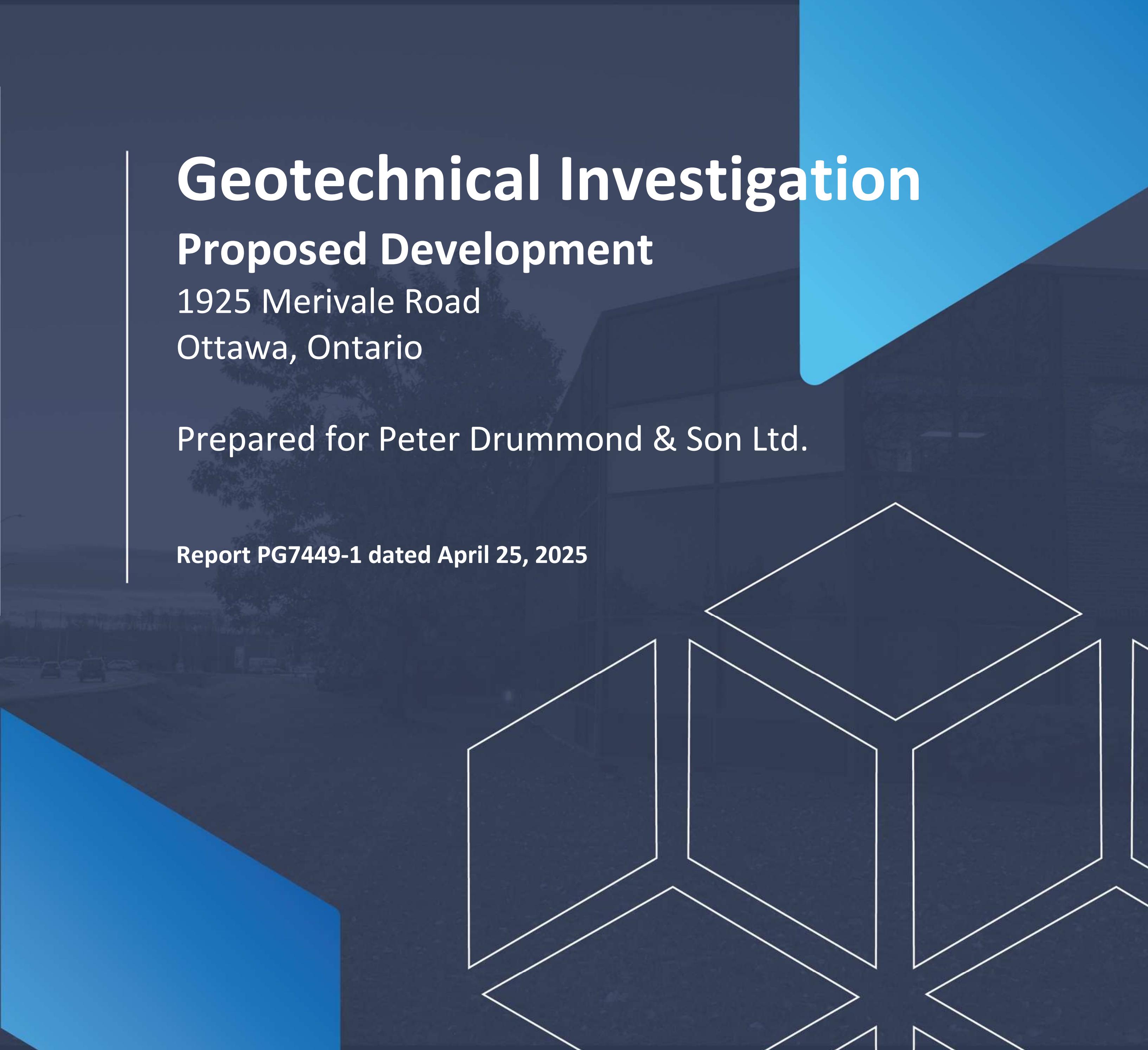

Geotechnical Investigation

Proposed Development

1925 Merivale Road
Ottawa, Ontario

Prepared for Peter Drummond & Son Ltd.

Report PG7449-1 dated April 25, 2025

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Peter Drummond and Son Ltd. to conduct a geotechnical investigation for the proposed development to be located at 1925 Merivale Road in the City of Ottawa, Ontario (reference should be made 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 boreholes and to;

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

This 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

No drawings were available during the preparation of this report, however, it is anticipated that the proposed development will consist of one or more commercial building with slab-on-grade construction.

Associated parking areas with landscaped margins are also anticipated to surround the proposed building. It is further understood that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on March 27, 2025, and consisted of advancing 6 boreholes to a maximum depth of 7.5 m below existing ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground utilities and site features. The borehole locations are shown on Drawing PG7499-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a truck-mounted auger drilling rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The testing procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split spoon (SS) sampler. All samples were visually inspected and initially classified on-site. The auger and split-spoon samples were placed in sealed plastic bags.

All samples were transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU, and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils. 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

Groundwater monitoring wells were installed in boreholes BH 1-25 through BH 5-24 to permit long-term groundwater measurement subsequent to the field investigation. Flexible polyethylene standpipes were installed in the remaining boreholes to permit further groundwater measurement.

The groundwater observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data sheets in Appendix 1.

Monitoring Well Installation

Typical monitoring well construction details are described below:

- 1.5 m of slotted 51 mm diameter PVC screen at the base of the boreholes.
- 51 mm diameter PVC riser pipe from the top of the screen to the ground surface.
- No. 3 silica sand backfill within annular space around screen.
- 300 mm thick bentonite hole plug directly above PVC slotted screen.
- Clean backfill from top of bentonite plug to the ground surface.

Refer to the Soil Profile and Test Data sheets in Appendix 1 for specific well construction details.

3.2 Field Survey

The borehole locations, and ground surface elevation at each borehole location, were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum. The locations of the boreholes, and the ground surface elevation at each borehole location, are presented on Drawing PG7499-1 – 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. From the current test holes, one sample was submitted for grain size distribution testing.

Soil samples will be stored for a period of one month after this report is completed, unless we are otherwise directed.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is mostly occupied by a gas station and associated asphalt-paved access lanes and parking areas, with a yard for construction equipment and materials along the eastern boundary of the site. The site is relatively flat between an approximate geodetic elevation of 89 and 90 m.

The site fronts onto Merivale Road to the west, and is bordered by existing commercial buildings to the north and east, and by Bongard Avenue to the south.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the borehole locations consists of an approximate 0.5 to 4.7 m thickness of fill underlain by a sand/silt deposit. The fill was generally observed to consist of a crushed stone surface, underlain by silty sand. However, at boreholes BH 3-25 and BH 4-25, the lower 0.8 to 1.2 m of clay was observed to consist of a silty clay with traces of topsoil and organics.

The fill was generally underlain by a compact to dense brown sand/silt, turning grey with depth. A layer of very stiff to hard silty clay was encountered at boreholes BH 3-25 and BH 4-25 at approximate depths of 1.8 m and 2.2 m below the 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

Based on available geological mapping, the bedrock in the subject area consists of interbedded sandstone and dolomite of the March formation, and an overburden drift thickness between 10 to 15 m depth.

Grain Size Distribution and Hydrometer Testing

Grain size distribution analysis was completed on 1 selected sand deposit sample from the current investigation. The results of the grain size distribution analysis is presented in Table 1 and on the Grain Size Distribution sheets in Appendix 1.

Table 1 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 2-25 SS5	3.1	0.1	91.3	8.6	

4.3 Groundwater

Groundwater levels were measured within the monitoring wells following the investigation. The measured groundwater levels noted at that time are presented in Table 2 below and are also presented in Appendix 1.

Table 2 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Dated Recorded
		Depth (m)	Elevation (m)	
BH 1-25	89.96	4.17	85.79	April 10, 2025
BH 2-25	90.18	4.08	86.10	
BH 3-25	90.48	4.91	85.57	
BH 4-25	90.37	4.06	86.31	
BH 5-25	90.13	3.88	86.25	

Note: Ground surface elevations at borehole location are referenced to a geodetic datum.

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 to be approximately **4 to 5 m** below ground surface.

However, 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 development. The proposed buildings are recommended to be founded on conventional spread footings placed on the compact sand/silt, stiff silty clay, or on the existing fill which is free of deleterious material and significant organics, and which has been improved in accordance with our recommendations below.

Due to the presence of the silty clay deposit, the subject site is subject to grade raise restrictions. 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 significant amounts of organic materials, should be stripped from under proposed buildings and pipe bedding, and other settlement sensitive structures. In particular, the fill containing organics and topsoil which was encountered at boreholes BH 3-25 and BH 4-25, and which may be encountered elsewhere, should be removed from under proposed buildings and pipe bedding.

Subgrade Improvement for the Existing Fill

Once the existing fill has been exposed at the slab-on-grade or pavement subgrade, or at the underside of footing elevation, it should be proof rolled in **dry conditions and above freezing temperatures** using a large vibratory roller making several passes.

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

The subgrade improvement program should be observed and approved by Paterson at the time of construction.

Fill Placement

Fill placed for grading beneath the building footprint 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 to the site. The fill should be placed in lifts with a maximum loose lift thickness of 300 mm and compacted by suitable compaction equipment. Fill placed beneath the proposed building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath exterior parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on the compact sand/silt, stiff silty clay, or existing fill which has been improved in accordance with our recommendations above, can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was applied to the 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 footings.

Footing designed using the bearing resistance value at SLS, provided above, 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. Above the groundwater level, adequate lateral support is provided to the in-situ bearing medium soils when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil.

Permissible Grade Raise Recommendations

Due to the presence of the silty clay deposit in portions of the site, a permissible grade raise restriction of **2.0 m** may be considered throughout the remainder of the subject site. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class X_D**. If a higher seismic site class (such as Class X_C) is required, then a site-specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed building(s), as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2024. The soils underlying the site are not susceptible to liquefaction.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and deleterious materials within the footprints of the proposed buildings, the existing fill subgrade, prepared in accordance with the recommendations in Section 5.2 above, and approved by Paterson, is considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab construction.

As noted above, where the slab-on-grade subgrade consists of existing fill, it should be proof-rolled with several passes of a vibratory drum roller. Any poor performing areas should be removed and reinstated with an engineered fill, such as OPSS Granular B Type II.

It is recommended that the upper 200 mm of sub-floor fill consist of OPSS Granular A crushed stone. All backfill material within the footprints of the proposed structures should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

For design purposes, the pavement structures presented in Tables 3 and 4 below are recommended for the design of car only parking areas, access lanes and heavy vehicle parking areas.

Table 3 - 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 in situ soils or OPSS Granular B Type I or II material placed over in situ soil.	

Table 4 - Recommended Pavement Structure - Access Lanes and Heavy Vehicle Parking Areas

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

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project where the pavement structures outlined in Tables 4 and 5 are considered.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment, noting that excessive compaction can result in subgrade softening.

6.0 Design and Construction Precautions

6.1 Foundation Backfill

Excavated on-site fill could be re-used for backfilling the foundation walls. However, this material would need to be maintained in an unfrozen state and at a suitable moisture content for compaction if it is to be re-used for this purpose.

Otherwise, imported granular materials, such as clean sand or OPSS Granular B Type I granular material, can be used for this purpose.

6.2 Protection of Footings Against Frost Action

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

Foundations of unheated structures are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure. These foundations should be provided with a minimum 2.1 m thick soil cover, or an equivalent thickness of soil cover and foundation insulation.

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 expected that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. Excavations below the groundwater level should be cut back at a maximum slope of 1.5H:1V.

The subsoil at this site is considered to be mainly 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

The pipe bedding for the sewer and water pipes placed on a relatively dry, undisturbed soil subgrade surface should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm.

The material should be placed in a maximum 225 mm thick loose lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A or Granular B Type II, with a maximum size of 25 mm, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet site-generated fill will be difficult to re-use, as the high-water contents make compaction impractical without an extensive drying period.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material’s SPMDD.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long 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 maximum 225 mm thick loose lifts and compacted to a minimum of

95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at no more than 60 m intervals in the service trenches.

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. Excavations which may be undertaken below the saturated sand layer and into the underlying clay deposit are anticipated to experience moderate to higher influx of groundwater and should be planned to handle the associated influx accordingly.

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.

Impacts to Neighboring Properties

As the proposed structure is anticipated to be slab-on-grade, it is not expected to be founded below the long-term groundwater level. As a result, the building excavation would not extend below the groundwater level, and therefore, no adverse effects to neighboring properties are expected as a result of dewatering.

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 founding level.

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

6.7 Corrosion Potential and Sulphate

One (1) representative soil sample was submitted for corrosion analysis testing. The analytical test results of the soil sample indicate that the sulphate content is less than 0.1%. These results along with the chloride and pH value are indicative that Type 10 Portland cement (Type GU) would be appropriate for this site. The chloride content and the pH of the sample indicate they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a slightly to moderately aggressive environment.

6.8 Tree Planting Restrictions

Based on the results of our review, a low to medium sensitivity clay soil may encountered below the anticipated underside of footing elevations. Therefore, the following tree planting setbacks are recommended for the low to medium sensitivity area as per City of Ottawa Guidelines.

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 height up to 7.5 m) and medium size trees (mature height 7.5 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. This footing level 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.

❐ A small tree must be provided with a minimum 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 height up to 7.5 m) to medium size (mature 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) to provide ductility.

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

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and future details of the proposed development have been prepared:

- Review detailed grading and servicing plans, from a geotechnical perspective.

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

- Review and inspection of the installation of the foundation drainage systems.
- 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 Paterson personnel.

All excess soil must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

8.0 Statement of Limitations

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

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

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

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Peter Drummond & Son Ltd. 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.

LICENSED PROFESSIONAL ENGINEER
April. 25, 2025
S. S. DENNIS
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Scott Dennis
PROVINCE OF ONTARIO

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Report Distribution:

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☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 365873.20 **NORTHING:** 5021384.00 **ELEVATION:** 89.96

PROJECT: Proposed Commercial Development

ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

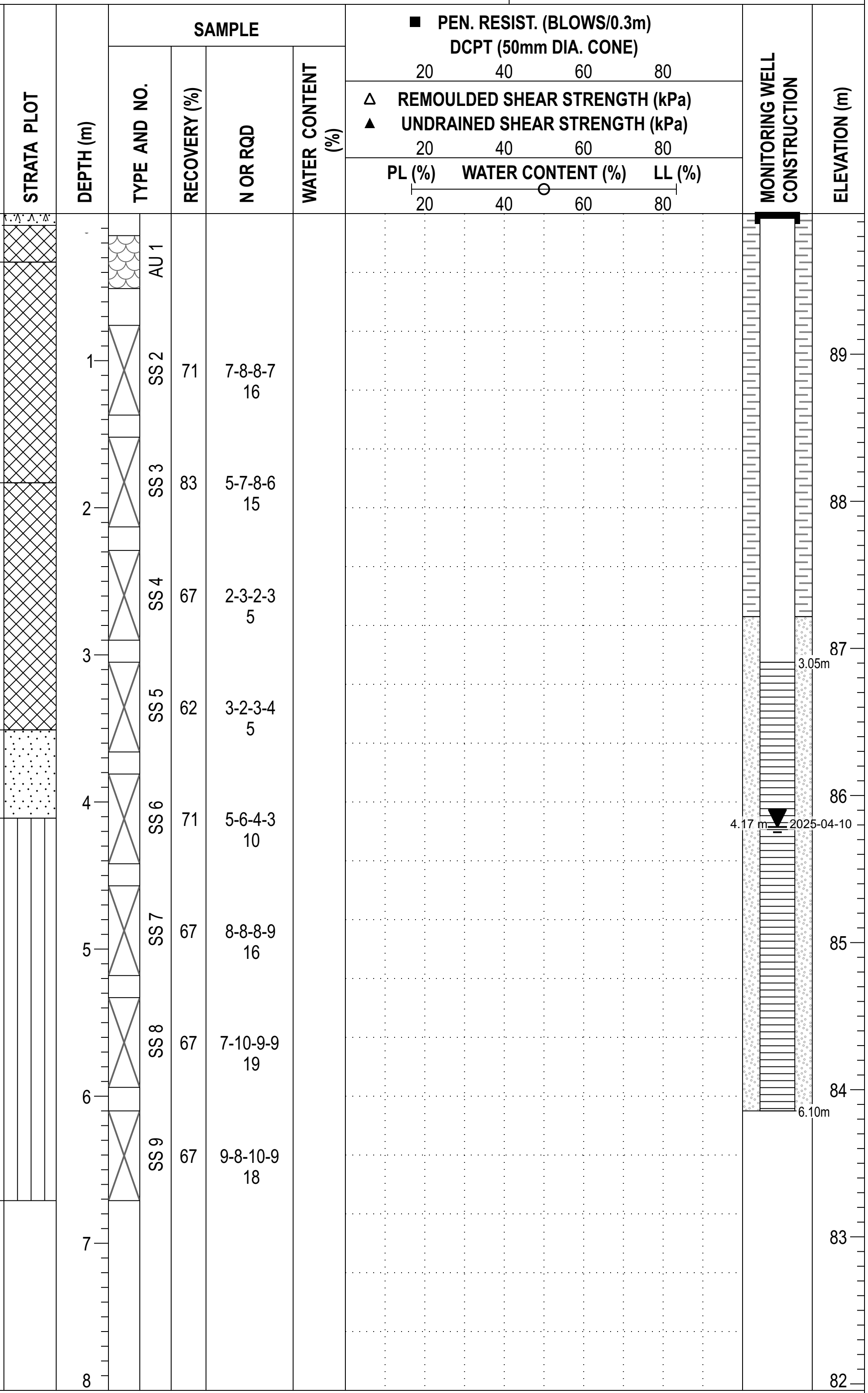
DATE: March 27, 2025

FILE NO. : PG7499

HOLE NO. : BH 1-25

SAMPLE DESCRIPTION	Depth to base
GROUND SURFACE	
ASPHALT	0.08m [89.88m]
FILL: Gravel and crushed stone, with silty sand	0.33m [89.63m]
FILL: Compact, brown silty sand, some gravel and crushed stone - Trace clay and brick by 0.7 m depth	1.83m [88.13m]
FILL: Loose to compact, brown silty sand, some clay, occasional gravel	3.51m [86.45m]
Loose, brown **SAND**, some silt	4.11m [85.85m]
Compact, grey **SILT**, with sand	6.71m [83.25m]
End of Borehole (GWL at 4.17 m depth - April 10, 2025)	

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	71	7-8-8-7 16	
SS 3	83	5-7-8-6 15	
SS 4	67	2-3-2-3 5	
SS 5	62	3-2-3-4 5	
SS 6	71	5-6-4-3 10	
SS 7	67	8-8-8-9 16	
SS 8	67	7-10-9-9 19	
SS 9	67	9-8-10-9 18	



DISCLAIMER: THE DATA PRESENTED IN THIS SHEET IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHOM IT WAS PRODUCED. THIS SHEET SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

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PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 365895.07 **NORTHING:** 5021387.50 **ELEVATION:** 90.18

PROJECT: Proposed Commercial Development

ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

DATE: March 27, 2025

FILE NO. : PG7499

HOLE NO. : BH 2-25

SAMPLE DESCRIPTION

GROUND SURFACE

ASPHALT
0.10m [90.08m]

FILL: Gravel, with crushed stone and silty sand
0.28m [89.90m]

FILL: Compact, brown silty sand, some gravel and crushed stone
3.20m [86.98m]

FILL: Loose, brown silty sand
4.72m [85.46m]

Compact to dense, grey **SILT** , with sand
7.47m [82.71m]

End of Borehole

(GWL at 4.08 m depth - April 10, 2025)

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	62	12-12-10-7 22	
SS 3	54	5-4-5-5 9	
SS 4	37	6-5-6-5 11	
SS 5	79	4-2-2-2 4	
SS 6	67	2-2-2-6 4	
SS 7	62	4-14-15-14 29	
SS 8	62	5-9-15-6 24	
SS 9	71	7-14-17-19 31	
SS 10	71	5-9-17-15 26	

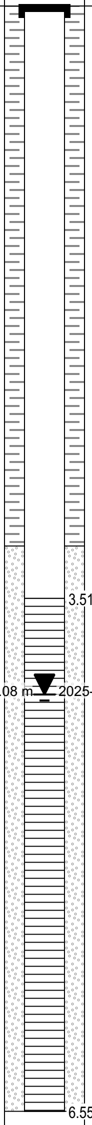
DEPTH (m): 1, 2, 3, 4, 5, 6, 7, 8

■ PEN. RESIST. (BLOWS/0.3m)
DCPT (50mm DIA. CONE)
20 40 60 80

△ REMOULDED SHEAR STRENGTH (kPa)
▲ UNDRAINED SHEAR STRENGTH (kPa)
20 40 60 80

PL (%) WATER CONTENT (%) LL (%)
20 40 60 80

MONITORING WELL CONSTRUCTION



ELEVATION (m): 90, 89, 88, 87, 86, 85, 84, 83

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PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 365920.79 **NORTHING:** 5021391.69 **ELEVATION:** 90.48

PROJECT: Proposed Commercial Development

ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

DATE: March 27, 2025

FILE NO. : PG7499

HOLE NO. : BH 3-25

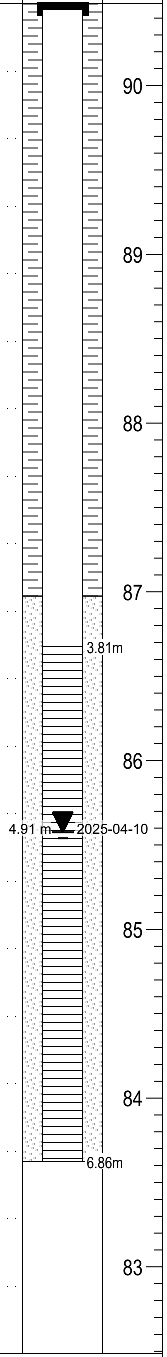
■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE): 20 40 60 80

△ REMOULDED SHEAR STRENGTH (kPa)
▲ UNDRAINED SHEAR STRENGTH (kPa): 20 40 60 80

PL (%) WATER CONTENT (%) LL (%): 20 40 60 80

SAMPLE DESCRIPTION	Base depth [elevation]
GROUND SURFACE	
ASPHALT	0.10m [90.39m]
FILL: Gravel, with crushed stone and silty sand	0.61m [89.88m]
FILL: Loose, dark brown silty clay, trace topsoil, organics and sand	1.83m [88.66m]
Very stiff to hard, brown to dark brown **SILTY CLAY**	2.29m [88.19m]
Compact, brown **SILT**, trace sand and clay	3.20m [87.28m]
Compact to dense, brown **SILT**, with sand, trace clay - Grey by 6.8 m depth	7.47m [83.02m]
End of Borehole (GWL at 4.91 m depth - April 10, 2025)	

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	42	6-3-4-5 7	
SS 3	19	7-6-10-10 16	
SS 4	100	P	
SS 5	105	3-9-12-12 21	
SS 6	71	5-12-12-17 24	
SS 7	67	7-15-17-18 32	
SS 8	62	7-11-11-13 22	
SS 9	67	8-13-13-25 26	
SS 10	67	11-17-19-13 36	



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PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 365932.02 **NORTHING:** 5021365.26 **ELEVATION:** 90.37

PROJECT: Proposed Commercial Development

ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

DATE: March 27, 2025

FILE NO. : PG7499

HOLE NO. : BH 4-25

SAMPLE DESCRIPTION	Bottom depth [elevation]
GROUND SURFACE	
ASPHALT	0.10m [90.27m]
FILL: Gravel, with crushed stone and silty sand	0.66m [89.71m]
FILL: Loose to compact, dark brown silty clay, trace organics and topsoil	1.45m [88.92m]
Very stiff to hard, brown to grey **SILTY CLAY**, trace sand, occasional organics	2.21m [88.16m]
Stiff, grey **CLAY**, with silt, trace sand	2.97m [87.40m]
Very dense, light brown **SILTY SAND**	4.50m [85.87m]
Compact to dense, brown **SILT**, with sand	7.47m [82.90m]
End of Borehole (GWL at 4.06 m depth - April 10, 2025)	

SAMPLE TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	67	5-4-7-7 11	
SS 3	100	5-5-6-9 11	
SS 4	100	3-2-2-2 4	
SS 5	87	10-21-27-27 48	
SS 6	87	9-21-23-12 44	
SS 7	67	10-19-24-19 43	
SS 8	71	9-11-13-15 24	
SS 9	67	11-13-15-18 28	
SS 10	67	4-9-9-9 18	

STRATA PLOT

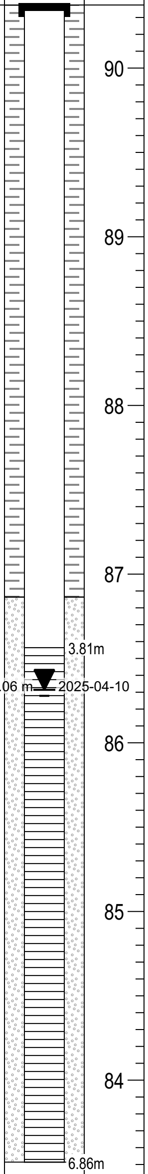
DEPTH (m): 1, 2, 3, 4, 5, 6, 7, 8

■ PEN. RESIST. (BLOWS/0.3m)
DCPT (50mm DIA. CONE)
20 40 60 80

△ REMOULDED SHEAR STRENGTH (kPa)
▲ UNDRAINED SHEAR STRENGTH (kPa)
20 40 60 80

PL (%) WATER CONTENT (%) LL (%)
20 40 60 80

MONITORING WELL CONSTRUCTION



ELEVATION (m): 90, 89, 88, 87, 86, 85, 84, 83

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

PATERSON GROUP

COORD. SYS.: MTM ZONE 9 **EASTING:** 365892.31 **NORTHING:** 5021359.42 **ELEVATION:** 90.13

PROJECT: Proposed Commercial Development

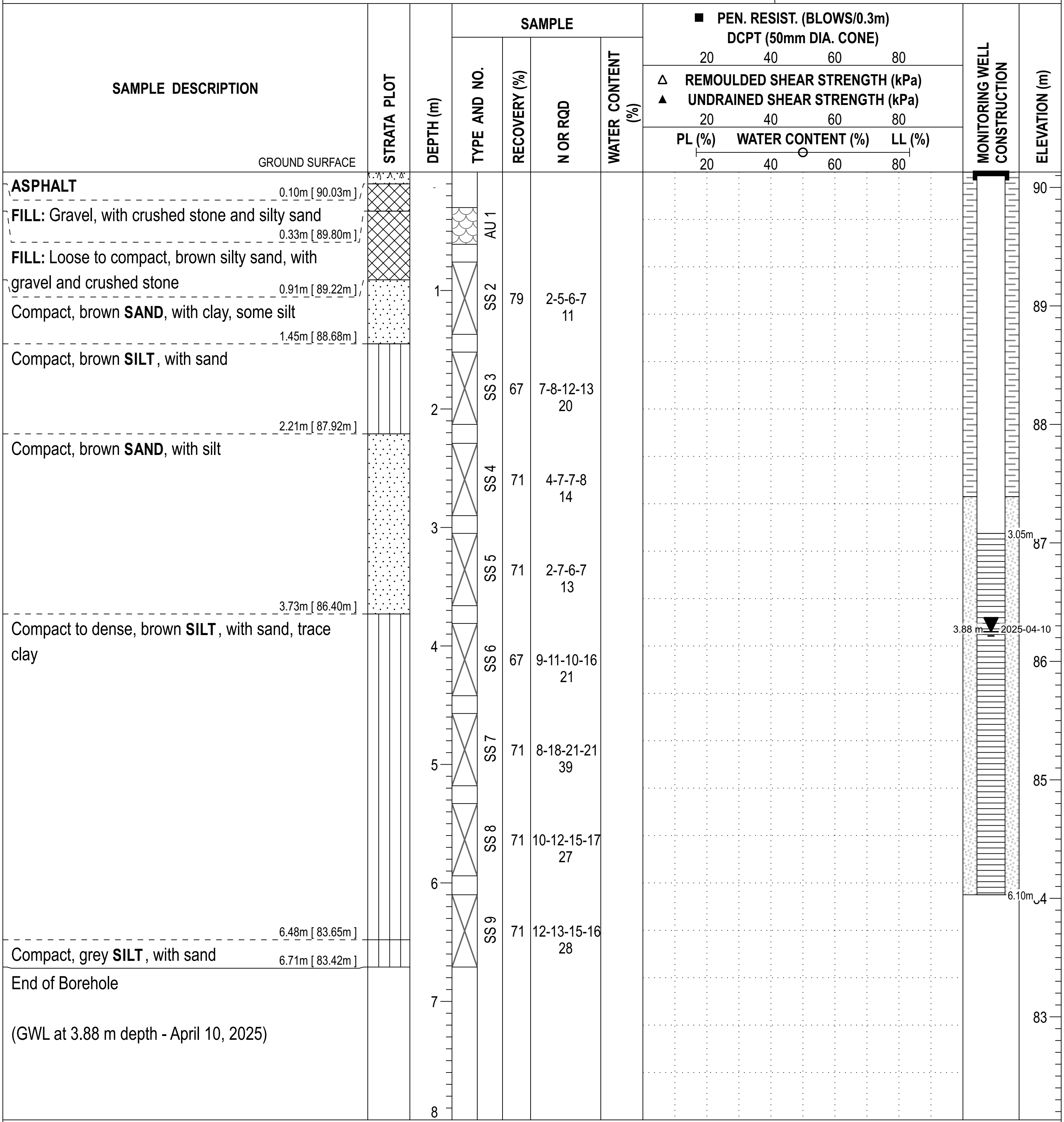
ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

DATE: March 28, 2025

FILE NO. : PG7499

HOLE NO. : BH 5-25



SAMPLE DESCRIPTION	Depth / Elevation
ASPHALT	0.10m [90.03m]
FILL: Gravel, with crushed stone and silty sand	0.33m [89.80m]
FILL: Loose to compact, brown silty sand, with gravel and crushed stone	0.91m [89.22m]
Compact, brown **SAND**, with clay, some silt	1.45m [88.68m]
Compact, brown **SILT**, with sand	2.21m [87.92m]
Compact, brown **SAND**, with silt	3.73m [86.40m]
Compact to dense, brown **SILT**, with sand, trace clay	6.48m [83.65m]
Compact, grey **SILT**, with sand	6.71m [83.42m]

End of Borehole

(GWL at 3.88 m depth - April 10, 2025)

TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
AU 1			
SS 2	79	2-5-6-7 11	
SS 3	67	7-8-12-13 20	
SS 4	71	4-7-7-8 14	
SS 5	71	2-7-6-7 13	
SS 6	67	9-11-10-16 21	
SS 7	71	8-18-21-21 39	
SS 8	71	10-12-15-17 27	
SS 9	71	12-13-15-16 28	

PATERSON GROUP

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

1925 Merivale Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 365886.70 **NORTHING:** 5021417.49 **ELEVATION:** 89.39

PROJECT: Proposed Commercial Development

ADVANCED BY: Truck Mounted Drill Rig

REMARKS:

DATE: March 28, 2025

FILE NO. : **PG7499**

HOLE NO. : **BH 6-25**

SAMPLE DESCRIPTION	SAMPLE TYPE AND NO.	RECOVERY (%)	N OR RQD	WATER CONTENT (%)
GROUND SURFACE				
ASPHALT 0.10m [89.29m]				
FILL: Gravel, with crushed stone and silty sand 0.56m [88.83m]	AU 1			
Stiff, brown **SILTY CLAY** 1.45m [87.94m]	SS 2	33	5-4-5-4 9	
Dense to compact, brown **SAND**, with silt 2.21m [87.18m]	SS 3	75	6-13-24-28 37	
Dense, brown **SILTY SAND** 3.73m [85.66m]	SS 4	79	9-22-24-24 46	
	SS 5	100	15-19-24-22 43	
Compact to dense, brown **SILT**, with sand 6.71m [82.68m]	SS 6	67	5-9-11-11 20	
	SS 7	67	8-18-17-23 35	
	SS 8	75	6-15-15-17 30	
	SS 9	58	3-12-14-15 26	
End of Borehole				

STRATA PLOT

DEPTH (m): 1, 2, 3, 4, 5, 6, 7, 8

■ PEN. RESIST. (BLOWS/0.3m)
DCPT (50mm DIA. CONE)
20 40 60 80

△ REMOULDED SHEAR STRENGTH (kPa)
▲ UNDRAINED SHEAR STRENGTH (kPa)
20 40 60 80

PL (%) WATER CONTENT (%) LL (%)
20 40 60 80

PIEZOMETER CONSTRUCTION

ELEVATION (m): 89, 88, 87, 86, 85, 84, 83, 82

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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 relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	‘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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity: $S_t < 2$
Medium Sensitivity: $2 < S_t < 4$
Sensitive: $4 < S_t < 8$
Extra Sensitive: $8 < S_t < 16$
Quick Clay: $S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G - "Grab" sample from test pit or surface materials
AU - Auger sample or bulk sample
WS - Wash sample
RC - Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

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

CONSOLIDATION TEST

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

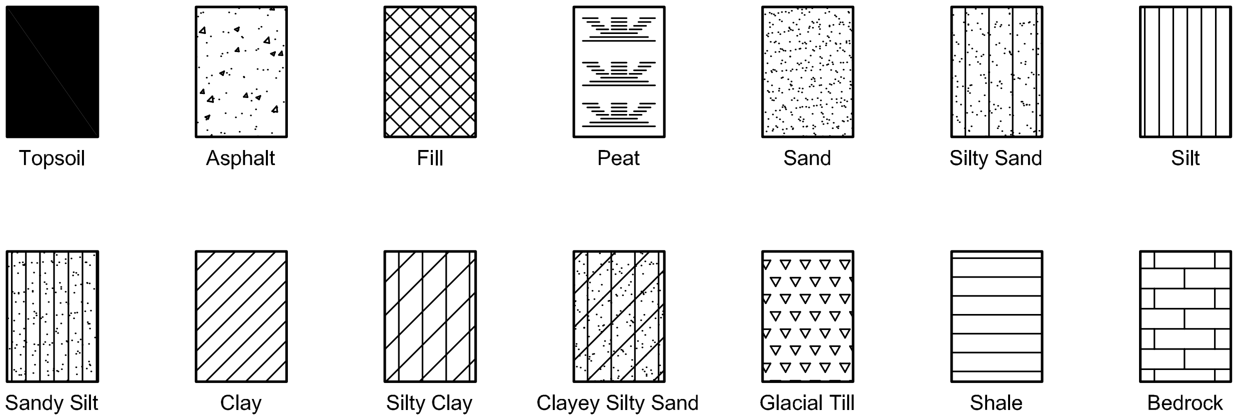
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

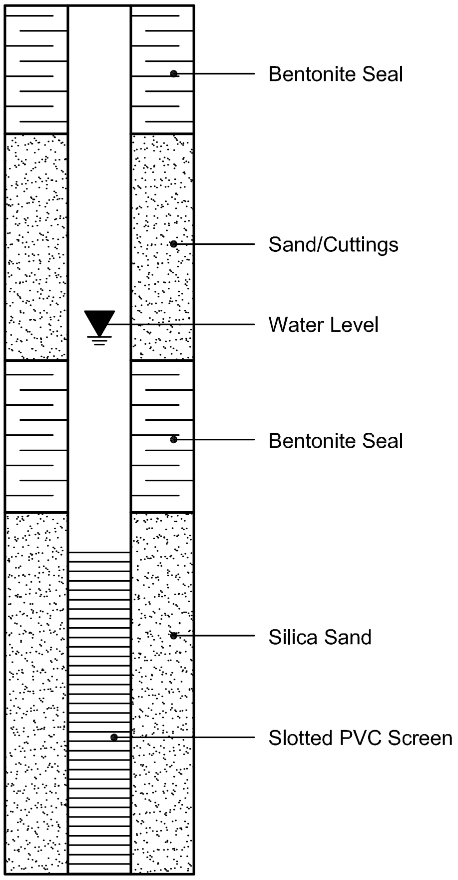
SYMBOLS AND TERMS (continued)

STRATA PLOT

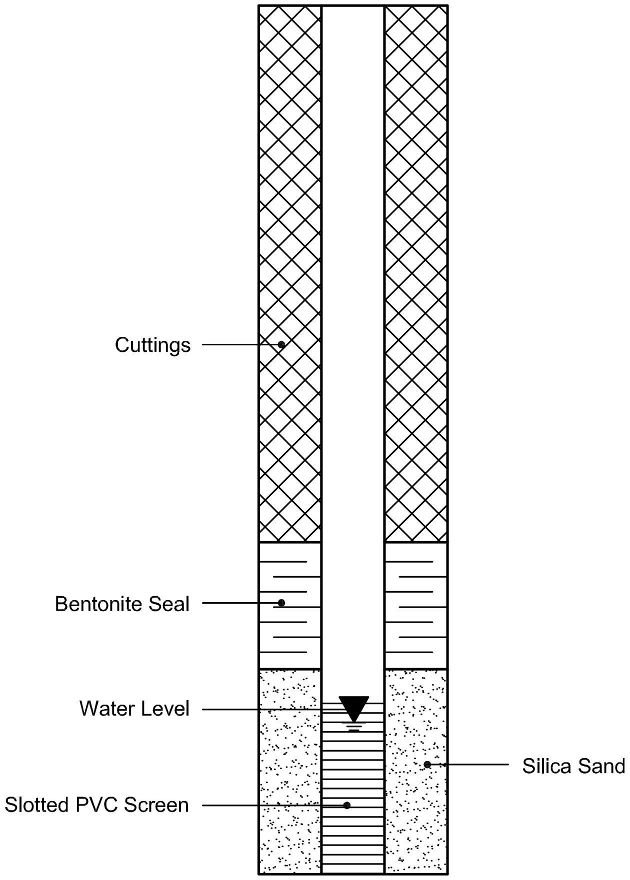


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



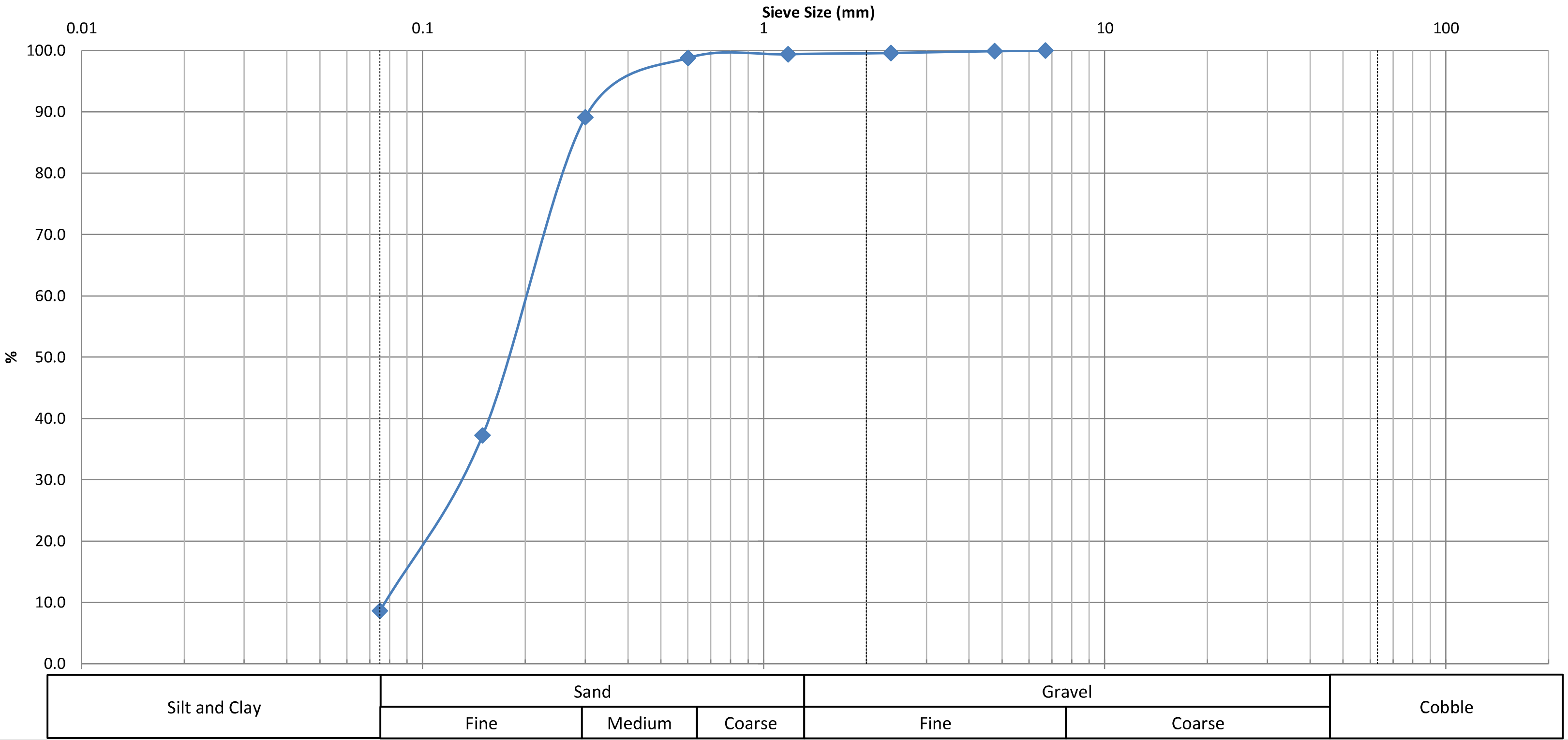
PIEZOMETER CONSTRUCTION



PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Drummond Fuels	DESCRIPTION:	Sand	FILE NO:	PG7499
CONTRACT NO.:	-	SPECIFICATION:	**Sand**	LAB NO:	59138
PROJECT:	1925 Merivale Rd	INTENDED USE:	-	DATE RECEIVED:	31-Mar-25
		PIT OR QUARRY:	-	DATE TESTED:	1-Apr-25
DATE SAMPLED:	31-Mar-25	SOURCE LOCATION:	BH2-25 SS5	DATE REPORTED:	3-Apr-25
SAMPLED BY:	A.E.	SAMPLE LOCATION:	3.05 - 3.66	TESTED BY:	CP/RP



Identification	**Soil Classification**					**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
										1.23	2.6
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	6.7	0.205	0.14	0.078	0.1	91.3		8.6			

Comments:

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

Certificate of Analysis

Report Date: 07-Apr-2025

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 1-Apr-2025

Client PO: 62704

Project Description: PG7499

Client ID:		BH6-25 SS3	-	-	-	-	-
Sample Date:		28-Mar-25 09:00	-	-	-		
Sample ID:		2514166-01	-	-	-		
Matrix:		Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	87.2	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.84	-	-	-	-	-
Resistivity	0.1 Ohm.m	3.9	-	-	-	-	-
Anions							
Chloride	10 ug/g	1420	-	-	-	-	-
Sulphate	10 ug/g	75	-	-	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG7499-1 - TEST HOLE LOCATION PLAN

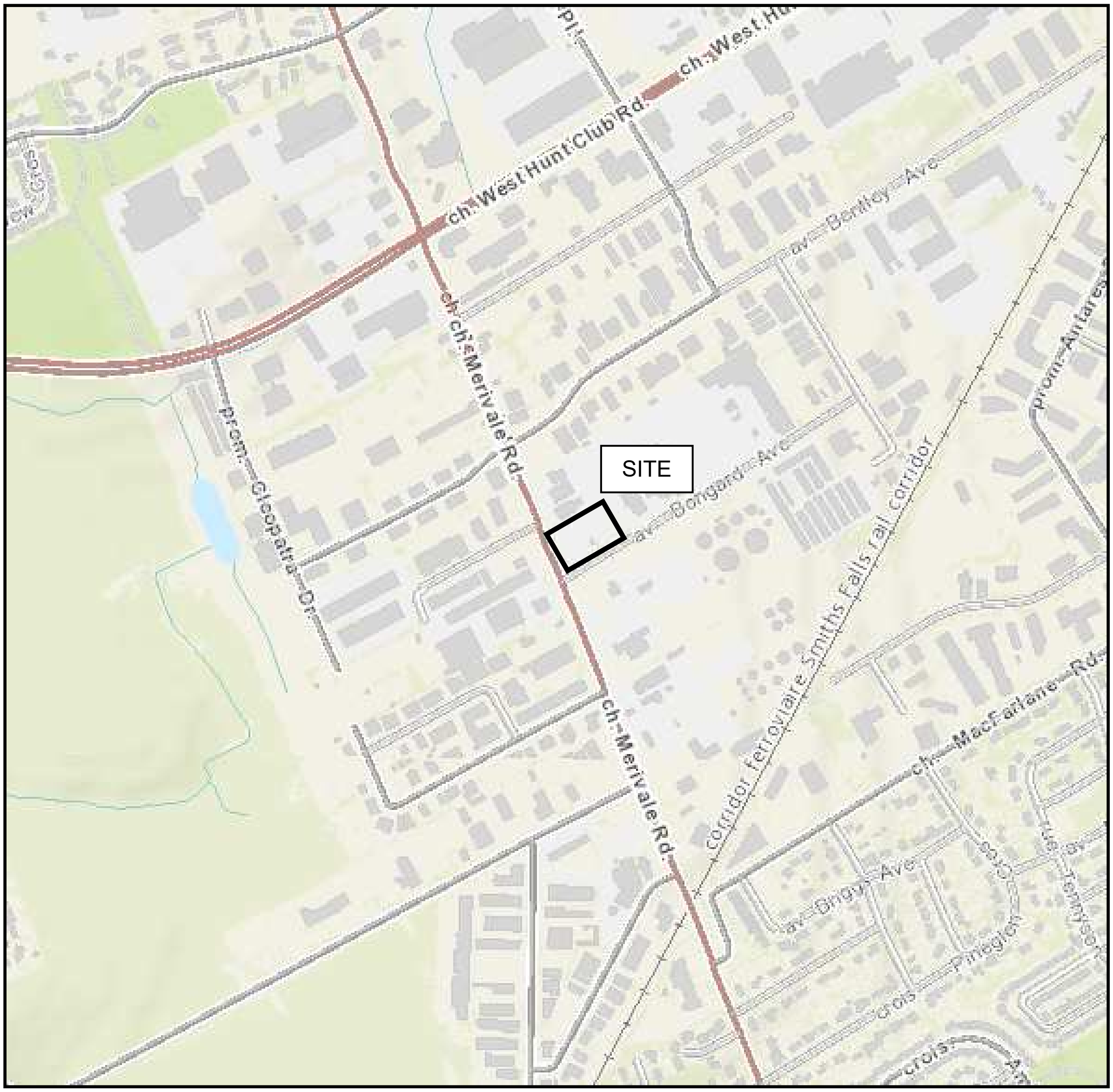
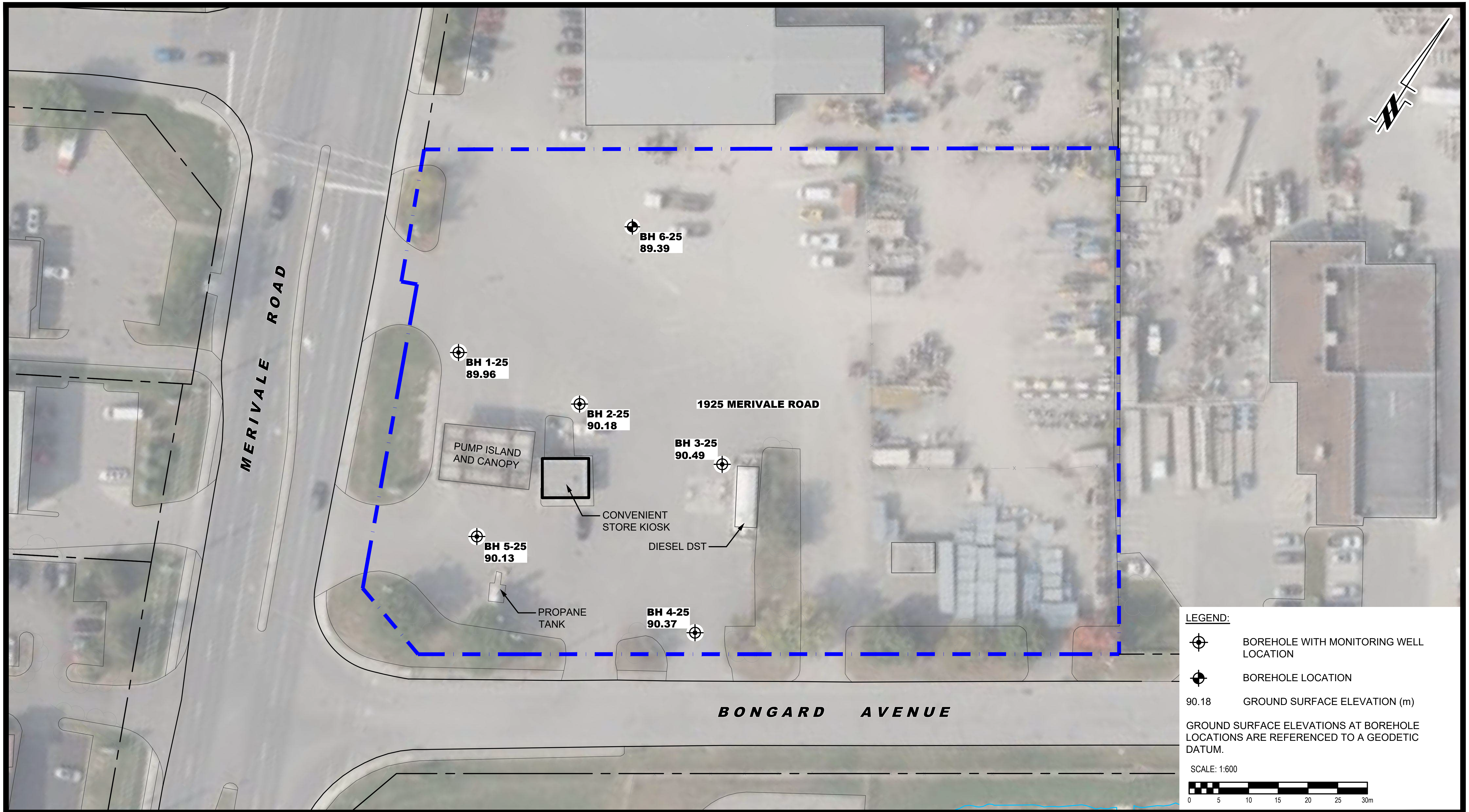


FIGURE 1

KEY PLAN

PATERSON
GROUP



PATERSON GROUP

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

NO.	REVISIONS	DATE	INITIAL

PETER DRUMMOND & SON LTD.
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
1925 MERIVALE ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:600
Date: 04/2025
Drawn by: ZS
Report No.: PG7499-1
Checked by: PB
Dwg. No.: PG7499-1
Approved by: SD
Revision No.:

11x17

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