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Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

Building Science

Archaeological Services

Consolidated Geotechnical Investigation

Proposed Residential Development Kanata North Development March Road - Ottawa, Ontario

Prepared For

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Report PG4258-2

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1.0 Introduction

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Paterson Group (Paterson) was commissioned by Novatech Engineering Consultants to prepare a geotechnical report outlining the geotechnical constraints for the Kanata North Urban Expansion Area Community Design Plan (CDP) along March Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The current report consolidates the existing geotechnical studies completed for the individual properties. The relevant geotechnical studies are listed below:

- Paterson Report PG4258-1 dated June 14, 2018 entitled "Geotechnical and Hydrological Investigation, Proposed Storm Water Management Facility, Kanata North Development, March Road - Ottawa, Ontario"
- Paterson Report PG2878-3 dated April 8, 2013 entitled "Preliminary Geotechnical Investigation, 1075 March Road, Ottawa, Ontario"
- Paterson Letter Report PG1823-LET.01 dated March 18, 2009 entitled "Preliminary Geotechnical Investigation, Proposed Residential Development, Burke and Maxwell Properties, March Road, Ottawa.
- Paterson Letter Report PG1716-LET.01 dated August 25, 2009 entitled "Preliminary Geotechnical Investigation Proposed Residential Development, Foley Lands, March Road, Ottawa."

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

2.0 Proposed Development

It is understood that the proposed development will consist of low rise residential and commercial buildings. It is further anticipated that the development will be municipally serviced and include local, car parking and landscaped areas.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

Test pits excavated by a hydraulic shovel or rubber tired backhoe were completed throughout the subject properties. The test holes were distributed in a manner to provide general coverage of the subject sites. Approximate locations of the test holes are shown in Drawing PG2878-1 - Test Hole Location Plan included in Appendix 2.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation and all soil samples were initially classified on site. All samples were transported to our laboratory for further examination and classification. The depths at which the grab samples were recovered from the test holes are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

Undrained shear strength testing, using a hand held vane apparatus, was carried out at regular intervals of depth in cohesive soils.

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

In conjunction with the recovery of the split spoon samples, the Standard Penetration Test (SPT) was conducted. 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.

The recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are presented on the borehole logs. The recovery value is the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the total length of intact rock pieces longer than 100 mm over the length of the core run. The values indicate the bedrock quality.

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

Groundwater

Open hole groundwater infiltration levels were observed at the time of excavation at each test pit location.

Monitoring wells were installed in the boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. Our observations are presented in the Soil Profile and Test Data sheets in Appendix 1.

Hydraulic Conductivity Testing

Hydraulic conductivity testing was completed in the three monitoring wells. Falling head and rising head tests ("slug tests") were completed in accordance with ASTM Standard Test Method D4404 - Field Procedure for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers.

Slug testing was completed on November 14, 2017 by Paterson personnel. The general test method consisted of the measurement of the static water level in the well, followed by inducing a near-instantaneous change of head in the monitoring well and subsequent monitoring of water level recovery with an electronic water level tape and a Mini Diver water level logger. The change in head was induced by the introduction of an aluminum slug, 1 m in length and 40 mm in diameter. The slug was introduced to raise the groundwater level in the monitoring well, following which the decrease in water level over time was monitored (falling head test). Once the water level had stabilized (or nearly stabilized), the slug was then removed to lower the groundwater level, following which the increase in water level over time was monitored (rising head test).

3.2 Field Survey

The location and ground surface elevations at the borehole locations are presented on Drawing PG4258-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Soil samples will be stored for a period of one month after this report is completed, unless otherwise directed.

3.4 Analytical Testing

Three 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 analysed to determine the concentrations of sulphate and chloride, the resistivity and the pH of the sample. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site covers an area of approximatly 49.5 hectares. The majority is currently undeveloped and used as agricultural land. The ground surface is generally flat and gently slopes down from west to east towards March Road. An existing creek flows from west to east across the subject site.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of a native, stiff to hard silty clay deposit followed by a layer of glacial till which in turn is overlying bedrock. The glacial till consisted of a silty clay fine soil matrix with trace to some sand and gravel, and trace cobbles and boulders. Grey limestone bedrock was encountered underneath the glacial till at approximately 2.1 to 3.5 m depth. Generally, the bedrock quality is fair to good within the upper 0.5 to 1 m and good to excellent quality at depth based on the RQD values. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on geological mapping, the local bedrock consists of sandstone and dolomite of the March Formation. The overburden thickness is expected to range from approximately 2 to 3 m.

4.3 Groundwater

The groundwater level (GWL) readings were recorded at the borehole locations on November 14, 2017 and in the test pits upon completion of the field program. The results are presented in Table 1 below and in the Soil Profile and Test Data sheets. It is important to note that based on observations of the soil samples recovered from the borehole locations, such as colouring, moisture levels and consistency, the long-term groundwater level is not expected within the overburden soils. The groundwater level readings within the monitoring wells indicate that an artesian pressure is present below the bedrock surface. It should be noted that groundwater levels are subject to seasonal fluctuations and therefore groundwater levels could differ at the time of construction.

Table 1 - Summary of Groundwater Level Readings											
Borehole	Ground	Groundwa	ater Levels, m								
Number	Elevation, m	Depth	Elevation	Recording Date							
PG4258-1											
BH 1	83.20	0.04	83.16	November 14, 2017							
BH 2	82.43	0.50	81.93	November 14, 2017							
BH 3	81.77	-0.04	81.81	November 14, 2017							
PG2878-3											
TP25	89.66	dry	-	March 21, 2013							
TP26	89.74	dry	-	March 21, 2013							
TP27	88.96	dry	-	March 21, 2013							
TP28	86.85	dry	-	March 21, 2013							
TP29	86.13	dry	-	March 21, 2013							
TP30	86.42	dry	-	March 21, 2013							
TP31	88.37	dry	-	March 21, 2013							
TP32	86.81	dry	-	March 21, 2013							
TP33	84.00	dry	-	March 21, 2013							
TP34	84.02	dry	-	March 21, 2013							
TP35	82.99	2.70	80.29	March 21, 2013							
TP36	84.76	2.60	82.16	March 21, 2013							
PG1823-LET.0 ⁻	1										
TP1	88.10	dry	-	February 9,2009							
TP2	88.57	1.40	87.17	February 9,2009							
TP3	85.48	dry	-	February 9,2009							
TP4	88.13	dry	-	February 9,2009							
TP5	88.50	dry	-	February 9,2009							
TP6	89.10	dry	-	February 9,2009							
TP7	88.06	1.80	86.26	February 9,2009							
TP8	89.86	1.10	88.76	February 9,2009							
TP9	91.42	1.90	89.52	February 9,2009							
TP10	90.76	2.50	88.26	February 9,2009							
TP11	90.22	1.00	89.22	February 9,2009							
TP12	89.26	dry	-	February 9,2009							

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PG1716-LET.01									
TP 1	81.70	1.75	79.95	July 9, 2008					
TP 2	83.10	dry		July 9, 2008					
TP 3	83.80	1.75	82.05	July 9, 2008					
TP 4	86.20	1.20	85.00	July 9, 2008					
TP 5	86.80	1.10	85.70	July 9, 2008					
TP 6	90.70	dry		July 9, 2008					
TP 7	89.40	dry		July 9, 2008					
TP 8	88.80	dry		July 9, 2008					
TP 9	81.90	1.50	80.40	July 9, 2008					
TP 10	88.40	2.65	85.75	July 9, 2008					
TP 11	89.50	dry		July 9, 2008					
Notes: The test hole locations were located in the field and surveyed by Novatech Engineering Consultants Ltd. The ground surface elevations are referenced to a geodetic datum.									

The negative depth at BH 3 denotes water level recorded in the monitoring well above ground surface.

Hydraulic Conductivity

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Following the completion of the slug testing, the test data was analyzed as per the method set out by Hvorslev (1951). Assumptions inherent in the Hvorslev method include a homogeneous and isotropic aquifer of infinite extent, zero-storage assumption, and a screen length significantly greater than the monitoring well diameter. The assumption regarding aquifer storage is considered to be appropriate for groundwater flow through the overburden aquifer. The assumption regarding screen length and well diameter is considered to be met based on a typical screen length of 1.52 m and a diameter of 0.05 m.

While the idealized assumptions regarding aquifer extent, homogeneity, and isotropy are not strictly met in this case (or in any real-world situation), it has been our experience that the Hvorslev method produces effective point estimates of hydraulic conductivity in conditions similar to those encountered at the subject site.

Hvorslev analysis is based on the line of best fit through the field data (hydraulic head recovery vs. time), plotted on a semi-logarithmic scale. In cases where the initial hydraulic head displacement is known with relative certainty, such as in this case where a physical slug has been introduced, the line of best fit is considered to pass through the origin. In cases where the initial hydraulic head displacement is known with less certainty (e.g. a bail test, where water is pumped rapidly from the well), the best-fit line is drawn regardless of the origin.

Based on the above test methods, the monitoring wells from the current investigation displayed hydraulic conductivity values ranging from 1.1×10^{-5} to 5.8×10^{-5} m/sec, with a geometric mean of 3.3×10^{-5} m/sec. The results of the hydraulic conductivity testing are presented in Appendix 1.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed development. It is expected that low rise wood framed buildings could be founded on conventional shallow footings placed on an undisturbed, stiff silty clay, compact glacial till or surface-sounded bedrock bearing surface.

A permissible grade raise restriction is required for the proposed residential development where the silty clay layer is present below the proposed buildings.

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

5.2 Site Preparation

Stripping Depth

Topsoil and deleterious materials, such as those containing significant amounts of organics, should be removed from within any settlement sensitive structure.

Bedrock Removal

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

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

As a general guideline, peak particle velocity (measured at the property line) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing nearby buildings.

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



Any bedrock removed via hoe-ramming or blasting methods may be stockpiled at the site and reviewed by the geotechnical consultant for use as backfill below building footprints and as general landscaping fill.

Vibration Considerations

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

The following construction equipments could be the source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the shoring system using soldier piles or sheet piling will require the use of these equipments. Vibrations, whether it is caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

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

Fill Placement

Fill used for grading beneath any settlement sensitive structures 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 proposed building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Bearing Resistance Values

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Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit state (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit state (ULS) of **225 kPa**. Footings placed on an undisturbed, compact glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**. Footings placed on a clean, weathered bedrock can be designed using a bearing resistance value at SLS of **500 kPa** and a factored bearing resistance value at ULS of **750 kPa**.

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 above noted allowable bearing capacities are provided for design purposes and should be confirmed in the field prior to placement of concrete for structures.

Permissible Grade Raise

A **permissible grade raise restriction of 2 m** is recommended for areas where building foundations are founded over a silty clay deposit. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG4258-2 - Permissible Grade Raise Plan in Appendix 2. Footings bearing on a dense glacial till or bedrock surface are not subjected to permissible grade raise restrictions.

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 engineered fill or native soil above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered within the west and central portion of the subject site. A higher site class, such as site Class A or B may be applicable for the subject site, but would need to be confirmed with site specific shear wave velocity testing.

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

5.5 Basement Slab

With the removal of all topsoil and deleterious fill, such as those containing organic materials, from within the footprint of the proposed buildings, the native soil surface or approved engineered fill 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 consist of 19 mm clear crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Structure

Access roads, paved walkways and car parking areas are anticipated for the proposed development. The proposed pavement structures are presented in Tables 2 and 3.

Table 2 - 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										
450	SUBBASE - OPSS Granular B Type II										
SUBGRADE - Either fill, in soil or fill	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill										

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

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

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It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

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

Clay seal recommendations at the creek crossings have been provided in memorandum PG4258-MEMO.01 dated June 13, 2018 presented in Appendix 1.

6.2 **Protection of Footings Against Frost Action**

Perimeter footings, of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover, or an equivalent combination of soil cover and 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 an equivalent 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 be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

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

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept at least 3 m away from the excavation sides.

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

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

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for bedding for sewer pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's standard Proctor maximum dry density (SPMDD).

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.

Generally, it should be possible to re-use the moist (not wet) brown silty sand above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty sand 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.

6.5 Groundwater Control

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. It is anticipated that groundwater infiltration into the excavations should be moderate, if encountered, and controllable using open sumps.

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

The subsoil conditions for the silty-clay area of the site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

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

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

6.7 Corrosion Potential and Sulphate

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

6.8 Tree Planting Restrictions

Based on the subsurface conditions encountered in the boreholes, the hard to stiff silty clay crust extends to a glacial till layer of bedrock. As such, the silty clay should be considered low to medium sensitivity clay and should not be considered a sensitive marine clay.

Based on the above discussion, it is recommended that trees placed within 4.5 m of the foundation wall consist of street trees with shallow root systems that extend less than 1.5 m below ground surface. Trees placed greater than 4.5 m from the foundation wall may consist of moderate water demanding trees with roots extending to a maximum 2 m depth. It should be noted that shrubs and other small plantings are permitted within the 4.5 m setback area.

It is documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils which 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 should not be considered in the landscaping design.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- Review of the finalized pond design drawings from a geotechnical perspective, once available.
- Periodic site visits during controlled blasting operations and to monitoring the groundwater influx during construction.
- □ Observation of all bearing surfaces prior to the placement of concrete and/or precast structures.
- 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 and bearing surfaces prior to backfilling.
- **G** Field density tests to determine the level of compaction achieved.

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 materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request permission to review the grading plan once available. Also, our recommendations should be reviewed when the drawings and specifications are complete.

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

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

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

Paterson Group Inc.

Joey R Villeneuve, M.A.Sc, EIT



David J Gilbert, P.Eng

Report Distribution:

- □ Novatech Engineering Consultants Ltd.
- Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TEST RESULTS

SOIL PROFILE AND TEST DATA patersongroup Geotechnical investigation Proposed Stormwater Management Facility 154 Colonnade Road South, Ottawa, Ontario K2E 7J5 1053 March Road, Ottawa, Ontario Ground surface elevations provided by Novatech Engineering Consultants Ltd. DATUM FILE NO. **PG4258** REMARKS HOLE NO. **BH 1** BORINGS BY CME 55 Power Auger DATE October 20, 2017

SOIL DESCRIPTION			ELEV.	 Pen. Resist. Blows/0.3m 50 mm Dia. Cone 					Nell				
	TRATA P	LYPE	JMBER	°° SOVERY	VALUE ROD	(m)	(m)	0	Water	Conter	nt %)	nitoring structio
GROUND SURFACE	S.		NC	REC	Z O	0	00.00	20	40	60	80)	C O
TOPSOIL		-				- 0-	-83.20						<u>+++++++++++++++++++++++++++++++++++++</u>
Very stiff to stiff, brown SILTY CLAY , trace sand		ss	1	92	10	1 -	-82.20				······································		
1.68 GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles, some boulders 2.13		ss	2	96	30	2-	-81.20						իրդիիրի Սրդիրիրի
BEDROCK: Grey limestone		RC	1	96	76	3-	-80.20						
		RC	2	98	87	4-	-79.20						
4.98		_											
(GWL @ 0.04m depth - Nov 14/17)													

20

40

Shear Strength (kPa) ▲ Undisturbed △ Remoulded

60

80

100

SOIL PROFILE AND TEST DATA patersongroup Geotechnical investigation **Proposed Stormwater Management Facility** 154 Colonnade Road South, Ottawa, Ontario K2E 7J5 1053 March Road, Ottawa, Ontario DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd. FILE NO. **PG4258** REMARKS HOLE NO. **BH 2** BORINGS BY CME 55 Power Auger DATE October 20, 2017 SAMPLE Pen. Resist. Blows/0.3m Monitoring Well Construction STRATA PLOT DEPTH ELEV. SOIL DESCRIPTION 50 mm Dia. Cone (m) (m) RECOVERY N VALUE or RQD NUMBER TYPE o/0 Water Content % \bigcirc **GROUND SURFACE** 80 20 40 60 0 + 82.431111111 TOPSOIL 0.40 1+81.43 SS 1 100 11 Stiff to hard, brown SILTY CLAY, trace sand SS 2 100 10 2+80.43 SS 3 100 50 +2.72 GLACIAL TILL: Very dense, brown 3+79.43 silty clay with sand, gravel, cobbles, trace boulders SS 4 71 50 +3.48 4+78.43 RC 1 100 67 **BEDROCK:** Grey limestone 5+77.43RC 2 100 69 6+76.43 6.20 End of Borehole (GWL @ 0.5 m depth - Nov 14/17) 20 40 60 80 100 Shear Strength (kPa) Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA patersongroup Geotechnical investigation **Proposed Stormwater Management Facility** 154 Colonnade Road South, Ottawa, Ontario K2E 7J5 1053 March Road, Ottawa, Ontario DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd. FILE NO. **PG4258** REMARKS HOLE NO. BH 3 BORINGS BY CME 55 Power Auger DATE October 20, 2017 SAMPLE Pen. Resist. Blows/0.3m Monitoring Well Construction STRATA PLOT DEPTH ELEV. SOIL DESCRIPTION 50 mm Dia. Cone • (m) (m) RECOVERY N VALUE or RQD NUMBER TYPE o/0 Water Content % \bigcirc **GROUND SURFACE** 80 20 40 60 0 + 81.77TOPSOIL 0.35 AU 1 1 + 80.77SS 2 92 10 Very stiff to stiff, brown SILTY CLÁY, trace sand SS 3 100 8 2+79.77 2.59 SS 4 75 13 **GLACIAL TILL:** Compact to very dense, brown silty clay with sand, 3+78.77 gravel, cobbles, trace boulders SS 5 50 50+ 3.45 RC 1 100 0 4+77.77 RC 2 100 91 **BEDROCK:** Grey limestone 5+76.77RC 3 92 79 5.54 End of Borehole (GWL @ 0.04 m above ground surface - Nov 14/17) 20 40 60 80 100 Shear Strength (kPa)

Undisturbed

△ Remoulded

natoreonar		ın	Con	sulting		SOII	_ PRO	FILE AN	D TEST	DATA			
154 Colonnade Road South, Ottawa, Ont	tario H	(2E 7J	Eng	ineers	Sentinel Monitoring Wells Kanata North Community Design Plan Ottawa, Ontario								
DATUM Ground surface elevations	prov	ided b	y No	vatech	Cor	sulting Er	ngineerin	g Ltd.	FILE NO.	00075			
REMARKS Northing 5025146.3; Easti	Northing 5025146.3; Easting 348117.8												
BORINGS BY CME 55 Power Auger				DA	ATE	Novembe	er 16, 20 ⁻	17	B	H 2A-16	;		
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Res	sist. Blows	/0.3m	Well n		
	LA P	M	R	ΞRΥ	Ba	(m)	(m)	• 50			ring ⁻ uctio		
GROUND SURFACE	STRA	ІЛТРІ	NUMBI	RECOVI	N VAL or R(0 Wa	ater Conten 40 60	t %	Monito Constri		
						- 0-	-82.95						
OVERBURDEN						1-	-81.95						
2.51						2-	-80.95				<u>րդդորդի</u>		
		RC	1	100	47	3-	-79.95				<u>լինինինը</u>		
BEDROCK: Poor to fair quality, grey limestone, some shale partings		RC	2	100	80	4-	-78.95						
		RC	3	100	69	5-	-77.95						
6.07		_				6-	76.95						
(GWI @ 0.98m-Dec. 20.2016)													
(GWL @ 0.0011 Dec. 20, 2010)								20	40 60	80 10	00		
								Shear ▲ Undistur	Strength (I	(Pa) noulded			

natersonar		ın	Con	sulting	3	SOIL	_ PRO	FILE AND TEST DATA			
			Eng	ineers	S	Sentinel Monitoring Wells Kanata North Community Design Plan					
154 Colonnade Road South, Ottawa, On		(2E /J	5	(ataab	0	Ottawa, Ontario					
DATUM Ground surface elevations	s prov		0 INON	alech	Con	sulling Er	igineerin				
REMARKS INOILINING 5025140.3, Easu	ng 34	0117.	0	D		Novombo	vr 16 201	HOLE NO. BH 2B-16			
BURINGS BY CIVIL 33 FOWER Auger			SAN		AIE		110,20	Pon Posist Ployo/0.2m —			
SOIL DESCRIPTION	A PLOI		SAIV «		Но	DEPTH (m)	ELEV. (m)	● 50 mm Dia. Cone			
	STRAT	ТҮРЕ	NUMBEI	% RECOVEI	N VALU or RQI			○ Water Content %			
						- 0-	82.95				
						1-	-81.95				
OVERBURDEN						2-	-80.95				
3.02		= RC	1	100		3-	-79.95				
		RC	2	100	67	4-	-78.95				
		_ RC	3	100	66	5-	-77.95				
						6-	-76.95				
BEDROCK: Fair to excellent quality, grey limestone, some shale partings		RC	4	100	61	7-	-75.95				
		RC	5	100	93	8-	-74.95				
						9-	-73.95				
		RC	6	100	95	10-	-72.95				
		RC	7	100	90	11-	-71.95				
End of Borehole <u>12.17</u>						12-	-70.95				
(20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded			

natoreonar		In	SOIL PROFILE AND TEST DATA									
154 Colonnade Road South, Ottawa, Ont	ario k	(2E 7J	Eng	Sentinel Monitoring Wells Kanata North Community Design Plan Ottawa, Ontario								
DATUM Ground surface elevations	prov	ided b	y Nov	vatech	Cor	nsulting Er	ngineerin	g Ltd.	FILE NO.	DC 2075	,	
REMARKS Northing 5025257.5; Eastin	ng 34	7719.	.2							PG3975)	
BORINGS BY CME 55 Power Auger				D	ATE	Novembe	er 18, 201	7		^{^{′′} BH 3A-1}	6	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH	ELEV.	Pen. Re ● 50	esist. Blo 0 mm Dia	ows/0.3m a. Cone	Well	
	RATA I	(PE	(BER	°° SVERY	ALUE	(m)	(m)		/ater Cor	ntent %	itoring structic	
GROUND SURFACE	STI	E	NUN	REC	N C	; 0-	-88 84	20	40 6	io 80	Mon Con	
							00.04				<u>իրիրի</u> դերել	
OVERBURDEN						1-	-87.84		· · · · · · · · · · · · · · · · · · ·			
<u>1.73</u>			4	100	67	2-	-86.84					
		-		100	07	3-	-85.84					
		RC	2	100	86		04.04				10000000000000000000000000000000000000	
BEDROCK: Fair to good qualtiy, grey limestone, some shale partings						4-	-04.04			· · · · · · · · · · · · · · · · · · ·		
		RC	3	100	68	5-	-83.84					
6.02 End of Borehole						6-	-82.84					
(GWL @ 3.27m-Dec. 20, 2016)												
								20 Shea ▲ Undistr	40 6 ar Streng urbed △	60 80 1 th (kPa) Remoulded	⊣ 00	

natoreonar		ır	a	SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, On	tario ł	K2E 7J	Se Ka Ot	Sentinel Monitoring Wells Kanata North Community Design Plan Ottawa, Ontario						
DATUM Ground surface elevations	prov	ided b	y No	vatech	Con	sulting Er	ngineerin	ng Ltd. FILE NO.		
REMARKS Northing 5025257.5; Easti	ng 34	17719.	2					HOLENO		
BORINGS BY CME 55 Power Auger				D	ATE	Novembe	er 18, 20 ⁻	17 BH 3B-16		
SOIL DESCRIPTION	LOT		SAN	/IPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m $=$ 50 mm Dia. Cone		
GROUND SURFACE	STRATA I	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	O Water Content % 0 20 40 60 80 V		
						- 0-	-88.84			
OVERBURDEN						1-	-87.84			
1.13		RC	1	100	81	2-	-86.84			
		-				3-	-85.84			
		RC	2	95	41	4-	-84.84			
BEDROCK: Good to fair quality, grey limestone, some shale partings		RC	3	100	58	5-	-83.84			
			4	100	50	6-	-82.84			
- excellent to good quality by 7.5m			4	100	28	7-	-81.84			
depth		RC	5	100	100	8-	-80.84			
		- BC	6	100	93	9-	-79.84			
		_				10-	-78.84			
10.00		RC	7	100	81	11-	-77.84			
End of Borehole (GWL @ 4.01m-Dec. 20, 2016)						12-	+76.84			
								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded		

natoreonar		ır	Cor	nsulting	SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Or	ntario k	(2E 7J	Sentinel Monitoring Wells Kanata North Community Design Plan Ottawa, Ontario								
DATUM Ground surface elevation	s prov	ided b	by No	vatech	Con	sulting Er	ngineerin	ig Ltd. FILE NO.			
REMARKS Northing 5024849.7; East	ting 34	7680.	.5					HOLE NO.			
BORINGS BY CME 55 Power Auger				D	ATE	Novembe	er 18, 20 [°]	17 BH 4A-16			
SOIL DESCRIPTION	LOT		SAI	MPLE		DEPTH	TH ELEV.	Pen. Resist. Blows/0.3m $=$ 50 mm Dia Cone			
	RATA P	(PE	IBER	°° DVERY	ALUE RQD	(m)	(m)	Water Content %			
GROUND SURFACE	STI	Ţ.	NUN	RECO	N OR N	0-	-80.34	20 40 60 80 Z C			
							09.04				
OVERBURDEN						1-	-88.34				
2.0	3					2-	-87.34				
		RC	1	100	88						
BEDROCK: Good to excellent quality, grey limestone, some shale						3-	+86.34				
partings		RC	2	100	97	4-	-85.34				
		RC	3	95	90	5-	-84.34				
6.0	$7^{\frac{1}{1}\frac{1}{1}\frac{1}{1}\frac{1}{1}}_{\frac{1}{1}\frac{1}{1}\frac{1}{1}}$					6-	-83.34				
(GWI @ 0.49m-Dec. 20. 2016)											
(GWL @ 0.4011 Dec. 20, 2010)											
								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded			

natersonar	In		SOIL PROFILE AND TEST DATA								
154 Colonnade Road South, Ottawa, On	tario ł	(2E 7J	Sentinel Monitoring Wells Kanata North Community Design Plan Ottawa, Ontario								
DATUM Ground surface elevations	s prov	ided b	y No	vatech	Con	sulting Er	gineerin	g Ltd. FILE NO.			
REMARKS Northing 5024849.7; Easti	ing 34	7680.	5					PG3975			
BORINGS BY CME 55 Power Auger	DRINGS BY CME 55 Power Auger DATE November 16, 2017										
	LOT		SAMPLE			DEPTH	ELEV.	Pen. Resist. Blows/0.3m			
SOIL DESCRIPTION	ATA P	Э.Е.	BER	ÆRY	CD CD	(m)	(m) (m)				
GROUND SURFACE	STRI	алт	INUME	RECOV	N VA of F	н 10 11		○ Water Content % 11 ts 20 40 60 80 ≥0			
						- 0-	-89.34				
OVERBURDEN						1-	-88.34				
OVERBORDEN											
2.26)	-				2-	-87.34				
		RC	1	100	91	3-	-86.34				
		RC	2	100	97		95.24				
						4	-05.54				
		RC	3	100	98	5-	-84.34				
						6-	-83.34				
BEDROCK: Excellent quality, grey		RC	4	100	100	7-	-82.34				
limestone, some shale partings		_				8-	-81 3/				
		RC	5	100	81		01.04				
		_				9-	-80.34				
		RC	6	100	88	10-	-79.34				
						11-	-78.34				
10 10		RC	7	100	93	12-	-77.34				
End of Borehole (MW blocked at 0.35m depth - Dec. 20, 2016)											
-,,								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded			

patersongroup ^{Consulting} 154 Colonnade Road South, Ottawa, Ontario K2E 7J5						SOIL PROFILE AND TEST DATA Geotechnical investigation Proposed Stormwater Management Facility 1053 March Road, Ottawa, Ontario							
REMARKS									HOLE N	0.			
BORINGS BY Backhoe				DA	TE C	October 1	9, 2017			TP 1			
SOIL DESCRIPTION	PLOT	SAMPLE				DEPTH . (m)	ELEV. (m)	Pen. Resist. Blows/0.3m • 50 mm Dia. Cone			er tion		
	STRATA	STRATA	ТҮРЕ	NUMBER	% SECOVER	OF ROD		• Water Content %			Diezomet		
					-	0-	-85.22		40				
TOPSOIL 0.40		-											
Stiff, brown SILTY CLAY, trace	X										-		
BEDROCK: Grey limestone 0.66													
End of Test Pit		-											
(TP dry upon completion)													
								20 She ▲ Undis	40 ear Streng sturbed 2	60 80 1 jth (kPa) ∖ Remoulded	⊣ 00		

natorsonar						SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, Ont	tario I	(2E 7J	Eng J5	ineers	Geotechnical investigation Proposed Stormwater Management Facility 1053 March Road, Ottawa, Ontario								
DATUM Ground surface elevations	prov	ided k	oy No	vatech	Engi	neering C	Consultar	nts Ltd.	FILE N	10. PG425	R		
REMARKS									HOLE	NO. TD 0	5		
BORINGS BY Backhoe				DA	TE	October 1	9, 2017			IP 2			
SOIL DESCRIPTION	PLOT		SAN	/IPLE 거		DEPTH (m)	ELEV. (m)	Pen. R • 5	esist. 0 mm [esist. Blows/0.3m) mm Dia. Cone			
	STRATA	ТҮРЕ	NUMBER	ECOVER	I VALUI or RQD	or RQD		• v	Vater C	ontent %	iezome onstruc		
GROUND SURFACE				<u></u>	4	0-	-88.12	20	40	40 60 80			
TOPSOIL		_											
Very stiff to stiff, brown SILTY CLAY, trace sand													
										•			
						1-	-87.12						
1.65											⊻		
GLACIAL TILL: Brown silty clay with													
sand, gravel, cobbles, trace boulders						2-	-86.12						
2.16		-											
TP terminated on bedrock surface at 2.16m depth													
(GWL @ 1.5m depth based on field observations)													
								20	40	60 80	100		
								Shear Strength (kPa) ▲ Undisturbed △ Remoulded					

natersonaroun						SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Ont	Ge Pr 10	Geotechnical investigation Proposed Stormwater Management Facility 1053 March Road, Ottawa, Ontario										
DATUM Ground surface elevations	prov	ided k	oy Nov	vatech	Engi	neering C	Consultar	nts Ltd.	FILE NO.	PG4258		
REMARKS									HOLE NO).		
BORINGS BY Backhoe				DA	TE	October 1	9, 2017			IP 3		
SOIL DESCRIPTION	SAMPLE					DEPTH (m)	ELEV. (m)	Pen. R • 5	ows/0.3m a. Cone	ter tion		
	STRATA	ТҮРЕ	NUMBER	ECOVER	N VALUI or RQD	or ROD	-89.87	• Water Content %			iezome onstruc	
GROUND SURFACE				Ř	4	0-		20	60 80			
TOPSOIL												
<u>0.30</u>												
Very stiff to stiff, brown SILTY CLAY. trace sand												
						1-	-88.87					
						•	00.07					
1.42												
<u>I.TZ</u>											-	
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, trace boulders												
0.10						2-	-87.87					
End of Test Pit	[^^^^/											
TP terminated on bedrock surface at 2.13m depth												
(GWL @ 1.4m depth based on field observations)												
								20 Shea ▲ Undist	40 € ar Streng turbed △	50 80 1 th (kPa) Remoulded	⊣ 00	

natoreonarc	Con	sulting	SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, On	ineers	Preliminary Geotechnical Investigation Future Development Lands - March Road Ottawa, Ontario								
DATUM Ground surface elevations p	rovide	ed by a	Annis,	O'Sulliv	an, Vollebekl	k Ltd.		FILE NO.	PG2878	
REMARKS 18T 0425287; 5023780										
BORINGS BY Hydraulic Excavator				DA	TE March 21	, 2013			TP25	1
SOIL DESCRIPTION		SAMPLE			DEPTH	ELEV.	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone			eter
	FRATA	ГҮРЕ	UMBER	COVERY		(m)	• Water Content %			Diezome
GROUND SURFACE	ζ.	. .	E	REC	- ⁻ ⁻ ⁻	90.66	20 40 60 80			
TOPSOIL 0.30 Very stiff to stiff, brown SILTY CLAY 0.61 End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.61m depth (TP dry upon completion)		G	1					o		
							20 She	40 60 ar Strength	80 11	00
natoreonard	TOUP Consulting Engineers				Iting SOIL PROFILE AND TEST DATA					
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154 Colonnade Road South, Ottawa, On	Itario	К2Е 7	Eng J5	ineers	P F O	reliminary uture Dev ttawa, Or	/ Geotec elopmer ntario	hnical Investigation nt Lands - March Road		
DATUM Ground surface elevations p	rovide	ed by <i>i</i>	Annis,	O'Sulliv	van,	Vollebekk	Ltd.	FILE NO. DC20270		
REMARKS 18T 0425362; 5023727										
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013	TP26		
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m		
	ATA P	ΡE	BER	VERY	ALUE ROD	(m)	(m)			
GROUND SURFACE	STR	Т	MUN	RECO	N VI		90 74	20 40 60 80		
TOPSOL 0.60 Very stiff to stiff, brown SILTY CLAY 1.22 GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 1.52 End of Test Pit Practical refusal to excavation on inferred bedrock surface at 1.52m depth (TP dry upon completion) (TP dry upon completion)		G	1			- 0-	- 88.74	20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded		

natoreonard	roup Consulting Engineers			SOIL PROFILE AND TEST DATA					
154 Colonnade Road South, Ottawa, On	ntario	К2Е 7	Eng J5	ineers	PI Fi	reliminary uture Dev ttawa, Or	y Geotec velopmer ntario	hnical Investigation It Lands - March Road	
DATUM Ground surface elevations p	rovid	ed by	Annis,	O'Sulliv	van,	Vollebekk	Ltd.	FILE NO. DC0070	
REMARKS 18T 0425446; 5023599									
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013	TP27	
	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m	er ion
SOIL DESCRIPTION	A P.		R	ïRΥ	ËQ	(m)	(m)	• 50 mm Dia. Cone	omet
	TRAT	ТҮРЕ	UMBE	COVE	VAL RC			• Water Content %	Piez
GROUND SURFACE	S		z	RE	z ⁰	- 0-	- 88 96	20 40 60 80	Ŭ
TOPSOIL									
Very stiff to stiff, brown SILTY CLAY, trace sand						2-	- 87.96		
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 2.44m depth (TP dry upon completion)								20 40 60 80 10 Shear Strength (kPa)	00

natoreonarc	TOUD Consulting Engineers				SOIL PROFILE AND TEST DATA					
154 Colonnade Road South, Ottawa, On	Itario	К2Е 7	Eng J5	lineers	Ρι Fι Ο	reliminary uture Dev ttawa. Or	/ Geotec elopmer ntario	hnical Investigation t Lands - March Ro	า วad	
DATUM Ground surface elevations p	rovide	ed by	Annis,	, O'Sulliv	van, '	Vollebekk	Ltd.	FILE NO.	DC0070	
REMARKS 18T 0425582; 5023702									PG20/0	
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013	HOLE NO	TP28	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Resist. Blo	ows/0.3m	ter tion
	ATA P	E	BER	VERY	ROD	(m)	(m)			szome
GROUND SURFACE	STR	ЛТ	MUN	RECO	N V		00.05	20 40 6	itent %	.≣ G B B
TOPSOIL 0.41 Very stiff to stiff, brown SILTY CLAY 1.52 End of Test Pit 1.52 Practical refusal to excavation on inferred bedrock surface at 1.52m depth (TP dry upon completion) (TP dry upon completion) 0.41		G	1			- O-	-85.85			
								20 40 6 Shear Streng ▲ Undisturbed △	0 80 10 th (kPa) Remoulded	00

natersonaro		n	Con	sulting	1	SOI	l pro	FILE AND TEST DATA
154 Colonnade Road South, Ottawa, Ont	ario	Р К2Е 7	Eng J5	ineers	Pr Fl	eliminary uture Dev ttawa, Or	r Geotec elopmer itario	chnical Investigation nt Lands - March Road
DATUM Ground surface elevations pro	ovide	ed by	Annis,	O'Sulli	van, '	Vollebekk	Ltd.	FILE NO.
REMARKS 18T 0425480; 5023826								HOLENO
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013	TP29
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Resist. Blows/0.3m ● 50 mm Dia Cone
	RATA P	YPE	MBER	°% OVERY	ROD	(m)	(m)	• Water Content %
GROUND SURFACE	ST	F	DN N	REC	N O			20 40 60 80
TOPSOIL 0.41 Firm to stiff, brown SILTY CLAY 1.07 GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 1.52 End of Test Pit 1.52 Practical refusal to excavation on inferred bedrock surface at 1.52m depth (GWL @ 0.7m depth based on field observations)		G	1			1-	-85.13	
								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded

natoreonard	TOUD Consulting Engineers				ting SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Or	ntario	К2Е 7	Eng 'J5	ineers	Ρι Fι	reliminary uture Dev Itawa, Or	/ Geotec elopmen	hnical Investiga t Lands - March	ition 1 Road		
DATUM Ground surface elevations p	rovid	ed by .	Annis,	, O'Sulli	van, '	Vollebekk	Ltd.	FILE	NO. DO0070		
REMARKS 18T 0425420; 5023875									PG28/8		
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013	HOLI	TP30		
	Ŀ		SAN	IPLE		DEPTH	ELEV.	Pen. Resist.	Blows/0.3m	on	
SOIL DESCRIPTION	A PI		щ	RY	Ë۵	(m)	(m)	🗢 50 mm	Dia. Cone	mete	
	TRAT.	ГYРЕ	UMBE		VALU RQ			• Water	Content %	Const	
GROUND SURFACE	5 S		Ы.	REC	z ö	0-	86 12	20 40	60 80	_0	
							00.42				
0. <u>38</u>											
Vonustiff to stiff brown SILTV											
CLAY, trace sand						1-	-85.42				
		G	1						0		
<u>1.83</u>	Γ <i>Ι</i> Χ	1						· · · · · · · · · · · · · · · · · · ·			
inferred bedrock surface at 1.83m											
(IP dry upon completion)											
								20 40 Shear Stre	60 80 10 ength (kPa)	00	

natorsonard	FOUD Consulting Engineers				Iting SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, On	Itario	K2E 7	Eng J5	ineers	Pr Ft Ot	reliminary uture Dev ttawa. Or	Geotec elopmer Itario	hnical Inv nt Lands -	estigatior March Ro	n bad	
DATUM Ground surface elevations p	rovide	ed by <i>i</i>	Annis,	O'Sulliv	van, '	Vollebekk	Ltd.		FILE NO.	000070	
REMARKS 18T 0425562; 5023981										PG2070	
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013		HOLE NO	[·] TP31	
	Ъ.		SAM	IPLE		DEPTH	ELEV.	Pen. R	esist. Blo	ows/0.3m	er on
SOIL DESCRIPTION	A PI		Ж	RY	Ľ۵	(m)	(m)	• 5	0 mm Dia	. Cone	ructi
	TRAT	LYPE	JMBE	°∾ E	VALU RQ			• v	Vater Con	tent %	oiezc
GROUND SURFACE	เงิ		Ĩ	REC	z ö	0	00.07	20	40 6	0 80	
TOPSOIL 0.41 Stiff, brown SILTY CLAY, some sand, trace gravel 0.81 End of Test Pit 0.81 Practical refusal to excavation on inferred bedrock surface at 0.81m depth 0.81 (TP dry upon completion) 0.00000000000000000000000000000000000											
								20 Shea ▲ Undist	40 6 ar Strengi urbed △	0 80 1 th (kPa) Remoulded	00

natoreonard	TOUD Consulting Engineers				SOIL PROFILE AND TEST DATA									
154 Colonnade Road South, Ottawa, On	Itario	К2Е 7	Eng J5	ineers	Pi Fi	reliminary uture Dev Itawa Or	/ Geotec elopmer	hnical nt Land	Inve Is - I	esti Mar	gatio ch Ro	า bad		
DATUM Ground surface elevations p	rovid	ed by .	Annis,	O'Sulli	van, '	Vollebekk	Ltd.			FIL	E NO.		00070	
REMARKS 18T 0425629; 5023917												P	G28/8	
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013			нс	DLE NC	"Т	P32	
	TOT		SAN	IPLE		DEPTH	ELEV.	Per	1. Re	esis	t. Blo	ows/().3m	er on
SOIL DESCRIPTION	A PI		R	RY	Ħа	(m)	(m)		• 5	0 m	m Dia	a. Co	ne	omet
	TRAT	ГYPE	UMBE	COVE %	VALI r RQ			C	> W	/ate	r Cor	itent	%	Piezo
GROUND SURFACE	N.		N	REC	z ö	0.	06 01	2	0	40	6	0	80	_0
							00.01				· · · · · · · · · · · · · · · · · · ·			
TOPSOIL											· · · · · · · · · · · · · · · · · · ·			
											· · · · · · · · · · · · · · · · · · ·			
0.66		-									· · · · · · · · · · · · · · · · · · ·			
Practical refusal to excavation on inferred bedrock surface at 0.66m														
(TP dry upon completion)											· · · ·			
											· · · ·			
											· · · ·			
											· · · ·			
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											· · · ·			
								2 S	0 Shea	40 ar Si	6 treng	ບ th (kl	80 10 Pa)	00
								🔺 Ui	ndist	urbeo	∆ k	Rem	oulded	

natoreonard					Iting SOIL PROFILE AND TEST DATA									
154 Colonnade Road South, Ottawa, Or	ntario	К2Е 7	Eng J5	ineers	Pi Fi	reliminary uture Dev ttawa, Or	/ Geotec elopmer	hnical nt Land	Inve Is - I	esti Mar	gatio rch Re	n Dad		
DATUM Ground surface elevations p	orovid	ed by	Annis,	O'Sulliv	van, '	Vollebekk	Ltd.			FII	LE NO.		0070	
REMARKS 18T 0425702; 5023822													120/0	
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013			H	JLE NC	^{).} TF	9 33	
	E		SAM	IPLE		DEDTU		Per	1. R	esis	st. Bl	ows/0	.3m	~ <u>-</u> <u>-</u>
SOIL DESCRIPTION	A PLO		~	۲.	Що	(m)	m)		• 5	0 m	ım Dia	a. Con	е	mete uctio
	RATZ	ЧЪЕ	MBEF	OVEF	ROL			C	> W	/ate	er Cor	ntent	%	iezo
GROUND SURFACE	LS I	H	DN N	REC	N N N			2	0	40) e	60	80	шO
						- 0-	-84.00							
TOPSOIL														
End of Test Pit										<u></u>	<u> </u>		<u></u>	-
Practical refusal to excavation on inferred bedrock surface at 0.61m depth														
(TP dry upon completion)											· · · · · · · · · · · · · · · · · · ·			
											· · · · · · · · · · · · · · · · · · ·			
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								2	0 Shea	4(ar 9) (0 th (kP	80 1 a)	00
								▲ Ui	ndist	urbe	d ∆	Remo	ulded	

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154 Colonnade Road South, Ottawa, On	Itario	К2Е 7	Eng J5	gineers	Pr Ft Of	reliminary uture Dev ttawa, Or	Geotec elopmer tario	hnical Inventional Inventional Inventional Inventional Inventional Inventional Inventional Inventional Invention Inventional Inve Internet Inventional Inventional Inventional Inventional Inventional Inventional Inventional Inventional Invention	estigation March Roa	d	
DATUM Ground surface elevations p	rovide	ed by <i>i</i>	Annis	, O'Sulliv	van, '	Vollebekk	Ltd.		FILE NO.	DC0070	
REMARKS 18T 0425799; 5023895										PG2070	
BORINGS BY Hydraulic Excavator				DA	TE	March 21,	2013		HOLE NO.	TP34	
	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. Re	esist. Blov	vs/0.3m	er ion
SOIL DESCRIPTION	A PI		Ř	RY	Ë Q	(m)	(m)	• 5	J mm Dia.	Cone	omet
	TRAT	ТУРЕ	UMBE	COVE %	VALI F RQ			• N	ater Conte	ent %	Piez
GROUND SURFACE	ß		Z	RE	z ^o	- 0-	-84 02	20	40 60	80	
TOPSOIL 0.41 Hard to very stiff, brown SILTY 1.52 GLACIAL TILL: Brown silty sand with gravel, cobbles, boulder, 1.92 End of Test Pit 1.92 Practical refusal to excavation on inferred bedrock surface at 1.92m depth 1.92 (TP dry upon completion) 1.92		GGG	1			1 -	-83.02	0	D		22
								20 Shea ▲ Undistu	40 60 r Strength ⊮bed △ F	80 10 (kPa) lemoulded	00

natoreonar	OUP Consulting Engineers					SOI	L PRO	SOIL PROFILE AND TEST DATA					
154 Colonnade Road South, Ottawa, O	ntario	K2E 7	Eng J5	lineers	Pr Ft Ot	reliminary uture Dev ttawa, Or	/ Geotec elopmer ntario	hnical Invo nt Lands -	estigation March Road				
DATUM Ground surface elevations p	orovid	ed by A	Annis,	O'Sulliv	van, '	Vollebekk	Ltd.		FILE NO.	00020			
REMARKS 18T 0425826; 5024040										G2070			
BORINGS BY Hydraulic Excavator	_			DA	TE	March 21,	2013		HOLE NO.	TP35			
SOIL DESCRIPTION	PLOT		SAN			DEPTH	ELEV.	Pen. R 5	esist. Blows 0 mm Dia. Co	/0.3m one	eter Stion		
	STRATA	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	○ V 20	Vater Conten	t %	Piezome Construc		
TOPSOIL 0.46		G	1			- 0-	- 81.99						
Lad to very still, brown Siz 11 CLAY End of Test Pit Practical refusal to excavation on inferred bedrock surface at 4.27m depth (GWL @ 2.7m depth based on field observations)		G	2			3-	- 79.99 - 78.99				Ţ		
USE VAIIONS								20 Shea ▲ Undist	40 60 ar Strength (I urbed △ Rer	80 10 (Pa) noulded	00		

natoreonard	Consulting Engineers				SOIL PROFILE AND TEST DATA						
154 Colonnade Road South, Ottawa, Or	ntario	Р К2Е 7	Eng J5	ineers	P F	reliminary uture Dev	/ Geotec elopmer	hnical Investigation t Lands - March Road			
DATUM Ground surface elevations p	rovid	ed by <i>i</i>	Annis,	O'Sulli	van,	Vollebekk	Ltd.	FILE NO.			
REMARKS 18T 0425699; 5024001								PG287	8		
BORINGS BY Hydraulic Excavator				DA	ΔTE	March 21,	2013	HOLE NO. TP36			
	Ę		SAN	IPLE				Pen. Resist. Blows/0.3m			
SOIL DESCRIPTION	A PLC		æ	RY	빋ㅇ	DEPTH (m)	ELEV. (m)	• 50 mm Dia. Cone	meter		
	TRAT	ТҮРЕ	IUMBE	COVE)	VALU r RQI			 Water Content % 	Piezo Const		
GROUND SURFACE	ω		2	RE	z ^o	- 0-	-84.76	20 40 60 80			
TOPSOIL											
						1-	-83.76				
Hard to very stiff, brown SILTY CLAY		G	1			2-	-82.76	<u>о</u>	108		
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 2.74m depth (GWL @ 2.6m depth based on field observations)									¥		
								20 40 60 80 Shear Strength (kPa) ▲ Undisturbed △ Remoulded	100		

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SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, ON	Ot	tawa, On	tario			icii noau					
DATUM Ground surface elevations p	ech En	gineer	ing Consu	ultants Lto	d.	FILE NO.	PG1823				
REMARKS									HOLE NO.	TP 1	
BORINGS BY Hydraulic Shovel				D	ATE	9 Feb 09				11 1	
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)	Pen. R • 5	esist. Blo 0 mm Dia.	ws/0.3m Cone	neter uction
	STRATA	ТҮРЕ	IUMBER	% COVER3	VALUE r RQD			• v	/ater Cont	ent %	Piezon Constru
GROUND SURFACE	07		4	RE	z	0-	-88 10	20	40 60	80	
TOPSOIL							00.10				
Brown SILTY SAND, trace organic matter GLACIAL TILL: Brown silty		G	1					·····		· · · · · · · · · · · · · · · · · · ·	
sand with gravel, cobbles and 0.70 boulders End of Test Pit											
Practical refusal to excavation on inferred bedrock surface @ 0.70m depth											
(TP dry upon completion)								20	40 60		
								Shea	ar Strengt	h (kPa) Remoulded	

natercond	r۸		n	Consulting		SOIL PROFILE AND TEST DATA										
28 Concourse Gate, Unit 1, Ottawa	a, ON K	(2E)	Υ 777	Engi	ineers	Pro Pro Ot	eliminary oposed R tawa, On	Geotech lesidentia tario	nical Inves al Developr	tiga ner	atio nt - I	n Mar	ch F	load	ł	
DATUM Ground surface elevation	ons pro	ovide	d by N	Vovate	ech Engi	neer	ing Consu	Iltants Ltc	1.	FIL	LEN	Ю.	PC	G18	23	
REMARKS										нс	DLE	NO.	т	רם)	
BORINGS BY Hydraulic Shovel						TE 🤅	9 Feb 09		_ _					. 4	•	
SOIL DESCRIPTION		A PLOT		SAN	IPLE 것		DEPTH (m)	ELEV. (m)	Pen. Re	esis 0 m	st. I m D	3lov Dia.	vs/0 Con	.3m e		meter uction
		STRAT	ТҮРЕ	NUMBER	ECOVER	OF ROD			• W	/ate	r Co	onte	ent '	%		Piezo Consti
GROUND SURFACE						-	0-	-88.57	20	40) 	60	:::	80		
TOPSOIL	<u>0.25</u>		G	1							•••••••••••••••••••••••••••••••••••••••	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
										•••••						
- grey by 0.75m depth			G 	2			1-	-87.57								⊊
							2-	-86.57								
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders End of Test Pit	<u>2.90</u>						3-	-85.57								
Practical refusal to excavation on inferred bedrock surface @ 3.20m depth											•••••••••••••••••••••••••••••••••••••••				· · · · · · · · · · · · · · · · · · ·	
(Open hole GWL @ 1.4m depth)											· · · · · · · · · · · · · · · · · · ·				•••••••••••••••••••••••••••••••••••••••	

▲ Undisturbed

20 40 60 80 Shear Strength (kPa)

 \triangle Remoulded

100

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SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, Ol	K2E	7T7			Ot	tawa, On	tario	ai Develop		IICII NUdu			
DATUM Ground surface elevations p	orovide	ed by I	Novate	ech En	gineer	ring Consu	ultants Lto	d.	FILE NO.	PG1823			
REMARKS									HOLE NO	^{).} ТР 3			
BORINGS BY Hydraulic Shovel				D	ATE	9 Feb 09							
SOIL DESCRIPTION	PLOT	SAMPLE DEPTH ELEV.				Pen. R • 5	esist. Blo 0 mm Dia	neter uction					
	TRATA	ТҮРЕ	UMBER	% COVER3	VALUE r RQD			• v	later Con	tent %	Piezon Constru		
GROUND SURFACE	01		Z	RE	z ^o	0-	95 19	20	40 6	0 80			
TOPSOIL							-05.40						
Brown SILTY CLAY		G	1										
		G	2										
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles						1-	-84.48						
clay with sand, gravel, cobbles and boulders													
1.90													
End of Test Pit													
Practical refusal to excavation on inferred bedrock surface @ 1.90m depth													
(TP dry upon completion)													
								20 Shea ▲ Undist	40 6 ar Strengt	0 80 10 t h (kPa) Remoulded	00		

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SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, ON K2E 717 Ottawa, Ontario											
DATUM Ground surface elevations p	provide	ed by I	Novate	ech En	gineer	ing Consu	ultants Lto	d.	FILE NO.	PG1823	
REMARKS									HOLE NO)	
BORINGS BY Hydraulic Shovel	1			D	ATE	9 Feb 09		1		TP 4	
SOIL DESCRIPTION	PLOT	SAMPLE DEPTH ELEV.						Pen. R • 5	esist. Blo 0 mm Dia	ows/0.3m . Cone	eter ction
	АТА	田山	BER	VERY	ROD	(11)	(11)				ezom
	STR	ЦĶ	MUM	ECO.	N VA OF]				Vater Con	itent %	Б С Б
GROUND SURFACE				—		0-	-88.13	20	40 6		
TOPSOIL0.20											
Brown SILTY SAND		G	1								
<u>0.5</u> 0											
		G	2								
GLACIAL TILL: Grey clayey		-									
cobbles and boulders						1-	-87.13				
1.40											
End of Test Pit											
Practical refusal to excavation on inferred bedrock surface @ 1.40m depth											
(TP dry upon completion)											
								20	40 €	+ · · · + · · · · · · · · · · · · · · ·	1 00
								Shea Undist	ar Streng urbed △	tn (KPa) Remoulded	

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SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, ON	IK2E	7T7	Ottawa, Ontario									
DATUM Ground surface elevations p	orovide	ed by I	Novate	ech En	gineer	ring Consu	ultants Lto	J.	FILE NO. PG1823			
REMARKS				п	лте (9 Feb 119			HOLE NO. TP 5			
	Б		SAN					Pen. Resist. Blows/0.3m				
SOIL DESCRIPTION	PLO		-	к	DEPTH ELEV.		• 50) mm Dia. Cone	neter uctior			
	TRATA	YPE	MBER	°∾ OVER	VALUE ROD			• w	/ater Content %	iezor		
GROUND SURFACE	ខ		NC	REC	IO N N	0.	88 50	20	40 60 80	L O		
TOPSOIL							00.00					
		– G	1									
Brown SANDY SILT , trace gravel		_							•••••••••••••••••••••••••••••••••••••••			
0.80												
clay with sand, gravel, cobbles		G	2			1-	-87 50					
<u>1.15</u>		-										
Practical refusal to excavation on inferred bedrock surface @ 1.15m depth												
(TP dry upon completion)												
								20 Shea	40 60 80 1 ar Strength (kPa)	00		
								▲ Undist	\land Remoulded			

natersonaroun	Consulting	SOIL PROFILE A	ND TEST DATA					
28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7	Engineers	Preliminary Geotechnical Investigation Proposed Residential Development - March Road Ottawa, Ontario						
DATUM Ground surface elevations provided by	Novatech Engi	neering Consultants Ltd.	FILE NO.	PG1823				
REMARKS	DA	re 9 Eab 09	HOLE NO.	TP 6				

BURINGS BY HYURAUNC SHOVEN	-	1		Ľ			1	
SOIL DESCRIPTION	PLOT		SAMPLE			DEPTH (m)	ELEV.	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone
	UATA	ЪЕ	BER	VERY	ALUE ROD	(,	(,	
	STF	Ϋ́Τ	NUM	RECO	N VI OF			20 40 60 80
						0-	-89.10	
TOPSOIL	25							
[_]		+						
		G	1					
Brown SILTY CLAY								
0	85							
		G	2			1-	-88.10	
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles								
and boulders								
								······································
						2-	-87.10	
2	20							
End of Test Pit								
Practical refusal to excavation on inferred bedrock surface @ 2.20m depth								
(TP dry upon completion)								
								20 40 60 80 100
								Shear Strength (kPa)
								▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa	a, ON K2E	P	Engii	neers	Prel Prop Otta	iminary bosed R wa, Oni	Geotech esidentia tario	nical Inves al Developi	stigati ment	ion - Mar	ch Ro	ad	
DATUM Ground surface elevation	ons provid	ed by	Novate	ch Engi	neerin	g Consu	ltants Lto	J.	FILE	NO.	PG	1823	
REMARKS									HOL	E NO.	тр		
BORINGS BY Hydraulic Shovel		DATE 9 Feb 09									IP	1	
SOIL DESCRIPTION	РІОТ		SAM	PLE	[DEPTH (m)	ELEV. (m)	Pen. R	esist. 0 mm	Blov Dia.	ws/0.3 Cone	m	neter uction
	STRATA	ТҮРЕ	NUMBER	SCOVER'	VALUE Dr RQD			• v	Vater (Conte	ent %		Piezor Constri
GROUND SURFACE				RI 2	z	0-	-88.06	20	40	60	8) -:-::-	
TOPSOIL	<u>0.2</u> 0	G	1			1-	-87.06						
Very stiff, brown SILTY CLAY													
- grey-brown by 1.4m depth	2.60	G	2			2-	-86.06						8 <i>⊻</i>
GLACIAL TILL: Grey-brown silty sand with clay, gravel, cobbles and boulders End of Test Pit	<u>2.90 ^^^</u>	G	3						••••••				
Practical refusal to excavation on inferred bedrock surface @ 2.90m depth													
(Open hole GWL @ 1.8m depth)								20 Shea	40 ar Stro	60 ength	80 81 1 (kPa	0 1()	00

Undisturbed

△ Remoulded

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SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, O	N K2E	7T7				tawa, On	tario	ai Develop					
DATUM Ground surface elevations	provide	ed by l	Novate	ech En	ginee	ring Consu	Iltants Lto	d.	FILE NO.	PG1823			
REMARKS BOBINGS BY Hydraulic Shovel				Г		9 Feb (19			HOLE NO	^{D.} TP 8			
	Ę		SAN	/IPLE				Pen. R	esist. Bl	ows/0.3m			
SOIL DESCRIPTION	A PLC		6	RY	۲o	(m)	ELEV. (m)) • 50	0 mm Dia) mm Dia. Cone			
	STRAT	ТҮРЕ	IUMBE	COVE	VALU NE RQI			• v	Vater Cor	itent %	Piezo Const		
GROUND SURFACE				RI	zv	- 0-	-89.86	20	40 6	50 80 + : : : + : : : :			
TOPSOIL	25							·					
Brown SANDY SILT , trace		– G	1										
	<u>;0;1;1;1;</u>	-								······			
		G	2										
Brown SILTY CLAY			_			1-	-88.86						
							00.00				₽		
1.4	0												
End of Test Pit													
Practical refusal to excavation on inferred bedrock surface @ 1.40m depth													
(Open hole GWL @ 1.1m depth)													
								20 Shea	40 6 ar Streng	50 80 1 th (kPa)	o o		
								🔺 Undist	urbed 🛆	Remoulded			

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28 Concourse Gate, Unit 1, Ottawa, ON	K2E	7 77	Engi	ineers	Pre Pro Ott	eliminary oposed R awa. On	Geotech Iesidentia tario	nical Inves al Develop	stigation ment - Mar	ch Road	
DATUM Ground surface elevations p	orovide	ed by I	Novate	ech Eng	ineeri	ing Consu	Itants Lto	l.	FILE NO.	PG1823	
REMARKS									HOLE NO.		
BORINGS BY Hydraulic Shovel				DA	TE 9) Feb 09				189	
SOIL DESCRIPTION	PLOT		SAN	IPLE		DEPTH (m)	ELEV. (m)	Pen. R ● 5	esist. Blov 0 mm Dia.	ws/0.3m Cone	neter uction
	STRATA	ТҮРЕ	UMBER	°° COVER	VALUE r RQD			• V	Vater Conte	ent %	Piezor Constr
GROUND SURFACE	0		z	RE	z ^o	0-	-91.42	20	40 60	80	
TOPSOIL 0.20)					C	••••				
Brown SILTY CLAY		G	1			1-	-90.42				
GLACIAL TILL: Grey-brown clayey silt with gravel, cobbles and boulders, trace sand		G	2			2-	-89.42				¥
End of Test Pit	<u>''^^^'</u>										
Practical refusal to excavation on inferred bedrock surface @ 2.30m depth (Open hole GWL @ 1.9m depth)								20 She ▲ Undist	40 60 ar Strength urbed △	80 10 1 (kPa) Remoulded	00

natersonaroun	Consulting	SOIL PROFILE AND TEST DAT						
28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7	Engineers	Preliminary Geotechnical Inves Proposed Residential Develop Ottawa, Ontario	stigation ment - Marc	h Road				
DATUM Ground surface elevations provided by	Novatech Engi	neering Consultants Ltd.	FILE NO.	PG1823				
			HOLE NO.	TP10				

Γ

BORINGS BY Hydraulic Shovel	Y Hydraulic Shovel DATE 9 Feb 09										TP10		
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV. (m)	Pen. R	Resist. Blows/0.3m 50 mm Dia. Cone			n	neter uction
	STRATA	ТҮРЕ	NUMBER	* ECOVER	N VALUE or RQD			• N	/ater (Conte	ent %		Piezon Constru
GROUND SURFACE				×	4	0-	-90.76	20	40	60	80		
TOPSOIL	0.20												
Brown SANDY SILT , some organic matter	_ <u>0.70 · · · · · · · · · · · · · · · · · · ·</u>	G 	1						••••••				
		G	2			1-	-89.76						
GLACAIL TILL: Grey silty sand with gravel, cobbles and boulders													
		G	3			2-	-88.76			· · · · · · · · · · · · · · · · · · ·			∇
	2.90												*
End of Test Pit													
Practical refusal to excavation on inferred bedrock surface @ 2.90m depth													
(Open hole GWL @ 2.5m depth)													
								20 Shea	40 ar Stre	60 ength	80 (kPa)	10	00

Undisturbed

patersongroup	
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Consulting Engineers Preli

SOIL PROFILE AND TEST DATA

28 Concourse Gate, Unit 1, Ottawa, ON	K2E	7T7			Ot	tawa, On	tario			
DATUM Ground surface elevations p	rovide	ed by I	Novate	ech En	gineer	ing Consu	ultants Lto	d.	FILE NO. PG1823	
BORINGS BY Hydraulic Shovel				D	ATE S	9 Feb 09			HOLE NO. TP11	
SOIL DESCRIPTION	LOT		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Blows/0.3m 0 mm Dia. Cone	eter
	STRATA I	ТҮРЕ	NUMBER	% RECOVERY	N VALUE or RQD	(m)	(m)	• W	/ater Content %	Piezome Construc
GROUND SURFACE						0-	-90.22			-
TOPSOIL 0.25 Brown SILTY SAND , some organic matter 0.90		G 	1							
GLACIAL TILL: Grey-brown silty sand with clay and gravel I.20 End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 1.20m depth (Open hole GWL @ 1.0m depth)		G	2			1-	-89.22	20 Shea	40 60 80 1 ar Strength (kPa)	₽

natersonaroun	Consulting	SOIL PROFILE AND TEST DAT						
28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7	Engineers	Preliminary Geotechnical Inves Proposed Residential Develop Ottawa, Ontario	stigation ment - Marc	h Road				
DATUM Ground surface elevations provided by I	Novatech Engir	neering Consultants Ltd.	FILE NO.	PG1823				
REMARKS	541	0 Ech 00	HOLE NO.	TP12				

Г

BORINGS BY Hydraulic Shovel				D	ATE S	9 Feb 09				^{IO.} TP12	
SOIL DESCRIPTION	PLOT		SAN	MPLE		DEPTH (m)	ELEV. (m)	Pen. R ● 5	esist. B 0 mm Di	lows/0.3m a. Cone	neter uction
	STRATA	ТҮРЕ	NUMBER	* ECOVER	I VALUE or RQD			• v	/ater Co	Piezon Constru	
GROUND SURFACE				<u></u> м	4	0-	-89.26	20	40	60 80	
TOPSOIL	20 										
Brown SILTY SAND						1-	-88.26		· · · · · · · · · · · · · · · · · · ·		
GLACIAL TILL: Grey silty sand with clay and gravel							00.20				
End of Test Pit	<u>50 ^^^^</u>										
Practical refusal to excavation on inferred bedrock surface @ 1.60m depth											
(TP dry upon completion)											
								20 Shea ▲ Undist	40 ar Stren urbed	60 80 1 gth (kPa) △ Remoulded	00

natoreonar		in	Con	sulting		SOI	l pro	FILE A	ND TES	T DATA			
154 Colonnade Road South, Ottawa,	Ontario	К2Е 7	Eng 'J5	ineers	Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa, Ontario								
DATUM TBM - Centreline of March geodetic elevation = 82.00	n Road, Om.	adjace	ent to 1	the north	n prop	erty limit	, assume	d	FILE NO.	PG1716			
REMARKS					TE		ng		HOLE NO.	TP 1			
	н		SAN			uly 5, 200		Pen. R	esist. Blo	ws/0.3m			
SOIL DESCRIPTION	PLO			ک	ы .	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia.	Cone	meter		
	FRAT	LYPE	JMBEF	COVER	VALU			• V	Vater Cont	ent %	Piezol		
GROUND SURFACE	รั		N	REC	z ^ö	0-	-81 70	20	40 60	80	<u> </u>		
TOPSOIL						Ū	01.70						
0.2	<u>25</u>												
crow by 0.5m dopth													
- giey by 0.5m depth													
						1-	-80.70			1	28		
										1	28		
											₽⊻		
						2-	-79.70						
<u>2</u> .		1											
CLACIAL TILL Composite danse													
grey silty clay, trace sand and gravel													
			4			3-	-78.70				-		
3.2	20												
End of Test Pit													
Practical refusal to excavation @ 3.20m depth													
(Open hole WL @ 1.75m depth)													
									40 ~~~				
								Shea	ar Strengtl	n (kPa)	UU		
								▲ Undist	urbed ∆ I	Remoulded			

natersonar		in	Con	sulting	SOIL PROFILE AND TEST DATA							
154 Colonnade Road South, Ottawa, O	Intario	K2E 7	Eng 'J5	ineers	G P O	eotechnic roposed F Ottawa, Or	cal Inves Resident ntario	tigation ial Develo	pment - F	oley Lands		
DATUM TBM - Centreline of March geodetic elevation = 82.00	Road, m.	adjace	ent to t	he north	h pro	operty limit	, assume	d	FILE NO.	PG1716		
BORINGS BY Rubber Tired Backhoe				DA	TE	July 9, 200	08		HOLE NO	TP 2		
	ШO		SAM	IPLE		DEDTH		Pen. R	esist. Blo	ows/0.3m	r n	
SOIL DESCRIPTION	A PL		R	:RY	Вe	(m)	(m)	• 5	i0 mm Dia	. Cone	omete tructic	
	STRAT	ТУРЕ	NUMBE	ECOVE	Dr RC			• \	Vater Con	tent %	Piez	
GROUND SURFACE				8	z ·	- 0-	-83.10	20	40 6) 80		
TOPSOIL		G	1									
0.4	0	_										
Practical refusal to excavation @												
0.40m depth												
								20 Shea	40 60 ar Strengt) 80 10 h (kPa)	 00	
								▲ Undis		Remoulded		

nate	areonari		In	Cor	sulting		SOI	L PRO	FILE AI	ND TES	ST DATA	
154 Colonna	ade Road South, Ottawa, O	ntario	K2E 7	Eng J5	Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa, Ontario							
DATUM	TBM - Centreline of March geodetic elevation = 82.00	Road, n.	adjace	ent to	the nort	h pro	perty limit	, assume	d	FILE NO.	PG1716	
BORINGS BY	Bubber Tired Backhoe				DA	TF.	July 9-20	08		HOLE NO	^{).} TP 3	
		н		SAN					Pen. R	esist. Bl	ows/0.3m	_
SO	IL DESCRIPTION	A PLO		<u>с</u>	RY	ËQ	DEPTH (m)	ELEV. (m)	• 5	i0 mm Dia	a. Cone	ometer
		STRAT	ЭДХТ	NUMBE		N VALI			0 V	Vater Co	ntent %	Piezo
GROUND SU	JRFACE				<u></u>	4	0-	83.80	20	40 (30 80	-
TOPSOIL	0.21	-										
	0.23											
			G	1								
Hard, brown	SILTY CLAY											
											1	28
	1.1(-				1-	-82.80				-
			â									
GLACIAL T	ILL: Dense brown silty		<u>_</u>									
clay, trace g	ravel and cobbles		G	2								
End of Test	<u>1.80</u> Pit	D <u>[^^^^</u>										- ×
Practical ref	usal to excavation on rock surface @ 1.80m											
(Open belo	MI @ 1.75m donth)											
(Open noie												
									Shea	ar Streng	ith (kPa)	00
									▲ Undist	urbed 🛆	Remoulded	

natersonar	sulting	SOIL PROFILE AND TEST DATA												
154 Colonnade Road South, Ottawa, O	ntario	K2E 7	Eng 'J5	jineers	Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa, Ontario									
DATUM TBM - Centreline of March I geodetic elevation = 82.00r	Road, n.	adjace	ent to t	the nortl	h pro	perty limit	, assume	d	FILE NO.	PG1716				
BOBINGS BY Bubber Tired Backhoe				DA	TE	.lulv 9 20(08		HOLE NO	[.] TP 4				
	ы		SAN					Pen. B	ows/0.3m					
SOIL DESCRIPTION	A PLO		<u>с</u>	RY	۲o	DEPTH (m)	ELEV. (m)	• 5	i0 mm Dia	a. Cone	meter			
	TRAT	ТУРЕ	UMBE	COVE %	VALC RQ			• v	Vater Cor	itent %	Piezo			
GROUND SURFACE	ß		Z	RE	z ⁰	- 0-	-86.20	20	40 6	0 80				
TOPSOIL 0.3()													
Hard, brown SILTY CLAY						1-	- 85 20			1	28			
1.5	5						00.20			1	₽ 28			
GLACIAL TILL: Brown-grey silty clay, some sand and cobbles		G	1			2-	-84.20							
2.30		^ 												
Practical refusal to excavation @ 2.30m depth														
(Open hole WL @ 1.2m depth)														
								20 Shea ▲ Undist	40 6 ar Streng turbed \triangle	0 80 1 th (kPa) Remoulded	00			

natersonard	ור	In	Cor	sulting	S	OIL P	ROFILE A	ND TEST DATA	
154 Colonnade Road South, Ottawa, O	ntario	K2E 7	Eng J5	jineers	Geotecl Propose Ottawa,	nical In d Resid Ontario	vestigation lential Develo	opment - Foley Lands	
DATUM TBM - Centreline of March F geodetic elevation = 82.00r REMARKS	Road, n.	adjace	ent to t	the north	n property I	mit, ass	umed	FILE NO. PG1716	;
BORINGS BY Rubber Tired Backhoe				DA	TE July 9,	2008		HOLE NO. TP 5	
	Ę		SAN	IPLE			Pen. F	Resist. Blows/0.3m	, с
SOIL DESCRIPTION	PLC			к	DEP	H EL) (n	בע. ו) ● ל	50 mm Dia. Cone	mete uctio
	RATZ	ТРE	MBEF		VALU		0	Water Content %	iezo
GROUND SURFACE	IS		DN	REC	N O	0-969	20	40 60 80	шO
TOPSOIL						0 00.0			
<u>0.2</u> 3		-							
		G	1						
Very stiff, brown SILTY CLAY									
						1-85 8	80		_
						1 00.0			¥
<u>1.6</u> 0									
GLACIAL TILL: Compact to dense		G	2			2-84.8	80		
and cobbles						2 04.0			
									•
2.50	\mathbf{D}								
End of Test Pit									
Practical refusal to excavation @ 2.50m depth									
(Open hole WL @ 1.1m depth)									
							20 She	40 60 80 ar Strength (kPa)	100
							▲ Undis	sturbed \triangle Remoulded	

natersonard	sulting	g SOIL PROFILE AND TEST DATA										
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa, Ontario							
DATUM TBM - Centreline of March P geodetic elevation = 82.00m	load, 1.	adjace	ent to t	he north	h pro	operty limit,	, assume	d	FILE NO.	PG1716		
BORINGS BY Rubber Tired Backhoe				D۵	TF	July 9 200	28		HOLE NO.	TP 6		
	Ę		SAM	IPLE				Pen. R	esist. Blo	ows/0.3m		
SOIL DESCRIPTION	A PLC		~	ХХ	ы о	DEPTH (m)	ELEV. (m)	• 5	0 mm Dia	. Cone	meter uctio	
	TRAT?	ТҮРЕ	UMBEI	COVEI	VALU F ROI	1		• v	Vater Con	tent %	Piezo Const	
GROUND SURFACE	S		N	R	z °	- 0-	-90.70	20	40 60	0 80		
TOPSOIL												
0.30 End of Test Pit												
Practical refusal to excavation on												
									40 ~~			
								Shea	ar Strengt	u 80 10 h (kPa) Bemoulded	JU	
										nemoulueu		

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154 Colonnade Road South, Ottawa, Or	ntario	К2Е 7	Eng J5	ineers	P	Reotechnic Proposed F	al Invest Residenti	tigation ial Develor	oment - Fo	oley Lands	
DATUM TBM - Centreline of March F geodetic elevation = 82.00n	load, 1.	adjace	ent to t	he nort	h pro	operty limit,	, assumed	d	FILE NO.	PG1716	
REMARKS							20		HOLE NO.	TP 7	
BORINGS BY Rubber Lired Backnoe			CAN		AIE	July 9, 200	58	Don Dr	aiat Dia		
SOIL DESCRIPTION	LOIT			IPLE 것	<u>ы</u>	DEPTH (m)	ELEV. (m)	• 50	0 mm Dia.	Cone	meter uction
	STRAT?	ТҮРЕ	UMBEF	ICOVEF	VALU Sr ROL			• w	ater Cont	ent %	Piezo Constr
GROUND SURFACE	03		2	RE	z ^o	, 0-	-89.40	20	40 60	80	_
TOPSOIL 0.15 GLACIAL TILL: Silty sand with gravel, cobbles and boulders 0.54											
BEDROCK: Weathered limestone	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					1-	-88.40				
<u>1.35</u> End of Test Pit											
(TP dry upon completion)											
								20 Shea ▲ Undistu	40 60 Ir Strength urbed △ F	80 10 n (kPa) Remoulded	00

natersonard	ור	In	Con	sulting		SOI	l pro	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, Or	ntario	K2E 7	Eng J5	ineers	G P O	eotechnic roposed f ttawa. Or	cal Inves Resident Itario	tigation ial Develo	pment - I	Foley Lands	
DATUM TBM - Centreline of March F geodetic elevation = 82.00r	Road, n.	adjace	ent to t	he nortl	h pro	operty limit	, assume	d	FILE NO.	PG1716	
REMARKS				ПА	TE	July 9, 20(ng		HOLE NO	^{).} TP 8	
	н		SAM	IPLE				Pen. R	esist. Bl	ows/0.3m	_
SOIL DESCRIPTION	PLO		_	ĸ	M -	DEPTH (m)	ELEV. (m)	• 50 mm Dia. Cone			meter uctior
	TRATA	ТҮРЕ	UMBER	COVER	VALUI F ROD			• v	Vater Co	ntent %	Piezor
GROUND SURFACE	ũ	_	N	RE	z ^ö	0-	- 88 80	20	40	60 80	
Bedrock at surface								20	40	60 80 1	00
								Shea Mundisi	ar Streng	jth (kPa)	

natoreon	aro	In	Cor	nsulting		SOI	l pro	FILE AI	ND TES	ST DATA					
154 Colonnade Road South, Ott	154 Colonnade Road South, Ottawa, Ontario K2E 7J5							Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa, Ontario							
DATUM TBM - Centreline of geodetic elevation =	March Road 82.00m.	d, adjac	ent to	the north	h proj	perty limit	, assume	d	FILE NO.	PG1716	;				
BOBINGS BY Hydraulic Shovel				D۵	TF.	luly 9 20	08		HOLE NO	^{).} TP 9					
	F		SAN		<u></u> (Pen. F	Resist. Bl	ows/0.3m					
SOIL DESCRIPTION				RY	۲ ۲	DEPTH (m)	ELEV. (m)	• 5	50 mm Dia	a. Cone	meter				
	стр. В л. Ст. С. С. С. С. С. С. С. С. С. С. С. С. С.	TYPE	NUMBE	ECOVE	I VALU or RQ			۰ ۱	Water Cor	ntent %	Piezo Const				
GROUND SURFACE		-		8	z	0-	81.90	20	40 (50 80					
TOPSOIL	<u>0.3</u> 0														
Very stiff, grey-brown SILTY CL	AY	G	1												
						1-	-80.90				128 ▲ 128 128 ↓				
	1.60					2-	- 79.90				· · · · · · · · · · · · · · · · · · ·				
brown-grey silty clay, trace grave cobbles and boulders	nse (^^^)], (^^^ (^^^ (^^^														
End of Test Pit	2.60	G	2								-				
Practical refusal to excavation @ 2.60m depth)														
(Open hole WL @ 1.5m depth)															
								20 She ▲ Undis	40 € ar Streng turbed △	50 80 1 th (kPa) Remoulded	100				

natoreonar		In	Cons	sulting		SOI	l pro	FILE AI	ND TES	ST DATA	
154 Colonnade Road South, Ottawa, O	neers	Geotechnical Investigation Proposed Residential Development - Foley Lands Ottawa Ontario									
DATUM TBM - Centreline of March F geodetic elevation = 82.00r	Road, n.	adjace	ent to th	ne north	n prop	perty limit	, assume	d	FILE NO.	PG1716	
							20		HOLE NO	[.] TP10	
BORINGS BY Rubber Lired Backnoe			CAM			uly 9, 200	18	Don D	laciat Dk		
SOIL DESCRIPTION	A PLOI			רב א ו	що	DEPTH (m)	ELEV. (m)	● 5	io mm Dia	a. Cone	meter uction
	TRAT	ТҮРЕ	UMBEI		VALU r RQI			• v	Vater Cor	itent %	Piezo Consti
GROUND SURFACE	ß		Z	SE SE	z ^o	0-	-88.40	20	40 6	0 80	
TOPSOIL 0.35 Very stiff, brown SILTY CLAY 1.60 GLACIAL TILL: Brown-grey silty clay, some gravel and cobbles 1.60						1- 2-	- 87.40				28
End of Test Pit Practical refusal to excavation @ 2.70m depth (Open hole WL @ 2.65m depth)								20 Shea ▲ Undist	40 € ar Streng turbed △	0 80 1 th (kPa) Remoulded	₩

natoreonar		in	Cons	sulting		SOI	L PRO	FILE AN	ND TE	ST DATA	
154 Colonnade Road South, Ottawa, O	ntario	ГР К2Е 7	Engir 'J5	neers	Ge Pro	otechnic posed F	cal Invest Residenti	tigation ial Develo	pment -	Foley Lands	
DATUM TBM - Centreline of March I geodetic elevation = 82.00r	Road, n.	adjace	ent to th	ne north	n prop	erty limit	, assumed	d	FILE NO	PG1716	;
BOBINGS BY Rubber Tired Backhoe				D۵	TE J	ulv 9 200	08		HOLE N	^{o.} TP11	
	E		SAM	PLE		aly 0, 200		Pen. R	esist. B	lows/0.3m	
SOIL DESCRIPTION	A PLO		ĸ	IRY	50	DEPTH (m)	ELEV. (m)	• 5	0 mm Di	a. Cone	2 meter tructior
	STRAT	TYPE	NUMBE		N VALI of RC			0 V	Vater Co	ntent %	Piezo
GROUND SURFACE						0-	-89.50		40		
TOPSOIL	5										
<u>_</u>											28
Very stiff, brown SILTY CLAY											
						1-	-88.50			1	28
<u>1.2</u> (
GLACIAL TILL: Dense brown-grey silty clay, trace gravel and cobbles											
- boulders at 1.7m											
2.00		<u>_</u>				2-	- 87 50				_
End of Test Pit						-	07.00				
Practical refusal to excavation @ 2.00m depth											
(TP dry upon completion)											
								20 Shea ▲ Undist	40 ar Streng urbed 2	<u> : : : : : :</u> 60 80 1 g th (kPa) ∆ Remoulded	⊣ I00

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 i	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 **Client: Paterson Group Consulting Engineers** Client PO: 22658

Report Date: 01-Nov-2017

Order Date: 26-Oct-2017

Project Description: PG4258

	Client ID:	BH2-SS4	-	-	-
	Sample Date:	20-Oct-17	-	-	-
	Sample ID:	1743469-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.5	-	-	-
General Inorganics	-				
рН	0.05 pH Units	7.90	-	-	-
Resistivity	0.10 Ohm.m	67.8	-	-	-
Anions					
Chloride	5 ug/g dry	9	-	-	-
Sulphate	5 ug/g dry	16	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4258-1 - TEST HOLE LOCATION PLAN

DRAWING PG4258-2 - PERMISSIBLE GRADE RAISE PLAN

patersongroup

FIGURE 1 KEY PLAN





Drawn by:		Report No) .:			
Scale:	1:4000	Date:	11/2017			
Seeler		Deter				
0 50	100	150	200 250m			
ENGINEER SCALE: 1:4000	ING CONSULT	ANTS LTD.				
TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY NOVATECH						
[01.7]						
[91 7]						
(82 25)	GROUNDWAT	FR OBSE	RVATIONS (m)			
83.20	GROUND SUF	RFACE ELE	EVATION (m)			
\boxtimes	TEST PIT LOC GROUP REPO	CATION, PA	ATERSON 16, 2008			
	TEST PIT LOC GROUP REPO	CATION, PA DRT PG182	ATERSON 23, 2009			
⊕	TEST PIT LOC GROUP REPO	CATION, PA DRT PG287	ATERSON 78, 2013			
.	SENTINEL MO LOCATION, PA REPORT PG3	ONITORINO ATERSON 975, 2017	GROUP			
#	TEST PIT LOCATION, CURRENT INVESTIGATION					
¢	BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION					

MPG

ΝZ

DJG

Approved by:

Dwg. No.:

Revision No.:

PG4258-1

PG4258-1

2



PERMISSIBLE GRADE RAISE:

UP TO 2.0m

LEGEND:

¢	BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
₽	TEST PIT LOCATION, CURRENT INVESTIGATION
¢	SENTINEL MONITORING WELL LOCATION, PATERSON GROUP REPORT PG3975, 2017
₽	TEST PIT LOCATION, PATERSON GROUP REPORT PG2878, 2013
•	TEST PIT LOCATION, PATERSON GROUP REPORT PG1823, 2009

- \boxtimes TEST PIT LOCATION, PATERSON GROUP REPORT PG1716, 2008
- 83.20 GROUND SURFACE ELEVATION (m)
- GROUNDWATER OBSERVATIONS (m) (82.25)
- BEDROCK SURFACE ELEVATION (m) [81.7]

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY NOVATECH ENGINEERING CONSULTANTS LTD. SCALE: 1:4000

							1
	/	/					
0		50	10	0 15	50 20	00 25	.0m

	Scale:		Date:
		1:4000	05/2019
	Drawn by:		Report No.:
		JV	PG4258-2
ONTARIO	Checked by:		Dwg. No.:
		DJG	DC1259 2
	Approved by:		PG4250-2
		DJG	Revision No.: 2