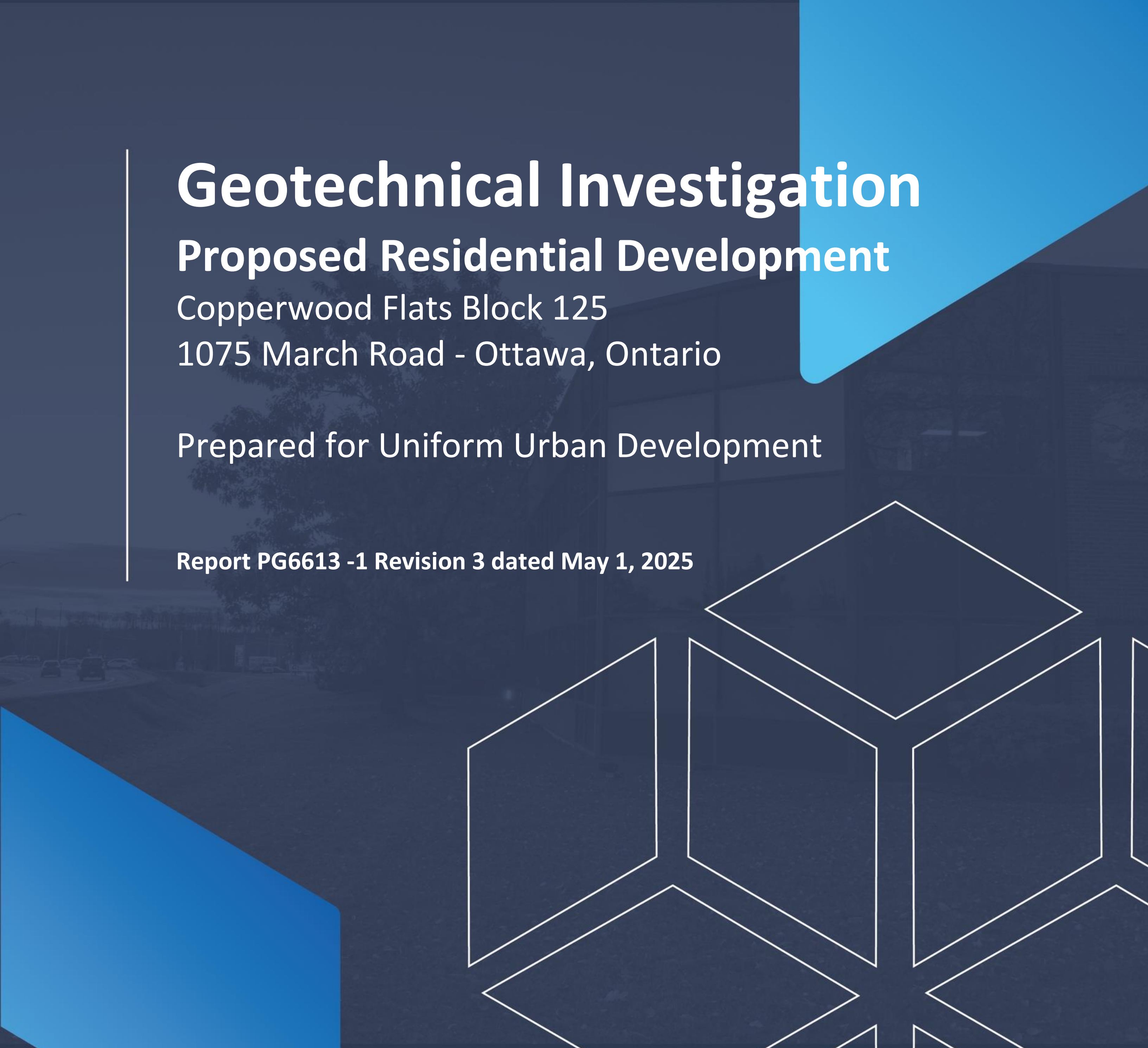

Geotechnical Investigation

Proposed Residential Development

Copperwood Flats Block 125
1075 March Road - Ottawa, Ontario

Prepared for Uniform Urban Development

Report PG6613 -1 Revision 3 dated May 1, 2025

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Uniform Urban Development to conduct a geotechnical investigation for the proposed development to be located at 1075 March Road, Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the geotechnical investigation was to:

☐ Determine the subsoil and groundwater conditions at the site by means of test holes.

☐ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect its design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development 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 Block 125 of the proposed development will consist of three low-rise residential buildings. It is anticipated that the proposed development will include associated driveways, local roadways, parking areas, and landscaped areas. It is further anticipated that the development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was carried out on March 17, 2023, and consisted of excavating three (3) test pits to a maximum depth of 1.7 m below the existing grade. A supplemental geotechnical investigation was conducted on November 22 and 25, 2024, and consisted of three (3) boreholes advanced to a maximum depth of 7.0 m below the existing ground surface and four (4) test pits advanced to a maximum depth of 2.5 m below the existing ground surface. Historical boreholes and test pits were completed by Paterson within the vicinity of the subject site. The findings at the test hole locations of our previous investigations are also discussed in the present report.

The test hole locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and existing site features and conditions. The test hole locations for the current and previous investigations are presented on Drawing PG6613-1 - Test Hole Location Plan included in Appendix 2.

The test pits were excavated using a hydraulic shovel and the boreholes were completed using a low-clearance track-mounted auger drill rig operated by a two-person crew at the selected locations across the site. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical department. The drilling and excavation procedure consisted of advancing to the required depths at the selected locations, sampling, and testing the overburden and bedrock.

Sampling and In Situ Testing

The soil samples were recovered from the auger flights and using a 50 mm diameter split-spoon sampler during drilling operations and grab samples were collected from the open test holes during test pitting operations. Further, the bedrock was cored to assess the bedrock quality. All soil samples and rock cores were visually inspected and initially classified on site. The auger, split-spoon, and grab samples were placed in sealed plastic bags, and rock cores were placed in cardboard boxes. The depths at which the auger, split-spoon, grab samples, and rock cores were recovered from the test holes are shown as AU, SS, G, and RC, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

Diamond drilling was completed at each borehole location to assess the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown as RC on the Soil Profile and Test Data sheets in Appendix 1.

The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock. Test pit were excavated using a track mounted excavator and samples were taken from the side of the excavation.

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

Groundwater

All boreholes were fitted with flexible piezometers to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. Sidewall infiltration was also observed at the time of completing the test pits and was recorded prior to backfilling the test pits. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

3.2 Field Survey

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 and ground surface elevation at each test hole location are presented on Drawing PG6613-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of two (2) Atterberg Limits tests, one (1) grain size analysis, and one (1) shrinkage test were completed on selected soil samples. Moisture content testing was completed on all recovered soil samples from geotechnical investigations. The results are presented in Subsection 4.2 and enclosed in Appendix 1.

Sample Storage

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

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 by others. The samples were 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 currently consists of undeveloped land, previously used for agricultural purposes. Topsoil stripping and construction activities were underway at the time of preparation of this report within and/or near the subject site. Small fill piles and boulders extracted from construction activities were observed at some locations. An existing creek flows from west to east across the subject site. It is understood that this creek will be diverted to an engineered channel outside the site as part of the main Copperwood Estates Development.

The site is bordered by March Road to the east, by Buckbean Avenue to the north, by a residential building and active construction site to the northeast, by undeveloped land to the west, and by Bosch Place to the south. The ground surface is generally flat and gently slopes down from west to east towards March Road from approximate geodetic elevations of 86.5 to 83.2 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface soil profile encountered at the test hole locations consists of topsoil or fill underlain by silty clay, glacial till, and/or bedrock surface. The fill is observed to extend a depth ranging from 0.9 to 3.1 m below the ground surface. The silty clay deposit was encountered within all test holes with the exception of BH 2-24, BH 3-24, and TP 1-24 to TP 3-24, and it was observed to consist of a hard to stiff brown silty clay crust. Glacial till was encountered underlying the brown silty clay layer or fill. The glacial till layer was observed to consist of dense to very dense brown silty clay with some sand, gravel, cobbles, and boulders.

Practical refusal to excavation on bedrock surface was encountered at all test pit locations except for TP 1-24, TP2-24, and TP3-24 at depths ranging between 0.7 to 3.1 m below existing ground surface.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Bedrock consisting of grey limestone was encountered at boreholes BH 1-24 to BH 3-24 at a depth ranging from 1.4 to 3.1 m below the existing ground surface. The bedrock was cored at the location of boreholes BH 1-24, BH2-24, and BH 3-24, to a depth of 4.0, 7.0, and 6.1 m, respectively. RQD values indicate that the bedrock consists of fair to excellent quality, grey limestone.

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

In addition, based on available geological mapping and information, the bedrock in the subject area consists of sedimentary rocks including limestone, sandstone, and dolomite of the March Formation, with an overburden thickness of 1 to 3 m depth.

Grain Size Distribution and Hydrometer Test

One sieve analysis was completed to classify selected soil samples 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 (%)	Clay (%)
TP 8-23	G2	10.7	4.5	43.8	41.0

Atterberg Limit Tests

Two selected silty clay samples were submitted for Atterberg Limit testing. The test results indicate that the silty clay is classified as clay of High Plasticity (CH) in accordance with the Unified Soil Classification System. 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 (%)
TP 1-23	G2	67	29	38
TP 7-23	G2	68	33	35

Shrinkage Test

The shrinkage limit and shrinkage ratio of the tested silty clay sample (TP4-23-G2) were found to be 17.13% and 1.839, respectively.

4.3 Groundwater

Groundwater infiltration levels were recorded in the open test holes upon completion of the investigation program. Also, groundwater levels were recorded in the piezometers installed at the borehole locations on December 2, 2024. The groundwater level readings at that time are presented in Table 3 and are noted on the applicable Soil Profile and Test Data sheets in Appendix 1.

The test pits were noted to be generally dry, with the exception of TP 2-24, and TP 4-23 to TP 8- 23 in which 'perched' water infiltration was noted at depths ranging between 1 and 2.6 m.

Table 3 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-24	85.06	0.29	84.77	December 2, 2024
BH 2-24	85.94	4.42	81.52	
BH 3-24	86.53	5.52	81.01	

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

At BH 1-24, the groundwater was observed at a depth of 0.29 m (elevation 84.77 m), which may reflect surface water infiltration into the borehole. Surface water can sometimes become trapped in a backfilled borehole, leading to higher than typical groundwater level observations. Based on the data from BH 2-24 and BH 3-24, groundwater levels were measured at depths of 4.42 m (elevation 81.52 m) and 5.52 m (elevation 81.01 m), respectively.

The Long-term groundwater levels can also be estimated based on the observed color, consistency, and moisture content of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at an approximate elevation between **81.5 and 82.5 m**. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed residential development. It is anticipated that the future buildings will be founded over conventional shallow footings placed on an undisturbed, very stiff brown silty clay, or an undisturbed, dense to very dense glacial till, or a clean, surface-sounded bedrock bearing surface.

Due to the presence of a silty clay deposit at the subject site, a permissible grade raise restriction is required for the proposed development where the silty clay layer is present below the building footprint.

It is anticipated that the removal of bedrock and/or large boulders will be required for building construction and servicing installation. Therefore, the contractor should be prepared for bedrock removal and the presence of large boulders within the subject site.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoils and deleterious fill, such as those containing organic materials or construction debris, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

The existing fill material, where free of significant amounts of organic material, should be proof rolled by a vibratory roller making several passes under dry and above-freezing conditions, and reviewed and approved by Paterson Group at the time of construction. Provided that minimal flexing is observed, the fill layer can be left in place as subgrade for pavement structure. However, all existing fill materials should be stripped from under the proposed foundations.

Bedrock Removal

Bedrock and/or boulder removal may be required at the subject site and can be accomplished by hoe ramming where the bedrock and/or boulders are weathered, and/or where only small quantities need to be removed. Sound bedrock and/or boulders may be removed by line drilling in conjunction with controlled blasting and/or hoe ramming.

Excavating boulders and bedrock will often lead to over excavation due to the natural aspect of boulders and lamination in the rock. The contractor should be ready to backfill and compact over excavated areas with engineered fill or lean concrete. Paterson should review field conditions as they arise on site.

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 the 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 or claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed the below noted vibration limits during the blasting program to reduce the risks of damage to the existing surrounding 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 carried out using near vertical sidewalls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing of the overburden. The 1 m horizontal ledge setback can be eliminated with a shoring program which has drilled piles extending below the proposed founding elevation.

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 into the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment 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 to be completed to minimize the risks of claims during or following the construction of the proposed buildings.

Overbreak in Bedrock

Sedimentary bedrock formations, such as limestone, dolomite, and shale, contain bedding planes, joints and fractures, and mud seams which create natural planes of weakness within the rock mass. Although several factors of a blast or rock removal may be controlled to reduce backbreak and overbreak, the rock mass will tend to break along natural planes of weakness that may be present beyond the designed profile. However, estimating the exact amount of backbreak and overbreak that may occur is not possible.

Backbreak should be expected to occur along the perimeter of the building excavation footprint with conventional bedrock removal methods. Further, overbreak is expected to occur throughout the lowest lifts of blasting due to the variable bedding planes and planes of weakness in the in-situ bedrock. It is very difficult to mitigate significant overbreak given the constraints posed by footing geometry and spacing with respect to the zone of influence of removal equipment and the bedrock in-situ characteristics.

Depending on the methodology undertaken by the contractor, efforts taken to minimize backbreak and overbreak may add significant time and costs to the excavation operations and is not guaranteed to completely eliminate the potential for backbreak and overbreak. As such, volume estimates of bedrock to be removed may not be reflective of the actual volume of bedrock that may be required to be removed at the time of construction. This may result in additional materials, such as imported fill and concrete, to make up for additional rock loss.

It is recommended that the tender considers overbreaks in the rock and budgetary allowance be made for the installation of engineered fill or lean concrete based on the structural bearing requirements.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A, Granular B Type II or well graded blast rock (max. size of 200 mm diameter) and approved by the geotechnical consultant at the time of construction. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

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

In-Filling Existing Creek

In-filling operations for the existing creek, if required, should be completed in a stepped fashion in accordance with the following procedure:

☐ The existing creek side slopes should be stepped to provide a 1.5H:1V profile with maximum 600 mm high steps. All existing sediment and topsoil should be removed from the side slopes and bed of the creek.

- ☐ A well graded blast rock (maximum 300 mm diameter), or suitable alternative backfill to be approved by Paterson, should be placed in maximum 500 mm loose lifts under dry conditions and compacted using suitable compaction equipment from the base of the creek up to 500 mm below the subbase level of the proposed pavement structure.
- ☐ The blast rock fill layer, or suitable alternative, should be capped with a minimum 300mm thick layer of Granular B Type II. The cap layer should be placed in a maximum 300 mm loose lifts and compacted to 98% of its SPMDD below the proposed roadway and design underside of footings for future residential units. The granular pad should be compacted to a minimum 98% of its SPMDD within the right-of-way.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Footings)

Using continuously applied loads, isolated footings, placed over an undisturbed very stiff brown silty clay, or an undisturbed dense to very dense glacial till, or a clean, surface-sounded bedrock bearing surface can be designed using the bearing resistance values presented in Table 4 below.

Table 4 - Recommended Bearing Resistance Values – Conventional Shallow Foundations

Bearing Surface	SLS (kPa)	ULS (kPa) **
Very Stiff Brown Silty Clay *	150	225
Dense to Very Dense Glacial Till	200	300
Sound Bedrock	N/A	1500

Note:
* - Strip footings, up to 2 m wide, and pad footings, up to 5 m wide, placed over a silty clay bearing surface can be designed using the above noted bearing resistance values.
** - A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance values at ULS.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose or disturbed soil, whether in situ or not, have been removed, in the dry, prior to placement of concrete 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 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.

Footings bearing on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

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

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 hard to very stiff silty clay, very dense glacial till, or engineered fill bearing media when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as that of the bearing medium. In unfractured bedrock, a plane with a slope of 1H:6V can be used.

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 sub-excavation 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.

Permissible Grade Raise Recommendations

Based on the undrained shear strength values of the silty clay deposit encountered within the subject site, a **permissible grade raise restriction of 3.0 m** is recommended for the site. Footings bearing on bedrock are not subjected to permissible grade raise restrictions.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class X_C** for foundations constructed at the subject site, according to Table 4.1.8.4.A of the 2024 Ontario Building Code (OBC 2024). A higher seismic site class would be applicable for the proposed building if a site-specific seismic shear wave velocity test is completed at the subject site.

The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2024 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Floor Slab Construction

With the removal of all topsoil and deleterious fill, such as those containing organic materials, from within the footprints of the proposed buildings, the native soil surface or approved engineered fill surface will be considered an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

If the floor slab is constructed in the areas of shallow bedrock, it is recommended that a minimum 300 mm thick layer (native soil plus crushed stone layer) be present between the floor slab and the bedrock surface to reduce the risks of bending stresses developing in the concrete slab.
The bending stress could lead to cracking of the concrete slab. This requirement could be waived in areas where the bedrock surface is relatively flat within the footprint of the building. This recommendation does not refer to potential concrete shrinkage cracking which should be controlled in the usual manner.

5.6 Pavement Design

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

Table 5 - Recommended Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE – Either fill, in situ soils or bedrock or OPSS Granular B Type I or II material placed over in situ soil, bedrock or fill	

Table 6 - Recommended Pavement Structure – Access Lanes and Heavy Truck Parking Areas

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

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material’s SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

For foundations placed at an elevation of 82.0 and above it is recommended that a perimeter foundation drainage system be provided for the proposed development. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfilling

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Terraxx, 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.

Concrete Sidewalks and Walkways

Backfill material below sidewalks and walkway subgrade areas throughout the subject site, including along the buildings, should be provided with a minimum 300 mm thick layer of OPSS Granular A or OPSS Granular B Type II crushed stone. This material should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the materials SPMDD. The subgrade for walkway structures against the building should be shaped to promote drainage towards the buildings perimeter drainage system.

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

Where footings are founded directly on clean, surface-sounded bedrock with no near-surface cracks or fissures and is approved by Paterson personnel at the time of the excavation, the minimum soil cover, listed above, is not required.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

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. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Excavation completed into the bedrock can be completed near vertical (1H:6V) with proper benching between the overburden. Deep bedrock excavation should be cleaned and reviewed to ensure the face is stable.

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 95% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the upper portion of the dry to moist (not wet) sandy silt above the cover material if the excavation and filling operations are carried out in dry weather conditions. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement.

The backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, 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.

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 non-aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

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. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. The results of our testing are presented in Table 1 and Table 2 in Subsection 4.2 and in Appendix 1. Based on our Atterberg Limits test results, the plasticity index limit generally does not exceed 40%. Based on the results of our review, the encountered clays below Block 1 and Block 2 at the subject site are classified as low/medium sensitivity clay soils as per City Guidelines at the subject site.

Based on our review, the following tree planting setbacks are recommended for footings supported on the low to medium sensitivity area for Block 1 and Block 2. Footings bearing on the encountered bedrock bearing medium and footings for Block 3 will not be subject to tree planting setbacks. Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). 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 must be satisfied for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan.

☐ A small tree must be provided with a minimum of 25 m^3 of available soils volume while a medium tree must be provided with a minimum of 30 m^3 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), as noted on the subdivision Grading Plan.

If consideration is given to place trees within 4.5 m of the foundation walls of Block 1 and Block 2, it is recommended that the thin layer of silty clay encountered below Block 1 and Block 2 be removed and replaced with engineered fill as described in section 5.2.

Swimming Pools, Above Ground Hot Tubs, Decks and Additions

The in-situ soils are considered to be acceptable for swimming pools. Above ground swimming pools must be placed at least 5 m away from the residence foundation and neighboring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

Additional grading around the hot tub should not exceed permissible grade raises. Otherwise, hot tub construction is considered routine, and can be constructed in accordance with the manufacturer’s specifications.

Additional grading around proposed deck or addition should not exceed permissible grade raises. Otherwise, standard construction practices are considered acceptable.

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 of the grading and site servicing plans from a geotechnical perspective.

☐ Review of the proposed excavation activities

☐ 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 ensure that the specified level of compaction has been achieved.

☐ Sampling and testing of the bituminous concrete including mix design reviews.

All excess soils generated by construction activities should be handled as per ***Ontario Regulation 406/19: On-Site and Excess Soil Management***.

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.

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 Uniform Urban Development 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.

LICENSED PROFESSIONAL ENGINEER
May 1, 2025
J. R. VILLENEUVE
100504344
PROVINCE OF ONTARIO

Jahangiri

Ghodratollah Jahangiri, M.Sc.

Joey R. Villeneuve, P.Eng., ing., M.A.Sc.

Report Distribution:

☐ Uniform Urban Development (email copy)
☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ROCK CORE PHOTOGRAPHS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 348020.16 **NORTHING:** 5025101.84 **ELEVATION:** 85.06

PROJECT: Proposed Residential Development

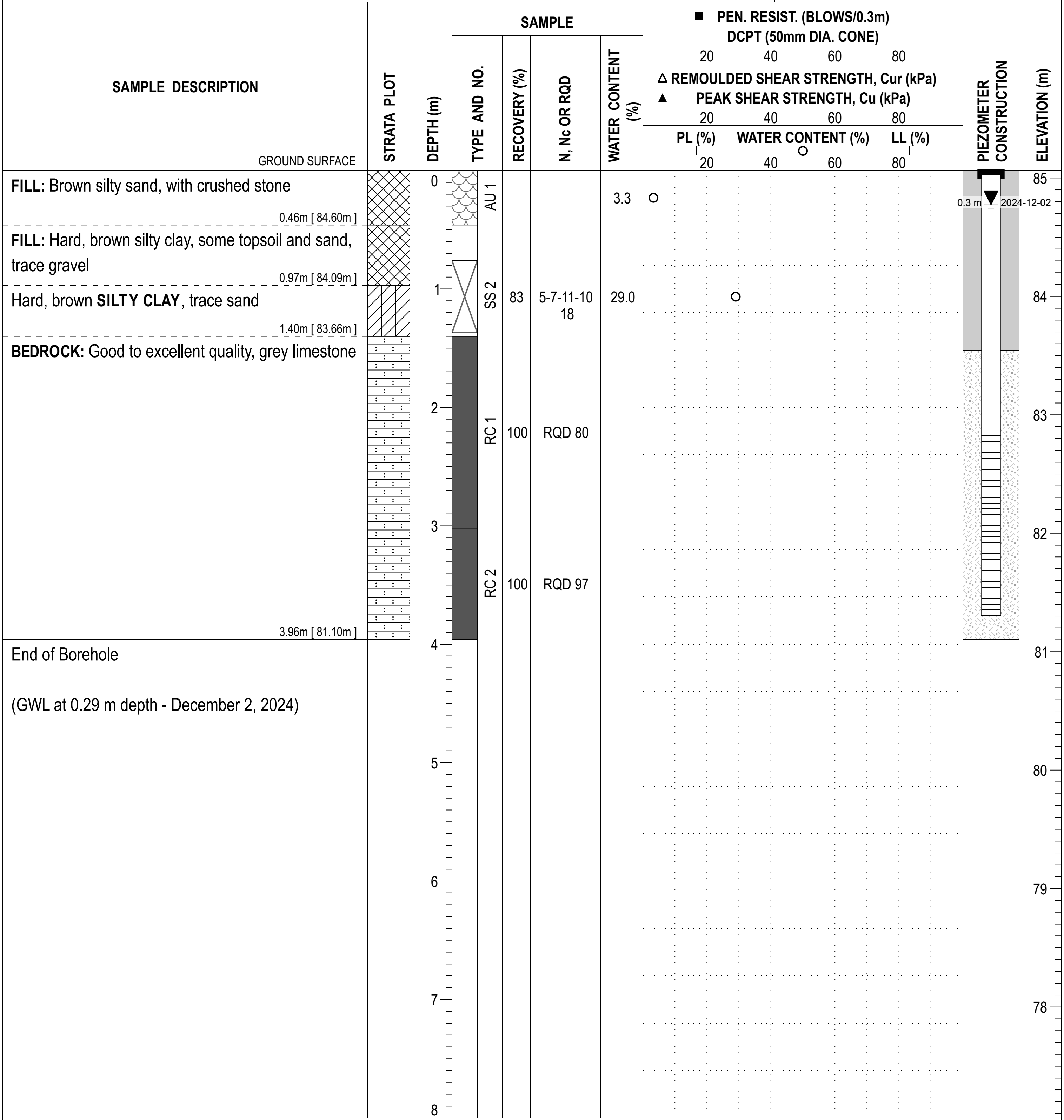
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: November 25, 2024

FILE NO. : PG6613

HOLE NO. : BH 1-24



SAMPLE DESCRIPTION	
GROUND SURFACE	
FILL: Brown silty sand, with crushed stone	0.46m [84.60m]
FILL: Hard, brown silty clay, some topsoil and sand, trace gravel	0.97m [84.09m]
Hard, brown **SILTY CLAY**, trace sand	1.40m [83.66m]
BEDROCK: Good to excellent quality, grey limestone	3.96m [81.10m]
End of Borehole (GWL at 0.29 m depth - December 2, 2024)	

SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			3.3
SS 2	83	5-7-11-10 18	29.0
RC 1	100	RQD 80	
RC 2	100	RQD 97	

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 348006.96 **NORTHING:** 5025073.00 **ELEVATION:** 85.94

PROJECT: Proposed Residential Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

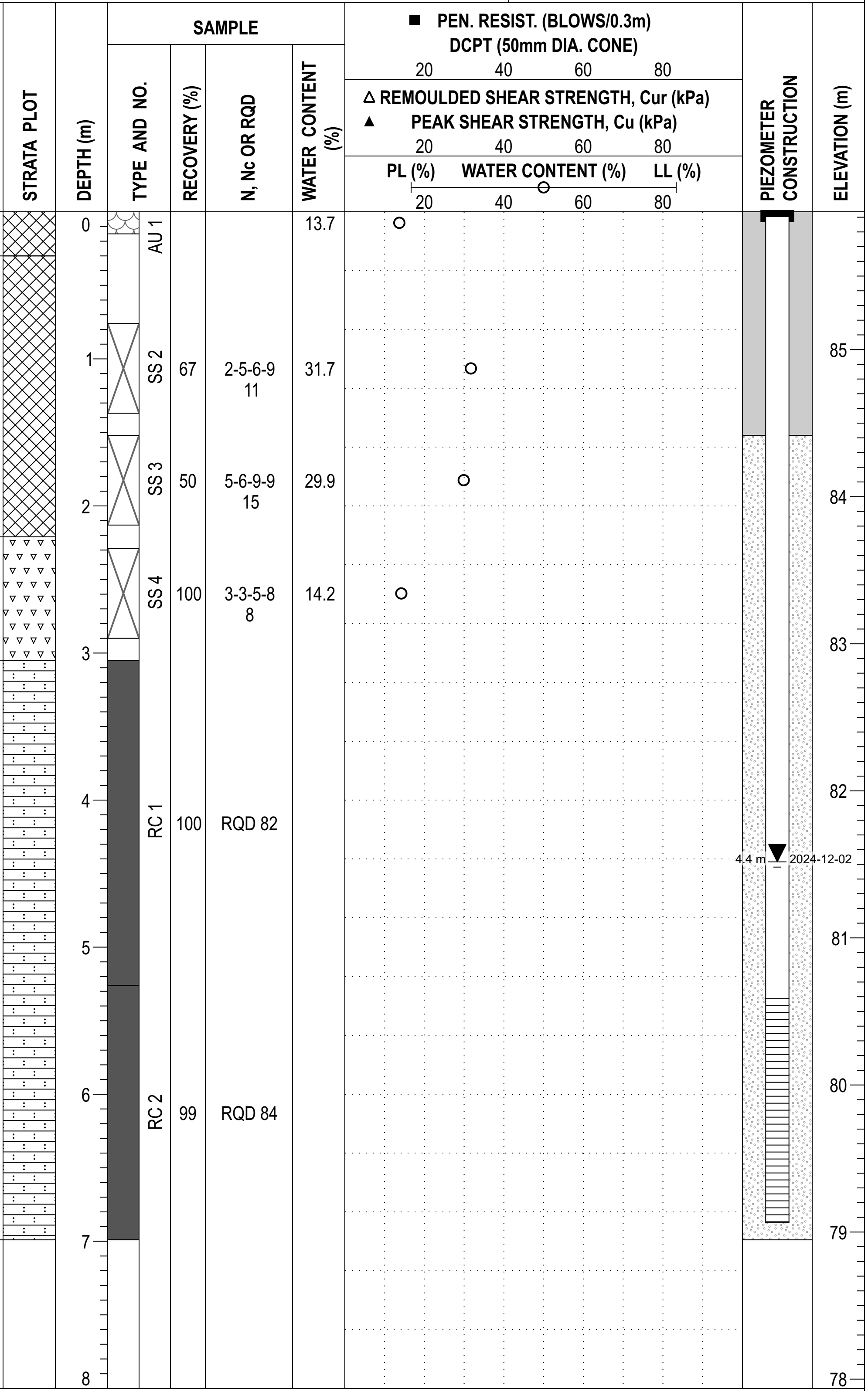
DATE: November 25, 2024

FILE NO. : PG6613

HOLE NO. : BH 2-24

SAMPLE DESCRIPTION	DEPTH (m)
GROUND SURFACE	0
FILL: Brown silty clay, some cobbles and sand, trace gravel	0.30m [85.64m]
FILL: Brown silty clay, with to trace topsoil, trace sand and brick	2.21m [83.73m]
GLACIAL TILL: Loose, brown silty sand, with cobbles and boulders, some clay, trace gravel	3.05m [82.89m]
BEDROCK: Good quality, grey limestone	6.99m [78.95m]
End of Borehole (GWL at 4.42 m depth - December 2, 2024)	

SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
AU 1			13.7
SS 2	67	2-5-6-9 11	31.7
SS 3	50	5-6-9-9 15	29.9
SS 4	100	3-3-5-8 8	14.2
RC 1	100	RQD 82	
RC 2	99	RQD 84	



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 348008.06 **NORTHING:** 5025020.54 **ELEVATION:** 86.53

PROJECT: Proposed Residential Development

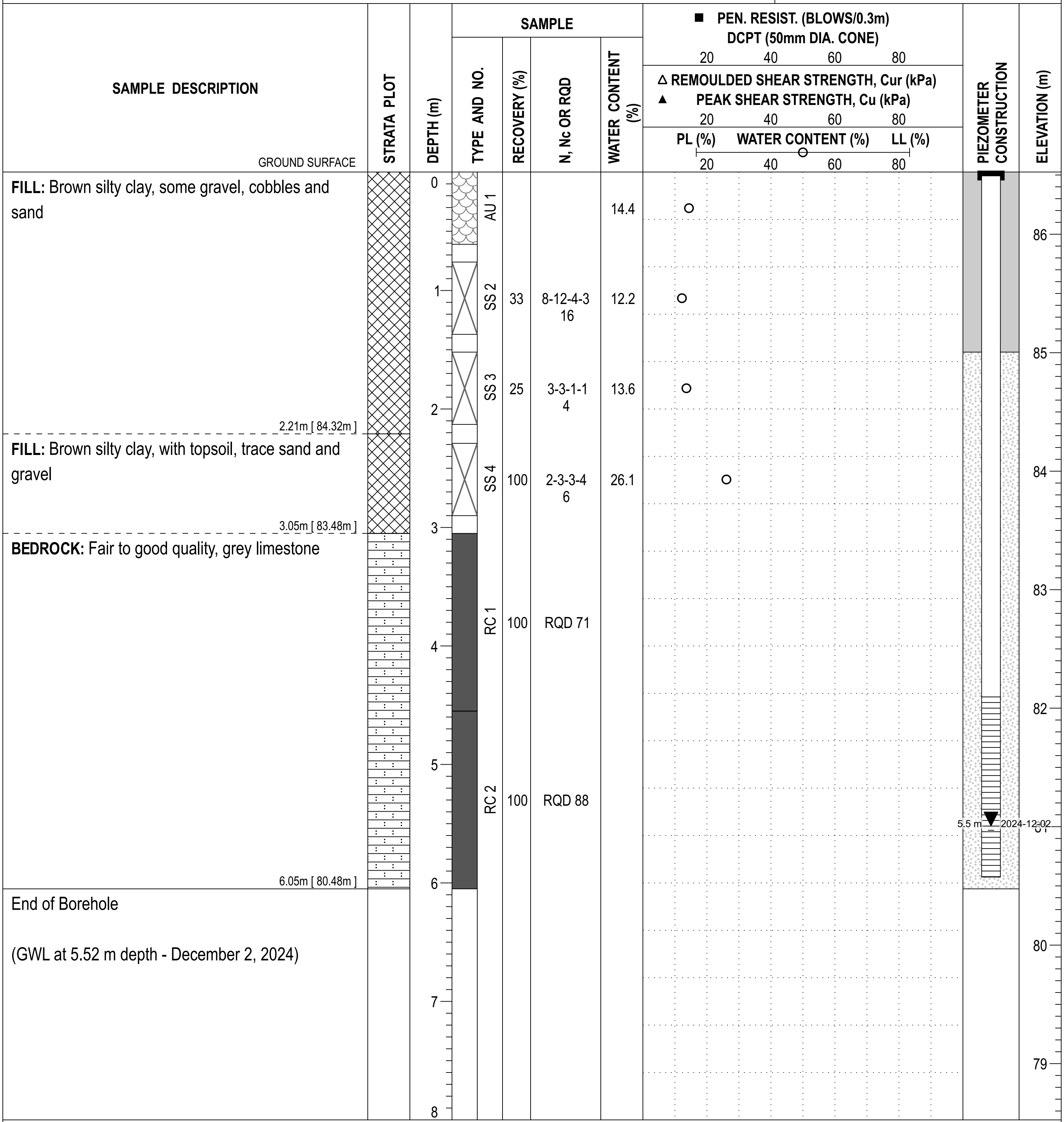
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: November 25, 2024

FILE NO. : PG6613

HOLE NO. : BH 3-24



SAMPLE DESCRIPTION	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
GROUND SURFACE					
FILL: Brown silty clay, some gravel, cobbles and sand		AU 1			14.4
		SS 2	33	8-12-4-3 16	12.2
		SS 3	25	3-3-1-1 4	13.6
2.21m [84.32m]					
FILL: Brown silty clay, with topsoil, trace sand and gravel		SS 4	100	2-3-3-4 6	26.1
3.05m [83.48m]					
BEDROCK: Fair to good quality, grey limestone		RC 1	100	RQD 71	
		RC 2	100	RQD 88	
6.05m [80.48m]					
End of Borehole					
(GWL at 5.52 m depth - December 2, 2024)					

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 348030.69 **NORTHING:** 5025036.44 **ELEVATION:** 85.46

PROJECT: Proposed Residential Development

BORINGS BY: Excavator

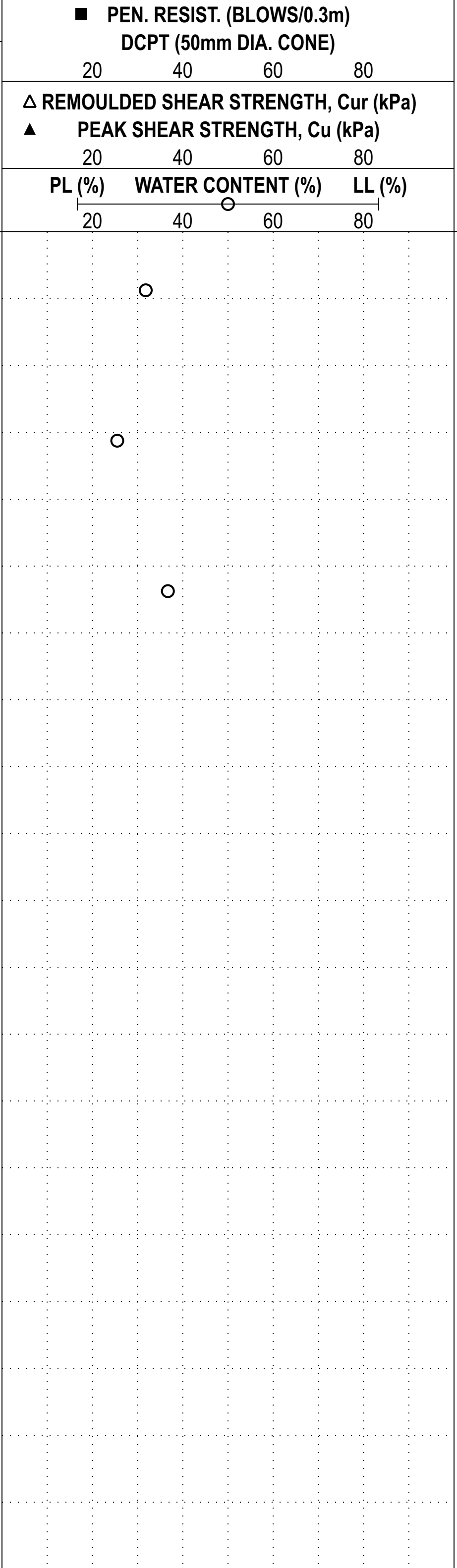
REMARKS:

DATE: November 22, 2024

FILE NO. : PG6613

HOLE NO. : TP 1-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE		0					
FILL: Brown silty clay, with gravel, cobbles and boulders, some sand and topsoil	▨		G 1			31.8	85
		1	G 2			25.5	84
2.10m [83.36m]		2					
TOPSOIL with organics, trace gravel	■		G 3			36.7	83
2.50m [82.96m]							
End of Test Pit Practical refusal to excavating on bedrock surface at 2.50 m depth Test pit dry upon completion		3					82
		4					81
		5					80
		6					79
		7					78
		8					



PIEZOMETER CONSTRUCTION

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 347999.81 **NORTHING:** 5025099.78 **ELEVATION:** 86.06

PROJECT: Proposed Residential Development

BORINGS BY: Excavator

REMARKS:

DATE: November 22, 2024

FILE NO. : PG6613

HOLE NO. : TP 2-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 △ REMOULDED SHEAR STRENGTH, Cur (kPa) ▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							86
FILL: Crushed stone and gravel	▨								
0.50m [85.56m]									
FILL: Blast rock	▨	1							85
1.70m [84.36m]									
FILL: Brown silty clay, trace sand and topsoil	▨		G 1			39.1	○		
1.90m [84.16m]		2							84
End of Test Pit									
		3							83
		4							82
		5							81
		6							80
		7							79
		8							

Practical refusal to excavating on bedrock surface at 1.90 m depth

Groundwater infiltration observed at 1.0 m depth

P:/Autocad Drawings/Test Hole Data Files/PG66xx/PG6613/data.sqlite 2024-12-17, 18:14 Paterson_Template None

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 347997.81 **NORTHING:** 5025048.76 **ELEVATION:** 85.60

PROJECT: Proposed Residential Development

BORINGS BY: Excavator

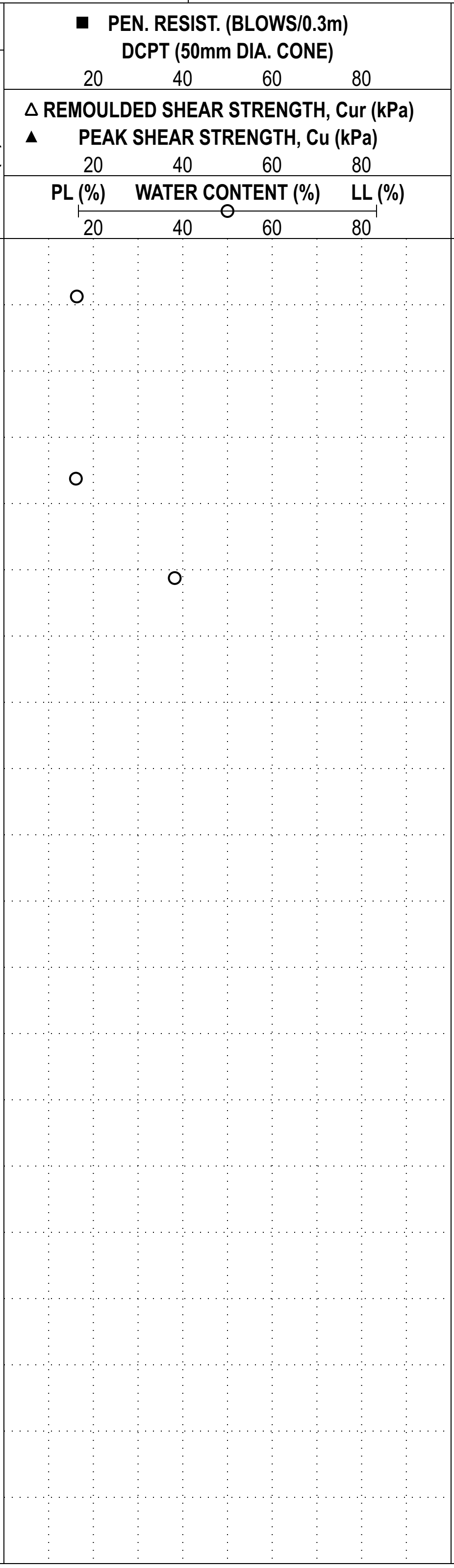
REMARKS:

DATE: November 22, 2024

FILE NO. : PG6613

HOLE NO. : TP 3-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0						
FILL: Brown silty clay, with gravel, cobbles and boulders, some topsoil, organics and sand	▨		G 1			16.3		85
		1	G 2			16.1		84
1.90m [83.70m]								
TOPSOIL with organics	■	2	G 3			38.2		
2.30m [83.30m]								
End of Test Pit Practical refusal to excavating on bedrock surface at 2.30 m depth Test pit dry upon completion		3						83
		4						82
		5						81
		6						80
		7						79
		8						78



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1075 March Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 348027.29 **NORTHING:** 5025063.32 **ELEVATION:** 85.31

PROJECT: Proposed Residential Development

BORINGS BY: Excavator

REMARKS:

DATE: November 22, 2024

FILE NO. : PG6613

HOLE NO. : TP 4-24

SAMPLE DESCRIPTION

GROUND SURFACE

FILL: Brown silty sand, with gravel, cobbles and boulders

0.90m [84.41m]

Very stiff, brown **SILTY CLAY**

1.30m [84.02m]

GLACIAL TILL: Very dense, brown silty sand to sandy silt, with gravel, cobbles and boulders, trace clay

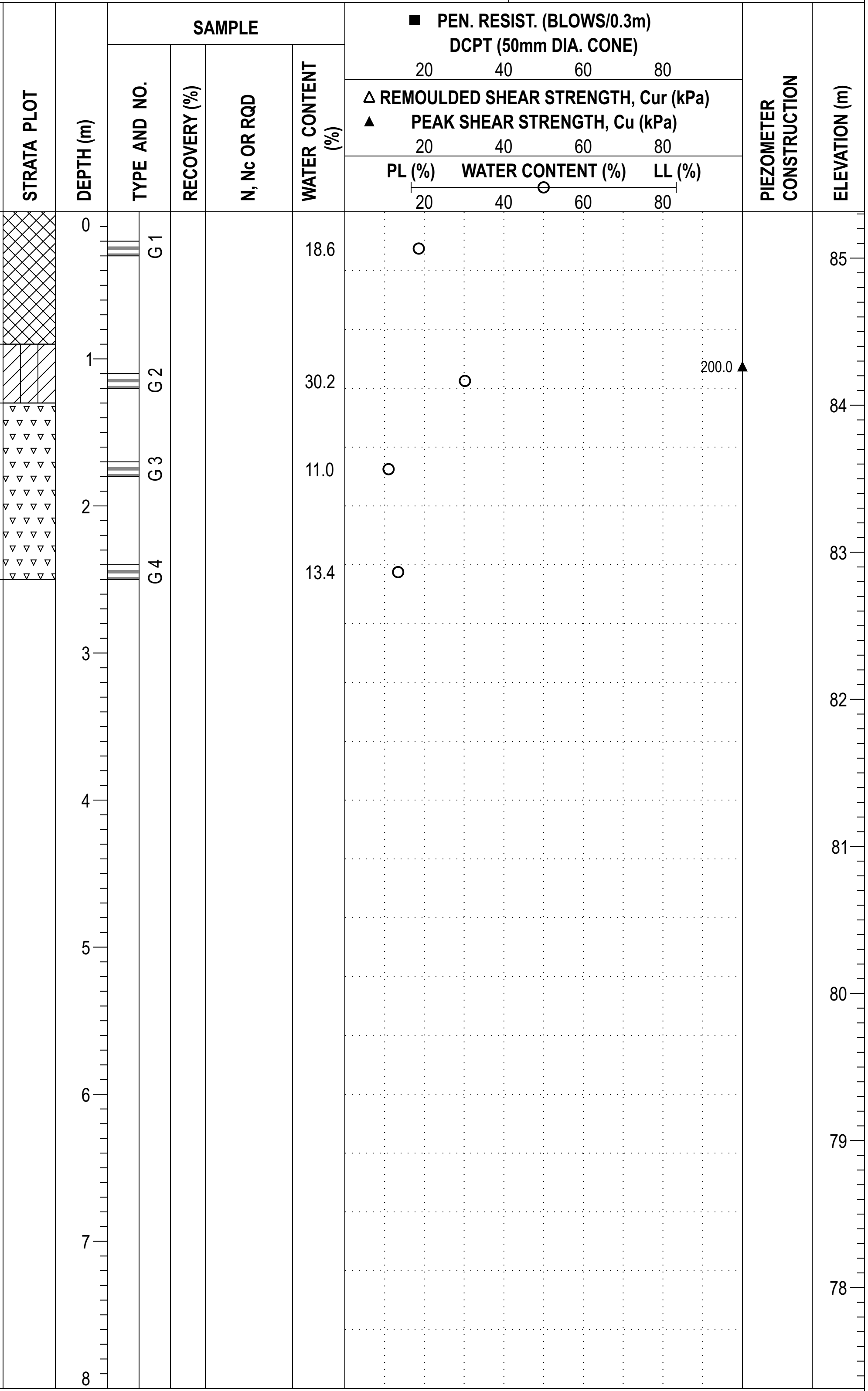
2.50m [82.81m]

End of Test Pit

Practical refusal to excavating on bedrock surface at 2.50 m depth

Test Pit dry upon completion

SAMPLE			
TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)
G 1			18.6
G 2			30.2
G 3			11.0
G 4			13.4



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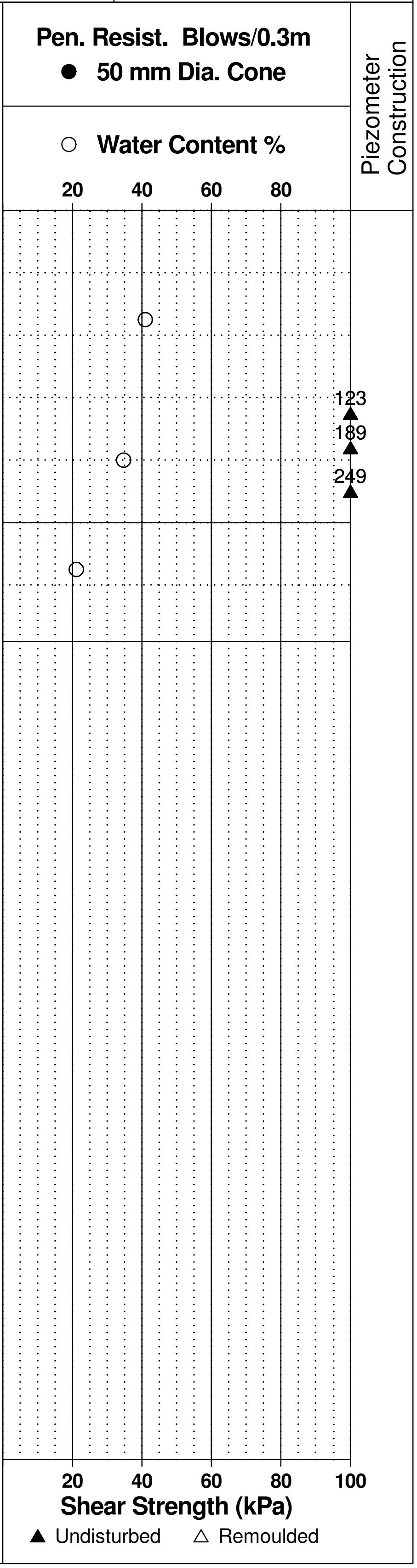
9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Excavator
DATE March 17, 2023
FILE NO. **PG6613**
HOLE NO. **TP 1-23**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
Ground Surface						0	84.44
TOPSOIL 0.30							
		G	1				
Very stiff to hard, brown **SILTY CLAY** with sand		G	2				
1.00						1	83.44
GLACIAL TILL: Very dense, brown silty clay with sand, some gravel, cobbles and boulders 1.38		G	3				
End of Test Pit TP terminated on bedrock surface at 1.38m depth. (TP dry upon completion)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

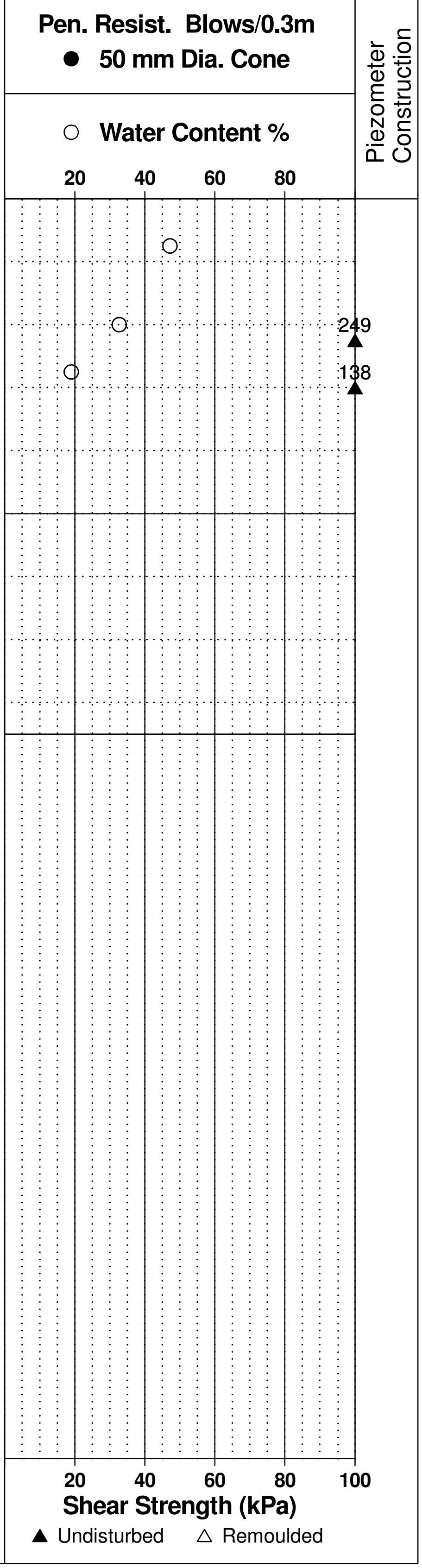
BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

HOLE NO. TP 2-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	85.25
TOPSOIL 0.30		G	1				
Hard to very stiff, brown **SILTY CLAY,** trace sand 0.70		G G	2 3				
GLACIAL TILL: Very dense, brown silty clay, some sand, gravel, cobbles and boulders 1.70						1	84.25
End of Test Pit TP terminated on bedrock surface at 1.70m depth. (TP dry upon completion)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

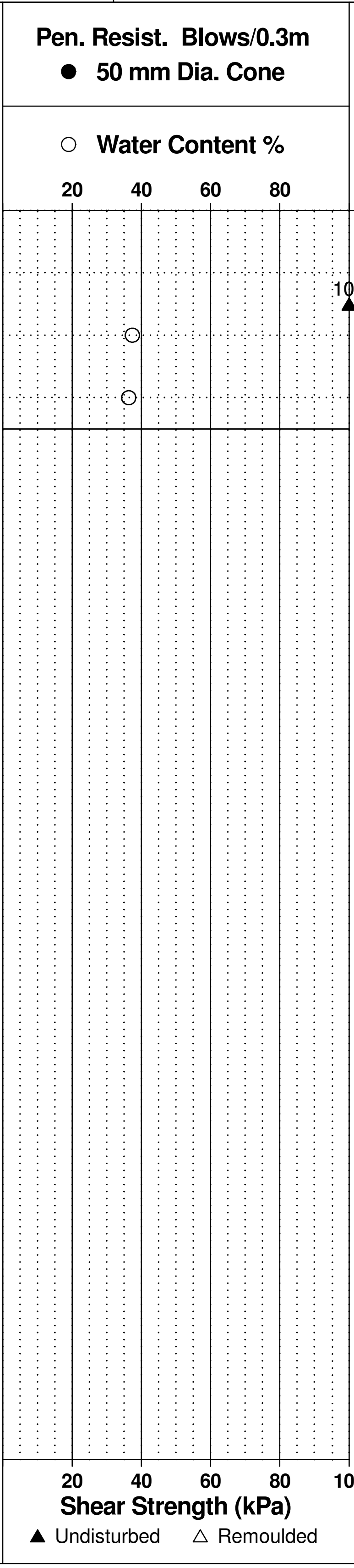
BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

HOLE NO. TP 3-23

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
Ground Surface							0	83.78	
TOPSOIL	0.20	■							
Very stiff, brown **SILTY CLAY,** trace sand	0.40	▨							
GLACIAL TILL: Dense, brown silty clay with sand, some gravel, cobbles and boulders	0.70	^ ^ ^	G G	1 2					
End of Test Pit TP terminated on bedrock surface at 0.70m depth. (TP dry upon completion)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

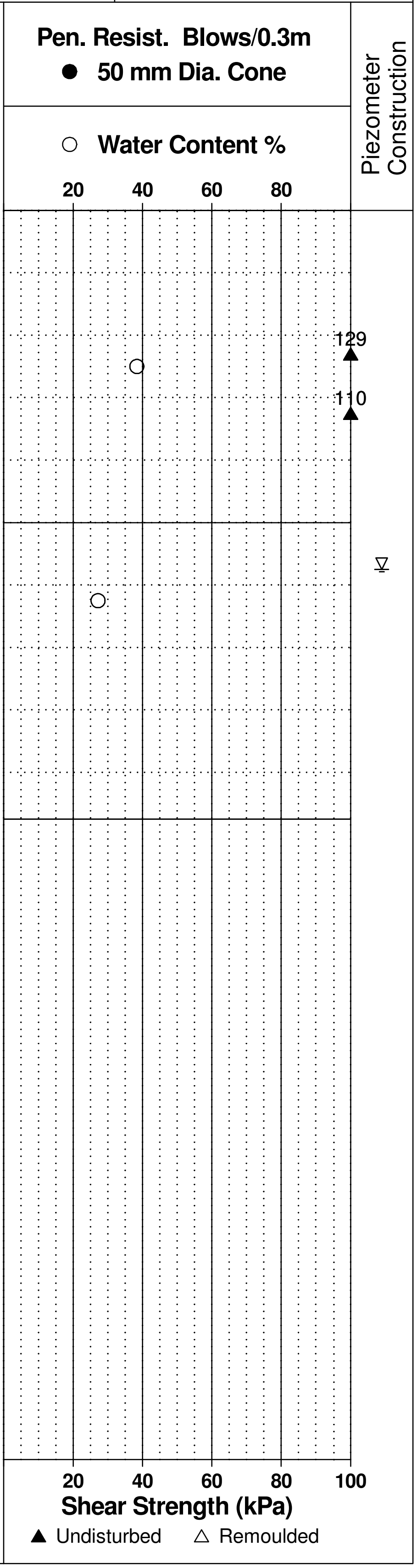
BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

HOLE NO. TP 4-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	85.25
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY** with sand 0.80		G	1				
GLACIAL TILL: Dense, brown silty clay with sand, some gravel, cobbles and boulders 1.95		G	2			1	84.25
End of Test Pit TP terminated on bedrock surface at 1.95m depth. (Groundwater infiltration at 1.15m depth)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

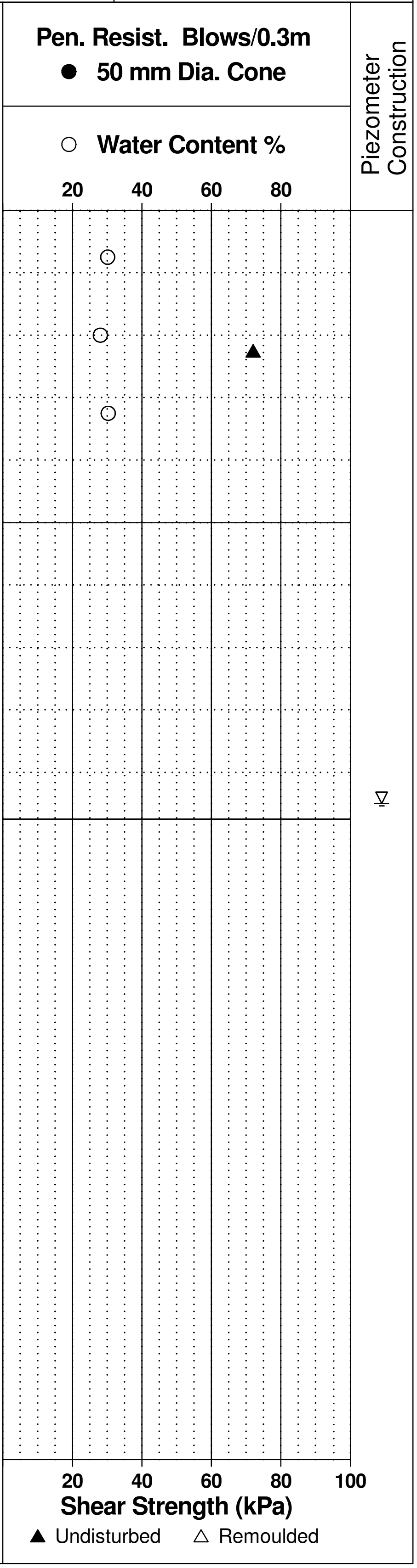
BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

HOLE NO. TP 5-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
Ground Surface						0	85.15
TOPSOIL		G	1				
0.30							
Stiff to very stiff, brown **SILTY CLAY**		G	2				
0.50							
GLACIAL TILL: Dense, brown silty clay with sand, some gravel, cobbles and boulders		G	3				
						1	84.15
1.95							
End of Test Pit TP terminated on bedrock surface at 1.95m depth. (Groundwater infiltration at 1.9m depth)							



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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

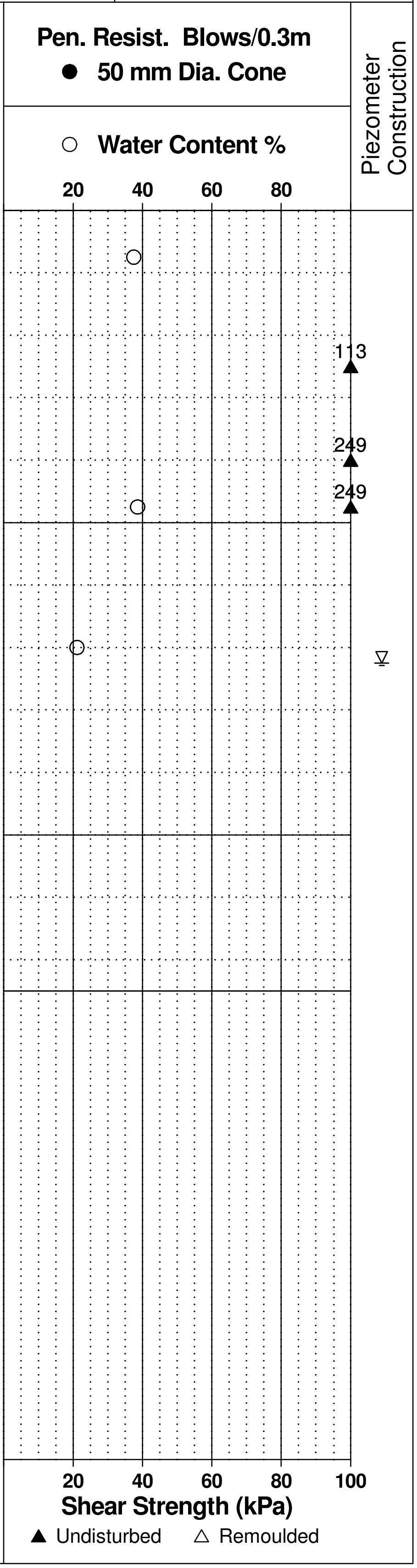
BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

HOLE NO. TP 6-23

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	83.62
TOPSOIL	0.30	G	1				
Hard to very stiff, brown **SILTY CLAY,** trace sand	1.30	G	2			1	82.62
GLACIAL TILL: Dense, brown silty clay with sand, some gravel, cobbles and boulders	2.50	G	3			2	81.62
End of Test Pit TP terminated on bedrock surface at 2.50m depth. (Groundwater infiltration at 1.45m depth)							



patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG6613**

REMARKS

HOLE NO. **TP 7-23**

BORINGS BY Excavator

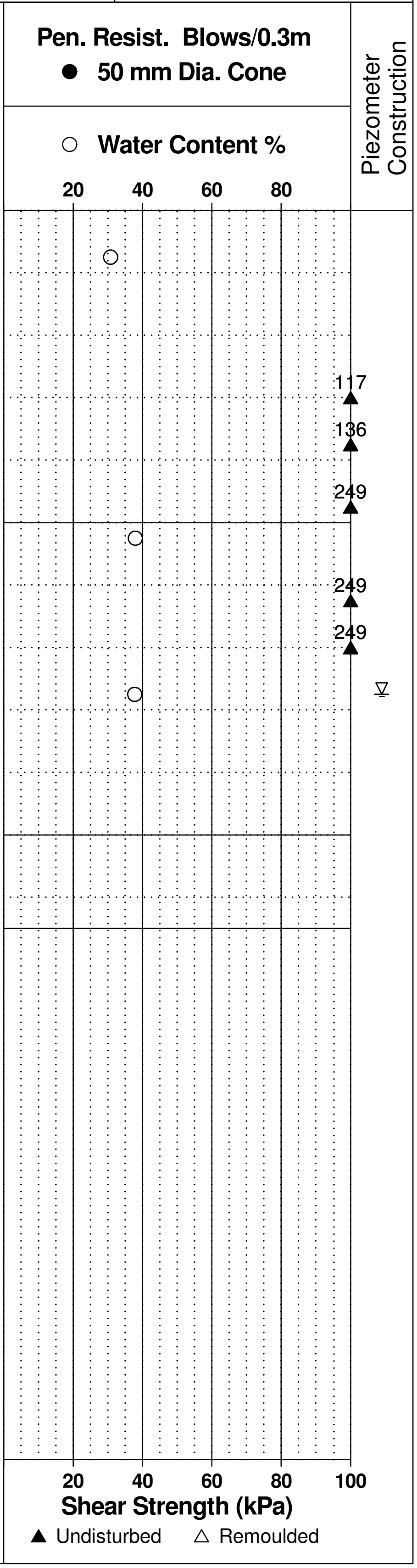
DATE March 17, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	84.92
TOPSOIL	■	G	1				
0.30							
Very stiff to hard, brown **SILTY CLAY**	▨	G	2			1	83.92
1.55		G	3				
GLACIAL TILL: Very dense, brown silty clay with sand, some gravel, cobbles and boulders	^^^					2	82.92
2.30							

End of Test Pit

TP terminated on bedrock surface at 2.30m depth.

(Groundwater infiltration at 1.55m depth)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE March 17, 2023

FILE NO. PG6613

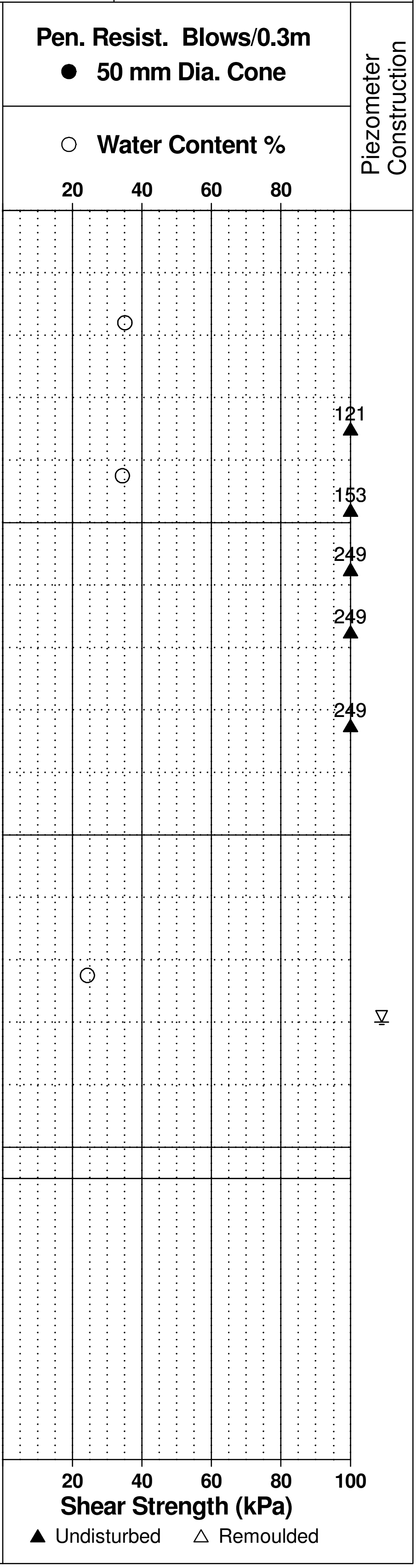
HOLE NO. TP 8-23

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface					0	83.23
TOPSOIL 0.30						
Very stiff to hard, brown **SILTY CLAY,** trace gravel	G	1				
	G	2			1	82.23
2.30					2	81.23
GLACIAL TILL: Dense, brown silty clay with sand, some gravel, cobbles and boulders	G	3				
3.10					3	80.23

End of Test Pit

TP terminated on bedrock surface at 3.10m depth.

(Groundwater infiltration at 2.6m depth)



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storm Water Management Pond Channel
Kanata North, March Road - Ottawa, Ontario

DATUM Geodetic

REMARKS

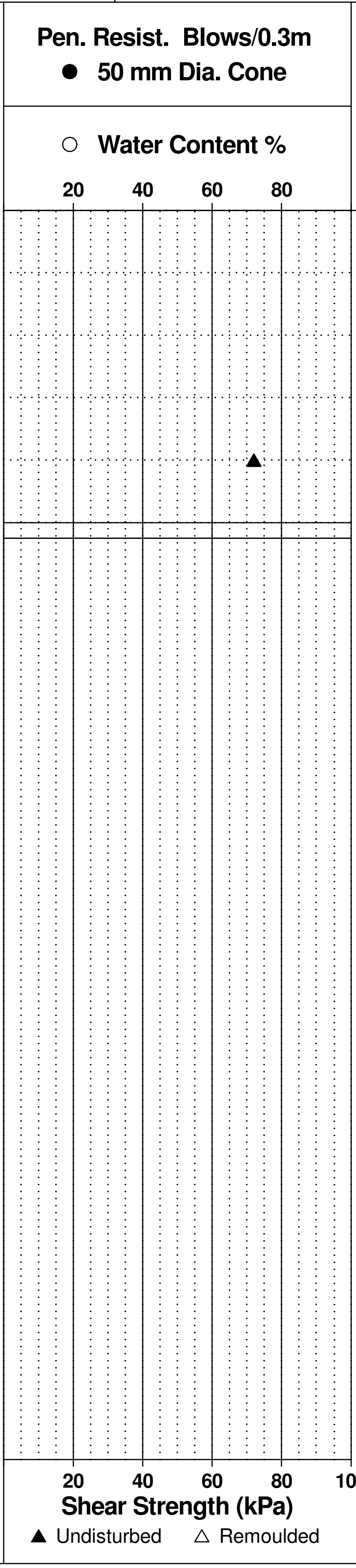
BORINGS BY Excavator

DATE April 7, 2021

FILE NO. PG4258

HOLE NO. TP 7-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	83.99
TOPSOIL 0.35	■						
Stiff, brown **SILTY CLAY** 0.85	▨						
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 1.05	^^^					1	82.99
End of Test Pit Practical refusal to excavation on bedrock surface at 1.05m depth (TP dry upon completion)							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storm Water Management Pond Channel
Kanata North, March Road - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4258

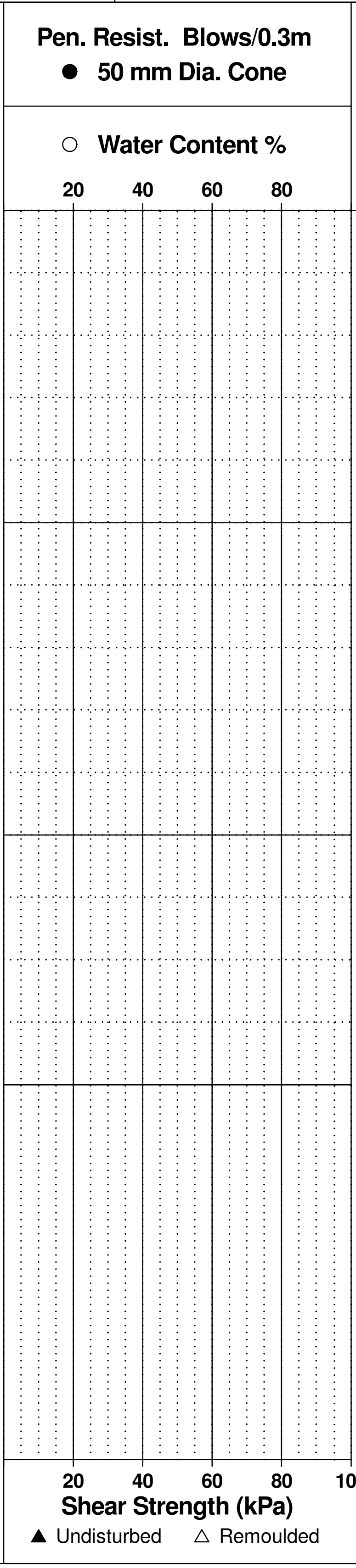
REMARKS

HOLE NO. TP 8-21

BORINGS BY Excavator

DATE April 7, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	82.97
FILL: Brown silty clay, some crushed stone and organics 0.25							
TOPSOIL 0.40							
						1	81.97
Stiff, brown **SILTY CLAY** 2.05		G	1				
						2	80.97
GLACIAL TILL: Brown silty clay with gravel, cobbles and boulders 2.80		G	2				
End of Test Pit Practical refusal to excavation on bedrock surface at 2.80m depth (Water infiltration observed at 2.0m depth at time of excavation)							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Residential Development - Kanata North
March Road, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4258

REMARKS

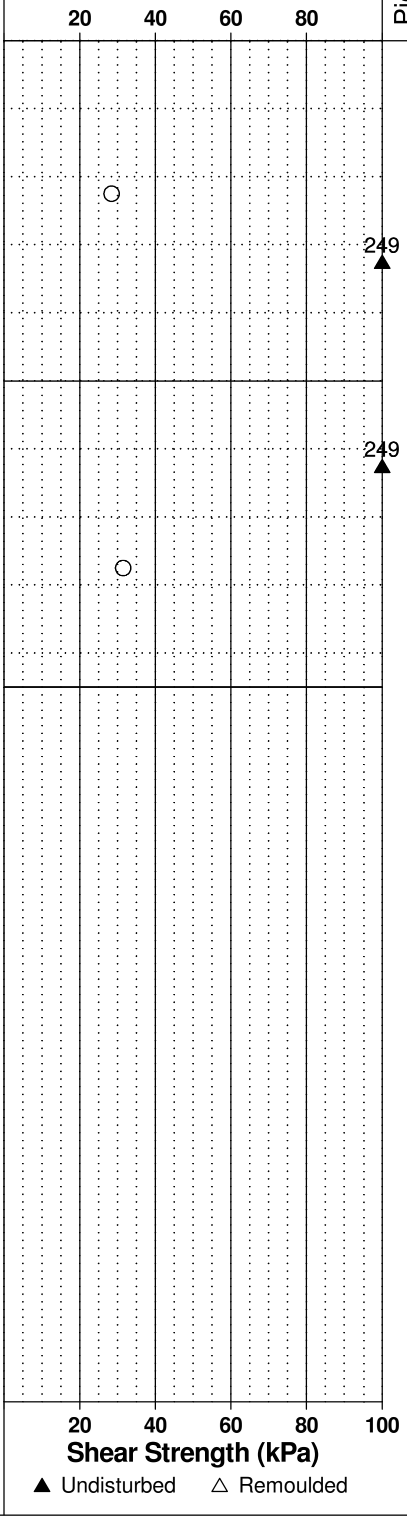
HOLE NO. TP13-21

BORINGS BY Excavator

DATE November 9, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	84.55
TOPSOIL 0.35	■						
Hard, brown **SILTY CLAY**	▨	G	1				
	▨					1	83.55
	▨	G	2				
1.90 End of Test Pit TP terminated on bedrock surface at 1.90m depth. (TP dry upon completion)							

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



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

SOIL PROFILE AND TEST DATA

Geotechnical investigation
Proposed Stormwater Management Facility
1053 March Road, Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG4258

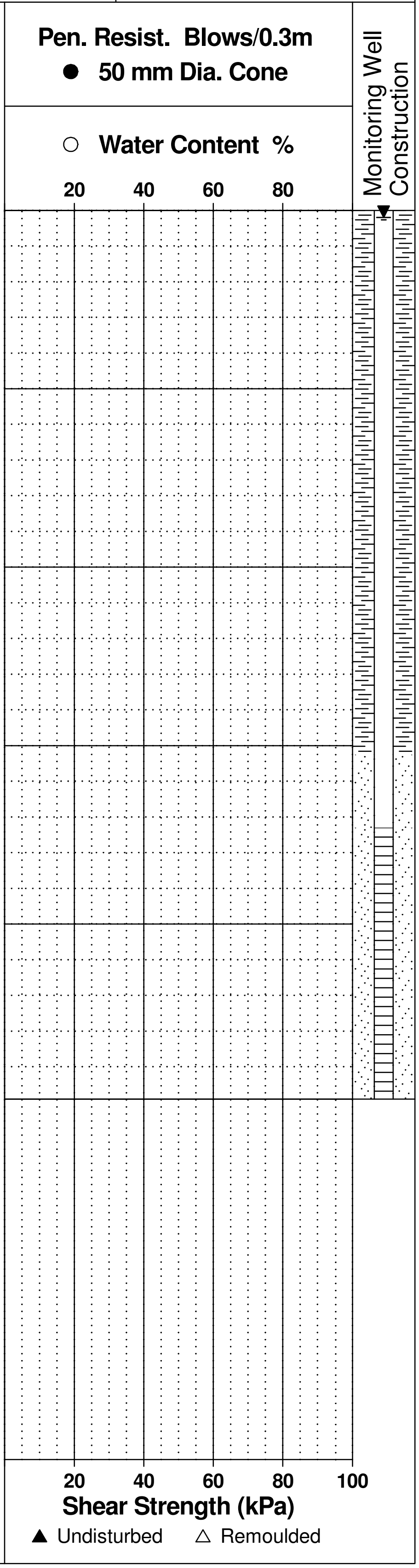
REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger

DATE October 20, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	83.20
TOPSOIL 0.40							
Very stiff to stiff, brown **SILTY CLAY,** trace sand 1.68		SS	1	92	10	1	82.20
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles, some boulders 2.13		SS	2	96	30	2	81.20
BEDROCK: Grey limestone		RC	1	96	76	3	80.20
		RC	2	98	87	4	79.20
4.98							
End of Borehole (GWL @ 0.04m depth - Nov 14/17)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

REMARKS

BORINGS BY Rubber Tired Backhoe

DATE July 9, 2008

FILE NO. PG1716

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	83.10		
TOPSOIL 0.40	■	G	1						
End of Test Pit Practical refusal to excavation @ 0.40m depth									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS 18T 0425702; 5023822

BORINGS BY Hydraulic Excavator

DATE March 21, 2013

FILE NO. PG2878

HOLE NO. TP33

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	84.00		
TOPSOIL 0.61	■								
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.61m depth (TP dry upon completion)									

20 40 60 80 100
Shear Strength (kPa)
▲ 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 = $(D30)^2 / (D10 \times D60)$
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)

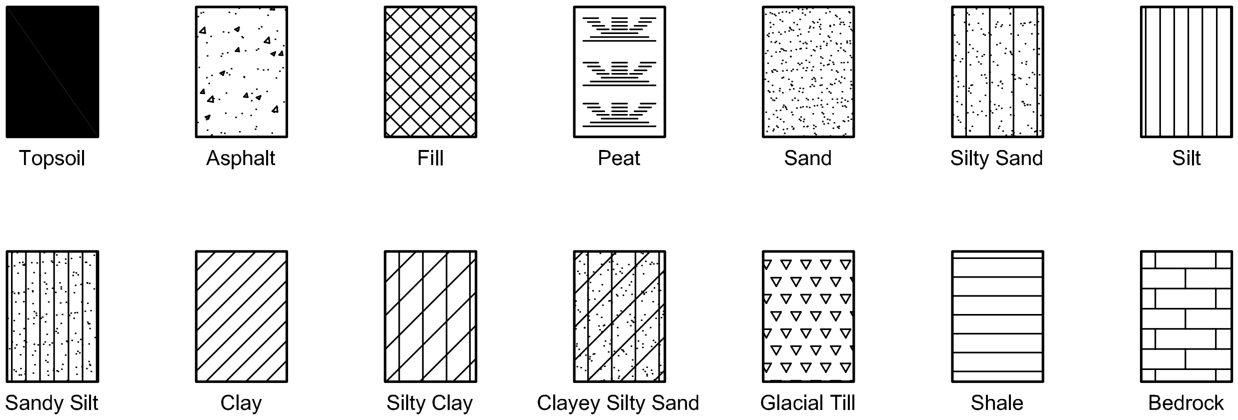
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

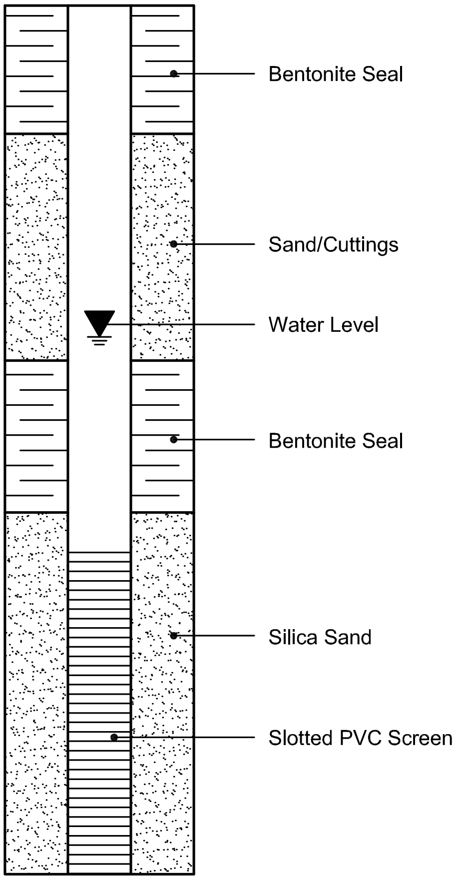
SYMBOLS AND TERMS (continued)

STRATA PLOT

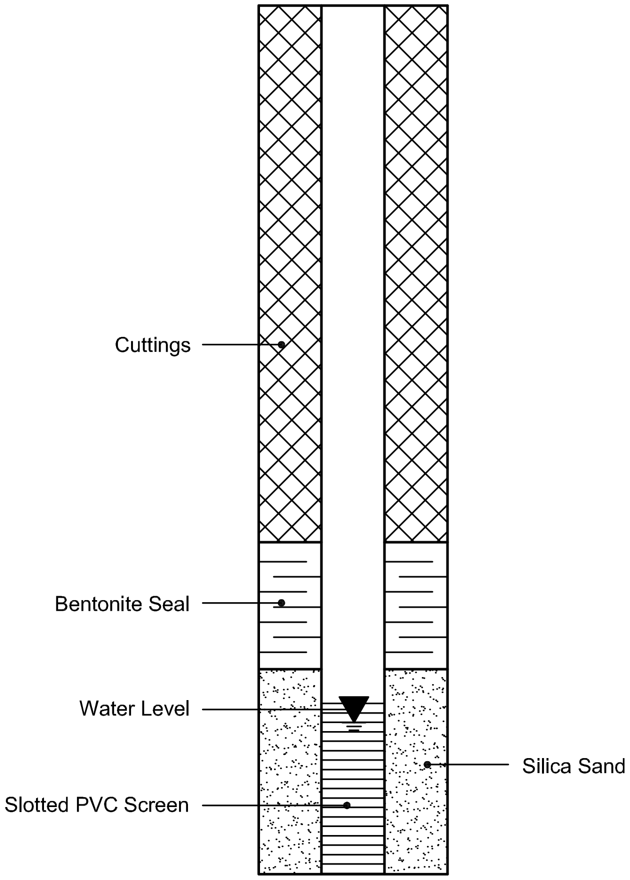


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Photograph of Rock Cores – BH1-24 – RC1

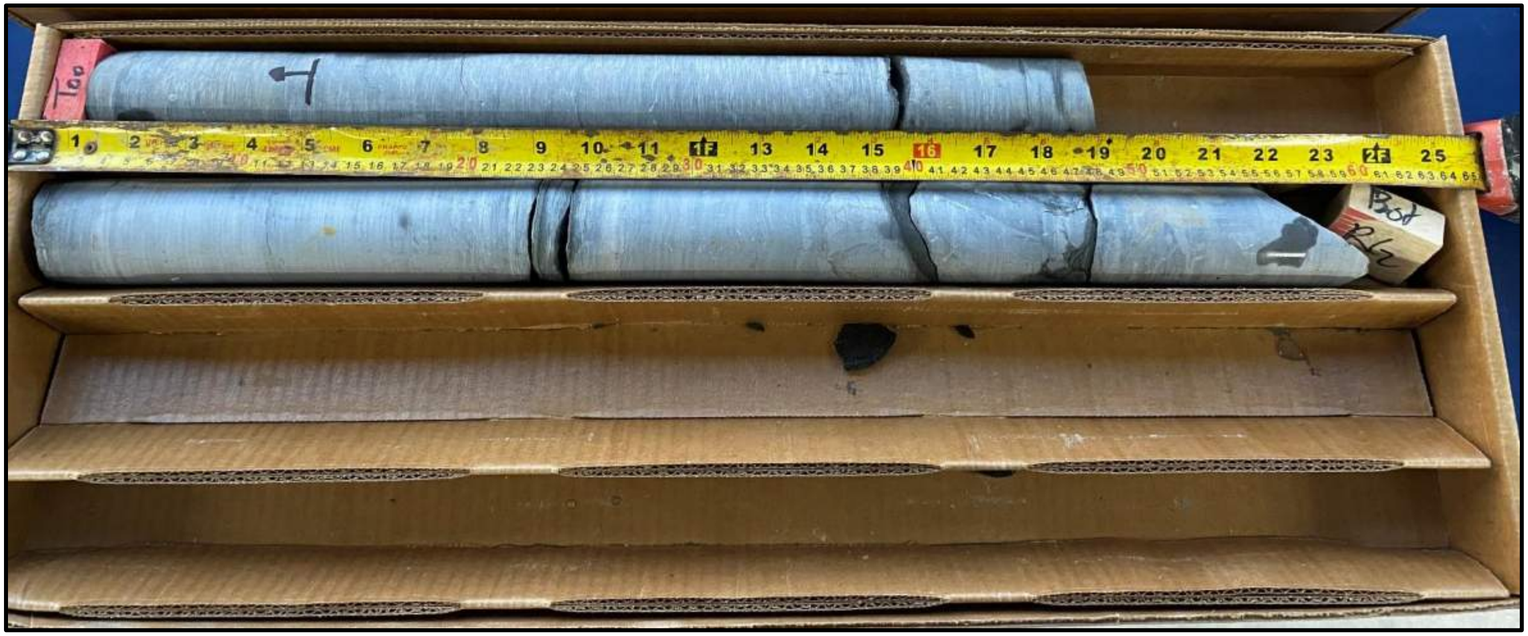
Photograph of Rock Core obtained from BH 1-24 from interval RC1

Rock Core interval ranged between 4’7” to 9’11”

Recovery (%) = 100

Rock Quality Designation (RQD) = 80

Photograph of Rock Cores – BH1-24 – RC2



Photograph of Rock Core obtained from BH 1-24 from interval RC2

Rock Core interval ranged between 9’11” to 13’

Recovery (%) = 100

Rock Quality Designation (RQD) = 97

Photograph of Rock Cores – BH2-24 – RC1

Photograph of Rock Core obtained from BH 2-24 from interval RC1

Rock Core interval ranged between 10’ to 17’3”

Recovery (%) = 100

Rock Quality Designation (RQD) = 82

Photograph of Rock Cores – BH2-24 – RC2

Photograph of Rock Core obtained from BH 2-24 from interval RC2

Rock Core interval ranged between 17’3” to 22’11”

Recovery (%) = 99

Rock Quality Designation (RQD) = 84

Photograph of Rock Cores – BH3-24 – RC1

Photograph of Rock Core obtained from BH 3-24 from interval RC1

Rock Core interval ranged between 10’ to 14’11”

Recovery (%) = 100

Rock Quality Designation (RQD) = 71

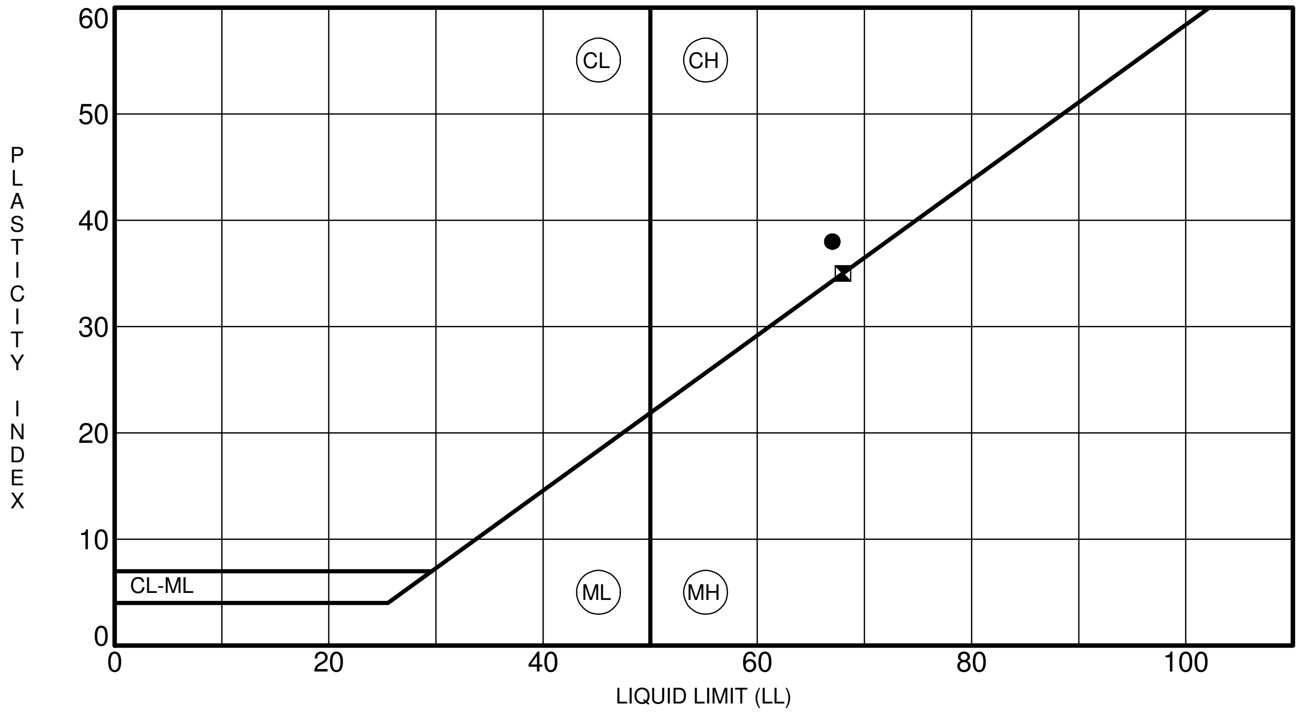
Photograph of Rock Cores – BH3-24 – RC2

Photograph of Rock Core obtained from BH 3-24 from interval RC2

Rock Core interval ranged between 14’11” to 19’10”

Recovery (%) = 100

Rock Quality Designation (RQD) = 88



	Specimen Identification	LL	PL	PI	Fines	Classification
●	**TP 1-23**	**67**	**29**	**38**		**Inorganic Clay of Low Plasticity**
⧗	**TP 7-23**	**68**	**33**	**35**		**Inorganic Clay of Low Plasticity**

CLIENT **Uniform Urban Developments**

PROJECT **Geotechnical Investigation - Copperwood Flats - Blocks 125 & 132 - 1075 March Rd.**

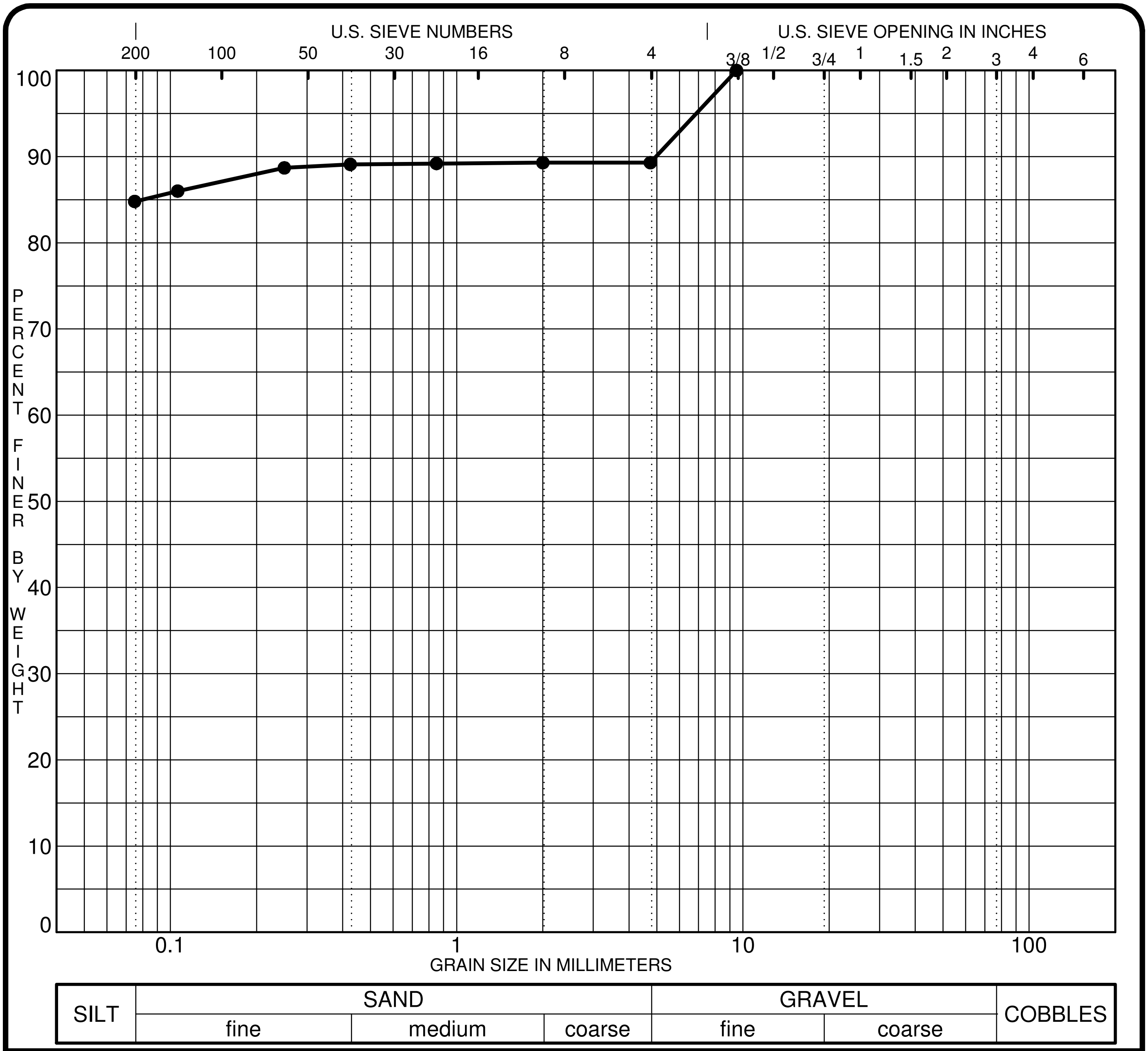
FILE NO. **PG6613**

DATE **17 Mar 23**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS



Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP 8-23**							
⧗								
▲								
★								

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP 8-23**	**9.50**	**0.01**			**10.7**	**4.5**	**84.8**	
⧗									
▲									
★									

CLIENT **Uniform Urban Developments**

FILE NO. **PG6613**

PROJECT **Geotechnical Investigation - Copperwood Flats -**
Blocks 125 & 132 - 1075 March Rd.

DATE **17 Mar 23**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Client PO: 57048

Report Date: 24-Mar-2023

Order Date: 21-Mar-2023

Project Description: PG6613

	Client ID:	TP3-23-G3 [0.55-0.65m]	-	-	-
	Sample Date:	17-Mar-23 00:00	-	-	-
	Sample ID:	2312242-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.6	-	-	-
General Inorganics					
pH	0.05 pH Units	6.91	-	-	-
Resistivity	0.1 Ohm.m	129	-	-	-
Anions					
Chloride	10 ug/g dry	<10	-	-	-
Sulphate	10 ug/g dry	<10	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG6613-1 – TEST HOLE LOCATION PLAN

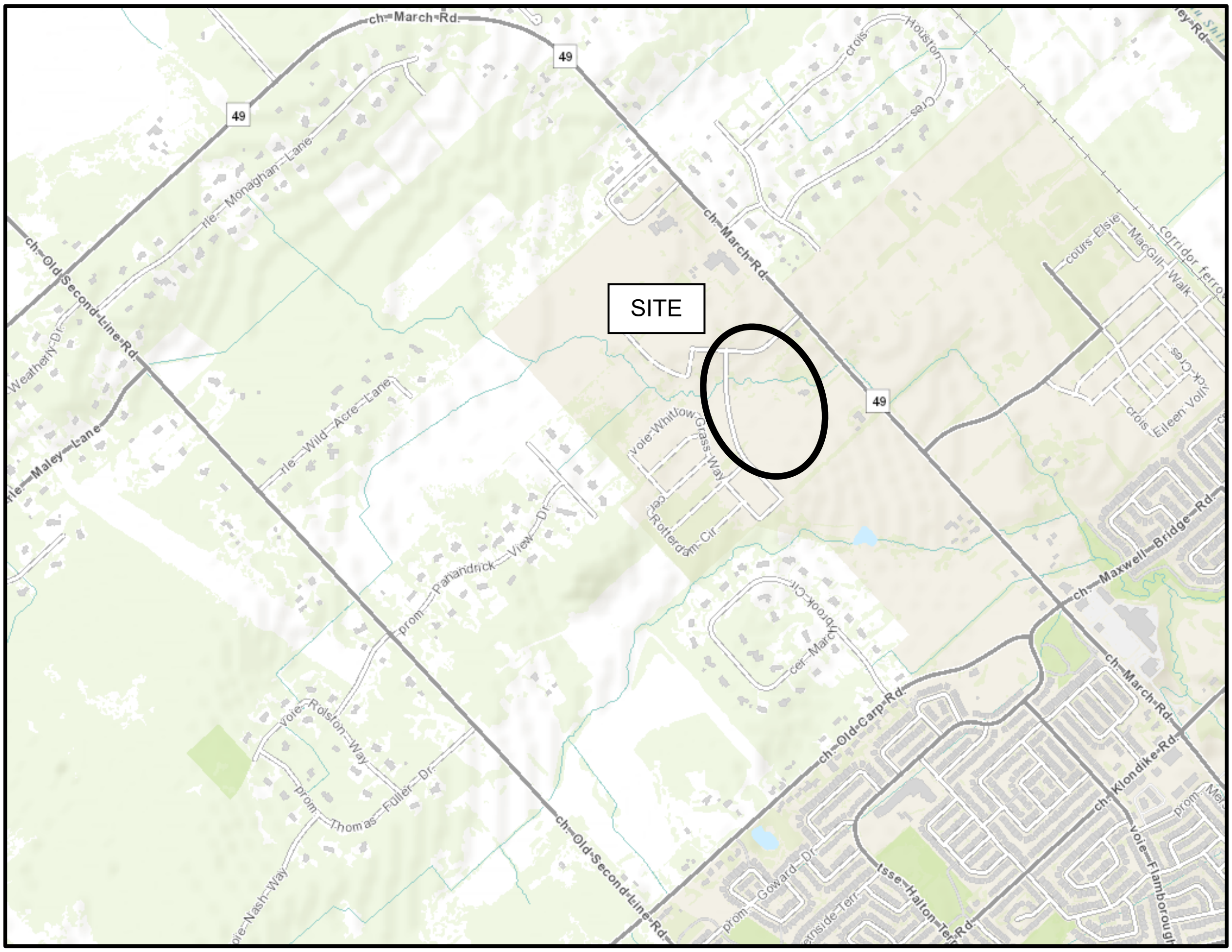
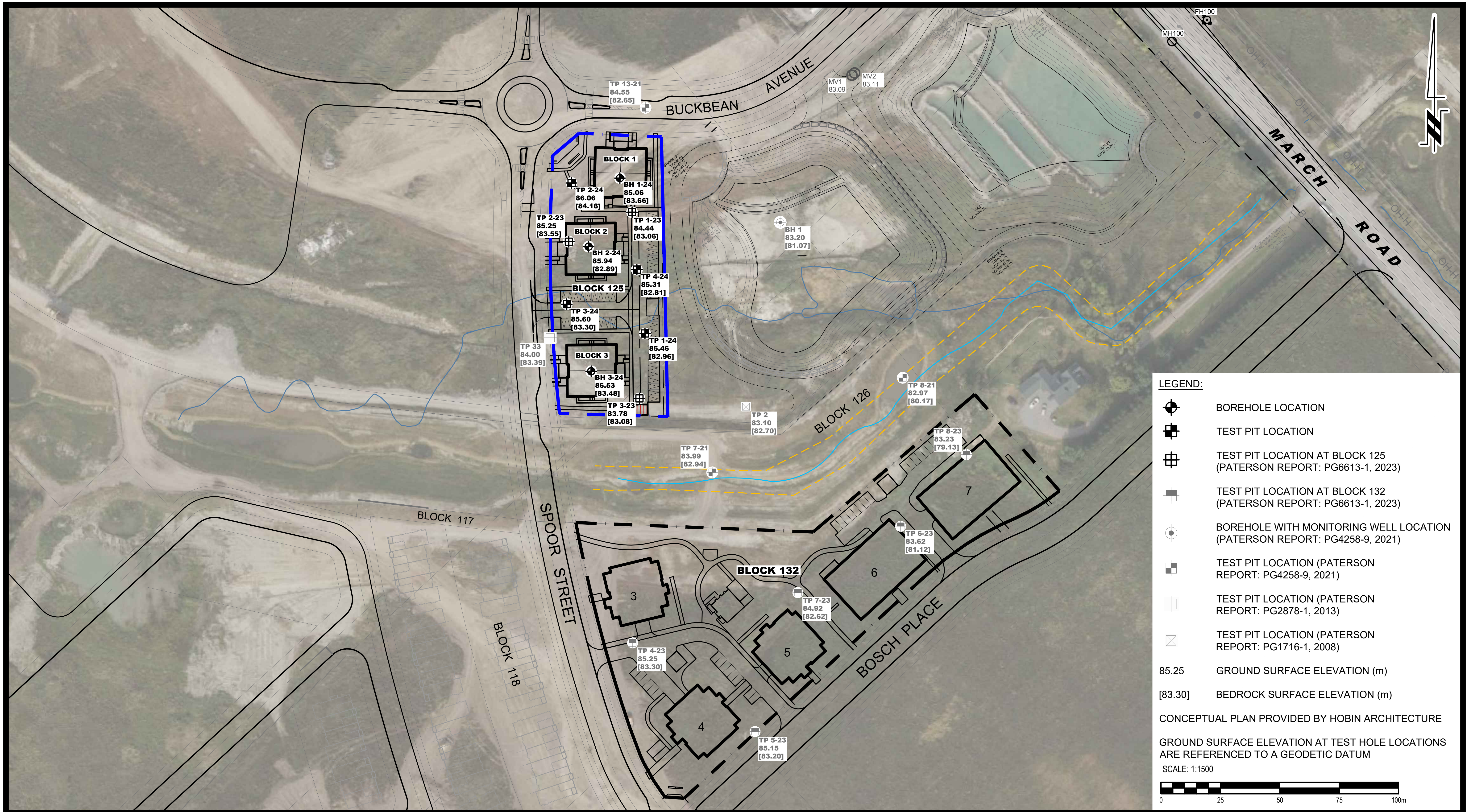


FIGURE 1

KEY PLAN

PATERSON
GROUP



LEGEND:

⌖	BOREHOLE LOCATION
✚	TEST PIT LOCATION
⊞	TEST PIT LOCATION AT BLOCK 125 (PATERSON REPORT: PG6613-1, 2023)
▤	TEST PIT LOCATION AT BLOCK 132 (PATERSON REPORT: PG6613-1, 2023)
⊙	BOREHOLE WITH MONITORING WELL LOCATION (PATERSON REPORT: PG4258-9, 2021)
▚	TEST PIT LOCATION (PATERSON REPORT: PG4258-9, 2021)
⊞	TEST PIT LOCATION (PATERSON REPORT: PG2878-1, 2013)
☒	TEST PIT LOCATION (PATERSON REPORT: PG1716-1, 2008)
85.25	GROUND SURFACE ELEVATION (m)
[83.30]	BEDROCK SURFACE ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY HOBIN ARCHITECTURE

GROUND SURFACE ELEVATION AT TEST HOLE LOCATIONS 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
3	AS PER CITY COMMENTS	28/04/2025	GJ
2	UPDATED BLOCK NUMBERS TO MATCH THE REVISED M-PLAN	05/02/2025	GJ
1	UPDATED CONCEPTUAL PLAN, ADDED 2024 BOREHOLE AND TEST PIT LOCATIONS	26/11/2024	GJ

UNIFORM URBAN DEVELOPMENT
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
COPPERWOOD FLATS - BLOCK 125
1075 MARCH ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500
Date: 04/2023
Drawn by: YA
Report No.: PG6613-1
Checked by: YZ
Dwg. No.: PG6613-1
Approved by: ZA
Revision No.: 3

p:\autocad drawings\geotechnical\pg66xx\pg6613\pg6613-1-test hole location plan (rev.02).dwg

11x17