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Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Geotechnical Investigation

Proposed Commercial Development 5707 Hazeldean Road Ottawa, Ontario

Prepared For

North American (Goulbourne) Limited Partnership

Paterson Group Inc.

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Report: PG1899-2 Revision 1

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1.0 Introduction

Paterson Group (Paterson) was commissioned by North American (Goulbourne) Limited Partnership (North American) to conduct a geotechnical investigation for the commercial development located at the northeast corner of the intersection of Huntmar Drive and Hazeldean Road (5707 Hazeldean Road), 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 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 the design.

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

2.0 Proposed Development

It is understood that the current phase of the commercial development will consist of several buildings of slab on grade construction. Associated access lanes, parking and landscaped areas are also anticipated.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation was carried on April 26, 2016. At that time, six (6) boreholes were extended to a maximum depth of 6.4 m. A previous investigation was carried between July 7 and 13, 2009. At that time, eighteen (18) boreholes were extended to a maximum depth of 9.8 m. The test hole locations were distributed across the subject site in a manner to provide general coverage of the proposed buildings. The borehole locations were selected and located in the field by Paterson. The test hole locations are shown on Drawing PG1899-2 - Test Hole Location Plan included in Appendix 2.

The boreholes were put down using a track-mounted auger drill rig operated by a crew of two. 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 at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter splitspoon (SS) sampler, using 73 mm diameter thin walled (TW) Shelby tubes in conjunction with a piston sampler, or the auger flights. All soil samples were visually inspected and initially classified on site. The split-spoon samples were placed in sealed plastic bags and the Shelby tubes were sealed at both ends on site. All samples were transported to our laboratory for further examination and classification. The depths at which the split-spoon, Shelby tube, and auger samples were recovered from the test holes are shown as SS, TW, and AU, 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 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 of this report.

Groundwater

A flexible standpipe was installed in all boreholes, except BHs 3, 5 and 16, to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

3.2 Field Survey

The test hole locations for the current investigation were determined in the field by Paterson personnel with consideration of existing site features. It should be noted that the ground surface elevations at the borehole locations are referenced to a temporary benchmark (TBM), consisting of the top of a fire hydrant located northeast of CRU A. A geodetic elevation of 102.38 m was provided for the TBM. The borehole locations for the previous investigation were surveyed by Fairhall, Moffatt & Woodland Limited. The locations and ground surface elevation at the borehole locations are presented on Drawing PG1899-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

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

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

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 samples. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The ground surface at the subject site currently consists of asphaltic concrete and or granular fill, with several commercial buildings constructed during the previous development phases of the subject site. The ground surface at the subject site is relatively flat gradually slopes downward to the south. The subject site is approximately at grade with Huntmar Road and Hazeldean Road.

4.2 Subsurface Profile

Generally, the soil profile at the test holes consists of asphaltic concrete and/or granular fill, such as crushed stone and/or silty sand with gravel and cobbles. Very stiff to stiff brown silty clay crust was encountered below the abovenoted fill layers followed by a firm grey silty clay layer. Practical refusal to dynamic cone penetration testing was completed at BHs 4, 6, 11 and 14, at depths varying between 11 and 15 m. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profile encountered at each test hole location.

Based on available geological mapping, the subject site consists of interbedded dolostone and limestone of the Gull River formation to depth ranging between 3 to 15 m.

Silty Clay

Two (2) samples of silty clay were subjected to unidimensional consolidation (oedometer) testing. The test results are presented in Subsection 5.3 and the Consolidation Test sheets in Appendix 1. The consolidation test results indicate that the silty clay is overconsolidated with overconsolidation ratios (OCR) for the tested samples varying between 1.9 and 2.1. The OCR is the ratio of the preconsolidation pressure to the effective pressure at the sample depth. This is further discussed in Subsection 5.3.

One (1) silty clay sample was submitted for Atterberg Limits testing. The tested material was classified as inorganic clays of low plasticity (CL). The results are summarized in Table 1 and presented on the Atterberg Limits results sheet in Appendix 1.

Table 1 - Summary of Atterberg Limits Tests								
Sample	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Classification			
BH 11 TW 2	41.6	30	18	12	CL			

4.3 Groundwater

The measured groundwater levels at the borehole locations are presented in Table 2. It should be noted that groundwater readings could be influenced by surface water infiltrating the backfilled boreholes. The groundwater level can also be estimated based on moisture levels and colour of the recovered soil samples. Based on these observations at the borehole locations, the permanent groundwater table is expected to be between 3 and 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 2 Summary of G	roundwater Level	Readings		
Test Hole	Ground	Groundwa	ter Levels, m	Decending Dete
Number	Elevation, m	Depth	Elevation	Recording Date
BH1-16	102.08	1.92	100.16	May 3, 2016
BH2-16	102.11	3.62	98.49	May 3, 2016
BH3-16	102.04	2.91	99.13	May 3, 2016
BH4-16	101.83	Dry	n/a	May 3, 2016
BH5-16	101.50	2.20	99.30	May 3, 2016
BH6-16	101.75	3.19	98.56	May 3, 2016
PG1988-1R - F	ebruary 24, 2012			
BH 1	102.81	1.76	101.05	July 16, 2009
BH 2	102.55	2.28	100.27	July 16, 2009
BH 4	101.98	2.51	99.47	July 16, 2009
BH 6	102.74	1.93	100.81	July 16, 2009
BH 7	102.46	2.03	100.43	July 16, 2009
BH 8	101.92	1.50	100.42	July 16, 2009
BH 9	101.68	1.52	100.16	July 16, 2009

Test Hole	Ground	Groundwa	ter Levels, m	Decending Date
Number	Elevation, m	Depth	Elevation	Recording Date July 16, 2009 July 16, 2009
BH 10	101.54	1.55	99.99	July 16, 2009
BH 11	101.34	1.40	99.94	July 16, 2009
BH 12	101.15	1.42	99.73	July 16, 2009
BH 13	100.95	0.60	100.35	July 16, 2009
BH 14	100.24	0.52	99.72	July 16, 2009
BH 15	100.76	1.61	99.15	July 16, 2009
BH 17	101.55	1.27	100.28	July 16, 2009
BH 18	100.47	1.58	98.89	July 16, 2009

The ground surface elevations are referenced to a temporary benchmark (TBM), consisting of the top of a fire hydrant to be located northeast of CRU A. A geodetic elevation of 102.38 m was provided for the TBM.

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5.0 Discussions

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed commercial development. It is anticipated that all structures will be founded on conventional shallow footings placed on the undisturbed, stiff to very stiff silty clay. However, due to the presence of a silty clay layer, the proposed development will be subjected to grade raise restrictions.

Our permissible grade raise recommendations are discussed in Subsection 5.3. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, deleterious fill, such as those containing organic materials, and construction debris should be stripped from under any buildings 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 buildings and paved areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and 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

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

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, in the dry, prior to the placement of concrete for footings.

Footings founded on the silty clay will experience up to 25 mm of total settlement and 15 mm of differential settlement.

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 very stiff to stiff silty clay above groundwater table when a plane extending down and out from the bottom edge of the fooring at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Settlement/Grade Raise

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

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. These characteristics are estimated in the laboratory by conducting unidimensional consolidation tests on undisturbed soil samples collected using Shelby tubes in conjunction with a piston sampler. Two (2) site specific consolidation tests are being carried out for this project. The results of the consolidation tests are included in Appendix 1 to the present report.

Value p'_{\circ} is the preconsolidation pressure of the sample and p'_{\circ} is the effective overburden pressure. 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 C_{cr} and C_{c} are the recompression and compression indices, respectively, and are a measure of the compressibility of the soil 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.

It should be noted that the values of p'_{c} , p'_{o} , C_{cr} and C_{c} are determined using standard engineering practices and are estimates only. In addition, natural variations within the soil deposit would also affect the results. Furthermore, the p'_{o} parameter is directly influenced by the groundwater level. While the groundwater levels were measured at the time of the fieldwork, the levels vary with time and this 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 being 0.5 m above the bottom of the silty clay crust. The level of the silty clay.

For design purposes, the total and differential settlements associated with the combination of grade raises and footing loading conditions using the bearing resistance values are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

Table 3 Summary of Consolidation Test Results										
Borehole No.	Sample	Depth (m)	p' _c (kPa)	p'。 (kPa)	C _{cr}	C _c	Q (*)			
BH 11	TW 2	4.99	148	70	0.013	0.674	А			
BH 18	TW 4	5.07	126	65	0.013	0.466	А			
* - Q - Quality assessment of sample - G: Good A: Acceptable P: Likely disturbed										

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

Based on our laboratory and field testing results, a permissible grade raise restriction of 1.2 m is recommended for the subject site.

If higher grade raises and/or higher loading conditions are required, post construction settlements can be reduced by several methods. The following options can be considered:

- preloading and surcharging
- □ lightweight fill (LWF)

5.4 Design for Earthquakes

The site class for seismic site response is a **Class D** for the foundations considered. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4 A) for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of the topsoil layer and fill containing organic matter, within the footprint of the proposed building, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

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

5.6 Pavement Design

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

Table 4 - Recommended Pavement Structure Car Only Parking Areas							
Thickness mm	Material Description						
50	WEAR COURSE - Superpave 12.5 Asphaltic Concrete						
150	BASE - OPSS Granular A Crushed Stone						
300	SUBBASE - OPSS Granular B Type II						
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil or fill.							

Table 5 - Recommended Pavement Structure Access Lanes, Fire Routes and Heavy Truck Parking Areas						
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 in situ soil, fill 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 I or II material. Weak subgrade conditions may be experienced over service trench fill materials.

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.

In areas where silty clay is encountered at subgrade, consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

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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 100 mm to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or sump pit.

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 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 used for this purpose.

6.2 **Protection 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 minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided in this regard.

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 side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the 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 Type 2 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical side walls.

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

The groundwater infiltration into the excavations should be low and controllable with 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 MOE permit to take water (PTTW) may be required for this project if more than 50,000 L/day is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MOE.

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 analytical testing results are presented in Table 6 along with industry standards for the applicable threshold values. These results are indicative that Type 10 Portland cement (Type GU, or normal cement) would be appropriate for this site.

Table 6 - Corrosion Potential									
Parameter	Laboratory Results	Threshold	Commentary						
	BH6 SS2								
Chloride	66 µg/g	Chloride content less than 400 mg/g	Negligible concern						
рН	7.5	pH value less than 5.0	Neutral Soil						
Resistivity	21.8 ohm.m	Resistivity greater than 1,500 ohm.cm	Moderate Corrosion Potential						
Sulphate	251 µg/g	Sulphate value greater than 1 mg/g	Negligible Concern						

6.8 Landscaping Considerations

The proposed development is located in a moderate sensitivity area with respect to tree plantings over a silty clay deposit. It is recommended that trees placed within 4 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 4 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

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

7.0 Recommendations

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

- Review master grading plan from a geotechnical perspective, once available.
- 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 backfilling and follow-up 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. 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.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work.

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 North American (Goulbourne) Limited Partnership Limited or their agent(s) are not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:



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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS SYMBOLS AND TERMS CONSOLIDATION TESTING RESULTS ATTERBERG LIMIT TESTING RESULTS ANALYTICAL TESTING RESULTS

patersongroup						SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Ont		-		ineers	Geotechnical Investigation Proposed Commercial Development-Hazeldean Road Ottawa, Ontario							
DATUM TBM - Top spindle of fire h	iydrar	nt. Geo	odetic	eleva	tion	= 102.38n	n.		FILE NO.	PG1899		
REMARKS									HOLE NO.	BH 1-16		
BORINGS BY CME 55 Power Auger					ATE	April 26, 2	2016					
SOIL DESCRIPTION	PLOT			IPLE 것	E .	DEPTH (m)	ELEV. (m)		esist. Blo 60 mm Dia.		ter tion	
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			 Water Content % 20 40 60 80 			Piezometer Construction	
Asphaltic concrete0.06						- 0-	102.08					
FILL: Crushed stone 0.51		AU AU	1 2									
		SS	3	4	2	1-	-101.08	· · · · · · · · · · · · · · · · · · ·				
Very stiff to stiff, brown SILTY						2-	-100.08					
CLAY, trace sand						3-	-99.08					
- firm to stiff and grey by 3.8m depth						4-	-98.08					
						5-	-97.08					
6.40 End of Borehole						6-	-96.08	A				
(GWL @ 1.92m-May 3, 2016)								20 Shea ▲ Undist	40 60 ar Strength turbed △ 1		00	

patersongr		In	Con	sulting		SOIL	- PRO	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, Ont		_		ineers	Geotechnical Investigation Proposed Commercial Development-Hazeldean Road Ottawa, Ontario						
DATUM TBM - Top spindle of fire h	nydrar	nt. Ge	odetic	elevat					FILE NO.	PG1899	
REMARKS									HOLE NO		
BORINGS BY CME 55 Power Auger	TE	April 26, 2	2016			BH 2-16					
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)	-	esist. Blo 0 mm Dia		en K
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE of ROD	(,	(,	• v	Vater Con	tent %	Piezometer Construction
GROUND SURFACE			-	8	zř		102.11	20	40 6	0 80	i⊑ ŭ ‱ ∭
Crushed stone0.15 FILL: Silty sand with gravel and cobbles0.90		≂ AU	1								
		ss	2	46	27	1-	-101.11				
						2-	-100.11			1	
Very stiff to stiff, brown SILTY CLAY, trace sand						3-	-99.11				
- firm to stiff and grey by 4.0m depth						4-	-98.11				
						5-	-97.11				
6.40 End of Borehole (GWL @ 3.62m-May 3, 2016)						6-	-96.11				
(GIVE @ 0.02111-191ay 0, 2010)								20 Shea ▲ Undist	40 60 ar Strengt turbed △		00

patersongr		In	Con	sulting	,	SOIL	- PRO	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, On		-		ineers	P	Geotechnic Proposed (Ottawa, Or	tigation cial Develo	opment-Ha	azeldean Roa	ad	
DATUM TBM - Top spindle of fire h	nydrar	nt. Ge	odetic	c eleva		,			FILE NO.	DC1000	
REMARKS									HOLE NO	PG1899	
BORINGS BY CME 55 Power Auger	-1			D	ATE	April 26, 2	2016	1		BH 3-16	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blo 0 mm Dia		- u
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE OF ROD	(m)	(m)	• V	Vater Con	tent %	Piezometer Construction
GROUND SURFACE	5		NC	REC	zČ		100.04	20	40 6	0 80	Cor
Crushed stone0.15						- 0-	-102.04				
0.85	5	ss	1	42	37		-101.04				
		ss	2	21	5						
						2-	-100.04				
Very stiff to stiff, brown SILTY CLAY, trace sand - firm and grey by 4.0m depth						3-	-99.04				
						4-	-98.04				
						5-	-97.04				
6.40						6-	-96.04				
(GWL @ 2.91m-May 3, 2016)											
(GATE & 2.0 m may 0, 2010)								20 Shea ▲ Undis	40 6 ar Strengt		00

SOIL PROFILE AND TEST DATA SOIL PROFILE AND TEST DATA Soil Description Test Colonnade Road South, Ottawa, Ontario K2E 73 Datum TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m. REMARKS BORINGS BY CME 55 Power Auger DATE April 26, 2016 SOIL DESCRIPTION SAMPLE DEPTH (m) GROUND SURFACE AU 1.32 FILL: Brown silty sand with gravel Inter or Borehole Bor or Bury Salt Bor or Bury Salt Colspan="2">Colspan="2">Perture sand Soil DESCRIPTION Soil A Esc NIPTION Soil A Esc NIPTION Soil A Esc NIPTION Soil A AU 1.32 AU 1 1.32 Soil A Esc NIPTION Soil A AU 1.32 AU 1.32 Soil A AU 1.32 A <th>natorsonar</th> <th></th> <th>ır</th> <th>Con</th> <th>sulting</th> <th></th> <th>SOIL</th> <th>- PRO</th> <th>FILE AI</th> <th>ND TEST DAT</th> <th>ГА</th>	natorsonar		ır	Con	sulting		SOIL	- PRO	FILE AI	ND TEST DAT	ГА
DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m. FILE NO. BORINGS BY CME 55 Power Auger DATE April 26, 2016 SOIL DESCRIPTION The main set of the hydrant. Geodetic elevation = 102.38m. FILE NO. BORINGS BY CME 55 Power Auger DATE April 26, 2016 SOIL DESCRIPTION The main set of the hydrant. Geodetic elevation = 102.38m. PG1899 MUE NO. BORINGS BY CME 55 Power Auger DATE April 26, 2016 Soil DESCRIPTION The main set of the hydrant. Geodetic elevation = 102.38m. DEPTH (m) ELEV (m) BORINGS BY CME 55 Power Auger GROUND SURFACE O Water Content % GROUND SURFACE O Water Content % FILL: Brown silty sand with gravel Stiff to very stiff, brown SILTY CLAY, trace sand 3.35 End of Borehole			-		ineers	P	roposed (tigation cial Develo	pment-Hazeldean	Road	
BORINGS BY CME 55 Power Auger DATE April 26, 2016 HOLENO. BH 4-16 SOIL DESCRIPTION Image: Solution of the second seco	DATUM TBM - Top spindle of fire h	nydrar	nt. Ge	odetic	c elevat		-			FILE NO. PG18	399
Solid Description Sample Depth description Pen. Resist. Blows/0.3m GROUND SURFACE Image: Solid description Image										HOLE NO. BH 4-	16
SOIL DESCRIPTION OPA DEPTH ME ELEV. (m) 0 = 50 mm Dia. Cone GROUND SURFACE Max Max <td>BORINGS BY CME 55 Power Auger</td> <td></td> <td></td> <td></td> <td></td> <td>TE</td> <td>April 26, 2</td> <td>2016</td> <td></td> <td></td> <td></td>	BORINGS BY CME 55 Power Auger					TE	April 26, 2	2016			
FILL: Brown silty sand with gravel I SS 2 42 14 1-100.83 I-100.83 Stiff to very stiff, brown SILTY I CLAY, trace sand I End of Borehole I	SOIL DESCRIPTION					M -	(m)				
FILL: Brown silty sand with gravel I SS 2 42 14 1-100.83 I-100.83 Stiff to very stiff, brown SILTY I CLAY, trace sand I End of Borehole I		STRATA	ТҮРЕ	UMBER	COVER	VALU Dr RQD			• v	Vater Content %	Piezometer Construction
FILL: Brown silty sand with gravel SS 2 42 14 SS 2 42 14 1-100.83 2-99.83 Stiff to very stiff, brown SILTY CLAY, trace sand End of Borehole CLAY and CLAY are sand CLAY A CLAY AR A CLAY A CLAY A CLAY A CLAY A	GROUND SURFACE			4	RE	z ⁰		-101.83	20	40 60 80	ŭ <u>5</u>
	FILL: Brown silty sand with gravel		≖ AU	1							
Stiff to very stiff, brown SILTY CLAY, trace sand End of Borehole	<u>1.3</u> 2		SS	2	42	14	1-	-100.83			
End of Borehole	CLAY, trace sand										
(BH dry - May 3, 2016)		YX/V	-								
20 40 60 80 100 Shear Strength (kPa)	(BH dry - May 3, 2016)										100

patersongr		ır	Con	sulting		SOIL	- PRO	FILE AI	ND TES	T DATA	
154 Colonnade Road South, Ottawa, On		-		ineers	P	igation al Develo	opment-Ha	zeldean Roa	ad		
DATUM TBM - Top spindle of fire h	nydrar	nt. Ge	odetic	c elevat	-	ttawa, Or = 102.38n			FILE NO.	PG1899	
REMARKS									HOLE NO.		
BORINGS BY CME 55 Power Auger				DA	TE	April 26, 2	2016			BH 5-16	
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)		esist. Blo 0 mm Dia.		er ion
	STRATA	ТҮРЕ	NUMBER	* RECOVERY	VALUE Sr ROD			• V	Vater Cont	ent %	Piezometer Construction
GROUND SURFACE	ي. ۲		N	REC	N OK		101 50	20	40 60	80	C Pie
FILL: Brown silty sand with gravel		≊ AU	1			_ 0-	-101.50				
<u>0.8</u> 6		ss	2	42	9	1-	-100.50				
						2-	-99.50			•	Y
Stiff to very stiff, brown SILTY CLAY , trace sand						3-	-98.50			1:	
- firm and grey by 4.3m depth						4-	-97.50	4			
						5-	-96.50	A			
End of Borehole						6-	-95.50				
(GWL @ 2.20m-May 3, 2016)								20 Shea ▲ Undist	40 60 ar Strength turbed △		00

patersongr		In	Con	sulting	,	SOIL	PRO	FILE AND TEST DATA	
154 Colonnade Road South, Ottawa, Ont		-		ineers	Pi		Commerc	tigation cial Development-Hazeldean Roa	d
DATUM TBM - Top spindle of fire h				eleva	-	ttawa, Or = 102.38n		FILE NO. PG1899	
REMARKS									
BORINGS BY CME 55 Power Auger	1			D	ATE	April 26, 2	2016	BH 6-16	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m • 50 mm Dia. Cone	r N
	STRATA I	ТҮРЕ	NUMBER	% RECOVERY	VALUE r ROD	(m)	(m)	 Water Content % 	Piezometer Construction
GROUND SURFACE	STI	Ê	NUN	RECO	N N N			20 40 60 80	Piez Con:
		⊠ AU	1			- 0-	101.75		88
FILL: Brown silty sand with gravel and cobbles									
1.30		ss	2	62	17	1-	-100.75		
1.00									
		SS	3	67	7	2-	-99.75		
Very stiff to stiff, brown SILTY CLAY		ss	4	100	4				
with sand		ss	5	100	2	3-	-98.75		
		ss	6	100	2	4-	-97.75		
- firm and grey by 4.5m depth		ss	7	100	Р				
End of Borehole		Λ				5-	-96.75		
(GWL @ 3.19m-May 3, 2016)									
								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded	0

patersongro		-				SOIL	- PRO	FILE AI	ND TES	T DATA	
154 Colonnade Road South, Ottawa, O		-	-	ineers	Pi	eotechnic oposed C ttawa, On	commerc	igation ial Develop	oment-Haze	ldean Road	
DATUM Ground surface elevations p	orovide	ed by F	airha	II, Moffa					FILE NO.	DC1000	
REMARKS									HOLE NO.	PG1899	
BORINGS BY CME 55 Power Auger	T			DA	TE	13 July 20	09	1		BH 1	
	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blow		Pon
SOIL DESCRIPTION			æ	RY	Що	(m)	(m)	• 5	0 mm Dia. (Cone	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	~ RECOVERY	N VALUE or RQD			• v	later Conte	nt %	onst
GROUND SURFACE	N.	5	IN	REC	zö	0	-102.81	20	40 60	80	Ξ0
TOPSOIL0.13		🕈 AU	1			_ 0-	-102.01				
		ss	2	58	8	1-	-101.81	· · · · · · · · · · · · · · · · · · ·	••••••	••••••••••••••••••	
						0	-100.81	· · · · · · · · · · · · · · · · · · ·	······	· · · · · · · · · · · · · · · · · · ·	
Hard to very stiff, brown SILTY CLAY, trace sand						2-	- 100.81			2	
and sand seams						3-	-99.81			······	
							00.01	· · · · · · · · · · · · · · · · · · ·			
- very stiff to stiff and grey by						4-	-98.81				
2.8m depth						5-	-97.81				
<u>6.40</u>						6-	-96.81		·····		
End of Borehole											
(GWL @ 1.76m-July 16/09)											
								20 She	40 60 ar Strength	80 10 (kPa)	0
								▲ Undist		lemoulded	

patersongro		n	Con	sulting ineers		SOIL	_ PRO	FILE AN	ND TES	T DATA	
154 Colonnade Road South, Ottawa, O		-		ineers	P		commerc		oment-Haze	eldean Road	k
DATUM Ground surface elevations p	orovide	ed by l	Fairha	ll, Moffa		ttawa, On Woodland			FILE NO.	DC1000	
REMARKS									HOLE NO.	PG1899	
BORINGS BY CME 55 Power Auger				DA	TE	13 July 20	09		HOLL NO.	BH 2	
	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blov		۲ü
SOIL DESCRIPTION			~	х	ы о	(m)	(m)	• 5	0 mm Dia.	Cone	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater Conte	ent %	^o iezo
GROUND SURFACE	ŗ.		NC NC	REC	z ⁰		100 55	20	40 60	80	шO
TOPSOIL0.15						- 0-	-102.55				
		ss	1		5	1-	101.55		••••••		
							100 55		· · · · · · · · · · · · · · · · · · ·		
						2-	-100.55				
Hard to very stiff, brown SILTY CLAY, trace sand and						3-	-99.55				
sand seams										· · · · · · · · · · · · · · · · · · ·	
- firm to stiff and grey by 4.3m						4-	-98.55	· · · · · · · · · · · · · · · · ·			
depth						5-	-97.55	4			
<u>6.40</u>						6-	-96.55		•••••••••		
End of Borehole											
(GWL @ 2.28m-July 16/09)											
								20 She	40 60 ar Strength	80 10 (kPa)	1 DO
								▲ Undist		Remoulded	

patersongro		n	Con	sulting		SOIL	_ PRO	FILE AI	ND TES	T DATA	
154 Colonnade Road South, Ottawa, C		-		sulting ineers	Pr		commerc		oment-Haze	eldean Roac	k
DATUM Ground surface elevations p				ll, Moffa		tawa, On Woodland			FILE NO.	DO1000	
REMARKS										PG1899	
BORINGS BY CME 55 Power Auger				DA	TE ⁻	13 July 20	09		HOLE NO.	BH 3	
	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blov		er on
SOIL DESCRIPTION			<i>c</i> ;	X I	ч о	(m)	(m)	• 5	0 mm Dia.	Cone	ructio
	STRATA	ТҮРЕ	NUMBER	RECOVERY	N VALUE			• V	Vater Conte	ent %	Piezometer Construction
GROUND SURFACE	ß		N	RE :	z ⁰	0-	-102.59	20	40 60	80	0
TOPSOIL Brown CLAYEY SILT , some 0.15] 0-	102.59				
		ss	1		8	1-	101.59				
		10						• • • • • • • • • • •	••••••	• • • • • • • • • • • • • • • • • • •	
Very stiff, brown SILTY CLAY						2-	100.59	· · · · · · · · · · · · · · · · · · ·			
								<u> </u>			9
<u>3.3</u> 5	5					3-	-99.59				9
End of Borehole											
								20 Sho	40 60 or Strongth	80 10	bo
								She Undist	ar Strength urbed \triangle F	i (KPa) Remoulded	

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parcisongic		Y	Eng	ineers		eotechnic			mont-Hazol	ldean Boad	I
154 Colonnade Road South, Ottawa, O	ntario	rio K2E 7J5 Proposed Commercial Devel Ottawa, Ontario									
DATUM Ground surface elevations p	rovide	ed by F	airha	ll, Moff	att &	Woodland	l Ltd.		FILE NO.	PG1899	
REMARKS									HOLE NO.		
BORINGS BY CME 55 Power Auger		DATE 8 July 2009								BH 4	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.		esist. Blow 0 mm Dia. C		er ion
SOIL DESCRIPTION	р.		~	ξΥ	Цо	(m)	(m)	U	u min Dia. C	one	ruct
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	I VALUE or RQD			0 N	later Conter	nt %	Piezometer Construction
GROUND SURFACE			4	RE	z	0_	-101.98	20	40 60	80	
FILL: Silty clay wtih gravel and topsoil0.91		AU	1			0-	101.90				

	STF	T Y	MUN	RECO	N VI OF		
GROUND SURFACE			4	R	z		20 40 60 80
FILL: Silty clay wtih gravel		🕈 AU	1			0+101.98	
and topsoil 0.9	, IXX	∦≊ ^∪	'				
<u> </u>	2' }}}	ss	2		5	1+100.98	
			-		Ŭ		
							101010101010100101010101001
Very stiff to stiff, brown SILTY						2+99.98	
CLAY, trace sand	- HA	1					
		1				3-98.98	
- grey-brown by 2.0m depth		1				0 00.00	
		1					
		ТW	3	100		4+97.98	
- firm to stiff and grey by 3.7m		-					
depth						E 00 00	
		1				5+96.98	
		1					
						6+95.98	
						7-94.98	
	- AA	1					
8.1	5	1				8-93.98	
GLACIAL TILL: Stiff, grey							
clayey silt with sand, gravel, cobbles and boulders, trace		1					
cobbles and boulders, trace		1				9+92.98	
clay	75	t∦ SS	4		2		
Dynamic Cone Penetration Test		1				10-91.98	
commenced @ 9.75m depth		2				10 01.00	
	\^ <u>^</u> ^^^	2					
		1				11+90.98	
Inferred GLACIAL TILL		2					
		2				12-89.98	
		^				12-09.90	
		2					
		<u>^</u>				13+88.98	
13 6	<u>82 \^^^^</u>	1					
End of Borehole		1					
Practical refusal to DCPT @							
13.62m depth							
(GWL @ 2.51m-July 16/09)							
							20 40 60 80 100
							Shear Strength (kPa)
							▲ Undisturbed △ Remoulded

patersongro		n	Con	sulting ineers		SOIL	- PRO	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, C		-		ineers	Pr	eotechnic oposed C tawa, On	commerc	igation ial Develop	oment-Haz	eldean Road	i
DATUM Ground surface elevations p	orovide	ed by F	Fairha	ll, Moffa		-			FILE NO.	PG1899	
REMARKS									HOLE NO		
BORINGS BY CME 55 Power Auger		1		DA	TE	7 July 200	9	1		BH 5	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		esist. Blo 0 mm Dia.		Piezometer Construction
		ы	ER	ERY		(m)	(m)				zome
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• V	Vater Cont	ent %	Con
GROUND SURFACE				RI :	z	- 0-	-102.27	20	40 6	0 80	
TOPSOIL0.20											
		ss	1		5	1-	101.27				
Very stiff, brown SILTY CLAY								·		••••••	4
with some sand						2-	100.27				
3.35	5/1/2					3-	-99.27				3 9
End of Borehole											
								20 She	40 60 ar Strengt		00
								▲ Undist	-	Remoulded	

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patersongre		Υ	Eng	ineers		eotechnic				
154 Colonnade Road South, Ottawa, O	ntario	o K2E	7J5			oposed C tawa, On		al Develop	oment-Hazeldean Road	ł
DATUM Ground surface elevations p	rovide	ed by I	Fairha	ll, Moff	att &	Woodland	l Ltd.		FILE NO. PG1899	
REMARKS									HOLE NO.	
BORINGS BY CME 55 Power Auger				D	ATE	7 July 200	9		BH 6	
	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Blows/0.3m	<u>ب</u> ۲
SOIL DESCRIPTION	PLC			~		(m)	(m)	• 5	0 mm Dia. Cone	nete
	STRATA	TYPE	NUMBER	% RECOVERY	VALUE r RQD			• v	/ater Content %	Piezometer Construction
GROUND SURFACE	51		, z	RE	z ⁰		100 74	20	40 60 80	
FILL: Silty sand with gravel0.30	\bigotimes	🔉 AU	1			1 0-	-102.74			
FILL: Black silty clay with 0.53	1XX	1								\mathbb{N}

	STR	LYT	MUN	RECO	N VA OF]		
GROUND SURFACE			4	RE	z	0 100 74	20 40 60 80
FILL: Silty sand with gravel	0.30	🔆 AU	1			0+102.74	
FILL: Black silty clay with	0.53						
\sand		SS 🕅	2	100	4	1+101.74	
		\mathcal{F}					
		2				2-100.74	
		2					
Stiff, mottled brown SILTY		2				0 00 74	
CLAY, some sand seams		2				3+99.74	
		2					
- firm to stiff and grey by 3.6m		2				4+98.74	
depth		2					
		2				5-97.74	
						6+96.74	
		2					
						7+95.74	
		2				8-94.74	
		2				0 04.74	
		2					
	9.45					9+93.74	
Dynamic Cone Penetration Test	777	4					
commenced @ 9.45m depth						10+92.74	
	11.10					11-91.74	
End of Borehole		-				11 91.74	
Practical refusal to DCPT @							
11.10m depth							
(GWL @ 1.93m-July 16/09)							
							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 DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd. REMARKS FILE NO.

									HOLE NO. BH 7		
BORINGS BY CME 55 Power Auger DATE						7 July 200	9				
SOIL DESCRIPTION	PLOT	SAMPLE			DEPTH (m)	ELEV. (m)		esist. Blows/0.3m 0 mm Dia. Cone		neter uction	
	STRATA	TYPE NUMBER % RECOVERY N VALUE or RQD		N VALUE of RQD			• v	Ater Content %		Piezometer Construction	
GROUND SURFACE				8	Z -	0-	-102.46	20	40	60 80	
FILL: Gravel0.0	β	🕈 AU	1			0	102.40				
	9 XXX	Ž oo		0.5	_	-	101.46				
FILL: Brown silty clay with	5 🔆 🔆	∦ ss	2	25	7	1	-101.46				
<u></u>		ss	3	100	2	2-	-100.46		• • • • • • • • • • • • •		
						_					
Very stiff to stiff, grey-brown SILTY CLAY with some sand							-99.46				
						4-	-98.46				
- grey by 3.6m depth											
						5-	-97.46			••••••••••••••••••••••••••••••••••••••	
6.4						6-	-96.46		· · · · · · · · · · · · · · · · · · ·		
End of Borehole											
(C)ML @ 2.02m http://16/00)											
(GWL @ 2.03m-July 16/09)											
		20 40 60 80 100								100	
								Shea	ar Streng	gth (kPa)	

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154 Colonnade Road South, Ottawa, C		-		ineers	Pr	eotechnic oposed C ttawa, On	ommerc		oment-Haze	eldean Road	t
DATUM Ground surface elevations p	orovide	ed by I	Fairha	ll, Moffa					FILE NO.	PG1899	
REMARKS									HOLE NO.		
BORINGS BY CME 55 Power Auger				DA	TE	9 July 200	9	1		BH 8	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH (m)	ELEV. (m)		esist. Blov 0 mm Dia. (neter iction
	STRATA	ТҮРЕ	NUMBER	~ RECOVERY	N VALUE or RQD		()	• V	Vater Conte	ent %	Piezometer Construction
GROUND SURFACE			Z	RE	z ⁰	- 0-	-101.92	20	40 60	80	
0.3(AU	1								
		∦ ss	2		4	1-	-100.92	· · · · · · · · · · · · · · · · · · ·		• • • • • • • • • • • • • • • • • • •	
						2-	-99.92				
Very stiff to stiff, brown SILTY CLAY with some sand						3-	-98.92				
- firm to stiff and grey by 3.6m depth		ss	3	92	Ρ	4-	-97.92				
						5-	-96.92	4			
6.40						6-	-95.92	· · · · · · · · · · · · · · · · · · ·			
End of Borehole											
(GWL @ 1.50m-July 16/09)											
								20 She	40 60 ar Strength	80 10 (kPa)	00
								▲ Undist	urbed $ riangle$ F	Remoulded	

patersongro		n	Con	sulting ineers		SOIL	_ PRO	FILE AND ⁻	TEST DAT	4
154 Colonnade Road South, Ottawa, O		-		ineers	P	eotechnic roposed C ttawa, On	Commerc	igation ial Developmen	nt-Hazeldean Ro	ad
DATUM Ground surface elevations p	orovide	ed by I	airha	ll, Moffa				FILE	E NO. PG189	,
REMARKS								HOL		,
BORINGS BY CME 55 Power Auger	1	1		DA	TE	9 July 200)9		BH 9	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.		t. Blows/0.3m	ion
SUIL DESCRIPTION			Ř	IRY	Ë Q	(m)	(m)		n Dia. Cone	Piezometer Construction
	STRATA	TYPE	NUMBER	% RECOVERY	N VALUE or RQD			• Water	Content %	Piez
GROUND SURFACE	ß		N	RE	z °		-101.68	20 40	60 80	
Loose, brown SILTY SAND, 0.63							101.00			
some clay		ss	1		4	1-	100.68		• • • • • • • • • • • • • • • • • • • •	
						2	-99.68			
						2-	-99.00			
Very stiff to stiff, brown SILTY CLAY						3-	98.68			
							07.00			
- firm and grey by 3.6m depth						4-	-97.68			
						5-	96.68	4		
6.40		図 AU	2			6-	-95.68		/ · · · · · · · · · · · · · · · · · · ·	
End of Borehole										
(GWL @ 1.52m-July 16/09)										
								20 40 Shear Str	60 80 rength (kPa)	100
								▲ Undisturbed		

patersongro		n	Con	sulting	3	SOIL	- PRO	FILE AN	ND TEST	Γ ΟΑΤΑ	
154 Colonnade Road South, Ottawa, Or			Engi	ineers	G Pi	eotechnic oposed C ttawa, On	commerci		oment-Haze	ldean Road	ł
DATUM Ground surface elevations p	rovide	ed by F	airha	ll, Moff	att &	Woodland	l Ltd.		FILE NO.	PG1899	
REMARKS BORINGS BY CME 55 Power Auger				D	ATE	8 July 200	9		HOLE NO.	BH10	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.		esist. Blow 0 mm Dia. 0		ion
SUL DESCRIPTION	е	ы	ER	ERY	VALUE 2 RQD	(m)	(m)	• 5	u mini Dia. C		Piezometer Construction
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VAJ OF R			0 W 20	Ater Conte	nt % 80	Con
TOPSOIL0.20	. P I I I	AU	1			- 0-	-101.54				
Loose, brown SANDY SILT 0.69		per la compacta de la							•••••••••••••••••••••••••••••••••••••••		$\otimes \otimes$

TOPSOIL	0.20	∶& AU	1			0-	-101.54	• • • • • •				
Loose, brown SANDY SILT	0.69	SS 10	2	92	7	1-	-100.54				· · · · · · · · · · · · · · · · · · ·	
		1 33	2	92	/		100.04					
Stiff to very stiff, brown SILTY CLAY						2-	-99.54			· · · · · · · · · · · · · · · · · · ·		
- grey-brown by 2.0m depth						3-	-98.54					
						5	90.04					
- firm to stiff and grey by 3.8m depth		1				4-	-97.54	· · · · / · ·			1	
depin						5-	-96.54					
							30.34					
	6.40					6-	-95.54	·····	••••••		······································	
End of Borehole												
(GWL @ 1.55m-July 16/09)												
										Strength	ı (kPa)	100
									ndisturbe	d ∆ I	Remoulde	ed

patersongro		n	Con	sulting	,	SOIL	. PRO	FILE AN	ID TES	DATA	
Pateroligic		Υ	Eng	ineers		eotechnic		igation ial Developi	mont Uozo	Idean Poor	ч
154 Colonnade Road South, Ottawa, O	ntario	K2E	7J5			ttawa, On					
DATUM Ground surface elevations p	rovide	ed by F	airha	ll, Moff	att &	Woodland	Ltd.		FILE NO.	PG1899	
REMARKS								-		FG1033	
BORINGS BY CME 55 Power Auger				D	ATE	8 July 200	9		HOLE NO.	BH11	
	F .		SAN	IPLE				Pen Be	esist. Blow	rs/0.3m	
SOIL DESCRIPTION	PLOT					DEPTH	ELEV.) mm Dia. C		Piezometer Construction
		FI	R	ΞRY	ALUE ROD	(m)	(m)				struc
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			O Wa	ater Conte	nt %	Piez
GROUND SURFACE	S		Z	RE	z ^o		-101.34	20	40 60	80	Ŭ
TOPSOIL 0.20	· · []·						101.34				
Loose, brown SILTY SAND with some clay		🛛 ss	1	100	4	1-	-100.34	• • • • • • • • • • • • • •		•••••	
<u>1.45</u>								· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	•••••••••••••••••••••••••••••••••••••••	
Stiff, brown SILTY CLAY						2-	-99.34		· · · · · · · · · · · · · · · · · · ·		
- grey-brown by 2.6m depth											
- grey-blown by 2.0m depth						3-	-98.34	A	· · · · · · · · · · · · · · · · · · ·		
- stiff to firm and grey by 3.6m						4-	-97.34				
depth							57.04	.4			
		ΤW	2	100		5-	-96.34		þ.		
								••••••	÷	••••••	
						6-	-95.34	•••••••••••••••••••••••••••••••••••••••	······································	•••••••••••••••••••••••••••••••••••••••	
									·····	• • • • • • • • • • • • • • • • • • • •	
						7-	-94.34				
		тw	3	100		8-	-93.34				
							JU.J7			· · · · · · · · · · · · · · · · · · ·	
						9-	-92.34				
9.45 Dynamic Cone Penetration Test											
commenced @ 9.45m depth						10-	-91.34				

Inferred GLACIAL TILL

12.20

Inferred grey SILTY CLAY

9-92.34 10-91.34 11-90.34 12-89.34 13-88.34

14+87.34

15+86.34

20 40 60 80 Shear Strength (kPa)

riangle Remoulded

▲ Undisturbed

100

patersongroup Consulting Engineers SOIL PROFILE AND TEST D. Geotechnical Investigation Geotechnical Investigation													
154 Colonnade Road South, Ottawa, Or			-	ineers	Pre	oposed C	ommerci		ment-Haz	eldean Road	i		
DATUM Ground surface elevations pr				ll, Moff		t awa, On Woodland			FILE NO.				
REMARKS		,								PG1899			
BORINGS BY CME 55 Power Auger				D	ATE {	3 July 200	9		HOLE NO.	BH12			
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)		esist. Blo) mm Dia.		neter Iction		
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• w	ater Cont	ent %	Piezometer Construction		
GROUND SURFACE			4	RE	z ^o	0-	-101.15	20	40 60) 80 ····	<u></u>		
Loose, brown SILTY SAND 0.69 with clay		X ss	1	75	4	1-	-100.15						
Very stiff to stiff, brown SILTY						2-	-99.15			· · · · · · · · · · · · · · · · · · ·			
CLAY - grey-brown by 2.5m depth						3-	-98.15						
firm and arou by 2 fm dapth						4-	-97.15						
- firm and grey by 3.6m depth		тw	2	100		5-	-96.15						
6.40		፼ ፼ AU	3			6-	-95.15			· • · · · · • · · · · · · · · · · · · ·			
End of Borehole													
(GWL @ 1.42m-July 16/09)													

20 40 60 80 Shear Strength (kPa)

riangle Remoulded

Undisturbed

100

154 Colonnade Road South, Ottawa, Ontario K2E 7J5 Proposed Commercial Development-Hazeldean Road Ottawa, Ontario DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd. FILE NO. PG1899 MOLE NO. BORINGS BY CME 55 Power Auger DATE 10 July 2009 Pen. Resist. Blows/0.3m BORINGS DESCRIPTION SOIL DESCRIPTION Image: Pen. Resist. Blows/0.3m Proposed Commercial Development-Hazeldean Road Ottawa, Ontario MOLE NO. PG1899 BORINGS BY CME 55 Power Auger DATE 10 July 2009 Pen. Resist. Blows/0.3m Proposed Commercial Development-Hazeldean Road Ottawa, Ontario SOIL DESCRIPTION Image: Date 10 July 2009 Pen. Resist. Blows/0.3m Point of the pen term of the pen term of te	natoreonarc	Consulting Engineers					SOIL	PRO	FILE AI	ND TE	ST DATA	
Datum Claved, Onlaid Claved, Onlaid Claved, Onlaid BORINGE BUY CME 55 Power Augor DATE 10 July 2009 Pen. Resist. Biows0.3m SOIL DESCRIPTION SAMPLE DEPTH ELEV. (m) Pen. Resist. Biows0.3m SOUND SURFACE COUND SURFACE DATE 10 July 2009 Pen. Resist. Biows0.3m SOUND SURFACE TOPSOIL OLITY CLAY - stift and grey by 3.6m depth Sound add to see the set of t			-		ineers	Pro	oposed Co	ommerci	igation ial Develor	oment-H	azeldean Roa	d
REMARKS PG1899 BORINGS BY_CME 55 Power Auger DATE 10 July 2009 HOLE NO. BH13 SOIL DESCRIPTION Image: Boring of the state of					ll. Moffa					FILE NO).	
BORINGS BY CME 55 Power Auger DATE 10 July 2009 BH13 SOIL DESCRIPTION SAMULE DEPTH (m) Pen. Resist. Blows0.3m • 50 mm Dia. Cone Pen. Resist. Blows0.3m • 50 mm Dia. Cone GROUND SURFACE 0.223 SAU 1 99.95 -			,		,						PG1899	
SOIL DESCRIPTION 0.23 <th0.23< th=""> 0.23 0.23</th0.23<>	BORINGS BY CME 55 Power Auger				DA	TE 1	10 July 200	9		HOLEN	^{IO.} BH13	
GROUND SURFACE 0 10 1 0 100.95 20 40 60 80 TOPSOL 0.23 AU 1 1 199.95 2 98.95 2 98.95 3 -97.95 4 -96.95 5 -95.95 5 -95.95 5 -95.95 5 -95.95 4 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 -96.95 5 -96.95 5 -96.95		Ę		SAN	IPLE				Pen. R	lesist. B	lows/0.3m	<u>,</u> с
GROUND SURFACE 0 10 1 0 100.95 20 40 60 80 TOPSOL 0.23 AU 1 1 199.95 2 98.95 2 98.95 3 -97.95 4 -96.95 5 -95.95 5 -95.95 5 -95.95 5 -95.95 4 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 -96.95 5 -96.95 5 -96.95	SOIL DESCRIPTION				ж				• 5	0 mm Di	a. Cone	netel uctio
GROUND SURFACE 0 10 1 0 100.95 20 40 60 80 TOPSOL 0.23 AU 1 1 199.95 2 98.95 2 98.95 3 -97.95 4 -96.95 5 -95.95 5 -95.95 5 -95.95 5 -95.95 4 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -95.95 4 -96.95 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 5 -96.95 -96.95 5 -96.95 5 -96.95		RATA	YPE	MBER	OVER %	ALUF			• V	Vater Co	ntent %	iezor
AU 1 Very stiff, brown SILTY CLAY - stiff and grey by 3.6m depth - stiff and grey by 3.6m depth - f.40 AU 3 AU 4 AU 60 90 80 100 AU 4 AU 4	GROUND SURFACE	S	H	ŊŊ	REC	N OL		100.05	20	40	60 80	шO
Very stiff, brown SILTY CLAY - stiff and grey by 3.6m depth - stiff and grey by 3.6m depth Erd of Borehole (GWL @ 0.60m-July 16/09) AU 3 AU 40 60 80 80 100 AU 40 60 80 100 AU 40 80 100 80 100 AU 40 80 80 80 80 100 AU 40 80 80 80 100 AU 40 80 80 80 100 AU 40 80 80	↑<u>TOPSOIL0.2</u>3	XX	🕈 AU	1			0+	100.95				
Very stiff, brown SILTY CLAY - stiff and grey by 3.6m depth 6.40 End of Borehole (GWL @ 0.60m-July 16/09) AU 3 6 - 94.95 2 - 95.95 6 - 94.95 2 - 95.95 7 -			ss	2		4	1-	99.95				
Very stiff, brown SiLTY CLAY - stiff and grey by 3.6m depth 6.40 End of Borehole (GWL @ 0.60m-July 16/09) AU 3 6 - 94.95 20 40 60 80 100 Shear Strength (KPa)									·	· · · · · · · · · · · · · · · · · · ·	······································	
- stiff and grey by 3.6m depth 6.40 End of Borehole (GWL @ 0.60m-July 16/09) AU 3 AU							2-1	98.95		4		
6.40 AU 3 6-96.95 5-95.95 6-94.95 6-94.95 6-94.95 6-94.95 7-95.95 6-94.95 7-95.95 6-94.95 7-95.95 6-94.95 7-95	Very stiff, brown SILTY CLAY						3-	97.95				
6.40 AU 3 6-96.95 5-95.95 6-94.95 6-94.95 6-94.95 6-94.95 7-95.95 6-94.95 7-95.95 6-94.95 7-95.95 6-94.95 7-95	stiff and grow by 2 6m dopth											
6.40 End of Borehole (GWL @ 0.60m-July 16/09) 6 - 94.95 6 - 94.95 20 40 60 80 100 Shear Strength (kPa)	- sun and grey by s.on depth						4-9	96.95	· · · · · · · · · · · · · · · · · · ·			
6.40 End of Borehole (GWL @ 0.60m-July 16/09) (GWL @ 0.60m-July 16/09)							5-	95.95				
End of Borehole (GWL @ 0.60m-July 16/09)			×	2			_					
(GWL @ 0.60m-July 16/09)	6.40			3			6-	94.95				
20 40 50 80 100 Shear Strength (kPa)	End of Borehole											
Shear Strength (kPa)	(GWL @ 0.60m-July 16/09)											
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)												
Shear Strength (kPa)									20	<u> </u>	60 80 1	
									She	ar Streng	gth (kPa)	

patersongro		n	Con	sulting	3	SOIL	- PRO	FILE AN	ND TE	EST D	ΑΤΑ	
154 Colonnade Road South, Ottawa, O			Engi	ineers	Ge	eotechnic oposed C tawa, On	commerci	gation ial Develop	oment-H	lazeldea	an Road	d
DATUM Ground surface elevations p	rovide	ed by F	airha	ll, Mof	fatt &	Woodland	d Ltd.		FILE N		61899	
REMARKS BORINGS BY CME 55 Power Auger				D	ATE	10 July 20	09		HOLE	NO. BI	H14	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.	-		Blows/0. ia. Cone	-	ter tion
GROUND SURFACE	STRATA P	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)			ontent %		Piezometer Construction
TOPSOIL 0.15	120	× AU	1			- 0-	100.24					
Very loose, brown SANDY 0.23		ss	2		3	1-	-99.24					
Hard to very stiff, brown SILTY CLAY with some sand						2-	-98.24		A		2	
seams						3-	-97.24					

seams		8			3-	-97.24	
- grey-brown by 2.8m depth					4-	-96.24	
- stiff and grey by 3.6m depth					5-	-95.24	
					6-	-94.24	
					7-	-93.24	
					8-	-92.24	
GLACIAL TILL: Stiff, grey	<u>8.84</u>				9-	-91.24	
silty clay with sand, gravel, cobbles and boulders	9.75	ŝî∦ ss Ŝĵ	3	16	10-	-90.24	
Dynamic Cone Penetration Test commenced @ 9.75m depth							
					11-	-89.24	
Inferred GLACIAL TILL					12-	-88.24	
End of Borehole	_13.03				13-	-87.24	
Practical refusal to DCPT @							
13.03m depth (GWL @ 0.52m-July 16/09)							

4.

2.

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1

100

20 40 60 80 Shear Strength (kPa)

▲ Undisturbed

patersongr	n	Con	sulting	ng SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa,			Eng	ineers	Pr		ommerci		oment-Hazelo	dean Roac	1
DATUM Ground surface elevations				II Moffe		tawa, On			FILE NO.		
REMARKS	provide	eu by i	aiina	, 1010172	ui a	vvoouland				PG1899	
BORINGS BY CME 55 Power Auger				DA	тс	10 July 20	00		HOLE NO.	BH15	
	-		SVI	/PLE			00	Pon B	esist. Blows	:/0 3m	
SOIL DESCRIPTION	PLOT					DEPTH (m)	ELEV. (m)	-	0 mm Dia. Co		neter uction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	VALUE r rod			• v	later Conten	t %	Piezometer Construction
GROUND SURFACE	Ω.		N.	REC	N O U	0	100.76	20	40 60	80	
FILL: Grey-brown silty clay 0.6 with sand, gravel, cobbles and	50 XX	X AU	1			0-	-100.76				
vboulders		ss	2		5	1-	-99.76		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
								· · · · · · · · · · · · · · · · · · ·	· • • • • • • • • • • • • • • • • • • •	· · · · · · · · · · · · · · · · · · ·	₽
Hard to very stiff, brown SILTY CLAY						2-	-98.76			2	
						3-	-97.76				
- grey-brown by 2.8m depth											
stiff and every by A Ore double						4-	-96.76	· · · · · · · · · · · · · · · · · · ·			
- stiff and grey by 4.3m depth		ss	3	100	2	5-	-95.76				
				00					*		
		TW TW	4	29 67		6-	-94.76			· · · · · · · · · · · · · · · · · · ·	
7.0	1		5	07		7-	-93.76				
End of Borehole							35.70				
(GWL @ 1.61m-July 16/09)											

20 40 60 80 Shear Strength (kPa)

▲ Undisturbed

100

patersongro	וור	n	Con	sulting		SOIL	. PRO	FILE AN	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, G		-	-	sulting ineers	Pr		ommerc	igation ial Develop	oment-Haz	zeldean Road	b
DATUM Ground surface elevations				II, Moffa		tawa, On t Woodland			FILE NO.	DO1000	
REMARKS									HOLE NO	PG1899	
BORINGS BY CME 55 Power Auger				DA	TE 🤅	9 July 200	9		HOLE NC	⁶ BH16	
	E		SAN	/IPLE		DEDTU		Pen. R	esist. Blo	ows/0.3m	Ϋ́
SOIL DESCRIPTION	PLOT			ĸ		DEPTH (m)	ELEV. (m)	• 5	0 mm Dia	. Cone	mete
	STRATA	ТҮРЕ	NUMBER	°	VALUE r rod			• v	later Con	tent %	Piezometer Construction
GROUND SURFACE	ST	Ĥ	ЮN	REC	N OF			20	40 6		۵Ö
FILL: Silty sand with gravel 0.1	5 XX		1			0-	-100.88				1
TOPSOIL 0.2	3	∦ I ss	2	42	7	1-	-99.88		•		
Very stiff to hard, brown SILTY CLAY								· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • •		-
		ss	3	50	4	2-	-98.88	••••••	•••••••••••••••		
- grey-brown by 2.8m depth						2	07.00				3
3.3	5					3	-97.88				44
								20 Shea	40 6 ar Strengt	0 80 10 h (kPa)	00

▲ Undisturbed

patersongro	Consulting Engineers				SOIL	PRO	FILE AN	ND TEST	DATA		
154 Colonnade Road South, Ottawa, O		-		ineers	Pr		ommerci	igation ial Develop	oment-Hazel	dean Road	d
DATUM Ground surface elevations p				ll, Moffa		tawa, On Woodland			FILE NO.		
REMARKS		-								PG1899	
BORINGS BY CME 55 Power Auger				DA	TE S	9 July 200	9		HOLE NO.	BH17	
	Ĕ		SAN	IPLE		DEDTU		Pen. R	esist. Blow	s/0.3m	- c
SOIL DESCRIPTION	PLOT			к	64	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia. C	one	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• v	Vater Conte	nt %	iezol
GROUND SURFACE	ST	H	Ď	REC	N O H			20	40 60	80	۵Ö
FILL: Silty clay with gravel0.08						- 0-	-101.55				
(TOPSOIL 0.2)		ss	1			1-	-100.55				
								· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
						2-	-99.55			2	
Hard to very stiff, brown SILTY CLAY with some sand						3-	-98.55			*	
seams								Å			
						4-	-97.55	······································			
- stiff by 4.3m depth						5-	-96.55				
		au	2								
<u>6.40</u>			2			6-	-95.55		· · · · · · · · · · · · · · · · · · ·	<u> </u>	
End of Borehole											
(GWL @ 1.27m-July 16/09)											
								20	<u>+ + + + + + + + + + + + + + + + + + + </u>		‡ 00
								Shea Undist	ar Strength urbed \triangle Re	(kPa) emoulded	

patersongro	Consulting Engineers			SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, C	-			P	Proposed Commercial Development-Hazeldean Road				ł		
DATUM Ground surface elevations p				II, Moffa		ttawa, On Woodland			FILE NO.	DO (000	
REMARKS										PG1899	
BORINGS BY CME 55 Power Auger				DA	ATE	13 July 20	09		HOLE NO.	BH18	
	PLOT		SAMPLE			DEPTH	ELEV. (m)		lesist. Blov		er
SOIL DESCRIPTION			RY RY		ËQ	ສຸດ (m)		• 5	0 mm Dia. (Cone	Piezometer Construction
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD			• V	Vater Conte	ent %	Piez Cons
GROUND SURFACE		~	z	RE	z ^o	- 0-	-100.47	20	40 60	80	ACCI 1255
		Å AU	1				100117				
		ss	2	50	7	1-	-99.47			· · · · · · · · · · · · · · · · · · ·	
Hard to very stiff brown						2-	-98.47		•••••••••••••••••••••••••••••••••••••••		
Hard to very stiff, brown SILTY CLAY										2	
						3-	-97.47				
- grey-brown by 2.8m depth		x ss	3			4-	-96.47	· · · · · · · · · · · · · · · · · · ·		2	
			3								
- firm and grey by 3.7m depth		TW	4	100		5-	-95.47				
<u>6.40</u>						6-	-94.47	······································		••••••••••••••••••••••••••••••••••••••	
End of Borehole											
(GWL @ 1.58m-July 16/09)											
									40 60 ar Strength	(kPa)	† DO
								▲ Undist	urbed △ F	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% LL PL PI	- - -	Natural moisture content or water content of sample, % Liquid Limit, % (water content above which soil behaves as a liquid) Plastic limit, % (water content above which soil behaves plastically) Plasticity index, % (difference between LL and PL)				
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size				
D10	-	Grain size at which 10% of the soil is finer (effective grain size)				
D60	-	Grain size at which 60% of the soil is finer				
Сс	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$				
Cu	-	Uniformity coefficient = D60 / D10				
Cc and Cu are used to assess the grading of sands and gravels:						

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

CONSOLIDATION TEST

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

PERMEABILITY TEST

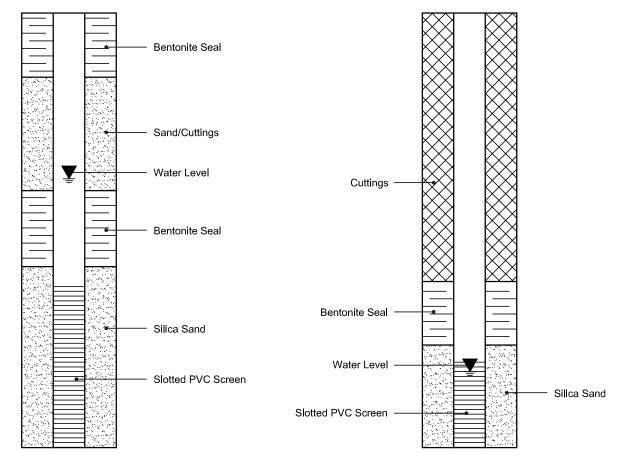
k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during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

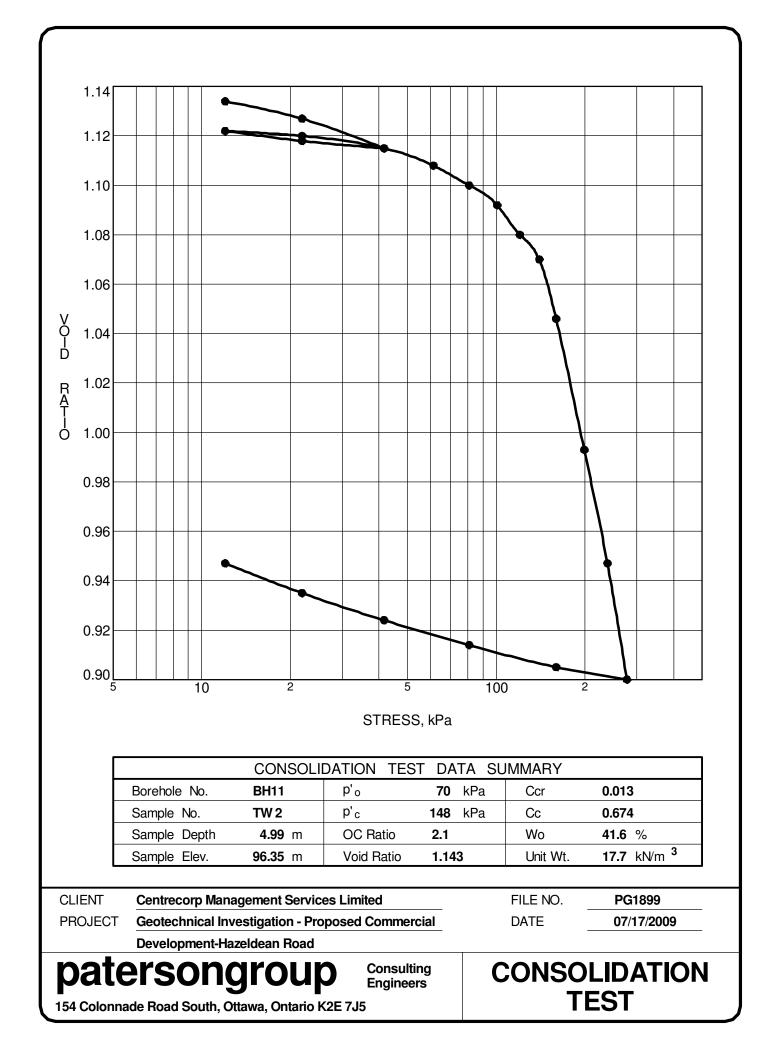
SYMBOLS AND TERMS (continued) STRATA PLOT Topsoil Asphalt Peat Sand Silty Sand Fill Δ Sandy Silt Clay Silty Clay Clayey Silty Sand Glacial Till Shale Bedrock

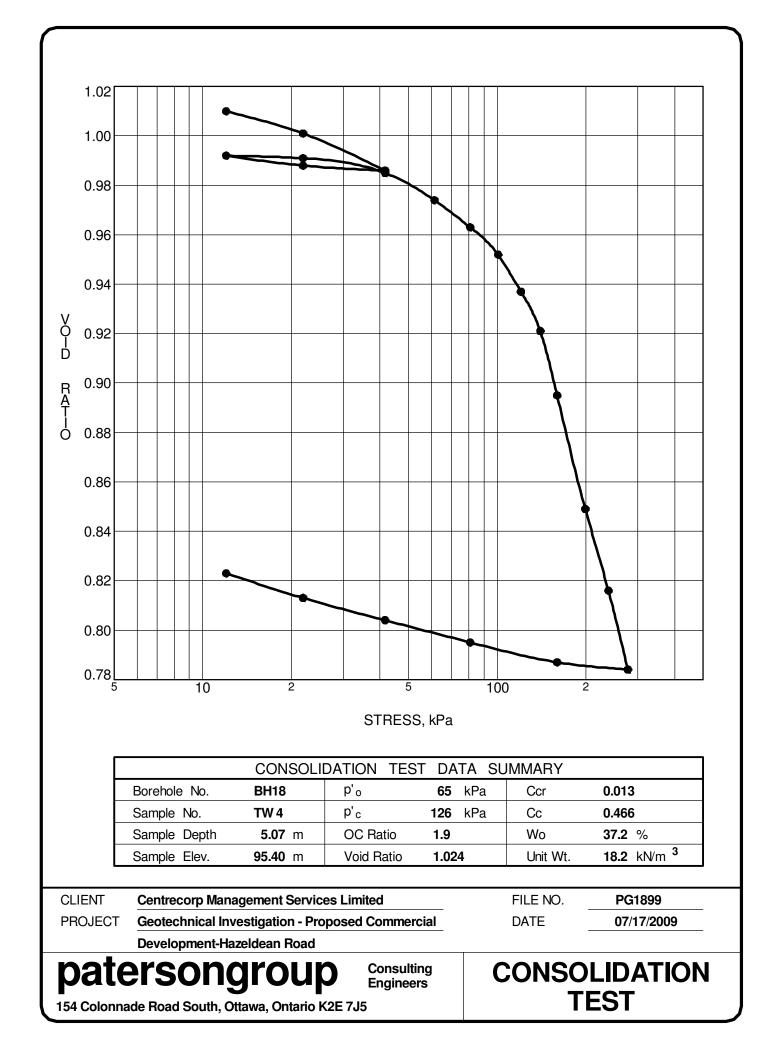
MONITORING WELL AND PIEZOMETER CONSTRUCTION

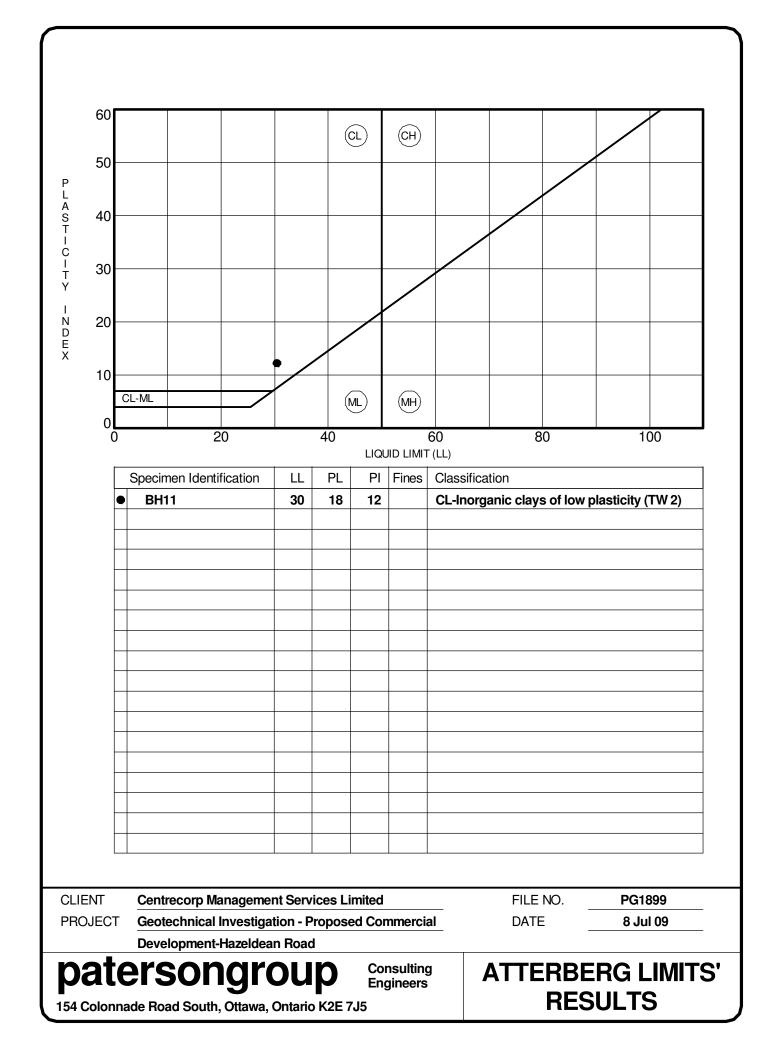
MONITORING WELL CONSTRUCTION

PIEZOMETER CONSTRUCTION











Certificate of Analysis Client: Paterson Group Consulting Engineers Client PO: 17631

Report Date: 16-May-2016

Order Date: 10-May-2016

Project Description: PG1899

	_				
	Client ID:	BH6-SS2	-	-	-
	Sample Date:	26-Apr-16	-	-	-
	Sample ID:	1620196-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.5	-	-	-
General Inorganics					
рН	0.05 pH Units	7.50	-	-	-
Resistivity	0.10 Ohm.m	21.8	-	-	-
Anions					
Chloride	5 ug/g dry	66	-	-	-
Sulphate	5 ug/g dry	251	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG1899-2 - TEST HOLE LOCATION PLAN

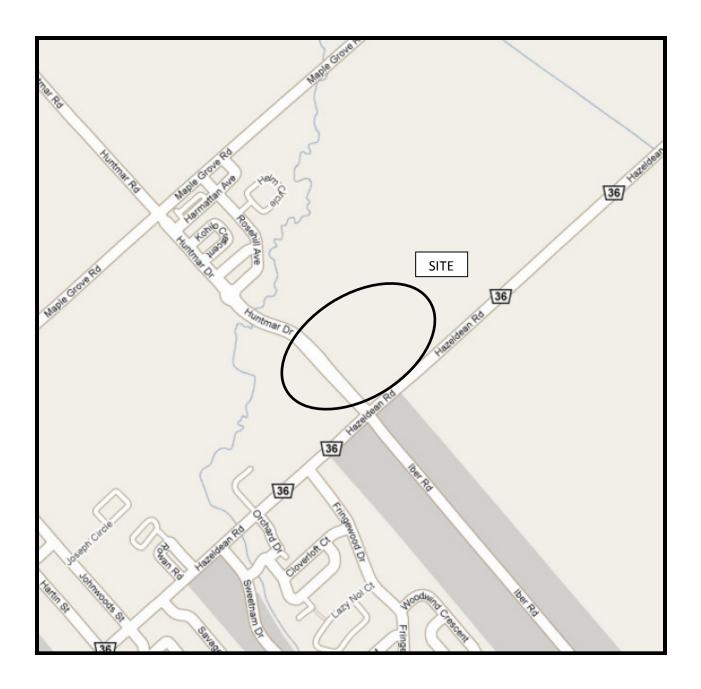


FIGURE 1 KEY PLAN

