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Geotechnical Engineering

Environmental Engineering

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Materials Testing

Building Science

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Geotechnical Investigation

Proposed Multi-Storey Complex 801 Albert Street Ottawa, Ontario

Prepared For

Trinity Development Group

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Report PG3272-2 Revision 1

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Trinity Development Group to conduct a geotechnical investigation for the proposed multi-storey complex to be located at 801 Albert Street in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were to:

- determine the subsurface soil, bedrock and groundwater conditions by means of boreholes.
- □ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

It is understood that the proposed complex is to consist of two 30 storey office buildings with a retail complex in the lower levels. Final design and parking requirements have not been finalized prior to issuing this report. It is expected that underground parking will be approximately 2 to 3 levels. The footprint of the parking garage will extend to the property boundaries.

It is also our understanding that consideration may be given to expanding the complex and building over the existing O-Train alignment and provide access to the station.

Due to existing servicing easements within the boundaries of the subject site will either be relocated to accommodate the parking garage or will remain in place and will be included in the design.



3.0 Method of Investigation

3.1 Field Investigation

Field Program

The initial field program for the geotechnical investigation was conducted on June 4, 5, 6 and July 24, 2014. At that time a total of 4 boreholes were advanced to a maximum depth of 33 m below existing ground surface. In addition, a total of 10 test pits were advanced to a maximum depth of 3.7 m below existing ground surface on June 11, 2014.

A supplemental field program was conducted on April 15 and 16, 2015. At that time a total of 8 boreholes were advanced to a maximum depth of 16.4 m below existing ground surface. Along the existing bridge embankment along the north property boundary, a hydraulic shovel was used to create a platform to support a track mounted drill using the excavated material. Once the boreholes were completed the excavated platform was reinstated using the excavated material.

The boreholes for the current investigation were completed with a track mounted drill rig operated by a two-person crew on November 13, 16, 17, 18, 22, 23, 25 and 26, 2015. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The drilling procedure consisted of hollow stem augering to the required depths at select locations, sampling and testing the overburden.

Previous test holes carried out by others were also used to supplement this investigation and the borehole logs are appended to this report.

Sampling and In Situ Testing

Soil samples from the boreholes were recovered from a 50 mm diameter split-spoon, the auger flights or grab samples. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets.

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

Diamond drilling was completed at 22 locations, BH 1, BH 2, BH 3, BH 4, BH 2-15, BH 3-15, BH 4-15, BH 5-15 and BH 6-15, BH 9-15 to BH 22-15 to confirm the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are presented as RC on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio of the bedrock sample length recovered over the drilled section length, in percentage. The RQD value is the total length ratio of intact rock core length more than 100 mm in one drilled section over the length of the drilled section, in percentage. These values are indicative of the quality of the bedrock.

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

Groundwater

Piezometers were installed in all boreholes to permit the monitoring of water levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The current and supplemental test hole locations were selected by Paterson personnel to provide general coverage of the subject site. The test hole locations and elevations were surveyed in the field by Stantec Geomatics to a geodetic datum. The initial test hole locations were selected and determined in the field by Paterson personnel to provide general coverage of the subject site. The test hole locations and elevations were surveyed in the field by Paterson. A manhole cover was used as a temporary benchmark with an assumed geodetic elevation of 56.03 m.

The location and ground surface elevation at each test hole location is presented on Drawing PG3272-3 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil and bedrock samples recovered from the subject site were visually examined in our laboratory to review the field logs.

3.4 Analytical Testing

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



4.0 Observations

4.1 Surface Conditions

The subject site is currently vacant. The ground surface is relatively flat and covered with grass, brush and mature trees. A gravel access road runs east-west along the south property boundary, which provides access to the existing fibre optic shelter structure at the southwest corner of the site. The existing railway corridor and multiuse pathway run along the west property boundary of the subject site and Albert Street runs along the north side of the subject site. The alignment of Albert Street adjacent to the subject site is elevated above the subject site due to the bridge embankment for the Albert Street overpass above the existing railway corridor.

4.2 Subsurface Profile

Overburden Conditions

Generally, the subsurface profile at the borehole locations consists of varying fill material overlying a silty clay and/or silty sand and glacial till deposit. The silty clay, where encountered, was noted to be firm to stiff in consistency based on the testing results. The glacial till deposit overlies an interbedded limestone and shale bedrock. The glacial till layer was noted to consist of a fine soil matrix varying between a silty clay to silty sand mixed with sand and gravel, cobbles and boulders.

The fill material varies between a silty clay to a silty sand with organics, debris, railway bed fill, crushed stone, gravel, cobbles and boulders. The fill extended from 2.3 to 8.1 m below the existing grade. Also, remnants of the former rail lines were encountered within the fill areas at several locations.

Bedrock

Bedrock was encountered at all borehole locations, at geodetic elevations between 44.5 to 49.6 m. The bedrock recovered from the borehole locations consisted of an interbedded grey limestone and shale. Based on the RQD values from the cores recovered, the majority of the bedrock appears to be of fair to good quality within the upper 1 m of the bedrock surface. The bedrock quality increases to excellent quality approximately 1 m below the bedrock surface.

Based on available geological mapping, bedrock in the area of the subject site consists of interbedded limestone and shale of the Verulam Formation.

4.3 Groundwater

Groundwater monitoring wells were installed at BH 9-15 to BH 18-15, BH 1, BH 2, BH 3 and BH 4 to measure groundwater levels. The groundwater levels that were measured in the monitoring wells on December 1, 2015 for our current investigation and water levels measured on June 17, 2014 and on July 31, 2014 at the original monitoring well locations are summarized in Table 1. The groundwater level is subject to seasonal fluctuations and therefore, groundwater levels could vary at the time of construction.

Table 1 - Groundwater Level Readings												
Borehole	Ground	Donth of	Groundw	ater Levels								
Number (m)	Elevation (m)	Depth of Screen (m)	Depth (m)	Elevation (m)	Recording Date							
BH 1	56.35	13.4 - 16.4	3.12	53.23	June 16, 2014							
БПІ	50.35	13.4 - 10.4	3.36	52.99	July 31, 2014							
BH 2	55.22	15.1 - 18.1	7.68	47.54	June 16, 2014							
вп 2	55.22	15.1 - 16.1	7.01	48.21	July 31, 2014							
DU 2	EE 00	15.0 18.0	1.84	53.78	June 16, 2014							
BH 3	55.62	15.0 - 18.0	July 31, 2014									
BH 4	55.21	30.2 - 33.2	1.91	53.30	July 31, 2014							
BH 9-15	57.12	54.1 - 51.1	3.81	53.31	December 1, 2015							
BH 10-15	56.29	47.7 - 46.2	3.52	52.77	December 1, 2015							
BH 11-15	55.94	48.9 - 45.8	1.92	54.02	December 1, 2015							
BH 12-15	55.15	53.55 - 50.55	2.08	53.07	December 1, 2015							
BH 13-15	55.02	53.8 - 50.8	1.92	53.10	December 1, 2015							
BH 14-15	54.81	52.4 - 50.0	2.09	52.72	December 1, 2015							
BH 15-15	55.06	45.0 - 43.7	2.02	53.04	December 1, 2015							
BH 16-15	55.01	52.8 - 50.1	2.02	52.99	December 1, 2015							
BH 17-15	55.02	52.8 - 50.1	2.02	53.00	December 1, 2015							
BH 18-15	60.11	52.5 - 50.7	5.56	54.55	December 1, 2015							

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the proposed multistorey complex. The proposed buildings are expected to be founded on conventional spread footings placed on a clean, surface sounded bedrock.

Bedrock removal will most likely be required to complete a portion of the underground parking levels. Line drilling and controlled blasting where large quantities of bedrock need to be removed is recommended. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations. A vibration monitoring program should be implemented and monitored by the geotechnical consultant to confirm that the controlled blasting program does not negatively impact the existing watermain running along the south property boundary of the subject site.

Control and management of the groundwater will be required for the lower parking garage levels. A waterproofing system in combination with a back-up drainage system, consisting of underfloor drainage and perimeter drainage systems, will be required for the portion of the building extending below the long term groundwater table.

It is understood that a temporary shoring system will be in place during the excavation program for the proposed structure. The temporary shoring system will consist of a series of interlocking sheet piles supported by tiebacks anchored into the bedrock along the south property boundary adjacent to the existing 1200 mm diameter watermain. Based on our review of the current design shoring drawings available at the time of issuance of this report, the temporary shoring will provide adequate support of the soils below the existing watermain and limit dewatering of the soils in the immediate area. It is recommended that a periodic survey of selected locations along the adjacent watermain alignment be completed by a legal surveyor to verify that the watermain alignment is not being negatively impacted by the excavation work for the proposed complex.

As part of the proposed development, the relocation of the existing deep services within the boundaries of the subject site is anticipated.

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

5.2 Site Grading and Preparation

Stripping Depth

Due to the anticipated number of underground parking levels and depth of the bedrock at the subject site, it is anticipated that all existing overburden material will be excavated from within the proposed building footprint. Bedrock removal will be required for the construction of the parking garage levels.

Bedrock Removal

Based on the volume of the bedrock encountered in the area, it is expected that linedrilling in conjunction with hoe-ramming and controlled blasting will be required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

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

As a general guideline, peak particle velocity (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

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

Excavation side slopes in sound bedrock can be completed with almost vertical side walls. A minimum of 1 m horizontal bench, should remain between the bottom of the overburden and the top of the bedrock surface to provide an area for potential sloughing or to provide a stable base for the overburden shoring system.

Vibration Considerations

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

The following construction equipments could be the source of vibrations: piling equipment, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the shoring system with soldier piles or sheet piling will require the use of these equipments. Vibrations, whether it is caused by blasting operations or by construction operations could be the cause of the source of detrimental vibrations on the adjacent buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the permissible vibrations, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards.

These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

Rock Stabilization

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

The requirement for horizontal rock anchors will be evaluated during the excavation operations and should be discussed with the structural engineer during the design stage.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in maximum of 300 mm thick loose lifts and compacted using suitable compaction equipment. Fill placed beneath the buildings should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).



Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

5.3 Foundation Design

Bearing Resistance Values

For the most part, footings will be founded on the sound bedrock. A factored bearing resistance value at ULS of **4,500 kPa**, incorporating a geotechnical resistance factor of 0.5, and a bearing resistance value at SLS of **3,000 kPa** is available for footings founded on limestone bedrock which is free of seams, fractures and voids within 1.5 m below the founding level. This should be verified by completing and probing 50 mm diameter drill holes to a depth of 1.5 m below the founding level within the all the footing footprints. A minimum of one probe hole should be completed per major footing. The drill hole inspection should be completed by the geotechnical consultant.

Footings for auxiliary structures founded at a higher elevation within the silty clay or glacial till can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **250 kPa**, incorporating a geotechnical resistance factor of 0.5, and a bearing resistance value at serviceability limit states (SLS) of **150 kPa**.

Settlement

Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Lateral Support

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

5.4 Design for Earthquakes

A site specific shear wave velocity test was completed to accurately determine the applicable seismic site classification for foundation design of the proposed building as presented in Table 4.1.8.4.A of the Ontario Building Code 2012. A seismic shear wave velocity test was completed by Paterson at the subject site. Two shear wave velocity profiles are presented in Appendix 2.

Field Program

The shear wave test location is presented in Drawing PG3272-3 - Test Hole Location Plan in Appendix 2. Paterson field personnel installed 24 horizontal geophones in a straight line oriented roughly in a north-south direction along the east site boundary. The 4.5 Hz. horizontal geophones were mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 1 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was connected to a computer and a trigger switch attached to a 12 pound dead blow hammer. The hammer trigger sends a signal to the seismograph to commence recording. The hammer strikes an I-Beam seated into the ground surface, which produces a polarized shear wave. The shots are repeated between four to eight times at each shot location to provide an accurate signal and reduce noise. The shot locations are completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were distributed at the centre of the geophone array and 4, 5 and 30 m away from the first and last geophone.

The test method completed by Paterson are guided by the standard test procedures outlined by expert seismologists at Carleton University and Geological Survey of Canada (GSC).



Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson. The shear wave velocity measurement was calculated by the reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30} , immediately below the proposed buildings foundation of the upper 30 m profile. To compute the bedrock depth at each location, the layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave graphs. The bedrock velocity was interpreted by the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. As bedrock quality increases, the bedrock shear wave velocity increases.

Based on our analysis, the bedrock seismic shear wave velocity was calculated to be 1,900 m/s. The V_{s30} was calculated using the standard equation for average shear wave velocity from the Ontario Building Code (OBC) 2012, as presented below;

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$
$$V_{s30} = \frac{30m}{\left(\frac{0m}{322m/s} + \frac{30m}{1,900m/s}\right)}$$
$$V_{s30} = 1,900m/s$$

Based on the seismic results, the average shear wave velocity, V_{s30} , for shallow foundations located at the subject site is 1,900 m/s. Therefore, a **Site Class A** is applicable for design of the proposed building at the subject site, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Basement Slab

For the subject site development, all overburden soil should be removed from the subject site and the basement floor slab will be founded on a bedrock medium. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. For the proposed parking garage slab, 300 mm of OPSS Granular A should be considered to support the vehicle traffic loads.

In consideration of the groundwater conditions encountered at the time of the fieldwork, a subfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear stone backfill under the lower basement floor.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m³. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3 , where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Two (2) distinct conditions, static and seismic, must be reviewed for design calculations. The parameters for design calculations for the two (2) conditions are presented below.

Static Conditions

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

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

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

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

Seismic Conditions

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

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

- $a_c = (1.45 a_{max}/g)a_{max}$
- γ = unit weight of fill of the applicable retained soil (kN/m³)
- H = height of the wall (m)
- $g = gravity, 9.81 \text{ m/s}^2$

The peak ground acceleration, (a_{max}) , for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using P_o = 0.5 K_o γ H², where K_o = 0.5 for the soil conditions noted above.

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

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

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Rock Anchor Design

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

A third failure mode of shear failure along the grout/steel interface should be reviewed by a qualified structural engineer to ensure all typical failure modes have been reviewed. Typical rock anchor suppliers, such as Dywidag Systems International (DSI Canada) or Williams Form Engineering, have qualified personnel on staff to recommend appropriate rock anchor size and materials.

The centre to centre spacing between bond lengths should be a minimum of 1.2 m or four times the anchor hole diameter to ensure the group influence effects are minimized. Anchors in close proximity to each other are recommended to be grouted at the same time to ensure any fractures or voids are completely in-filled and grout fluid does not flow from one hole to an adjacent empty one.

Anchors can be of the "passive" or the "post-tensioned" type, depending on whether the anchor tendon is provided with post-tensioned load or not, prior to servicing.

Regardless of whether an anchor is a passive or the post tensioned type, it is recommended that the anchor is provided with a fixed anchor length at the base, which will provide the capacity, and a free anchor length between the rock surface and the top of the bonded length. As the depth at which the apex of the shear failure cone develops midway along the bonded length, a fully bonded anchor would tend to have a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is limited to the bottom part of the overall anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, this requires that the entire drill hole be filled with cementitious grout. The free anchor length is provided by installing a sleeve to act as a bond break, with the sleeve filled with grout. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems International or Williams Form Engineering Corp.

Grout to Rock Bond

The unconfined compressive strength of limestone bedrock ranges between 65 and 125 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, should be provided. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

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

Recommended Grouted Rock Anchor Lengths

Parameters used to calculate grouted rock anchor lengths are provided in Table 2.

Table 2 - Parameters used in Rock Anchor Review											
Grout to Rock Bond Strength - Factored at ULS	1 MPa										
Compressive Strength - Grout	40 MPa										
Rock Mass Rating (RMR) - Good quality Limestone Hoek and Brown parameters	69 m=0.575 and s=0.00293										
Unconfined compressive strength - Limestone	65 MPa										
Effective unit weight - Bedrock	15 kN/m ³										
Apex angle of failure cone	60°										
Apex of failure cone	mid-point of fixed anchor length										

The fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths are provided in Table 3. The factored tensile resistance values provided are based on a single anchor with no group influence effects.

Table 3 - Recommended Rock Anchor Lengths - Grouted Rock Anchor										
Diameter of	A	Factored Tensile								
Drill Hole (mm)	Bonded Length	Unbonded Length	Total Length	Resistance (kN)						
	1.9	0.8	2.7	500						
75	2.6	1	3.6	750						
75	75 2.6 3.2	1.2	4.4	1000						
	4.5	2	6.5	1500						
	1.6	0.6	2.2	500						
	2	1	3	750						
125	2.2	1.3	3.5	1000						
	3	1.8	4.8	1500						

Other considerations

It is recommended that the anchor drill hole diameter be within 1.5 to 2 times the rock anchor tendon diameter. The anchor drill holes should be inspected by geotechnical personnel and should be flushed clean prior to grouting. A tremie pipe is recommended to place grout from the bottom to top of the anchor holes.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on test procedures can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

5.8 Pavement Structure

Asphalt pavement is not anticipated to be required at the subject site. However, should pavement be considered for the project, the recommended pavement structures shown in Tables 4 and 5 would be applicable.

Table 4 - Recommended Pavement Structure - Car Only Parking Areas											
Thickness (mm)	Material Description										
50	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete										
150	BASE - OPSS Granular A Crushed Stone										
300	SUBBASE - OPSS Granular B Type II										
	SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil										

	Table 5 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas										
Thickness (mm)	Material Description										
40	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete										
50	Binder Course - HL-8 or Superpave 19.0 Asphaltic Concrete										
150	BASE - OPSS Granular A Crushed Stone										
400	SUBBASE - OPSS Granular B Type II										
	SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil										

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be sub-excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the SPMDD with suitable vibratory equipment.

5.9 Relocation of Deep Services

Various scenarios are being contemplated for the relocation of the existing deep services. Since the piping is significant and considered relatively aged and in moderate condition, any consideration to leaving the pipes in place will require caution with the excavation, construction and containment of the pipe backfill.

For piping founded directly on bedrock outside the building footprint, relocating the service onto similar bedrock will be acceptable. Building construction will be similar to any conventional shored excavation approach.

Piping remaining along the easements adjacent to the proposed foundation will require adequate stabilization to prevent long term movement especially if founded within the overburden. It is expected that heavy gauge sheet piling will be used to support the excavation sidewalls within the overburden material all the way down to the underlying bedrock. Whalers and tie backs will provide lateral stability to aid in the support of the existing piping. The sheet piling will remain in place especially if the foundation wall is blind poured against the shoring system.

Once the final alternative is selected, Paterson will conduct a further review and will provide more detailed information once the founding depth and proximity to the proposed building foundation is determined.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is understood that the portion of the proposed building foundation walls located below the long-term groundwater table will be placed against a groundwater infiltration control system. Also, a perimeter foundation drainage system will be required as a secondary system to account for any groundwater, which comes in contact with the proposed building's foundation walls.

For the groundwater infiltration control system for the foundation walls, the following is suggested:

- Temporary shoring along the excavation perimeter or line drill below the bedrock surface along the excavation perimeter.
- A waterproofing product should be applied to the temporary shoring face to at least 1 m above the long-term groundwater level.
- □ Hoe ram and grind any irregularities and prepare bedrock surface. Shotcrete areas to fill in cavities and smooth out angular features at the bedrock surface.
- Spray the bedrock vertical surfaces using an elastomeric coating (6 mm thick). The coating should extend to the bottom of the excavation. The coating should also extend horizontally a minimum 600 mm below the perimeter footings to create a seal at the juncture of the horizontal and vertical bedrock surfaces.
- Place a composite drainage layer, such as Delta Drain 6000 or equivalent, over the waterproofing product and elastomeric coating, where required. The composite drainage layer should extend from finished grade to underside of footing level. All joints should be taped with the appropriate adhesive tape based on a reversed shingle effect.
- Pour foundation wall against the composite drainage system.

It is recommended that 150 mm diameter sleeves at 3 m centres be cast in the footing or at the foundation wall/footing interface to allow the infiltration of any water that breaches the waterproofing and/or elastomeric coating system to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to a cistern or sump pit(s) within the lower basement area.

Concrete Mud Slab

To lessen the potential groundwater infiltration at the base of the excavation, consideration should be given to pouring a 100 mm thick concrete mud slab using 20 MPa compressive strength concrete directly on the bedrock surface prior to pouring footings. The purpose of the concrete mud slab is to provide a uniform layer to restrict the bulk of the groundwater infiltration. The effectiveness of the concrete mud slab is dependent on pouring a uniform layer on a flat surface avoiding pits and horizontal surfaces from deeper excavations. More details can be provided once the excavation plan is available.

Underfloor Drainage

An underfloor drainage system will be required to control water infiltration. For design purposes, it is recommended that minimum 150 mm diameter perforated pipes be placed at 6 to 8 m centres. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

It is expected that the deep parking garage will be blind poured against the shoring system for the bulk of the building footprint. However, for auxiliary building sections above the bedrock surface, backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, as recommended above, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 **Protection of Footings Against Frost Action**

Perimeter footings of heated structures are recommended to be protected against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a combination of soil cover and foundation insulation should be provided.

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

It is expected that the parking garage will not require protection against frost action due to the founding depth. Unheated structures such as the access ramp may required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

6.3 Excavation Side Slopes and Temporary Shoring

Side Slopes

The side slopes of the shallow excavations anticipated should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled.

The subsurface soil at this site is considered to be mainly a Type 2 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects. Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

Temporary Shoring

Temporary shoring will be required to support the overburden soils. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system.

The designer should take into account the potential for a fully saturated condition following a significant precipitation event allowing for full hydrostatic pressure in the design. Any changes to the approved shoring design system should be reported immediately to the owner's representative prior to implementation.

Temporary shoring will be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements will depend on the depth of the excavation, the proximity of the adjacent buildings and underground structures and the elevation of the adjacent building foundations and underground services.

Within the existing bridge embankment, the upper composition of the embankment at the property line is primarily a sand with gravel and cobbles and should not obstruct the proposed shoring installation. However, once the shoring reaches the underlying former railway beds followed by the glacial till, it is possible that boulders and rail timber ties may be encountered which will require drilled piles to penetrate. Furthermore, since the excavation will penetrate the bedrock, it is expected that the drilled piles will continue within the bedrock to at least below the proposed founding level.

The temporary system could consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. These systems can be cantilevered, anchored or braced. Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure the stability. It is further recommended that the toe of the shoring be adequately supported to resist toe failure, if required, by means of rock bolts or extending the piles into the bedrock through pre-augered holes if a soldier pile and lagging system is the preferred method.

The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 6 - Soil Parameters										
Parameters	Values									
Active Earth Pressure Coefficient (K _a)	0.33									
Passive Earth Pressure Coefficient (K_p)	3									
At-Rest Earth Pressure Coefficient (K _o)	0.5									
Dry Unit Weight (γ), kN/m ³	20									
Effective Unit Weight (γ), kN/m ³	13									

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be used full weight, with no hydrostatic groundwater pressure component.

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

6.4 Pipe Bedding and Backfill

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on soil/bedrock subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the SPMDD.

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

6.5 Groundwater Control

Groundwater Control for Building Construction

A local groundwater lowering is anticipated under short-term conditions due to construction of the proposed building. It should be noted that the extent of any significant groundwater lowering will take place within a limited range of the subject site due to the minimal groundwater lowering.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium. Based on the groundwater level being located within the bedrock, infiltration levels will be low to moderate through the excavation face.

A temporary MOE permit to take water (PTTW) will be required for this project since more than 50,000 L/day will be pumped during the construction phase. A minimum of four to five months should be allocated for completion of the application and issuance of the permit by the MOE.

Long-term Groundwater Control

Our recommendations for the proposed building's long-term groundwater control are presented in Subsection 6.1. Any groundwater encountered along the building's perimeter or sub-slab drainage system will be directed to the proposed building's cistern/sump pit. Provided the proposed groundwater infiltration control system is properly implemented and approved by the geotechnical consultant at the time of construction, it is expected that groundwater flow will be low (i.e. less than 50,000 L/day) with peak periods noted after precipitation events. It is anticipated that the groundwater flow will be controlled using conventional open sumps.

Impacts on Neighbouring Structures

Due to the presence of a groundwater infiltration control system in place against the temporary shoring and bedrock face, long-term groundwater lowering is anticipated to be negligible for the area. Also, the neighbouring structures are located at a significant distance from the subject site and, where encountered, are founded within native glacial till or directly over a bedrock bearing surface based on available soils information within the area. Based on the proposed groundwater control system, soils encountered and proximity to the adjacent structures, it is anticipated that the neighbouring structures will not be negatively impacted by long-term groundwater lowering due to the proposed development.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

Where excavations are completed in proximity of existing structures which may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is constructed, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and tarpaulins or other suitable means. The base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

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

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- **Q** Review the bedrock stabilization and excavation requirements.
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials used.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- **G** Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the grading plan, drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests notification immediately in order to permit reassessment of the recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Trinity Development Group, or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

David J. Gilbert, P.Eng.



Carlos P. Da Silva, P.Eng.

Report Distribution

- Trinity Development Group (3 copies)
- Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL RESULTS

BOREHOLE LOGS BY OTHERS

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ont	tawa, Or		Jevelopme	nt - 801 A	Aldert Street								
DATUM Ground surface elevations	provi	ded b	y Sta	ntec G	àeoma	atics Limi	ted.		FILE NO.	PG3272			
REMARKS									HOLE NO	^{).} BH 1-15			
BORINGS BY CME 75 Power Auger				D	ATE	April 15, 2	2015		БЦ 1-1 Э				
SOIL DESCRIPTION			SAN	IPLE		DEPTH	ELEV.		esist. Blo 0 mm Dia	ows/0.3m I. Cone	Piezometer Construction		
	STRATA	STRATA PLOT TYPE NUMBER % RECOVERY		N VALUE or RQD	(m)	(m)		• Water Content %					
GROUND SURFACE FILL: Black silty sand/sandy silt with	\times	×	-	щ		0-	-55.80	20	40 6	0 80	XX XX		
gravel		S AU	1										
 rail bedmat at 1.1m depth some brick pieces at 2.0m depth 		∦ss ∦ss	2 3	67 38	30 21		-54.80						
FILL: Brown to black sand, some 2.59		⊼ ss ∦ ss	4	67	9	2-	-53.80				¥ N		
		ss	5	75	3	3-	-52.80						
Stiff to firm, grey SILTY CLAY , some sand 4.72		ss	6	100	6	4-	-51.80				्रातातात		
_ * ./4		∦ ss	7	75	7	5-	-50.80						
		ss	8	100	3	6-	-49.80						
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		ss	9	38	4								
		ss	10	58	19	/-	-48.80						
8.53		∬ SS ≍ SS	11 12	67 50	43 50+	8-	-47.80						
End of Borehole		- 00	12		50+								
Practical refusal to augering at 8.53m depth													
(GWL @ 2.05m-May 1, 2015)													
								20 Shea ▲ Undist	ar Strengt	0 80 10 t h (kPa) Remoulded	00		

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	ario k	(2E 7J	5			tawa, Or		Jevelop	ment	- 001 A	upert	SILEEL	
DATUM Ground surface elevations	Geoma	atics Limi	ted.		F	ILE NO.	PG	3272					
REMARKS									н	OLE NO			
BORINGS BY CME 75 Power Auger	ATE	April 15, 2	BH 2-15										
SOIL DESCRIPTION	РІОТ		SAN	IPLE		DEPTH	ELEV.	Per		st. Blo nm Dia			Piezometer Construction
		ЭE	BER	ÆRY	VALUE r ROD	(m)	(m)						zome
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VA or I					er Con			CP
GROUND SURFACE		× AU	1	Щ.		0-	60.12	2	04	0 6		80	X X
FILL: Brown silty sand, some topsoil, trace clay and gravel		§ AU ∏ SS		50		1-	-59.12						
1.90			2	50	4		55.12		· · · · · · · · · · · · · · · · · · ·	••••••			
1.00		∦ ss ⊽ ss	3	38	9	2-	-58.12						
		∦ss ⊽	4	58	15	3-	-57.12				· · · · · · · · · · · · · · · · · · ·		
FILL: Brown sand, some silt, trace		∦ss ⊽	5	71	30		50.10		· · · · · · · · · · · · · · · · · · ·				
cobbles		ss	6	75	31	4-	-56.12		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	
- rail bedmat, coal from 6.1 to 6.7m depth		ss	7	58	24	5-	-55.12						
		ss	8	62	12	6-	-54.12						
6.90		ss	9	71	10				· · · · · · · · · · · · · · · · · · ·				
FILL: Grey-brown silty clay, trace gravel		∬ss	10	75	9	7-	-53.12						
8.08 TOPSOIL 8.23		ss	11	100	11	8-	-52.12						
Dense, grey-brown SAND , some silt and gravel 9.14	'	∑ss	12	59	50+	g_	-51.12						
		ss	13	100	2		01.12		· · · · · · · · · · · · · · · · · · ·				
Grey SILTY CLAY, some sand						10-	-50.12	Δ			A		
10.0/		⊠ SS	14	88	50+	11-	49.12				· · · · · · · · · · · · · · · · · · ·		
		∦ss	15	38	13	10	40.40						
GLACIAL TILL: Grey silty clay with some sand, gravel, cobbles and		ss	16	100	6	12-	-48.12						
boulders		ss	17	67	31	13-	47.12						
		ss	18	50	25	14-	-46.12				· · · · · · · · · · · · · · · · · · ·		
14.53		-											
BEDROCK: Grey limestone		RC	1	65	54	15-	-45.12						
interbedded with black shale						16-	-44.12						
		-				17-	-43.12		· · · · · · · · · · · · · · · · · · ·				
								2		o 6 Strengt			00
									ndisturb	-	Remo	-	

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On		Ottawa, Ontario											
DATUM Ground surface elevations	ntec G	àeoma	atics Limi	ted.		F	ILE NO.	PG	3272				
REMARKS									н	OLE NC). DU	2-15	
BORINGS BY CME 75 Power Auger				D	ATE	April 15, 2	2015				БП	2-15	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH (m)	ELEV. (m)	Pen ●		st. Blo nm Dia			eter ction
	STRATA	ЭДХТ	NUMBER	° ≈ © ©	N VALUE or RQD		(,	 		er Cor		% 60	Piezometer Construction
BEDROCK: Grey limestone		RC	2	73	45	17-	-43.12						
End of Borehole									· · · · · · · · · · · · · · · · · · ·				
(GWL @ 8.5m depth based on field observations)													
(GWL @ 6.09m-May 1, 2015)													
										Streng		a)	00

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	tario ł	(2E 7J	5			tawa, Or		Jevelop	ment	- 001 /	Albert	Sileei			
DATUM Ground surface elevations	s prov	ided b	y Sta	ntec (Geoma	atics Limi	ted.		F	FILE NO.		33272			
REMARKS								H	HOLE NO. BH 3-15						
BORINGS BY CME 75 Power Auger	1			0	DATE	April 16, 2	2015		DTI 3-13						
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH	ELEV.	Per		ist. Ble nm Dia			Piezometer Construction		
		ы	ER	ERY	Ba	(m)	(m)						ome		
	STRATA	ТҮРЕ	NUMBER	* RECOVERY	N VALUE or RQD			C	Wa	ter Cor	ntent	%	Con		
GROUND SURFACE		~	2	RE	z ⁰	0-	-58.41	2	0 4	40 6	0	80			
		B AU	1												
		ss	2	17	18	1-	57.41		······································						
FILL: Brown silty sand, some gravel		ss	3	71	362					•					
and cobbles		Д				2-	-56.41								
		ss	4	42	36	3-	-55.41								
		ss	5	83	38										
		ss	6	33	17	4-	-54.41	······	······································	· · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·			
4.78		ss	7	67	3	_									
FILL: Rail bedmat, tar, coal 4.93						5-	-53.41						₽		
sand and gravel5.92		ss	8	100	11	6-	-52.41		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·			
(TOPSOIL5.94	+	⊠ SS	9	100	50+					• • • • • • • • • • • • • • • • • • •		· · · · · · · · · · · · · · · · · · ·			
		≍ SS	10	100	50+	7-	-51.41								
Very dense, brown SAND with		ss	11	86	68		50.44								
gravel and boulders, some silt						8-	-50.41								
9.14		ss	12	83	95	9-	49.41		······································						
GLACIAL TILL: Grey silty clay with		ss	13	62	3										
sand, gravel and cobbles		ss	14	67	10	10-	48.41								
10.97	·[^^^^^/	ss ss	15	78	50+	11	-47.41								
		RC	1	76	0		47.41				· · · · · · · · · · · ·				
BEDROCK: Grey limestone interbedded with shale		RC	2	98	49	12-	46.41					······			
- vertical mud seam at 13.5m depth			2	90	49										
		RC	3	96	71	13-	-45.41								
13.62 End of Borehole		_													
(GWL @ 6.1m depth based on field observations)															
(GWL @ 5.23m-May 1, 2015)															
(CAME & 5.2011-Way 1, 2015)															
								2	<u> </u>	40 6	0	80 1	00		
								S	hear	Streng	th (kP	a)	00		
								▲ Ui	ndisturk	oed ∆	Remo	ulded			

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ont	ario K	2E 7J	5			tawa, Or		Jevelopi	nent -		ert Street	
DATUM Ground surface elevations	TUM Ground surface elevations provided by Stantec G									E NO.	PG3272	
REMARKS									нс	LE NO.		
BORINGS BY CME 75 Power Auger				D	ATE	April 16, 2	2015				BH 4-15	
SOIL DESCRIPTION	тол		SAN	IPLE	1	DEPTH	ELEV.	Pen.		t. Blow m Dia. (ster
	STRATA I	ТҮРЕ	NUMBER	% RECOVERY	VALUE r rod	(m)	(m)			0		Piezometer Construction
GROUND SURFACE	STR	ТҮ	MUN	RECO	N VI OF			0 20	wate 40	r Conte 60	nt % 80	CDE CDE
	\bigotimes	Ž AU	1			0-	-57.06					
FILL: Brown silty sand, some gravel, and topsoil		∛ss	2	62	10	1-	-56.06		· · · · · · · · · · · · · · · · · · ·			
2.30		ss	3	71	26	2-	-55.06				· · · · · · · · · · · · · · · · · · ·	
		ss	4	100	12							
FILL: Rail bed, coal, some tar		ss	5	33	7	3-	-54.06					
FILL: Brown silty sand, some clay		ss	6	25	18	4-	-53.06					
and gravel5.28		ss	7	54	35	5-	-52.06					
		ss	8	79	79		54.00					
Very dense, brown SAND with gravel and boulders, trace silt		≍ SS	9	43	50+	6-	-51.06					
7.62		ss	10	50	68	7-	-50.06					
GLACIAL TILL: Grey silty clay, some sand, gravel and cobbles 8.23		ss	11	65	50+	8-	-49.06					E C
		RC	1	87	57	9-	-48.06				· · · · · · · · · · · · · · · · · · ·	
BEDROCK: Black shale interbedded with grey limestone		_				10	-47.06					
		RC	2	100	94	10-	-47.00					
11.18 End of Borehole		_				11-	-46.06					
(GWL @ 4.6m depth based on field observations)												
(GWL @ 3.78m-May 1, 2015)												
										rength		00

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	tawa, Or		Jevelop	ment	- 801 4	Albert Stre	el					
DATUM Ground surface elevations	TUM Ground surface elevations provided by Stantec									LE NO.	PG327	72
REMARKS									н	OLE NC)	
BORINGS BY CME 75 Power Auger				D	ATE	April 16, 2	2015				BH 5-1	5
SOIL DESCRIPTION	РГОТ		SAN	IPLE	1	DEPTH (m)	ELEV. (m)	Per			ows/0.3m . Cone	eter ction
GROUND SURFACE	STRATA	TYPE	NUMBER	% RECOVERY	N VALUE of RQD			2			itent % 0 80	Piezometer Construction
FILL: Brown silty sand with gravel 0.46		au	1			0-	-55.29					
FILL: Rail bed and coal 1.42		∛ss	2	75	13	1-	-54.29					
FILL: Brown sand with gravel, some silt 2.44		ss	3	62	20	2-	-53.29					
TOPSOIL2.74		ss	4	75	8	3-	-52.29					
Compact to very dense, grey SILTY SAND , some gravel and cobbles		∦ ss ⊽ ss	5	50	28	1-	-51.29					
Grey SILTY CLAY, trace sand		∦ss ∛ss	6 7	79 67	79 2							
5.33		ss	, 8	75	7		-50.29					
GLACIAL TILL: Grey silty clay with sand and gravel		ss	9	46	15	6-	-49.29					
<u>7.11</u>		≝ SS	10	0	50+	7-	-48.29					
BEDROCK: Black shale		RC	1	90	61	8-	-47.29					
9.27		RC	2	71	71	9-	-46.29			· · · · · · · · · · · · · · · · · · ·		
End of Borehole												
(GWL @ 1.82m-May 1, 2015)								2	0 4	0 6	0 80	100
								S		trengt	t h (kPa) Remoulded	

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On		tawa, Or		evelopme	ent - 801 A	idert Street					
DATUM Ground surface elevations	s provi	ded b	y Sta	ntec C	àeoma	atics Limi	ted.		FILE NO.	PG3272	
REMARKS									HOLE NO		
BORINGS BY CME 75 Power Auger				D	ATE	April 17, 2	2015			BH 6-15	1
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blo 0 mm Dia		ster
	STRATA	луры	NUMBER	°% ©™ERY	VALUE r rod	(m)	(m)		Vater Con	topt 9/	Piezometer Construction
GROUND SURFACE	STR	Т	NUM	RECO	N OF		55.00	0 V 20	40 6		ĞĞ
FILL: Black silty sand with gravel		aU 8	1				-55.38				
- brown by 1.1m depth		ss	2	71	16	1-	-54.38				
FILL: Grey silty clay, some sand 2.30		ss	3	42	9	2-	-53.38		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	₽
and gravel		ss	4	100	1	3-	-52.38				
Grey SILTY CLAY, some sand		ss	5	100	2						
4.42		ss	6	100	2	4-	-51.38				
		X ss	7	71	7	5-	-50.38				
GLACIAL TILL: Grey silty clay with		X ss	8	88	3	6-	-49.38				
sand and gravel		X ss ⊽ ss	9	67	8	7-	-48.38				
		∦ss ∏ss	10 11	17 50	9 50+						
8.59		_ 00			00+	8-	-47.38				
		RC	1	90	40	9-	-46.38				
BEDROCK: Black shale		_				10-	-45.38				
interbedded with grey limestone		RC	2	93	82	11-	-44.38				
11.63											
(GWL @ 4.6m depth based on field observations)											
(GWL @ 1.77-May 1, 2015)											
								20 Shea ▲ Undist	40 6 ar Strengt turbed △		oo

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	Ot	tawa, Or	ntario	•								
DATUM Ground surface elevations	Geoma	atics Limi	ted.		FILE N	0. PG	3272					
REMARKS									HOLE	NO		
BORINGS BY CME 75 Power Auger				D	ATE /	April 17, 2	2015	1		BH 7	7-15	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH (m)	ELEV. (m)			Blows/0.3 Dia. Cone		eter ction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(11)	(11)	• V	Vater C	ontent %)	Piezometer Construction
GROUND SURFACE	ŝ	-	IN	REC	z ö		FF 00	20	40	60 80)	щО
FILL: Brown silty sand with gravel, trace cobbles 0.66		AU	1			0-	-55.26					
FILL: Rail bed, coal and tar		ss	2	79	7	1-	-54.26					
FILL: Brown silty clay, some sand 2.29		ss	3	29	20	2-	-53.26					Ĩ
and gravel	Ĭ	ss	4	50	7		50.00					
		∦ss	5	71	50+	3-	-52.26					
Very dense, brown SILTY SAND, some gravel		⊠ SS	6	60	50+	4-	-51.26					
<u>4.88</u>		ss	7	4	16	5-	-50.26			· · · · · · · · · · · · · · · · · · ·		
		ss	8	79	4		40.00					
		ss	9	42	28	6-	-49.26				······································	<u>lululu</u> Tululul
		ss	10	67	6	7-	-48.26					
GLACIAL TILL: Grey silty sand with gravel, some clay and cobbles		ss	11	0	10	8-	-47.26					
		ss	12	54	12	0	40.00				· · · · · · · · · · · · · · · · · · ·	
		ss	13	100	10	9-	-46.26					
		ss	14	62	8	10-	-45.26					
End of Borehole 10.72	<u>^^^^</u>	= SS	15	50	50+							
Practical refusal to augering at 10.72m depth												
(GWL @ 1.57m-May 1, 2015)												
								20	40	60 80		00
								Shea ▲ Undis		i gth (kPa) △ Remoul		

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ont	tawa, Or		evelop	omeni	- 801 4		Street						
DATUM Ground surface elevations	provi	ded b	y Sta	ntec G	Geoma	atics Limi	ted.		I	FILE NO.	PG	3272	
REMARKS										HOLE NC)_	8-15	
BORINGS BY CME 75 Power Auger					ATE	April 17, 2	2015						
SOIL DESCRIPTION	РГОТ		SAN			DEPTH (m)	ELEV. (m)	Per		ist. Blo mm Dia			Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	° © © © © © © ©	N VALUE or RQD		(11)) Wa	ter Con	tont o		ezome
GROUND SURFACE	STI	Ţ	NUN	RECO	N OF C		- /	2		40 6		0	ĒÖ
		§ AU	1			0-	-54.92						
FILL: Black to brown silty sand with gravel, some cobbles		ss	2	79	6	1-	-53.92				· · · · · · · · · · · · · · · · · · ·		
2.29		ss	3	38	11	2-	-52.92				· · · · · · · · · · · · · · · · · · ·		
		ss	4	67	72								
Very dense, brown silty sand with gravel, some cobbles		∛ss	5	71	50+	3-	-51.92						Ť
		≍ SS	6	33	50+	4-	-50.92				· · · · · · · · · · · · · · · · · · ·		
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles5.31 End of Borehole		ss	7	52	9	5-	-49.92						
Practical refusal to augering at 5.31m depth													
(GWL @ 3.0m depth based on field observations)													
(GWL @ 1.72m-May 1, 2015)													
										40 6 Strengt ⊳ed △			00

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ont	tawa, Or		Jevelopme	nt - 801 Albert Stre	et					
DATUM Ground surface elevations	provi	ded b	y Sta	ntec G	àeoma	atics Limi [.]	ted.		FILE NO. PG327	72
REMARKS									HOLE NO. BH 9-1	F
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	r 13, 201	15	БП 9-1	D
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blows/0.3m 0 mm Dia. Cone	Stion
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	∾ RECOVERY	N VALUE or RQD	(m)	(m)	0 V 20	/ater Content % 40 60 80	Monitoring Well Construction
		AU	1			0-	-57.12			
FILL: Dark brown silty sand with		< ss	2	54	7	1-	-56.12			
some cobbles.		ss	3	33	+50	2-	-55.12			
2.59		$\langle ss $	4	50	10					
		ss	5	43	+50	3-	-54.12			
FILL: Black sand and gravel		⟨ss	6	63	+50	4-	-53.12			
F 40		⟨ss	7	29	50	5-	-52.12			
 <u>5.49</u>		⟨ss	8	83	13	6-	-51.12			
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders 7.00		$\langle ss $	9	58	9					
		-				7-	-50.12			
		RC	1	32		8-	-49.12		· · · · · · · · · · · · · · · · · · ·	
DEDDOOK. Over limestere		- RC	0	15		9-	-48.12		· · · · · · · · · · · · · · · · · · ·	
BEDROCK: Grey limestone		RC	2 3	83	83	10	47.40			
		RC	4	98	82	10-	-47.12			
<u>11.38</u>		_				11-	-46.12			
End of Borehole										
(GWL @ 3.81m-Dec. 1, 2015)										
								20 Shea ▲ Undist	40 60 80 ar Strength (kPa) urbed △ Remoulded	100

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	ario r	2E /J	5		Ot	tawa, Or	ntario		•							
DATUM Ground surface elevations	Geom	atics Limi [.]	ted.				FIL	E NO		G3	272					
REMARKS										ł	но	LE NO	<u>ר</u>			
BORINGS BY CME 75 Power Auger	1			D	DATE	Novembe	r 13, 201	5					B	H1()-15	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		Pen ●				ows/ a. Co		n	Well
	STRATA	ТҮРЕ	NUMBER	°% ©™	N VALUE or RQD	(m)	(m)		0	W	ate	r Coi	ntent	%		Monitoring Well Construction
GROUND SURFACE	L2	н	NU	REC	NO				20)	40	(50	80		Σ0 Σ
		au 8	1			- 0-	-56.29									
FILL: Dark brown silty sand, some cobbles		ss	2	25	12	1-	-55.29			· · · · · · · · · · · · · · · · · · ·						
1.65		∛ ss	3	67	22	2-	-54.29			· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · ·		
FILL: Black silty sand and gravel, some ash, spent coal and iron slag		ss	4	58	10					· · · · · · · · · · · · · · · · · · ·						
3.35	\bigotimes	∛ss	5	38	+50	3-	-53.29									₿ _₹ ₿
FILL: Brown silty sand and gravel,		x ss	6	67	+50	4-	-52.29			· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·				
some cobbles and boulders		∑SS	7	91	+50	5-	-51.29			· · · · · · · · · · · · · · · · · · ·						<u> </u>
		ss	8	67	7											
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders.		∑ ss	9	100	3	6-	-50.29				· · · · · · · · ·					։ ԱՄԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐ ԴԻՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐԵՐ
-						7-	-49.29									
7.49		_								• • • • • •						
		RC	1	77	39	8-	-48.29									
BEDROCK: Grey limestone		-				0	-47.29	• • • •				· · · · · · · ·				
interbedded with shale		RC	2	100	95	9	47.29	• • • •				· · · · · · · ·				
10.13		_				10-	-46.29				;	· · · · · ·				
End of Borehole																
(GWL @ 3.52m-Dec. 1, 2015)																
									20		40		50	80	1)0
										heai distu			th (k Rem		ed	

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ont		tawa, Or		Jevei	pm	ent	- 801	Alber	Stree	20				
	. ,										ILE NO). P(G327	2
REMARKS				_		.		. –		н	OLE N	^{0.} BH	111-1	5
BORINGS BY CME 75 Power Auger			~ ~ ~ ~		ATE	Novembe	er 16, 201							
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)	Pe				lows/(a. Cor		g Wel
GROUND SURFACE	STRATA	ΞፈΥΤ	NUMBER	% RECOVERY	N VALUE or RQD				0 V 20	Wate		ntent 60	% 80	Monitoring Well Construction
	\times		1			0-	-55.94				•			
		≊ ≍ SS	2	56	+50	1-	-54.94			; . ; ; . ;	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
		⊠ss	3	56	+50	2-	-53.94			· · · · · · · · · · · · · · · · · · ·	······································			¥
FILL: Dark brown silty sand with cobbles and boulders		⊠ SS	4	33	+50	3-	-52.94) - () - () - (· · · · · · · · · · · · · · · · · · ·			
		_ ∦ ss	1 5	89 54	71		-51.94							
FILL: Black silty sand and gravel, some ash, spent coal and iron slag 5.74	\boxtimes	-				5-	-50.94							
some ash, spent coal and iron slag <u>5.7</u>		RC	2	100	68	6-	-49.94							
BEDROCK: Interbedded limestone		- RC	3	88	88		-48.94			· · · · · ·	· · · · · · · · · · · · · · · · · · ·			
and shale		-	Ū				-47.94			· · · · · · · · · · · · · · · · · · ·	·······			
		RC	4	98	98		-46.94			· · · · · · · · · · · · · · · · · · ·				
10.13 End of Borehole		_				10-	45.94			<u></u>				
(GWL @ 1.92m-Dec. 1, 2015)														
									20 She Undis		Streng	60 gth (kF ∆ Remo		 100

154 Colonnade Road South, Ottawa, Ont	ario k	tawa, Or		evelopine	111 - OUT A	ibert Street					
DATUM Ground surface elevations	provi	ded b	y Sta	ntec C	Geoma	atics Limi	ted.		FILE NO.	PG3272	
REMARKS									HOLE NO.	BH12-15	
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	r 16, 201	5		БП12-1Э	
SOIL DESCRIPTION	РІОТ		SAN	IPLE		DEPTH	ELEV.		esist. Blo 0 mm Dia.		Well
	STRATA	ТҮРЕ	NUMBER	°% ©™ERY	VALUE r rod	(m)	(m)		Vater Cont	ent %	Monitoring Well Construction
GROUND SURFACE	ST	H	ŊŊ	REC	N O N		FF 4F	20	40 60		Mor
FILL: Dark brown silty sand, some gravel, cobbles, organics, burnt wood, ash and coal.		ŠAU ∛ SS	1	70	05		-55.15 -54.15				<u> Արևրիկի</u>
- 200mm thick layer of decayed wood at 1.8m depth 2.18		∑ss ∑ss	2 3	79 75	25 16						
at 1.8m depth 2.18		∆ SS X SS	4	55	+50	2-	-53.15				
		⊠ss	5	50	+50	3-	-52.15				
FILL: Grey silty sand with gravel, cobbles and boulders		∑ss	6	71	+50	4-	-51.15				
		≍ SS	7	88	+50	5-	-50.15				
6.20		RC	1	50		6-	-49.15				
		RC	2	100	80	7-	-48.15				
BEDROCK: Grey limestone interbedded with black shale		- RC	3	100	95		-47.15				
		RC					-46.15				
End of Borehole9.40		- RC	4	100	92		40.13				
(GWL @ 2.08m-Dec. 1, 2015)											
								20 Shea ▲ Undist	40 60 ar StrengtI urbed △	9 80 10 h (kPa) Remoulded	00

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	tario k	(2E 7J	5			tawa, Or		evelop	oment	- 8017	Albert	Street	
DATUM Ground surface elevations	prov	ided b	y Sta	ntec G	àeoma	atics Limi [.]	ted.		F	ILE NO.	PC	G3272	
REMARKS									ŀ	IOLE NO). BH	13-15	
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 17, 201	5			БΠ	13-15	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH (m)	ELEV. (m)	Per •		ist. Ble nm Dia			g Well ction
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or ROD	(11)	(11)	2		ter Cor		% 80	Monitoring Well Construction
		au	1			0-	-55.02						EE
FILL: Dark brown silty sand, some gravel, cobbles and organics		x ∑ss	2	25	4	1-	-54.02					· · · · · · · · · · · · · · · · · · ·	
<u>2.13</u>		ss	3	64	52	2-	-53.02						
FILL: Dark grey/black silty sand, some gravel and cobbles, trace 3.05		ss	4	42	14	3-	-52.02						
		∑ ss ∝ ss	5 6	69 60	+50 +50					· · · · · · · · · · · · · · · · · · ·		•••••••••••••	
FILL: Grey silty sand with gravel,		⊼ SS X SS	6 7	56	+50	4-	-51.02						
cobbles and boulders		RC	1	21		5-	-50.02						
6.58						6-	-49.02						
BEDROCK Interbedded limestone and shale		RC RC	2 3	90 50	0 0	7-	-48.02				· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
- vertical fracture from 7.5 to 8.4m		RC	4	100	70	8-	-47.02	· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·	
depth 8.61 End of Borehole		_											
(GWL @ 1.92m-Dec. 1, 2015)													
										Streng		'a)	00

SOIL PROFILE AND TEST DATA

Ottawa, Ontario												
DATUM Ground surface elevations	provi	ded b	y Sta	ntec C	deoma	atics Limi	ted.		FILE NO	PG3272	2	
REMARKS									HOLE N).	-	
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	r 18, 201	5		BH14-1)	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH	ELEV.		esist. Bl) mm Dia	ows/0.3m a. Cone	y Well ction	
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)		ater Co	ntent %	Monitoring Well Construction	
GROUND SURFACE	ST	H	ΝŪ	REC	N N			20		50 80	Σ Δ	
	\otimes	× AU	1			0-	-54.81					
FILL: Dark brown silty sand with gravel, some cobbles, trace boulders		ss	2	67	13	1-	-53.81				<u>իրիդիդի</u> Միրկիդիդի	
- dark grey by 2.0m depth 2.08		∛ss	3	67	33	0	-52.81					
		ss	4	67	36							
		∛ss	5	75	22	3-	-51.81					
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		ss	6	100	4	4-	-50.81					
		∛ss	7	25	3	5-	-49.81					
5.64												
EDROCK: Grey limestone		RC	1	75	72	6-	-48.81					
		_				7-	-47.81					
		RC	0	05	05							
		RC	2	95	95	8-	-46.81					
End of Borehole												
(GWL @ 2.09m-Dec. 1, 2015)												
								20 Shea	40 r Streng		100	
								Jilea ▲ Undist		Remoulded		

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	ario K	2E /J	5		0	tawa, Or	ntario	•			
DATUM Ground surface elevations	ded b	y Sta	Geom	atics Limi	ted.		FILE NO.	PG3272			
REMARKS									HOLE NO.	DU15 15	
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 17, 201	5		BH15-15	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH (m)	ELEV. (m)		esist. Blov 0 mm Dia.		g Well ction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	VALUE r ROD	(11)	(11)	0 N	/ater Cont	ent %	Monitoring Well Construction
GROUND SURFACE	ν.	L .	IN	REC	N O H			20	40 60	80	ž
	\bigotimes	s AU	1			0-	-55.06				
FILL: Dark brown silty sand, some gravel and organics		ss	2	33	4	1-	-54.06				
1.73		ss	3	88	3	2-	-53.06				▓⊻▓
Brown SILTY SAND, some clay		ss	4	100	2		-52.06				
						5	52.00		Δ	1	
Grey SILTY CLAY, trace sand		ss	5	100	2	4-	-51.06				
GLACIAL TILL: Grey silty clay with		ss	6	100	2	5-	-50.06				
sand, some gravel5.79		ss	7	0	3						
		ss	8	83	6	6-	-49.06				
GLACIAL TILL: Grey silty sand, some gravel, cobbles and boulders		ss	9	79	9	7-	-48.06				
		ss	9 10	63	40	0	-47.06				
		ss	11	27	9	0	47.00				
9.47		A 33		21	9	9-	-46.06		· · · · · · · · · · · · · · · · · · ·		<u>արդորի</u>
		RC	1	90	60	10-	-45.06				
BEDROCK: Interbedded shale and limestone		- RC	2	100	90						
11.35 End of Borehole		_				11-	-44.06				
(GWL @ 2.02m-Dec. 1, 2015)											
(GWL @ 2.0211-Dec. 1, 2013)											
								20 Shea ▲ Undist	40 60 ar Strength urbed △ I	80 10 n (kPa) Remoulded	00

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ontario K2E 7J5 Ottawa, Ontario												
DATUM Ground surface elevations										NO. PG3	272	
REMARKS									HOLE	NO		
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 18, 201	15		BH1	5-15	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH	ELEV.			Blows/0.3 Dia. Cone	n N	ction
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE of RQD	(m)	(m)	0 V 20	Vater C 40	Content % 60 80	Monitoring	Construction
FILL: Dark brown silty sand with gravel, some organics and cobbles		X AU	1				-55.01 -54.01					կկկկկկ
-metal slag and ash from 0.8 to 2.1m depth 2.24		∦ss ∛ss	2 3	63 13	8 8		-53.01					
FILL: Brown silty sand with gravel,		_ ∑ss ∝ss	4 5	58 71	47 +50		-52.01					
Grey SILTY CLAY, trace silty sand		∡ 55 7 ∦ SS	6	100	2	4-	-51.01					
seams5.28		ss	7	100	4	5-	-50.01					
		∦ss ∛ss	8 9	67 75	2 8	6-	-49.01					
GLACIAL TILL: Grey silty sand with		ss	10	67	28	7-	-48.01					
gravel, cobbles and boulders		ss	11	63	41	8-	-47.01					
						9-	-46.01		· · · · · · · · · · · · · · · · · · ·			
BEDROCK: Interbedded shale and		-		00	70	10-	-45.01					
limestone 		RC	1	98	70	11-	-44.01					
End of Borehole		_										_
(GWL @ 2.02m-Dec. 1, 2015)								20	40	60 80		
								Snea ▲ Undist		ngth (kPa) △ Remould		

SOIL PROFILE AND TEST DATA

54 Colonnade Road South, Ottawa, Ontario K2E 7J5 Ottawa, Ontario												
DATUM Ground surface elevations	prov	ided b	y Sta	ntec C	Geoma	atics Limi [.]	ted.		FILE NO.	PG3272		
REMARKS									HOLE NO	^{).} BH17-15		
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 18, 201	15		впі/-іэ		
SOIL DESCRIPTION	PLOT		SAN	IPLE	1	DEPTH	ELEV.		esist. Blo 0 mm Dia	ows/0.3m a. Cone	l Well ction	
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	0 W 20	Vater Con	ntent %	Monitoring Well Construction	
FILL: Dark brown silty sand, some gravel and organics		aU 🕈	1			0-	-55.02				<u>111111</u>	
- slag and coal at 0.8m depth		ss	2	79	8	1-	-54.02				րիինիինիին Սիինինինին	
1.91		∑ss -ss	3 4	40 0	+50 +50	2-	-53.02		· · · · · · · · · · · · · · · · · · ·		¥	
FILL: Brown silty sand and gravel with cobbles and boulders		∛ss	5	100	57	3-	-52.02					
with cobbles and boulders		ss	6	25	7	4-	-51.02					
4.88		-				5-	-50.02					
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders		∦ss	7	05	9	6-	-49.02					
7.11		∆ 	/	25		7-	-48.02					
BEDROCK: Interbedded limestone and shale		RC RC	1 2	97 100	80 90	8-	-47.02					
8.66 End of Borehole		-	2	100	30				······································			
(GWL @ 2.02m-Dec. 1, 2015)												
								20 Shea ▲ Undist	ar Strengt	0 80 10 t h (kPa) Remoulded	00	

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	tario ł	(2E 7J	5			tawa, Or		Jevelopine		Albert Street	
DATUM Ground surface elevations	prov	ided b	y Sta	ntec C	Geoma	atics Limi	ted.		FILE NO.	PG3272	
REMARKS									HOLE NO). DU10.15	
BORINGS BY CME 850 Power Auger	1			D	ATE	Novembe	er 23, 201	15		[®] BH18-15	
SOIL DESCRIPTION	PLOT		SAN	IPLE	1	DEPTH	ELEV.		esist. Blo 0 mm Dia		Well
GROUND SURFACE	STRATA 1	ТҮРЕ	NUMBER	°⊗ RECOVERY	N VALUE or RQD	(m)	(m)	0 V 20	Vater Con 40 6	itent %	Monitoring Well Construction
TOPSOIL 0.20		-				0-	-60.11				
FILL: Brown silty sand with gravel, cobble sand boulders		8 AU ∑ SS	1 2	67	23	1-	-59.11				
-black @ 0.8m depth		ss	3	17	17	2-	-58.11				
-brown @ 1.4m depth		ss	4	17	27						
-black @ 3.8m depth		ss	5	50	57	3-	-57.11				
4.42		ss	6	50	31	4-	-56.11				
		ss	7	50	45	5-	-55.11				
		ss	8	75	12	5	55.11				Ĩ
GLACIAL TILL: Grey silty clay with and, gravel, cobbles and boulders		ss	9	75	12	6-	-54.11				
		ss	10	83	10	7-	-53.11				
8.20		ss	11	75	23	8-	-52.11				
		ss	12	17	32						
		ss	13	67	42	9-	-51.11			· · · · · · · · · · · · · · · · · · ·	
						10-	-50.11				
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders		ss	14	75	47	11-	-49.11				
,,						12-	-48.11				
		ss	15	42	3		10.11				
						13-	-47.11				
		ss	16	100	15	14-	-46.11				
14.73		_				15-	-45.11				
BEDROCK: Grey limestone		RC	1	96	86						
End of Borehole 16.15						16-	-44.11				
(GWL @ 8m depth based on field observations) (GWL @ 5.56m-Dec. 1, 2015)											
								20 Shea ▲ Undis	40 6 ar Strengt turbed △		+ DO

SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, On	tawa, Or		evelopn	ient -	801 F		Street										
										E NO.	PG	3272					
REMARKS									нс	DLE NO	PG3272 ^{0.} BH19-15						
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 25, 201	5			БП	19-15					
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.						ster Stion				
GROUND SURFACE	STRATA	ЭДҮТ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	0 20	Wate 40				Piezometer Construction				
	$\times \times \times$	ž AU	1			0-	-59.68					-					
FILL: Brown silty sand with gravel		×	-	75			-58.68										
- black @ 0.8m depth		X ss	2	75	29		-00.00		· · · · · · · · · · · · · · · · · · ·								
- brown @ 1.4m depth		X ss	3	58	5	2-	-57.68		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	······································					
- brick piece at 2.1m depth		ss	4	83	6	3-	-56.68		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	•••••••••••••	· · · · · · · · · · · · · · · · · · ·					
- some clay from 2.5 to 2.7m depth		∦ ss	5	25	13		00.00		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	••••••••••••					
		ss	6	38	10	4-	-55.68										
5.11		ss	7	54	33	5-	-54.68										
		ss	8	38	11												
GLACIAL TILL: Grey silty clay with		ss	9	58	6	6-	-53.68						▓₹₩				
sand and gravel, trace cobbles			-		-	7-	-52.68		· · ; · ; · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·					
7.62		X ss	10	50	31		000		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
		ss	11	67	28	8-	-51.68										
		∦ ss	12	62	33	9-	-50.68		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·					
		ss	13	83	62				· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
						10-	-49.68										
		∛ss	14	50	50+	11-	-48.68										
GLACIAL TILL: Dense to very dense, grey silty sand with gravel,		V 00			001		+0.00										
cobbles, boulders						12-	-47.68					···········					
		∦ ss	15	67	31	10	40.00				· · · · · · · · · · · · · · · · · · ·						
						13-	-46.68										
14.38		ss	16	91	50+	14-	-45.68					······································					
		=							· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
BEDROCK: Grey limestone		RC	1	100	60	15-	-44.68					······································					
15.90																	
(GWL @ 8.0m depth based on field observations) (GWL @ 6.08m-Dec. 1, 2015)																	
								20 Sh ▲ Und		trengt	0 8 t h (kPa Remou	I)	00				

SOIL PROFILE AND TEST DATA

54 Colonnade Road South, Ottawa, Ontario K2E 7J5 Ottawa, Ontario												
DATUM Ground surface elevations	provi	ded b	y Sta	ntec G	àeoma	atics Limi [.]	ted.		FILE NO.	PG3272		
REMARKS									HOLE NO). DU00 15		
BORINGS BY CME 75 Power Auger				D	ATE I	Novembe	er 22, 201	15		^[^] BH20-15	1	
SOIL DESCRIPTION	РГОТ		SAN	IPLE		DEPTH	ELEV.		esist. Bl	ows/0.3m a. Cone	ster Stion	
	STRATA I	ΡE	BER	% VERY	ROD	(m)	(m)				Piezometer Construction	
GROUND SURFACE	STR	ТҮРЕ	NUMBER	°% RECOVERY	N VALUE or ROD			0 V 20	Vater Cor 40 6	ntent %	CDE	
TOPSOIL0.23	\times	ž AU	1			0-	-55.68					
FILL: Black silty sand with gravel		∛ss	2	50	7	1-	-54.68				-	
and brick pieces - concrete piece at 1.9m depth		ss	3	38	7	2-	-53.68					
		ss	4	25	5	3-	-52.68					
		ss	5	50	8						-	
		∦ss ⊽	6	62	7	4-	-51.68					
GLACIAL TILL: Grey silty sand with		∦ ss ⊽ ss	7	8	8	5-	-50.68					
GLACIAL TILL: Grey silty sand with gravel and cobbles		∦ss ∛ss	8 9	83 88	30 64	6-	-49.68					
		∑ SS	9 10	100	60	7-	-48.68				-	
		∛ss	11	100	11	8-	-47.68					
		ss	12	100	12						-	
9.42		RC	1	100	61	9-	-46.68				•	
			2	100	47	10-	-45.68					
BEDROCK: Grey limestone		RC	3	100	100	11-	-44.68				-	
		_				12-	-43.68					
		RC	4	100	95	12-	-42.68					
13.49		_				13	42.00					
End of Borehole												
(GWL @ 5.0m depth based on field observations)												
								20 Shea ▲ Undist	ar Streng		¹ 00	

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SOIL PROFILE AND TEST DATA

154 Colonnade Road South, Ottawa, Ontario K2E 7J5 Ottawa, Ontario												
DATUM Ground surface elevations	provi	ded b	y Sta	ntec G	Geoma	atics Limi [.]	ted.		FILE NO	D. PG327	2	
REMARKS									HOLE	10		
BORINGS BY CME 75 Power Auger				D	ATE	Novembe	er 23, 201	15		[©] BH21-1	5	
SOIL DESCRIPTION	РГОТ		SAN	IPLE	1	DEPTH	ELEV.			Blows/0.3m ia. Cone	l Well ction	
GROUND SURFACE	STRATA	ЭДХТ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	0 V 20	Vater Co	ontent % 60 80	Monitoring Well Construction	
		≅ AU	1			0-	-55.88					
FILL: Brown to black clayey sand,		ss ∦	1 2	92	12	1-	-54.88		• • • • • • • • • •			
some gravel 2.40		ss	3	100	8	2-	-53.88					
2.40	<u> </u>	∛ ss	4	83	8	2	-52.88					
		ss	5	50	5	3-	-02.00		• • • • • • • • • •			
		ss	6	50	3	4-	-51.88					
GLACIAL TILL: Grey clayey silt with		ss	7	75	17	5-	-50.88					
sand, gravel, cobbles and boulders		ss	8	50	13	6-	-49.88					
		ss	9	50	30							
		ss	10	75	18	7-	-48.88					
		ss	11	92	50+	8-	-47.88		· (· · · · · · · · · · · · · · · · · ·			
		RC	1	29		9-	-46.88					
		_				10-	-45.88		· · · · · · · · · · · · · · · · · · ·			
10.80		RC	2	39								
BEDROCK: Grey limestone		RC	3	91	84	11-	-44.88					
12.22						12-	-43.88					
End of Borehole												
(GWL @ 4.0m depth based on field observations)												
(GWL @ 1.84m-Dec. 1, 2015)												
								20	40	60 80	100	
								Shea ▲ Undist		gth (kPa) △ Remoulded		

SOIL PROFILE AND TEST DATA

DATUM Ground surface elevations provided by Stantec Geomatics Limited. FILE NO. REMARKS BORINGS BY CME 75 Power Auger DATE November 26, 2015 FILE NO. SOIL DESCRIPTION Image: Solution Surface Pen. Resist. Blows/0.3 GROUND SURFACE O Water Content % TOPSOIL O.08 AU 1 SS 2 12 20 Image: Solution Surface FILL: Dark brown silty sand, some gravel SS 2 12 20 1 FILE NO. PER Solution Surface O Solution Surface O Value O Value O O Value O Solution Surface SS 2 12 20 40 60 BH2 O <th colspan="6" solution"solution"solution"solution"solution"solution"solution"sol<="" th=""><th>3272</th></th>	<th>3272</th>						3272
REMARKS BORINGS BY CME 75 Power Auger DATE November 26, 2015 BH2 SOIL DESCRIPTION Image: Sample with the second secon							
BORNINGS BY Civil 751 Owen Adgen Date November 20, 2013 SOIL DESCRIPTION Image: Sample Date DepTh (m) ELEV. (m) GROUND SURFACE Image: Simple Image: Simple Image: Simple Image: Simple GROUND SURFACE Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple GROUND SURFACE Image: Simple Image: Simple Image: Simple Image: Simple Image: Simple Image: TopSoil							
SOIL DESCRIPTION OT H ELEV. (m) DEPTH (m) ELEV. (m) GROUND SURFACE H </td <td>2-15</td>	2-15						
GROUND SURFACE Image: Book of the second	d Well m						
TOPSOIL 0 55.58 FILL: Dark brown silty sand, some SS 2 12 20 1	Monitoring Well						
FILL: Dark brown silty sand, some SS 2 12 20 1-54.58) ²⁰						
-black @ 0.8m depth SS 3 62 11 2-53.58							
-brown @ 1.4m depth SS 4 54 22							
3 + 52.58							
$3 \times 3 \times$							
3							
GLACIAL TILL: Brown silty sand							
with gravel, clay, cobbles and boulders SS 9 83 10 6+49.58							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$							
$\begin{array}{c c} & & & \\ & & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & &$							
SS 12 67 34							
3+46.58 37 $9+46.58$ 37 $9+46.58$							
10.52 ^^^^^ SS 14 67 50+							
BEDROCK: Grey limestone RC 1 100 82 11-44.58							
End of Borehole 12-43.58							
(GWL @ 3.0m depth based on field observations)							
(GWL @ 2.84m-Dec. 1, 2015)							
20 40 60 80 Shear Strength (kPa ▲ Undisturbed △ Remoul)						

SOIL PROFILE AND TEST DATA

Geotechnical Investigation Prop. Commercial Development - 801 Albert Street Ottawa Ontario

Undisturbed

△ Remoulded

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

						lawa, Ol			1			
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03m	r loca n.	ted ne	ar the	northv	vestco	orner of si	ubject site	9.	FILE NO		3272	
-				_					HOLE	^{10.} BH	1	
BORINGS BY CME 55 Power Auger				D	ATE 、	June 4, 20)14				•	
SOIL DESCRIPTION	PLOT		SAM	IPLE		DEPTH (m)	ELEV. (m)			Blows/0.3 Dia. Cone		g Well ction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(11)	(11)	• •	/ater Co	ontent %	6	Monitoring Well Construction
GROUND SURFACE	ST	H	IUN	REC	N N			20	40	60 8		No No
	××	₿AU	1			0-	-56.35					
		≊ ∧o ∏ ss	2	33	26	1-	-55.35		· · · · · · · · · · · · · · · · · · ·			, լիկսինինինինինինինինինինինինինինինինինինի
FILL: Brown silty sand with organics,		ss	3	0	12						· · · · · · · · · · · · · · · · · · ·	
some gravel and crushed stone	\bigotimes					2-	-54.35	· · · · · · · · · · · · · · · · · · ·	- 	<u>.</u>		
	\bigotimes	X ss	4	43	17	3-	-53.35					
 black with trace asphalt by 2.7m depth 	\bigotimes	ss	5	55	60	Ū	00.00	- 4 3 4 1 4 4. - 4 3 4 4 4 3. - 4 3 4 4 4 3.			· · · · · · · · · · · · · · · · · · ·	
deptil		∑ss	6	80	50+	4-	-52.35		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
		∦ss	7	92	68	5-	-51.35					երերից երերերին երերերին երերերին երերերին երերերին։ Արերերերին երերերին երերերին երերերին երերերին երերերին երերերին երեր
	\bigotimes	ss	8	67	50+	Ū	01.00				· · · · · · · · · · · · · · · · · · ·	
<u>6.10</u>		x ss	9	100	50+	6-	-50.35					
GLACIAL TILL: Grey silty clay with 6.68 sand, gravel, some cobbles, trace		=				-	40.05		· · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
boulders	$\begin{array}{c} 2 & 2 \\ \hline \end{array}$	_RC	1	100	16	/-	-49.35					
	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	RC	2	100	53	8-	48.35		· · · · · · · · · · · · · · · · · · ·			
		110	-									յիկ
	$\frac{1}{2}$,	_				9-	-47.35					
		RC	3	100	95	10	40.05					
		_				10-	-46.35					
BEDROCK: Grey limestone		RC	4	100	98	11-	45.35		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
interbedded with black shale		110	•									րիկ հիկկ
	$ \begin{array}{c} 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 $	_				12-	-44.35					րրիրի Մ
		RC	5	98	95	13-	-43.35					<u>ihh</u> Thh
		_				10	+0.00				· · · · · · · · · · · · · · · · · · ·	
	$ \begin{array}{ccccccccccccccccccccccccccccccccc$	RC	6	100	98	14-	42.35		· · · · · · · · · · · · · · · · · · ·		••••••••	
			Ū									
		_				15-	-41.35					
		RC	7	95	35	16-	-40.35				•••••••	
16.46 End of Borehole		_							<u> </u>		· · · · · · · · · · · · · · · · · · ·	SE:
(GWL @ 3.12m-June 16, 2014)												
(GWL @ 3.36m-July 31, 2014)												
								20 Shea	40 ar Stren	60 8 gth (kPa		JU

sulting **SOIL**

SOIL PROFILE AND TEST DATA

Undisturbed

△ Remoulded

Geotechnical Investigation Prop. Commercial Development - 801 Albert Street Ottawa, Ontario

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

DATUM TBM - Top of manhole cover located near the northwest corner of subject site. FILE NO. **PG3272** Geodetic elevation = 56.03m. REMARKS HOLE NO. BH₂ BORINGS BY CME 55 Power Auger DATE June 5, 2014 SAMPLE Pen. Resist. Blows/0.3m Monitoring Well Construction STRATA PLOT DEPTH ELEV. SOIL DESCRIPTION 50 mm Dia. Cone (m) (m) RECOVERY VALUE Pr ROD NUMBER TYPE 0/0 Water Content % 0 N OL <u>4</u>0 ഫ RU **GROUND SURFACE** 20 0+55.22AU 1 3 2 FILL: Brown silty sand with gravel SS 25 13 1+54.22 and crushed stone, trace brick SS 58 16 2+53.22 2.44 SS 4 33 8 3+52.22 SS 5 83 3 Stiff, brown SILTY CLAY 4+51.22 SS 6 100 W - grey by 4.6m depth 5+50.226.10 6+49.22 SS 7 25 7 **GLACIAL TILL:** Grey silty 7+48.22 V SS 8 28 clay/clayey silt with sand, gravel, trace 17 cobbles and boulders SS 9 50+ 17 8+47.22 8.53 SS 10 38 50 +RC 1 100 87 9+46.22 2 RC 100 92 10+45.22 11+44.22 RC 3 100 92 12+43.22 RC 4 100 100 13+42.22 BEDROCK: Grey limestone interbedded with black shale 14+41.22 5 RC 98 88 15 + 40.226 100 RC 100 16+39.22 (GWL @ 7.68m-June 16, 2014) 17 + 38.227 RC 100 100 (GWL @ 7.01m-July 31, 2014) 18.06 18+37.22 End of Borehole 20 40 60 80 100 Shear Strength (kPa)

SOIL PROFILE AND TEST DATA

Geotechnical Investigation Prop. Commercial Development - 801 Albert Street Ottawa Ontario

Undisturbed

△ Remoulded

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

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DATUM TBM - Top of manhole cove Geodetic elevation = 56.03r	r loca n.	ited ne	ar the	northy	vestc	orner of s	ubject sit	е.	FILE NO	PG	3272	
BORINGS BY CME 55 Power Auger					ATE .	June 6, 2(11/		HOLE NO	D. BH	3	
												_
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH (m)	ELEV. (m)		esist. Bl 0 mm Di			Monitoring Well
		ы	ER	ERY	VALUE r RQD		(11)					oring
	STRATA	ТҮРЕ	NUMBER	% RECOVERY				• V	Vater Co	ntent %	6	Onit
GROUND SURFACE	S S S S S S S S S S S S S S S S S S S		z	RE	z ^o	0-	- 55.62	20	40	60 8	0	Σ_
		₿AU	1				55.02					
		ss	2	42	12	1-	54.62		· · · · · · · · · · · · · · · · · · ·			
FILL: Dark brown silty sand with organics, some gravel and crushed		ss	3	25	8	2-	- 53.62		· · · · · · · · · · · · · · · · · · ·			¥
stone, trace asphalt and coal		ss	4	58	2							
		ss	5	42	68	3-	- 52.62					
ture e blacture de bus 4 Oue de ath		x ss	6	60	50+	4-	-51.62		· · · · · · · · · · · · · · · · · · ·			
- trace blast rock by 4.0m depth 5.03			-	47								
<u>5.03</u>		∦ ss	7	17	36	5-	-50.62			· · · · · · · · · · · · · · · · · · ·		
		ss	8	0	3	6-	49.62					
GLACIAL TILL: Grey silty		ss	9	42	5				· · · · · · · · · · · · · · · · · · ·			
		ss	10	33	21	7-	48.62					
clay/clayey silt with sand, gravel, some cobbles and boulders		ss	11	33	9	8-	47.62		· · · · · · · · · · · · · · · · · · ·			
some cooples and boulders		ss	12	8	14							
		ss	13	42	19	9-	46.62		· · · · · · · · · · · · · · · · · · ·			
		k k ss	14	26	36	10-	45.62		·····			
10.70						44	-44.62		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
		RC	1	100	82		44.02					
		-				12-	43.62					
		RC	2	100	58	12-	42.62			•		
BEDROCK: Grey limestone interbedded with black shale							42.02					
		RC	3	100	90	14-	41.62					
						15-	40.62					
					07	15	40.02		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · ·		
		RC	4	98	87	16-	39.62					
(GWL @ 1.84m-June 16, 2014)		 				17	-38.62		· · · · · · · · · · · · · · · · · · ·			
(GWL @ 2.03m-July 31, 2014)		RC	5	100	95	1/-	30.02					
18.04 End of Borehole		1				18-	37.62					
								20 Shea	40 ar Streng			00

SOIL PROFILE AND TEST DATA

Geotechnical Investigation Prop. Commercial Development - 801 Albert Street Ottawa, Ontario

FILE NO.

PG3272

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

TBM - Top of manhole cover located near the northwest corner of subject site. DATUM Geodetic elevation = 56.03m. REMARKS B G F F r F S S _

REMARKS									HOLE	NO		
BORINGS BY CME 55 Power Auger				D	ATE 、	July 24, 20	014			BI	14	1
SOIL DESCRIPTION	РГОТ		SAM	IPLE		DEPTH	ELEV.			Blows/ Dia. Co		y Well ction
	STRATA I	ТҮРЕ	NUMBER	% RECOVERY	VALUE r RQD	(m)	(m)	• V	/ater (Content	%	Monitoring Well Construction
GROUND SURFACE	LN LN	н	NU	REC	N OL			20	40	60	80	NO NO
FILL: Black silty sand, some gravel	$\times\!\!\times\!\!\times$	ŠAU	1			0-	-55.21		· · · · · · · ·			
FILL: Crushed stone with sand, blat rock, cobbles, boulders 1.45		ss	2	26	46	1-	-54.21		· · · · · · · · · · · · · · · · · · ·			<u>իրիկիի</u> Սրիկիրի
~		ss	3	67	57	2-	-53.21					144444
FILL: Brown silty sand with crushed stone, blast rock, cobbles, boulders		ss	4	61	46		-52.21					
3.76		🛛 ss	5	8	11	5	52.21		· · · · · · · · · ·			<u>1111</u> 1111
Stiff, brown SILTY CLAY, trace sand		ss	6	100	2	4-	-51.21					<u>ինինի</u>
- grey by 4.5m depth		ss	7	100	2	5-	-50.21					<u>իրիի</u>
6.04 Loose, grey SANDY SILT , trace clay		∛ss	8	42	4	6-	-49.21	<u> </u>				ներեներությունը երերերերին երերերերերերերերերերերերերերերերերերեր
and gravel 6.86 GLACIAL TILL: Dark grey silty clay ₇ .47 with gravel, cobbles, boulders, trace ^{7.47}		ss	9	42	29	7-	-48.21					<u>իրիիի</u> իրիկի
Ishale		RC	1			8-	-47.21					<u>լիկկի</u>
		- RC	2	100	00	9-	-46.21					<u>իկկի</u>
		- HC	2	100	80	10-	-45.21		· · · · · · · · · · · · · · · · · · ·			<u>իրիի</u>
		RC	3	100	100	11-	-44.21					<u>իրիրի</u> դրիրի
		-				12-	-43.21					<u>իրիի</u>
BEDROCK: Grey limestone interbedded with shale		RC	4	100	88	13-	-42.21					
		RC	5	98	75	14-	-41.21					<u>իկիկի</u> իկիկի
		_					-40.21					<u>իրիրի</u> Մրիրի
		RC	6	100	88		-39.21					<u>իրիի</u> լերել
		-	7	100	100							լիկիի հերկի
		RC	7	100	100		-38.21					<u>իրիի</u>
		RC	8	98	98		-37.21					ուներությունը որությունը ուրենին ուրեներին որությունը ուրեներունը ուրեներությունը ուրեներությունը ուրեները ուրե
						19-	-36.21	20 Shea ▲ Undist		60 ength (k ∆ Rem	Pa)	, <u>-</u> − − 00

SOIL PROFILE AND TEST DATA

Geotechnical Investigation Prop. Commercial Development - 801 Albert Street

Undisturbed

△ Remoulded

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

,						tawa, Or						
DATUM TBM - Top of manhol Geodetic elevation = REMARKS	e cover loca 56.03m.	ted ne	ar the	northv	vestc	orner of si	ubject site	9.	FILE	ю. РС	3272	
				_					HOLE	NO. BH	4	
BORINGS BY CME 55 Power Aug	er			D		July 24, 20	J14					[
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)			Blows/0. Dia. Con		Monitoring Well Construction
	STRATA	ТҮРЕ	NUMBER	° ≈ © © © ©	VALUE Dr RQD	(,	(,	0	Wator (Content	%	nitorin
GROUND SURFACE	STH	Ĩ	NUN	RECO	N N N			20	40		80	N N N N N N N
						19-	-36.21					EE
		RC	9	100	100	20-	-35.21			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
	x x x 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	<u> </u>				21-	-34.21			· · · · · · · · · · · · · · · · · · ·		
		RC	10	98	98							
	2 2 2 2 2 2	_				22-	-33.21					
		RC	11	100	100	23-	-32.21			· · · · · · · · · · · · · · · · · · ·		
		_				24-	-31.21			· · · · · · · · · · · · · · · · · · ·	·····	
BEDROCK: Grey limestone interbedded with shale		RC	12	100	100	25-	-30.21					
			10	100	100	26-	-29.21		· · · · · · · · · · · · · · · · · · ·			
		RC	13	100	100							
		RC	14	100	100	27-	-28.21			·····		
	x x 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2					28-	-27.21		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
		RC	15	98	98	29-	-26.21			· · · · · · · · · · · · · · · · · · ·		
		_				30-	-25.21					
		RC	16	98	98							
	1 2 2 2 2 2 2 2	_				31-	-24.21			· · · · · · · · · · · · ·		
		RC	17	100	100	32-	-23.21					
End of Borehole	33.17	RC	18	100	100	33-	-22.21					
(GWL @ 1.91m-July 31, 2014)												
								20 She	40 ar Stre	60 a ngth (kP	80 10 a))0

patersongro						SOI	l pro	FILE AI		EST	DATA	
154 Colonnade Road South, Ottawa, Or		-		ineers	80	eotechnic 1 Albert \$ tawa, Or	Street	tigation				
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03r	r loca n.	ted ne	ar the	northwo	est co	orner of su	ubject site	Э.	FILE 1	NO.	PG3272	
BORINGS BY Backhoe				DA	TE .	June 11, 2	2014		HOLE	^{E NO.} T	P 1	
	PLOT		SAN	IPLE		DEPTH	ELEV.	Pen. R				er on
SOIL DESCRIPTION		ы	ER	TERY	CUE CDE	(m)	(m)	• 5	o mm	Dia. Co	one	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	* RECOVERY	N VALUE or RQD			0 V 20	Vater C	Conten 60	t% 80	Con
GROUND SURFACE						0-	-57.47					
		G	1									
FILL: Dark brown silty sand with gravel, cobbles, trace concrete												
- trace metal, brick and asphalt by												
0.6m depth						1-	-56.47					
		G	2									
						2-	-55.47					
		G	3									
2.80 End of Test Pit	\times											
(TP dry upon completion)												
										60 ength (l	kPa)	 DO
								▲ Undist	turbed		noulded	

patersongro		In	Consult	ing SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, O		-		rs	Geotechnic 801 Albert S Ottawa, Or	Street	tigation				
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03	er loca m.	ted ne	ar the nort	hwes	st corner of si	ubject site	e. FILE NO. PG3272				
REMARKS BORINGS BY Backhoe				DAT	E June 11, 2	2014	HOLE NO. TP 2				
	Б		SAMPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m				
SOIL DESCRIPTION	A PLOT		м р		(m)	(m)	• 50 mm Dia. Cone				
	STRATA	ТҮРЕ		VALI	or ROD		Pen. Hesist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %				
GROUND SURFACE	XXX				; v	-56.78	20 40 60 80				
		G	1								
		G	2								
FILL: Brown silty sand with gravel,					1-	-55.78					
cobbles, trace brick											
- some asphalt, brick and rebar by		G	3								
0.3m depth		-									
- with some coal by 1.5m depth											
					2-	-54.78					
		G	4								
- with wood pieces by 2.7m depth											
		G	5								
					3-	-53.78					
3.60	6										
End of Test Pit											
							20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded				

patersongro		In	Con	sulting		SOI	l pro	PROFILE AND TEST DATA					
154 Colonnade Road South, Ottawa, O		—		ineers	80	otechnic 1 Albert S tawa, Or	Street	tigation					
DATUM TBM - Top of manhole cov Geodetic elevation = 56.03	er loca 3m.	ted ne	ear the	northwe	est co	orner of si	ubject site	Э.	FILE NO	D. PG3272			
BORINGS BY Backhoe				DA	TE J	lune 11, 2	2014		HOLEN	^{ю.} ТР 3			
	Ę		SAN	IPLE		DEPTH	ELEV.	Pen. F	lesist. E	Blows/0.3m	- 5		
SOIL DESCRIPTION	A PLOT		ж	RY	۲ ۲	(m)	ELEV. (m)	• 5	50 mm D	ia. Cone	Piezometer Construction		
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			0 1	Nater Co	ontent %	Piezo		
GROUND SURFACE	0		2	RE	zÓ	0-	-56.34	20	40	60 80			
FILL: Brown silty sand with gravel, cobbles, rebar and rock fragments - with brick and pvc by 1.4m depth - Solution Solu		G	2			2-	- 55.34				Σ		
observations)								20 She ▲ Undis		60 80 1 gth (kPa) △ Remoulded	100		

natoreonar		in	Con	sulting		SOI	l pro	FILE AN	ND TEST	DATA	
patersongr 154 Colonnade Road South, Ottawa, O		-		lineers	801	technic Albert S wa, On		tigation			
DATUM TBM - Top of manhole cov Geodetic elevation = 56.03	er loca m.	ted ne	ear the	northwe		-		Э.	FILE NO.	PG3272	
REMARKS BORINGS BY Backhoe				ПА	TE .lu	ne 11, 2	2014		HOLE NO.	TP 4	
	E		SAN					Pen. R	esist. Blov	vs/0.3m	_
SOIL DESCRIPTION	A PLOT					EPTH (m)	ELEV. (m)		0 mm Dia.		Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater Conte	ent %	Piezo Const
GROUND SURFACE			4	RE	z	0-	-55.90	20	40 60	80	
FILL: Brown silty sand with gravel, cobbles, rock fragments and asphalt - dark brown to black by 1.5m depth		G	1			1-	-54.90				
FILL: Brown silty sand with gravel, cobbles, trace boulders		G	2								
End of Test Pit											
(TP dry upon completion)								20 Shea ▲ Undist	40 60 ar Strength urbed △ F		00

patersongro		In	Con	sulting		SOI	l pro		ND TEST	T DATA	
154 Colonnade Road South, Ottawa, O		-		ineers	80	otechnic I Albert S awa, On		tigation			
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03	er loca m.	ted ne	ar the	northwe).	FILE NO.	PG3272	
BORINGS BY Backhoe				DA	TE J	une 11, 2	2014		HOLE NO.	TP 5	
	Ц		SAM	IPLE		DEPTH	ELEV.	Pen. R	esist. Blov	ws/0.3m	r
SOIL DESCRIPTION	A PLOT		ж	RY		(m)	(m)	• 5	0 mm Dia.	Cone	mete
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	later Cont	ent %	Piezometer Construction
GROUND SURFACE	N N		Z	RE	zo	0-	-54.76	20	40 60	80	
FILL: Brown silty sand with gravel, cobbles, boulders, trace brick		G	1			1-	-53.76				¥
End of Test Pit (GWL @ 2.0m depth based on field observations)											
								20 Shea ▲ Undist	40 60 ar Strength urbed △ F	80 10 n (kPa) Remoulded	00

patersongr		in	Consulting			SOI	L PRO	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, C		-		ineers	80	eotechnic 1 Albert 9 tawa, On	Street	tigation			
DATUM TBM - Top of manhole cov Geodetic elevation = 56.03	rer loca 3m.	ited ne	ear the	northwe				9.	FILE NO.	PG3272	
BORINGS BY Backhoe				DA	TE .	June 11, 2	2014		HOLE NO	^{).} TP 6	
	П		SAN	IPLE		DEPTH	ELEV.	Pen. R	lesist. Bl	ows/0.3m	-5
SOIL DESCRIPTION	A PLOT		ĸ	RY	년 o	(m)	cccv. (m)	• 5	50 mm Dia	a. Cone	mete
	STRATA	ТУРЕ	NUMBER	∾ RECOVERY	N VALUE or ROD			• •	Nater Cor	ntent %	Piezometer Construction
GROUND SURFACE	w XXX		z	RE	z ö	0-	-54.83	20	40 0	50 80	
		× × ×									
		× ×									
		× ×									-
		* *									-
		G	1								
FILL: Brown silty sand with gravel,		×— × ×				1-	-53.83				-
cobbles, boulders, trace asphalt		× ×									
		× ×									
		* * *									
		G	2								
		× < ×									₽
		× ×				2-	-52.83				-
		× ×									-
		× ×									
2.5	9	× ×									
End of Borehole											
(GWL @ 1.8m depth based on field observations)											
									ar Streng	th (kPa)	00
								▲ Undis	turbed △	Remoulded	

patersong		In	Cons	ulting	SC	IL PRO	FILE AND TEST DATA
154 Colonnade Road South, Ottawa				neers	Geotechr 801 Alber Ottawa, 0	t Street	stigation
DATUM TBM - Top of manhole c Geodetic elevation = 56.	over loca 03m.	ted ne	ar the n	orthwe			FILE NO. PG3272
REMARKS BORINGS BY Backhoe					re June 11	2014	HOLE NO. TP 7
DONINGS BY DACKING	ы		SAMP			, 2014	Pen. Resist. Blows/0.3m
SOIL DESCRIPTION	A PLOT				DEPTI (m)	H ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %
	STRATA	ТҮРЕ		RECOVERY	OF ROD		• Water Content %
GROUND SURFACE				2		0+55.62	20 40 60 80
FILL: Brown silty sand with gravel, cobbles, trace boulders							
FILL: Black silty sand	0.94					1-54.62	
FILL: Brown silty sand with gravel, cobbles						2-53.62	
End of Test Pit (TP dry upon completion)	2.59						20 40 60 80 100
							Shear Strength (kPa) ▲ Undisturbed △ Remoulded

natoreonar		in	Con	sultina		SOI	L PRO	FILE AI	ND TES	T DATA	
patersongr 154 Colonnade Road South, Ottawa, C		-		ineers	801	technic Albert S wa, Or		tigation			
DATUM TBM - Top of manhole cov Geodetic elevation = 56.03	rer loca 3m.	ted ne	ar the	northwe		-		Э.	FILE NO.	PG3272	
BORINGS BY Backhoe				DA	TE Ju	ne 11, 2	2014		HOLE NO.	TP 8	
	E		SAN	IPLE		EPTH	ELEV.	Pen. R	esist. Blo	ws/0.3m	<u>_</u> د
SOIL DESCRIPTION	A PLOT		щ	RY		(m)	cccv. (m)	• 5	50 mm Dia	. Cone	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater Con	tent %	Piezo Const
GROUND SURFACE	0 0		z	RE	zö	0-	-55.59	20	40 60) 80	
FILL: Brown silty sand with gravel, cobbles and boulders - black from 0.6 to 1.0m depth		G	1								
		G	3			1-	- 54.59				
FILL: Grey silty clay to clayey silt, trace sand	3	G	4			2-	- 53.59				V
3.0 End of Test Pit (GWL @ 2.1m depth based on field	0					3-	- 52.59				
observations)								20 Shea ▲ Undist	40 60 ar Strengt turbed △		00

patersongro		In	Con	sulting		SOI	l pro	FILE AN	ND TEST DA	ТА
154 Colonnade Road South, Ottawa, Or		-		ineers	801	otechnic I Albert S awa, Or		tigation		
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03r	r loca n.	ted ne	ar the	northwe				Э.	FILE NO. PG3	272
REMARKS BORINGS BY Backhoe				DA	TE J	une 11, 2	2014		HOLE NO. TP 9	
	Ę		SAN	IPLE				Pen. R	esist. Blows/0.3	m
SOIL DESCRIPTION	A PLOT		~	RY		DEPTH (m)	ELEV. (m)	• 5	0 mm Dia. Cone	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater Content %	Piezo
GROUND SURFACE	s N		Z	RE	zö	0-	-55.27	20	40 60 80	
FILL: Brown silty sand with gravel, trace bricks, organics						-				
FILL: Black silty sand		G	1							
FILL: Light brown clayey silt, trace		G	2			1-	-54.27			
sand										
FILL: Brown-orange silty sand with gravel, cobbles and boulders		G	3			2-	-53.27			
2.44										
TP terminated on bedrock surface at 2.44m depth										
								20 Shea ▲ Undist	40 60 80 ar Strength (kPa) urbed △ Remould	

patersongro		In	Con	sulting		SOI	l pro	FILE A	ND TE	ST [DATA	
154 Colonnade Road South, Ottawa, O		-		isulting jineers	80	otechnic 1 Albert S tawa, Or	Street	tigation				
DATUM TBM - Top of manhole cove Geodetic elevation = 56.03	er loca m.	ted ne	ear the	northwe	-			e.	FILE N	o. P	G3272	
REMARKS BORINGS BY Backhoe				۵۵	TE .	lune 11, 2	2014		HOLE	NO. TI	P10	
	Ę		SAN					Pen. R	esist. E	Blows/	0.3m	
SOIL DESCRIPTION	A PLOT		ĸ	RY	벌ㅇ	DEPTH (m)	ELEV. (m)	• 5	0 mm D	Dia. Co	one	Piezometer Construction
	STRATA	ТУРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater C	ontent	t %	Piezo Const
GROUND SURFACE	w w		2	RE	z ^o	0-	-55.90	20	40	60	80	
		G	1			1-	- 54.90					
FILL: Brown silty sand with gravel, cobbles, boulders, trace brick		G	2			2-	-53.90					
		G	3			3-	-52.90					Ϋ́
						_						
<u>3.3</u> End of Test Pit		+										
(GWL @ 3.0m depth based on field observations)												
								20 Shea ▲ Undist	40 ar Strer turbed	60 19th (k △ Rem	Pa)	⊣ 00

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

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

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

RQD % ROCK QUALITY

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard
		Penetration Test (SPT))

- TW Thin wall tube or Shelby tube
- PS Piston sample
- AU Auger sample or bulk sample
- WS Wash sample
- RC Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

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

PERMEABILITY TEST

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

SYMBOLS AND TERMS (continued) STRATA PLOT Topsoil Asphalt Peat Sand Silty Sand Fill Δ Sandy Silt Clay Silty Clay Clayey Silty Sand Glacial Till Shale Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION









Certificate of Analysis

Report Date: 25-Jun-2014 Order Date:20-Jun-2014

Client: Paterson Group Consulting Engineers

Client PO: 16047		Project Descript	ion: PG3272		
	Client ID:	BH3 SS13	-	-	-
	Sample Date:	06-Jun-14	-	-	-
	Sample ID:	1425330-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.9	-	-	-
General Inorganics					
рН	0.05 pH Units	8.15	-	-	-
Resistivity	0.10 Ohm.m	50.5	-	-	-
Anions					
Chloride	5 ug/g dry	40	-	-	-
Sulphate	5 ug/g dry	65	-	-	-

P: 1-800-749-1947 E: paracel@paracellabs.com WWW.PARACELLABS.COM OTTAWA 300–2319 St. Laurent Blvd. Ottawa, ON K1G 4J8

MISSISSAUGA 6645 Kitimat Rd. Unit #27 Mississauga, ON L5N 6J3 NIAGARA FALLS 5415 Morning Glory Crt. Niagara Falls, ON L2J 0A3

SARNIA 123 Christina St. N. Sarnia, ON N7T 5T7

Page 3 of 7

	Log of	f Borehol	e 1	¥	Trow
Project No:	OTGE00017721A			Figure No. 3	
Project:	Geotechnical Investigation - Proposed Develo	pment			-
Location:	Albert and City Centre Street, Otlawa, ON			Page. <u>1</u> of <u>2</u>	-
Date Drilled:	December 14th, 2004	Split Spoon Sample	8	Combustible Vapour Reading	
Drill Type:		Auger Sample SPT (N) Value	00	Natural Moisture Content Atlantary Limits	×
Datum:	Depth below grade	Dynamic Cone Test Sheby Tube		Undrained Triaxial at % Strain at Fabura	. e
Logged by:	Checked by:	Shear Strength by Vere Test	<u></u>	Shear Strength by Penetrometer Test	

Ģ	SOIL DESCRIPTION	Geodetto		20	4	stration Test		80	2	50	500 500 Isture Contr Its (% Ory 1	150	S A M P	Natura Unit W
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11 M P (55.3	1	301311) . I.	2829	88		Š.X	1928	12131		X	
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IIIK	888-			201211	:: ! :	2122 2	212	1938	21:12	222	1. (12)	2613	M	
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1112	brown, moist (soft).		T.	Q :::::::::	::: ! :	2.22	ž:::	:::: <u>:</u> ::	2112	222	: X ::	22.2	XI	
H		52.6		3313413	5 ÷ į	<u> </u>	844	1.1.2.1	3443	- și	11 61 3 6	36.5	В	
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ΉŁ	(compact to dense).	1.00					-		Ś				E	
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			t	2.12.1.1			213.		1.12			3813	11	
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Ē	LIMESTONE BEDROCK Some shale		ĺ.,	326545		71 <u>5</u> 7151	<u></u>	1121	\${-}\$	-1-5-6-1	11 (A) (A)	2615	Ħ.	
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_F	TContinue the Date		J 12	3813:13	1.1.1	\$13\$ 3	÷ ; ; ;	-1-1-2 12	41.14	-1-12		19613	H.	
NOTE	Continued Next Page													
1.Bore	ehole/Test Pit data requires Interpretation by Trow		RL	EVEL RÉCO					COF	RE DR	ILLING R			
		lapsed		Water	H I	ole Open		Run	Depl		% Ro	C.	RQ	0%
2. Piez	zometer installed upon completion.	Time	_ L	.evol (m) 2.3	-	To (m) NA	-11	No.	(m) 4 2 -		45			
		mpletion		2.3		144		1	4.3 -	-	15			
1 6	id work supervised by a Trow representative	4 Days		2.4	1		-11	2 3	5 - 6. 8.9 - 9		18 43	6		
									9.6 - S					
4.See	Notes on Sample Descriptions							4			100			12
5. This	s Figure is to read with Trow Associates Inc. report						- []	5	9.8 - 1	- 1	42			3
OTG	GE00017721A		_		<u> </u>		_ [<u> </u>	11.9 - 1	12.3	100			3

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Project No: OTGE00017721A

Project: Geotechnical Investigation - Proposed Development

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3 Figure No.

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	-	(continued)					Î				111		1111		_	_
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bei	ione us	Test Pit date requires interpretation by Trow e by others	Elapsed		Water		200	ola Oper		Run	Dep	1	% Rec		RQD	%
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		s on Sample Descriptions	1							4	9.6 -		100			
		e is to read with Trow Associates Inc. report 17721A							11	5	9.8 - 1		42		32	
												12.5				

Log of	Borehole	2
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SpD Spoon Sample

Dynamic Cone Test

Shear Strength by Vana Tesi

Auger Sample

SPT (N) Value

Shaby Tube



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Page. 1 of 1

Combustible Vapour Reading

Natural Moisture Content

Atterbarg Limits

Undrained Triaxial at % Sirain at Faltera

Shear Strangth by Penetrometer Tast

Figure No.

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Project:

Location:

Date Drilled: December 13th, 2004

Drill Type:

Project No: OTGE00017721A

Geotechnical Investigation - Proposed Development

Albert and City Centre Street, Otlawa, ON

Checked by:

Datum: Depth below grade

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		Borehol	e <u>3</u>	木	Trow
Project No:	OTGE00017721A			Figure No. 5	
Project:	Geotechnical Investigation - Proposed Develope	nent	150		
Location:	Albert and City Centre Street, Ottawa, ON			Page. <u>1</u> of <u>1</u>	- (S)
Date Drilled:	December 13th, 2004	Spill Spoon Sample		Combustible Vapour Reading	
Drill Type:		Auger Sample	00	Natural Moisture Content	×
		SPT (N) Value	0	Allerburg Linits	⊢
Datum:	Depth below grade	Dynamic Cone Test		Undrained Triadal at	Ð
Logged by:	Checked by:	Shelby Tube Shear Sirength by Vishe Test	# *	% Strate al Fathere Shear Strangh by Panatrometer Tast	

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¥		SOIL DESCRIPTION		•	b Shear Sh	40 ngih	60	_60 kPa	Atte	itural Not	stare Cor its (% Dr)	teni % / Weight)	- F	Unit 1 kN/o
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Ŧ	883	-	٦	54.3	2 33355		52.52						H	
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Ш		-grained, brown to grey, wet (loose to dense).	-						12:00				F	
Ш	88			- [×				XI	
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Ш		SILTY CLAY Slightly organic, grey, wet (soft).											Δ	
111										1			Н	
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Ш		SILTY SAND TILL Clayey, fine to coars grained sand and fine to coarse grained	8	- Ì				21121			6		H	
Ш	<i>}}</i> 2	grained sand and fine to coarse grained gravel, grey, wet (loose to compact).	1 1										11	
Ш	80	- Graver, Brey, wet (loose to compact).	_					11121	202	1211	112			
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Project No: OTGE00017721A

Project: Geotechnical Investigation - Proposed Development

Location: Albert and City Centre Street, Oltawa, ON

Date Drilled: December 14th, 2004

Drill Type:

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Datum: Logged by: Depth below grade ______ Checked by: Spill Spoon Sample Auger Sample SPT (M) Value Dynamic Cone Test Sheby Tube Shear Sirangih by Vane Test

Page1_ of _1_
Combusible Vapour Reading
Natural Molature Contant. X
Alterberg Limits J
Understeed Triadal at 🛛 🕀

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Figure No.

Sheer Strength by Penetromater Test

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	ş			Canada	To		ndard P	neistion	Test N V	atre			pour Reac 600	ding (ppm 750		Nati
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1	120	-	٦.	47.7		25131	1221	10000	3243			3223	1 1 1 2 2	3010		
f	11	LIMESTONE BEDROCK With shale		**.*	Ι.										Ξh.	
F	┯┹	partings, grey/black (excellent quality	». T		!					1						
ł	╧┲┨	_	_					12122		1326	2013	1.1.1	1.136		11	
F						33131		12122	333	<u> 1986</u>	3113	3361	1:1::			
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Bo	rES: prehole	/Test Pil data requires Interpretation by Trow a by others				EVEL RE			_						_	
		·	Elapse Time			Waler sve! (m)		Hole Op To (m)		Run No.	Dep (m)		% Re	c.	RQ	ID %
.Pi	ezomei	lar installed upon completion.	Complet			2.3		NA	-1	1	3.6 - (100			
			44 Day			2.3				2	4.2 -		59			
.Fi	eld wor	tk supervised by a Trow representative								3	4.8 - 3		16			
		es on Sample Descriptions								4	7.8 - 1	9.3	100		1	88
		re is to read with Trow Associates Inc. report 017721A		1						1						
		ETE IS ID (BAG WILD LYOW ASSOCIATES INC. (BODIL)	1							I				1		

Log	of	Borehole	5
			the local division in which the

¥Trow

Project No: OTGE00017721A

Depth below grade

Project: Geotechnical Investigation - Proposed Development

Albert and City Centre Street, Ottawa, ON

Checked by:

Location:

Date Drilled: December 14th, 2004

Drill Type:

Datum:

Logged by:

Spit Spoon Sample Auger Sample SPT (N) Volue Dynamic Cone Test Shaby Tube Shaar Strength by Vane Test

	rigato tio.
20	Page. <u>1</u> of <u>1</u>
-	
	Combustble Vapour Reading
	Hatural Moisture Content X
	Attention Limits
	Underlined Triaxial at 🕀
	Shear Strength by A

Eigune No.

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Standard Penetrolion Test N Value Combusible Vapour Reading (ppm) SYMAOL D i0 600 758 Holistave Contant % erg Linsta (% Dry Weigt Netural ŵ Gaodetic 250 SOIL DESCRIPTION 40 80 Unit Wt. kN/mª 20 Shear Sinesgib LP₂ m ĸÖ 55.4 55.3 200 50 20 40 60 TOPSOIL ~100 mm. FILL Sandy silt with organics, asphalt ÷.... pieces, dark grey to black, moist (loose). 53.9 SAND AND GRAVEL TILL Fine to coarse 1981 8198 9811 1981 8 5**9** 8 8 8 7 8 1981 1981 8 1211:1121 grained sand and fine to medium gravel, -1 - (-) 53.3 some shells, grey, moist (compact to and the second sec 505 t ist 2013 dense). utar nooq : N -44.14 3343 Frequent cobbles and boulders below 3.0 3848 m depth 212:1221:2122 613:1361:6136 49.9 LIMESTONE BEDROCK With shale partings, grey/black (poor to good quality). 521 202 2113 1.56 ald 1961 alla data lara alar alar alar alar Ald 1961 alla data data lara alar alar 0440 3713 3122 2213 \$133. 3213:5333 13\$1: 3:13 47.9 80/92/5 TROW OTTAWA.GDT OPEBH1-7.GPJ ព័ NOTES: 1.Borehole/Test Pi dela raquiras Interpretation by Trow before use by others WATER LEVEL RECORDS CORE DRILLING RECORD Elapsed Water Hole Open Run Depih % Rec. ROD % ž Time Level (m) To (m) No. (m) 2. Piezometer installed upon completion. 빌 40 Completion 24 NA 1 31-4 44 Days 2.1 2 4 - 5.2 27 BORE 3. Field work supervised by a Trow representative 3 5.2 - 5.5 100 4 5.5 - 5.9 100 32 4.See Notes on Sample Descriptions ъ 5 5.9 - 7.5 100 88 5. This Figure is to read with Trow Associates Inc. report OTGE00017721A

Field work supervis See Notes on Sam	sed by a Trow representative	Completion 44 Days		2.7		NA		1 2 3	2.9 - 4.7 4.7 - 6.2 6.2 - 7.9		47 40 91	65
before use by other Piezometer installe	rs Id upon completion.	Elapsed Time	L	Water evel (m)		Inia Ope To (m)		Run No.	Depth (m)		Rec.	RQD %
ITES: lorshole/Test Pil d	late requires Interpretation by Trow		ERL	evel re							RECOR	
TES: lorshole/Test Fit d efore use by other												
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]	ľ			*134 3138	3313		8883			
parting	ys, grey/black (fair quality).]		24.1		÷			202			
	TONE BEDROCK With shale	49.2	6			**** ****	1211 1311					i I
		1		3213		202			2.3		5	
		-1	5		1.24							
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(very c	Jense).	-	4	2013	1381		9413 3213				28 38) 28 28)	Ĩ
_graine	d sand with fine to medium gra ant cobbles and boulders, grey	ivel, _										H
SAND). AND GRAVEL TILL, Fine to co		3	3813 3613		i di	() () () 변종() ()	<u>+(18)</u> -(18)	3 X2	\$61-61 \$61-61	38 38) 38 38)	
	EY SILT Olive grey, moist. Partially decayed, black, wet	- 52.8									2020	
** -			3.2	0 1		8138			5 X 3	<u>.</u>	1. FA 18 4. 1	Ň
* -		-		2013			421) 121)		2023	<u></u>	28 20 28 20	
Pieces	אן סטיא אוסץ זיי טומטא, וווטואן (וטט	_	1	0			2044				31 30	
XXX FILL	<u>OIL</u> ~ 175 mm. Sandy silt with organics, aspha s, dark grey to black, moist (loo	^{55.2}		Ö		12132	(2×12		131328	30100	<u>.</u>	M
	SOIL DESCRIPTION	55.4		b Shear	20 Sirengtii 50 1		60	200	20	40	Content % Dry Weight) 80	P Uni L kN S
S V B O		Geode	nde je			neiration 1	Fest NV	ette	250	500	teading (pp) 750	10 Nat
ogged by:	Checked by:	;		Shear S Vene Te	vength bj sk	r	5		Shear Sina Penatroma			
1977 V-161 - 19	Depth below grade		_	Dynamie Shelby 1	: Cone Te Tube	a !			Undrained % Sitein al	Falure		⊕
rill Type:			_	Augur S SPT (N)	Value		0 C		Naturni Mo Alterberg L	inits	ant	× e
ate Drilled:	December 14th, 2004			Spit Sp	oon Same	da	Ø		Combustib	le Vapour F	baading	
ocation:	Geotechnical Investigation - P Albert and City Centre Street,		opin						Page	1_	ol _1	
Project:		roonsed Devel	onm.	801					Figure No			•

		Borehol	e <u>7</u>	木	Trow
Project No: Project:	Geotechnical Investigation - Proposed Develo	pment		Figure No. 9 Page. 1 of 2	-
Location:	Albert and City Centre Street, Ottawa, ON				
Date Drilled: Drill Type:	January 14th, 2005	Spit Spoon Sample Auger Sample		Combustible Vapour Reading Natural Moisture Content	DX C
Datum:	Depth below grade	 SPT (N) Value Oynamic Cone Test Shaby Tube 		Atlenberg Limite Undrained Triaxial at % Strain at Failure	——€ ⊕
Logged by:	Checked by:	Shear Strength by Vane Test	\$	Shear Strength by Penelsometer Test	

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	1			_	Vane Test				<u>, </u>	Penela		1.25			
G M W B	SOIL DESCRIPTION		Geodette	2	Sonor 20		Wration To				250	500	ding (ppri 750		Natu
Ψ ĕ	JUL DESCRIPTION		an -	ŝ	Shear Sire	-			eg kPa		ilumi Mot berg Lim	ture Con Is (14 Dry	tent % Weight)		Unit ^u KNVr
	FILL Sand to silty sand with occasi	lonal	64.3	•	50	10	15		200 1	4.12	20	40	80	S S	├
	gravel layers and rock fragments, b moist (compact to dense).	nown, _			3813311	225	\$13\$:)::[:	1:1:1:1:1	2133	121	1:12			
	molat (compact to dense).			Ł							134	112			
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					3813513	<u> </u>		213		2013 700 7	1211	<u> (</u>		11	
IXX-,	Some wood fragments, black stainin			•										Ц	
1888-3	rganics present from 9.1 m depth.				2212212	<u>d</u>	192	21:2:	1.1.2.1:	2:12		-€-1÷-€	23:12	XI	
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	Continued Next Page			12	38 3 13	81 1 2	1380	212	:::::::	ះពុះ	10(1)		2013		
OTES: Borehole/T	est Pi) data requires Interpretation by Trow	[WATER	LE	VEL RECO	RDS				COF	E DRA	LING R	ECORD		
before use	by others	Elapse	d	٧	Vatar	Но	e Open		Run	Depi	<u>6</u>	% Re			0%
Piezomeler	installed upon completion.	Time Completi	ion		vel (m) dry		<u>o(m)</u> 4.3 m		No. {	(m) 13.5 - 1		67		-	0
Field work	upervised by a Trow representative	14 Day	\$		11.1				2	14.4 - 1	5.2	0		3	D
	on Sample Descriptions														
	is to read with Trow Associates Inc. report 7721A	[1			- I				



Project No: OTGE00017721A

Project:

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Figure No. 9

											2_of		
. \$	-		0	51	andard Pi	nanion	Test N V	ans.				sing (ppm) 750	C Na
	SOIL DESCRIPTION	10.000	al alle alle alle alle alle alle alle a	-	20	40	80	80	Ne	kumal Micla	itare Cont Itare Cont Itari 1% Dry	iani %	DU 91
11		52.3			Strength 50	102	50	100 kPa	AZA	owing Linni 20	49 49	Weight)	R IN
	FILL Sand to slity sand with occasi	onal	12	227-1-2	11200		1201-	terre	2110	1200	1 11 24	21.24	1
	gravel layers and rock fragments, b	rown,			1		100	1331	: 81:13 	1.000			M
1888	moist (compact to dense). (continue	ed) -		- ••			121	t i i i					Ŵ
1888				22:13	1321	2133	1211	143		120	: 6124	5413	hď
1000		7	14	3213	1321	2132	2011			1211	1124	2 2 2 1 2	
8888		50.8	- 1	32.13	1921	0.000	27.6.	11121	12133	1221	11151	3813	
	SAND AND GRAVEL TILL Frequent			32.3	1321	\$112	1000	1.181	31.13	1.5.63	1131	30.13	n
1.1	cobbles and boulders, fine to coarse	e sand	1.	100	1	1.1.1.2	321	1.1.2.1	15135	12211	11.121	12.1.2	11
1 F W	and fine to coarse gravel, grey.			13213	1321	12122		11221	0140	1041	1:121	3112	11
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			- 1	2213	1261	305	1211	1931	3113	1261	6134	3012	11
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TES.	Test Pit data requires Interpretation by Trow			VELRE	CORDS				COR	EDR		ECORD	1
bafore us	a by others	Elapsed		Valer		loia Ope		Run [Dept		% Rec		ROD %
Danmai	ler installed upon complotion.	Time		wel (m)	1.	To (m)		No.	(m)				
L. IOTOLINE		Completion		dry		14.3 m		1	13.5-1		67		0
F-16404 High		14 Days	1	11.1			- 11	2	14.4 - 1	5.2	0		0
		and the second second second											
	k supervised by a Trow representative	ala sensi di kacilaria.											
Field wor	k supervised by a Traw representative is on Sample Descriptions												

Log	of	Borehole	e 8

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4. See Notes on Sample Descriptions 5. This Figure is to read with Trow Associates Inc. report OTT-00020193-A0



Project No:	OTT-00020493-A0			Floure No. 10	
Project:	Geotechnical Investigation - Proposed Residentia	al Development		- galorio.	-
Location:	801 Albert Street, City of Ottawa, Ontario			Page. 1 of 2	-
Date Drilled:	July 20, 2010	Spit Spoon Sample	8	Combusible Vapour Reading	
Drill Type:	20	Auger Sample	00	Natural Moisture Content	×
Dun Type:		SPT (N) Value	0	Attorberg Limits	⊢− 0
Datum:	Geodetic	Dynamic Cone Test Sheiby Tube		Undrained Thaxai at % Strain at Fallure	⊕
Logged by:	Checked by:	Shear Strength by Vane Test		Shear Strength by Penetrometer Test	

8 Y		Geocesc	9	Stand	iard Pe	netration Test i	N Value	250	pour Reading (ppn 500 750		Natur
	SOIL DESCRIPTION	Elevation	1	20 Shear Su	sogih	40 _ 60	80 kPa	Natural Mo Attention Lin	isture Content % its (% Dry Weight)	n) N≪⊒n -num	Unit V IdN/m
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-	TOPSOIL - 230 mm	54.8								:М	
***			1	21			- (-) - (-) - (*	+++++++++++++++++++++++++++++++++++++++	÷XI	
	Sand and gravel with asphalt grinders, frequent cobbles and boulders, brown and	nd -				0.010.00.020			1040-00-040	3/\	
	black, moist		Ľ							H	
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	Basement floor	49.8	5		÷44					74	
	CLAYEY SILT TILL	40.0		122121				· · · · · · · · · · · · · · · · · · ·		訂	
	Some sand, fine to medium gravel, grey,									١٧	
Ŵ	wet			Sec. 14					1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	1	
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		48.6	5							W	
SHA.	SILTY SAND TILL			221213	-9-4- 					17	
	Fine to coarse gravel, some cobbles and	V		15 0						١V	
	boulders, grey, very moist									ΞAI	
	Protocol data da Processi		١,			<u>etre et</u>	1111			:11	
OTES	Continued Next Page				000	8		CODE OF	ILLING RECOR	0	1.01
. Borehole	Test Pit data requires Interpretation by Trow e by others	Elapsed	л L	EVEL REC Water		s Hole Open	Run	Depth	% Rec.		20%
	slotled standpipe was installed in the	Time		evel (m)		To (m)	No.	(m)			
borehole		14 days		2.0			1	8.9 - 10.9	100		100
Chald	to summarize and bull a Trong appropriation						2	10.9 - 11.9	100	32	94
rieki wor	k supervised by a Trow representative										
	s on Sample Descriptions										

Log of Borehole <u>8</u>



Project: Gentechnical Investigation - Proposed Residential Development

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Project No: OTT-00020493-A0

Figure No. 10

SY MBO	SOIL DESCRIPTION	Geodetic Elevation	D Standa 0 20	40 60	80	Combustble Vapour 250 500	750	S M Nati P Unit L KN/
8	SOIL DESCRIPTION		IN COMPANY	ngth	kPa	Natural Moisture Atlerberg Limits (9		
	SILTY SAND TILL Fine to coarse gravel, some cobbies and	47.96	7 50		200	20 40	60	
	boulders, grey, very moist (continued)							₩
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		46.1	00000	121121212121				H.
	UMESTONE BEDROCK Shatey partings, horizontally bedded thingly	-					444 444	11
	to medium bedded, vertical joint planes, grey (excellent quality)				1		100 0010	
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늭	Borehole Terminated @ 11.9 m depth	43.1						
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- 1								
		2						
- 1								
ES:								
oreholi	VTest Pit data regulaes Interpretation by Trow Etap		Water	Hole Open	Run	CORE DRILLI Depth	NG RECORD	ROD %
19 mm prehole	slotted standpipe was installed in the	ne	Level (m) 2.0	Το (π)	<u>No.</u> 1	(m) 8.9 - 10.9	100	100
					2	10.9 - 11.9	100	94
	rk supervised by a Trow representative							
	es on Sample Descriptions							
hie Fir-								

Log	of	Bo	ret	lor	e 9



Project No:	OTT-00020493-A0		الموسلونية -	- 1570 	
Project:	Geotechnical Investigation - Proposed Residentia	Figure No. 11	-		
Location:	801 Albert Street, City of Ottawa, Ontario			Page. 1 of 2	-
Date Drilled:	'July 20, 2010	Spit Spoon Sample	2	Combusticle Vapour Reading	
Drill Type:		Auger Sample	00	Natural Moissure Content	×
onin rypo.		SPT (N) Value	0	Atterberg Limita	⊢ −0
Datum:	Geodetic	Dynamic Cone Test Sheloy Tube		Undrained Triaxial at % Strain at Failure	⊕
Logged by:	Checked by:	Shear Strength by Vane Test	÷	Shear Strength by Penetrometer Test	

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OTES:	Continued Next Page	WATER	11	EVEL RECO	RDS				00	RE DBI	LING R	ECOB	5	
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Field work	supervised by a Trow representative							3	9.3 - 1		58			95
See Note:	s on Sample Descriptions									1				
	re is to read with Trow Associates Inc. report 20493-A0			1			- 11							



Project No: OTT-00020493-A0 Project: Geotechnical Investigation - Proposed Residential Development

Figure No. 11

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		e by others	Elapsed Time		Wat Level		Т	Hole Op To (m		Run No,	Dep (m)		% Re	c.	RQD	29
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	Log of E	orehole	10	¥.	Trow
Project No: Project:	OTT-00020493-A0 Geotechnical Investigation - Proposed Residentia			Figure No12 Page1of _2	-
Location: Date Drilled: Drill Type:	801 Albert Street, City of Ottawa, Ontario	Spit Spoon Sample Auger Sample SPT (N) Value		Combustible Vapour Reading Natural Moissure Content Attentieng Limits	□×□ •
Datum: Logged by:	Geodetic Checked by:	Dynamic Cone Test Sheiby Tube Shear Strength by Vane Test		Undrained Triaxial at % Strain at Failure Shear Strangth by Penetrometer Test	⊕ ▲

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Figure No. 12

Project No: OTT-00020493-A0_



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S Y MB O L	SOIL DESCRIPTION	Grada		Shear Stren	gui	kPa		stura Contant % its (% Dry Walght) 40 60	
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OTT-00020493-A0			Figure Ma 13	
Geotechnical Investigation - Proposed Residentia	al Development			-
801 Albert Street, City of Ottawa, Ontario			Page1_ or _2	-
July 19, 2010	Spit Spoon Sample	Ø	Combusible Vapour Reading	
	Auger Sample	00	Natural Molature Content	×
	SPT (N) Value	0	Acerberg Limits	⊢ −0
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Checked by:	Shear Strength by Vane Test	+ 5	Shear Strength by Penatrometer Tasl	
	Geotechnical Investigation - Proposed Residentia 801 Albert Street, City of Ottawa, Ontario 'July 19, 2010 Geodetic	Geotechnical Investigation - Proposed Residential Development 801 Albert Street, City of Ottawa, Ontario 'July 19, 2010 Spit Spoon Sample Auger Sample SPT (N) Value Geodetic Dynamic Cone Test Shedy Tube Checked by: Shear Strength by	Geotechnical Investigation - Proposed Residential Development 801 Albert Street, City of Ottawa, Ontario 'July 19, 2010 Spit Spoor Sample Auger Sample II Geodetic Dynamic Cone Test Checked by: Shear Strength by	Geotechnical Investigation - Proposed Residential Development Figure No. 13 801 Albert Street, City of Ottawa, Ontario Page. 1 of 2 'July 19, 2010 Spit Spoon Sample Combusible Vapour Reading Auger Sample III Nature Molecure Cortem SPT (N) Vable O Accreterg Limits Geodetic Dynamic Corte Test Undrained Triacial at the Stream Strength by Checked by: Shear Strength by +

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Figure No.

Project: Geniechnical Investigation - Proposed Residential Development

Project No: OTT-00020493-A0

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iorehole Field work supervi See Notes on San	andpipe was installed in the sed by a Trow representative role Descriptions sed with Trow Associates Inc. report	Time 15 days		<u>yel (m)</u> 1,6		<u>To (ri)</u>		No. 1 2 3	(m 5.9 - 6 - 7 7.5 -	-6 .5	97 100 97		97 100 97

Log of Borehole <u>12</u>

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Project No:	OTT-00020493-A0				
Floject No.	011-00020493-40			Figure No. 14	
Project:	Geotechnical Investigation - Proposed Residentia	al Development			-
Location:	801 Albert Street, City of Ottawa, Ontario			Page. 1 of 2	<u>-</u>
Date Drilled:	July 19, 2010	Spit Spoon Sample	8	Combustible Vapour Reading	
Drill Type:		Auger Sampie	00	Natural Moisture Content	×
опіл тура.		SPT (N) Value	0	Atterberg Limits	0
Datum:	Geodetic	Dynamic Cone Tast She by Tube		Undrained Traulal at % Strain at Failure	⊕
Logged by:	Checked by:	Shear Strength by Vane Test	÷ s	Shear Strength by Penatrometer Test	

SYMBOL Cyl	SOIL DESCRIPTION	Geodelic Elevation m	Deper	20 Sharat Street		etration T 0 6		808 80 14 Pa	2	50 5	ture Conte is (% Dry V	50	PLEE YO	Naturi Unit W
	TOPCOIL DO man	55.29	0	- EO	1	0 15		200		0	40 1	50	5	
	<u>TOPSOIL</u> ~ 80 mm Fill	55.2				68	230 maa		4112		1111	141-1	N	
	Sity sand and gravel with asphalt				÷÷		· <u>0</u>	11111	X		++++++	2 401-2	÷Ц	1
	grandings, wood pieces, some organics,	4	L					1.1.51	15133	1.1.6.	- 6.2.0.1-	361.3	1/1	
	Silly sand and gravel with asphalt grandings, wood pieces, some organics, brown and black, moist to wet		L				111		12112		tist	1111	t	
				10000					6416	-1644	46166	Q (+1-)	-	
		1	1.					1101			1.1.1.1		N	1
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								11.121	31.14		1.111		V	
		_						11171	1111	11711	1			1
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		53.11				+ + + +	444 1		4444			4444	H	
		1												
		-		1999 (d) 1999 (d)	-	45	<u> </u>	11111	51.15	1211	11:11	13610	N	
	Frequent cobbles and boulders					o			*		tritt	1111	X	
				1.01.0	÷.	A. 1. S. S.		+1-1-1-1-	61.10	-101-1	-6466	\$ \$ 1.9	11	
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		1									+++++		11	
	-	4											11	
				<u></u>		$\frac{1}{2}$	<u>1919</u>	++++++	朝守	4944	t ti të t			
								F						
		4				1111							11	
			1		÷	****	1 - 1 - 1	1.1.1.1.1	*****		1.1.1		H	
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	_			2012-12	÷ŀ	919 <u>9</u>	· } -> { -> ·	$(\cdot, \cdot) (\cdot)$	0 (3 -)	4944	<u> </u>	2412		
	SILTY SAND TILL]50.7 1				50/150	1.1.1.1						H	
	Slightly cohesive, scattered gravel, cobbles			4044		۹. e		-1-11-	X		- (-) - (-	4414	X	
	and boulders, grey, wet	4								111	1	1111	H	
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		4			Ŷŀ					444		2412		
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					÷	$\left\{ \left\{ i,j\right\} \right\} \right\}$	1-1-1		~ 0.1	-1 (1	1.1.4	2.44		
	Continued New Deer	L	,					t	THE		1:1:2	17.77	U	
OTES	Continued Next Page	WATER		EVEL RECO	RDS				co	RE DRI	LUNG R	ECORD	,	
belore use	by others Elap	sed	-	Water		lole Ope	n	Run	Dep	ih T	% Re			ÓD %
. A 19 mm sl borehole	otted standpipe was installed in the Tin 15 d		<u>.</u> L	<u>evel (m)</u> 2.2		<u>To (m)</u>		No. 1	<u>(m)</u> 7.8 - 9	9.1	100			100
.Field work	supervised by a Trow representative							2	9.1 - 1	0.6	99			99
	on Sample Descriptions													
	is to read with Trow Associates Inc. report													
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Log of Borehole <u>12</u>



14

Figure No.

Project: Geotechnical Investigation - Proposed Residential Development

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Project No: OTT-00020493-A0

FIQ	detrecimical investigation + Prop			0.000				Pag		_	2	
Ş.	SOIL DESCRIPTION	Geodeti Elevato 48.29	n 8	20 ar Streng	ជា	60	80 kPa	Net. Allero	io 5 Iral Moist erg Limit	our Reedin 00 75 ure Conten s (% Diy We 40 40	g (ppm) 0 t % sight)	S Natur P Unit V KN/n
	SILTY SAND TILL Slightly cohesive, scattered gravel, cobl and boulders, grey, wet (continued)	1	7	50			200	2		40 60 (-1-)		5
	2 – 2	47.5			•	-3 [-3		X 4 (-1 4) 4 (-1 4) 4 (-1 4)				
	LIMESTONE BEDROCK Shaley partings, horizontally bedded, th to medium beds, vertical joints, grey (excellent quality)	In -	B									
眒	과 	-										Ru
	그 그 Borehole Terminated © 10.6 m dept 기	n -	B				- (-) - (-)	+11+ +11+ +11+ +11+				
	7 म- म	-										
	н Н	-	10									Rur
		- 44.7						\$103 				
IOTES	Net/Test Elt data seguine late essentation hu Tesu	WATE		RECOR			<u></u>	COP	E DRIL	LING RE	CORD	
	iole/Test Pit data requires Interpretation by Trow a use by others	Elapsed Time	Wate Level (r T	Hole Op To (m)		Run No.	Depti (m)		% Rec.		ROD %
LA 19 boret	mm slotted standpipe was installed in the lote	15 days	2.2		17.00		1 2	7.8 - 9 9.1 - 10	· · ·	100 99		100 99
.See I	work supervised by a Trow representative lotes on Sample Descriptions						Ē	9.1 * H		99		
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Log	of	Borehole	13
_			No. of Concession, Name



22773333333334			No. of Concession, Name		
Project No:	OTT-00020493-A0			Figure No. 15	
Project:	Geotechnical Investigation - Proposed Residentia	I Development			-
Location:	801 Albert Street, City of Ottawa, Ontario			Page. <u>1</u> of <u>2</u>	-
Date Drilled:	July 16, 2010	Split Spoon Sample		Combustible Vapour Reading	
Dall Trees		Auger Sample		Natural Mosture Content	×
Drill Type:		SPT (N) Value	0	Atlerberg Limits	⊢0
Datum:	Geodetic	Dynamic Cone Test Shotby Tube		Undrained Triaxial et % Strain at Failure	⊕
Logged by:	Checked by:	Shear Strength by Vane Test	+	Shear Strength by Penetrometer Test	

9		Geodetic	0	Standa	d Penetration	Test N Vi	ikue -	Combustib 250	Ne Vapour Pi 500	eeding (pp) 750	15) S	Natur
G M M L L	SOIL DESCRIPTION	Bevation	1ê	20	40	60	80		i Molsture C p Limits (% E		5) 0420, LU0	Unit V
18		m.	1	Shear Stren	-		kPa	Atterben	g Limits (% C	iy Weight)	įĘ	kN/m
1 3 5	700000 100	58.05	0	50	100	150	200	20	40	60	: 15	-
xxx	TOPSOL ~ 100 mm	1 ^{58.0}		124.24			11111				1	
	FILL Silty sand and gravel with asphalt			144444 14	50 Q		4444	X		44 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	÷X	
	grandings, topsoil, some organics, brown			19919419	(\cdot,\cdot)	12:12		< (-1 ÷1	2010	<u></u>	· //	
	and black, moist	7									1	4
	and black, moist			1 · · · · · · · · ·	***		+				험	
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	150 mm Peat Lavers	54.3		1			+					
	SILTY SAND TILL	-100					tritt				:E	1
U.A	-Fine to coarse, slightly cohesive, frequent -	4	4				96/360	mn	++++		÷Ν	
	gravel, cobbies and boulders, grey, wel		Ł		11 11 1	1111	†	×	22112		ΞIX	
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10.1	Continued Next Page	1	1,			11111	1				÷.	
OTES: Borehole		WATER	٩L	EVEL RECO	RDS			CORE	DRILLIN	G RECOF	RD	
	Test Pit data requires Interpretation by Trow Elap			Water	Hote Or	pen	Run	Depth	%	Rec.	R	QD %
A 19 mm borehols	slotted standpipe was installed in the		L	<u>_evel (m)</u>	To (m		Ng.	(m) 7.1 - 7.6	;	83	-	70
							2	7.6 - 8.9		100		85
.Field wo	rk supervised by a Trow representative						3	8.9 - 10.	4	100		96
	es on Sample Descriptions											
. This Fig	tre is to read with Trow Associates Inc. report											
011-00	20493-AD								-	-	-	-

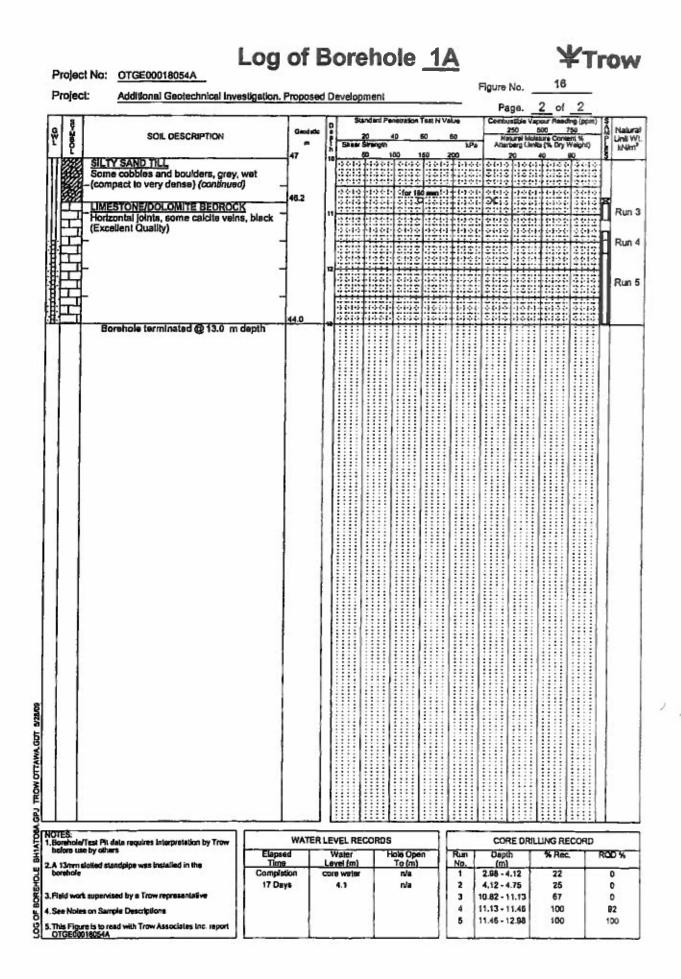


15

Project No: OTT-00020493-A0

Project: Geotechnical Investigation - Proposed Residential Development						Figure No.	15	
rojec	t: Geotechnical Investigation - Pro	posed Hesideni	militar -	and Street Calif	-	Page.	2 of 2	
S N	SOIL DESCRIPTION	Geodatic Elevation				Combusible V 250	apour Reading (ppr 500 750 Sistura Content % nita (% Dry Weight)	n) S Nat P Unit
S Y B O L	SUL DESCRIPTION	51.05	P 20 Shear Strer 50	រដ្ឋជា	~ kРа 00	Atterberg Ur 20	nta (% Dry Weight) 40 50	LE KN
9322	LIMESTONE BEDROCK	51.0	1			· • • • • • • • • • • • • • • • • • • •		ŝ.H
	Shaley partings, horizontally thingly to medium bedded, vertical joint, grey (go	boo	*****		- (-) - (- (-) - (i Ru
	to excellent quality)			····	histi		1	ξ.
μ,	Basement floor	-						
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	-	-						
╧┥							44-6166-661	
	Borehole Terminated @ 10.6 m dep	_{2th} -	9			· · · · · · · · · · · · · · · · · · ·	······	ŧ.
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- 1								
ES	Trace Oit date your does interpretediets by Terry	WATER	ILEVEL RECO	RDS		CORED	RILLING RECOF	D
alore u	e Test Pit data regulies interpretation by Trow are by others	Elapsed	Water	Hole Open	Run	Depth	% Rec.	ROD
19 mm orehole	slotted standpipe was installed in the	Time 18 days	Level (m) 4.8	<u>To (m)</u>	<u>No.</u> 1	(<u>m)</u> 7.1 - 7.6	83	70
ield wo	rk supervised by a Trow representative				2	7.6 - 8 .9 8.9 - 10.4	100 100	65 58
	es on Sample Descriptions							
	ure is to read with Trow Associates Inc. report 20493-AO				1	1	1	

Project No:	OTGE00018054A	og of E	Borehole _	<u>1A</u>		*	Trow
Project:	Additional Geotechnical Inve	stigation, Proposed	Development		Figure No.	16	-
Location:	Scott Street and City Centre				Page.	_1_of_2	2
Date Drilled:	Construction of the second second second second				0121002-0125-007		
Drill Type:	11200		Spit Spoon Sampla Auger Sampla	8	Combusible Natural Moist	Vepour Reading ure Content	×
_	Geodetic		SPT (H) Value Dynamic Cone Test	0	Atterberg Lim Lindrained Tri		⊷0
Logged by:	Checked by		Shelby Tube		% Strain at Fa	alure	Θ
209900 03.	Checked by		Sheer Strength by Vane Testi	+ 5	Penetromeler		
	SOIL DESCRIPTION	Geodástic ra	Standard Penetration Test 20 40 60 Shear Strength 50 100 150	aQ LPa	250 Natura' le Atterberg L	Vapour Reacing (r 500 750 Iolature Content % Imite (% Dry Weigi	. D. Natur
I Kõõi—numai	y silt and gravel, occasional n rous cobbles and boulders shout the fill matrix, brown, mo	-					Λ
		- 52.9		250 mm : 1 250 mm			Run 2
Grey, w	Y SILT TIL1, Y SILT TIL1, pravel, moist (stiff).						X
Some c	SAND TILL obbies and boulders, grey, we ct to very dense) Continued Next Page	47.9				1-4-1-6-1-6-1	
OTES: Borshole/Test Pit da	ita requires Interpretation by Trow	WATERL	EVEL RECORDS		CORE DR	ILLING RECOP	کې
before use by others A 13mm slotted stan	s Idpipe was installed in the	Elapsed Time	Water Hole Open	Run No.	Depin (m)	% Rec.	ROD %
borehole	appe free free free like in the		4.1 rva		2.98 - 4.12	22	0
Field work supervise See Notes on Sampi	ad by a Trow representative le Descriptions	17 Days	nva	4	4.12 - 4.75 10.82 - 1 1.13 1.13 - 11.46	25 67 100	0 0 92
This Figure is to real OTGE00016054A	d with Trow Associates Inc. report			5	1.46 - 12.98	100	100



	Log of I	Borehole) 2A	¥	Trow
Project No:	OTGE00018054A			Figure No. 17	
Project:	Additional Geotechnical Investigation. Proposed	d Development			<u>.</u>
Location:	Scott Street and City Centre Street, Ottawa, On	larlo		Page1_ of _1	-
Date Drilled:	7/25/05	Spil Spoon Sample		Combusible Vapour Reading	
Drill Type:		Auger Sample	00	Netural Moisture Content	×
Brin Type.		- SPT (N) Value	0	Altarberg Limits	⊢0
Datum:	Geodetic	Dynamic Cons Test Sheby Tube		Undrained Triaxial at 16 Strain at Fature	•
Logged by:	Checked by:	Sheer Strength by Vano Tasl	+ \$	Shear Strength by Penetrometer Test	

G Y			Geodetic	101			Standard Penelration Test N Value		Combusible Vapour Reading (ppm) 250 500 750			ş	Natura		
ų	U B O L	SOIL DESCRIPTION	37	Ī	20 Shear Street	40 with	5	0 8	0 kPa	Na	Aural Mola	ture Cont	ent %	1PI	Unit V
	Ľ		56.4	h	50			50 20			20	40	80	E.	kN/m
				ľ									-	П	
	RXXI	Silty sand and gravel with numerous - cobbles and boulders, brown, moist (loose -	ł	L	1221211			12.11	1131	3113	1320	1000	122.2	11	
	XX	to compact)	1	L	-24-1-2-1-2						1.5			1	
	∞		1									1		11	
	XXI		1	11						1111	1.2.2.2				
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	<u> </u>			5		111		1911	1444	4619	1.3 - 1 - 1	11144			_
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ł	920	SANDY SILT TILL		f	-1	-4-1-0	for 270	aner£ -5	1-1 -> 1-	0.000	4-44	1.1.02		Ы	
		Fine to modium gravel, limestone	49.9									4 3 3	3313	Ă	
- [Ш́г	fragments, grey, moist (very dense)			2012012	÷ 1 · 6		0010			1.5.64	6-1-2-0		H.	_
	- -1	Some calcite veins, black (Fair to Excellent				26 Q	132	1212	645 R	- (-) -	1.44	4444	198152		Run
ł	╧╥⊢	Quality)	i	7			122							Ц.	
ļ										2242 2432			132324 136445	H.	
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ſ		Borehole terminated @ 9.0 m depth					T								
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			1												
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.В	ES: xehole	Test Pil data requires Interpretation by Trow			EVEL RECO								ECORD		
		- Caps			Walar avel (m)		le Opei 'o (m)		Run No.	Depi (m)		% Re	c.	RQ	D%
. 190	rencie	backfilled upon completion of drilling Comple			we waler		n/a		1	4.06 - 4		52		1	4
									2	4.75 - 5		31			0
.Fi	eid wor	k supervised by a Trow representative							3	6.33 - 3	7.06	93			9
.S	e Note	a on Sample Descriptions			1				4	7.06 - 1	8.51	100		1	00
,π	ús Flou	re is to read with Trow Associates Inc. report													
		016054A			1.1										

Project No:	Log	ofl	Boi	rei	ho	ole	3	A				¥	۲ ^י	rov	
Project:	Additional Geotechnical Inve	sligation. I	Propose	d Deve	loom	ent				Figure	e No.		18		
Location:	Scott Street and City Centre Street, Ottawa, Ontario									P	age,	1	of _	2	
Date Drilled:									~	1211	0.022				
Drill Type:					Spoon or Sam				83 D0		wsible' al Moist			•	X
	Geodetic		<u> </u>		(H) Val			_	0		wg Lim wed Tri			F	-0
Logged by:		Sharked burn		Shet	by Tub					% Sin	ais at Fa	ilure			⊕
Loggod by.	Checked by	·	-		Test	gih by	1		\$	Penel	romaber	Test			
G X W B U L O	SOIL DESCRIPTION		Geodelis	D P She	Stands 20 sar Size		neirzücn 40	Test N 1 60	/alus 	Const	250 250 Istural M Istory U 20	Vepour 800 Iolsiure Imits (%	Reading 750 Conteni Dou Ma	(ppen)) %	S Natu P Unit V
I SSSS FILL		·	55.7	n	60	1		150	200						e kNh
Sandy Southern Sand b Southern Sand b Southern Sand b	v silt to sandy silt, numerous c oulders, some fine to medium rey to brown, very moist (com	gravel, -		1323	- 1-1		12.22	: 321					<u>::::</u> [.		
XXX dense)	· _		1			12133			1344					
) (* *) (* *	01-9-0 04-9-0	-1-1-1							
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Grey, r	irey, moist to very moist (very stiff)				1		2122						21		1
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		7		244	2 1 2 - 2	순난	*****	-2 -2 -1 -2	- (-) - (10110	1.1.2.1	1 + (+1)	÷ (2	010	4
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	SAND TILL					끩	~1-) < 	141.)		24-12 	1222	2122	2:42		
(compa		•			Ģ	9				X					3
		1	7.3												Run
	ONE/DOLOMITE BEDROCK		1.2						<u> Fiit</u>	12112	1	1121	~ · ·		1
	lack limestone inclusions, cal Good to Excellent Quality)	ute	1	سنبسا ه			040) 6 313 3			00-10 00-10)			
															Run
		-	1	-2-6-4-3 -2-6-4-3 -2-6-4-3										6-9-5- 1-1-5-	
	Continued Next Page		,				\$13\$	3713	†::::	41-14 31-12 41-14					
OTES: Borehole/Test Pit da	te requires interpretation by Trow		WATER	LEVEL R	RECO	RDS	- A - 3			co	RE DR	ILLING	REC	ORO	
before use by others	dpipe was lastalled in the	Elapsed Time		Water Level (m		Н	ole Ope To (m)	n	Run No.	Dep (m)	ih		Rec.		IQD %
borehole	ala la anna suargentin (s. 110	Complete 16 Days	on o	2.4			n/a n/a		1	7.8 - 8	.44		40		0
Field work supervise	d by a Trow representative	то рауз		2.9			TW N		23	8.44 - 10 - 10			00 93		95 82
See Notes on Sampi		6													
This Figure is to real OTGED0018054A	d with Trow Associates Inc. report								1						

Log of Borehole <u>3A</u>

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Project No: OTGE00018054A



Projec	L Additional Geotechnical Investi	gation. Propos	ea Developin	ant		Page.	2 of 2	
			Stand	and Penetration Test N	Value		pour Reading (p)	- m)[\$]
Cont- too	SOIL DESCRIPTION	Geodel	01	40 60	80	250	500 750	D Na
8	goig bedonir hon		Shear Sin		kPa		isture Contant % its (% Dry Weight	
	LIMESTONE/DOLOMITE BEDROCK	45.7	10 00000	100 150	200	20	40 60	
	Some black limestone inclusions, cald	ite	11111					R
E-	-veins, (Good to Excellent Quality)	-		201-0120-201	1-1-1-1-1	01-10-104	1- 6100 00	17
T	(continued) Borehole terminated @ 10.8 m de	44.9		201-01-0-00	-1-1-1-0-0	01-10-101-		H-
	eorenoia terminated @ 10.6 m de	put						
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TES: orchole	/Test Pit data requires Interpretation by Trow	WATE	R LEVEL RECO			CORE DRI	LLING RECOR	Ð
elore us	e by others slotted standpipe was installed in the	Elapsed Time	Water Level (m)	Hole Open To (m)	Run No.	Depih (m)	% Rec.	ROD
orshole		Completion	core water	n/a	1	7.8 - 8.44	40	0
left	a supervised by a Trow representative	16 Days	2.4	n/a	2	8.44 - 10	100 83	85
				1		10-10-11		02
KE PIOIO	is on Sample Descriptions				4			
	re is to read with Trow Associates Inc. report 018054A			1				

Log of	Borehol	e 4A
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Project No:	0705000480544		Contraction of the local division of the loc		
Project No:	OTGE00018054A			Figure No. 19	
Project:	Additional Geotechnical Investigation. Proposed	Development			-0
Location:	Scott Street and City Centre Street, Ottawa, Onta	oh		Page. <u>1</u> of <u>1</u>	-
Date Drilled:	7/28/05	Split Spoon Sample		Combusible Vapour Reading	o
Drill Type:		Auger Sample	00	Natural Molstere Content	×
Dim Type.		SPT (N) Value	0	Adarberg Limits	-0
Datum:	Geodetic	Dynamic Cone Test Sheby Tube		Undrained Triaxial at % Strain at Fallure	0
Logged by:	Checked by:	Shear Sinengih by Vana Test	+ 5	Shear Strength by Pensitrameter Test	

G¥L C¥L	SOIL DESCRIPTION	Georfelic	I	21	al Penetration 40	Teci N V 60	atua 50	250 500 750			Natural Unit W1
ΰĘ		5	ĥ	Shirer Sire	ngth	150	12a 200	Alterberg L	ioisture Content % Insts (% Dry Weight) 40 80	Lug	kN/m ³
	FILL Sandy silt to silty sand with gravel, cobbies.		0								
П	-occasional bouiders, some peat packets or layers, wood pleces, grey brown, wet (very loose)	1		22-12-1	01-0-1-30 01-0-1-30		• • • • • • • • •	\$1.15 HZ	*****		
		1	1			3.1			4-1		
	-	1								X	{
T	-	- 52.9	*	71171			1	******** 2012 12	61. 61. 61. 25.11	- 4	
	-	1			011 01-30 011 01-30	1) - 1-	_	· • • • • • • • • • •	(1) (1) () () ()		
	-	-	1		*1- 21-12 *1- 21-12			***********		M	
	-	1								$\left \right $	
	-		4				╺╢┽┽┽┉				
	•	-					1.1.2.	04-10 	(-1(-1()(Н	
	-	1	5							21-1	
	-							2112 12			
	CLAYEY SILT TILL Sandy, some fine grave! (very soft)	49.0	6		0100100	10010	+ i - i - i -		61-61-66-06-14 61-66-06-06-14 61-66-06-06-06-14		
		1			<pre></pre>	-3 e (-) -3 e (-)	- 1-1 - 1-		(- 1	
		1	7			12:00:00	1:12:0	0110 -101 0110 -101			
	- 	47.1									D
	LIMESTONE/DOLOMITE BEDROCK Horizontal to slightly dipping joints, calcite seams, (poor to good quality)	7	•								Run 1
計		-			01-01-50						Run 2
		1	•		6						
╧╬╌╧	Borehole terminated @ 9.6 m depth	45.4							-1		
NOTES:	Teat Bit data requires fatementation by Tenu	WATER	s r e	EVEL RECO	RDS		[:::··]	CORED	RILLING RECORD		-20
before us		psed	-	Water evel (m)	Hole Op To (m)		Run No.	Depth (m)	% Rec.		20 %
borshole	Com	pletion Days		ve water 2.1	n/a n/a		1 2	7.75 - 8.08 8.08 - 9.63	54 96		31 88
	k supervised by a Trow representative s on Sample Descriptions										
2.A Tomm: borshole 3.Field wor 4.See Note 5.This Figu OTGE00	re is to read with Trow Associates Inc. report 018054A							_			

	Log of E	Borehole	5A	¥.	Frow
Project No:	OTGE00018054A			Figure No. 20	_
Project: Location:	Additional Geotechnical Investigation, Proposed Scott Street and City Centre Street, Ottawa, Onto			Page. <u>1</u> of <u>2</u>	5
Date Drilled: Drill Type:	7/27/05	Spit Spoon Sample Auger Sample SPT (N) Value		Combustible Vapour Reading Natural Moisture Content Attentieng Limits	× ×
Datum:	Geodetic	Dynamic Cone Test - Shefby Tube		Undrained Triaxial at % Strain at Fallure	⊕
Logged by:	Checked by:	Shear Strength by Vane Test	+ s	Shear Strength by Penetrometer Test	

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	s T		Depth Below	6	Standar	Penetratio	on Test N Va	lue	Combustible Va 250	pour Reading (ppm) 500 750	SAXP-180	Nature
Ŵ	SY MBOL	SOIL DESCRIPTION	Grade	ļ	20 Shear Streng	40	60	80 kPa		sture Content % Its (% Dry Weight)	٦Ē	Unit W kN/m
-	191		55.2	ŀ	4 60	100	150 2	200		40 80	Ē	KN/m
	888	FLL		l°					31.5.5			
l	888	Sandy slit to slity sand with gravel, cobbles.			122213		2.3243	1.121	2:12:12:			
ļ	888	- occasional boulders, grey brown, wet -	8					+				
I	88	(loose)	5	Ľ	33343			1	0410-104 0400-104		9	
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1		Horizontal layered, some silt partings, grey			0.0100		• • • • • • •	1:2:1		R 112612513	١Ň	Į
		-brown, molst (stiff) -	1					ł i i i			Ĥ	1
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	UH)	SILTY SAND TILL, Fine to medium gravel, occasional cobbles									- 1	
		-and bouklers, grey, very moist (compact) -	1	۱.	10010-00	er- er-	· · · · · · · · ·	<u></u>	01404000	1+61+61+861+3 1+61+361+361+3	-	1
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	Ш́				1			1			'n	Run
1		LIMESTONE BEDROCK	S					1			H	
1		Continued Next Page		110	0			_				
. E	TES: Jorehola	Test Pit data requires interpretation by Trow	WATER	31	EVEL RECO	RDS			CORE OF	ILLING RECOR		
b	vetore u	se by others Elap		_	Water	Hole	Open	Run	Depth	% Rec.	F	00%
Ļ	13mm	slotted standpipe was installed in the Comp			Level (m) core water		(m) /a	<u>No.</u>	(m) 9.55 - 9.83	100		68
¢	porehole	, comp			2.0		/a	2	9.83 - 11.36	100		66
I. F	-Tield wo	rk supervised by a Trow representative	-/-				- I	3	11.36 - 12.88	99		99
		es on Sample Descriptions										
		ure is to read with Trow Associates Inc. report 0018054A			i							
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Log of Borehole <u>5A</u>



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Figure No.

Project No: OTGE00018054A

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	Ň.	SOIL DESCRIPTION	Grade	18	-	20		0 6	0	80	r		urai Moisi ang Limb	ure Can	190	PUnit
	ay Mao		45.2	1	Shear	Streng		10 24		kPi	1	Allert	ang Limb	s (% Dry	Weight)	Nature Unit
╉	÷+	LIMESTONE BEDROCK	45.2	10	-> 6-1-5	4-1-5	10	0 1	1.7 4. 2.	1+1-10	1.0	1-1-0	-1-2-2-1	+ 6- 5-5	0.00	11-
		Horizontal to slightly dipping joints, calcite			3213	113	\$11	3133	331	1012	113	1:13	13CE	1:12		1
H	┺┳┝	-seams, (Fair to Excellent Quality)	-	1	12010	1	211	0100	1001	+++++++++++++++++++++++++++++++++++++++		1.1.0	12001	61.5	0 0 0 1 0	Rur
F	Ļ	(continued)			3443			5146		11:13	:13	115		1:13	3 (-1-)	1
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F	ц.	Borehole terminated @ 12.88 m depth	42.3	+	1111	11			111			111				11-
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DTI	ES:	Test Pit data requires Interpretation by Trow	WAT	ERL	EVEL R	ECO	RDS	3		-		CO	REDRI	LLING	RECORD	,
bel	CIE US		Elapsed	-	Water			Hole Op		Aun	Т	Dep	th	% R		ROD
A 1	3mm :	slotted standpipe was installed in the	Time		evel (m ore wate		-	To (m) rva		No.	+	(m 9.55 -		10	0	68
oQI	ençie		15 Days	0	2.0			n/a		2		.83 -		10	0	66
Fie	id wor	k supervised by a Trow representative								3	1	1.36 -	12.88	9	9	99
		s on Sample Descriptions				i i			- 1		1					
50	e Note															

Project No: Project:	OTGE00018054A Additional Geolechnical Investigation.	Proposed	Development	Figure No21	Trow
Location:	Scott Street and City Centre Street, O	tlawa, Oni	ario	Page. <u>1</u> of <u>2</u>	<u>.</u>
Date Drilled: Drill Type:	7/27/05		Split Spoon Sampia 🛛 Auger Sampla 🔲	Combustible Vepour Reading Natural Moisture Content	DX 0
Datum:	Geodelic		SPT (M) Value O Dynamic Cone Test Sheby Tube	Atan'berg Limits Undreined Tritodal at % Sitein et Faiture	F0 ⊕
Loggad by:	Checked by:	—	Shear Strength by + Vane Toat S	Shear Strength by Panetromoter Test	
G Å	SOIL DESCRIPTION	Geodetic	D Standard Penetration Test N Value 20 40 60 60	Combustble Vapour Reading (z 250 500 750 Natural Molsture Content % Alterberg Limits (% Dry Weigt	P Unit W1

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1.9.1	L		1	Geodetic	15			- ~	-			250	500	750	LΩ	Natura
Ð	Å G	SOIL DESCRIPTION		m	1	20 Shaar Stree	gth	<u>a ec</u>		60 kPa	Aller	Suzal Mol berg Lini	sture Con Its (% Dry	lani % Walghi)		Unit W kN/m
a n	∞	TOPOSOIL -150mm		55.7 55.7	٥			0 15		<u>90</u>	121112	20		80 	f	
11	88	FILL					÷.	: ::::				1.1.1	-			
н.	88	-Clayey silt to silty clay with organics,	roots -		L	2012-1					1111					
	888	and organics, brown, moist (loose to loose)	very						200			11 fr				
	888		-		1							1.2.2		12		
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	14	CLAYEY SILT TILL				0.010-10										
	2/2	Occasional sand seams or layers, fine medium gravel, moist to very moist (v			8	P			****				1	11111	Ŵ	
		soft to stiff)	"					112	1213	te ĝe	÷•••	-2-24-	1:1:1	1 10 1 1 10	Н	
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	2	SILTY SAND TILL					57		_	- 4- 9-0- 4-			1.1.1.1		Щ	
IIB		Fine to medium gravel, occasional col	bbles			-26-1-2		4444	101-1							
	84 T	and boulders, grey, very moist (compa			1	241211	:::	1122	1212	1121	21:2	-1-2-1-1	1920		11	
			J			2012 120		(-1-3 () 		-1-1-1-	유민수		4-1-2-1			
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	923								30149	1-1-0-{-	~ 1.0	.1		3445		
		WEATHERED LIMESTONE BEDROCK		8.7			***		1411	44444		-1-24-1		44.44	H	
IIÈ		WEATHERED LIMESTONE BEDROCH	<u> </u>			2010-110	20)	술음호함	101-1-1	· · · · ·	2012	2222	1:12:2	2:22	H	_
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UE		Continued Next Page			10	0.000-000	<u>etq</u>	\$1.50 J.				-1	40.00	0.010	Ц	
NOT	ES: Tehoie			WATER	L	EVEL RECO	RDS				CO	RE DRI	LLING R	ECORD		
be	fore us	Test Pit data requires Interpretation by Trow a by others	Elapse			Water	н	ole Oper	-11	Run	Dep		- % Re	<u>e.</u>	RC	DD 🖌
2.A 1 bo	13mm) rehole	slotted standpipe was installed in the	<u>Tima</u> Complet			evel (m) re water	23 - 2	To (m) n/a	-	<u>No.</u>	<u>(m)</u> 8.97 - 1		72			45
			15 Day			2.4		n/a			9.76 - 1		58			53
3.Fle	aid wor	k supervised by a Trow representative					6				11.36 -		95			93
		s on Sample Descriptions								4	12.85 -	13.59	100		1	00
	سمتكا ما	re is to read with Trow Associates Inc. report		1			10									

¥Trow

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Figure No. Additional Geotechnical Investigation. Proposed Development Project: 2 of 2 Page. oour Reads Combusible Vac Standard Penel/af on Test N Value Neturni Unit WL KN/m³ . 20 500 750 Natural Molsaure Context %, Userberg Linita (% Dry Weight 20 40 60 ID BE CU ¥ Geode SOIL DESCRIPTION 40 80 80 -Chasse thes εP₂ A λÚ 100 45.7 50 150 200 WEATHERED LIMESTONE BEDROCK (continued) 01-10 51-10 51-10 Run 2 44.3 LIMESTONE/DOLOMITE BEDROCK Horizontal to slightly dipping joints, calcite Т seams, (excellent quality) Run 3 and a substrate of the a da la cita de la cita A Cita de la A Cita de la \$2.15 Run 4 41.10 п 42 TARA CALLS AND A STATE Borehole terminated @ 13.6 m depth 5/28/06 ------TROW OTTAWA.GDT -----5 NOTES: 1. Borehole/Test Pit data requires Interpretation by Trow before use by others AT08 WATER LEVEL RECORDS CORE DRILLING RECORD ROD % Water Run Depth % Rec. Elaosed Hole Open Time Lavel (m) To (m) ND. (m) 2.A 13mm slotted standpipe was installed in the 45 Completion core waler л/а 1 8.97 - 9.75 72 15 Days 2.4 n/a 2 9.76 - 11.35 58 53 3 11.38 - 12.85 95 93 3. Field work supervised by a Trow representative 12.65 - 13.59 4 100 100 4. See Notes on Sample Descriptions č This Figure is to read with Trow Associates Inc. report OTCE00018054A ŝ

Project No: OTGE00018054A

										BOREHOLE	NUMBER	MW-1
PROJECT	NUMBER	MC-	12302A						DATE BEGUN	Febuory 17	1998	
PROJECT		Cho NCC		ond S	Scott P	roper	ty		DATE COMPLETED ORILLING METHOD	Febuory 17 Hollow Stem (1998	
CEPTH Lactres	ELEVATION (m d s !)	SAMPLES COLLECTED	SUBRITTED FOR LAB ANALYSIS	1	ntal orga NPOUR (p		3	INTER LEVEL	SOIL/ROCK DESCRI	PTION	STRAI LGRAPHT	HELL INSTALLATION DETAILS
								2	Dork, Brown, Medium SILIY SAND, chonging to Light B Medium SAND and Fine GRAV No petroleum stains or ad Medium, Red/Brown, Coarse with some Fine GRAVEL No petroleum stains or ad Light, Yellow/Brown, Medin SAND, with traces of Fine moist at 2 Om No petrole or adours Auger Refusal, End of bord	COHN EL Jours SAND Jours um to Coorse GRAVEL, um stoins		

				BOREHOLE NUMBER	MM-5
PROJECT NUMBER	HC-12302A	1	DATE BEGUN	Febuory 17, 1998	
PROJECT NAME CLIENT NAME	Choepogne NCC	e and Scott Property	DATE COMPLETED ORILLING METHOO	Febuary 17, 1998 Hollow Sten Auger	
DCP1H lactres) CLEYATION (a o s 1)	SAMPLES Collected Subnitited for	10TAL DRGANIC 대 YAPOUR Ippel 또 20 40 64 64	SOIL/ROCK DESCRI	PTION Issued	HELL INSTALLATION OCTAILS
	*		Dork, Block, Medium SILTY SAND and Fine GRAVEL No petroleum stoins or add Medium, Gray/Brown, Fine SILTY SAND with Traces of Fine GRAVEL. No petroleum stoins or adours Medium, Gray/Brown, Saturn Fine GRAVEL, changing to t Gray SILTY CLAY at 2 40m No petroleum stains or ad End of borehole	ated, Light	

BOREHOLE NUMBER MH-3 PRUJECT NUME Deseggere and Scott Property DATE BEQUIT Febuary 17, 1998 PRUJECT NUME Deseggere and Scott Property DATE COPPLETD Febuary 17, 1998 QUILTH MWC WCC ORILLING RETIND Mathematics Mathematics Image: Provide the p		ō f		
PROJECT MATE Disappope and Scatt Property DATE COPPLETED February 17, 1998 CLIDHI MARE NCC OBLILING METHOD Hollow Stee Arger IDATE COPPLETED IDATE COPPLETED Hollow Stee Arger IDATE COPPLETED IDATE COPPLETED IDATE COPPLETED IDATE COPPLETED IDATE COPPLETED IDATE COPPLETED IDATE COPPLETED		 20	BOREHOLE NUMBER	MW-3
CLICH MME NCC DRILING NCHOD Holiou Stee Auger E E E E E E E E E E E E E E E E E E E E E E E E E E E E O E E E E E E O E E E E E SOIL/ROCK DESCRIPTION E O E E E SOIL/ROCK DESCRIPTION E E O E E E SOIL/ROCK DESCRIPTION E O E E E SOIL/ROCK DESCRIPTION E O E E E SOIL/ROCK DESCRIPTION E O E E E O E E O E E E E O E O E E E E E E O E E E E E E O E E E E E E O E E E				
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Herius Gray/Eran, Redus SiLTY SND ord Fine GRAVEL No petroleue stoins or adours Auger Refusal, End of barehale	OEPTH (netrca) ELEVATION In a s II	SOIL/ROCK DESCRIP	TION Have been supported by the second secon	
90 + 0		SAND and Fine GRAVEL No petroleum stains ar adaur	r5	

INPLETED Febuory 17, 1998 IG NETHOD Hollow Stem Auger K DESCRIPTION Medium SILTY SAND, //EL stoins or odours Coorse SAND with AVEL mixed with Block TILL	WELL INSTALLATIO
K DESCRIPTION	
Medium SILTY SAND, /EL stoins or adours Coorse SAND with AVEL mixed with Block	
IEL stoins or adours Coorse SAND with AVEL mixed with Black	
TH 6699	
roces of fine GRAVEL accord stains or odours	
	ow/Brown, Medium to Coorse roces of fine GRAVEL stoins or odours 1, End of borehole

										BOREHOLE	NUMBER	BH-4
PROJECT	t Number	HC-3	123020						OATE BEGUN	Febuary 17	1998	
PROJECT	i nahe	Cho	npogne	ond	Scot	t Prop	erty		DATE COMPLETED	Febuory 17	1998	
CLIENT	NAME	NCC							DRILLING METHOD	Hollow Stem	Auger	
OCP1H Lactres)	ELEVATION In a s ! !	SAMPLES	LAB ANALYSIS			ORGANIC) BO	WIEB LEVE.	SOIL/ROCK DESCRIP	PTION	STRATIGRAPHT	WELL INSTALLATION DETAILS
				0				-	Dark, BLACK, Medium SILIY S and Fine GRAVEL No petroleum stains ar adau			
- 0 : - -				D					Medium, Brown, Coorse SAND some Fine GRAVEL changing t Yellow/Brown Fine SILTY SAN 1 Om No petroleum stoins c	10 10 ot		
2 0 +				9—					Medium, Yellow/Brown, Fine SILTY SAND No petroleum st odours	to fled (um io)ns or		
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APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURES 2 AND 3 - SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG3272-3 - TEST HOLE LOCATION PLAN

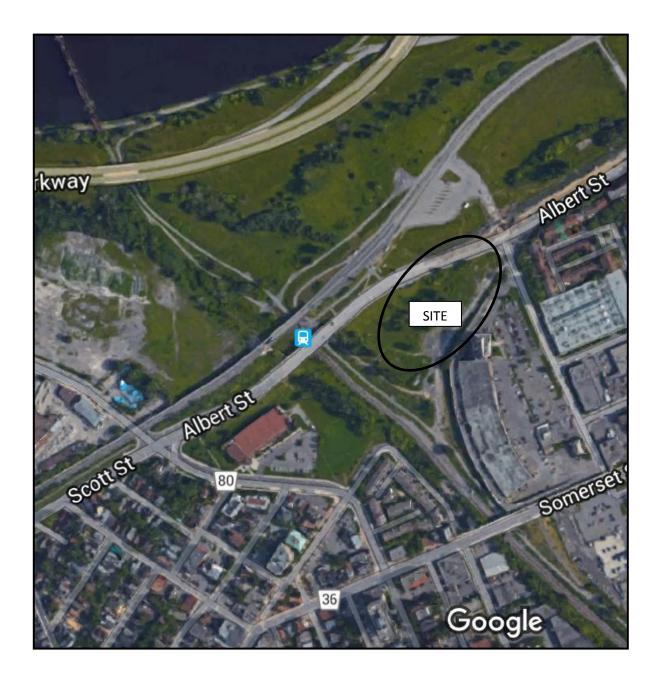


FIGURE 1 KEY PLAN

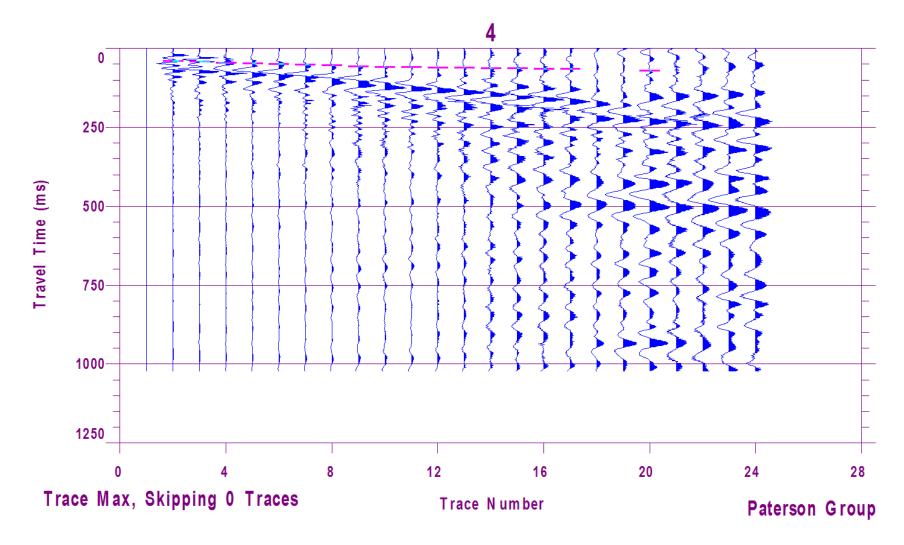


Figure 2 – Shear Wave Velocity Profile at Shot Location – 4.5 m

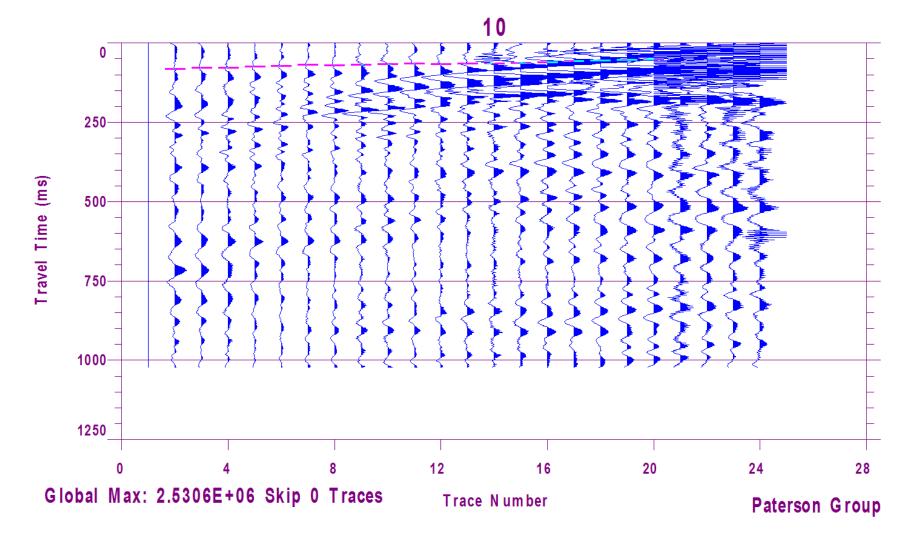


Figure 3 – Shear Wave Velocity Profile at Shot Location 72.0 m

