

# **Montfort Hospital**

## c/o ZW Project Management Inc.

## **Detailed Geotechnical Investigation**

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

### **Project Name**

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

Project Number OTT-000240904-A0

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Date Submitted: March 14, 2018

# **Montfort Hospital** c/o ZW Project Management Inc.

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## **Geotechnical Investigation**

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**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 m² 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.



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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 (4<sup>th</sup> 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 m² 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;
- 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;



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- 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.



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# 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).



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## 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.



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## 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



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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



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## 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/m³ 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.



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### 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/m³.

## 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/m³.

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.



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Table II: One-Dimensional Oedometer Test Results on Brown to Greyish Brown Silty Clay Sample									
BH No Sample No.	Elevation (Depth) (m)	σ' <sub>v0</sub> (kPa)	<b>W</b> c (%)	γ (kN/m³)	σ' <sub>p</sub> (kPa)	eo	Cr	Cc	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), θo = initial void ratio, ; Cr = re-compression index; Cc = compression index; OC= over-consolidation pressure (kPa);

Note: σ'v<sub>0</sub> 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 extrasensitive. 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/m³.

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.



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Table III:	Table III: Summary of Results from Grain Size Analysis – Grey Silty Clay Samples							
Borehole		Grain Size Analysis (%)						
No Sample No.	Depth (m)	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								
Barrah ala Ma		Atterberg Limit Results						
Borehole No Sample No.	Depth (m)	<b>W</b> <sub>n</sub> (%)	LL (%)	PL (%)	PI (%)	LI	Soil Classification (1)	
BH22 – SS8	6.1 – 6.7	88	56	30	26	2.2	СН	
BH31 – SS7	4.6 – 5.2	89	60	26	34	1.9	СН	
BH41-SS12	12.2 – 12.8	61	52	24	28	1.3	СН	
BH47-TW11	10.7 – 11.3	88	50	25	25	2.5	CL	

**W**<sub>n</sub>: Water Content, **LL**: Limit Liquid; **PL:** Plastic Limit; **PI**: Plasticity Index; **LI**: Liquidity Index; <sup>(1)</sup>: 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.



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Table V	Table V: One-Dimensional Oedometer Test Results on Grey Silty Clay Samples								
BH No Sample No.	Elevation (Depth) (m)	σ' <sub>v0</sub> (kPa)	w <sub>c</sub> (%)	γ (kN/m³)	σ' <sub>p</sub> (kPa)	e <sub>o</sub>	Cr	Cc	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), θο = initial void ratio, ; Cr = re-compression index; Cc = compression index; OC= over-consolidation pressure (kPa);

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		Grain Size Analysis (%)					
No Sample No.	Depth (m)	Clay	Silt	Sand	Gravel		
BH41-SS13	13.7-14.3	49	27	14	10		
BH47-SS13	13.7-14.3	54	33	10	3		



σ'<sub>v0</sub> calculated using July 21, 2017 groundwater level measurements.

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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), 4<sup>th</sup> 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/m³. 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.



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	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 A	reas					
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				
		Propo	sed 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.



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# 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<sup>2</sup> (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

<sup>&</sup>lt;sup>1</sup> 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., 2<sup>nd</sup> European Symp. on Penetration Testing, Amsterdam, pp. 67–72.



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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.



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## 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 (4<sup>th</sup> 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.



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# 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.



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## 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.



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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 downdrag 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.

at U	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)						
	245 mm O.D. by 10 mm wall	1,275	315						
Steel Pipe	245 mm O.D. by 12 mm wall thickness	1,445	315						
	324 mm O.D. by 12 mm wall thickness	2,120	420						
041	HP 310 x 79	1,260	500						
Steel H	HP 310 x 110	1,775	510						
Н	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.



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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.



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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					



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### 9.2.2 Lateral Resistance of Piles

The ultimate lateral resistance (capacity), H<sub>u</sub>, and deflection, y<sub>g</sub>, 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<sup>4</sup>

 $k = k_h = \text{coefficient of horizontal subgrade reaction} = 2995/b \text{ where b is in metres and } k_h \text{ is in kPa} / m^3$ 

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

H<sub>u</sub> = Lateral load capacity of pile

C<sub>u</sub> = Clay Cohesion = 50 kPa

d = Diameter or width of pile, m

L = Embedded length, m

 $\gamma$  = unit weight of soil = 16 kN/m<sup>3</sup>

M yield = Yield moment of pile

e = Height of lateral load above ground surface

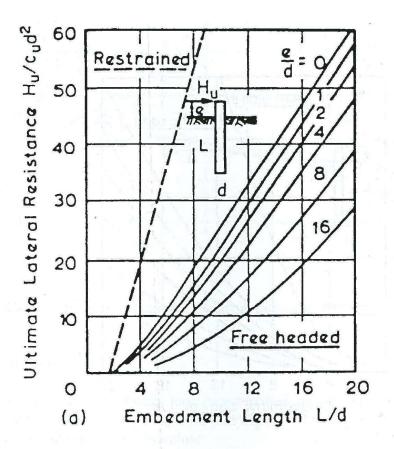
The computed resistance should be multiplied by a geotechnical resistance factor of 0.5.

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



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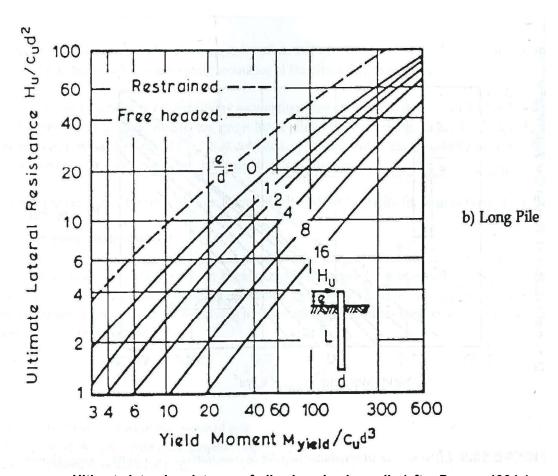


a) Short Pile



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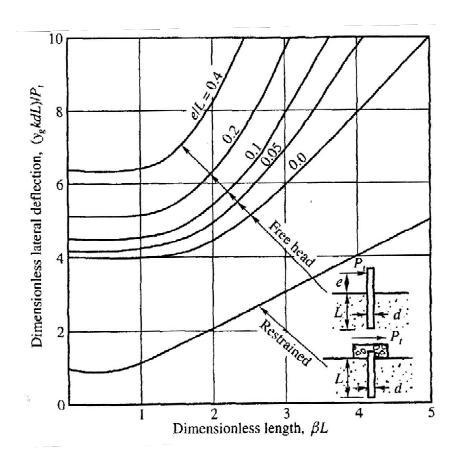
Ultimate lateral resistance of piles in cohesive soils (after Broms, 1964a)

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



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

Where:

$$\beta h = \beta$$

Pt = 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.



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# 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/m³ 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.



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# **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 freedraining 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.

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

where  $P_{PA}$ = combined active lateral earth pressure at depth h below top of wall

(kPa)

 $K_a$ = active earth pressure coefficient = 0.27

KAE is the seismic earth pressure coefficient = 0.37; based on PGA = 0.32g for Ottawa area; kh = 0.5 times PGA for yielding walls with

displacements up to 80 mm (250PGA in mm)

is the unit weight of the soil backfill = 22 kN/m<sup>3</sup>, unit weight of LWF = γ

0.21 kN/m3

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

= total height of wall (m) Н

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

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.



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



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#### 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.



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#### 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.



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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 m³/day, but less than 400 m³/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 m³/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.



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#### **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.



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#### 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	Table X: Recommended Pavement Structure Thicknesses										
Pavement Layer	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 100% SPMDD 450 mm 600 mm (OPSS 1010)											
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



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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.



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#### 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, Chlorid	•	ate and Ele	ectrical Re	sistivity Tests on Soil
Borehole No. (Sample No.)	Soil	Depth (m)	рН	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.



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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.



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#### 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.



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#### 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.



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#### 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.



EXP Services Inc.

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

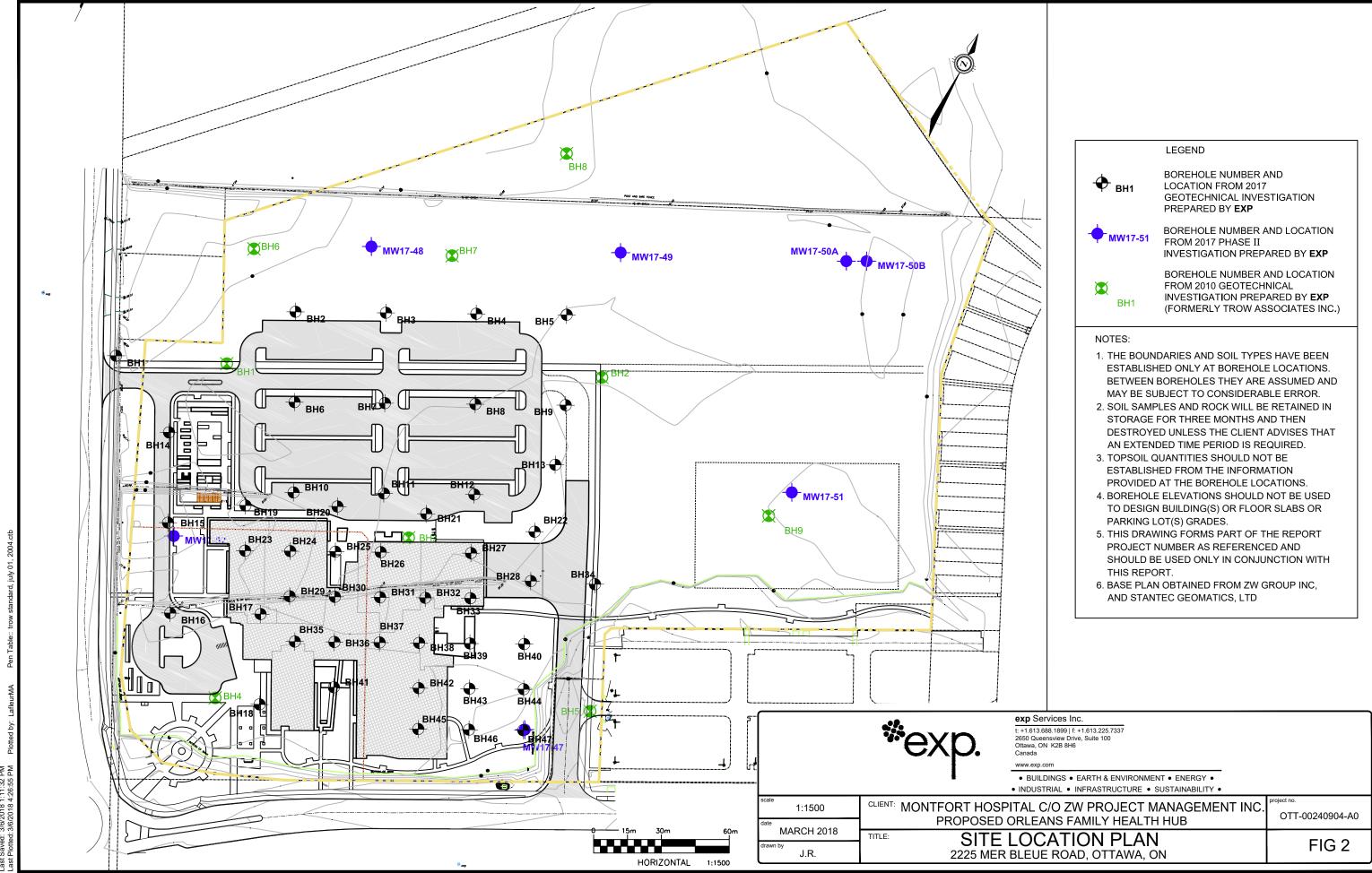
Final

#### **FIGURES**



trow standard, july 01, 2004.ctb

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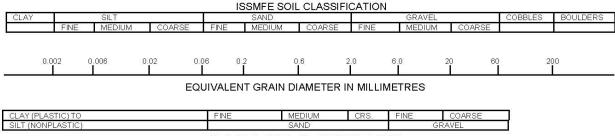


roject Number: 011-00240904-A0 Date: March 14, 2018

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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 Society 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.



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.



Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 1 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 21, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Natural 250 500 750 Geodetic -MBOL SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt kPa Shear Strength kN/m<sup>3</sup> 88.55 TOPSOIL ~180 mm 88.4 216 SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist, (hard) 87.95 18.3 6 17.2 86.4 SILTY CLAY H.W. Grey, sensitive to medium sensitivity, wet, (stiff to firm) H.W. S = 6Borehole Terminated at 4.7 m Depth 1) Methane Reading: 0% NOTES: 1.Borehole data requires interpretation by exp. before CODE DOILLING DECODE

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

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

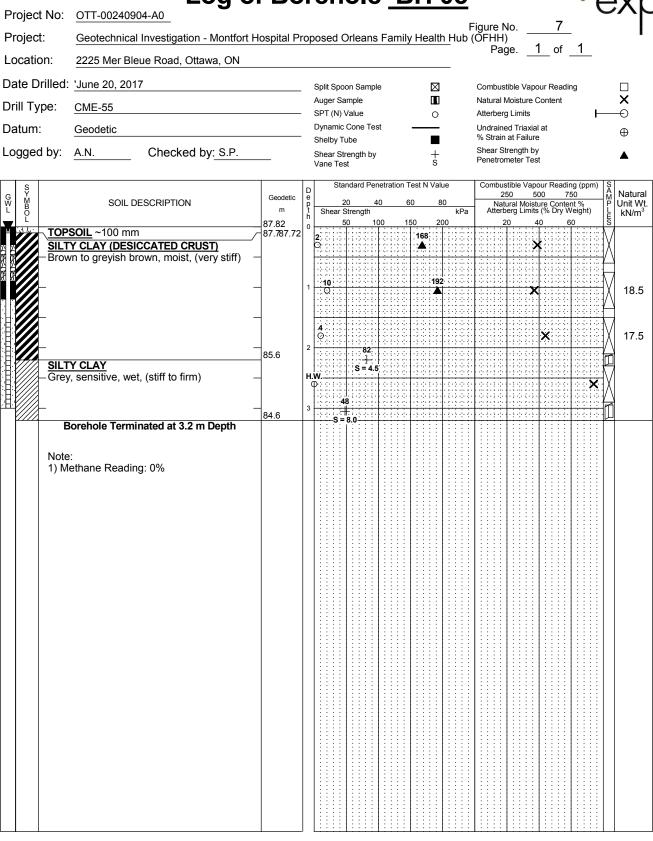
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Elapsed									
Time	Level (m)	To (m)							
Upon Completion	3.7	7.6							
30 days									

CORE DRILLING RECORD										
Run	Depth									
No.	(m)									

Project No:	OTT-00240904-A0	•	-	•			_		<del></del>			4		C	₹ <b>^</b> }
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NOTES: 1. Borehole data re	equires interpretation by exp. before	WATE	_l ER L	EVEL R	ECOF	RDS			1::::	CO	RE DR	ILLING R	ECOR	.D	1
use by others  Elapsed 2. Borehole backfilled with cuttings upon completion.  Time		L	Water evel (m)	)	Н	lole Oper To (m)	n	Run No.	Dep (m		% Re	C.	F	RQD %	
2. Borehole backfilled with cuttings upon completion. 3. Field work supervised by an exp representative. 4. See Notes on Sample Descriptions			1.5			2.3									
5. This Figure is to OTT-00240904-	read with exp. Services Inc. report A0														

roject No:	OTT-00240904-A0	g of Bo	r	el	h	0	le	• -	<u>B</u>	<u>H</u>		<u>0</u> :							_		(	9	Χþ
roject:	Geotechnical Investigation - M	ontfort Hospital P	rop	ose	d C	)rle	ans	Far	nily	Hea	altl	<u> 1</u> Ηւ	- ) d∟	igu OF	HH)	)	_		5	-			ı
ocation:	2225 Mer Bleue Road, Ottawa	, ON													Pag	ge.	_	<u> </u>	of	_1	_		
ate Drilled:	'June 20, 2017			Split S	Snor	n S	amol	e			$\boxtimes$			Cor	nhus	tible '	Van	our R	Readi	ina			
rill Type:	CME-55			Auge	Sa	mple		•						Nat	ural I	Moist	ure (			9			×
atum:	Geodetic			SPT ( Dynar	,			st			0					g Lim ed Tri		l at			-		<b>⊕</b>
		C D	-	Shelb	y Tu	ıbe								% S	train	at Fa	ailure	Э					$\oplus$
gged by:	A.N. Checked by:	<u>5.P.</u>		Shear Vane			h by				+ s					neter							<b>A</b>
S Y M B O	SOIL DESCRIPTION	Geodetic m	D e p t		2	0	4	netratio	on T	est N		0	:Pa		2	50	5	00	7	ng (p '50 ent % Veigh		S A M P	Natural Unit Wt.
L	<b>SOIL</b> ~ 75 mm	87.92 7 87.8	h 0	- : :	5		-	00	15	50	2	00				0.g 2		10 1 : : :		60 		L S	kN/m³
SILT	SILTY CLAY (DESICCATED CRUST)  — Brown to greyish brown, moist, (very st			5 O:					144									*					17.9
		_	1	- <b>1</b> ′						168						×							18.4
			2	<b>4</b> ⊙	.0.						.;		3 () 3 () 3 () 4 ()					×		1000			
	Y CLAY , sensitive, wet, (stiff)	85.785.82	H.	. <b>w</b> .—	.3.	S		0											>	•			
			3			62					: : :		:::::									:/\  m	
В	orehole Terminated at 3.2 m De	84.7 epth		1 1 1	s	= 5.	2				::-		111	1 1 1	111		(· )·		1 1	1:3:4	111	Ш	
	Note: 1) Methane Reading: 0%																						
TES:	equires interpretation by exp. before	WATE	R LI	EVEL	RE	CO	RDS	3			   [				СО	RE [	DRII	LIN	IG R	ECC	 DRD		
se by others		Elapsed Time		Wate evel (	er			Hole	Ope (m)		1	Ru			Dep (m	th	T		6 Re		T		QD %
	ed with cuttings upon completion.  vised by an exp representative.	Upon Completion		<u>.ever (</u> 2.1	111)			2			1	INC	<i>,</i> .		(111)	,	$\dagger$				+		
	ample Descriptions																						
	read with exp. Services Inc. report																						

Project No:	: <u>OTT-00240904-A0</u>								<u>•</u>	-: <b>.</b>	1-		6		7	7	^ト
Project:	Geotechnical Investigation - Month	ort Hospital F	Prop	osed (	Orlea	ns	Family	Healt			) –		6_ of	1			ı
Location:	2225 Mer Bleue Road, Ottawa, Of	N								Pa	ye		ול	<u>'</u>			
Date Drilled:	'June 20, 2017		Split Spoon Sample 🔲							Combus	tible Va	oour Re	eadin	ıg		[	
Drill Type:	CME-55		Auger Sample  — SPT (N) Value							Natural M Atterberg		Conte	nt		<u> </u>	; (	<b>X</b> Ə
Datum:	Geodetic		_	Dynamic	Cone	Tes	t	_		Undraine % Strain	ed Triaxi				-	(	∌
Logged by:	A.N. Checked by: S.P	Checked by: S.P.			Shelby Tube  Shear Strength by + Vane Test S					Shear St Penetror	trength b	ру					<b>A</b>
G M B O L	SOIL DESCRIPTION	Geodetic m		Shear	250 500			Noisture Content % imits (% Dry Weight)			n)	Ϋlu	Natural Init Wt. kN/m³				
TOP:	SOIL ~125 mm	87.89 87.7	0	2	50	10	0 15	168	200	2	20	40		<u>.</u> .:. :::		Š –	
	Y CLAY (DESICCATED CRUST)  In to greyish brown, moist, (very stif	f) –		0::::::								×			· · · · · · · · · · · · · · · · · · ·		
		_	1	<b>10</b>			0-1-3-0-1 0-1-3-0-1 0-1-3-0-1	168				×		200	· · · · · · · · · · · · · · · · · · ·	X	18.1
			2	<b>4</b> ⊙		86						×		3 (1)	: 1	X	17.1
SILT - Grey	Y CLAY , sensitive to extra sensitive, wet, (s	85.7 tiff) —	H	<b>.w</b>	7.3.3	+ = 4.8		-2-0-0-2						×			
		84.7	3		53								: :- : :-	3 3 3	/	1	
Note 1) M	: ethane Reading: 0%																
NOTES: 1. Borehole data re use by others	equires interpretation by exp. before		ER L	EVEL R	ECOF						RE DR						
2. Borehole backfill 3. Field work super 4. See Notes on Sa	rvised by an exp representative.  ample Descriptions  read with exp. Services Inc. report	Elapsed Time on Completion	L	Water evel (m Dry	)	F	lole Ope To (m) 2.3		Run No.	Dep (m		%	Red	). ————————————————————————————————————		RQI	D %



BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

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

WAT	ER LEVEL RECO	RDS							
Elapsed									
Time	Level (m)	To (m)							
Upon Completion	2.4	3.0							
31 days									

	CORE DR	RILLING RECOF	RD							
Run No.	Depth % Rec. RQD %									
140.	(111)									

Project No:	OTT-00240904-A0	g of Bo	reh	ole	<u>B</u>	<u>H</u>		Tiques N		Q		е	хр
Project:	Geotechnical Investigation - M	Montfort Hospital P	roposed	Orlean	s Family I	Healt			_	8 1 of	- 1		•
Location:	2225 Mer Bleue Road, Ottawa	a, ON						Pag	e	<u>1</u> of	_1_		
Date Drilled:	'June 28, 2017		_ Split Sp	oon Samp	le	$\boxtimes$		Combustil	ble Vap	our Read	ing		
Drill Type:	CME-55		Auger S					Natural M		Content			
Datum:	Geodetic		- SPT (N) Dynamic	c Cone Te	st –			Atterberg Undrained	d Triaxi	al at			<del>О</del>
Logged by:	A.N. Checked by:	S.P.	Shelby Shear S Vane Te	trength by	,	+ s		% Strain a Shear Stre Penetrom	ength b	у			<b>A</b>
S Y M B O L	SOIL DESCRIPTION	Geodetic m	e p t Shear	20 Strength	netration Tes 40 60	8	30 kPa	250 Natur Atterbe	nal Mois rg Limi	sture Conte ts (% Dry \	750 ent % Weight)	JÂI	Natural Unit Wt. kN/m³
Y I TOP	<b>SOIL</b> ~280 mm	87.9 87.7	4	50	00 150	168	00	20	<u> </u>	1:::::	60	:::\	
SILT Brow	Y CLAY (DESICCATED CRUST In to greyish brown, moist, (very	Y stiff) —	1 9			19:	2		**************************************	×			19.3
		_	4.							×			17.3
	Y CLAY v, sensitive, wet, (stiff to firm)	85.7 85.5	2 H.W.	77 + S = 6.4							×		
			<b>H.W</b>	62 S = 5.0								82/ **X	
			H.W. S = 4	4.0								86	
	Sorehole Terminated at 4.7 m D	83.2		4.6					<del>: : : : :</del>				
Note		epui											
NOTES: 1. Borehole data re use by others	equires interpretation by exp. before		R LEVEL R	RECORD			D.:			ILLING R			ND 0/
•	led with cuttings upon completion.	Elapsed Time	Water Level (m 2.4	)	Hole Open To (m) 3.8		Run No.	Depth (m)	'	% Re	C.		QD %
3. Field work supervised by an exp representative.  4. See Notes on Sample Descriptions					3.8								
	read with exp. Services Inc. report A0												

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 1 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 20, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) SYMBOL Natural 250 500 750 G W L Geodetic SOIL DESCRIPTION Unit Wt Shear Strength kN/m<sup>3</sup> 87.94 TOPSOIL ~180 mm 87.787.74 SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, sensitive, moist to wet, (hard) 18.5 6 17.3 85.7 SILTY CLAY Grey, sensitive, wet, (stiff) 62 84.7 Borehole Terminated at 3.2 m Depth Note: 1) Methane Reading: 0% NOTES: 1.Borehole data requires interpretation by exp. before CODE DOILLING DECODE

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

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

WAT	WATER LEVEL RECORDS											
Elapsed												
Time	Level (m)	To (m)										
Upon Completion	pon Completion 2.7											
31 days	0.2											

CORE DRILLING RECORD  Run Depth % Rec. RQD %											
Depth (m)	% Rec.	RQD %									
, ,											

Project No:	OTT-00240904-A0	of Bo	ì	re	h	0	le	<b>)</b> _	В	<u>H</u>		<u>30</u>		iau	re N	lo.		1	10		$\in$	X	0
Project:	Geotechnical Investigation - Montfor	t Hospital F	Pro	pos	sed (	Orle	eans	Fa	mily	/ Hea	lth	<u>H</u> L	ıb (	ŎFI	HH)		_			1		ı	
Location:	2225 Mer Bleue Road, Ottawa, ON											_			Pag	je.		_	)T _	ı			
Date Drilled:	: 'June 21, 2017			Sp	lit Spo	on S	Samp	le		ſ	$\boxtimes$			Con	nbust	ible \	/apo	ur Re	eadir	na			
Drill Type:	CME-55		_	Au	ger Sa	amp	le			[	I			Natı	ural N	/loistu	ire C	onte		.5	_	×	
Datum:	Geodetic		-		T (N) 'namic			st			0					Limi d Tri		at			-	<b>→</b>	
			-	Sh	elby T	ube				ı	•			% S	train	at Fa	ilure					0	
Logged by:	A.N. Checked by: S.P.				ear St ne Tes		gth by			-	+ s					neter						•	
S Y Y M B L O	SOIL DESCRIPTION	Geodetic m	D e p t	e t s		20	4	netrai		est N \	/alı 8	0	Pa		25	50	50	00	75	ng (ppi 50 nt % /eight)	ľ	Natura Unit W	/t.
L	<b>SOIL</b> ~200 mm	87.84 87.6	0			0	1	00	1;	50 168	20	00			2	0	4	0	6	0	∴.\	/	=
SIL1 Trac	Y CLAY (DESICCATED CRUST) te sand, brown to greyish brown, moist y stiff)			0	0.1.0 0.1.0 0.1.0 0.1.0					<b>A</b>							×					17.3	i
	,,	+	1	1 3	<b>10</b>						192							×				7	
		+		<b>3</b> .	0.1.0				-2-0- -2-0- -2-0-							- 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2		×				17.3	3
▼ SIL1 —Grey	Y CLAY /, sensitive, wet, (stiff to firm)	85.6 85.4	4 H	1.W.	0-1-3- 0-1-3- 0-1-3-	S	77 + = 6.4									- 3 - 3	(.)		3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3				
	,		3	φ: ::: ::::	38 + S = 8	.0														<b>K</b>			
		-	Н	<b>1.W.</b> Φ.:.	34																×	\ \ 1	
		-	н	<b>ι.w.</b> Φ	S = 7.0	0															88	<u>,</u>	
		- 83.1			34 + S = 7.0	<u> </u>																1	
Note	Borehole Terminated at 4.7 m Depth E: ethane Reading: 0%																						
NOTES: 1 Borehole data n	equires interpretation by exp. before	WATE	RL	LEV	EL RI	EC	ORD	 S			_				COI	RE C	RIL	LINC	 3 RI	ECOF	RD		٦
use by others	E	lapsed Time		W	ater el (m)			Hole	Ope (m)			Ru No			Dept	h	T		Rec			RQD %	$\dashv$
		Completion			<u>er (m)</u> 2.4				3.8	,		INU	<u>'-</u>		(111)		$\dagger$						$\dashv$
	ample Descriptions																						
5.This Figure is to OTT-00240904	o read with exp. Services Inc. report																						

Project No:	OTT-00240904-A0		•	<b>0</b> 11	<b>O</b> .		_		<del></del>			4.4		7	スト
Project:	Geotechnical Investigation - Montfort	Hospital F	rop	osed (	Orlea	ns	Family	Healt	h Hub		) –	11	- 1		ı
Location:	2225 Mer Bleue Road, Ottawa, ON									Pa	ge	<u>1</u> of	_1_		
Date Drilled	: 'June 20, 2017			Split Spo	on Sa	mple	<del>)</del>	×	1	Combus	tible Var	oour Read	ing		
Drill Type:	CME-55			Auger Sa						Natural I		Content			<b>X</b>
Datum:	Geodetic		_	Dynamic		Test	t		•	Undraine	ed Triaxi				— ⊕
Logged by:	A.N. Checked by: S.P.		_	Shelby To Shear St		ı by		+ s		% Strain Shear St	trength b	у			<b>A</b>
				Vane Tes	st	.,		Ś		Penetror	meter Te	est			
S Y M	COIL DESCRIPTION	Geodetic	D e		indard 20	Pene	etration T		lue 80	2	50	pour Read 500 7	50	n)	S A M Natural
GW L BO L	SOIL DESCRIPTION	m 87.84	t h	Shear S					kPa 200	1	urai Mois erg Limi 20	sture Conte ts (% Dry \ 40	ent % Veight) 60		Natural Unit Wt. kN/m³
	PSOIL ~ 200 mm TY CLAY (DESICCATED CRUST)	87.687.84	4 0	4				168				×		:::\	18.0
	wn to greyish brown, moist to wet, (very	· —								1 2 2 2 2 2			1	/	
- Still	)		1	9				168						:::\	18.0
										3000			1000		10.0
				<b>4</b>			21.20					×	13.33	:::\	7
		85.6	2			91	4-1-2-4-1 4-1-2-4-1	-2-0-6-2					10000	/	
	TY CLAY y, sensitive, wet, (stiff to firm)		н	w	s	= 4.	8								7
	,		'	D	8							×	1000	:: <u>/</u>	Ĭ
	Borehole Terminated at 3.2 m Depth	84.6	3	s=	5.7—		<del>2.1.2.2</del>								1
	Borenoie Terminated at 3.2 m Depth														
Not	e: ⁄lethane Reading: 0%														
	notified (todding. 57)														
NOTES:		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	_  		ECO						DE DE		ECO		_ I
Borehole data use by others		apsed		Water			lole Ope		Run	Dep	th	ILLING F % Re			RQD %
		Completion	L	<u>evel (m)</u> 0.0	)		To (m) 2.4		No.	(m	)				
	Sample Descriptions														
5. This Figure is t OTT-00240904	o read with exp. Services Inc. report														

Projec	t No:	OTT-00240904-A0	g 0. D0	•	011					<u></u>	<b>.</b>		1	2		C	プス	1
Projec	t:	Geotechnical Investigation - Me	ontfort Hospital P	rop	osed (	Orlea	ans	Family	Healt			) —		<u>2</u> f	1			1
Location	on:	2225 Mer Bleue Road, Ottawa	, ON								Pag	ge	0	' _	<u> </u>			
Date D	rilled:	'June 28, 2017		_	Split Spo	on Sa	mpl	е	$\boxtimes$		Combust	tible Var	our Re	adin	g			
Drill Ty	/pe:	CME-55		-	Auger Sa						Natural N Atterberg		Conten	t		<u> </u>	<b>×</b>	
Datum	:	Geodetic		_	Dynamic	Cone		st	_		Undraine % Strain	ed Triaxi				-	0	
Logged	d by:	A.N. Checked by:	S.P		Shelby T Shear St Vane Tes	rength	ı by		<del> </del>   S		Shear St Penetror	trength b	у				•	
S Y M B O		SOIL DESCRIPTION	Geodetic	D e p t	2	20	4	netration To		80	25	stible Va 50 ural Mois erg Limi	500	75	0	n) i	P Unit	tural t Wt.
M   B   O   L   O   D   O   D   O   D   O   D   O   D   O   D   O   D   O   O	TOR	SOIL ~ 300 mm	87.93	h 0	Shear S	Streng 50		00 15	50 2	kPa 200	1	erg Limi 20 1 : : : :	40 1 : : :	9 VV			kN	/m <sup>3</sup>
	SILT	Y CLAY (DESICCATED CRUST) n to greyish brown, moist to wet	87.6		2 O:			120					*			· · · · · · · · · · · · · · · · · · ·		
	stiff)	n to greyish brown, moist to wet	, (very	1	9				19	2							7 1,	3.4
	_				.: O; .:											4	<u>}</u> ''	J. <del>4</del>
_///					5. ⊙								×			:::{\ :::{\	17	7.6
¥		Y CLAY	85.785.83	3 2	3010			06     4.4										
	— Grey	, sensitive, wet, (very stiff to stiff	) –	Н	<b>.w</b>								×			\ 		
	_	orehole Terminated at 3.2 m De	84.7	3	-2-1-1-2		<del></del>		-3-11-11-3					· ( · )				
	Note: 1) Me	ethane Reading: 0%																
NOTES:				 	L::::	L::				<u> </u>	1::::	DE 5-	1:::			: <u> </u>		
		quires interpretation by exp. before	Elapsed		Water N			Hole Ope		Run	Dep			RE Rec			RQD <sup>(</sup>	%
3. Field wo	ork super	ed with cuttings upon completion.  vised by an exp representative.	Time Upon Completion	L	<u>evel (m)</u> 2.1	)		To (m) 2.3		No.	(m)	)						
5. This Fig		Imple Descriptions read with exp. Services Inc. report																

roject No: roject:	OTT-00240904-A0  Geotechnical Investigation - Montfort I	Hospital P	ror	0086	ed C	)rle:	ans	Far	milv	Hea	lth F	- -lub	igu (OF	re N	No. )	_		13	-			
ocation:	2225 Mer Bleue Road, Ottawa, ON		٠,										,	Pa	ge.	_1	_	of .	_1	_		
	'June 20, 2017			0-14	0	0-	1						0-		411-1-	\	5	S 11:-				_
rill Type:	CME-55		•			on Sa imple		9		_	<b>⊠</b> <b>D</b>			mbus tural I				Readii ent	ng			×
atum:	Geodetic				. ,	/alue Cone		ıt			) -			erber draine	-		at			H		<b>-</b> ⊙
ogged by:	-		-	She	by Tu	ube				•	_		% 5	Strain ear S	at F	ailure	:					0
ogged by.	A.N. Checked by: S.P.				ar Str e Tes	engtl st	h by				<b>⊢</b> 3			netro								•
S		O deti-	D e		Sta	ndard	l Pen	etrati	ion T	est N V	alue		Co		stible 50	Vapo 50		Readir	ng (p 50	pm)	S	Na
M B O	SOIL DESCRIPTION	Geodetic m	e p t h			0 Streng	th 4	0	6	0	80	kPa	۲.					Conte Dry W		nt)	SAMPLIES	Ur
	<b>SOIL</b> ~ 100 mm	87.95 ⁄~87.9	0	7		0	10	00	15	50	200	16:::			20		0	6	0		s̄ :\/	$\vdash$
	Y CLAY (DESICCATED CRUST) vn to greyish brown, moist to wet, (hard			0							4	<b>N</b> :: ::			×						X	
to ve	ery stiff)				11					-5 -5 -6-1	92								13.3		7	
	,	1	1		Ο						<b>A</b>					×					X	_
		-		4	1.23		0-13 1-1-1		3 (i) 2 (i)		2   1   1   1   1   1   1   1   1   1	100			1.1.0	. ( . ] .		1 - 5 - 5 -	100	-1-5		
		85.8 <sup>85.85</sup>	2	ō.		70	:: (: ) :- (: )										×				X	_
SILT	Y CLAY	85.800.00				S = 7															四	
Grey	y, sensitive, wet, (stiff)			- <b>5</b>												×					X	
		84.8	3		<del>. ; ; ; ;</del>	53											. 2				n	
В	orehole Terminated at 3.2 m Depth	01.0			S=	5.5							1								ľ	
	ethane Reading: 0%																					
OTES:	a witros interpretation burner bef	WATER	S 1	F\/E	l be		RDS				: L:	: : :	1::	CO	RE I	וואַ	I IN	IG R	EC(	JBD		
use by others		psed		Wa evel	ter			Hole	Ope (m)	en		Run No.		Dep (m	th			6 Re		T	R	QD
		ompletion		2.					.3		F.	٧U.		(111)		+				+		

Project No:	OTT-00240904-A0	9 0. 20		•			_		<del></del>			4	4		C	<b>₹</b> ^├
Project:	Geotechnical Investigation - M	ontfort Hospital P	rop	osed (	Orlea	ns	Family	Healt	h Hub	Figure N (OFHH)	) –	14		1		- 1
Location:	2225 Mer Bleue Road, Ottawa	, ON								Рас	ge	<u>1</u> of	_	<u>'</u>		
Date Drilled:	'June 28, 2017		_	Split Spo	on Sa	mple	•	$\boxtimes$		Combus	tible Va	our Rea	ading	3		
Drill Type:	CME-55		_	Auger Sa SPT (N)						Natural M Atterberg		Content	t	ĺ		×
Datum:	Geodetic		_	Dynamic	Cone	Tes	t			Undraine % Strain	ed Triaxi				.!	$\oplus$
Logged by:	A.N. Checked by:	S.P		Shelby T Shear St Vane Te	trength	by		<del> </del>   S		Shear St Penetror	trength b	у				•
G W B O L	SOIL DESCRIPTION	Geodetic m	D e p t h	Shear S	20 Strengt	40 h		0	80 kPa	2	50	pour Rea 500 sture Cor ts (% Dry 40	750	% eight)	) SAMPLES	Natural Unit Wt. kN/m³
TOPS	<b>SOIL</b> ~ 50 mm	87.92 87.9	0	5	50	10	0 15	00 2	00		0	40	60		V	
	I and gravel, brown, moist, (loos			O::::											$\Delta$	
SILT Brow (hard	Y CLAY (DESICCATED CRUST) on to greyish brown, moist to wei	<u>_</u>	1	<b>10</b>					216		×				X	18.3
			2	<b>4</b>								×			X	17.1
<u>SILT</u> —Grev	Y CLAY , sensitive, wet, (stiff)	85.7 85.62	2 H.	W.	71 	5.3		13 (1.4.2								7
	, , ( ,		3	D: : : : : : : : : : : : : : : : : : :	58			-2-0-6-2				×				1
В	orehole Terminated at 3.2 m De	84.7 epth		S	6.0											J
Note 1) Me	: ethane Reading: 0%															
NOTES: 1. Borehole data re	equires interpretation by exp. before	WATE	R L	EVEL R	ECOF	RDS	;			CO	RE DR	ILLING			D	
use by others  2. Borehole backfill	ed with cuttings upon completion.	Elapsed Time	L	Water evel (m)	)	ŀ	lole Ope To (m)	en	Run No.	Dep (m)		% F	Rec.		R	QD %
3. Field work super 4. See Notes on Sa	vised by an exp representative.	Upon Completion		2.3			2.3									
O 1 1-00240904-/		1							1							

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 1 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 20, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 0 SPT (N) Value 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) SYMBOL Natural 250 500 750 G W L Geodetic SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt Shear Strength kN/m<sup>3</sup> 87.78 TOPSOIL ~ 150 mm 87.687.78 168 SILTY CLAY (DESICCATED CRUST) X • Brown to greyish brown, moist to wet, (very 192 17.4 18.3 85.6 SILTY CLAY H.W Grey, medium sensitivity to sensitive, wet, (stiff to firm) 84.6 Borehole Terminated at 3.2 m Depth Note: 1) Methane Reading: 0% NOTES: 1.Borehole data requires interpretation by exp. before CODE DOILLING DECODE

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	0.0	3.0
31 days	0.0	

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

Project	No:	OTT-00240904-A0	g 0. D	•	<b>U</b> 11		_	<u> </u>	• •	Figure I	No.	16		C	*X
Project:		Geotechnical Investigation - M	Iontfort Hospital P	rop	osed (	Orlear	ns Fan	nily Hea	alth Hub	(ŎFHH	) – ge.		- 1		'
Location	n:	2225 Mer Bleue Road, Ottawa	a, ON							га	ye		<u>'</u>		
Date Dr	illed:	'June 20, 2017		_	Split Spo	on San	nple		$\boxtimes$	Combus	stible Va	oour Read	ing		
Drill Typ	e:	CME-55			Auger Sa SPT (N)				<b>II</b>	Natural Atterber		Content		<u> </u>	<b>X</b> →
Datum:		Geodetic			Dynamic	Cone 1	est		_	Undrain	ed Triaxi n at Failu			-	$\oplus$
Logged	by:	A.N. Checked by:	S.P.		Shelby T Shear St Vane Te	rength I	ру		+ s	Shear S	trength I	ру			•
G M B O L		SOIL DESCRIPTION	Geodetic m 87.99	D e p t h	Shear S	andard F 20 Strength	40	60 150	Value 80 kPa 200	Na Atterl	250	sture Conte ts (% Dry	750	n) S	Natural Unit Wt. kN/m³
		<u>SOIL</u> ~ 125 mm Y CLAY (DESICCATED CRUST)	<i>∕</i> −87.9	0	6				192		<b>)</b>				
		n to greyish brown, moist to we			9			168	7 ::::: :::::::::::::::::::::::::::::::					:::\/ ::::\	
	-			1	0			<b>A</b>				×			18.2
	-			2	<b>4</b> ⊙	77						×			17.8
		Y CLAY , sensitive, wet, (stiff)	85.8	Н.	<b>w</b>	S = 4	.6					×			
	_		84.8	3		58								:::/ 	1
	Note:	orehole Terminated at 3.2 m De													
NOTES:	data ro	quires interpretation by eye, hefere	WATE	-' R I I	EVEL R	ECOR	DS		] [	CC	RE DR	ILLING F	RECOR	'	_
use by ot	hers	quires interpretation by exp. before	Elapsed Time		Water evel (m)		Hole (		Run No.	Dep (m	oth	% Re			RQD %
3. Field wor 4. See Note	k super s on Sa	ed with cuttings upon completion.  vised by an exp representative.  imple Descriptions	Upon Completion		Dry		2.		INO.	, (II	''				
5. This Figu OTT-002	re is to 40904-	read with exp. Services Inc. report A0													

Project No:	OTT-00240904-A0	g oi bo	/I G	110	16		<u>'1 1                                  </u>		Figure N	lo.	17		$\Theta$	X
Project:	Geotechnical Investigation - M	ontfort Hospital P	ropose	ed Orle	ans	Family	/ Healt	h Hub	(OFHH) Pag	) —	1 of	-		'
Location:	2225 Mer Bleue Road, Ottawa	, ON							Γαί	Je				
Date Drilled:	'June 30, 2017		Split	Spoon S	ample				Combus	tible Var	oour Readi	ng		
Drill Type:	CME-55		-	er Sample (N) Valu					Natural M Atterberg		Content		<u> </u>	<b>X</b> →
Datum:	Geodetic		Dyna	amic Con					Undraine % Strain	ed Triaxi			•	$\oplus$
Logged by:	A.N. Checked by:	S.P.	Shea	by Tube ar Streng e Test	th by		+ s		Shear St Penetror	rength b	у			<b>A</b>
S Y M B B O	SOIL DESCRIPTION	Geodetic m	D e p	Standar 20 ear Stren	40		est N Va	lue 30 kPa	2	50	pour Readii 500 7 sture Conte ts (% Dry V	50	JÃ	Natural Unit Wt. kN/m <sup>3</sup>
FILL		88.41	0 4	50	100	15	50 2	00	2	0	40 6	30 	_ \s ∷ \/	
<b>▼</b> ‱–(con	d and gravel, construction debris crete and brick pieces), brown, r		0							×			$\perp$ $\setminus$	
	ie) <mark>Y CLAY (DESICCATED CRUST)</mark> In to greyish brown, moist, (very	87.6	1 23 3	<b>13</b>			19	2			×		$\sqrt{}$	
		_	6								×	-3 (-1	M	18.2
	Y CLAY , sensitive, wet, (very stiff to firm	86.2	2 H.W		10 	1.2								
– Gley	, sensitive, wet, (very sun to initi		3	62							<b>&gt;</b>			16.4
		_	H.W.	S = 5								×		
_		-	H.W Φ:::	S = 4.5								-2 (-1	88/ <b>X</b>	
	orehole Terminated at 4.7 m De	83.7		34										
Note														
NOTES: 1. Borehole data re use by others	equires interpretation by exp. before	WATER				-1- 0					ILLING R			OD 0/
•	led with cuttings upon completion.	Elapsed Time Upon Completion	Wat <u>Level</u> 0.6	(m)	Н	ole Ope To (m) 3.9		Run No.	Dep (m		% Re	C.	—— ——	QD %
	rvised by an exp representative.	Sport Sompletion	0.0	•		5.5								
	ample Descriptions read with exp. Services Inc. report A0													

ocation: ate Drilled:				and ranning	T ICCITIT I	lub (	ŎFHH)	1 25 1		
ate Drilled:	2225 Mer Bleue Road, Ottawa	, ON					Page.	_1_ of _1	_	
	'June 30, 2017		_ Split Spoon S	ample	$\boxtimes$		Combustible Va	apour Reading		
rill Type:	CME-55		Auger Sample - SPT (N) Value				Natural Moistur Atterberg Limits			<b>X</b> ⊕
atum:	Geodetic		Dynamic Con-		<u> </u>		Undrained Tria	xial at		— ⊕
ogged by:	A.N. Checked by:	S.P	Shelby Tube Shear Strengt Vane Test	h by	+ s		% Strain at Fail Shear Strength Penetrometer	by		<b>A</b>
S Y M B O	SOIL DESCRIPTION	Geodetic m	D e 20 the Shear Streng	d Penetration Te 40 60 gth		kPa	250	apour Reading (p 500 750 sisture Content % nits (% Dry Weig	M	Natura Unit Wt
TOPS	<b>SOIL</b> ~300 mm	87.82	0 50	100 15	0 200		20	40 60	\    	<del>                                     </del>
SILT	Y CLAY (DESICCATED CRUST) on to greyish brown, moist to wet	87.5 <sub>87.52</sub>	2					×	X	1
		_	1 8		192			×	X	18.5
		-	<b>4</b>					*	X	17.5
	Y CLAY r, sensitive, wet, (stiff to firm)	85.6	2 H.W.	86 						<u>}</u> 7
_	,		58: 3 S = 4.8					******	/ 	<u> </u>
		4	H.W. 0 38						×	\ \ \
		-	S = 5.3 H.W.			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			88 <b>X</b> X	<del>,</del>
		- 83.1	38 S = 4.0			· ; · ; · ; · ; · ; · ; · ; · ; · ; · ;				Ì
Note	erehole Terminated at 4.7 m De : ethane Reading: 0%									
OTES: Borehole data re	equires interpretation by exp. before	WATE	R LEVEL RECO	RDS			CORE DI	RILLING REC	ORD	
use by others	standpipe was installed in the	Elapsed Time	Water Level (m)	Hole Ope To (m)		Run No.	Depth (m)	% Rec.		RQD %
borehole upon co Field work super		Upon Completion 21 days	2.4	(//			···/			

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	2.4	
21 days	0.3	

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

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 1 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 30, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 0 SPT (N) Value 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) SYMBO-Natural 250 500 750 G W L Geodetic SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt Shear Strength kN/m<sup>3</sup> 88.2 TOPSOIL ~ 300 mm 144 87.9 SILTY CLAY (DESSICATED CRUST) Brown to greyish brown, moist to wet, (very 192 18.9 86.7 **5** 17.5 86.0 SILTY CLAY Grey, medium sensitivity to sensitive, wet, (stiff) 85.0 Borehole Terminated at 3.2 m Depth Note: 1) Methane Reading: 0% NOTES: 1.Borehole data requires interpretation by exp. before WATER LEVEL RECORDS CORE DRILLING RECORD use by others RQD % Water Hole Open Run Depth % Rec. Elapsed 2. Borehole backfilled with cuttings upon completion. Time Level (m) To (m) No (m) **Upon Completion** 1.5 39 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

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

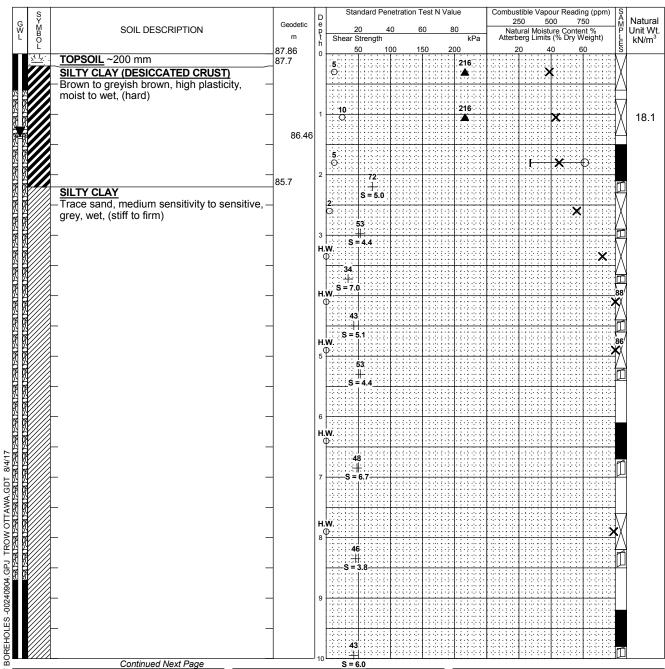
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roject:	Geotechnical Investigation - Mor	ntfort Hospital P	ropo	sed C	Orlea	ns F	amily	/ Heal	lth H		gure N OFHH)	) —	20	-		ı
ocation:	2225 Mer Bleue Road, Ottawa, ON															
ate Drilled:	June 27, 2017 Split Spoon Sample ⊠ Combustible Vapour Reading															
	CME-55		Auger Sample					Combustible Vapour Reading  Natural Moisture Content  Atterberg Limits  Undrained Triaxial at					□ <b>X</b> —⊖			
	Geodetic		SPT (N) Value O  Dynamic Cone Test													
ogged by:		D	Shelby Tube  Shear Strength by					% Strain at Failure Shear Strength by					<b>⊕</b>			
ogged by.	A.N. Checked by. 3	.F		ne Tes		by		5	6			neter Tes				•
S Y M B O	SOIL DESCRIPTION	Geodetic m	D e p t		:0	40	ration T		80	kPa	2	50 5	our Readii 00 7 ure Conte s (% Dry V	50	SA M P L	Natura Unit W kN/m
, L	SOIL ~280 mm	87.74 87.64	1 0 3		0	-			200		l .		40 60		Ē S	
SILTY	Y CLAY (DESICCATED CRUST)		Ŏ									×			1	
stiff)	n to greyish brown, moist to wet,	(very	1	7					92				×			16.6
		_	3.0									>				17.5
	EV OLAV	85.5	2	V 1 1 2 1	· · · · · · ·	36	- 1 - 2 - 2 - 1						1 2 2 2 2 2 2	0.000		
	Y CLAY sensitive, wet, (stiff to firm)	-	<b>н.w</b> .		S =	4.5		-3-6-6-					3443	(		
			3	38												
			<b>H.W.</b> Φ.:	S = 5	3::::									×		
		+		34												
		_	H.W.	S = 4.	7 : : : : : : 											
			"	29												
Be	orehole Terminated at 4.7 m Dep	83.0 <b>th</b>		S = 6.0											Ш	
Note: 1) Me	ethane Reading: 0%															
OTES:			J L:	:::: =:=	-65-	: L:	:::		: <u> </u> :	: : : 1		DE 5-	1::::	F66=		
	quires interpretation by exp. before	WATEI Elapsed	W	ater		Нс	ole Ope			un	Dep	th	LING R % Re			QD %
A 19mm slotted s borehole upon co	standpipe was installed in the ompletion.	Time Ipon Completion	;	<u>el (m)</u> 3.0		-	<u>To (m)</u> 4.5		N	0.	(m)	1		+		
	vised by an exp representative.	24 days	(	0.1												
See Notes on Sa	mple Descriptions															

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

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

Log of Borehole BH 19 Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 21, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Natural 250 500 750 Geodetic SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. kPa Shear Strength kN/m<sup>3</sup>



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

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5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

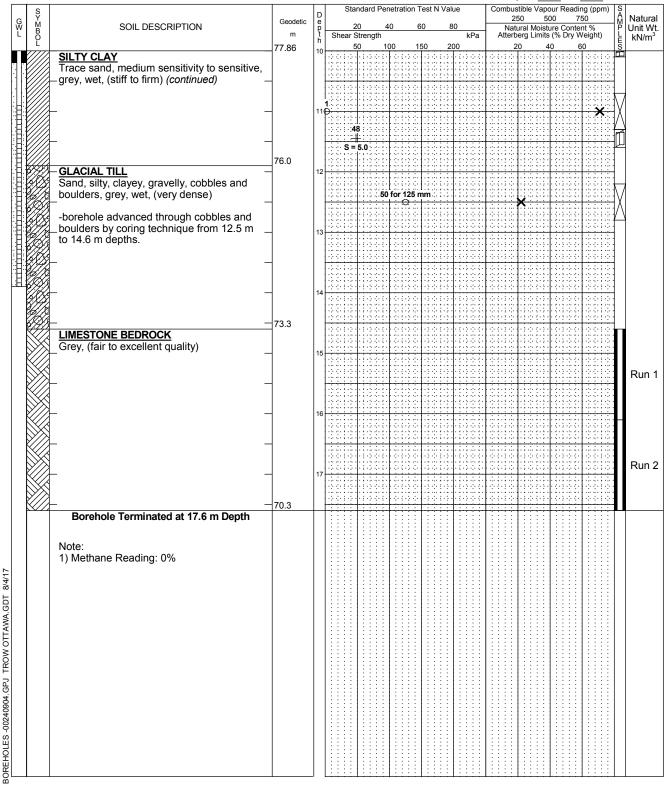
	0 - 0.0							
WATER LEVEL RECORDS								
Elapsed	Water	Hole Open						
Time	Level (m)	To (m)						
Upon Completion	0.6	12.2						
30 days	1.4							
		l						

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

Project No: OTT-00240904-A0

Figure No.

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page.



LOGS OF

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							
Water	Hole Open						
Level (m)	To (m)						
0.6	12.2						
1.4							
	Water Level (m) 0.6						

CORE DRILLING RECORD							
Depth (m)	% Rec.	RQD %					
14.6 - 16.1	100	81					
16.1 - 17.6	100	98					
	Depth (m) 14.6 - 16.1	Depth % Rec. (m) 14.6 - 16.1 100					

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 28, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Natural 250 500 750 G W L Geodetic -MBO-SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. Shear Strength kN/m<sup>3</sup> 87.79 TOPSOIL ~150 mm 87.6 SILTY CLAY (DESICCATED CRUST) × Brown to greyish brown, moist, (very stiff) 192 17.8 X 16.8 85.6 SILTY CLAY Grey, medium sensitivity to sensitive, wet, 85.09 (stiff to firm) 5.5 H.W. H.W 38 H.W H.W 81.5 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 Next Page NOTES:

1. Borehole data requires interpretation by exp. before WATER LEVEL RECORDS CORE DRILLING RECORD use by others RQD % Water Hole Open Run Depth % Rec. Elapsed 2. Borehole backfilled with cuttings upon completion. Time Level (m) To (m) No (m) Upon Completion 5.3 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

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BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

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LOG OF

Project No: OTT-00240904-A0

Figure No.

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

	S			D	Τ	Sta	ndard Pe	netration 1	Test N V	alue				Vapo	our F	Readir	ng (pp 50	m) S A M P	Natura
G W L	S M B O	SOIL DESCRIPTION	Geodetic m	e p t h	Sł	near (	20 Strength	40 6	80	80 kPa	At	Nati tterb	ural N erg L	loisti imits	ure C	Conte	nt % Veight)	) MP LES	Unit W
-	L ////	INFERRED SILTY CLAY	77.79	10			50 ′	100 1	50	200	+	2	0	4	10	6	0		
		Sampled portion of borehole terminated at = 6.0 m depth.	t _											::::			10.00		
		Dynamic Cone Penetration Test (DCPT)												( · · · · · · · · · · · · · · · · · · ·					
		Dynamic Cone Penetration Test (DCPT)  advanced from 6.3 m to cone refusal at 14.1 m depth. (continued)		11															
		_	_											::::: :::::					
k		_		12	, 🔛									· · ·					
		_																	
		_	_	13	,							; ; ;		:::: :::::		::::::			
		_							12 C C 2 C C			1 - 1 - 1		(+)+ (+)+		***	12.5		
		Refusal of Cone Penetration Test at 14.1	-73.7	14				+			1:::	: · · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·		+++	1::::		
		m Depth																	
		Note: 1) Methane Reading: 0%																	
		,																	
														: :		<u> </u>			
1.B	TES: orehole	e data requires interpretation by exp. before	WATE	RL	EVE	L RI	ECORD	S			(	COI	RE D	DRIL	LIN	G R	ECO	RD	
	se by co	e backfilled with cuttings upon completion.	lapsed Time	L		l (m)		Hole Op To (m)		Run No.		Dept (m)			%	6 Re	c.	R	RQD %
		Upon brk supervised by an exp representative.	Completion		2.	7		5.3											
4.S		es on Sample Descriptions ure is to read with exp. Services Inc. report 240904-A0																	
		ure is to read with ever Services Inc. report																	

ER LEVEL RECO	RDS
Water	Hole Open
Level (m)	To (m)
2.7	5.3
	Water Level (m)

	CORE DR	RILLING RECOF	RD
Run	Depth (m)	% Rec.	RQD %
No.	(111)		

	roject		OTT-00240904-A0	g Oi							_					— F	igur	e N	lo.	_	2	23		`		<b>^ \</b>
	roject		Geotechnical Investigation - N		ospital P	rop	oos	ed (	<b>Orle</b>	ans	га	mıly	/ He	eaitl	<u>n</u> Hı	ub (		HH) Pag		_1	_	of _	1	_		-
	ocatio	•	2225 Mer Bleue Road, Ottawa	a, UN											_											
		_	June 29, 2017			-		it Spo ger Sa			e								tible \ ∕loisti				ıg			□ <b>X</b>
	ill Typ	_	CME-55			-	SP	T (N)	Valu	е	et			0			Atte	rberç	g Lim	its				<b>—</b>		<b>→</b>
	atum:	-	Geodetic	0.5		-	She	namic elby T	ube					_			% S	train	ed Tri at Fa	ailure						$\oplus$
Lo	gged	by: /	A.N. Checked by:	S.P.	_			ear St ne Te		th by				+ s					rengt							•
G W L	S Y M B		SOIL DESCRIPTION		Geodetic m	D e p t			andar 20 Stren	4	netrat		est N		80	:Pa		2	stible 50 ural N	50	00	75	50			Natura Unit W
	L 'x\ 1 <sub>\v.'</sub> .	TOPS	OIL ~200 mm		87.78 87.6	h 0	4		50	-	00	15	50 1 : : :	2	00		 		0	4		6		·	\ \ \	KIW/III
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Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 20, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Natural 250 500 750 G W L Geodetic -MBO-SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. kPa Shear Strength kN/m<sup>3</sup> 87.75 A 1/ TOPSOIL ~280 mm 87.5 216 SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (hard) 216 18.2 17.4 85.6 85.45 SILTY CLAY Trace sand, sensitive to extra sensitive, H.W high plasticity, grey, wet, (firm to stiff) H.W 38 H.W H.W. H.W. 62 Continued Next Page NOTES:

1. Borehole data requires interpretation by exp. before WATER LEVEL RECORDS CORE DRILLING RECORD use by others RQD % Water Hole Open Run Depth % Rec. Elapsed 2. Borehole backfilled with cuttings upon completion. Time Level (m) To (m) No (m) Upon Completion 14.6 - 16.2 98 81 17.5 3. Field work supervised by an exp representative. 2 16.2 - 17.6 98 83 4. See Notes on Sample Descriptions 5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

8/4/17

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

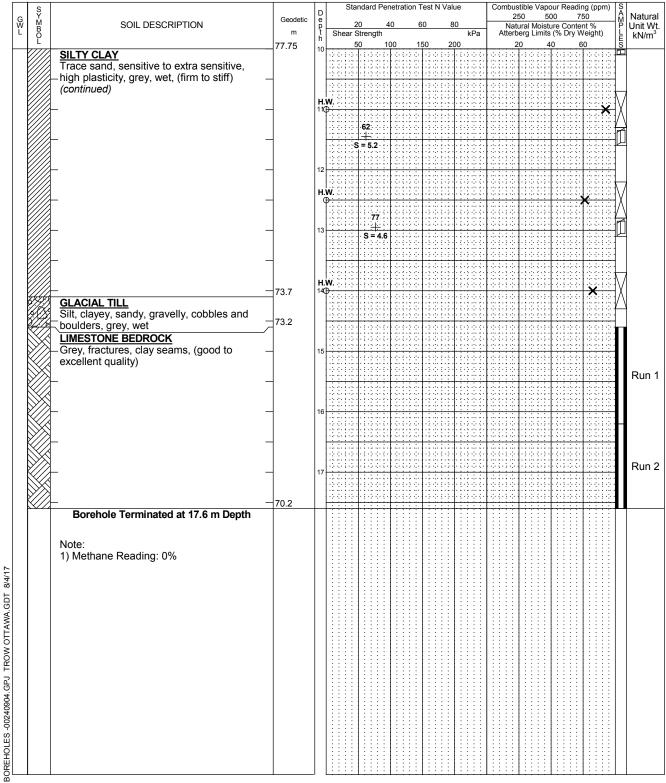
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Project No: OTT-00240904-A0

Figure No.

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

of 2



LOGS OF

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 LOG OF I

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion		17.5

	CORE DR	RILLING RECOF	RD
Run No.	Depth (m)	% Rec.	RQD %
1	14.6 - 16.2	98	81
2	16.2 - 17.6	98	83

Project No: Project:	OTT-00240904-A0  Geotechnical Investigation - Mon	otfort Hoonital	Dro	ma	604	Orla	2222	Fo	mils	, Ha	الد			igure		O. <sub>.</sub>		2	5			
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Location:	2225 Mer Bleue Road, Ottawa, C	JIN .									_	_										_
	'June 28, 2017		_		olit Sp uger S			e						Comb Natura						g		□ <b>X</b>
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Datum:	Geodetic		_		ynami nelby		ie re:	SI						Undra % Stra	ain a	at Fail	lure	at				$\oplus$
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1) Me																						
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3. Field work super 4. See Notes on Sa	vised by an exp representative.  ample Descriptions  read with exp. Services Inc. report	pon Completion			5.0				5.3													

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Locatio	n:	2225 Mer Bleue Road, Ottawa	a, ON							Pag	je	<u>1</u> of	_1_		
Date D	rilled:	'June 29, 2017		_	Split Spoon S	ample		$\boxtimes$		Combust	ible Var	our Readi	ng		
Drill Ty	pe:	CME-55			Auger Sample SPT (N) Value					Natural N		Content		i	<b>X</b>
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Logged	d by:	A.N. Checked by:	S.P.	_	Shelby Tube Shear Strengt Vane Test	h by		+		% Strain Shear St Penetron	rength b	у			<b>A</b>
S Y M		CON DECODIDATION	Geodetic	D			ration Test N			25	50	oour Readi 500 7	50	n) i	Natural
GWL BOL		SOIL DESCRIPTION	m 88.05	p t h	Shear Streng	40 gth 100	60 150		80 kPa 00	Atterb		sture Conte ts (% Dry V 40	nt % Veight) 80		Natural Unit Wt. kN/m³
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	Project		Geotechnical Investigation - M	-	Pro	pos	sed	Orle	ans	Fam	ily H	ealt	h Hub		l) ige	1		1	_	•
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			'June 29, 2017		_			oon S Sample		е					stible Va			ng		□ <b>X</b>
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19mm slotted sta rehole upon cor	andpipe was installed in the npletion. Tim Upon Col	mpletion	L	evel (m) 3.0			<u>o (m)</u> 6.0		No.	<u>(m</u>	1)				
eld work supervi	sed by an exp representative. 22 d	ays		0.4											

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

5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

Project No: 0	OTT-00240904-A0						_					00			<b>^</b>
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Location: 2	2225 Mer Bleue Road, Ottawa, C	ON								Pag	ge	of	_1_		
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Proje	ct No:	OTT-00240904-A0	9 0. 5	<b>.</b>		•								2	^		プグ	1
Proje	ct:	Geotechnical Investigation - Mo	ontfort Hospital	Pro	pos	sed	Orle	ans	Famil	y Heal	th Hub		) -	1 2	_			ı
Locat	ion:	2225 Mer Bleue Road, Ottawa,	, ON									Ра	ge	_1_ o	f <u>1</u>	-		
Date I	Orilled:	'June 28, 2017			Sp	lit Spo	oon S	ampl	e	D	3	Combus	stible Va	pour Rea	ading			
Drill T	уре:	CME-55				ger S T (N)						Natural Atterber		e Conten	t	_	<b>×</b> —≎	
Datun	n:	Geodetic		_	Dy	namio	c Con		st	_	- -	Undrain % Strair	ed Triax	ial at		•	Φ	
Logge	ed by:	A.N. Checked by:	S.P		Sh	elby 1 ear S ne Te	treng	h by		<del> </del>	- 3	Shear S Penetro	trength	by			•	
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			-	н	I.W.	38 S = 5	3 : : : :										Υ\ ፲ 31/	
				5	Φ I.W.	38 + S = 5	-1:::	2-1- 2-1- 2-1-		1 - 2 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0			-3 -3 -3 -4 -   -3 -3 -3 -4 -   -3 -3 -3 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4		6 - 3 6 - 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	<b></b>		
				6	φ:		3									×	X	
		anahala Tamminatad at C 2 na Da	81.6	°	<u></u>	-s=	4.5										1	
	В	orehole Terminated at 6.3 m De	ptn															
	Note 1) Me	: ethane Reading: 0%																
					:													
	ole data re	equires interpretation by exp. before	WATE	ER L			RECC							RILLING				
2.A 19m	others	Elapsed Time	ı	Lev	ater el (m	1)		Hole Op To (m		Run No.	Dep (m		% F	Rec.		RQD	%	
	ole upon co work super	Upon Completion 23 days			3.7 ).6			5.3										
		ample Descriptions																
5. This F OTT-0	igure is to 0240904-	read with exp. Services Inc. report																

Project No:	OTT-00240904-A0	g oi		•	CI	10			<u>'I I </u>				0.4			X
Project:	Geotechnical Investigation - M	lontfort Ho	spital Pi	rop	osed	Orle	ans	Family	/ Healt			) –	31	_		ı
Location:	2225 Mer Bleue Road, Ottawa	ı, ON									Ра	ge	1_ of	_2_		
Date Drilled:	'June 28, 2017				Split Sp	oon S	ample	Э			Combus	stible Va	oour Read	ding		
Drill Type:	CME-55				Auger S						Natural Atterber		Content			<b>X</b> →
Datum:	Geodetic				Dynam	ic Cone		t			Undrain	ed Triaxi			1	⊕
Logged by:	A.N. Checked by:	S.P.			Shelby Shear S		h by		+		Shear S		ру			•
			_		Vane T				Ś		Penetro	meter Te	est			_
SY MBOL	SOIL DESCRIPTION		Geodetic m	D e p t h		20 Streng	4		0	80 kPa	Na Atter	250	pour Read 500 sture Cont ts (% Dry 40	750	I A	Natural Unit Wt. kN/m <sup>3</sup>
<u>x\lambda l_y</u> <u>TOP</u>	<b>SOIL</b> ~355 mm		37.47 37.1	0	3							Ĭ.	Ĵ	Ĭ.		
FILL Sand mois	d and gravel, concrete pieces, but, (very loose to loose)	rown,	36.6		10					216			<b>N</b>		<u> </u>	7
Brov	Y CLAY (DESICCATED CRUST) vn to greyish brown, moist, (hard	d to		1	0					<b>A</b>		>	<		<u> </u>	17.9
_very	stiff)	-			. 9		0-1-1 0-1-1 2-1-1		168						$\frac{1}{\sqrt{2}}$	18.3
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Grey	<ul> <li>medium sensitivity to sensitive to firm)</li> </ul>	e, wet,		3	-3 3 1 1	58										
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	m depth.	,		7												
Dyna adva	amic Cone Penetration Test (DC anced from 6.3 m to cone refusa	lat														
13.4	m depth.				3 3 1 1											
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- A		4					:::			######################################					:::	
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BOREHOLES -00240904.GPJ TROW OTTAWA.GDT adds adds a 13.4				10												
り NOTES:	Continued Next Page equires interpretation by exp. before		WATER	R LI	EVEL I	RECO	RDS	 S			CC	RE DR	ILLING I	RECOF	 RD	
use by others		Elapse	ed		Water evel (n			Hole Ope	en	Run No.	Dep (m	oth	% R			RQD %
9 3. Field work supe	lled with cuttings upon completion.  rvised by an exp representative.	Upon Comp			3.7	-,		5.3			,,,	,				
χI	ample Descriptions															
5. This Figure is to OTT-00240904-	read with exp. Services Inc. report A0															
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Project No: OTT-00240904-A0

Figure No. Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)
Page. 2 of 2 Project:

G W L	S Y M B O L	SOIL DESCRIPTION	Geodetic m	D e p t		20 ar S	0 trength		60	80 kPa	Comb	250 latur erber	ble Va <sub>l</sub>	500 sture 0 ts (%	Readir 75 Conter Dry W	nt % /eight)	I A	Natural Unit Wt. kN/m³
	L	INFERRED SILTY CLAY Sampled portion of borehole terminated  6.0 m depth.	77.47 d at	10		50	0	00 1	50	200		20	) -	40	6	0		
		Dynamic Cone Penetration Test (DCPT advanced from 6.3 m to cone refusal at 13.4 m depth. (continued)		11														
				12														
		_	-															
		_	_    74.1	13														
		Refusal of Cone Penetration Test at 1 m Depth	3.4															
		Note: 1) Methane Reading: 0%																
1.B	TES:	e data requires interpretation by exp. before	WATE	R L												ECOF		
l	se by o orehole	e backfilled with cuttings upon completion.	Elapsed Time	L	Wate	m)		Hole Op To (m)	en )	Run No.		epth m)		9/	% Red	D	R	QD %
4.S	ee Not	ork supervised by an exp representative.  les on Sample Descriptions  ure is to read with exp. Services Inc. report 240904-A0	oon Completion		3.7			5.3										
5.TI O	OTT-00:	240904-A0																

- 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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	3.7	5.3

	CORE DR	RILLING RECOF	RD
Run No.	Depth (m)	% Rec.	RQD %

	oject		OTT-00240904-A0	y Oi							_					_ F	igui	e N	No.	_		32	_	•	<u> </u>	
	oject		Geotechnical Investigation - N		spital F	rol	oos	ed (	Jrle	ans	Fa	mily	/ He	alth	<u>.</u> Hu	ıb (		HH) Pag		_	1_	of	_1			-
	catio		2225 Mer Bleue Road, Ottawa	a, ON											_											
			'July 4, 2017			-		it Spo ger Sa			е									Vapo ture (		Readi ent	ing			□ <b>X</b>
	ill Typ	oe:	CME-55			-	SP	T (N)	Value	е	<b>.</b> 4			0			Atte	rberç	g Lin	nits				F		<del>-</del>
	atum:		Geodetic			-	-	namic elby T		e res	śί			_			% S	train	at F	riaxia ailure	е					$\oplus$
Lo	gged	by:	A.N. Checked by:	: S.P.	_			ear St		th by				+ s						gth by r Tes						•
G W L	S Y M B O L		SOIL DESCRIPTION		Geodetic m	D e p t h	S	hear S	20	4 gth	netrat	ion T 6		Valu 8	0 kl	Pa		Nati tterb	50	5 Moist Limits	00	Conte Dry V	50		SAMPLIES	Natura Unit W kN/m
	<u> </u>		SOIL ~330 mm	8	37.68 37.4	0	5		0	::::	JU 	10									1	×	·:- ·		Ň	
		Brow	Y CLAY (DESICCATED CRUST n to greyish brown, sensitive, r	noist to								.; :. : 	1.3 (3) 1.3 (3) 1.3 (3) 1.3 (3)		. ( . ; . - <del></del> . - ( ; .			; .;. ; .;.		- ( - ; - ; - ; - ; - ; - ; - ; - ; - ;					<u>:</u> [	
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							<b>4</b> O													×					$\left   \right $	18.5
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		SILT	Y CLAY	8	35.2		. <b>w</b> Φ			S	= 4.4		13.6									×		<u> </u>	$\bigvee$	
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						6	Φ:	42																	X	
		В	ovehele Towningted at 6.2 m D	No matte	31.4			-S = 4	4.5-				-2-0			: : :										
71/4		В	orehole Terminated at 6.3 m D	eptn																						
		Note:	ethane Reading: 0%				:																			
		. , 1410					:																			
INOW OT LAWA. GD																										
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0.904							:																			
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BOREHOLES -00240304.GFJ							L																			
NO	TES: Borehole	data re	quires interpretation by exp. before		WATE	RL	EVE	EL RI	ECC	RDS	3			7 [				СО	RE	DRII	LLIN	NG R	EC	ORD	)	
j u	ise by of	thers	ed with cuttings upon completion.	Elapse Time		L	eve	ater el (m)	)			(m)		] [	Rui		[	Dep (m			9/	% Re	C.	$\perp$	R	QD %
3.F			vised by an exp representative.	Upon Com	pletion			.7				5.3														
쉬			imple Descriptions																							
5. T	nis Figu OTT-002	re is to 40904- <i>F</i>	read with exp. Services Inc. report																							
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Log of Borehole BH 31 Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) 1 of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 22, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) SYMBO-Natural 250 500 750 G W L Geodetic SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. Shear Strength kN/m<sup>3</sup> 87.93 A 1/ TOPSOIL ~250 mm 87.7 SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very 168 6 18.3 85.7 SILTY CLAY Grey, medium sensitivity to sensitive, high plasticity, wet, (stiff to firm) 62 S = 7.0 84.13 S = 4. 34 H.W.

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

8/4/17

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

LOGS OF

5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

5 = 4.4	<u> </u>
ER LEVEL RECO	RDS
Water	Hole Open
Level (m)	To (m)
3.8	17.8
	ER LEVEL RECO Water Level (m)

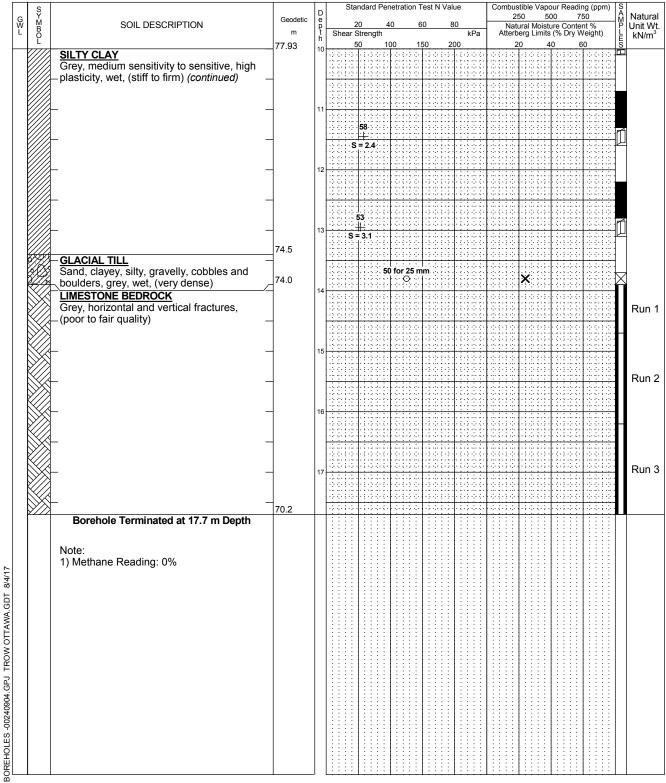
H.W.

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

Project No: OTT-00240904-A0

Figure No.

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page.



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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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	3.8	17.8

	CORE DR	RILLING RECOF	RD
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

Project	No:	OTT-00240904-A0	-	00				<b></b>			24		C	·/	
Project:	•	Geotechnical Investigation - M	ontfort Hospital F	Prop	posed Orle	ans	Family Hea	lth	ı Hub (		_	1 25			- 1
Locatio	n:	2225 Mer Bleue Road, Ottawa	, ON						_	Pag	je	1_ of			
Date Dr	illed:	'July 4, 2017		_	Split Spoon S	ampl	e [	$\boxtimes$		Combust	ible Va	oour Readi	ng		
Drill Typ	oe:	CME-55		_	Auger Sampl SPT (N) Valu					Natural N Atterberg		Content		ı	X
Datum:		Geodetic		_	Dynamic Con			_		Undraine % Strain	d Triaxi				⊕
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		Y CLAY (DESICCATED CRUST) n to greyish brown, moist, (very		1	6 0		168					×		\ \ \	18.2
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	R	orehole Terminated at 6.3 m De	81.8		S = 6.0									$\mathbb{I}$	
	Note:		spui												
NOTES: 1.Borehole use by ot	data re	quires interpretation by exp. before	WATE Elapsed	RL	EVEL RECO		S Hole Open		Run	COI Dept		ILLING R % Re			QD %
		ed with cuttings upon completion.	Time Upon Completion	L	Level (m) 3.0	<u> </u>	To (m) 5.3		No.	(m)		,0 I C			/0
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															

ect:	Geotechnical Investigation - Mo	ntfort Hospital F	rop	osed	Orle	ans	Famil	y Heal	th Hub	Figure (OFHH	l) –	35	_		•
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Drilled:	'July 4, 2017			Split Sp	oon S	Samnl	۵.	×	 1	Combu	etihle \/aı	pour Read	tina		
Туре:	CME-55		_	Auger S	ampl	le						Content	an ig		×
ım:	Geodetic			SPT (N) Dynami			st		) -		rg Limits ied Triaxi	ial at		<u> </u>	→
			-	Shelby	Tube					% Strai	n at Failu Strength I	ire			0
jeu by.	A.N. Checked by: S	<u>.г.                                    </u>		Shear S Vane Te		gtn by		+ s	-		meter Te				•
S Y M B D	SOIL DESCRIPTION	Geodetic m	D e p t	Stear	20	4	netration of		alue 80 kPa	:	250	pour Read 500 sture Cont its (% Dry	750		Natural Unit Wt kN/m <sup>3</sup>
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SILT	Y CLAY (DESICCATED CRUST) n to greyish brown, moist to wet,			<b>2</b> ○								×			
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		81.7	6		ە 4.5-						1.1.2.1.				
В	orehole Terminated at 6.3 m Dep	oth													
Note:															
1) Me	ethane Reading: 0%														
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ehole data re by others	quires interpretation by exp. before	WATE Elapsed		EVEL F Water			S Hole Op	en	Run	CC De <sub>l</sub>		ILLING F			QD %
ehole backfill	ed with cuttings upon completion.	Time Jpon Completion		evel (m 3.7	)		To (m)		No.	(n					-
	vised by an exp representative.	pon completion													

		OTT-00240904-A0	- <b></b> -	-				_ ~	-			_		- igure	No.		36		(		^
Projec		Geotechnical Investigation - Montfor	t Hospital P	roj	pos	ed (	Orle	ans	Fa	mily	Hea	lth	Hub	(ŎFHF	l) ige.	1		1			
Locati		2225 Mer Bleue Road, Ottawa, ON											_				_		_		
Date D	Orilled:	'June 30, 2017				it Spo			е		_	$\boxtimes$			stible Va			ng			□ <b>X</b>
Drill Ty	ype:	CME-55				ger Sa Γ (N) '									Moistur rg Limits		ntent		⊢		$\stackrel{\bigstar}{\circ}$
Datum	1:	Geodetic				namic elby T		e Tes	st			_			ned Tria: n at Fail		at				$\oplus$
Logge	d by:	A.N. Checked by: S.P.			She	ear St	rengt	th by			-	+ s			Strength ometer T						<b>A</b>
G M B O		SOIL DESCRIPTION	Geodetic m	D e p t h	SI		20	4	netrat 0	ion T	est N V	/alu			ustible V 250 atural Mo rberg Lin	500	) 7	50		SAMPLES	Natui Unit V kN/m
7/1/N	TOPS	<u>SOIL</u> ~355 mm	87.99 87.6	0	3		0	10	00	1! 144		200	0 		20	40		30		\\ .\\	
	Brow	Y CLAY (DESICCATED CRUST)  n to greyish brown, moist to wet, (ver			0			::::::::::::::::::::::::::::::::::::::					11111			*			::1::::: :-::::::::::::::::::::::::::::	$\mathbb{A}$	
	stiff)		4	1	6							192	1331			×				M	18.
						(	. : . :	1: 1: 3: 1:										13:		$\mathbb{H}$	
					<b>2</b>												×			M	16.
	SILT	Y CLAY	85.8	2		43											<del></del> 				
<b>▼</b> ////		, sensitive, wet, (firm to soft)	85.29	1	. <b>w</b> Φ	S = (	5.0						111111					×	: : : : : : : : : : : : : : : : : : :	M	
				3		34															
					. <b>w</b> . δ	S = 5.	6													81 <b>¥</b> X	
					100	24															
	_		+	н	Φ	= 4.0							1.1.1.1						· · · · · · · · · · · · · · · · · · ·	191 1¥X	
						38													::::::::::::::::::::::::::::::::::::::	:/\  m	
////	В	orehole Terminated at 4.7 m Depth	83.3			S = 4	3			<del>: : :</del>										Ш	
	Note				1																
		ethane Reading: 0%			1																
					1																
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NOTES:		1		<u></u>	Ŀ	: : :	L	::	L	::			::::	1::::	1:::	: 1	::::	1 :			
	ole data re others	equires interpretation by exp. before	WATEF Elapsed	٦L	EVE. Wa		ECC		S Hole	Ope	en		Run	C( De	DRE DE	RILL	.ING R % Re		ORD	R	QD %
		led with cuttings upon completion.	Time Completion	L		l (m)			To	(m) 3.9			No.	<u>(r</u>		+		_	+		
		rvised by an exp representative.  ample Descriptions																			
5. This Fig		read with exp. Services Inc. report																			
J11-00	∪ <u>∠</u> ⊣∪⊍U4-/																				

Project N	No: <u>OTT-00240904-A0</u>		<b>-</b> .		•			′ - <del>'</del>		-	<del></del>				0.	_		C		4
Project:	Geotechnical Investigation - Montfor	t Hospital F	Pro	ро	sed	Orl	eans	Fam	nily l	Healt			H)		3		1			ı
Location	2225 Mer Bleue Road, Ottawa, ON											P	age.	_	<u>1</u> of	_	<u>1</u>			
Date Dril	lled: 'July 4, 2017		_	Sp	olit Sp	oon	Samp	е		$\boxtimes$		Combi	ustible	e Vap	our Rea	ading	9			
Drill Type	e: CME-55				iger S PT (N)							Natura Atterbe			Content	1		ı	<b>×</b> —⊖	
Datum:	Geodetic			Dy	/nami	c Co	ne Te	st	_	0		Undra	ined 7	Ггіахіа					Ф	
Logged b	by: A.N. Checked by: S.P.		_	Sh	nelby <sup>-</sup> near S ane Te	tren	gth by			+		% Stra Shear Penetr	Strer	igth b	y				<b>A</b>	
G M M B O L	SOIL DESCRIPTION	Geodetic m	D e p t		Shear	20	ngth	netratio	n Tes 60 150		80 kPa		250	Mois Limit	oour Rea 500 sture Cor ts (% Dry 40	750	t % eight)	16	Na Un	itural it Wt. V/m³
	TOPSOIL ~150 mm SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very	87.74 87.687.7	4 0	3 C				T : : :	144						×			\ Z		
	stiff)	_	1		<b>6</b> ⊃					19	2				×			\ \ \ \	1	8.4
		85.5	2	<b>2</b> O			72									×		\ 	1	7.3
	SILTY CLAY Grey, sensitive, wet, (stiff to firm)		н	<b>I.W</b> . Φ	4		= 6.0										×	\ /		
			3 H	<b>I.W</b> . Φ.:	S =													- [ 8 *	2/	
		-	н	<b>I.W</b> . Φ	S =													×		
			H 5	ı.w.	S =	5.3												[ _ <b>x</b>		
			н	<b>I.W</b> . Φ	_s=	6.0_												*		
		81.4	6	3	4 -	3 	201	2:3:2		: -:- : - : 	111111			· · · · · · · · · · · · · · · · · · ·				∵:/ ∷:[	n	
	Borehole Terminated at 6.3 m Depth	01.4			S =	4.5												:     : :		
	Note: 1) Methane Reading: 0%																			
NOTES: 1. Borehole of use by other	data requires interpretation by exp. before	WATE	RL			REC								DRI	LLING					
2.A 19mm sl	lotted standpipe was installed in the	lapsed Time Completion	L	Lev	ater el (m 3.7	1)		Hole C To ( 5.3	m)		Run No.		epth m)		% F	≀ec.			RQD	%
		7 days			0.0															
	e is to read with exp. Services Inc. report 0904-A0																			

Pı	roject No:	OTT-00240904-A0	g of B	OI	reho	le	<u>B</u>	<u>H</u>		Figure I	No	38	<b>:</b>	е	хр.
Pı	roject:	Geotechnical Investigation - N	Montfort Hospital	Pro	posed Orle	eans l	Family	Healt	h Hub	OFHH) Pa	) –	1 of	_		- 1
Lo	ocation:	2225 Mer Bleue Road, Ottawa	a, ON							ı a	ge				
Da	ate Drilled:	'July 4, 2017		_	Split Spoon S	Sample		$\boxtimes$		Combus	stible Va	pour Rea	ding		
Dr	ill Type:	CME-55		_	Auger Sampl SPT (N) Valu					Natural Atterber		Content			<b>X</b> ⊕
Da	atum:	Geodetic			Dynamic Con		-			Undrain % Strair	ed Triax	ial at		•	<b>⊕</b>
Lc	gged by:	A.N. Checked by:	S.P.		Shelby Tube Shear Streng Vane Test	th by		+ s		Shear S Penetro	trength I	by			<b>A</b>
G W L	S Y M B O L	SOIL DESCRIPTION	Geodetic m 87.76	t h	20 Shear Stren	40			lue 80 kPa	Nat Atterl	50	pour Read 500 sture Con its (% Dry 40	750	I A	Natural Unit Wt. kN/m³
		SOIL ~200 mm	87.6	0	4		144		Ĭ		Ĭ	Ŭ			
		Y CLAY (DESICCATED CRUST In to greyish brown, moist to we		1	8			19	2			×			19.0
		Y CLAY , sensitive, wet, (very stiff to firr	85.6	2	4 	10 # S=						×			18.1
Ţ	- Gicy	, sensitive, wet, (very sun to iii)	84.7	76 <sub>3</sub>	48 3 5 = 5.0 1.W. 0								×		
	-		_		S = 5.3 1.W 38 S = 5.3 1.W									91/ X 192/	
			_	5 H	43   S = 6.0   L.W.									*\ 	
	В	orehole Terminated at 6.3 m D	81.5 epth	•	S = 5.1-										
	Note 1) M	: ethane Reading: 0%													
1.E	OTES: Borehole data re	equires interpretation by exp. before	WATE	ER L	_EVEL RECO	ORDS				CO	RE DR	RILLING	RECOF	RD	
2.E 3.F	use by others Borehole backfil Field work super	led with cuttings upon completion.  rvised by an exp representative.  ample Descriptions	Elapsed Time Upon Completion	L	Water Level (m) 3.0	Н	ole Opei To (m) 5.3	n	Run No.	Dep (m		% R	ec.	R	QD %
		read with exp. Services Inc. report A0													

Project	t No:	OTT-00240904-A0	9 0. –	-	00	-			<u> </u>			20		7	フ	^ト
Project	t:	Geotechnical Investigation - Mo	ontfort Hospital F	Prop	osed Orle	ans	Family Hea	ltr	ו Hub <u>-</u>		_	39 1 of	_			ı
Location	on:	2225 Mer Bleue Road, Ottawa,	ON						_	Pag	je	<u> </u>	_1_	-		
Date D	rilled:	'July 5, 2017		_	Split Spoon S	ample		$\boxtimes$		Combust	tible Va <sub>l</sub>	pour Read	ding		[	
Drill Ty	pe:	CME-55		_	Auger Sample SPT (N) Valu					Natural N Atterberg		Content		_		<b>X</b>
Datum:	:	Geodetic		_	Dynamic Con			_		Undraine % Strain	d Triax			•	(	∌
Logged	d by:	A.N. Checked by:	S.P		Shelby Tube Shear Streng Vane Test	th by	-	+ S		Shear St Penetror	rength I	by			,	•
S Y M B O L		SOIL DESCRIPTION	Geodetic m 87.75	D e p t h		40		/alı 8	0 kPa	25	50	pour Read 500 sture Cont its (% Dry	750		ΡU	Natural Init Wt. kN/m³
<u>21 12</u>		SOIL ~250 mm	87.5 <sup>87.7</sup>	5 0	3			192				Ĭ	Ĭ	1	Ĭ	
	-Brow	Y CLAY (DESICCATED CRUST) n to greyish brown, moist to wet, o hard)	, (very —	1	8				216			×		\ \ \ \	A X	18.4
	- SILT	Y CLAY	85.6	2	5.	91 						×		\ \ !		17.7
		sensitive, wet, (stiff to firm)	-	3	W. → 53 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓							>	<	\ \ \ \		
	_		_	(	⊕								×	/ ! *	X 円1 X	
	_		_		38								<b>&gt;</b>	<b>c</b>		
	_		_	H. 6	S = 5.3 W.									       	1 19/ X 17	
	В	orehole Terminated at 6.3 m De	81.5 <b>pth</b>		S = 5.3											
	Note: 1) Me	ethane Reading: 0%														
NOTES:	e data re	quires interpretation by exp. before	WATE	-' :R L	EVEL RECO	RDS		_		COI	RE DR	ILLING I	RECO	RD		
use by c	others		Elapsed Time		Water .evel (m)		ole Open To (m)		Run No.	Dept (m)	th	% R			RQ	D %
3. Field wo	ork super tes on Sa	ed with cuttings upon completion.  vised by an exp representative.  imple Descriptions  read with exp. Services Inc. report	Upon Completion		0.0		5.3		110.	(111)	,					

Projec	ct No:	OTT-00240904-A0	9 0. –						•	<del>"</del>	igure N	lo.	40		C	*X
Projec	ct:	Geotechnical Investigation - M	lontfort Hospit	al Pro	opos	ed Orle	eans	Family	Healt	h Hub	OFHH) Pag	) –	1 of	- 1		'
Locati	on:	2225 Mer Bleue Road, Ottawa	ı, ON								Га	Je	0			
Date [	Orilled:	'July 5, 2017			Spl	it Spoon :	Sampl	Э	$\boxtimes$		Combus	tible Vap	our Readi	ng		
Drill T	уре:	CME-55				ger Samp T (N) Valı					Natural M Atterberg		Content			<b>X</b> ⊕
Datum	1:	Geodetic			Dyr	namic Co	ne Tes	t -			Undraine % Strain	ed Triaxi			•	Φ
Logge	d by:	A.N. Checked by:	S.P.		She	elby Tube ear Streng ne Test			+ s		Shear St Penetror	rength b	y			•
G Y M B O L		SOIL DESCRIPTION	n	detic n	D e p t h	20 hear Stre	4 ngth	etration Te	) ;	80 kPa	Nati Atterb	50 ural Mois erg Limi	ture Conte ts (% Dry V	50	n) SA MP LES	Natural Unit Wt. kN/m³
. 74 1 <sup>N</sup> .		SOIL ~200 mm	87.79 87.6		0 .5		10	00 150 	<u>U 2</u>	200	<u> </u>	0	40 (			7
		Y CLAY (DESICCATED CRUST) In to greyish brown, moist to we			1 C				168				<b>*</b>		\ \ \	18.2
	_		_		2.0		2 (- 1 - 2 (- 1 - 3 (- 1 - 3 (- 1 - 3 (- 1 -							<b>*</b>	/ /	17.5
		Y CLAY , sensitive, wet, (stiff to firm)	85.6 		2 Н.W	s	77 + = 4.0						×			\ 1 7
			-		3 H.W.	43 S = 6.0									92 *X	\ <u>1</u> .7
<b>_</b>			3	33.39	<b>H.W</b> .	S = 5.3			-2 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3							1 7 1
			_		H.W. 5	S = 5.3									89 <b>X</b> X	7
	_		81.5		H.W.	S = 6.0									86 *X	./\ \ ]
2777	Note:					÷S = 6.0-										
	1) Me	ethane Reading: 0%														
NOTES: 1.Borehouse by	ole data re	quires interpretation by exp. before		ATER		EL REC							LLING R			
2. Boreho	ole backfill	ed with cuttings upon completion. vised by an exp representative.	Elapsed Time Upon Completion	on	Leve	ater el (m) .4		Hole Oper To (m) 5.3	n	Run No.	Dep (m		% Re	C.	F	RQD %
		Imple Descriptions read with exp. Services Inc. report														

Project Project	No: <u>OTT-00240904-A0</u>	ort Hospital P									- F	igure N	lo	4	<u>1</u>	$\epsilon$	
Locatio			10	pos	cu	Onc	ans	ı amı	iy i ica	<u></u> .u	<b>D</b> (	Pag	je	<u>1</u> o	f _2_		
	rilled: 'July 5, 2017									_				_			
Drill Ty			-			oon S ample		е	_	<b>⊠</b> <b>□</b>		Combust Natural N			-		×
			-			Value Con		et .		) _		Atterberg Undraine		ial at		-	—
Datum:			-		elby 7		0 100		-			% Strain	at Failu	ire			$\oplus$
Logged	I by: A.N. Checked by: S.P.				ear S ne Te	treng est	th by			+		Shear St Penetror					<b>A</b>
SYMBOL	SOIL DESCRIPTION	Geodetic m 87.59	D e p t h	S	hear	andar 20 Stren 50	4 gth	0	Test N V 60 150	'alue 80 kF 200	Pa .	25	50 ural Moi erg Lim	500	ading (ppr 750 ntent % y Weight) 60	ĺ	Natural Unit Wt
: <u>x\ 1<sub>z</sub>.</u>	TOPSOIL ~200 mm SILTY CLAY (DESICCATED CRUST)	87.487.59		4				1	44					×			Λ
	Brown to greyish brown, moist to wet, (ve stiff to hard)	ry –				1.1.1										/	
			1		9					216							18.4
					O: ::									1		<u> </u>	10.4
	_	7		4							. ; .					::\	7
	_	_	2	9	· · · · ·			115		5 1 1 1 1 5 1			:			_/_	18.1
		85.1	L	I.W.				S = 4.8			: (; ; : (; ;						7
	SILTY CLAY Grey, sensitive, wet, (stiff to firm)			Φ:		53									×		$\langle  $
	=	_	3 H	I.W.	s	= 5.5											<u> </u>
	_	_		φ	4	3	· · · · · · · · · · · · · · · · · · ·								×		
			ا	I.W	s =	⊢ 6.0											
	_	7		φ												$ \mathbf{x}\rangle$	
	_	-		1	38 	T:::				;; .; .; .; .; .; .; .; .; .; .; .;							
	_			I.W.												old x	$\langle  $
					38	4::::										/ 	
	_	7	н	I.W.	S = 8	5.3										—, <b>Ж</b>	1 <sup>1</sup>
	_	_	6	3	4	3		0.1.2		5 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 -			. 5 - 5 - 6 -			/ /	1
	INFERRED SILTY CLAY	81.3			S =	4.5											Ц
8/4/17	Sampled portion of borehole terminated a 6.0 m depth.	at T			- 1 · 2 - 1 · 3					2 - 1 - 2 - 2 - 2			- 1 - 2 - 2 -		. (		
		-	7														
WA.	advanced from 6.3 m to cone refusal at 14.0 m depth.	_			· · · · ·	1:1:		(* 1 * 2 * 0   <del>             </del>		2 - 1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -			· ? · ? · ? · .	! - - <- ! -: ! - - : - : - :	· ( ·   · · · · · · · · · · · · · · · ·		
	·																
N N	_		8	3	<del></del>												
<u>a</u>	_	_															
40904	_		9		(+ 1 + ) (+ 1 + )												
S-00Z						1.1.1											
	_	-			 							-0-1-1-1					
BOREHOLES -00240904. GPJ TROW OTTAWA, GDT	Continued Next Page		_	0		1:1:		0.1.2.0		1 - 1 - 1 - 1 - 1	. ; .	÷ (+ ) + ;				:::	
K NOTES:	e data requires interpretation by exp. before	WATE	R L	_EVE	EL R	ECC	RDS	3				COI	RE DR	RILLING	RECOF	RD	
Use by o	thoro	Elapsed Time			ater el (m	)	ŀ	Hole Op To (m		Rur No.		Dept (m)		% I	Rec.	F	RQD %
의 3. Field wo	urk supervised by an exp representative.	n Completion			.0			6.2			T						
ЖI	es on Sample Descriptions																
⊥   5. I nis Figi	ure is to read with exp. Services Inc. report 240904-A0																
9																	

Project No: OTT-00240904-A0

Figure No.

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

	S			D		Sta	andard F	Penet	ration T	est N V	alue	Co			Vap			ng (pp	m) S A M P	Notur
G W L	S M B O L	SOIL DESCRIPTION	Geodetic m	e p t h	Sh		20 Strength	40 n	6	0	80 kPa	+	Nat Atterl	tural I berg I	Moist Limits	ure ( s (%	Conte Dry V	ent % Veight	) MP LES	Natura Unit W kN/m
_	[ ////	INFERRED SILTY CLAY	77.59	10			50	100	15	50	200			20		40		60		1
		Sampled portion of borehole terminated at –6.0 m depth.																133		
																		10.00		
		Dynamic Cone Penetration Test (DCPT)  advanced from 6.3 m to cone refusal at		11														1.5.2.		
		14.0 m depth. (continued)																		
		_		12																
					33													33		
		_		13	1												: .:. : : .:. :	133		
							11120			-2-0-6-								20	1 -2 -	
		-			1		1.1.2.0						. ; .:.		. ; . ;			13.5		
		Refusal of Cone Penetration Test at 14.0	73.6	14	15.5		<u> </u>	4			( )				- 2-1			153		
		m Depth																		
		Note: 1) Methane Reading: 0%																		
		,																		
															: :					
					: :										: :					
					: :															
					: :															
					: :															
					: :										: :					
NO I. B	TES:	e data requires interpretation by exp. before	WATE	RL	EVE	EL R	ECOR	DS					CO	REI	DRII	LLIN	IG R	ECO	RD	
u	se by c	thers	osed ne		Wa	ter		Н	ole Ope To (m)	en	Run No.		Dep	oth	$\top$		6 Re			RQD %
			mpletion	<u> </u>	<u>.eve</u> 0.	<u>l (m)</u> .0	<del>'</del>		6.2		INO.		(m	.)	+					
		es on Sample Descriptions																		
		ure is to read with exp. Services Inc. report 240904-A0																		
U	, i i -002	24U3U4-AU																		

- 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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
<b>Upon Completion</b>	0.0	6.2

	CORE DR	RILLING RECOF	RD
Run No.	Depth (m)	% Rec.	RQD %
INO.	(111)		

Project No:	OTT-00240904-A0	, OI D	O.	Ci						<b>-</b> :		4	,		X
Project:	Geotechnical Investigation - Mo	ntfort Hospital	Pro	posed	Orle	ans	Family	Healt		igure i OFHH)	) –	42 1 of	_		- 1
Location:	2225 Mer Bleue Road, Ottawa,	ON								Pa	ge	01	_2_		
Date Drilled:	'July 5, 2017		_	Split Sp	oon Sa	ample	e	$\boxtimes$		Combus	stible Va	pour Rea	ding		
Drill Type:	CME-55			Auger S						Natural Atterber		Content		_	<b>X</b> →
Datum:	Geodetic			Dynami	ic Cone		t .			Undrain % Strair	ed Triax	ial at		•	Φ
Logged by:	A.N. Checked by: S	S.P.		Shelby Shear S		h by		+		Shear S	trength	by			•
				Vane T				S		Penetro					
G W L BO L	SOIL DESCRIPTION	Geode m 87.57	tic e	Shear	20 Streng	40		) ;	80 kPa	Nat Atterl	250	pour Rea 500 sture Con its (% Dry 40	750	· IA	Natural Unit Wt. kN/m³
	SOIL ~300 mm	87.3	0	3			144					×			/
Brow	Y CLAY (DESICCATED CRUST) vn to greyish brown, moist to wet,	(very		3				-2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -						#/	1
stiff)			1	7				19	2			×			18.6
							0100								\ .0.0
				3			3133								17.5
		85.4	2		2 <u>  1   1   2</u> 2   1   1   2	82	0.10.00	-2-0-6-2			1-1-0-0-		(+) +2 (+) (+) +2 (+)		17.5
	Y CLAY y, sensitive, wet, (stiff to firm)		Н	l.W	s	= 5.7									7
<u> </u>	,	84	.87	Φ:::::	53								:   : <b>: :</b>	<u> </u>	
			3 H		\$ = 5.7										7
		-		Φ	43									<b>*</b> /	
			Н	s=	<del> </del> = 6.0									∷.[∐ 85	<u> </u>
				Φ::::3	8									X	
		-		S =										- [	<u> </u>
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B NOTES:	Continued Next Page		10	12.4.1.	: 1:1:2	2:3:1	*****	-> -> ->	1. ( . ) ( . )	0000	1000	14010	<u> </u>	<u>::1</u>	
NOTES: 1. Borehole data re use by others 2. Borehole backfill	equires interpretation by exp. before	WA1 Elapsed	TER L	EVEL F Water			Hole Ope	ın en	Run	CO		RILLING % R			RQD %
2. Borehole backfil	led with cuttings upon completion.	Time Upon Completion		_evel (n 2.7			To (m) 5.3		No.	(m		,,,,,			
3. Field work super	rvised by an exp representative.  ample Descriptions	p		•											
五 5. This Figure is to	read with exp. Services Inc. report														
OTT-00240904-	<b>^</b>														

Project No: OTT-00240904-A0

Figure No.

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

_ [	S			D	)	S	Stand	dard	Per	etrat	ion T	l'est	N Va	lue		Co		stible		oour 500	Read	ling ( 750	ppm)	S A M P	Natur
G N L	S M B O L	SOIL DESCRIPTION	Geodetic	D e p	Ļ	· L	20		4	0	6	60		80	I.D	H	Na	tural	Mois	ture	Cont	ent 9	6 *b*\	11	Unit V
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ļ		Sampled portion of borehole terminated at					: [													13		: [ :		: ]	
		-6.0 m depth.	7						: : :					1			: : : :				1 : : :				
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		rk supervised by an exp representative.	ompletion		2	.7				5	5.3														
		es on Sample Descriptions																							
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WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
<b>Upon Completion</b>	2.7	5.3

	CORE DR	RILLING RECOF	RD
Run No.	Depth (m)	% Rec.	RQD %

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 26, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Natural 250 500 750 G W L Geodetic -MBO-SOIL DESCRIPTION Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. Shear Strength kN/m<sup>3</sup> 87.77 A 1/ TOPSOIL ~250 mm 168 87.5 • SILTY CLAY (DESICCATED CRUST) Brown to greyish brown, moist to wet, (very 180 16.7 85.6 85.47 SILTY CLAY Grey, medium sensitivity to sensitive, high H.W plasticity, wet, (firm to stiff) H.W S = 4. 29 H.W. H.W. 60 Continued Next Page NOTES:

1. Borehole data requires interpretation by exp. before WATER LEVEL RECORDS CORE DRILLING RECORD use by others RQD % Water Hole Open Run Depth % Rec. Elapsed 2. Borehole backfilled with cuttings upon completion. Time Level (m) To (m) No (m) Upon Completion 14 7 - 15 8 12 0 3. Field work supervised by an exp representative. 2 15.8 - 17.4 98 80 4. See Notes on Sample Descriptions 17.4 - 19 3 100 95 5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

8/4/17

BOREHOLES -00240904.GPJ TROW OTTAWA.GDT

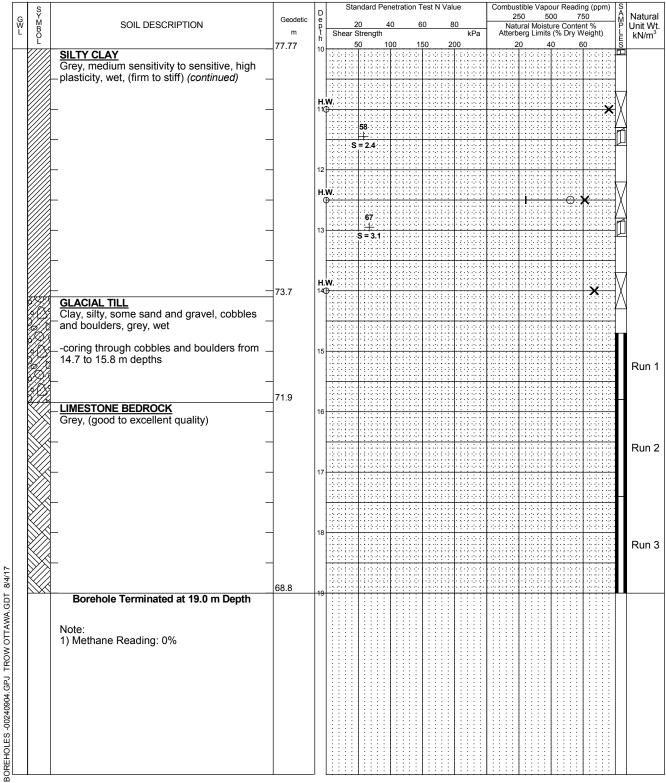
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LOG OF

Project No: OTT-00240904-A0

Figure No.

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page.



LOGS OF

LOG OF

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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	2.3	12.0

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

Proje	ct No:	OTT-00240904-A0	,	•	00						4.4		C	·/
Proje	ct:	Geotechnical Investigation - Mo	ntfort Hospital P	rop	osed Orle	ans	Family Heal	th Hub		) –	44 1 of			ı
Locat	ion:	2225 Mer Bleue Road, Ottawa,	ON						Ра	ge	_1_ of _			
Date I	Drilled:	'July 5, 2017		_	Split Spoon S	ample	e 🗵	]	Combus	stible Va	pour Readii	ng		
Drill T	уре:	CME-55		_	Auger Sample SPT (N) Value					Moisture g Limits	Content		ı	X
Datun	n:	Geodetic		_	Dynamic Con			, -	Undrain	ed Triaxi n at Failu	ial at			⊕
Logge	ed by:	A.N. Checked by: S	S.P		Shelby Tube Shear Strengt Vane Test	h by	+ 8	-	Shear S	Strength I	by			•
SY MB OL		SOIL DESCRIPTION	Geodetic m	D e p t h		4		80 kPa	2	250	sture Conte its (% Dry W	50	SAMPLES	Natural Unit Wt. kN/m³
<u> </u>		SOIL ~200 mm Y CLAY (DESICCATED CRUST)	87.76 87.6	0	4		144	1		Ĭ	J	Ĭ	V	
		n to greyish brown, moist to wet,	(very —	1	7		11	92			<b>X</b>			18.1
		Y CLAY , sensitive, wet, (stiff to firm)	85.6 _	2 H.	3.	-::::					×	×		17.5
▼			_ _ _ _ 	H.	S = 5.0 W. 3 = 5.0 W. S = 6.0 W. 38							×		
_				H.	S = 5.3 W									] 7 N J
		Township to the Company	81.5	6	3 + S = 4.5	: i :								
	Note	orehole Terminated at 6.3 m Dep	oth .											
NOTES:	ole data ro	equires interpretation by exp. before	WATF	-I R L	EVEL RECC	RDS	3		CC	DRE DR	RILLING R	ECOR	D D	l
use by	y others		Elapsed Time		Water		Hole Open To (m)	Run No.	Dep (m	oth	% Re			QD %
3. Field v	work super lotes on Sa	ed with cuttings upon completion.  vised by an exp representative.  ample Descriptions  read with exp. Services Inc. report  40	Jpon Completion		<u>evel (m)</u> 4.4		5.3	INU.	, (III	,				

Project No	Log	Figure No. 45														E	exp
Project:	Geotechnical Investigation - Mon	tfort Hospital P	rop	oosed C	Orlea	ıns	Family	Heal	th	Hub (	(ŎFH	H) age	_	1 of	_		'
Location:	2225 Mer Bleue Road, Ottawa, O	N								_	Г	aye	_	01		-	
Date Drilled	d: 'June 30, 2017		_	Split Spoo	on Sai	mple	•	×	]		Comb	ustible	e Vapo	our Rea	ding		
Drill Type:	CME-55			Auger Sa							Natura Atterb			Content			<b>X</b> ⊕
Datum:	Geodetic			Dynamic		Tes	t		, -		Undra	ined 7	Ггіахіа				Φ
Logged by:	A.N. Checked by: S.I	P	_	Shelby Tu Shear Str Vane Tes	rength	by		+ s	-		% Stra Shear Penet	Strer	igth by	y			<b>A</b>
S Y M B O L	SOIL DESCRIPTION	Geodetic m	D e p t h	2 Shear S	20 Strengt	40 th		0	80	kPa		250 Vatural erberg	5 Moist Limits	our Rea 500 ture Cor s (% Dry 40	750 tent % Weight	I A	Natural Unit Wt. kN/m³
<u> </u>	PSOIL ~200 mm	87.72 87.5	0	1		10		1 <b>68</b>	200			20		40	60		
	.TY CLAY (DESICCATED CRUST) own to greyish brown, moist to wet, (\( f \)	very —	1	7 .0				19	92					* : : : : : : : : : : : : : : : : : : :		X	18.1
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- GI	ey, sensitive, wet (stiff to firm).	-	3 H.	.W. ⊖ 38. + S = 5.	67 S=4.0	0											
		-	5	34 								3   3				88 <b>X</b> <b>X</b> <b>X</b> <b>X</b> <b>X</b>	
	Parabala Tarminated at 6.2 m Dont	81.4	Ĺ	+ S = 6.	4												
No 1) l	Borehole Terminated at 6.3 m Deptite: Methane Reading: 0%	n															
NOTES: 1.Borehole data	requires interpretation by exp. before	WATE	RL	EVEL RE	COF	RDS	; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;				C	ORE	DRII	LLING	RECO	RD	
use by others		Elapsed Time	1	Water evel (m)		H	Hole Ope			Run No.		epth m)		% F	lec.	F	RQD %
3. Field work sup 4. See Notes on	crilled with cuttings upon completion.  Derivised by an exp representative.  Sample Descriptions  to read with exp. Services Inc. report 4-A0	oon Completion		2.4			5.3			. 10.		,					

Project N Project:	No: OTT-00240904-A0  Geotechnical Investigation - Monti	fort Hospital B	)ro	nos	ed.	Orla	ana	ς Fα	mil	, µ,	الجم	h ⊔	F	Figu	re N	No.	_		46	_			- 1
Location		-	10	pus	cu	OH	ans	, , ,		y 1 10	cail	<u></u> 11	uD (		Pa		_	1_	of	_1	_		
	lled: 'June 30, 2017	•		C	i# C		\ar-	la.				_		0-	h	Alb I	\ <i>t</i>		Ja''				
Drill Type			-	Aug	lit Spo ger S	ampl	е	ie						Nat	ural I	Mois	ture		Readi ent	ing			×
Datum:	Geodetic		-		T (N) namid			st		_	0				erber		nits riaxia	ıl at			H		<b>⊕</b>
Logged b			-	She	elby T	Гubе								% 5	Strain	at F	ailun	е					Φ.
Logged i	Dy. A.N. Checked by. 3.F	<u> </u>			ear S ne Te		ith by				+ s						er Tes						•
S Y M B O.	SOIL DESCRIPTION	Geodetic m	D e p t	S		20		netra 40		Fest I		30	kPa		2	50	5	00	Readi 7 Conte Dry V	50		SAMPLES	Natura Unit W kN/m
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	SILTY CLAY Grey, sensitive, wet, (stiff to firm)	05.4	н	.w.			S = 5	1														9	
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			"	φ	4	3			:::::						::::::		: : : : : : : : :	#:	! ::: :: <del>! ! !</del>		×	<u>: </u>	
			l.,		s =	H 6.0																	
				. <b>w</b> Φ :	<del>(- -)</del>										.;		<del>- 1 - 1</del> - 3 - 1		<del>         </del>			***	
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	Borehole Terminated at 6.3 m Depth	81.3 I		1::	-s=	4.5-			: :					: :		1::-			: :: ::			Щ	
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NOTES:	data requires interpretation by exp. before	WATE	R L	.EVI	EL R	ECC	ORD	S							СО	RE	DRII	LLIN	IG R	EC	ORD	1	
use by oth	packfilled with cuttings upon completion.	Elapsed Time	L		ater el (m	)		Hole To	Op (m)			Rı Nı			Dep (m			9	% Re	C.		R	QD %
	supervised by an exp representative.	on Completion			.4				5.3														
4. See Notes	s on Sample Descriptions																						
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Lo	ocatio	n:	2225 Mer Bleue Road, Ottaw	a, ON									Pa	ge	of			
Da	ate Dr	illed:	'June 27, 2017				Split Sp	oon S	ample	9	×	1	Combus	tible Va	pour Rea	ding		
	ill Typ		CME-55			_	Auger 9	Sample	9			]	Natural	Moisture	e Content	-		×
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G W L	S Y M B O L		SOIL DESCRIPTION		m	p t h		20 Stren	-			80 kPa	Nat Atterb	ural Moi erg Lim	isture Con iits (% Dry		) AMPLIES	Unit Wt. kN/m <sup>3</sup>
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						ľ	φ										$\mathring{\mathbb{X}}$	
1		_		-	81.5	6	)	43 										
			RRED SILTY CLAY pled portion of borehole termin	ated at			-5-6-1-					10000			14.2.13			
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		Dyna adva	mic Cone Penetration Test (Denced from 6.3 m to cone refusa	CPT) al at		'	22 22 22					111111					) : 	
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1.E			quires interpretation by exp. before	Elap		ER L	EVEL I			Hole Op	en	Run	CO		RILLING 8 R			QD %
2. <i>k</i>	A 19mm porehole	slotted s	standpipe was installed in the ompletion.	Tin Upon Co	ne		Level (n 2.4		<u> </u>	To (m)		No.	(m		,,,,,			
			vised by an exp representative.	24 d			0.2											
			ample Descriptions															
	This Figu DTT-002		read with exp. Services Inc. report															

Project No: OTT-00240904-A0

Figure No.

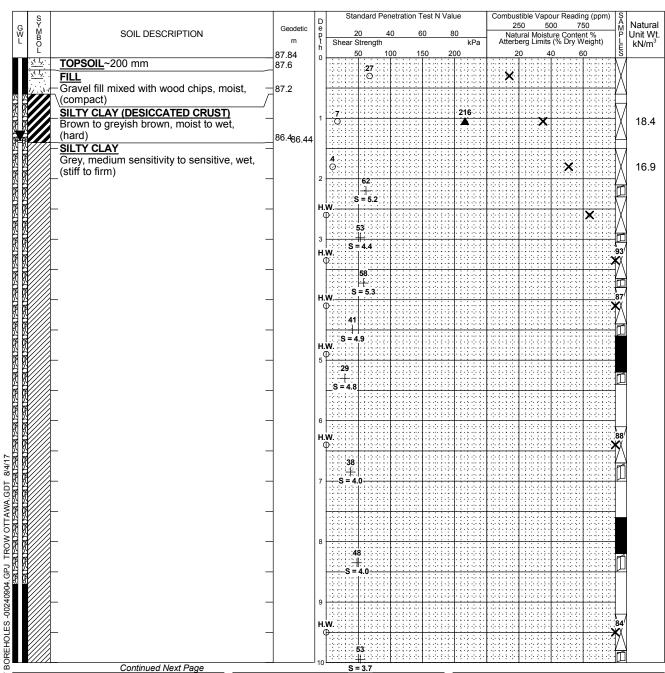
Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH)
Page. Project:

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1	////	INFERRED SILTY CLAY	77.76	10	) 					Ĭ						7			· ; ::			·: :·				
		Sampled portion of borehole terminated at																								
		-6.0 m depth.	1				;												-; .;	· · ·	. ; . ;	· · ·	-:-	i -:- :		
		Dynamic Cone Penetration Test (DCPT)  advanced from 6.3 m to cone refusal at							: :											<u> </u>						
		advanced from 6.3 m to cone refusal at	1	11		:::	:  -	: :	<del>: :</del>	÷				:  -	<del></del>		<del>: : : :</del>		-; -;	<del>; ; ;</del>		<del>::::</del>	:::	<del>; ; ,</del>		
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	.,,,,	Refusal of Cone Penetration Test at 14.3	1.2.2	T	Ħ					Ė									::	::		::				
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		1) Methane Reading: 0%			1:			: :		:	::					:			: :	: :		: :				
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ı.B u	orenole se by o	e data requires interpretation by exp. before thers	sed	- L		ater					e Op	en	$\dashv$	-	Run	$\top$		ept		\ \ \		Re		עריי	R	QD %
2. A	19mm	slotted standpipe was installed in the	me	_ <u>L</u>	eve	el (m				To	m) c	1)			No.	+		(m)		+				-		
		04.	mpletion days			.4 .2					5.3															
		The supervised by air expresentative.	auyo		U.																					
		es on Sample Descriptions																								
5. T	his Fig	ure is to read with exp. Services Inc. report 240904-A0																								
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WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	2.4	5.3
24 days	0.2	

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

Project No: OTT-00240904-A0 Figure No. Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page. Location: 2225 Mer Bleue Road, Ottawa, ON Date Drilled: 'June 23, 2017 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading × Auger Sample Natural Moisture Content Drill Type: CME-55 SPT (N) Value 0 0 Atterberg Limits Dynamic Cone Test Datum: Undrained Triaxial at Geodetic  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: A.N. Checked by: S.P. Shear Strength by Penetrometer Test Vane Test



NOTES:

1. Borehole data requires interpretation by exp. before use by others

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

P

5. This Figure is to read with exp. Services Inc. report OTT-00240904-A0

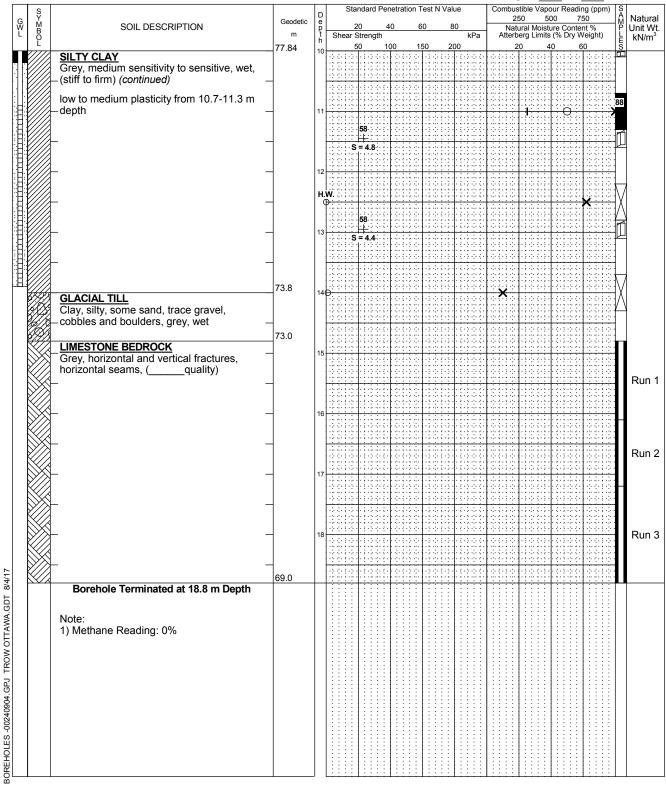
WATER LEVEL RECORDS									
Elapsed	Hole Open								
Time	Level (m)	To (m)							
Upon Completion	2.4	14.3							
28 days	1.4								

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					

Project No: OTT-00240904-A0

Figure No.

Project: Geotechnical Investigation - Montfort Hospital Proposed Orleans Family Health Hub (OFHH) of 2 Page.



LOGS OF

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

WAT	ER LEVEL RECO	RDS
Elapsed	Water	Hole Open
Time	Level (m)	To (m)
Upon Completion	2.4	14.3
28 days	1.4	

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

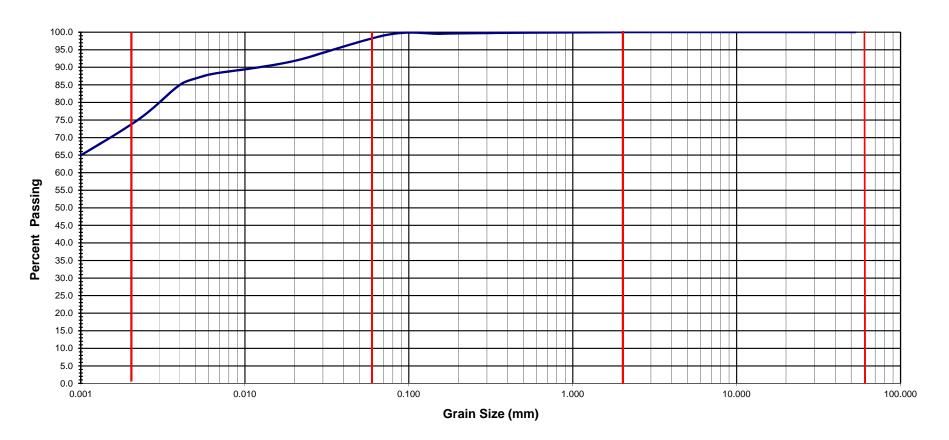


100-2650 Queensview Drive Ottawa, ON K2B 8H6

# 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	



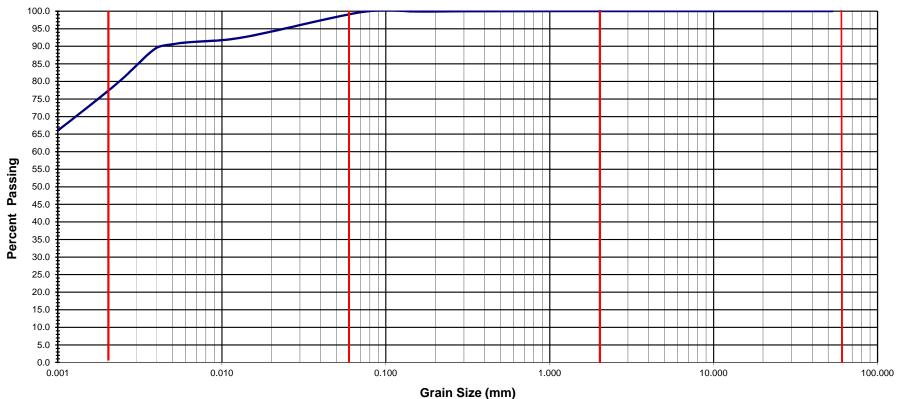
Exp Project No.: OTT-00240904-AO		Project Name :	Geotechnical Investigation - Proposed Orleans Family Health Hub (OFHH)						
Client :	Montfort Hospital. c/o ZW Group	Project Location :	2225 Mer Bleue	2225 Mer Bleue Road, Ottawa					
Date Sampled :	June 21, 2017	Borehole No.:	8	Sample No.:	SS2	Depth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



100-2650 Queensview Drive Ottawa, ON K2B 8H6

### Method of Test for Particle Size Analysis of Soil ASTM D-422

CLAY		SILT			SAND			GRAVEL		
CLAT	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 Descript	ion :	Silty Clay, trace	e Sand			Figure :	50		

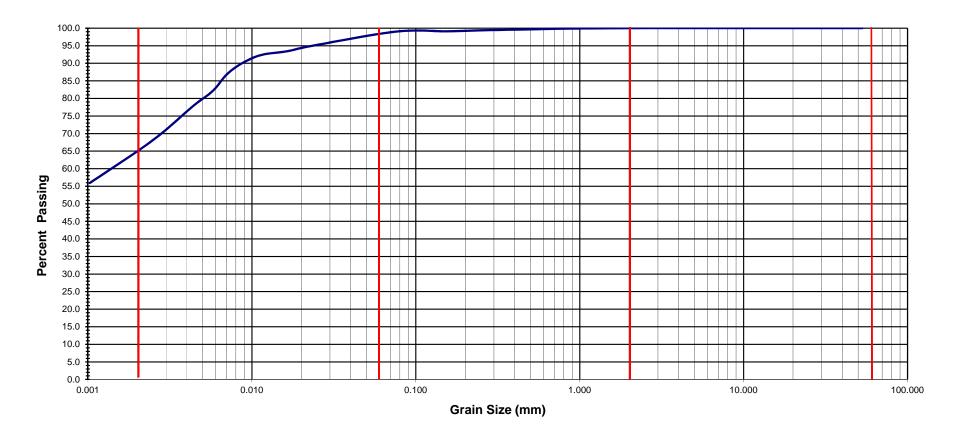


### **Grain-Size Distribution Curve**

100-2650 Queensview Drive Ottawa, ON K2B 8H6

# Method of Test for Particle Size Analysis of Soil ASTM D-422

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



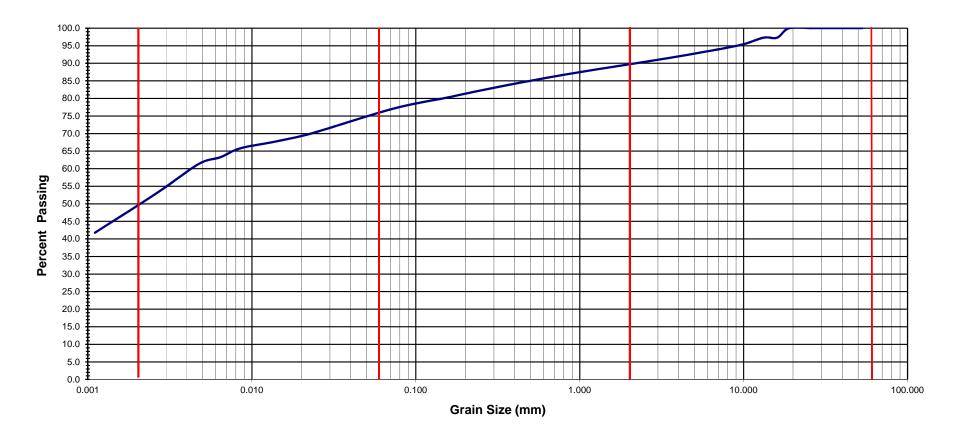
Exp Project No.:	OTT-00240904-AO	Project Name :	Geotechnical Ir	vestigation - Propos	ed Orleans F	amily Health Hub (	OFHH)
Client :	Montfort Hospital, c/o ZW Group	Project Location :	2225 Mer Bleue	Road, Ottawa, ON			
Date Sampled :	June 27, 2017	Borehole No.:	22	Sample No.:	SS11	Depth (m):	10.7-11.3
Sample Descript	ion :	Silty Clay, trace	e Sand			Figure :	51



100-2650 Queensview Drive Ottawa, ON K2B 8H6

# Method of Test for Particle Size Analysis of Soil ASTM D-422

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



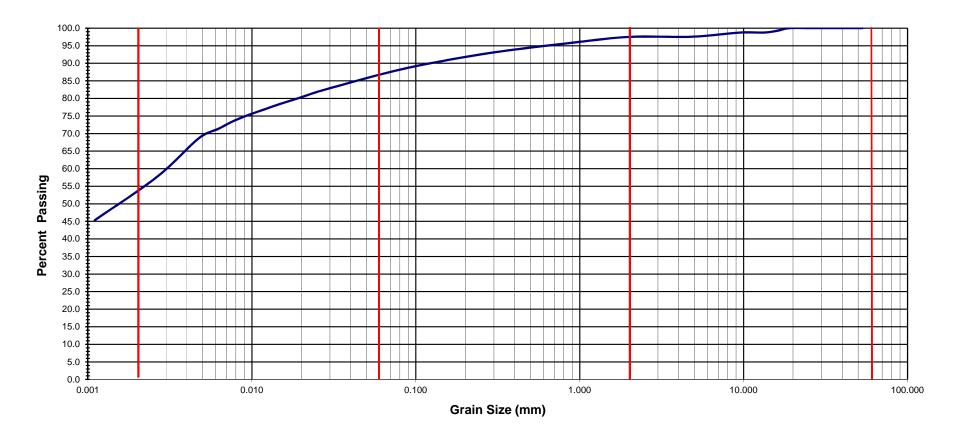
Exp Project No.:	OTT-00240904-AO	Project Name :	Geotechnical Ir	vestigation - Propos	ed Orleans F	amily Health Hub (	OFHH)
Client :	Montfort Hospital. C/O ZW Group	Project Location :	2225 Mer Bleue	Road, Ottawa, ON			
Date Sampled :	June 26, 2017	Borehole No.:	41	Sample No.:	SS13	Depth (m) :	13.7-14.3
Sample Descript	ion :	Silty Clay, some San	d and Gravel			Figure :	52



100-2650 Queensview Drive Ottawa, ON K2B 8H6

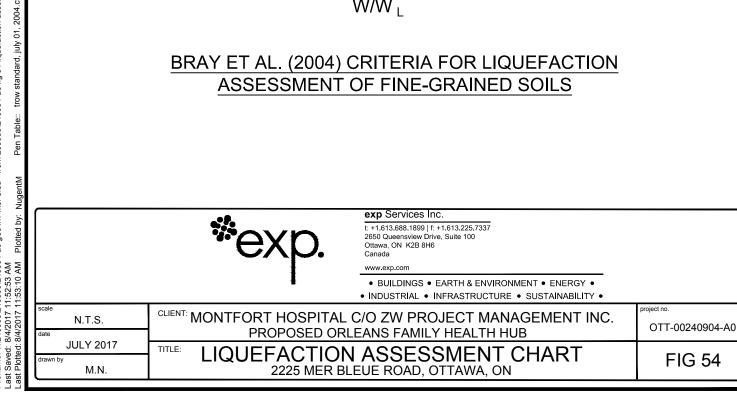
# Method of Test for Particle Size Analysis of Soil ASTM D-422

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

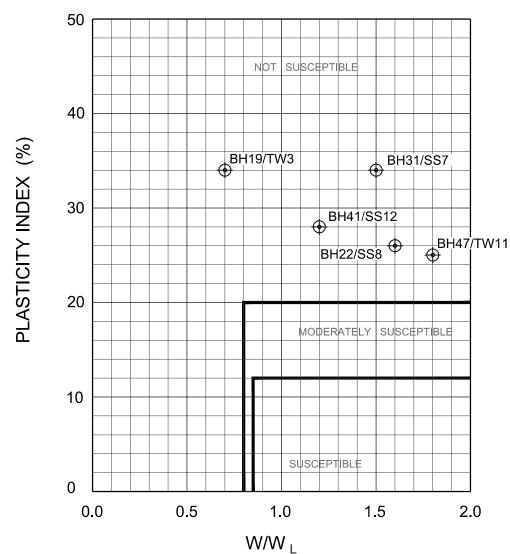


Exp Project No.:	OTT-00240904-AO	Project Name :	Geotechnical Ir	vestigation - Propos	ed Orleans F	amily Health Hub (	OFHH)
Client :	Montfort Hospital. c/o ZW Group	Project Location :	2225 Mer Bleue	Road, Ottawa, ON			
Date Sampled :	June 23, 2017	Borehole No.:	47	Sample No.:	SS13	Depth (m):	13.7-14.3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





**FIG 54** 



Client: Montfort Hospital c/o ZW Project Management Inc. Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH) Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario Project Number: OTT-00240904-A0 Date: March 14, 2018

Final

APPENDIX A: Borehole Logs from 2010
Geotechnical Investigation





Project:	No: OTGE00020336A  Geotechnical Investigation. Pro	nosed Orleans F	amily He	alth H	ub (OE	пп/	F	igure	No.	2			
Location			arring rie	zanii i i	db (Oi	11(1)		Pa	ge.	of	_1_		
	illed: 'December 22, 2009	KDUITI Dypass											
			Split Spo Auger S	oon Sam ample	ple					apour Rea			
Orill Typ			SPT (N)	Value		0		Atterbe				<b> </b>	<del>-</del>
Datum:	Geodetic Elevation		Dynamic Shelby 1	Cone Touble	est			Undrain % Strain					$\oplus$
.ogged	by: Checked by:		Shear S Vane Te	trength b	у	+ s		Shear S Penetro					<b>A</b>
SYMBOL	SOIL DESCRIPTION	Geodetic Elevation	p Shear	20 Strength		δO ε	80 kPa	Nat Attert	tural Mo perg Lin	apour Rea 500 histure Con hits (% Dry	750	SAMPLES	Nat Unit
	TOPSOIL ~100mm SILTY CLAY	87.8 87.7	3	50 1	00 1	50 2	00		20	40	60	S \	
	Brown to grey, moist to wet (very stiff	to - 87.17	0 1 1 1									$\bot$ $\bigwedge$	
	stiff)		6			168		0.000					
			1 Ö ::			<b>A</b>				×		X	1
		_	40000			-3-0-4-3- -3-0-4-3-		4.4.1.4		1 - 2 - 1 - 2 - 1			
		-057	2		<u> Line</u>					×		X	1
	SILTY CLAY TO CLAY	85.7	-		118			0.4-1-0					
	Grey, wet (firm)	-	/HW		s=12	10 4 11 11 11 11 11 11 11 11 11 11 11 11 1		0.000			×	-M	
			3	70									
			/ <b>HW</b>	s=29								M	
		-	44							1 1 2 1 2 2 2 2		$ \square$	
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			/HW	•		-2-0-1-2- -3-0-1-3-						M	
		7	5										
		4	s=1	8			-1-3-5-1						
			6 (D)		0.1.2.0	2212							
		4	/Push						1	0		>83	15
			44										
			7 s=2	9								Ш	
			100000	-1-2-0-1-		-2 (-1.2)							
			иw			3366		3:33				83	
		-	8								1		
	Tomain at al G O F 1 . 11	79.3	46	- 1.3 3.1.									
	Terminated @ 8.5 m depth		s=	9									
								::::	::::		1::::		
OTES: Borehole/I before use	Fest Pit data requires Interpretation by Trow		LEVEL RE	CORDS	6			COF	RE DR	ILLING F	RECOR	 D	
A 50 monit	toring well was installed in the borehole	Elapsed Time	Water Level (m)	ŀ	Hole Ope To (m)	n	Run No.	Dept (m)		% Re	C.	RQ	D %
upon comp	pletion	Completion	4.3					<u>\</u>					
Field work	supervised by a Trow representative	13 days 24 days	0.7 0.6		-								
	on Sample Descriptions												
This Figure	e is to read with Trow Associates Inc. report 20336A										- 1		

I	WAT	ER LEVEL RECO	DRDS
	Elapsed Time	Water Level (m)	Hole Open To (m)
ĺ	Completion	4.3	19 (111)
	13 days	0.7	-
ı	24 days	0.6	
1			

	CORE DR	RILLING RECO	RD
Run No.	Depth (m)	% Rec.	RQD %



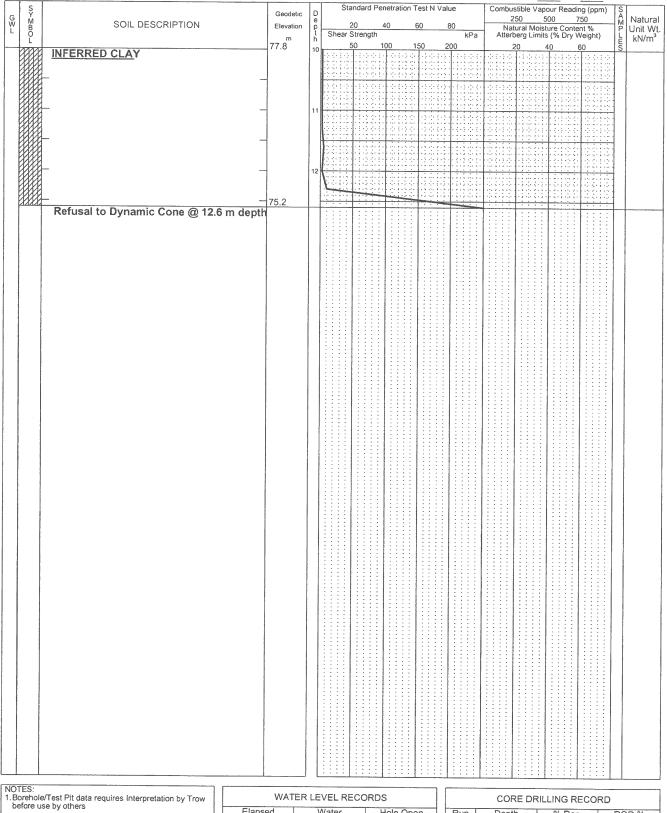
Project No: OTG	E00020336A	Log of	DOI					IFU
-	technical Investigation. P	Proposed Orleans	Eamily Hoo	Ith Hub (OFHI)		Figure No.	3	_
	Bleue Road & Future Bla		ь ганну пеа	IIII HUD (OFHH)		Page.	_1_ of _2	_
Date Drilled: 'Janu		ackbulli bypass						
oate Drilled. <u>Jani</u> Orill Type:	lary 13, 2010		Split Spoo Auger San	·	⊠ 000	Combustible Natural Moist	Vapour Reading ure Content	(
	Jatia Elevation		— SPT (N) V	alue	0	Atterberg Lim	its	<del></del>
	detic Elevation		Dynamic C Shelby Tul			Undrained Tr % Strain at F	ailure	0
ogged by:	Checked by:		Shear Stre Vane Test	ngth by	<del>+</del> s	Shear Streng Penetrometer		4
S		Geodetic	c [D]	ard Penetration Test N	Value	Combustible 1	/apour Reading (pp 500 750	m) S A N
S/ M B O L	SOIL DESCRIPTION	Elevation	t Shear Str	_	80 kP	Natural M Atterberg Li	oisture Content % mits (% Dry Weight)	m) SAMPLES
TOPSOIL SILTY CLA		87.8 87.6	0 50	100 150	200	20	40 60	Š
Brown to g	rey, moist to wet (very st	tiff to	0					$ \bigvee$
S(II)			1 9	120				$\mathcal{H}$
			0,					$\mathbb{Z}$
			4					
		4	2	117				$\mathbb{A}$
				s=8				P
SILTY CLA	AY TO CLAY	85.1	P:	68				X
Grey, wet (	firm)		1/HW. s	=14				
		4	39					
		s=16						
			4 0-					X
		-	54	2				
			1/HW.					M
			54					
		-	s=2	2	<u> </u>			
			6		11111			
			1/HW.					M
			56					
		-	7 H	5				
			1/HW					М
			8	38				Δ
		-	S2	9.3				
			9					
			1/HW					M
		-		**************************************				$ \bigvee$
	Continued Next Page	77.8	100000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
OTES: Borehole/Test Pit data red before use by others	quires Interpretation by Trow		R LEVEL REC			CORE DE	RILLING RECOR	D
Borehole backfilled upon (	completion of drilling	Elapsed· Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD
Field work supervised by								
See Notes on Sample Des	Trow Associates Inc. report							



Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH) Figure No.

Page. 2 of 2



- 2. Borehole backfilled upon completion of drilling
- 3. Field work supervised by a Trow representative
- 4. See Notes on Sample Descriptions

GPJ TROW OTTAWA.GDT 1/21/10

BH 1 TO 9.

5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

ER LEVEL RECO	DRDS
Water Level (m)	Hole Open To (m)

	CORE DE	RILLING RECO	RD
Run No.	Depth (m)	% Rec.	RQD %



Project No: OTGE000	1203364	y or	DGI	CI		<u>- 7</u>				7	-	LOW
	ical Investigation. Propos	sed Orleans I	Family Ha	aalth H	ub (OE	.HH/		Figure No	·	4		
	e Road & Future Blackbu		allilly 116	zaiui i ii	ub (Or	пп)		Page	. 1	_ of .	2	
Date Drilled: 'Decembe		п Буразэ					_					
Drill Type:	1 23, 2003		Split Sp Auger S	oon Sam <sub>i</sub> ample	ple			Combustib Natural Mo			ing	□ <b>×</b>
Datum: Geodetic I	Elevation		- SPT (N) Dynamic	Value Cone Te	est	0		Atterberg L Undrained		24	-	
Logged by:			Shelby	Γube				% Strain at	Failure	at		$\oplus$
Logged by.	_ Checked by:		Shear S Vane Te	trength b	у	+ s		Shear Stre Penetrome				•
G X		Geodetic	D Sta	andard Pe	netration	Test N Val	lue	Combustib 250	le Vapou			S A M Natu P Unit
G N M B SOI	L DESCRIPTION	Elevation	P	Strength			kPa	Natura Atterberg	Moisture Limits (9	Conter Dry W	nt % 'eight)	P Unit kN/i
<u>10PSOIL</u> ~300	mm	88 87.7	3	0 1	00 1	168	00	20	40	6	0	Š.
SILTY CLAY Brown to grey, r	noist to wet (very stiff to	87.51	0							×	31131	M
stiff)			. 6			168						
			Ι' Ο						×		31.1.1	18
		+	3. 2. 1. 2		0.100	1000000				1100	4444	7
		4	2		121					×	0000	17
		85.5	20000		s=24							回
SILTY CLAY TO Grey, wet (firm)	CLAY		á	58	****							XI
		+	3 /HW	=24			111111					用
			D:								×	XI
			s=14									
		-	JHW.								,	92∕ \$\
		-	43									
			/Push									8
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		_	6									
			/HW									37
		7	43								7	Δ
		-	7 s=1	8						1.5.2.		耳
			/HW									7
			8 43								1	Δ
		4	+ S>3	σ				3 ( ) ( ) ( )				口
			9			12 0 1 1 2 1 12 0 1 1 2 1						
			/HW									7
		-	0:	122311		-2-0-1-2- -2-0-1-2-	· • • • • • • • • • • • • • • • • • • •			1 - 2 - 2 - 1 -	<b>×</b> /	$\bigvee$
Cont	inued Next Page		10	63 ==13								<u>d</u>
NOTES: I.Borehole/Test Pit data requires I		WATER	LEVEL RE		3			CORE	DRILLI	NG RE	CORD	
before use by others  2. Borehole backfilled upon comple	E	lapsed Time	Water Level (m)	F	Hole Ope To (m)		Run No.	Depth (m)	9	% Rec.		RQD %
		mpletion	1.8									
3. Field work supervised by a Trow												
<ol> <li>See Notes on Sample Description</li> <li>This Figure is to read with Trow</li> </ol>	11											
5.This Figure is to read with Trow of OTGE00020336A												

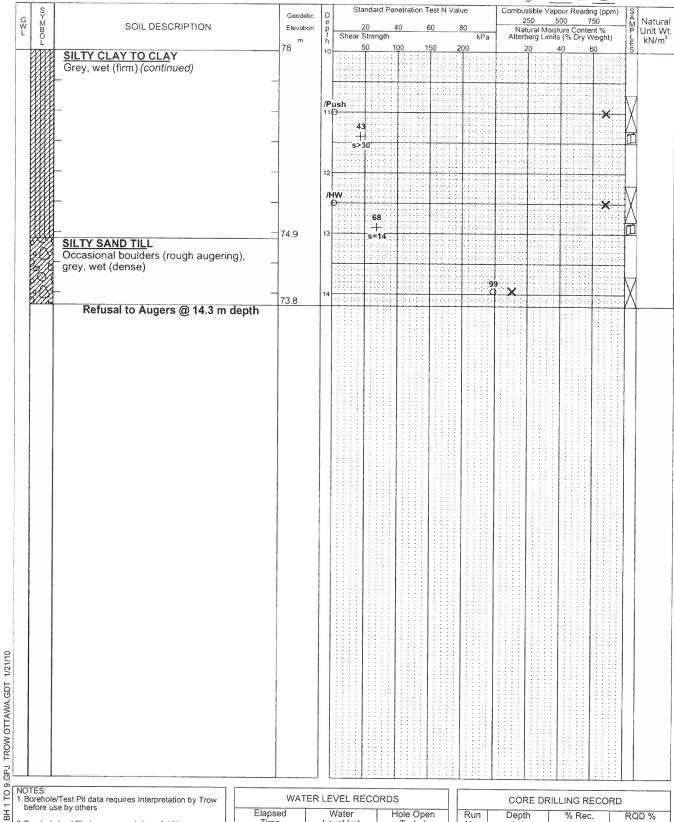


Project No: OTGE00020336A

Figure No.

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

of 2 Page.



LOG OF BOREHOLE

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 QTGE00020336A

WAT	ER LEVEL RECO	ORDS
Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	1.8	-

	CORE DE	RILLING RECO	RD
Run No.	Depth (m)	RQD %	



Project No: OTGE00020336A Figure No. Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH) 1 of 2 Page. Location: Mer Bleue Road & Future Blackburn Bypass Date Drilled: 'December 22, 2009  $\boxtimes$ Split Spoon Sample Combustible Vapour Reading Auger Sample Natural Moisture Content × Drill Type: SPT (N) Value 0 Atterberg Limits 0 Datum: Geodetic Elevation Dynamic Cone Test Undrained Triaxial at  $\oplus$ % Strain at Failure Shelby Tube Shear Strength by Logged by: Checked by: Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) SYEMO-Natural 250 500 Natural Moisture Content % Atterberg Limits (% Dry Weight) SOIL DESCRIPTION Elevation Unit Wt. Shear Strength kN/m3 87.7<sup>m</sup> TOPSOIL ~150 mm 3. SILTY CLAY Brown to grey, moist to wet (very stiff to 17.5 132 X 17.0 À 85.0 68 SILTY CLAY TO CLAY s=9.3 Grey, wet (firm) /Push s=10 /HW /Push 80.7 INFERRED CLAY Continued Next Page 1.Borehole/Test Pit data requires Interpretation by Trow WATER LEVEL RECORDS CORE DRILLING RECORD Elapsed Water Hole Open Run Depth % Rec. RQD % 2.A 50 monitoring well was installed in the borehole upon completion Time Level (m) No. (m)Completion 4.6 12 days 0.5 3. Field work supervised by a Trow representative 23 days 0.5 4. See Notes on Sample Descriptions 5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

TROW OTTAWA.GDT 1/21/10

BH 1 TO 9.

P



Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH) Figure No.

2 of 2 Page. Combustible Vapour Reading (ppm) Standard Penetration Test N Value 250 Natural 500 750 SOIL DESCRIPTION Elevation Natural Moisture Content % Atterberg Limits (% Dry Weight) Unit Wt. kN/m³ Shear Strength 77.7 INFERRED CLAY(continued) Refusal to Dynamic Cone @ 14.5 m depth 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

WAT	ER LEVEL RECO	ORDS
Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	4.6	
12 days	0.5	
23 days	0.5	

	CORE DR	RILLING RECO	RD
Run No.	Depth (m)	% Rec.	RQD %



Project No: O	)TGE00020336A	Log of	DOIG		2			ITOW
_	Geotechnical Investigation. Pr	roposed Orleans	Family Healt	h Hub (OEHH)		Figure No.	6	_
	fer Bleue Road & Future Bla		army rroam			Page.	_1_ of _2_	-
Date Drilled: 'Us		7	Split Spoon	Comple		Combination		
Drill Type:		22.0	Auger Samp	ole		Natural Moist	Vapour Reading ure Content	×
-	eodetic Elevation		<ul> <li>SPT (N) Val</li> <li>Dynamic Co</li> </ul>		0	Atterberg Lim Undrained Tr		<del></del>
Logged by:	Checked by:		Shelby Tube Shear Stren			% Strain at Fa	ailure	<b>⊕</b>
			Vane Test	guiby	+ s	Penetrometer		•
G M B O L	SOIL DESCRIPTION	Geodetic Elevation	Standa  D e 20 1 Shear Street	*	80 kPa 200	250	/apour Reading (pp 500 750 oisture Content % mits (% Dry Weight)	A Natura
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Brown t	to grey, moist to wet (very sti	ff to						
Suii)			4	144				
			0	96				
			2	s=5.4				V
		-	2 49		1-1-1-1-1-1			
SILTY	CLAY TO CLAY vet (firm)	85.5	s=5.0					
Grey, w	et (IIIII)		41					
			1/HW s=6.7				-1	
		-	s=5.6					
			4 1				-1	
			46					$\mathbb{N}$
			s=7.5					
			5					$ \mathbb{N}$
		_	54 #- s=14.	8				
		7	1/HW					
		-	0::::::::					$\mathbb{A}$
			7 s=14.					
			1/HW					
21/10		-	8 D:					$\mathbb{H}$
10			46 					
WA.G								31
TROW OTTAWA, GDT 1/2/1/10			1/HW:					
WO TROW		+	D24412441				-1	$\mathbb{A}$
ਰੂ <b>ਸਿੰਘ</b>	Continued Next Page	77.8	10   58 				-1	
NOTES:	ta requires Interpretation by Trow	WATER	R LEVEL RECO			CORE D	RILLING RECOF	RD
2 Porobolo bookfilled u	upon completion of drilling	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depth (m)	% Rec.	RQD %
3. Field work supervised	. ,							
3. Field work supervised	d by a Trow representative					CART - APPROXIMATION		
	e Descriptions d with Trow Associates Inc. report					A CANADA		



Project No:

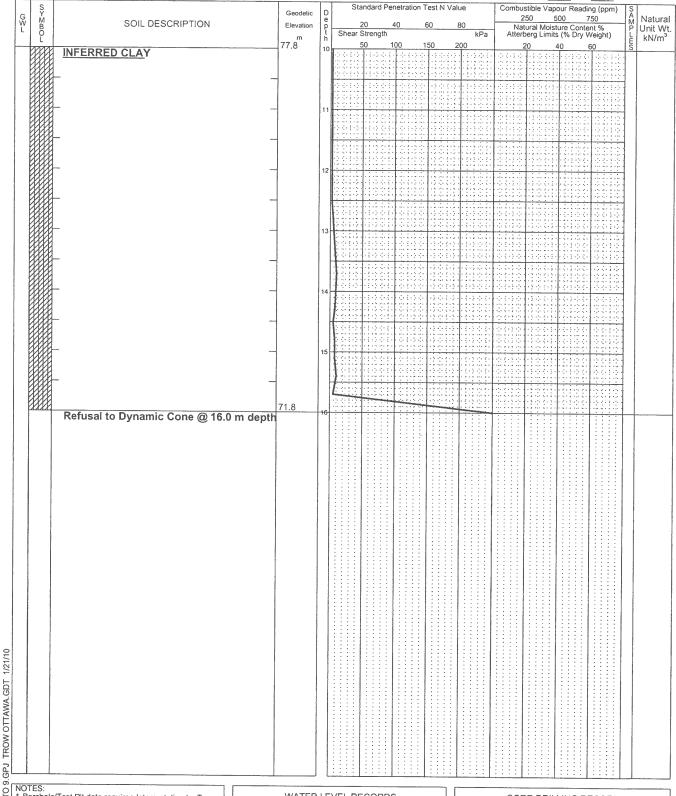
Project:

OTGE00020336A

Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH)

Figure No.

Page. of 2



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

LOG OF BOREHOLE 5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WAT	TER LEVEL RECO	ORDS
Elapsed Time	Water Level (m)	Hole Open To (m)

	CORE DF	RILLING RECO	RD
Run No.	Depth (m)	% Rec.	RQD %



Projec	ocation: Mer Bleue Road & Future Blackburn ate Drilled: 'January 13, 2010 rill Type: atum: Geodetic Elevation ogged by: Checked by:	3							•					_			UY
Location: Mer Bleue Road & Future Blackbur  Date Drilled: 'January 13, 2010  Drill Type:		oposed Orleans	Far	mily He	ealth	ո Hւ	ıb (OF	HH)		Figure No.							
		kburn Bypass								Page.			1	of	1		
	Type:		-	Split Spoon Sample								tible Vi Moistui			-		□ <b>X</b>
			-	SPT (N) Dynamic			st	0	·			g Limit ed Tria			ł	-	—
			-	Shelby T	ube				•	% S	Strain	at Fai	lure	I			$\oplus$
Logget	True Checked by:			Shear St Vane Te		th by	,	<del> </del>   S	-			trength meter					
SY M BOL	SOIL DESCRIPTION	Geodetic Elevation	Depth	Shear	20 Stren	gth		60	80 kPa	1	Nat Atterb	50 ural Mo erg Lim	500 isture nits (%	Conte Dry V	ing (ppm) '50 ent % Veight)	SAMPLIES	Nati Unit kN/
222		87.9 87.8	0	4	50	10	14	1	200		. ; . ; .	0 	40		60	s	-
	Brown to grey, moist to wet (very still	ff to		0									1111		3333	X	
	-	_	1	6 O			14 ^	4	111111						3 3 1 1	$\bigvee$	1
			`	6		96											
	-	86.1		Ö					1 1 1 2 2 3 3			17.5.7	1:13	·	4 6 1 1	X	
hann	Terminated @ 1.8 m depth	1	T													1	
NOTES:	e/Test Pit data requires Interpretation by Trow	WATER	R LE	EVEL RE	ECO	RDS				-	COF	RE DR	ILLII	NG R	ECORD	)	
	se by others  be backfilled upon completion of drilling	Elapsed Time		Water evel (m)		H	lole Ope To (m)		Run No.		Dept (m)			% Re	C.	R	QD %
4. See Not	rk supervised by a Trow representative es on Sample Descriptions ure is to read with Trow Associates Inc. report						÷*****										



Proje	ect No: OTGE00020336A	9 0.				-				•						-	
	Project: Geotechnical Investigation. Proposed ocation: Mer Bleue Road & Future Blackburn Proposed ocation: Mer Bleue Road & Future Blackburn Proposed ocation: January 13, 2010  Prill Type: Geodetic Elevation ogged by: Checked by:	ed Orleans	Fan	nily He	eal	lth H	ub (O	FHI	Ⅎ)		Figure No						
											Pa	ige.	_1	1_ of			
				Split Sp	005	Sam	nle			— 1	Comb	etible.	\/o=	our Pec	tina		_
	Typo:		Split Spoon Sample  Auger Sample						0	Natura	Moist	ure	our Read Content	ıng		)	
				SPT (N) Dynami			est	_	(	) -	Atterbe Undrai			al at	ŀ		-(
			-	Shelby	Tub	e				-	% Strai	n at Fa	ailur	e			(
-099	Checked by.			Shear S Vane Te		ngth b	У		5	-	Penetro						4
S Y		Geodetic	D	Sta	and	ard Pe	netration	n Tes	t N V	alue		stible \	Vapo 50	our Readi	ng (ppm) 50	S	1
GW BO	SOIL DESCRIPTION	Elevation m	Depth	Shear		ength	40	60		80 kPa	Na Atter	tural M berg Li	loistu imits	ure Conte (% Dry V	nt % Veight)	SAMPLING	i
111,	TOPSOIL ~200mm	88.1 87.9	0	6	50	551	100	150 144		200		20	4	0 6	50	Š	_
	SILTY CLAY  Brown to grey, moist to wet (very stiff to	4		0		331		<b>A</b>								W	
	stiff)			6				144							3.10	M	
			1												33.1.3		
		- 00.2		8 : .			6			1.1.2.2.2	+ + + + + + +	1-2-0	(+ 1 + (+ 1 +	- (- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	-0-0-1-0	- X	
m	Terminated @ 1.8 m depth	86.3	H		T	1111				1 : : : :	1:::::	1:::		* * * * * * * * * * * * * * * * * * * *		1	-
OTES:	S: hole/Test Pit data requires Interpretation by Trow	WATER	L	VEI R	EC:	OBD	<u> </u>		7		L	PE D	DII /	LING RE			_
before	e use by others	lapsed Time	\ \	Vater			Hole O		$\dashv$	Run	Dep	th	RILL	% Rec		RQ	Σ
3.Field v 4.See N	work supervised by a Trow representative  Notes on Sample Descriptions  Figure is to read with Trow Associates Inc. report  E00020336A	Jane	Le	vel (m)			_To (m	-		No.	(m	)					No.

WATER LEVEL RECORDS							
Elapsed Water Time Level (m)							
	-						

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



Pro	oiec	t No:	OTGE00020336A		,								-										_		-	, W
	ojec		Geotechnical Investigation. F	Proposed	Orleans	Far	nilv	Нο	alt	h H	uh /	(OF	НН	١		F	Figu	ıre i	No.	_		9		_		
	catio		Mer Bleue Road & Future Bla			. aı	у	, 10	با ا ل <u>ب</u>	11	an (	(01-	. 11 1					Pa	ge.	_	1_	of	1	_		
			'January 13, 2010			-		Spo er Sa		Samp de	ple								stible Mois				ling			□ <b>X</b>
	Ту		One delle Flancii			-		(N)		ue ne Te	oct			0			Atte	erbei	rg Lin	nits						0
	tum:		Geodetic Elevation			-		lby T			ESI						% 5	Straii	ned T n at F	ailur	re					$\oplus$
.og	gged	by:	Checked by	•				ar St e Te		gth b	У			+ S					Streng							<b>A</b>
	ş				Geodetic	D		Sta	nda	rd Pe	netra	ation 1	Test	N Va	lue		Co		stible	Vap	our R			om)	S	
G N L	SYMBOL		SOIL DESCRIPTION		Elevation	e p t h	Sh	ear S	0 Stren		40		60		80	kPa	Ι,	Na Atterl	tural it berg l	Moist Moist	00 ure C s (% l	Conte Dry W	50 nt % /eight	)	PI	Nat Jnit kN
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NOT	ES:					]	::	::	: :	::	: :	::		::	<u> </u> :	:::	1::	: :			::					
.Bo	rehole	e/Test Pit se by oth	data requires Interpretation by Trow lers	Elap	WATER		VEI Wat		CC			Ор	en		R	un		CO	RE E	RIL		G RE			RQ	D %
.Во	rehole	backfille	ed upon completion of drilling	Tim			evel			<u> </u>		(m)		-	N			(m)		+	/0	. 100			1100	
.Se	e Note	es on Sai	rised by a Trow representative mple Descriptions read with Trow Associates Inc. report																							



Project No: OTGE00020336A Figure No. Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH) 1 of 2 Page. Location: Mer Bleue Road & Future Blackburn Bypass Date Drilled: 'December 23, 2009 Split Spoon Sample  $\boxtimes$ Combustible Vapour Reading Auger Sample Natural Moisture Content X Drill Type: SPT (N) Value 0 Atterberg Limits  $\Theta$ Dynamic Cone Test Datum: Geodetic Elevation Undrained Triaxial at  $\oplus$ % Strain at Failure Shelby Tube Logged by: Shear Strength by Checked by: Shear Strength by Penetrometer Test Vane Test Standard Penetration Test N Value Combustible Vapour Reading (ppm) Geodetic 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) Natural G W L SOIL DESCRIPTION Elevation 20 Shear Strength Unit Wt. kN/m³ 87.8 TOPSOIL ~200 mm 87.6 168 SILTY CLAY X Brown to grey, moist to wet (very stiff to TROWOTTAWA.GDT 1/21/10 TOTALI THE PERICE PERICA PERICA PERICA PERICA PER 18.4 86.65 3 × 17.0 85.1 SILTY CLAY TO CLAY Grey, wet (firm) **?HW** × /Push 14.7 | s=12 /HW /HW: /HW 63 /Push Continued Next Page Borehole/Test Pit data requires Interpretation by Trow before use by others WATER LEVEL RECORDS CORE DRILLING RECORD Water Hole Open Run Depth % Rec. RQD % 2. A 19 mm slotted standpipe was installed in the Time Level (m) To (m) Completion 4.6 13 days 1.8 3. Field work supervised by a Trow representative 23 days 1.2 4. See Notes on Sample Descriptions 5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

BH 1 TO 9.

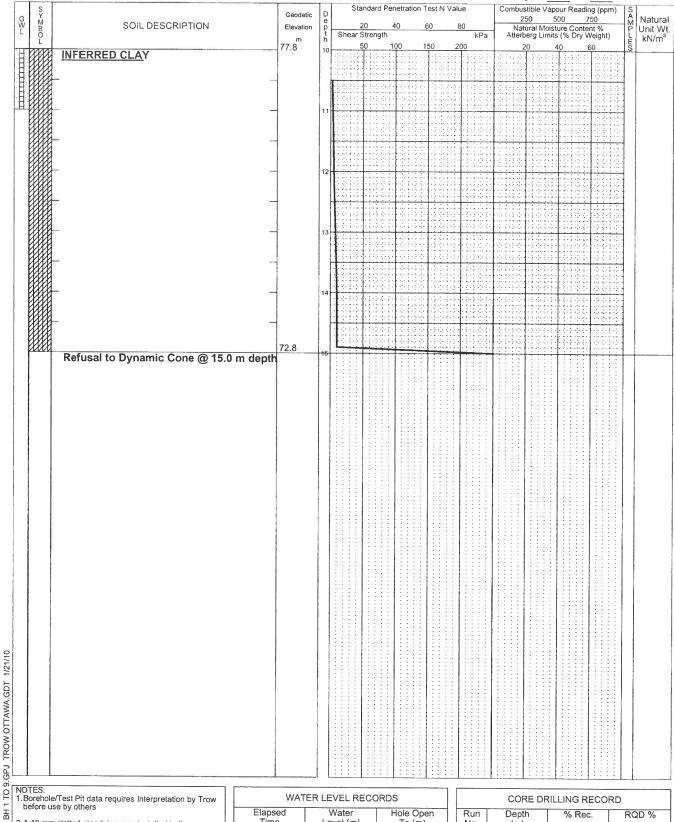
LOG OF



Project No: OTGE00020336A

Project: Geotechnical Investigation. Proposed Orleans Family Health Hub (OFHH) Figure No.

Page. 2 of



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

LOG OF BOREHOLE 5. This Figure is to read with Trow Associates Inc. report OTGE00020336A

WATER LEVEL RECORDS							
Elapsed Water Hole Open Time Level (m) To (m)							
Completion	4.6						
13 days	1.8	-					
23 days	1.2						

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

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

Final

# **APPENDIX B: One Dimensional Oedometer** (Consolidation) Test Results



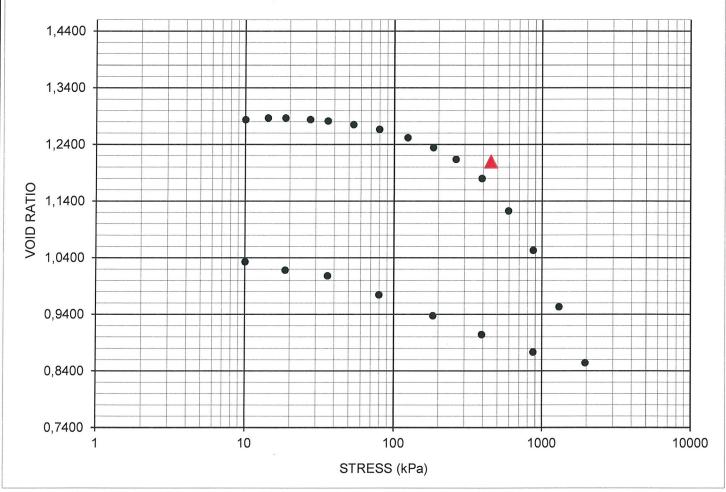


# One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

Client:	Client: Y/Project: OTT-00240904-A0							
Project :	EXP Ont	tario			Our file No. :	P-0011703-6-01		
Boring N	0. :	BH-19, TW-3	Sample No. :	3	Depth (m) :	1,80 to 1,90m		
Hydrosta	tic stress	s at the test (date)	:		Provided by ☐ the	client   Englobe		





### Geotechnical Characteristics of Soils:

Initial void ratio (e<sub>o</sub>): Recompression index (C<sub>r</sub>): 1,281 0,042 Virgin compression index (C<sub>c</sub>): Initial water content (w): 46,5% 0,57 Initial humid unit weight  $(\gamma_h)$ : 17,3 kN/m<sup>3</sup> Initial effective stress ( $\sigma'_v$ ): 32 kPa Initial saturation degree (S<sub>r</sub>): Preconsolidation pressure  $(\sigma'_p)$ : 450 kPa 99,8% 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 Boodma

Table

Adlane Bouadma, ing. jr. Famakhan Fainke, ing.

### DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "C," - MÉTHODE LENTE

Projet:

**EXP Ontario** 

Dossier: P-0011703-6-01

Sondage no: BH-19, TW-3

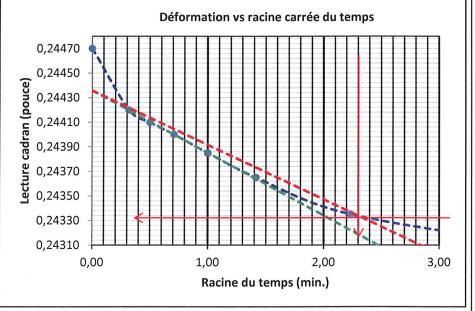
Echantillon no: 3

ESSAI A ENVIRON 50 % P'c							
Charge:	1,5 kg	53 kPa					
Temps T	Vτ	Déformation					
(min.)	(min.)	"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	<b>人们的人</b>					
National Association	5,48						
Lead Creation	5,48	Manager College					

Valeurs non corrigées p/r déformation du bâti

 $Cv = 0.848(H/2)^2/T90$ 

Lecture initiale (pce) = 0,2500 Lecture à D90 (pce) = 0,24334 Correction p/r bâti (pce) = 0,00640 Lecture corrigée (pce) = 0,24974 Déformation (pce) = 0,00026  $H_d$  (mm) = 9,43



Racine T90 = T90 (min) =lu sur graphe  $c_v (m^2/j) =$ e =

 $m_{v} (kPa^{-1}) =$ k (cm/s) =

2,3 lu sur graphe 5,29 2,05E-02 fin de palier 1,2753 1,59E-04 3,7E-08

1er ESSAI APRÈS P'c								
Charge:	3,5 kg	123 kPa						
Temps T	VT	Déformation						
(min.)	(min.)	"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	加美的"海人"的						
	5,48	Market State of						
	5,48	\$15700000						
(1) (1) (1) (1) (1)	5,48							

Valeurs non corrigées p/r déformation du bâti

 $Cv = 0.848(H/2)^2/T90$ 

Lecture initiale (pce) = 0,2500 0,23410 Lecture à D90 (pce) = Correction p/r bâti (pce) = 0,00900 Lecture corrigée (pce) = 0.24310 Déformation (pce) = 0,00690  $H_d$  (mm) = 9,34

lu sur graphe

			Défo	rmatio	on vs ra	acine	carre	ée d	u tei	mps				
	0,23800													
(e)	0,23700													
ran (po	0,23600			1	-									
Lecture cadran (pouce)	0,23500						1	1	13					
Lect	0,23400									./ ./	, ,			-
	0,23300											V		
	0,	00		1,00	)			2,0	00				3,0	0
				Ra	cine d	u tem	ıps (r	min.	)					

Racine T90 = T90 (min) = $c_v (m^2/j) =$ e =

 $m_v (kPa^{-1}) =$ 

k (cm/s) =

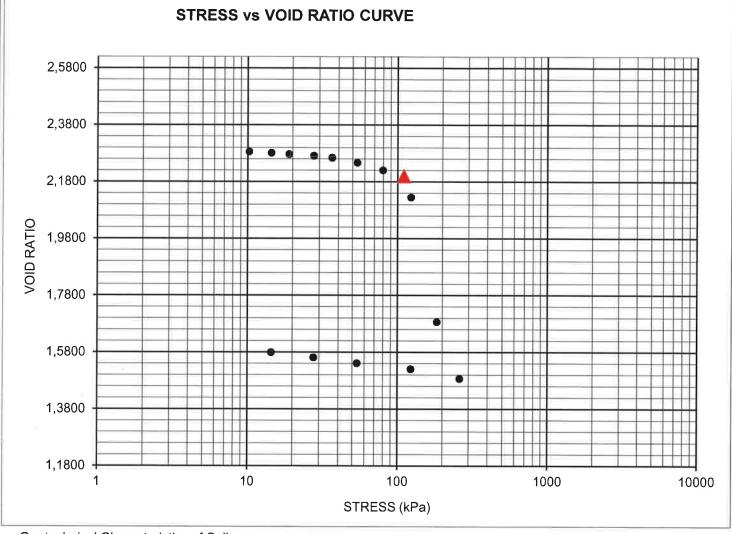
2,7 lu sur graphe 7,29 1,46E-02 1,2521 1,50E-04 2,5E-08



## **One-Dimensional Consolidation Properties** of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

Client:	EXP On	tario			Date :	2017-07-16
Project:	Y/ Proje	ect: OTT-00240904-A	A0		Our file No. :	P-0011703-6-01
Boring N	o. : _	BH-47, TW-11	Sample No. :	4	Depth (m):	11,0 to 11,10m
Hydrosta	tic stres	s at the test (date) :			Provided by   the	client   Englobe



### Geotechnical Characteristics of Soils:

Initial void ratio (e<sub>o</sub>):

Initial void ratio (e <sub>o</sub> ):	2,289	Recompression index (C <sub>r</sub> ):	0,032
Initial water content (w):	82,8%	Virgin compression index (C <sub>c</sub> ):	1,95
Initial humid unit weight $(\gamma_n)$ :	15,0 kN/m <sup>3</sup>	Initial effective stress ( $\sigma'_v$ ):	85 kPa
Initial saturation degree $(S_r)$ :	99,5%	Preconsolidation pressure (σ'ρ):	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 :	Verified by :
	touth
Adlane Bouadma, ing. jr	Famakhan Fainke, ing.

EQ-09-IM-274 Rev. 04 (13-10)

### DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "C," - MÉTHODE LENTE

Projet:

Y/ Project: OTT-00240904-A0

Sondage no: BH-47, TW-11

Echantillon no:

Dossier: P-0011703-6-01

ESSAI A ENVIRON 50 % P'c Charge: 1,5 kg 54 kPa Temps T Vτ Déformation "D" (po)\* (min.) (min.) 0,00 0,24080 0,00 0,32 0,10 0,23990 0,25 0,50 0,23960 0,50 0,71 0,23940 1,00 0,23910 1,00 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

 $Cv = 0.848(H/2)^2/T90$ 

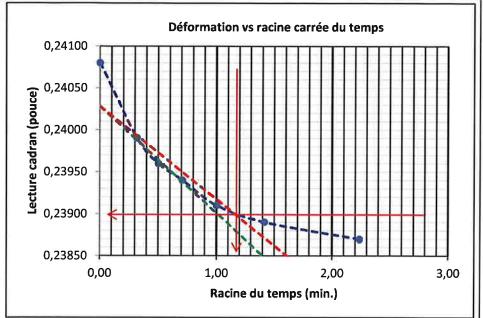
Lecture initiale (pce) = Lecture à D90 (pce) = Correction p/r bâti (pce) =

Lecture corrigée (pce) = Déformation (pce) =

 $H_d$  (mm) =

0,2500 0,23900 0,00450 0,24350 0,00650

9,33



lu sur graphe

T90 (min) = $c_v (m^2/j) =$ e =  $m_{v} (kPa^{-1}) =$ k (cm/s) =

Racine T90 =

1,15 lu sur graphe 1,3225 8,04E-02

2,2468 fin de palier 3,02E-04

2,7E-07

Charge:	3,5 kg	123 kPa
Temps T	٧T	Déformation
(min.)	(min.)	"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	A 14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
30,00	5,48	
	5,48	
	5,48	
	5,48	

 $Cv = 0.848(H/2)^2/T90$ 

3,5 kg	123 kPa
٧T	Déformation
(min.)	"D" (po)*
0,00	0,22900
0,32	0,22700
0,50	0,22630
0,71	0,22580
1,00	0,22520
1,41	0,22440
2,24	0,22320
3,87	
5,48	
5,48	
5,48	
5,48	
gées p/r déform	nation du bâti

Lecture initiale (pce) =	0,2500	
Lecture à D90 (pce) =	0,22500	lu sur graphe
Correction p/r bâti (pce) =	0,00710	
Lecture corrigée (pce) =	0,23210	<del></del> -
Déformation (pce) =	0,01790	<del></del>
$H_a$ (mm) =	9.19	<del>-</del> 8

Déformation vs racine carrée du temps 0,23000 0,22900 ecture cadran (pouce) 0,22800 0,22700 0,22600 0,22500 0,22400 0,22300 0,00 1.00 2,00 3,00 Racine du temps (min.)

> Racine T90 = 1,1 lu sur graphe T90 (min) =1.21  $c_v (m^2/j) =$ 8,52E-02 2,1253  $m_v (kPa^{-1}) =$ 6,83E-04 k (cm/s) =6,6E-07

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

Final

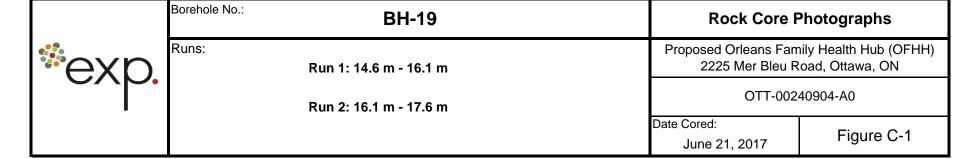
# **APPENDIX C: Bedrock Core Photographs**



### DRY BEDROCK CORES







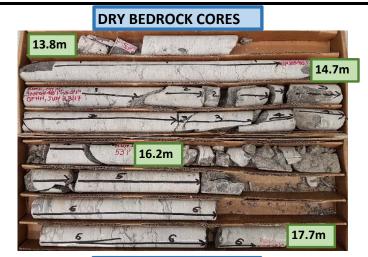
### DRY BEDROCK CORES







Borehole No.:  BH-22  Rock Core Photograph			Photographs	
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







Borehole No.:	BH-31 Rock Core Photographs			Photographs
Runs: Run 1: 13.8 m - 14.7 m		Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON		
	Run 2: 14.7 m - 16.2 m		OTT-00240904-A0	
	Run 3: 16.2 m - 17.7 m		Date Cored: June 22, 2017	Figure: C-3

# 14.7m 15.8m 17.4m Ruk3 of Fills 17.4m Ruk3 of Fills 19.0m





Borehole No.: BH-41		Rock Core Photographs		
Runs: Run 1: 14.7 m - 15.8 m		Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON		
Run 2: 15.8 m - 17.4 m Run 3: 17.4 m - 19.0 m			OTT-00240904-A0	
			Date Cored: June 26, 2017	Figure: C-4

### **DRY BEDROCK CORES**







Borehole No.: BH-47			Rock Core Photographs	
Runs: Run 1: 14.8 m - 16.1 m Run 2: 16.1 m - 17.2 m		Prop	Proposed Orleans Family Health Hub (OFHH) 2225 Mer Bleu Road, Ottawa, ON	
		OTT-00240904-A0		
	Run 3: 17.2 m - 18.8 m	Date Co	ored: une 23, 2017	Figure: C-5

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

Final

**Appendix D: Shear Wave Velocity Survey Report** 





100 – 2545 Delorimier Street Tel.: (450) 679-2400 Longueuil (Québec) Fax: (514) 521-4128 Canada J4K 3P7 info@geophysicsgpr.com www.geophysicsgpr.com

February 5<sup>th</sup>, 2018

Transmitted by email: <a href="mailtaki@exp.com">ismail.taki@exp.com</a>

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 25<sup>th</sup>, 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<sub>S</sub>) 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  $V_S$  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 SeislmagerSW™ 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 shearwave 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  $\mu$ s for the MASW surveys, and 4096 data, sampled at 50  $\mu$ s 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 ( $\pm$  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<sub>S</sub> 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  $\overline{V}_{\rm S30}$  value for the Site Class determination. The  $\overline{V}_{\rm S30}$  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 <  $\overline{V}_{S30}$  ≤ 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  $\overline{V}_{s_{30}}$  value.

The  $V_{\text{S}}$  values calculated are representative of the in situ materials, and are not corrected for the total and effective stresses.

Jean-Luc Arsenault, P.Eng., M.A.Sc.

Project Manager





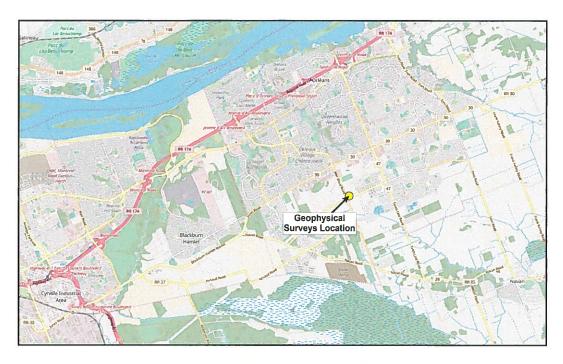


Figure 1: Regional location of the Site (source: OpenStreetMap®)



Figure 2: Location of the seismic spreads (source: *Google Earth*™)



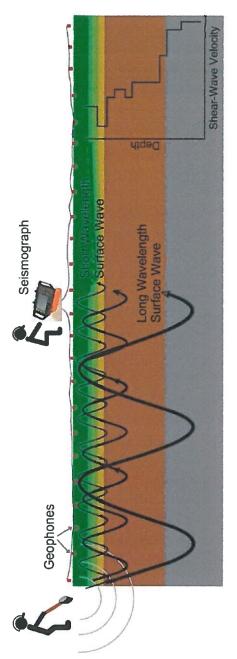


Figure 3: MASW Operating Principle

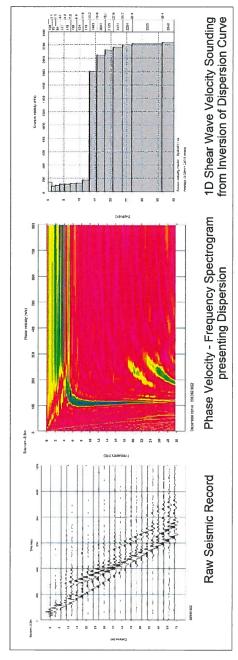
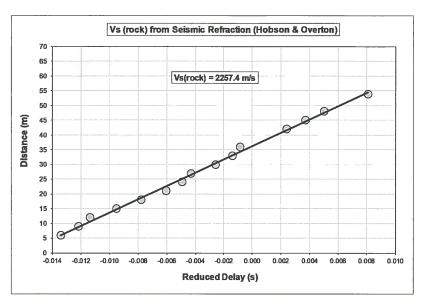


Figure 4: Example of a MASW/ESPAC record, Phase Velocity - Frequency curve and resulting 1D Shear Wave Velocity Model





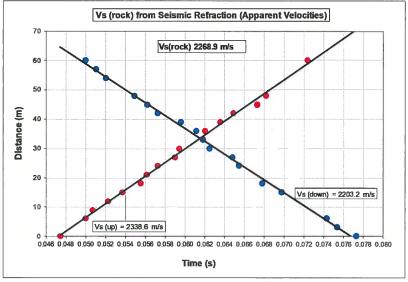


Figure 5: Rock V<sub>S</sub> from Seismic Refraction



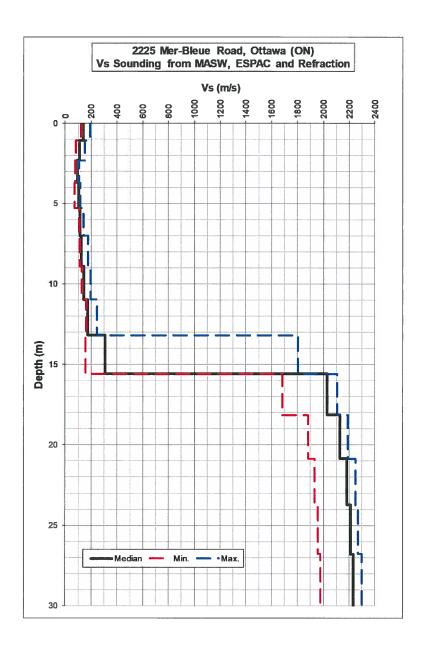


Figure 6: MASW Shear-Wave Velocities Sounding



 $\frac{\text{TABLE 1}}{V_{S30}} \text{ Calculation for the Site Class}$ 

Donth		Vs		Thickness	Cumulative	Delay for	Cumulative	Vs at given
Depth	Min.	Median	Max.	Thickness	Thickness	Med. Vs	Delay	Depth
(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 <sub>S30</sub> (m/s)	245.7
Class	D (1)

<sup>(1):</sup> Geotechnical assessment should be realized for the low seismic velocities materials located from the surface to approximately 13 metres deep.

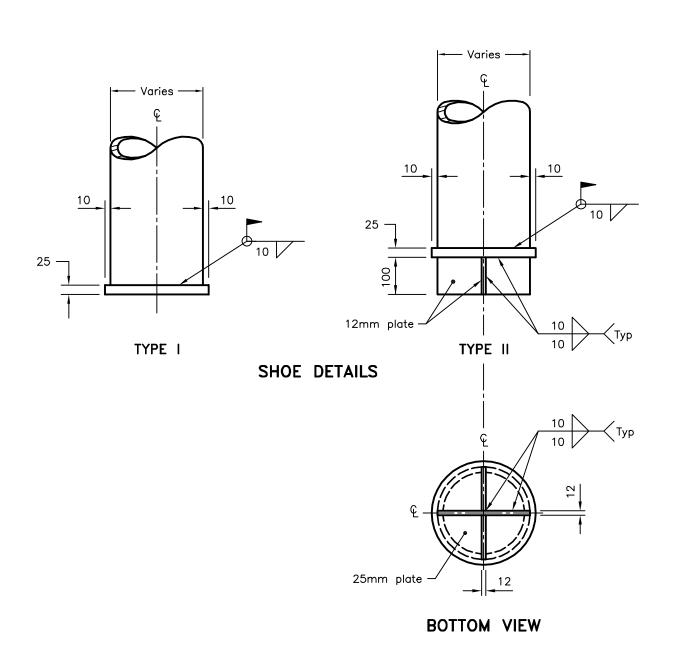


Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

Final

APPENDIX E: Ontario Provincial Standard Drawing (OPSD) 3001.100, Type II, dated November 2010





### **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
	1 01 00 001.100

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0
Date: March 14, 2018

Final

## **APPENDIX F: AGAT Certificate of Laboratory Analysis**





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 (V1)

\*NOTEC

Page 1 of 5

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.



**CLIENT NAME: EXP SERVICES INC** 

**SAMPLING SITE:Orleans Family Health Hub** 

**Certificate of Analysis** 

**AGAT WORK ORDER: 17Z236289** 

PROJECT: OTT-240904-A0

**ATTENTION TO: Susan Potyondy** 

SAMPLED BY:exp

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

#### **Inorganic Chemistry (Soil)**

DATE RECEIVED: 2017-07-12						ED: 2017-07-18	07-18				
							BH 15 SS3	BH 18 SS3	BH 19 SS3	BH 22 SS7	BH 31 SS9
SAMPLE DESCRIPTION: BH 1 SS3 (5-7ft) BH 5 SS3 (5-7ft) BH 7 SS3 (5-7ft)					(5-7ft)	(5-7ft)	(5-7ft)	(15-17ft)	(25-27ft)		
SAMPLE TYPE: Soil Soil				Soil	Soil	Soil	Soil	Soil	Soil		
		DATE	DATE SAMPLED: 20		2017-06-21 2017-06-27		2017-06-30	2017-06-27	2017-06-21	2017-06-26	2017-06-22
Parameter	Unit	G/S	RDL	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

				BH 41 SS11	BH 47 SS12	
	S	AMPLE DESC	CRIPTION:	(35-37ft)	(40-42ft)	
		SAMPLE TYPE:		Soil	Soil	
		DATE S	AMPLED:	2017-06-26	2017-06-23	
Parameter	Unit	G/S	RDL	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



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

## **Quality Assurance**

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 17Z236289
ATTENTION TO: Susan Potyondy

PROJECT: OTT-240904-A0

SAMPLED BY:exp

SAMPLING SITE:Orleans Family Health Hub

	Soil Analysis														
RPT Date:			DUPLICATE F			REFERENCE MATERIAL			METHOD	BLANK	SPIKE	MATRIX SPIKE			
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured		ptable nits	Recovery	Lin	ptable nits	Recovery	Acceptable Limits	
		ld					Value	Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Soil)															
pH, 2:1 CaCl2 Extraction	8548877 8	3548877	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



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

## **Method Summary**

SAMPLED BY:exp

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 17Z236289

PROJECT: OTT-240904-A0

ATTENTION TO: Susan Potyondy

SAMPLING SITE:Orleans Family Health Hub

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



# **AGGAT** Laboratories

5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2

Ph: 905.712.5100 Fax: 905.712.5122 webearth.agatlabs.com

Work Order #:		0	1
Cooler Quantity:	ne. n	ש וכנ	
Arrival Temperatures:	18.41	18.5	18.5
1 Blue;	8.3	8.91	8.5
Custody Seal Intact:	□Yes	□No	□N/A
Neton			

177236289

**Laboratory Use Only** 

Chain of Custody Record If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable wa								vater int	ended fo	or human co	nsumpti	on)	Arriv		pera	tures:				8.5	18,	
Report Information:	ces In	د		Re (Pies	Regulatory Requirements:   [] No Regulatory Requirement (Please check all applicable boxes)							ent								]N/		
Contact:	censulew	Deive			Regulation 153/04 Table	☐ Sewe			□ Re	gulation s	58					Tim		/	equi			
Phone:  Reports to be sent to:		-	□Ind/Com □Res/Park □Agriculture	□Storm		1110		Prov. Water Quality Objectives (PWQO)			Regular TAT  Rush TAT (Rush Surchs			Surchnr			Busine	ess Day	s			
1. Email: Susan potyon	dy @ex	P.Com		Soi	il Texture (Check One) ☐Coarse ☐Fine	RegionIndic	ate One		Ot	her Indicate C	ne			Day			ired (R	2 Bus Days tush Si		☐ ges Ma	Next Bus Day Apply):	sine
Project Information:  Project:  Site Location:  Sampled By:				R	Is this submission for a Report Guideline on Certificate of Analysis  Yes No Yes No No Please provide prior notification for *TAT is exclusive of weekends and status  For 'Same Day' analysis, please contact you								statuto	ory holidays								
AGAT Quote #:  Please note: If quotation number is	PO:	vill be billed full price	for analysis	Sa	ample Matrix Leg	gend	, CrVI		O. Reg (sep)	153								PCBs				
Invoice information:  Company: Contact: Address: Email:	270	Bill To Same:	Yes No		V Ground Water Oil Paint Soil O Sediment		Field Filtered - Metals, Hg,	Inorganics	☐ 153 Metals stals	□ B-HWS □ CI: □ CN: □ EC □ FOC □ Hg □ SAR	Full Metals Scan Regulation/Custom Metals	OTP ONH OTKN	0 voc	Fractions 1 to 4		Total	Pesticides	ki □vocs □ABNs □B(a)P		phyles	5:54:0:4y	
Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Commer Special Instr		Y/N	etals	☐ All Metals ☐ Hydride Me	ORPs:	Full Metals	Nutrients:	Volatiles:	ABNS ABNS	PAHs		Organochlorine	TCLP: ☐ M&I	4	541p	5 2	
BH 1 55 3 (5-794)																			1	1	11	
BH 7 55 3 (5-701)																						
RH 15 553 (5-701)											- 1							4				
RH19 SS 3 (5-791)																						
BH 22 SS7 (15-1791)																						
RH 71 559 (25-2764)	1							-														

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sugar	Ditte Time	
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Samples Relinquished By (Print Denedand Sign);	Date 11/17 Date 1 - 17	Time	Samples Received By (Print Name and Sign):  Samples Received By (Print Name and Sign):  Samples Received By (Print Name and Sign):	Date Time	Page of/
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Nº: 1 041766

Client: Montfort Hospital c/o ZW Project Management Inc.
Project Name: Geotechnical Investigation, Proposed Orleans Family Health Hub (OFHH)
Location: 2225 Mer Bleue Road, Ottawa, (formerly Orleans), Ontario
Project Number: OTT-00240904-A0

Date: March 14, 2018

Final

## **List of Distribution**

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