PATERSON GROUP

Geotechnical Investigation

Proposed Commercial Development

575 Dealership Drive
Ottawa, Ontario

Prepared for RF Ottawa Limited Partnership

Report PG6514-1 dated January 11, 2023

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by RF Ottawa Limited Partnership to prepare a geotechnical investigation report for the proposed commercial development to be located at 575 Dealership Drive, Ottawa, Ontario (refer to Drawing -1 - Key Plan presented in Appendix 2).

The objective of the geotechnical investigation was to:

- determine the subsoil and groundwater conditions at the sites by means of test holes
- provide geotechnical recommendations for the design of the proposed developments including construction considerations which may affect its design.

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

2.0 Proposed Development

Based on the available conceptual drawings, it is understood that **one** industrial building is being proposed at 575 Dealership Drive. It is anticipated that the building will be one story with slab on grade construction. Access lanes, driveways and parking garages, and landscaped areas are also anticipated as part of the proposed developments. It is further understood that the proposed commercial development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation at 575 Dealership Drive was carried out between December 1, 2022, and December 15, 2022. At that time, a total of **seventeen (17)** boreholes were advanced down to a maximum depth of 9.14m below existing ground surface. The test holes were placed in a manner to provide general coverage of the subject site taking into consideration site features and underground utilities. The test hole locations for the current investigation are presented on Drawing PG6514-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were put down using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The test hole procedures consisted of auguring to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were recovered during drilling from the auger flights or a 50 mm diameter split-spoon sampler. The split-spoon samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory for further examination and classification. The split-spoon samples and auger grab-samples recovered from the boreholes are shown as SS and AU, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

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

The thickness of the overburden was evaluated during the course of the investigation by a dynamic cone penetration test (DCPT). The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

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

Groundwater

Flexible polyethylene standpipes were installed in the boreholes to permit monitoring of the groundwater levels subsequent to the completion of the field investigations.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after the issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the subject site. 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 test holes is presented in Appendix 2.

3.3 Laboratory Review

Soil samples were recovered from the subject sites and visually examined in our laboratory to review the results of the field logging. two (2) samples were submitted for Atterberg Limits testing, one (1) sample for shrinkage limit testing, and one (1) sample for grain size distribution testing.

All test results are included in Appendix 1 and further discussed in Subsection 4.2 of the current report.

3.4 Analytical Testing

One soil sample was submitted for analytical testing from each site, to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures by others. 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 discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site on 575 Dealership Drive is currently undeveloped. The site slopes gradually upwards from east to west from an approximate geodetic elevation of 97 to 109 m an approximately 3 to 4 m high slope runs along the west property boundary down to a drainage ditch running along the Highway 416 northbound lane.

The subject site is bordered by Citigate Drive to the east, Highway 416 to the west, agricultural land to the north and south and commercial property to the east.

4.2 Subsurface Profile

Generally, the subsurface profile at the test hole locations consisted of a thin layer of topsoil underlain by a fill layer of silty sand to sandy silt with gravel, cobbles and boulders throughout most of the subject site. The fill throughout the eastern portion of the site was observed to be underlain by a very stiff deposit of silty clay at most of the borehole locations. Practical refusal to DCPT was encountered at the location of BH 1-22, BH 3A-22, BH 4-22, BH 5-22, BH 6-22, BH 7-22, BH 8-22, BH 9-22, BH 10-22, BH 11-22, BH 12-22, BH 13-22, BH 14-22, BH 15-22, BH 16-22 and BH 17-22 at depths ranging between 1.26 and 9.14m below existing ground surface.

The silty clay deposit was observed to be hard, **brown,** and underlain by a compact to very dense glacial till deposit. The fine matrix of the glacial till consisted of either a silty clay or silty sand with gravel, cobbles and boulders, throughout the east portions of the subject site. Additionally, a very stiff **grey** silty clay deposit was observed at the northwest side of the project at BH 6-22. the fine matrix of the glacial till was observed to consist of silty sand to sandy silt with gravel, cobbles and boulders.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Based on available geological mapping, the subject sites are located in an area where the bedrock consists of interbedded limestone and dolomite of the Gull River formation with an overburden drift thickness between 1 to 15 m.

Grain Size Distribution and Hydrometer Test

A sieve analysis was completed to classify selected soil sample according to the Unified Soil Classification System (USCS). The results are summarized in Table 1 and presented in Appendix 1.

Table 1 - Grain Size Distribution and Hydrometer Testing

Test Hole	Sample	Gravel (%)	Sand (%)	Silt and Clay (%)
BH 1-22	SS4	0	4.6	95.4

Atterberg Limit Tests

Two selected silty clay samples were submitted for Atterberg Limit testing. The test results indicate that both low and high plasticity silty clays are anticipated at the subject site. The results are summarized in Table 2 and presented in Appendix 1.

Table 2 - Summary of Atterberg Limits Test Results

Test Hole	Sample No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
BH 8-22	SS4	44	27	17
BH9-22	SS4	51	27	24

4.3 Groundwater

Groundwater levels were measured in the installed piezometers during the current investigations. The measured groundwater level (GWL) readings and groundwater infiltration observations are presented in Tables 3 below and are shown on the Soil Profile and Test Data sheets in Appendix 1.

Table 3 - Summary of Groundwater Level Readings				
Test Hole Number	**Ground Surface Elevation (m)**	**Groundwater Depth (m)**	**Groundwater Elevation (m)**	**Date**
BH 1-22	99.57	4.27	95.3	December 9, 2022
BH 2-22	103.68	4.58	99.1	
BH 3A-22	106.26	Dry	Dry	
BH 4-22	106.66	2.9	103.76	
BH 5-22	105.58	3.94	101.64	
BH 6-22	108.02	1.05	106.97	
BH7-22	104.82	2.17	102.65	
BH 8-22	102.11	4.25	97.86	
BH 9-22	100.87	Dry	Dry	
BH 10-22	97.12	3.53	93.59	
BH 11-22	97.75	2.45	95.3	
BH 12-22	98.85	2.65	96.2	
Note: Ground surface elevations at all test hole locations were surveyed by Paterson and are referenced to a geodetic datum.				

The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

It should be noted that surface water can become perched within a backfilled borehole, which can lead to higher than normal groundwater readings. Based on field observations, it is expected that the long-term groundwater level It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is anticipated that the proposed building will be founded on conventional shallow footings bearing on an undisturbed, compact to very dense glacial till, stiff to very stiff brown silty clay bearing surface, or on approved engineered fill pad placed upon an approved subgrade soil.

Due to the presence of silty clay within the eastern portion of the site, a permissible grade raise restriction will be required where the building and settlement sensitive structures are to be founded over the silty clay layer. Once the detailed grading plans are prepared for the subject site, Paterson should complete a review of the proposed grades to ensure they are acceptable from a geotechnical perspective.

Recommendations are provided herein for the re-use of the site generated fill material in consideration of the cut and fill operation that will be required to accommodate the proposed grades.

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

5.2 Site Grading and Preparation

Stripping Depth

The upper topsoil layer and any fill containing significant amounts of deleterious or organic materials should be stripped from under buildings' footprints. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Any soft areas should be removed and replaced in accordance with the following fill placement recommendations.

Fill Placement

It is anticipated that the site will require notable soil excavation within the west and central portions of the site and in-filling within the east portion of the site. Therefore, in-filling operations are anticipated to be completed using approved fill generated from the cut operations.

Boulders larger than 300 mm in their longest dimensions should be removed from the glacial till prior to being reused. All fill used for grading below settlement sensitive structures should be placed in loose lifts no greater than 300 mm thick and compacted using suitable heavy sheepsfoot or smooth drum vibratory compaction equipment as deemed appropriate. Fill placed beneath the building area should be compacted, **under dry conditions, and above freezing temperatures**, to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

If site excavated cobbles and boulders are to be used as fill to build up the subgrade for roadways or the bearing mediums, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 300 mm. Any crushed site-generated material greater than 300 mm in diameter should be segregated and hoe rammed into acceptable fragments. Where the fill is open-graded, a blinding layer of finer granular fill, such as OPSS Granular A, well-graded sand, crushed stone dust or a geotextile liner may be required to prevent adjacent finer materials from migrating into the voids, with associated loss of ground and settlements.

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids.

Placement of site-generated soil fill material during winter months increases the risk of placing frozen material which may result in poor-performing areas that may require sub-excavation of the material and subsequent reinstatement.

Alternatively, fill used for grading beneath the building areas could consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. Granular material should be tested and approved prior to delivery to the site. The fill should be placed in loose lifts of 300 mm thick or less and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath parking areas. 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 the SPMDD.

Footprint Bearing Medium Preparation

Consideration could be given to placing the proposed footings and floor slab over site-generated glacial till fill provided the placement of the fill is reviewed and approved by Paterson at the time of construction. The approved grade raise fill material should be proof rolled using suitable compaction equipment under dry conditions, above freezing temperatures, tested and approved by Paterson personnel. A minimum 300 mm thick granular pad, consisting of an OPSS Granular A crushed stone, compacted to 98% of its SPMDD is recommended to be placed at footing level over the approved grade raise fill subgrade. The sub-footing fill should be extended a minimum 300 mm horizontally beyond the footing face in all directions and throughout the lateral support zone of the footings.

5.3 Foundation Design

Strip footings, up to 2 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, very stiff to stiff brown silty clay bearing surface or on engineered fill pad over a very stiff to stiff brown silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **250 kPa**.

Conventional spread footings placed on an undisturbed, compact glacial till bearing surface can be designed using bearing resistance values at serviceability limit states (SLS) of **250 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **400 kPa**.

Footings placed directly on clean, surface-sounded bedrock, or on lean concrete filled trenches placed directly over clean, surface sounded bedrock, can be designed using a factored bearing resistance value at ULS value of **1,000 kPa**, incorporating a geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

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.

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 the encountered overburden material above the groundwater table when a plane extending down and out from

the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Permissible Grade Raise and Settlements

A permissible grade raise restriction of 2 m above existing ground surface is recommended for areas where building foundations are founded over a silty clay deposit. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise calculations. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site, according to Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC 2012). The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and fill, containing deleterious or organic materials, within the footprint of the proposed building, the native soil and/or approved fill pad will be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 300 mm of sub-slab fill should consist of an OPSS Granular A crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD.

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

5.6 Pavement Design

Car only parking areas, heavy truck parking areas and access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 4 and 5.

Table 4 – Recommended Pavement Structure – Driveways 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-situ soil, or OPSS Granular B Type I or II material over in-situ soil or LWF (see below).	

Table 5 - Recommended Pavement Structure – Access Lanes and Heavy Vehicle 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-situ soil, or OPSS Granular B Type I or II material over in-situ soil or LWF (see below).	

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

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.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

The pavement structure performance is dependent on the moisture condition at the contact zone between the subgrade material and granular base. Failure to provide adequate drainage under conditions of heavy wheel loading could result in the subgrade fines pumped into the stone subbase voids, thereby reducing the load bearing capacity.

Due to the impervious nature of the subgrade and fill materials and transitions between various pavement structures, consideration should be provided to installing subdrains during the pavement construction. At transition zones between various pavement structures, subdrains should be installed longitudinally to drain any potential water trapped in the granular layers. The subdrains at catch basins should extend in four orthogonal directions and longitudinally when placed along a curb.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

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

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or Miradrain G100N. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

Backfill material below sidewalk subgrade areas or other settlement sensitive structures should consist of free draining, non-frost susceptible material placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD under dry and above freezing conditions.

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.

Exterior unheated footings, such as those for isolated exterior piers, footings located below loading docks and loading dock ramp wing-walls are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure. These unheated structures require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation. It is recommended that Paterson review the proposed footing and/or insulation details for the above-noted items prior to construction to ensure the effects of frost action are mitigated appropriately.

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. Given that the proposed building is anticipated to extend close to the property lines, it is expected that a temporary shoring may be required to support the excavation on the north side. This is discussed further below.

Unsupported Excavations

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

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

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

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

It is good to note that the subject site has a high content of boulders which may require heavy machinery for the removal of these large boulders, also that might end up with potential sub excavation due to the removal of these boulders.

Temporary Shoring

As noted above, a temporary shoring system may be required to support the overburden soils. The design and approval of the temporary shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any impact to the adjacent properties and include dewatering control measures.

The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that precipitation will not negatively impact the shoring system or soils supported by the system.

The temporary shoring system may consist of a soldier pile and lagging system or steel sheet piles which could be cantilevered, anchored, or braced.

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

Once the substantial landscape and structural drawings for the proposed building are available, other engineering solutions may be applicable.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa. A minimum of a 150 mm layer of OPSS Granular A crushed stone should be placed for pipe bedding for sewer and water pipes for a 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. The bedding and cover materials should be placed in maximum 300 mm thick lifts compacted to a minimum of 99% of the SPMDD.

It should generally be possible to re-use the site materials above the cover material if the operations are carried out in dry weather conditions. The site excavated material may be placed above cover material if the excavation operations are completed in dry weather conditions and the site excavated material is approved by the geotechnical consultant. All cobbles greater than 200 mm in the longest dimension should be removed prior to the site materials being reused.

Glacial till with cobbles less than 250 mm in the longest dimension can be reused in the subgrade below parkway. However, no greater that 100 mm cobbles can be reused in the granular layers.

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) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material standard Proctor maximum dry density.

6.5 Groundwater Control

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

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) Category 3 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 Category 3 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's 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.

Impacts on Neighboring Properties

It is understood that a notable cut of native material will be sub-excavated to accommodate the proposed building throughout the subject site. It is anticipated that the neighboring portion of Highway 416 and the commercial building located to the east of the site are founded within the dense glacial till and very stiff silty clay deposit, respectively. The glacial till deposit encountered was observed to be sufficiently dense and have a relatively high content of fine-grained soils such that the groundwater table will be lowered marginally within the vicinity of the subject site at the time of construction and as is typically experienced by temporary short-term dewatering for construction.

It should be noted that no issues are expected with respect to groundwater lowering that would long term damage to adjacent structures surrounding the proposed development.

6.6 Winter Construction

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

The subsoil conditions at this site mostly 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.

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 Moderate to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks for the portion of the building founded over the silty clay deposit within the east portion of the site. Atterberg limits testing was completed for the recovered silty clay samples at selected locations. The soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Table 1 in Subsection 4.2 and in Appendix 1.

High Sensitivity Area

Based on the results of our review, a high-sensitivity clay soil was encountered as per City Guidelines. Based on our Atterberg Limits test results, the plasticity index limit generally exceeds 40%. The following tree-planting setbacks are recommended for these high-sensitivity areas.

The following tree planting setbacks are recommended for the low to medium sensitivity silty clay deposit throughout the subject site.

- Large trees (mature height over 14 m) can be planted within these areas provided that a tree to foundation setback equal to the full mature height of the tree can be provided.

- Tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the conditions noted below are met.

- The underside of footing (USF) is 2.1 m or greater below the lowest finished grade for footings within 10 m from the tree, as measured from the center of the tree trunk.

- A small tree must be provided with a minimum of 25 m3 of available soils volume while a medium tree must be provided with a minimum of 30 m3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.
- The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree)

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

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ Review detailed grading plan from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ Review and inspections of the cut and fill operations carried out to build up the subgrade.
- ❑ 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 ensure that the specified level of compaction has been achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection 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 RF Ottawa Limited Partnership or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Escandar Abdullah, EIT.

January 11, 2023

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ RF Ottawa Limited Partnership (email copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Prop. Commercial Development - 575 Dealership Drive
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 1-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.34		
FILL: Brown silty clay		G	1						
0.40									
TOPSOIL 0.55									
GLACIAL TILL: Dense, dark brown silty sand, some gravel, cobbles and boulders, trace clay 0.90		G	2						
		G	3			1	107.34		
GLACIAL TILL: Dense, light brown silty sand to sandy silt, some gravel, cobbles and boulders		G	4			2	106.34		
		G	5			3	105.34		
4.10						4	104.34		
End of Test Pit									
(TP dry upon completion)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 575 Dealership Drive
Ottawa, Ontario

DATUM Geodetic

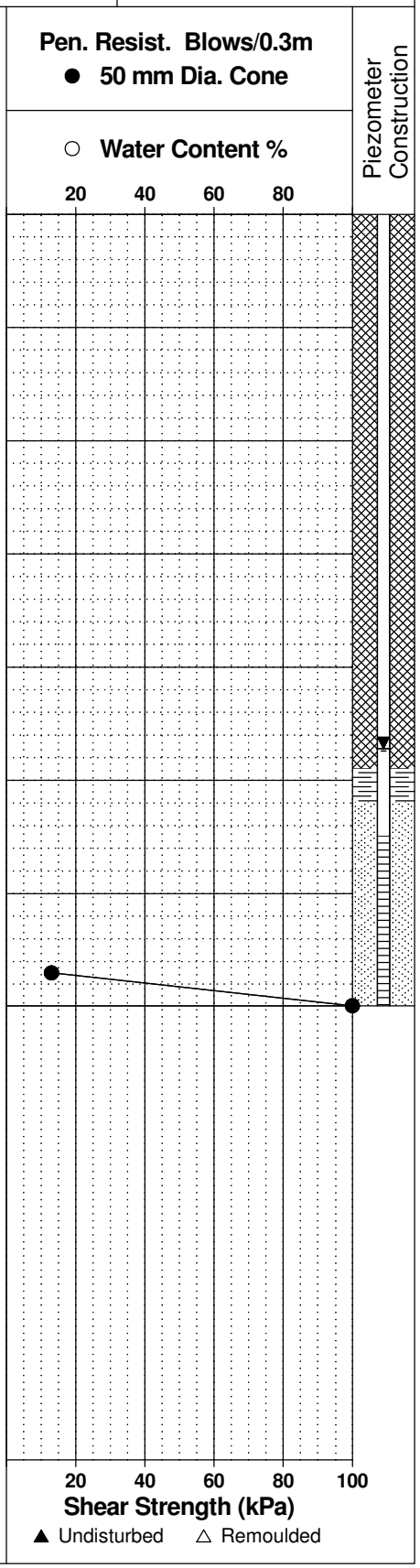
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 1, 2022

FILE NO. PG6514

HOLE NO. BH 1-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.57
TOPSOIL 0.25							
FILL: Brown silty clay with sand, trace gravel and rock fragments		AU	1				
		SS	2	29	15	1	98.57
1.60							
		SS	3	50	7	2	97.57
Hard, brown **SILTY CLAY**		SS	4	100	10		
2.97						3	96.57
		SS	5	71	11		
GLACIAL TILL: Comapct, brown silty sand to sandy silt, trace to some clay, gravel, cobbles, boulders		SS	6	92	10	4	95.57
		SS	7	75	14	5	94.57
		SS	8	71	8		
5.94						6	93.57
Dynamic Cone Penetration Test commenced at 5.94m depth.							
6.99							
End of Borehole							
Practical DCPT refusal at 6.99m depth.							
(GWL @ 4.72m - Dec. 9, 2022)							



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Prop. Commercial Development - 575 Dealership Drive
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DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 1, 2022

FILE NO. PG6514

HOLE NO. BH 2-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.68
TOPSOIL 0.05		AU	1				
FILL: Brown silty sand to sandy silt, some clay, gravel, occasional cobbles, trace topsoil		SS	2	42	4	1	102.68
1.62							
Brown **SILTY SAND** with gravel and topsoil 1.88		SS	3	75	13	2	101.68
		SS	4	83	8		
GLACIAL TILL: Compact to dense, brown silty sand to sandy silt with gravel, cobbles and boulders, some to trace clay		SS	5	100	10	3	100.68
		SS	6	92	29	4	99.68
- increasing boulder content below 4.5m depth		SS	7	8	50+	5	98.68
		SS	8	83	36		
		SS	9	100	48	6	97.68
6.71							
End of Borehole							
(GWL @ 4.58m - Dec. 9, 2022)							

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

20 40 60 80

Piezometer Construction

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

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Geotechnical Investigation
Prop. Commercial Development - 575 Dealership Drive
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 1, 2022

FILE NO. PG6514

HOLE NO. BH 3-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.08
TOPSOIL 0.05							
FILL: Brown silty clay, trace sand and gravel 0.69		AU	1				
		SS	2	71	50+	1	105.08
GLACIAL TILL: Very dense to dense, brown silty sand to sandy silt with gravel, cobbles and boudlers, trace clay		SS	3	71	38	2	104.08
		RC	1	100			
- 300mm long section of boulder cored starting at 2.26m depth						3	103.08
- 375mm long section of boulder cored starting at 2.6m depth.		RC	2	25			
4.06						4	102.08
End of Borehole							

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

20 40 60 80

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

Piezometer Construction

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DATUM Geodetic

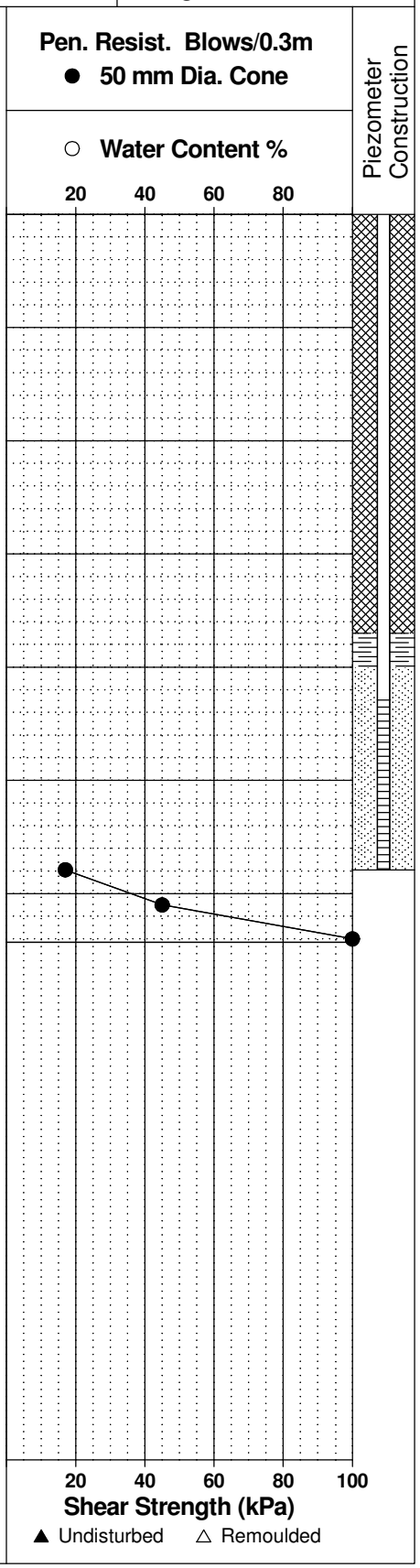
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 1, 2022

FILE NO. PG6514

HOLE NO. BH 3A-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.26
TOPSOIL 0.05							
FILL: Brown silty clay, trace sand and gravel 0.69							
GLACIAL TILL: Very dense to compact, brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		SS	1	87	50+	1	105.26
- increasing boulder content below 2.5m depth		RC	1	27		2	104.26
- 300mm section of boulder cored starting at 2.7m depth		SS	2	100	50+	3	103.26
		SS	3	58	29	4	102.26
5.79						5	101.26
Dynamic Cone Penetration Test commenced at 5.79m depth.						6	100.26
6.43							
End of Borehole							
Practical DCPT refusal at 6.43m depth.							
(BH dry - December 9, 2022)							



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Ottawa, Ontario

DATUM Geodetic

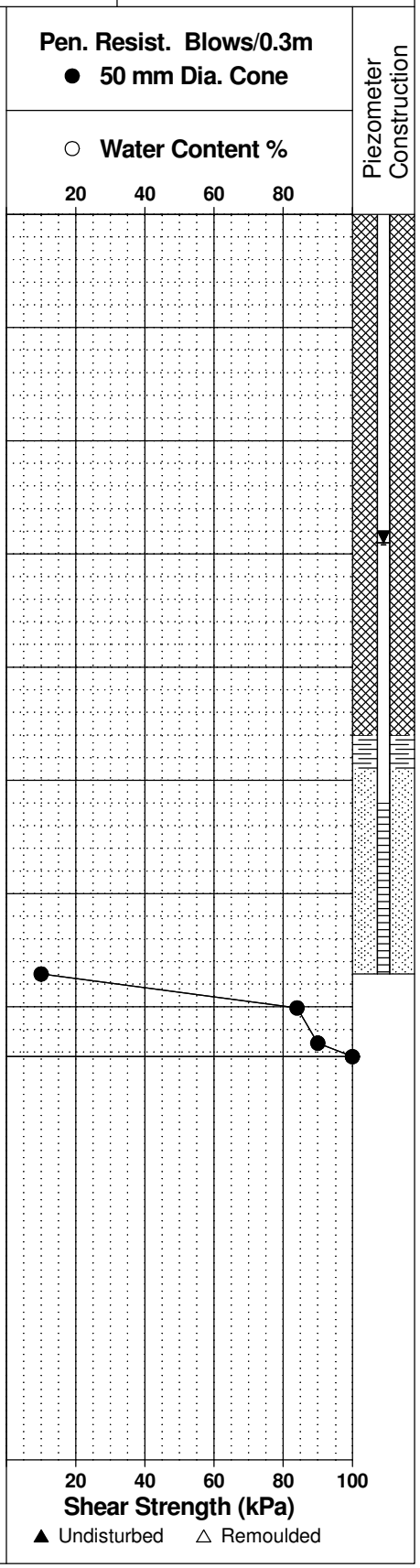
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 2, 2022

FILE NO. PG6514

HOLE NO. BH 4-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.67
TOPSOIL 0.08							
FILL: Brown silty clay with gravel, trace sand 0.69		AU	1				
		SS	2	83	15	1	105.67
		SS	3	92	50+	2	104.67
GLACIAL TILL: Very dense to dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	4	100	50+		
- increasing boulder content below 1.5m depth		SS	5	100	50+	3	103.67
		SS	6	100	50+	4	102.67
- grey by 4.5m depth		SS	7	100	45	5	101.67
		SS	8	79	34	6	100.67
		SS	9	83	50+		
6.71						7	99.67
Dynamic Cone Penetration Test commenced at 6.71m depth.							
7.44							
End of Borehole							
Practical DCPT refusal at 7.44m depth.							
(GWL @ 2.90m - Dec. 9, 2022)							



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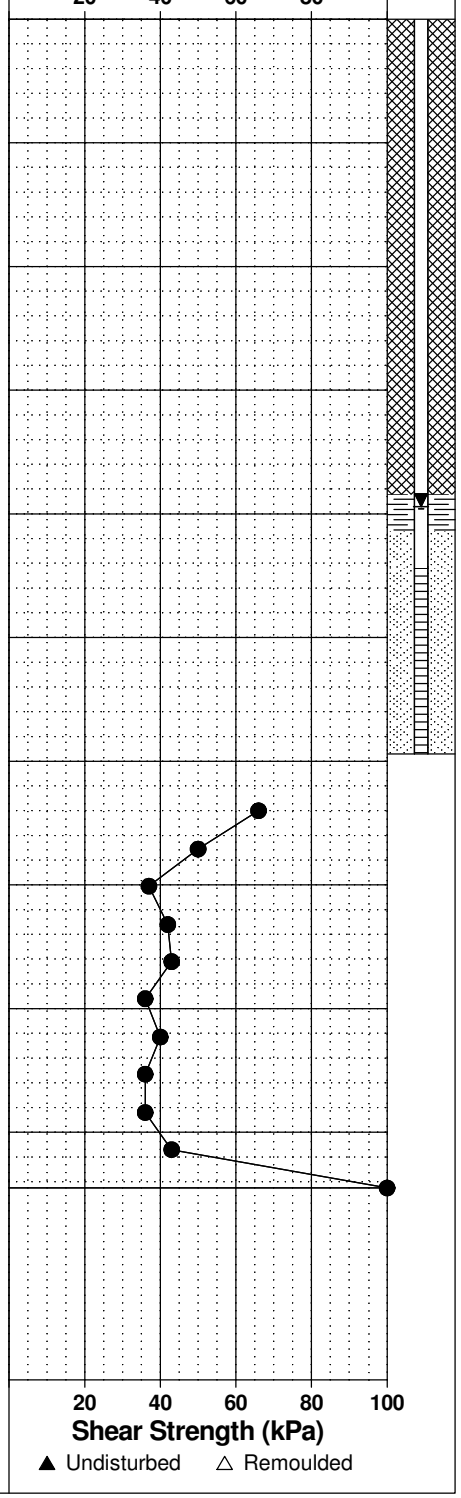
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 2, 2022

FILE NO. PG6514

HOLE NO. BH 5-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.58
TOPSOIL 0.05							
FILL: Brown silty sand to sandy silt with gravel, cobbles and boulders 0.80		AU	1				
		SS	4	100	50+		
		SS	2	0	50+	1	104.58
		SS	3	100	31	2	103.58
GLACIAL TILL: Very dense to dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	5	100	49	3	102.58
- high boulder and cobble content below 3.5m depth		SS	6	100	50+	4	101.58
		SS	7	100	50+	5	100.58
		SS	8	100	39		
6.10						6	99.58
Dynamic Cone Penetration commenced at 6.10m depth.						7	98.58
						8	97.58
						9	96.58
9.45							
End of Borehole							
Practical DCPT refusal at 9.45m depth.							
(GWL @ 3.94m - Dec. 9, 2022)							



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DATUM Geodetic

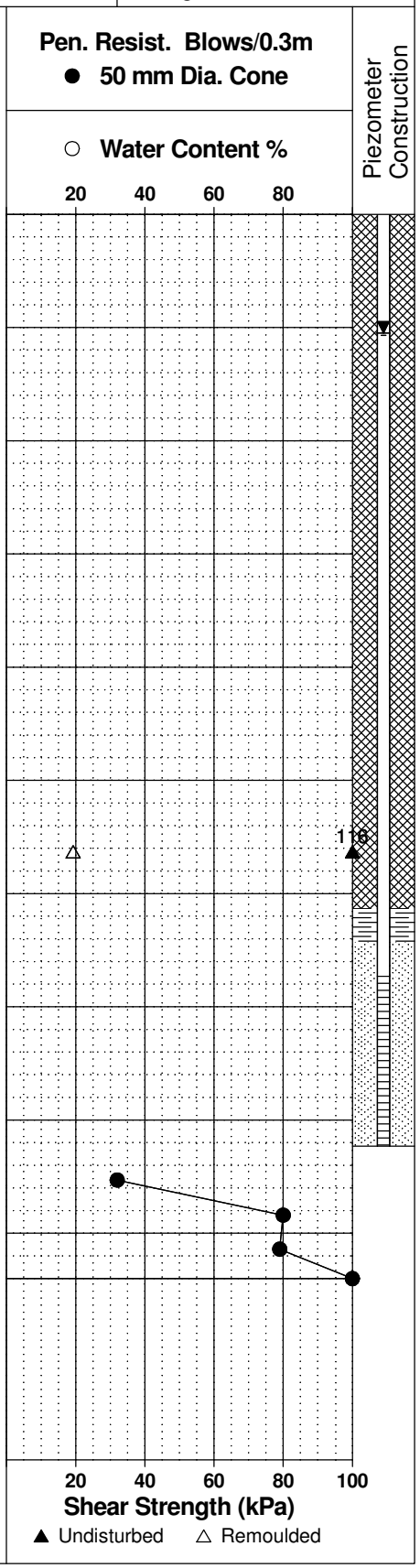
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 2, 2022

FILE NO. PG6514

HOLE NO. BH 6-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.02
TOPSOIL 0.05							
FILL: Brown silty sand to sandy silt with gravel, trace clay and organics, occasional cobbles and boulders 0.50		AU	1				
		SS	2	83	18	1	107.02
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	.3	58	26	2	106.02
		SS	4	75	49		
3.20						3	105.02
		SS	5	75	22		
		SS	6	100	2	4	104.02
Very stiff, grey **SILTY CLAY,** trace sand and gravel		SS	7	100	3	5	103.02
		SS	8		P		
5.94						6	102.02
		SS	9	79	24		
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt with gravel, cobbles and boulders, trace to some clay		SS	10	62	6	7	101.02
		SS	11	50	31		
8.23						8	100.02
Dynamic Cone Penetration Test commenced at 8.23m depth.							
- increasing boulder content below 9.0m depth						9	99.02
9.40							
End of Borehole							
Practical DCPT refusal at 9.40m depth.							
(GWL @ 1.05m - Dec. 9, 2022)							



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Prop. Commercial Development - 575 Dealership Drive
Ottawa, Ontario

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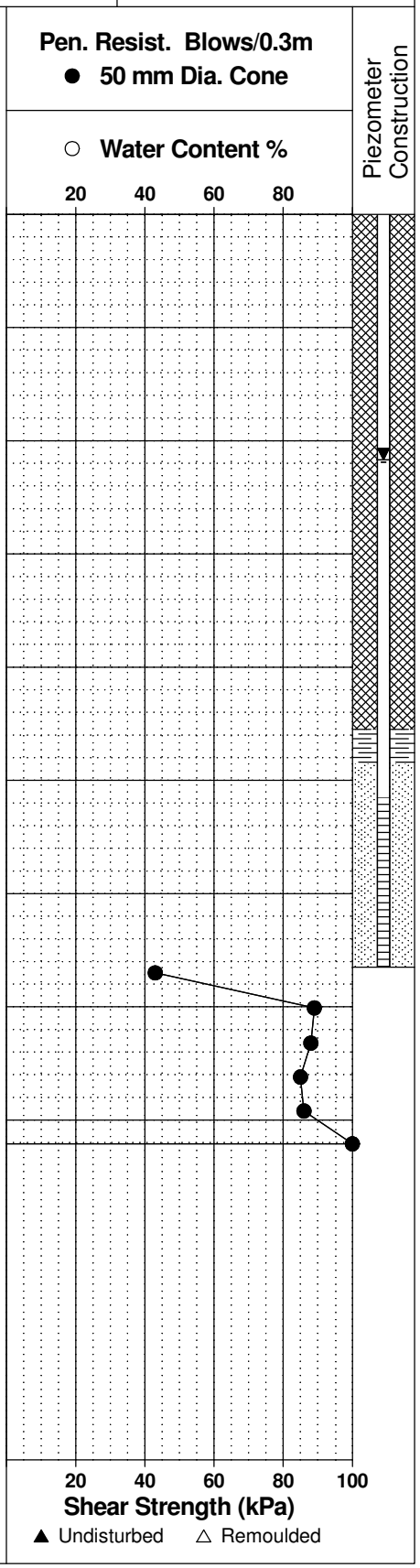
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 5, 2022

FILE NO. PG6514

HOLE NO. BH 7-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.82
TOPSOIL 0.05		AU	1				
FILL: Grey to brown silty sand to sandy silt, trace clay and gravel, occasional cobbles and boulders		SS	2	54	10	1	103.82
1.45		SS	3	33	9	2	102.82
		SS	4	84	50+		
GLACIAL TILL: Very dense to dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	5	100	50+	3	101.82
		SS	6	50	50+	4	100.82
- increasing boulder content below 2.5m depth		SS	7	80	50+		
- 300mm long section of boulder cored starting at 5.0m depth		RC	1	100		5	99.82
		SS	8	71	40	6	98.82
6.65						7	97.82
Dynamic Cone Penetration Test commenced at 6.65m depth.							
8.21						8	96.82
End of Borehole							
Practical DCPT refusal at 8.21m depth.							
(GWL @ 2.17m - Dec. 9, 2022)							



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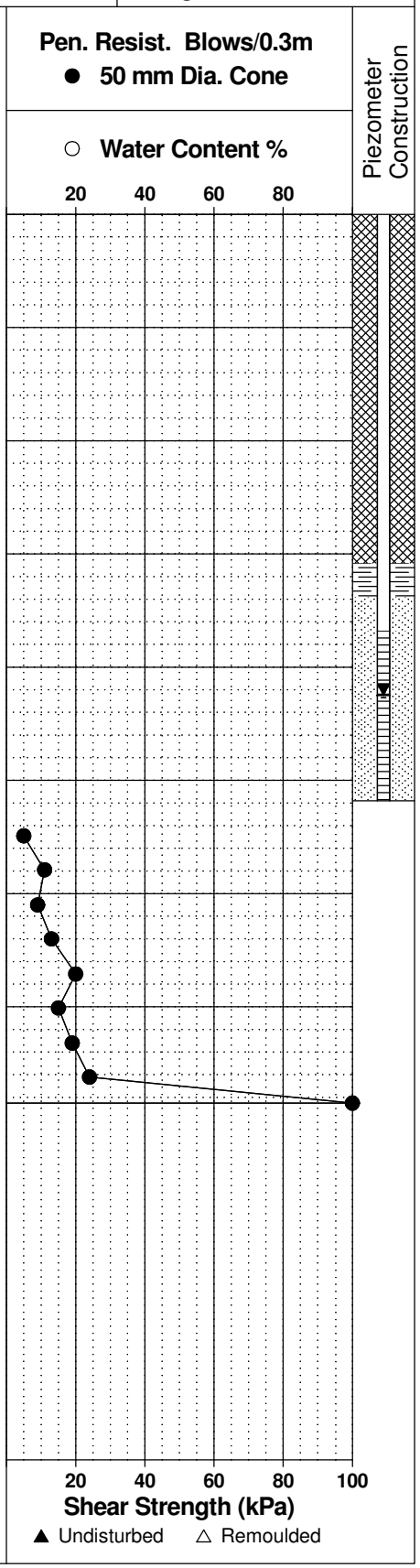
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 5, 2022

FILE NO. PG6514

HOLE NO. BH 8-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.11
TOPSOIL 0.05							
FILL: Brown silty sand with clay, gravel, crushed stone, occasional cobbles and boulders 0.69		AU	1				
FILL: Brown silty clay with sand, gravel, occasional cobbles and boulders 1.68		SS	2	75	9	1	101.11
FILL: Brown to grey silty sand to sandy silt with gravel, cobbles and boudlers 2.03		SS	3	50	23	2	100.11
Very stiff, brown **SILTY CLAY,** trace sand		SS	4	100	12	3	99.11
3.73		SS	5	100	12		
GLACIAL TILL: Compact, brown siltys and to sandy silt with gravel, cobbles and boulders, trace to some clay		SS	6	71	13	4	98.11
5.18		SS	7	83	10	5	97.11
Dynamic Cone Penetration Test commenced at 5.18m depth.						6	96.11
						7	95.11
7.85							
End of Borehole Practical DCPT refusal at 7.85m depth. (GWL @ 4.25m - Dec. 9, 2022)							



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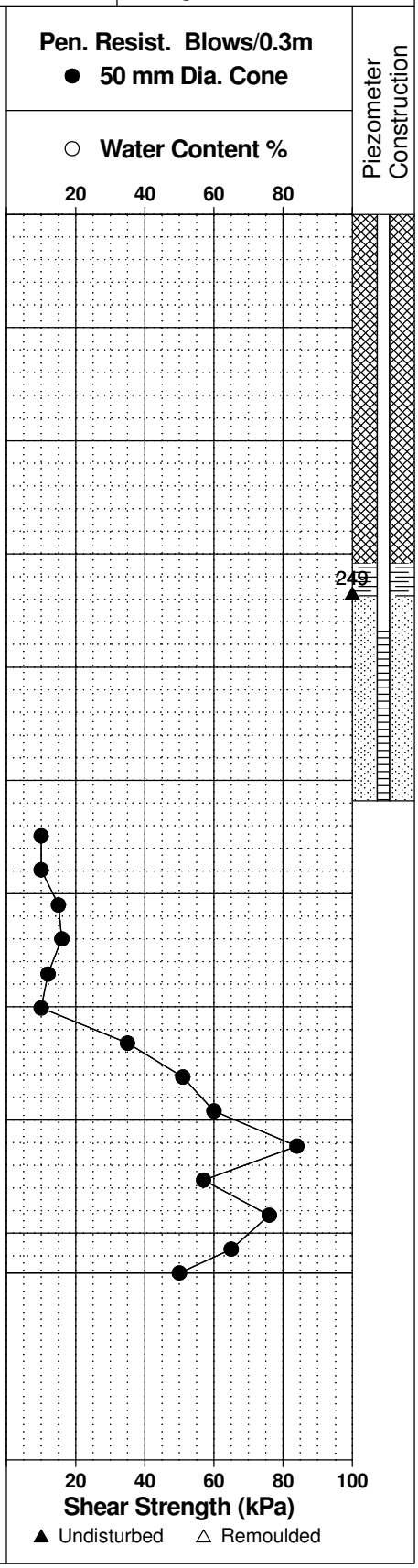
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 5, 2022

FILE NO. PG6514

HOLE NO. BH 9-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.87
TOPSOIL 0.25		AU	1				
FILL: Brown silty clay with sand, trace to some gravel		SS	2	100	8	1	99.87
		SS	3	100	4	2	98.87
2.44		SS	4	100	11		
Hard, brown **SILTY CLAY,** trace sand		SS	5	100	P	3	97.87
4.06		SS	6	83	6	4	96.87
GLACIAL TILL: Loose, brown silty sand to sandy silt with gravel, occasional cobbles and boulders, trace to some clay		SS	7	67	7	5	95.87
5.18						6	94.87
Dynamic Cone Penetration Test commenced at 5.18m depth.						7	93.87
						8	92.87
						9	91.87
9.35							
End of Borehole							
Practical DCPT refusal at 9.35m depth.							
(BH dry - December 9, 2022)							



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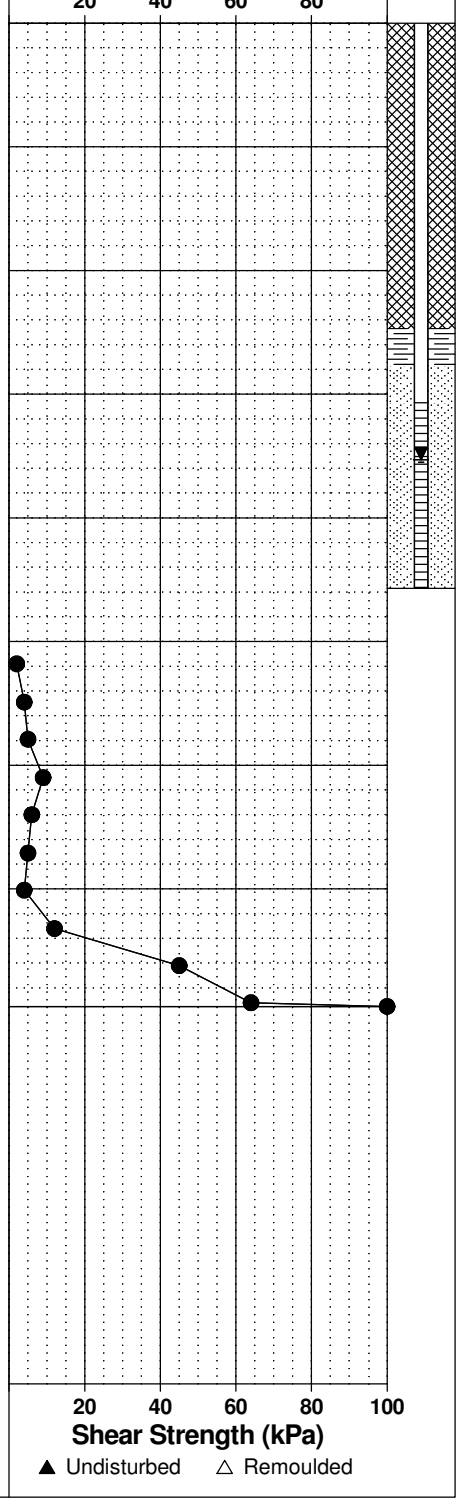
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 6, 2022

FILE NO. PG6514

HOLE NO. BH10-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.12
TOPSOIL 0.05		AU	1				
FILL: Brown silty sand with gravel, trace to some clay		SS	2	50	5	1	96.12
1.45							
Hard, brown **SILTY CLAY**		SS	3	100	10	2	95.12
2.21		SS	4	67	10		
GLACIAL TILL: Compact to loose, brown silty sand with gravel, some clay, occasional cobbles		SS	5	54	14	3	94.12
		SS	6	71	5	4	93.12
4.57							
Dynamic Cone Penetration Test commenced at 4.57m depth.						5	92.12
						6	91.12
						7	90.12
7.95							
End of Borehole							
Practical DCPT refusal at 7.95m depth.							
(GWL @ 3.53m - Dec. 9, 2022)							



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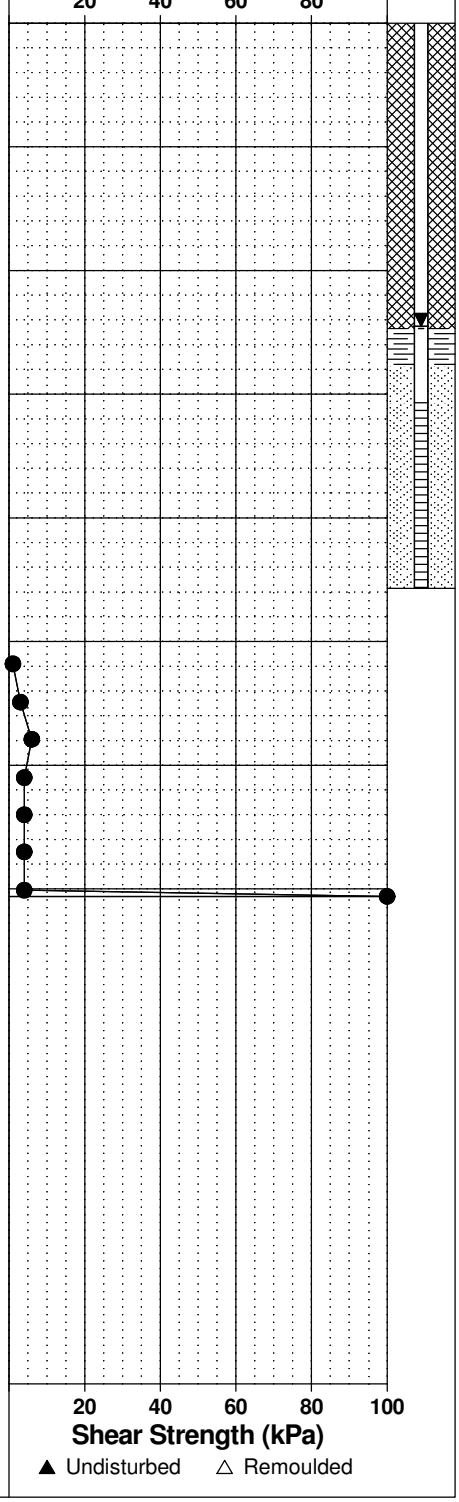
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 6, 2022

FILE NO. PG6514

HOLE NO. BH11-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.75
TOPSOIL 0.05							
FILL: Grey to brown silty sand to sandy silt with gravel, trace clay, occasional cobbles and boulders - high boulder contetn at 1.0m depth		AU	1				
		SS	2	89	50+	1	96.75
1.45							
Hard, brown **SILTY CLAY**		SS	3	100	10	2	95.75
2.64		SS	4	100	6		
GLACIAL TILL: Loose, brown silty sand to sandy silt with clay and gravel, occasional cobbles and boulders		SS	5	62	8	3	94.75
		SS	6	100	9	4	93.75
4.57							
Dynamic Cone Penetration Test commenced at 4.57m depth.						5	92.75
						6	91.75
7.06						7	90.75
End of Borehole							
Practical DCPT refusal at 7.06m depth.							
(GWL @ 2.45m - Dec. 9, 2022)							



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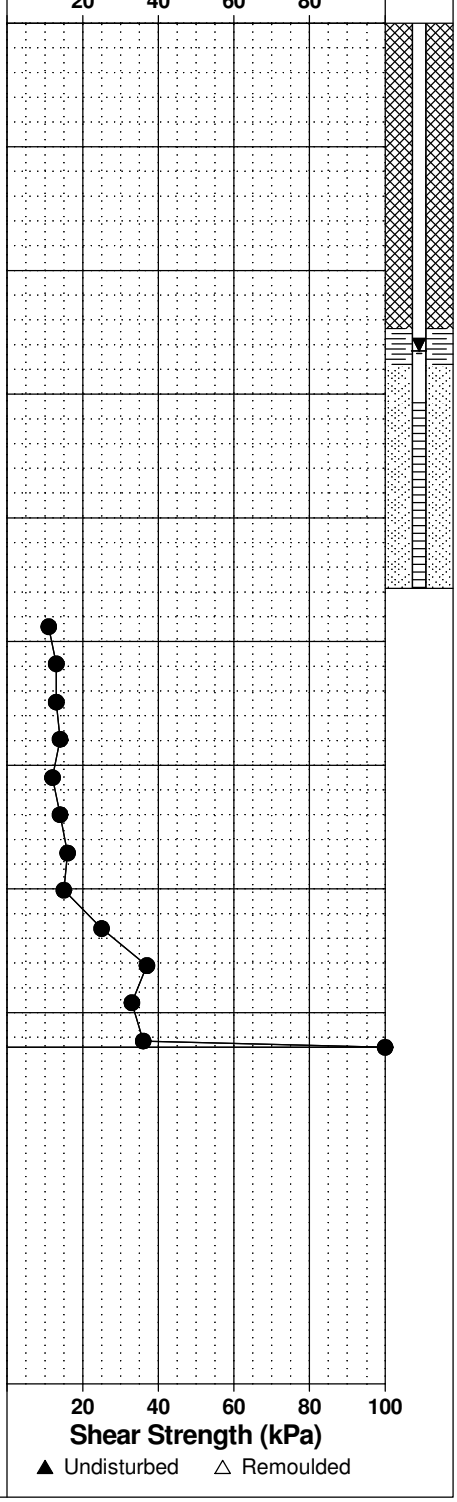
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 6, 2022

FILE NO. PG6514

HOLE NO. BH12-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.85
TOPSOIL 0.05		AU	1				
FILL: Brown silty clay with sand, trace gravel		SS	2	50	5	1	97.85
1.45							
Hard, brown **SILTY CLAY**		SS	3	100	11	2	96.85
2.39		SS	4	71	18		
GLACIAL TILL: Compact, brown sitly sand to sandy silt with gravel, cobbles and boulders, trace clay		SS	5	75	21	3	95.85
		SS	6	54	10	4	94.85
4.57							
Dynamic Cone Penentration Test commenced at 4.57m depth.						5	93.85
						6	92.85
						7	91.85
8.28						8	90.85
End of Borehole							
Practical DCPT refusal at 8.28m depth.							
(GWL @ 2.65m - Dec. 9, 2022)							



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Geotechnical Investigation
Prop. Commercial Development - 575 Dealership Drive
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DATUM Geodetic

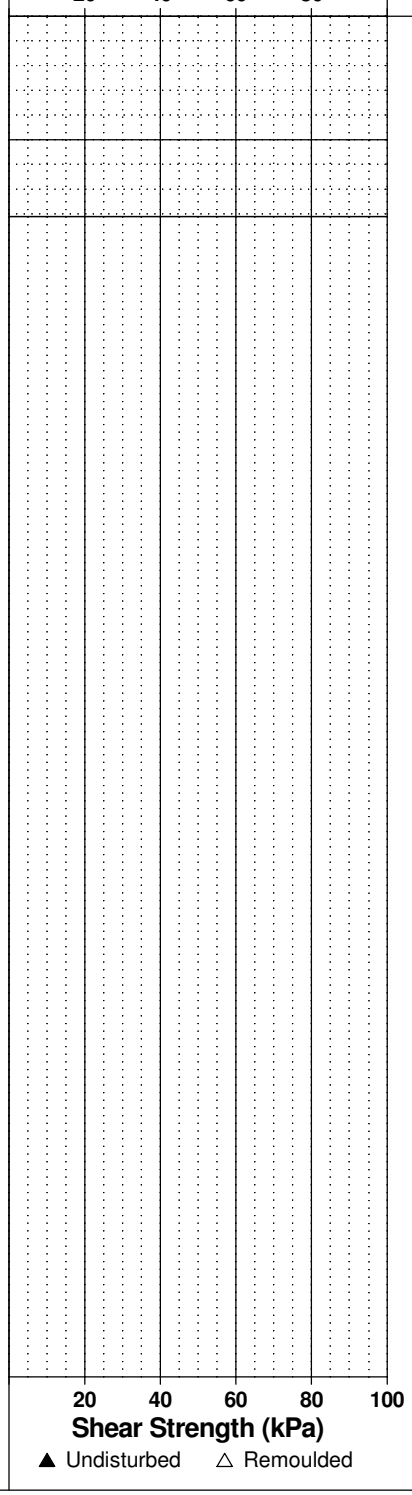
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH13-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.66		
OVERBURDEN						1	107.66		
1.62									
End of Borehole Practical refusal to augering at 1.62m depth.									



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DATUM Geodetic

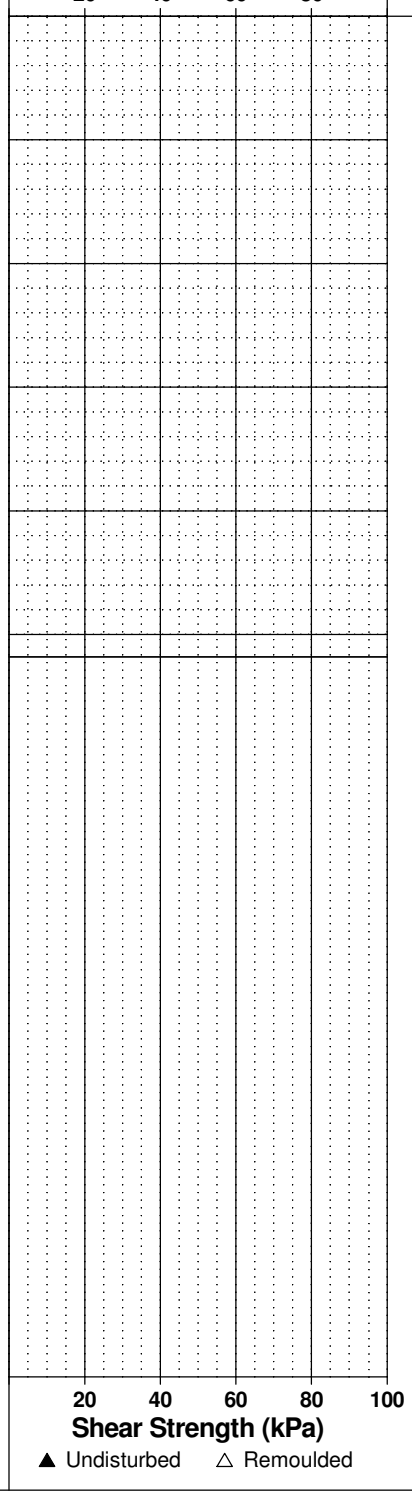
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH13A-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.66		
						1	107.66		
						2	106.66		
OVERBURDEN						3	105.66		
						4	104.66		
5.18						5	103.66		
End of Borehole									
Practical refusal to augering at 5.18m depth.									



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DATUM Geodetic

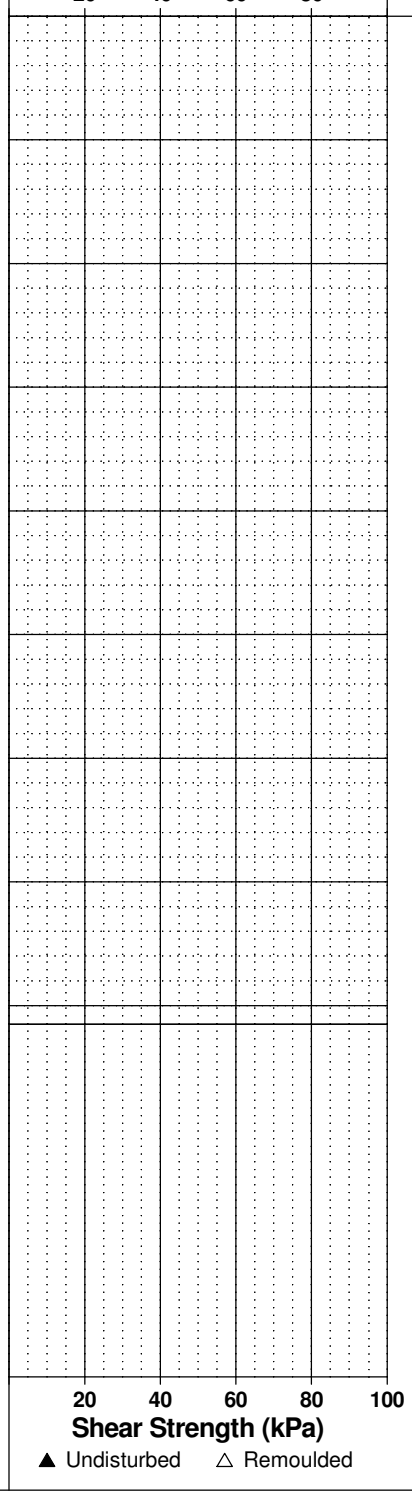
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH13B-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.66		
						1	107.66		
						2	106.66		
						3	105.66		
OVERBURDEN						4	104.66		
						5	103.66		
						6	102.66		
						7	101.66		
						8	100.66		
8.15									
End of Borehole									
Practical refusal to augering at 8.15m depth.									



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DATUM Geodetic

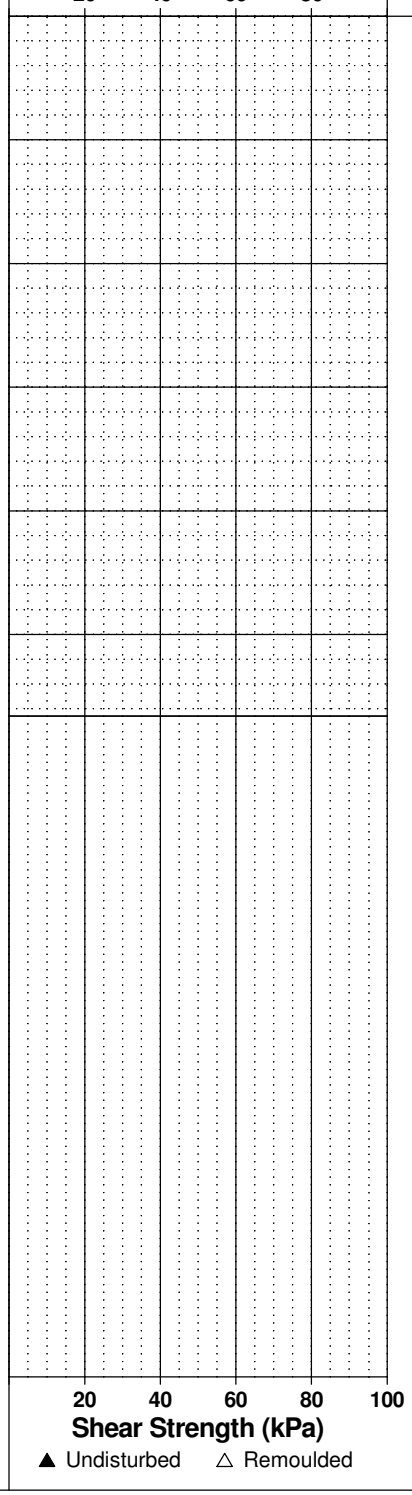
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH14-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.89		
						1	107.89		
						2	106.89		
OVERBURDEN						3	105.89		
						4	104.89		
						5	103.89		
5.66									
End of Borehole									
Practical refusal to augering at 5.66m depth.									



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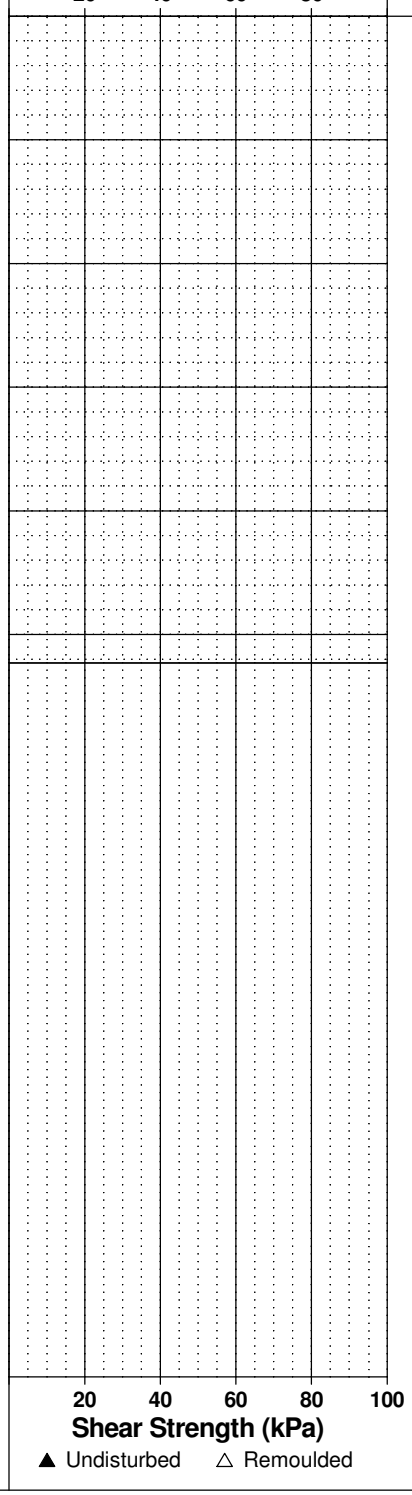
FILE NO. PG6514

HOLE NO. BH14A-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.89		
						1	107.89		
OVERBURDEN						2	106.89		
						3	105.89		
						4	104.89		
5.23						5	103.89		
End of Borehole Practical refusal to augering at 5.23m depth.									



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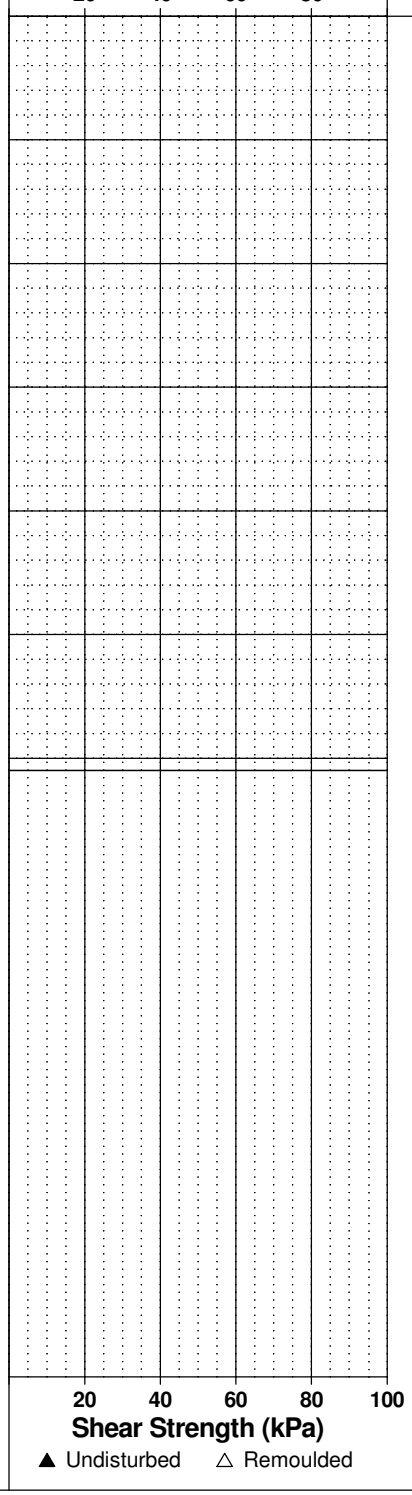
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH15-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.63		
						1	102.63		
						2	101.63		
OVERBURDEN						3	100.63		
						4	99.63		
						5	98.63		
6.10						6	97.63		
End of Borehole									



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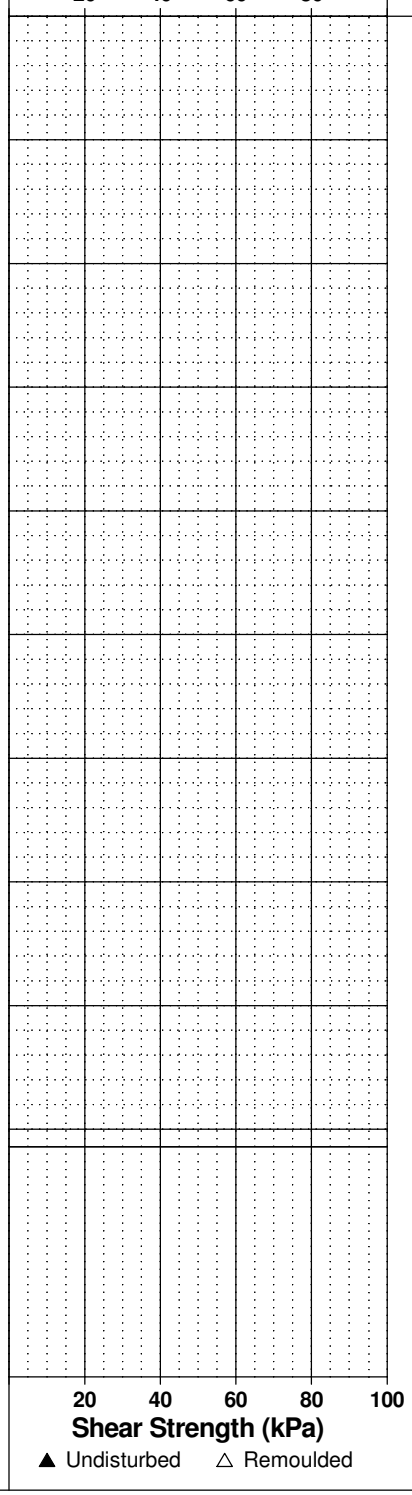
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH16-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	107.32		
						1	106.32		
						2	105.32		
						3	104.32		
						4	103.32		
OVERBURDEN						5	102.32		
						6	101.32		
						7	100.32		
						8	99.32		
						9	98.32		
9.14 End of Borehole									



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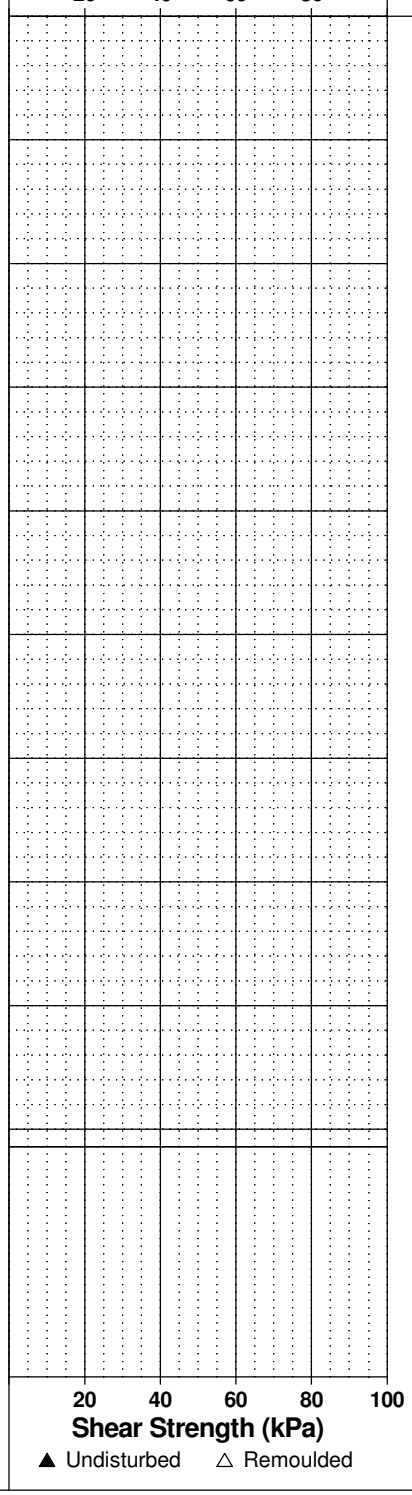
BORINGS BY Track-Mount Power Auger **DATE** December 15, 2022

FILE NO. PG6514

HOLE NO. BH17-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	109.38		
						1	108.38		
						2	107.38		
						3	106.38		
						4	105.38		
OVERBURDEN						5	104.38		
						6	103.38		
						7	102.38		
						8	101.38		
9.14						9	100.38		
End of Borehole									



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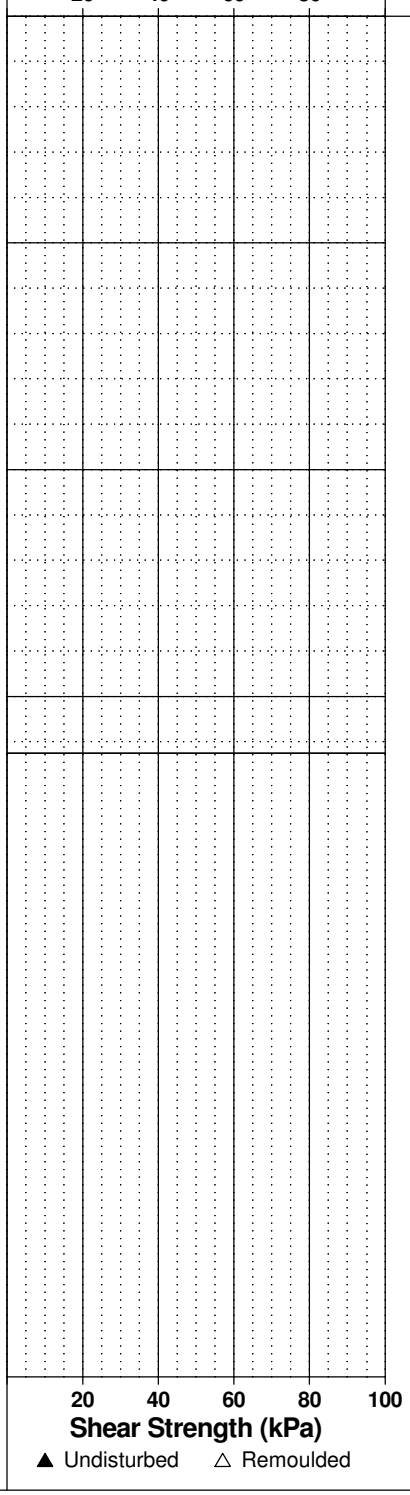
REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 2-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	107.79		
FILL: Brown silty clay, trace gravel		G	1						
0.25									
FILL: Dark brown silty sand with gravel, cobbles and boulders, trace clay		G	2						
1.00						1	106.79		
GLACIAL TILL: Very dense, light brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	3						
		G	4			2	105.79		
		G	5			3	104.79		
3.25									
End of Test Pit									
Practical refusal to excavation at 3.25m depth									
(TP dry upon completion)									



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DATUM Geodetic

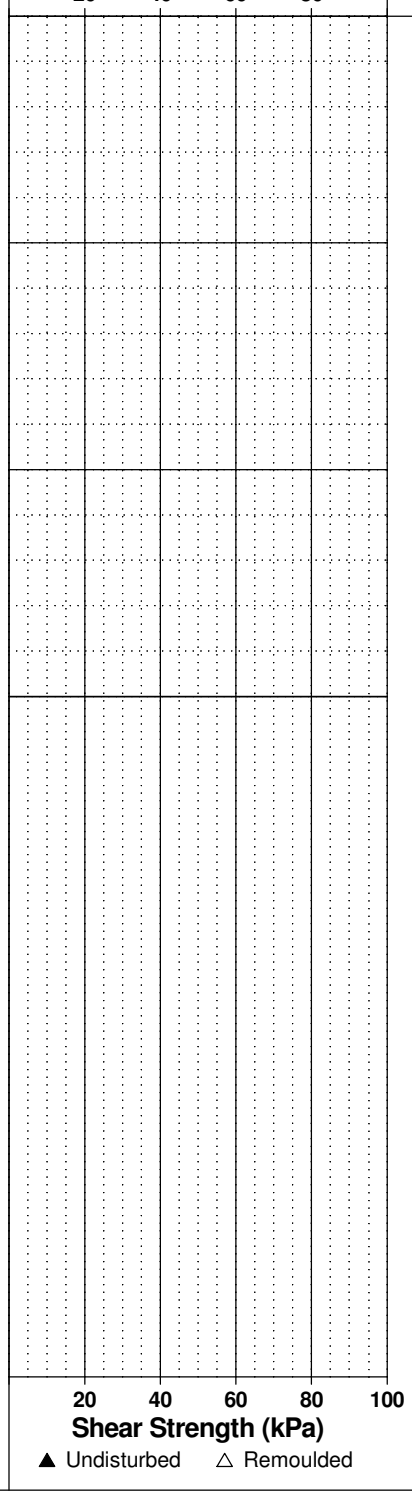
REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 3-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.49		
FILL: Grey silty clay mixed with dark brown silty and organics		G	1						
0.90						1	107.49		
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles and boulders		G	2						
1.50						2	106.49		
GLACIAL TILL: Very dense, light brown silty sand to sandy silt with clay, gravel, cobbles and boulders		G	3						
3.00						3	105.49		
End of Test Pit Practical refusal to excavation at 3.00m depth (TP dry upon completion)									



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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 4-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.08		
FILL: Brown silty and with gravel, cobbles and boulders									
0.40									
TOPSOIL		G	1						
0.60									
		G	2			1	105.08		▽
GLACIAL TILL: Dense, brown silty sand to sandy silt with clay, gravel, cobbles and boulders		G	3			2	104.08		
						3	103.08		
3.50									
End of Test Pit									
(Groundwater infiltration at 1.35m depth)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 5-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	101.89		
FILL: Brown silty clay mixed with gravel and cobbles		G	1						
1.20						1	100.89		
TOPSOIL									
1.50		G	2			2	99.89		
GLACIAL TILL: Dense, light brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	3			3	98.89		
		G	4			4	97.89		
		G	5						
4.80									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20, 40, 60, 80

Water Content %: 20, 40, 60, 80

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

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DATUM Geodetic

REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 6-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	102.49		
FILL: Brown silty sand with gravel and cobbles		G	1						
		G	2			1	101.49		
1.60									
TOPSOIL									
1.90						2	100.49		
GLACIAL TILL: Dense, light brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	3						
		G	4			3	99.49		
		G	5			4	98.49		
4.80									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 7-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.22		
FILL: Dark brown silty clay, some sand and gravel		G	1						
		G	2			1	97.22		
1.45									
TOPSOIL 1.55									▽
		G	3			2	96.22		
GLACIAL TILL: Dense, light brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	4			3	95.22		
		G	5			4	94.22		
		G	6						
4.70									
End of Test Pit									
(Groundwater infiltration at 1.6m depth)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 8-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.60		
FILL: Silty clay with gravel and cobbles		G	1			1	99.60		
		G	2			2	98.60		
Stiff, brown **SILTY CLAY** with sand and gravel		G	3			3	97.60		
		G	4			4	96.60		
End of Test Pit									
(Groundwater infiltration at 3.55m depth)									

1.60

4.00

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP 9-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	101.93		
FILL: Brown silty clay with topsoil		G	1						
						1	100.93		
		G	2						
Hard to very stiff, brown **SILTY CLAY** with sand and gravel						2	99.93		
		G	3						
						3	98.93		
		G	4						
4.00						4	97.93		
End of Test Pit									
(TP dry upon completion)									

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

20 40 60 80

240

206

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG6080

HOLE NO. TP10-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.74		
FILL: Brown silty sand with gravel and cobbles		G	1						
1.00						1	97.74		
TOPSOIL									
1.20									
		G	2			2	96.74		
		G	3			3	95.74		
GLACIAL TILL: Dense to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	4			4	94.74		
4.40									
End of Test Pit									
(TP dry upon completion)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP11-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.07
FILL: Dark brown silty clay, trace gravel and organics		G	1				
0.60							
		G	2			1	96.07
GLACIAL TILL: Dense to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders, trace clay		G	3				
2.10						2	95.07
		G	4				
GLACIAL T ILL: Brown silty clay with sand, gravel, cobbles and boulders						3	94.07
						4	93.07
4.45							
End of Test Pit							
(TP dry upon completion)							

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

20 40 60 80

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

Piezometer Construction

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REMARKS

BORINGS BY Excavator **DATE** November 23, 2021

FILE NO. PG6080

HOLE NO. TP12-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	96.91		
FILL: Brown silty clay with gravel and cobbles		G	1			1	95.91		
1.30									
GLACIAL TILL: Very stiff, brown silty clay with sand, gravel, cobbles and boulders		G	2			2	94.91		
		G	3			3	93.91		
3.80		G	4						
End of Test Pit						4	92.91		
(Groundwater infiltration at 1.15m depth)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	107.67		
FILL: Brown silty sand, some gravel and organics		G	1						
0.40									
		G	2			1	106.67		
GLACIAL TILL: Compact to dense, brown sand with gravel, cobbles and boulders, trace silt		G	3			2	105.67		▽
2.65									
End of Test Pit Practical refusal to excavation on boulders at 2.65m depth. (Groundwater infiltration at 1.7m depth)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.91		
FILL: Brown silty sand with gravel, cobbles and boulders, trace to some clay		G	1						
		G	2			1	102.91		
1.70									
GLACIAL TILL: Dense, brown sand with gravel, cobbles and boulders, trace silt		G	3			2	101.91		
2.80									
End of Test Pit Practical refusal to excavation on boulders at 2.80m depth. (TP dry upon completion)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	99.59		
FILL: Brown silty clay, some rootlets within upper 200mm		G	1						
		G	2			1	98.59		
1.50									
Very stiff to stiff, grey-brown **SILTY CLAY**						2	97.59		
						3	96.59		▽
3.50									
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles and boulders		G	3						
4.00						4	95.59		
End of Test Pit									
(Groundwater infiltration at 3.3m depth)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

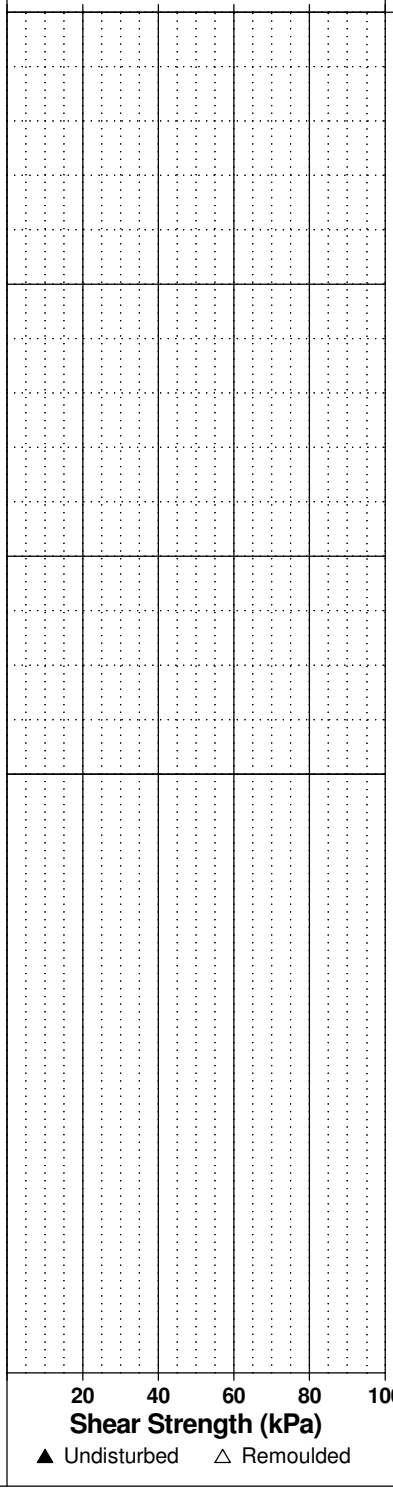
REMARKS

FILE NO. PG5025

HOLE NO. TP 4

BORINGS BY Backhoe **DATE** August 8, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.51
FILL: Brown silty clay, some organics		G	1				
0.90						1	104.51
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders, trace organics		G	2				
1.70						2	103.51
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, some clay		G	3				
2.80							
End of Test Pit Practical refusal to excavation on boulders at 2.80m depth. (TP dry upon completion)							



Piezometer Construction

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	99.65		
FILL: Brown silty clay with organics and gravel		G	1						
		G	2			1	98.65		
1.60									
GLACIAL TILL: Compact to dense, brown silty clay with sand, gravel, cobbles and boulders		G	3			2	97.65		
						3	96.65		
4.00									
End of Test Pit						4	95.65		
(Groundwater infiltration at 3.9m depth)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

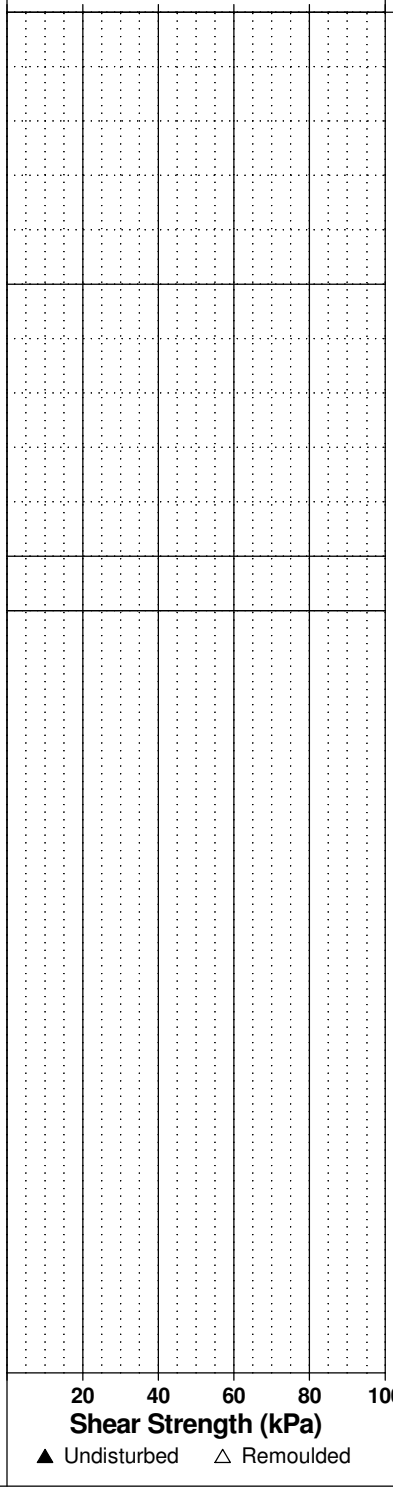
REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.99		
FILL: Brown silty clay with rootlets		G	1						
0.30									
GLACIAL TILL: Compact to dense, brown sand with gravel, cobbles and boulders		G	2			1	105.99		
		G	3			2	104.99		
2.20									
End of Test Pit Practical refusal to excavation on boulders at 2.20m depth. (TP dry upon completion)									



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

FILE NO. PG5025

HOLE NO. TP 7

BORINGS BY Backhoe **DATE** August 8, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.77
FILL: Brown silty sand, some gravel, cobbles and boulders, trace clay		G	1				
		G	2				
1.00						1	98.77
FILL: Brown silty clay with sand, trace gravel		G	3				
1.90						2	97.77
Stiff, brown **SILTY CLAY**		G	4				
3.70						3	96.77
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles, boulders		G	5				
4.00						4	95.77
End of Test Pit							
(Groundwater infiltration at 3.7m depth)							

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

20 40 60 80

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

Piezometer Construction

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
575 Dealership Drive
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located approx. 50m west of Strandherd Drive. Geodetic elevation = 96.22m, provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY Backhoe **DATE** August 8, 2019

FILE NO. PG5025

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	96.93		
FILL: Brown silty sand with gravel, some clay, cobbles and boulders		G	1						
		G	2			1	95.93		
1.60									
Stiff, brown **SILTY CLAY**		G	3			2	94.93		▽
2.70									
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles and boulders		G	4			3	93.93		
3.30									
End of Test Pit									
Practical refusal to excavation on boulders at 3.30m depth.									
(Groundwater infiltration at 2.7m depth)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x 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

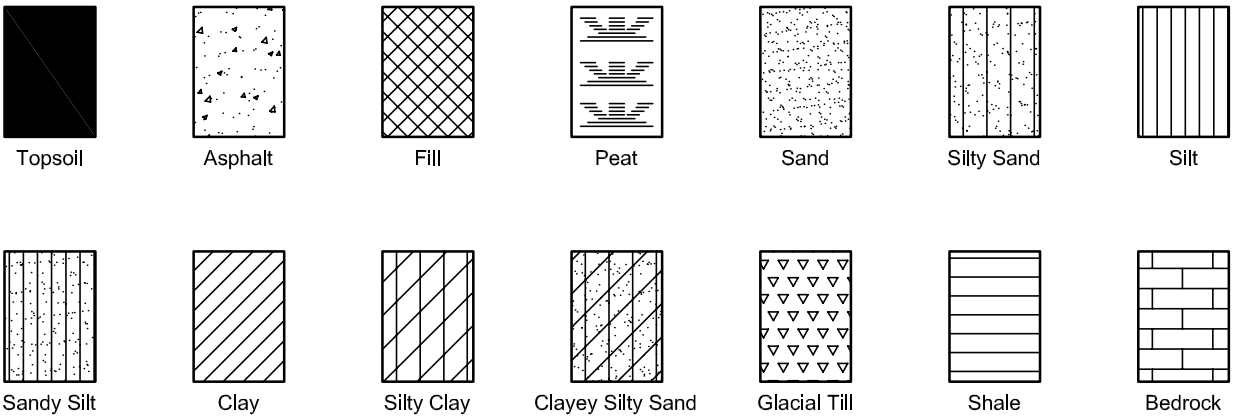
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

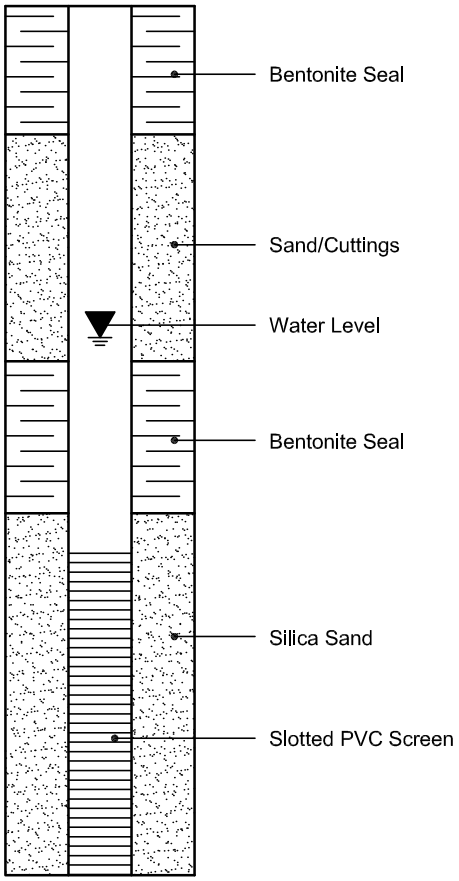
SYMBOLS AND TERMS (continued)

STRATA PLOT

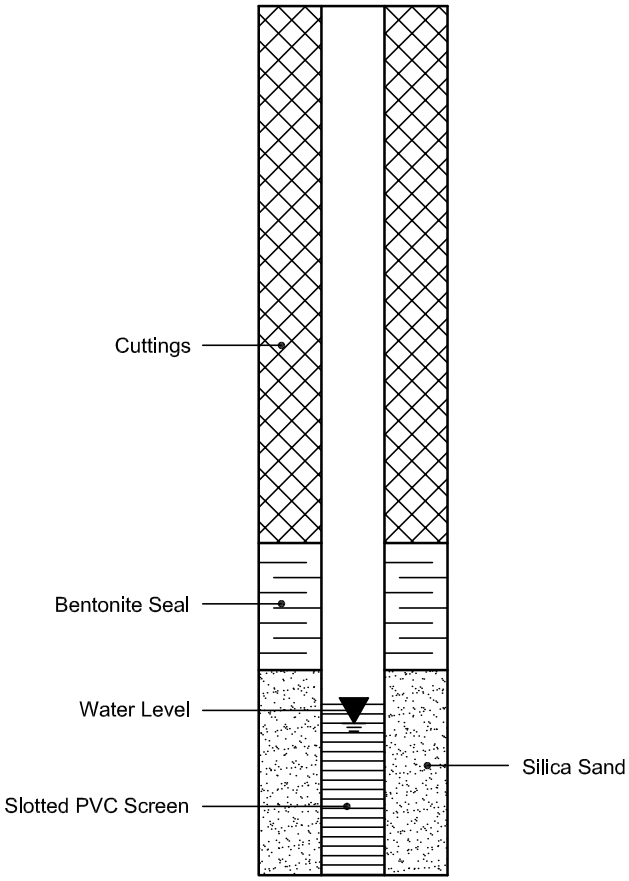


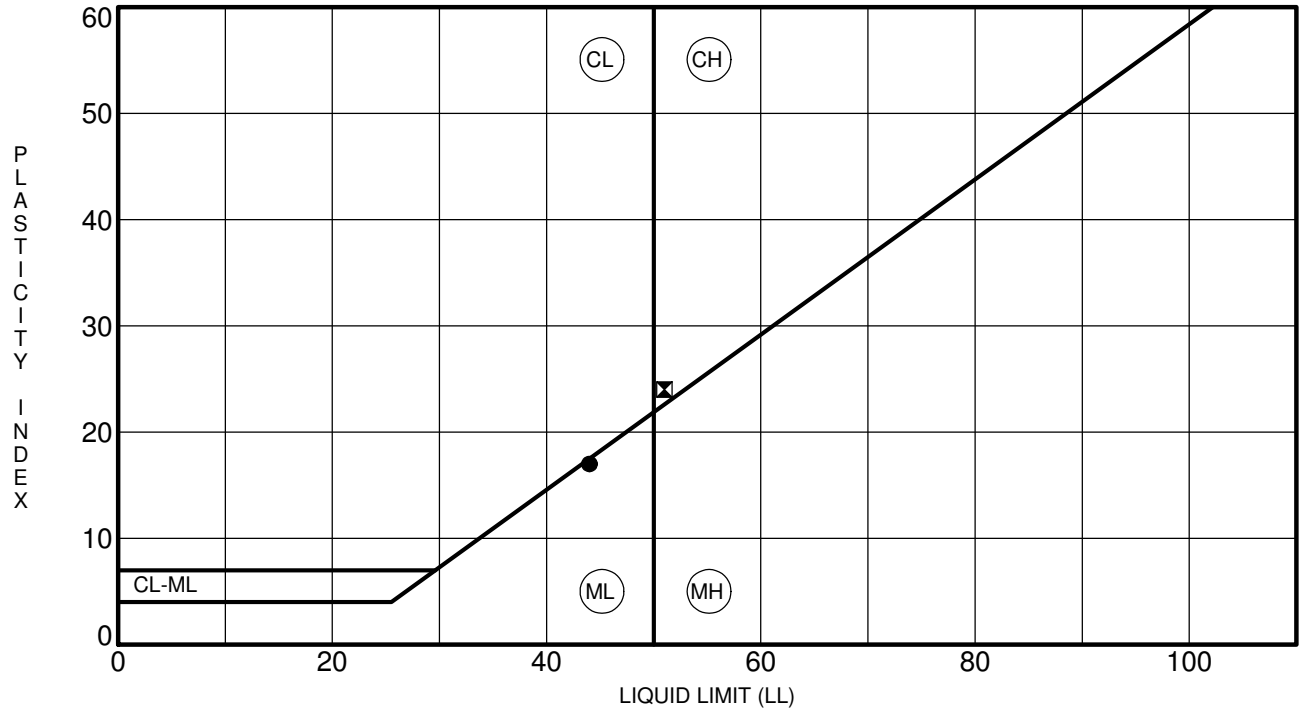
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



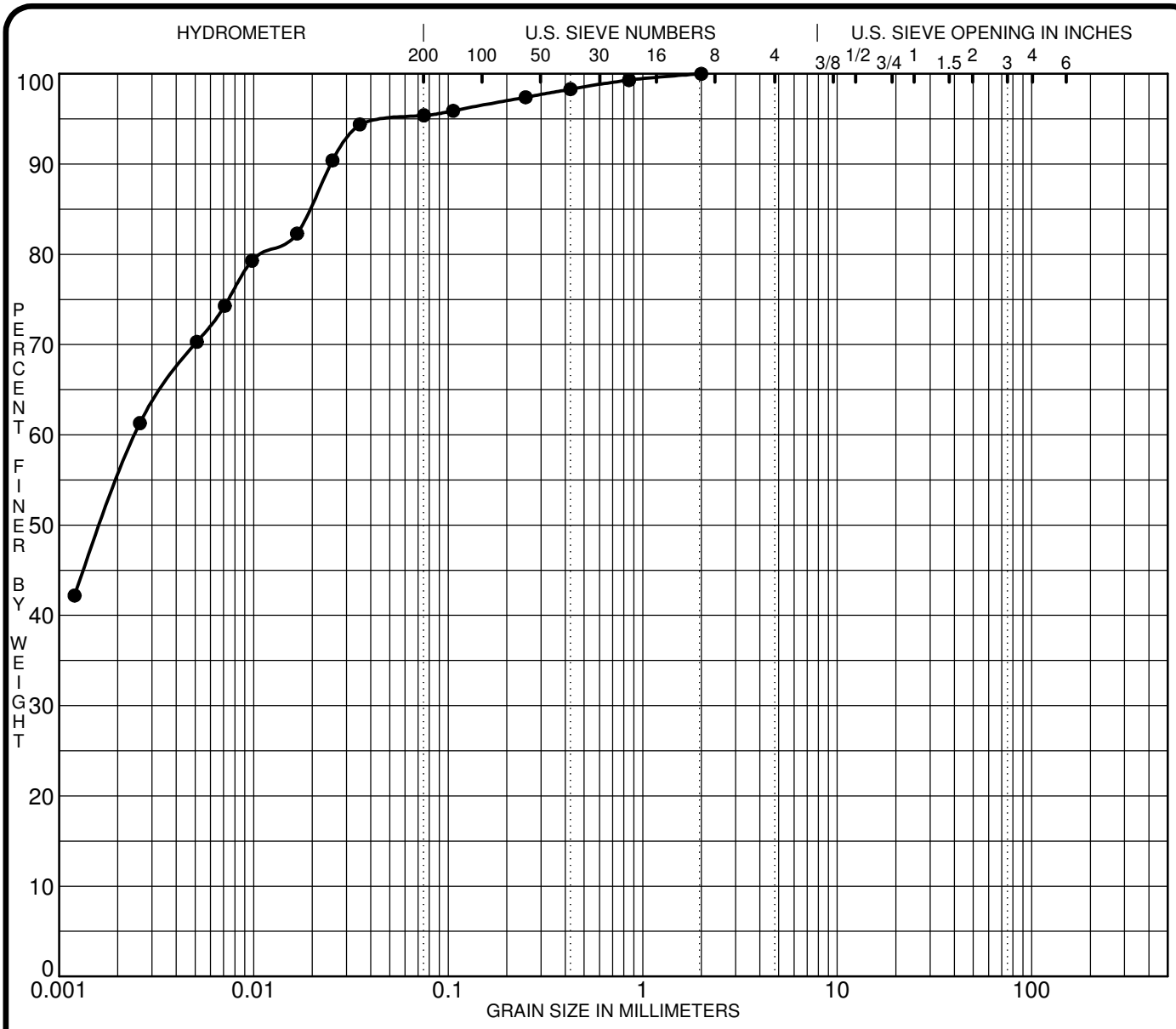


Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 8-22 SS4**	**44**	**27**	**17**		**ML - Inorganic silt of low plasticity**
⧓	**BH 9-22 SS4**	**51**	**27**	**24**		**CH - Inorganic clay of high plasticity**

CLIENT **RF Ottawa Limited Partnership c/o Rosefellow Dev.**
FILE NO. **PG6514**
PROJECT **Geotechnical Investigation - Prop. Commercial Development - 575 Dealership Drive**
DATE **5 Dec 22**

patersongroup Consulting Engineers
9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **BH 1-22 SS4**	**CH - Inorganic clay of high plasticity**						
⊠							
▲							
★							

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH 1-22 SS4**	**2.00**	**0.00**			**0.0**	**4.6**	**95.4**	
⊠								
▲								
★								

CLIENT **RF Ottawa Limited Partnership c/o Rosefellow Dev.**
FILE NO. **PG6514**
PROJECT **Geotechnical Investigation - Prop. Commercial Development - 575 Dealership Drive**
DATE **1 Dec 22**

patersongroup Consulting Engineers
9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION

	Client ID:	BH7 - 22 (BHF) SS5	-	-	-		
	Sample Date:	06-Dec-22 09:00	-	-	-	-	-
	Sample ID:	2250361-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	92.3	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.69	-	-	-	-	-
Resistivity	0.1 Ohm.m	88.1	-	-	-	-	-
Anions							
Chloride	5 ug/g	<5	-	-	-	-	-
Sulphate	5 ug/g	12	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG6514-1 – TEST HOLE LOCATION PLAN

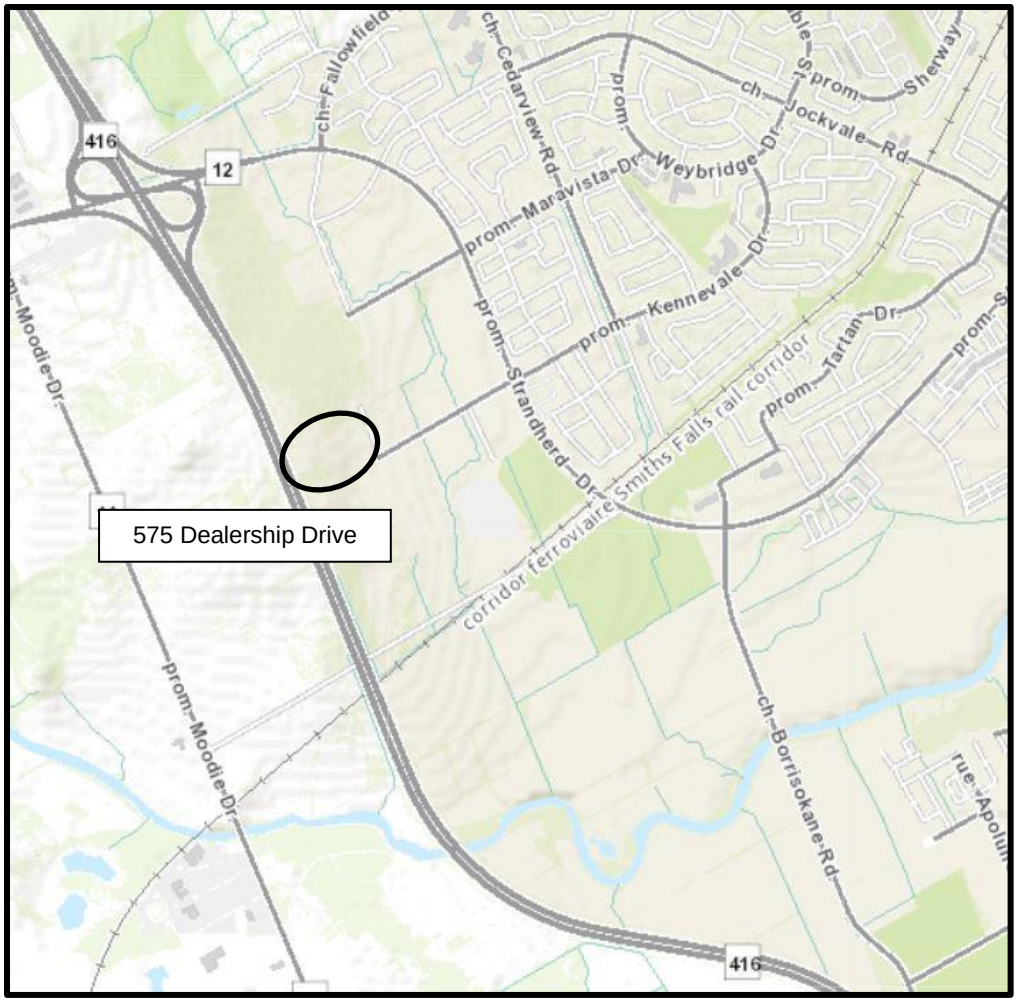
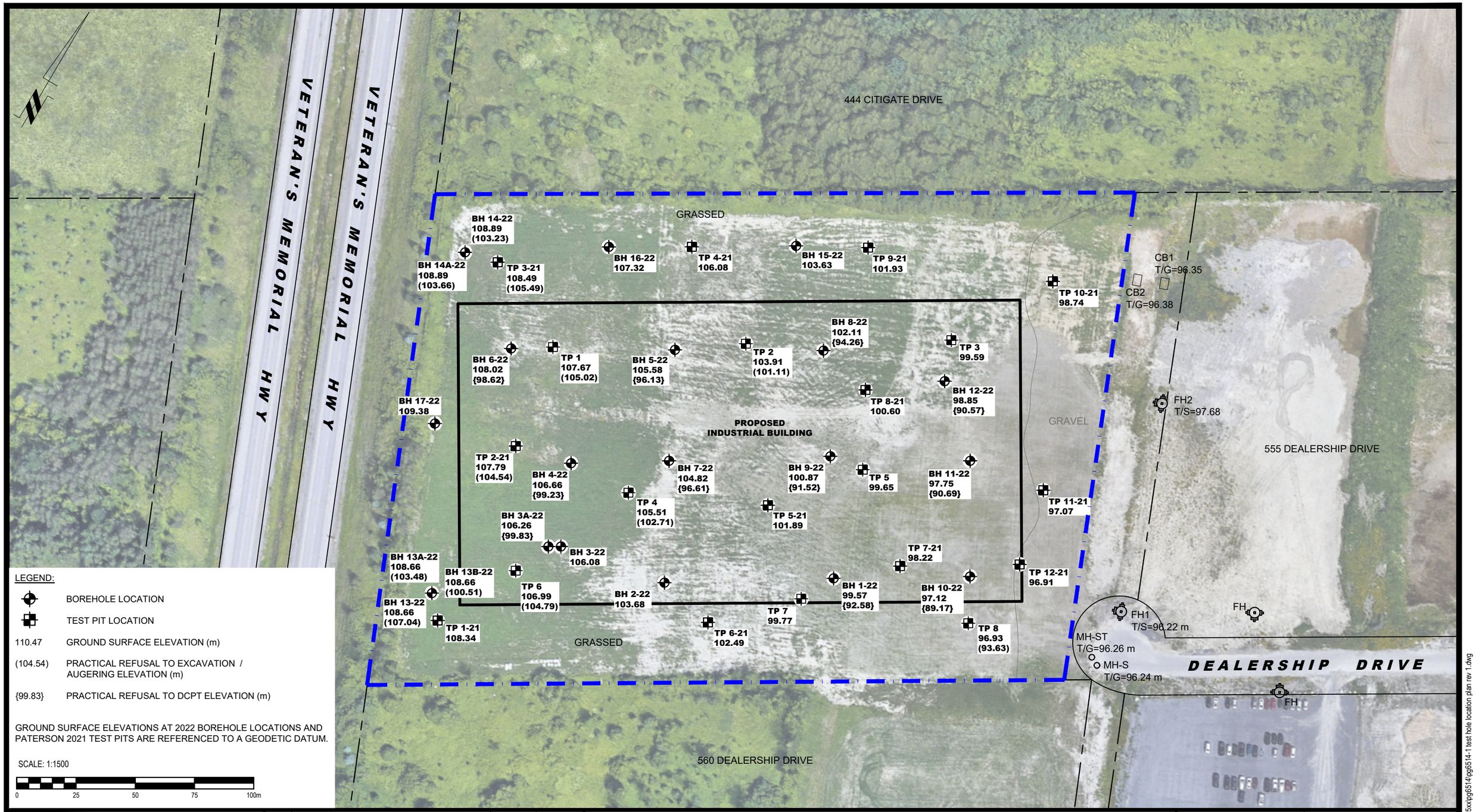


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

- BOREHOLE LOCATION
- TEST PIT LOCATION
- 110.47 GROUND SURFACE ELEVATION (m)
- (104.54) PRACTICAL REFUSAL TO EXCAVATION / AUGERING ELEVATION (m)
- {99.83} PRACTICAL REFUSAL TO DCPT ELEVATION (m)

GROUND SURFACE ELEVATIONS AT 2022 BOREHOLE LOCATIONS AND PATERSON 2021 TEST PITS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1500

0 25 50 75 100m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	BH 13-22 - BH 17-22 ADDED TO PLAN	05/01/2023	MS

RF OTTAWA LIMITED PARTNERSHIP C/O ROSEFELLOW DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
575 DEALERSHIP DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 12/2022
Drawn by: YA	Report No.: PG6514-1
Checked by: MS	Dwg. No.: PG6514-1
Approved by: DJG	Revision No.: 1

11x17

p:\autocad drawings\geotechnical\pg65xx\pg6514\pg6514-1 test hole location plan rev 1.dwg