Geotechnical Engineering

Environmental Engineering

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Geotechnical Investigation

Proposed Commercial Development
6045 Bank Street
Ottawa (Greely), Ontario

Prepared For

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Maverick Development Corporation

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1.0 INTRODUCTION

Paterson Group Inc. (Paterson) was commissioned by Greely Family Farm Inc. and Maverick Development Corporation to conduct a geotechnical investigation for the proposed commercial development, to be located at 6045 Bank Street, in the City of Ottawa (Greely) (refer to Figure 1 - Key Plan presented in Appendix 2). This report includes revisions and refinements in interpretation based on City of Ottawa review.

The objectives of the investigation have been:

- ❑ to characterize the subsoil and groundwater conditions at this site by means of a subsurface investigation, consisting of boreholes, to supplement the information obtained from the previous investigation;

- ❑ to provide geotechnical recommendations for the design of the currently proposed development, as well as the future development parcel, including foundation design for proposed buildings, bedding for services, pavement design, and construction considerations which may affect the design.

This geotechnical investigation has been completed in general accordance with the requirements of the City of Ottawa's *Geotechnical Investigation and Reporting Guidelines for Development Applications*.

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

2.0 PROPOSED DEVELOPMENT

It is understood that commercial development is proposed at this site, to consist of basementless slab-on-grade buildings. The western portion of the investigated property, (Parcel A), consisting of Lot 73 - Part 1 - PIN 04320-0416, will be developed initially with future potential to develop the balance of the subject site (Parcel B) at 6045 Bank Street. A Stormwater Management Facility (SWMF) exists at the southeastern extent of the property and extends onto the neighbouring lands.

Several slab-on-grade commercial buildings are proposed within Parcel A and are identified on available plans as Retail A through Retail D. It is further understood that water supply based on wells, municipal sewers, parking areas, landscaped areas and access roads are also anticipated.

3.0 METHOD OF INVESTIGATION

3.1 Field Investigation

Field Program

The field program for the current investigation was carried out between October 12 and 19, 2016. At that time, a total of 31 boreholes were advanced to depths ranging from 4.6 to 8.0 m below existing ground surface. The current boreholes supplement the 12 test pits put down at the site in December, 2004. Parcel A contains a total of 17 test holes and Parcel B contains a total of 26 test holes. The additional borehole locations were distributed in a manner to provide specific coverage of the currently proposed development (Parcel A), and general coverage of the future development (Parcel B). The locations of all the test holes are shown on Drawing PG3957-1 - Test Hole Location Plan, included in Appendix 2.

The boreholes were advanced using a track-mounted auger drill rig operated by a two-person crew. The drilling procedure consisted of augering to the required depths at the selected locations, while sampling and testing the overburden. The fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. Sampling and testing the overburden was completed in general accordance with ASTM D5434-12 - Guide for Field Logging of Subsurface Explorations of Soil and Rock.

Sampling and In Situ Testing

Soil samples from the boreholes were recovered from the auger flights or using a 50 mm diameter split-spoon sampler. The depths at which the auger and split spoon samples were recovered from the test holes are shown as, AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was 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 sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm. This testing was done in general accordance with ASTM D1586-11 - Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

The overburden soil thickness was evaluated during the course of the investigation by augering to practical refusal in 14 boreholes or dynamic cone penetration testing (DCPT) at BH 13-16. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm depth increment. At present there is no ASTM standard for the DCPT.

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for further review and testing. Transportation of the samples was completed in general accordance with ASTM D4220-95 (2007) - Standard Practice for Preserving and Transporting Soil Samples.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Flexible polyethylene standpipes were installed in selected boreholes to permit the monitoring of groundwater levels subsequent to the completion of the field program.

Monitoring wells, using 50 mm diameter flush-mount PVC screen and risers were installed in each of BH 12-16, BH 15-16 and BH 29-16 to facilitate the measurement of groundwater levels and the collection of groundwater samples.

It is anticipated that the boreholes can be decommissioned at the time of construction.

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 borehole locations for retail Building A, in Parcel A, were chosen by the prospective tenant. The borehole locations in the balance of Parcel A were selected by the client to represent the proposed buildings. The borehole locations in Parcel B were selected by the client to provide general coverage of the proposed development lands. The borehole locations were marked out, and the ground surface elevations at the borehole locations were provided, by ARK Engineering and are referenced to geodetic datum.

The locations and ground surface elevations of the test holes are presented on Drawing PG3957-1 - Test Hole Location Plan, in Appendix 2. Note that ground elevations provided for the test pits were accurate in 2004, but may not be accurate currently. The ground elevations provided for the boreholes are current as of October, 2016 and can be taken to be accurate.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging. The subsurface soils were classified in general accordance with ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

The split spoon samples of the cohesive soils were examined in our laboratory as part of the laboratory review. The consistency of these soil samples was estimated based on tactile examination, as the SPT results tend to underestimate the consistency.

Four (4) representative split spoon samples of coarse-grained soils were submitted for grain size analyses. The testing was performed in general accordance with ASTM C117 Test Method for Materials Finer Than 75-m (No. 200) Sieve in Mineral Aggregates by Washing and ASTM C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates. The results of the grain size analysis testing are presented on the Grain Size Distribution sheets, in Appendix 1.

As a follow-up to the City of Ottawa review, four (4) representative split spoon samples of cohesive soils were submitted for Atterberg Limits testing to determine their plasticity characteristics. The natural water content of each of the samples was also determined. The results of the Atterberg Limits tests are presented on the plasticity chart, labeled Atterberg Limits' Results, in Appendix 1. The water contents are plotted graphically on their respective Soil Profile and Test Data sheets, in Appendix 1. Further interpretation is provided under Sections 4.2 and 5.6 of this report.

3.4 Analytical Testing

Four (4) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples were submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 2 and are discussed further in Subsection 6.7.

Three (3) soil samples, recovered from the boreholes corresponding to monitoring well locations, were submitted for electrical conductivity and sodium adsorption ratio (SAR). The tests were conducted to compare the concentrations to Ontario Regulation 153/04 Table 2. The results are presented in Appendix 2 and are discussed further in Subsection 6.7.

Soil samples selected for testing consisted of a silty sand (BH 7-SS3), a sandy silt (BH 12-SS4), a sandy silty (BH 18-SS4), and a silty sand with trace gravel (BH 24-SS4) sample. It is expected that the selected soil samples are representative of the subsoils to be encountered at the subject site.

Three (3) groundwater samples were recovered from the monitoring wells and were submitted for chloride and sodium testing. The tests were conducted to compare the concentrations to Ontario Regulation 153/04 Table 2. The results are presented in Appendix 2 and are discussed further in Subsection 6.7.

Paracel Laboratories (Paracel), of Ottawa, performed the laboratory analysis of the soil sample submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Environmental Analytical Laboratories (SCC/CAEAL). Paracel is accredited and certified by SCC/CAEAL for specific tests registered with the association.

The following testing guidelines were utilized for the submitted soil samples. The anions were analyzed using EPA 300.1, the pH was analyzed using EPA 150.1, the resistivity was analyzed using EPA 120.1, and the percent solids was determined using gravimetrics. The electrical conductivity was analyzed with MOE E3138 and the SAR is a calculated value provided by Paracel.

4.0 OBSERVATIONS

4.1 Surface Conditions

The subject site is currently undeveloped former agricultural land and covers an area of over 8 hectares, including the SWMF, with a small treed area. It is anticipated that the excavated materials from the existing SWMF were spread across the majority of the site. As the fill material consists of previously native material excavated from the site, the transition between the fill material and existing native material is difficult to distinguish without a well defined topsoil layer. The ground grades from the test pits from the preliminary investigation have been used to assist in our interpretation of the fill deposits.

Parcel A, within the currently proposed commercial development area, contains clean fill material along the northern and eastern portions with the west, south and central portions consisting of native materials with sparse clean fill piles. A gravel roadway extends from Parkway Road along the north boundary of Parcel A and extends across Parcel B to the eastern site boundary. A second gravel roadway extends from the south site boundary in Parcel A, within the area of the proposed Building A and B, and extends to the east-west gravel roadway. The site is bordered to the north by grassed park land, to the west by Parkway Road, to the south by Bank Street and residential developments, and to the east by commercial development.

The subject parcel has minimal natural topographical relief, but is sloping downwards from south to north. The clean fill material provides variable topographic changes within both investigated parcels. The ground surface elevation along the south edge varies from 90 to 91 m with a topographical low point in the north central area with elevations ranging from 87.3 to 87.9 m. The SWMF is the lowest point on site and is currently filled with water.

4.2 Subsurface Profile

The ground surface at the site is covered with 0.1 to 0.3 m of topsoil. Below the topsoil, the soil profile encountered at the test hole locations consists predominantly of coarse-grained deposits of glacial till, silty fine to coarse sand and/or sandy silt. Within the north and west parts of the site, a thin silty clay layer was observed to be interbedded within the silty sand to sandy silt strata.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole.

Fill Material

A layer of clean fill material was found over a large portion of the property and is assumed to have been placed on site from the existing SWMP excavation. The fill material consists of various site excavated material that may be difficult to differentiate from native materials. The fill layer has been interpreted to range from 0.6 to 2.1 m depth from ground surface within Parcel A and from 0.6 to 1.8 m in Parcel B.

Note that the test pits (TP1 to TP12) were put down in December, 2004, prior to site works conducted in subsequent years and therefore do not necessarily show current surficial conditions. Also the ground elevations shown at the test pit locations may have changed since the time of that investigation, as a result of the placing of fill materials.

Silty Clay

A layer of silty clay, ranging from 0.0 to 2.8 m from ground surface within Parcel A, is typically interbedded with silty sand or sandy silt within BHs 3, 4, 5, 8, 10, 11, 13 and 14. The interpreted thicknesses of silty clay range from 0.30 m to 1.17 m, with a mean thickness of 0.65 m for Parcel A. Within Parcel B, the silty clay layer was found within BHs 15, 17, 18, 20 and 21 and ranges from 0.6 to 3.4 m from ground surface. The interpreted thicknesses of silty clay range from 0.10 m to 2.59 m, with a mean thickness of 0.97 m for Parcel B.

The silty clay is generally brown in colour and can generally be considered to have been desiccated to a “crust”. The results of the SPTs indicate that the consistency of the silty clay is within the very stiff to stiff ranges. The shear strength of the silty clay can be expected to decrease with increasing depth, in thicker deposits, but to remain within the stiff range.

The interpretation of the consistency of the silty clay from the SPT results has been based on local knowledge of the correlation between the SPT “N” values and the shear strength, supplemented by tactile observation of the recovered clay samples in our laboratory.

Where shear vane testing was conducted, the cohesive soil layers are thicker and the sensitivity is interpreted to be within the extra-sensitive to quick clay range. Where the layers are thinner and are interpreted to be very stiff, the sensitivity based on tactile examination is within the “sensitive” range. Sensitivity ranges are provided under Symbols and Terms, in Appendix 1.

The test Atterberg Limits test results indicate that the four (4) cohesive soils tested are classified as clays of low plasticity (CL).

The Bray criteria states that soils with a plasticity index, PI, less than 20% may have reduced strength following the strong cyclic loading resulting from a severe earthquake. If reference is made to the Atterberg Limits test results, in Appendix 1, only two (2) of the four (4) samples tested had plasticity indices less than 20, and need to be evaluated, as follows:

BH11-16, Sample SS2 has a plasticity index (PI) of 15, which is in the range of $12 < PI < 20$, so if $w/w_L \geq 0.80$ there is some reduction for the residual strength. The water content, w, of this sample is 17%, and the liquid limit, w_L is 30%, so $w/w_L = 0.57$, and there are no effects to be applied. The residual strength after cyclic loading will be the undisturbed undrained shear strength for the silty clay at BH11-16.

BH14-16, Sample SS4 has a plasticity index (PI) of 10, which is in the range of PI $\leq$ 20, so if $w/w_L \geq 0.85$ there is some reduction for the residual strength. The water content, w, of this sample is 20%, and the liquid limit, w_L is 24%, so $w/w_L = 0.83$, so there are no reductions to be applied. The residual strength will be the undisturbed undrained shear strength.

Silty Fine Sand and Glacial Till

The predominantly coarse grained soils within the subject development parcel consist of silty fine to coarse sand, sandy silt and "glacial till". The glacial till consists of a silty sand matrix containing varying quantities of gravel, cobbles and boulders. Based on geological mapping, it is our interpretation that the sandy silt and silty fine sand are also glacial deposits that have been "modified" or reworked by water action.

Four (4) split spoon samples were submitted for grain size analyses. The results are presented on the Grain Size Distribution sheets in Appendix 1. The textural descriptions of the samples are indicated under the Classification heading, along with the Unified Classification group. Tested samples varied from GW to SP to SM to ML.

The results of the SPTs indicate that the state of compaction of these coarse-grained soils is predominantly within the compact to very dense ranges.

The investigation was conducted using hollow stem augers, which require a "plug" to be removed prior to retrieving a sample. There were a few localized zones within the deposits that appeared, based on their SPT "N" values to be within the loose to compact range. These "loose" zones were generally confined within compact to dense deposits, but are located near or slightly below the groundwater level, and it is inferred that the state of compaction of these samples has been underestimated because of the conditions during sampling. Shallow deposits of loose silty fine sand were encountered at BHs 1 and 2, and were underlain by compact to dense deposits.

Bedrock

Augering was conducted to the depth of practical refusal, at BH 2, BH 9 and BH 13 within Parcel A. Practical refusal was encountered at depths of 7.0, 7.5, and 8.0 m, respectively.

Parcel B encountered practical refusal to augering at BH 16, BH 17, BH18, BH 19, BH 21, BH 22, BH 26, BH 27, BH 30 and BH 31. Practical refusal was encountered at depths of 5.8, 6.1, 5.8, 5.2, 5.5, 3.7, 3.1, 6.1, 6.6, and 6.9 m, respectively. The elevations corresponding to these depths are shown in parentheses on the Test Hole

Location Plan, in Appendix 2. The depths of practical refusal to augering do not necessarily indicate the position of the bedrock and in many cases may be within dense soil and/or on cobbles and/or boulders.

Based on digital geological mapping produced by Natural Resources Canada, sourced from the Geological Survey of Canada, the bedrock in this area consists of dolomite of the Oxford formation with an overburden drift thickness of 5 to 25 m depth with the majority extending from 5 to 15 m depth.

4.3 Groundwater

The measured groundwater levels from the current investigation are presented in Table 1, on the following page.

The groundwater levels in all but BHs 12-16, BH 15-16 and BH 29-16 were measured in the standpipe tubing. The groundwater levels in each of BH 12-16, BH 15-16 and BH 29-16 were measured in monitoring wells, consisting of 50 mm diameter flush-mount PVC screen and risers.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could be different at the time of construction.

Where the groundwater was encountered, the recorded groundwater depths varied from 1.1 to 3.2 m and the elevations varied from to 85.8 to 88.8 m.

Table 1: Summary of Groundwater Level Readings

Borehole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH 1-16	90.78	2.82	87.96	October 26, 2016
BH 2-16	90.84	2.09	88.75	October 26, 2016
BH 3-16	91.30	3.23	88.07	October 26, 2016
BH 4-16	90.79	2.92	87.87	October 26, 2016
BH 6-16	90.35	2.43	87.92	October 26, 2016
BH 7-16	90.68	3.01	87.67	October 26, 2016
BH 8-16	89.25	1.65	87.60	October 26, 2016
BH 9-16	89.40	1.88	87.52	October 26, 2016
BH 10-16	89.81	2.46	87.35	October 26, 2016
BH 11-16	89.78	2.56	87.22	October 26, 2016
BH 12-16	89.88	1.90	87.98	October 26, 2016
BH 13-16	89.76	2.56	87.20	October 26, 2016
BH 14-16	89.70	2.60	87.10	October 26, 2016
BH 15-16	89.47	2.66	86.81	October 26, 2016
BH 16-16	88.97	2.20	86.77	October 26, 2016
BH 17-16	89.28	2.44	86.84	October 26, 2016
BH 18-16	89.01	2.08	86.93	October 26, 2016
BH 19-16	88.65	1.89	86.76	October 26, 2016
BH 20-16	87.32	1.55	85.77	October 26, 2016
BH 21-16	87.93	1.07	86.86	October 26, 2016
BH 22-16	90.14	3.38	86.76	October 26, 2016
BH 23-16	88.49	1.67	86.82	October 26, 2016
BH 25-16	89.86	3.03	86.83	October 26, 2016
BH 26-16	90.53	2.88	87.65	October 26, 2016
BH 27-16	90.05	2.96	87.09	October 26, 2016
BH28-16	90.24	3.49	86.75	October 26, 2016
BH29-16	90.51	2.61	87.90	October 26, 2016
BH30-16	90.27	2.91	87.36	October 26, 2016
BH 31-16	90.12	3.03	87.09	October 26, 2016

Notes:
1. The ground surface elevations at the test hole locations were provided by ARK Engineering and are referenced to geodetic datum.
2. Boreholes with no groundwater readings have been omitted from the list.

5.0 DISCUSSION

5.1 Geotechnical Assessment

Based on the results of the geotechnical investigation, the subject site is suitable, from a geotechnical perspective, for the proposed commercial development.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, and any fill containing deleterious or organic materials, should be stripped from under any buildings and other settlement sensitive structures, such as retaining walls, hard landscaping and pavements.

Fill Placement

Fill used for grading beneath building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A, Granular B Type II, Granular B Type I or select subgrade material. This material should be tested and approved prior to delivery to the site. Testing may consist of the suppliers own Quality Control testing, or samples can be submitted to the geotechnical consultant for testing. Initial acceptance testing can consist of gradation analyses and comparison to OPSS MUNI 1010 (Nov, 2013) gradation limits.

The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Engineered fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD) value. Engineered fill placed below the subgrade level for pavements should be compacted to at least 95% of its SPMDD value. The materials comprising the pavement structures should be compacted to at least 100% of their SPMDD values.

The laboratory testing reference for the specified density is ASTM D698-07 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)).

Site-excavated soil, along with non-specified existing fill, can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. It is anticipated that site-excavated material within the glacial till areas will include cobbles and large boulders. Boulders should be culled from the material before reuse to allow the resulting material to be placed in appropriate lift thicknesses.

If site-excavated soil materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. These materials should meet the requirements for Select Subgrade Material (SSM) under OPSS MUNI 1010 (Nov, 2013). Non-specified existing fill and site-excavated soils, are not suitable as backfill against foundation walls unless a composite drainage blanket, connected to a perimeter drainage system, is provided.

5.3 Foundation Design

Bearing Resistance for Shallow Foundations

The commercial structures proposed for the subject development can be supported by footing foundations. Footings should be founded on undisturbed in situ soil bearing media or engineered granular fill materials placed over undisturbed in situ soil subgrade media and compacted to a minimum of 98% of their SPMDD value.

The bearing resistance values for the various founding media are provided below and then an interpretation of the conditions at each of the presently proposed buildings in Parcel A is provided later in this section to provide clarification regarding the application of the recommendations.

In localized areas where loose granular soils are present below, and in close proximity to the footing level, such as at BH 1-16 and BH 2-16, these materials should be densified by vibratory compaction (i.e. precompacted) and/or removed in whole or part and replaced with compacted engineered native fill and/or engineered granular fill.

An undisturbed in situ soil bearing surface consists of one from which all topsoil and deleterious materials, such as unspecified fill, and loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings, or select granular fill materials for engineered fill bearing media.

Strip or square footings, up to 3 m wide, placed on undisturbed, stiff to very stiff silty clay bearing surfaces can be designed using a bearing resistance at SLS (serviceability limit states) value of **100 kPa** and a factored bearing resistance at ULS (ultimate limit states) value of **175 kPa**. A geotechnical resistance factor of 0.5 has been applied to the above noted bearing resistance at ULS value. These values should be confirmed by field review by geotechnical personnel at the time of construction. These bearing resistance values are also applicable to precompacted loose to compact coarse grained soils, such as sand and silty sand.

Footings, up to 2.5 m wide, placed on an undisturbed, compact to dense glacial till bearing surface can be designed using a bearing resistance at SLS value of **150 kPa** and a factored bearing resistance at ULS value of **250 kPa**. A geotechnical resistance factor of 0.5 has been applied to the above noted bearing resistance at ULS value. These values should be confirmed by field review by geotechnical personnel at the time of construction. These bearing resistance values are also applicable to other dense coarse grained soils, such as sand and silty sand.

Note that the allowable soil pressure for working stress design can be taken to be equal to the bearing resistance at SLS values, as noted above, for the appropriate bearing medium.

Where the placing of engineered granular fill is required, to establish the bearing medium, the bearing resistance values can be taken to be equivalent to the bearing resistance values of the parent subgrade soil, as detailed above, provided OPSS Granular B Type II or Granular A materials, compacted to a minimum of 98% of their SPMDD values are used.

Settlement and Permissible Grade Raises

Footings designed using the above-noted bearing resistance at SLS values will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively. These are the generally accepted tolerable settlement values for steel-frame commercial construction.

A permissible grade raise of up to 2.5 m is applicable for the portions of the development within the area underlain by the limited silty clay deposits. This is based on an estimate of the preconsolidation pressure for stiff to very stiff silty clay. If the permissible grade raise is to be exceeded, in these areas, the geotechnical consultant should be asked to review the grading plan. Greater grade raises could be acceptable on the basis of further review and/or further investigation and testing.

Where the silty clay is absent, there is essentially no practical grade raise restriction.

As part of the revisions to this report, geotechnical review was conducted of the revised Grading Plan in place at the time of the resubmission to the City of Ottawa for Parcel A. This is review is provided under section 5.5 of this report.

5.4 Building Specific Interpretation

General Comments

The proposed buildings will consist of basementless slab-on-grade configuration. The interior underside of footing (USF) levels will depend on the finished floor elevation (FFE) of the buildings, and the thickness of the footings, but are typically 1.0±m below the FFE. The USF for the perimeter (exterior) footings needs consideration of the exterior finished grade to ensure that adequate soil cover (1.5 m) for frost protection is provided. For retail buildings, the exterior finished grades are typically close to the FFE to facilitate access from outside without a step, so a perimeter USF of about 1.7 m below the FFE is generally adequate. The larger buildings (Retail A and B) will have loading docks along the rear (south) side that will drop the exterior finished grade for those portions, and the entire side of the buildings. For those cases, the USF should be set at least 1.5 m below the exterior finished grade.

Perimeter USF levels can be raised, if foundation insulation is used to supplement the soil cover. Interior USF levels can be lower, if a pier is constructed over the footing to the column base plate. The building-specific interpretations provided below will assume that interior footings will be 1.0±m below the FFE, perimeter footings will be 1.7±m below the FFE and perimeter footings in loading dock areas will be 1.5±m below the exterior finished grade.

Parcel A: Retail A and B

Retail A and Retail B in Parcel A have similar grading and subsurface conditions and will be discussed together. These buildings have a FFE (finished floor elevation) of 92.10 m (revised from 91.95 m from our original report). Loading dock areas are proposed along most of the rear (south) walls of the buildings, with finished exterior grades between 90.8 and 91.3 m. As such, approximate USF levels will be as follows:

USF for Interior Footings:	91.1±m
USF for Perimeter Footings:	90.5±m
USF for Loading Area Footings:	89.3±m

Based on review of the applicable boreholes, interior, perimeter, and perimeter loading area footings are expected to be founded on a combination of native soil and engineered granular fill, with the latter being the predominant bearing medium. It is recommended that the footings be designed using a bearing resistance at SLS (serviceability limit states) value of **100 kPa** and a factored bearing resistance at ULS (ultimate limit states) value of **175 kPa**.

The preliminary grading for buildings Retail A and Retail B in Parcel A is within the permissible grade raise of 2.5 m.

Parcel A: Retail C

Building Retail C has a FFE of 91.00 m. This building does not have a loading dock area. As such, approximate USF levels will be as follows:

USF for Interior Footings:	90.0±m
USF for Perimeter Footings:	89.3±m

Based on review of the applicable boreholes, interior footings are expected to be founded on engineered granular fill and perimeter footings are expected to be founded on a combination of native soil and engineered granular fill. It is recommended that the footings be designed using a bearing resistance at SLS (serviceability limit states) value of **100 kPa** and a factored bearing resistance at ULS (ultimate limit states) value of **175 kPa**.

The preliminary grading for building Retail C in Parcel A is within the permissible grade raise of 2.5 m.

Parcel A: Retail D

Building Retail D has a FFE of 91.65 m (revised from 91.20 m from our original report). This building does not have a loading dock area. As such, approximate USF levels will be as follows:

USF for Interior Footings:	90.7±m
USF for Perimeter Footings:	89.9±m

Based on review of the applicable boreholes, interior footings are expected to be founded on engineered granular fill and perimeter footings are expected to be founded

on native soil. It is recommended that the footings be designed using a bearing resistance at SLS (serviceability limit states) value of **100 kPa** and a factored bearing resistance at ULS (ultimate limit states) value of **175 kPa**.

The preliminary grading for building Retail D in Parcel A is within the permissible grade raise of 2.5 m.

5.5 Grading Plan Review

Paterson has conducted a geotechnical review of the development Site Grading Plan, prepared by The Odan/Detech Group Inc., listed below, and the plan is in general conformance with our geotechnical recommendations:

Odan/Detech Drawing No. 2 of 4, Project No. 16241 - Revision 3, dated January 19, 2017 - “Reissued for SPA”.

The finished floor elevations (FFE) of the proposed buildings shown on the grading plan are as stated under Section 5.4 of this report. Paterson has reviewed the grading for Parcel A and are of the opinion that the Grading Plan is in conformance with our geotechnical recommendations for site grading.

5.6 Design for Earthquakes

The site class for seismic site response can be taken as Class C for the foundations considered at this site, for both Parcels A and B. This assessment was based on (rational) average Vs using a representative subsurface profiles, where the test holes were extended to practical refusal, as shown on Table 5, in Appendix 2. The analyses indicates that the average Vs is within the range for Site Class B at many of the boreholes, but Site Class C is applicable, as the thickness of the soil overburden is in excess of 3 m in all cases. Reference should be made to the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

The soils underlying the subject site are not susceptible to seismic liquefaction. The shallow loose sand at various boreholes is dry and will be precompacted under buildings. The fine sand and silty fine sand soils below the groundwater level that had low “N” values have been determined to actually be compact to dense deposits and, therefore, not susceptible. The state of compaction had been underestimated by the testing within the hollow stem auger. The high silt contents observed in the soils also significantly reduces the risk of liquefaction.

The Bray criteria have been interpreted to confirm that the plasticity characteristics of the silty clay soils encountered at the site are not susceptible to loss of strength under the cyclic loading that would occur during and earthquake, as described in more detail below. As previously noted, the Atterberg Limits Results are provided in Appendix 1.

The Bray criteria states that soils with plasticity indices less than 20% may have reduced strength following the strong cyclic loading resulting from a severe earthquake. If reference is made to the Atterberg Limits Results, only two (2) of the four (4) samples tested had plasticity indices less than 20, and need to be evaluated, as follows:

BH11-16, Sample SS2 has a plasticity index (PI) of 15, which is in the range of $12 < PI < 20$, so if $w/w_L \geq 0.80$ there is some reduction for the residual strength. The water content, w, of this sample is 17%, and the liquid limit, w_L is 30%, so $w/w_L = 0.57$, and there are no reduction of shear strength effects to be applied. The residual shear strength after cyclic loading will be the undisturbed undrained shear strength.

BH14-16, Sample SS4 has a plasticity index (PI) of 10, which is in the range of $PI \leq 20$, so if $w/w_L \geq 0.85$ there is some reduction for the residual strength. The water content, w, of this sample is 20%, and the liquid limit, w_L is 24%, so $w/w_L = 0.83$, so there are no reduction of shear strength effects to be applied. The residual shear strength after cyclic loading will be the undisturbed undrained shear strength.

5.7 Pavement Structures

Proposed Pavement Structures

For design purposes, the pavement structures presented in the following tables could be used for the design of car parking areas (Table 2) or access lanes, including fire lanes, (Table 3).

Table 2: Recommended Pavement Structure
Car Parking Areas

Thickness (mm)	Material Description
50	**Wear Course:** Superpave 12.5 Asphaltic Concrete (or HL-3)
150	**BASE:** OPSS Granular A Crushed Stone
300	**SUBBASE:** OPSS Granular B Type II
SUBGRADE:	Either in situ soils, engineered native fill (min. 95% SPMDD) or OPSS Granular B Type I or II material placed over in situ soil (min. 95% SPMDD).

Table 3: Recommended Pavement Structure Access Lanes/Local Subdivision Streets	
Thickness (mm)	**Material Description**
40	**Wear Course:** Superpave 12.5 Asphaltic Concrete (or HL-3)
50	**Binder Course:** Superpave 19.0 Asphaltic Concrete (or HL8)
150	**BASE:** OPSS Granular A Crushed Stone
400	**SUBBASE:** OPSS Granular B Type II
SUBGRADE:	Either in situ soils, engineered native fill (min. 95% SPMDD) or OPSS Granular B Type I or II material placed over in situ soil (min. 95% SPMDD).

The subgrade materials for the pavement structures are anticipated to be stiff to very stiff silty clay, compact to dense silty fine sand, compact to dense glacial till, loose sand/remnant native fill materials and/or compacted engineered granular fill. Table 4 presents the California Bearing Ratio (CBR) for the anticipated subgrade materials. Note that the CBR values take into consideration not only the soil type, but the expected density that will be encountered within the subgrade after it has been proof-rolled.

Table 4: CBR for Subgrade Materials	
Soil Type	**CBR Ratio**
Stiff to Very Stiff Silty Clay	4
Compact to Dense Silty Fine Sand	10
Compact to Dense Glacial Till	20
Loose Sand and/or Remnant Native Fill Materials	8
Engineered Granular Fill	70

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. Use of a geotextile between the subgrade and the pavement structure is not routinely required. Field review should be conducted during subgrade preparation to evaluate whether any supplementary measures are required, such as subexcavation and replacement of unsuitable materials, use of a geotextile or geogrid and/or proof-rolling of subgrades.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD value using suitable vibratory equipment.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. Asphaltic concrete mixes should be in conformance with OPSS MUNI 1151 (Nov 2006), for Ontario Traffic Category C. The asphaltic concrete should be compacted in conformance with OPSS 310 (Nov 2012), Table 9.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the low permeability nature of much of the expected subgrade media consideration should be given to installing subdrains during the pavement construction. If pavement drainage is implemented, the subdrains should be installed at each catch basin as per City of Ottawa standards and specifications. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 DESIGN AND CONSTRUCTION PRECAUTIONS

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for each of the proposed structures. The system should consist of a 100 mm to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

The greater part of the site excavated materials will consist of frost susceptible soils and, as such, are not recommended for re-use as backfill against the foundations especially at areas where exterior slabs are at grade with the FFE. Where minor frost action would be tolerable, unselected site excavated soils can be used in conjunction with a composite drainage system (such as system Platon or Miradrain 6000 or G100N), connected to a foundation drainage system.

Alternatively, backfill against the exterior sides of the foundation walls can consist of free-draining non frost susceptible granular materials, such as selected native clean sand or sand and gravel, or OPSS Granular B Type I material. No geotextile separator is required between these materials and the native soils, although the perforated foundation drainage pipe should have a geotextile “sock”.

Please note that, in the case of basementless slab-on-grade structures, it is our understanding that the provision of a foundation drainage system is not a requirement of the Ontario Building Code (OBC 2012).

The provision of foundation drainage generally ensures that groundwater is not present adjacent to the foundations of the applicable structures. Parts of the development under consideration are located within silty clay, sandy silt and other soils that have a low permeability. Without foundation drainage, the backfill zone around foundations in low permeability soils can tend to become saturated by a “bathtub” effect, where infiltrating water gets trapped within the fill zone within the low permeability soils. As such, the “perched” groundwater level adjacent to the foundations can be higher than the actual stabilized groundwater levels because this water does not have a convenient outlet.

During conditions of extended precipitation, or snow-melt, high perched groundwater levels adjacent to the exterior of the foundations could lead to high groundwater levels on the inside of the foundations, under the floor slab, with associated moisture issues.

Where foundations are not drained, groundwater can be expected to be present adjacent to the building for frost action to potentially occur around the perimeter of the buildings. This can be especially problematic for retail and commercial buildings, where the exterior slabs are at grades that are very close to the FFE. If frost heaving of these slabs occur, problems can be experienced with the opening of doors.

As such, non-frost susceptible granular backfill materials preferably in conjunction with a foundation drainage system, should be used, especially at areas where exterior slabs are at grade with the FFE. Where minor frost action is tolerable, and a foundation drainage system is not provided, a “bond-break” should be provided on the exterior face of the foundation wall if frost susceptible backfill materials are to be used, in order to prevent adfreezing (adhesion frost heaving) from occurring.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover (or equivalent) should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers and wing walls may require more soil cover or a combination of soil cover and insulation.

Manufactured insulation can be used to supplement soil cover. As this generally requires a specific engineered design, incorporating specific foundation details, it should be addressed, if required, at Building Permit stage.

6.3 Excavation Side Slopes

Unsupported Excavations

The side slopes of excavations in the soil overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the applicable structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavations for the commercial structures to be undertaken by open-cut methods (i.e. unsupported excavations).

Excavation side slopes above the groundwater level, and extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter.

Flatter excavation slopes will be required for excavation below the groundwater level. In the case of the glacial till and the silty sand/sandy silt, excavations below the groundwater will require slopes of 2H:1V or shallower. Where active groundwater seepage occurs, a non-woven geotextile can be placed over the toe of the slope, covered with clear stone to provide a free-draining ballast that lets seepage through but holds back the soil, and thereby reduce sloughing-in of the excavation toe.

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. The frequency of monitoring can be established by the geotechnical consultant at the time when the need arises, based on the specific conditions that warrant the monitoring.

Trench Excavations and Support

The installation of the proposed services in soils can be carried out safely within the confines of a trench box or in an open cut. An open cut in overburden materials will require that all side slopes be cut back at appropriate inclinations, as noted above, to maintain stability. If a shoring system (i.e. trench box) is used to support the walls of the cut, the trench box design should, for safety purposes, allow for additional surcharge pressures associated with construction equipment and stockpiled fill materials above the cut, although stockpiling of materials above excavations is strongly discouraged.

The interpretation of the soil descriptions in the Occupational Health and Safety Act, Regulations for Construction Projects, for purposes such as trench box design, should be undertaken by experienced geotechnical personnel. The information provided in the Soil Profile and Test Data sheets in Appendix 1 can be consulted for this purpose, with due consideration that the information is only accurate at the applicable test hole locations, and in consideration that the contractor's equipment and methods, as well as the depth of the excavation, can have a significant effect on the actual earth pressures in force at the time of construction.

Basal Instability of Trench Excavations

Where trench excavations will extend below the groundwater level in areas of sand, silty sand and sandy silt soils, basal instability could occur due to groundwater influx. This phenomenon is referred to as a "quick" condition, where the effective strength of the soil is reduced by upward flowing groundwater. This situation is exacerbated where the sand is overlain by a low permeability "confining" layer, such as silty clay and/or glacial till, that extend below the groundwater level. When the excavation penetrates the confining layer, the sand is under higher groundwater pressure and the ensuing seepage into the excavation leads to a quick condition.

It is recommended that trench excavations in areas where basal instability is observed should be dewatered from within the excavation by pumping in a slow and controlled manner in order to give time for the groundwater to be lowered beyond the excavation limits. In order to reduce the loss of soil fines from the trench base and walls, non-woven geotextile can be placed against the soil and covered with fine clear crushed stone. The geotextile will retain the soil fines, be held in place by the clear stone, and the clear stone will allow the influx water to be collected and pumped.

In extreme conditions, the basal instability can be avoided by lowering the groundwater level in the offending sand, silty sand or sandy silt soil stratum by pumping from deep wells or well-points installed outside the proposed excavation so that the excavation is completed "in the dry".

Extensive dewatering should not be conducted without consideration of potential off-site effects if the work is being conducted in close proximity to existing structures that could be adversely affected by groundwater lowering.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa. Trench details should be as per Detail Drawing Nos. W17, S6 and S7.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD value. The bedding material should extend at least to the spring line of the pipe.

Where site conditions at the bedding subgrade are poor, it may be necessary to subexcavate and increase the thickness of the bedding, as indicated in Note 5 of both Detail Drawing Nos. W17 and S6. For this development, such a case would be the result of unexpected conditions encountered during construction and would, therefore, be an evaluation to be made in the field. This would be an issue that would be evaluated as part of the field review services during construction.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD value.

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 minimize 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 material's SPMDD.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be moderate to high depending upon depth of excavation. Pumping from open or cased sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The use of non-woven geotextile and clear stone may be necessary to control silt and prevent clogging of submersible pumps. 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.

A temporary Ministry of the Environment and Climate Change (MOECC) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MOECC.

For typical ground or surface water volumes, being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to

be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MOECC review of the PTTW application.

6.6 Additional Construction Precautions

Winter Construction

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

The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, 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.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. Also, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure.

Protection of Clay Subgrades and Bearing Media

The silty clay soils encountered at several areas of the site are susceptible to disturbance due to drying shrinkage, and resulting cracking, under hot and/or windy conditions. These soils are also susceptible to disturbance due to machine and worker traffic, especially in the presence of water. Silty clay subgrades or bearing surface should not be left exposed for extended periods. Disturbed soil should be removed prior to placing granular fill over subgrades or concrete over bearing surfaces.

To reduce the propensity for drying shrinkage to occur during susceptible exposure conditions, subgrades should generally be covered with appropriate fill materials on a daily basis. Concrete for footings should be placed on bearing surfaces within two days of final excavation for bearing media, unless the surface is wet (i.e. from precipitation) or the bearing medium can be covered with a 100 mm to 150 mm thick layer of sand to provide protection for a week, with the sand removed from within the forms prior to concrete placement. It is recommended that all bearing surfaces be field-reviewed by geotechnical personnel prior to the placement of concrete or engineered fill.

6.7 Corrosion Potential and Sulphate and Additional Testing

The results of the analytical testing for corrosion of four (4) soil samples from the current investigation are provided in Appendix 1. The results of analytical testing show that the sulphate content is less than 0.1% (1 mg/g). This result indicates that Type GU (general use) cement, as per CSA A23.1 Section 4.2.1.1.2, is appropriate for this site.

The chloride content is less than 400 mg/g and the pH of the sample is greater than 5. These results indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site. The resistivity values range from 2530 to 9940 ohm-cm and are indicative of a non-aggressive to very aggressive corrosive environment for exposed ferrous metals at this site, with the lower resistivity values indicating more aggressive conditions.

The appropriate concrete exposure class is “N”, for soil contact based on chloride content, where freezing and thawing (F-1 or F-2 exposure class) is not an issue.

Three (3) soil samples were submitted for electrical conductivity and sodium adsorption ratio (SAR) testing. The tests were conducted to compare the concentrations to Ontario Regulation 153/04 Table 2. The measured values were less than 1400uS/cm and 12, respectively, and therefore meet the Table 2 limits. Three (3) groundwater samples recovered from the monitoring wells were submitted for chloride and sodium testing. The tests were conducted to compare the concentrations to Ontario Regulation 153/04 Table 2. The measured values were less than 790mg/L and 490mg/L, respectively, and therefore meet the Table 2 limits.

6.8 Landscaping Considerations

Tree Planting Restrictions

Based on our review of the subsurface conditions, the soils underlying the site are predominantly coarse-grained and not susceptible to shrinkage. Where fine-grained silty clay soils are present, they are generally in relatively thin layers and are stiff to very stiff in consistency. The fine-grained soils are classified as silty clays of low plasticity, as indicated on the attached plasticity chart. From the perspective of volume change potential (shrinkage) related to trees, these soils are within the medium (20% $\leq$ PI < 40%) to low (10% $\leq$ PI < 20%) ranges, as shown on the Atterberg Limits Results, in Appendix 1.

The standard City of Ottawa tree to structure setback of 7.5 m is too great to be realistic for this site that has discontinuous medium to low volume change potential cohesive soils. Using the NHBC Standards, 2016, from the UK, a 3.0 m tree to structure setback, in conjunction with a 1.5 m footing depth, is suitable for maximum 8 m high trees consisting of up to moderate water demand broadleaf trees or up to high water demand coniferous trees. The landscape plan should conform to those requirements, where fine-grained soils are present, and other interpretations for clearance distances and trees species can be made, as necessary

As such, it is recommended that minimum setback of 3 m from the foundation wall should be provided for areas within the subject site where a silty clay deposit is encountered, and where large trees of up to 8 m in mature height are proposed.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design, and lower water demand trees should be used.

7.0 RECOMMENDATIONS

It is recommended that the following be carried out once the site development plans are finalized and during site development:

- ❑ Geotechnical review of development grading plans. Note that the grading for the Parcel A development, under current SPA has been checked and conforms to geotechnical recommendations (Section 5.5 of this report).
- ❑ 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.
- ❑ 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 the completion of a satisfactory field review and materials testing program by the geotechnical consultant.

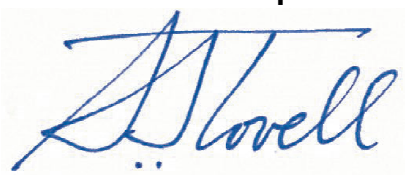
8.0 STATEMENT OF LIMITATIONS

The recommendations made in this report are in accordance with our present understanding of the project.

A geotechnical investigation of this nature 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. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities.

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) or entities other than Greely Family Farm Inc. and Maverick Development Corporation 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.



Andrew J. Tovell, P.Eng.

Report Distribution:

- ❑ Greely Family Farm Inc. (7 copies)
- ❑ Paterson Group Inc. (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN SIZE DISTRIBUTION SHEETS

ATTERBERG LIMITS' RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH 1-16

BORINGS BY CME 55 Power Auger **DATE** October 13, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.78
FILL: Brown sand, trace silt, gravel, cobbles, boulders and rootlets		AU	1				
1.22		SS	2	25	50+	1	89.78
Dense to loose, brown **SILTY SAND,** trace gravel		SS	3	50	5	2	88.78
		SS	4	33	5	3	87.78
3.28							
Dense, brown **SANDY SILT** 3.35		SS	5	58	36	4	86.78
		SS	6	54	37		
Dense to very dense, brown **SAND-GRAVEL,** trace cobbles and boulders		SS	7	73	50+	5	85.78
		SS	8	60	50+	6	84.78
		SS	9	0	50+		
6.70							
End of Borehole							
(GWL @ 2.82m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH 2-16

BORINGS BY CME 55 Power Auger **DATE** October 13, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.84
TOPSOIL 0.10		AU	1				
Compact, grey **SANDY SILT,** trace clay 0.91		SS	2	67	21	1	89.84
Compact, brown **SAND,** trace silt		SS	3	54	8	2	88.84
		SS	4	62	17		
2.90						3	87.84
Compact to very dense, grey **SANDY SILT,** trace clay		SS	5	71	12	4	86.84
		SS	6	71	50+		
		SS	7	67	50	5	85.84
5.33							
Dense, grey **SILTY SAND**		SS	8	62	30	6	84.84
6.10							
Very dense, grey **SANDY SILT**		SS	9	71	50+		
7.01						7	83.84
End of Borehole							

Practical refusal to augering at 7.01m depth

(GWL @ 2.09m-October 26, 2016)

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

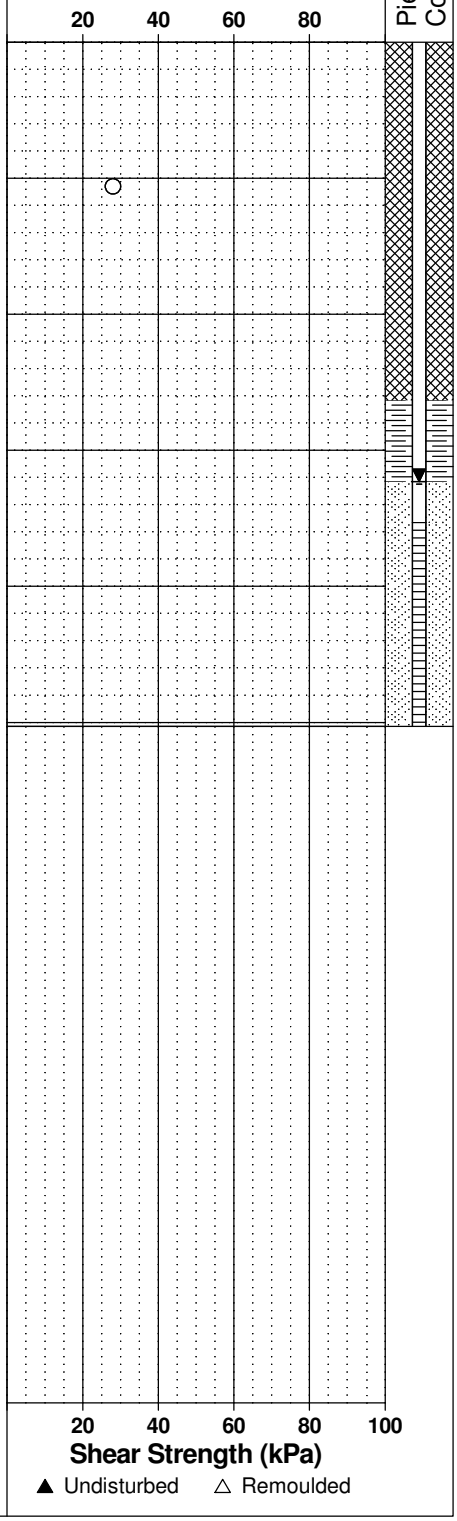
HOLE NO. BH 3-16

BORINGS BY CME 55 Power Auger **DATE** October 12, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.30
FILL: Silty sand, some gravel (0.46)		AU	1				
Compact, brown **SILTY SAND** with gravel (0.76)							
Stiff, brown **SILTY CLAY,** trace sand and gravel (1.62)		SS	2	58	10	1	90.30
Dense, brown **SILTY SAND,** trace clay (2.29)		SS	3	58	31	2	89.30
Compact to dense, brown **SILTY SAND,** trace cobbles (3.96)		SS	4	62	24	3	88.30
		SS	5	83	43		
Very dense to dense, grey **SILTY SAND,** some gravel, trace cobbles and boulders (5.03)		SS	6	67	50+	4	87.30
		SS	7	62	46	5	86.30
End of Borehole							
(GWL @ 3.23m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH 4-16

BORINGS BY CME 55 Power Auger **DATE** October 13, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.79
Grey **SILT,** trace rootlets and gravel 0.10		AU	1				
Loose, grey **SANDY SILT** 1.52		SS	2	75	7	1	89.79
Very stiff, brown **SILTY CLAY,** trace sand and gravel 2.69		SS	3	75	15	2	88.79
		SS	4	71	22		
Compact, grey **SANDY SILT**		SS	5	71	21	3	87.79
		SS	6	62	15	4	86.79
		SS	7	58	18	5	85.79
5.18 End of Borehole							

(GWL @ 2.92m-October 26, 2016)

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG3957

REMARKS

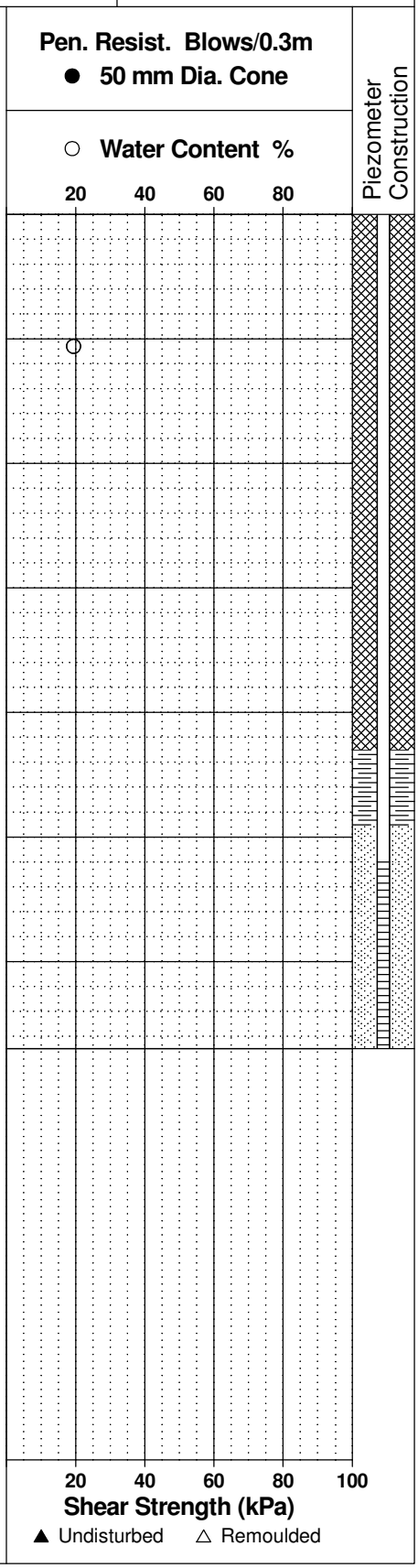
HOLE NO. BH 5-16

BORINGS BY CME 55 Power Auger **DATE** October 12, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.99
FILL: Silty sand, trace clay and rootlets (0.60)		AU	1				
Very stiff, brown **SILTY CLAY,** trace sand and gravel (1.22)		SS	2	83	18	1	89.99
Compact, grey **SANDY SILT** (1.65)							
Compact, brown **SILTY SAND** (2.41)		SS	3	79	15	2	88.99
		SS	4	100	19		
Compact, grey **SILT,** trace sand (3.35)		SS	5	25	50+	3	87.99
Dense to very dense, grey fine to coarse **SAND-GRAVEL**		SS	6	38	37	4	86.99
		SS	7	17	39	5	85.99
		SS	8	59	50+	6	84.99
(6.70)		SS	9	46	50+		

End of Borehole

(Piezometer blocked - October 26, 2016)



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Ottawa, Ontario

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FILE NO. PG3957

REMARKS

HOLE NO. BH 6-16

BORINGS BY CME 55 Power Auger **DATE** October 12, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.35
FILL: Brown silt with gravel, cobbles, boulders, sand and rootlets in upper 100mm		AU	1				
		SS	2	58	13	1	89.35
		SS	3	58	24	2	88.35
2.11							
Compact to dense, brown **SILTY SAND**		SS	4	62	16	3	87.35
		SS	5	54	33		
		SS	6	71	27	4	86.35
4.57							
Dense, brown **SILT,** trace sand		SS	7	62	31	5	85.35
5.18							
End of Borehole							
(GWL @ 2.43m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH 7-16

BORINGS BY CME 55 Power Auger **DATE** October 12, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.68
FILL: Brown silty sand with gravel, trace rootlets		AU	1				
1.07		SS	2	33	17	1	89.68
Compact, brown **SANDY SILT,** trace clay 1.37							
Compact, grey **SILTY SAND,** trace clay 1.98		SS	3	83	28	2	88.68
Dense, brown **SILTY FINE SAND**		SS	4	83	44		
		SS	5	4	40	3	87.68
3.50							
Very dense, grey-brown **SAND-GRAVEL,** trace cobbles and boulders		SS	6	42	50+	4	86.68
4.60		SS	7	31	50+		
End of Borehole							
(GWL @ 3.01m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG3957

REMARKS

HOLE NO. BH 8-16

BORINGS BY CME 55 Power Auger **DATE** October 13, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.25
Brown **SILTY CLAY,** trace sand, gravel and rootlets in upper 100mm (0.60)		AU	1				
Compact, brown **SILTY SAND** (1.22)		SS	2	75	27	1	88.25
		SS	3	46	23	2	87.25
Compact, brown **SANDY SILT**		SS	4	58	15		
		SS	5	62	20	3	86.25
(3.81) Very stiff, grey **SILTY CLAY** with gravel (4.42)		SS	6	54	37	4	85.25
Very dense, grey **SAND-GRAVEL,** trace silt		SS	7	33	50+	5	84.25
		SS	8	71	50+		
(6.10) Very dense, grey medium **SAND** (6.38)		SS	9	55	50+	6	83.25
End of Borehole							
(GWL @ 1.65m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG3957

REMARKS

HOLE NO. BH 9-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.40
FILL: Brown silt, trace gravel and rootlets in upper 150mm (0.60)		AU	1				
FILL: Brown silty clay, trace sand and gravel (1.32)		SS	2	100	11	1	88.40
Compact, brown **SANDY SILT** (2.90)		SS	3	67	19	2	87.40
		SS	4	54	17		
Dense to very dense, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boulders (7.47)		SS	5	29	37	3	86.40
		SS	6	46	39	4	85.40
		SS	7	54	50+	5	84.40
		SS	8	67	50+		
		SS	9	64	50+	6	83.40
						7	82.40

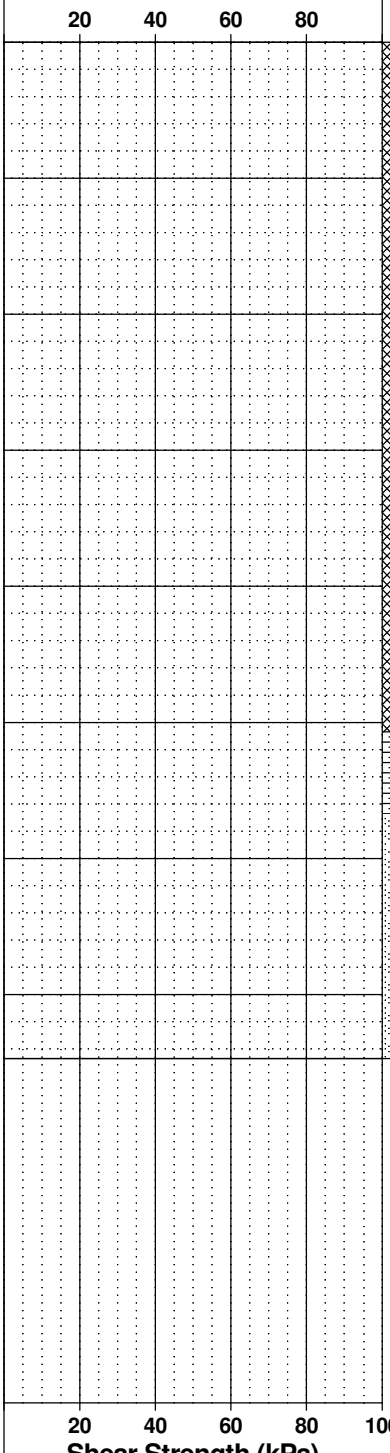
End of Borehole

Practical refusal to augering at 7.47m depth

(GWL @ 1.88m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ **Water Content %**



▲ Undisturbed △ Remoulded

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REMARKS

HOLE NO. BH10-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.81
FILL: Brown silt, trace gravel, cobbles and rootlets in upper 100mm (0.76)		AU	1				
Compact, brown **SILTY SAND** (1.07)		SS	2	62	11	1	88.81
Grey-brown **SILTY CLAY,** trace rootlets (1.37)							
Compact, brown **SILTY SAND** (1.83)		SS	3	67	26	2	87.81
		SS	4	46	14		
Compact to dense, grey **SANDY SILT**		SS	5	46	20	3	86.81
		SS	6	50	28	4	85.81
		SS	7	46	32	5	84.81
(5.18) End of Borehole							

(GWL @ 2.46m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

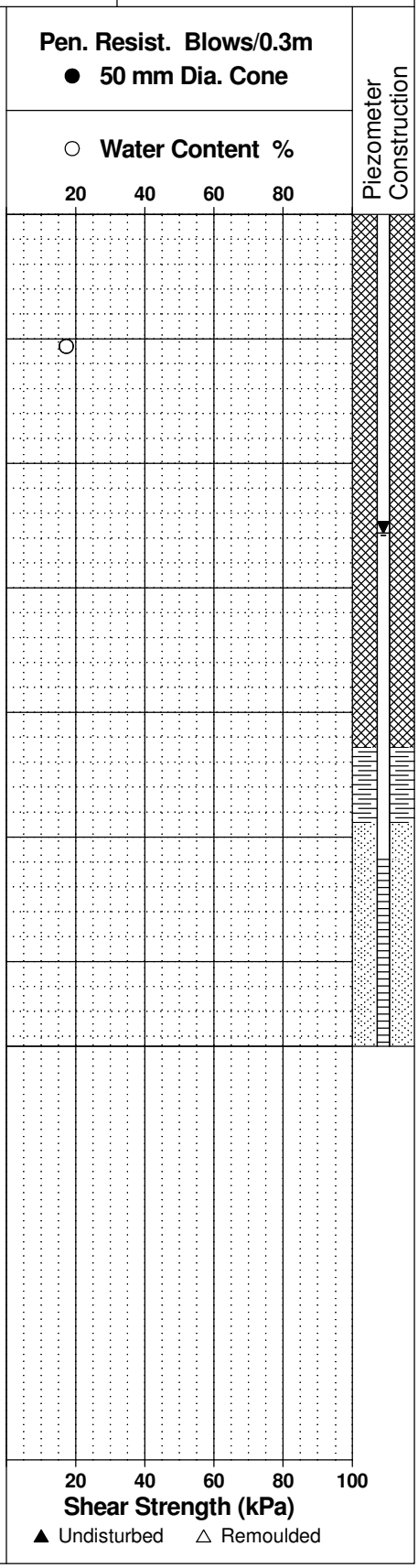
HOLE NO. BH11-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.78
FILL: Brown silt, trace clay, gravel and rootlets in upper 50mm (0.76)		AU	1				
Very stiff, brown **SILTY CLAY,** trace sand (1.14)		SS	2	96	23	1	88.78
Compact, brown **SILTY SAND** (1.83)		SS	3	96	27	2	87.78
		SS	4	50	28		
Compact, grey **SANDY SILT** (4.57)		SS	5	62	24	3	86.78
		SS	6	67	28	4	85.78
Very dense to dense, grey **SILTY SAND** (6.68)		SS	7	67	50+	5	84.78
		SS	8	75	44	6	83.78
		SS	9	87	38		

End of Borehole

(GWL @ 2.56m-October 26, 2016)



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REMARKS

HOLE NO. BH12-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.88
Brown **SILTY SAND** with rootlets 0.10		AU	1				
Compact, brown **SILTY SAND**		SS	2	79	14	1	88.88
1.68		SS	3	62	29	2	87.88
		SS	4	71	45		
Dense to compact, grey **SANDY SILT**		SS	5	58	24	3	86.88
		SS	6	62	34	4	85.88
		SS	7	67	22	5	84.88
5.33							
Dense to very dense, grey **SAND-GRAVEL,** trace silt, cobbles and boulders		SS	8	42	48	6	83.88
6.27		SS	9	43	50+		
End of Borehole							
(GWL @ 1.90m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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REMARKS

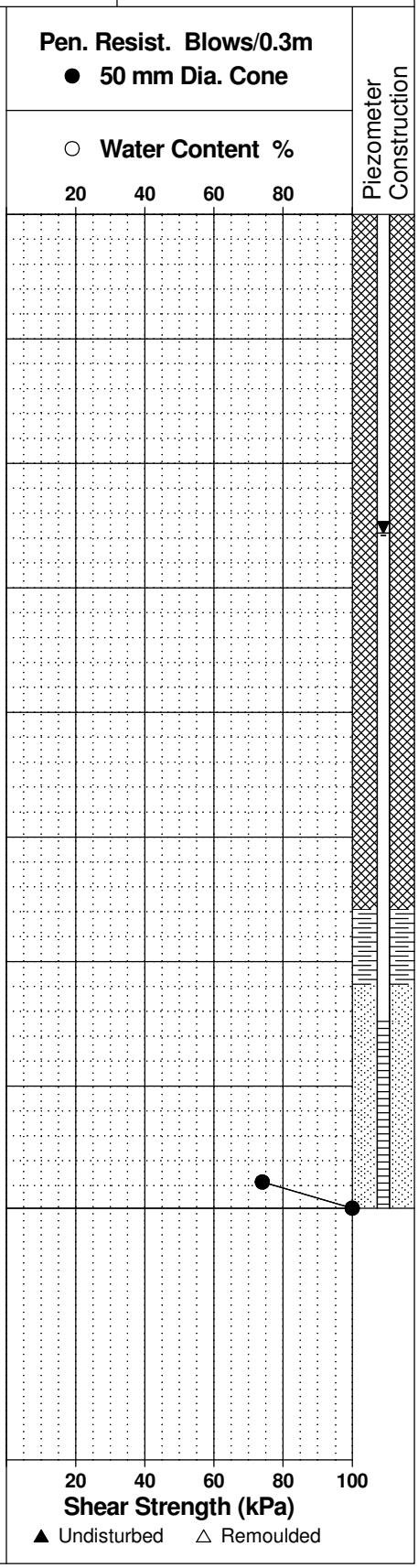
HOLE NO. BH13-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.76
FILL: Brown silt, trace gravel, cobbles and rootlets in upper 50mm		AU	1				
0.91 Brown **SILTY SAND,** trace rootlets		SS	2	62	6	1	88.76
1.22 Brown **SILTY CLAY** with rootlets							
1.58 Compact to dense, brown **SILTY SAND**		SS	3	54	15	2	87.76
		SS	4	58	11		
- grey by 2.3m depth						3	86.76
		SS	5	50	35		
		SS	6	58	24	4	85.76
		SS	7	67	49		
5.33 Compact, grey **SANDY SILT**						5	84.76
5.49		SS	8	42	13		
						6	83.76
Compact to dense, grey **SAND-GRAVEL,** trace silt, cobbles and inferred boulders		SS	9	50	38		
						7	82.76
7.62 Dynamic Cone Penetration Test commenced at 7.62m depth.							
7.98 End of Borehoe							

Practical DCPT refusal at 7.98m depth

(GWL @ 2.56m-October 26, 2016)



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REMARKS

HOLE NO. BH14-16

BORINGS BY CME 55 Power Auger **DATE** October 14, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.70
Grey-brown **SANDY SILT,** trace clay and rootlets in upper 100mm (0.91)		AU	1				
Brown **SILTY SAND,** some clay (1.22)		SS	2	58	11	1	88.70
Brown **SILTY CLAY** (1.37)							
Compact, brown **SILTY SAND,** some clay (2.06)		SS	3	75	14	2	87.70
Stiff to firm, grey **SILTY CLAY,** trace sand (2.80)		SS	4	92	P		
Dense to compact, grey **SANDY SILT**		SS	5	58	32	3	86.70
		SS	6	62	27	4	85.70
(4.82)		SS	7	62	26	5	84.70
Compact to very dense, grey **SAND-GRAVEL,** trace silt, cobbles, inferred boulders		SS	8	44	50+	6	83.70
(6.53)		SS	9	100	50+		
End of Borehole							
(GWL @ 2.60m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

HOLE NO. BH15-16

BORINGS BY CME 55 Power Auger **DATE** October 17, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.47
FILL: Grey sandy silt, trace gravel, cobbles and rootlets (0.76)		AU	1				
Stiff, brown **SILTY CLAY,** trace sand and rootlets (1.52)		SS	2	67	9	1	88.47
Compact, brown **SANDY SILT to SILTY SAND**		SS	3	79	27	2	87.47
- grey by 2.0m depth		SS	4	54	28	3	86.47
(3.73)		SS	5	58	20		
Dense to very dense, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boulders		SS	6	38	33	4	85.47
		SS	7	53	50+	5	84.47
		SS	8	25	50+		
(5.79)							

End of Borehole

Practical refusal to augering at 5.79m depth

(GWL @ 2.66m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

HOLE NO. BH16-16

BORINGS BY CME 55 Power Auger **DATE** October 17, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.97
FILL: Brown sandy silt, trace gravel, cobbles, boulders and rootlets in upper 75mm (0.76)		AU	1				
FILL: Brown silty clay, trace sand, rootlets and inferred boulders (1.52)		SS	2	50	6	1	87.97
Dense, grey **SILTY SAND to SANDY SILT** (1.83)		SS	3	67	35	2	86.97
Compact, grey **SANDY SILT**		SS	4	58	21		
		SS	5	58	24	3	85.97
		SS	6	46	18	4	84.97
(4.57)							
Dense to very dense, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boulders		SS	7	42	43	5	83.97
		SS	8	33	50+		
(5.84)							

End of Borehole

Practical refusal to augering at 5.84m depth

(GWL @ 2.20m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

HOLE NO. BH17-16

BORINGS BY CME 55 Power Auger **DATE** October 17, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.28
FILL: Grey-brown sandy silt, some clay, trace gravel, cobbles, rootlets and inferred boulders (0.76)		AU	1				
FILL: Brown silty clay, trace sand and gravel (1.52)		SS	2	50	8	1	88.28
Dense, grey **SILTY SAND to SANDY SILT** (2.13)		SS	3	75	39	2	87.28
- some clay from 1.7 to 1.8m depth		SS	4	54	32		
Dense, grey **SANDY SILT** (4.70)		SS	5	58	34	3	86.28
						4	85.28
Dense to very dense, grey **SAND-GRAVEL**, trace silt, cobbles and inferred boulders (6.12)		SS	6	42	36	5	84.28
		SS	7	53	50+		
						6	83.28

End of Borehole

Practical refusal to augering at 6.12m depth

(GWL @ 2.44m-October 26, 2016)

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

HOLE NO. BH18-16

BORINGS BY CME 55 Power Auger **DATE** October 17, 2016

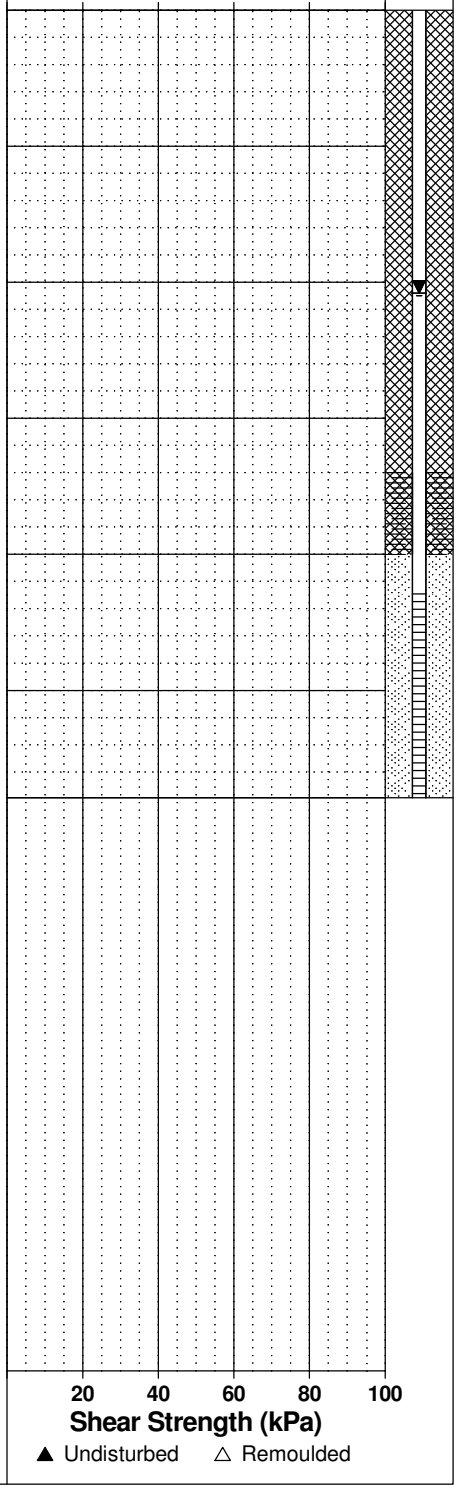
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.01
FILL: Grey-brown sandy silt, trace gravel, cobbles and inferred boulders		AU	1				
1.14		SS	2	71	11	1	88.01
FILL: Brown silty clay 1.30							
FILL: Grey coarse sand 1.37							
Stiff, grey **CLAYEY SILT,** trace sand 1.98		SS	3	54	11	2	87.01
Compact, grey **SANDY SILT**							
- trace clay from 2.3 to 2.6m depth 2.59		SS	4	58	12		
Compact, grey **SANDY SILT**		SS	5	67	24	3	86.01
4.42		SS	6	50	15	4	85.01
Compact to very dense, grey **SAND-GRAVEL,** trace silt, cobbles and inferred boulders		SS	7	38	28	5	84.01
5.79		SS	8	27	50+		
End of Borehole							
Practical refusal to augering at 5.79m depth							
(GWL @ 2.08m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH19-16

BORINGS BY CME 55 Power Auger **DATE** October 17, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.65
FILL: Grey-brown sandy silt, trace gravel, cobbles, rootlets and inferred boulders (0.76)		AU	1				
FILL: Brown sand with gravel, trace silt, cobbles and inferred boulders (1.83)		SS	2	67	43	1	87.65
Compact, brown **SANDY SILT to SILTY SAND** (2.29)		SS	3	62	19	2	86.65
Compact, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boulders (3.81)		SS	4	17	22	3	85.65
		SS	5	42	19		
Compact, brown coarse **SAND,** trace gravel (4.42)		SS	6	58	29	4	84.65
Very dense, grey **SAND,** some gravel (5.21)		SS	7	60	50+	5	83.65

End of Borehole

Practical refusal to augering at 5.21m depth

(GWL @ 1.89m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH20-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.32
FILL: Brown clay with sand and silt, trace gravel, rootlets, cobbles and inferred boulders 0.60		AU	1				
Very stiff, grey **SILTY CLAY,** trace sand 1.37		SS	2	100	9	1	86.32
Dense, grey **SANDY SILT** 2.39		SS	3	12		2	85.32
Dense to very dense, grey **SAND-GRAVEL,** trace silt, cobbles and boulders 3.81		SS	4	46	38	3	84.32
		SS	5	50	50+		
End of Borehole							
(GWL @ 1.55m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

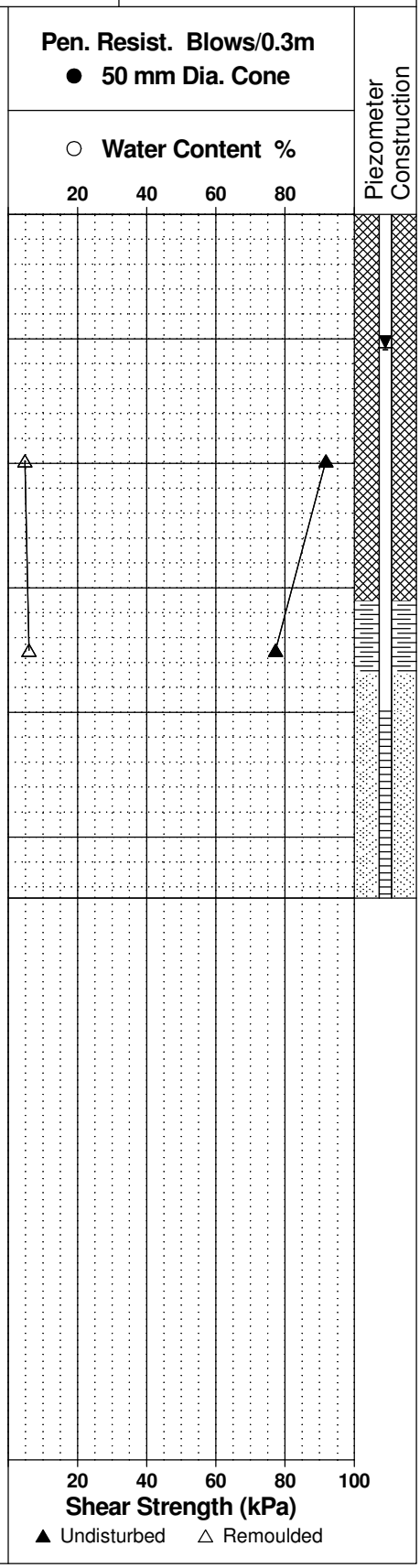
FILE NO. PG3957

REMARKS

HOLE NO. BH21-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.93
FILL: Brown clay with sand, silt and rootlets in upper 50mm		AU	1				
0.76							
Very stiff to stiff, brown **SILT CLAY,** trace sand		SS	2	83	12	1	86.93
		SS	3	46	NV	2	85.93
- grey by 2.1m depth		SS	4	100	0		
3.35		SS	5	50	NV	3	84.93
Compact, grey **SANDY SILT**		SS	6	54	13	4	83.93
4.57							
Compact to very dense, grey **SAND-GRAVEL,** some silt, trace cobbles and inferred boulders		SS	7	25	23	5	82.93
5.49		SS	8	50	50+		
End of Borehole							
Practical refusal to augering at 5.49m depth							
(GWL @ 1.07m-October 26, 2016)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

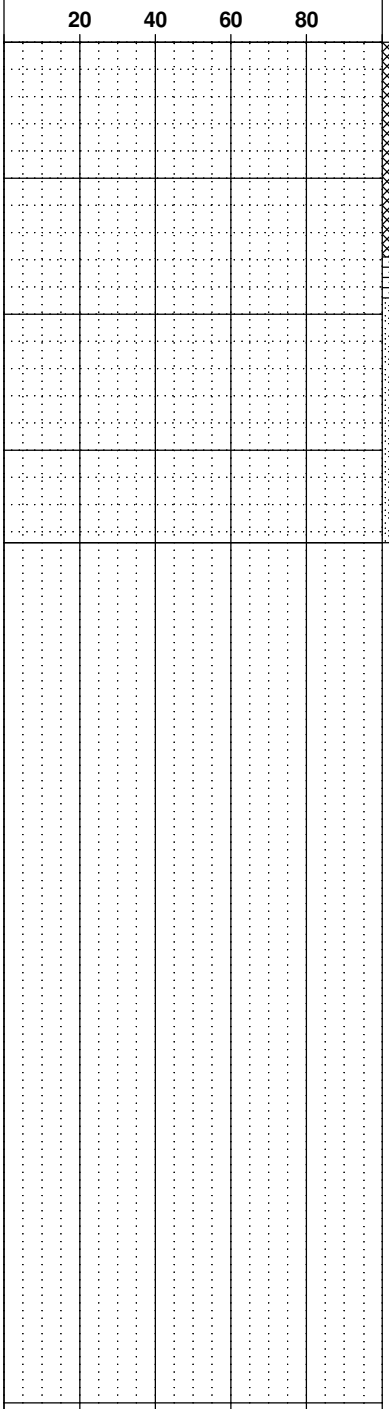
HOLE NO. BH22-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.13
Grey-brown **SANDY SILT,** some gravel, cobbles, inferred boulders and rootlets in upper 25mm (0.76)		AU	1				
		SS	2	70	50+	1	89.13
		SS	3	40	50+		
Very dense, brown coarse to fine **SAND** with gravel, trace silt						2	88.13
		SS	4	60	50+	3	87.13
(3.68)							
End of Borehole							
Practical refusal to augering at 3.68m depth							
(GWL @ 3.38m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

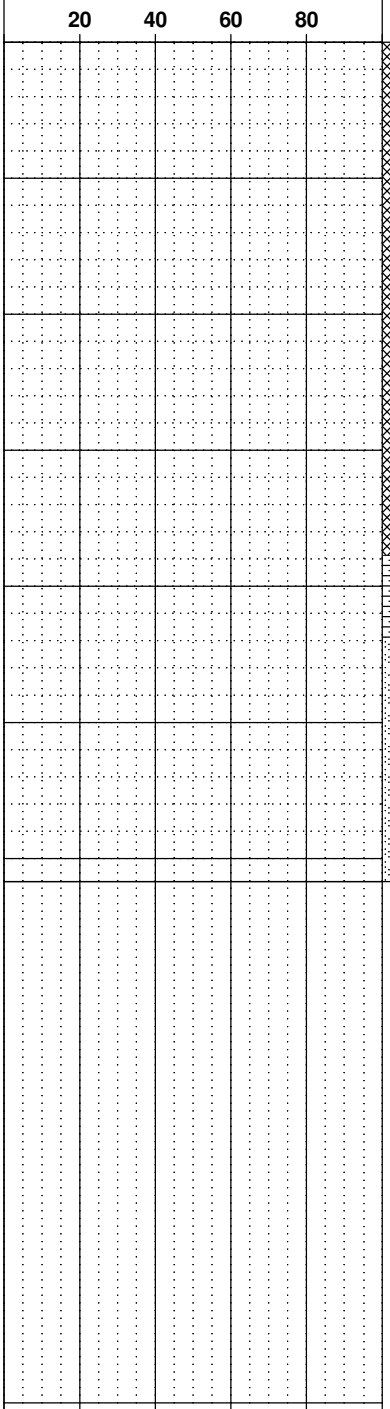
HOLE NO. BH23-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.49
Brown **SILTY SAND,** some gravel, cobbles, rootlets in upper 50mm and inferred boulders		AU	1				
- grey by 1.2m depth		SS	2	50	42	1	87.49
		SS	3	58	50+	2	86.49
2.29							
Very dense, grey **SAND-GRAVEL,** trace silt, inferred boulders and cobbles		SS	4	50	50+	3	85.49
		SS	5	25	50+		
		SS	6	79	50+	4	84.49
		SS	7	67	50+	5	83.49
		SS	8	44	50+		
6.17		SS	8	67	50+	6	82.49
End of Borehole							
(GWL @ 1.67m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

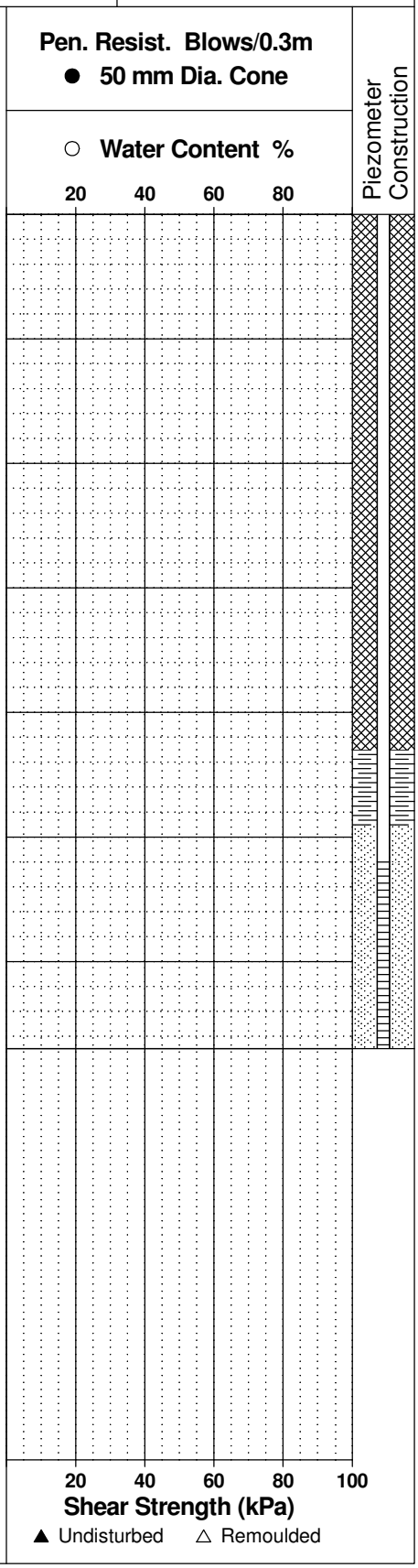
FILE NO. PG3957

REMARKS

HOLE NO. BH24-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.83
Very dense, brown **SILTY SAND,** some gravel inferred cobbles and boulders, trace clay		AU	1				
		SS	2	67	50+	1	88.83
		SS	3	70	50+		
						2	87.83
2.29 Dense, fine to medium **SAND,** trace gravel 2.46		SS	4	62	43		
Dense, brown **SANDY SILT** 2.90							
Very dense, brown medium to coarse **SAND** with gravel 3.45		SS	5	63	50+	3	86.83
Very dense to dense, brown **SAND** with gravel, some silt		SS	6	58	50+	4	85.83
		SS	7	50	40	5	84.83
5.33 Compact, grey **SAND**		SS	8	100	16		
						6	83.83
6.32 Grey **SAND-GRAVEL,** some cobbles 6.45 6.70		SS	9	79	50+		
Very dense, grey **SANDY SILT**							
End of Borehole							
(BH dry - October 26, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH25-16

BORINGS BY CME 55 Power Auger **DATE** October 18, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.86
TOPSOIL 0.10		AU	1				
Very dense, brown **SANDY SILT,** trace gravel, cobbles and inferred boulders		SS	2	0	50+	1	88.86
1.80		SS	3	45	50+	2	87.86
Very dense, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boudlers		SS	4	71	50+	3	86.86
		SS	5	50	50+		
3.81 Dense, brown medium **SAND** 4.11		SS	6	46	36	4	85.86
Dense, grey **SANDY SILT** 4.40							
Very dense, brown medium to coarse **SAND,** trace gravel 4.47		SS	7	42	50+	5	84.86
Very dense, brown **SAND-GRAVEL,** trace silt, cobbles and inferred boulders		SS	8	54	50+	6	83.86
		SS	9	42	50+		
7.21						7	82.86

End of Borehole

Practical refusal to augering at 7.21m depth

(GWL @ 3.03m-October 26, 2016)

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH26-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.53
FILL: Brown silty sand to sandy silt, trace rootlets (0.60)		AU	1				
Loose, brown **SILTY SAND** (1.52)		SS	2	62	9	1	89.53
		SS	3	50	50+	2	88.53
Very dense, brown medium to coarse **SAND** with gravel, inferred cobbles and boulders (3.05)		SS	4	71	50+	3	87.53

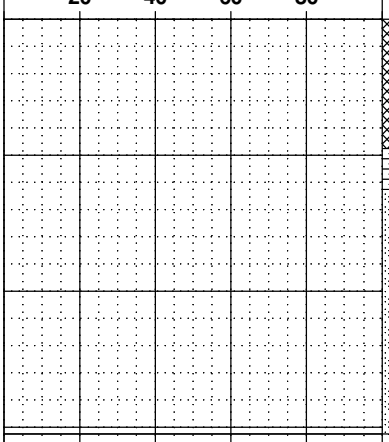
End of Borehole

Practical refusal to augering at 3.05m depth

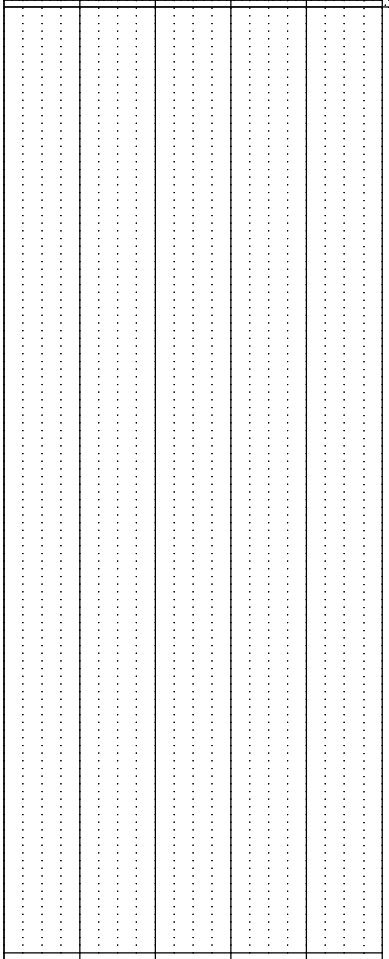
(GWL @ 2.88m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction



20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH27-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.05
FILL: Brown silty sand with rootlets (0.60)		AU	1				
FILL: Red-brown silty sand (0.91)							
Compact, brown **SANDY SILT to SILTY SAND** (2.13)		SS	2	58	19	1	89.05
		SS	3	62	21	2	88.05
Very dense, brown **SAND-GRAVEL,** trace silt, inferred cobbles and boulders (4.27)		SS	4	62	50+	3	87.05
		SS	5	58	50+		
		SS	6	33	35	4	86.05
Very dense to dense, brown fine to medium **SAND,** trace silt, inferred cobbles and boulders (6.12)		SS	7	46	50+	5	85.05
		SS	8	62	35	6	84.05

End of Borehole

Practical refusal to augering at 6.12m depth

(GWL @ 2.96m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH28-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.24
FILL; Grey sandy silt with rootlets 0.10		AU	1				
FILL: Grey sandy silt 0.76							
FILL: Brown sandy silt, trace clay and gravel 1.52		SS	2	62	9	1	89.24
Compact, brown **SILTY SAND** 2.13		SS	3	67	20	2	88.24
Compact to dense, grey **SANDY SILT** 3.96		SS	4	62	25	3	87.24
		SS	5	58	45		
Dense to very dense, grey **SAND-GRAVEL** 6.43		SS	6	58	21	4	86.24
		SS	7	33	50+	5	85.24
		SS	8	38	35	6	84.24
		SS	9	85	50+		

End of Borehole

(GWL @ 3.19m-October 26, 2016)

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH29-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.51
FILL: Brown silty clay, trace cobbles and rootlets (0.20)		AU	1				
FILL: Brown sandy silt to silty sand, trace cobbles (0.76)							
Compact, brown **SANDY SILT to SILTY SAND** (1.37)		SS	2	58	19	1	89.51
		SS	3	62	28	2	88.51
Compact to dense, grey **SANDY SILT**		SS	4	58	23		
		SS	5	50	43	3	87.51
(3.81)							
		SS	6	12	19	4	86.51
Compact to vey dense, grey **SAND-GRAVEL,** trace to some silt		SS	7	42	28	5	85.51
		SS	8	50	50+		
						6	84.51
(6.35)		SS	9	30	50+		
End of Borehole							
(GWL @ 2.61m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH30-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.27
FILL: Brown sandy silt, trace gravel and rootlets (0.13)		AU	1				
FILL: Brown sandy silt, trace gravel (1.52)		SS	2	62	21	1	89.27
Compact to dense, grey **SANDY SILT** (3.66)		SS	3	67	16	2	88.27
		SS	4	67	41		
		SS	5	58	47	3	87.27
Very dense, grey **SAND-GRAVEL,** trace silt, cobbles and inferred boudlers (4.42)		SS	6	42	50+	4	86.27
Dense, grey **SANDY SILT** with gravel, trace inferred cobbles and boulders (5.18)		SS	7	42	50+	5	85.27
Dense to very dense, grey **SAND-GRAVEL,** trace silt, inferred cobbles and boulders (6.55)		SS	8	75	41	6	84.27
		SS	9	45	50+		

End of Borehole

Practical refusal to augering at 6.55m depth

(GWL @ 2.91m-October 26, 2016)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 6045 Bank Street
Ottawa, Ontario

DATUM Ground surface elevations provided by ARK Engineering

FILE NO. PG3957

REMARKS

HOLE NO. BH31-16

BORINGS BY CME 55 Power Auger **DATE** October 19, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.12
Brown **SANDY SILT,** trace rootlets 0.10							
Compact, brown **SANDY SILT to SILTY SAND** 0.76		AU	1				
		SS	2	58	11	1	89.12
		SS	3	75	21	2	88.12
Compact to dense, grey **SANDY SILT**		SS	4	62	50+		
		SS	5	62	42	3	87.12
		SS	6	54	21	4	86.12
4.40							
		SS	7	42	30	5	85.12
Dense to compact, brown **SAND-GRAVEL,** trace silt, inferred cobbles and boulders		SS	8	38	26	6	84.12
6.40		SS	9	58	41		
Dense, grey **SANDY SILT** 6.93							
End of Borehole							
Practical refusal to augering at 6.93m depth							
(GWL @ 3.03m-October 26, 2016)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

DATUM Ground surface elevation interpolated from topographic plan prepared by M.E. Renaud Land Surveyor. Approx. geodetic.

REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	90.70		
TOPSOIL 0.37									
						1	89.70		
Compact, brown **SAND-GRAVEL**, some silt, cobbles and boulders		G	1						
						2	88.70		
						3	87.70		
		G	2						
3.45 End of Test Pit (Water infiltration @ 2.6m depth)									

Water Content % scale: 20, 40, 60, 80

Shear Strength (kPa) scale: 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

DATUM Ground surface elevation interpolated from topographic plan prepared by M.E. Renaud Land Surveyor. Approx. geodetic.

REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

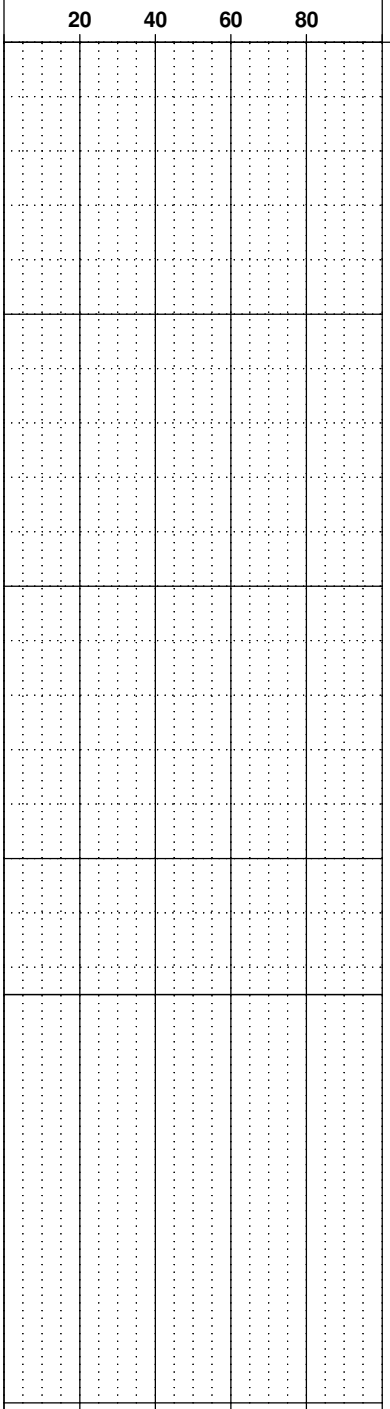
FILE NO. PG0525

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.29
TOPSOIL 0.31							
Loose, reddish brown to brown **SAND**, some silt 0.95		G	1			1	89.29
Compact, brown **SAND** with gravel 1.25							
Compact, brown-grey **SANDY SILT**, with silty clay layers 1.65		G	2			2	88.29
Compact, grey **SANDY SILT** 2.60		G	3				
Dense, grey **SAND-GRAVEL**, some silt, cobbles and boulders 3.50		G	4			3	87.29
End of Test Pit (Water infiltration @ 2.8m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

DATUM Ground surface elevation interpolated from topographic plan prepared by M.E. Renaud Land Surveyor. Approx. geodetic.

REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

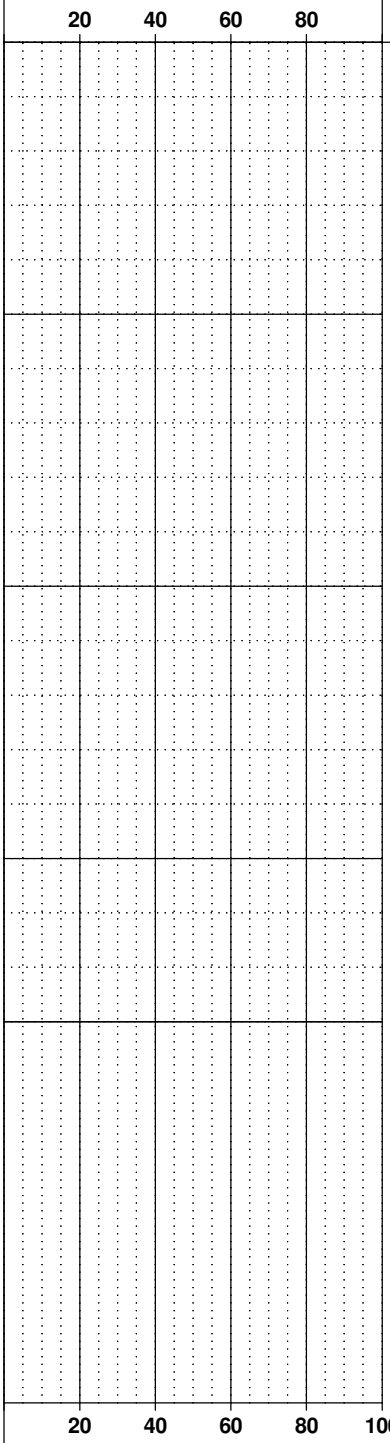
FILE NO. PG0525

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.37
TOPSOIL 0.60							
Loose to compact, brown **CLAYEY SILTY SAND**, some gravel 1.10		G	1			1	89.37
Brown to grey **SAND-GRAVEL** with cobbles and boulders		G	2			2	88.37
		G	3			3	87.37
3.60 End of Test Pit (Water infiltration @ 2.8m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

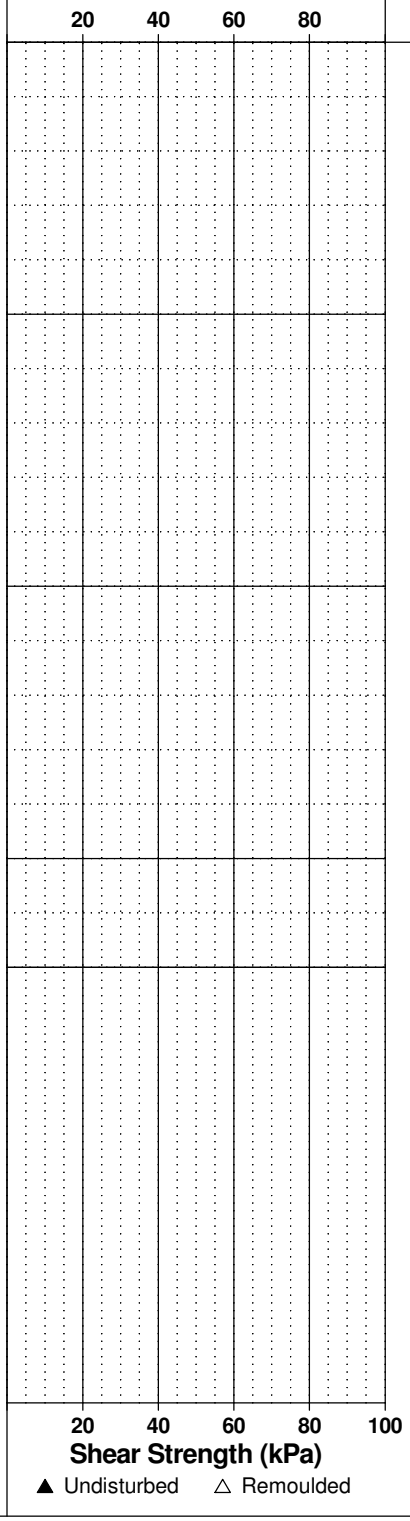
FILE NO. PG0525

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.54
TOPSOIL 0.24							
Loose, reddish brown **SAND**, some silt 0.95						1	90.54
Compact to dense, grey-brown **SILTY FINE SAND** 2.40		G	1			2	89.54
Dense, grey silty **SAND GRAVEL** with cobbles and boulders 3.40		G	2			3	88.54
End of Test Pit (Water infiltration @ 2.4m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	91.64		
FILL: Topsoil with gravel, sand and concrete pieces									
0.80						1	90.64		
Compact, brown **SILTY SAND**		G	1						
1.50									
		G	2			2	89.64		
Compact, brown **SAND-GRAVEL**, some silt, cobbles and boulders									
						3	88.64		
		G	3						
3.50									
End of Test Pit									

Shear Strength (kPa) (20 40 60 80 100)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.52
TOPSOIL 0.26							
Loose to compact, brown **SAND** 0.67							
Compact, brown **CLAYEY SILTY SAND** 1.05		G	1			1	89.52
		G	2				
Compact to dense, grey-brown to grey **SILTY FINE SAND**						2	88.52
- occasional boulder below 2.0m depth						3	87.52
3.80 End of Test Pit (Water infiltration @ 1.2m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

DATUM Ground surface elevation interpolated from topographic plan prepared by M.E. Renaud Land Surveyor. Approx. geodetic.

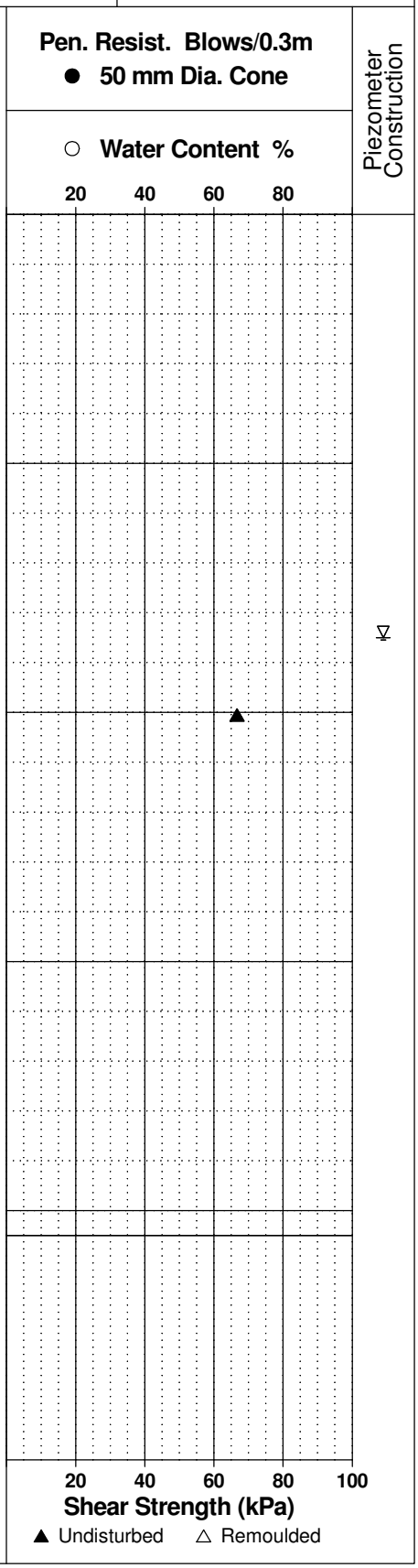
REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.00
TOPSOIL 0.32							
Loose, brown **SAND** 0.60							
Stiff, brownish grey **CLAYEY SILT**, some sand 1.60		G	1			1	89.00
Stiff, grey **SILTY CLAY**, some fine sand seams 2.20		G	2				
		G	3			2	88.00
Dense, grey **SILTY FINE SAND**, with silty clay seams 4.10		G	4			3	87.00
End of Test Pit (Water infiltration @ 1.7m depth)						4	86.00



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SOIL PROFILE AND TEST DATA

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Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

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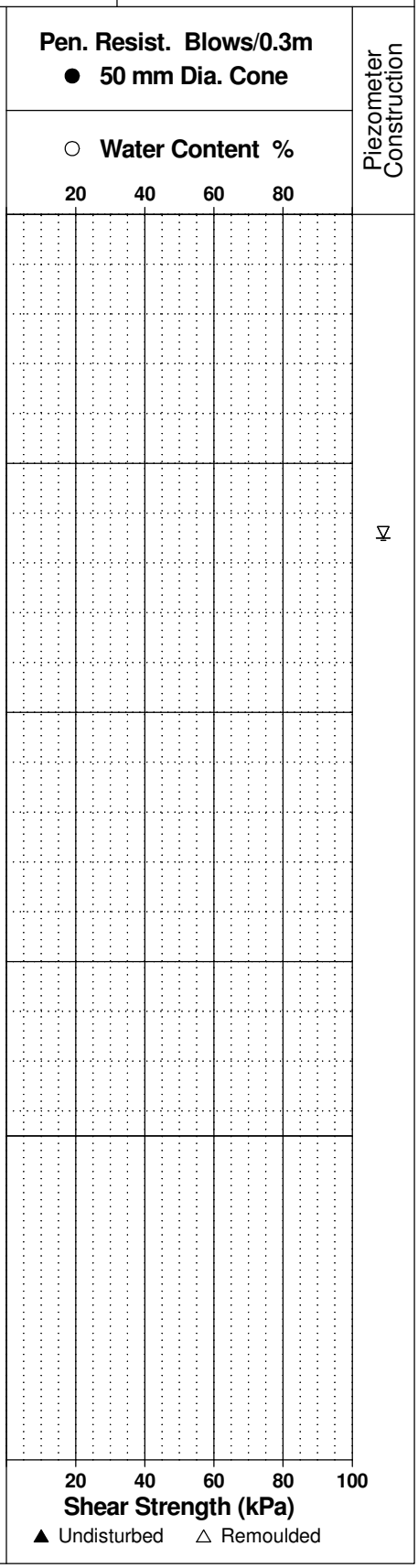
REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.10
TOPSOIL 0.27							
Stiff, brown **CLAYEY SILT**, some sand and reddish brown mottling		G	1			1	88.10
1.45		G	2				
Compact, grey **SILTY FINE SAND** to **SANDY SILT**		G	3			2	87.10
3.70						3	86.10
End of Test Pit (Water infiltration @ 1.3m depth)							



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SOIL PROFILE AND TEST DATA

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Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.72
TOPSOIL 0.27							
Loose, reddish brown **SAND** 0.95		G	1				
Compact, brown **SILTY SAND** 1.20		G	2			1	89.72
Compact, brown-grey **SAND**, some silt 1.60		G	3				
Compact, grey **SILTY FINE SAND** 2.40		G	4			2	88.72
Dense, grey **SAND-GRAVEL** with some cobbles and boulders 3.55		G	5			3	87.72
End of Test Pit (Water infiltration @ 1.4m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

FILE NO. PG0525

HOLE NO. TP10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.70
TOPSOIL 0.23							
Compact to dense, brown **SAND**, some silt 0.90		G	1				
Compact, grey **SANDY SILT**, some clay 1.60		G	2			1	89.70
Stiff, grey **CLAYEY SILT**, trace of sand 2.60		G	3			2	88.70
		G	4				
End of Test Pit (Water infiltration @ 1.0m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Ottawa (Greely), Ontario

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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

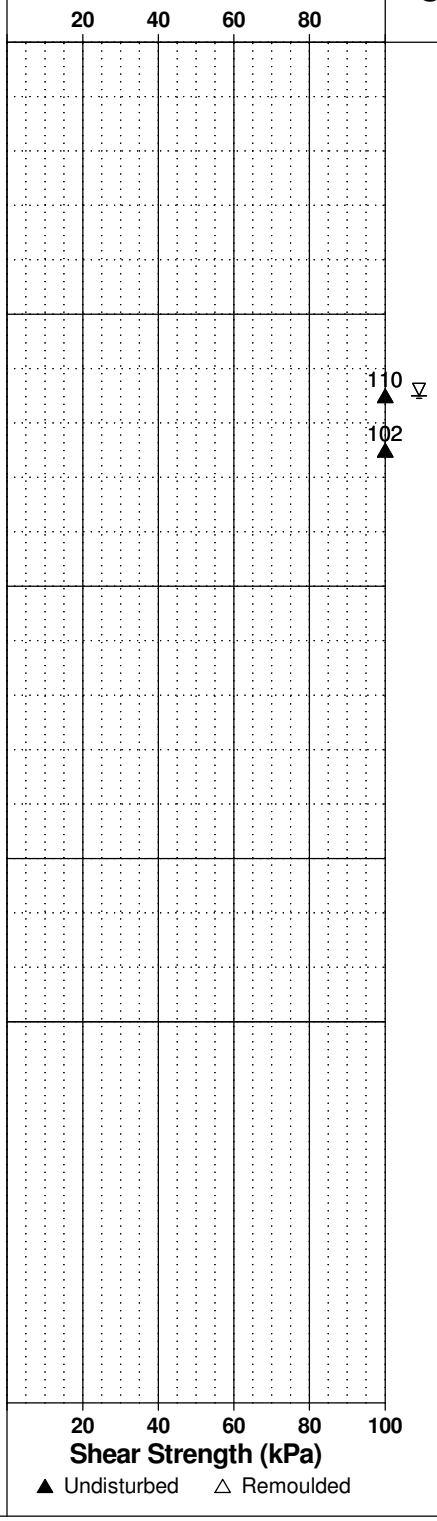
FILE NO. PG0525

HOLE NO. TP11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.79
TOPSOIL 0.31							
Loose, reddish brown **SILTY SAND** 0.60		G	1				
Stiff, grey-brown **CLAYEY SILT** 1.25		G	2			1	87.79
Very stiff, grey **CLAYEY SILT**, some sand seams 2.10		G	3			2	86.79
Compact, grey **SILTY FINE SAND** with silty clay layers 3.60		G	4			3	85.79
End of Test Pit (Water infiltration @ 1.3m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Commercial Development - Bank St. @ Parkway Rd.
Ottawa (Greely), Ontario

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REMARKS

BORINGS BY Hydraulic Shovel **DATE** Dec 17, 04

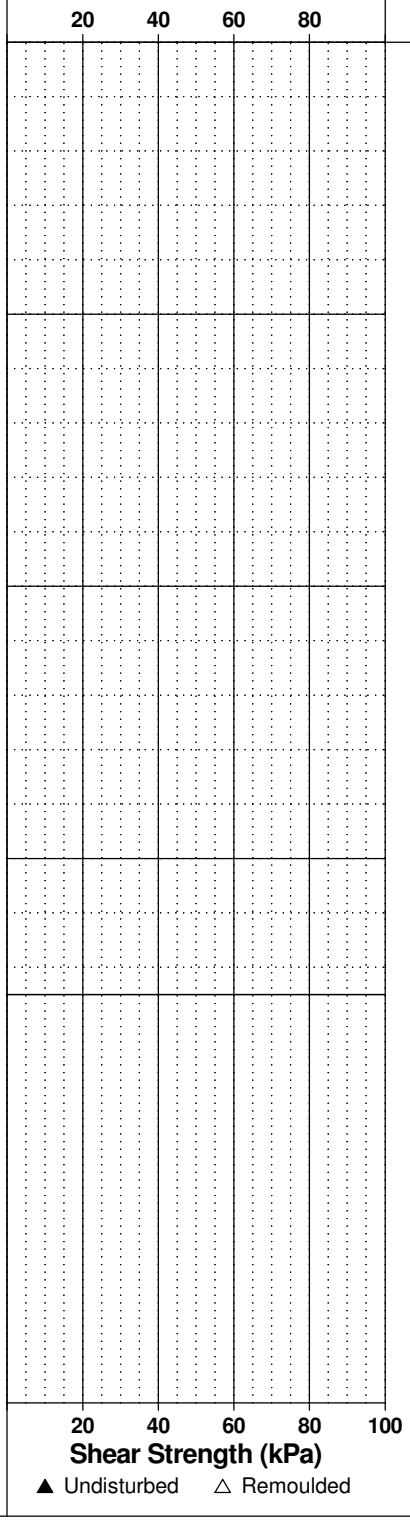
FILE NO. PG0525

HOLE NO. TP12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.59
TOPSOIL 0.45							
Loose, reddish brown **SAND** 0.90						1	87.59
Stiff, grey-brown **CLAYEY SILT**, trace of gravel 1.50		G	1				
Stiff, grey **CLAYEY SILT** to **SILT** 2.20		G	2			2	86.59
Compact to dense, grey **SILTY FINE SAND** 3.50		G	3			3	85.59
End of Test Pit (Water infiltration @ 1.5m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Piezometer Construction

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 relative strength of cohesionless soils is the compactness condition, 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.

Compactness Condition	'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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at 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
Cc	-	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 $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands 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

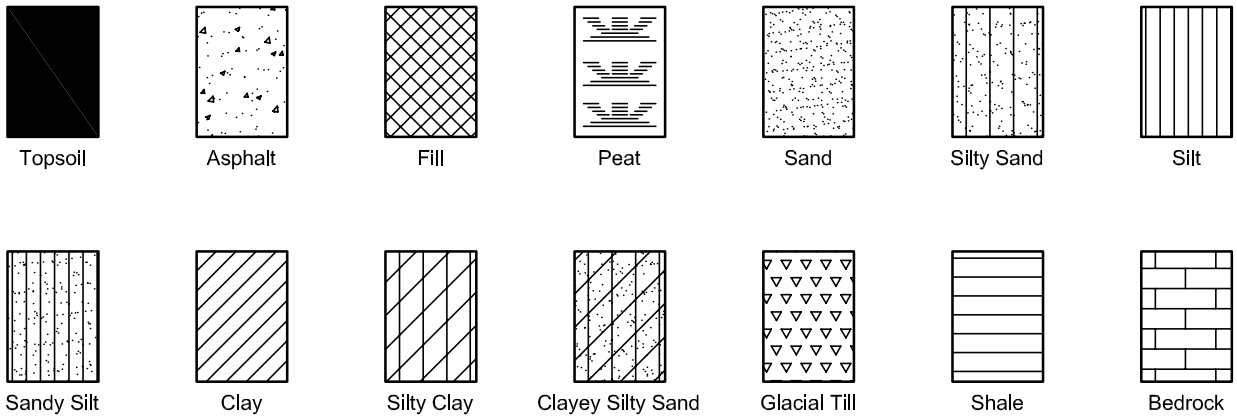
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		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.

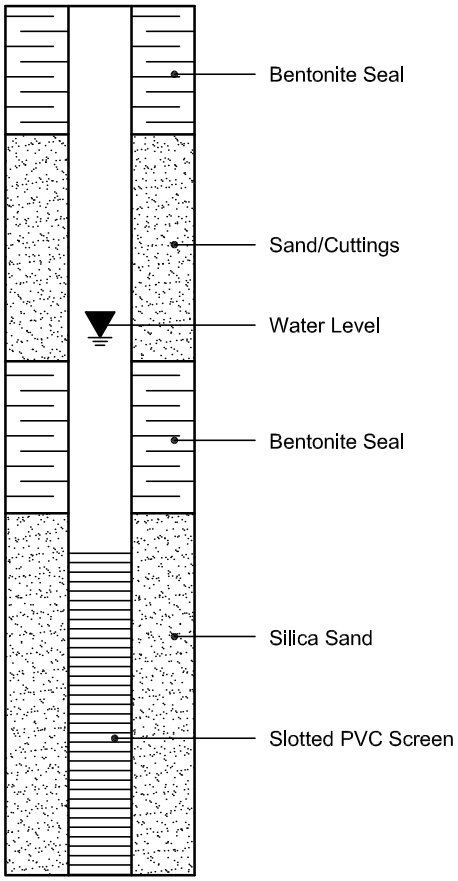
SYMBOLS AND TERMS (continued)

STRATA PLOT

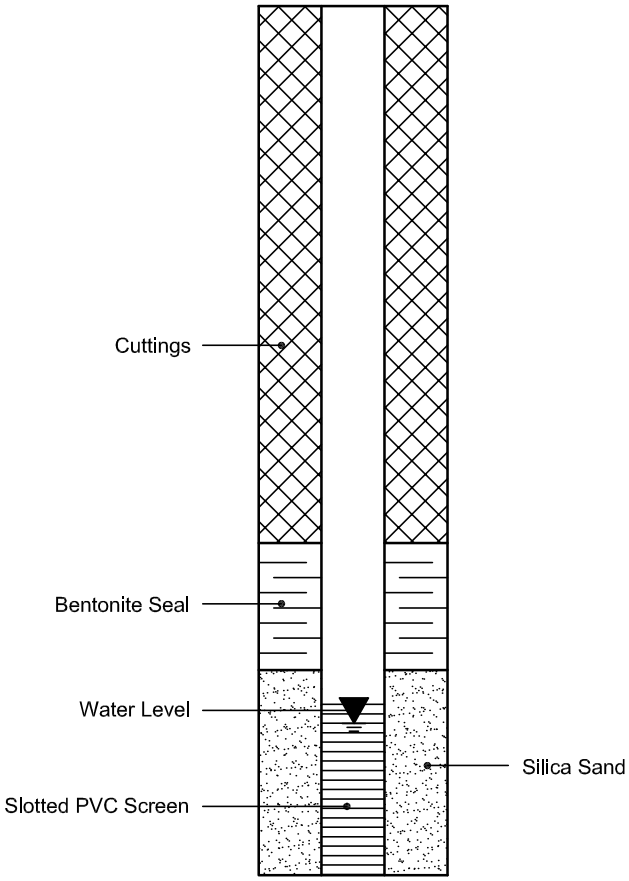


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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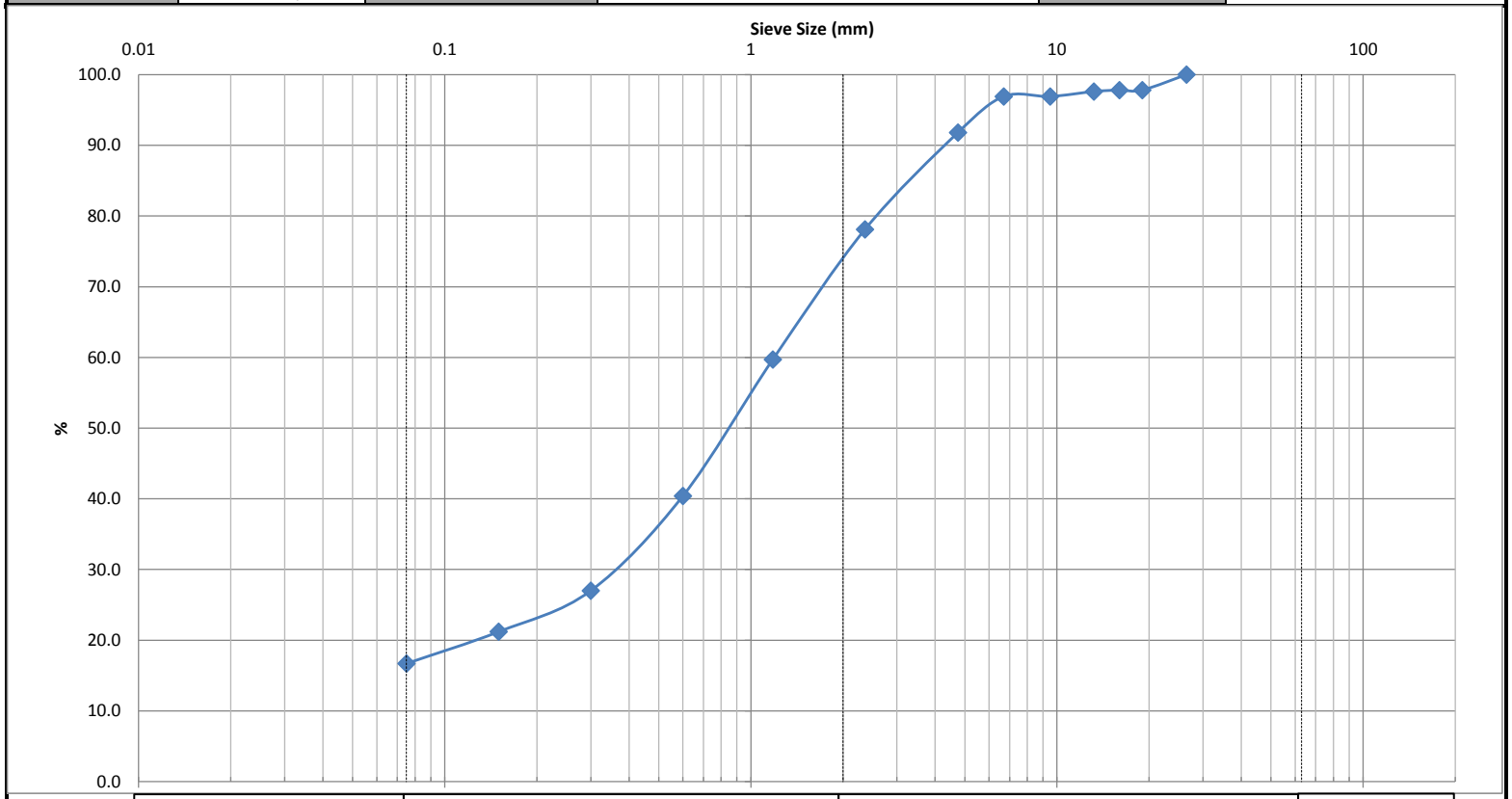
SIEVE ANALYSIS
ASTM C136

CLIENT:	Family Farm & Maverick De	DESCRIPTION:	Sand / Gravel	FILE NO:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	89814
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE RECEIVED:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH6	DATE REPORTED:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS5	TESTED BY:	DB



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										3.70	43.3
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	28	1.3	0.38	0.03	8.2	75.1		16.7			

Comments	

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Greely Family Farm & Maverick Dev Cor	DESCRIPTION:	Sand / Gravel	FILE NO.:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	89814
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE REC'D:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH6	DATE REP'D:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS5	TESTED BY:	DB

WEIGHT BEFORE WASH			A+B	721.3
WEIGHT AFTER WASH	A	B	A+B	614.0

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5	**0.0**	0.0	**100.0**			
19	**15.7**	2.2	**97.8**			
16	**15.7**	2.2	**97.8**			
13.2	**17.5**	2.4	**97.6**			
9.5	**22.6**	3.1	**96.9**			
6.7	**22.6**	3.1	**96.9**			
4.75	**59.3**	8.2	**91.8**			
2.36	**158.1**	21.9	**78.1**			
1.18	**291.0**	40.3	**59.7**			
0.6	**430.2**	59.6	**40.4**			
0.3	**526.6**	73.0	**27.0**			
0.15	**568.4**	78.8	**21.2**			
0.075	**600.6**	83.3	**16.7**			
PAN	**613.7**					
SIEVE CHECK FINE		0.05	0.3% max.			**REFERENCE MATERIAL**

OTHER TESTS	RESULT	LAB NO.	RESULT

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.

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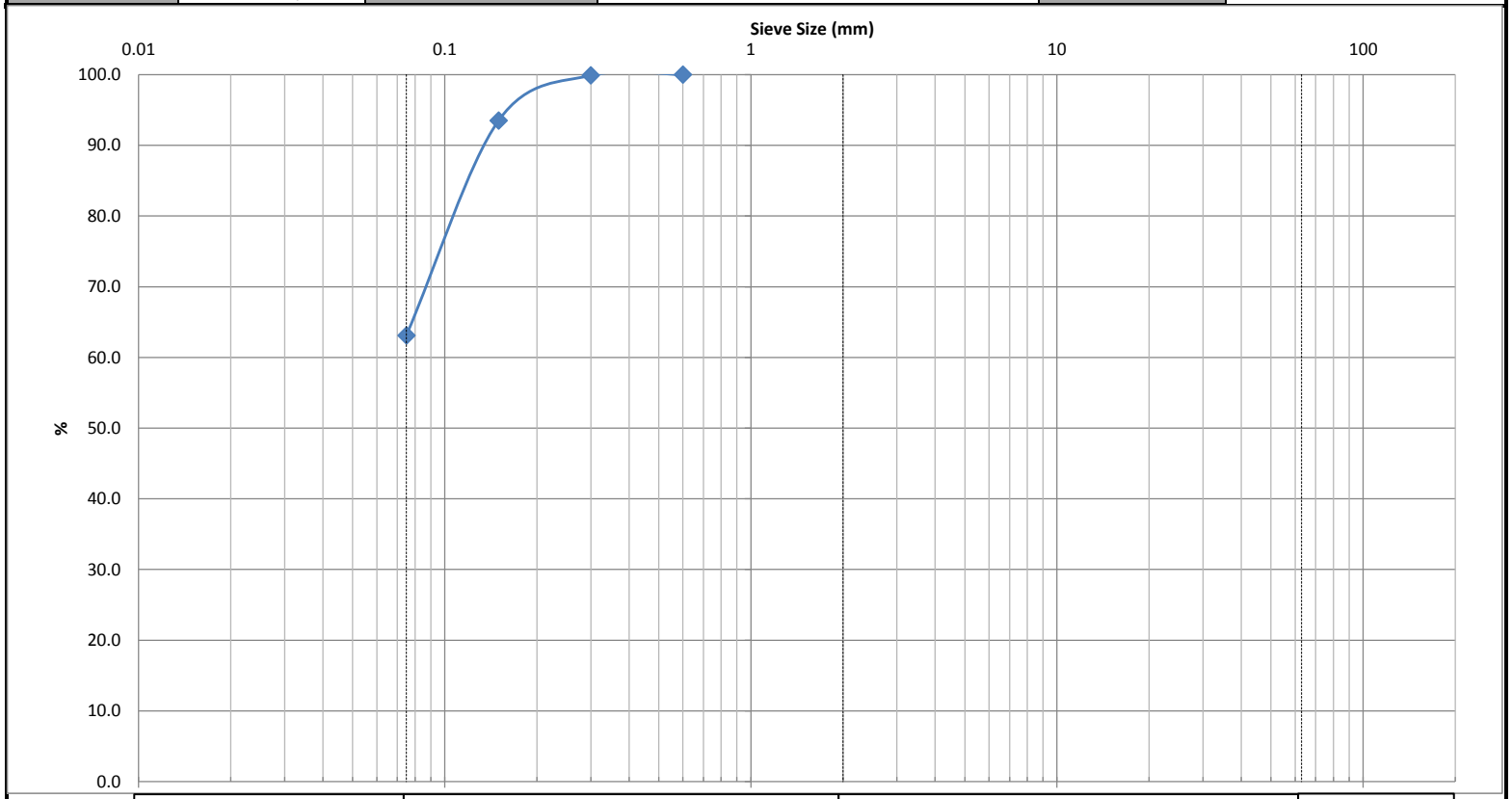
SIEVE ANALYSIS
ASTM C136

CLIENT:	Family Farm & Maverick De	DESCRIPTION:	Silt	FILE NO:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	89815
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE RECEIVED:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH8	DATE REPORTED:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS3	TESTED BY:	DB



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										0.60	3.8
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	0.6	0.075	0.03	0.02	0.0	0.0		63.1			

Comments	

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Greely Family Farm & Maverick Dev Cor	DESCRIPTION:	Silt	FILE NO.:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	89815
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE REC'D:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH8	DATE REP'D:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS3	TESTED BY:	DB

WEIGHT BEFORE WASH			A+B	721.3
WEIGHT AFTER WASH	A	B	A+B	614.0

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5						
19						
16						
13.2						
9.5						
6.7						
4.75						
2.36						
1.18						
0.6	**0.0**	0.0	**100.0**			
0.3	**0.9**	0.1	**99.9**			
0.15	**46.8**	6.5	**93.5**			
0.075	**266.0**	36.9	**63.1**			
PAN	**317.5**					
SIEVE CHECK FINE		48.29	0.3% max.			

OTHER TESTS	RESULT	REFERENCE MATERIAL LAB NO.	REFERENCE MATERIAL RESULT

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.

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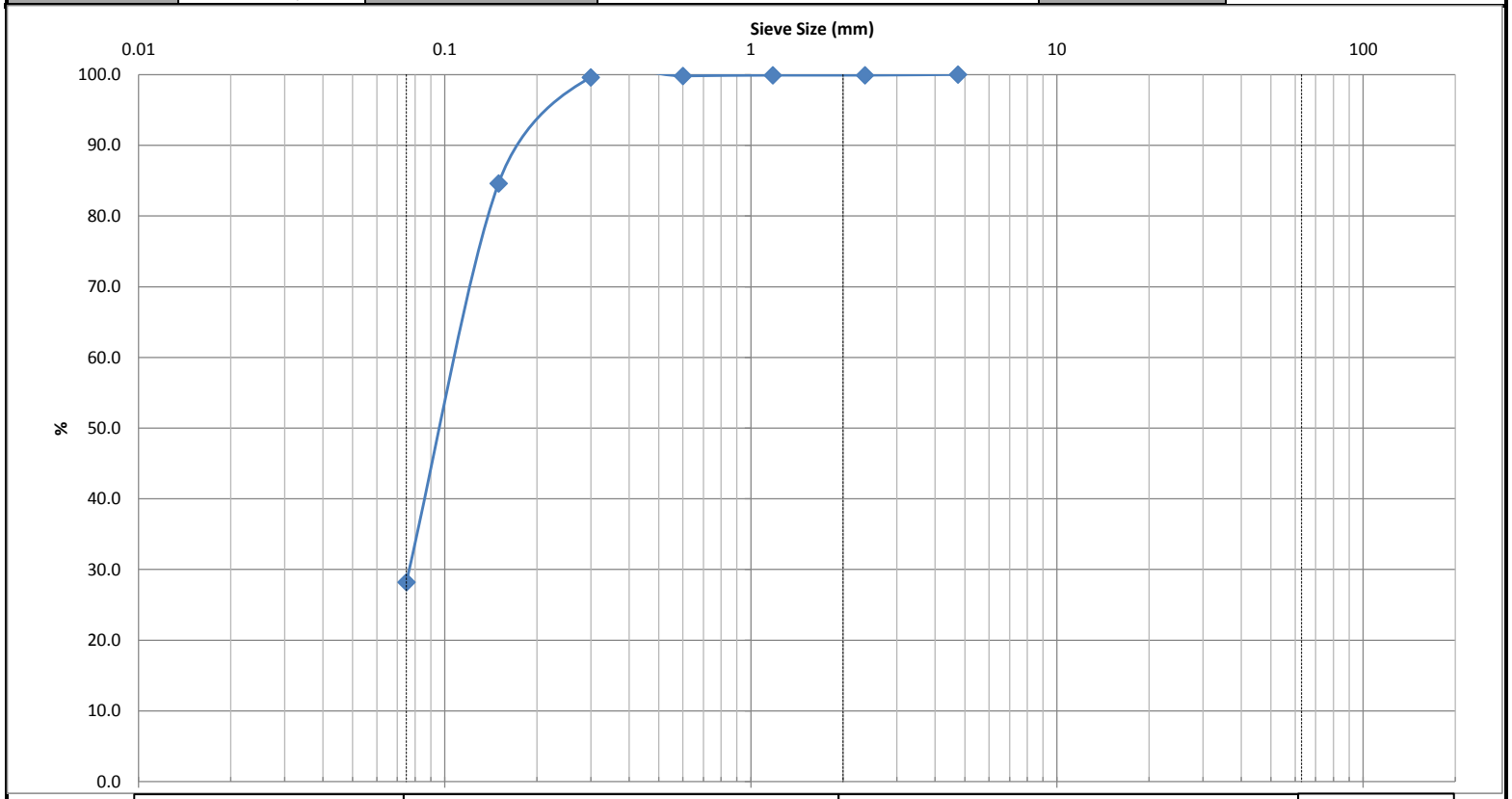
SIEVE ANALYSIS
ASTM C136

CLIENT:	Family Farm & Maverick De	DESCRIPTION:	Sand / Silt	FILE NO:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	89816
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE RECEIVED:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH13	DATE REPORTED:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS4	TESTED BY:	DB



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										0.78	2.0
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	4.8	0.12	0.075	0.06	0.0	71.8		28.2			

Comments	

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Greely Family Farm & Maverick Dev Cor	DESCRIPTION:	Sand / Silt	FILE NO.:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	89816
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE REC'D:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH13	DATE REP'D:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS4	TESTED BY:	DB

WEIGHT BEFORE WASH			A+B	467.5
WEIGHT AFTER WASH	A	B	A+B	394.3

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5						
19						
16						
13.2						
9.5						
6.7						
4.75	**0.0**	0.0	**100.0**			
2.36	**0.5**	0.1	**99.9**			
1.18	**0.7**	0.1	**99.9**			
0.6	**0.9**	0.2	**99.8**			
0.3	**1.8**	0.4	**99.6**			
0.15	**72.1**	15.4	**84.6**			
0.075	**335.5**	71.8	**28.2**			
PAN	**394.3**					
SIEVE CHECK FINE		0.00	0.3% max.			**REFERENCE MATERIAL**

OTHER TESTS	**RESULT**	**LAB NO.**	**RESULT**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

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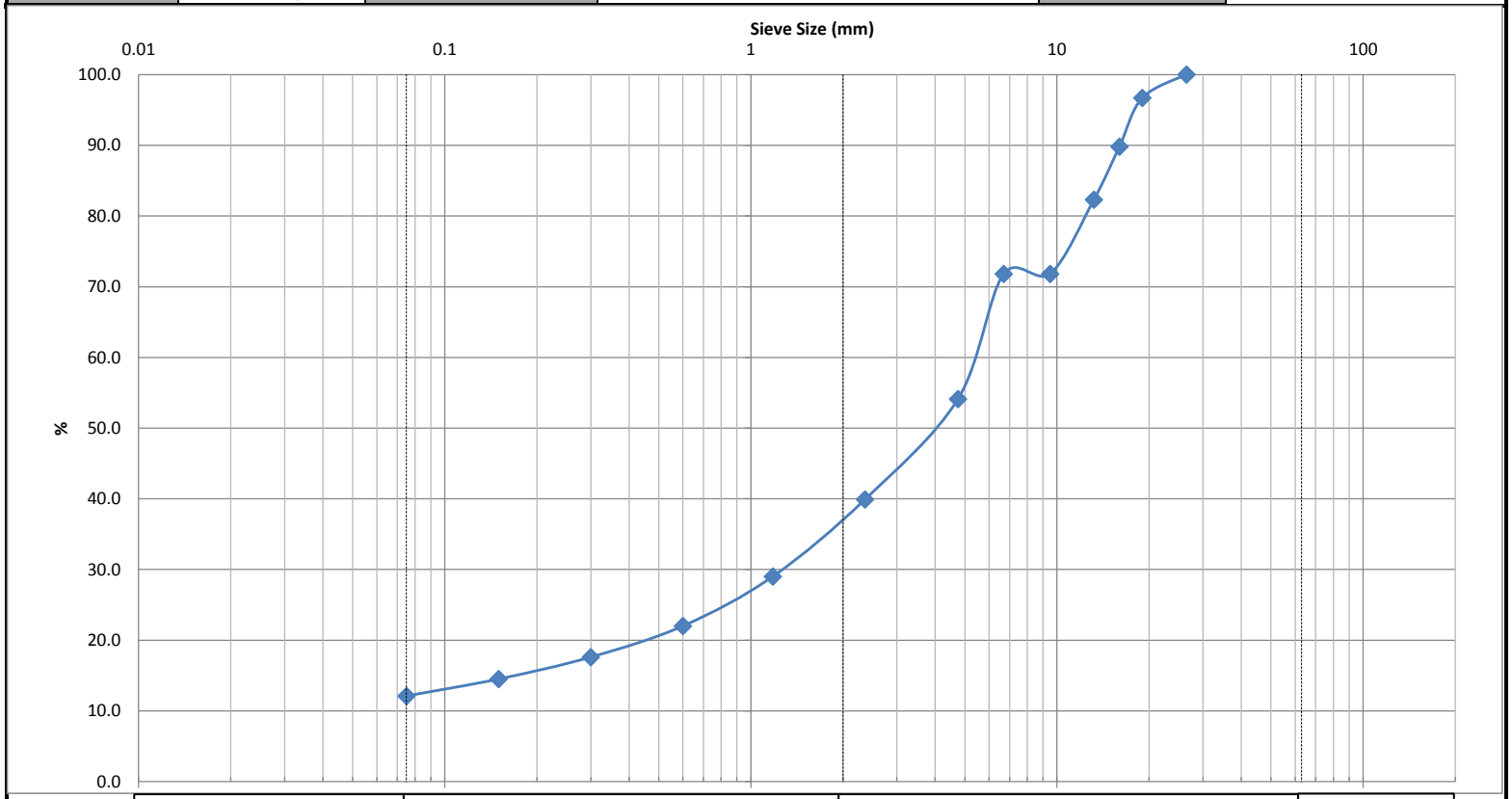
SIEVE ANALYSIS
ASTM C136

CLIENT:	Family Farm & Maverick De	DESCRIPTION:	Sand / Gravel	FILE NO:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	89817
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE RECEIVED:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH27	DATE REPORTED:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS6	TESTED BY:	DB



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										7.82	135.0
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	27	5.4	1.3	0.04	45.9	42.0		12.1			

Comments	

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SIEVE ANALYSIS
ASTM C136

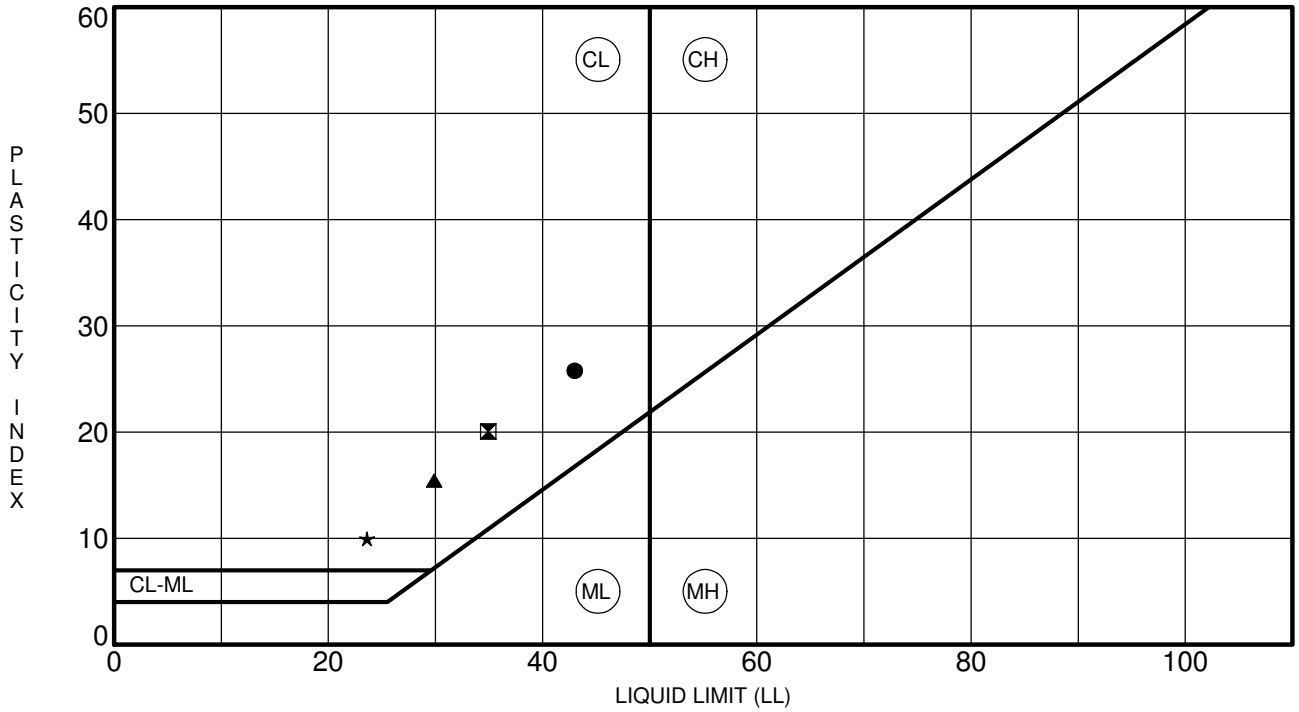
CLIENT:	Greely Family Farm & Maverick Dev Cor	DESCRIPTION:	Sand / Gravel	FILE NO.:	PG3957
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO.:	89817
PROJECT:	6045 Bank Street	INTENDED USE:	-	DATE REC'D:	25-Oct-16
		PIT OR QUARRY:	-	DATE TESTED:	28-Oct-16
DATE SAMPLED:	13-Oct-16	SOURCE LOCATION:	BH27	DATE REP'D:	28-Oct-16
SAMPLED BY:	E. Ardley	SAMPLE LOCATION:	SS6	TESTED BY:	DB

WEIGHT BEFORE WASH			A+B	624.1
WEIGHT AFTER WASH	A	B	A+B	552.8

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150						
106						
75						
63						
53						
37.5						
26.5	**0.0**	0.0	**100.0**			
19	**20.7**	3.3	**96.7**			
16	**63.5**	10.2	**89.8**			
13.2	**110.3**	17.7	**82.3**			
9.5	**176.3**	28.2	**71.8**			
6.7	**176.3**	28.2	**71.8**			
4.75	**286.4**	45.9	**54.1**			
2.36	**375.1**	60.1	**39.9**			
1.18	**443.2**	71.0	**29.0**			
0.6	**486.5**	78.0	**22.0**			
0.3	**514.4**	82.4	**17.6**			
0.15	**533.9**	85.5	**14.5**			
0.075	**548.8**	87.9	**12.1**			
PAN	**552.8**					
SIEVE CHECK FINE		0.00	0.3% max.			**REFERENCE MATERIAL**

OTHER TESTS	**RESULT**	**LAB NO.**	**RESULT**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 3-16**	**SS 2**	**43**	**17**	**26**		**CL - Inorganic clays of low plasticity**
⧗	**BH 5-16**	**SS 2**	**35**	**15**	**20**		**CL - Inorganic clays of low plasticity**
▲	**BH11-16**	**SS 2**	**30**	**14**	**15**		**CL - Inorganic clays of low plasticity**
★	**BH14-16**	**SS 4**	**24**	**14**	**10**		**CL - Inorganic clays of low plasticity**

CLIENT	**Greely Family Farm & Maverick Dev.**	FILE NO.	**PG3957**
PROJECT	**Geotechnical Investigation - Prop. Commercial Development - 6045 Bank Street**	DATE	**13 Mar 17**

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

PARACEL LABORATORIES LTD.

Order #: 1643068

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20963

Report Date: 24-Oct-2016

Order Date: 17-Oct-2016

Project Description: PG3957

	Client ID:	BH12-SS4	-	-	-
	Sample Date:	14-Oct-16	-	-	-
	Sample ID:	1643068-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	85.2	-	-	-
General Inorganics					
SAR	0.01 N/A	1.94	-	-	-
Conductivity	5 uS/cm	256	-	-	-
pH	0.05 pH Units	8.12	-	-	-
Resistivity	0.10 Ohm.m	39.1	-	-	-
Anions					
Chloride	5 ug/g dry	110	-	-	-
Sulphate	5 ug/g dry	37	-	-	-

PARACEL LABORATORIES LTD.

Order #: 1643286

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21106

Report Date: 25-Oct-2016

Order Date: 19-Oct-2016

Project Description: PG3957

	Client ID:	BH15-SS4	BH7-SS3	BH18-SS4	BH24-SS4
	Sample Date:	17-Oct-16	12-Oct-16	17-Oct-16	18-Oct-16
	Sample ID:	1643286-01	1643286-02	1643286-03	1643286-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	80.8	88.0	80.6	87.5
General Inorganics					
SAR	0.01 N/A	0.46	-	-	-
Conductivity	5 uS/cm	346	-	-	-
pH	0.05 pH Units	-	7.54	7.82	7.92
Resistivity	0.10 Ohm.m	-	43.7	25.3	99.4
Anions					
Chloride	5 ug/g dry	-	10	102	10
Sulphate	5 ug/g dry	-	146	98	8

PARACEL LABORATORIES LTD.

Order #: 1643497

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21109

Report Date: 26-Oct-2016

Order Date: 21-Oct-2016

Project Description: PG3957

	Client ID:	BH29-SS4	-	-	-
	Sample Date:	19-Oct-16	-	-	-
	Sample ID:	1643497-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	82.9	-	-	-
General Inorganics					
SAR	0.01 N/A	1.42	-	-	-
Conductivity	5 uS/cm	150	-	-	-

PARACEL LABORATORIES LTD.

Order #: 1644385

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21169

Report Date: 02-Nov-2016

Order Date: 27-Oct-2016

Project Description: PG3957

	Client ID:	BH12	BH15	BH29	-
	Sample Date:	26-Oct-16	26-Oct-16	26-Oct-16	-
	Sample ID:	1644385-01	1644385-02	1644385-03	-
	MDL/Units	Water	Water	Water	-
Anions					
Chloride	1 mg/L	746	286	653	-
Metals					
Sodium	0.200 mg/L	286	145	307	-

APPENDIX 2

FIGURE 1 - KEY PLAN

TABLE 5 - SEISMIC SITE CLASS - OBC 2012

DRAWING PG3957-1 - TEST HOLE LOCATION PLAN

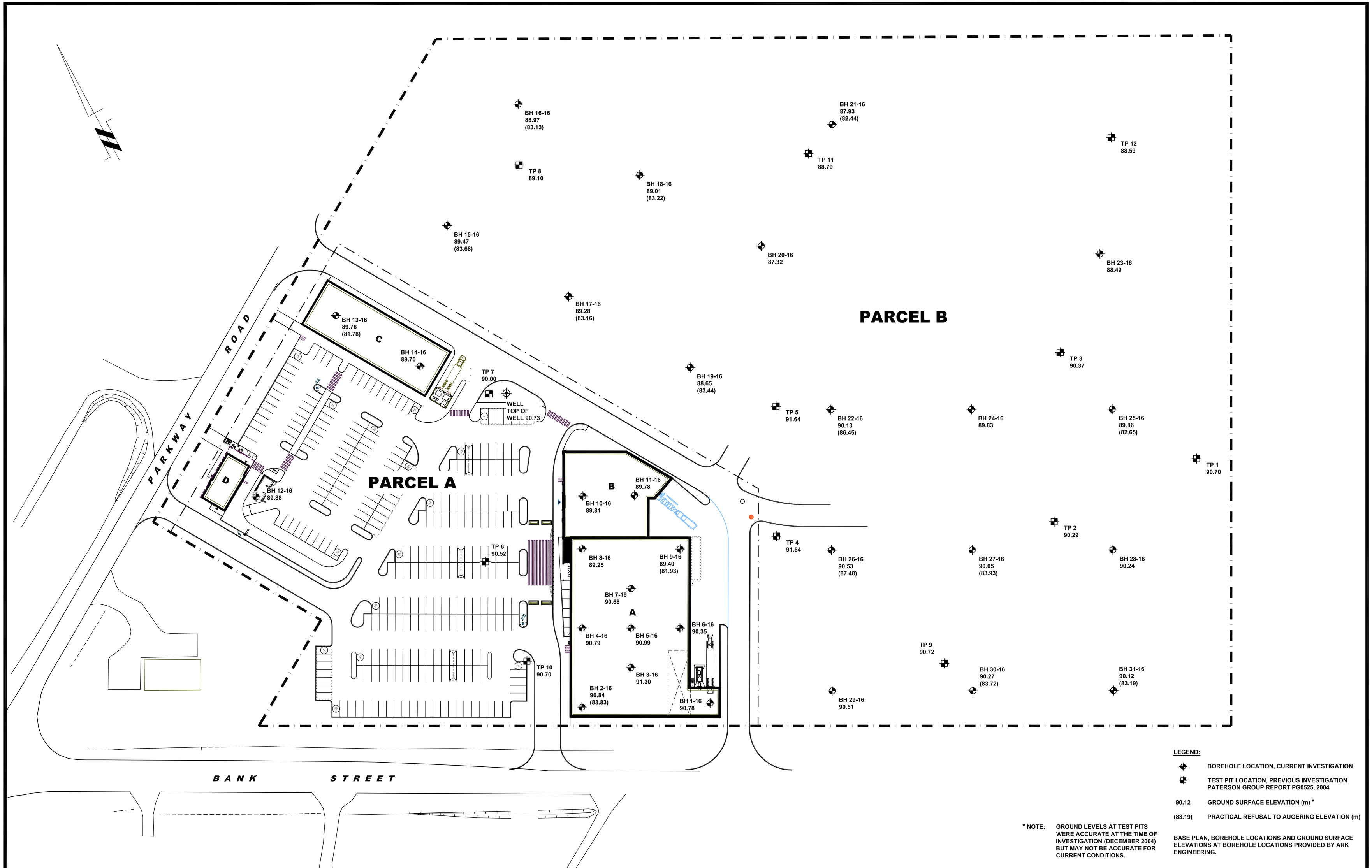
FIGURE 1

KEY PLAN

Table 5: BH Summary of Seismic Site Class - OBC 2012 - Using Typical Vs Values

Project:	Greely Family Farm Inc. and Maverick Development Corp. - 6045 Bank Street - Ottawa										
File No:	PG3957-REP.01	**Date:**	November 9, 2016								
						Note: Analyses Assume USF Levels at Ground Surface.					
PGA	0.32	**Region:**	Ottawa (Greely)			**Analyses based on borehole descriptions only.**					
Layer Description		**Layer Vs**	**Depths (m) of Various Layers at Specified Borehole**								
			BH 2-16	**BH 9-16**	**BH 13-16**	**BH 15-16**	**BH 16-16**	**BH 17-16**	**BH 21-16**	**BH 25-16**	**BH 30-16**	**BH 31-16**
stiff silty clay		200	0.0	0.0	0.4	0.8	0.0	0.0	2.6	0.0	0.0	0.0
grey silty clay (input)		130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vs by Equation (= 125 + 1.1667*Z)			125.0	125.0	125.2	125.5	125.0	125.0	126.5	125.0	125.0	125.0
compact sand and/or silt		200	2.9	2.9	2.7	2.9	4.6	1.5	2.0	0.0	1.8	2.2
dense sand and/or silt		250	4.1	0.0	2.4	0.0	0.0	3.2	0.0	2.4	2.7	2.7
dense glacial till		350	0.0	4.6	2.5	2.1	1.3	1.4	0.9	4.8	2.1	2.0
weathered bedrock		1500	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
sound bedrock		2200	21.0	20.5	20.0	22.2	22.1	21.9	22.5	20.8	21.4	21.1
Total of Thicknesses:		**N/A**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
More than 3 m Soft Soil? (Y/N)			N	N	N	N	N	N	N	N	N	N
Average Vs and Site Class by Each Method:												
Vs Input for Grey Clay:		**Avg. Vs**	718.1	783.4	703.1	835.1	787.5	843.0	807.9	879.7	813.9	780.5
		Class	**C**	**B**	**C**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Vs Eqn. for Grey Clay:		**Avg. Vs**	718.1	783.4	703.1	835.1	787.5	843.0	807.9	879.7	813.9	780.5
		Class	**C**	**B**	**C**	**B**	**B**	**B**	**B**	**B**	**B**	**B**

Note:
1. Vs values are representative values based on texture and state of compaction or consistency.
2. Equation Vs = 125 + 1.1667*Z for sensitive silty clay from Hunter, Burns, et. al. - Figure 16 (conservative interpretation without high Lemieux BH)
3. Where Site Class is indicated as B and the thickness of soil is greater than 3.0 m, **Site Class C** is applicable.



LEGEND:

◆	BOREHOLE LOCATION, CURRENT INVESTIGATION
◆	TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG0525, 2004
90.12	GROUND SURFACE ELEVATION (m) *
(83.19)	PRACTICAL REFUSAL TO AUGERING ELEVATION (m)

* NOTE: GROUND LEVELS AT TEST PITS WERE ACCURATE AT THE TIME OF INVESTIGATION (DECEMBER 2004) BUT MAY NOT BE ACCURATE FOR CURRENT CONDITIONS.

BASE PLAN, BOREHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS PROVIDED BY ARK ENGINEERING.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

GREELY FAMILY FARM & MAVERICK DEVELOPMENT CORP.

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT - 6045 BANK STREET
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Stamp:

Scale: 1:600	Report No.: PG3957-1
Drawn by: MPG	Drawing No.: PG3957-1
Checked by: MK	
Approved by: AJT	
Date: 10/2016	Revision No.: 0