Geotechnical Investigation

Proposed Residential Development

640 Compass Street
Ottawa, Ontario

Prepared for Richcraft

Report PG6406-1 Revision 1 dated October 10, 2024

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft to conduct a geotechnical investigation for the proposed residential development to be located at 640 Compass Street, in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report for the general site location).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of test holes.
- Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of 6 residential townhouse blocks located around the perimeter of the site, with an amenity area in the central portion of the site. At finished grades, the proposed townhouse blocks will be surrounded by landscaped areas, asphalt-paved access lanes and parking areas, and sidewalks. It is also anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was carried out on September 9, 2022, and consisted of advancing a total of 4 boreholes (BH 1-22 through BH 4-22) to a maximum depth of 6.7 m below ground surface. Previous investigations carried out by Paterson included a total of 5 test holes within the subject site: borehole BH 4-20 in May 2020, borehole BH 10 in August 2011, hand auger hole HA 5-09 in May 2009, and borehole BH 11-08 and test pit TP 11-08 in August 2008.

The test holes undertaken by Paterson as part of the current investigation were placed in a manner to provide general coverage of the subject site taking into consideration underground utilities, site features, and previous test hole locations. The test hole locations are shown on Drawing PG6406-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a truck-mounted drill rig operated by a two-person crew. The test pit was completed using a backhoe. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The testing procedure consisted of augering or excavating to the required depth at the selected locations, and sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or from the auger flights. The split-spoon and auger samples were classified on-site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are shown as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A 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 (silty clays) using a field vane apparatus.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at boreholes BH 11-08, BH 10, BH 4-20, and BH 4-22. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the 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 boreholes 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

Flexible polyethylene standpipes were installed in all boreholes to allow groundwater level monitoring subsequent to advancing the boreholes. The groundwater level readings were obtained after a suitable stabilization period. The groundwater observations are discussed in Section 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

3.2 Field Survey

The borehole location and ground surface elevation at each borehole location were surveyed by Paterson using a high precision, handheld GPS and referenced to a geodetic datum. The location of the boreholes is presented on Drawing PG6406-1 - 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 4 Atterberg Limits tests, 1 grain size distribution/hydrometer test, and 1 shrinkage test have been performed on the soil samples obtained from the current and previous test holes.

Soil samples from the current investigation will be stored for a period of 1 month after this report is completed, unless we are otherwise directed. Testing results are presented in Appendix 1 and discussed further in Section 4.2.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The site is currently vacant and generally grass-covered, with a relatively level ground surface at an approximate geodetic elevation of 87 to 88 m. The site is bordered to the east by vacant land, to the north by Brian Coburn Boulevard, to the west by Compass Street, and to the south by residential townhouse blocks.

4.2 Subsurface Profile

Overburden

Generally, the soil profile at the test hole locations consists of topsoil and/or fill underlain by silty clay. The fill material was observed at borehole BH 1-22, extending to an approximate depth of 1.3 m below the existing ground surface, and consists of grey to brown, silty sand to silty clay with varying amounts of gravel and organics.

A deep deposit of silty clay was encountered underlying the topsoil and/or fill. The upper portion of the silty clay deposit, extending to approximate depths of 3 to 4 m, was generally brown in colour and very stiff to stiff, becoming grey and firm below these depths.

Practical refusal of the DCPT was encountered at depths ranging from 24.1 to 25.3 m below the existing ground surface.

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

Atterberg Limits Results

The results of the Atterberg Limit tests conducted within the silty clay are presented in Table 1 - Summary of Atterberg Limits Results on the next page, and also in Appendix 1. The tested material was classified as an Inorganic Clay of High Plasticity (CH).

Table 1 - Summary of Atterberg Limits Results (Current Investigation, 2022)					
Sample	**Moisture Content %**	**Liquid Limit %**	**Plastic Limit %**	**Plasticity Index %**	**Classification**
BH 1-22 - SS 4	55.6	81	26	55	CH
BH 3-22 - SS 4	63.9	82	26	56	CH
BH 4-22 - SS 4	54.6	76	25	41	CH
Atterberg Limits Results (Previous Investigation, 2020)					
BH 4-20 – SS 3	39.4	72	31	41	CH
Notes: CH – Inorganic clays of high plasticity					

Grain Size Distribution/Hydrometer Test

One (1) representative soil sample was submitted for grain size distribution analysis, including hydrometer testing. The results are summarized in Table 2 below and are presented on the Grain Size Distribution sheet in Appendix 1.

Table 2 - Summary of Grain Size Distribution Analysis (Current Investigation, 2022)				
Sample	**Gravel %**	**Sand %**	**Fines Content**	
			Silt %	**Clay %**
BH 3-22 - SS 3	0.0	0.4	34.6	65.0

Shrinkage Test

One (1) representative soil sample (BH 1-22, SS3) was submitted for shrinkage test. The shrinkage limit and ratio were found to be 18% and 1.65, respectively.

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and shale of the Lindsay Formation with an overburden thickness of 25 to 50 m.

4.3 Groundwater

Groundwater levels for the current investigation were measured on September 22, 2022, in the piezometers installed at the borehole locations. The measured groundwater levels noted at that time are presented in Table 3 below.

Table 3 – Summary of Groundwater Levels (Current Investigation, 2022)				
Test Hole Number	**Ground Surface Elevation (m)**	**Measured Groundwater Level**		**Dated Recorded**
		Depth (m)	**Elevation (m)**	
BH 1-22	87.78	2.43	85.35	September 22, 2022
BH 2-22	86.99	1.83	85.16	
BH 3-22	87.32	1.95	85.37	
BH 4-22	87.17	2.00	85.17	
Groundwater Levels (Previous Investigation, 2020)				
BH 4-20	87.57	4.28	83.29	May 29, 2020
Groundwater Levels (Previous Investigation, 2011)				
BH 10	86.97	2.30	84.37	August 11, 2011
Groundwater Levels (Previous Investigation, 2008)				
BH 11-08	87.14	0.61	86.53	August 28, 2008
TP 11-08	87.14	1.00	86.14	
Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS and referenced to a geodetic datum.				

It should be noted that surface water can become trapped within a backfilled borehole, which can lead to higher than typical groundwater level observations. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples.

Based on these observations, the long-term groundwater table can be expected at an approximate 3 to 4 m depth. 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 recommended that the proposed buildings be supported on conventional spread footings placed on the undisturbed, stiff silty clay.

Due to the presence of the silty clay deposit, permissible grade raise restrictions have been provided for this site. The permissible grade raise recommendations are discussed in Subsection 5.3.

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

5.2 Site Grading and Preparation

Stripping Depth

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

Fill Placement

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material’s SPMDD.

5.3 Foundation Design

Bearing Resistance Values

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

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

The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table 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.

Permissible Grade Raise

Consideration must also be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For buildings, a minimum value of 50% of the live load is often recommended by Paterson. A post-development groundwater lowering of 0.5 m was assumed.

Our permissible grade raise recommendations for the proposed development are presented in Drawing PG6406-2 – Permissible Grade Raise Plan in Appendix 2.

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

For foundations constructed at the subject site, the site class for seismic site response can be taken as **Class E**, according to the 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 OBC 2012 for a full discussion of the earthquake design requirements.

5.5 Slab on Grade Construction

With the removal of all topsoil and deleterious fill within the footprints of the proposed buildings, the native soils or approved engineered fill pad will be considered an acceptable subgrade upon which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Types I or II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slabs (outside the zones of influence of the footings).

For structures with basement slabs, it is recommended that the upper 200 mm of subfloor fill consists of 19 mm clear crushed stone. For any structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone.

5.6 Pavement Structure

For design purposes, the pavement structure presented in Tables 4 and 5 can be used for the design of car parking areas and access lanes/heavy truck parking areas.

Table 4 - 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 - OPSS Granular B Type I or II material placed over in situ soil or engineered fill	

Table 5 - Recommended Pavement Structure – Access Lanes & Local Roadways	
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 - OPSS Granular B Type I or II material placed over in situ soil or engineered fill	

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.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in a maximum of 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction 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.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction, as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below the 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

A perimeter foundation drainage system is recommended for each proposed structure. Each system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated and corrugated plastic pipe which is surrounded by 150 mm of 19 mm clear crushed stone and is placed at the footing level around the exterior perimeter of each structure. Each pipe should have a positive outlet, such as a gravity connection to the storm sewer.

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

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are recommended to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

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

6.3 Excavation Side Slopes

The side slopes of excavations in the overburdened 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 anticipated that sufficient space will be available for the greater part of the excavations to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below the 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.

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.

The pipe bedding for sewer and water pipes placed on a relatively dry, undisturbed subgrade surface should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the firm grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The 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 and cover materials should be placed in a maximum of 225 mm thick lifts compacted to 99% 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) silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being reused.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in a maximum of 225 mm thick loose lifts and compacted to a minimum of 95% of the material’s SPMDD.

To reduce the long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in a maximum of 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

If a project qualifies for a PTTW based on anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

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

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost into 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 on the sample, BH 4-22 – SS3, show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a low to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Setbacks

In general 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 and grain size distribution analysis were completed for recovered silty clay samples at selected locations throughout the subject site. The above noted test results were completed between the anticipated underside of footing elevation and a 3.5 m depth below the expected finished grade. The results of our testing are presented in Tables 1 and 2 in Section 4.2 and in Appendix 1.

A medium to high sensitivity clay soil was encountered between the anticipated underside of footing elevations and 3.5 m below anticipated finished grades at the subject site. Based on our Atterberg Limits test results, the plasticity index limit exceeds 40% across the subject site. Therefore, the following tree planting setbacks are recommended for the medium to high-sensitivity areas.

Large trees (mature height over 14 m) can be planted within this area 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). A tree planting setback limit of **7.5 m** is applicable for small (mature tree height up to 7.5 m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions 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 centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- ❑ A small tree must be provided with a minimum of 25 m^3 of available soil 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.

Swimming Pools

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 neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed per the manufacturer`s requirements.

Aboveground Hot Tubs

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.

Installation of Decks or Additions

Additional grading around a 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 the final 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.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming 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

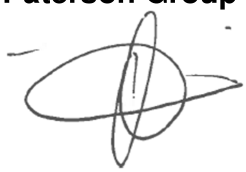
The recommendations provided herein are in accordance with our present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

The soils investigation by others is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations by others, 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 Richcraft, or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



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Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS TEST RESULTS

GRAIN SIZE DISTRIBUTION ANALYSIS RESULT

SHRINKAGE TEST RESULT

ANALYTICAL TEST RESULTS

patersongroup Consulting Engineers

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Trails Edge West
Block 140 - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

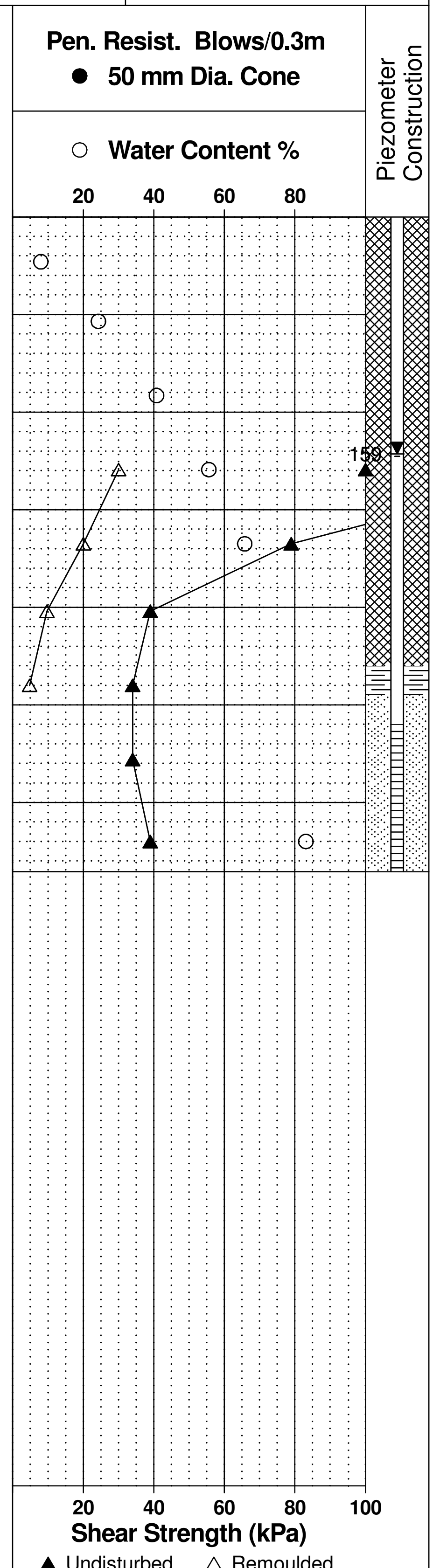
DATE September 9, 2022

FILE NO. PG6406

HOLE NO. BH 1-22

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.78
TOPSOIL (to 0.10)						
FILL: Brown silty sand with gravel and crushed stone, some clay, trace organics (0.10 to 0.76)	AU	1				
FILL: Grey-brown silty clay, trace sand, gravel and organics (0.76 to 1.32)	SS	2	75	10	1	86.78
Very stiff to stiff, brown **SILTY CLAY** (1.32 to 6.71)	SS	3	83	8	2	85.78
- firm and grey by 3.7m depth	SS	4	88	P	3	84.78
	SS	5	83	P	4	83.78
					5	82.78
	SS	6	92	P	6	81.78
End of Borehole (6.71)						

(GWL @ 2.43m - Sept. 22, 2022)



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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Trails Edge West
Block 140 - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE September 9, 2022

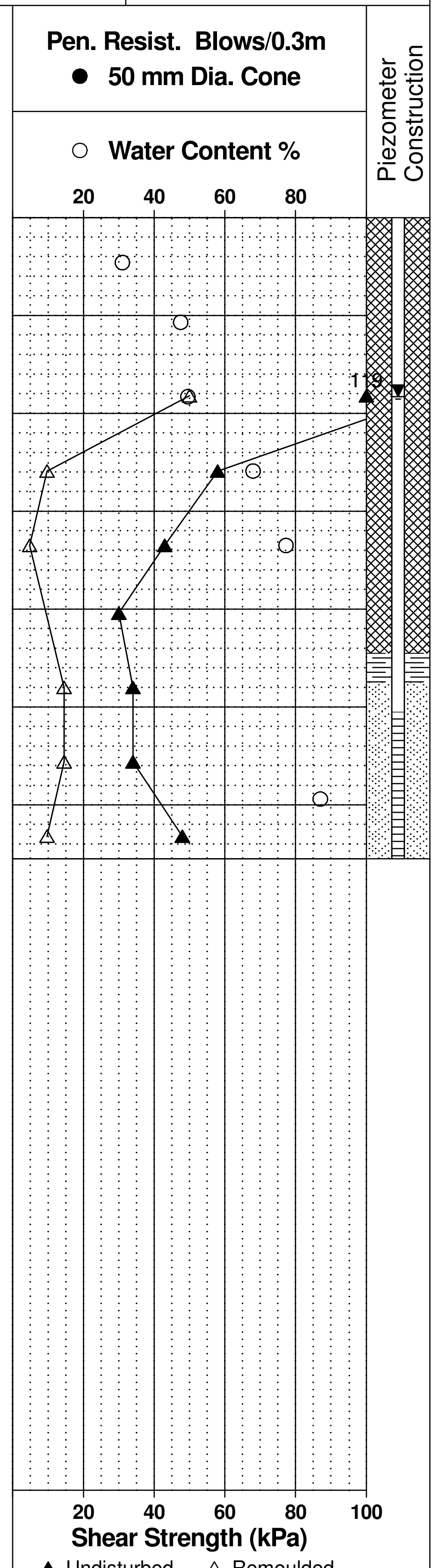
FILE NO. PG6406

HOLE NO. BH 2-22

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
TOPSOIL (0.08)	AU	1		
Very stiff to stiff, brown **SILTY CLAY**	SS	2	83	7
	SS	3	8	P
- firm and grey by 2.7m depth	SS	4	88	P
	SS	5	88	P
	G	6		
(6.55) End of Borehole				

(GWL @ 1.83m - Sept. 22, 2022)

DEPTH (m)	ELEV. (m)
0	86.99
1	85.99
2	84.99
3	83.99
4	82.99
5	81.99
6	80.99



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Trails Edge West
Block 140 - Ottawa, Ontario

DATUM Geodetic

REMARKS

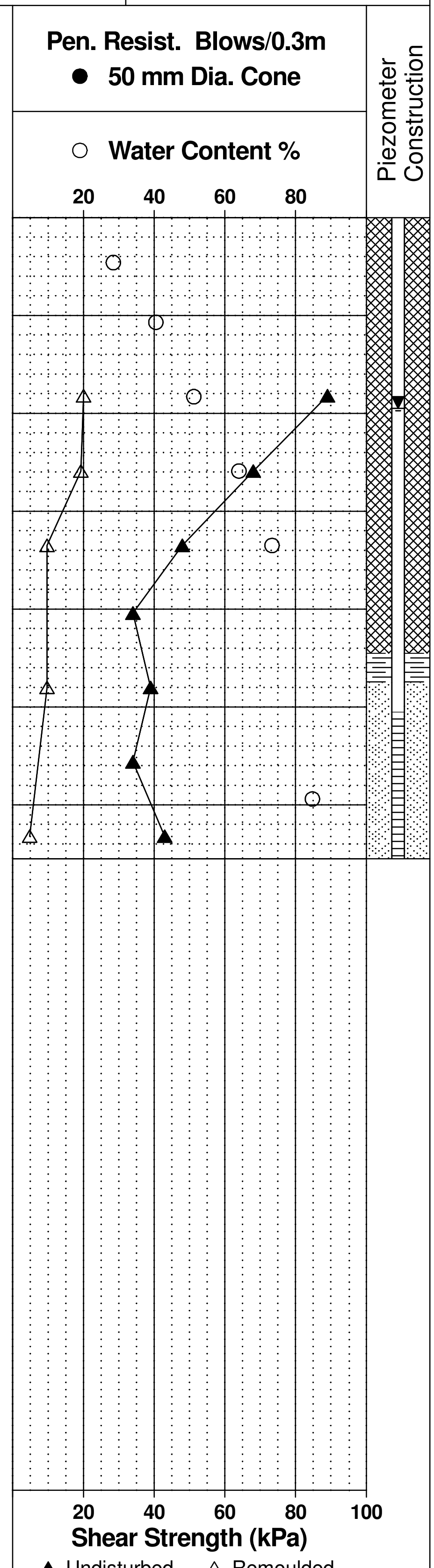
BORINGS BY CME-55 Low Clearance Drill

DATE September 9, 2022

FILE NO. PG6406

HOLE NO. BH 3-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.32
TOPSOIL 0.15							
		AU	1				
		SS	2	83	10	1	86.32
		SS	3	88	P	2	85.32
Very stiff to stiff, brown **SILTY CLAY**		SS	4	83	P		
- firm and grey by 3.0m depth		SS	5	83	P	3	84.32
						4	83.32
						5	82.32
		G	6			6	81.32
6.55							
End of Borehole							
(GWL @ 1.95m - Sept. 22, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Trails Edge West
Block 140 - Ottawa, Ontario

DATUM Geodetic

REMARKS

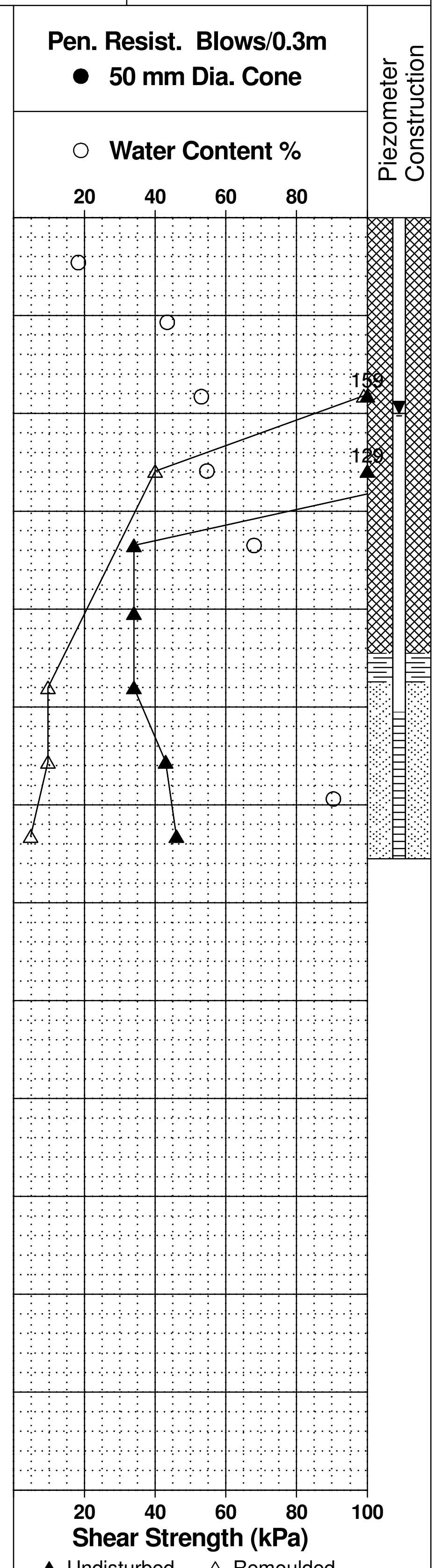
BORINGS BY CME-55 Low Clearance Drill

DATE September 9, 2022

FILE NO. **PG6406**

HOLE NO. **BH 4-22**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.17
TOPSOIL 0.20		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	2	75	11	1	86.17
		SS	3	92	P	2	85.17
		SS	4	75	P		
- firm and grey by 3.0m depth		SS	5	75	P	3	84.17
						4	83.17
						5	82.17
6.55		G	6			6	81.17
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 20.1m depth.						7	80.17
						8	79.17
						9	78.17
						10	77.17
						11	76.17
						12	75.17
						13	74.17



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Trails Edge West
Block 140 - Ottawa, Ontario

DATUM Geodetic

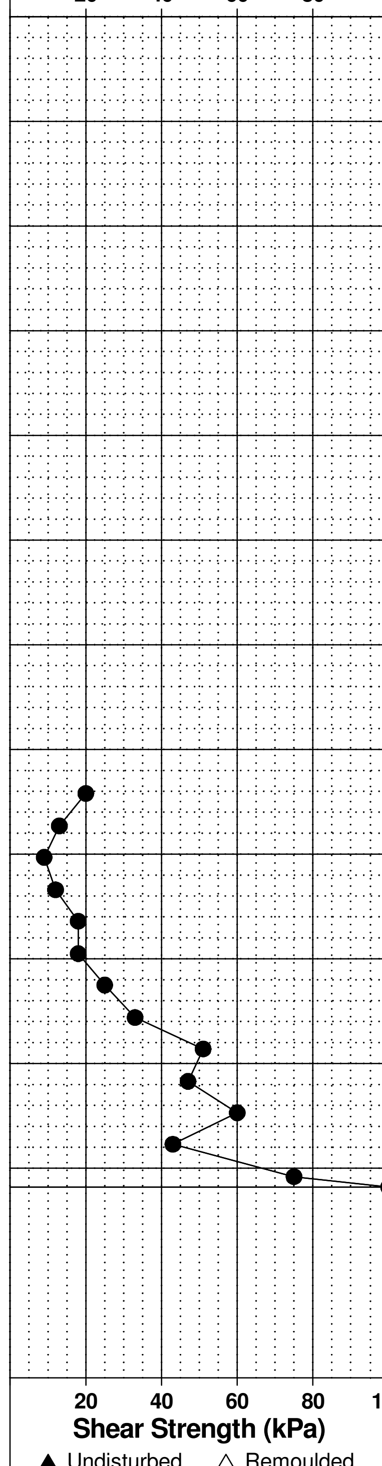
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 9, 2022

FILE NO. PG6406

HOLE NO. BH 4-22

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								20 40 60 80	
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 20.1m depth.						13	74.17		
						14	73.17		
						15	72.17		
						16	71.17		
						17	70.17		
						18	69.17		
						19	68.17		
						20	67.17		
						21	66.17		
						22	65.17		
						23	64.17		
24.18						24	63.17		
End of Borehole Practical DCPT refusal at 24.18m depth (GWL @ 2.00m - Sept. 22, 2022)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Residential Development - Trail's Edge
Renaud Road, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG2392

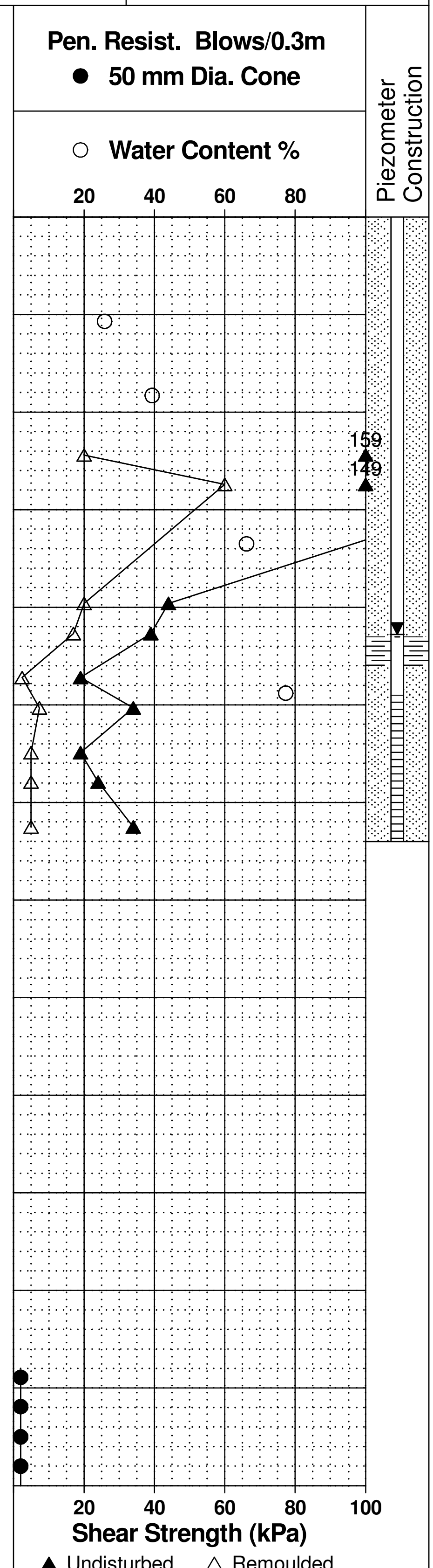
REMARKS

HOLE NO. BH 4-20

BORINGS BY Track-Mount Power Auger

DATE May 7, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.57
FILL: Brown silty clay, trace organics, gravel and cobbles — 0.60		AU	1				
Brown **SILTY CLAY,** trace sand and organics — 1.52		SS	2	58	9	1	86.57
Very stiff to stiff, grey-brown **SILTY CLAY**		SS	3	100	7	2	85.57
- firm and grey by 3.0m depth		SS	4	100	2	3	84.57
						4	83.57
						5	82.57
— 6.40						6	81.57
Dynamic Cone Penetration Test commenced at 6.40m depth. Cone pushed to 11.3m depth.						7	80.57
						8	79.57
						9	78.57
						10	77.57
						11	76.57
						12	75.57
						13	74.57



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Proposed Residential Development - Trail's Edge
Renaud Road, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG2392

REMARKS

HOLE NO. BH 4-20

BORINGS BY Track-Mount Power Auger

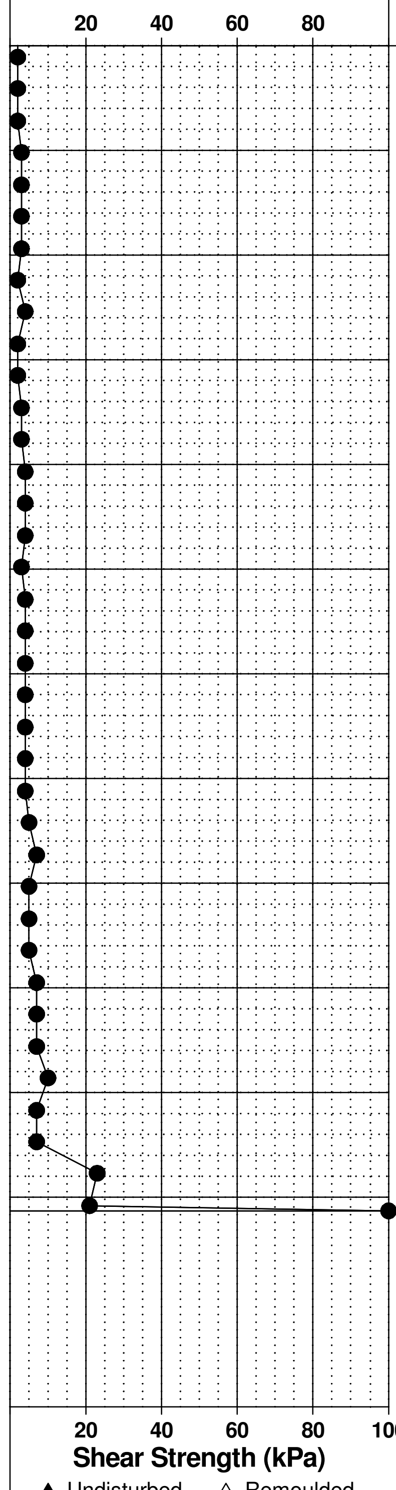
DATE May 7, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						13	74.57		
						14	73.57		
						15	72.57		
						16	71.57		
						17	70.57		
						18	69.57		
						19	68.57		
						20	67.57		
						21	66.57		
						22	65.57		
						23	64.57		
24.13						24	63.57		

End of Borehole

Practical DCPT refusal at 24.13m depth.

(GWL @ 4.28m - May 29, 2020)



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-Trails Edge Phase 2
Ottawa, Ontario

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

FILE NO. PG2392

REMARKS

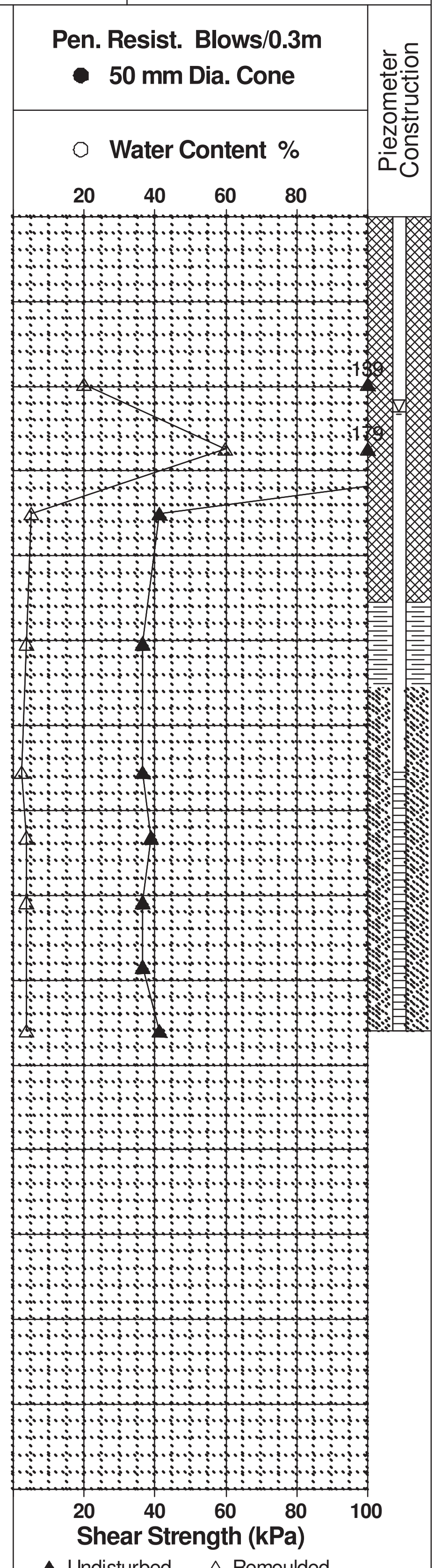
HOLE NO. BH10

BORINGS BY CME 55 Power Auger

DATE 17 August 2011

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.20	AU	1		
Brown **SILTY CLAY** with sand, trace gravel	0.69	SS	2	92	7
Very stiff to stiff, brown **SILTY CLAY**	3.30				
Firm, grey **SILTY CLAY**	9.60	TW	2		
		TW	3		
Dynamic Cone Penetration Test commenced @ 25.27m depth. Cone pushed to 22.7m depth.					

DEPTH (m)	ELEV. (m)
0	86.97
1	85.97
2	84.97
3	83.97
4	82.97
5	81.97
6	80.97
7	79.97
8	78.97
9	77.97
10	76.97
11	75.97
12	74.97
13	73.97
14	72.97
15	71.97



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development-Trails Edge Phase 2
Ottawa, Ontario

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

FILE NO. PG2392

REMARKS

HOLE NO. BH10

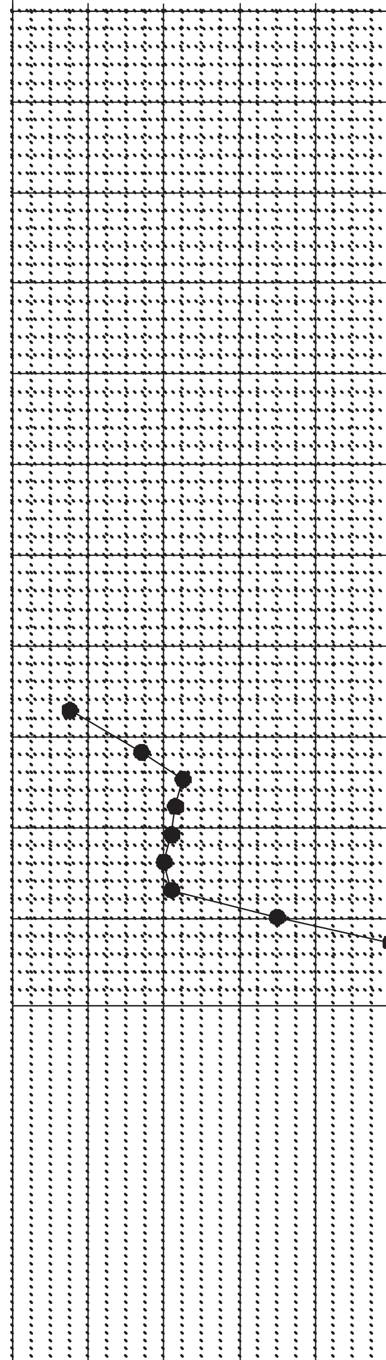
BORINGS BY CME 55 Power Auger **DATE** 17 August 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						15	71.97
						16	70.97
						17	69.97
						18	68.97
						19	67.97
						20	66.97
						21	65.97
						22	64.97
						23	63.97
						24	62.97
25.27						25	61.97
End of Borehole Practical cone refusal @ 25.27m depth (GWL @ 2.3m depth based on field observations)							

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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development-Renaud Road
Ottawa, Ontario

DATUM	FILE NO. PG1605
REMARKS	HOLE NO. HA 5-09
BORINGS BY Hand Auger — DATE 11 May 2009	

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 % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL — 0.30									
Very stiff, brown **SILTY CLAY**						1		128 ▲	
								128 ▲	
1.60 — End of Hand Auger Hole									

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

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Renaud Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

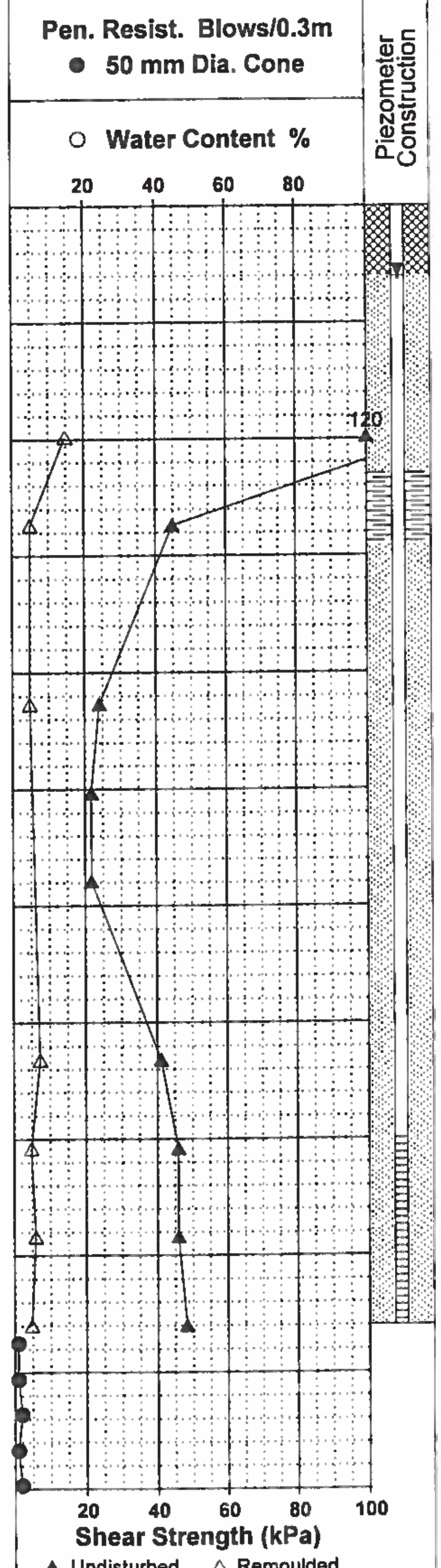
FILE NO. PG0861

REMARKS

HOLE NO. BH11-08

BORINGS BY CME 55 Power Auger **DATE** 7 Aug 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.14
TOPSOIL 0.20							
		SS	1		9	1	86.14
Very stiff to stiff, brown **SILTY CLAY**						2	85.14
- firm and grey by 2.9m depth						3	84.14
		TW	2	88			
						4	83.14
						5	82.14
						6	81.14
		TW	3	100			
						7	80.14
						8	79.14
9.60						9	78.14
Dynamic Cone Penetration Test commenced @ 9.60m depth						10	77.14
Inferred **SILTY CLAY**						11	76.14



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Renaud Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

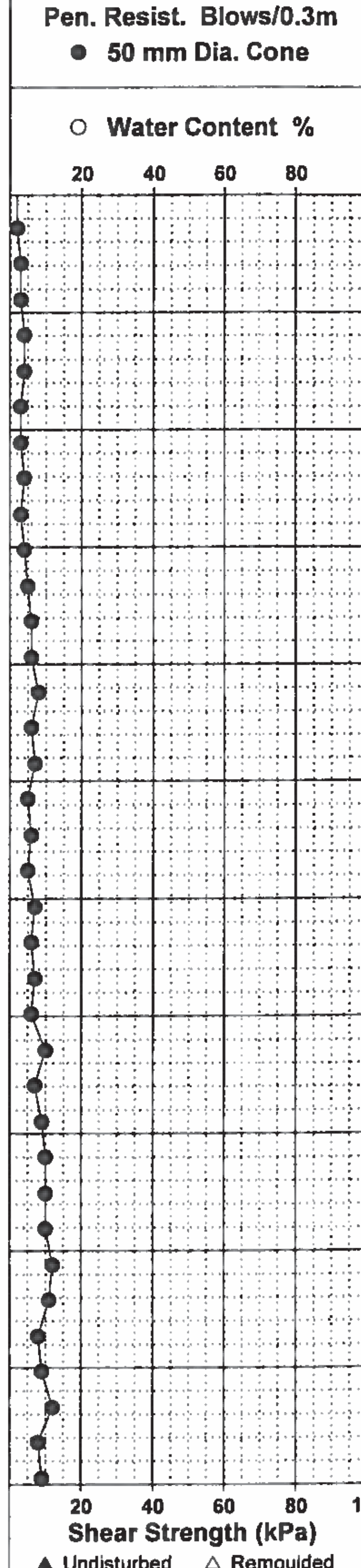
BORINGS BY CME 55 Power Auger

DATE 7 Aug 08

FILE NO. PG0861

HOLE NO. BH11-08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						11	76.14
						12	75.14
						13	74.14
						14	73.14
						15	72.14
Inferred **SILTY CLAY**						16	71.14
						17	70.14
						18	69.14
						19	68.14
						20	67.14
						21	66.14
						22	65.14



Piezometer Construction

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Renaud Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 7 Aug 08

FILE NO. PG0861

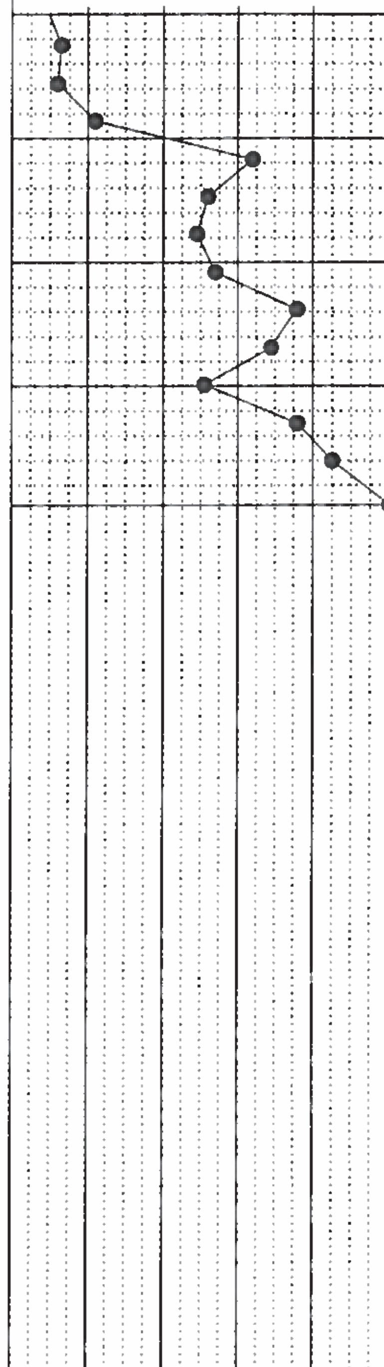
HOLE NO. BH11-08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
						22	65.14
Inferred **SILTY CLAY** 22.90							
						23	64.14
						24	63.14
Inferred **GLACIAL TILL**							
						25	62.14
25.96							
End of Borehole Practical DCPT refusal @ 25.96m depth (GWL @ 0.61m-Aug. 28/08)							

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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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Renaud Road
Ottawa, Ontario

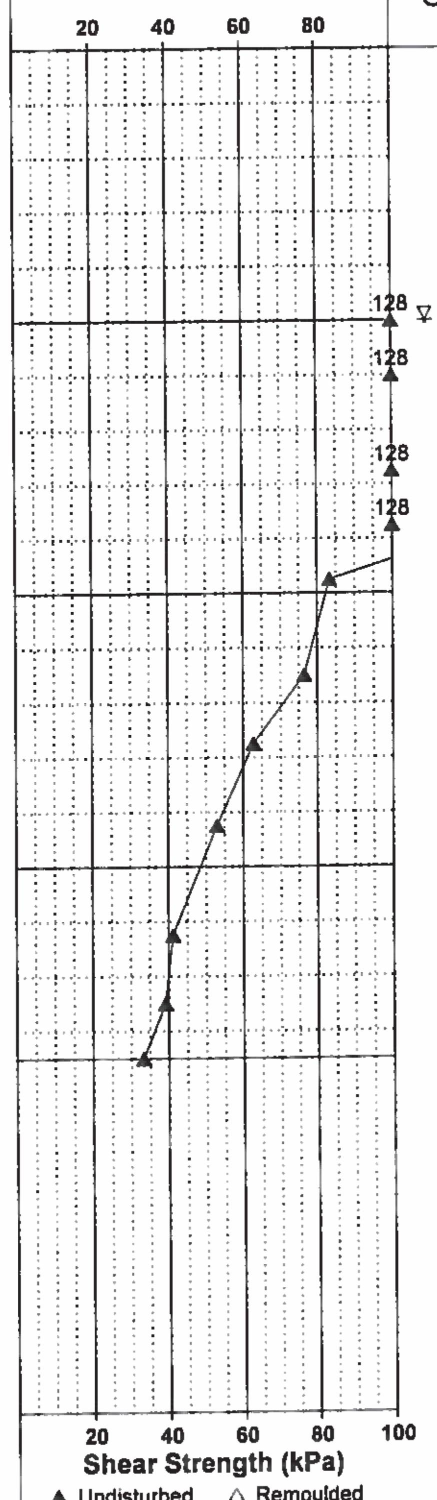
DATUM	Ground surface elevations provided by Stantec Geomatics Ltd.
FILE NO.	PG0861
REMARKS	
HOLE NO.	TP11-08
BORINGS BY	Hydraulic Shovel
DATE	28 Aug 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.14
TOPSOIL 0.20							
						1	86.14
Very stiff to stiff, brown SILTY CLAY							
						2	85.14
- stiff to firm and grey by 2.9m depth						3	84.14
3.70							
End of Test Pit							
(GWL @ 1.0m-Aug. 28/08)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



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

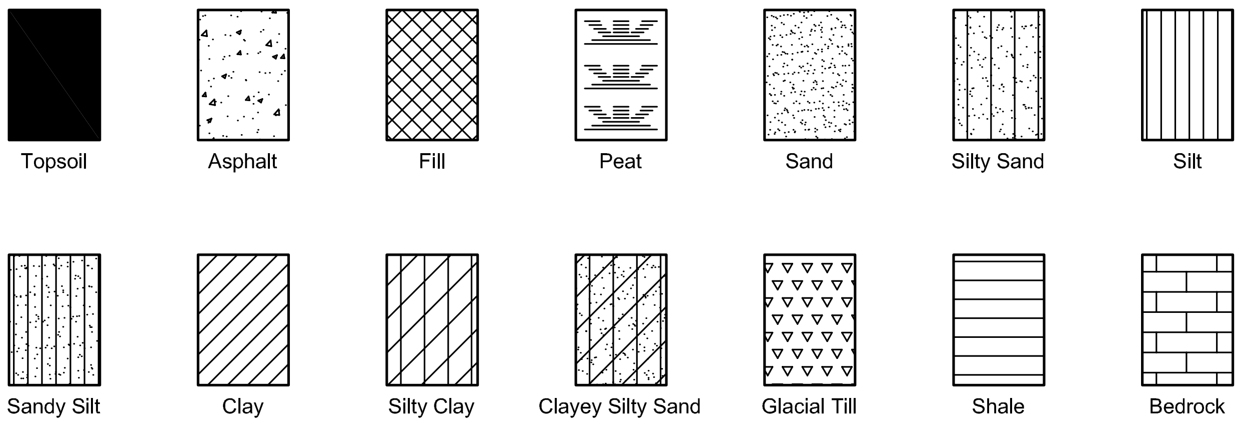
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

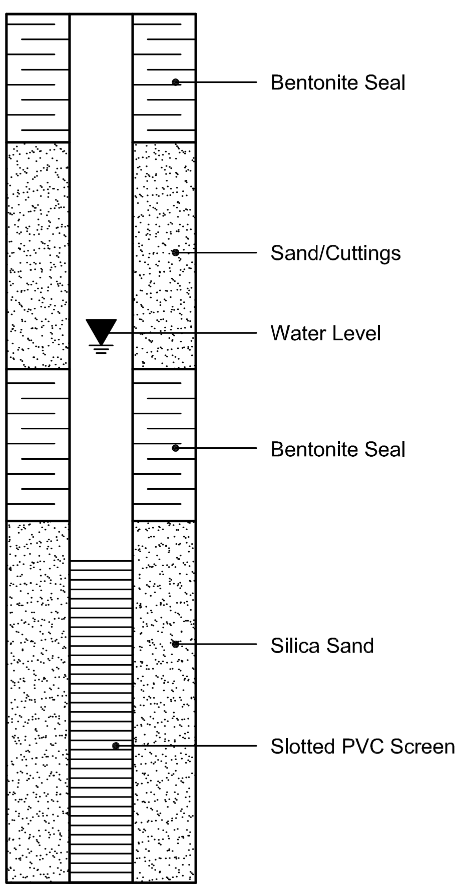
SYMBOLS AND TERMS (continued)

STRATA PLOT

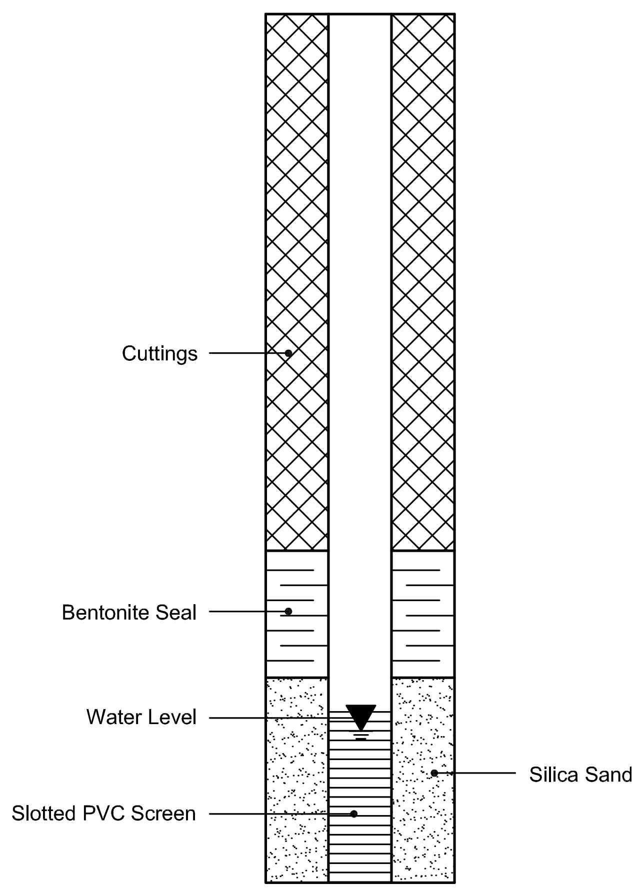


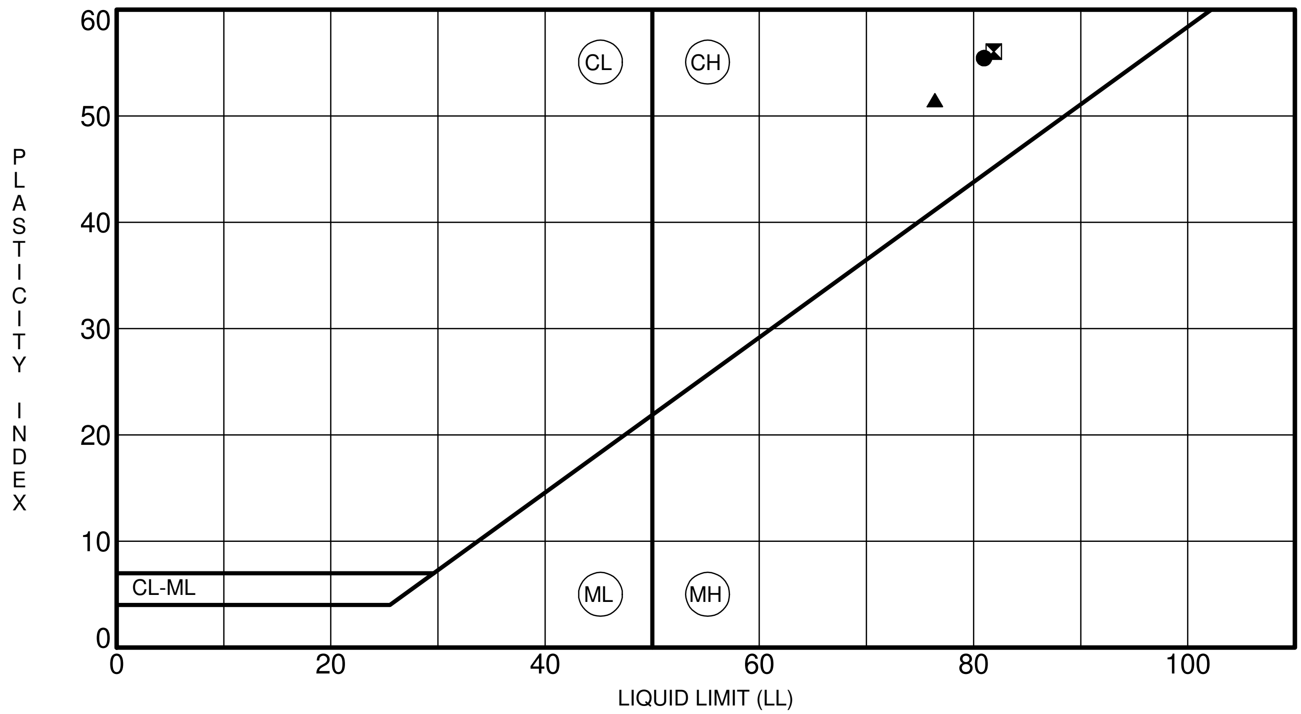
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-22**	**SS4**	**81**	**26**	**55**		**CH - Inorganic clays of high plasticity**
⌧	**BH 3-22**	**SS4**	**82**	**26**	**56**		**CH - Inorganic clays of high plasticity**
▲	**BH 4-22**	**SS4**	**76**	**25**	**52**		**CH - Inorganic clays of high plasticity**

CLIENT **Richcraft Homes**

FILE NO. **PG6406**

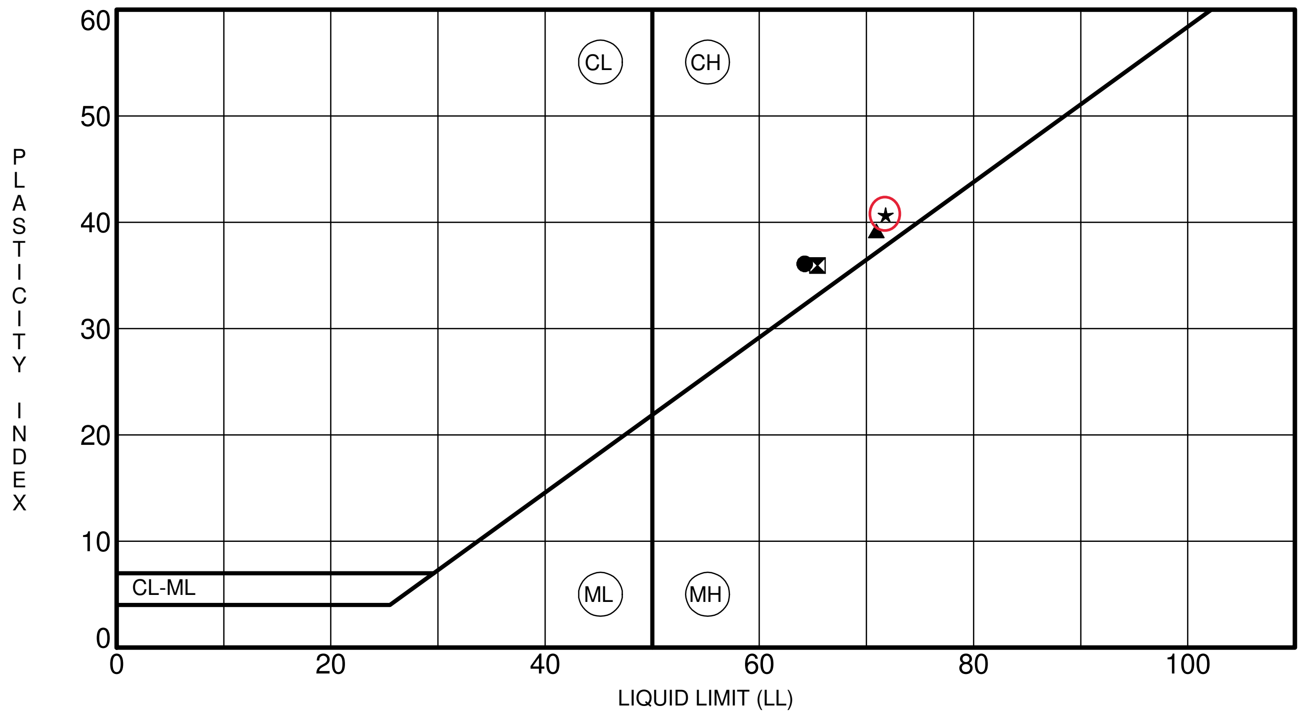
PROJECT **Geotechnical Investigation - Prop. Residential Development - Trails Edge West**

DATE **9 Sep 22**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-20**	**SS 3**	**64**	**28**	**36**		**CH - Inorganic clays of high plasticity**
⧗	**BH 2-20**	**SS 3**	**65**	**29**	**36**		**CH - Inorganic clays of high plasticity**
▲	**BH 3-20**	**SS 3**	**71**	**32**	**39**		**CH - Inorganic clays of high plasticity**
★	**BH 4-20**	**SS 3**	**72**	**31**	**41**		**CH - Inorganic clays of high plasticity**

CLIENT **Minto Communities Inc.**

FILE NO. **PG2392**

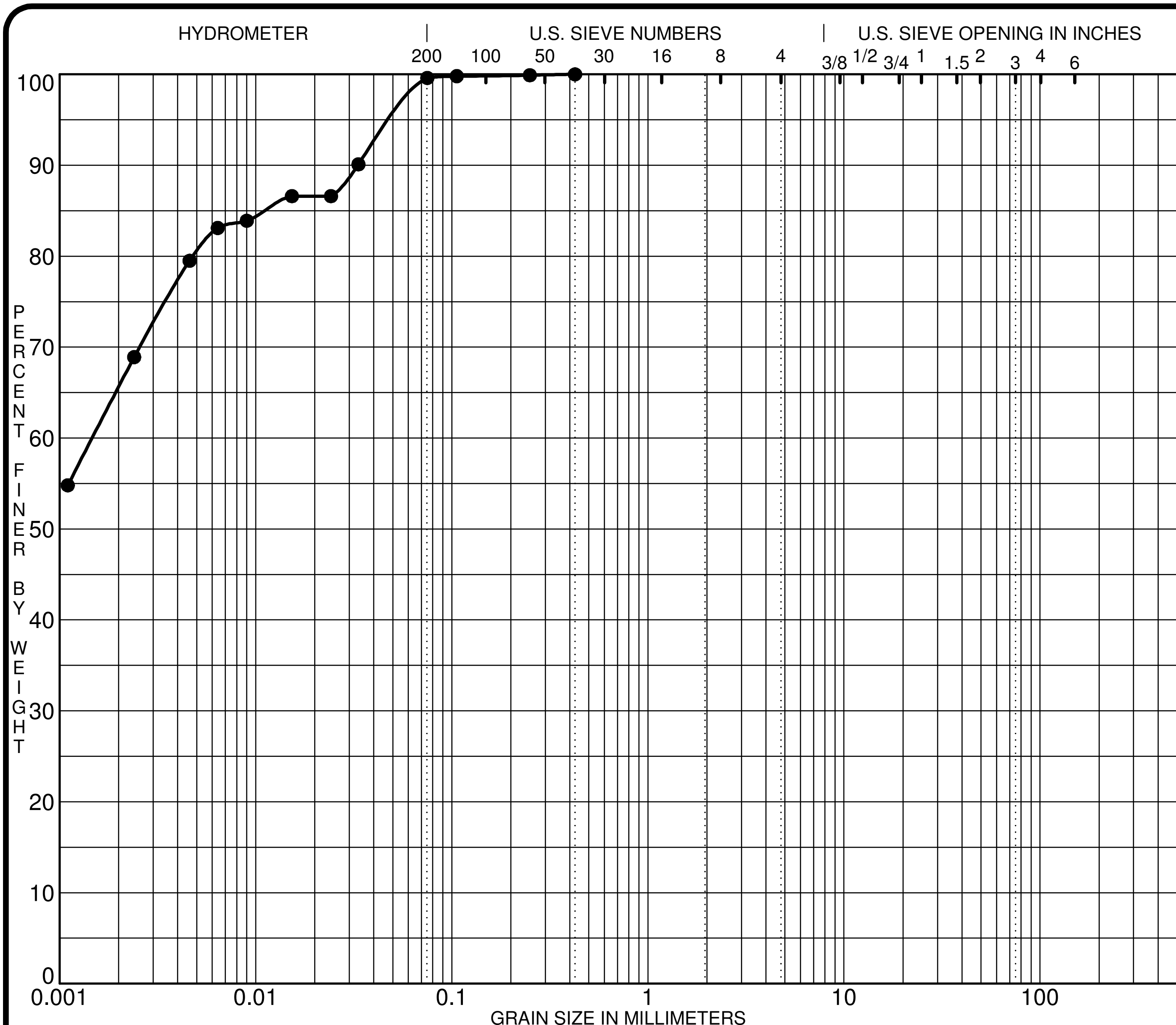
PROJECT **Supplemental Geotechnical Investigation - Proposed Residential Development - Trail's Edge**

DATE **7 May 20**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS



SILT OR CLAY	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-22**	**SS3**	**CH - Inorganic clays of high plasticity**						
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-22**	**SS3**	**0.43**	**0.00**			**0.0**	**0.4**	**99.6**	
⊠										
▲										
★										

CLIENT **Richcraft Homes**

FILE NO. **PG6406**

PROJECT **Geotechnical Investigation - Prop. Residential Development - Trails Edge West**

DATE **9 Sep 22**

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Richcraft	DEPTH	5'-0" to 7'-0"	FILE NO.:	PG6406
PROJECT:	Trails Edge West - Block 140	BH OR TP No:	BH-1 SS3	DATE SAMPLED	9-Sep
LAB No:	38433	TESTED BY:	CP / CS	DATE RECEIVED	13-Sep
SAMPLED BY:	D.R	DATE REPORTED:	27-Sep-22	DATE TESTED	22-Sep

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(8)	Calibration (Two Trials)	Tin NO.(x21)	
Tare	5.09	Tin	4.83	4.84
Soil Pat Wet + Tare	61.4	Tin + Grease	5.12	5.12
Soil Pat Wet	56.31	Glass	48.97	48.97
Soil Pat Dry + Tare	35.35	Tin + Glass + Water	94.46	91.48
Soil Pat Dry	30.26	Volume	40.37	37.39
Moisture	**86.09**	**Average Volume**	**38.88**	

Soil Pat + String	30.27
Soil Pat + Wax + String in Air	31.74
Soil Pat + Wax + String in Water	11.79
Volume Of Pat (Vdx)	19.95

RESULTS:

Shrinkage Limit	**18.07**
Shrinkage Ratio	**1.654**
Volumetric Shrinkage	**112.479**
Linear Shrinkage	**22.213**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

Certificate of Analysis

Report Date: 19-Sep-2022

Client: **Paterson Group Consulting Engineers**

Order Date: 13-Sep-2022

Client PO: 55763

Project Description: PG6406

Client ID:		BH4-22 SS3	-	-	-		
Sample Date:		09-Sep-22 09:00	-	-	-	-	-
Sample ID:		2238192-01	-	-	-		
Matrix:		Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	66.8	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.43	-	-	-	-	-
Resistivity	0.1 Ohm.m	54.3	-	-	-	-	-
Anions							
Chloride	5 ug/g	<5	-	-	-	-	-
Sulphate	5 ug/g	67	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

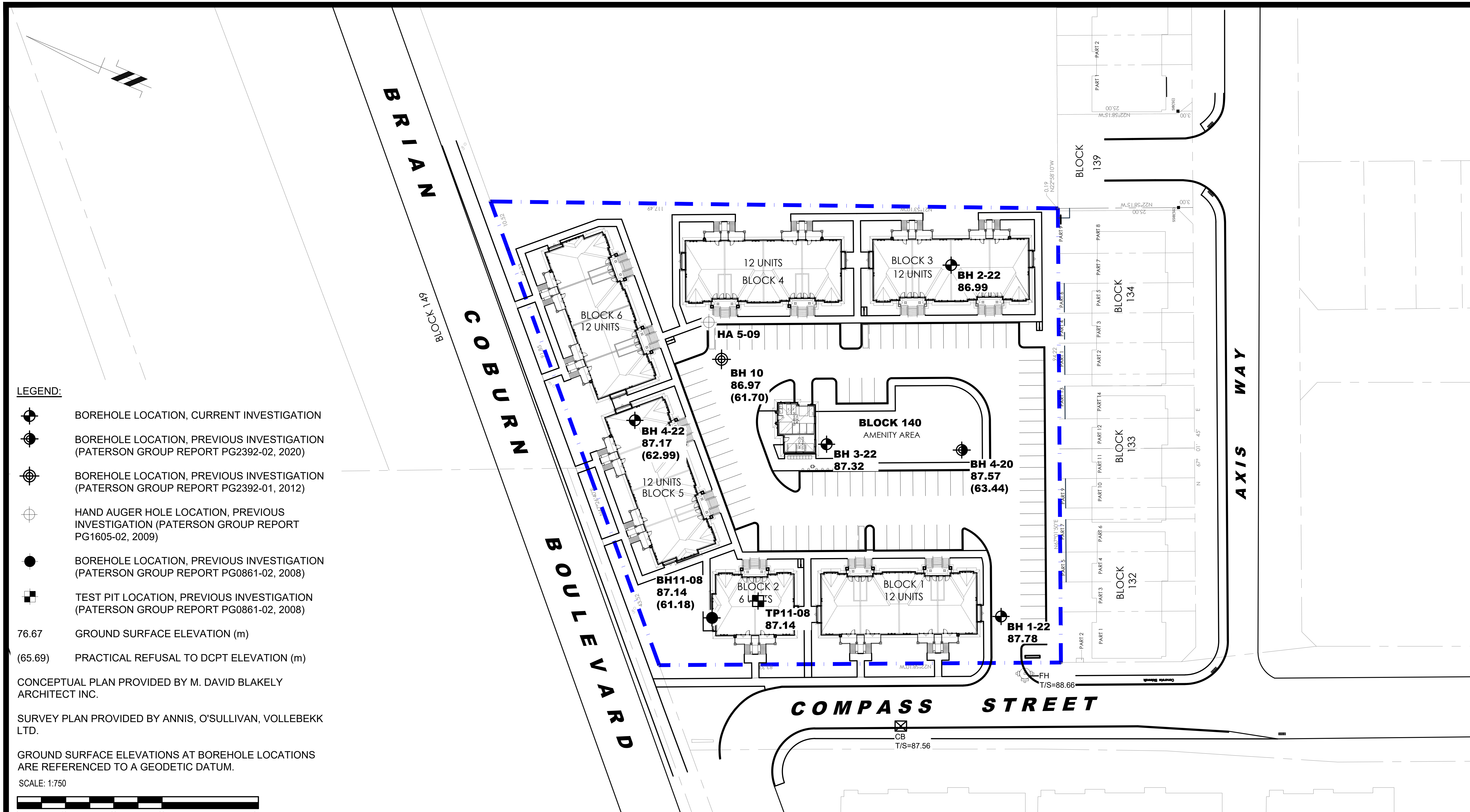
DRAWING PG6406-1 – TEST HOLE LOCATION PLAN

DRAWING PG6406-2 – PERMISSIBLE GRADE RAISE PLAN

FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

- BOREHOLE LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PATERSON GROUP REPORT PG2392-02, 2020)
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PATERSON GROUP REPORT PG2392-01, 2012)
- HAND AUGER HOLE LOCATION, PREVIOUS INVESTIGATION (PATERSON GROUP REPORT PG1605-02, 2009)
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PATERSON GROUP REPORT PG0861-02, 2008)
- TEST PIT LOCATION, PREVIOUS INVESTIGATION (PATERSON GROUP REPORT PG0861-02, 2008)

76.67 GROUND SURFACE ELEVATION (m)

(65.69) PRACTICAL REFUSAL TO DCPT ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY M. DAVID BLAKELY ARCHITECT INC.

SURVEY PLAN PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

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

SCALE: 1:750

0 10 20 30 50m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	UPDATED CONCEPTUAL PLAN	09/10/2024	OM

RICHCRAFT

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
640 COMPASS STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 09/2022
Drawn by: GK	Report No.: PG6406-1
Checked by: SK	Dwg. No.: PG6406-1
Approved by: SD	Revision No.: 1

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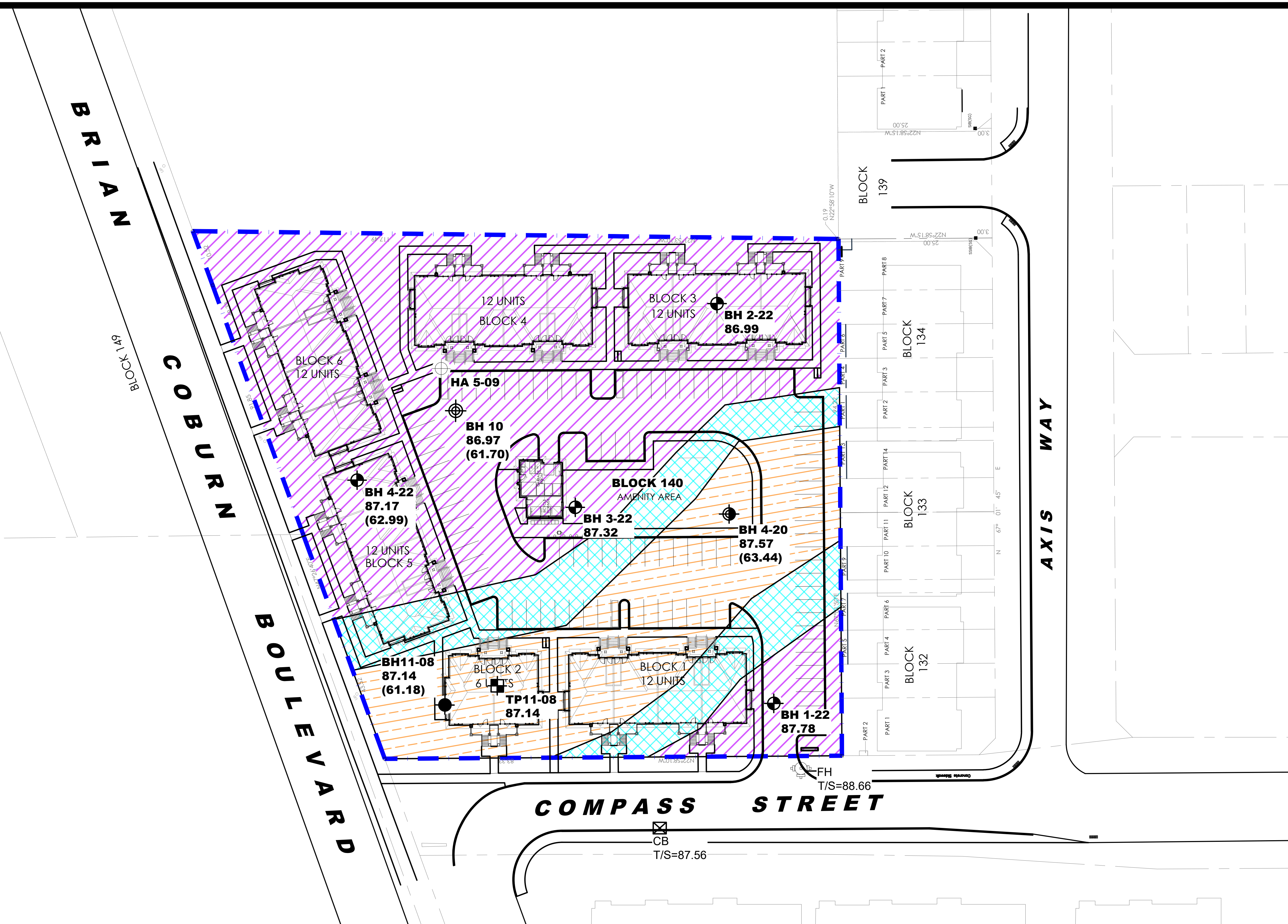
11x17



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SURVEY PLAN PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

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

PERMISSIBLE GRADE RAISE

- **UP TO 0.5 m**
- **UP TO 1.0 m**
- **UP TO 1.5 m**

SCALE: 1:750

0 10 20 30 50m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	UPDATED CONCEPTUAL PLAN	09/10/2024	OM

RICHCRAFT

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
640 COMPASS STREET

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:750	Date: 09/2022
Drawn by: GK	Report No.: PG6406-1
Checked by: SK	Dwg. No.: PG6406-2
Approved by: SD	Revision No.: 1

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