Geotechnical Engineering

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Geotechnical Investigation

Proposed Residential Development
Block 15, 22 and 24
335 St. Laurent Boulevard
Ottawa, Ontario

Prepared For

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Mattamy Homes to conduct a geotechnical investigation for the proposed residential development located within Block 15, 22 and 24 at 335 St. Laurent Boulevard in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the current investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of test holes.
- Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. 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.

The relevant test holes and laboratory testing completed the previous geotechnical investigations, Report IN-SO-026755 dated November 16, 2016 and Report OE-OT-015358 dated November, 2015 prepared by DST Consulting Engineers are presented in Appendix 1.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation. A Phase I - Environmental Site Assessment (ESA) was conducted by Paterson for the subject site. The results and recommendations of the Phase I - ESA are presented under separate cover.

2.0 Proposed Development

Based on the available site plans, the proposed development within Block 15, 22 and 24 will consist of single family residential dwellings, townhouses and terrace blocks with bioswales. It is further expected that asphalt covered car parking, access lanes and landscaping areas are also anticipated as part of the proposed development.

It is expected that the aforementioned blocks will be fully municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was carried out on March 3, 6, 7 and 8, 2017. During that time, a total of 16 boreholes (BH 1-17 to BH 16-17) were advanced to a maximum depth of 10 m below existing ground surface. In addition, a total of 17 test pits (TP 1-17 to TP 17-17) were extended to a maximum depth of 2.2 m using a hydraulic excavator to assess the depth and quality of the overlying fill throughout the subject sites. The test holes were located in a manner to provide general coverage of the site and taking into consideration of existing site features and underground utilities. The locations of the test holes are shown on Drawing PG4064-2 - Test Hole Location Plan included in Appendix 2.

Test pits were excavated using a hydraulic shovel and the boreholes were extended using a track mounted drill rig. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department. The excavating procedures consisted of advancing each test hole to the required depths at the selected locations and sampling the overburden.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets presented in Appendix 1 of this report.

Sampling and In Situ Testing

Soil samples were recovered during drilling from the auger flights or a 50 mm diameter split-spoon sampler while the soil samples from the test pits were recovered from the side walls of the open excavation. The auger and split spoon samples recovered from the boreholes and the grab samples recovered from the sidewalls of the open test pits were placed in sealed plastic bags and all samples were transported to our laboratory. The depths at which the auger, split-spoon and grab samples were recovered from the test holes are shown as ‘AU’, ‘SS’ and ‘G’, 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.

Undrained shear strength testing was conducted in cohesive soils using a field vane apparatus.

Overburden thickness was evaluated during the course of the site investigation by dynamic cone penetration testing (DCPT) at several of the borehole locations. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the 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 increment.

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection.

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

51 mm diameter PVC groundwater monitoring wells were installed within BH 11-17, BH 14-17 and BH 16-17 to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Monitoring Well Installation

Typical monitoring well construction details are described below:

- ❏ 1.5 m of slotted 51 mm diameter PVC screen at the base of the aforementioned boreholes.
- ❏ 51 mm diameter PVC riser pipe from the top of the screen to the ground surface.
- ❏ No.3 silica sand backfill within annular space around screen.
- ❏ A minimum of 300 mm thick bentonite hole plug directly above PVC slotted screen.
- ❏ Clean backfill from top of bentonite plug to the ground surface.

The remainder of the boreholes completed during the geotechnical investigation were instrumented with flexible standpipes to monitor the groundwater level subsequent to the completion of the sampling program. The groundwater levels were recorded during the open test pits upon completion of the sampling program.

Sample Storage

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

3.2 Field Survey

The boreholes completed during the current investigation were selected by Paterson and located in the field and surveyed by J. D. Barnes Limited. The test pits were selected, located and surveyed in the field by Paterson personnel to provide general coverage of the subject site by taking into consideration of former buildings, existing site features and underground utilities. The ground surface elevations at the test pits locations were reference to the ground surface elevations at nearby borehole locations previously surveyed by J. D. Barnes Limited. The locations and ground surface elevation at each test hole location are presented on Drawing PG4064-2 - Test Hole Location Plan in Appendix 2.

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.

A total of 12 soil samples were submitted for grain size distribution analysis during the previously geotechnical investigation completed for the adjacent roadways by DST Consulting Engineers. The Grain Size Distribution sheets are provided in Appendix 1

In addition, a total of 3 undisturbed soil samples recovered within Block 15 and 6 nearby undisturbed soil samples were submitted for one-dimensional consolidation testing by LVM during the previous geotechnical investigation. The One-Dimensional Consolidation test sheets are provided in Appendix 1.

Furthermore, Atterberg Limits testing was also conducted on seven (7) representative soils samples within the adjacent roadways during the previous geotechnical investigation completed by DST Consulting Engineers. The Atterberg Limits testing sheets are provided in Appendix 1.

3.4 Analytical Testing

A total of 4 representative soil samples were submitted by others during the previous geotechnical investigation 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 at that time to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample within the adjacent roadways. The results are presented in Appendix 1 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.

4.0 Observations

4.1 Surface Conditions

Blocks 15, 22 and 24 were acquired by the Department of National Defence in the 1890's and used as a military base known as CFB Rockcliffe until the early 2010's. The majority of the subject section of the site was occupied by Private Married Quarters (PMQ's), outbuildings and common areas which were municipally serviced and linked by private asphalt covered roadways. By 2013, all structures within the subject section of the site were demolished while leaving the bulk of the asphalt covered roadways and municipal services intact.

The location of the former structures are illustrated on the 1991 aerial photograph provided on Drawing PG4064-1 - Aerial Photograph - 1991 in Appendix 2.

Currently, Blocks 15, 22 and 24 are generally grass covered and sparsely treed at the time of our field investigation completed between March 3 and 8, 2017. Several areas of the subject sites are currently being utilized by the local contractors by placing construction trailers, generators and stockpiling material and equipment for the installation of the municipal services and construction of the proposed roadways around the perimeter of the sites.

The subject sites are generally at grade with neighbouring properties and appear to be at grade with the proposed roadways which are currently under construction.

4.2 Subsurface Profile

Block 15

As part of the current geotechnical investigation, a total of 5 boreholes (BH 7-17 to BH 11-17) and 5 test pits (TP 13-17 to TP 17-17) were extended to a maximum depth of 10 m below existing ground surface within Block 15. The subsoil conditions at the test hole locations consist of an overlying fill extending to a maximum depth of 1.8 m overlying a very stiff to stiff brown silty clay which in turn is overlying a stiff to firm grey silty clay.

Practical auger/DCPT refusal was encountered at each borehole location (with the exception of BH 11-17) varying between 9.1 and 24.1 m at BH 7-17 and BH 8-17, respectively below existing ground surface within Block 15.

Block 22

A total of 3 boreholes (BH 5-17, BH 6-17 and BH 16-17) and 2 test pits (TP 5-17, and TP 6-17) were extended to a maximum depth of 3.9 m below existing ground surface within Block 22. The subsoil conditions encountered at the test hole locations consist of an overlying fill extending to a maximum depth of 0.7 m overlying a very stiff to stiff brown silty clay which in turn is overlying a compact glacial till consisting of a brown to grey silty sand with gravel, trace clay, gravel, cobbles and boulders.

Practical auger refusal was encountered at each borehole location varying between 3.3 and 3.9 m at BH 6-17 and BH 5-17, respectively below existing ground surface within Block 22.

Block 24

A total of 4 boreholes (BH 1-17, BH 2-17, BH 3-17 and BH 4-17) and 6 test pits (TP 7-17 to TP 12-17) were extended to a maximum depth of 7 m below existing ground surface within Block 24. Generally, the subsoil conditions encountered at the test hole locations consist of an overlying fill extending to a maximum depth 2.1 m overlying a very stiff to stiff brown silty clay/compact to dense silty sand which in turn is overlying a compact glacial till consisting of a brown to grey clayey silty to silty clay with sand, gravel, cobbles and boulders.

Practical auger refusal was encountered at each borehole location varying between 1.7 and 6.9 m at BH 1-17 and BH 3-17, respectively below existing ground surface within Block 24.

Based on available geological mapping, the subject sites are located in an area which straddles an interbedded limestone, shale and quartz sandstone of the Gull River Formation and a grey limestone of the Bobcaygeon Formation. The overburden drift thickness is estimated to be between 2 to 15 m depth.

4.3 Groundwater

Groundwater level readings were recorded on March 20, 2017, at the borehole locations. The groundwater level readings are presented in Table 1 below. Long-term groundwater level can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, the long-term groundwater level is expected between 2 to 3 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations, therefore the groundwater levels could vary at the time of construction.

Table 1 - Summary of Groundwater Level Readings

Borehole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-17	92.29	damaged	-	March 20, 2017
BH 2-17	89.72	1.84	87.88	March 20, 2017
BH 3-17	88.99	2.62	86.37	March 20, 2017
BH 4-17	90.20	2.80	87.40	March 20, 2017
BH 5-17	88.50	damaged	-	March 20, 2017
BH 6-17	88.51	n/a	-	March 20, 2017
BH 7-17	89.79	3.72	86.07	March 20, 2017
BH 8-17	89.88	1.07	88.81	March 20, 2017
BH 9-17	89.31	2.05	87.26	March 20, 2017
BH 10-17	88.80	2.02	86.78	March 20, 2017
* BH 11-17	89.38	1.92	87.46	March 20, 2017
BH 12-17	87.46	damaged	-	March 20, 2017
BH 13-17	87.61	damaged	-	March 20, 2017
* BH 14-17	87.77	2.72	85.05	March 20, 2017
BH 15-17	87.81	damaged	-	March 20, 2017
* BH 16-17	88.25	1.22	87.03	March 20, 2017

Note:
* - Denotes borehole instrumented with a 51 mm diameter monitoring well.
- The ground surface elevations at each borehole location were provided by J. D. Barnes Limited.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is expected that the proposed residential buildings will be founded on conventional spread footings placed on a stiff silty clay, compact glacial till, engineered fill and/or bedrock bearing surface

It is expected that some bedrock removal will be most likely be required within the north portion of Block 22 and 24 for building construction and service installation.

Permissible grade raise recommendations are discussed in Subsection 5.3 and recommended permissible grade raise areas are presented in Drawing PG4064-3 - Permissible Grade Raise Areas in Appendix 2. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

Where the existing fill is encountered at design underside of footing elevation, it is anticipated that the footings will be extended to reach an undisturbed bearing surface or placed on an approved engineered fill placed on an undisturbed bearing surface.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprint, outside of lateral support zones for the footings, and below the proposed parking area and access lane. However, it is recommended that the existing fill layer be proof-rolled several times and approved by the geotechnical consultant at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved fill.

Existing foundation walls, service pipes and other construction debris should be entirely removed from within the building perimeter.

Bedrock Removal

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

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

As a general guideline, peak particle velocity (measured at the structures) should not exceed 50 mm/s during the blasting program to reduce the risks of damage to the existing structures.

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

Vibration Considerations

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

Two parameters determine the recommended vibration limit, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people. A pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading purposes beneath the proposed buildings, such as for in-filling existing channels/ditches, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm in thickness and compacted using suitable compaction equipment for the specified lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil 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 be compacted at minimum by the tracks of the spreading equipment to minimize voids. If these 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. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls.

5.3 Foundation Design

Bearing resistance values are provided in Table 2 for footings placed on an undisturbed silty clay, glacial till or clean bedrock bearing surface. Footings designed using the bearing resistance values at SLS provided in Table 1 will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. Footings placed on clean, surface sounded bedrock will be subjected to negligible settlements.

An undisturbed soil bearing surface consists of a surface from which all organic materials and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings. A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Table 2 - Bearing Resistance Values

Bearing Surface	Factored Bearing Resistance Values at ULS (kPa)	Bearing Resistance Values at SLS (kPa)
Stiff Silty Clay	225	150
Engineered Fill over In Situ Soil	225	150
Dense Glacial Till	250	175
Clean Surface Sounded Bedrock	1,500	1,000

Notes:
- ULS - Ultimate Limit States
- SLS - Serviceability Limit States
- A geotechnical resistance factor of 0.5 was applied to the provided bearing resistance values at ULS

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the subexcavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

Permissible Grade Raise Recommendations

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For dwellings, a minimum value of 50% of the live load is recommended by Paterson.

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. These characteristics can be further estimated in the laboratory by conducting unidimensional consolidation tests on undisturbed soil samples collected using Shelby tubes in conjunction with a piston sampler.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when building are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

To reduce potential long term liabilities, consideration should be given to accounting for a larger groundwater lowering and to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the dwellings, etc). Buildings on silty clay deposits increases the likelihood of movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking compared to unreinforced foundations.

Based on the undrained shear strength values recovered at the borehole locations completed during the current investigation and previous one-dimensional consolidation testing completed during the previous investigation, we have determined the preliminary permissible grade raise recommendations for the subject site.

Our preliminary permissible grade raise recommendations are presented in Drawing PG4064-3 - Permissible Grade Raise Areas in Appendix 2.

Based on the above discussion, several options could be considered to accommodate proposed grade raises with respect to our permissible grade raise recommendations, such as, the use of lightweight fill, which allow for raising the grade without adding a significant load to the underlying soils. Alternatively, it is possible to preload or surcharge the subject site in localized areas provided sufficient time is available to achieve the desired settlements.

Underground Utilities

The underground services may be subjected to unacceptable total or differential settlements. In particular, the joints at the interface building/soil may be subjected to excessive stress if the differential settlements between the building and the services are excessive. This should be considered in the design of the underground services.

Once the required grade raises are established, the above options could be further discussed along with further recommendations on specific requirements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the insitu soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil. In sound unfractured bedrock, a 1H:6V slope may be used.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the shallow foundations considered within Block 22 and 24. A higher site class, such as Class A or B, may be available for foundations placed on or near the bedrock surface. However, the higher site class would have to be confirmed by site specific seismic shear wave velocity testing.

The site class for seismic site response can be taken as **Site Class D** for the shallow foundations considered within Block 15.

The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill, such as those containing organic materials, within the footprint of the proposed buildings, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

Car only parking areas, access lanes and local roadways are anticipated within the subject blocks. The proposed pavement structures are shown in Tables 3 and 4.

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

Table 4 - Recommended Pavement Structure - Access Lanes and Local Roadways	
Thickness (mm)	**Material Description**
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

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

For residential driveways and car only parking areas, an Ontario Traffic Category A will be used. For local and collector roadways, an Ontario Traffic Category B should be used for design purposes.

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 Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

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.

Where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction. The sub-drain inverts should be approximately 300 mm below subgrade level and run longitudinal along the curblines. 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 the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by a minimum of 150 mm of 19 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 sump pit or storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose.

6.2 Protection of Footings Against Frost Action

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

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

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

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

In bedrock, almost vertical side slopes can be used provided that all loose rock and blocks with unfavourable weak planes are removed or stabilized.

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.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist (not wet) silty clay, glacial till above the cover material if the excavation and filling operations are carried out in dry weather conditions. The silty clay, when wet, will be difficult to reuse due to its high fines content which makes compacting this material without an extensive drying period impractical.

Well fractured bedrock should be acceptable as backfill provided the rock fill is placed only from at least 300 mm above the top of the service pipe and that all stones 300 mm or larger in their longest dimension are removed. Where blast rock is used a blinding layer (OPSS Granular A crushed stone) or a geotextile may be required above the blast rock to reduce the loss of fine particles within the voids of the rockfill.

Based on the soil profile encountered, the subgrade for the services will be placed in both bedrock and in overburden soils. It is recommended that the subgrade medium be inspected in the field to determine how steeply the bedrock surface, where encountered, drops off. A transition treatment should be provided where the bedrock slopes at more than 3H:1V. At these locations, the bedrock should be excavated and extra bedding be placed to provide a 3H:1V (or flatter) transition from the bedrock subgrade towards the soil subgrade. This treatment reduces the propensity for bending stress to occur in the service pipes.

Trench backfill material within the frost zone (approximately 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce 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.

Typically, clay seals are recommended to be placed within service trenches where silty clay is present at invert level. Paterson has reviewed the available service profile drawings for the current phase. Based on our review and existing subsoils information, the silty clay deposit where encountered along proposed service alignment is located above the lowest service pipe invert level. Therefore, clay seals are not required. However, if silty clay is encountered at the lowest service invert level, it is recommended that, clay seals be provided in the service trenches at no more than 60 m intervals in the service trenches.

The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

Due to the relatively impervious nature of the overlying silty clay within the east portion of the site, it is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Where excavations are extended within the glacial till and/or bedrock surface below the long term groundwater level, the groundwater infiltration is anticipated to be moderate to high. Generally, pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

A temporary Ministry of the Environment and Climate Change (MOECC) permit to take water (PTTW) Category 3 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 the review 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.

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.

6.6 Winter Construction

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

The subsoil conditions at this site consist of frost susceptible materials. In the 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.

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

6.7 Corrosion Potential and Sulphate

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

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed residential dwellings are located in a low to moderate sensitivity area with respect to tree plantings over a silty clay deposit. It is recommended that trees placed within 5 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface for buildings where footings are founded over a silty clay deposit. Trees placed greater than 5 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

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.

Swimming Pools

The in-situ soils are considered to be acceptable for in-ground swimming pools. Above ground swimming pools must be placed at least 3 m away from the residence foundation and neighbouring foundations founded on silty clay. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ Carry out a supplemental geotechnical investigation for each stage of the development.
- ❑ Recover undisturbed soil samples of the sensitive silty clay deposit during the supplemental geotechnical investigation and submit for consolidation testing to confirm the permissible grade raise recommendations.
- ❑ Review master grading plan from a geotechnical perspective.
- ❑ 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 inspection 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. Our recommendations should be reviewed when the project drawings and specifications are complete.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Mattamy Homes or their agent(s) are not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Colin Belcourt, M.Eng.

Carlos P. Da Silva, P.Eng., ing., QP_{ESA}

Report Distribution:

- ❑ Mattamy Homes (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

TEST DATA SHEETS BY OTHERS

GRAIN SIZE DISTRIBUTION ANALYSIS BY OTHERS

CONSOLIDATION TESTING BY OTHERS

ATTERBERG LIMITS TESTING RESULTS BY OTHERS

ANALYTICAL TESTING RESULTS BY OTHERS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. BH 1-17

BORINGS BY CME 55 Power Auger **DATE** March 3, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.27
FILL: Topsoil with organics, some sand and gravel (0.33)		AU	1				
		AU	2				
FILL: Brown silty sand with gravel, trace cobbles and boulders		SS	3	21	4	1	91.27
(1.68)		SS	4	50	50+		
End of Borehole							
Practical refusal to augering at 1.68m 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

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Geotechnical Investigation
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FILE NO. PG4064

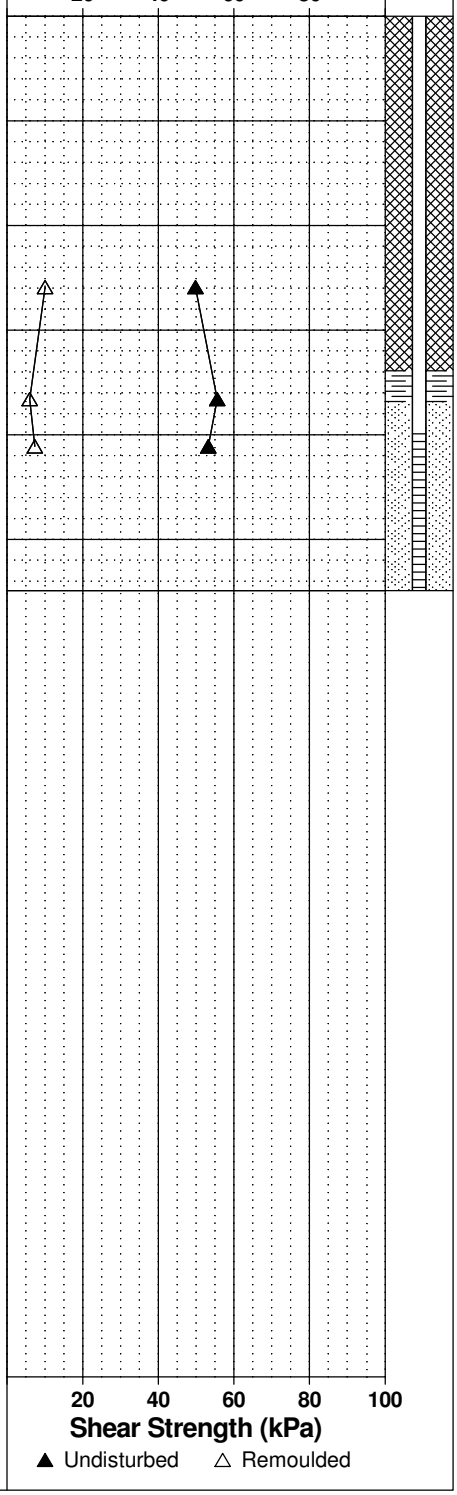
REMARKS

HOLE NO. BH 2-17

BORINGS BY CME 55 Power Auger **DATE** March 3, 2017

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	89.72
Asphaltic concrete	0.08		AU	1				
FILL: Brown silty sand with crushed stone	0.18		AU	2				
	0.51						1	88.72
FILL: Brown silty clay with sand and gravel, some topsoil, trace organics			SS	3	21	10		
			SS	4	100	5	2	87.72
Very stiff to siff, brown **SILTY CLAY**								
	3.05						3	86.72
Stiff, grey **CLAYEY SILT** with sand, trace gravel								
	4.50		SS	5	67	50+	4	85.72
GLACIAL TILL: Very dense, brown silty clay with sand, gravel, cobbles and boulders							5	84.72
	5.49		SS	6	43	50+		
End of Borehole								
Practical refusal to augering at 5.49m depth								

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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FILE NO. PG4064

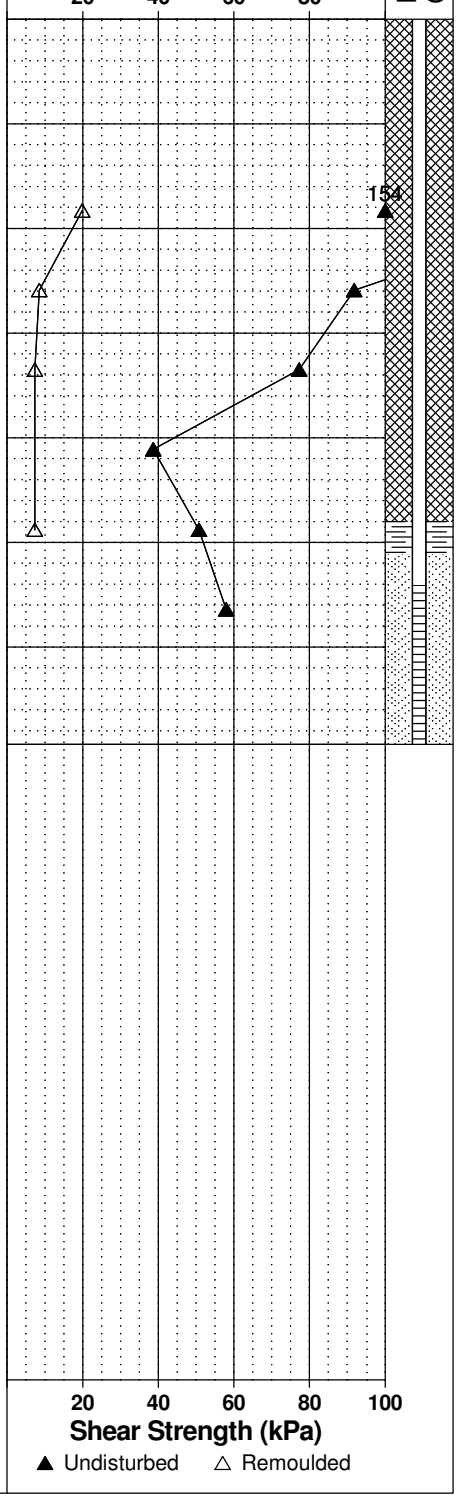
REMARKS

HOLE NO. BH 3-17

BORINGS BY CME 55 Power Auger **DATE** March 3, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.99
TOPSOIL 0.33		AU	1				
		AU	2				
		SS	3	100	8	1	87.99
Very stiff to stiff, brown **SILTY CLAY**						2	86.99
3.80						3	85.99
		SS	4	100		4	84.99
Firm to stiff, grey **SILTY CLAY**						5	83.99
5.94						6	82.99
GLACIAL TILL: Grey clayey silt with sand, trace gravel and cobbles		SS	5	2	6		
6.93		SS	6	100	50+		
End of Borehole							
Practical refusal to augering at 6.93m depth							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



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FILE NO. PG4064

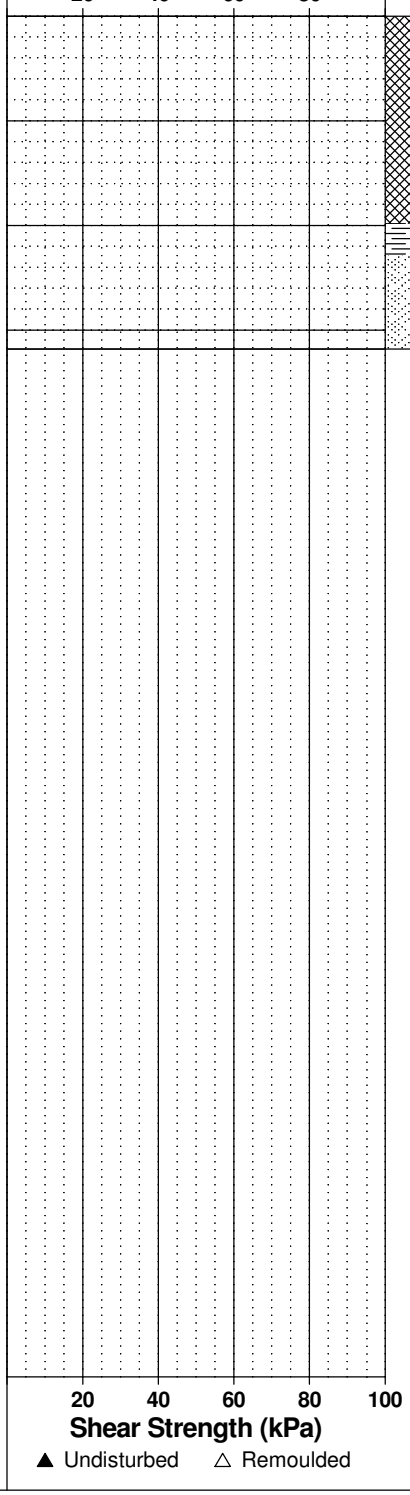
REMARKS

HOLE NO. BH 4-17

BORINGS BY CME 55 Power Auger **DATE** March 3, 2017

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	90.20
TOPSOIL with organics	0.15		AU	1				
FILL: Brown silty clay with sand, some gravel and organics	0.60		AU	2				
Compact to dense, brown **SILTY SAND** with gravel, cobbles, trace boulders	1.52		SS	3	46	27	1	89.20
			SS	4	50	45	2	88.20
GLACIAL TILL: Grey clayey silt with sand, gravel, trace cobbles			SS	5	50	24		
	3.18		SS	6	100	50+	3	87.20
End of Borehole								
Practical refusal to augering at 3.18m depth								

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



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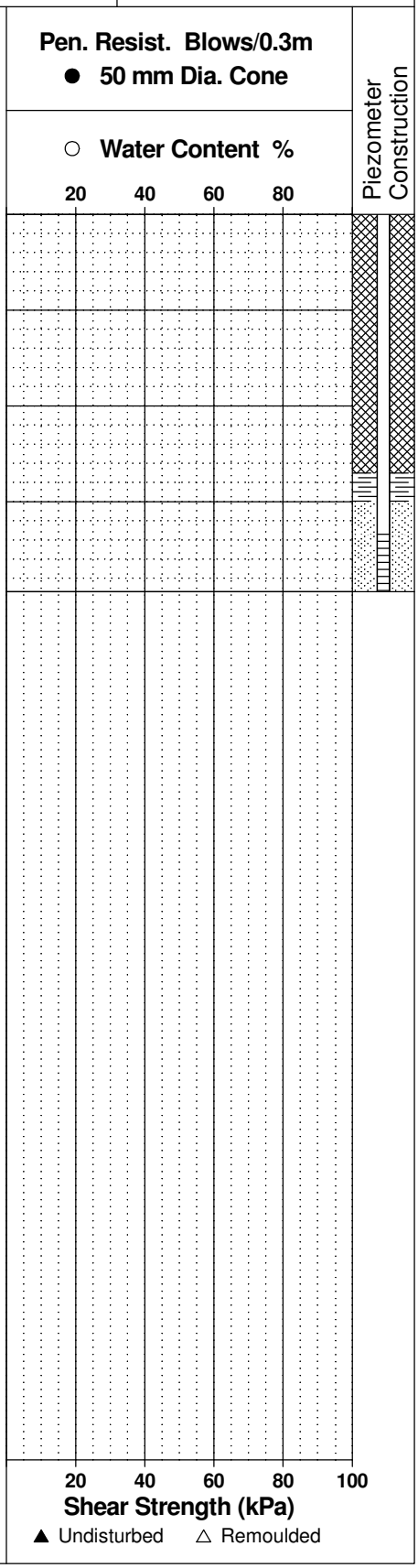
FILE NO. PG4064

REMARKS

HOLE NO. BH 5-17

BORINGS BY CME 55 Power Auger **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.50
Asphaltic concrete 0.08		AU	1				
FILL: Crushed stone 0.60		AU	2				
- some sand by 0.46m depth		SS	3	15	10	1	87.50
Very stiff to stiff, brown **SILTY CLAY** 2.13		SS	4	67	8	2	86.50
GLACIAL TILL: Brown silty sand with gravel, trace clay and cobbles		SS	5	17	20	3	85.50
- grey by 2.6m depth		SS	6	42	13		
3.94		SS	7	100	50+		
End of Borehole							
Practical refusal to augering at 3.94m depth							



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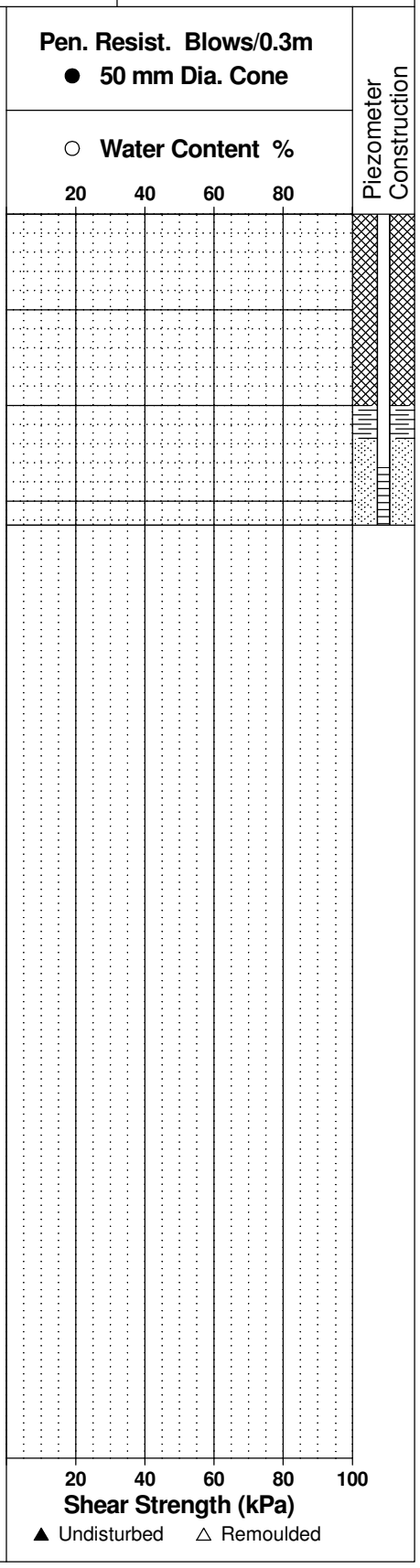
REMARKS

HOLE NO. BH 6-17

BORINGS BY CME 55 Power Auger **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
25mm Asphaltic concrete over crushed stone, some sand **FILL** 0.51		AU	1			0	88.51
		AU	2				
		SS	3	29	11	1	87.51
Very stiff to stiff, brown **SILTY CLAY**		SS	4	67	13	2	86.51
		SS	5	100	16		
3.18		SS	6	100	50+	3	85.51
GLACIAL TILL: Brown silty clay with sand, gravel, trace cobbles and boulders 3.25							
End of Borehole							
Practical refusal to augering at 3.25m depth							



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SOIL PROFILE AND TEST DATA

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REMARKS

HOLE NO. BH 7-17

BORINGS BY CME 55 Power Auger **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.79
Asphaltic concrete 0.08		AU	1				
FILL: Crushed stone with sand and clay 0.41		AU	2				
		AU	3				
Loose, brown **SILTY SAND,** trace gravel		SS	4	50	5	1	88.79
- running sand from 0.76 to 1.50m depth 1.50		SS	5	54	3	2	87.79
Stiff, brown **SILTY CLAY**		SS	6	100	P		
3.05						3	86.79
						4	85.79
Firm, grey **SILTY CLAY,** trace sand		SS	7	100	P	5	84.79
						6	83.79
		SS	8	100	P	7	82.79
7.77							
GLACIAL TILL: Loose to compact, grey silty fine sand with clay, trace gravel and cobbles		SS	9	100	4	8	81.79
		SS	10	46	7		
9.09						9	80.79
End of Borehole							
Practical refusal to augering at 9.09m 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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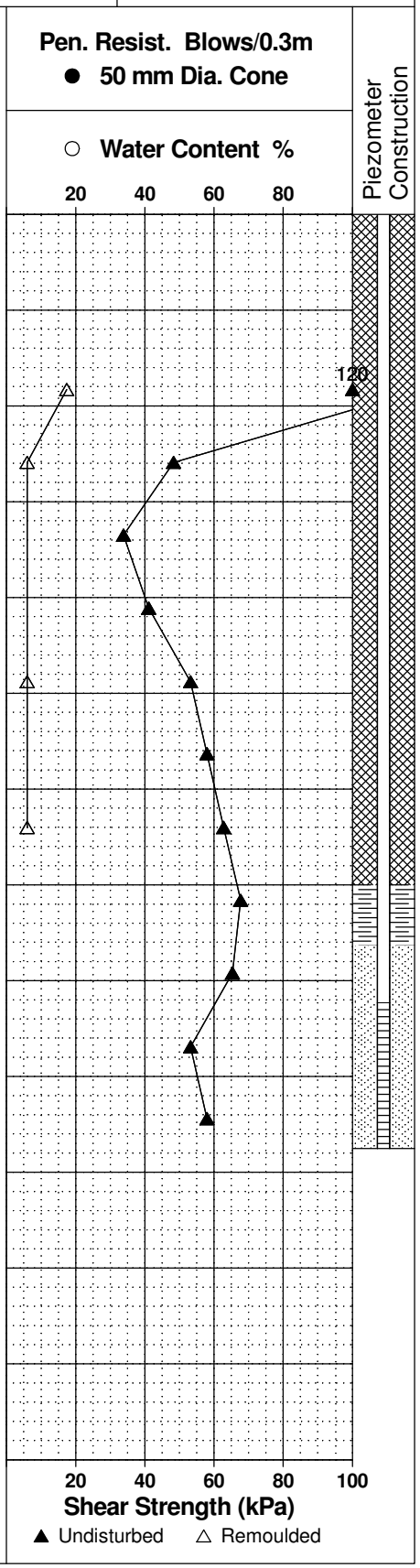
REMARKS

HOLE NO. BH 8-17

BORINGS BY CME 55 Power Auger **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.88
TOPSOIL with organics 0.28		AU	1				
		AU	2				
		SS	3	100	5	1	88.88
Very stiff to stiff, brown **SILTY CLAY**						2	87.88
3.05		SS	4	100	P	3	86.88
						4	85.88
		SS	5	100	P	5	84.88
Firm to stiff, grey **SILTY CLAY**						6	83.88
		SS	6	100	P	7	82.88
						8	81.88
		SS	7	100	P	9	80.88
9.75							
Dynamic Cone Penetration Test (DCPT) commenced at 9.75m depth. Cone pushed to 17.0m depth.						10	79.88
						11	78.88
Inferred **SILTY CLAY**						12	77.88
						13	76.88



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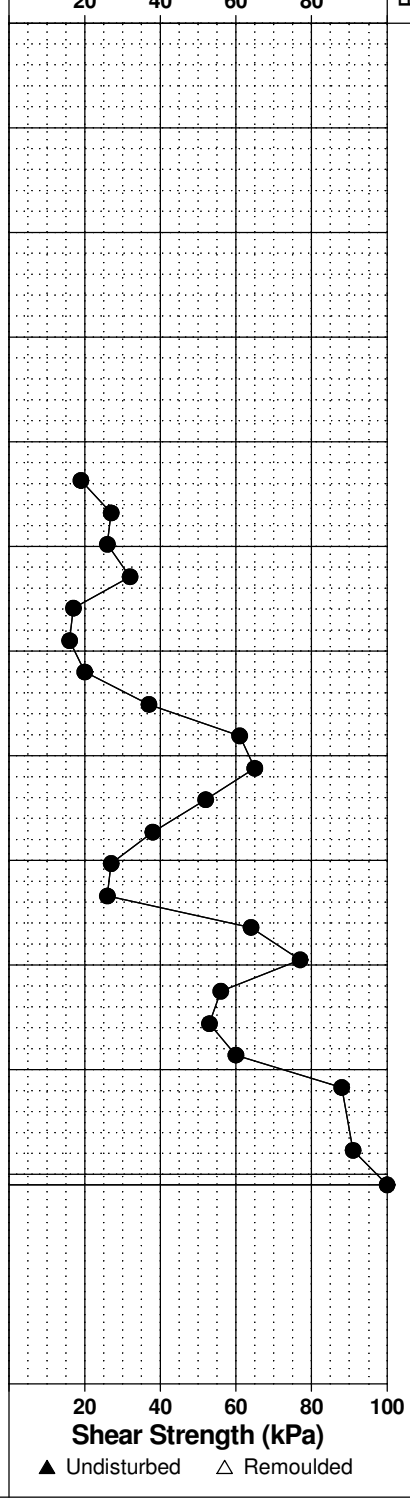
BORINGS BY CME 55 Power Auger **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Inferred **SILTY CLAY**						13	76.88
						14	75.88
						15	74.88
						16	73.88
17.00						17	72.88
Inferred **GLACIAL TILL**						18	71.88
						19	70.88
						20	69.88
						21	68.88
						22	67.88
						23	66.88
24.10						24	65.88
End of Borehole							
Practical DCPT refusal at 24.10m depth							



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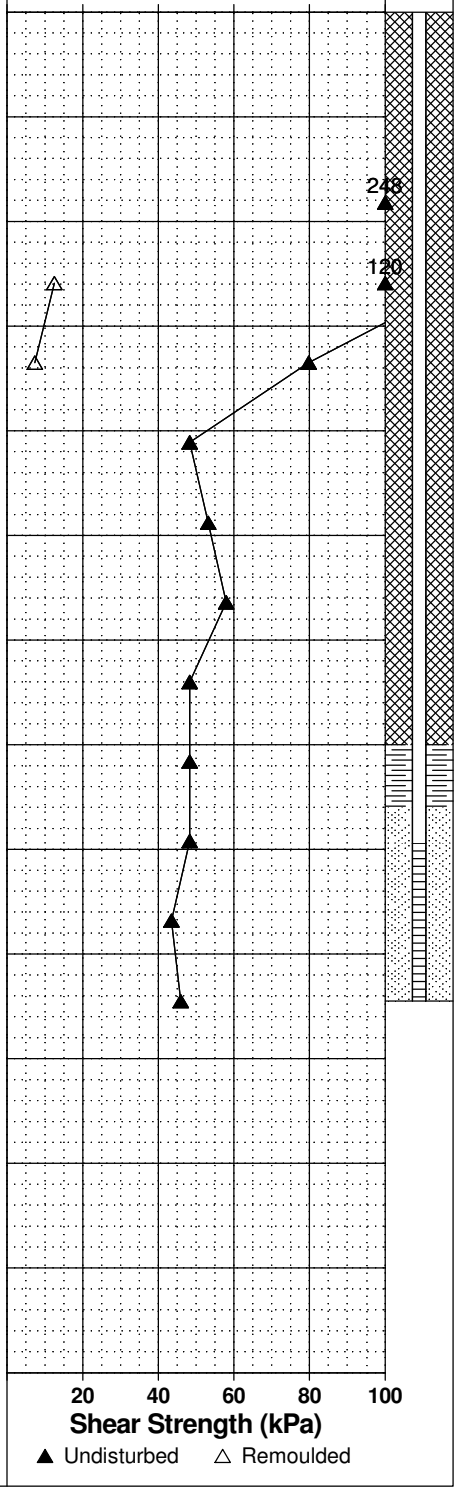
FILE NO. PG4064

REMARKS

HOLE NO. BH 9-17

BORINGS BY CME 55 Power Auger **DATE** March 7, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.31
TOPSOIL with organics 0.13		AU	1				
FILL: Brown silty clay, trace sand, gravel, cobbles 0.53		AU	2				
		SS	3	100	8	1	88.31
		SS	4	100	4	2	87.31
Hard to stiff, brown **SILTY CLAY**						3	86.31
3.80		SS	5	100	P	4	85.31
						5	84.31
Stiff to firm, grey **SILTY CLAY**		SS	6	100	P	6	83.31
						7	82.31
		SS	7	100	P	8	81.31
9.45						9	80.31
Dynamic Cone Penetration Test (DCPT) commenced at 9.45m depth. Cone pushed to 13.0m depth.						10	79.31
						11	78.31
Inferred **SILTY CLAY**						12	77.31
13.00						13	76.31



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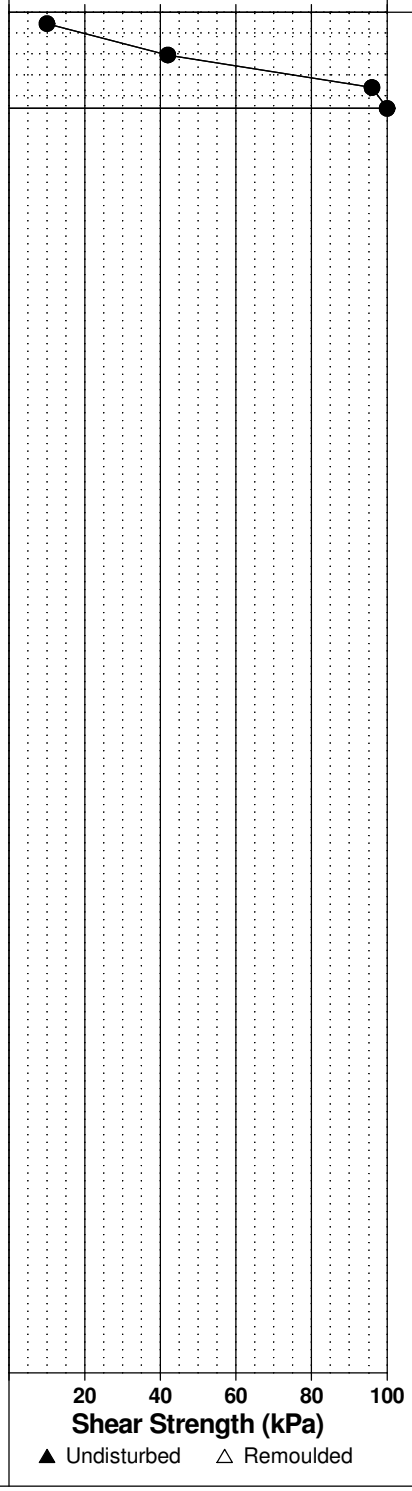
REMARKS

HOLE NO. BH 9-17

BORINGS BY CME 55 Power Auger **DATE** March 7, 2017

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									
Inferred **GLACIAL TILL**						13	76.31		
13.92									
End of Borehole									
Practical DCPT refusal at 13.92m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

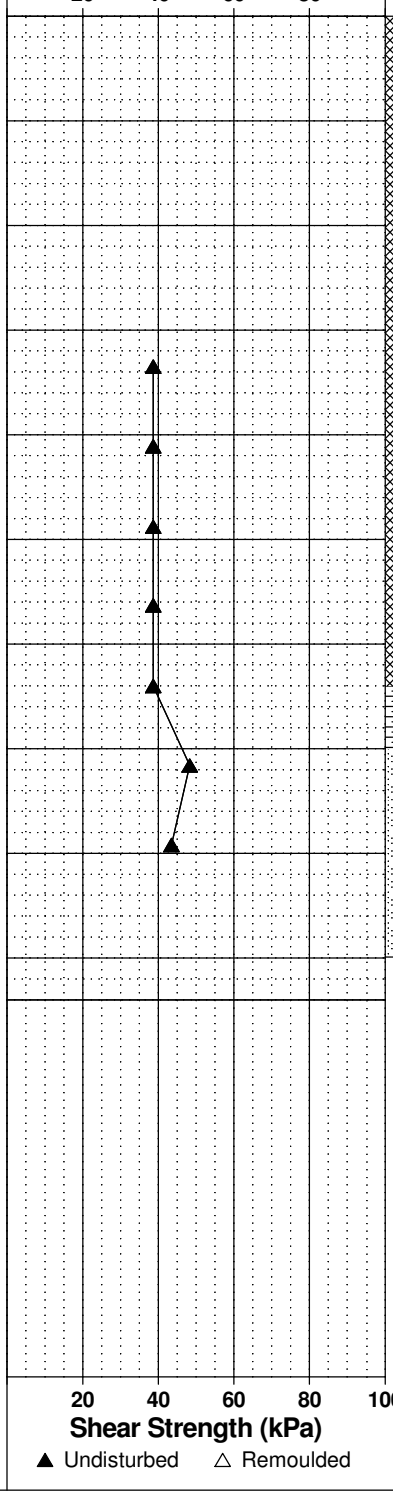
REMARKS

HOLE NO. BH10-17

BORINGS BY CME 55 Power Auger **DATE** March 7, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.80
		AU	1				
FILL: Brown silty clay, tarce sand and organics		SS	2	33	3	1	87.80
		SS	3	42	P	2	86.80
2.59		SS	4	58	P		
Stiff to firm, brown **SILTY CLAY**		SS	5	83	P	3	85.80
3.80						4	84.80
						5	83.80
Firm, grey **SILTY CLAY**		SS	6	100	P	6	82.80
						7	81.80
		SS	7	100	P	8	80.80
8.38							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	8	42	P	9	79.80
8.99							
Dynamic Cone Penetration Test (DCPT) commenced at 8.99m depth.							
9.40							
Inferred **GLACIAL TILL**							
End of Borehole							
Practical DCPT refusal at 9.40m depth.							

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

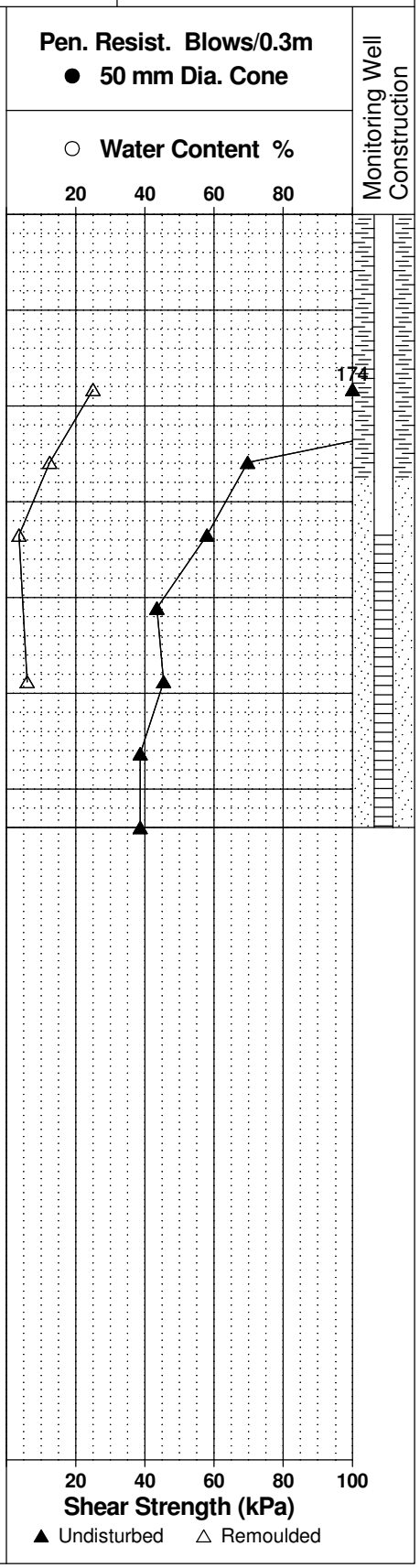
FILE NO. PG4064

REMARKS

HOLE NO. BH11-17

BORINGS BY CME 55 Power Auger **DATE** March 7, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.38
TOPSOIL with organics 0.25		AU	1				
		AU	2				
		SS	2	100	7	1	88.38
Very stiff to stiff, brown **SILTY CLAY**						2	87.38
		SS	3	100	P	3	86.38
3.80						4	85.38
Firm, grey **SILTY CLAY**						5	84.38
		SS	4	100		6	83.38
6.40							
End of Borehole							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. BH12-17

BORINGS BY CME 55 Power Auger **DATE** March 8, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.46
Asphaltic concrete 0.08		AU	1				
FILL: Crushed stone with sand 0.28		AU	2				
Hard to very stiff, brown **SILTY CLAY**		SS	3	100	14	1	86.46
2.13		SS	4	100	11	2	85.46
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders		SS	5	92	P	3	84.46
		SS	6	73	3		
3.99		SS	7	67	50+		
End of Borehole							
Practical refusal to augering at 3.99m 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. BH13-17

BORINGS BY CME 55 Power Auger **DATE** March 8, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.61
TOPSOIL with organics 0.20		AU	1				
FILL: Brown silty clay, trace sand and gravel 0.60		AU	2				
		SS	3	100	12	1	86.61
Hard, brown **SILTY CLAY**		SS	4	100	12	2	85.61
2.64		SS	5	100	12		
		SS	6	58	49	3	84.61
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders		SS	7	30	28	4	83.61
- grey by 4.6m depth		SS	8	42	18	5	82.61
5.49							
End of Borehole							
Practical refusal to augering at 5.49m 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. BH14-17

BORINGS BY CME 55 Power Auger **DATE** March 8, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.77
TOPSOI 0.10		AU	1				
FILL: Brown silty sand with clay, trace gravel 0.66		AU	2				
		SS	3	100	12	1	86.77
		SS	4	100	12	2	85.77
Hard to very stiff, brown **SILTY CLAY**		SS	5	100	9		
3.63		SS	6	100	7	3	84.77
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders		SS	7	50	19	4	83.77
- grey by 4.1m depth		SS	8	7	50+		
5.11						5	82.77
End of Borehole							
Practical refusal to augering at 5.11m depth							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

248

Monitoring Well 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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

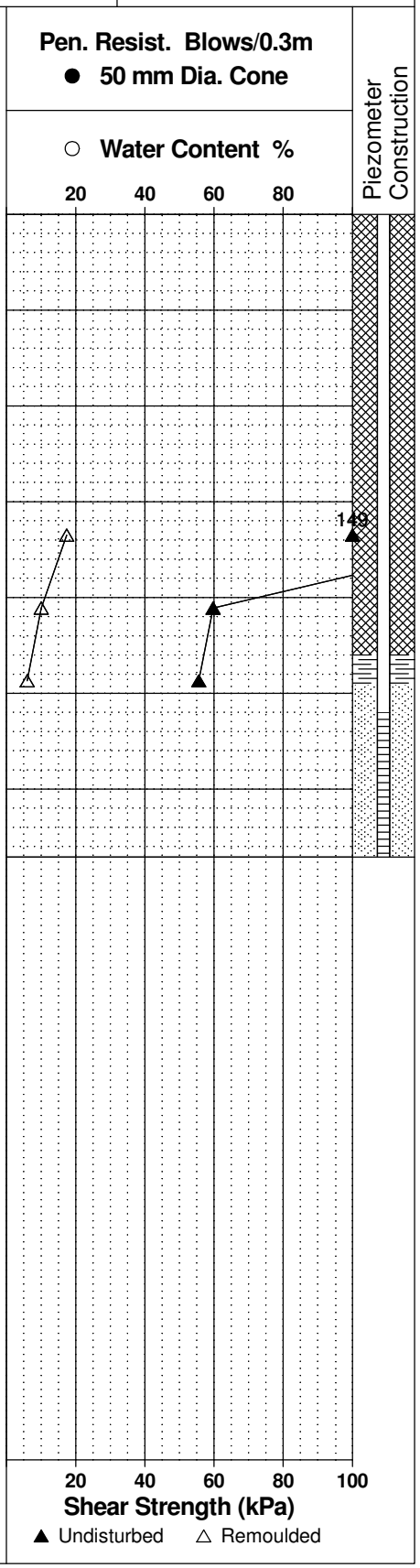
FILE NO. PG4064

REMARKS

HOLE NO. BH15-17

BORINGS BY CME 55 Power Auger **DATE** March 8, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.81
25mm Asphaltic concrete over crushed stone and sand **FILL** 0.28		AU	1				
		AU	2				
		SS	3	100	17	1	86.81
		SS	4	100	12	2	85.81
Hard to stiff, brown **SILTY CLAY,** trace sand		SS	5	100	5	3	84.81
4.57						4	83.81
Stiff, grey **SILTY CLAY** 5.18		SS	6	100	P	5	82.81
		SS	7	100	2		
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	8	54	12	6	81.81
6.71							
End of Borehole							
Practical refusal to augering at 6.71m depth							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

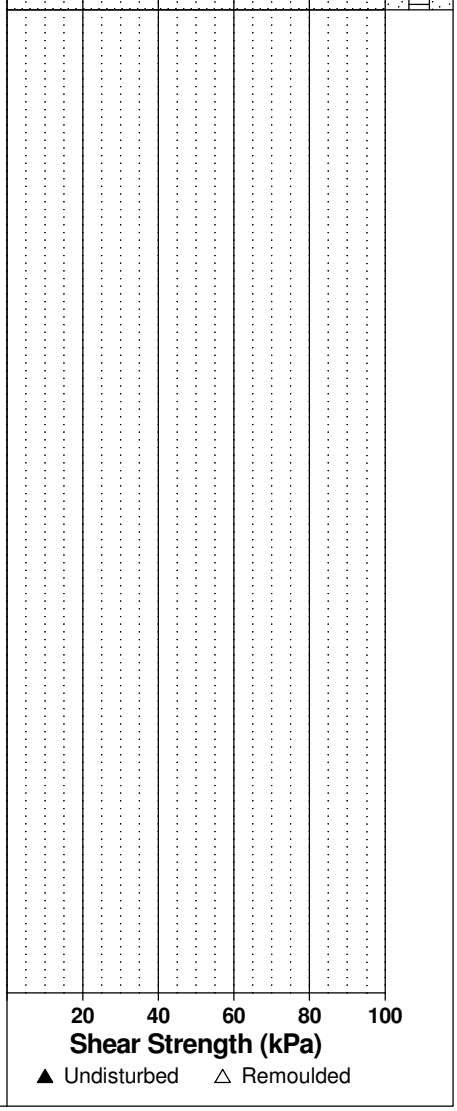
FILE NO. PG4064

REMARKS

HOLE NO. BH16-17

BORINGS BY CME 55 Power Auger **DATE** March 8, 2017

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 %	Monitoring Well Construction
GROUND SURFACE						0	88.25	20 40 60 80	
OVERBURDEN						1	87.25		
						2	86.25		
2.74									
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	1	100	11	3	85.25		
3.61									
End of Borehole									
Practical refusal to augering at 3.61m depth									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP 1-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.50
FILL: Brown silty clay, some sand, trace crushed stone and topsoil		G	1				
0.45							
Very stiff to stiff, brown **SILTY CLAY**		G	2				
		G	3				
0.95							
End of Test Pit							
(TP observed to be dry upon completion - March 6, 2017)							

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

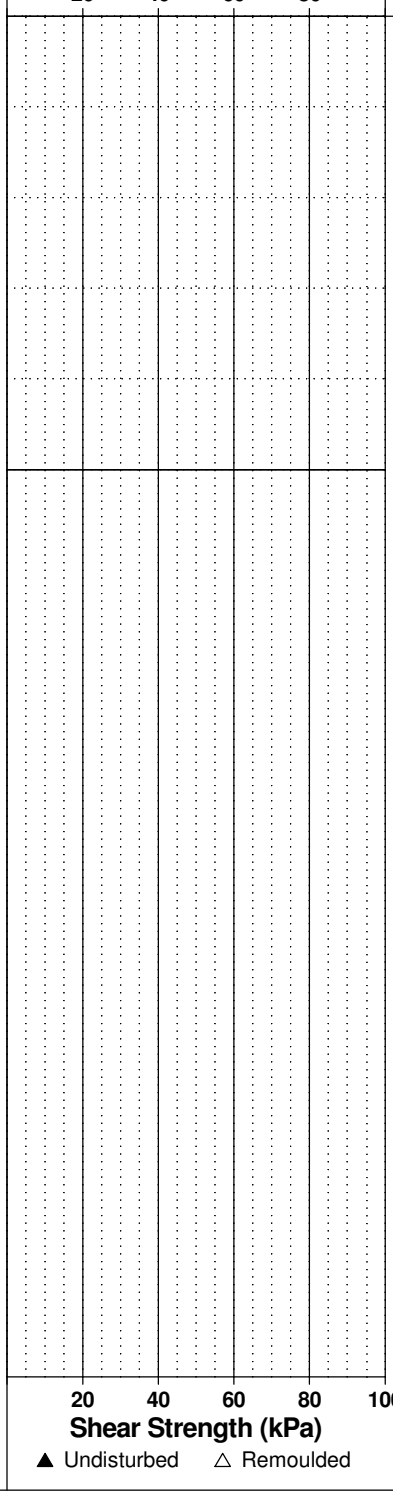
REMARKS

HOLE NO. TP 2-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.09
FILL: Crushed stone							
0.10							
FILL: Brown silty sand with crushed stone and gravel, trace clay, brick, glass, coal and slag		G	1				
0.60							
TOPSOIL		G	2				
0.80							
Very stiff to stiff, brown **SILTY CLAY**		G	3				
1.00						1	87.09
End of Test Pit							
(TP observed to be dry upon completion - March 6, 2017)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP 3-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	87.98		
FILL: Brown silty sand with clay, crushed stone, gravel, trace cobbles, boulders, metal wire, shingles, tile and brick		G	1						
0.70		G	2						
Very stiff to stiff, brown **SILTY CLAY**						1	86.98		
1.50									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									

20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

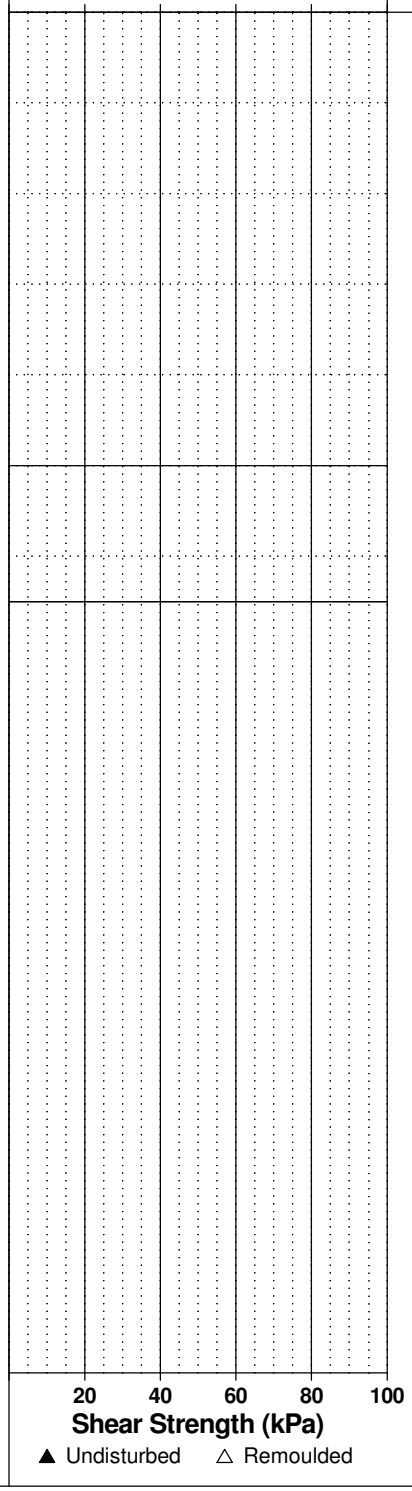
FILE NO. PG4064

REMARKS

HOLE NO. TP 4-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	87.96		
FILL: Topsoil with brown silty clay, some sand and crushed stone, trace coal and slag		G	1						
0.65									
Very stiff to stiff, brown **SILTY CLAY**		G	2			1	86.96		
1.30									
End of Test Pit (TP observed to be dry upon completion - March 6, 2017)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

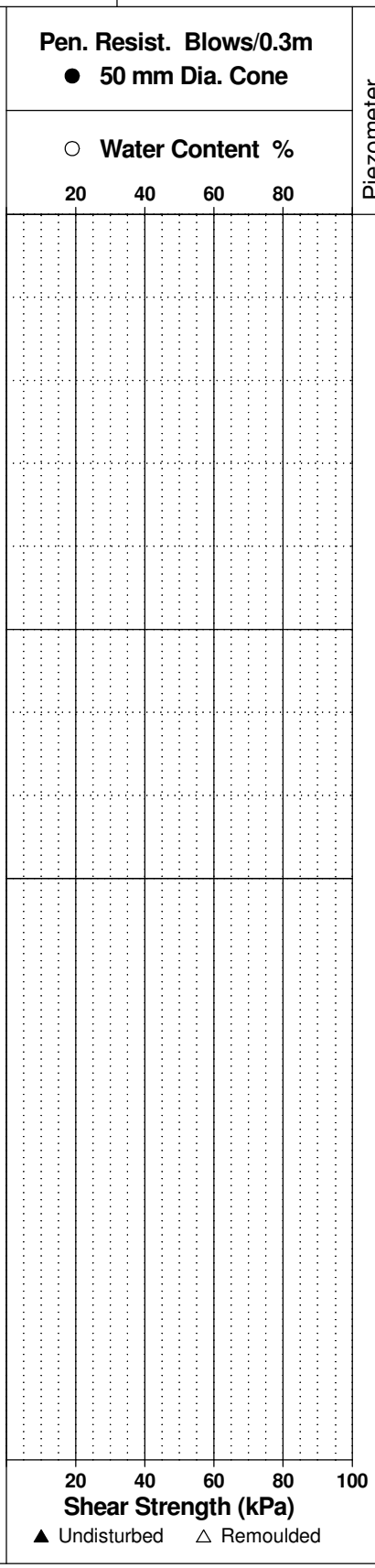
FILE NO. PG4064

REMARKS

HOLE NO. TP 5-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.31
FILL: Topsoil, some crushed stone and gravel		G	1				
0.35							
FILL: Brown silty clay with sand, gravel, trace concrete, coal and slag		G	2			1	87.31
1.20							
Very stiff to stiff, brown **SILTY CLAY**		G	3				
1.60							
End of Test Pit							
(TP observed to be dry upon completion - March 6, 2017)							



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

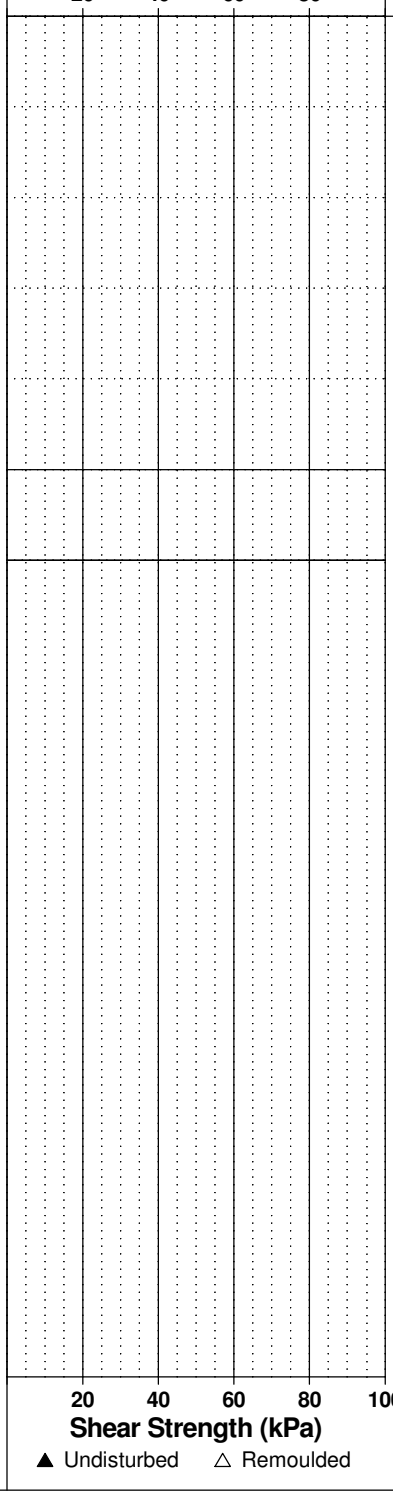
FILE NO. PG4064

REMARKS

HOLE NO. TP 6-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	88.84		
FILL: Topsoil with brown silty clay, sand and crushed stone		G	1						
0.40									
Very stiff to stiff, brown **SILTY CLAY**		G	2			1	87.84		
1.20									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP 7-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	89.80		
FILL: Brown silty clay with sand, trace wood and concrete. Thin layer of coal and slag at 0.3m depth.		G	1						
0.90									
TOPSOIL		G	2			1	88.80		
1.13									
Very stiff to stiff, brown **SILTY CLAY**		G	3						
1.30									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									

20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP 8-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	90.96		
FILL: Brown silty sand with organics, crushed stone and gravel, trace coal and asphalt		G	1						
		G	2						
0.90									
Dense, light brown **SILTY FINE SAND,** some gravel		G	3			1	89.96		
1.35									
End of Test Pit (TP observed to be dry upon completion - March 6, 2017)									

20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

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FILE NO. PG4064

REMARKS

HOLE NO. TP 9-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.34
FILL: Light brown silty sand, some gravel and cobbles		G	1				
0.50							
		G	2				
FILL: Brown silty sand, some topsoil and organics, trace wood, coal and nails							
0.80							
Dense, light brown **SILTY FINE SAND** with gravel, trace cobbles and boulders		G	3			1	91.34
1.30							
End of Test Pit							
(TP observed to be dry upon completion - March 6, 2017)							

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
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335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

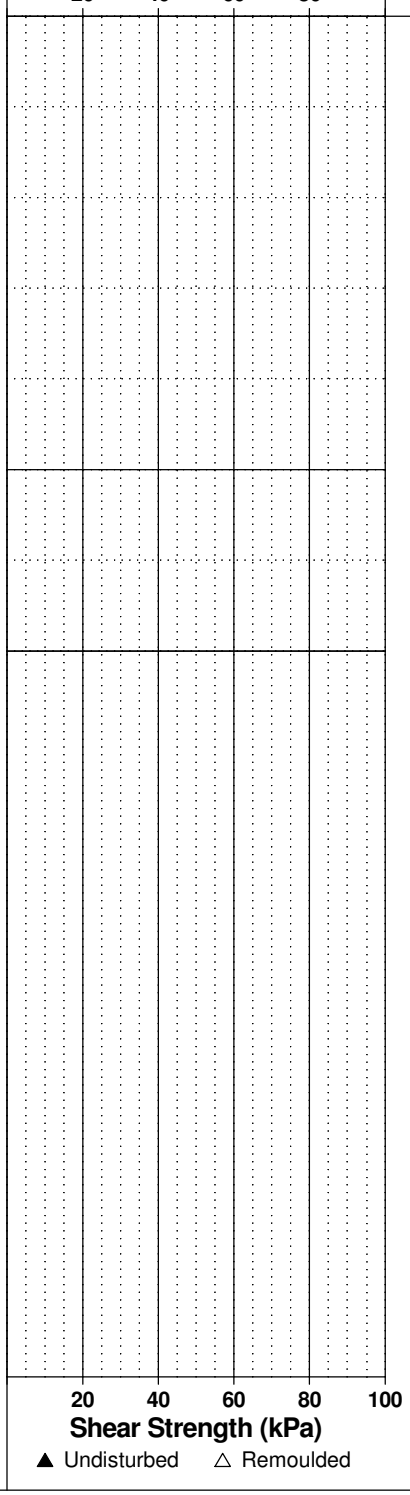
FILE NO. PG4064

REMARKS

HOLE NO. TP10-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	90.39		
FILL: Brown silty clay, trace gravel		G	1						
- some construction debris (wood, concrete, nails) by 1.0m depth		G	2			1	89.39		
1.30									
Very stiff to stiff, brown **SILTY CLAY**		G	3						
1.40									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

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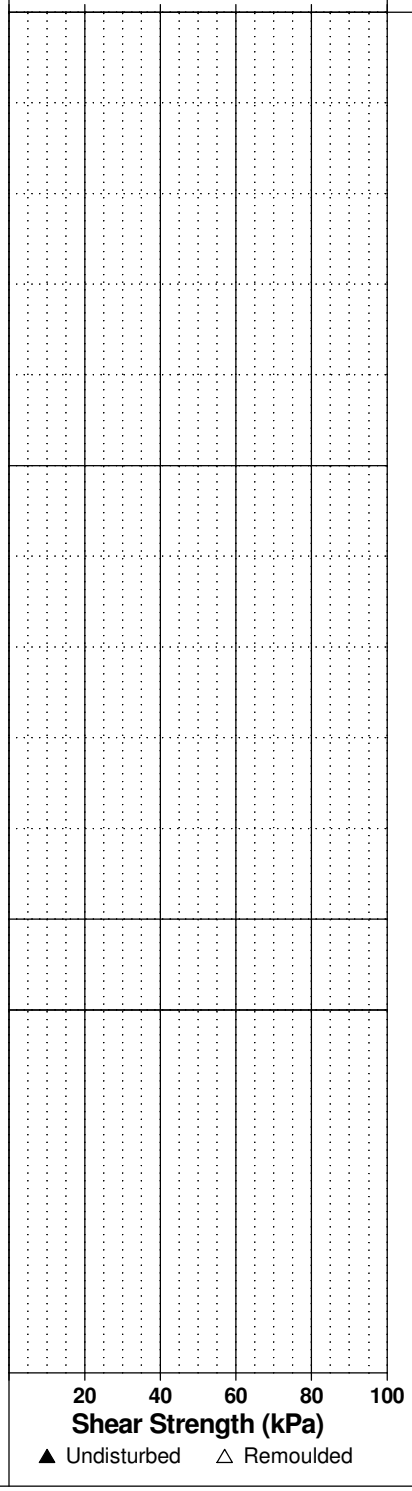
FILE NO. PG4064

REMARKS

HOLE NO. TP11-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	90.26		
FILL: Brown silty sand, some gravel, trace clay, concrete, metal and slag		G	1						
- some clay by 1.0m depth						1	89.26		
		G	2						
						2	88.26		
2.10									
Very stiff to stiff, brown **SILTY CLAY**		G	3						
2.20									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

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FILE NO. PG4064

REMARKS

HOLE NO. TP12-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	89.68		
FILL: Brown silty clay, some crushed stone, trace sand		G	1						
0.50									
Very stiff to stiff, brown **SILTY CLAY**		G	2			1	88.68		
1.10									
End of Test Pit (TP observed to be dry upon completion - March 6, 2017)									

20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

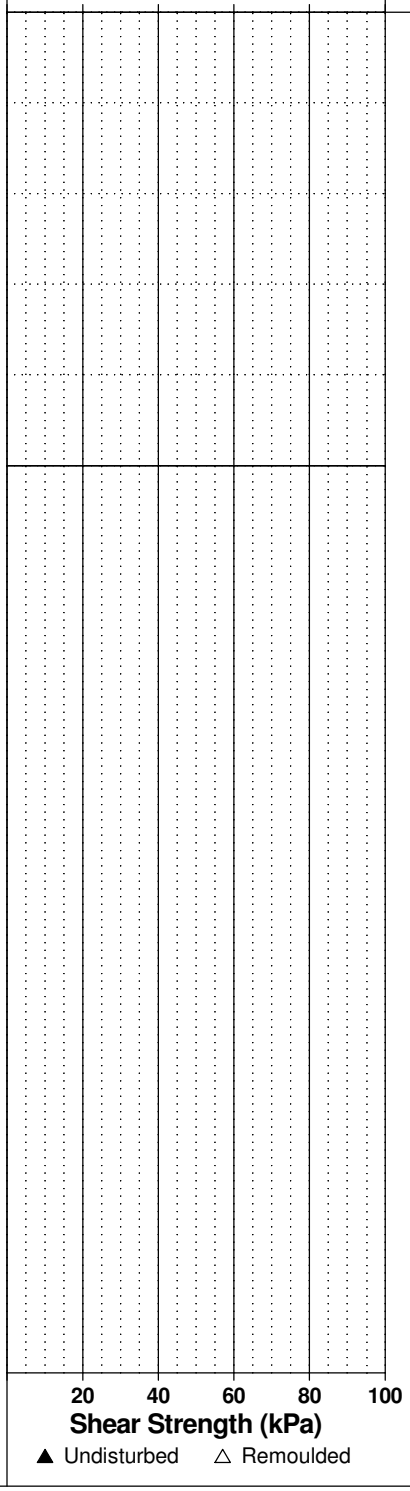
FILE NO. PG4064

REMARKS

HOLE NO. TP13-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	89.81		
FILL: Topsoil with silty clay, sand, some gravel, trace concrete and asphalt		G	1						
0.40									
Very stiff to stiff, brown **SILTY CLAY**		G	2						
1.00						1	88.81		
End of Test pit (TP observed to be dry upon completion - March 6, 2017)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

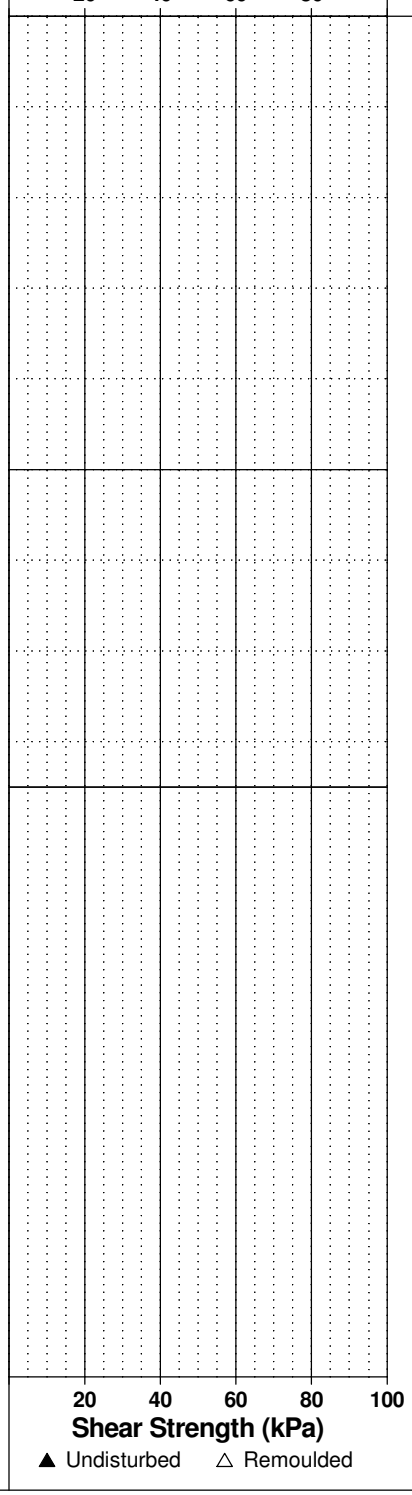
FILE NO. PG4064

REMARKS

HOLE NO. TP14-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	89.79		
FILL: Brown silty clay, some gravel, trace topsoil, coal, slag and brick		G	1						
		G	2			1	88.79		
1.40									
Very stiff to stiff, brown **SILTY CLAY**		G	3						
1.70									
End of Test Pit									
(Perched groundwater conditions observed within the overlying fill material)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP15-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	90.56		
FILL: Brown silty clay, trace shingles		G	1						
0.45									
TOPSOIL		G	2						
0.60									
Very stiff to stiff, brown **SILTY CLAY**		G	3			1	89.56		
1.00									
End of Test Pit									
(TP observed to be dry upon completion - March 6, 2017)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

FILE NO. PG4064

REMARKS

HOLE NO. TP16-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	90.04		
FILL: Brown silty clay with gravel, cobbles, boulders and blast rock, some concrete, brick and insulation		G	1						
		G	2			1	89.04		
1.80									
Very stiff to stiff, brown **SILTY CLAY** 1.90		G	3						
End of Test Pit									
(Perched groundwater conditions observed within the overlying fill material)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

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. Residential Development - Blocks 15, 19, 22 & 24
335 St. Laurent Blvd., Ottawa, Ontario

DATUM Ground surface elevations referenced from the ground surface elevations of borehole locations provided by J.D. Barnes Limited.

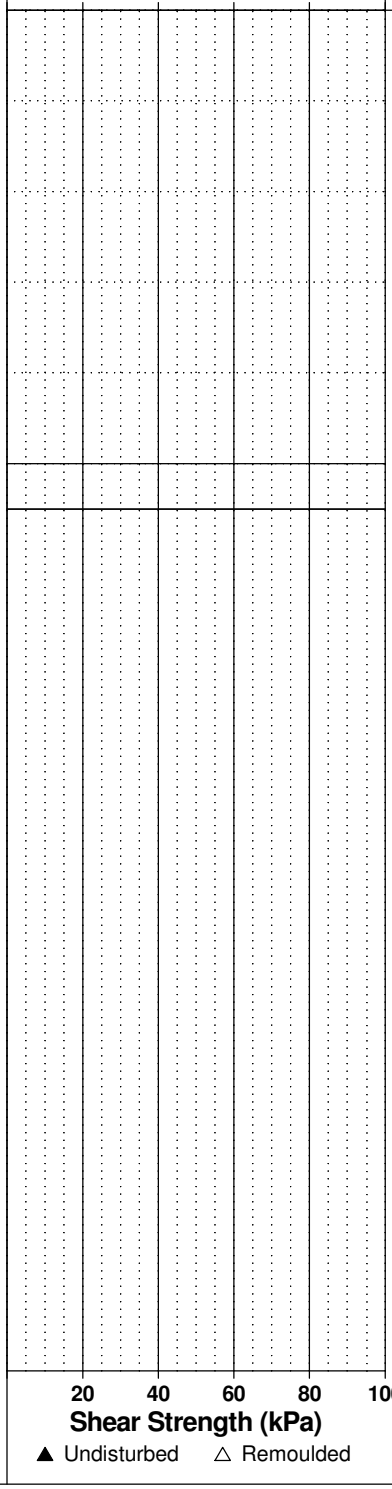
FILE NO. PG4064

REMARKS

HOLE NO. TP17-17

BORINGS BY Hydraulic Excavator **DATE** March 6, 2017

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	89.21		
FILL: Brown silty clay/silty sand with crushed stone and blast rock, some concrete, brick, insulation, steel		G	1						
		G	2			1	88.21		
1.10									
End of Test Pit TP terminated on concrete basement floor slab at 1.10m depth. (Perched groundwater conditions observed within the overlying fill material)									



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture 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 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 x 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

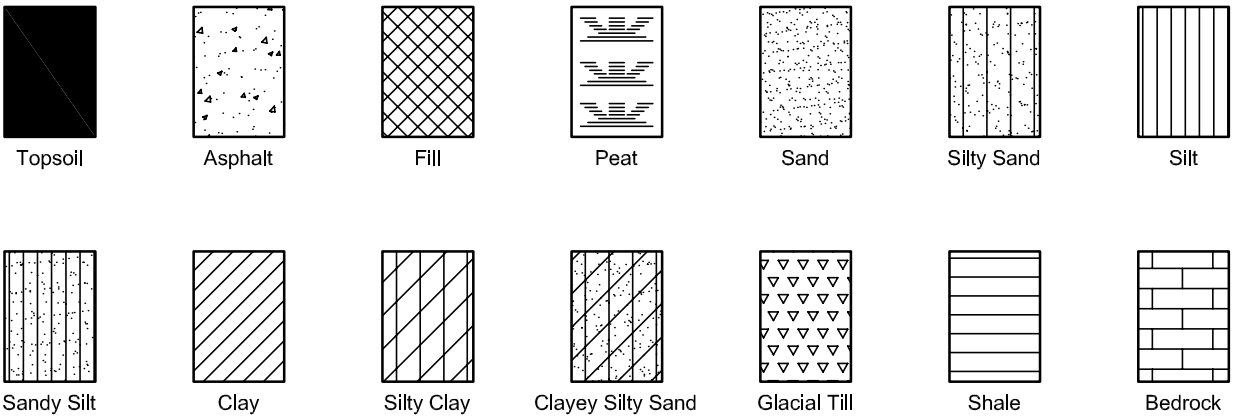
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

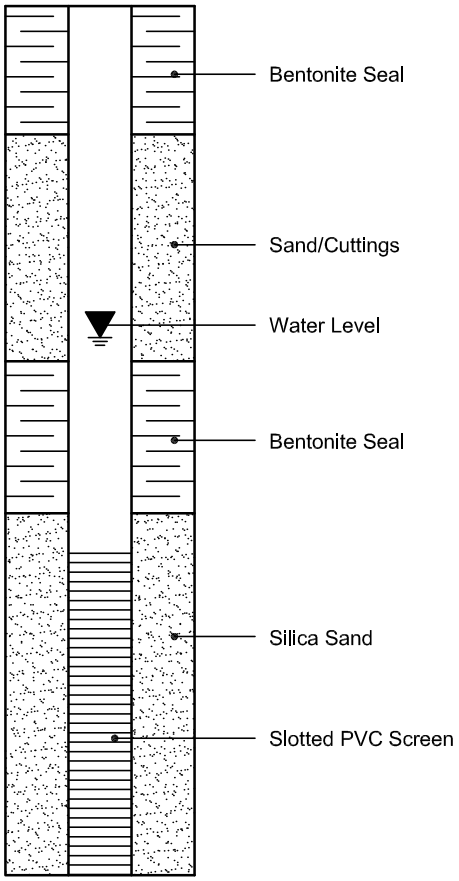
SYMBOLS AND TERMS (continued)

STRATA PLOT

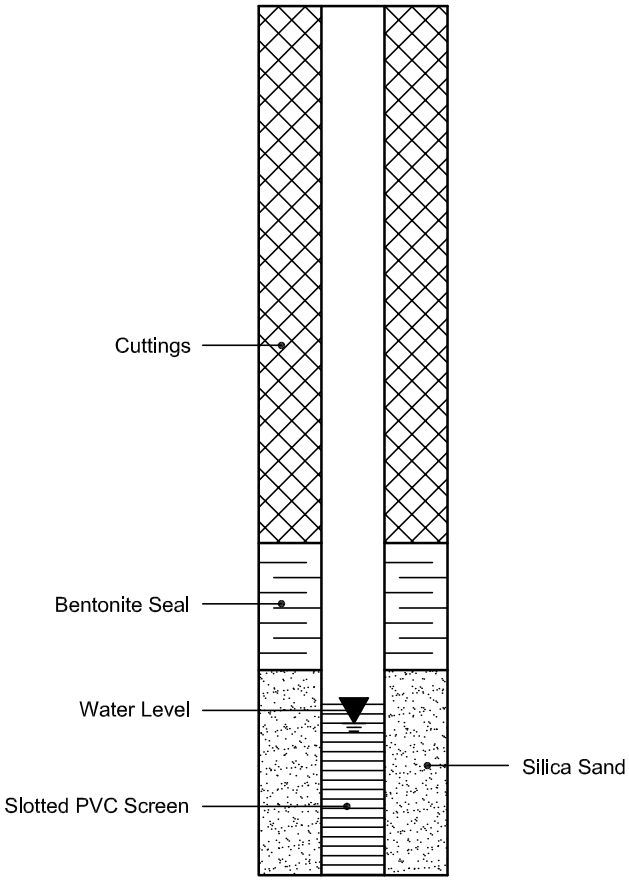


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



LOG OF BOREHOLE BH16-01

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **87.71 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035157.53** m N, **372599.17** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				TOPSOIL - grass 180 mm thick					
					FILL - SAND AND GRAVEL - trace silt, asphalt fragments, brown, loose	SS1		4		
1.0					CLAY - silty, brown, stiff	SS2		10		Standpipe piezometer 20 mm diameter installed as shown
2.0	86				CLAY - silty, grey, stiff to very stiff	SS3		11		Groundwater level is 2.0 m (Elev. 85.71 m), on Sept. 8, 2016
	85					SS4		8	✖	
3.0					TILL - sand, some clay and silt, trace of gravel, grey, loose	SS5		10		
4.0	84					SS6		8		9 70 (21)
	83				End of Borehole at 4.4 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
5.0										
6.0	82									
7.0	81									
	80									

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

LOG OF BOREHOLE BH16-02

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.05 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035157.52** m N, **372671.86** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
	88				ASPHALT - 250 mm thick					
					FILL - SAND AND GRAVEL - trace clay and silt, brown, compact	SS1		28		37 57 (6)
1.0	87		●			SS2		18		
					FILL - GRAVELLY SAND - trace clay and silt, brown, compact to dense	SS3		10		22 65 (13)
2.0	86									
						SS4		37		29 60 (11)
3.0	85		●			SS5		16		
						SS6		50+		
4.0	84				End of Borehole at 4.0 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-03

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.25 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **September 16, 2016**
COORDINATES: **5035157.56** m N, **372725.95** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - trace of clay, brown, compact	SS1		29		
1.0	87					SS2		10		
2.0	86					SS3		26		
						SS4		16		
3.0	85				TILL - Clay, some sand, trace of gravel, grey, hard	SS5		50+		
					LIMESTONE BEDROCK - Light grey RC1 = 0.61 m TCR = 87% RQD = 56%	RC1				
4.0	84									Possible 50 mm thick clay seam at 4.4 m
5.0	83				RC2 = 1.55 m TCR = 95% RQD = 95%	RC2				
					RC3 = 0.46 m TCR = 100% RQD = 47%	RC3				
6.0	82				End of Borehole at 6.1 m					
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-04

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.52 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 2, 2016**
COORDINATES: **5035156.93** m N, **372783.61** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - brown, compact	SS1		13		
1.0	87				CLAY - silty, trace of sand and gravel, brown (possible fill), stiff to very stiff	SS2		14		
2.0						SS3		20		
	86				TILL - sand, gravelly, trace clay, brown, compact	SS4		25		
2.7					End of Borehole at 2.7 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	85									
4.0	84									
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-05

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.01 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035156.92** m N, **372873.6** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p — W — W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				TOPSOIL - 230 mm thick					
					FILL - SAND - some gravel, trace silt, possible cobbles and boulders, brown, very loose to dense	SS1		5		
1.0	89		●			SS2		30		
			●			SS3		37		12 81 (7)
2.0	88				End of Borehole at 2.1 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	87									
4.0	86									
5.0	85									
6.0	84									
7.0	83									

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DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-06

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **92.09 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 2, 2016**
COORDINATES: **5035156.35** m N, **372959.35** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
	92				TOPSOIL - 50 mm thick					
					ASPHALT - 180 mm thick	SS1		17		
					FILL - SAND - some gravel, trace silt, possible cobbles and boulders, light brown, compact to very dense					
1.0	91					SS2		55		
						SS3		51		
2.0	90									
						SS4		35		15 76 (9)
3.0	89				TILL - Clay, silty, some gravel, trace of sand, brown, hard					
						SS5		38		
4.0	88					SS6		50+		
					End of Borehole at 4.0 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
5.0	87									
6.0	86									
7.0	85									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-07

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.45 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 1, 2016**
COORDINATES: **5035156.4** m N, **373046.35** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				TOPSOIL - 25 mm thick					
					FILL - SAND - gravelly, trace clay and silt, possible cobbles and boulders, light brown to grey, compact to very dense	SS1		24		32 62 (6)
1.0	92					SS2		75		
2.0	91					SS3		28		
						SS4		98		
3.0	90					SS5		50+		
					End of Borehole at 3.1 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
4.0	89									
5.0	88									
6.0	87									
7.0	86									

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

LOG OF BOREHOLE BH16-08

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.58 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035156.34** m N, **373117.37** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93.58				TOPSOIL - 180 mm thick					
					FILL - SAND AND GRAVEL - silty, brown, compact	SS1		11		
1.0	93					SS2		50+		
					LIMESTONE BEDROCK - Light grey					
	92				RC1 = 1.55 m TCR = 98% RQD = 71%	RC1				
2.0										
	91									
3.0					RC2 = 1.55 m TCR = 100% RQD = 83%	RC2				
	90									
4.0										
	89				RC3 = 1.55 m TCR = 93% RQD = 84%	RC3				
5.0										
	88				End of Borehole at 5.6 m					
6.0										
	87									
7.0										
	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-09

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.39 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035170.89** m N, **373171.56** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				TOPSOIL - 150 mm thick					
					FILL - SAND - gravelly, some clay and silt, brown, compact to very dense	SS1		10		
1.0	92					SS2		31		32 38 (30)
						SS3		50+		
2.0	91				End of Borehole at 1.8 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	90									
4.0	89									
5.0	88									
6.0	87									
7.0	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-10

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.07 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035099.92** m N, **373199.58** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				FILL - SAND AND GRAVEL - trace of clay, brown, compact	SS1		16		
1.0	92				CLAY - silty, brown, firm	SS2		6		
					TILL - Clay, some gravel, trace of sand, brown	SS3		50+		
1.7	91.37				End of Borehole at 1.7 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
2.0	91									
3.0	90									
4.0	89									
5.0	88									
6.0	87									
7.0	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-11

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **89.13 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 1, 2016**
COORDINATES: **5035076.08** m N, **372873.57** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	89				TOPSOIL - 25 mm thick					
					CLAY - silty, brown, firm to very stiff	SS1		13		
1.0	88					SS2		17		
						SS3		10		
2.0	87					SS4		4		Standpipe piezometer 20 mm diameter installed as shown Groundwater level is 2.55 m (Elev. 86.58 m), on Sept. 8, 2016
3.0	86				CLAY - silty, grey, firm	SS5			✖	
					TILL - silty clay, trace sand and gravel, light grey, soft to firm	SS6		2		
4.0	85					SS7		7		
5.0	84					SS8		50+		
					End of Borehole at 5.3 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
6.0	83									
7.0	82									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-12

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **87.87 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 31, 2016**
COORDINATES: **5035071.7** m N, **372783.61** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0					ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - some silt, brown, loose	SS1		9		
1.0	87				CLAY - Silty, brown, hard	SS2		8		
2.0	86					SS3		12	>>✖	
						SS4		10		
3.0	85					SS5		2		
4.0	84				CLAY - Silty, grey, firm	SS6		0	✖	
						SS7		2	✖	
5.0	83				TILL - silty clay, some sand and gravel, grey					
					End of Borehole at 5.1 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
6.0	82									
7.0	81									
	80									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-13

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **87.66 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035075.11** m N, **372672.07** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					ASPHALT - 75 mm thick					
					TOPSOIL - 50 mm thick					
	87				FILL - SAND - gravelly, trace clay and silt, brown, compact	SS1		13		22 67 (11)
1.0					CLAY - Silty, brown, stiff to hard	SS2		8		
	86					SS3		10	>>✖	
2.0										
	85									
3.0						SS4		2		
	84									
4.0						SS5		0	✖	
	83				CLAY - Silty, grey, soft to stiff				✖	
5.0						SS6		0		
	82					SS7		0	✖	
6.0					TILL - Silty clay, grey, stiff	SS8		14		
	81				End of Borehole at 6.7 m					
7.0										
	80									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-14

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.66 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 31, 2016**
COORDINATES: **5035000.95** m N, **372873.59** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88		●		FILL - CLAY AND SAND - brown, firm / loose	SS1		6	□	
1.0	87		●		CLAY - Silty, brown, soft to firm	SS2		6	□	
2.0						SS3		3	□	
	86				CLAY - Silty, grey, soft to stiff	SS4		1	□ ✖	
3.0						ST1			✖	
4.0	85		●			SS5		0	□ ✖	
	84					SS6		0	□ ✖	
5.0										
	83		●			SS7		50+	✖ □	
6.0					End of Borehole at 5.8 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
7.0	82									
	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-15

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.18 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 2, 2016**
COORDINATES: **5035000.94** m N, **373043.64** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				FILL - SAND - organics, brown					
					CLAY - Silty, brown, stiff	SS1		12		
1.0	89					SS2		8		
2.0	88					SS3		5		
						SS4		3		
3.0	87				CLAY - Silty, grey, firm	SS5		0		
4.0	86					SS6		0		
5.0	85					SS7		0		
						SS8		0		
6.0	84				TILL - Clay, trace of sand and gravel, grey, very soft	SS9		0		
6.7					End of Borehole at 6.7 m					
7.0	83									

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-16

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.07 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 1, 2016**
COORDINATES: **5034915.62** m N, **373044.27** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				TOPSOIL - 230 mm thick				
					FILL - SAND AND GRAVEL - some clay, brown, compact	SS1		11	Standpipe piezometer 20 mm diameter installed as shown
1.0	89					SS2		20	
					ASPHALT - 50 mm thick				
					CLAY - Silty, brown, stiff to very stiff	SS3		4	
2.0	88					SS4		2	
3.0	87					SS5		0	
4.0	86				CLAY - Silty, grey, soft to firm	SS6		0	
5.0	85					SS7		0	
						SS8		0	Borehole dry on Sept. 8, 2016
6.0	84				End of Borehole at 6.2 m				
7.0	83								

VANE (kPa) ✖ 20 40 60 80
SPT (N) □ DCPT ◆ Blows/0.3m 20 40 60 80

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-17

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.22 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 30, 2016**
COORDINATES: **5034822.44** m N, **373044.56** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) / SPT (N) Blows/0.3m / DCPT	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				TOPSOIL - 25 mm thick					
					FILL - SAND - gravelly, trace silt, brown, compact	SS1		16		Standpipe piezometer 20 mm diameter installed as shown
1.0	89					SS2		19		
					CLAY - Silty, brown, firm	SS3		4		
2.0	88					SS4		0		Groundwater level is 2.35 m (Elev. 87.87 m) on Sept. 30, 2016
					CLAY - Silty, grey, soft to firm	SS5		0		
3.0	87					SS6		0		
4.0	86					SS7		0		
5.0	85					SS8		0		
6.0	84				End of Borehole at 6.2 m					
7.0	83									

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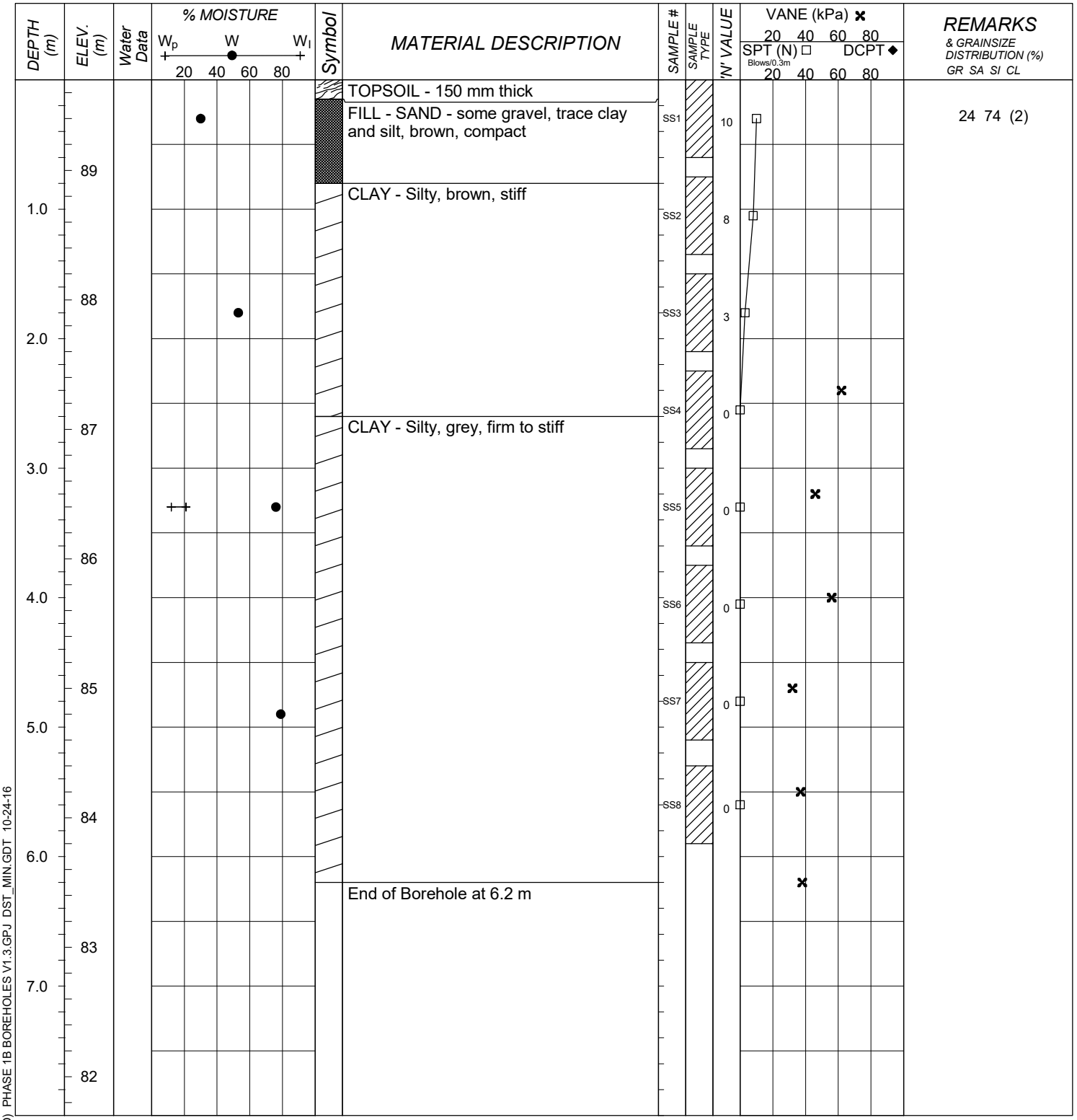
SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-18

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **89.70 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 30, 2016**
COORDINATES: **5034839.19** m N, **372972.32** m E



BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-19

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.81 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 1, 2016**
COORDINATES: **5034869.23** m N, **372896.41** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) / SPT (N) Blows/0.3m / DCPT	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88.81				ASPHALT - 75 mm thick					
					FILL - SAND - gravelly, trace silt, brown, loose	SS1		9		25 66 (9)
1.0	88				CLAY - Silty, brown, stiff	SS2		9		
2.0	87					SS3		3		
3.0	86				CLAY - Silty, grey, firm to stiff	SS4		0		
						SS5		0		
4.0	85					SS6		0		
5.0	84					SS7		0		
						SS8		0		
6.0	83				End of Borehole at 6.2 m					
7.0	82									
	81									

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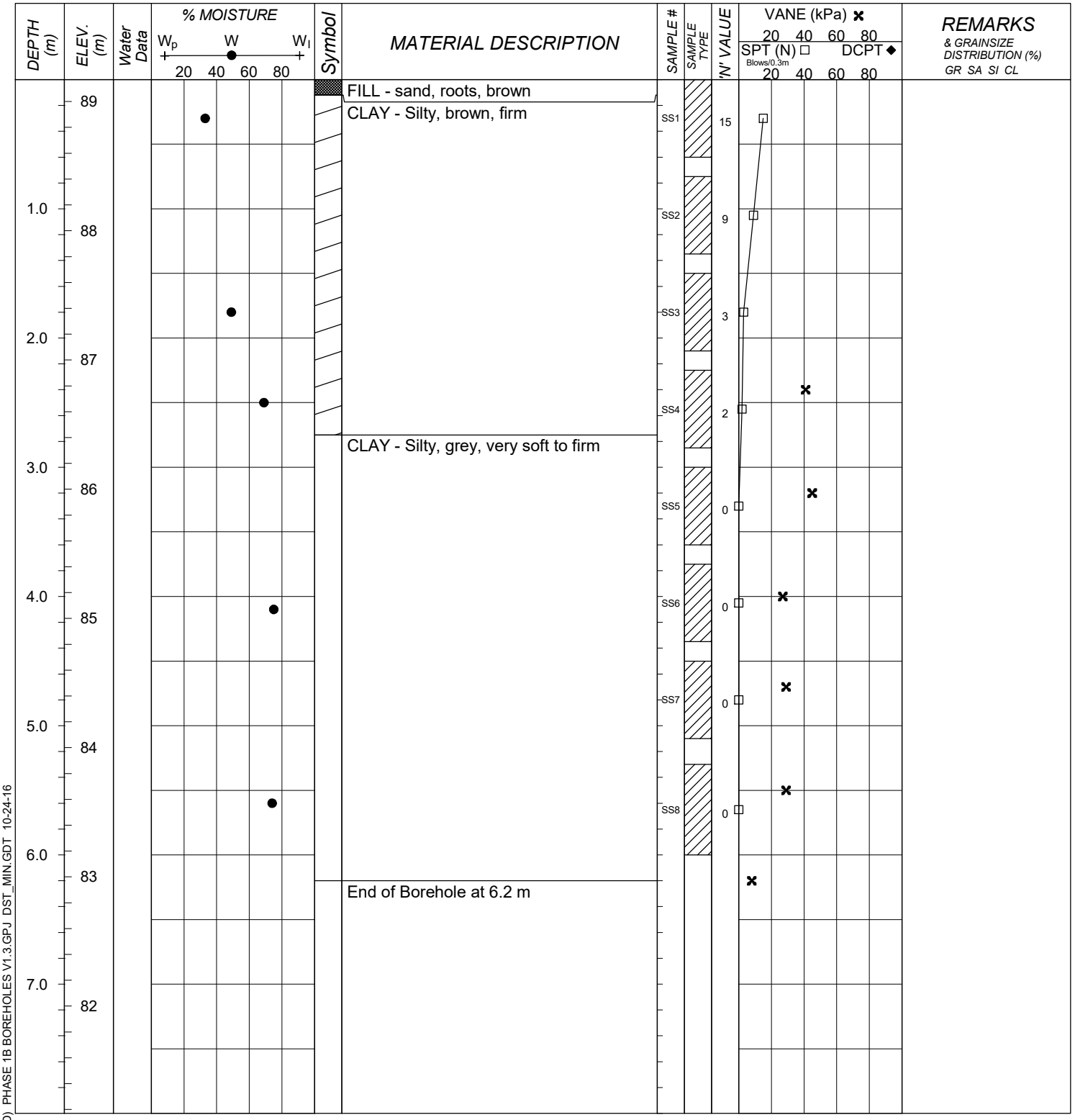
SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-20

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **89.17 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 31, 2016**
COORDINATES: **5034931.51** m N, **372873.56** m E



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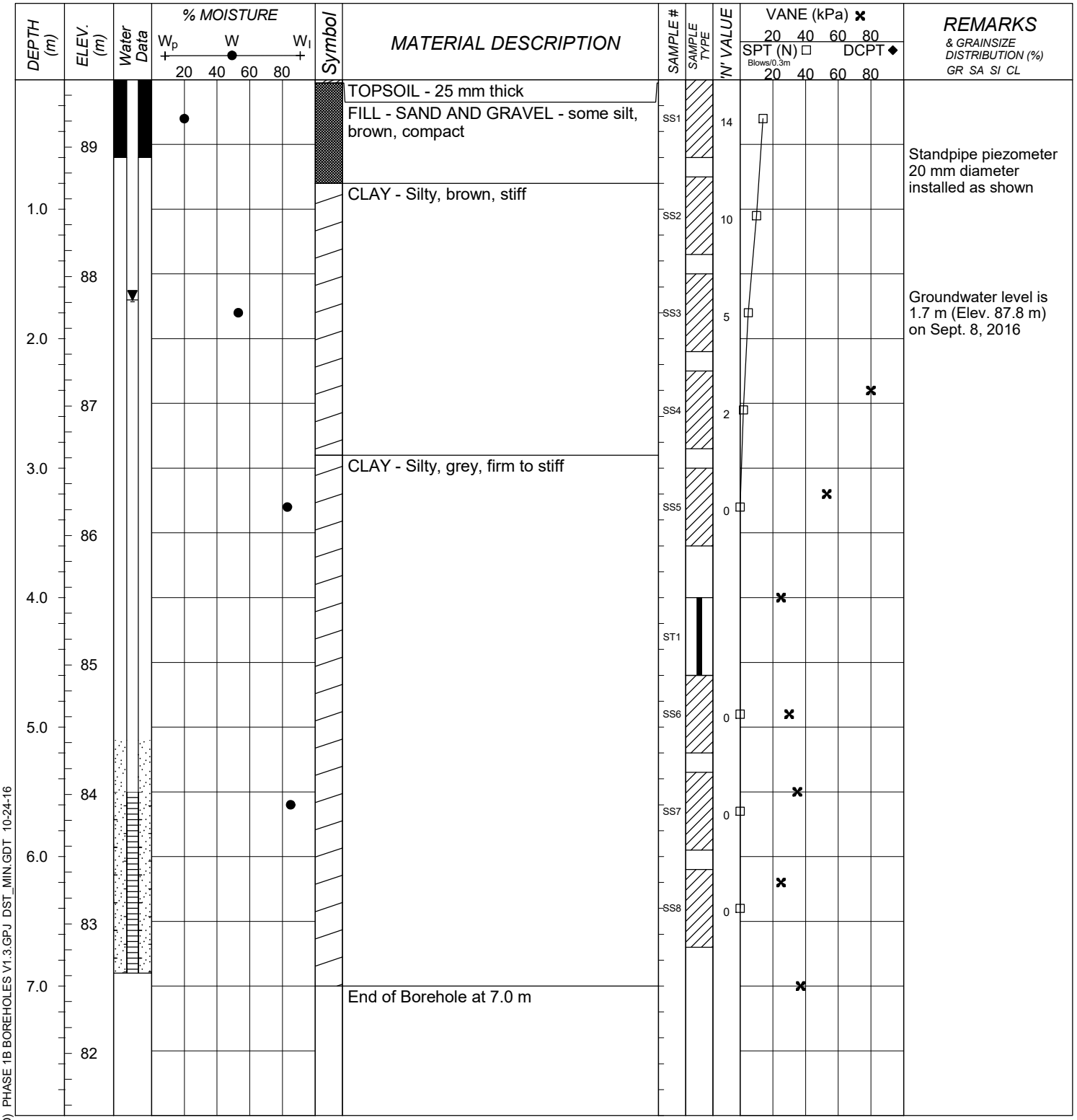
SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-21

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **89.52 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 30, 2016**
COORDINATES: **5034852.08** m N, **372878.12** m E



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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-22

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.37 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5034793.74** m N, **373096.25** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					TOPSOIL - 180 mm thick					
	90				FILL - SAND AND GRAVEL - trace silt, brown, loose	SS1		8		50 43 (7)
1.0					CLAY - silty, brown, stiff	SS2		10		
	89					SS3		3		
2.0										
	88					SS4		0	✖	
3.0					CLAY - Silty, grey, soft to firm	SS5		0	✖	
	87									
4.0						SS6		0	✖	
	86									
						SS7		0	✖	
5.0										
	85					ST1			✖	
6.0										
	84					SS8		0	✖	
7.0										
	83					SS9		0	✖	
					- possible silt at 7.8 m					
					End of Borehole at 7.8 m					

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-23

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.26 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE:
COORDINATES: **5035209.85** m N, **372533.31** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - some clay, trace organics, possible cobbles and boulders, brown, compact to very dense	SS1		10		
1.0	87					SS2		59		
2.0	86					SS3		27		
						SS4		54		
3.0	85				End of Borehole at 2.9 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
4.0	84									
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-24

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.28 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035209.64** m N, **372567.49** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick FILL - SAND AND GRAVEL - brown, loose	SS1		7		
1.0	87					SS2		10		
						SS3		50+		
2.0	86				LIMESTONE BEDROCK - light grey RC1 = 0.94 m TCR = 84% RQD = 64%	RC1				
3.0	85				RC2 = 1.75 m TCR = 97% RQD = 85%	RC2				
4.0	84				End of Borehole at 4.2 m					
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH15-14

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 87.77 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033470.374** m N, **450323.531** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				TOPSOIL ~ 75 mm					
					FILL - SAND AND GRAVEL - silty, brown ~ 100 mm	SS1		6		
1.0					ORGANIC SAND - Silty, some roots and rootlets, black	SS2		50+		
	86				CLAY - Silty, some sand and gravel, brown					
2.0					End of Borehole at 1.1 m. Auger Refusal					
	85									
3.0										
	84									
4.0										
	83									
5.0										
	82									
6.0										
	81									
7.0										
	80									
8.0										
	79									
9.0										
	78									
10.0										
	77									
11.0										
	76									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 15

LOG OF BOREHOLE BH15-15

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 87.76 N/A

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 26, 2015**
COORDINATES: **5033477.421** m N, **450420.068** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ×; SPT (N) □ Blows/0.3m; DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87.76				ASPHALT ~ 150 mm					- 19 mm diameter standpipe piezometer installed as shown
					FILL - SAND - silty, brown, loose	SS1		5		
1.0	87				CLAY - Silty, brown, stiff	SS2		13		
2.0	86				TILL - Sand, silty, some gravel, grey, compact	SS3		50		
					LIMESTONE BEDROCK - Grey to dark grey RC1 - 0.78 m, TCR = 100%, SCR = 78%, RQD = 50%	RC1				
3.0	85									- Groundwater level is 3.27 m (Elev. 84.5 m) on October 1, 2015
					RC2 - 1.45 m, TCR = 98%, SCR = 98%, RQD = 88%	RC2				
4.0	84									
5.0	83				RC3 - 1.60 m, TCR = 92%, SCR = 92%, RQD = 81%	RC4				
6.0	82									
7.0	81				RC4 - 1.52 m, TCR = 97%, SCR = 95%, RQD = 89%	RC3				
8.0	80				RC5 - 0.59 m, TCR = 95%, SCR = 95%, RQD = 69%	RC5				
					End of Borehole at 8.0 m.					
9.0	79									
10.0	78									
11.0	77									
	76									

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 16

LOG OF BOREHOLE BH15-17

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 86.42 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033291.753** m N, **450306.8** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	86				ASPHALT ~ 75 mm					
					FILL - SAND AND GRAVEL - brown and grey, compact	SS1		18		
1.0	85				FILL - CLAY AND SILT - Sandy, some wood pieces, dark brown to black, compact	SS2		10		
2.0	84				CLAY - Silty, brown, hard	SS3		13		
						SS4		13		
3.0	83					SS5		7		
4.0	82	▼								200 × 200 ×
					CLAY - Silty, grey, stiff to very stiff	SS6		1		
5.0	81									
6.0	80					SS7		1		
7.0	79				End of Borehole at 7.3 m.					131 × 122 ×
8.0	78									
9.0	77									
10.0	76									
11.0	75									

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 18

LOG OF BOREHOLE BH15-18

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 87.18 N/A

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 24, 2015**
COORDINATES: **5033318.423** m N, **450416.451** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				TOPSOIL~380 mm	SS1		5		
					FILL - SAND AND GRAVEL - silty, brown, loose					
1.0	86				FILL - SILT AND SAND - trace gravel, rootlets, dark brown, loose	SS2		7		
					CLAY - Silty, brown, stiff	SS3		15		
2.0	85									
						SS4		11		
3.0	84					SS5		8		
					CLAY - Silty, grey, very stiff to hard					200
4.0	83					SS6		3		
										147
5.0	82									129
		▼				SS7		1		
6.0	81									200
					TILL- Sand, silty, some clay and gravel, grey, compact	SS8		12		
7.0	80				LIMESTONE BEDROCK - Grey to dark RC1 - 0.46 m, TCR = 100%, SCR = 65%, RQD = 65%	RC1				
8.0	79				RC2 - 1.37 m, TCR = 91%, SCR = 52%, RQD = 50%	RC2				
9.0	78				SHALE BEDROCK - Black					
					RC3 - 1.39 m, TCR = 84%, SCR = 71%, RQD = 71%	RC3				
10.0	77				End of Borehole at 10.0 m.					
11.0	76									

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BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 19

LOG OF BOREHOLE BH15-19

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 88.25 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 24, 2015**
COORDINATES: **5033321.045** m N, **450560.448** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				TOPSOIL~125 mm					- 19 mm diameter standpipe piezometer installed as shown
					FILL - CLAY AND SILT - trace to some rootlets, brown to dark brown, stiff	SS1		9		
1.0	87				CLAY - Silty, brown, very stiff to hard	SS2		16		
2.0	86					SS3		11		
						SS4		8		
3.0	85					SS5		4		- Groundwater level is 4.22 m (Elev. 84.0 m) on October 1, 2015
4.0	84									172 ×
										200 ×
5.0	83				CLAY - Silty, grey, stiff	SS6		0		
6.0	82					SS7		0		
7.0	81				TILL - Sand, silty, some clay and gravel, grey, loose	SS8		9		
8.0	80				End of Borehole at 7.9 m.					
9.0	79									
10.0	78									
11.0	77									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 20

LOG OF BOREHOLE BH15-20

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 88.69 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 24, 2015**
COORDINATES: **5033318.102** m N, **450672.636** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✕ 20 40 60 80 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				TOPSOIL~150 mm					
					FILL - TOPSOIL, SAND and GRAVEL MIXTURE - trace rootlets, dark brown, compact	SS1		17		
1.0					FILL - SAND AND GRAVEL - brown	SS2		12		
	87				FILL - SILTY CLAY - brown, with 100 mm thick sand and gravel layer with brick fragments at 1.9 m depth, stiff	SS3		13		
2.0										
	86				CLAY - Silty, brown, very stiff to hard	SS4		5		
3.0									✕ 176	
									✕ 200	
	85									
4.0					- with 25 mm thick reddish brown, sand seam at 3.8 m	SS5		2		
					CLAY - Silty, grey, stiff to very stiff					
	84									
5.0										
	83					SS6		0		
6.0										
	82								✕ 102	
7.0						SS7		0		
	81				End of Borehole at 7.5 m.					
8.0										
	80									
9.0										
	79									
10.0										
	78									
11.0										
	77									

REVISION A

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SAMPLE TYPE LEGEND

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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 21

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

LOG OF BOREHOLE BH15-21

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 89.43 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2015**
COORDINATES: **5033311.248** m N, **450878.096** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	89				FILL - SAND AND GRAVEL - brown to grey, compact	SS1		11		- 19 mm diameter standpipe piezometer installed as shown
1.0	88				CLAY - Silty, brown, firm	SS2		8		
2.0	87	▼				SS3		5		
3.0	86				CLAY - Silty, grey, firm to stiff	SS4		3	×	- Groundwater level is 2.40 m (Elev. 87.0 m) on October 1, 2015
4.0	85					SS5		0	×	
5.0	84				End of Borehole at 5.0 m.				×	
6.0	83									
7.0	82									
8.0	81									
9.0	80									
10.0	79									
11.0	78									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 22

LOG OF BOREHOLE BH15-22

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 90.65 N/A

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 24, 2015**
COORDINATES: **5033310.093** m N, **451001.086** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				TOPSOIL ~ 200 mm					
					FILL - SILTY CLAY - some sand, trace gravel, concrete pieces, brown to dark brown, stiff	SS1		11		
1.0					CLAY - Silty, brown, very stiff	SS2		12		
	89				- with trace roots in upper 300 mm	SS3		5		
2.0									180 ×	
	88								151 ×	
3.0					CLAY - Silty, grey, very soft	SS4		2		
	87				TILL - Sand, silty, some clay and gravel, some brown silty clay seams, grey, compact	SS5		13		
4.0										
	86					SS6		14		
5.0										
	85									
6.0						SS7		51		
	84				LIMESTONE BEDROCK - Grey to dark grey RC1 - 0.92 m, TCR = 100%, SCR = 77%, RQD = 86%	RC1				
7.0										
	83									
8.0					RC2 - 1.37 m, TCR = 95%, SCR = 95%, RQD = 87%	RC2				
	82									
9.0					RC3 - 1.12 m, TCR = 100%, SCR = 100%, RQD = 91%	RC3				
	81									
10.0					End of Borehole at 9.7 m.					
	80									
11.0										
	79									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 23

LOG OF BOREHOLE BH15-25

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 90.80 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 23, 2015**
COORDINATES: **5033098.496** m N, **451059.478** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0	90				TOPSOIL ~ 150 mm	SS1		10		- 19 mm diameter standpipe piezometer installed as shown
					ASPHALT ~ 50 mm					
1.0					FILL - SAND - silty, some gravel, brown, loose	SS2		7		
2.0	89	▼			CLAY - Silty, brown, very stiff to hard	SS3		5		- Groundwater level is 1.92 m (Elev. 88.9 m) on October 1, 2015
									191	
									200	
3.0	88				CLAY - Silty, grey, stiff to very stiff	SS4		1		
4.0	87									
5.0	86					SS5		0		
									104	
6.0	85								102	
						SS6		0		
7.0	84								108	
8.0	83					SS7		0		
									122	
9.0	82								122	
						SS8		0		
10.0	81								131	
					End of Borehole at 10.4 m.					
11.0	80									
	79									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 26

LOG OF BOREHOLE BH15-26

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 91.25 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 27, 2015**
COORDINATES: **5033102.941** m N, **451133.099** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	91				TOPSOIL ~ 250 mm					
					FILL - SILT - Clayey, brown and grey, stiff	SS1		8		
1.0	90				CLAY - Silty, brown, very stiff to hard	SS2		9		
						SS3		4		
2.0	89									200
										188
3.0	88				CLAY - Silty, grey, stiff	SS4		0		
4.0	87									
5.0	86					SS5		0		
6.0	85				End of Borehole at 5.8 m.					
7.0	84									
8.0	83									
9.0	82									
10.0	81									
11.0	80									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 27

LOG OF BOREHOLE BH15-32

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 86.60 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2015**
COORDINATES: **5033207.38** m N, **450340.36** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80 / SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	86.60				TOPSOIL ~ 230 mm					
0.2					FILL - SILT AND SAND MIXTURE - some clay and gravel, wood pieces, reddish brown clayey silt pockets, brown, loose	SS1		7		
1.0	86					SS2		5		
1.7	85				CLAY - Silty, brown, very stiff to hard	SS3		7		
2.0										
2.9	84					SS4		4		
3.0									× 200	
3.4									× 196	
3.7	83				CLAY - Silty, grey, very stiff					
4.0						SS5		0		
4.7	82				End of Borehole at 4.7 m.				× 109	
5.0										
	81									
6.0										
	80									
7.0										
	79									
8.0										
	78									
9.0										
	77									
10.0										
	76									
11.0										
	75									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 34

LOG OF BOREHOLE BH15-34

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 88.74 N/A

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2015**
COORDINATES: **5033186.268** m N, **450453.679** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ×; SPT (N) □ Blows/0.3m; DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT ~ 200 mm					- 19 mm diameter standpipe piezometer installed as shown
					FILL - SAND AND GRAVEL - grey - compact (hydrocarbon odour)	SS1		21		
1.0					FILL - SAND AND GRAVEL - silty, brown to dark brown, compact	SS2		11		
	87	▼			FILL - CLAY - silty, some sand and gravel, some black stains, hydrocarbon odour, brown	SS3		7		- Groundwater level is 1.84 m (Elev. 86.9 m) on October 1, 2015
2.0					CLAY - Silty, brown, stiff to hard					
3.0	86					SS4		8		
						SS5		6		
4.0	85					SS6		3	200 ×	
	84								×	
5.0									×	
	83				CLAY - Silty, grey, stiff	SS7		0		
6.0					End of Borehole at 6.2 m.				×	
	82									
7.0										
	81									
8.0										
	80									
9.0										
	79									
10.0										
	78									
11.0										
	77									

REVISION A

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/6/15

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SAMPLE TYPE LEGEND

- Auger Sample
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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 36

LOG OF BOREHOLE BH14-33

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **90.35 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **March 18, 2014**
COORDINATES: **5033187.85** m N, **450939.06** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	90				ASPHALT - 50 mm	AS1				
0.5	89.5				SAND & GRAVEL - trace silt, compact	SS2		12		
1.0	89				SAND - some clay and gravel, trace silt, compact	SS3		11		
2.0	88					ST1				
3.0	87				CLAY - Silty, trace sand, grey, very soft to stiff, high plasticity	SS4		1		
4.0	86					ST2				
5.0	85					SS5		1		
6.0	84					ST3				
7.0	83									
8.0	82					SS6		0		
9.0	81									
10.0	80					SS7		0		
11.0	79									
12.0	78				Start Dynamic Cone Penetration Test (DCPT)					
13.0	77									
14.0	76									
15.0	75									
16.0	74									
17.0	73									
18.0	72									
19.0	71									
20.0	70									
21.0	69									
22.0	68									
23.0	67									
24.0	66									
25.0	65									
26.0	64									
27.0	63									
28.0	62									
29.0	61									
30.0	60									
31.0	59				End of Borehole at 31.4 m					

REVISION 1

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 8

BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

LOG OF BOREHOLE BH14-34

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **89.28 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **March 4, 2014**
COORDINATES: **5033167.08** m N, **450624.26** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	89	▼			TOPSOIL - with grass and roots	AS1				Water level at 2.34 mbgs
0.6					CLAY - Silty, grey, firm to very stiff, high plasticity	SS2		14	>> ✖	115 kPa
1.0	88									
2.0	87					ST1			>> ✖	115 kPa
3.0	86					SS3		3		
4.0	85					ST2				
5.0	84					SS4		1		
6.0	83									
7.0	82					ST3				
8.0	81					SS5		1		
9.0	80					SS6		0		
10.0	79									
11.0	78					ST4				
12.0	77					SS7		0		
13.0	76									
14.0	75					SS8		0		
15.0	74									
16.0	73									
17.0	72					SS9		0		
17.9					End of Borehole at 17.9 m					
18.0	71									
19.0	70									

REVISION A

BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

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SAMPLE TYPE LEGEND

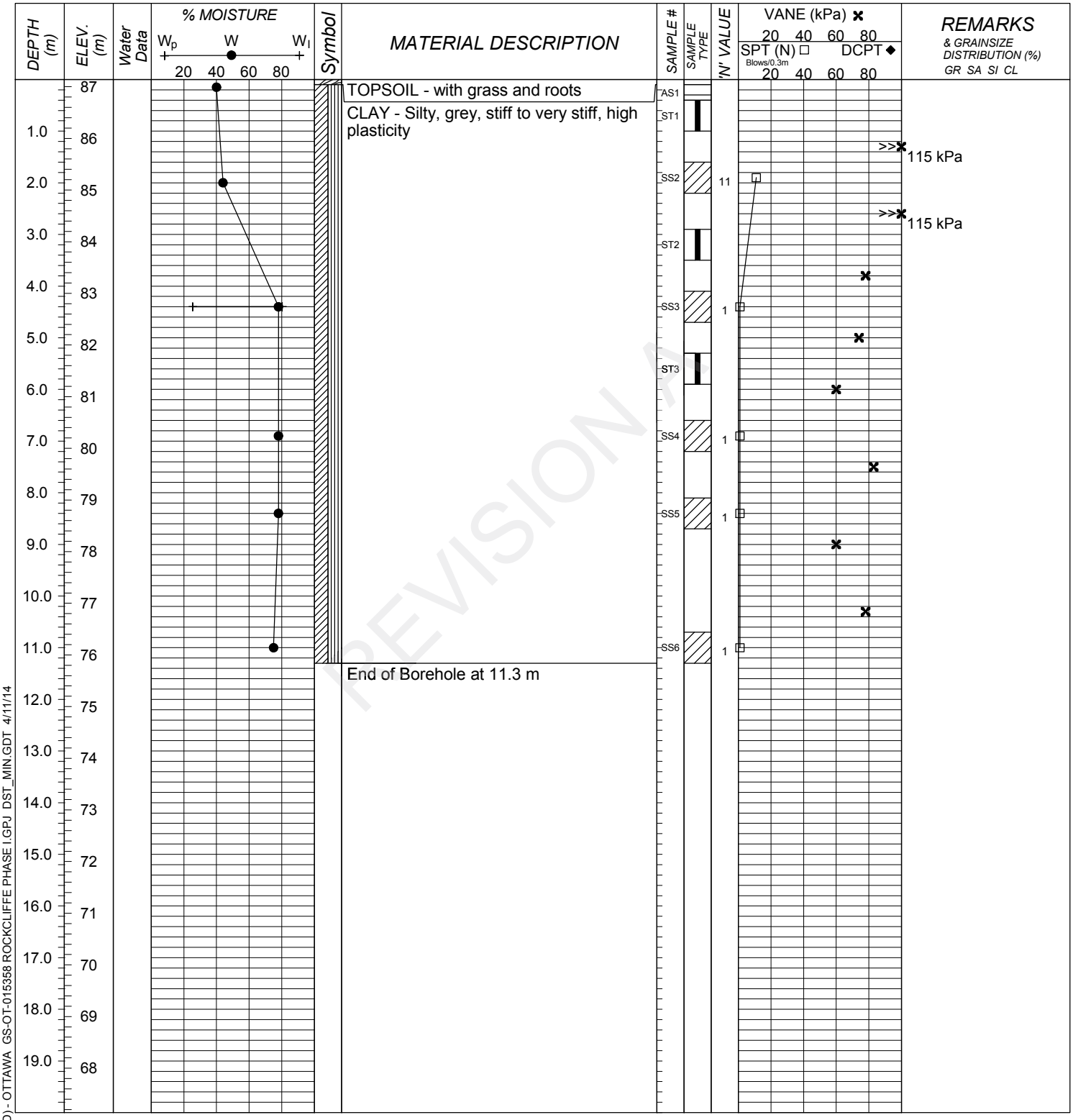
- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 9

LOG OF BOREHOLE BH14-37

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **87.14 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **February 25, 2014**
COORDINATES: **5033135.22** m N, **450324.71** m E



BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 12

LOG OF BOREHOLE BH13-01

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Storm Water Infiltration Ponds**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **87.12 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **August 7, 2013**
COORDINATES: **5033357.4** m N, **450411** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				ORGANICS - Grass and Roots					
					SAND - some roots, trace clay, compact					
					SAND - Silty, some clay, compact	SS1		10		
1.0	86				CLAY - Silty, dark grey, stiff	SS2		13		
						SS3		11		
2.0	85								✖	
						SS4		8		
3.0	84								✖	
4.0	83					SS5		1		
4.4					End of Borehole at 4.4 m					
5.0	82									

REVISION A

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 1

BOREHOLE (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 5/6/14

LOG OF BOREHOLE BH13-02

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **87.08 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **August 7, 2013**
COORDINATES: **5033403.6** m N, **450399.3** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				SAND - Silty, some gravel and clay, dark brown, compact	SS1		10		Water level at 2.97 mbgs on completion
1.0	86				CLAY - Silty, trace sand, grey, stiff	SS2		11		
2.0	85					SS3		14		
										10 59 (31)
3.0	84				SAND - with clay, some gravel, trace silt	SS4		100+		
					End of Borehole at 3.0 m Auger Refusal					
4.0	83									
5.0	82									
6.0	81									
7.0	80									
8.0	79									
9.0	78									
10.0	77									
11.0	76									
12.0	75									
13.0	74									
14.0	73									

REVISION A

BOREHOLE (STANDARD) OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/11/13

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

ENCLOSURE 2

LOG OF BOREHOLE BH13-03

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **88.04 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **August 7, 2013**
COORDINATES: **5033186.8** m N, **450482.5** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				SAND - Silty, some roots, trace gravel, dark brown, loose	SS1		9		4 87 (10)
1.0	87				CLAY - Silty, trace sand, dark grey, firm to stiff	SS2		8		Water level at 1.59 mbgs on completion
2.0	86					SS3		8	✖	
3.0	85					SS4		4	✖	
4.0	84					SS5		1		
4.6	83.4				End of Borehole at 4.6 m					
5.0	83									
6.0	82									
7.0	81									
8.0	80									
9.0	79									
10.0	78									
11.0	77									
12.0	76									
13.0	75									
14.0	74									

REVISION A

BOREHOLE (STANDARD) OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/11/13

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

ENCLOSURE 3

LOG OF TESTPIT TP13-09

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **87.45 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/9/2013**
COORDINATES: **5033428.8** m N, **450315.2** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH(m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) / CPT (kPa) ◆ (300 600 900 1200)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.2					FILL - SAND - some gravel, trace roots, dark brown					
0.4	87				FILL - SAND & GRAVEL - with cobbles and boulders, brown					
0.6										
0.8										
1.0						1				
1.2										
1.4	86									
1.6										
1.8					FILL - SAND - Silty, some gravel					
2.0						2				
2.2					End of Testpit at 2.1 m Refusal					
2.4	85									
2.6										
2.8										
3.0						3				
3.2										
3.4	84									
3.6										
3.8										
4.0						4				
4.2										
4.4	83									
4.6										
4.8										

REVISION A

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 9

LOG OF TESTPIT TP13-10

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **87.76 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/4/2013**
COORDINATES: **5033403.6** m N, **450499.2** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH(m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / CPT (kPa) ◆ 300 600 900 1200	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.2					FILL - SAND & GRAVEL - some silt, trace clay and roots, brown					
0.4										
0.6					FILL - SAND - some cobbles, light brown					
0.8	87				CLAY - Silty, some sand and gravel, brown, stiff					
1.0					CLAY - Silty, grey, stiff	1				
1.2										
1.4										
1.6										
1.8	86									
2.0						2				
2.2										
2.4										
2.6										
2.8	85				End of Testpit at 2.7 m					
3.0						3				
3.2										
3.4										
3.6										
3.8	84									
4.0						4				
4.2										
4.4										
4.6										
4.8	83									

REVISION A

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 10

LOG OF TESTPIT TP13-12

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **87.85 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/4/2013**
COORDINATES: **5033311.1** m N, **450531.3** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH(m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / CPT (kPa) ◆ 300 600 900 1200	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0					FILL - SAND - some roots and gravel, trace silt, cobbles and asphalt, brown					
0.4					CLAY - Silty, some sand and gravel, brown					
0.6					CLAY - Silty, grey,					
0.8	87									
1.0						1				
1.2										
1.4										
1.6					- very stiff					
1.8	86									
2.0						2				
2.2										
2.4										
2.6										
2.8	85									
3.0					End of Testpit at 3.0 m	3				
3.2										
3.4										
3.6										
3.8	84									
4.0						4				
4.2										
4.4										
4.6										
4.8	83									

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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 12

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

LOG OF TESTPIT TP13-13

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **89.82 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/9/2013**
COORDINATES: **5033149** m N, **450799.4** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (Wp, W, Wl; 20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / CPT (kPa) ◆ 300 600 900 1200	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0					ASPHALT - 76 mm					Water level at 1.8 m on completion
0.2					FILL - SAND & GRAVEL					
0.4					CLAY - Silty, trace roots, grey					
0.6										
0.8	89									
1.0						1				
1.2										
1.4										
1.6									>>✖	130+ kPa
1.8	88	▼							✖	94 kPa
2.0						2				
2.2										
2.4										
2.6										
2.8	87				End of Testpit at 2.7 m					
3.0						3				
3.2										
3.4										
3.6										
3.8	86									
4.0						4				
4.2										
4.4										
4.6										
4.8	85									

REVISION A

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 13

LOG OF BOREHOLE BH7

DST REF. No.: **OG06562**
CLIENT: **Canada Lands Company**
PROJECT: **Preliminary Geotechnical Investigation**
LOCATION: **CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **88.88 m (Geodetic)**

Drilling Data
METHOD: **CME 75 Drill Rig**
DIAMETER: **200 mm**

DATE: **August 14 2006**

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE TYPE	'N' VALUE	VANE DATA (KPA)× 100 200 300 400 SPT (N)□ DCPT◆ 10 20 30 40	REMARKS
0	88				GRASS COVER					
					CLAY - silty, very stiff to soft, olive grey					Standpipe with a diametre of 20 mm installed to 7.8 m depth.
1						SS1		15		
										Groundwater level recorded at 1.8 m depth on August 24, 2006.
2	87									
						S2				Shelby sample taken between 2.1 m and 2.7 m depth.
3	86									
						SS3		1		
4	85									
						S4				Shelby sample taken between 4.1 m and 4.7 m depth.
5	84				SAND - silty, trace gravel, compact, grey (till)					
						SS5		17		Auger refusal at 5.8 m depth.
						SS6		100	>>	
6	83				BEDROCK - grey crystalized limestone bedrock	CR7				Recovery 100% RQD 94%
7	82					CR8				Recovery 97% RQD 97%
8	81				End of borehole at 7.8 m depth.					
9	80									
	79									

REVISION

OG06562.GPJ DST_MIN.GDT 10/3/06

BOREHOLE (STANDARD)

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Thin Wall Tube
- Rock Core
- Side Sampler
- Grab Sample
- Ponar Sample

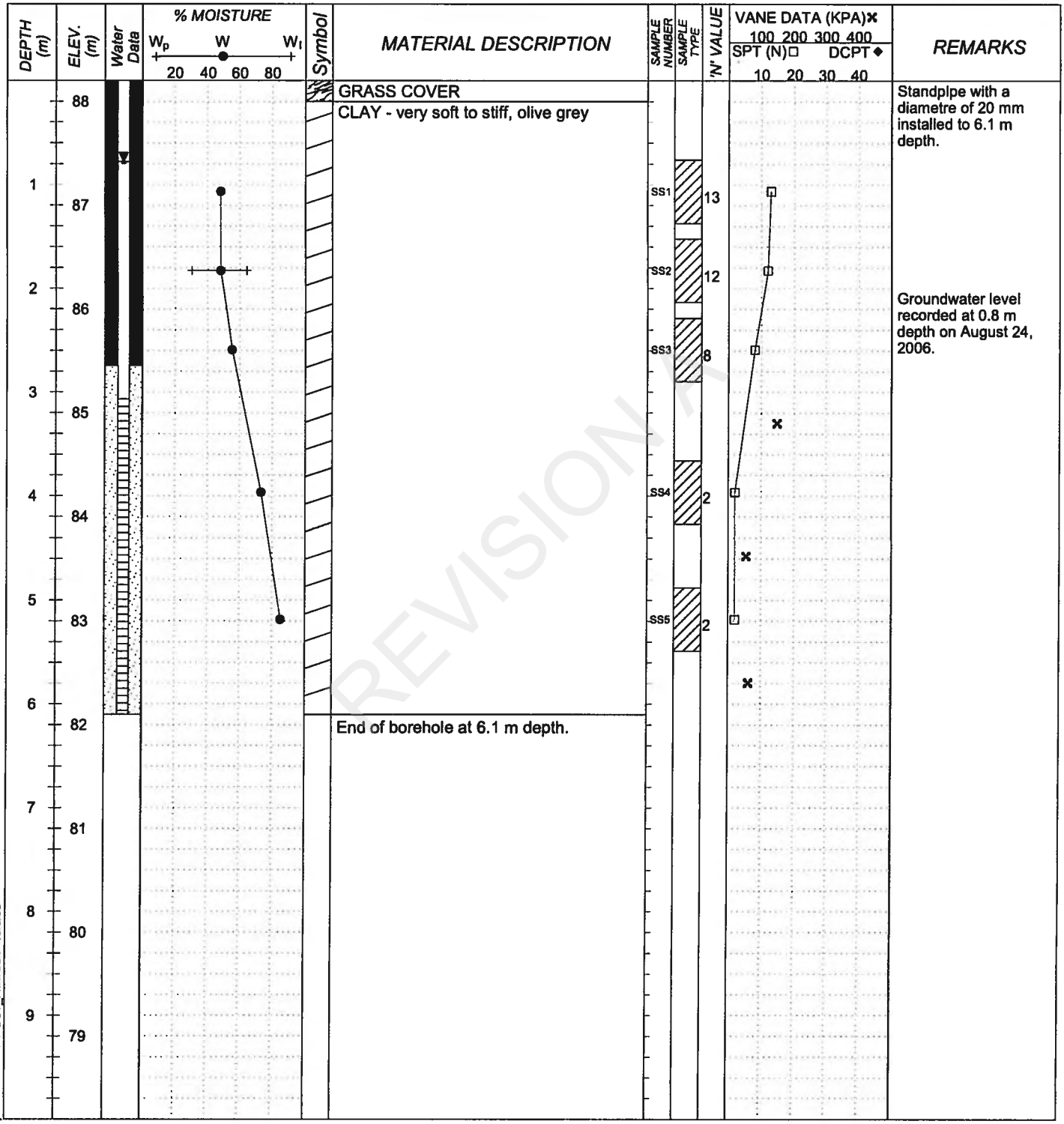
APPENDIX D

LOG OF BOREHOLE / MONITORING WELL BHMW11

DST REF. No.: **OG06562**
CLIENT: **Canada Lands Company**
PROJECT: **Preliminary Geotechnical Investigation**
LOCATION: **CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **88.20 m (Geodetic)**

Drilling Data
METHOD: **CME 75 Drill Rig**
DIAMETER: **200 mm**

DATE: **August 14 2006**



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BOREHOLE (STANDARD) OG06562.GPJ DST_MIN.GDT 10/3/06

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Thin Wall Tube
- Rock Core
- Side Sampler
- Grab Sample
- Ponar Sample

APPENDIX D

LOG OF BOREHOLE / MONITORING WELL BHMW1

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 25 2004**

CCGD * O RKI EAGLE (PPM) 20 40 60 80 □ MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						ASPHALT - 100 mm				Groundwater level observed 1.6m below grade on November 25, 2004.
						FILL - sand, some gravel, trace silt, compact, brown				
		SS1		25			0.5			
						CLAY - silty, stiff to soft, olive grey				
O	15	SS2		20			1.0			
O	15	SS3		11			1.5			
O	20	SS4		11			2.0			
O	10	SS5		8			2.5			
O	35	SS6		3			3.0			
O	15	SS7		2			3.5			
O	10	SS8		2			4.0			
						End of borehole at 4.9 m depth.	4.5			

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

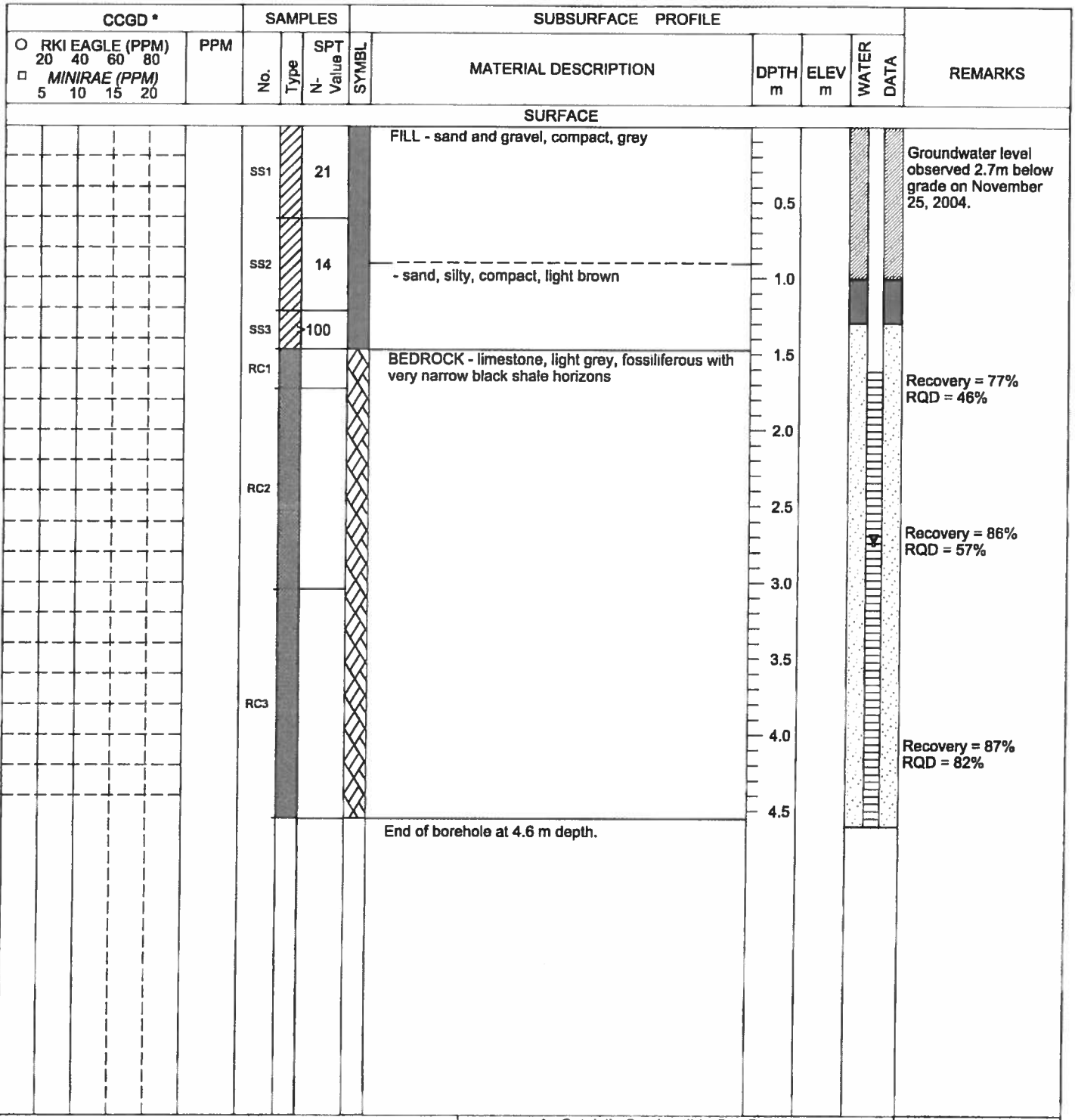
GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

LOG OF BOREHOLE / MONITORING WELL BHMW2

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 26 2004**



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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW3

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 27 2004**

CCGD * O RKI EAGLE (PPM) 20 40 60 80 □ MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
		SS1		>100		FILL - sand and gravel, very dense, grey - sand, silty, brown	0.5			Groundwater level observed 2.4 m below grade on November 25, 2004.
O	10	SS2		16		CLAY - silty, stiff, olive grey	1.0			
		SS3		>100			1.5			
		RC1				BEDROCK - limestone, fossiliferous, bedding at 90° to core axis				Recovery = 53% RQD = 0%
		RC2					2.5			Recovery = 87% RQD = 65%
		RC3					4.0			Recovery = 87% RQD = 75%
						End of borehole at 4.7 m depth.	4.5			

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW4

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 25 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
O RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
		SS1		27		SILT - clayey, compact, brown				Groundwater level observed 2.3 m below grade on November 25, 2004.
						GRAVEL AND COBBLES	0.5			
		SS2		>100		BEDROCK - Limestone, bedding at 90° to core axis with narrow black shale horizons	1.0			Recovery = 100% RQD = 87%
							1.5			
							2.0			Recovery = 80% RQD = 50%
							2.5			
							3.0			Recovery = 84% RQD = 84%
							3.5			
							4.0			Recovery = 90% RQD = 80%
							4.5			
						End of borehole at 4.7 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW5

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 27 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
		SS1		27		FILL - sand and gravel, compact to very dense, light brown	0.5			36 mm concrete slab
		SS2		>100			1.0			Groundwater level observed 2.7 m below grade on November 25, 2004.
		SS3		>100		- sand, silty, trace brick cinders, very dense, brownish grey	1.5			
		SS4		>100		TILL - sand, silty, trace clay and gravel, very dense to compact with depth, light brown	2.0			
		SS5		78			2.5			
		SS6		33			3.0			
		SS7		27			3.5			
	10						4.0			
						End of borehole at 4.3 m depth.				

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Power Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW6

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 11 2004**

CCGD * O RKI EAGLE (PPM) 20 40 60 80 □ MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						GRASS COVER				
	0	SS1		9		FILL - sand, silty, some gravel, trace clay, loose to compact, dark brown	0.5			Groundwater level observed 3.2 m below grade on November 25, 2004.
	0	SS2		21		- sand, some gravel, compact, orange brown	1.0			
	0	SS3		16		CLAY - silty, trace sand, very stiff to hard, brownish grey with limonite staining	1.5			
						- olive grey	2.0			
	0	SS4		48		- boulders	2.5			
	0	SS5		22		SAND - silty, some clay, compact to very dense, light brown	3.0			SS6: Insufficient sample recovery to collect duplicate fraction for CCGD
		SS6		89			3.5			
						End of borehole at 3.7 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

LOG OF BOREHOLE / MONITORING WELL BHMW7

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 11 2004**

CCGD *	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
O RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20										
						SURFACE				
		SS1		10		FILL - sand and gravel, some silt, loose, brown	0.5			Groundwater level observed 2.1 m below grade on November 25, 2004.
		SS2		13		- clay, sandy, some silt, compact, olive grey	1.0			
O	55	SS3		5		- silt, clayey, some sand, trace gravel, loose, brown	1.5			
O	5	SS4		5		CLAY - silty, firm to stiff, olive grey	2.0			
O	5	SS5		12			2.5			
O	5	SS6		10			3.0			
O	0	SS7		12			3.5			
O	70	SS8		12		- clayey sand layer ~20 cm thick	4.0			
		SS9		100		- trace cobbles	4.5			Strong petroleum hydrocarbon odour noted
						End of borehole at 5.2 m depth.	5.0			Sheen noted on water

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SAMPLE TYPE LEGEND

Auger Sample; Split Spoon Sample; Thin Wall Tube; Rock Core; Side Sampler; Grab Sample; Ponar Sample

APPENDIX H

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/08

LOG OF BOREHOLE / MONITORING WELL BHMW8

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 11 2004**

CCGD * RKI EAGLE (PPM) 20 40 60 80 / MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
	70	SS1		17		ASPHALT - ~100 mm thick FILL - sand and gravel, some silt, compact				Groundwater level observed 2.0 m below grade on November 25, 2004.
	310	SS2		18		CLAY - silty, very stiff to stiff, olive grey	0.5			
	>1000	SS3		13			1.0			Petroleum hydrocarbon odour noted
	30	SS4		22			1.5			
	10	SS5		11			2.0			
	50	SS6		9			2.5			
	20	SS7		8			3.0			
	0	SS8		11			3.5			
						End of borehole at 4.9 m depth.	4.0			
							4.5			

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Poner Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW9

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 12 2004**

CCGD * RKI EAGLE (PPM) 20 40 60 80 / MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						ASPHALT - ~100 mm thick				
						FILL - sand and gravel, some silt, compact to loose				Groundwater level observed 1.5 m below grade on November 25, 2004.
	0	SS1		23			0.5			
	10	SS2		8		- sand, silty, some clay	1.0			Black staining noted. Light odour.
						CLAY - silty, olive grey, stiff to soft, with depth				
	5	SS3		10			1.5			
	0	SS4		17			2.0			
	5	SS5		7			2.5			
	0	SS6		5			3.0			
	5	SS7		4			3.5			
	0	SS8		2			4.0			
	0	SS9		3			4.5			
	0	SS10		1			5.0			
							5.5			
						End of borehole at 6.1 m depth.	6.0			

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW11

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 12 2004**

CCGD * RKI EAGLE (PPM) 20 40 60 80 / MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						GRASS COVER				
	0	SS1		8		FILL - sand, some silt, trace gravel, organics to 0.2 m depth, loose, brown	0.5			Groundwater level observed 5.8 m below grade on November 25, 2004.
	0	SS2		12		- silt, sandy, trace gravel, compact, brown	1.0			
	0	SS3		12		- silt, sandy, trace clay, some gravel, grading to sandy silt with depth, dense to very dense with depth	1.5			
	0	SS4		36			2.0			
	0	SS5		49			2.5			
		SS6		78			3.0			
						TILL - sandy silt, trace clay and gravel, very dense, grey	3.5			
						BEDROCK - limestone, grey, fossiliferous with bedding noted at 90° to core axis.				
		RC1					4.0			Recovery = 67% RQD = 48%
							4.5			
		RC2					5.0			Recovery = 88% RQD = 87%
							5.5			
		RC3					6.0			Recovery = 100% RQD = 92%
						End of borehole at 6.1 m depth.				

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

DST CONSULTING ENGINEERS
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW25

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45c Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **February 01 2005**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
	0	SS1		17		FILL - sand, some gravel, trace silt and brick, compact, yellowish orange	0.5			
	0	SS2		4		- sand, silty, trace gravel, loose	1.0			
	0	SS3		3		- sand, silty, loose to compact with depth	1.5			
	0	SS4		5			2.0			
	0	SS5		16		- redish brown	2.5			
	35	SS6		19		TILL - sand, some gravel, compact, grey	3.0			Groundwater level observed 2.7 m below grade on February 2, 2005.
	5	SS7		41		- silt, trace gravel, grey, dense	3.5			
						End of borehole at 4.2 m depth on possible bedrock.	4.0			

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Email: ottawa@dstgroup.com
Web: www.dstgroup.com

* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Poner Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

LOG OF BOREHOLE / MONITORING WELL BHMW26

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45c Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **February 01 2005**

CCGD * RKI EAGLE (PPM) 20 40 60 80 / MINIRAE (PPM) 5 10 15 20	PPM	SAMPLES No.	Type	SPT N-Value	SUBSURFACE PROFILE SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
	0	SS1		21		FILL - sand, some silt, compact, brown	0.5			
	5	SS2		15		- silt, sandy, compact, brown	1.0			
	0	SS3		10		- sand, silty, compact, dark brown	1.5			
		SS4		5			2.0			
		SS5		7		- gravel, trace sand, loose, grey	2.5			Groundwater level observed 2.6 m below grade on February 2, 2005.
		SS6		4			3.0			
							3.5			
	0	SS7		3			4.0			
		SS8		>100		TILL - silt, some gravel, trace clay, very dense, grey	4.5			
						End of borehole at 4.6 m depth on possible bedrock.				

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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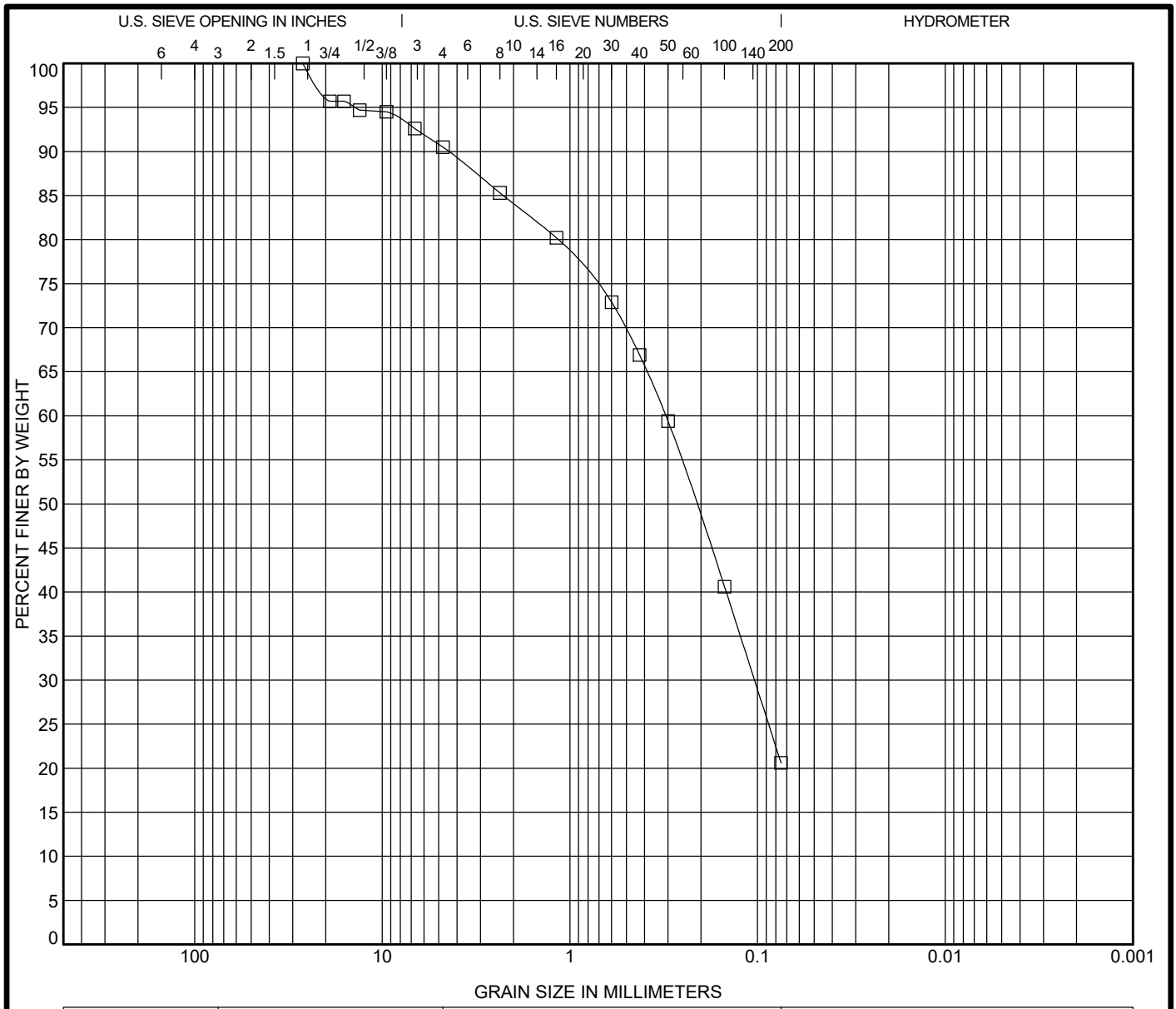
* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-01, SS6, Depth: 3.8 - 4.4 m**
	Date started:
	Date completed:

DST consulting engineers

DST Consulting Engineers
2150 Thurston Drive
Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

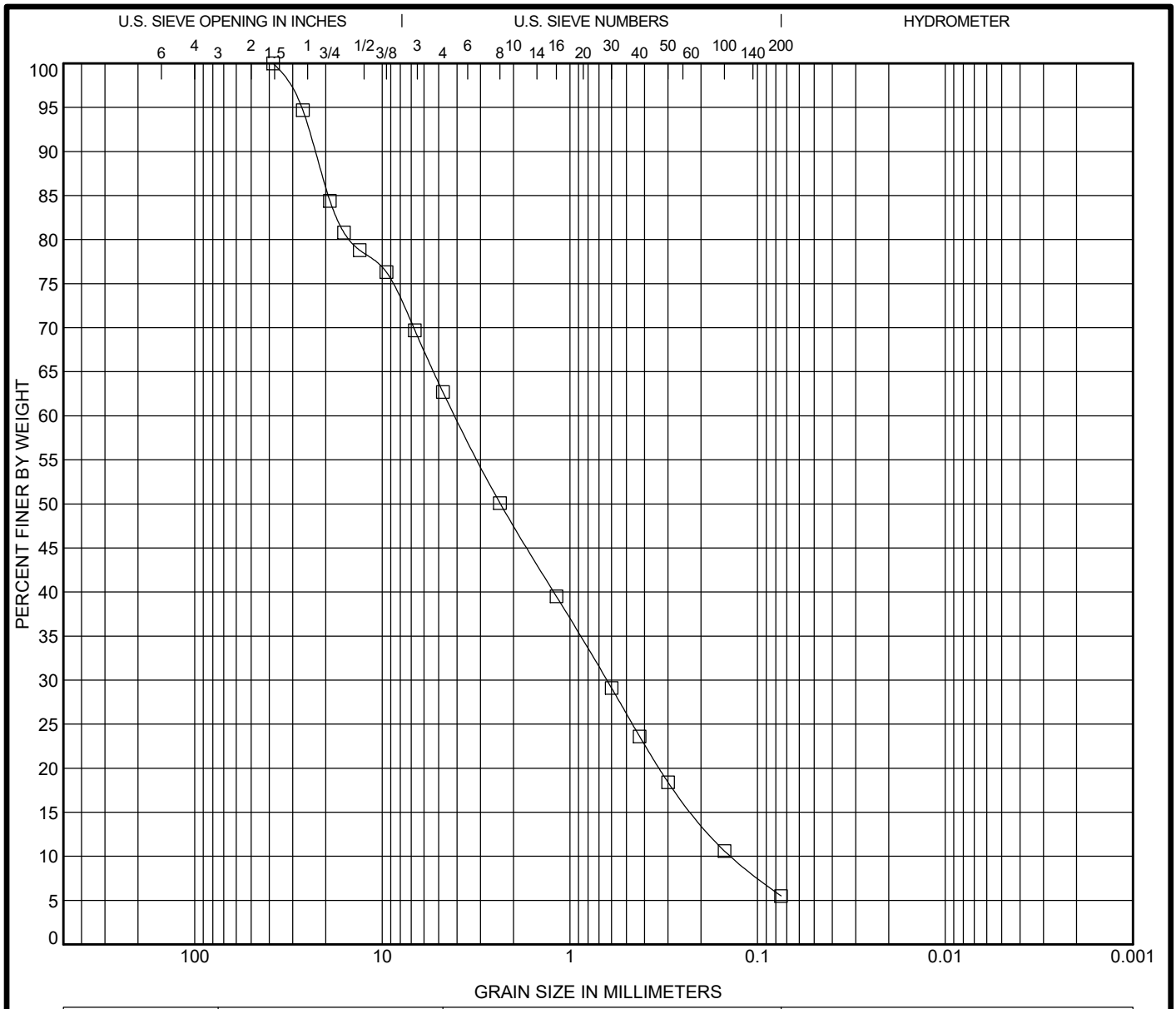
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-01(SS-6) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-02, SS-1, Depth: 0.1 - 0.7 m**
	Date started:
	Date completed:

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2150 Thurston Drive
Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

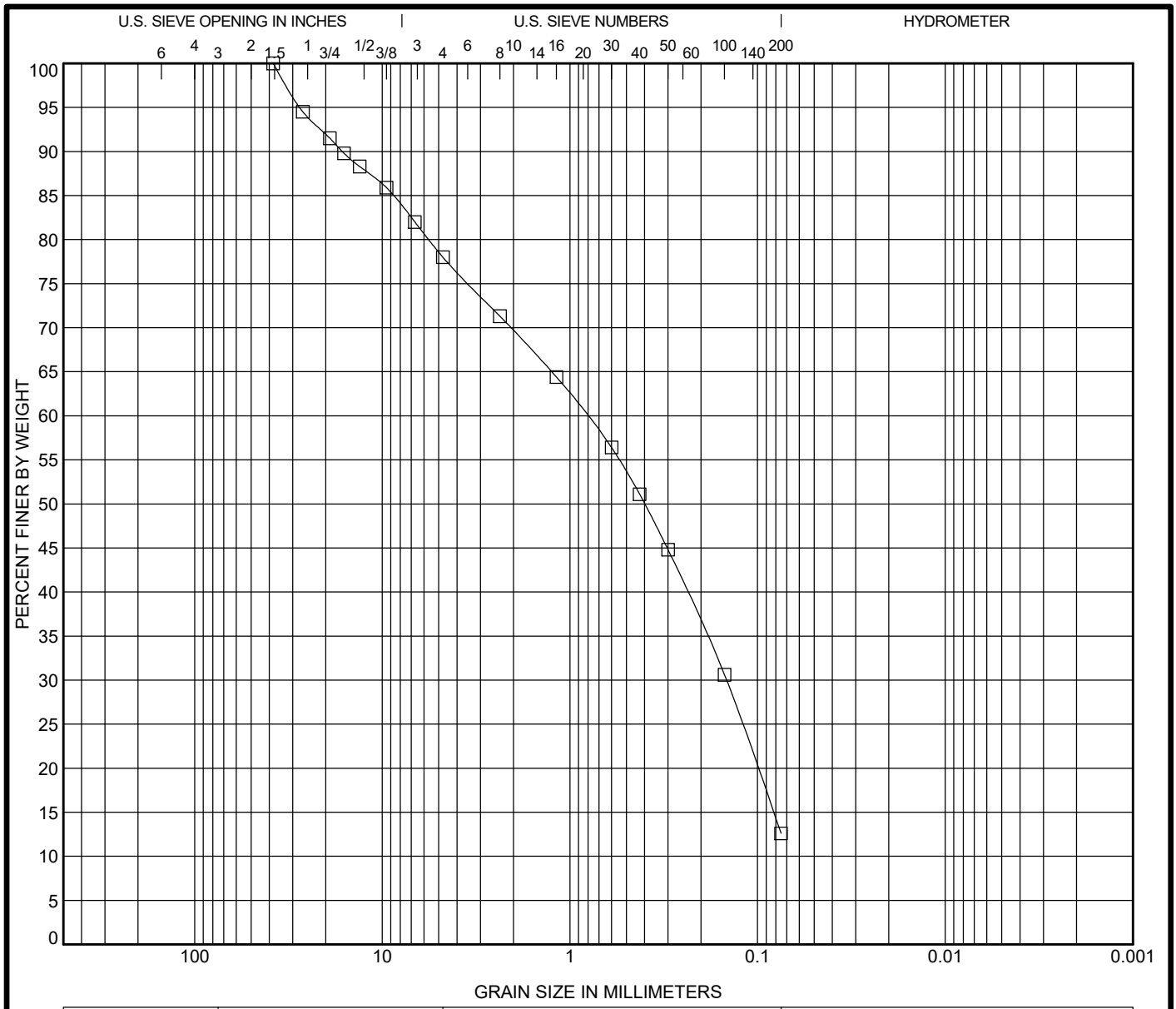
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-02(SS-1) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-02, SS-3, Depth: 1.5 - 2.1 m**
	Date started:
	Date completed:

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2150 Thurston Drive
Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

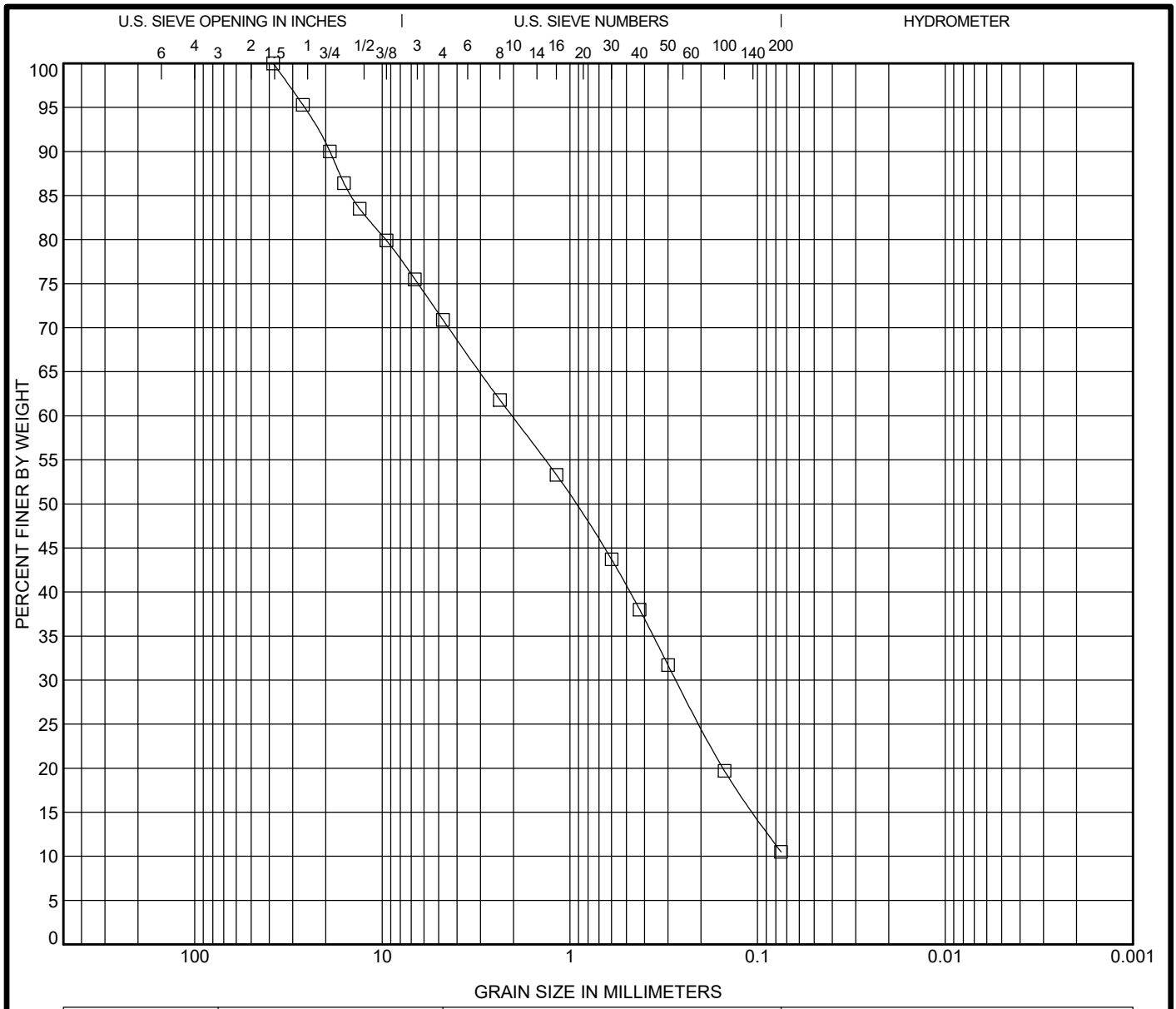
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-02(SS-3) V1.1.GPJ_DST_MIN.GDT_10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-02, SS-4, Depth: 2.3 - 2.9 m**
	Date started:
	Date completed:

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Ottawa, Ontario K1G 5T9
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Fax: (613) 748-1356

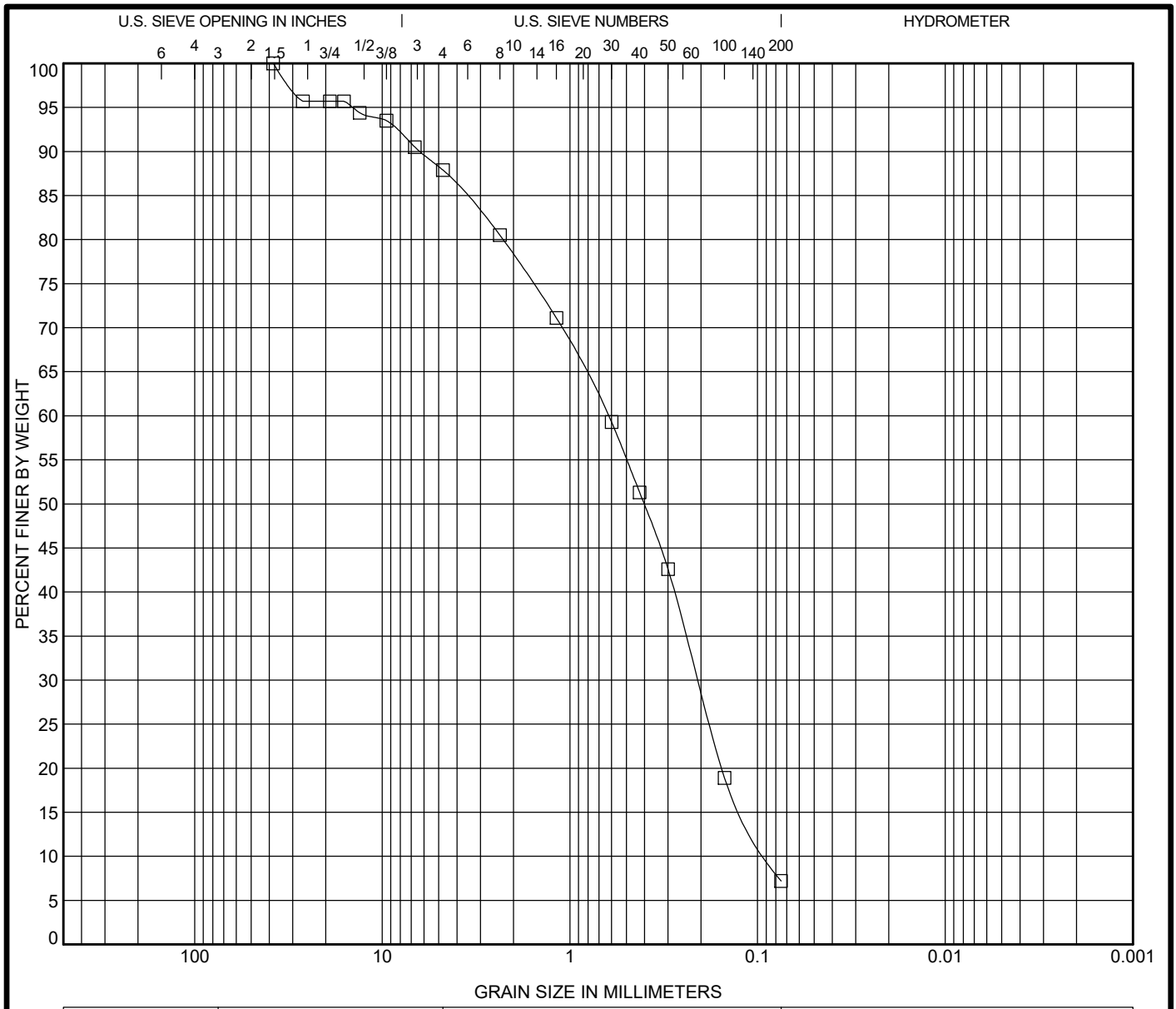
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-02(SS-4) V1.1.GPJ_DST_MIN.GDT_10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-05, SS-3, Depth: 1.5 - 2.1 m**
	Date started:
	Date completed:

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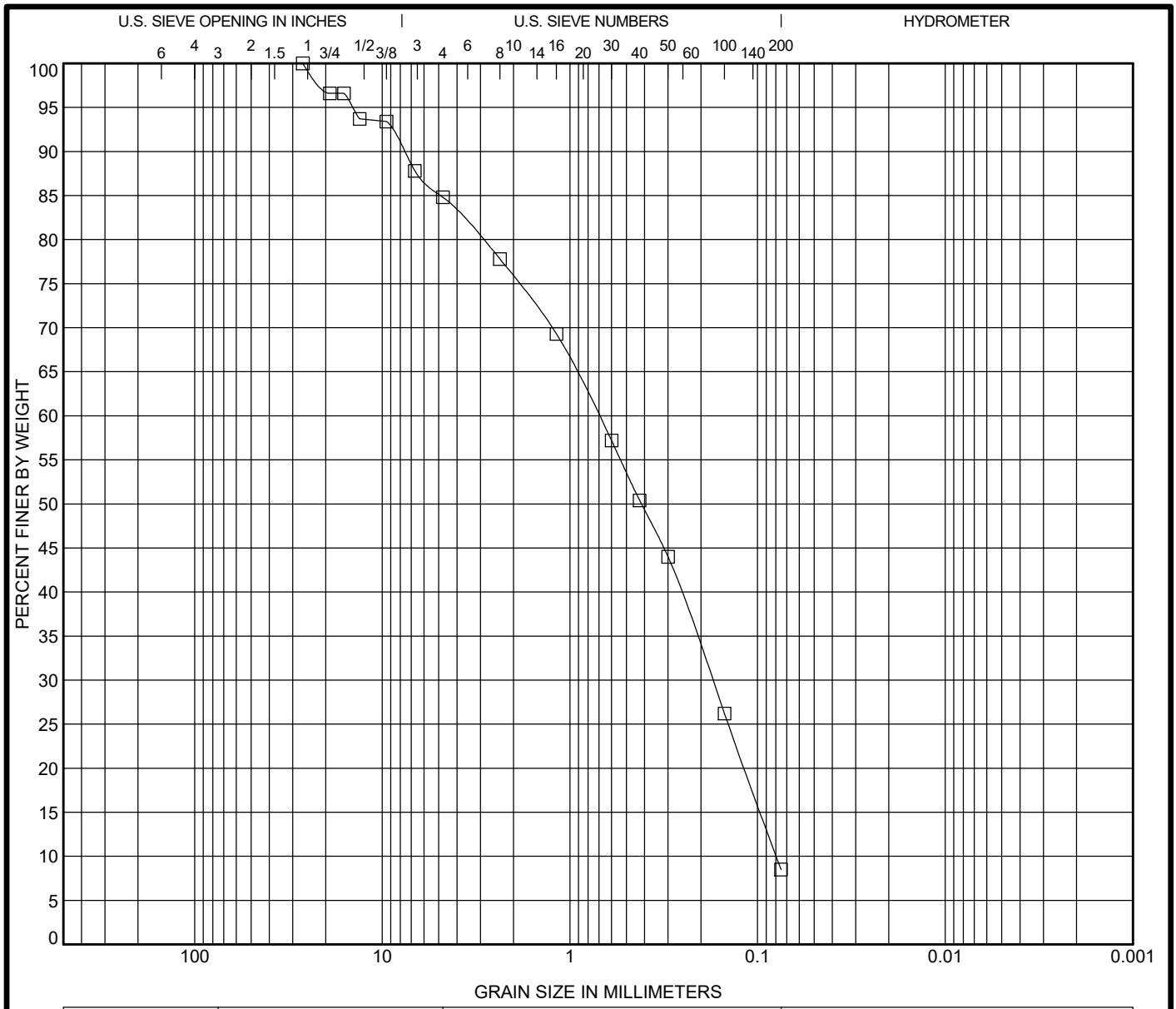
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-05(SS-3) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-06, SS-4, Depth: 2.3 - 2.9 m**
	Date started:
	Date completed:

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Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

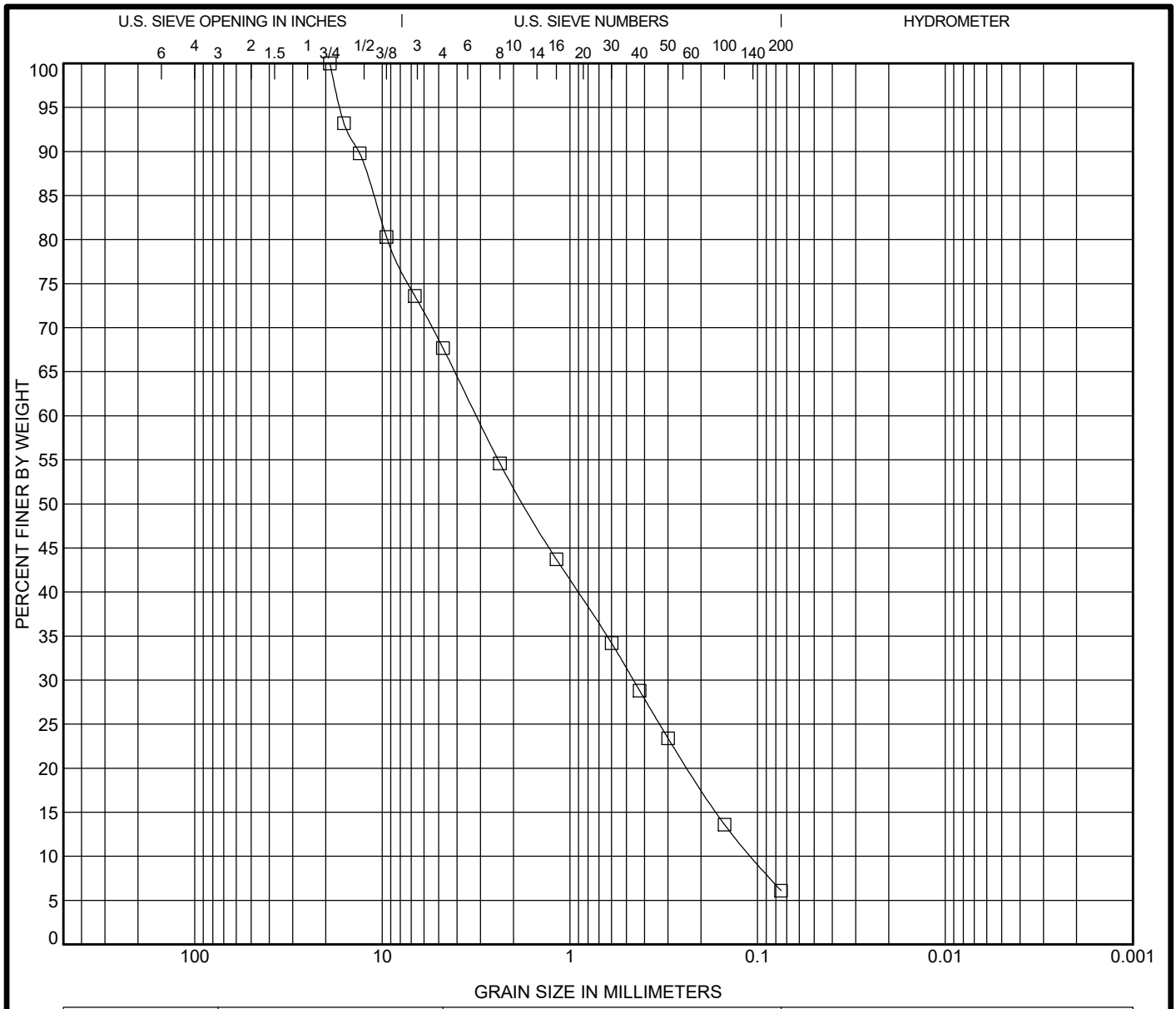
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-06(SS-4) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-07, SS-1, Depth: 0.0 - 0.6 m**
	Date started:
	Date completed:

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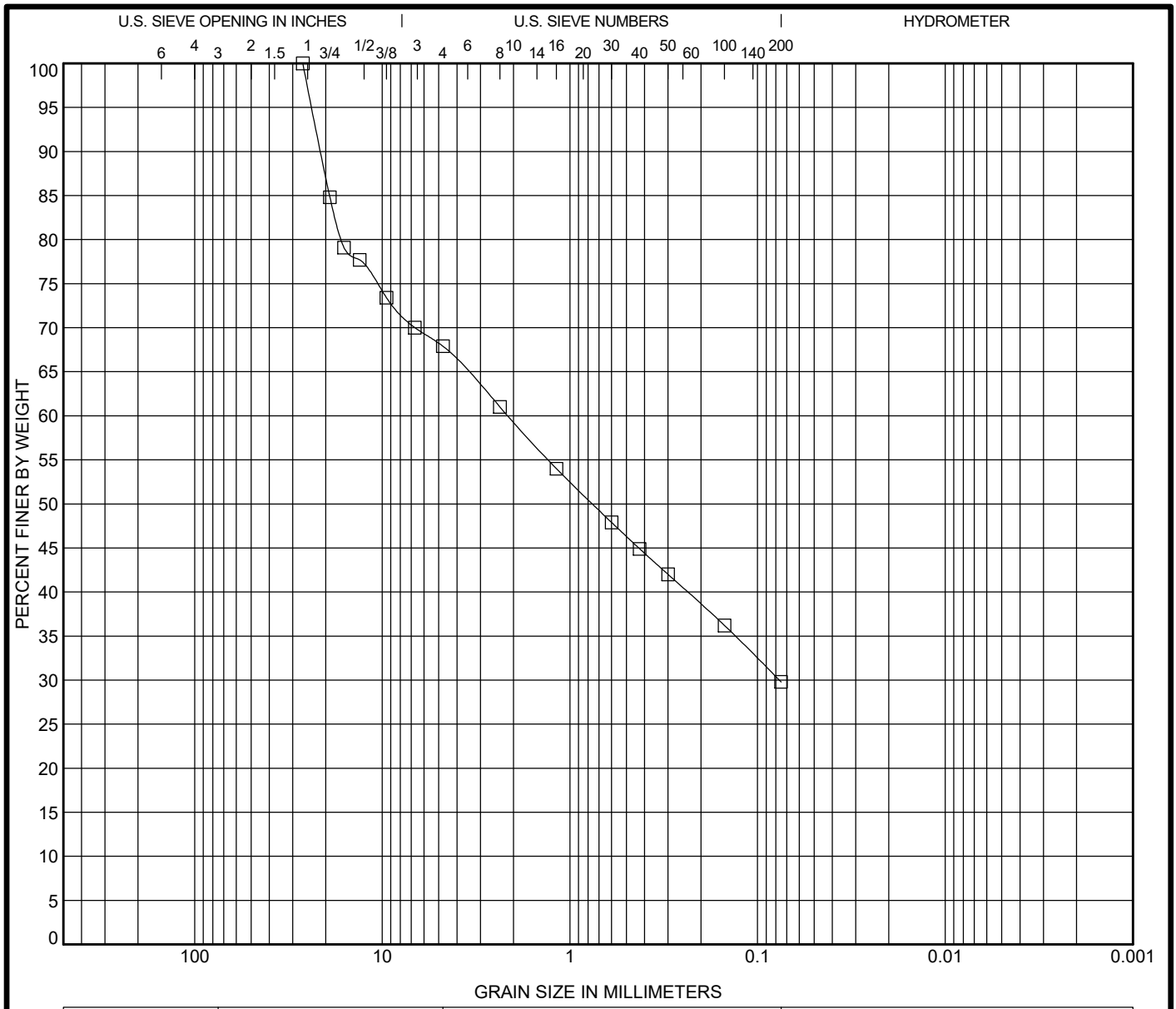
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-07(SS-1) V1.1.GPJ_DST_MIN.GDT_10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-09, SS-2, Depth: 0.8 - 1.4 m**
	Date started:
	Date completed:

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Ottawa, Ontario K1G 5T9
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Fax: (613) 748-1356

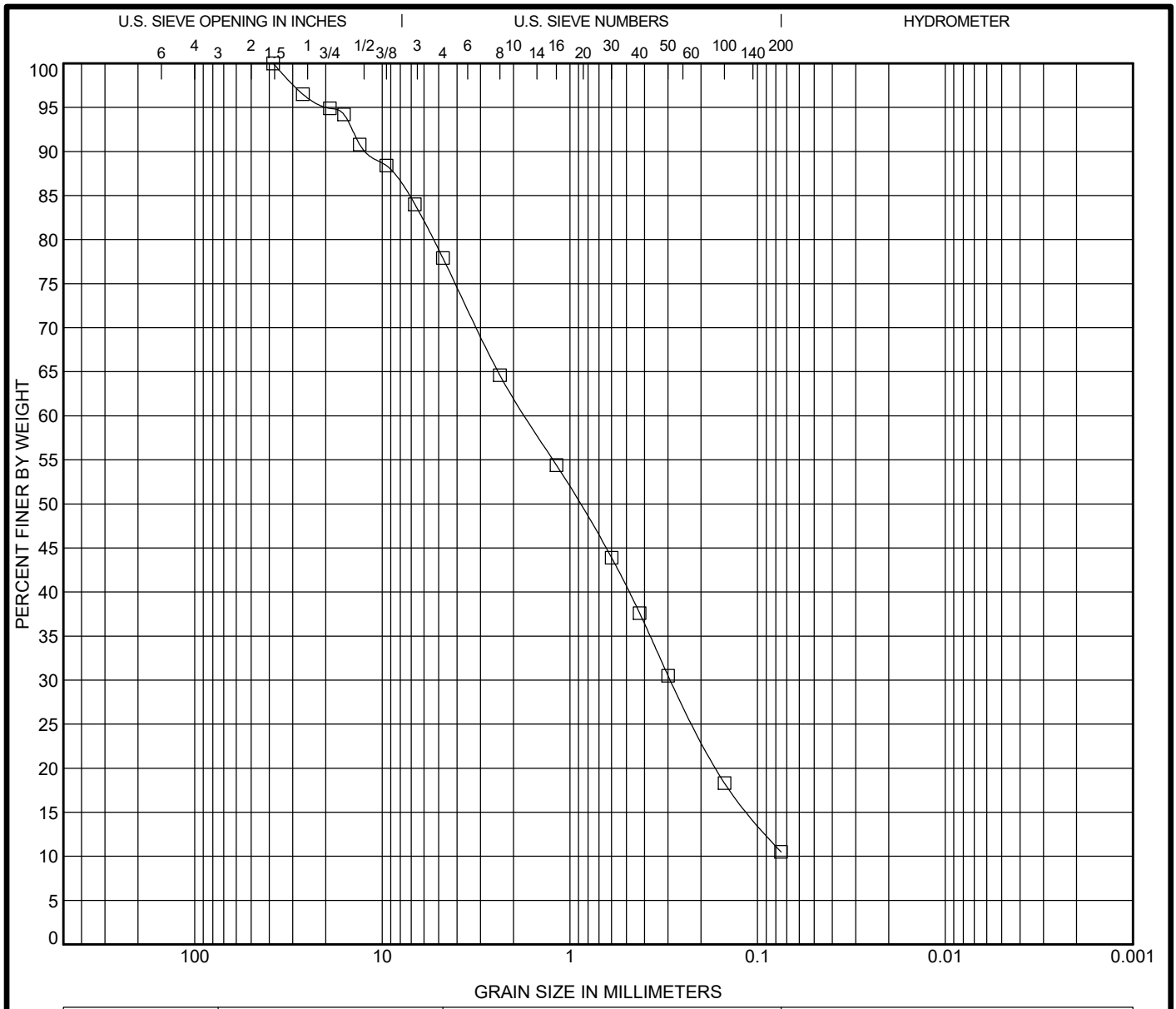
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-09(SS-2) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-13, SS-1, Depth: 0.1 - 0.7 m**
	Date started:
	Date completed:

DST consulting engineers

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Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

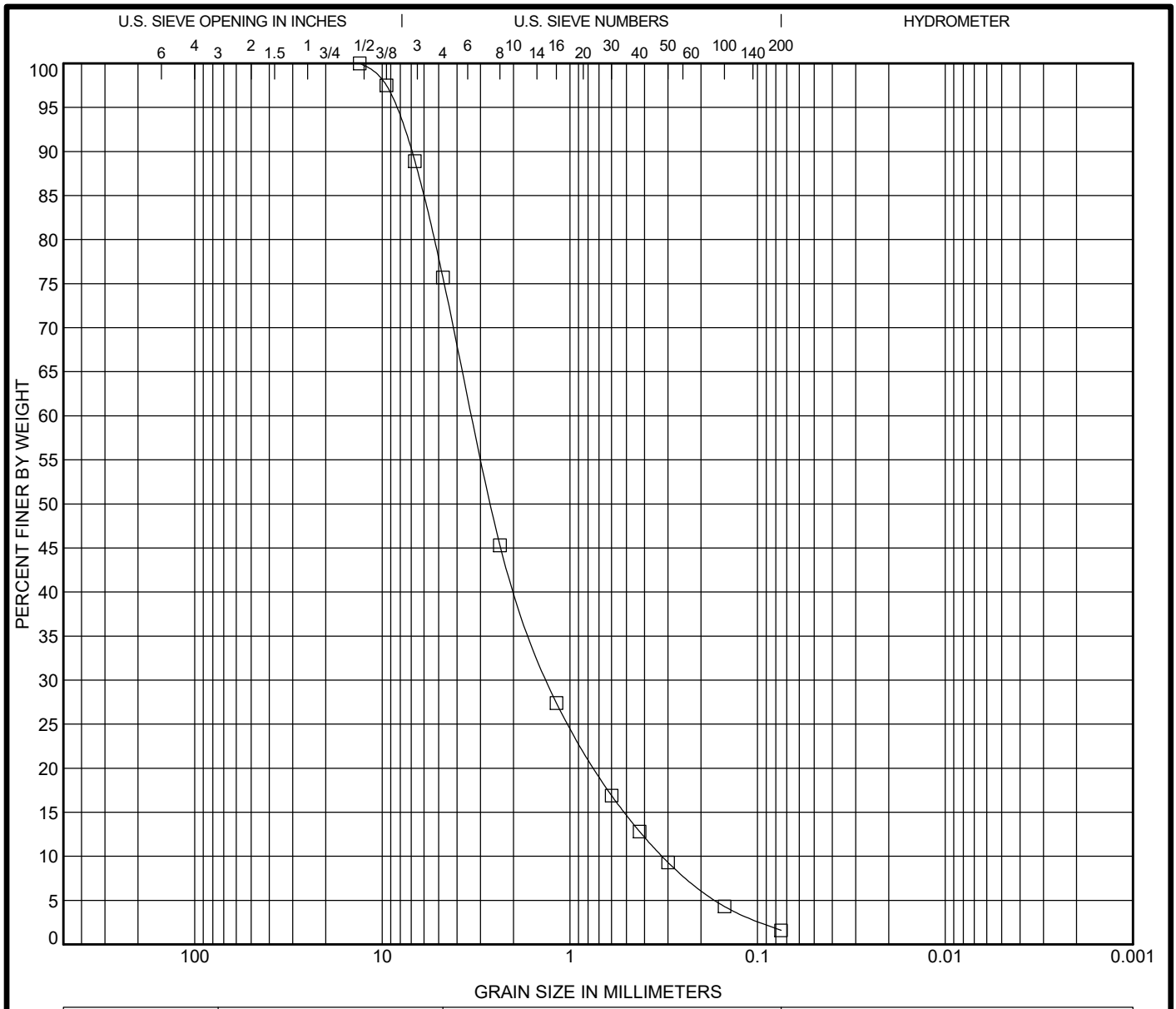
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-13(SS-1) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-18, SS-1, Depth: 0.0 - 0.6 m**
	Date started:
	Date completed:

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Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

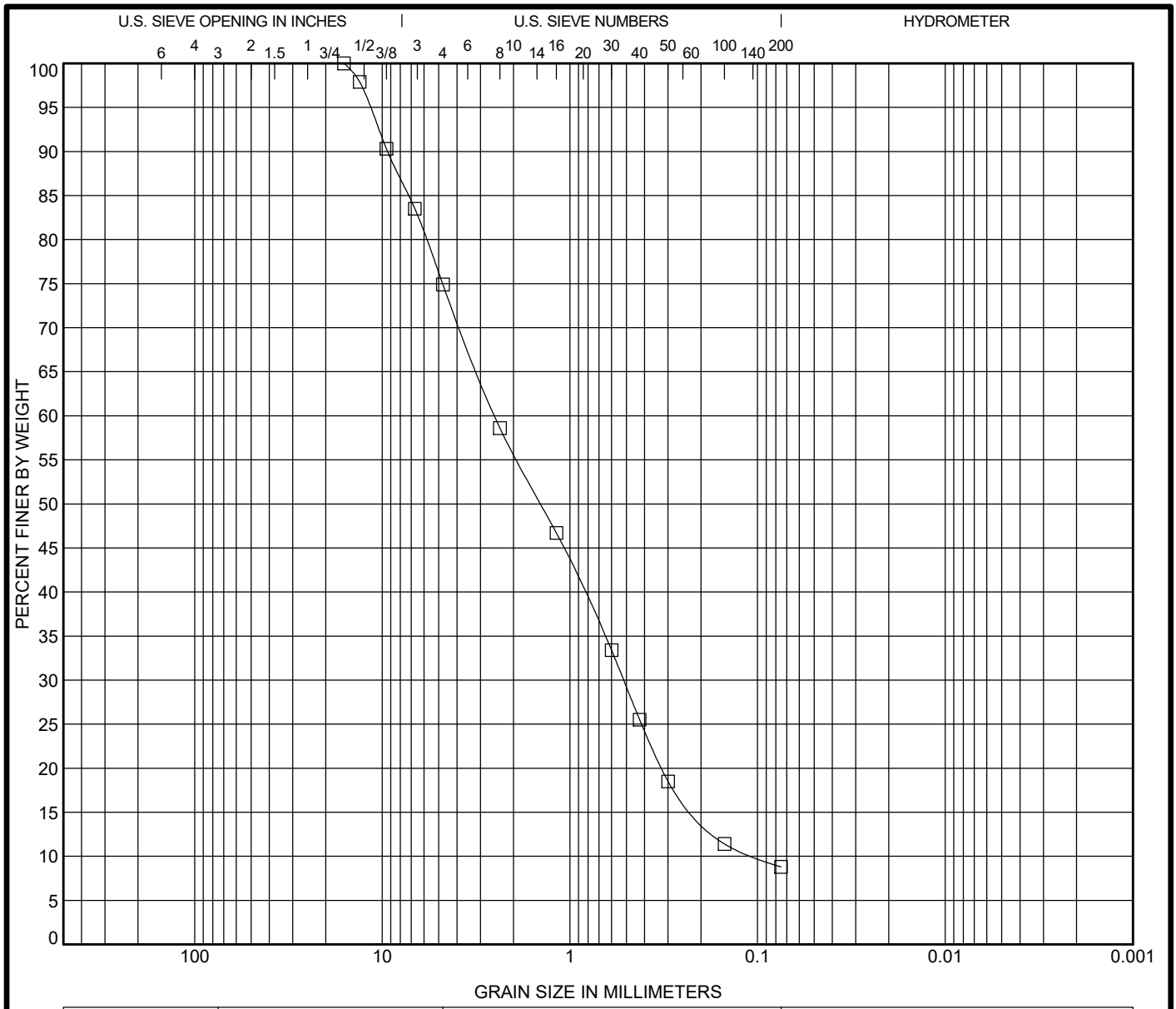
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-18(SS-1) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-19, SS-1, Depth: 0.1 - 0.7 m**
	Date started:
	Date completed:

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2150 Thurston Drive
Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

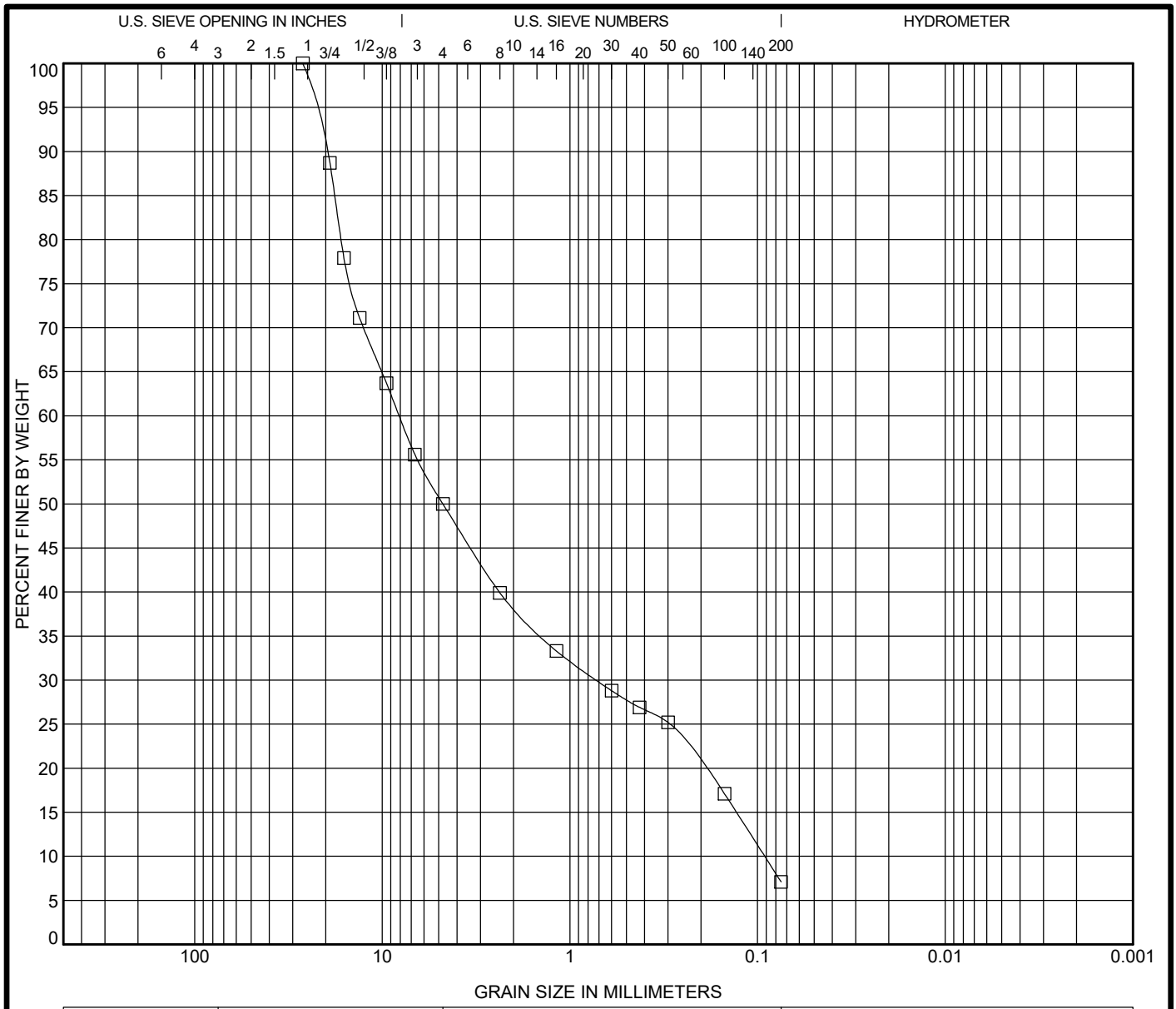
GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-19(SS-1) V1.1.GPJ DST_MIN.GDT 10-24-16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	
☐	**BH16-22, SS-1, Depth: 0.0 - 0.6 m**
	Date started:
	Date completed:

DST Consulting Engineers
2150 Thurston Drive
Ottawa, Ontario K1G 5T9
Telephone: (613) 748-1415
Fax: (613) 748-1356

GRAIN SIZE DISTRIBUTION CURVE

Project: Site Servicing Phase 1B

Location: Wateridge Village, Ottawa, Ontario

Project Number: IN-SO-026755

CAN_GRAIN_SIZE_SIEVE TEST BH-22(SS-1) V1.1.GPJ DST_MIN.GDT 10-24-16

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

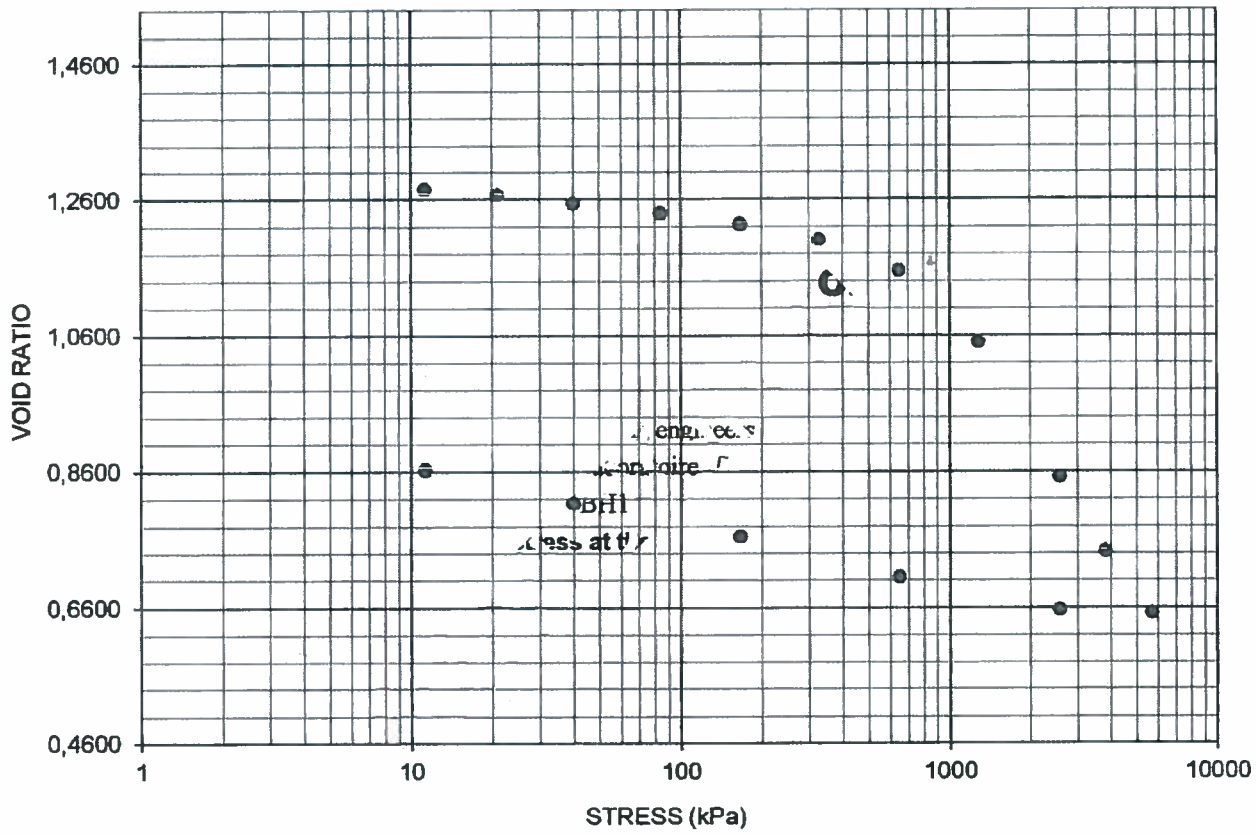
Client: DST Consulting engineers **Date :** 2014-04-01

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-33, S-1 **Sample No. :** 18 **Depth (m) :** 1,83 à 1,90

Hydrostatic stress at the test (date) : **Provided by** ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	1,272	Recompression index (C_r) :	0,049
Initial water content (w) :	44,9%	Virgin compression index (C_c) :	1,60
Initial humid unit weight (γ_h) :	17,3 kN/m³	Initial effective stress (σ'_v) :	33 kPa
Initial saturation degree (S_r) :	97,4%	Preconsolidation pressure (σ'_p):	850 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	817 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

Richard Jean-Legros, resp.géotechnique

Verified by :

Farnakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-33, S-1 Echantillon no: 18

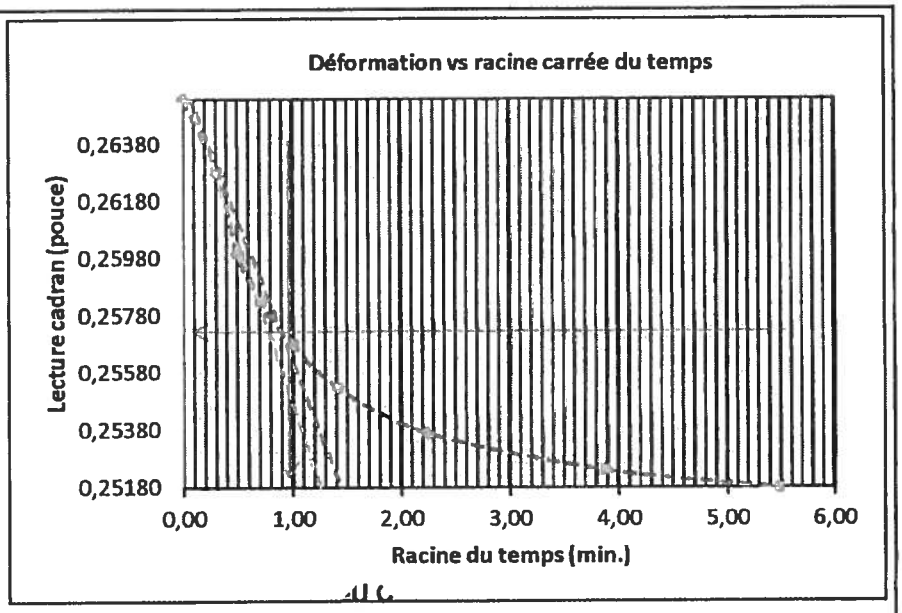
ESSAI A ENVIRON 50 % P'c

Charge: 11,56661 kg 646 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,26540
0,10	0,32	0,26280
0,25	0,50	0,26000
0,50	0,71	0,25830
1,00	1,00	0,25680
2,00	1,41	0,25530
5,00	2,24	0,25370
15,00	3,87	0,25240
30,00	5,48	0,25180
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,3000

Lecture à D90 (pce) = **0,25730** lu sur graphe

Correction p/r bâti (pce) = 0,01476

Lecture corrigée (pce) = 0,27206

Déformation (pce) = 0,02794

H_d (mm) = 8,93

Racine T90 = **0,9** lu sur graphe

T90 (min) = 0,81

c_v (m^2/j) = 3,00E-02

e = 1,1559 fin de palier

m_v (kPa^{-1}) = 6,31E-05

k (cm/s) = 2,1E-08

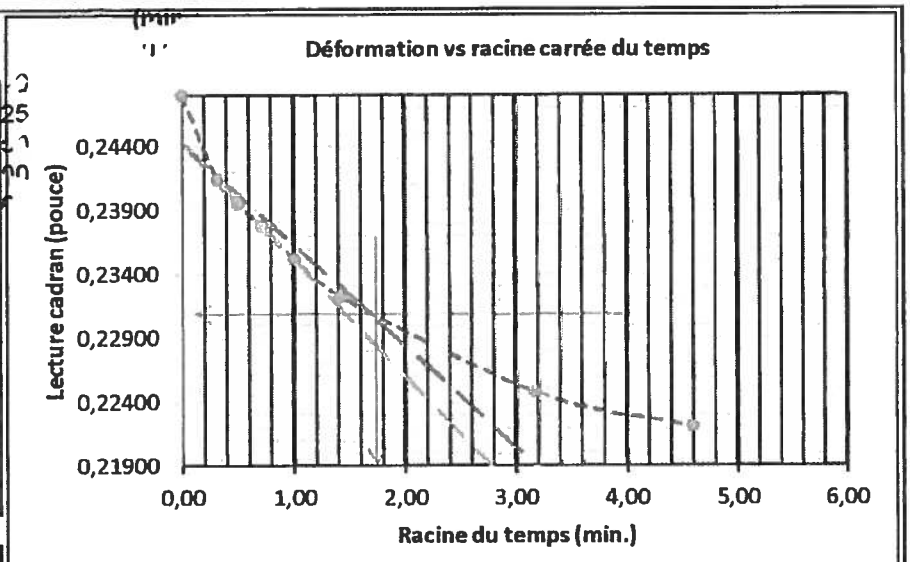
1er ESSAI APRÈS P'c

Charge: 22,90642 kg 1 278 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,24800
0,10	0,32	0,24150
0,25	0,50	0,23960
0,50	0,71	0,23780
1,00	1,00	0,23520
2,00	1,41	0,23230
10,00	3,16	0,22480
21,00	4,58	0,22210
	4,58	
	4,58	
	4,58	
	4,58	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,3000

Lecture à D90 (pce) = **0,23100** lu sur graphe

Correction p/r bâti (pce) = 0,01734

Lecture corrigée (pce) = 0,24834

Déformation (pce) = 0,05166

H_d (mm) = 8,63

Racine T90 = **1,7** lu sur graphe

T90 (min) = 2,89

c_v (m^2/j) = 7,86E-03

e = 1,0499

m_v (kPa^{-1}) = 7,79E-05

k (cm/s) = 6,9E-09

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

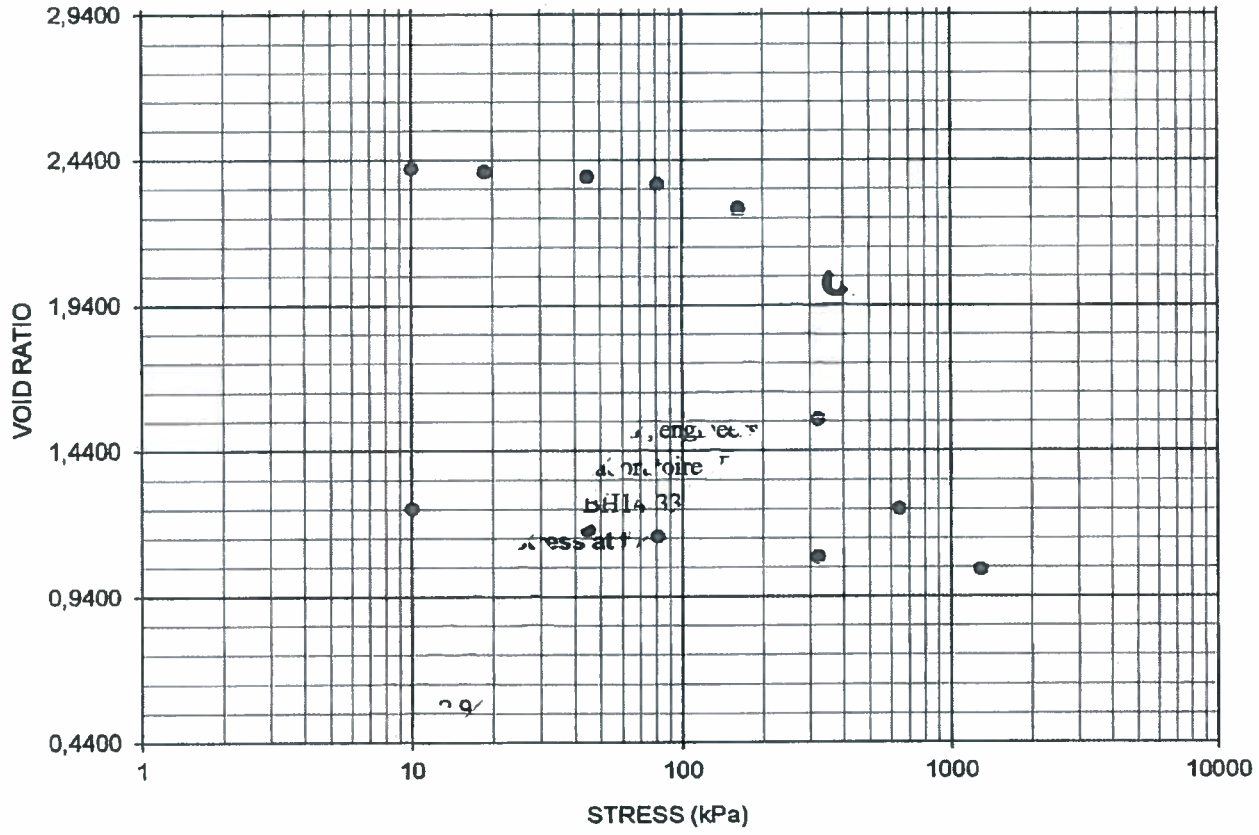
Client: DST Consulting engineers **Date :** 2014-04-04

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-33, S-2 **Sample No. :** 19 **Depth (m) :** 4,70 à 4,80

Hydrostatic stress at the test (date) : **Provided by** ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	2,417	Recompression index (C_r) :	0,048
Initial water content (w) :	87,5%	Virgin compression index (C_c) :	1,71
Initial humid unit weight (γ_h) :	14,8 kN/m³	Initial effective stress (σ'_v) :	71 kPa
Initial saturation degree (S_r) :	99,9%	Preconsolidation pressure (σ'_p):	161 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	90 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

R.Jean-Legros, resp.géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-33, S-2 Echantillon no: 19

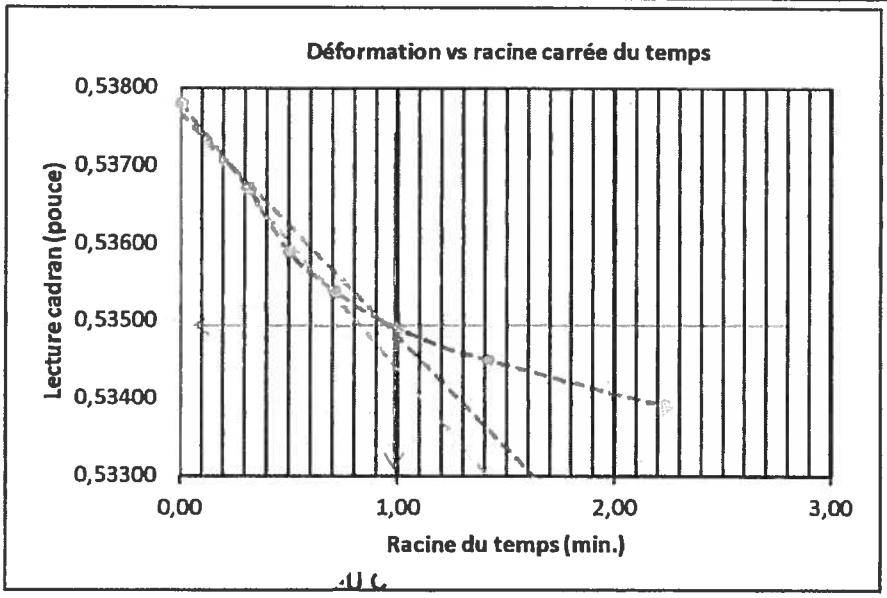
ESSAI A ENVIRON 50 % P'c

Charge: 2,3 kg 81 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,53780
0,10	0,32	0,53670
0,25	0,50	0,53590
0,50	0,71	0,53540
1,00	1,00	0,53490
2,00	1,41	0,53450
5,00	2,24	0,53390
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,5500		Racine T90 =	**0,97**	lu sur graphe
Lecture à D90 (pce) =	**0,53495**	lu sur graphe	T90 (min) =	0,9409	
Correction p/r bâti (pce) =	0,00636		c_v (m^2/j) =	2,80E-02	
Lecture corrigée (pce) =	0,54131		e =	2,3595	fin de palier
Déformation (pce) =	0,00869		m_v (kPa^{-1}) =	1,87E-04	
H_d (mm) =	9,29		k (cm/s) =	5,9E-08	

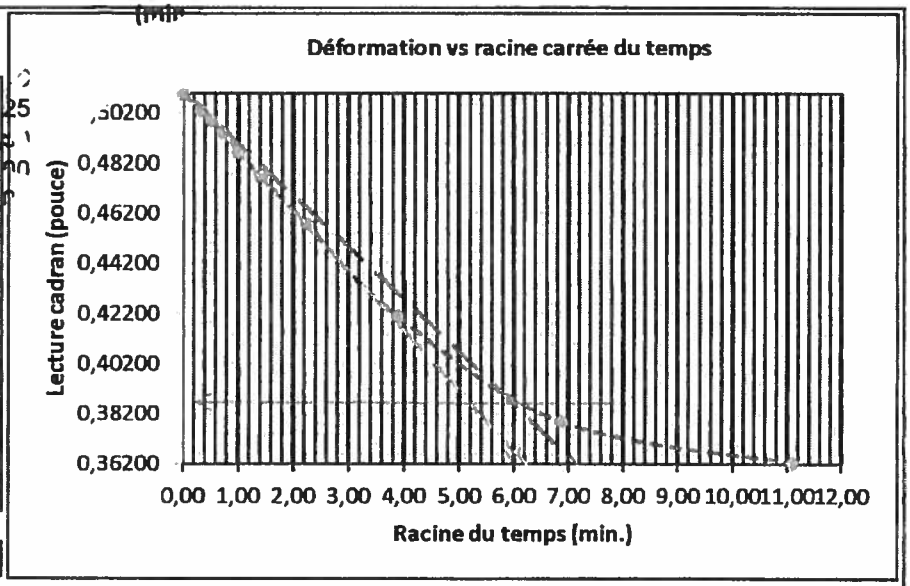
1er ESSAI APRÈS P'c

Charge: 9,2 kg 320 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,50960
0,10	0,32	0,50300
0,25	0,50	0,49910
0,50	0,71	0,49450
1,00	1,00	0,48650
2,00	1,41	0,47690
5,00	2,24	0,45750
15,00	3,87	0,42100
47,00	6,86	0,37910
123,00	11,09	0,36260
	11,09	
	11,09	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,5500		Racine T90 =	**5,93**	lu sur graphe
Lecture à D90 (pce) =	**0,38800**	lu sur graphe	T90 (min) =	35,1649	
Correction p/r bâti (pce) =	0,01161		c_v (m^2/j) =	4,87E-04	
Lecture corrigée (pce) =	0,39961		e =	1,5466	
Déformation (pce) =	0,15039		m_v (kPa^{-1}) =	1,39E-03	
H_d (mm) =	7,49		k (cm/s) =	7,7E-09	

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

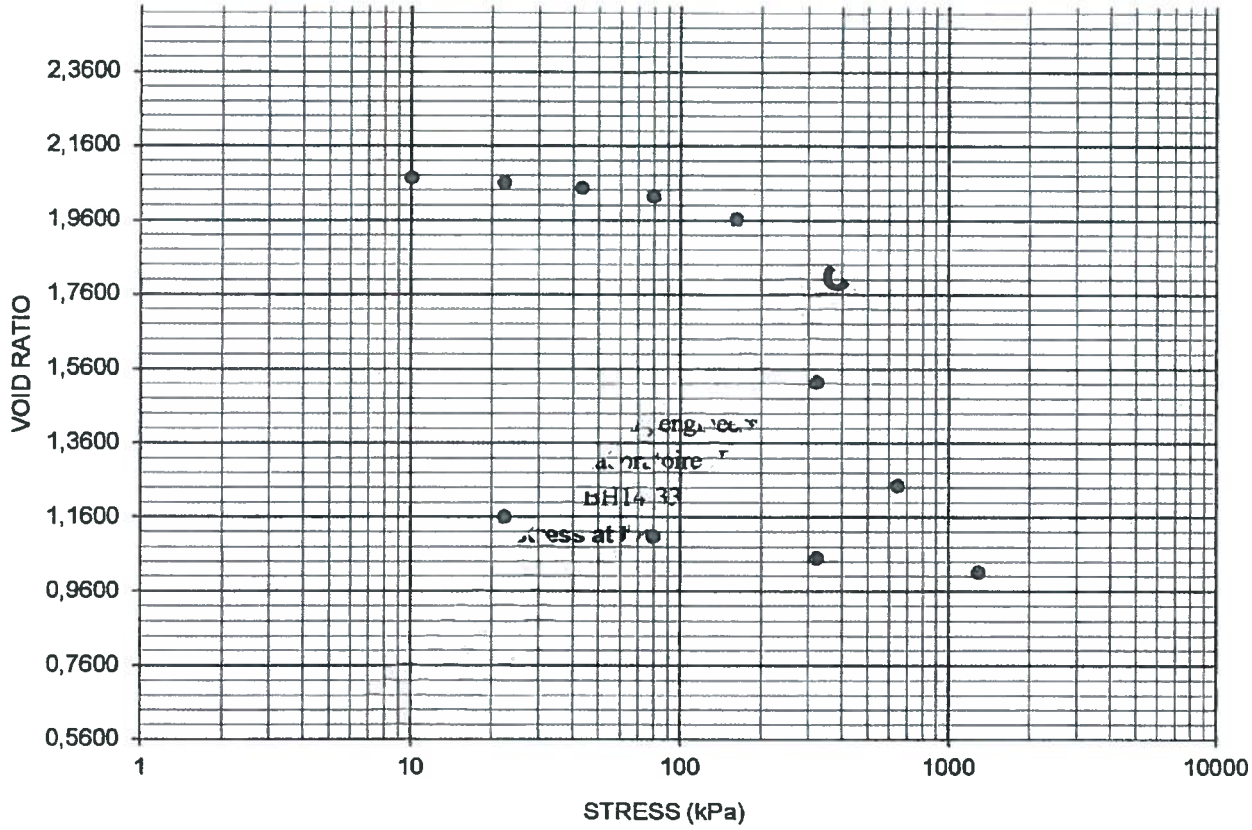
Client: DST Consulting engineers **Date :** 2014-04-07

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-33, S-3 **Sample No. :** 20 **Depth (m) :** 7,0 à 7,1

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	2,075	Recompression index (C_r) :	0,043
Initial water content (w) :	75,2%	Virgin compression index (C_c) :	1,19
Initial humid unit weight (γ_h) :	15,4 kN/m³	Initial effective stress (σ'_v) :	109 kPa
Initial saturation degree (S_r) :	100,0%	Preconsolidation pressure (σ'_p):	161 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	52 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

R.Jean-Legres, Tesp.géotechnique

Verified by :

Farrakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-33, S-3 Echantillon no: 20

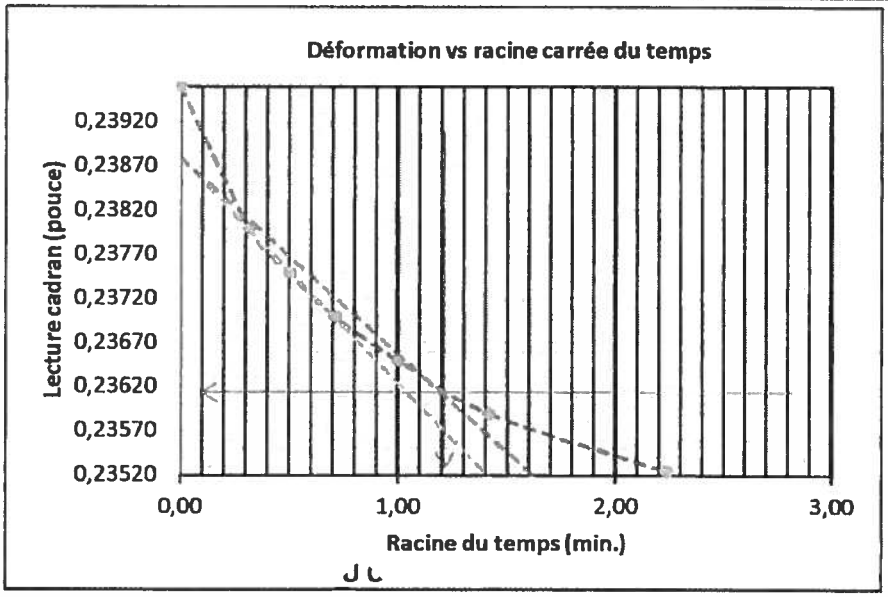
ESSAI A ENVIRON 50 % P'c

Charge: 2,25 kg 79 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23960
0,10	0,32	0,23800
0,25	0,50	0,23750
0,50	0,71	0,23700
1,00	1,00	0,23650
2,00	1,41	0,23590
5,00	2,24	0,23525
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,2500

Lecture à D90 (pce) = **0,23617** lu sur graphe

Correction p/r bâti (pce) = 0,00580

Lecture corrigée (pce) = 0,24197

Déformation (pce) = 0,00803

H_d (mm) = 9,34

Racine T90 = **1,2** lu sur graphe

T90 (min) = 1,44

c_v (m^2/j) = 1,85E-02

e = 2,0226 fin de palier

m_v (kPa^{-1}) = 2,18E-04

k (cm/s) = 4,6E-08

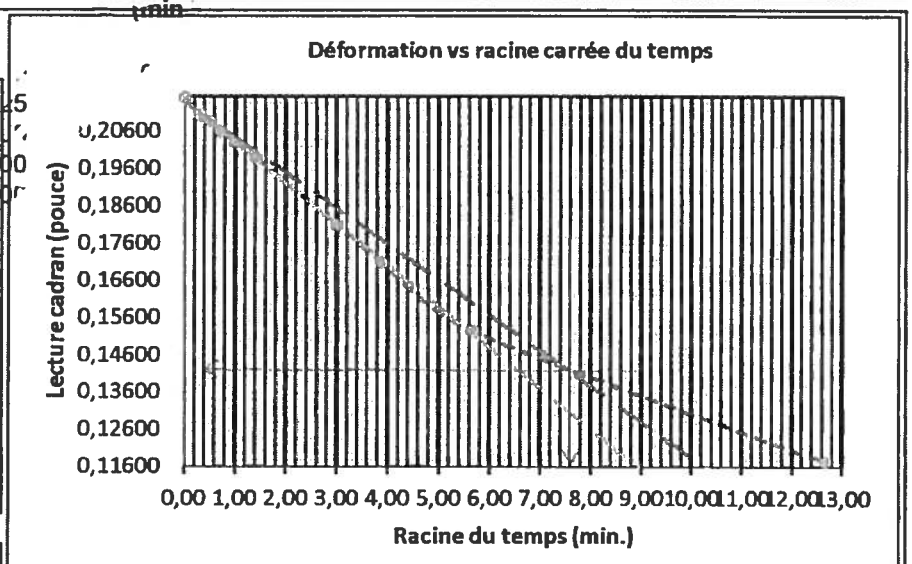
1er ESSAI APRÈS P'c

Charge: 9,2 kg 320 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,21530
0,10	0,32	0,21050
0,25	0,50	0,20870
0,50	0,71	0,20630
1,00	1,00	0,20320
2,00	1,41	0,19900
9,00	3,00	0,18110
15,00	3,87	0,17110
32,00	5,66	0,15280
160,00	12,65	0,11755
	12,65	
	12,65	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,2500

Lecture à D90 (pce) = **0,14300** lu sur graphe

Correction p/r bâti (pce) = 0,01063

Lecture corrigée (pce) = 0,15363

Déformation (pce) = 0,09637

H_d (mm) = 8,22

Racine T90 = **7,6** lu sur graphe

T90 (min) = 57,76

c_v (m^2/j) = 3,57E-04

e = 1,5216

m_v (kPa^{-1}) = 9,34E-04

k (cm/s) = 3,8E-09

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

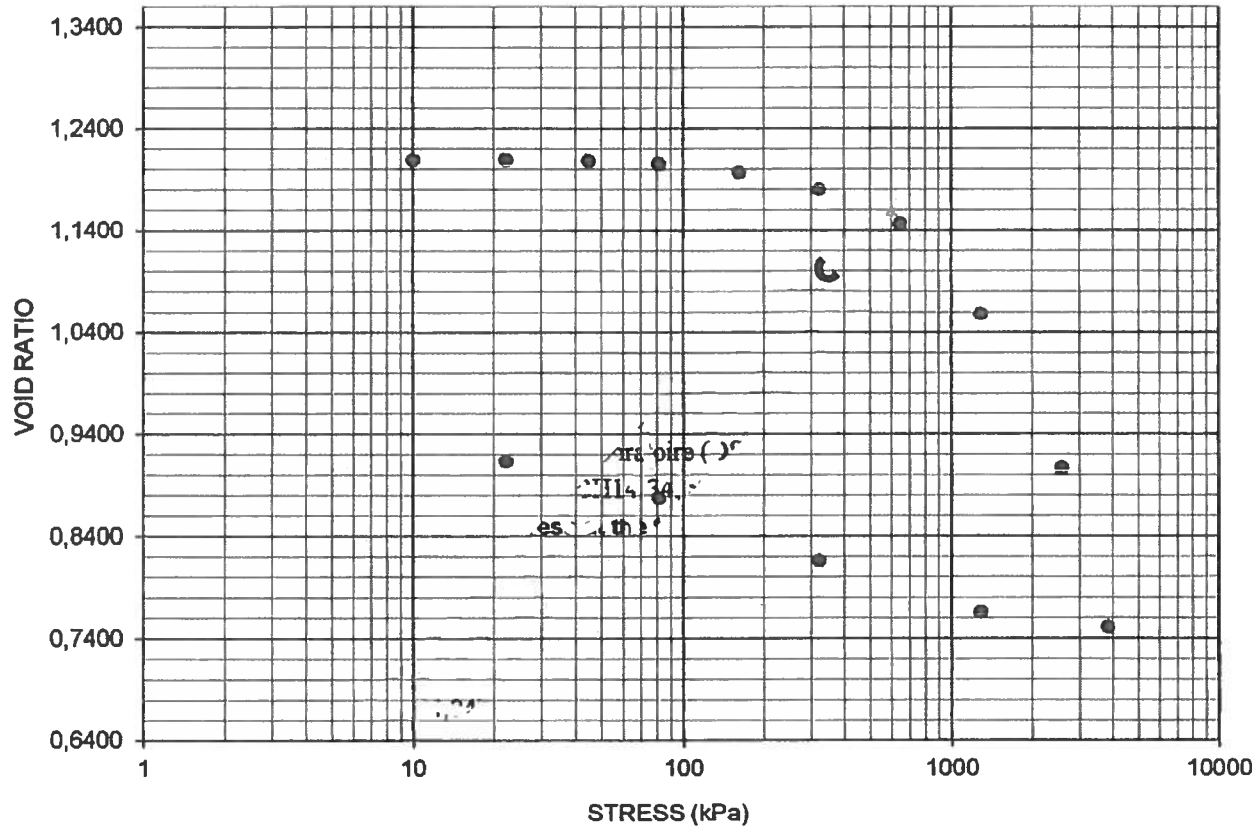
Client: DST Consulting engineers **Date :** 2014-03-31

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-34, S-1 **Sample No. :** 15 **Depth (m) :** 1,95 à 1,97

Hydrostatic stress at the test (date) : **Provided by** ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	1,205	Recompression index (C_r) :	0,006
Initial water content (w) :	43,6%	Virgin compression index (C_c) :	0,40
Initial humid unit weight (γ_h) :	17,6 kN/m³	Initial effective stress (σ'_v) :	35 kPa
Initial saturation degree (S_r) :	99,8%	Preconsolidation pressure (σ'_p):	600 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	566 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
At the client's request, the initial effective stress has been calculated without considering the water level. (Expansion)

Prepared by :

R.Jean-Legros, resp.géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-34, S-1 Echantillon no: 15

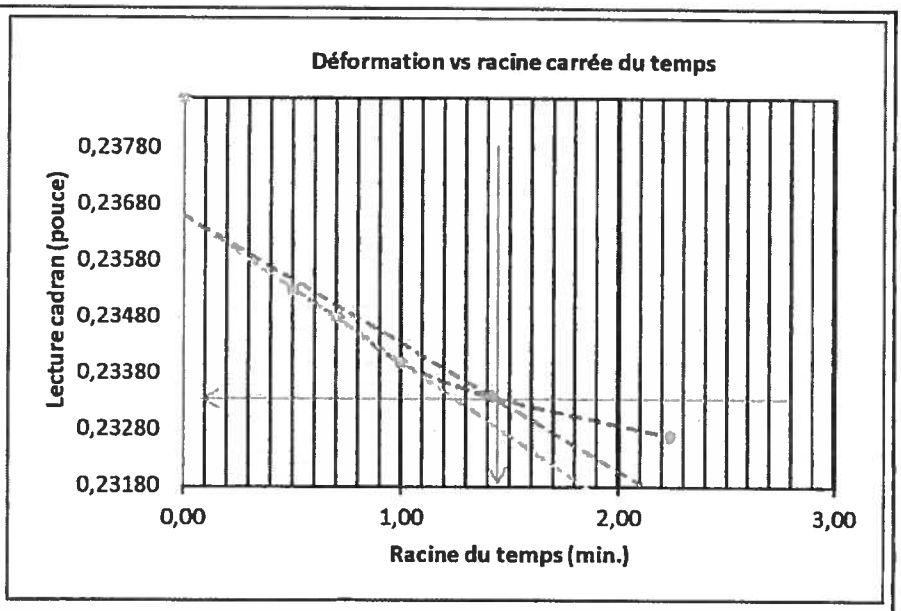
ESSAI A ENVIRON 50 % P'c

Charge: 9,2 kg 320 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23870
0,10	0,32	
0,25	0,50	0,23530
0,50	0,71	0,23480
1,00	1,00	0,23400
2,00	1,41	0,23340
5,00	2,24	0,23270
21,00	4,58	
	4,58	
	4,58	
	4,58	
	4,58	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	**1,43** lu sur graphe
Lecture à D90 (pce) =	**0,23340**	lu sur graphe	T90 (min) =	2,0449
Correction p/r bâti (pce) =	0,01113		c_v (m^2/j) =	1,32E-02
Lecture corrigée (pce) =	0,24453		e =	1,1802 fin de palier
Déformation (pce) =	0,00547		m_v (kPa^{-1}) =	4,75E-05
H_d (mm) =	9,39		k (cm/s) =	7,1E-09

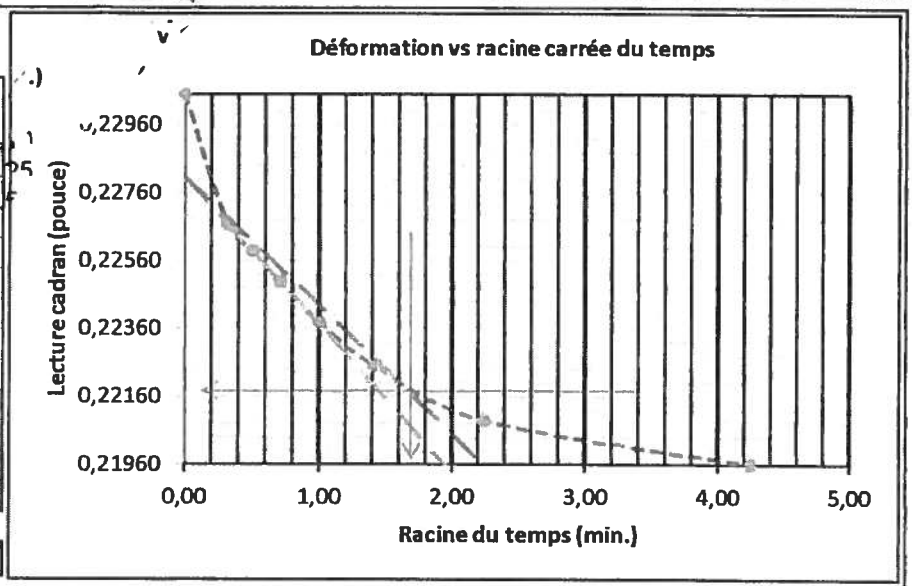
1er ESSAI APRÈS P'c

Charge: 18,5 kg 642 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23050
0,10	0,32	0,22670
0,25	0,50	0,22590
0,50	0,71	0,22500
1,00	1,00	0,22380
2,00	1,41	0,22250
5,00	2,24	0,22090
18,00	4,24	0,21960
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	**1,65** lu sur graphe
Lecture à D90 (pce) =	**0,22180**	lu sur graphe	T90 (min) =	2,7225
Correction p/r bâti (pce) =	0,01434		c_v (m^2/j) =	9,66E-03
Lecture corrigée (pce) =	0,23614		e =	1,1471
Déformation (pce) =	0,01386		m_v (kPa^{-1}) =	4,72E-05
H_d (mm) =	9,28		k (cm/s) =	5,2E-09

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

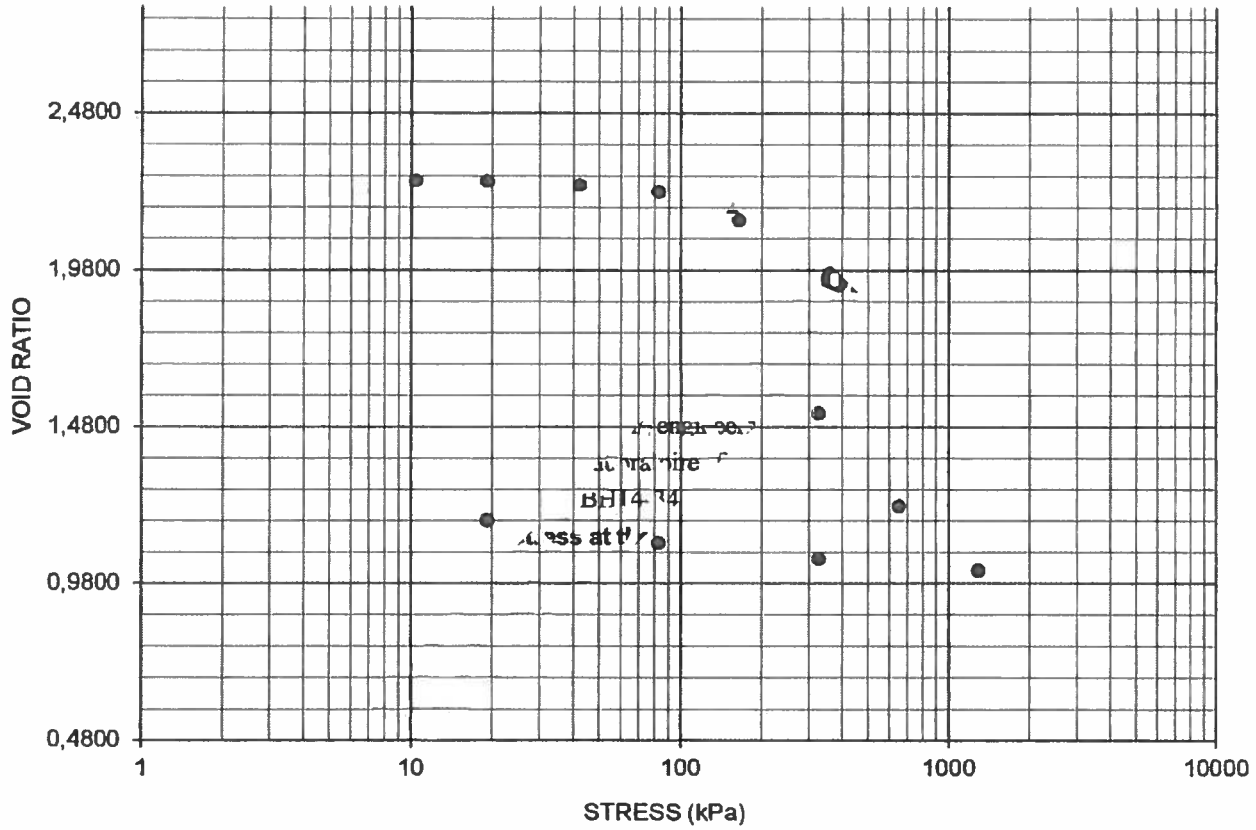
Client: DST Consulting engineers **Date :** 2014-03-24

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-34, S-2 **Sample No. :** 16 **Depth (m) :** 4,40 à 4,50

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	2,271	Recompression index (C_r) :	0,049
Initial water content (w) :	82,5%	Virgin compression index (C_c) :	1,51
Initial humid unit weight (γ_h) :	15,1 kN/m³	Initial effective stress (σ'_v) :	67 kPa
Initial saturation degree (S_r) :	100,3%	Preconsolidation pressure (σ'_p):	155 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	88 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
At the client's request, the initial effective stress has been calculated without considering the water level.

Prepared by :

R.Jean-Legros, resp.géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-34, S-2 Echantillon no: 16

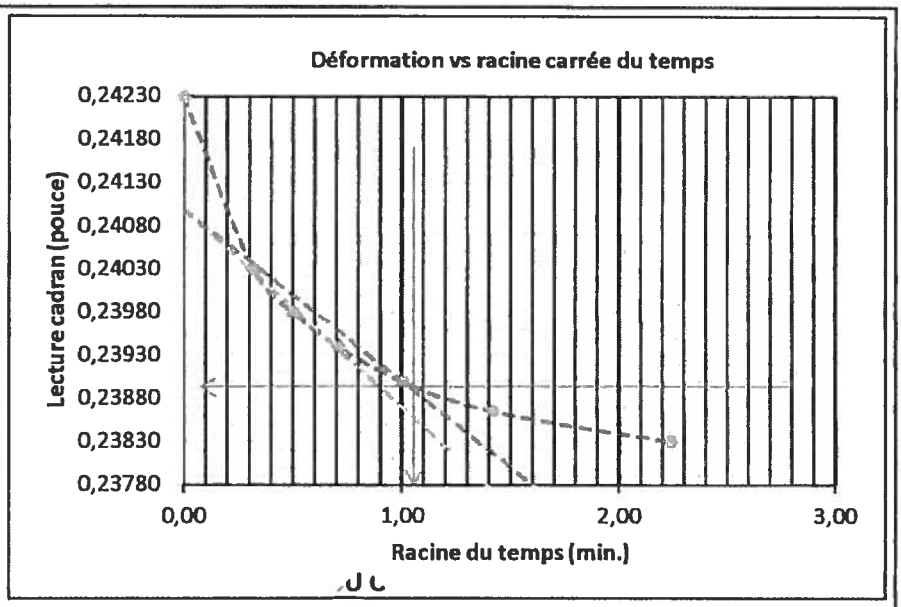
ESSAI A ENVIRON 50 % P'c

Charge: 1,58757 kg 83 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,24230
0,10	0,32	0,24030
0,25	0,50	0,23980
0,50	0,71	0,23940
1,00	1,00	0,23900
2,00	1,41	0,23865
5,00	2,24	0,23830
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,2500

Lecture à D90 (pce) = **0,23895** lu sur graphe

Correction p/r bâti (pce) = 0,00470

Lecture corrigée (pce) = 0,24365

Déformation (pce) = 0,00635

H_d (mm) = 9,46

Racine T90 = **1,03** lu sur graphe

T90 (min) = 1,0609

c_v (m^2/j) = 2,57E-02

e = 2,2311 fin de palier

m_v (kPa^{-1}) = 1,54E-04

k (cm/s) = 4,5E-08

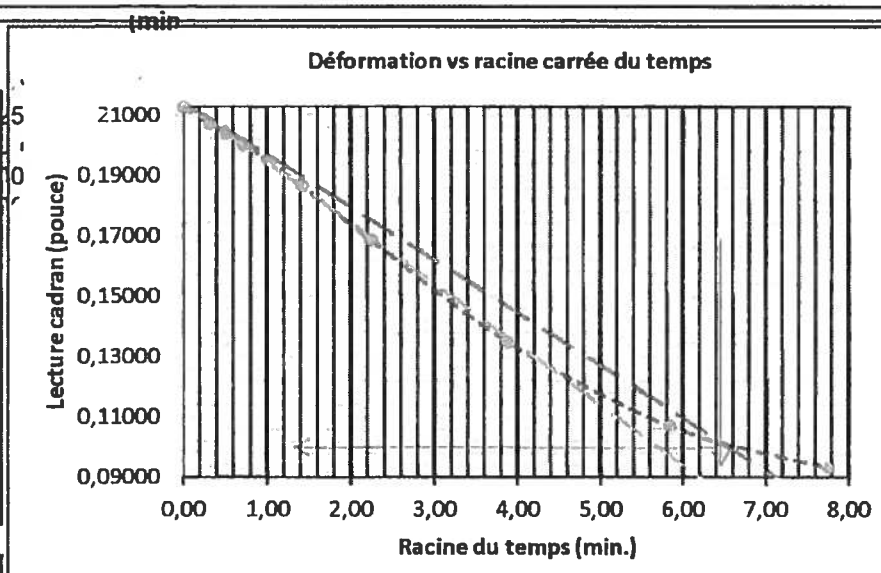
1er ESSAI APRÈS P'c

Charge: 6,35029 kg 325 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,21250
0,10	0,32	0,20700
0,25	0,50	0,20430
0,50	0,71	0,20060
1,00	1,00	0,19520
2,00	1,41	0,18660
5,00	2,24	0,16880
15,00	3,87	0,13500
34,00	5,83	0,10710
60,00	7,75	0,09330
	7,75	
	7,75	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) = 0,2500

Lecture à D90 (pce) = **0,10100** lu sur graphe

Correction p/r bâti (pce) = 0,00932

Lecture corrigée (pce) = 0,11032

Déformation (pce) = 0,13968

H_d (mm) = 7,76

Racine T90 = **6,45** lu sur graphe

T90 (min) = 41,6025

c_v (m^2/j) = 4,42E-04

e = 1,5217

m_v (kPa^{-1}) = 1,22E-03

k (cm/s) = 6,1E-09

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

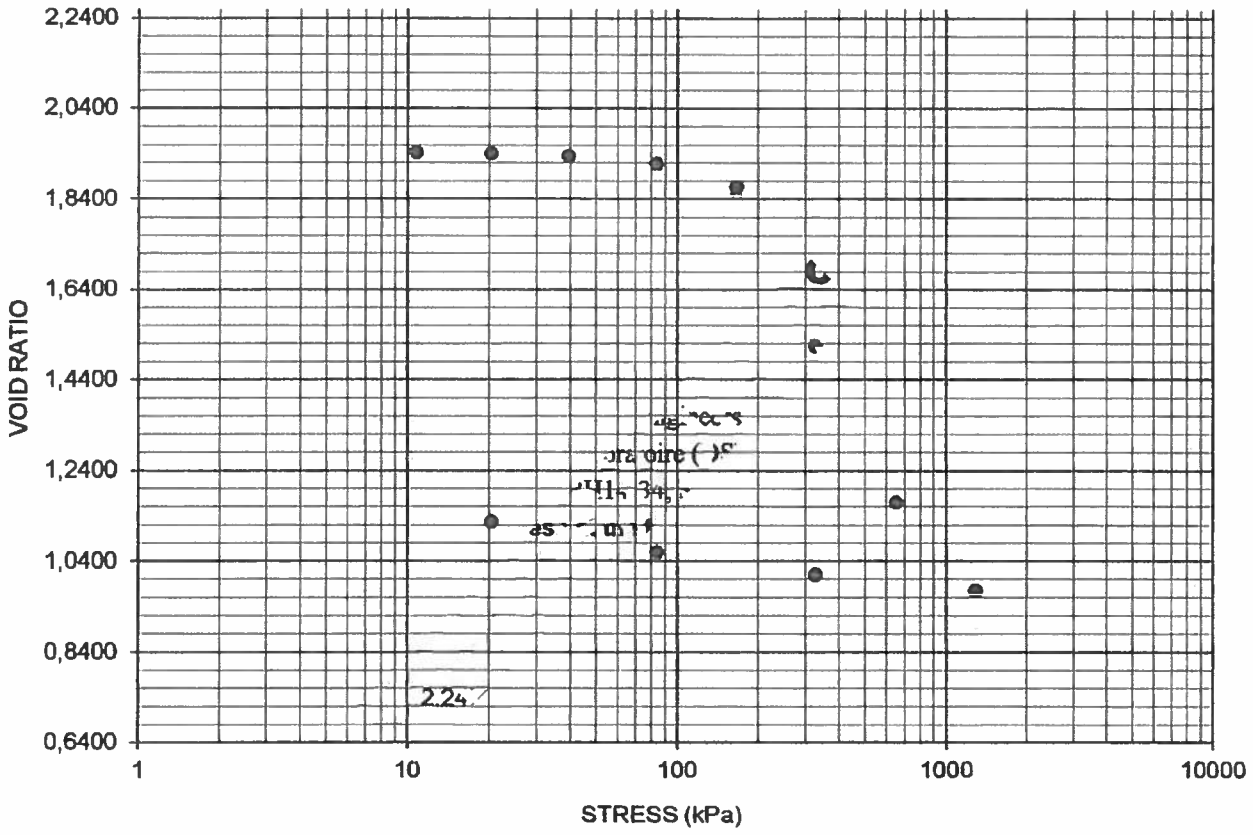
Client: DST Consulting engineers **Date :** 2014-03-24

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-01

Boring No. : BH14-34, S-4 **Sample No. :** 17 **Depth (m) :** 11,10 à 11,20

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	1,947	Recompression index (C_r) :	0,036
Initial water content (w) :	70,5%	Virgin compression index (C_c) :	1,15
Initial humid unit weight (γ_h) :	15,7 kN/m³	Initial effective stress (σ'_v) :	175 kPa
Initial saturation degree (S_r) :	100,0%	Preconsolidation pressure (σ'_p):	165 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	-10 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
At the client's request, the initial effective stress has been calculated without considering the water level.

Prepared by :

R.Jean-Legros, resp géotechnique

Verified by :

Famakhan Fainke, ing.

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

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-01

Sondage no: BH14-34, S-4 Echantillon no: 17

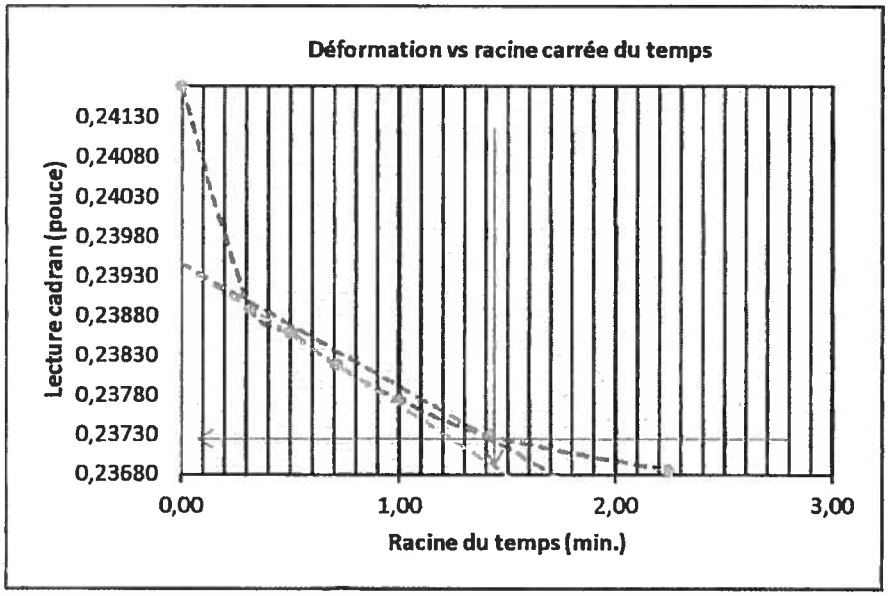
ESSAI A ENVIRON 50 % P'c

Charge: 1,474175 kg 84 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,24170
0,10	0,32	0,23890
0,25	0,50	0,23860
0,50	0,71	0,23820
1,00	1,00	0,23775
2,00	1,41	0,23730
5,00	2,24	0,23685
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	1,43	lu sur graphe
Lecture à D90 (pce) =	0,23730	lu sur graphe	T90 (min) =	2,0449	
Correction p/r bâti (pce) =	0,00836		c_v (m^2/j) =	1,24E-02	
Lecture corrigée (pce) =	0,24566		e =	1,9183	fin de palier
Déformation (pce) =	0,00434		m_v (kPa^{-1}) =	1,36E-04	
H_d (mm) =	9,12		k (cm/s) =	1,9E-08	

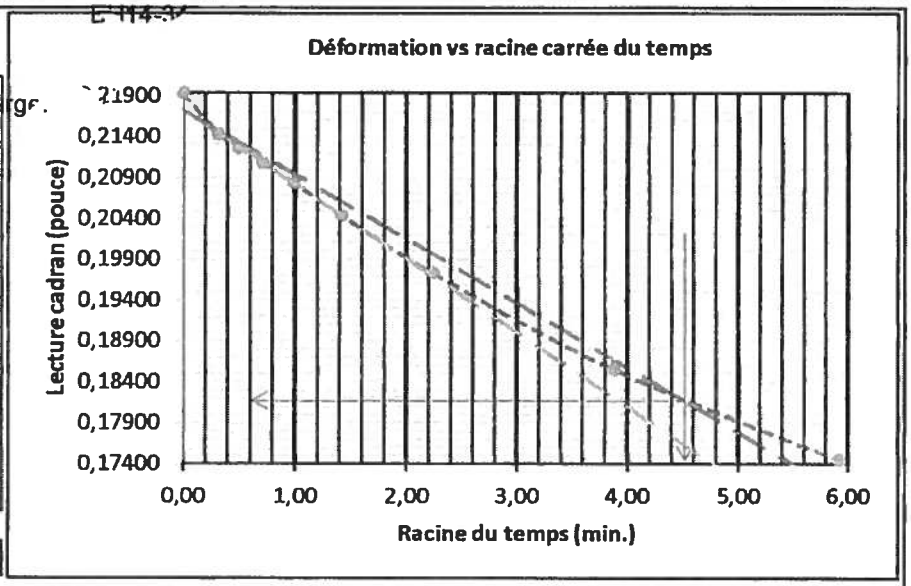
1er ESSAI APRÈS P'c

Charge: 5,7833 kg 325 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,21940
0,10	0,32	0,21440
0,25	0,50	0,21270
0,50	0,71	0,21090
1,00	1,00	0,20830
2,00	1,41	0,20440
5,00	2,24	0,19730
15,00	3,87	0,18550
35,00	5,92	0,17450
	5,92	
	5,92	
	5,92	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	4,5	lu sur graphe
Lecture à D90 (pce) =	0,18200	lu sur graphe	T90 (min) =	20,25	
Correction p/r bâti (pce) =	0,01430		c_v (m^2/j) =	1,09E-03	
Lecture corrigée (pce) =	0,19630		e =	1,5152	
Déformation (pce) =	0,05370		m_v (kPa^{-1}) =	7,77E-04	
H_d (mm) =	8,50		k (cm/s) =	9,6E-09	

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

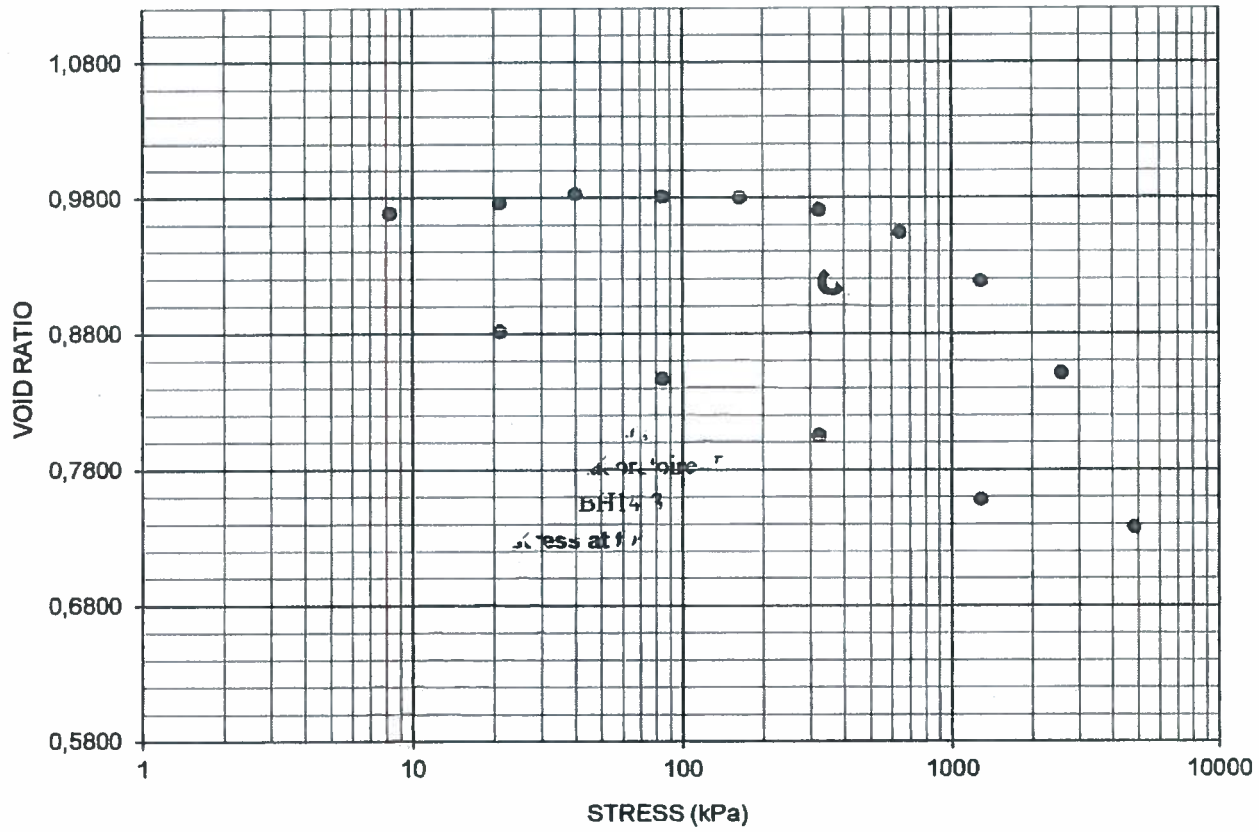
Client: DST Consulting engineers **Date :** 2014-03-05

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-1

Boring No. : BH14-37, S-1 **Sample No. :** 6 **Depth (m) :** 0,70 à 0,80

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	0,970	Recompression index (C_r) :	0,030
Initial water content (w) :	33,3%	Virgin compression index (C_c) :	0,41
Initial humid unit weight (γ_h) :	18,5 kN/m³	Initial effective stress (σ'_v) :	14 kPa
Initial saturation degree (S_r) :	95,5%	Preconsolidation pressure (σ'_p):	1 075 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	1 061 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative. The initial effective stress has been provided by the client. **(Expansion)**

Prepared by :

R.Jean-Legros, resp.géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-1

Sondage no: BH14-37, S-1 Echantillon no: 6

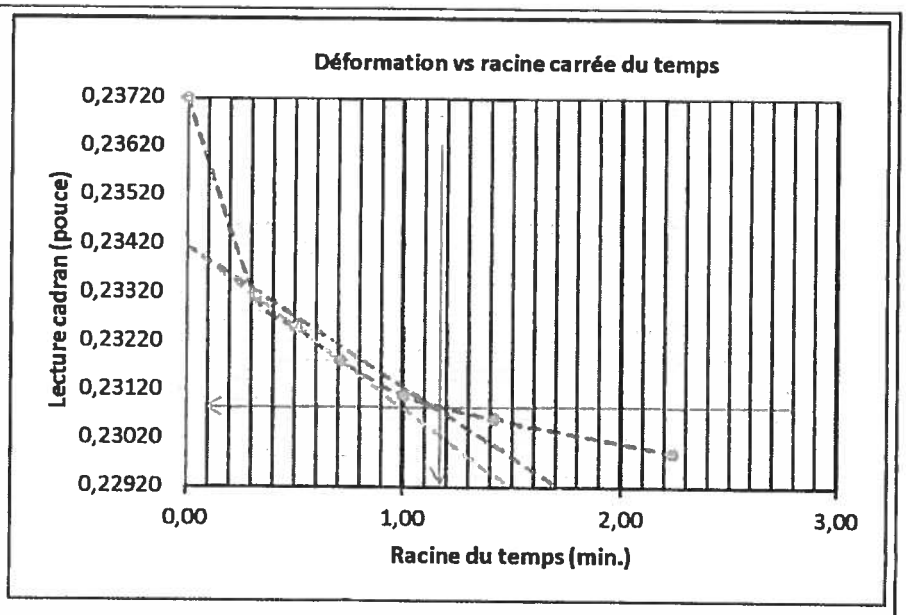
ESSAI A ENVIRON 50 % P'c

Charge: 11,45321 kg 642 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23720
0,10	0,32	0,23310
0,25	0,50	0,23250
0,50	0,71	0,23180
1,00	1,00	0,23110
2,00	1,41	0,23060
5,00	2,24	0,22990
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	1,15	lu sur graphe
Lecture à D90 (pce) =	0,23090	lu sur graphe	T90 (min) =	1,3225	
Correction p/r bâti (pce) =	0,01553		c_v (m^2/j) =	1,90E-02	
Lecture corrigée (pce) =	0,24643		e =	0,9544	fin de palier
Déformation (pce) =	0,00357		m_v (kPa^{-1}) =	2,61E-05	
H_d (mm) =	9,07		k (cm/s) =	5,6E-09	

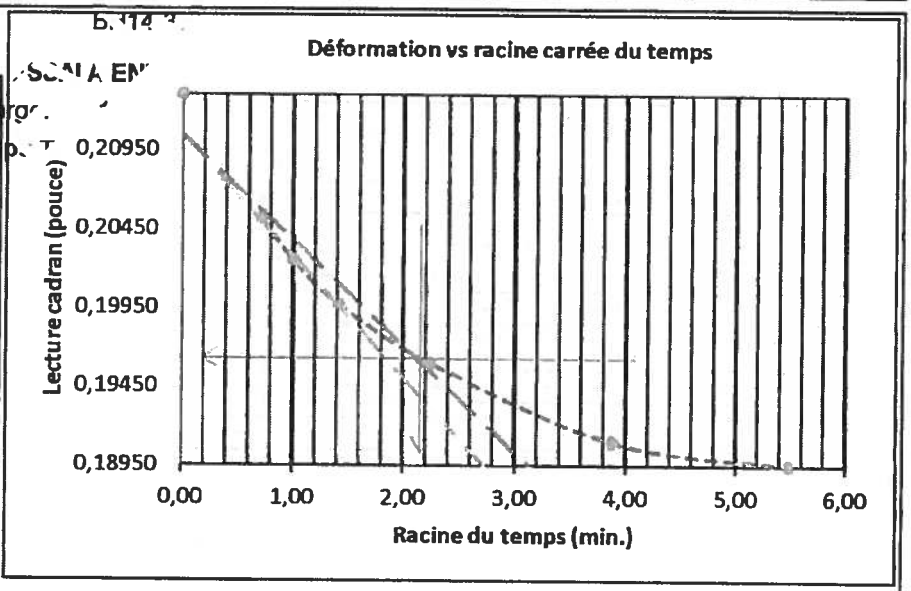
1er ESSAI APRÈS P'c

Charge: 45,81283 kg 2 561 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,21307
0,10	0,32	
0,25	0,50	
0,50	0,71	0,20520
1,00	1,00	0,20250
2,00	1,41	0,19970
5,00	2,24	0,19600
15,00	3,87	0,19100
30,00	5,48	0,18950
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	2,1	lu sur graphe
Lecture à D90 (pce) =	0,19650	lu sur graphe	T90 (min) =	4,41	
Correction p/r bâti (pce) =	0,02132		c_v (m^2/j) =	5,24E-03	
Lecture corrigée (pce) =	0,21782		e =	0,8506	
Déformation (pce) =	0,03218		m_v (kPa^{-1}) =	2,76E-05	
H_d (mm) =	8,70		k (cm/s) =	1,6E-09	

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

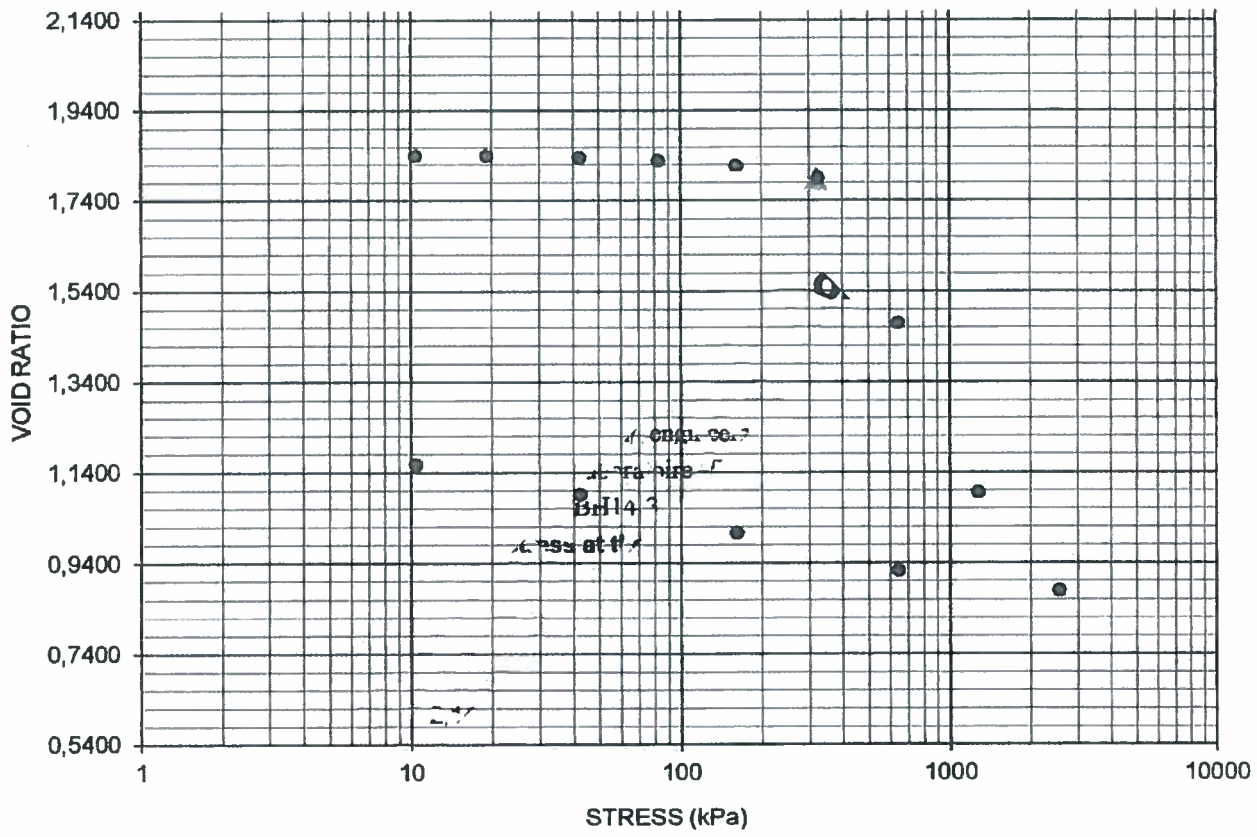
Client: DST Consulting engineers **Date :** 2014-03-05

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-1

Boring No. : BH14-37, S-2 **Sample No. :** 7 **Depth (m) :** 3,2 à 3,3

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	1,841	Recompression index (C_r) :	0,041
Initial water content (w) :	66,1%	Virgin compression index (C_c) :	0,99
Initial humid unit weight (γ_h) :	15,9 kN/m³	Initial effective stress (σ'_v) :	61 kPa
Initial saturation degree (S_r) :	99,8%	Preconsolidation pressure (σ'_p):	320 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	259 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

R.Jean-Legros, resp.géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-1

Sondage no: BH14-37, S-2 Echantillon no: 7

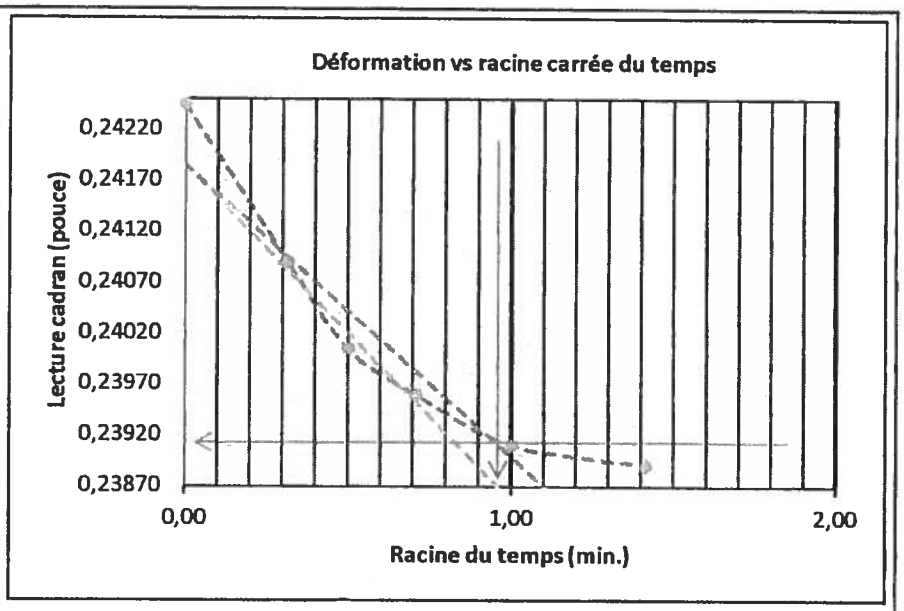
ESSAI A ENVIRON 50 % P'c

Charge: 3,107108 kg 160 kPa

Temps T (min.)	$\sqrt{T}$ (min.)	Déformation "D" (po)*
0,00	0,00	0,24245
0,10	0,32	0,24090
0,25	0,50	0,24005
0,50	0,71	0,23960
1,00	1,00	0,23910
2,00	1,41	0,23890
5,00	2,24	
15,00	3,87	
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	**0,95**	lu sur graphe
Lecture à D90 (pce) =	**0,23915**	lu sur graphe	T90 (min) =	0,9025	
Correction p/r bâti (pce) =	0,00665		c_v (m^2/j) =	3,04E-02	
Lecture corrigée (pce) =	0,24580		e =	1,8180	fin de palier
Déformation (pce) =	0,00420		m_v (kPa^{-1}) =	5,35E-05	
H_d (mm) =	9,48		k (cm/s) =	1,8E-08	

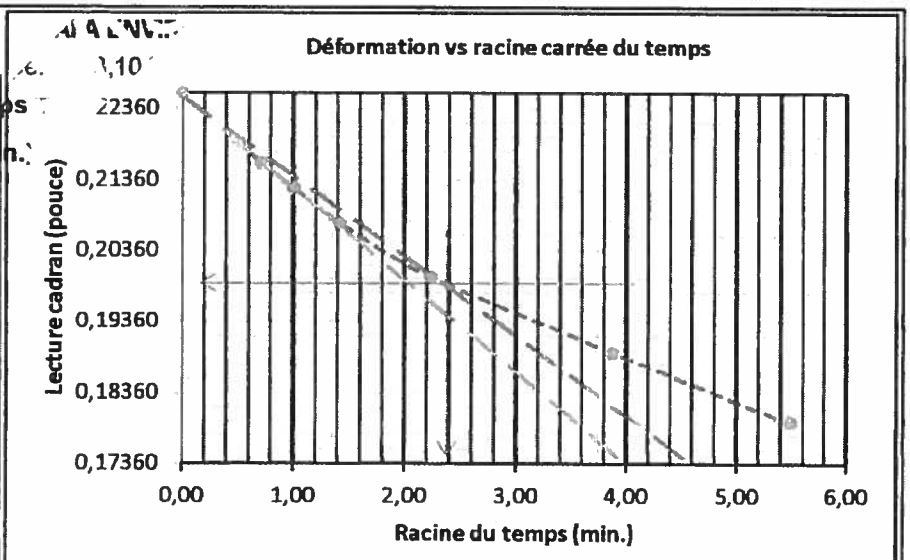
1er ESSAI APRÈS P'c

Charge: 12,56451 kg 641 kPa

Temps T (min.)	$\sqrt{T}$ (min.)	Déformation "D" (po)*
0,00	0,00	0,22580
0,10	0,32	
0,25	0,50	0,21900
0,50	0,71	0,21600
1,00	1,00	0,21250
2,00	1,41	0,20750
5,00	2,24	0,19990
15,00	3,87	0,18930
30,00	5,48	0,17950
58,00	7,62	
	7,62	
	7,62	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500		Racine T90 =	**2,35**	lu sur graphe
Lecture à D90 (pce) =	**0,19940**	lu sur graphe	T90 (min) =	5,5225	
Correction p/r bâti (pce) =	0,01195		c_v (m^2/j) =	4,52E-03	
Lecture corrigée (pce) =	0,21135		e =	1,4715	
Déformation (pce) =	0,03865		m_v (kPa^{-1}) =	3,60E-04	
H_d (mm) =	9,05		k (cm/s) =	1,8E-08	

LVM

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D 2435 - Taylor Method

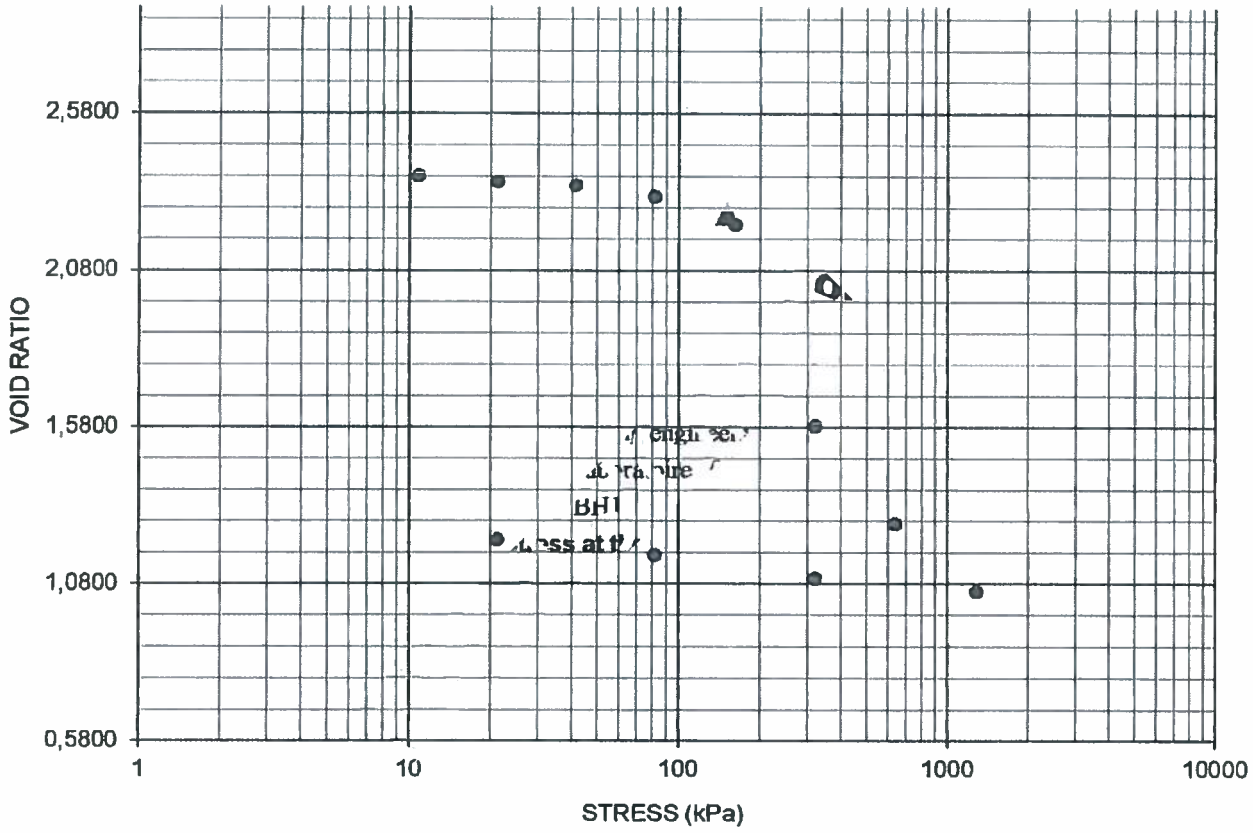
Client: DST Consulting engineers **Date :** 2014-03-06

Project : Essais de laboratoire (DST) **Our file No. :** P-0001929-4-1

Boring No. : BH14-37, S-3 **Sample No. :** 8 **Depth (m) :** 5,7 à 5,8

Hydrostatic stress at the test (date) : Provided by ☐ the client ☐ LVM

STRESS vs VOID RATIO CURVE



Geotechnical Characteristics of Soils :

Initial void ratio (e_o) :	2,386	Recompression index (C_r) :	0,077
Initial water content (w) :	85,5%	Virgin compression index (C_c) :	1,62
Initial humid unit weight (γ_h) :	14,9 kN/m³	Initial effective stress (σ'_v) :	106 kPa
Initial saturation degree (S_r) :	99,6%	Preconsolidation pressure (σ'_p):	150 kPa
		Overconsolidation deviation ($\Delta\sigma$) :	44 kPa

Remarks : The sampling and transportation of the sample were carried out by a client's representative.
The initial effective stress has been provided by the client.

Prepared by :

R.Jean-Legros, resp. géotechnique

Verified by :

Famakhan Fainke, ing.

DÉTERMINATION DU COEFFICIENT DE CONSOLIDATION "c_v" - MÉTHODE LENTE

Projet: Essais de laboratoire (DST) Dossier : P-0001929-4-1

Sondage no: BH14-37, S-3 Echantillon no: 8

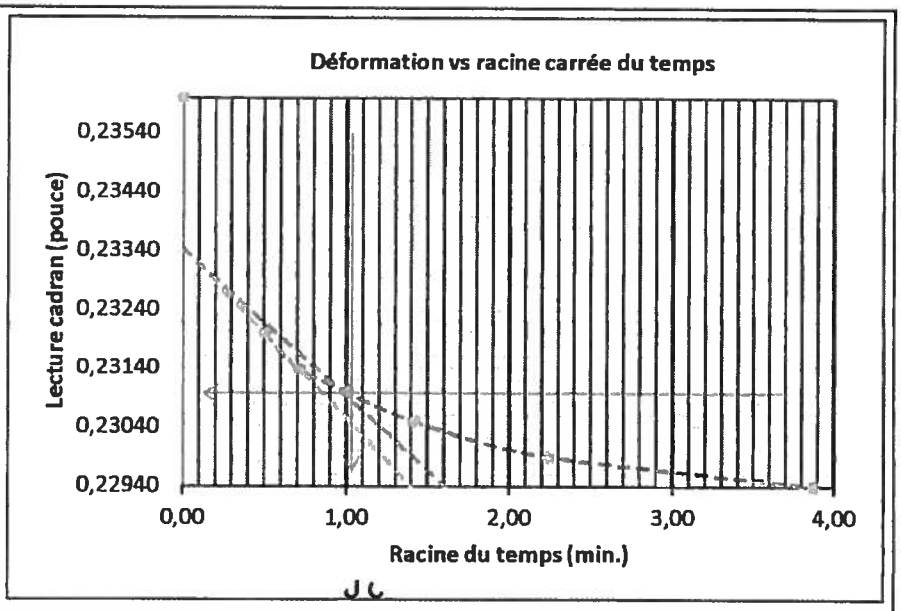
ESSAI A ENVIRON 50 % P'c

Charge: 1,43335 kg 81 kPa

Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,23600
0,10	0,32	
0,25	0,50	0,23200
0,50	0,71	0,23140
1,00	1,00	0,23100
2,00	1,41	0,23050
5,00	2,24	0,22990
15,00	3,87	0,22940
30,00	5,48	
	5,48	
	5,48	
	5,48	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500	Racine T90 =	1 lu sur graphe
Lecture à D90 (pce) =	**0,23100** lu sur graphe	T90 (min) =	1
Correction p/r bâti (pce) =	0,00824	c_v (m^2/j) =	2,50E-02
Lecture corrigée (pce) =	0,23924	e =	2,3170 fin de palier
Déformation (pce) =	0,01076	m_v (kPa^{-1}) =	2,55E-04
H_d (mm) =	9,04	k (cm/s) =	7,2E-08

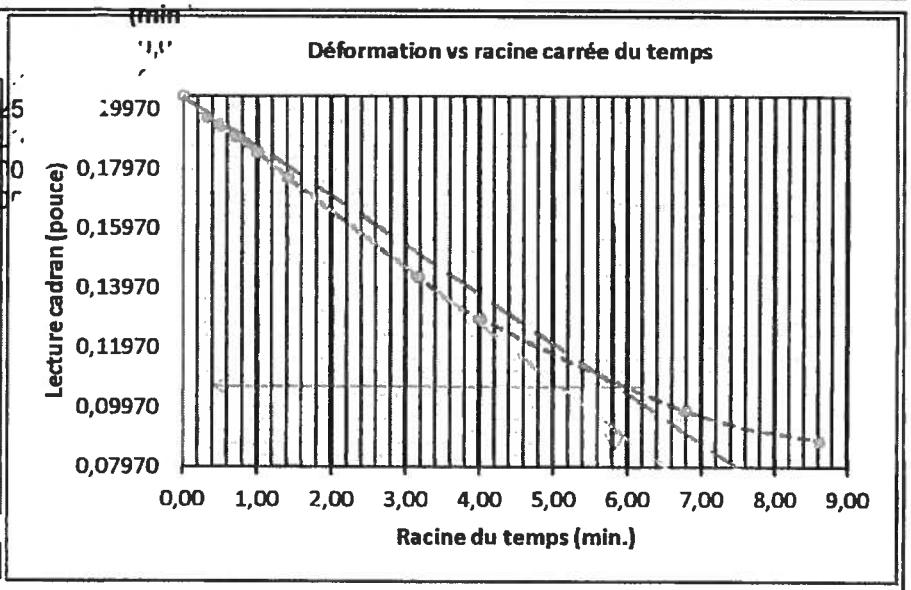
1er ESSAI APRÈS P'c

Charge: 5,6699 kg 318 kPa

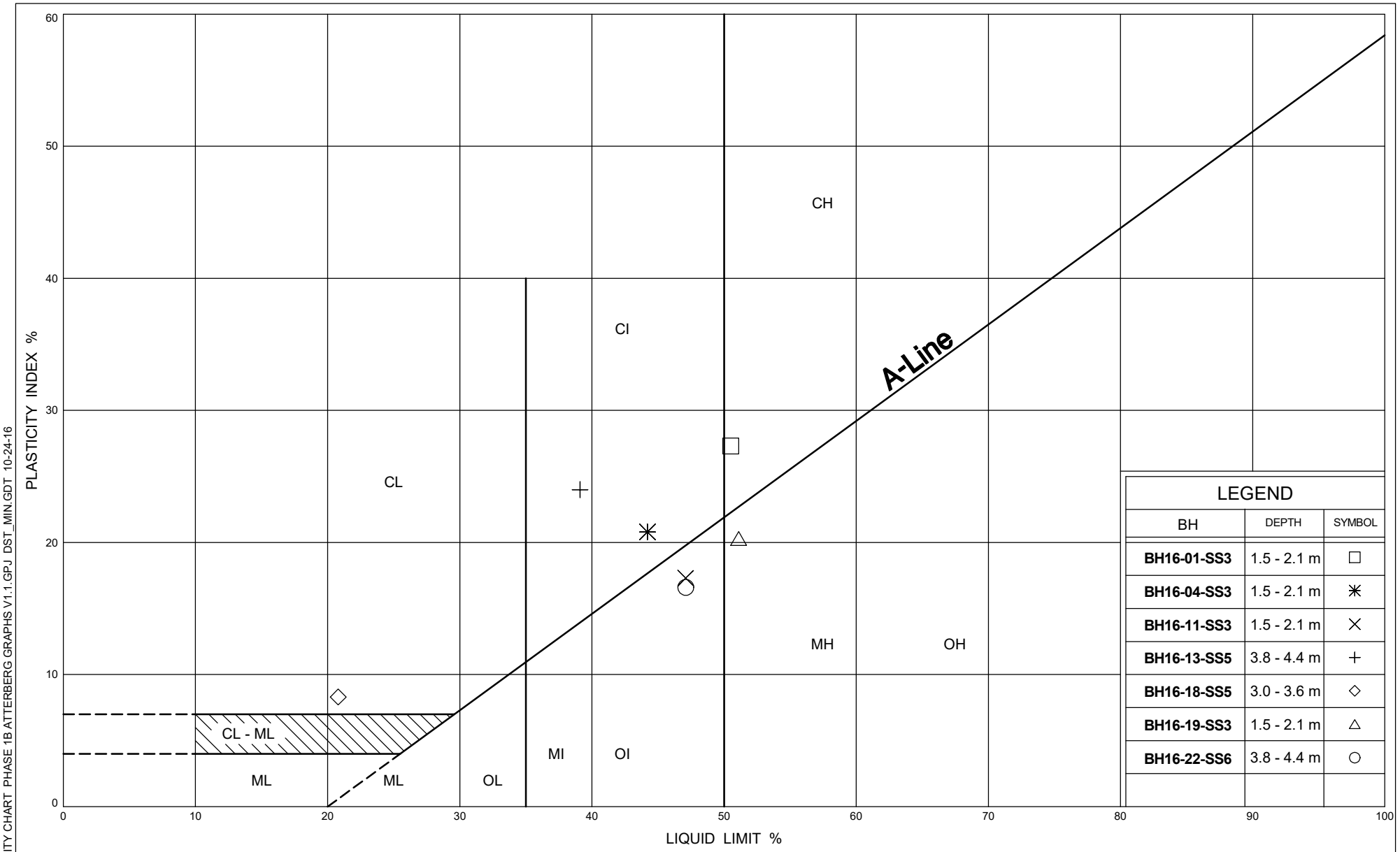
Temps T (min.)	√T (min.)	Déformation "D" (po)*
0,00	0,00	0,20420
0,10	0,32	0,19730
0,25	0,50	0,19440
0,50	0,71	0,19100
1,00	1,00	0,18530
2,00	1,41	0,17690
10,00	3,16	0,14350
16,00	4,00	0,12950
46,00	6,78	0,09860
74,00	8,60	0,08860
	8,60	
	8,60	

* Valeurs non corrigées p/r déformation du bâti

$Cv = 0,848(H/2)^2/T90$



Lecture initiale (pce) =	0,2500	Racine T90 =	**5,8** lu sur graphe
Lecture à D90 (pce) =	**0,10770** lu sur graphe	T90 (min) =	33,64
Correction p/r bâti (pce) =	0,01421	c_v (m^2/j) =	5,18E-04
Lecture corrigée (pce) =	0,12191	e =	1,5851
Déformation (pce) =	0,12809	m_v (kPa^{-1}) =	1,26E-03
H_d (mm) =	7,55	k (cm/s) =	7,4E-09



ONTARIO MOT PLASTICITY CHART PHASE 1B ATTERBERG GRAPHS V1.1.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers

PLASTICITY CHART

DST Ref. No.: **IN-SO-026755**

Client: **Canada Lands Company**

Project: **Site Servicing Phase 1B**

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Ottawa)

Client PO:

Report Date: 16-Sep-2016

Order Date: 15-Sep-2016

Project Description: IN SO 026755

	Client ID:	BH-17 (SS-8)	BH-14 (SS-7)	BH-13 (SS-6)	BH-6 (SS-6)
	Sample Date:	02-Sep-16	02-Sep-16	02-Sep-16	02-Sep-16
	Sample ID:	1638309-01	1638309-02	1638309-03	1638309-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	54.6	60.7	62.4	84.8
General Inorganics					
pH	0.05 pH Units	8.37	8.19	8.06	7.89
Resistivity	0.10 Ohm.m	11.9	29.8	11.3	34.7
Anions					
Chloride	5 ug/g dry	156	10	411	9
Sulphate	5 ug/g dry	146	186	170	254

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4064-1 - AERIAL PHOTOGRAPH - 1991

DRAWING PG4064-2 - TEST HOLE LOCATION PLAN

DRAWING PG4064-3 - PERMISSIBLE GRADE RAISE AREAS

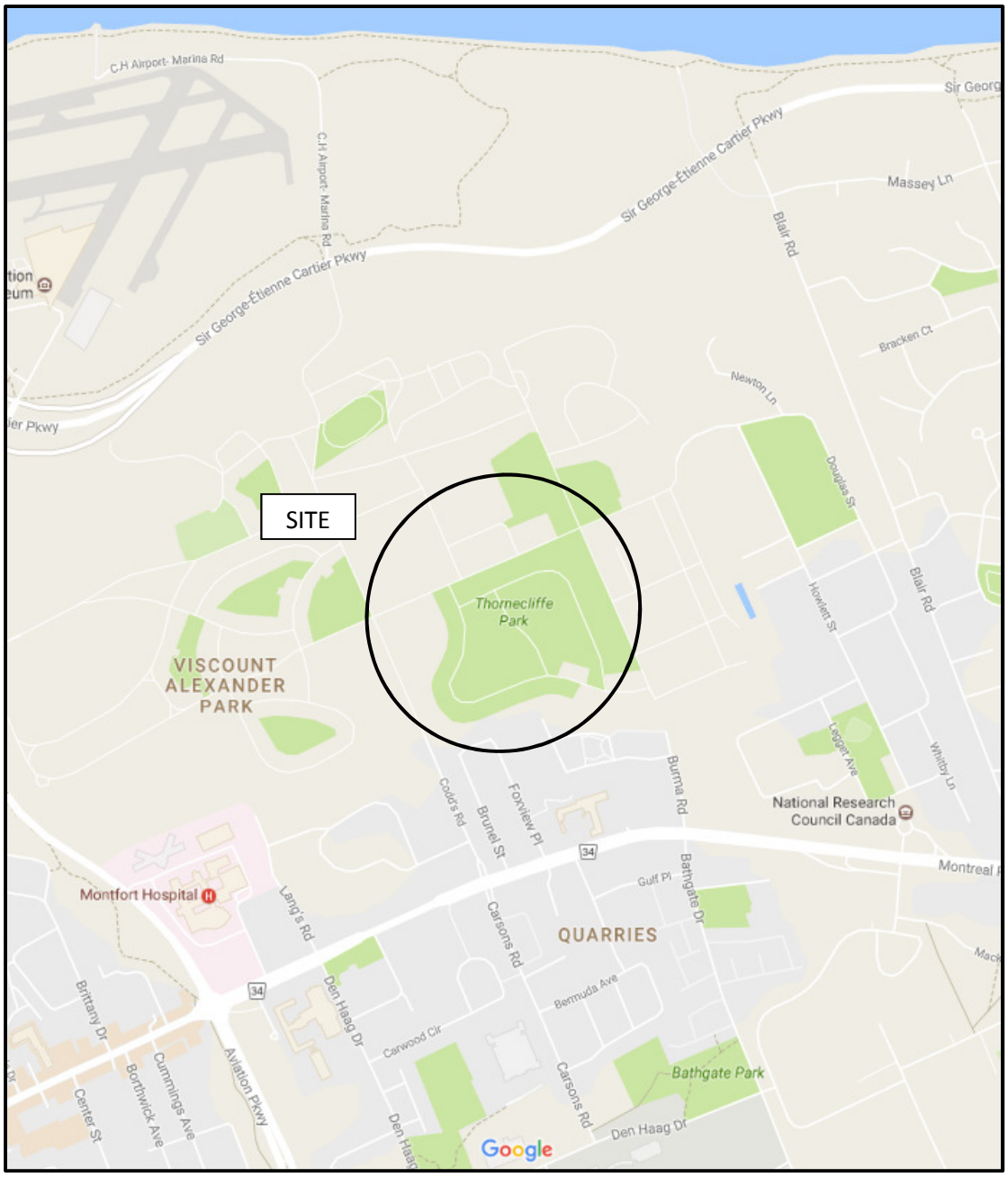


FIGURE 1

KEY PLAN

LEGEND:

SURVEY PLAN PROVIDED BY ANNIS, O'SULLIVAN & VOLLEBEKK LTD. JOB NO.14710-14 CLC Pt Lts 21-23 C1 OF GL Ph 1B SUB D13

AERIAL PHOTOGRAPH OBTAINED FROM geoOTTAWA (1991)

SCALE: 1:2500

0 25 50 75 100 125 150 175m

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
1	BASE PLAN UPDATED	03/08/2017	CB

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
335 ST. LAURENT BOULEVARD - BLOCK 15, 19, 22 AND 24

OTTAWA, ONTARIO

Title:

AERIAL PHOTGRAPH - 1991

Drawn by:	Checked by:	Date:
RCG	RG	03/2017
Scale: 1:2500		Drawing No.: PG4064-1
Report No.: PG4064-1		

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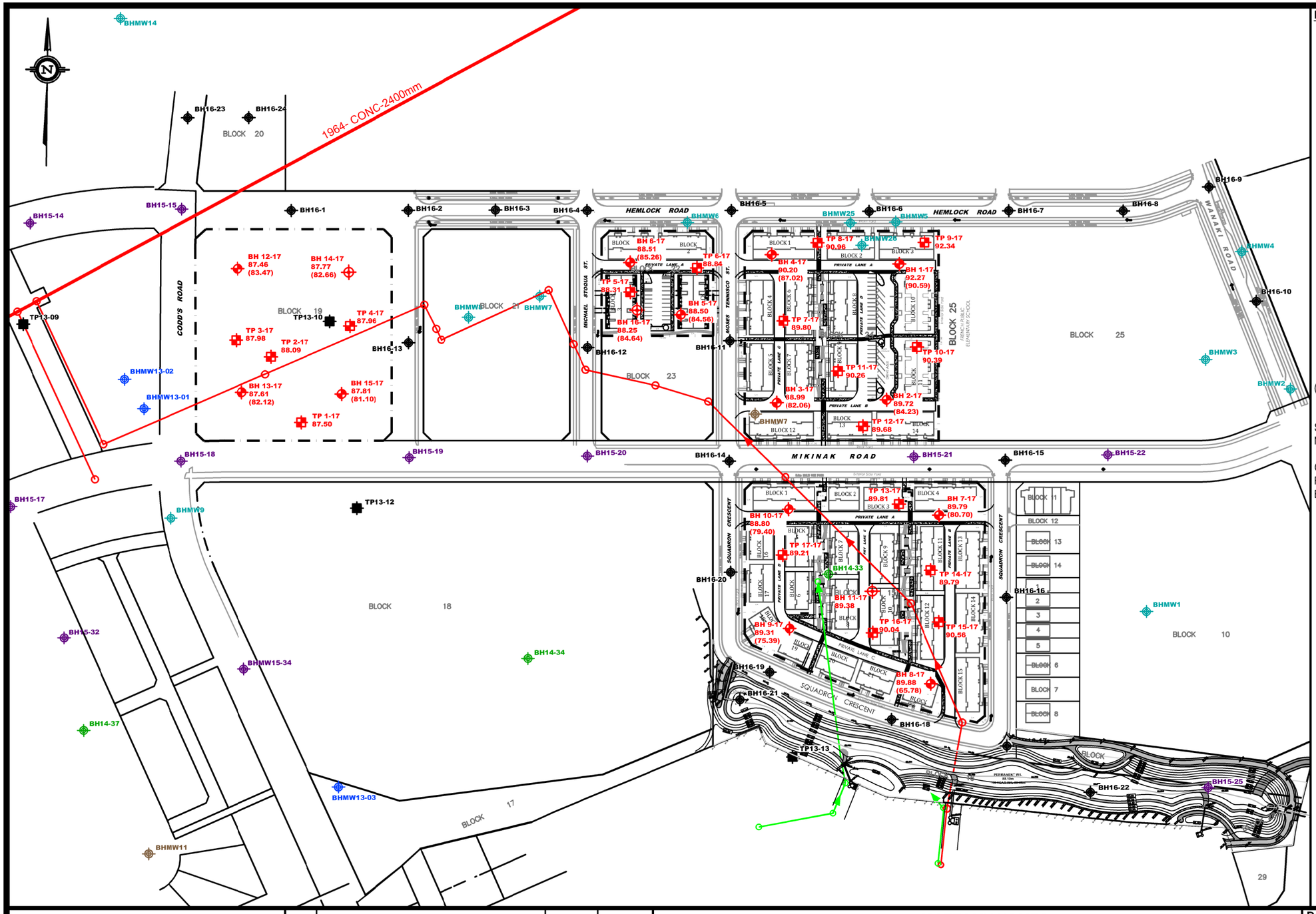

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- TEST PIT LOCATION
- TEST PIT BY OTHERS (DST,2013)
- BOREHOLE LOCATION (DST, 2016)
- BOREHOLE LOCATION (DST, 2015)
- BOREHOLE LOCATION / MONITORING WELL(DST, 2014)
- BOREHOLE WITH MONITORING WELL (DST, 2013)
- BOREHOLE WITH MONITORING WELL (DST, 2006)
- BOREHOLE WITH MONITORING WELL (DST, 2004)
- SANITARY SEWER (CITY OF OTTAWA ARC VIEW)
- STORM SEWER (CITY OF OTTAWA ARC VIEW)
- 92.27 GROUND SURFACE ELEVATION (m)
- (90.52) PRACTICAL REFUSAL TO AUGERING/DCPT ELEVATION (m)

SURVEY PLAN PROVIDED BY ANNIS, O'SULLIVAN & VOLLEBEKK LTD. JOB NO.14710-14 CLC Pt Lts 21-23 C1 OF GL Ph 1B SUB D13

GROUND SURFACE ELEVATIONS AT THE TEST PIT LOCATIONS REFERENCED FROM THE GROUND SURFACE ELEVATIONS OF NEARBY BOREHOLE LOCATIONS PROVIDED BY J.D. BARNES LIMITED.

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consulting engineers

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NO.	REVISIONS	DATE	INITIAL
1	BASE PLAN UPDATED	02/08/2017	CB

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
335 ST. LAURENT BOULEVARD - BLOCK 15,19,22 AND 24

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Drawn by:	Checked by:	Date:
RCG	RG	03/2017
Scale: 1:2500		Drawing No.: PG4064-2
Report No.: PG4064-1		

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LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- TEST PIT LOCATION
- TEST PIT BY OTHERS (DST,2013)
- BOREHOLE LOCATION (DST, 2016)
- BOREHOLE LOCATION (DST, 2015)
- BOREHOLE LOCATION/MONITORING WELL (DST, 2014)
- BOREHOLE WITH MONITORING WELL (DST, 2013)
- BOREHOLE WITH MONITORING WELL (DST, 2006)
- BOREHOLE WITH MONITORING WELL (DST, 2004)
- 92.27 GROUND SURFACE ELEVATION (m)
- (90.52) PRACTICAL REFUSAL TO AUGERING/DCPT ELEVATION (m

SURVEY PLAN PROVIDED BY ANNIS, O'SULLIVAN & VOLLEBEKK LTD. JO NO.14710-14 CLC Pt Lts 21-23 C1 OF GL Ph 1B SUB D13

GROUND SURFACE ELEVATIONS AT TEST PIT LOCATIONS REFERENCED FROM THE GROUND SURFACE ELEVATIONS OF NEARBY BOREHOLE LOCATIONS PROVIDED BY J.D. BARNES LIMITED.

AERIAL PHOTOGRAPH OBTAINED FROM geoOTTAWA (1991)

AREAS WHERE GRADE RAISES UP TO 1.0m IS PERMITTED

AREAS WHERE GRADE RAISES UP TO 1.5m IS PERMITTED

AREAS WHERE GRADE RAISE UP TO 2.0m IS PERMITTED

SCALE: 1:2500

0 25 50 75 100 125 150 175m

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consulting engineers

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Ottawa, Ontario, K2E 7J5
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NO.	REVISIONS	DATE	INITIAL
1	BASE PLAN UPDATED	02/08/2017	CB

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
335 ST. LAURENT BOULEVARD - BLOCK 15, 19, 22 AND 24

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE AREAS

Drawn by:	Checked by:	Date:
RCG	RG	03/2017
Scale: 1:2500		Drawing No.: PG4064-3
Report No.: PG4064-1		

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