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Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

Building Science

Noise and Vibration Studies

Geotechnical Investigation
Proposed Development
240-270 Lamarche and 3484 Innes Road
Ottawa, Ontario

Prepared For

Canadian Rental Development Services Inc.

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

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

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Canadian Rental Development Services Inc. to conduct a geotechnical investigation for the proposed development to be located at 240-270 Lamarche Avenue and 3484 Innes Road, in the City of Ottawa, Ontario (Refer to Figure 1 - Key Plan in Appendix 2)

The objectives of the current desktop review were:

☐ to determine the subsurface soil and groundwater conditions based on test holes,

☐ to provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Based on the available drawings, it is understood that the southern portion of the proposed development will consist of three (3) multi-storey residential buildings, having 6 to 7 floors, and sharing two (2) underground parking levels. Associated access lanes, at-grade parking and hardscaped areas, and walkways are also anticipated as part of the proposed development. The central east and northern portions of the site will be developed at a later stage. It is further anticipated that the site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Program

The field program for the current geotechnical investigation was carried out between December 14 and 17, 2021 and consisted of advancing a total of 13 boreholes to a maximum depth of 11.8 m below existing ground surface, within the southern portion of the site. The test hole locations were determined by the client, taking into consideration underground utilities and site features. Previous geotechnical investigations were completed by Paterson and by others within the subject site in 2018. At that time, 4 boreholes and 55 probe holes were advanced to a maximum depth of 8.63 m or refusal over bedrock surface. The test hole locations are shown on Drawing PG4488-1 - Test Hole Location Plan included in Appendix 2.

The test holes were completed using a low clearance drill rig operated by a two- person crew. The probe holes were completed using a track mounted air-track drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of drilling to the required depth at the selected location and sampling the overburden.

3.2 Field Survey

The test hole locations for the current investigation were selected by the client, taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision handheld GPS and referenced to a geodetic datum. The location of the boreholes and the ground surface elevation at each borehole location are presented on Drawing PG4488-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Review

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The majority of the subject is currently vacant and grass covered. The ground surface across the subject site is generally flat with a slight downward slope toward the south and east. The east portion of the site was observed to be approximately at grade with Avenue de Lamarche. The north portion of the site is occupied by a commercial development.

The subject site is border by Innes Road to the north, Lamarche Avenue followed by a vacant lot to the east, ungoing residential development to the south, and by commercial and residential developments to the west.

4.2 Subsurface Conditions

Overburden (North Portion)

Generally, the subsurface profile at the test hole locations along the north portion of the site consists of a fill layer of brown sandy silt to clayey silt with rootlets, overlying a very stiff brown-grey silty clay layer. Glacial till was encountered below the above noted soils consisting of silty sand with gravel, cobbles and boulders. Practical refusal to augering was encountered below the glacial till layer in all borehole locations. It should be noted that bedrock was encountered between 0.9 to 5 m below existing grade within the north portion of the site.

Overburden (South Portion)

Generally, the soil profile at the test hole locations consists of topsoil followed by a very stiff to stiff brown silty clay crust overlying a firm to stiff grey silty clay layer. A layer of compact to very dense glacial till was encountered below the above noted layers at the location of boreholes BH 1-21, BH 2-21, BH 3-21, BH 4-21, BH 8-21, BH 11-21, and BH 12-21. The glacial till deposit was found to consist of compact to dense grey silty clay with sand, gravel and cobbles. Practical refusal to augering was encountered in BH 9-21 through BH 13-21 at approximate depths between 6.0 and 7.4 m below existing ground surface. Bedrock was cored in boreholes BH 1-21 through BH 8-21 at approximate depths between 4.5 and 10.0 m below existing ground surface, with an average RQD value ranging from 45 to 100%. This is indicative of a poor to excellent quality bedrock within the footprint of the proposed building.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at borehole location.

Bedrock

Based on available geological mapping, the local bedrock consists of limestone and shale of the Bobcaygeon and Lindsay formations and the overburden thickness varies between 0 to 10 m.

4.3 Groundwater

The groundwater levels were recorded within the monitoring wells and piezometers installed within the boreholes during the current investigation on December 24, 2021. The recorded groundwater levels are presented in Table 1 below and are further noted on the Soil Profile and Test Data sheets in Appendix 1.

Table 1 - Measured Groundwater Levels – Current Investigation

Test Hole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
BH 1-21	88.59	1.01	87.58	December 24, 2021
BH 2-21	88.56	0.42	88.14	
BH 3-21	88.81	0.91	87.90	
BH 4-21	88.84	1.24	87.60	
BH 5-21	88.54	1.75	86.79	
BH 6-21	88.55	1.85	86.70	
BH 7-21	88.52	2.06	86.46	
BH 8-21	88.40	1.60	86.80	
BH 9-21	88.81	0.54	88.27	
BH 10-21	88.50	0.76	87.74	
BH 11-21	88.77	1.56	87.21	
BH 12-21	88.46	1.38	87.08	
BH 13-21	88.62	1.82	86.80	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS and are referenced to a geodetic datum.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered adequate for the proposed development. The proposed multi-storey buildings can be founded over conventional style shallow foundations placed on undisturbed, stiff to very stiff silty clay, comact to dense glacial till or a clean, surface sounded bedrock bearing surface. Buildings placed within the south portion of the subject site may require a series of near vertical, zero entry, concrete in-filled trenches extending to a clean, surface-sounded bedrock surface due to the depth of the clay deposit which may extend below design underside of footing level.

If buildings are founded directly over a clay deposit, a permissible grade raise restriction will be required. A preliminary permissible grade raise restriction of **2 m** is recommended for the south portion of the site.

Where bedrock removal is required, consideration should be given to hoe-ramming or controlled blasting. 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 blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations. The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

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

5.2 Site Grading and Preparation

Stripping Depth

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

Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where only small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

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

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

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

Excavation side slopes in sound bedrock can be excavated almost vertical side walls. A minimum 1 m horizontal ledge, should remain between the overburden excavation and the bedrock surface. The ledge will provide an area to allow for potential sloughing or a stable base for the overburden shoring system.

Vibration Considerations

Construction operations are 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: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to 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). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended be completed to minimize the risks of claims during or following the construction of the proposed buildings.

Bedrock Excavation Face Reinforcement

A bedrock stabilization system consisting of a combination of horizontal rock anchors and/or chain link fencing connected to the excavation face may be required at specific locations to prevent bedrock pop-outs. This system is usually considered where bedrock fractures are conducive to the failure of the bedrock surface. The requirement for horizontal rock anchors will be evaluated during the excavation operations.

Fill Placement

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. Non- specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

If excavated rock is to be used as fill, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 300 mm. This material should be used structurally only to build up the subgrade for pavements. Where the fill is open-graded, a blinding layer of finer granular fill and/or a woven geotextile may be required to prevent adjacent finer materials from migrating into the voids, with associated loss of ground and settlements. This can be assessed at the time of construction.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Foundation)

Bedrock Medium

Footings placed on a clean, surface sounded bedrock surface can be designed using a bearing resistance value at ULS of **2,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS. Alternatively, footings placed over zero entry, near vertical trenches extending to bedrock and in-filled with lean concrete (15 MPa) to underside of footing level can be designed using the values provided above. It is recommended that the trench sidewalls extend at least 300 mm beyond the outside face of the footings.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Footings bearing on surface sounded bedrock and designed using the above noted bearing resistance values will be subjected to negligible post-construction total and differential settlements.

Overburden

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

Footings placed on an undisturbed, compact to dense glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and at ULS of **225 kPa**. A geotechnical resistance factor of 0.5 was incorporated into the above noted bearing resistance values at ULS.

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

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to an undisturbed soil bearing surface above the groundwater table when a plane extending horizontally and vertically from the bottom edge of the footing at a minimum of 1.5H:1V, passing 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.

Bedrock/Soil Transition

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

Lean Concrete Filled Trenches

Where bedrock is encountered below the design underside of footing elevation, consideration should be given to excavating vertical trenches to expose the underlying bedrock surface and backfilling with lean concrete (**15 MPa** 28-day compressive strength). Typically, the excavation sidewalls will be used as the form to support the concrete. The additional width of the concrete poured against an undisturbed trench sidewall will suffice in providing a direct transfer of the footing load to the underlying bedrock.

The effectiveness of this operation will depend on the ability of maintaining vertical trenches until the lean concrete can be poured. It is suggested that once the bottom of the excavation is exposed, an assessment should be completed to determine the water infiltration and stability of the excavation sidewalls extending to the bedrock surface.

The trench excavation should be at least 150 mm wider than all sides of the footing at the base of the excavation. The excavation bottom should be relatively clean using the hydraulic shovel only (workers will not be permitted in the excavation below a 1.5 m depth). Once approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation.

Footings placed on lean concrete filled trenches extending to the bedrock surface can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **2,000 kPa**.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations to be constructed within the subject site. A higher seismic site classification such as Class A or B can be used for the subject site provided a site specific shear wave velocity test be completed. The soils underlying the proposed shallow foundations 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

The basement area for the proposed project will be mostly parking and the recommended pavement structure noted in Subsection 5.7 will be applicable. However, if storage or other uses of the lower level where a concrete floor slab will be constructed, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone. The upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone for slab on grade construction. All backfill material within the footprint of the proposed building(s) should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD. Alternatively, where the depth of in-filling is greater than 600 mm, blast rock with a maximum particle size no greater than 300 mm diameter can be used below the floor slab. The blast rock should be placed in maximum 300 mm loose lifts and compacted using vibratory compaction equipment making several passes. The compaction efforts should be completed under dry conditions and above freezing temperatures and be approved by Paterson personnel at the time of construction.

In consideration of the groundwater conditions encountered at the time of the current and previous fieldwork, a subfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear stone under the lower basement floor (discussed in Subsection 6.1).

5.6 Basement Walls

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structures. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3. The applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}). The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45\text{-}a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5 \cdot K_o \cdot \gamma \cdot H^2$, where K_o = 0.5 for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Structure

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

Table 2 - Recommended Flexible Pavement Structure - Parking Level

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, OPSS Granular B Type II material placed over in situ soil or fill	

Table 3 - Recommended Flexible Pavement Structure - Access Lanes and Heavy Truck Parking Areas

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

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

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

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

A perimeter foundation drainage system is recommended to be provided for the proposed structures. The composite drainage system (such as Miradrain G100N, Delta Drain 6000 or an approved equivalent) is recommended to extend to the footing level. Sleeves, 150 mm diameter, at 3 m centres are recommended to be placed in the footing or at the foundation wall/footing interface for blind sided pours to allow the infiltration of water to flow to the interior perimeter drainage pipe. The perimeter drainage pipe and underfloor drainage system should direct water to sump pit(s) within the lower basement area.

Where the underground parking structure is located below the long-term groundwater level, a waterproofing membrane will be required. Further details regarding waterproofing and foundation drainage can be provided once the detailed plans are received.

Underfloor Drainage

Underfloor drainage is recommend to control water infiltration due to groundwater infiltration at the proposed founding elevation. For design purposes, Paterson recommends 150 mm diameter perforated pipes be placed between each parking bay. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

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

6.2 Protection Against Frost Action

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

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

The footings located along parking garage entrance may require protection against frost action depending on the founding depth. Unheated structures, such as access ramps to underground parking, may be required to be insulated against the deleterious effects of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation should be provided.

6.3 Excavation Side Slopes

The side slopes of excavations in the 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). Where space restrictions exist, or to reduce the trench width, the excavation can be carried out within the confines of a fully braced steel trench box.

Unsupported Side Slopes

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 subsurface soil 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 maintain safe working distance from the excavation sides.

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

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

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements designed by a structural engineer specializing in those works will depend on the depth of the excavation, the proximity of the adjacent structures and the elevation of the adjacent building foundations and underground services. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer.

Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's structural design prior to implementation.

The temporary system could consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. These systems could be cantilevered, anchored or braced. Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. The shoring system is recommended to be adequately supported to resist toe failure and inspected to ensure that the sheet piles extend well below the excavation base. It should be noted if consideration is being given to utilizing a raker style support for the shoring system that lateral movements can occur and the structural engineer should ensure that the design selected minimizes these movements to tolerable levels. The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 4 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Dry Unit Weight (γ), kN/m^3	20
Effective Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be calculated full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

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

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

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

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.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches. Periodic inspection of the clay seal placement work should be completed by Paterson personnel during servicing installation work.

6.5 Groundwater Control

Groundwater Control for Building Construction

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

Permit to Take Water

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Long-term Groundwater Control

Any groundwater encountered along the buildings' perimeter or sub-slab drainage system will be directed to the proposed buildings' cistern/sump pit. Provided the proposed groundwater infiltration control system is properly implemented and approved by the geotechnical consultant at the time of construction, the expected long-term groundwater flow should be low (i.e. less than 25,000 L/day/building) with peak periods noted after rain events. A more accurate estimate can be provided at the time of construction, once groundwater infiltration levels are observed. The long-term groundwater flow is anticipated to be controllable using conventional open sumps.

Impacts on Neighboring Structures

Based on observations, the groundwater level is anticipated at a 2.0 to 3.0 m depth. A local groundwater lowering is anticipated under short-term conditions due to construction of the proposed buildings. The extent of any significant groundwater lowering should occur within a limited range of the subject site due to the minimal temporary groundwater lowering. No issues are expected, with respect to groundwater lowering, that would cause long term damage to adjacent structures surrounding the proposed buildings.

6.6 Winter Construction

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

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

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

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

6.7 Corrosion Potential and Sulphate

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

7.0 Recommendations

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

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

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

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

8.0 Statement of Limitations

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

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

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

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 Canadian Rental Development Services Inc. or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

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Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
February 15 2022
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Maha K. Saleh, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEET

SYMBOLS AND TERMS

TEST HOLE LOGS - BY OTHERS

ANALYTICAL TEST RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

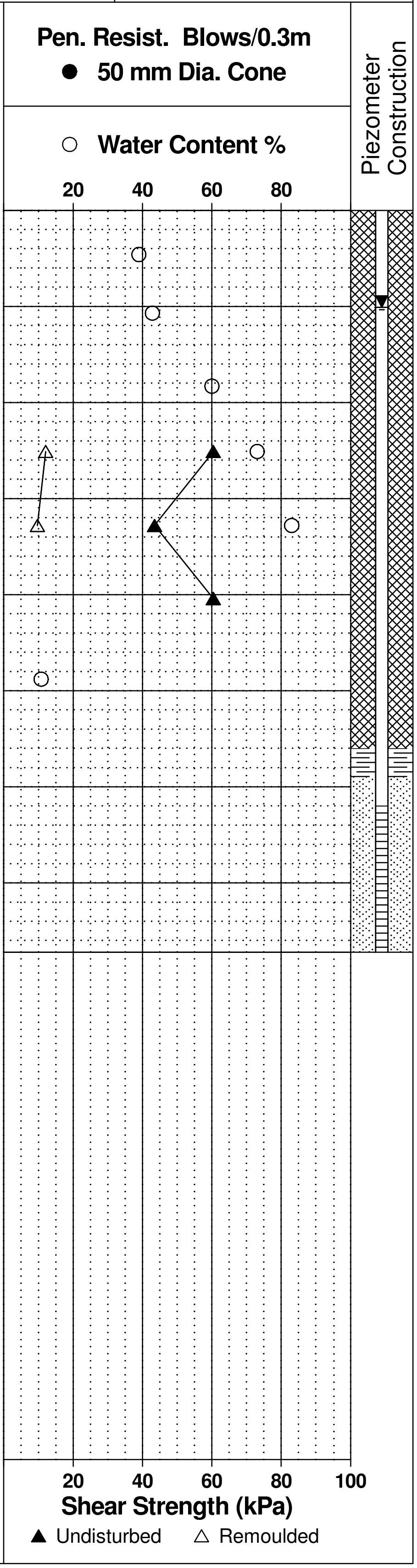
DATE December 14, 2021

FILE NO. PG6095

HOLE NO. BH 1-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.28					
Very stiff, brown **SILTY CLAY** - firm to stiff and grey by 2.9m depth 4.42		AU	1		
		SS	2	100	13
		SS	3	100	8
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 4.93		SS	4	67	50+
BEDROCK: Poor to good quality, grey limestone 7.72		RC	1	100	46
		RC	2	100	75
End of Borehole					
(GWL @ 1.01m - Dec. 24, 2021)					

DEPTH (m)	ELEV. (m)
0	88.59
1	87.59
2	86.59
3	85.59
4	84.59
5	83.59
6	82.59
7	81.59



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE December 14, 2021

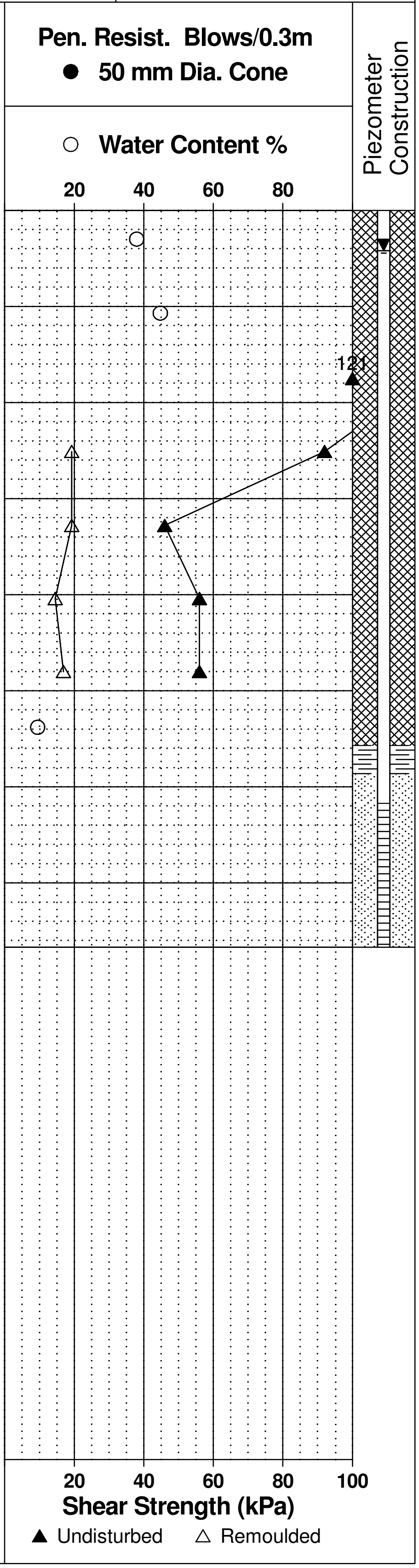
FILE NO. PG6095

HOLE NO. BH 2-21

SOIL DESCRIPTION	STRATA PLOT (depth, m)
GROUND SURFACE	
TOPSOIL	0.25
Very stiff to stiff, brown **SILTY CLAY** - firm to stiff and grey by 3.0m depth	5.18
GLACIAL TILL: Dense, grey silty sand with gravel, cobbles and boulders	5.49
BEDROCK: Good to excellent quality, grey limestone	7.67
End of Borehole (GWL @ 0.42m - Dec. 24, 2021)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	12
SS	3	0	50+
RC	1	100	88
RC	2	100	100

DEPTH (m)	ELEV. (m)
0	88.56
1	87.56
2	86.56
3	85.56
4	84.56
5	83.56
6	82.56
7	81.56



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG6095**

REMARKS

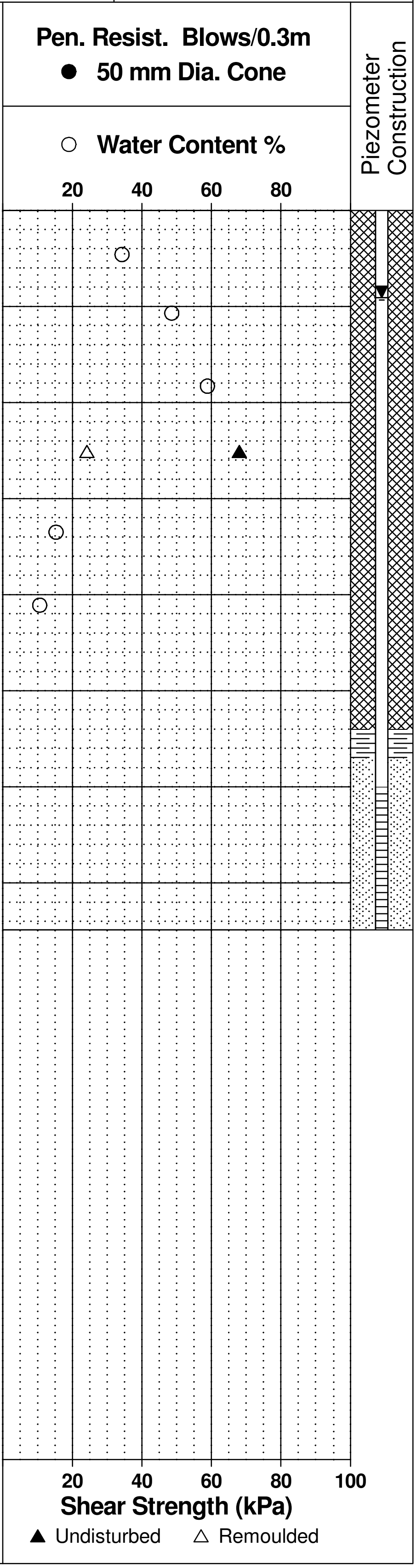
HOLE NO. **BH 3-21**

BORINGS BY CME-55 Low Clearance Drill **DATE** December 14, 2021

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.81
TOPSOIL 0.30						
	AU	1				
Very stiff to stiff, brown **SILTY CLAY**	SS	2	100	12	1	87.81
	SS	3	100	8	2	86.81
3.05					3	85.81
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders	SS	4	67	41		
	SS	5	42	22	4	84.81
4.47	SS	6	0	50+		
					5	83.81
BEDROCK: Excellent to fair quality, grey limestone	RC	1	100	93		
					6	82.81
	RC	2	100	67		
					7	81.81
7.49						

End of Borehole

(GWL @ 0.91m - Dec. 24, 2021)



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

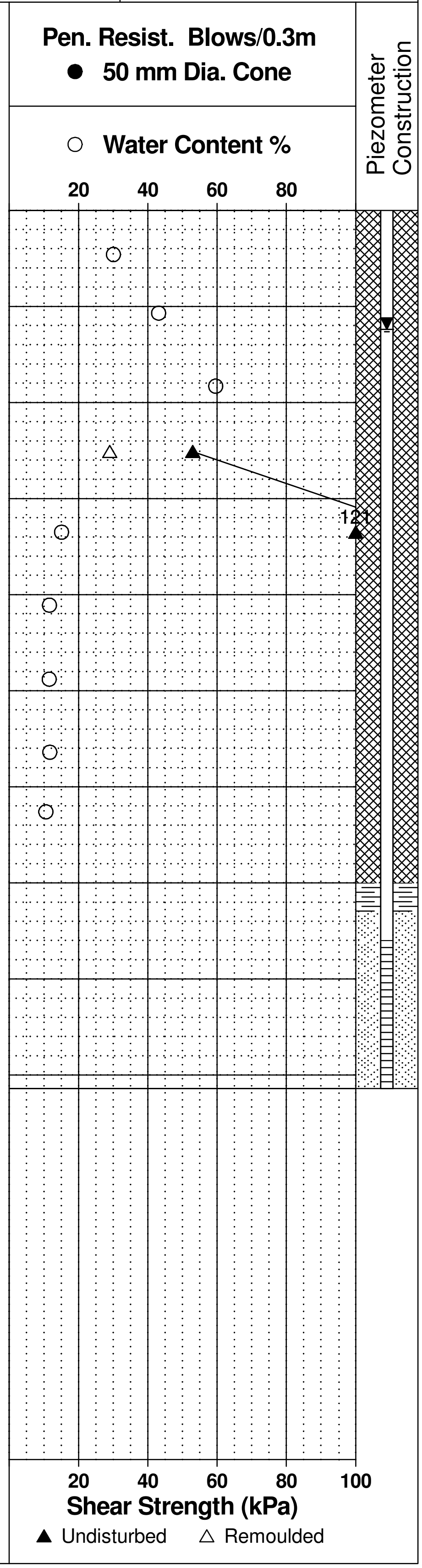
Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY CME-55 Low Clearance Drill
DATE December 14, 2021
FILE NO. PG6095
HOLE NO. BH 4-21

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.28
Stiff to very stiff, brown **SILTY CLAY** - grey by 2.9m depth	3.20
GLACIAL TILL: Grey silty clay with sand, trace gravel - clay content decreasing with depth	5.60
GLACIAL TILL: Compact, grey silty sand with clay, gravel, cobbles and boulders	6.43
BEDROCK: Fair to excellent quality, grey limestone - 12mm thick mud seam at 7.0m depth	9.14
End of Borehole (GWL @ 1.24m - Dec. 24, 2021)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	12
SS	3	100	6
SS	4		P
SS	5	25	6
SS	6	100	4
SS	7	75	12
SS	8	46	50+
RC	1	100	56
RC	2	100	100

DEPTH (m)	ELEV. (m)
0	88.84
1	87.84
2	86.84
3	85.84
4	84.84
5	83.84
6	82.84
7	81.84
8	80.84
9	79.84



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

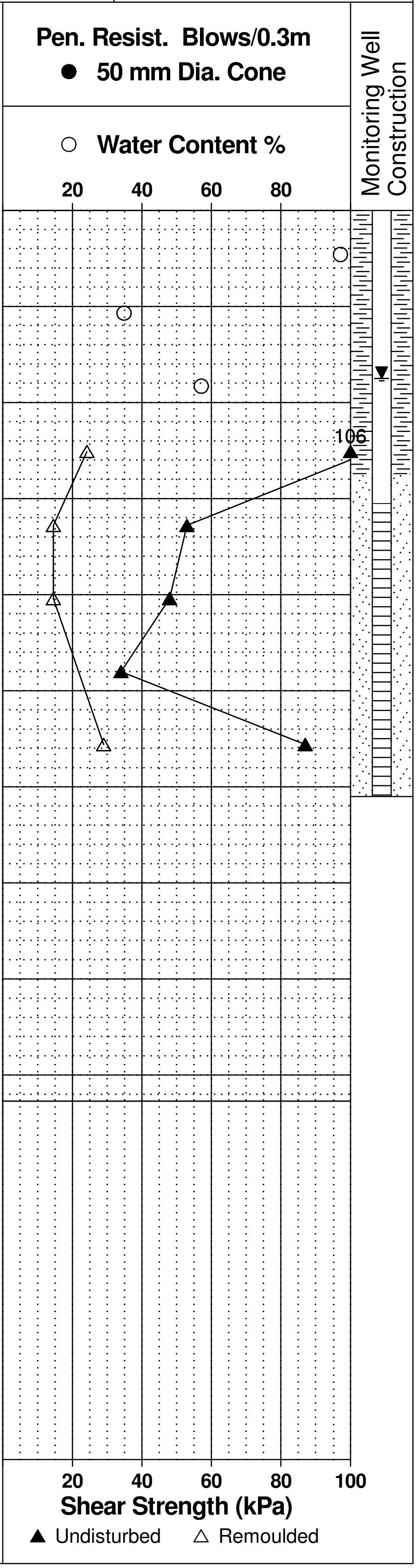
BORINGS BY CME-55 Low Clearance Drill

DATE December 15, 2021

FILE NO. PG6095

HOLE NO. BH 5-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.54
TOPSOIL 0.25						
	AU	1				
	SS	2	100	10	1	87.54
	SS	3	100	8	2	86.54
Very stiff, brown **SILTY CLAY** - stiff to firm and grey by 2.9m depth					3	85.54
					4	84.54
					5	83.54
6.22	SS	4	0	50+	6	82.54
BEDROCK: Poor to good quality, grey limestone	RC	1	100	32	7	81.54
					8	80.54
	RC	2	100	75	9	79.54
9.27						
End of Borehole (GWL @ 1.75m - Dec. 24, 2021)						



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SOIL PROFILE AND TEST DATA

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Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

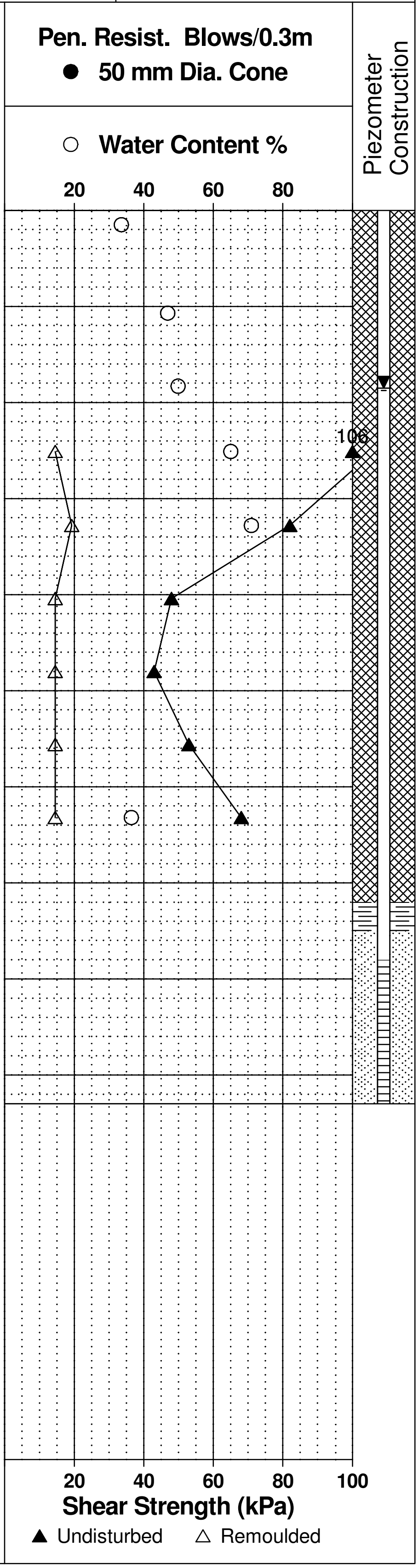
BORINGS BY CME-55 Low Clearance Drill

DATE December 15, 2021

FILE NO. PG6095

HOLE NO. BH 6-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.55
TOPSOIL 0.25		AU	1				
		SS	2	50	11	1	87.55
		SS	3	50	7	2	86.55
Very stiff to stiff, brown **SILTY CLAY**						3	85.55
- firm to stiff and grey by 3.5m depth						4	84.55
						5	83.55
						6	82.55
- trace sand and gravel by 6.4m depth 6.65							
		RC	1	100	100	7	81.55
BEDROCK: Excellent to poor quality, grey limestone						8	80.55
		RC	2	100	43	9	79.55
9.30							
End of Borehole (GWL @ 1.85m - Dec. 24, 2021)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

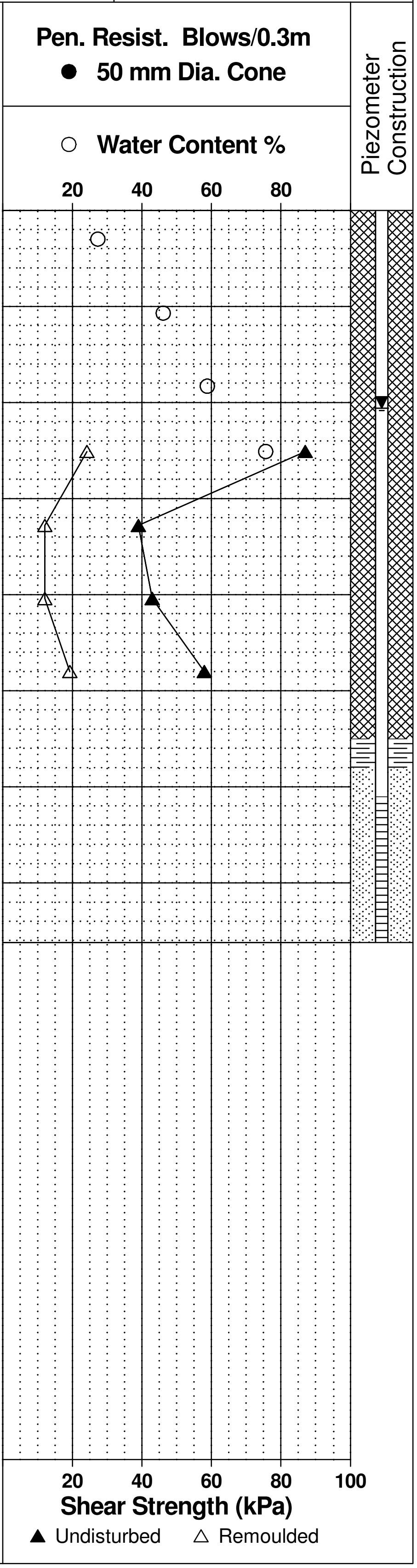
BORINGS BY CME-55 Low Clearance Drill

DATE December 15, 2021

FILE NO. PG6095

HOLE NO. BH 7-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.52
TOPSOIL 0.30	AU	1				
	SS	2	67	8	1	87.52
Very stiff to stiff, brown **SILTY CLAY**	SS	3	100	6	2	86.52
- firm to stiff and grey by 2.9m depth					3	85.52
					4	84.52
5.33					5	83.52
BEDROCK: Good to excellent quality, grey limestone	RC	1	100	80	6	82.52
7.62	RC	2	100	100	7	81.52
End of Borehole (GWL @ 2.06m - Dec. 24, 2021)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

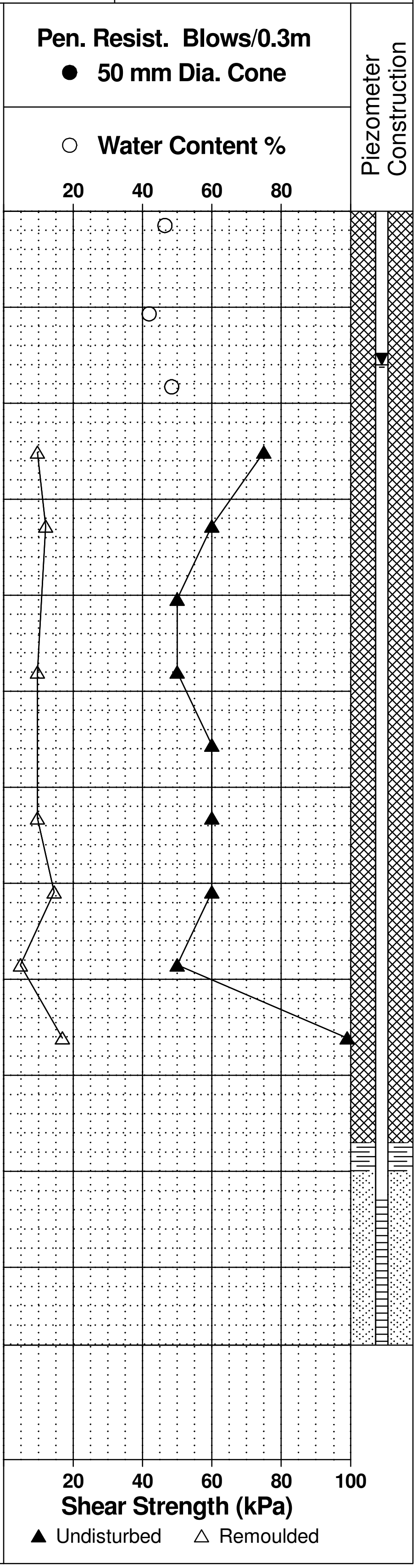
BORINGS BY CME-55 Low Clearance Drill

DATE December 15, 2021

FILE NO. PG6095

HOLE NO. BH 8-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.40
TOPSOIL 0.30		AU	1				
		SS	2	83	8	1	87.40
		SS	3	79	5	2	86.40
Stiff, brown **SILTY CLAY**							
- grey by 2.9m depth						3	85.40
						4	84.40
						5	83.40
						6	82.40
						7	81.40
						8	80.40
8.69							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders						9	79.40
10.03		RC	1	100	100	10	78.40
BEDROCK: Excellent to poor quality, grey limestone						11	77.40
11.81		RC	2	100	45		
End of Borehole							
(GWL @ 1.60m - Dec. 24, 2021)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

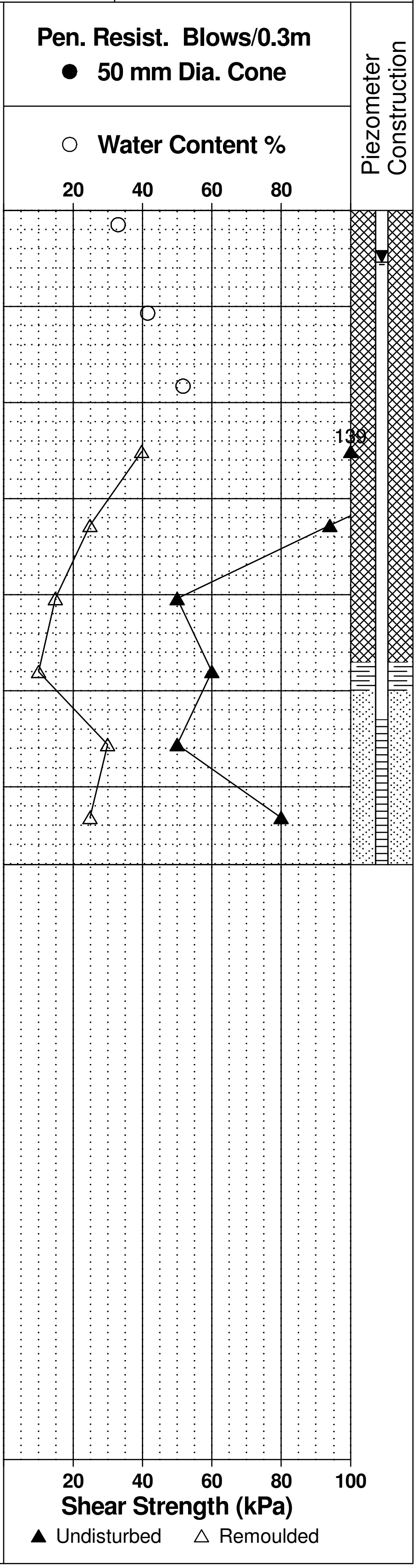
BORINGS BY CME-55 Low Clearance Drill

DATE December 16, 2021

FILE NO. PG6095

HOLE NO. BH 9-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.81
TOPSOIL 0.30	AU	1				
	SS	2	100	11	1	87.81
	SS	3	100	10	2	86.81
Very stiff to stiff, brown **SILTY CLAY**					3	85.81
- grey by 3.7m depth					4	84.81
					5	83.81
					6	82.81
6.81						
End of Borehole Practical refusal to augering at 6.81m depth (GWL @ 0.54m - Dec. 24, 2021)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG6095

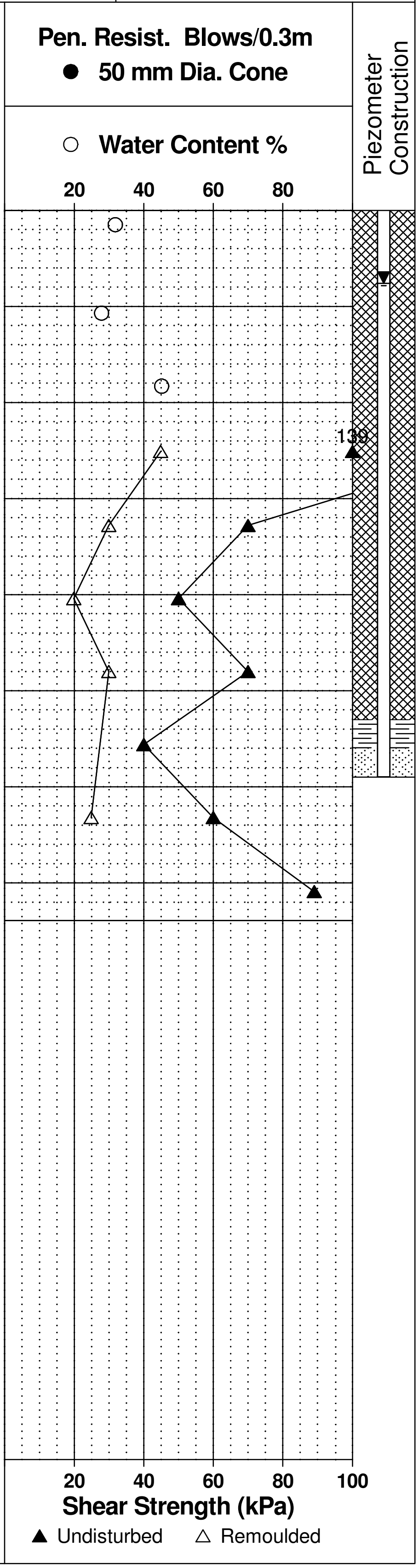
REMARKS

HOLE NO. BH10-21

BORINGS BY CME-55 Low Clearance Drill

DATE December 15, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.50
TOPSOIL 0.30		AU	1				
		SS	2	100	16	1	87.50
		SS	3	100	15		
						2	86.50
Very stiff to stiff, brown **SILTYCLAY** - grey by 3.7m depth						3	85.50
						4	84.50
						5	83.50
						6	82.50
7.39						7	81.50
End of Borehole Practical refusal to augering at 7.39m depth (GWL @ 0.76m - Dec. 24, 2021)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE December 16, 2021

FILE NO. PG6095

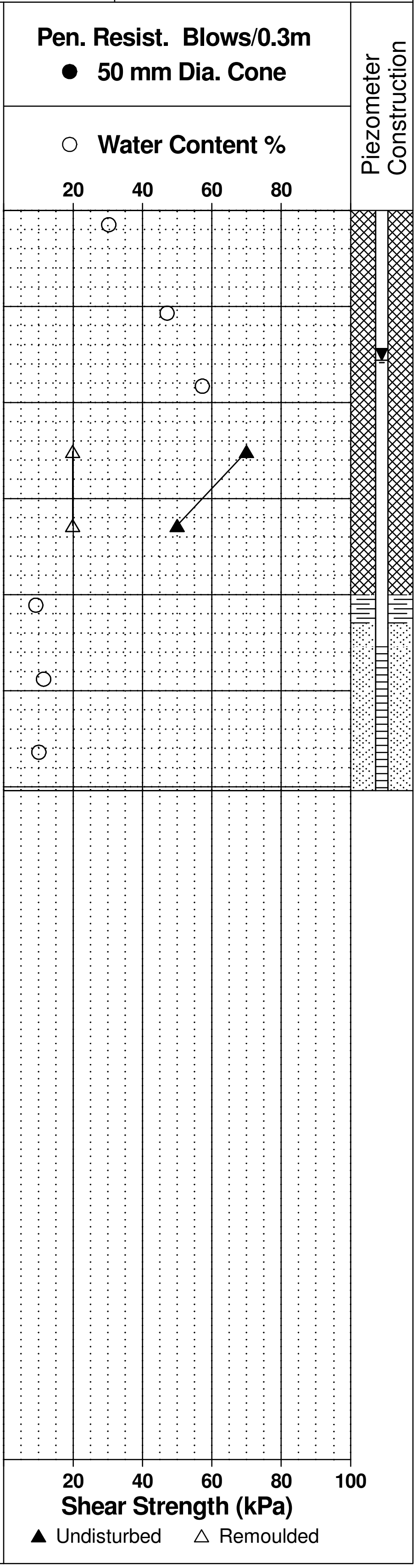
HOLE NO. BH11-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.77
TOPSOIL 0.25		AU	1				
Stiff, brown **SILTY CLAY**		SS	2	100	13	1	87.77
		SS	3	100	4	2	86.77
- firm and grey by 2.9m depth						3	85.77
3.66							
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders		SS	4	25	20	4	84.77
		SS	5	42	12	5	83.77
		SS	6	50	9		
6.04						6	82.77

End of Borehole

Practical refusal to augering at 6.04m depth

(GWL @ 1.56m - Dec. 24, 2021)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG6095**

REMARKS

HOLE NO. **BH12-21**

BORINGS BY CME-55 Low Clearance Drill

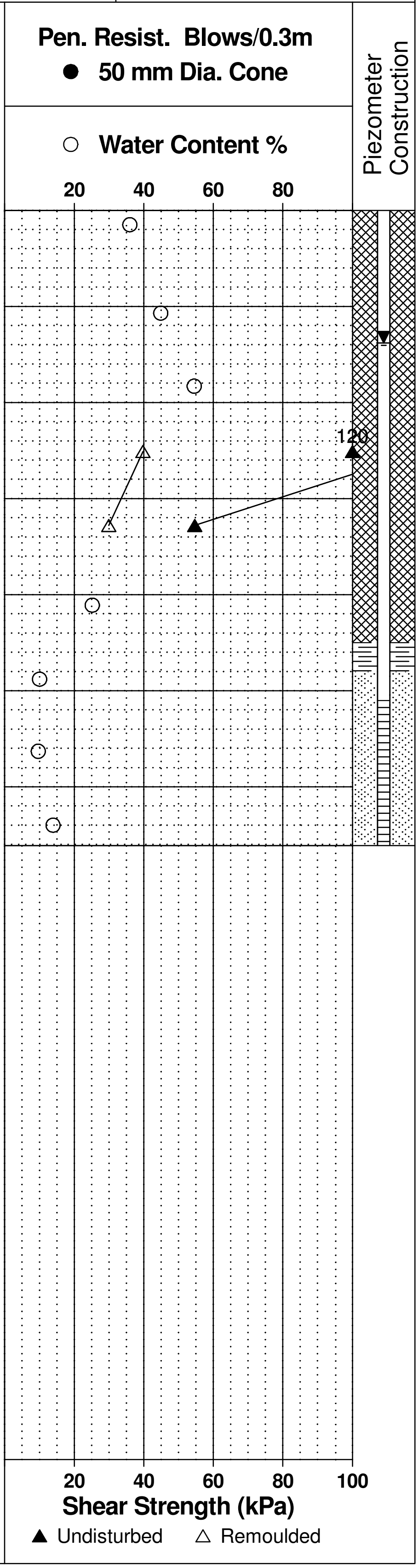
DATE December 16, 2021

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						
TOPSOIL 0.15	AU	1			0	88.46
	SS	2	100	18	1	87.46
Very stiff to stiff, brown **SILTY CLAY**	SS	3	100	8	2	86.46
- grey by 2.9m depth					3	85.46
4.11	SS	4	17	1	4	84.46
	SS	5	67	5	5	83.46
GLACIAL TILL: Stiff, grey silty clay with sand, gravel, cobbles and boulders	SS	6	42	5	6	82.46
6.61	SS	7		4		

End of Borehole

Practical refusal to augering at 6.61m depth

(GWL @ 1.38m - Dec. 24, 2021)



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - 270 LaMarche Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE December 17, 2021

FILE NO. PG6095

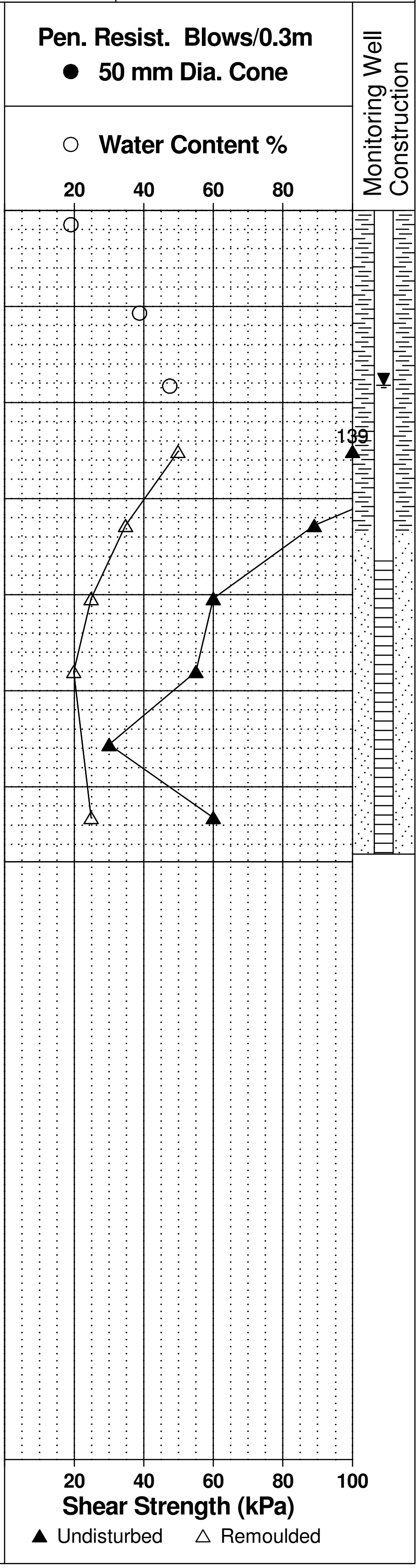
HOLE NO. BH13-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.62
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.7m depth - firm to stiff by 5.2m depth	▨	AU	1				
		SS	2	83	23	1	87.62
		SS	3	100	11	2	86.62
						3	85.62
						4	84.62
						5	83.62
						6	82.62
6.78							

End of Borehole

Practical refusal to augering at 6.78m depth

(GWL @ 1.82m - Dec. 24, 2021)



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS - Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))

TW - Thin wall tube or Shelby tube

PS - Piston sample

AU - Auger sample or bulk sample

WS - Wash sample

RC - Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic limit, % (water content above which soil behaves plastically)
PI - Plasticity index, % (difference between LL and PL)

Dxx - Grain size which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

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

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

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

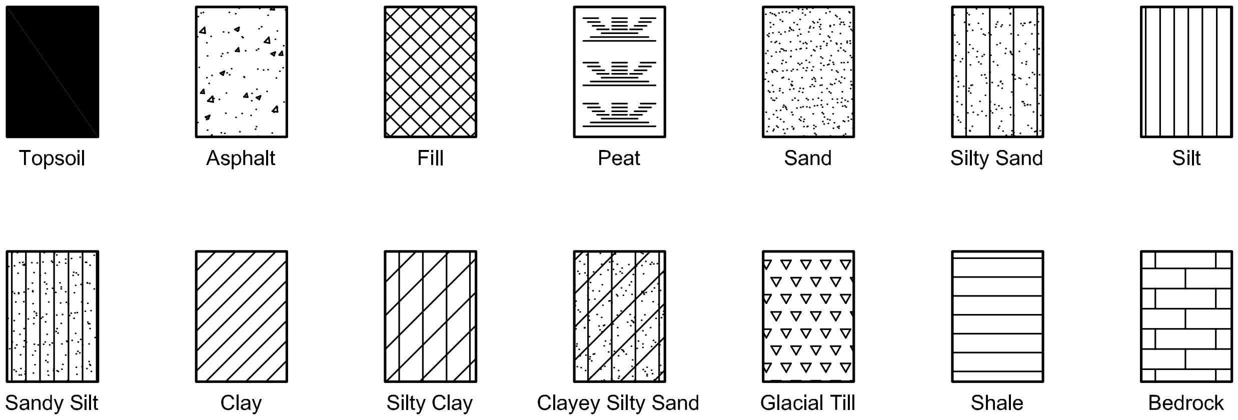
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

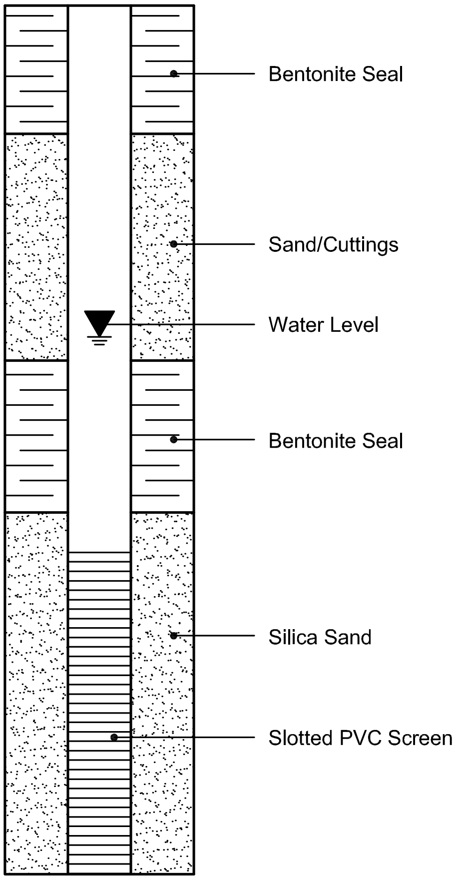
SYMBOLS AND TERMS (continued)

STRATA PLOT

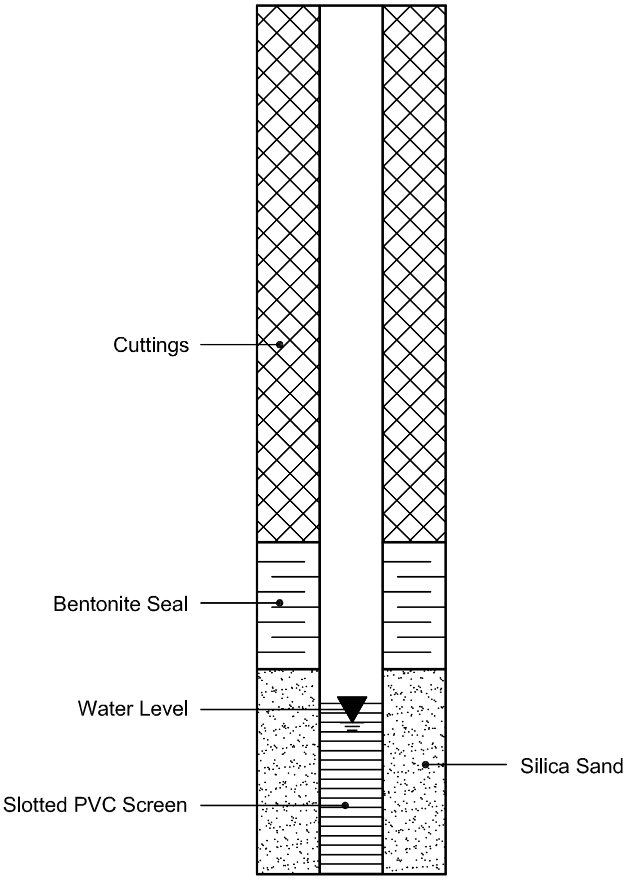


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PROJECT: 1660030

RECORD OF BOREHOLE: 16-1

SHEET 1 OF 1

LOCATION: N 5034598.0 ;E 381071.2

BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 / SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} / WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		90.95							
0	Power Auger 200 mm Diam. (Hollow Stem)	ASPHALTIC CONCRETE *(60 mm)*									
		FILL - (SW) gravelly SAND, angular; grey (PAVEMENT STRUCTURE)		0.06 90.68							
		ASPHALTIC CONCRETE *(50 mm)*									
		FILL - (SM) SILTY SAND, trace gravel and organics; brown to black; non-cohesive, moist, loose		0.33 89.88							
1		FILL - (SM/ML) SILTY SAND to sandy SILT, some gravel; brown; non-cohesive, moist, loose		1.07 89.43	1	SS	9				
		(SM) gravelly SILTY SAND; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist		1.52 89.12	2	SS	>50				
2		End of Borehole Auger Refusal		1.83							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-2

SHEET 1 OF 1

LOCATION: N 5034649.4 ;E 381258.4

BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m				
		GROUND SURFACE		90.23							
0	Power Auger 200 mm Diam. (HS)	FILL - (SP) gravelly SAND, some non-plastic fines; grey brown; non-cohesive, moist, compact	▨	0.00							
		FILL - (SM/SC) SILTY SAND to CLAYEY SAND, trace gravel; grey brown; non-cohesive, moist	▨	89.93 0.30	1	SS	26				
				89.32	2	SS	>50				
1		End of Borehole Auger Refusal		0.91							
2											
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DWM
CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-2A

SHEET 1 OF 1

LOCATION: 1.8 m East of BH 16-2

BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m				
		GROUND SURFACE		90.23							
0	Power Auger 200 mm Diam. (Hollow Stem)	For Stratigraphy see RECORD OF BOREHOLE 16-2		0.00							
1		End of Borehole Auger Refusal		89.26 0.97							
2											
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: DWM

CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-3

SHEET 1 OF 1

LOCATION: N 5034442.3 ;E 381033.5

BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger 200 mm Diam. (Hollow Stem)

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	88.98
FILL/TOPSOIL - (SM) SILTY SAND; brown	0.00
FILL - (ML) CLAYEY SILT, some sand; brown, contains roots (reworked native soil); cohesive, w>PL	0.15
(CI/CH) SILTY CLAY to CLAY, trace sand; brown (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff	88.37 0.61
(CI/CH) SILTY CLAY to CLAY; grey with brown mottling, contains occasional white shell; cohesive, w>PL, soft to firm	85.93 3.05
(ML) sandy CLAYEY SILT, trace gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet	83.95 5.03
End of Borehole Auger Refusal	83.65 5.33

SAMPLES NUMBER	TYPE	BLOWS/0.30m
1	SS	2
2	SS	8
3	SS	4
4	SS	PH
5	SS	WH

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

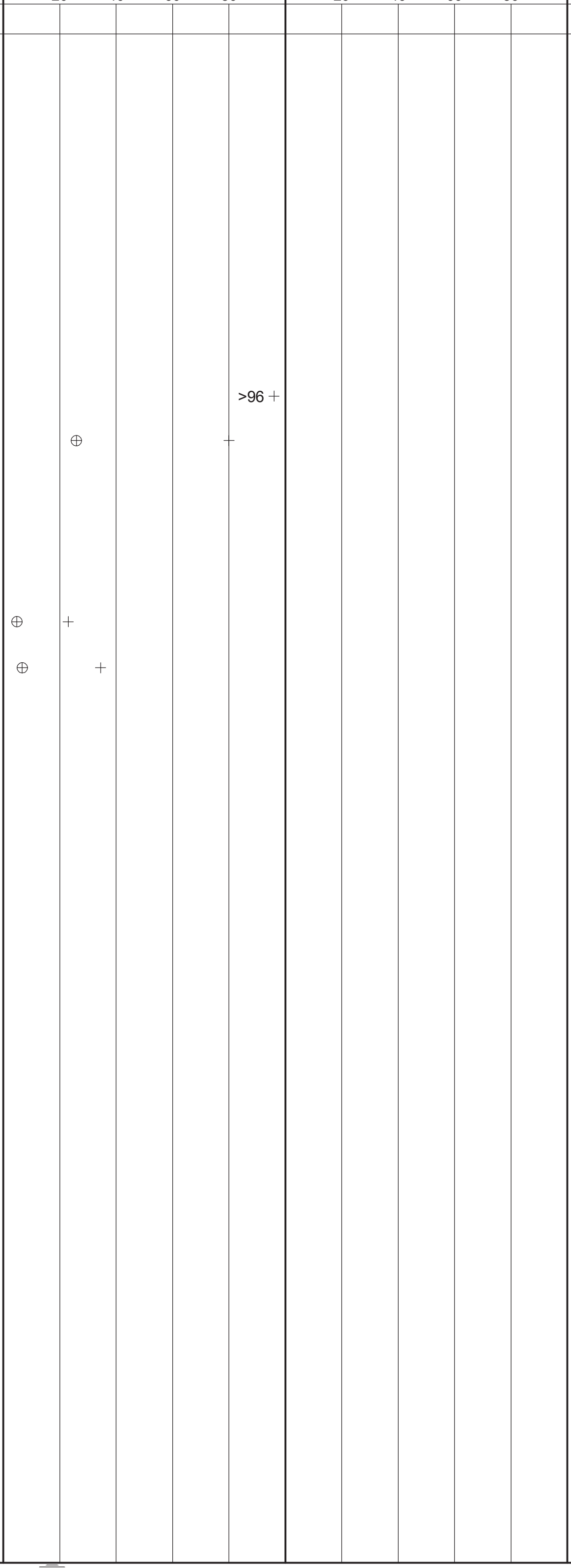
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE

1 : 50

LOGGED: DWM

CHECKED: WAM

MIS-BHS 001 1660030-GEOTECH.GPJ GAL-MIS.GDT 12/16/16 JEM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-4

SHEET 1 OF 1

LOCATION: N 5034496.5 ;E 381166.8

BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	90.14
FILL/TOPSOIL - (ML) sandy SILT; brown	0.00
FILL - (SM) SILTY SAND; brown (reworked native soil); non-cohesive, moist, very loose	0.12
(SM/ML) SILTY SAND to sandy SILT, some gravel to gravelly; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, loose to very dense - grey at 3.0 m depth	89.23 0.91
End of Borehole Auger Refusal	86.05 4.09

SAMPLES NUMBER	TYPE	BLOWS/0.30m
1	SS	3
2	SS	32
3	SS	20
4	SS	7
5	SS	17
6	SS	>50

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

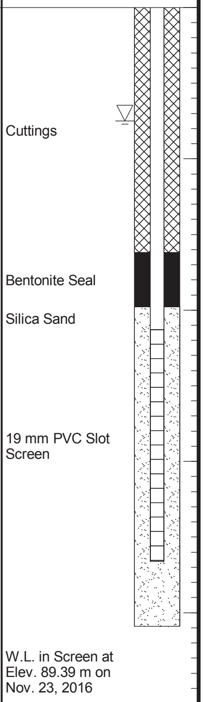
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ├──○W──┤ Wl : 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



W.L. in Screen at Elev. 89.39 m on Nov. 23, 2016

MIS-BHS 001 1660030-GEOTECH.GPJ GAL-MIS.GDT 12/16/16 JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-5

SHEET 1 OF 1

LOCATION: N 5034535.9 ;E 381317.6

BORING DATE: November 10, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m				
		GROUND SURFACE		89.36							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL/TOPSOIL - (ML) sandy SILT; brown		0.00							
		FILL - (ML) CLAYEY SILT, trace sand; brown with red mottling, contains rootlets (reworked native soil); cohesive, w<PL		89.13 0.23	1	SS	5				
1		(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red mottling (WEATHERED CRUST); cohesive, w>PL, very stiff		88.75 0.61	2	SS	10				
2		(SM) SILTY SAND, some gravel; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, loose to very dense		87.53 1.83	3 4	SS SS	6 >50				
		End of Borehole Auger Refusal		86.82 2.54							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-6

SHEET 1 OF 1

LOCATION: N 5034371.8 ;E 381143.3

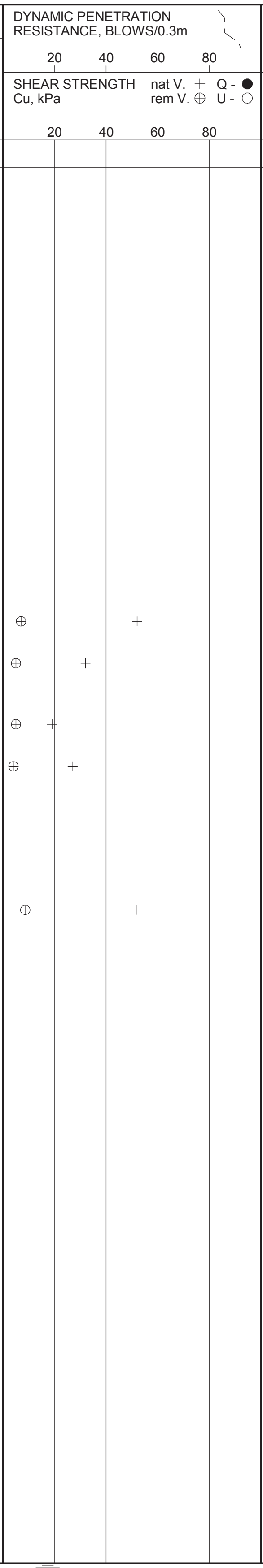
BORING DATE: November 1, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m
	GROUND SURFACE	88.72			
Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; brown	0.00			
	(CI/CH) SILTY CLAY to CLAY; grey brown with red mottling (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff	88.52 0.20	1	SS	7
			2	SS	6
			3	SS	5
			4	SS	1
	(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, soft to stiff	85.37 3.35			
			5	SS	PH
	End of Borehole Auger Refusal	83.19 5.53			



HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl: 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: WAM

PROJECT: 1660030

RECORD OF BOREHOLE: 16-7

SHEET 1 OF 1

LOCATION: N 5034408.7 ;E 381270.1

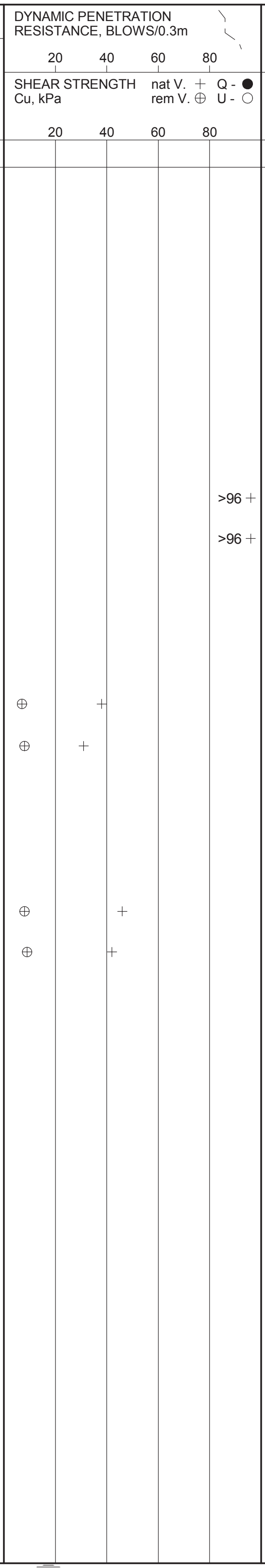
BORING DATE: November 2, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.30m
		GROUND SURFACE	88.71			
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; brown	0.00			
		(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red mottling (WEATHERED CRUST); cohesive, w>PL, very stiff	0.08	1	SS	8
1				2	SS	5
2				3	SS	5
3		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm	85.66 3.05	4	SS	PH
4						
5				5	SS	PH
6		(SM) gravelly SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, loose to very dense	82.46 6.25	6	SS	5
			81.70	7	SS	>50
7		End of Borehole Auger Refusal	7.01			
8						
9						
10						



HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl; 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

MIS-BHS 001 1660030-GEOTECH.GPJ GAL-MIS.GDT 12/16/16 JEM

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DWM
CHECKED: WAM

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33408

Report Date: 04-Jan-2022

Order Date: 23-Dec-2021

Project Description: PG6095

	Client ID:	BH9-21 SS2	-	-	-
	Sample Date:	16-Dec-21 09:00	-	-	-
	Sample ID:	2152466-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	71.8	-	-	-
General Inorganics					
pH	0.05 pH Units	7.41	-	-	-
Resistivity	0.10 Ohm.m	137	-	-	-
Anions					
Chloride	5 ug/g dry	<5	-	-	-
Sulphate	5 ug/g dry	9	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4488-1 - TEST HOLE LOCATION PLAN

DRAWING PG4488-2 - BEDROCK CONTOUR PLAN

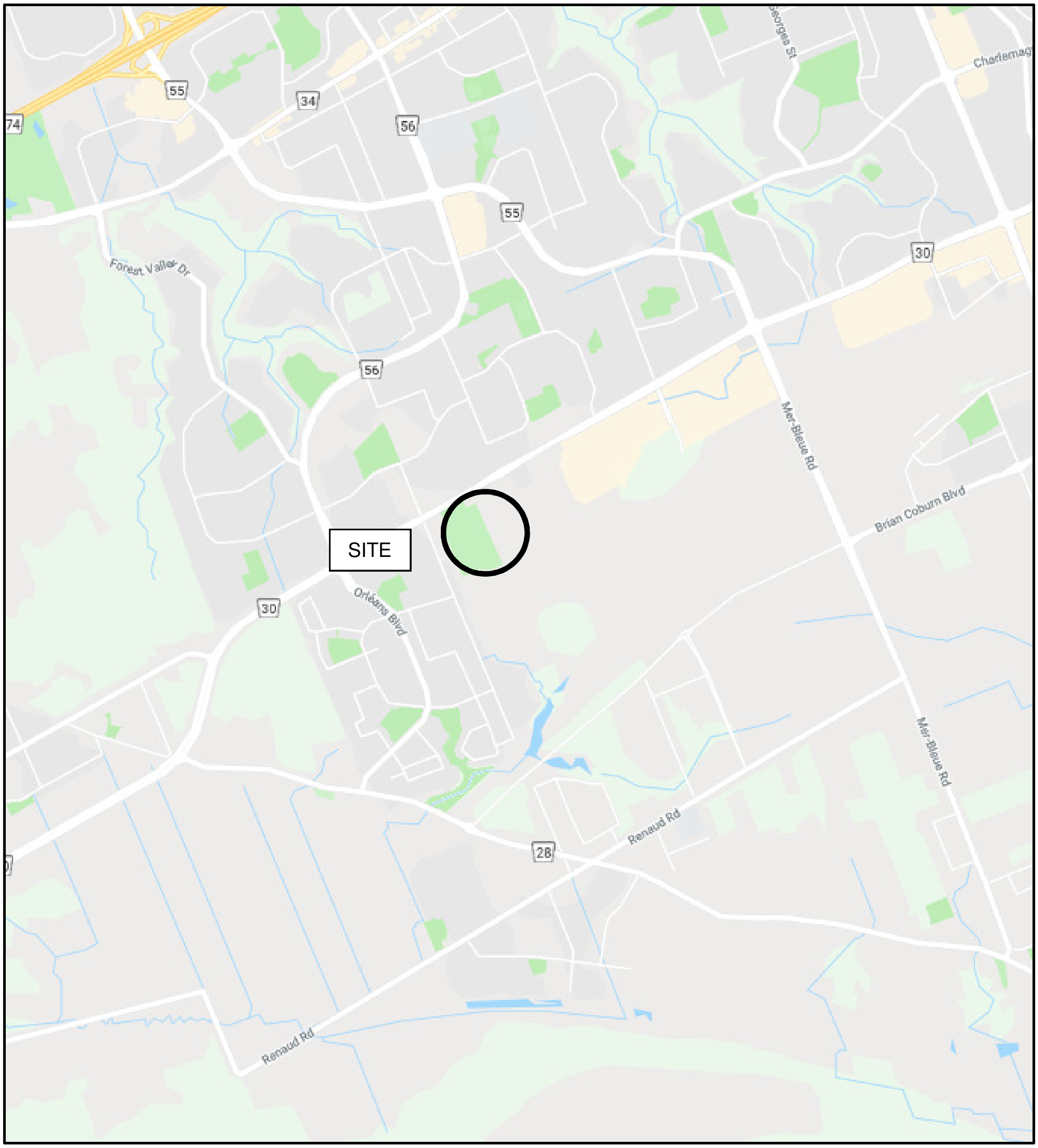


FIGURE 1

KEY PLAN

patersongroup

LEGEND:

⊕	BOREHOLE LOCATION (PATERSON GROUP REPORT PG6095-1, JANUARY 2022)
⊕	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT PG6095-1, JANUARY 2022)
⊕	PROBEHOLE LOCATION (2018)
⊕	APPROX. BOREHOLE LOCATION BY OTHERS (2018)
88.50	GROUND SURFACE ELEVATION (m)
[81.18]	INFERRED BEDROCK SURFACE ELEVATION (m)

PROBEHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

CONCEPTUAL PLAN PROVIDED BY NEUF ARCHITECT(E)S.

GROUND SURFACE ELEVATIONS AT 2021 BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
2	SUPPLEMENTAL BOREHOLES ADDED	28/01/2022	MS
1	UPDATED TO LATEST BASE PLAN	17/05/2019	FA

CANADIAN RENTAL DEVELOPMENT SERVICES
GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY RESIDENTIAL BUILDINGS
240-270 LAMARCHE AVENUE AND 3484 INNES ROAD
ORLEANS, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:1500
Date: 07/2018
Drawn by: RCG
Report No.: PG4488-1
Checked by: FA
Dwg. No.: PG4488-1
Approved by: DJG
Revision No.: 2

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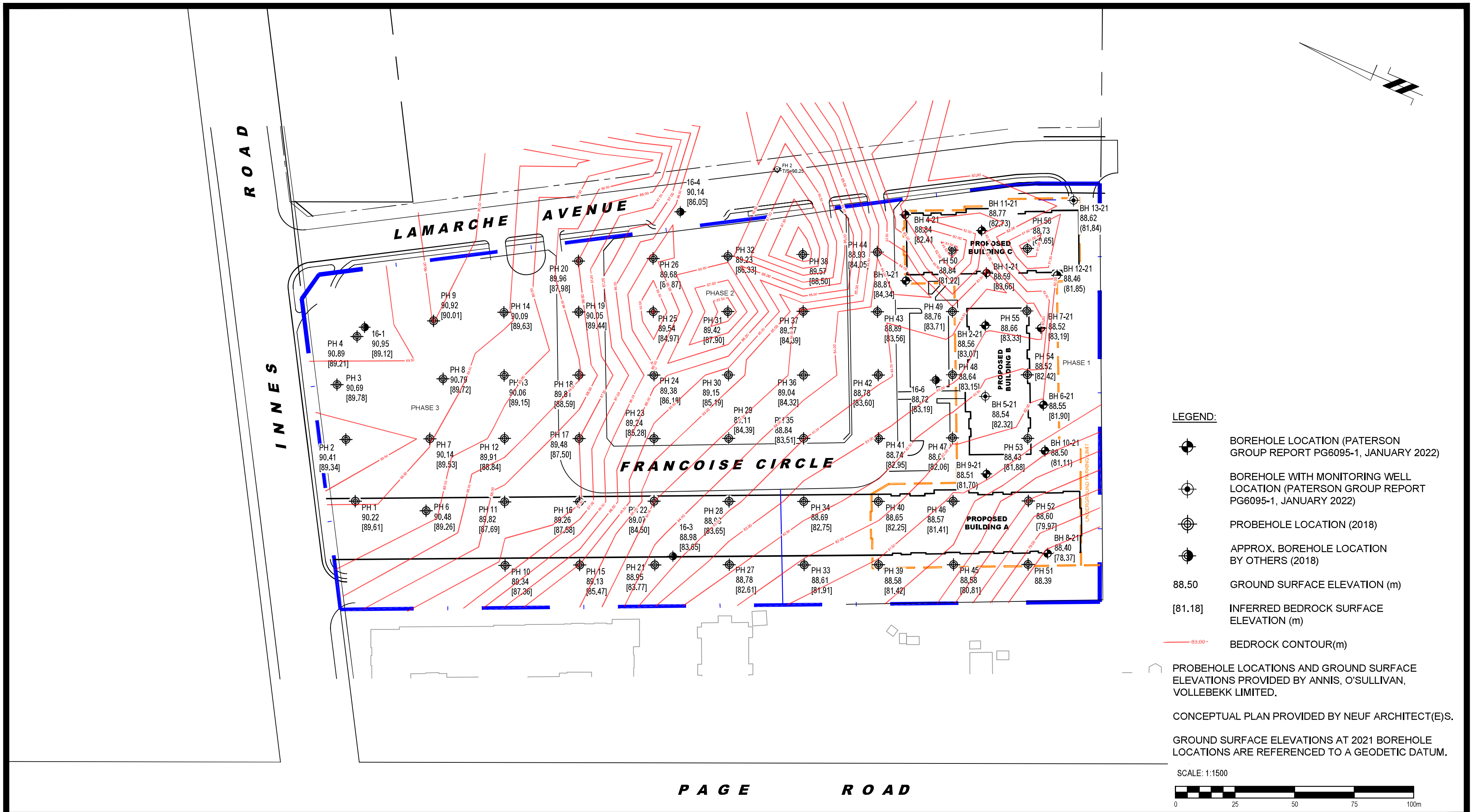

LEGEND:

⌖	BOREHOLE LOCATION (PATERSON GROUP REPORT PG6095-1, JANUARY 2022)
⌖	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT PG6095-1, JANUARY 2022)
⌖	PROBEHOLE LOCATION (2018)
⌖	APPROX. BOREHOLE LOCATION BY OTHERS (2018)
88.50	GROUND SURFACE ELEVATION (m)
[81.18]	INFERRED BEDROCK SURFACE ELEVATION (m)
83.00	BEDROCK CONTOUR(m)

PROBEHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

CONCEPTUAL PLAN PROVIDED BY NEUF ARCHITECT(E)S.

GROUND SURFACE ELEVATIONS AT 2021 BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1500

0 25 50 75 100m

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
2	SUPPLEMENTAL BOREHOLES ADDED	28/01/2022	MS
1	UPDATED TO LATEST BASE PLAN	17/05/2019	FA

CANADIAN RENTAL DEVELOPMENT SERVICES
GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY RESIDENTIAL BUILDINGS
240-270 LAMARCHE AVENUE AND 3484 INNES ROAD

ORLEANS, ONTARIO

Title:

BEDROCK CONTOUR PLAN

Scale: 1:1500	Date: 07/2018
Drawn by: RCG	Report No.: PG4488-1
Checked by: FA	Dwg. No.: PG4488-2
Approved by: DJG	Revision No.: 2

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