13 days	0.7	-
24 days	0.6	

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 2

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 3

Page. 1 of 2

Date Drilled: January 13, 2010

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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
		TOPSOIL ~200 mm	87.8	0
		87.6		
		SILTY CLAY		
		Brown to grey, moist to wet (very stiff to stiff)		
			85.1	
		SILTY CLAY TO CLAY		
		Grey, wet (firm)		
			77.8	10

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

Depth	Shear Strength (kPa)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)
0	2	144
1	9	120
2	4	117 s=8
	1	68 s=14
	1/HW	39 s=16
4	1	54 s=22
5	1/HW	54 s=22
6	1/HW	
7	1/HW	56 s=11
8	1/HW	68 s=9.3
9	1/HW	
10		67 s=6.9

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 2

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Figure No. 3

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		INFERRED CLAY	77.8	10
				11
				12
			75.2	
		Refusal to Dynamic Cone @ 12.6 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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

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

Log of Borehole 3

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 4

Page. 1 of 2

Date Drilled: 'December 23, 2009

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~300 mm	88	0
▼		**SILTY CLAY**	87.7	
		Brown to grey, moist to wet (very stiff to stiff)	87.51	
		SILTY CLAY TO CLAY	85.5	
		Grey, wet (firm)		

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

Depth	Standard Penetration Test N Value	Shear Strength kPa	Combustible Vapour Reading (ppm)	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
0	3	168		×		
1	6	168		×		18.2
2	3	121 s=24		×		17.5
3	2 /HW	58 s=24		×		
	/HW	34 s=14				
	/HW	43 s=14		92 ×		
5	/Push	41 s=17				
6	/HW			81 ×		
7		43 s=18				
8	/HW	43 S>30				
9	/HW			×		
10		63 s=13				

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	1.8	

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 3

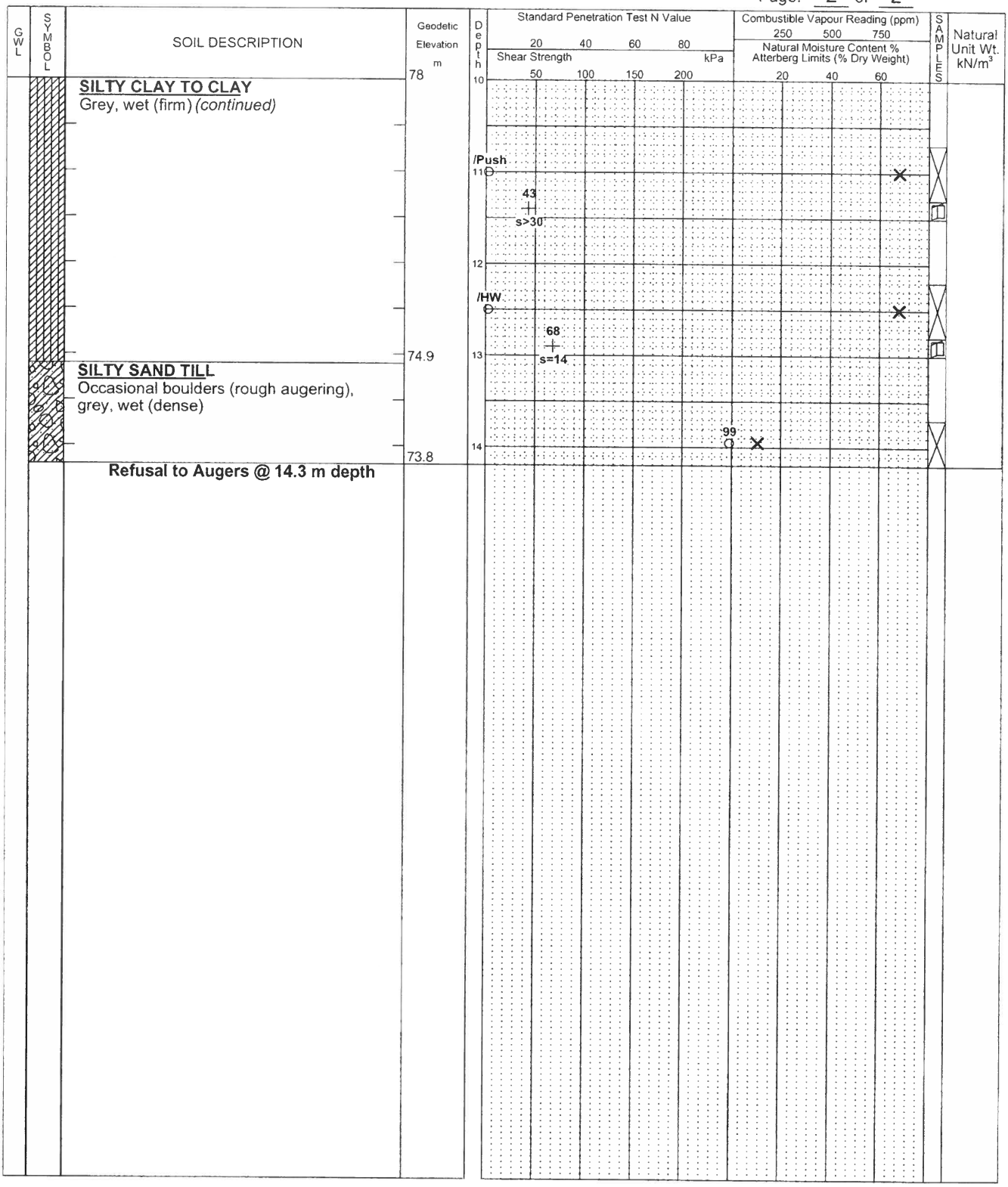
Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Figure No. 4

Page. 2 of 2



NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	1.8	-

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 4

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 5

Page. 1 of 2

Date Drilled: 'December 22, 2009

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~150 mm	87.7	0
		SILTY CLAY	87.6	
		Brown to grey, moist to wet (very stiff to stiff)		
		SILTY CLAY TO CLAY	85.0	
		Grey, wet (firm)		
		INFERRED CLAY	80.7	

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

Depth 0 1 2 3 4 5 6 7 8 9 10

3 ○
6 ○ 192 ▲
3 ○ 132 ▲
111 + s=11
2 ○
68 + s=9.3
/Push ○
24 + s=10
/HW ○
43 + s=18
/HW ○
39 + s=19
/Push ○
54 + s=27

17.5
17.0
85
89

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 50 monitoring well was installed in the borehole upon completion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.6	
12 days	0.5	
23 days	0.5	

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 4

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Figure No. 5

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
		INFERRED CLAY *(continued)*	77.7	10				
				11				
				12				
				13				
				14				
			73.2					
		Refusal to Dynamic Cone @ 14.5 m depth						

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 50 monitoring well was installed in the borehole upon completion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.6	
12 days	0.5	
23 days	0.5	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole 5

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 6

Page. 1 of 2

Date Drilled: 'January 12, 2010

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~150 mm	87.8	0
		SILTY CLAY	87.7	
		Brown to grey, moist to wet (very stiff to stiff)		
			85.5	
		SILTY CLAY TO CLAY		
		Grey, wet (firm)		
			77.8	10

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

Depth 0: 6 ○, 168 ▲
Depth 1: 4 ○, 144 ▲, 96 +, s=5.4
Depth 2: 2 ○, 49 +, s=5.0
Depth 3: 1 ○, 41 +, s=6.7
Depth 4: 1/HW ○, 34 +, s=5.6
Depth 5: 1 ○, 46 +, s=7.5
Depth 6: 1/HW ○, 54 +, s=14.8
Depth 7: 1/HW ○, 54 +, s=14.8
Depth 8: 1/HW ○, 46 +, s=19
Depth 9: 1/HW ○, 58 +, s=6.0

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 5

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Figure No. 6

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		INFERRED CLAY	77.8	10
				11
				12
				13
				14
				15
			71.8	16
		Refusal to Dynamic Cone @ 16.0 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

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 6

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 7

Page. 1 of 1

Date Drilled: 'January 13, 2010

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~150mm	87.9	0
		SILTY CLAY	87.8	
		Brown to grey, moist to wet (very stiff to stiff)		
				1
			86.1	
		Terminated @ 1.8 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

4 ○ 144 ▲
6 ○ 144 ▲
6 ○ 96 ▲

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 7

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 8

Page. 1 of 1

Date Drilled: January 13, 2010

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~200mm	88.1	0
		SILTY CLAY	87.9	
		Brown to grey, moist to wet (very stiff to stiff)		1
			86.3	
		Terminated @ 1.8 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

6 144
6 144
8 96

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 8

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 9

Page. 1 of 1

Date Drilled: 'January 13, 2010

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~150mm	87.9	0
		SILTY CLAY	87.8	
		Brown to grey, moist to wet (very stiff to stiff)		1
			86.1	
		Terminated @ 1.8 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

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 9

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Location: Mer Bleue Road & Future Blackburn Bypass

Figure No. 10

Page. 1 of 2

Date Drilled: 'December 23, 2009

Drill Type:

Datum: Geodetic Elevation

Logged by: _____ Checked by: _____

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

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

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		TOPSOIL ~200 mm	87.8	0
		SILTY CLAY	87.6	
		Brown to grey, moist to wet (very stiff to stiff)	86.65	1
			85.1	2
		SILTY CLAY TO CLAY		
		Grey, wet (firm)		3
				4
				5
				6
				7
				8
				9
			77.8	10

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

3 168
6 144
3 96
101 s=
2
54 s=22 /HW
41 s=20 /Push
24 s=12 /HW
49 s=24
/HW
49 s=25
/HW
63 s=31
/Push
51 s=26

90 14.7
86
88
83

18.4
17.0

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 19 mm slotted standpipe was installed in the borehole
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.6	
13 days	1.8	-
23 days	1.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

Log of Borehole 9

Trow

Project No: OTGE00020336A

Project: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)

Figure No. 10

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		INFERRED CLAY	77.8	10
				11
				12
				13
				14
			72.8	15
		Refusal to Dynamic Cone @ 15.0 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

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 19 mm slotted standpipe was installed in the borehole
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.6	
13 days	1.8	-
23 days	1.2	

CORE DRILLING RECORD

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

LOG OF BOREHOLE BH 1 TO 9.GPJ TROW OTTAWA.GDT 1/21/10

APPENDIX B: One Dimensional Oedometer (Consolidation) Test Results

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

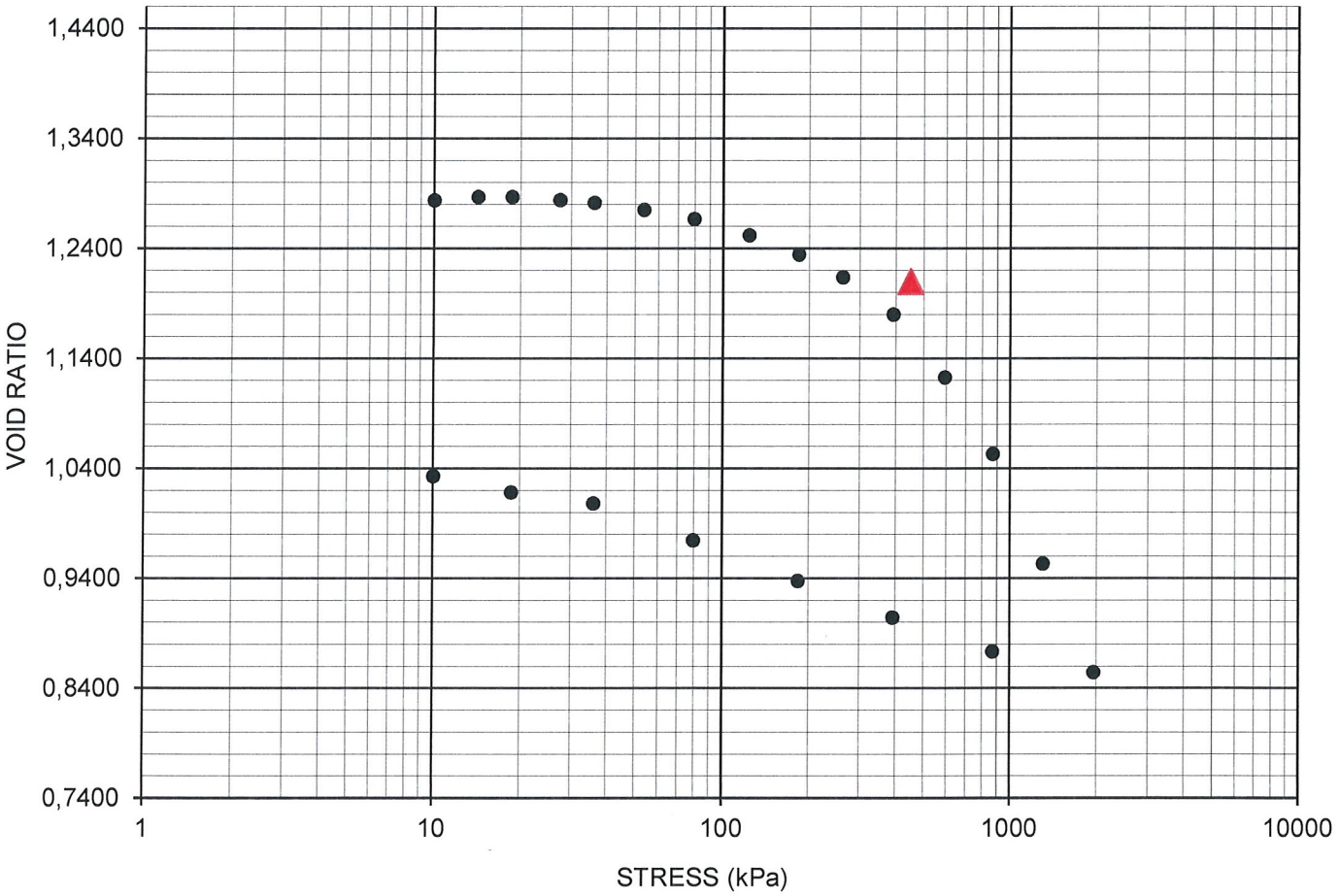
Client: Y/Project: OTT-00240904-A0 **Date :** 2017-07-24

Project : EXP Ontario **Our file No. :** P-0011703-6-01

Boring No. : BH-19, TW-3 **Sample No. :** 3 **Depth (m) :** 1,80 to 1,90m

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ Englobe

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	1,281	Recompression index (C_r) :	0,042
Initial water content (w) :	46,5%	Virgin compression index (C_c) :	0,57
Initial humid unit weight (γ_h) :	17,3 kN/m³	Initial effective stress (σ'_v) :	32 kPa
Initial saturation degree (S_r) :	99,8%	Preconsolidation pressure (σ'_p):	450 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	418 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

A Bouadma

Adlane Bouadma, ing. jr.

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: EXP Ontario — Dossier : P-0011703-6-01

Sondage no: BH-19, TW-3 — Echantillon no: 3

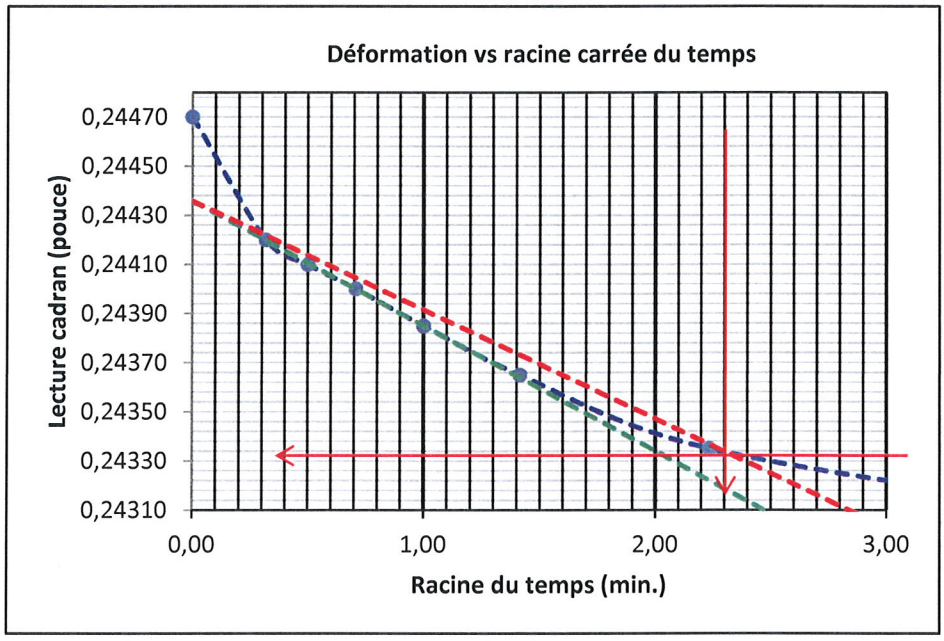
ESSAI A ENVIRON 50 % P'c

Charge: 1,5 kg — 53 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,24470
0,10	0,32	0,24420
0,25	0,50	0,24410
0,50	0,71	0,24400
1,00	1,00	0,24385
2,00	1,41	0,24365
5,00	2,24	0,24335
15,00	3,87	0,24310
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

Cv = 0,848(H/2)²/T90



Lecture initiale (pce) =	0,2500		Racine T90 =	**2,3**	lu sur graphe
Lecture à D90 (pce) =	**0,24334**	lu sur graphe	T90 (min) =	5,29	
Correction p/r bâti (pce) =	0,00640		c_v (m^2/j) =	2,05E-02	
Lecture corrigée (pce) =	0,24974		e =	1,2753	fin de palier
Déformation (pce) =	0,00026		m_v (kPa^{-1}) =	1,59E-04	
H_d (mm) =	9,43		k (cm/s) =	3,7E-08	

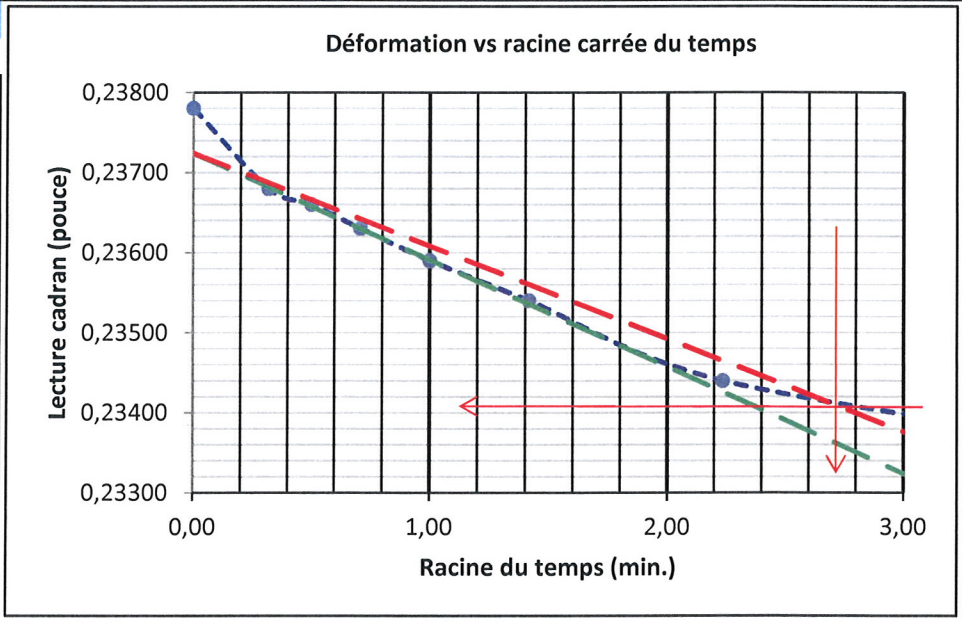
1er ESSAI APRÈS P'c

Charge: 3,5 kg — 123 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23780
0,10	0,32	0,23680
0,25	0,50	0,23660
0,50	0,71	0,23630
1,00	1,00	0,23590
2,00	1,41	0,23540
5,00	2,24	0,23440
15,00	3,87	0,23360
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

Cv = 0,848(H/2)²/T90



Lecture initiale (pce) =	0,2500		Racine T90 =	**2,7**	lu sur graphe
Lecture à D90 (pce) =	**0,23410**	lu sur graphe	T90 (min) =	7,29	
Correction p/r bâti (pce) =	0,00900		c_v (m^2/j) =	1,46E-02	
Lecture corrigée (pce) =	0,24310		e =	1,2521	
Déformation (pce) =	0,00690		m_v (kPa^{-1}) =	1,50E-04	
H_d (mm) =	9,34		k (cm/s) =	2,5E-08	

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

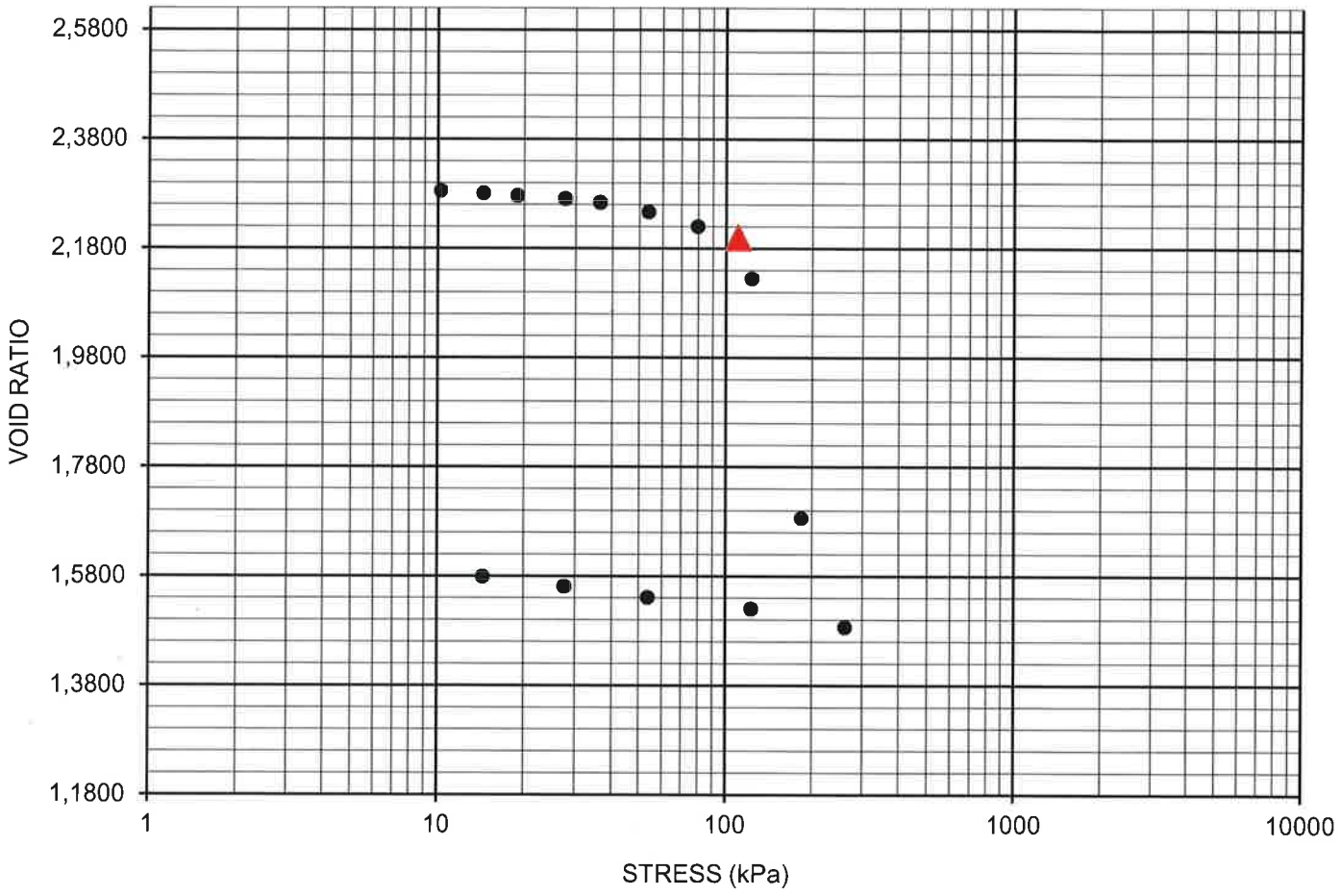
Client: EXP Ontario **Date :** 2017-07-16

Project : Y/ Project: OTT-00240904-A0 **Our file No. :** P-0011703-6-01

Boring No. : BH-47, TW-11 **Sample No. :** 4 **Depth (m) :** 11,0 to 11,10m

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ Englobe

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	2,289	Recompression index (C_r) :	0,032
Initial water content (w) :	82,8%	Virgin compression index (C_c) :	1,95
Initial humid unit weight (γ_h) :	15,0 kN/m³	Initial effective stress (σ'_v) :	85 kPa
Initial saturation degree (S_r) :	99,5%	Preconsolidation pressure (σ'_p):	110 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	25 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

Adlane Bouadma, ing. jr

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Y/ Project: OTT-00240904-A0 Dossier : P-0011703-6-01

Sondage no: BH-47, TW-11 Echantillon no: 4

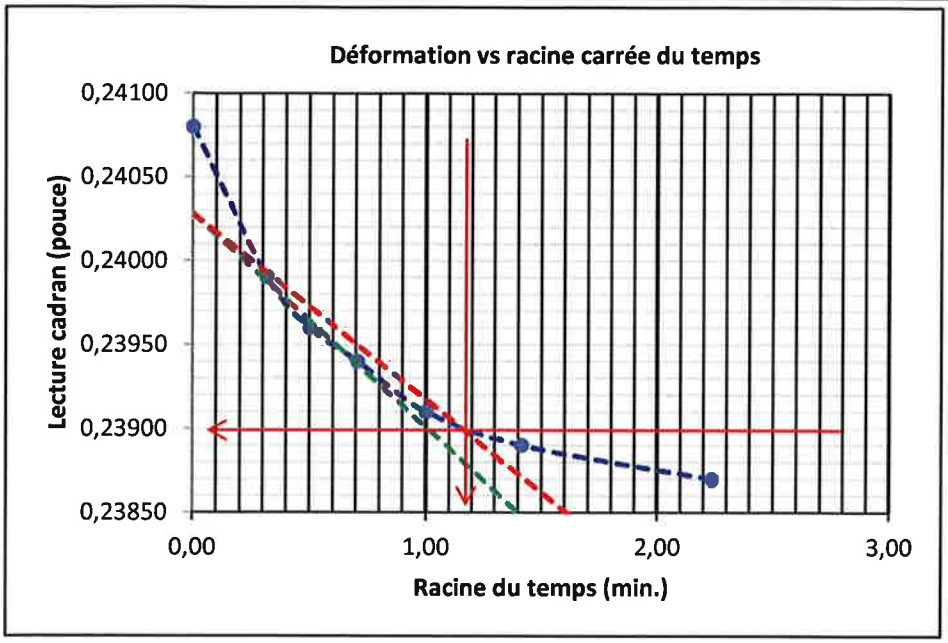
ESSAI A ENVIRON 50 % P'c

Charge: 1,5 kg 54 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,24080
0,10	0,32	0,23990
0,25	0,50	0,23960
0,50	0,71	0,23940
1,00	1,00	0,23910
2,00	1,41	0,23890
5,00	2,24	0,23870
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

Cv = 0,848(H/2)²/T90



Lecture initiale (pce) =	0,2500	Racine T90 =	**1,15** lu sur graphe
Lecture à D90 (pce) =	**0,23900** lu sur graphe	T90 (min) =	1,3225
Correction p/r bâti (pce) =	0,00450	c_v (m²/j) =	8,04E-02
Lecture corrigée (pce) =	0,24350	e =	2,2468 fin de palier
Déformation (pce) =	0,00650	m_v (kPa⁻¹) =	3,02E-04
H_d (mm) =	9,33	k (cm/s) =	2,7E-07

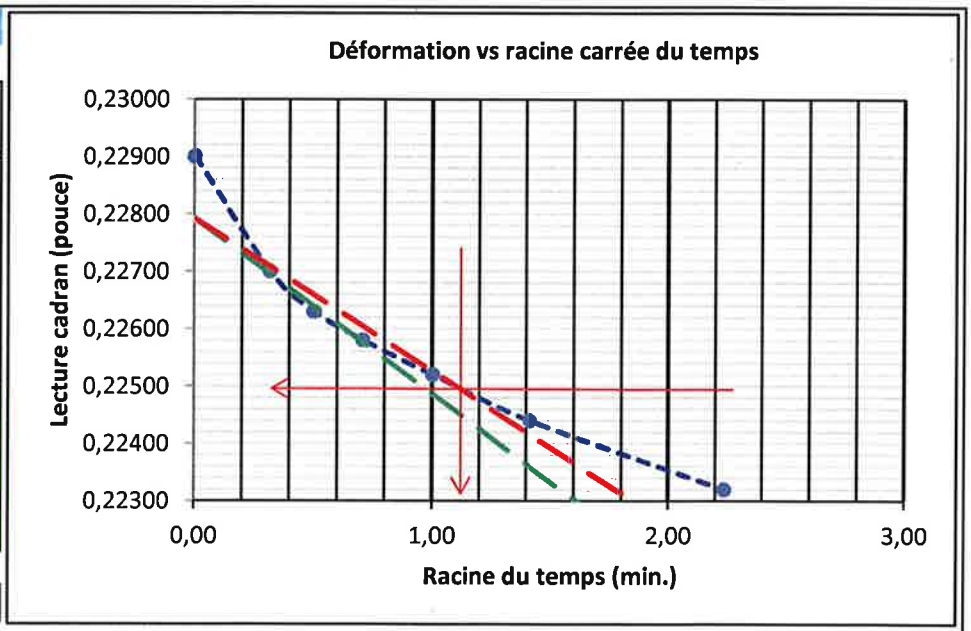
1er ESSAI APRÈS P'c

Charge: 3,5 kg 123 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,22900
0,10	0,32	0,22700
0,25	0,50	0,22630
0,50	0,71	0,22580
1,00	1,00	0,22520
2,00	1,41	0,22440
5,00	2,24	0,22320
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

Cv = 0,848(H/2)²/T90



Lecture initiale (pce) =	0,2500	Racine T90 =	**1,1** lu sur graphe
Lecture à D90 (pce) =	**0,22500** lu sur graphe	T90 (min) =	1,21
Correction p/r bâti (pce) =	0,00710	c_v (m²/j) =	8,52E-02
Lecture corrigée (pce) =	0,23210	e =	2,1253
Déformation (pce) =	0,01790	m_v (kPa⁻¹) =	6,83E-04
H_d (mm) =	9,19	k (cm/s) =	6,6E-07

APPENDIX C: Bedrock Core Photographs

DRY BEDROCK CORES

WET BEDROCK CORES

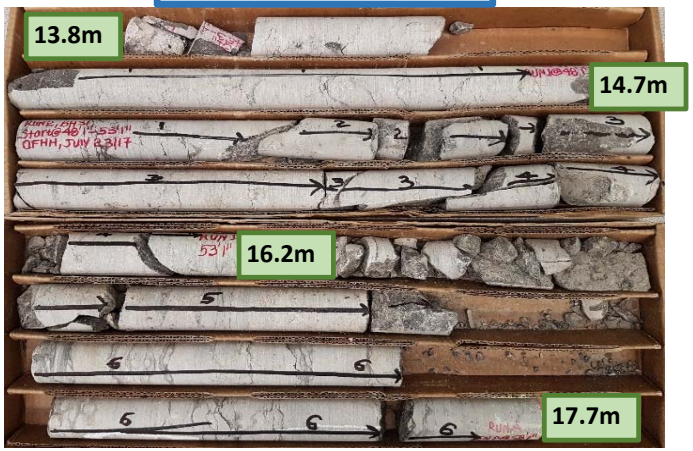
exp.	Borehole No.: **BH-19**	**Rock Core Photographs**
	Runs: **Run 1: 14.6 m - 16.1 m** **Run 2: 16.1 m - 17.6 m**	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON OTT-00240904-A0 Date Cored: June 21, 2017 Figure C-1

DRY BEDROCK CORES

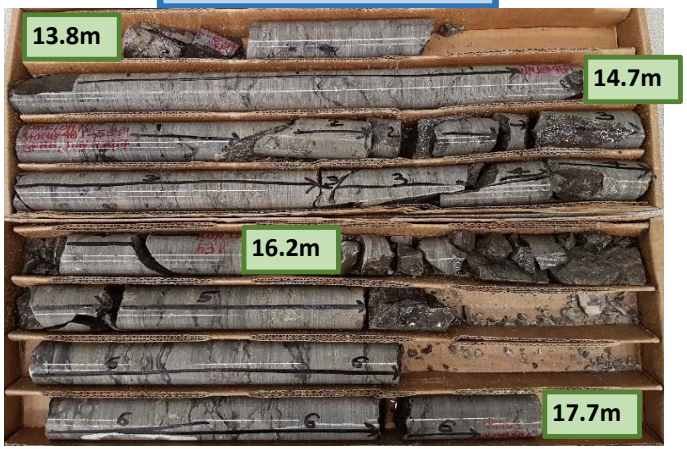
WET BEDROCK CORES

exp.	Borehole No.: **BH-22**	**Rock Core Photographs**
	Runs: **Run 1: 14.6 m - 16.2 m** **Run 2: 16.2 m - 17.6 m**	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON OTT-00240904-A0 Date Cored: June 20, 2017 Figure: C-2

DRY BEDROCK CORES



WET BEDROCK CORES



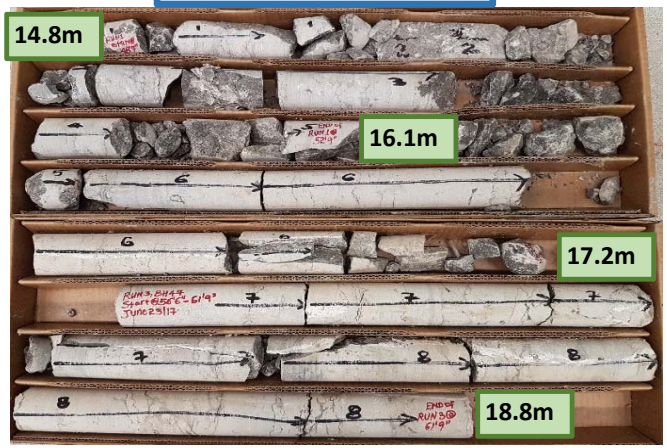
exp.	Borehole No.: **BH-31**	**Rock Core Photographs**
	Runs: **Run 1: 13.8 m - 14.7 m** **Run 2: 14.7 m - 16.2 m** **Run 3: 16.2 m - 17.7 m**	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON OTT-00240904-A0 Date Cored: June 22, 2017 Figure: C-3

DRY BEDROCK CORES

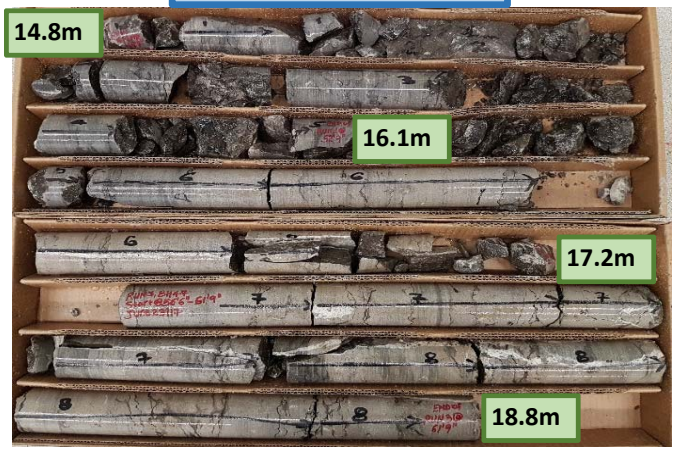
WET BEDROCK CORES

exp.	Borehole No.: **BH-41**	**Rock Core Photographs**
	Runs: **Run 1: 14.7 m - 15.8 m** **Run 2: 15.8 m - 17.4 m** **Run 3: 17.4 m - 19.0 m**	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON OTT-00240904-A0 Date Cored: June 26, 2017 Figure: C-4

DRY BEDROCK CORES



WET BEDROCK CORES



exp.	Borehole No.: **BH-47**	**Rock Core Photographs**
	Runs: **Run 1: 14.8 m - 16.1 m** **Run 2: 16.1 m - 17.2 m** **Run 3: 17.2 m - 18.8 m**	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON OTT-00240904-A0 Date Cored: June 23, 2017 Figure: C-5

Appendix D: Shear Wave Velocity Survey Report

GEOPHYSICS GPR INTERNATIONAL INC.

100 – 2545 Delorimier Street
Longueuil (Québec)
Canada J4K 3P7

Tel. : (450) 679-2400
Fax : (514) 521-4128
info@geophysicsgpr.com
www.geophysicsgpr.com

February 5th, 2018

Transmitted by email: ismail.taki@exp.com
Our Ref.: GPR-18-00395

Mr. Ismail M. Taki, M.Eng., P.Eng.
Manager, Geotechnical Services
exp Services inc.
100 - 2650 Queensview Drive
Ottawa (ON) K2B 8H6

Subject: **Shear Wave Velocity Sounding for Site Class Determination**
2225 Mer Bleue Road, Ottawa (ON)
[Project: OTT-00240904]

Dear Sir,

Geophysics GPR International Inc. has been requested by **exp** Services Inc. to carry out seismic shear wave surveys on a property, located North-East of the intersection of Mer Bleue Road and Brian Coburn Boulevard, in Ottawa (ON). The geophysical investigations used the Multi-channel Analysis of Surface Waves (MASW), the Extended SPatial AutoCorrelation (ESPAC), and the seismic refraction methods. From the subsequent results, the seismic shear wave velocities values were calculated for the soil and the rock.

The surveys were carried out, on January 25th, by Mr. Charles Trottier, M.Sc., phys., and Mr. Alexis Marchand. 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 test methods, and the results in graphic and table format.

METHODS PRINCIPLES

MASW Survey

The *Multi-channel Analysis of Surface Waves* (MASW) and the *Extended SPatial AutoCorrelation* (ESPAC 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 waves ("ground roll"). 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 ESPAC is considered a "passive" method, using the low frequency "noises" produced far away. The method can also be used with "active" seismic source records. The dispersion properties are expressed as a change of phase velocities with 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/ESPAC records, the corresponding spectrogram analysis and resulting 1D V_S model. The ESPAC method allows deeper Vs soundings, but generally with a lower resolution for the surface portion. Its dispersion curve can then be merged with the higher frequency one from the MASW to calculate a more complete inversion.

Seismic Refraction Survey

The method consists in measuring the propagation delays of the direct and refracted seismic waves (P and/or S) produced by an artificial source in the axis of a seismic linear spread. The seismic velocities of the materials can be directly calculated, then the refractors depths.

INTERPRETATION METHODS

MASW Surveys

The main processing sequence involved data inspection and edition when required; spectral analysis ("phase shift" for MASW, and "cross-correlation" for ESPAC); picking the fundamental mode; and 1D inversion of the MASW and ESPAC 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 of the order of 15% or better.

Seismic Refraction surveys

The considered seismic wave's arrival times were identified for each geophone. The General Reciprocal Method was used, with signal sources at both ends of the seismic spreads, to consider seismic wave propagation for two opposite directions. The measurements were realised to calculate the rock depth, and its seismic velocity (using P waves). The rock seismic velocities (V_S) were calculated using two methods: the reduced travel-times (the Hobson and Overton method) and the opposite apparent velocities. The first one allows independence from the surface and rock topography effect, as well as the overburden lateral variation of its seismic velocity, but remains limited to common geophones. Its application remains however limited to shallow to intermediate depths refractors. The second one can use longer segments of opposite directions signals, improving the linear regressions accuracy, but remains affected by the surface and rock topography effect, as well as the overburden lateral variation of the seismic velocity. Conversely to the MASW method, the seismic rock velocity calculated by seismic refraction is only representative of its superior part, due to the evanescent nature of the refracted wave.

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 acquisition spreads were located on a vacant field, at the North-East of the intersection of Mer Bleue Road and Brian Coburn Boulevard. The geophone spacing for the main spread was of 3 metres, using 24 geophones. A shorter seismic spread, with geophone spacing of 1 metre, was dedicated to the near surface materials.

The seismic records counted 4096 data, sampled at 1000 µs for the MASW surveys, and 4096 data, sampled at 50 µs for the seismic refraction. The records included a pre-trig portion of 10 ms. A stacking procedure was also used to improve the Signal / Noise ratio for the seismic records.

Unlike the refraction method, which allows producing a result point beneath each geophone, 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. The seismic records were made with a seismograph Terraloc MK6 (from ABEM Instrument), and the geophones were 4.5 Hz. A 9 kg sledgehammer was used as the energy source with impacts being recorded off both ends of the seismic spreads.

RESULTS

From seismic refraction surveys, the rock was calculated approximately 14 metres deep (± 10%). Its seismic velocity was calculated between 2255 and 2270 m/s for the upper portion (cf. Figure 5). These results were used as initial parameters for the basic geophysical model, prior to the MASW dispersion curves inversions.

The MASW calculated V_S results are illustrated at Figure 6 and they are also presented at Table 1.

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 up to 30 metres. This value represents an equivalent homogeneous single layer response.

The calculated $\overline{V}_{S30}$ value is 245.7 m/s (cf. Table 1), corresponding to the Site Class "D". However, very low seismic velocities were calculated for the clayey materials, from the surface to approximately 13 metres deep.

CONCLUSION

Geophysical surveys were carried out on a vacant field, located North-East of the intersection of Mer Bleue Road and Brian Coburn Boulevard, in Ottawa (ON). The seismic surveys used the MASW, ESPAC analysis methods, as well as the complementary seismic refraction method, to calculate the $\overline{V}_{S30}$ value for the Site Class determination. The $\overline{V}_{S30}$ calculation is presented in Table 1.

The calculated $\overline{V}_{S30}$ value of the actual site is 246 m/s corresponding to the Site Class "D" ($180 < \overline{V}_{S30} \leq 360$ m/s), as determined through the MASW, ESPAC and seismic refraction methods, Table 4.1.8.4.A of the NBC, and the Building Code, O. Reg. 332/12. It must be noted that very low seismic velocities were calculated for the unconsolidated materials between the surface and approximately 13 metres deep. A geotechnical assessment related to these materials should be realized.

It must be noted that other geotechnical information gleaned on site; including the presence of liquefiable soils, soft clays, high moisture content etc. 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.

P. Eng.

Jean-Luc Arsenault, P.Eng., M.A.Sc.
Project Manager

LICENSED PROFESSIONAL ENGINEER
J.-L. ARSENAULT
100148122
PROVINCE OF ONTARIO
05/02/2018

Figure 1: Regional location of the Site
(source: *OpenStreetMap©*)

Figure 2: Location of the seismic spreads
(source: *Google Earth™*)

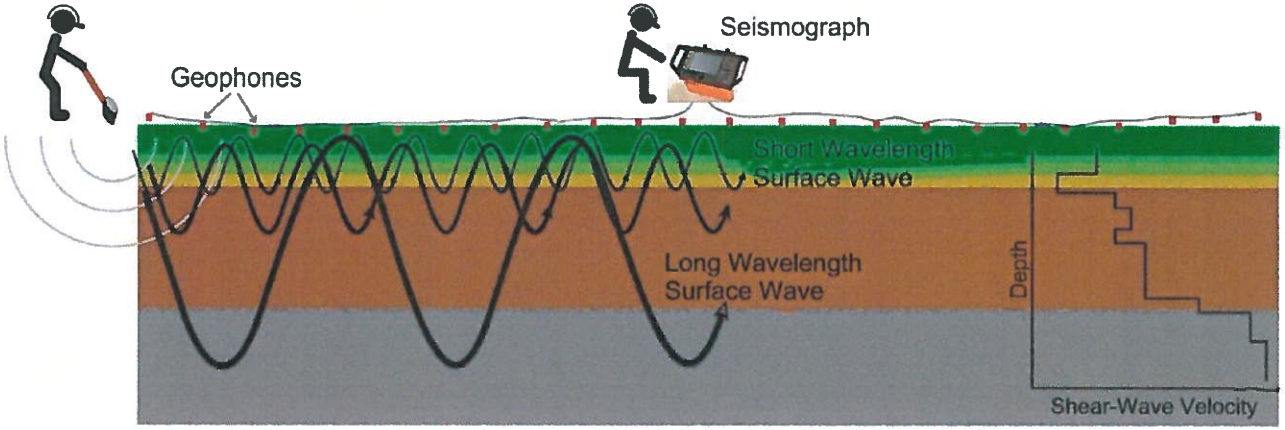


Figure 3: MASW Operating Principle

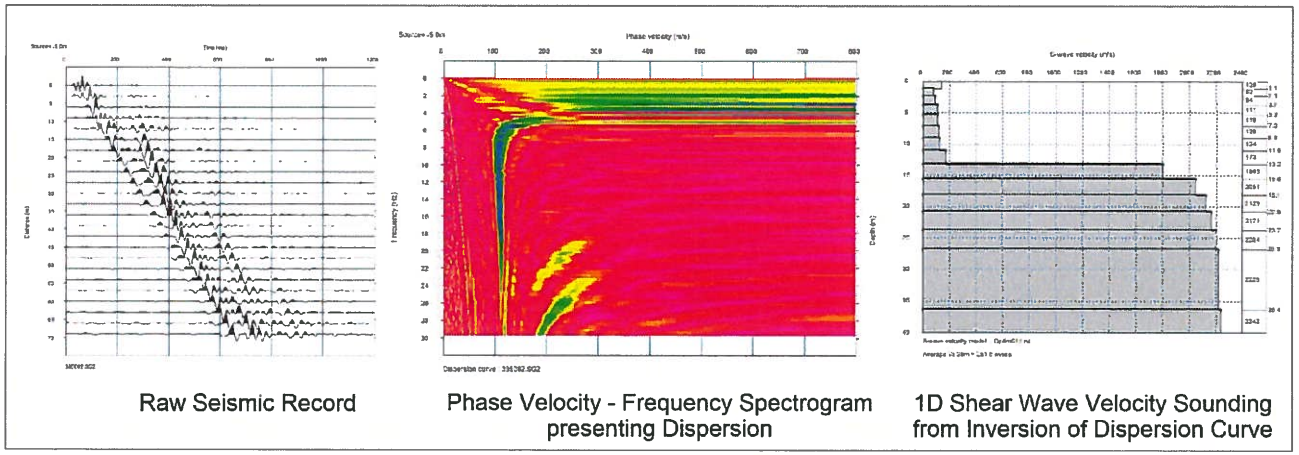
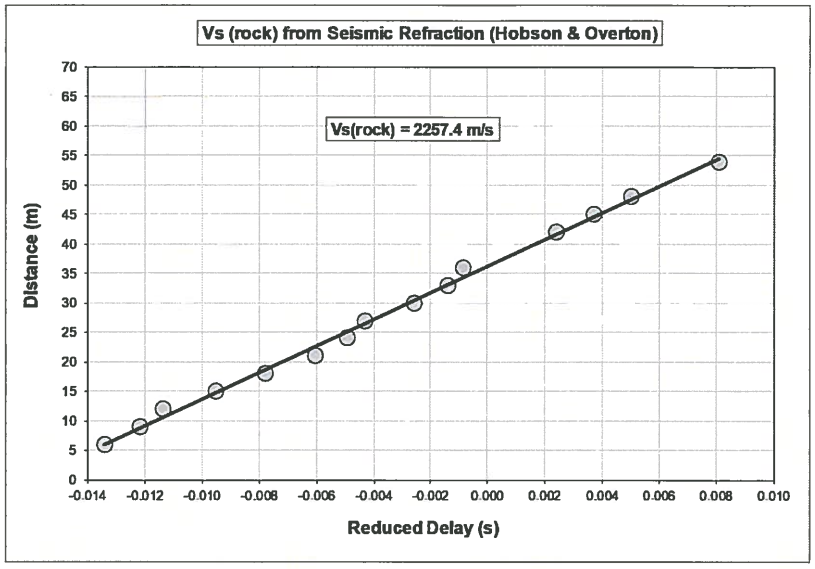


Figure 4: Example of a MASW/ESPAC record, Phase Velocity - Frequency curve and resulting 1D Shear Wave Velocity Model



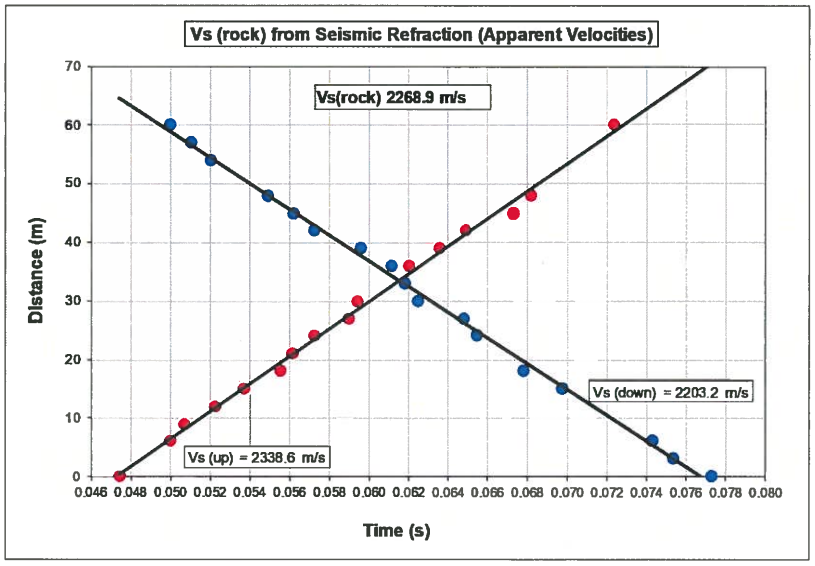


Figure 5: Rock V_S from Seismic Refraction

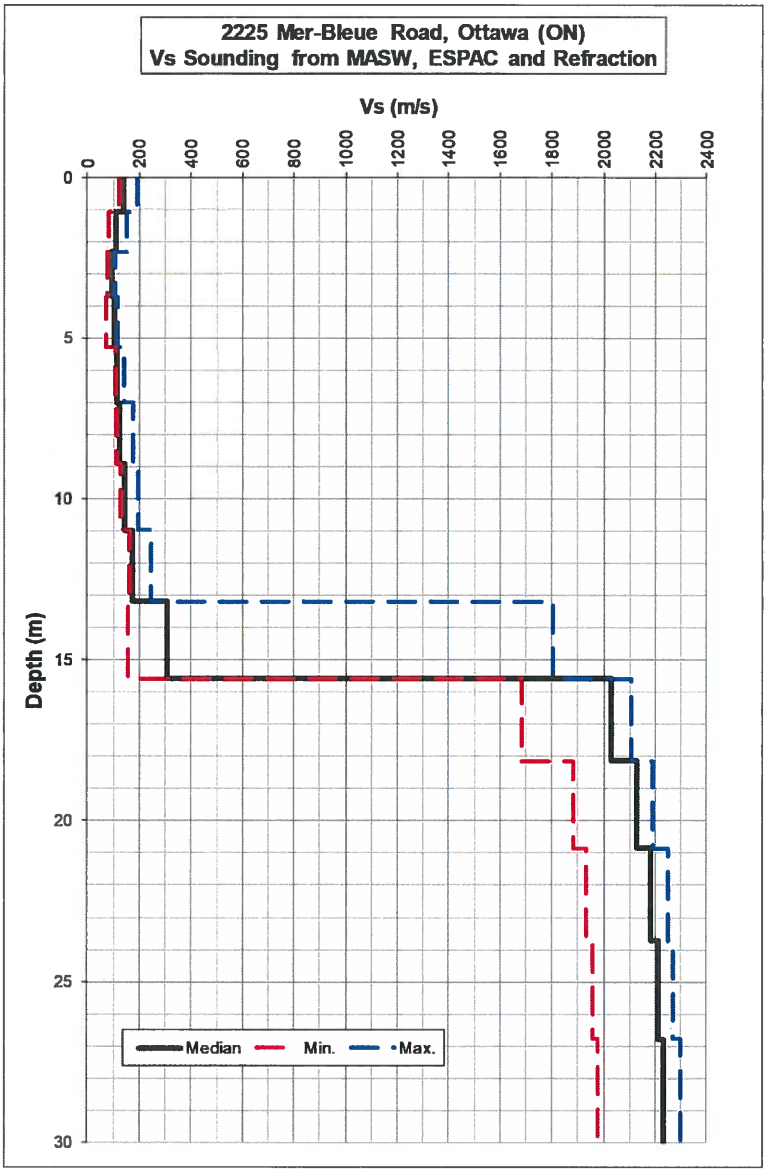


Figure 6: MASW Shear-Wave Velocities Sounding

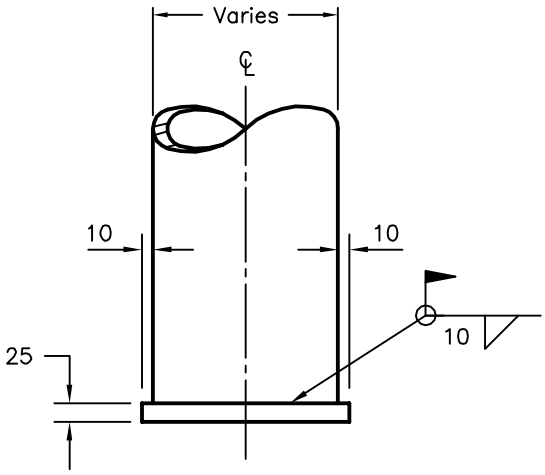
TABLE 1
V_{S30} Calculation for the Site Class

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	**121.2**	**136.5**	**192.6**					
1.07	**80.2**	**111.0**	**151.3**	1.07	1.07	0.007851	0.007851	136.5
2.31	**75.3**	**92.3**	**108.7**	1.24	2.31	0.011133	0.018984	121.6
3.71	**74.2**	**102.9**	**114.3**	1.40	3.71	0.015182	0.034166	108.6
5.27	**107.3**	**113.3**	**142.3**	1.57	5.27	0.015218	0.049384	106.8
7.01	**113.3**	**122.4**	**176.9**	1.73	7.01	0.015276	0.064660	108.3
8.90	**124.2**	**141.2**	**196.0**	1.90	8.90	0.015486	0.080146	111.1
10.96	**161.5**	**172.0**	245.0	2.06	10.96	0.014597	0.094743	115.7
13.19	**156.7**	308.3	1805.6	2.23	13.19	0.012935	0.107679	122.5
15.58	1686.7	2030.8	2103.5	2.39	15.58	0.007752	0.115430	134.9
18.13	1884.9	2129.7	2187.8	2.55	18.13	0.001258	0.116689	155.4
20.85	1930.2	2181.7	2249.5	2.72	20.85	0.001277	0.117966	176.8
23.74	1956.3	2213.7	2271.3	2.88	23.74	0.001322	0.119288	199.0
26.79	1975.2	2234.3	2296.4	3.05	26.79	0.001378	0.120665	222.0
30				3.21	30.00	0.001439	0.122104	245.7

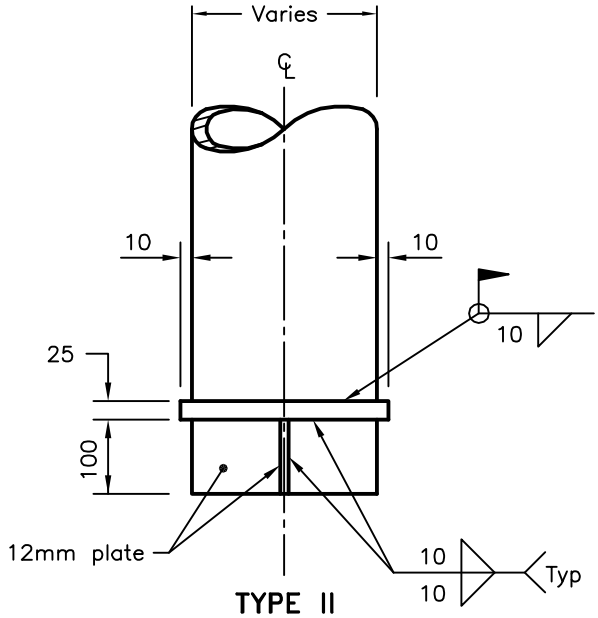
V_{S30} (m/s)	**245.7**
Class	**D [1]**

[1]: Geotechnical assessment should be realized for the low seismic velocities materials located from the surface to approximately 13 metres deep.

APPENDIX E: Ontario Provincial Standard Drawing (OPSD) 3001.100, Type II, dated November 2010

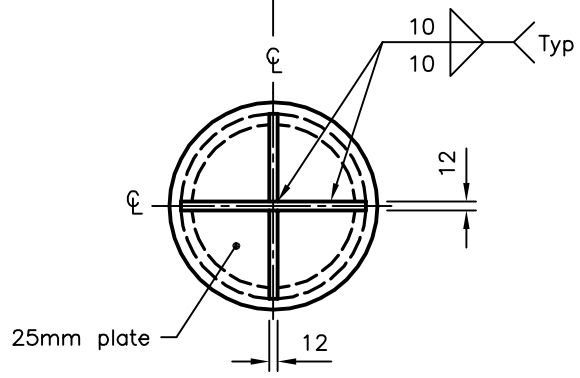


TYPE I



TYPE II

SHOE DETAILS



BOTTOM VIEW

NOTES:

A Driving shoe Type I or II as specified.
B Welding shall be according to CSA W59.
C Steel plates shall be according to CSA G40.20/G40.21, Grade 300W.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2010	Rev	1
FOUNDATION PILES STEEL TUBE PILE DRIVING SHOE			
	OPSD 3001.100		

APPENDIX F: AGAT Certificate of Laboratory Analysis

AGAT Laboratories

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: Susan Potyondy

PROJECT: OTT-240904-A0

AGAT WORK ORDER: 17Z236289

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Jul 19, 2017

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

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17Z236289

PROJECT: OTT-240904-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Susan Potyondy

SAMPLING SITE:Orleans Family Health Hub

SAMPLED BY:exp

Inorganic Chemistry (Soil)

DATE RECEIVED: 2017-07-12 **DATE REPORTED: 2017-07-18**

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: BH 1 SS3 (5-7ft)	BH 5 SS3 (5-7ft)	BH 7 SS3 (5-7ft)	BH 15 SS3 (5-7ft)	BH 18 SS3 (5-7ft)	BH 19 SS3 (5-7ft)	BH 22 SS7 (15-17ft)	BH 31 SS9 (25-27ft)
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2017-06-21	2017-06-27	2017-06-21	2017-06-30	2017-06-27	2017-06-21	2017-06-26	2017-06-22
				8548877	8548878	8548879	8548880	8548881	8548882	8548883	8548884
pH, 2:1 CaCl2 Extraction	pH Units			7.33	7.66	7.64	7.60	7.51	7.33	8.50	8.39
Resistivity (2:1)	ohm.cm		1	8770	2720	7140	3460	8470	2770	2790	4030
Chloride (2:1)	µg/g		2	9	68	4	16	6	30	51	12
Sulphate (2:1)	µg/g		2	34	97	29	180	29	224	72	39

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: BH 41 SS11 (35-37ft)	BH 47 SS12 (40-42ft)
SAMPLE TYPE:				Soil	Soil
DATE SAMPLED:				2017-06-26	2017-06-23
				8548885	8548886
pH, 2:1 CaCl2 Extraction	pH Units			8.41	8.52
Resistivity (2:1)	ohm.cm		1	2230	1820
Chloride (2:1)	µg/g		2	33	34
Sulphate (2:1)	µg/g		2	127	255

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

8548877-8548886 EC/Resistivity, Chloride and Sulphate were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 17Z236289

PROJECT: OTT-240904-A0

ATTENTION TO: Susan Potyondy

SAMPLING SITE:Orleans Family Health Hub

SAMPLED BY:exp

Soil Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Soil)															
pH, 2:1 CaCl2 Extraction	8548877	8548877	7.33	7.31	0.3%	<	101%	80%	120%	NA			NA		
Chloride (2:1)	8559695		3	4	NA	< 2	106%	70%	130%	102%	70%	130%	102%	70%	130%
Sulphate (2:1)	8559695		102	113	10.2%	< 2	95%	70%	130%	103%	70%	130%	106%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 17Z236289

PROJECT: OTT-240904-A0

ATTENTION TO: Susan Potyondy

SAMPLING SITE:Orleans Family Health Hub

SAMPLED BY:exp

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	EC METER
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH

AGAT Laboratories

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

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 17236289

Cooler Quantity: one - no ice

Arrival Temperatures: 18.4 | 18.5 | 18.5
1 Blue: 8.3 | 8.9 | 8.5

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: Exp Services Inc
Contact: Susan Potyondy
Address: 100-2650 Queensview Drive
Ottawa, Ont K2B-8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: susan.potyondy@exp.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

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

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

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

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

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):

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-240904-A0
Site Location: Orleans Family Health Hub
Sampled By: exp
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
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	Y/N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals; ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR)	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	pH	Sulphates	Chlorides	Resistivity
BH 1 ss 3 (5-7 ft)																					✓	✓	✓	✓
BH 5 ss 3 (5-7 ft)																								
BH 7 ss 3 (5-7 ft)																								
BH 15 ss 3 (5-7 ft)																								
BH 18 ss 3 (5-7 ft)																								
BH 19 ss 3 (5-7 ft)																								
BH 22 ss 7 (15-17 ft)																								
BH 31 ss 9 (25-27 ft)																								
BH 41 ss 11 (35-37 ft)																								
BH 47 ss 12 (40-42 ft)																					✓	✓	✓	✓

Samples Relinquished By (Print Name and Sign): Ryan DiGiuseppe	Date: July 11/17	Time:	Samples Received By (Print Name and Sign):	Date: 11-July-17	Time: 16h17
Samples Relinquished By (Print Name and Sign): FedEx 12-	Date: July-17	Time: 16h00	Samples Received By (Print Name and Sign): Neil Ramnarain	Date: July 13, 17	Time: 11:09
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

Page 1 of 1

N°: T 041766

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

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Report Distributed To:

Ms. Chantal Potvin, Montfort Hospital; Email: chantalgpotvin@montfort.on.ca

Mr. David Henselwood, P.Eng. ZW Project Management Inc.; Email: david.henselwood@zwgroup.com

Mr. Brian Johnson, Cleland Jardine Engineering Ltd.; Email: bjohnson@clelandjardine.com

Mr. Alam Ansari, EXP Services Inc.; Email: alam.ansari@exp.com