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Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Geotechnical Investigation

Proposed Residential Development
Seeley's Bay Street - Half Moon Bay
Ottawa, Ontario

Prepared For

Mattamy Homes

February 21, 2018

Report: PG2992-1

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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 to be located along Seeley's Bay Street in Half Moon Bay residential development in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

❑ Determine the subsoil and groundwater conditions at this site by means of boreholes.

❑ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect its 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.

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 report addressing environmental issues for the subject site was prepared under separate cover.

2.0 Proposed Project

It is our understanding that proposed project consists of five (5) residential blocks where each block consists of 12 townhome units stacked back to back with one basement level. At-grade parking areas and landscaped areas are also anticipated as part of the proposed development.

3.0 Method of Investigation

3.1 Field Investigation

The field program for our current geotechnical investigation was carried out on June 13, 14 and 17, 2013. At that time, a total of five (5) boreholes were advanced to a maximum depth of 25 m. The borehole locations were determined in the field by Paterson personnel taking into consideration site features and underground services. The locations of the boreholes are shown on Drawing PG2992-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were put down using a track-mounted auger drill rig operated by a two person crew. All fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer. The testing procedure consisted of augering to the required depths and at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the auger flights (AU) or using a 50 mm diameter split-spoon (SS) sampler. All soil samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

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

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

Diamond drilling was carried out at BH 1-13 to determine the nature of the bedrock and to assess its quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock.

Groundwater

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

Sample Storage

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

3.2 Field Survey

The borehole locations were determined by Paterson personnel taking into consideration the presence of underground and aboveground services. The location and ground surface elevation at each borehole location was surveyed by JD Barnes. The ground surface elevations at the borehole locations are referenced to a geodetic datum. The borehole locations and ground surface elevation at each borehole location are presented on Drawing PG2992-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.7 of this report.

4.0 Observations

4.1 Surface Conditions

Currently, the subject site is undeveloped with fill noted at ground surface across the site. The ground surface slopes gradually downward to the west across the site.

4.2 Subsurface Profile

Generally, the subsurface profile encountered at the boreholes locations consist of a fill material, consisting of brown silty sand with gravel, cobbles and boulders, overlying a silty clay deposit and/or glacial till deposit. Where encountered, the silty clay deposit was noted to extend between 4 to 7 m depth below existing ground surface. Based on our findings at BH 1-13, the glacial till deposit extends to a 22 m depth. Limestone bedrock was cored at BH 1-13 between a 22 to 25 m depth. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Silty Clay Deposit

In situ shear vane field testing carried out within the silty clay deposit yielded undrained shear strength values ranging from approximately 25 to 100 kPa. These values are indicative of a firm to very stiff consistency.

The results of the consolidation tests from our previous investigations are presented in Table 1 and in Appendix 1. The value for p'_c is the preconsolidation pressure and p'_o is the effective overburden pressure of the test sample. The difference between these values is the available preconsolidation. The increase in stress on the soil due to the cumulative effects of the fill surcharge, the footing pressures, the slab loadings and the lowering of the groundwater should not exceed the available preconsolidation if unacceptable settlements are to be avoided.

The values for C_{cr} and C_c are the recompression and compression indices, respectively. These soil parameters are a measure of the compressibility due to stress increases below and above the preconsolidation pressures. The higher values for the C_c, as compared to the C_{cr}, illustrate the increased settlement potential above, as compared to below, the preconsolidation pressure.

Table 1 - Summary of Consolidation Test Results

Borehole No.	Sample	Depth (m)	p'_c (kPa)	p'_o (kPa)	C_{cr}	C_c	Q (*)
BH 3-07	TW 3	2.54	81	34	0.014	0.550	G
BH 3-07	TW 4	4.19	71	45	0.013	0.253	A
BH 1A-10	TW 1	3.50	72	33	0.012	1.147	A

* - Q - Quality assessment of sample - G: Good A: Acceptable P: Likely disturbed

The values of p'_c, p'_o, C_{cr} and C_c are determined using standard engineering testing procedures and are estimates only. Natural variations within the soil deposit will affect the results. The p'_o parameter is directly influenced by the groundwater level. Groundwater levels were measured during the site investigation. Groundwater levels vary seasonally which has an impact on the available preconsolidation. Lowering the groundwater level increases the p'_o and therefore reduces the available preconsolidation. Unacceptable settlements could be induced by a significant lowering of the groundwater level. The p'_o values for the consolidation tests carried out for the present investigation are based on the long term groundwater level observed at each borehole location. The groundwater level is based on the colour and undrained shear strength profile of the silty clay.

4.3 Groundwater

The long term groundwater level at the current borehole locations was estimated based on the recovered soil samples' moisture levels and consistency. Based on these observations, the long term groundwater table is anticipated to be at a 3 to 5 m depth. It should be further noted that the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered acceptable for the proposed residential blocks. It is expected that the proposed buildings can be founded by conventional style shallow foundations provided the bearing resistance values are sufficient to support design loads. Due to the sensitive silty clay layer encountered within the west portion of the subject site, it is recommended to place footings as high as possible within the silty clay crust layer or alternatively, footings could be extended to the glacial till layer. A lean concrete in-filled trench could be utilized to transfer building loads through the silty clay layer to the glacial till deposit, if required.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the 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 and beneath parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted 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 unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Conventional Shallow Footings - Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, placed over an undisturbed, stiff silty clay bearing surface at or above geodetic elevation of 95.0 m can be designed using a bearing resistance value at SLS of **125 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

Footings placed over an undisturbed, compact glacial till bearing surface or over a lean concrete (minimum 15 MPa concrete) in-filled trench extending to an undisturbed, compact glacial till layer can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **250 kPa**. It is recommended that the trench sidewalls extend at least 150 mm beyond the footing face.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings.

The bearing resistance values at SLS given for footings will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a stiff silty clay 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.

Permissible Grade Raise Recommendations

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit if the proposed buildings are to be founded over the silty clay deposit. 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. A minimum value of 50% of the live load is often recommended by Paterson.

A permissible grade raise restriction of **1.0 m** from original ground surface is recommended for finished grading within 5 m of the proposed buildings where the proposed buildings are founded over the silty clay deposit. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise restriction calculations.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for the shallow foundations at the subject site. 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 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 for a basement slab. 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 the SPMDD.

5.6 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car parking areas and access lanes.

Table 2 - 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 3 - Recommended Pavement Structure - Access Lanes	
Thickness (mm)	**Material Description**
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** 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.

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 II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

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

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should be installed at each catch basin, be at least 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped 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, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000 or equivalent, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 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

Unsupported Excavations

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.

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

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the firm grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extent at least to the spring line of the pipe.

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

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

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

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, 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 material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of the shallow excavation. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

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

For typical ground or surface water volumes being pumped during the construction phase, typically 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, and EASR will not be allowed as a temporary dewatering measure while awaiting the MOECC review of the PTTW application.

6.6 Winter Construction

The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

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

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

6.8 Landscaping Considerations

The proposed residential dwellings are located in a high 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 consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. 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 2 m depth.

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.

7.0 Recommendations

It is recommended that the following be carried out once the master plan and site development are determined:

- ❏ Review detailed grading plan(s) from a geotechnical perspective.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ 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 placing backfilling materials.
- ❏ Field density tests to ensure that the specified level of compaction has been achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon request, following the completion of a satisfactory material testing and observation 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. We request permission to review the grading plan once available. Also, our recommendations should be reviewed when the drawings and specifications are complete.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

CONSOLIDATION TESTING RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG2992

REMARKS

HOLE NO. BH 1-13

BORINGS BY CME 55 Power Auger

DATE June 13, 2013

SOIL DESCRIPTION	Boundary depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.96
FILL: Brown silty clay with sand, gravel, cobbles, trace topsoil	1.45	AU	1				
		SS	2	21	3	1	91.96
FILL: Brown sand with gravel, some clay	1.83	SS	3	100	50+		
Compact, brown **SILTY SAND,** some clay	2.97	SS	4	0	16	2	90.96
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders	6.00	SS	5	100	50+	3	89.96
		SS	6	42	4	4	88.96
		SS	7	38	7	5	87.96
		SS	8	46	5		
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boulders, trace clay		SS	9	100	5	6	86.96
		SS	10	67	17	7	85.96
		SS	11	62	20	8	84.96
		SS	12		50+	9	83.96
						10	82.96
		RC	1	28		11	81.96
						12	80.96
		RC	2	34		13	79.96
						14	78.96

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

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 13, 2013

FILE NO. PG2992

HOLE NO. BH 1-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boulders, trace clay		RC	3	30		14	78.96
						15	77.96
		RC	4	25			
						16	76.96
		RC	5	34		17	75.96
						18	74.96
		RC	6				
						19	73.96
		RC	7			20	72.96
						21	71.96
		RC	8				
22.43						22	70.96
BEDROCK: Grey limestone		RC	9	97	65	23	69.96
						24	68.96
		RC	10	100	85		
25.37						25	67.96
End of Borehole							

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

○ Water Content %

20 40 60 80

Piezometer Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

REMARKS

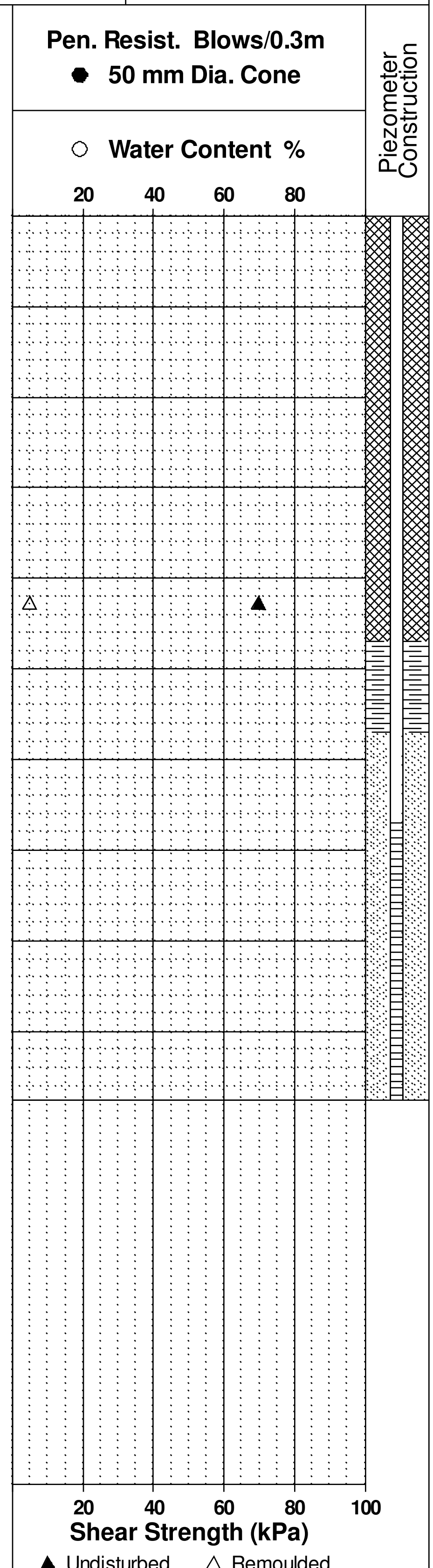
BORINGS BY CME 55 Power Auger

DATE June 17, 2013

FILE NO. PG2992

HOLE NO. BH 2-13

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.10
FILL: Brown silty clay with sand and gravel, trace cobbles	2.21	AU	1				
		SS	2		7	1	92.10
		SS	3	100	3	2	91.10
FILL: Brown silty sand with gravel, cobbles, trace boulders	2.59	SS	4	80	50+		
Stiff, brown **SILTY CLAY,** trace sand	4.27	SS	5	50	10	3	90.10
						4	89.10
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders	7.16	SS	6	83	17	5	88.10
		SS	7	67	21		
		SS	8	67	14	6	87.10
						7	86.10
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders, trace clay	9.75	SS	9	17	28	8	85.10
						9	84.10
		SS	10	21	10		
End of Borehole							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. **PG2992**

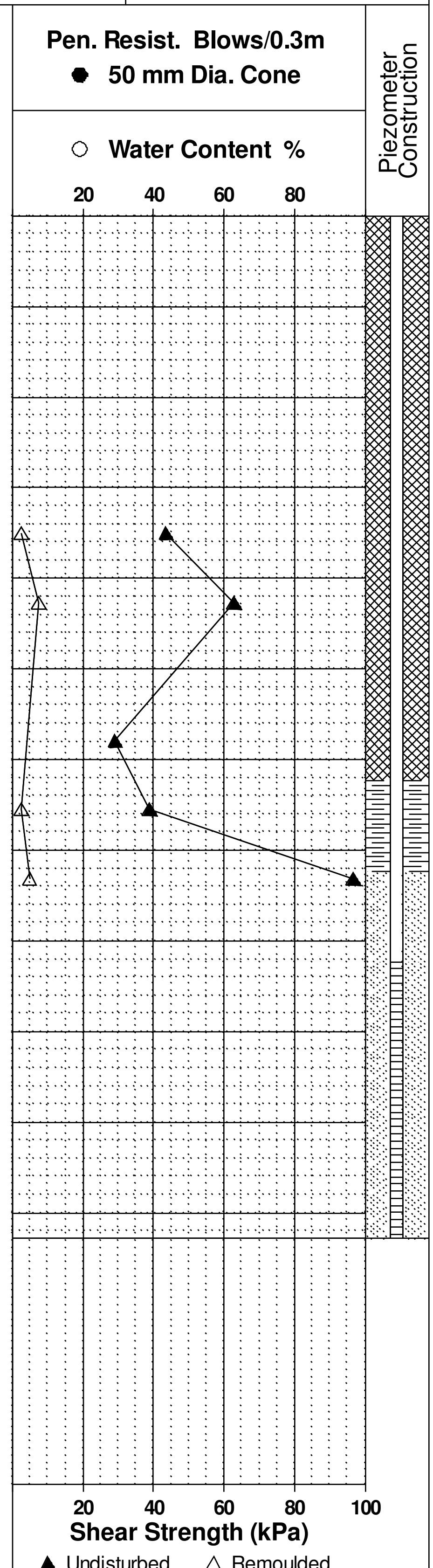
REMARKS

HOLE NO. **BH 3-13**

BORINGS BY CME 55 Power Auger

DATE June 13, 2013

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	92.57
FILL: Topsoil with brown silty clay, sand, gravel, cobbles, trace boulders — 0.60	SS	1				
FILL: Brown silty sand with gravel, trace boulders — 1.45	SS	2	50	25	1	91.57
Very stiff to stiff, brown **SILTY CLAY,** some sand	SS	3	58	21	2	90.57
	SS	4	83		3	89.57
- firm to stiff and grey by 3.2m depth					4	88.57
	SS	5	100	W	5	87.57
					6	86.57
— 7.47					7	85.57
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders					8	84.57
	SS	6	83	25	9	83.57
— 9.83	SS	7	67	3	10	82.57
GLACIAL TILL: Dense, grey silty sand with clay, gravel, cobbles and boulders — 11.28	SS	8	83	30	11	81.57
End of Borehole						



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. **PG2992**

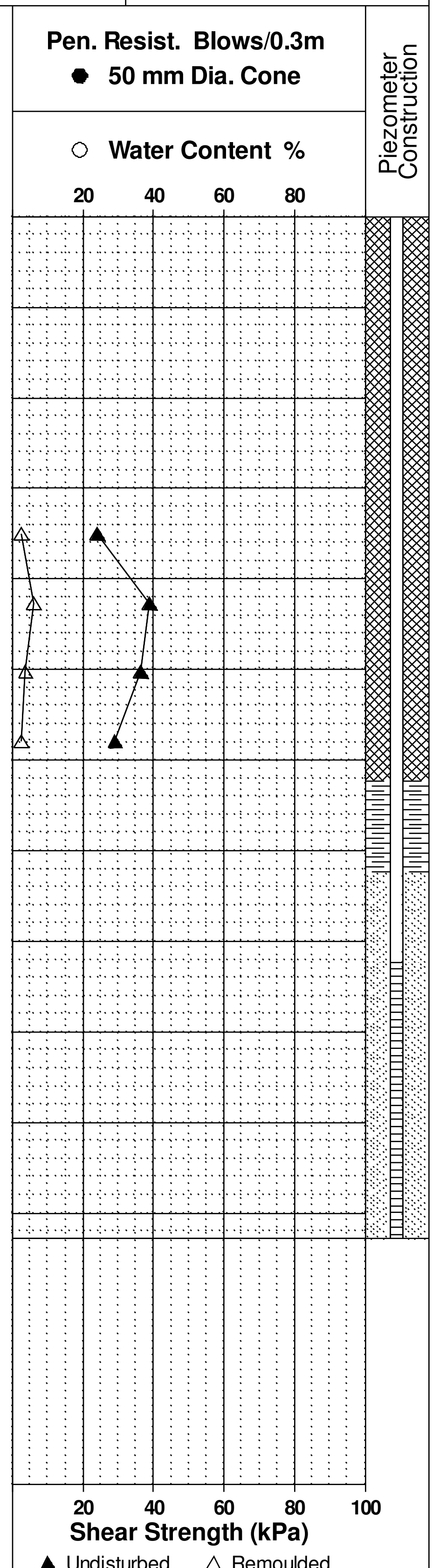
REMARKS

HOLE NO. **BH 4-13**

BORINGS BY CME 55 Power Auger

DATE June 14, 2013

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.12
FILL: Brown silty clay with sand, gravel, cobbles, trace boulders	0.30	AU	1				
FILL: Brown silty sand, trace gravel	1.45	SS	2	83	34	1	91.12
Firm to stiff, brown **SILTY CLAY** with sand - grey by 3.0m depth	6.10	SS	3	58	7	2	90.12
		SS	4	100	1	3	89.12
						4	88.12
						5	87.12
						6	86.12
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders	11.28	SS	5	67	8		
		SS	6	83	13	7	85.12
		SS	7	67	24	8	84.12
						9	83.12
		SS	8	100	2	10	82.12
		SS	9	83	15	11	81.12
End of Borehole							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Apartment Block - Seeley's Bay Street
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

REMARKS

BORINGS BY CME 55 Power Auger

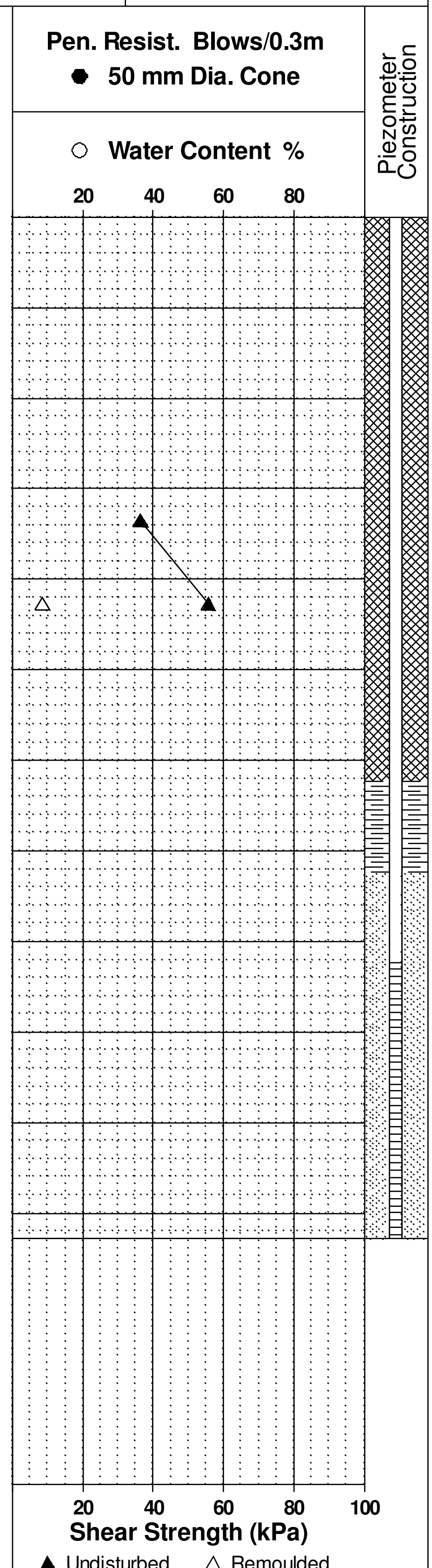
DATE June 14, 2013

FILE NO. PG2992

HOLE NO. BH 5-13

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Brown silty clay with sand, gravel, cobbles, trace boulders	0.60				
FILL: Brown silty sand with clay, gravel, cobbles and boulders	1.45	SS	1	79	63
Firm to stiff, brown **SILTY CLAY,** trace sand seams	5.00	SS	2		8
		SS	3	100	4
		SS	4	100	2
GLACIAL TILL: Compact to dense, grey silty sand with gravel, cobbles and boulders, trace clay	11.28	SS	5	62	27
		SS	6	85	30
		SS	7	67	37
		SS	8	100	50+
		SS	9	83	20
End of Borehole					

DEPTH (m)	ELEV. (m)
0	92.38
1	91.38
2	90.38
3	89.38
4	88.38
5	87.38
6	86.38
7	85.38
8	84.38
9	83.38
10	82.38
11	81.38



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Half Moon Bay - Phase 8 and Phase 9
Ottawa, Ontario

DATUM Geodetic, provided by JD Barnes Ltd.

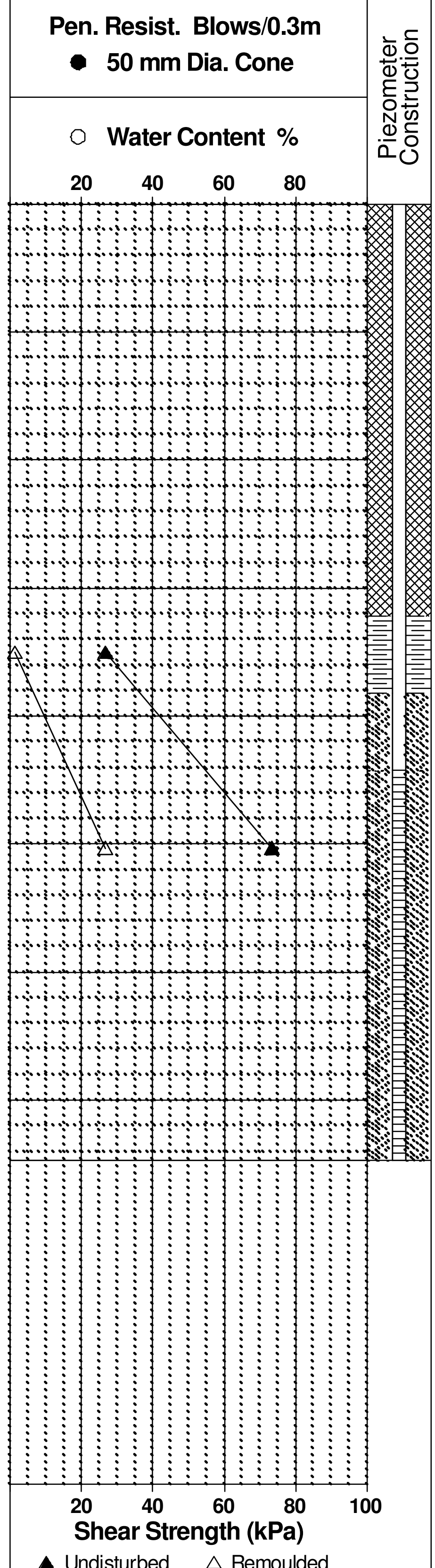
FILE NO. PG2099

REMARKS

HOLE NO. BH 1-10

BORINGS BY CME 55 Power Auger **DATE** 19 August 2010

SOIL DESCRIPTION	Sample TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	93.46
FILL: Brown silty sand, trace clay and gravel	AU	1				
	SS	2	73	50+	1	92.46
1.37						
Loose, brown **SANDY SILT** with clay	SS	3	83	6		
2.13					2	91.46
Firm to stiff, brown **SILTY CLAY**, trace sand	SS	4	100	2		
- grey by 2.9m depth					3	90.46
	TW	5			4	89.46
5.18					5	88.46
GLACIAL TILL: Loose to compact, grey silty sand with gravel, cobbles and boulders, trace clay	SS	6	33	7	6	87.46
	SS	7	21	16		
	SS	8	38	11	7	86.46
7.47						
End of Borehole						



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Half Moon Bay - Phase 8 and Phase 9
Ottawa, Ontario

DATUM Geodetic, provided by JD Barnes Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 20 August 2010

FILE NO. PG2099

HOLE NO. BH 1A-10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	93.46		
FILL: Brown silty sand, trace clay and gravel — 1.37						1	92.46		
Loose, brown **SANDY SILT** with clay — 2.13						2	91.46		
Firm to stiff, brown **SILTY CLAY**, trace sand - grey by 2.9m depth						3	90.46		
3.66		TW	1						
End of Borehole									

Pen. Resist. / Water Content scale: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development-Half Moon Bay
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

REMARKS

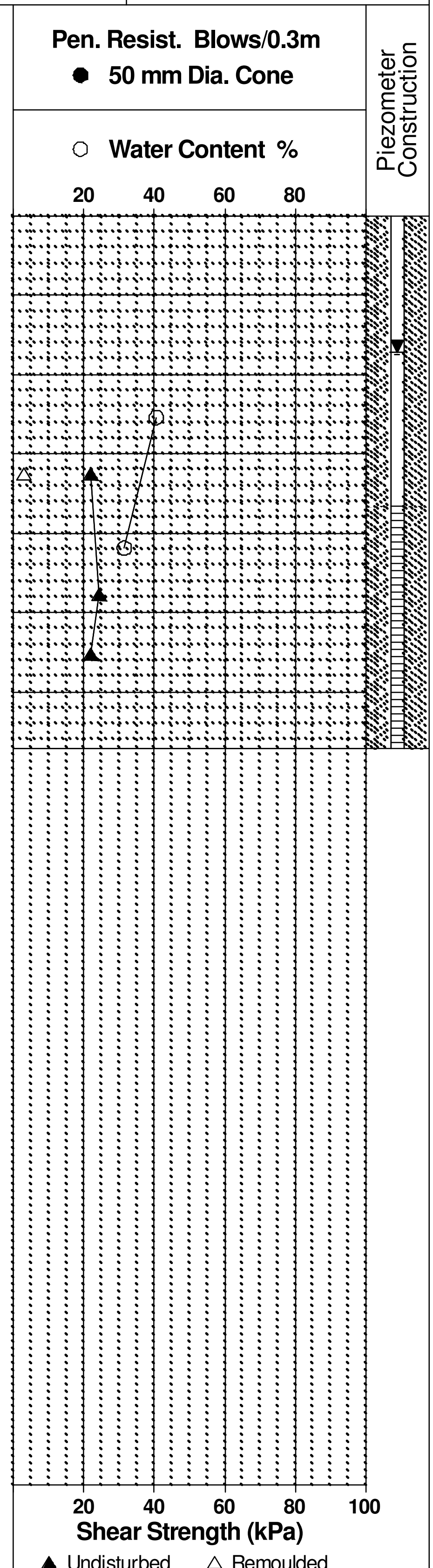
BORINGS BY CME 75 Power Auger

DATE 22 June 2007

FILE NO. PG0177

HOLE NO. BH 3-07

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.67
TOPSOIL 0.36							
Loose, brown **SILTY SAND**, trace clay 1.52		SS	1	50	4	1	91.67
Firm, brown **SILTY CLAY**, some sand seams		SS	2	75	1	2	90.67
- soft and grey by 2.3m depth		TW	3	88		3	89.67
		TW	4	92		4	88.67
						5	87.67
6.25						6	86.67
GLACIAL TILL: Stiff, grey silty clay with gravel, cobbles 6.71		SS	5	17	9		
End of Borehole							
(GWL @ 1.72-June 29/07)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development-Half Moon Bay
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG0177

REMARKS

HOLE NO. BH 6-05

BORINGS BY CME 55 Power Auger **DATE** 5 July 2005

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.69
TOPSOIL	0.19						
Loose, brown **SILTY** fine **SAND**, trace clay	0.76						
Very stiff to stiff, brown **SILTY CLAY**, some sand		SS	1	75	8	1	91.69
		SS	2	100	3	2	90.69
- firm and grey by 2.6m depth						3	89.69
	3.80	SS	3	100	1		
GLACIAL TILL: Compact to dense, grey silty fine sand with gravel, cobbles and boulders	3.89	SS	4	100	50+		

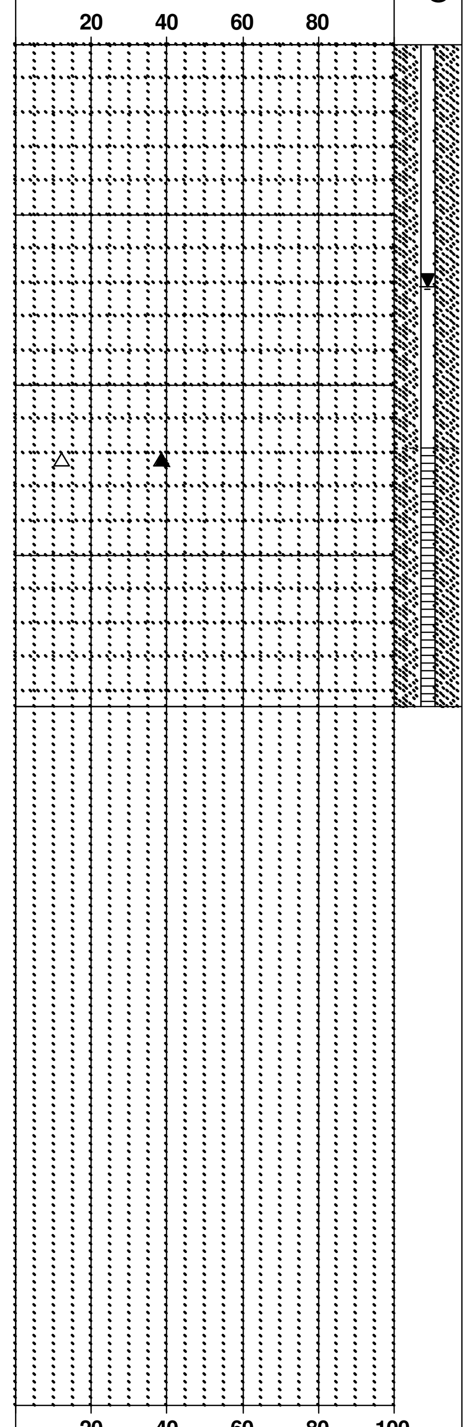
End of Borehole

Practical refusal to augering @ 3.89m depth

(GWL @ 1.42m-July 18/05)

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

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development-Half Moon Bay
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG0177

REMARKS

HOLE NO. BH 6A-05

BORINGS BY CME 55 Power Auger **DATE** 5 July 2005

SOIL DESCRIPTION	Depth to base (m)	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	92.69
TOPSOIL	0.20							
Loose, brown **SILTY** fine **SAND**, trace clay	0.76						1	91.69
Very stiff to stiff, brown **SILTY CLAY**, some sand - firm and grey by 2.6m depth	3.66						2 3	90.69 89.69
GLACIAL TILL: Grey silty fine sand with gravel, cobbles and boulders	5.18		SS	1	25	3	4 5	88.69 87.69
End of Borehole								

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

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Half Moon Bay - Phase 8 and Phase 9
Ottawa, Ontario

DATUM Geodetic, provided by JD Barnes Ltd.

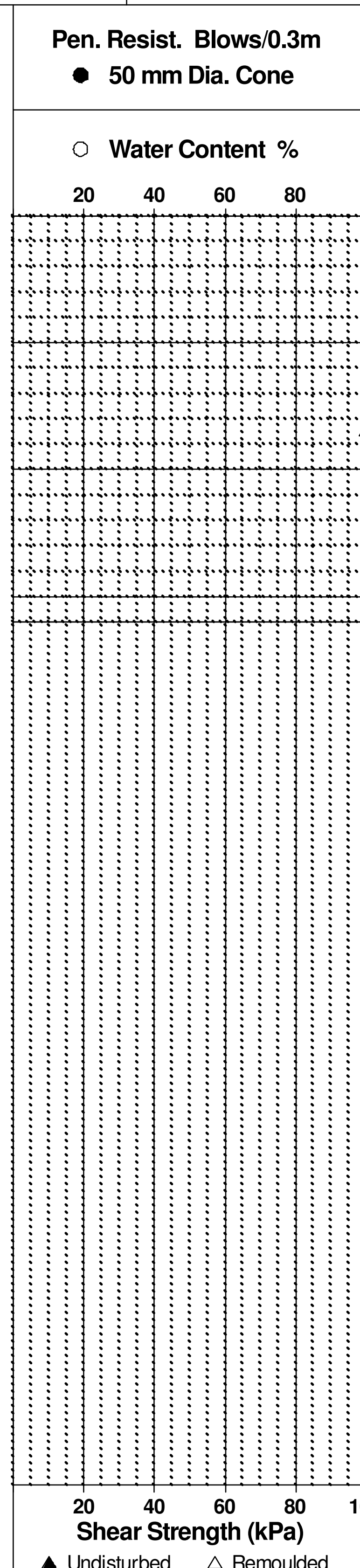
FILE NO. PG2099

REMARKS

HOLE NO. TP 1-10

BORINGS BY Hydraulic Shovel **DATE** 30 August 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.94
FILL: Brown silty sand with clay, gravel, cobbles, trace boulders — 0.69	▩						
Very stiff, brown **SILTY CLAY,** with sand seams — 1.80	▨					1	91.94
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles and boulders - grey by 2.7m depth — 3.20						2	90.94
End of Test Pit (Groundwater infiltration @ 1.6m depth)						3	89.94



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development-Half Moon Bay
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG0177

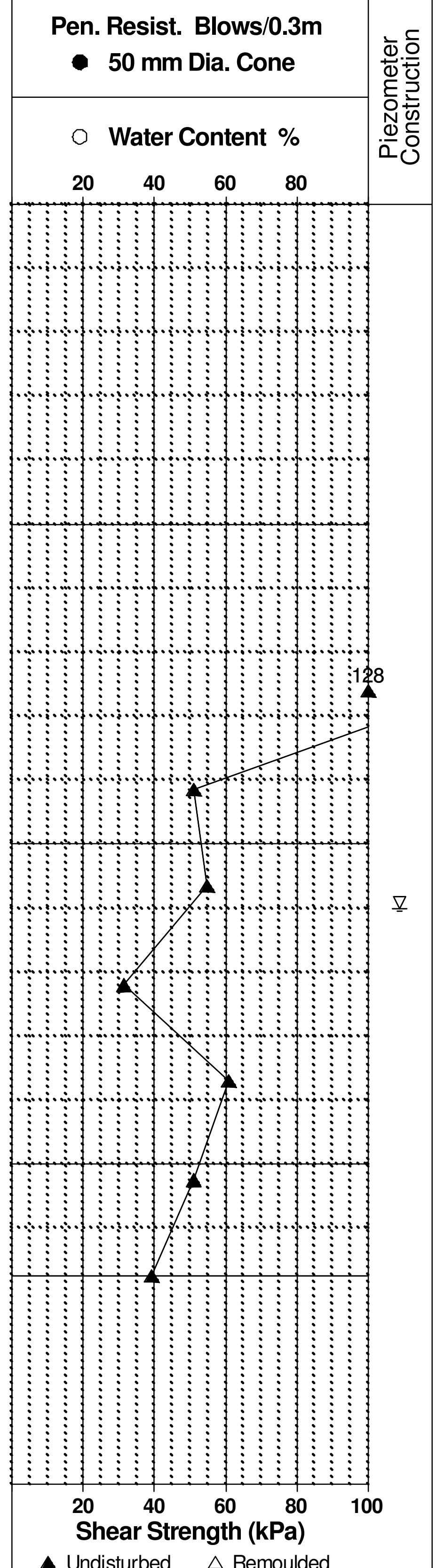
REMARKS

HOLE NO. TP24-07

BORINGS BY Backhoe

DATE 1 June 2007

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.75
TOPSOIL (to 0.28)							
Very stiff to stiff, brown SILTY CLAY (0.28 to 3.10)						1	91.75
						2	90.75
Firm, grey SILTY CLAY (3.10 to 3.35)						3	89.75
End of Test Pit							
(Open hole GWL @ 2.2m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Residential Development-Half Moon Bay Phase 6
Ottawa, Ontario

DATUM Ground surface elevations provided by JD Barnes Ltd.

FILE NO. PG1914

REMARKS

HOLE NO. TP 5

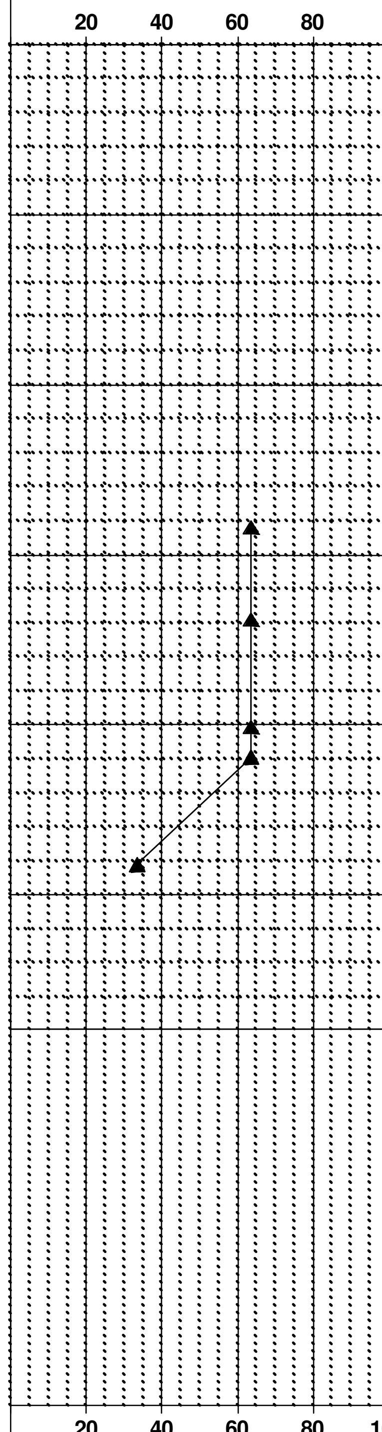
BORINGS BY Backhoe

DATE 21 April 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.43
FILL: Grey-brown silty clay, some sand, gravel, cobbles, trace boulders — 0.97						1	93.43
Dense, brown **SILTY SAND** with gravel, cobbles and boulders — 2.23						2	92.43
Stiff to firm, brown **SILTY CLAY,** some sand to 3.35m depth — 5.51						3	91.43
						4	90.43
						5	89.43
GLACIAL TILL: Dense, grey silty sand with gravel, cobbles and boulders, trace clay — 5.79							
End of Test Pit							

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Residential Development-Half Moon Bay Phase 6
Ottawa, Ontario

DATUM Ground surface elevations provided by JD Barnes Ltd.

FILE NO. PG1914

REMARKS

HOLE NO. TP 6

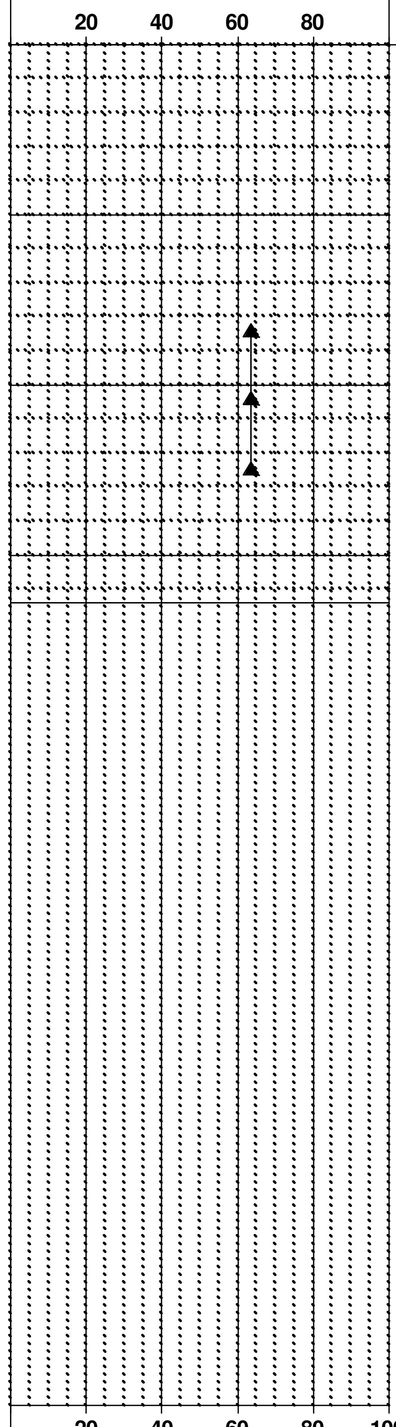
BORINGS BY Backhoe **DATE** 21 April 2010

SOIL DESCRIPTION	Bottom depth (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	92.95
TOPSOIL	0.30							
Red-brown **SILTY SAND**	0.60							
Stiff, brown **SILTY CLAY** with sand to 1.8m depth	2.57						1	91.95
							2	90.95
GLACIAL TILL: Dense, grey silty sand with gravel, cobbles and boulders, trace clay	3.28						3	89.95
End of Test Pit								

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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 = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

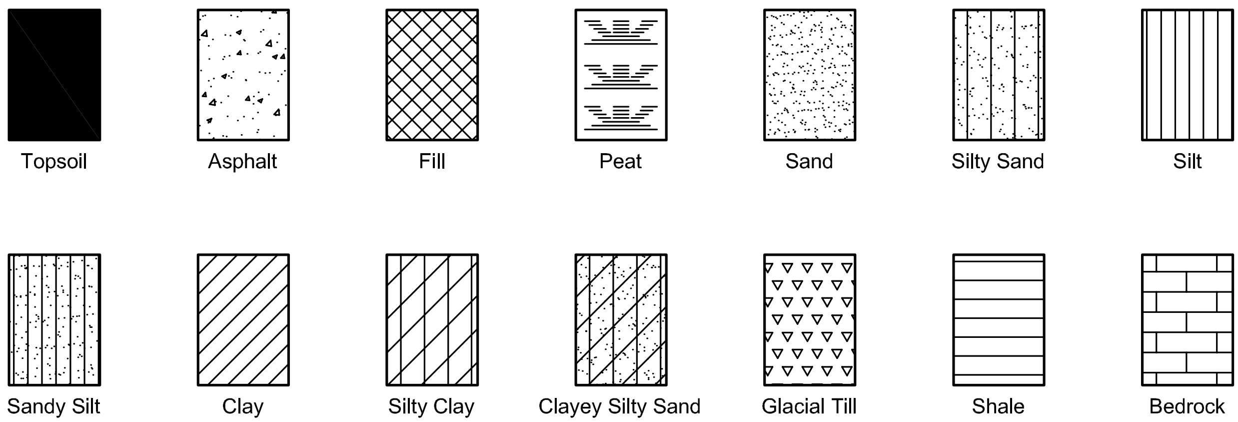
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

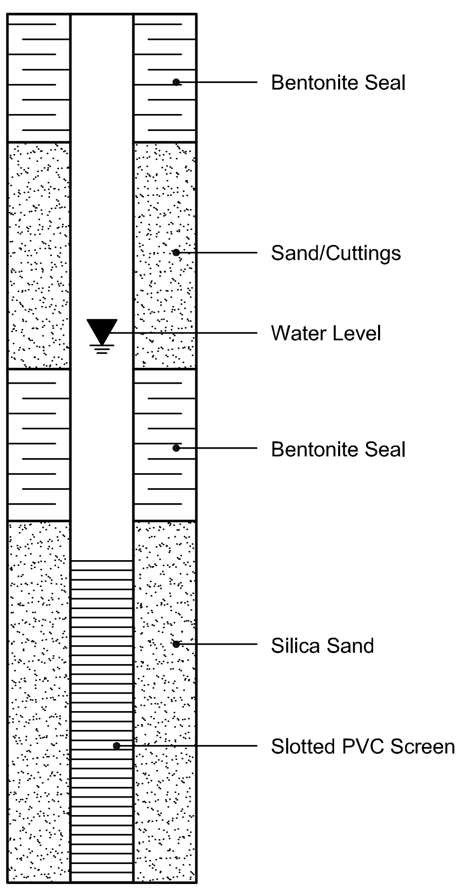
SYMBOLS AND TERMS (continued)

STRATA PLOT

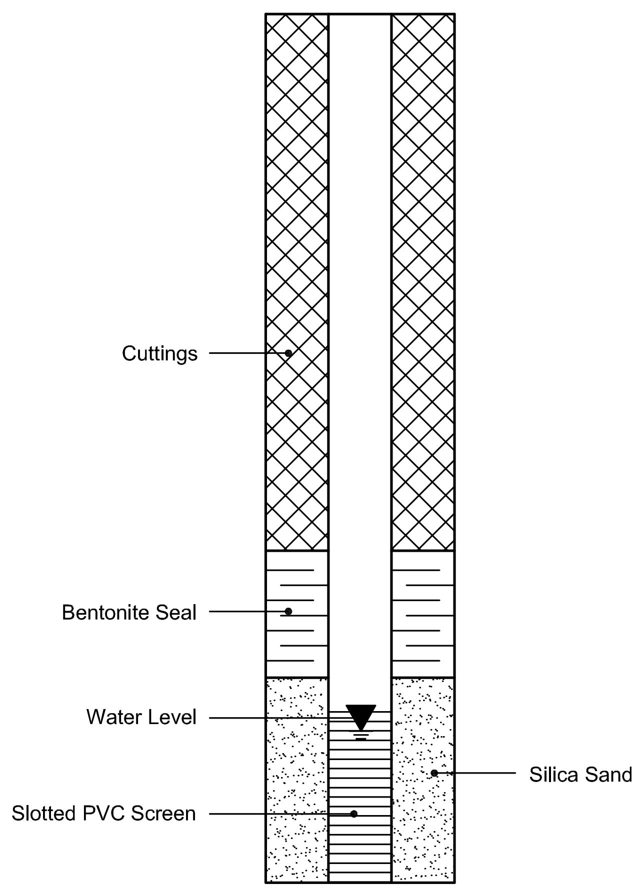


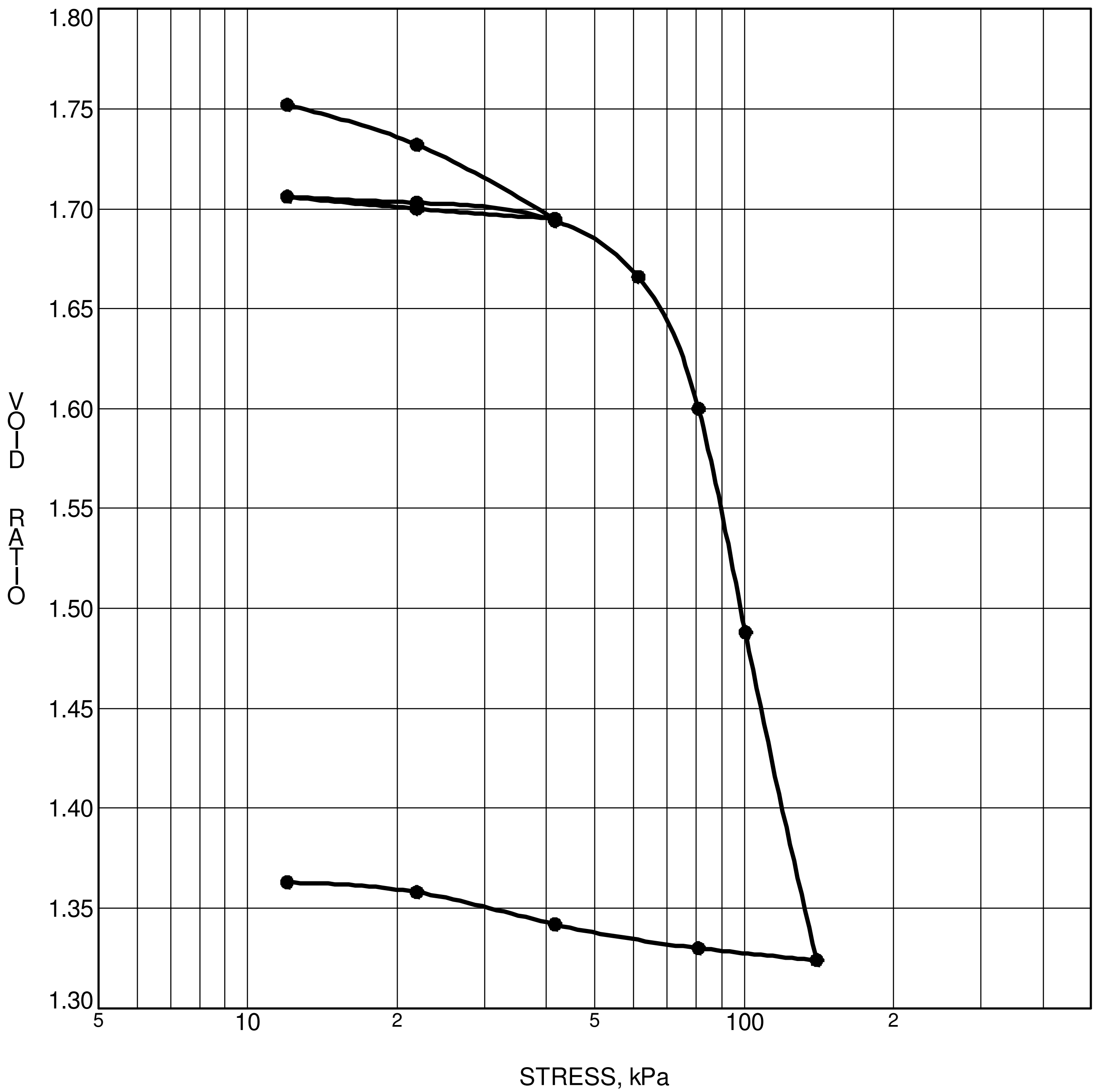
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 1A-10**	p'_o	**33** kPa	Ccr	**0.012**
Sample No.	**TW 1**	p'_c	**72** kPa	Cc	**1.147**
Sample Depth	**3.50** m	OC Ratio	**2.2**	Wo	**64.5** %
Sample Elev.	**89.96** m	Void Ratio	**1.773**	Unit Wt.	**16.0** kN/m^3

Overburden pressure based on original ground surface, elevation 92.6m.

CLIENT	**Mattamy Homes**	FILE NO.	**PG2099**
PROJECT	**Geotechnical Investigation - Half Moon Bay - Phase 8 and Phase 9**	DATE	**09/06/10**

patersongroup **Consulting Engineers**

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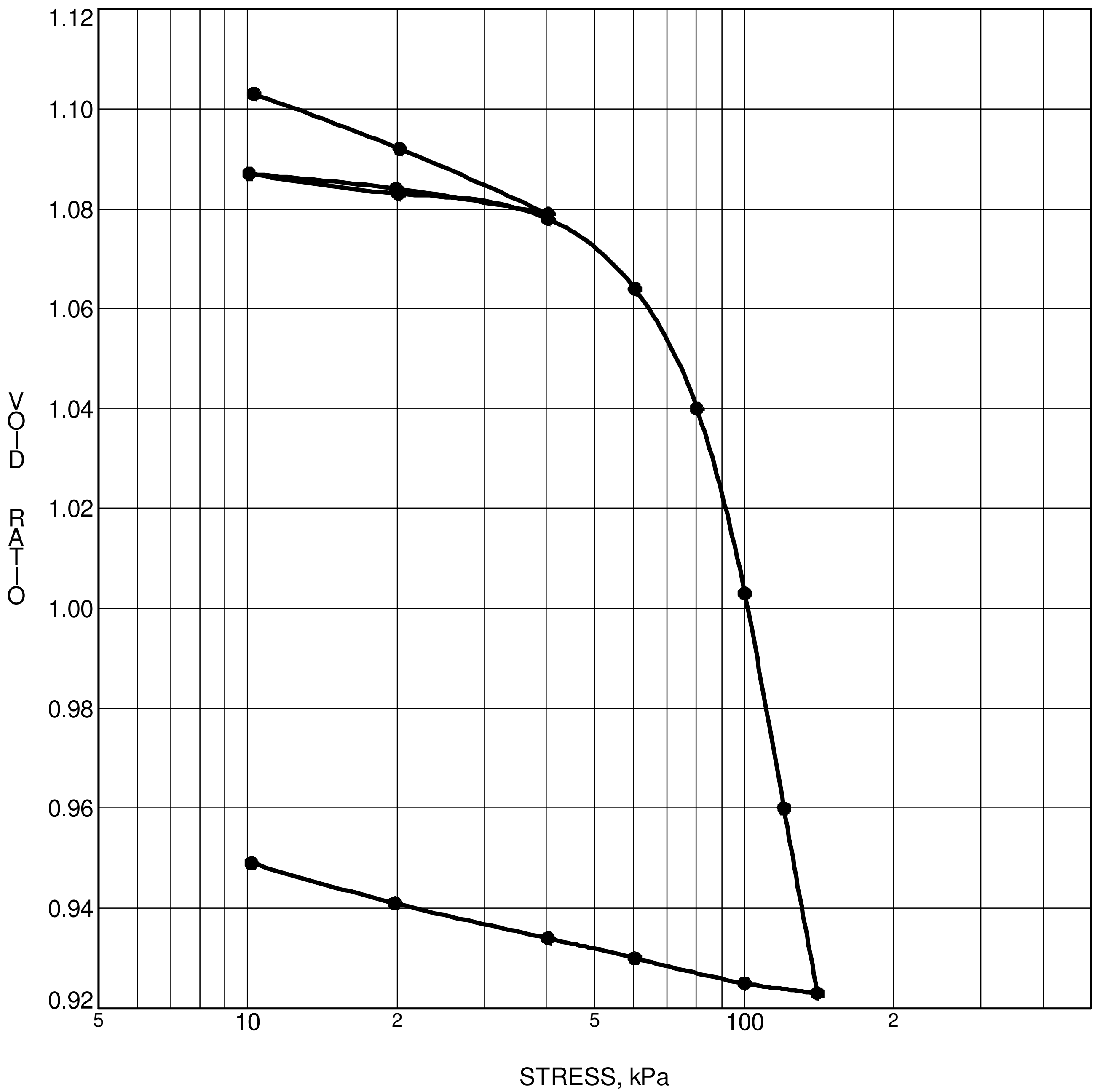
CONSOLIDATION TEST



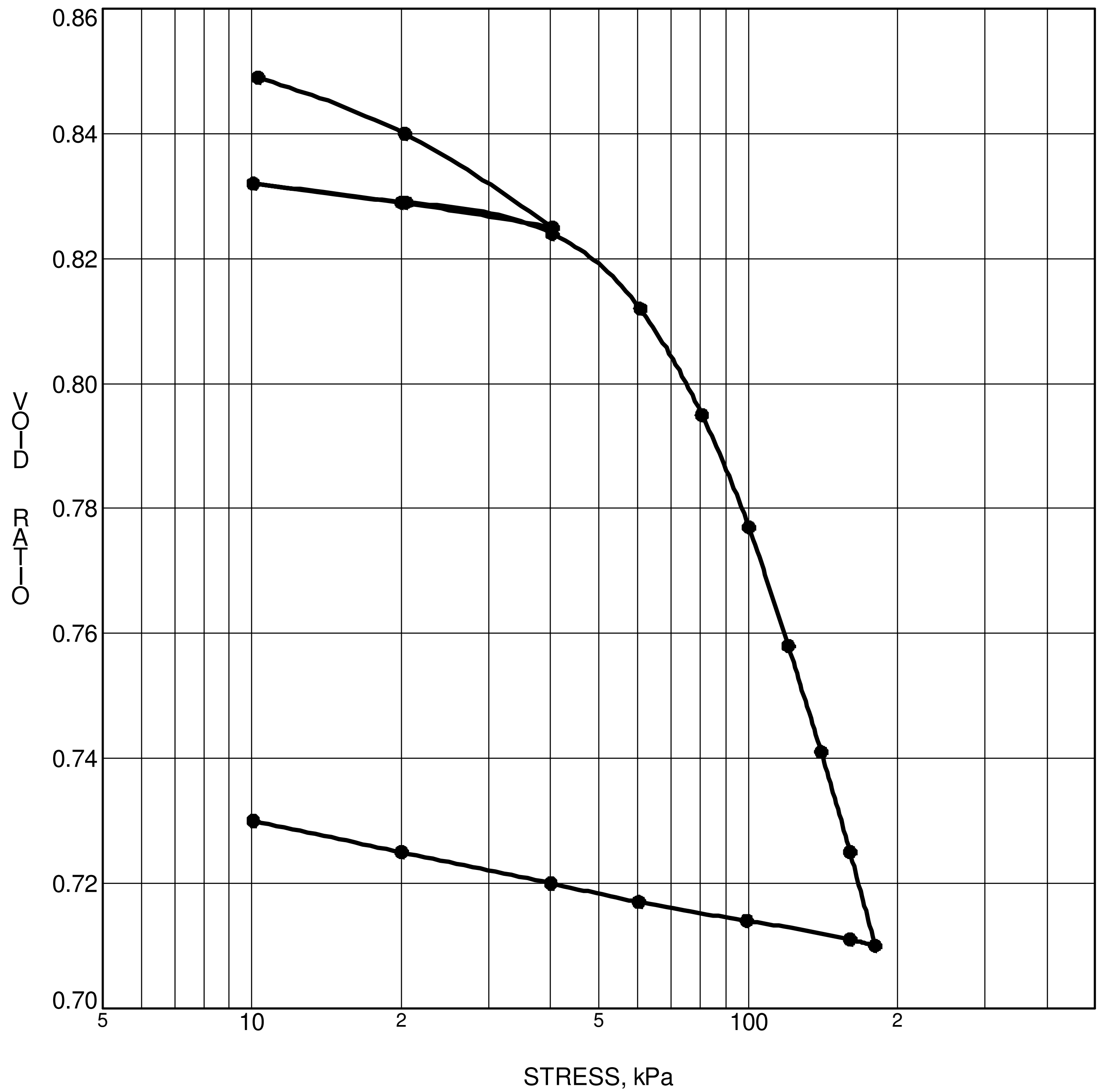
CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 3-07**	p'_o	**34** kPa	Ccr	**0.014**
Sample No.	**TW 3**	p'_c	**81** kPa	Cc	**0.550**
Sample Depth	**2.54** m	OC Ratio	**2.4**	Wo	**40.6** %
Sample Elev.	**90.13** m	Void Ratio	**1.115**	Unit Wt.	**17.9** kN/m^3

CLIENT	**Mattamy Homes**	FILE NO.	**PG0177**
PROJECT	**Geotechnical Investigation - Proposed Residential Development-Half Moon Bay**	DATE	**07/31/2007**

patersongroup **Consulting Engineers**

28 Concouse Gate, Unit 1, Ottawa, Ontario K2E 7T7

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 3-07**	p'o	**45** kPa	Ccr	**0.013**
Sample No.	**TW 4**	p'c	**71** kPa	Cc	**0.253**
Sample Depth	**4.19** m	OC Ratio	**1.6**	Wo	**31.5** %
Sample Elev.	**88.48** m	Void Ratio	**0.866**	Unit Wt.	**19.0** kN/m^3

CLIENT	**Mattamy Homes**	FILE NO.	**PG0177**
PROJECT	**Geotechnical Investigation - Proposed Residential Development-Half Moon Bay**	DATE	**07/27/2007**

patersongroup **Consulting Engineers**

28 Concouse Gate, Unit 1, Ottawa, Ontario K2E 7T7

CONSOLIDATION TEST

Certificate of Analysis

Report Date: 24-Jun-2013
Order Date:18-Jun-2013

Client: **Paterson Group Consulting Engineers**

Client PO: 13976 Project Description: PG2992

	Client ID:	BH4-13 SS4	-	-	-
	Sample Date:	14-Jun-13	-	-	-
	Sample ID:	1325129-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	76.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.56	-	-	-
Resistivity	0.10 Ohm.m	110	-	-	-
Anions					
Chloride	5 ug/g dry	7	-	-	-
Sulphate	5 ug/g dry	46	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG2992-1 - TEST HOLE LOCATION PLAN

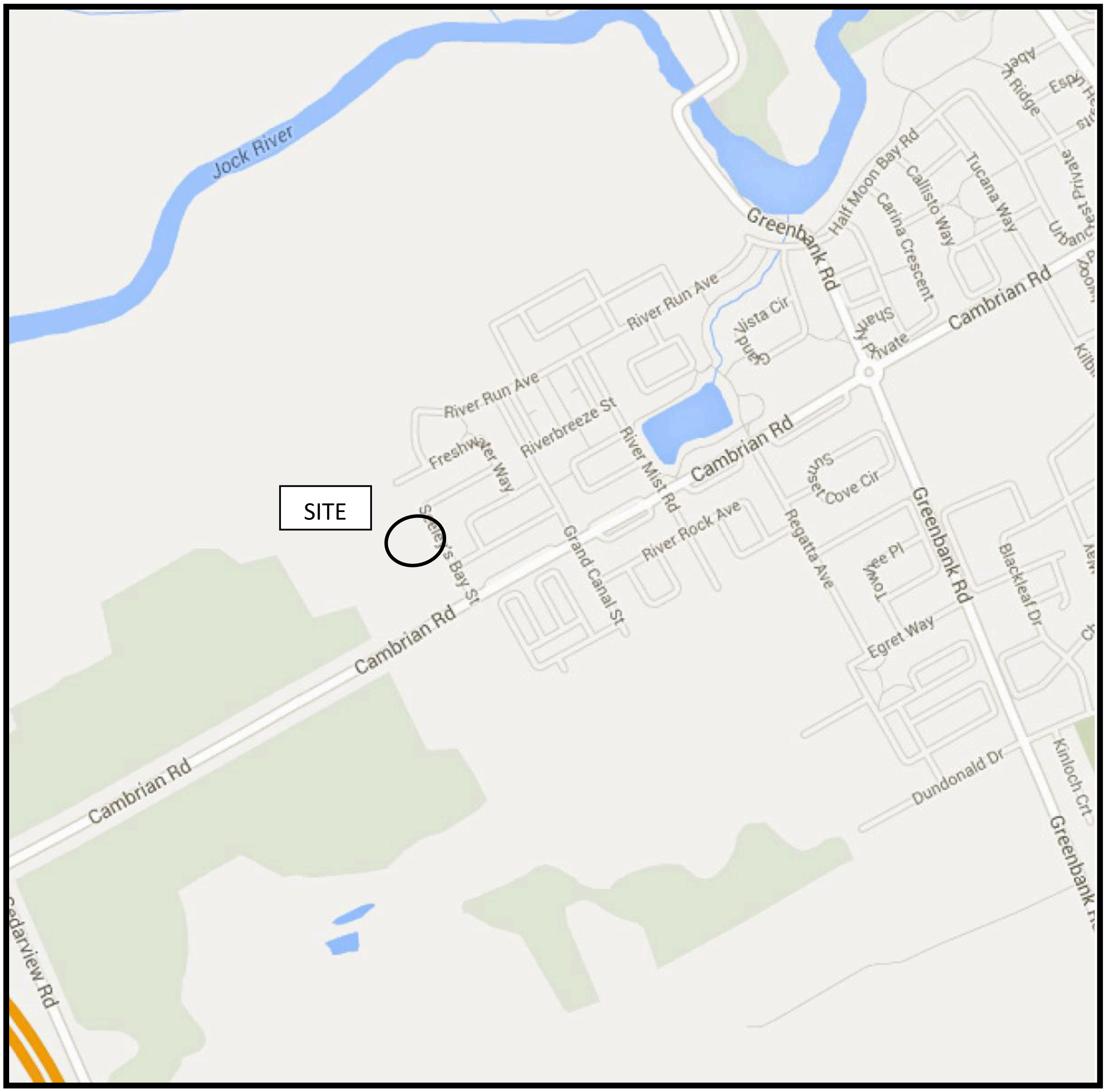
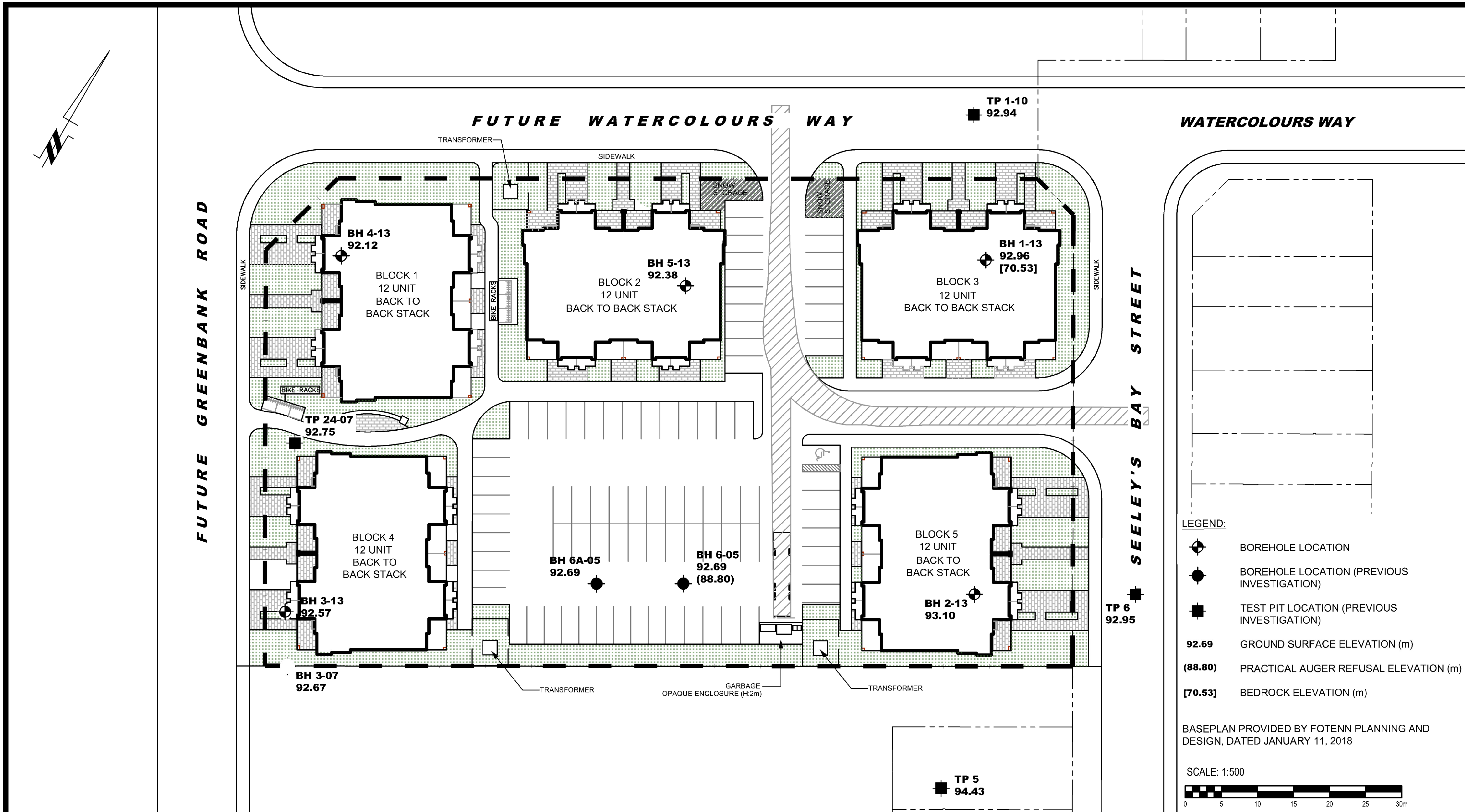


FIGURE 1

KEY PLAN



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patersongroup
consulting engineers

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Ottawa, Ontario K2E 7J5
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NO.	REVISIONS	DATE	INITIAL
2	BASE PLAN UPDATED	21/02/2018	FA
1	BASE PLAN UPDATED	23/01/2018	FA

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
SEELEY'S BAY STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 01/2018
Drawn by: RCG	Report No.: PG2992-2
Checked by: FA	Dwg. No.: PG2992-1
Approved by: DJG	Revision No.: 2