Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

**Materials Testing** 

**Building Science** 

**Archaeological Services** 

## **Geotechnical Investigation**

Proposed Commercial Development 197 Trainyards Drive Ottawa, Ontario

**Prepared For** 

**Controlex Corporation** 

#### Paterson Group Inc.

Consulting Engineers 154 Colonnade Road South Ottawa (Nepean), Ontario Canada K2E 7J5

Tel: (613) 226-7381 Fax: (613) 226-6344 www.patersongroup.ca

### August 22, 2019

Report PG3298-2 Revision 2

## **Table of Contents**

#### Page

1.0	Introduction
2.0	Proposed Project1
3.0	Method of Investigation3.1Field Investigation
4.0	Observations4.1Surface Conditions.44.2Subsurface Profile.44.3Groundwater.4
5.0	Discussion5.1Geotechnical Assessment.65.2Site Grading and Preparation.65.3Foundation Design.75.4Design for Earthquakes.85.5Slab-on-Grade Construction.85.6Pavement Structure.9
6.0	Design and Construction Precautions6.1Foundation Drainage and Backfill.106.2Protection of Footings Against Frost Action.106.3Excavation Side Slopes.106.4Pipe Bedding and Backfill.116.5Groundwater Control.116.6Winter Construction.126.7Corrosion Potential and Sulphate.12
7.0	Recommendations
8.0	Statement of Limitations14

## Appendices

Appendix 1	Soil Profile and Test Data Sheets
	Symbols and Terms
	Analytical Testing Results

Appendix 2Figure 1 - Key PlanDrawing PG3298-2 - Test Hole Location Plan

## 1.0 Introduction

Paterson Group (Paterson) was commissioned by Controlex Corporation to conduct a supplemental geotechnical investigation for the proposed commercial development to be located at 197 Train Yards Drive, in the City of Ottawa, Ontario (refer to Figure 1 -Key Plan in Appendix 2).

The objectives of the current investigation were to:

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

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

## 2.0 Proposed Development

Specific details of the proposed development were not available at the time of writing this report. However, it is expected that a commercial building of slab-on-grade construction and/or multi-storey commercial buildings, are anticipated for this site. Associated at-grade parking areas, access lanes and landscaped areas are further anticipated.

An existing building is currently occupying the north and northwest portion of the subject site. It is expected that this building will be demolished prior to commencing the construction of the proposed development.

## 3.0 Method of Investigation

## 3.1 Field Investigation

### **Field Program**

The field program for the present geotechnical investigation was conducted on August 1, 2014 by advancing a total of twelve (12) boreholes to a maximum depth of 9.4 m below existing ground surface. The test hole locations were distributed in a manner to provide general coverage of the subject site. Relevant test holes completed during our previous investigations have been emended to the current geotechncial report. The locations of the test holes are presented on Drawing PG3298-2 - Test Hole Location Plan included in Appendix 2.

The test holes were completed using both truck and track mounted drill rigs operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel with the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations to sample and test the overburden.

### Sampling and In Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to the laboratory. The depths at which the split-spoon and auger samples were recovered from the test holes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples and 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.

Overburden thickness was evaluated by a Dynamic Cone Penetration Test (DCPT) at BH 1 and BH 12 as part of our current investigation. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, and a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone 300 mm into the soil.

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

#### Groundwater

Groundwater monitoring wells were installed at BH 3, BH 8 and BH 11 of the current investigation. Standpipes were installed in all remaining boreholes to permit the monitoring of water levels subsequent to the sampling program completion.

#### Sample Storage

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

### 3.2 Field Survey

The test hole locations were selected and determined in the field by Paterson personnel to provide general coverage of the subject site. Ground surface elevations at test hole locations are referenced to a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located along the south side of Belfast Road. A geodetic elevation of 69.57m was provided for the TBM.

The location and ground surface elevation at each test hole location are presented on Drawing PG3298-2 - Test Hole Location Plan in Appendix 2.

## 3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in the laboratory to review the field logs.

## 3.4 Analytical Testing

One soil sample was submitted for analytical tests to determine the concentration of sulphate, chloride, resistivity and pH. The laboratory test results are presented in Appendix 1 and discussed in Subsection 6.7.

## 4.0 Observations

## 4.1 Surface Conditions

The subject site is bordered to the north by Belfast Road, to the east by an existing access road, to the south and west by commercial buildings. The subject site is currently a vacant gravel covered lot used primarily as an excess parking area. The general site topography is flat and at similar elevations to all surrounding properties.

## 4.2 Subsurface Profile

#### Overburden

Generally, the subsurface profile at the borehole locations consists of a silty sand with gravel fill material underlain by a brown silty sand fill layer. The abovenoted fill layers are underlain by a native silty sand layer and/or a compact to very dense glacial till. The glacial till consists of a silty sand matrix with gravel, cobbles and boulders. Practical refusal to augering was noted at BH 2 on inferred large boulders. Practical refusal to DCPT was encountered at BH 1 and BH 12 at a depth of 6.4 m and 9.3 m, respectively.

#### Bedrock

Based on available geological mapping, bedrock in the area of the subject site consists of shale bedrock from the Carlsbad Formation. The overburden drift thickness is estimated to be between 10 and 20 m depth.

### 4.3 Groundwater

Groundwater levels were measured at the piezometers and monitoring wells in the borehole locations of the current investigation on August 7, 2014. Our groundwater measurements are presented in Table 1 below. The groundwater elevation is subject to seasonal fluctuations and could vary at the time of construction.

pat	ersong	group
Ottawa	Kingston	North Bay

F

Table 1 - Summary of Groundwater Levels											
Borehole	Measured Gro	undwater Level	Decending Data								
Number	Depth (m)	Elevation (m)	Recording Date								
Groundwater Lev	els Based on Current Inves	stigation (Report PG3298)									
BH 1	1.91	66.91	August 7, 2014								
BH 2	2.18	67.30	August 7, 2014								
BH 3	2.28	66.91	August 7, 2014								
BH 4	1.65	67.14	August 7, 2014								
BH 5	3.28	66.18	August 7, 2014								
BH 6	1.56	67.45	August 7, 2014								
BH 7	1.63	66.88	August 7, 2014								
BH 8	1.73	67.33	August 7, 2014								
BH 9	1.55	67.38	August 7, 2014								
BH 10	1.65	67.00	August 7, 2014								
BH 11	1.87	67.11	August 7, 2014								
Groundwater Lev	els Based on Previous Inve	estigation (Report S5305)									
BH 1	1.52	67.47	December 7, 1990								
BH 2	N/A	N/A	December 7, 1990								
BH 3	1.30	67.41	December 7, 1990								
BH 4	1.24	67.61	December 7, 1990								
BH 5	0.56	67.96	December 7, 1990								
BH 6	1.60	67.58	December 7, 1990								
BH 7	1.45	67.62	December 7, 1990								
BH 8	0.73	67.67	December 7, 1990								
BH 9	N/A	N/A	December 7, 1990								
BH 10	0.61	67.93	December 7, 1990								

## 5.0 Discussion

## 5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the proposed development. The proposed commercial buildings could be founded on conventional style shallow foundations placed on an undisturbed, compact silty sand, glacial till or engineered fill bearing surface.

Boulders, within the existing fill, greater in diameter than 300 mm are recommended to be removed from below the proposed buildings footprint. The bearing surface can be reinstated by backfilling with an engineered fill approved by the geotechnical consultant or a lean concrete in-filled trench extending to an approved native soil bearing surface. In addition, the bearing surface should be compacted using suitable compaction equipment to 98% of its SPMDD.

Based on the geotechnical investigation, there were no sensitive silty clay layers encountered across the site. Therefore, the subject site will not be subjected to grade raise restrictions or tree planting restrictions.

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

## 5.2 Site Grading and Preparation

#### **Stripping Depth**

Topsoil, asphalt, and deleterious fill, such as material containing high content of organic materials, should be stripped from under the proposed buildings footprint and other settlement sensitive structures.

It is anticipated that the existing fill within the proposed building footprint, 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. 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.

#### Fill Placement

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

Alternatively, a near vertical trench extending to an undisturbed, compact glacial till bearing surface and backfilled with a minimum 15 MPa lean concrete could be used to support the proposed footings, where required due to excessive unsuitable fill below the design underside of footing level.

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where surface settlement is a minor concern. The material should be spread in thin lifts and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If the material is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

## 5.3 Foundation Design

#### Shallow Foundation

Footings placed on an undisturbed, compact silty sand, glacial till bearing or engineered backfill surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **180 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

An undisturbed soil bearing surface consists of a surface from which all topsoil 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.

The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 15 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 compact silty sand or glacial till bearing medium with a plane extending horizontally and vertically from the footing perimeter at a minimum of 1.5H:1V, passing through in situ soil or engineered fill of equal or higher capacity.

## 5.4 Design for Earthquakes

Foundations constructed at the subject site can be designed using a seismic site response **Class C** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A). The soils underlying the site are not susceptible to liquefaction.

### 5.5 Slab-on-Grade Construction

All topsoil and deleterious materials should be removed, within the proposed buildings footprints. The native soil surface or existing silty sand fill, free of organics and deleterious materials, and approved by the geotechnical consultant at the time of construction should be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 200 mm of sub-slab fill should consist of an OPSS Granular A material for slab-on-grade construction. All backfill material within the proposed buildings footprints should be placed in maximum 300 mm lifts and compacted to a minimum of 98% of the SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

#### 5.6 Pavement Structure

Car only parking and heavy truck parking areas, as well as access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 2 and 3.

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								
	<b>SUBGRADE</b> - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil								

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

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

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

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

## 6.0 Design and Construction Precautions

## 6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended for the proposed buildings. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear 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.

Backfill against the foundation exterior walls should consist of free-draining non frost susceptible granular materials. The majority of the site excavated soil is considered to be frost susceptible and not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a drainage geocomposite (Miradrain G100N or Delta Drain 6000) 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 placed for this purpose.

## 6.2 **Protection of Footings Against Frost Action**

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

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

## 6.3 Excavation Side Slopes

The excavation side slopes in the overburden material should either be excavated at acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled.

The excavation side slopes above the local groundwater elevation extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below local groundwater elevation. The subsurface soil is considered to be mainly 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 maintain safe working distance 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.

A trench box is recommended to be installed at all times to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not be remain exposed for extended periods of time.

#### Impacts on Adjacent Structures

The proposed excavations are anticipated to be shallow (slab-on-grade construction) and have adequate setbacks from the property lines. Therefore, no impacts on adjacent properties are anticipated as a result of the proposed excavation.

## 6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be placed 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 a minimum of 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 SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to 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 SPMDD.

### 6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

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, Conservation and Parks (MECP) 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 MECP.

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 MECP review of the PTTW application.

### 6.6 Winter Construction

Precautions should be provided if winter construction is considered for this project.

The subsurface conditions mainly consist of frost susceptible materials. In presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

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

The trench excavations should be constructed in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

## 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 aggressive to very aggressive corrosive environment.

## 7.0 Recommendations

For the foundation design data provided to be applicable a materials testing and observation services program is required to be completed. The following aspects be performed by the geotechnical consultant:

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

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

## 8.0 Statement of Limitations

The recommendations provided in the report are in accordance with Paterson's present understanding of the project. Paterson request permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from the test locations, Paterson requests immediate notification to permit reassessment of the recommendations.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose.

The present report applies only to the project described in the report. The use of the report for purposes other than those described above or by person(s) other than Controlex Corporation or their agents is not authorized without review by Paterson.

#### Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.



David J. Gilbert, P.Eng.

### Report Distribution:

- Controlex Corporation (3 copies)
- Paterson Group (1 copy)



## **APPENDIX 1**

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TEST RESULT

natersonard	SOIL PROFILE AND TEST DATA										
154 Colonnade Road South, Ottawa, Or	ntario	<b>М</b> К2Е 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive						
DATUM TBM - Bottom of flange of fi	re hyc	drant, lo	ocateo	d on sou	uth si	th side of Belfast Road, in front FILE NO.					
REMARKS	valioi	1 = 09.	5711.						HOLE NO.		
BORINGS BY CME 55 Power Auger				DA	TE	August 1,	2014		В	H 1	
SOIL DESCRIPTION	PLOT		SAN	SAMPLE		DEPTH ELEV.		Pen. Re	esist. Blows 0 mm Dia. Co	/0.3m one	eter Stion
	RATA I	ζ₽Ε	<b>ABER</b>	°% DVERY	ALUE ROD	(m)	(11)		Vater Conten	t %	ezome
GROUND SURFACE	STI	Ĥ	INN	RECC	N 0 N			20	40 60	80	ĒĞ
FILL: Brown gravel, sand with silt and cobbles 0.60		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	1			0-	-68.82				
<u>`</u>		ss	2	62	10	1-	-67.82				
Compact to loose, brown <b>SILTY</b> <b>SAND</b>		∆ ∏ss	3	83	3						
- grey by 2.0m depth		Δ				2-	-66.82				
- some gravel by 2.7m depth		ss	4	42	4	3-	-65.82				
<u>v.</u>		∬ss	5	75	26						
		ss	6	61	73	4-	-64.82				
<b>GLACIAL TILL:</b> Grey to black silt, gravel, sand, shale fragments, applying and baulders		ss	7	50	50+	5-	-63.82				
		ss	8	60	50+						
G 45						6-	-62.82			•	
End of Borehole		-									
Dynamic Cone Penetration Test commenced at 6.10m depth. Practical DCPT refusal at 6.45m depth.											
(GWL @ 1.91m-August 7, 2014)											
								20 Shea ▲ Undist	40 60 ar Strength (I urbed △ Rer	80 10 ( <b>Pa)</b> noulded	00

natoreonar	In	Con	sulting	SOIL PROFILE AND TEST DATA								
154 Colonnade Road South, Ottawa, On	Itario	K2E 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive Ottawa, Ontario							
DATUM TBM - Bottom of flange of fir of subject site. Geodetic ele	re hyc vatior	drant, lo n = 69.	ocateo 57m.	d on sou	uth s	ide of Belf	fast Road	l, in front	FILE NO.	PG3298		
BORINGS BY CME 55 Power Auger				DA	TE	August 1,	2014		HOLE NO	<sup>).</sup> BH 2		
	TOT		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Bl	ows/0.3m	n	
SOIL DESCRIPTION		E	ßER	ÆRY	LUE QD	(m)	(m)	• 5	0 mm Dia	a. Cone	zomet	
GROUND SURFACE	STR2	аут	NUME	RECOV	N VA or F		00.40	○ V 20	Vater Coi 40 (	ntent %	Die ODie	
FILL: Brown silty sand with gravel 0.53		& AU	1			_ 0-	-69.48					
FILL: Brown silty sand		ss	2	83	5	1-	-68.48					
Loose, brown SILTY SAND		ss	3	83	7	2-	67.48					
GLACIAL TILL: Grey to black silt, gravel, sand, shale fragments, cobbles and boulders End of Borehole Practical refusal to augering at 2.59m depth (GWL @ 2.18m-August 7, 2014)		X SS	4	86	50+							
								20 Shea ▲ Undist	40 € ar Streng urbed △	50 80 1 th (kPa) Remoulded	00	

natersonaroun Consultir						SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive Ottawa, Ontario							
DATUM TBM - Bottom of flange of fil of subject site. Geodetic ele	re hyc vatior	lrant, lo 1 = 69.	ocateo 57m.	d on sou	uth side of Belfast Road, in front				FILE NO. PG3298			
BORINGS BY CME 55 Power Auger				DA	TE .	August 1,	2014		HOLE NO.	BH 3		
방 SAN						DEDTH	EI EV	Pen. R	esist. Blov	ws/0.3m	Vell on	
SOIL DESCRIPTION	A PL		RY R		Ë Q	(m)	(m)	• 5	0 mm Dia.	Cone	ring V tructic	
GROUND SURFACE	STRAT	ТУРЕ	NUMBE	RECOVE	N VALI or RQ		-60.10	○ V 20	Vater Cont 40 60	ent % 80	Monito Cons	
		AU	1				-09.19				<u>իրիի</u>	
FILL: Brown silty sand, some gravel		ss	2	67	14	1-	-68.19				<u>սիրդիրիդիրի</u>	
		ss	3	75	10	2-	-67.19				<u>111111111111111</u> ₩ 1111111111111111	
2.74		ss	4	58	32						स्तिति द्वातिति	
<b>GLACIAL TILL:</b> Brown to black silt, gravel, sand, shale fragments, cobles and boulders		ss	5	67	31	3-	-66.19					
		ss	6	83	38	4-	-65.19					
		ss	7	75	74	5-	-64.19		······			
		ss	8	100	50+							
End of Borehole6.10	\ <u>^</u> ^^^/	-				6-	-63.19					
(GWL @ 2.28m-August 7, 2014)												
								20 Shea ▲ Undist	40 60 ar Strength urbed △	80 10 1 (kPa) Remoulded	00	

natoreonard	SOIL PROFILE AND TEST DATA										
154 Colonnade Road South, Ottawa, Or	ntario	К2Е 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive Ottawa Ontario						
DATUM TBM - Bottom of flange of fi of subject site. Geodetic ele	re hyc vatior	drant, lo 1 = 69.	ocateo 57m.	d on soi	uth s	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
BORINGS BY CME 55 Power Auger				DA	\TF	August 1	2014		HOLE NO	BH 4	
	F		SAN					Pen. R	esist. Blo	ows/0.3m	
SOIL DESCRIPTION	PLO			×.	61	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia	. Cone	neter uctior
	STRATA	ТҮРЕ	NUMBER	ECOVER	I VALUI or RQD			• v	Vater Con	tent %	Piezor Constr
GROUND SURFACE		8		Ř	4	- 0-	68.79	<b>20</b>	40 6	0 80	₩ ₩
FILL: Brown silty sand with gravel		₩ E A U A A A A A A A A A A A A A	1							· · · · · · · · · · · · · · · · · · ·	
Loose to very loose, brown SILTY		ss	2	42	6	1-	-67.79				
- grey by 2.0m depth		ss	3	67	3	2-	-66.79				
<u>2.34</u>		ss	4	50	16						
		ss	5	83	28	3-	-65.79				
<b>GLACIAL TILL:</b> Brown to black silt, gravel, sand, shale fragments, cobbles and boulders		ss	6	33	56	4-	-64.79				
		ss	7	83	70	5-	-63.79				
		× SS	8	60	50+						
End of Borehole6.10						6-	-62.79				
(GWL @ 1.65m-August 7, 2014)											
								20 Shea ▲ Undist	40 60 ar Strengt	0 80 10 h (kPa) Remoulded	 DO

natersonaroun Consultin						SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive Ottawa. Ontario							
DATUM TBM - Bottom of flange of fi of subject site. Geodetic ele	re hyc vatior	lrant, lo 1 = 69.	ocateo 57m.	d on sou	uth si	ide of Belf	ast Road	, in front	FILE NO. PG3298			
REMARKS				ПА	TE	August 1	2014		HOLE NO. BH 5			
								Pen. Re				
SOIL DESCRIPTION	A PLC		~	Х	ы о	DEPTH (m)	ELEV. (m)	• 50	0 mm Dia. Cone	meter		
	STRAT?	ТҮРЕ	NUMBEI	XECOVEI	N VALU or RQI			• W	Ater Content %	Piezo Consti		
GROUND SURFACE			1	н		- 0-	69.46					
FILL: Brown silty sand with gravel		<b>X</b> AU	2									
FILL: Brown silty sand		ss	3	71	5	1-	-68.46					
Loose, brown <b>SILTY SAND,</b> trace gravel 2.21		ss	4	50	10	2-	-67.46					
		ss	5	67	28				· · · · · · · · · · · · · · · · · · ·			
<b>GLACIAL TILL:</b> Brown to grey silt, gravel, sand, shale fragments and		ss	6	42	26	3-	-66.46					
		A Ss	7	83	18	4-	-65.46					
			0	00	00							
			0	03	29	5-	-64.46					
6.22		∦ SS ∑ SS	9	74	43 50 i	6-	-63.46					
End of Borehole					50+							
								20 Shea ▲ Undistu	40 60 80 ur Strength (kPa) urbed △ Remoulded	100		

natersonard	sulting	1	SOIL PROFILE AND TEST DATA								
154 Colonnade Road South, Ottawa, On	itario	К2Е 7	Eng J5	ineers	Geotechnical Investigation Prop. Commercial Development - 197 Trainyards Drive Ottawa, Ontario						
DATUM TBM - Bottom of flange of fin of subject site. Geodetic ele	re hyd vatior	Irant, lo 1 = 69.	ocateo 57m.	d on soi	uth s	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
				D	TE	August 1	2014		HOLE NO.	BH 6	
	_		CAN			August I,	2014	Dom D	aciat Dia	wo/0.2m	
SOIL DESCRIPTION	PLOT		SAW	VUMBER ************************************		DEPTH (m)	ELEV. (m)	• 5	. Resist. Blows/0.3m 50 mm Dia. Cone		
	STRATZ	ТҮРЕ	NUMBEF					• <b>v</b>	later Con	tent %	Piezol Constr
GROUND SURFACE		S	4	<u></u>	4	- 0-	-69.01	20	40 60	) 80 	× ×
FILL: Brown silty sand, trace clay, topsoil and gravel 0.69		× AU	2								
FILL: Brown silty sand		ss	3	83	11	1-	-68.01				
2.21		ss	4	83	5	2-	-67.01				
		ss	5	50	31	2-	66.01				
		ss	6	100	50+	0	00.01		· · · · · · · · · · · · · · · · · · ·		
gravel, sand, shale fragments, cobbles and boulders		∑ss	7		50+	4-	-65.01				
		× SS	8	40	50+	5-	-64.01				
6.22		x ss	9		50+	6-	-63.01		·····		
(GWL @ 1.56m-August 7, 2014)								20	40 60		00
								Shea	urbed $ riangledimension$	<b>h (kPa)</b> Remoulded	

natoreonard		in	Con	sulting		SOI	l pro		ID TEST	DATA	
154 Colonnade Road South, Ottawa, Or	ntario	К2Е 7.	Eng J5	ineers	G Pr	eotechnic rop. Com	cal Inves mercial [ ptario	tigation Developme	ent - 197 Ti	rainyards D	rive
DATUM TBM - Bottom of flange of fi of subject site. Geodetic ele	re hyc	drant, lo 1 = 69.	ocateo 57m.	d on sou	uth si	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
REMARKS			-						HOLE NO.		
BORINGS BY CME 55 Power Auger				DA	TE	August 1,	2014			ВН /	
SOIL DESCRIPTION	PLOT		SAN			DEPTH	ELEV.	Pen. Re	esist. Blov 0 mm Dia.	vs/0.3m Cone	eter ction
	STRATA	ТҮРЕ	NUMBER	* ECOVER	I VALUE or RQD			• <b>v</b>	ater Conte	ənt %	Piezom Constru
GROUND SURFACE		8		8	Z *	0-	-68.51	20	40 60	80	×× ×
FILL: Brown silty sand, some gravel		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	1								
		ss	2	62	10	1-	-67.51				
SAND, trace gravel		ss	3	67	9	2-	-66.51				F
- grey by 2.0m depth											
		ss	4	33	11	3.	65 51				
<u>3.40</u>		ss	5	91	50+		00.01				լիրիրիր Սիրիիրի
		ss	6	83	50+	4-	-64.51				
<b>GLACIAL TILL:</b> Black silt, gravel, sand, shale fragments, cobbles and		∑ ∑ss	7	67	50+						
boulders		x ss	8	50	50+	5-	-63.51				
6 10						6-	-62 51				
End of Borehole							02.01				알려먹었었
(GWL @ 1.63m-August 7, 2014)										20 11	
								Shea ▲ Undistu	$\frac{40}{10}  \frac{60}{10}$	( <b>kPa)</b> Remoulded	JU

patersondroup cons					g	SOI	l pro	FILE AN	ND TEST DA	TA
154 Colonnade Road South, Ottawa, On	Itario	K2E 7	Eng J5	ineers	G P O	eotechnic rop. Com ttawa. Or	cal Invest mercial E ntario	tigation Developme	ent - 197 Trainya	ards Drive
DATUM TBM - Bottom of flange of fin of subject site. Geodetic ele	re hyc vatior	Irant, Io 1 = 69.	ocateo 57m.	d on so	outh s	ide of Belf	ast Road	, in front	FILE NO.	3298
BORINGS BY CME 55 Power Auger				D	ATE	August 1.	2014		HOLE NO. BH	8
	Ę		SAN	IPLE				Pen. R	esist. Blows/0.3	Sm 🖶
SOIL DESCRIPTION	PLC			ĸ	M -	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia. Cone	ng W uction
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVER	N VALUI or RQD		00.00	○ V 20	Vater Content % 40 60 8	Monitori
FILL: Gravel with sand 0.30	$\bigotimes$	S				- 0-	-69.06			
FILL: Brown silty sand, trace gravel		S AU	1							
- some clay by 0.7m depth		ss	2	67	8	1-	-68.06			
Loose, brown SILTY SAND		ss	3	71	7	2-	-67.06			
<u>2</u> .21_		ss	4	100	50+				· · · · · · · · · · · · · · · · · · ·	
							00.00			
		ss	5	100	71	3-	-66.06			
GLACIAL TILL: Brown to grey silt,										
gravel, sand, shale fragments, cobbles and boulders		ss	6	71	50+	4-	-65.06		······································	
		= SS	7	100	50+				· · · · · · · · · · · · · · · · · · ·	
		BC	1	38		5-	-64.06			
5.66										
End of Borehole										
(GWL @ 1.73m-August 7, 2014)										
								20 Shea ▲ Undist	40 60 80 ar Strength (kPa urbed ∆ Remoul	) 100 ded

natersonard		In	Con	sulting	3	SOI	l pro	FILE AN	ND TES	T DATA	
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	G	eotechnic rop. Com ttawa Or	cal Inves mercial [ ptario	tigation Developme	ent - 197 T	rainyards [	Drive
DATUM TBM - Bottom of flange of fin of subject site. Geodetic ele	re hyc vatio	drant, lo n = 69.	ocateo 57m.	d on so	uth s	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
REMARKS				D/	\TF	August 1	2014		HOLE NO.	BH 9	
	E		SAN		~	//ugust i,		Pen. R	esist. Blo	ws/0.3m	_
SOIL DESCRIPTION	A PLO		ĸ	RY	Ľ۵	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia	. Cone	meter
	STRAT	ТҮРЕ	NUMBE	SECOVE	N VALU			○ V 20	Vater Cont	tent %	Piezo Const
GROUND SURFACE		⊗ AU	1			- 0-	68.93				⊠ ⊠
<b>FILL:</b> Gravel with sand		& AU	2						· · · · · · · · · · · · · · · · · · ·		
FILL: Brown silty sand		ss	3	67	8	1-	-67.93				
		ss	4	50	7	2-	-66.93		· · · · · · · · · · · · · · · · · · ·		
- trace gravel by 2.2m depth		ss	5	12	20				· · · · · · · · · · · · · · · · · · ·		
<u>2.97</u>						3-	-65.93				
		∬ss	6	67	8					• • • • • • • • • • • • • • • • • • • •	
CLACIAL THE Brown silt gravel		∕⊠ ss	7	75	50+	4-	-64.93				
sand, shale fragments, cobbles and boulders		∑ ∑ss	8	73	50+		~~~~~		· · · · · · · · · · · · · · · · · · ·		
		} ∕∑ss	9	60	50+	5-	-03.93				
<u>6.22</u>		x ss	10	100	50+	6-	-62.93				
End of Borehole											
(GWL @ 1.55m-August 7, 2014)											
								20 Shea ▲ Undist	40 60 ar Strengt urbed △	h <b>(kPa)</b> Remoulded	00

natersonard		In	Con	sulting		SOI	l pro	FILE AN	ND TES	T DATA	
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	G Pi O	eotechnic rop. Com ttawa, Or	cal Inves mercial [ ntario	tigation Developme	ent - 197 T	rainyards D	rive
DATUM TBM - Bottom of flange of file of subject site. Geodetic ele	re hyc vatior	drant, lo 1 = 69.	ocateo 57m.	d on soı	uth s	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
BORINGS BY CME 55 Power Auger				DA	TE	August 1,	2014		HOLE NO.	BH10	
	Ĕ		SAN	IPLE		DEDTU		Pen. R	esist. Blo	ws/0.3m	۲c
SOIL DESCRIPTION	A PLO		~	2	Шо	_ DEPTH (m)	(m)	• 5	0 mm Dia	. Cone	nete uctio
	STRAT?	ТҮРЕ	NUMBEF	XECOVEF	N VALU of RQI			• V	Vater Con	tent %	Piezol Constr
GROUND SURFACE		×			-	- 0-	68.65				₩ ₩
FILL: Dark grey crushed stone		₿ AU E	1								
0.19		ss	2	42	13	1-	-67.65				
FILL: Brown silty sand		ss	3	58	4	0-	66.65				¥ ₩
						2	00.00				
2.80		ss	4	67	15						
			F	10	F	3-	-65.65				
		1 22	5		Э						
GLACIAL TILL: Brown silt, gravel,		ss	6	33	5	4-	-64.65				
sand, shale fragments and cobbles, trace clay		μ L									
		ss	7	17	13	5-	-63.65				
		x ss	8	60	50+						
6 10						6-	62.65				
End of Borehole		-					02.05				<u>ad Haa</u>
(GWL @ 1.65m-August 7, 2014)											
								20 20 Shea ▲ Undist	40 60 ar Strengt urbed △		00

naterconar		In	Con	sulting	Ulting SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, O	ntario	K2E 7	Eng J5	ineers	G Pi O	eotechnic rop. Com ttawa, Or	cal Inves mercial I ntario	tigation Developmo	ent - 197 1	Frainyards D	Drive	
DATUM TBM - Bottom of flange of f of subject site. Geodetic ele	ire hyc evatior	Irant, lo 1 = 69.	ocateo 57m.	d on so	uth s	ide of Belf	ast Road	, in front	FILE NO.	PG3298		
BORINGS BY CME 55 Power Auger				DA	TE	August 1,	2014		HOLE NO	BH11		
	ЦО		SAN	IPLE		DEDTH	EI EV	Pen. R	esist. Blo	ows/0.3m	Vell	
SOIL DESCRIPTION	A PL		R	RY	Ë Q	(m)	(m)	• 5	0 mm Dia	. Cone	ring V tructio	
GROUND SURFACE	STRAT	ТУРЕ	NUMBE	RECOVE	N VALI or RQ			○ V 20	Vater Con 40 6	tent % 0 80	Monito	
		au Au	1			- 0-	-68.98					
FILL: Brown silty sand with gravel		ss	2	58	8	1-	-67.98		· · · · · · · · · · · · · · · · · · ·		ինինինին Սրիսինին	
- some clay by 0.7m depth		ss	3	67	4	2-	- 66 08					
<u>2.3</u> 6		µ⊥ ▼				2	00.90			· · · · · · · · · · · · · · · · · · ·		
		ss 	4	83	6	3-	-65.98					
		ss	5	42	4							
<b>GLACIAL TILL:</b> Grey to black silt, gravel, sand, shale fragments and		ss	6	33	2	4-	-64.98		· · · · · · · · · · · · · · · · · · ·			
cobbles, trace clay		ss	7	42	3	5-	-63.98					
6.1(		ss	8	58	12	6-	- 62 98		· · · · · · · · · · · · · · · · · · ·			
End of Borehole	<u>, , , , , , , , , , , , , , , , , , , </u>	+					02.00					
(GWL @ 1.87m-August 7, 2014)								20	40 6	0 80 1	00	
								▲ Undist	urbed $\triangle$	Remoulded		

natereonard		In	Con	sulting		SOI	L PRO	FILE AN	ND TES	T DATA	
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	G Pr O	eotechnic rop. Comi ttawa. Or	cal Inves mercial [ ntario	tigation Developme	ent - 197 T	rainyards D	)rive
DATUM TBM - Bottom of flange of fi of subject site. Geodetic ele	re hyc evatior	lrant, lo 1 = 69.	ocateo 57m.	d on sou	uth si	ide of Belf	ast Road	, in front	FILE NO.	PG3298	
BORINGS BY CME 55 Power Auger				DA	TE	August 1.	2014		HOLE NO.	BH12	
	E		SAN	IPLE				Pen. R	esist. Blov	ws/0.3m	_
SOIL DESCRIPTION	A PLO		ĸ	RY	E۵	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia.	Cone	meter
	STRAT	TYPE	NUMBE	RECOVE	N VALI or RQ			○ V 20	Vater Cont 40 60	ent % 80	Piezo Const
			4			- 0-	-68.60				
FILL: Brown silty sand with gravel			2	42	12	1-	-67.60				
<u>1.3</u> 7			2	22	7						
Loose to compact, brown <b>SILTY SAND,</b> trace clay		N 33	3	03	1	2-	-66.60		· · · · · · · · · · · · · · · · · · ·		¥ ¥
		ss	4	42	14	3-	-65.60				
Loose, black <b>SAND</b> , trace silt		ss	5	83	4						
		ss	6	42	5	4-	-64.60				
<b>GLACIAL TILL:</b> Grey silt, gravel, sand, shale fragments and cobbles, trace clay		ss	7	17	11	5-	-63.60				
6.10		ss	8	50	2	6-	-62.60				
Dynamic Cone Penetration Test commenced at 6.10m depth.						7	01.00				
						7-	-01.00				
Inferred GLACIAL TILL						8-	-60.60				
<u>9.3</u> 7	· · · · · · · · · · · · · · · · · · ·					9-	-59.60				
End of Borehole											
Practical DCPT refusal at 9.37m depth.											
(GWL @ 1.96m-August 7, 2014)											
								20 Shea ▲ Undist	40 60 ar Strengti urbed △	80 10 <b>ו (kPa)</b> Remoulded	00

## patersongroup Consulting Engineers

SOIL PROFILE AND TEST DATA

**Geotechnical Investigation** Proposed Commercial Development, Ottawa Trainyards

**PG1663** 

**BH10** 

80

60

40

Shear Strength (kPa)

20

Undisturbed

60

80

△ Remoulded

100

Piezometer Construction

DATUM

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7 Ottawa, Ontario TBM - Top of manhole cover located at the intersection of Trainyards Drive and FILE NO. Terminal Avenue. Assumed geodetic elevation = 67.90m. REMARKS HOLE NO. BORINGS BY CME 55 Power Auger DATE 13 May 2008 SAMPLE Pen. Resist. Blows/0.3m STRATA PLOT DEPTH ELEV. SOIL DESCRIPTION 50 mm Dia. Cone • (m) (m) RECOVERY N VALUE or RQD NUMBER TYPE 0/0 Water Content % 0 4٨ 20 **GROUND SURFACE** -68.90 0 FILL: Dark brown silty sand with gravel 0.30 AU 1 FILL: Brown silty sand 0.90 67.90 1-SS 2 21 12

Brown SILTY CLAY with sand seams SS 3 50 12 2 + 66.902.13 Compact, grey-brown SILTY SAND, trace gravel SS 4 50 9 3.00 3+65.90 5 SS 67 13 Compact, grey SANDY SILT 4+64.90 SS 6 17 13 4.42 End of Borehole (GWL @ 1.20m-May 27/08)

## patersongroup Consulting Engineers

SOIL PROFILE AND TEST DATA

**Geotechnical Investigation** Proposed Commercial Development, Ottawa Trainyards Ottawa, Ontario

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

DATUM

REMARKS

TBM - Top of manhole cover located at the intersection of Trainyards Drive and Terminal Avenue. Assumed geodetic elevation = 67.90m.

FILE NO. **PG1663** 

HOLE NO.

BORINGS BY CME 55 Power Auger		DATE 20 May 2008							BH16
SOIL DESCRIPTION	I SAMPLE DEPTH ELEV. Pen. Resist. Blows/0.						esist. Blows/0.3m 0 mm Dia. Cone		
	TRATA I	ТҮРЕ	UMBER	% COVERY	VALUE r rod	(m)	(m)	• <b>v</b>	Vater Content %
GROUND SURFACE	0		Z	RE	z °	0	<u></u>	20	40 60 80
FILL: Sand and gravel	<u>).46</u>	🕈 AU	1			- 0-	-68.83		
Compact to loose, brown		ss	2	42	17	1-	-67.83		
		ss	3	33	5	2-	-66.83		
Compact, grey <b>SAND</b>	<u>2.59.11.</u>	ss	4	50	15	3-	-65.83		
3	3.20	ss	5	58	40	5	-05.05		
GLACIAL TILL: Dense to compact, grey sandy silt, trace clay and gravel		ss	6	42	22	4-	-64.83		
End of Borehole	<u>+.42 (^,^,,^,</u>							· • · · · • · · · · · · · · ·	
(GWL @ 1.56m-May 27/08)								25	
								Shea ▲ Undist	ar Strength (kPa) urbed △ Remoulded

Consulting Engineers

## SOIL PROFILE AND TEST DATA

Geotechnical Investigation Proposed Commercial Development, Ottawa Trainyards Ottawa, Ontario

FILE NO.

PG1663

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

#### DATUM

#### REMARKS

POPINCE PX Hydraulia Shoval				-	ATE /		2008		HOLE	NO.	P10	
BORINGS BY Hydraulic Shover				U			2006					
SOIL DESCRIPTION	PLOT		SAN	MPLE		DEPTH (m)	ELEV. (m)	Pen. R	esist. 0 mm [	Blows/ Dia. Col	0.3m ne	neter uction
	STRATA	ТҮРЕ	NUMBER	SCOVER:	VALUE Dr RQD			• <b>v</b>	later C	ontent	%	Piezor Constri
GROUND SURFACE			4	RI	z	0-	_	20	40	60	80	
		_ G	1			1-	-					
FILL: Topsoil, trace sand and clay												
		G	2			2-	_					
		-	5			3-	-			· · · · · · · · · · · · · · · · · · ·		
<u>3.2</u>	0	_ G	4									
<b>FILL:</b> Grey-blue silty sand, trace crushed stone and concrete		- 6	5			4-	_		••••••	······		
4.2 End of Test Pit	0		0									
								20 Shea ▲ Undistr	40 ar Strei urbed	60 ngth (k △ Rem	80 10 Pa) oulded	<b>DO</b>

Consulting Engineers

## SOIL PROFILE AND TEST DATA

Geotechnical Investigation Proposed Commercial Development, Ottawa Trainyards Ottawa, Ontario

FILE NO.

PG1663

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

#### DATUM

#### REMARKS

BORINGS BY Hydraulic Shovel				D	ATE 2	21 August	2008		HOLE NO. TP19	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Blows/0.3m 0 mm Dia, Cone	ter tion
	RATA P	YPE	MBER	°° OVERY	/ALUE RQD	(m)	(m)	• • •	Vater Content %	iezome
	IS	H	DN N	REC	N N			20	40 60 80	чо
GROUND SURFACE	$\times$					0-	-			
FILL: Brown silty sand with clay		– G	1					· · · · · · · · · · · · · · · · · · ·		
Asphaltic concrete 0.70		_								
FILL: Brown silty sand with crushed stone1.00		G	2			1-	-	·····		
FILL: Brown silty sand with gravel and cobbles		G	3					·····	• • • • • • • • • • • • • • • • • • •	
<u>1.60</u>		G	4					·		
with sand, trace gravel						2-	-		······	
Brown SILTY CLAY, trace sand 2.60										
End of Test Pit								20 Shea	40 60 80 10 ar Strength (kPa)	00
								▲ Undist	urbed $\triangle$ Remoulded	

Consulting Engineers

## SOIL PROFILE AND TEST DATA

Geotechnical Investigation Proposed Commercial Development, Ottawa Trainyards Ottawa, Ontario

FILE NO.

PG1663

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

#### DATUM

#### REMARKS

BOBINGS BY Hydraulic Shovel				п		21 August	2008		HOLE NO.	<b>TP20</b>	
	TOT		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Blov	vs/0.3m	er ion
SUIL DESCRIPTION	ATA PI	Ш	BER	JERY	LUE	(m)	(m)			Cone	szomet
	STR	ГХЛ	IMUN		N VA or J			• <b>N</b>	ater Conte	ent %	Cor
GROUND SURFACE				<u></u>	4	0-	- :	20	40 60	80	
FILL: Brown silty sand with gravel		G	1								
0.50											
FILL: Brown silty sand with crushed stone		G	2								
FILL: Brown silty sand with gravel and cobbles						1-	-				
<u>1.5</u> 0											
FILL: Brown silty sand, trace clay, gravel, asphalt and organic matter		G	3					· · · · · · · · · · · · · · ·			
Blue to brown SILTY SAND		G	4			2-	-				
End of Test Pit											
								20	40 60	80 10	† 00
								Shea	ar Strength	( <b>kPa)</b> Remoulded	



End of Borehole

(GWL @ 1.52 m - Dec. 7/90)

JOHN D. PATERSON & ASSOCIATES LTD. Consulting Engineers and Geologists 28 Concourse Gate, Nepean, Ontario K2E 7T7

## **SOIL PROFILE & TEST DATA**

100

20

▲ Undisturbed

40

Shear Strength (kPa)

60

80

△ Remolded

Proposed Office / Warehouse Development 820 Belfast Road

Ottawa, Ontario

	-					Ullawa,	Untario	·								
DATUM Geodetic Elevation											FILE	NO.		S5	530	5
				r		3 Decemi	oer 1990				HOL	e NO	•	B	H 1	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Per (	netri D-	atio 50 r	n Re nm	esist Diar	anc	e B er C	low	s/.3m
	RATA F	YPE	MBER	× OVERY		(m)	(m)		0	Mo	oistı	ure (	Cont	ent	%	
GROUND SURFACE	S		ž	REC	zŏ	0-	- 69 00		20		40	60	)	80	1	00
Dark brown, silty fine sand TOPSOIL	5					0	00.99									
Loose, brown to arevish		∏ ss	1	88	7											
brown SAND with silty sand and sandy silt seams and		V				1-	67.99									
layers			- - -													
		ss	2	96	5					······································				(		¥
1.8	3															
		N.				2-	66.99									
		SS	3	58	13											
Loose to compact, grey SILT with clayey silt seams																
						3-	- 65.99									
		SS	4	75	5											
3.4	3															
TILL: Stiff, dark grey clayey silt with some gravel																
3.6	<u>ممتا</u> 0	ן <u>ט</u>		1				l ÷ ∔ .	14			÷ ÷ ∔	4.		- ;- ;-	<u>, i – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 – 1 –</u>



DATUM

JOHN D. PATERSON & ASSOCIATES LTD. Consulting Engineers and Geologists 28 Concourse Gate, Nepean, Ontario K2E 7T7

**Geodetic Elevation** 

## **SOIL PROFILE & TEST DATA**

Proposed Office / Warehouse Development 820 Belfast Road

Ottawa, Ontario

 T	FILE NO.	
1		

															S	53	)5	
REMARKS BORINGS BY CME 55 Power Auger				1	DATE	3 Decem	ber 1990				H	OLE	NC	).	E	BH	2	
	OT		SAN	APLE		DEDTH	EI EV	Pe	ne	trat	lion	Re	sis	tan	cel	Blov	ws/.3	m
SOIL DESCRIPTION	APL	<u> </u>	R	RY	병요	(m)	(m)	-	•	5	0 m	m l	Dia	met	er (	Con	e	_
	TRAT	ТҮРЕ	IUMBE	COVE	L ALL				0	)	Moi	istu	re (	Cor	nter	nt %		
GROUND SURFACE	S S		2	8	z	0-	69.14		2	0	4	0	6	0	80	<b>)</b>	100	
Loose, brown, silty sand																		
Compact, brown SAND with silty sand and sandy silt		55	5	/5	12													
seams and layers						1-	68.14											
		ss	6	100	5													
	TXX	l.																
Looso to stiff grov CLAVEV						2-	67.14											
SILT with silt seams and a trace of gravel																		
		∏ ss	7	96	3													
		I.																
						3-	66.14											
		55	8	54	5													
		l.																
		N.																
End of Borehole	r K.K.											1			• -			1
(Standpipe blocked - Dec. 7/90)												******						
									2	20	4	0	6	0	80	0		
									S Ur	ine ndi:	ar S stur	bec	ngt 1	.n (I △	kra Rei	i) mole	ded	

JOHN D. PATERSON	& AS	SOC	IATE	ES LT	D.	S	OIL PF	ROFILE	& 1	EST	DATA	
Consulting Enginee 28 Concourse Gate, Ne	ers a pear	nd Go n, Oni	eolog tario	gists K2E	717	Propose 820 Bel Ottawa,	ed Office last Road Ontario	/ Wareho d	ouse I	Develo	pment	
DATUM Geodetic Elevation									FILE	NO.	<b>S</b> 530	)5
REMARKS							4000		HOL	E NO.	BH	3
BORINGS BY CME 55 Power Auger			0.41		DATE		per 1990	Denstrat				vo / 2m
SOIL DESCRIPTION	A PLOI		SAN 22		щo	DEPTH (m)	ELEV. (m)	- 5	0 mm	Diame	ter Con	e
	TRAT	ТҮРЕ	UMBE	COVE	VALI			0	Moist	ure Co	ntent %	
GROUND SURFACE	05	G		R	zv	0-	68.71	20	40	60	80	100
Dark brown allty aand		ŭ	3									
TOPSOIL												
0.60												
		SS	10	92	10							
						1-	67.71					
Loose, brown SAND with												
sandy silt seams												
		] ss	11	67	2							
		Y										
						2-	- 66 71					
2 20		1				-	00.71					
		⊓ ss	12	71	7							
Loose, grey to greyish brown												
SAND with slit seams						3-	65.71					
		SS	13	71	6							
		A							,			
End of Borehole												
(GWL @ 1.30 m - Dec. 7/90)												
								20	<u>40</u>	<u> </u>	<u>80</u>	 100
								She ▲ Undis	ar Stre sturbe	ength ( ed ∆	(kPa) Remole	led
	<u> </u>			1	L	L	L	1				

JOHN D. PATERSON	& AS	SOC	IATE	ES LT	Ъ.	S	OIL PP	ROFILE	& TEST	DATA
Consulting Enginee 28 Concourse Gate, Ne	ers a pear	nd Gi I, Oni	eolo( tario	gists K2E	717	Propose 820 Beli Ottawa,	ed Office ast Road Ontario	/ Wareho d	ouse Develo	opment
DATUM Geodetic Elevation									FILE NO.	S5305
REMARKS									HOLE NO.	BH 4
BORINGS BY CME 55 Power Auger					DATE	3 Decemt	ber 1990		I	
SOIL DESCRIPTION	A PLOT		SAN œ	APLE ≿	ЩD	DEPTH (m)	ELEV. (m)	Penetrat	ion Resista ) mm Diam	nce Blows/.3m eter Cone
	STRAT	TYPE	NUMBE	% RECOVE	N VALL			20	Moisture C	ontent %
GROUND SURFACE	$\otimes$					0-	68.85			
FILL: Loose, dark grey, sand with some gravel										
FILL: Greyish brown clayey sandy silt		ss	14	58	6					
Loose, greyish brown <b>SANDY</b> SILT with some clay						1-	- 67.85			
Loose, greyish brown <b>SAND</b> with sandy silt and clayey silt seams		ss	15	92	5					
Loose, grey <b>SILT</b> with silty clay seams			10	100		2-	- 66.85			
		SS	16	42	9					
TILL: Stiff, grey clayey silt with some sand and gravel						3-	- 65.85			
Loose, grey SILTY SAND		SS	18	58	10					
End of Borehole (GWL @ 1.24 m - Dec. 7/90)									•	
								20 Shea ▲ Undis	40 60 Ir Strength turbed Δ	80 100 (kPa) Remolded

JOHN D. PATERSON	& AS	SOC		ES LT	D.	S	OIL PF	ROFILE	8	T	E	<b>;T</b>	D/	47/	4
Consulting Enginee 28 Concourse Gate, Ne	ers a pear	nd Go 1, Oni	eolog tario	gists K2E	717	Propose 820 Bel Ottawa,	ed Office fast Road Ontario	/ Wareho di	ous	e D	ev	elop	m	ent	
DATUM Geodetic Elevation									Ę	LE	NO.		S	53 <sup>(</sup>	05
REMARKS				_			h an 1000		н	OLE	ENC	).	E	3Н	5
BORINGS BY CME 55 Power Auger			CAN		DATE		<u>ber 1990</u>	Depotroi	l	Bo				Blo	
SOIL DESCRIPTION	A PLOT		SAN C		Що	DEPTH (m)	ELEV. (m)	- <b>-</b> 5	0 m	ml	Dia	me	ter	Cor	10
	STRATI	ТҮРЕ	NUMBE	ECOVE	D VALL			0	Moi	stu	ire	Coi	nte	nt %	2
GROUND SURFACE				<u>e</u>	2 -	0-	68.49	20	4	0	6		8	0	100
															un la
Compact, brown SAND		SS	19	46	10										
						1-	67.49								
													11.11		
1.58		] ss	20	71	14										
		V													
Stiff to compact, grey CLAYEY SILT/SILT with silty															
clay seams						2-	66.49								
2.20															
		SS	21	50	10										
												2			
		A													
with some sand and gravel														0	
		7 ss	22	79	4	3-	65.49								
		V I											e X		
3.66		]								-					
End of Borehole															
(GVVL @ 0.56 M - Dec. 7/90)							,								
					- -			20 She	4 ar S	o i <b>tre</b>	6 ng	0 t <mark>h (</mark> 1	<sup>8</sup> kPa	0 1)	100
								A Undis	stur	bec	1	Δ	Re	mol	ded

JOHN D. PATERSON	& AS	SOC		ES LT	D.	S	OIL PI					
Consulting Enginee 28 Concourse Gate, Ne	Consulting Engineers and Geologists 28 Concourse Gate, Nepean, Ontario K28											
DATUM Geodetic Elevation												
REMARKS												
BORINGS BY CME 55 Power Auger				0	DATE	4 Decemt	per 1990					
OOU DECODIDITION	LOT		SAN	IPLE		DEPTH	ELEV.					
SOIL DESCRIPTION	STRATA P	ТҮРЕ	NUMBER	× RECOVERY	N VALUE or ROD	(m)	(m)					
Dark brown, silty fine sand TOPSOIL						0-	- 69.18					
Loose, light brown SILTY FINE SAND		G	24									
Q./6		SS	25	67	10	1-	- 68.18					
		ss	26	83	7							
Loose, brown SAND with silty sand and sandy silt seams		ss	27	92	5	2-	- 67.18					

3.25

3.45

## **SOIL PROFILE & TEST DATA**

FILE NO.

HOLE NO.

S5305

**BH 6** 

100

80

40

Shear Strength (kPa) ▲ Undisturbed △ Remolded

20

60

Proposed Office / Warehouse Development 820 Belfast Road

Ottawa, Ontario

LOT		SAN	IPLE		DEPTH	ELEV.	Pene	tratio	n Re	sista	nce		ws/.	3m
STRATA P	TYPE	NUMBER	X RECOVERY	N VALUE or ROD	(m)	(m)	0		oistu 40		onter 8	nt %	100	
					0-	69.18								
	G	24												
	SS	25	67	10	1-	- 68.18								
	] ] ss	26	83	7										¥
					2-	67.18								
	SS	27	92	5										
					3-	66.18								
	SS	28	100									_		

(GWL @ 1.60 m - Dec. 7/90)

(Auger refusal on inferred

TILL: Compact to dense, dark grey clayey silt with some sand and gravel

End of Borehole

bedrock)

JOHN D. PATERSON	& AS	soc	IATE	ES LT	D.	S	OIL PF	ROFILE	: & TE	ST	DATA	
Consulting Engine 28 Concourse Gate, Ne	ers a pear	nd G 1, On	eolo tario	gists K2E	7T7	Propose 820 Bel Ottawa,	ed Office fast Road Ontario	e / Wareho d	ouse De	velop	ment	
DATUM Geodetic Elevation									FILE NO	Э.	<b>S</b> 530	5
REMARKS						4 Decem	har 1000		HOLEI	NO.	BH 7	7
BORINGS BY CML 55 Power Auger	ь		SVE		DAIE		<u>ber 1990</u>	Ponetrat	ion Res	istan		e/3m
SOIL DESCRIPTION	A PLO		2		坦이	DEPTH (m)	ELEV. (m)	- <b>-</b> - 5(	) mm Di	iamet	er Cone	9
	STRAT	ТҮРЕ	NUMBE	XECOVE	N VALL			0	Moistur	e Con	so	100
GROUND SURFACE		G	29			0-	69.07	20				ŤП
Loose, dark brown SILTY SAND with some gravel and												
organics												
Compact, brown SILTY SAND		SS	30	71	11	1-	68.07					
							00.07					
1.50		]										
		∏ ss	31	92	5						.()	
						2-	67.07					
Loose to compact, brown to greyish brown <b>SAND</b> with		∏ ss	32	92	10							
seams and layers		V										
		1				3-	66.07					-
Firm, grey CLAYEY SILT with silty sand seams		SS	33	100	8							
3.50												
TILL: Loose, grey silty sand with some gravel 3.66										+ - +		
(GWL @ 1.45 m - Dec 7/90)												
								20	<u>40</u>	<b>60</b>	<u>∔                                     </u>	100
								Shea Undis	ar Stren turbed	gth (k	(Pa) Remold	ed

JOHN D. PATERSON	& AS	ssoc		ES LT	D.	S	OIL PF	ROFILE	& TEST	' DATA
Consulting Enginee 28 Concourse Gate, Ne	ers a peai	nd G n, On	eolo tario	gists K2E	7T7	Propose 820 Bel Ottawa,	ed Office fast Roa Ontario	e / Wareho d	ouse Develo	pment
DATUM Geodetic Elevation									FILE NO.	S5305
REMARKS									HOLE NO.	BH 8
BORINGS BY CME 55 Power Auger		[			DATE	4 Decemi	ber 1990			
SOIL DESCRIPTION	A PLOT		SAN œ		띡으	DEPTH (m)	ELEV. (m)	5	0 mm Diam	eter Cone
	STRAT	TYPE	NUMBE	RECOVE	N VALI			0	Moisture Co	80 100
GROUND SURFACE		G	34			0-	68.40			
Loose, dark brown SILTY SAND with some organics										
		] ss	35	100	4					
						1-	67.40			
Very stiff, brownish grey to										
some sand		ss	36	100	4					
		1				2-	66.40			
End of Borehole		11 								
(GWL @ 0.73 m - Dec. 7/90)										
								20	40 60	80 100
								She Undis	ar Strength sturbed $\Delta$	(KPa) Remolded

JOHN D. PATERSON	& AS	soc		ES LT	D.	S	OIL PF	ROFILE & TEST DATA
Consulting Enginee 28 Concourse Gate, Ne	ers a pear	nd G 1, On	eolog tario	gists K2E	777	Propose 820 Bel Ottawa,	ed Office fast Road Ontario	e / Warehouse Development d
DATUM Geodetic Elevation								FILE NO. \$5305
REMARKS					ATE		bor 1000	HOLE NO. BH 9
BORINGS BY CME 55 Power Auger	⊢		SAN			4 Decen		Penetration Resistance Blows/.3m
SOIL DESCRIPTION	A PLO		Q.	۲ ۲	띡ㅇ	DEPTH (m)	ELEV. (m)	
	STRAT	ТҮРЕ	NUMBE	ECOVE	VALL			O Moisture Content %
GROUND SURFACE				2	2	<b>0</b> -	68.19	
TOPSOIL								
Dark brown SILTY SAND with some organics								
		ss	37	100	7			
Stiff, olive grey CLAYEY SILT						1-	67.19	
with some gravel		٨						
End of Borehole	<u>1</u> 22	]						
(No groundwater level reading was taken in this borehole.)								
								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remolded

JOHN D. PATERSON	& AS	soc		ES LT	D.	S	OIL PF	ROFILE	<b>&amp;</b> T	EST	DAT/	1
Consulting Enginee 28 Concourse Gate, Ne	ers a pear	nd G 1, On	eolog tario	gists K2E	717	Propose 820 Bell Ottawa,	ed Office ast Road Ontario	/ Wareho J	ouse D	evelo	pment	
DATUM Geodetic Elevation									FILE	NO.	S53	05
REMARKS						4 Decemb	or 1000		HOLE	E NO.	BH	10
BORINGS BY CIVIE 55 Power Auger			SVI		AIE	4 Decenii	Jei 1990	Ponetra	ion Be	eictar	ce Blo	ws/3m
SOIL DESCRIPTION	PLO.		JAN	<u>≻</u>	Ша	DEPTH (m)	ELEV. (m)	- <b>-</b> - 5	0 mm	Diame	ter Con	e
	<b>FRATA</b>	гүре	JMBER	% COVER	VALUI			0	Moistu	ire Co	ntent %	
GROUND SURFACE	ິທ		Ň	REC	zŏ	0-	- 68.54	20	40	60	80	100
Dark brown silty sand						-						
0.45												
												이 특히 가지 이 아이
Loose, brown SILTY SAND with some silt and clay		SS	38	71	6							
						1-	67.54					
1.62		ss	39	83	20							
Compact, grey SILT with		Ĭ										
Clayby sit scans						2-	66.54					
End of Borehole												
(GWL @ 0.61 m - Dec. 7/90)												
								20 She	40 ar Stre	ngth (	kPa)	
								A Undis	turbec		Remole	led

## 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				
Сс	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$				
Cu	-	Uniformity coefficient = D60 / D10				
Cc and Cu are used to assess the grading of sands and gravels:						

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

#### **CONSOLIDATION TEST**

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

#### PERMEABILITY TEST

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

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

#### MONITORING WELL AND PIEZOMETER CONSTRUCTION









### Certificate of Analysis

Report Date: 14-Aug-2014 Order Date:8-Aug-2014

## Client: Paterson Group Consulting Engineers Client PO: 16400

Client PO: 16400	O: 16400 Project Description: PG3298				
	Client ID:	BH6-SS5	-	-	-
	Sample Date:	01-Aug-14	-	-	-
	Sample ID:	1432257-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	94.2	-	-	-
General Inorganics					
рН	0.05 pH Units	7.86	-	-	-
Resistivity	0.10 Ohm.m	21.7	-	-	-
Anions					
Chloride	5 ug/g dry	66	-	-	-
Sulphate	5 ug/g dry	272	-	-	-

P: 1-800-749-1947 E: PARACEL@PARACELLABS.COM

OTTAWA-WEST

104-195 Stafford Rd. W. Nepean, ON K2H 9C1

OTTAWA-EAST 300-2319 St. Laurent Blvd. Ottawa, ON K1G 4J8 MISSISSAUGA 6645 Kitimat Rd. Unit #27 Mississauga, ON L5N 6J3

SARNIA

218-704 Mara St. Point Edward, ON N7V 1X4

NIAGARA 360 York Rd. Unit 16B Niagara-on-the-Lake, ON LOS 1J0

KINGSTON 1058 Gardiners Rd. Kingston, ON K7P 1R7

Page 3 of 7

WWW.PARACELLABS.COM

## **APPENDIX 2**

FIGURE 1 - KEY PLAN

DRAWING PG3298-2 - TEST HOLE LOCATION PLAN



FIGURE 1 KEY PLAN

## patersongroup



autocad drawings\geotechnical\pg32xx\pg3296-2 rt.c