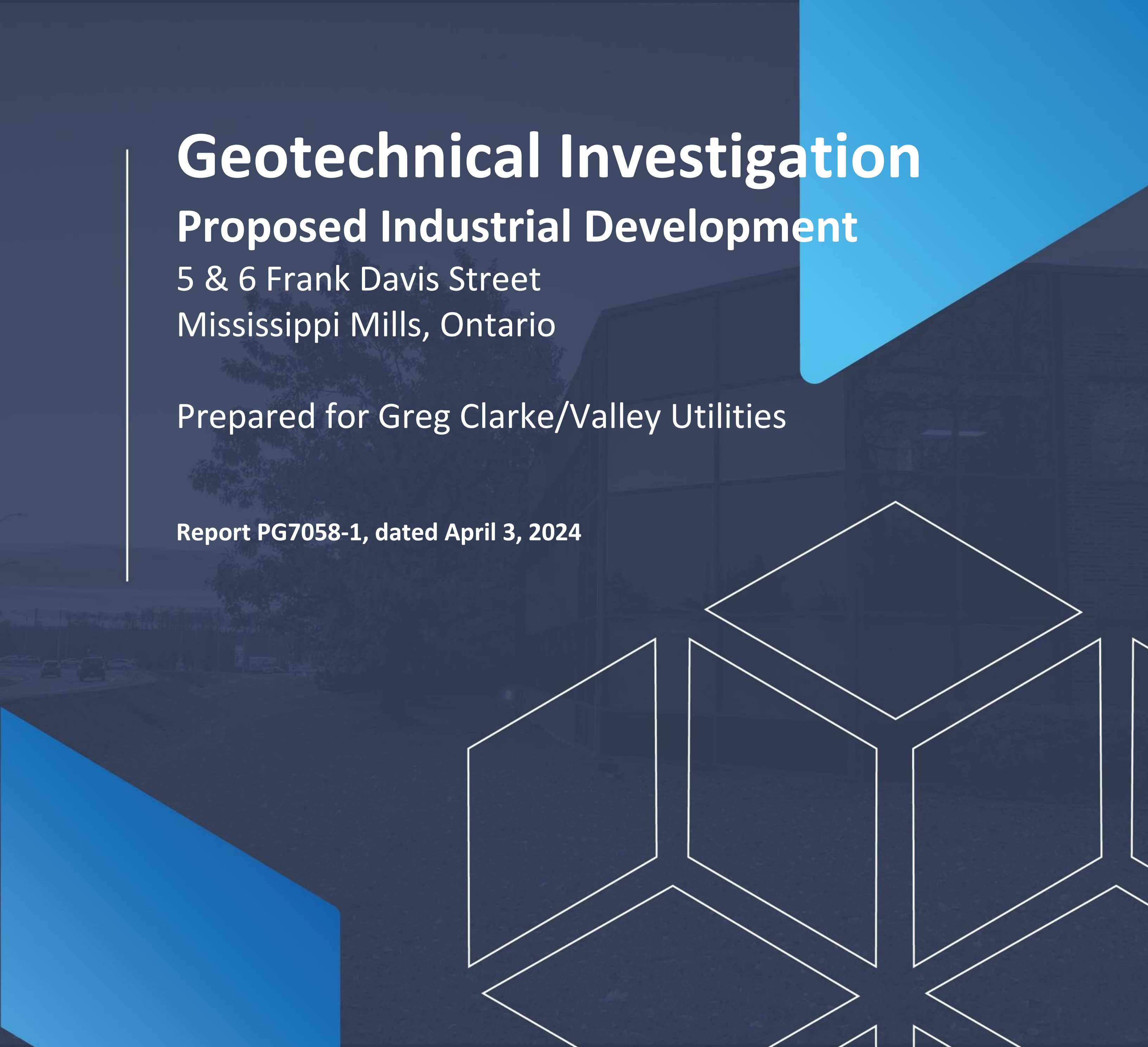

Geotechnical Investigation

Proposed Industrial Development

5 & 6 Frank Davis Street
Mississippi Mills, Ontario

Prepared for Greg Clarke/Valley Utilities

Report PG7058-1, dated April 3, 2024

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Greg Clarke/Valley Utilities to conduct a geotechnical investigation for the proposed industrial development to be located at 5 & 6 Frank Davis Street in the Town of Mississippi Mills (reference should be made to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of a test hole program.

- 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.

Investigating the presence or potential presence of contamination on the subject site was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

It is understood that the proposed development will consist of two, one-storey slab-on-grade structures and will be located along the east and west borders of the subject site. It is expected the proposed buildings will be surrounded with associated parking areas, access lanes and hardscaping.

It is further expected 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 20, 2024, and consisted of advancing a total of thirteen (13) test pits to a maximum depth of 0.9 m below the existing ground surface.

The test pits were advanced using a rubber-tired backhoe. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from our geotechnical department. The test pitting procedure consisted of advancing to the required depths at select locations, sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation. Grab samples were collected from the test pits at selected intervals. The samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory. The depths at which the grab samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

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

3.2 Field Survey

The test pit locations were selected by Paterson to provide general coverage of the development, taking into consideration the existing site features and underground utilities.

The test pit locations and ground surface elevation at each test pit location were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum. The location of the test pits and ground surface elevation at each test pit location are presented on Drawing PG7058-1 - 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. All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site consists of a vacant lot with tall grass and a treed area throughout the northeast corner.

An approximately 300 to 400 mm deep swale was observed crossing the northeastern portion of the subject site and adjacent to the wooded area. Further, an approximately 100 to 800 mm deep ditch was observed along the southern property boundary and adjacent to Frank Davis Street.

The subject site is bordered to the north, east and west, by vacant properties with grassed surfaces and moderate tree cover. The site is further bordered by Appleton Side Road to the east, and commercial buildings to the north. The southern portion of the site is bordered by Frank Davis Street. The ground surface across the subject site is relatively level. The ground surface elevation of the subject site lies approximately 200 to 900 mm below the nearest roadway.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile across the site consists of an approximately 200 to 800 mm thick layer of topsoil underlain by silty sand and/or glacial till and further by the bedrock formation. Bedrock was encountered directly underlying the topsoil at test pits TP 4-24, TP 11-24 and TP 13-24.

The topsoil was underlain by brown silty sand before reaching the glacial till layer in TP 7-24, TP 8-24 and TP 12-24, which extends to an approximate depth ranging between 400 to 600 mm. The glacial till layer was observed to extend to bedrock at depths of 500 to 900 mm.

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and dolomite of the Gull River formation with drift thickness ranging from 0 to 1 m.

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

4.3 Groundwater

Groundwater was not observed within the open test pits at the completion of excavation. However, it should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed building. It is recommended that the proposed building be founded on conventional spread footings placed on clean, surface sounded bedrock.

Bedrock removal may be required for the building excavation and installation of site service. This is discussed further in Section 5.2.

The above and other considerations are further 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 any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II or a well-graded site-crushed blast-rock meeting an OPSS Granular B Type ll gradation.

The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the 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, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least 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.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as CCW MiraDRAIN 2000 or Delta-Teraxx.

Bedrock Removal

Should bedrock removal be required, hoe-ramming is an option where the bedrock is weathered and/or only small quantities of bedrock need to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be completed prior to commencing site activities.

The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations. As a general guideline, peak particle velocities of 25 mm/sec (measured at the structures) should not be exceeded during the blasting program to reduce the risks of damage to the existing structures.

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

Vibration Considerations

Construction operations could cause vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated into the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could cause vibrations: piling equipment, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of a shoring system with soldier piles or sheet piling will require these pieces of equipment. Vibrations, caused by blasting or construction operations could cause detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the recommended vibration limit, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations.

As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards.

These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed buildings.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on clean, surface sounded bedrock can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **1,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

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

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

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 a sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passes through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site as deduced from Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC 2012).

If a higher seismic site class is required (Class A or Class B, dependent on founding conditions), a site-specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed buildings.

The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the silty sand, glacial till, and/or bedrock subgrade approved by the Paterson field personnel at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction.

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 materials required to raise grade within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

Car only parking areas, driveways and access lanes are anticipated at this site. The proposed pavement structures are shown in Tables 2 and 3.

Table 2 - Recommended Pavement Structure - Car Only Parking Areas and Fire-Truck Routes

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

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

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

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

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

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material’s SPMDD using suitable vibratory equipment.

If bedrock is encountered at the subgrade level, the total thickness of the pavement granular materials (base and subbase) could be reduced to 300 mm for the above-noted pavement structures. The bedrock surface should be reviewed and approved by Paterson prior to placing the base and subbase materials. Care should be exercised during the bedrock removal program to ensure that the bedrock subgrade does not have depressions that will trap the water.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

Since the building will consist of a slab-on-grade perimeter foundation drainage system is considered optional throughout the landscaped portions of the proposed building footprint. In areas where hard-scaping or pavement structures will abut the building footprint, it is recommended to implement a foundation drainage system.

The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe wrapped in a geosock and surrounded on all sides by 150 mm of 19 mm clear crushed stone. The pipe should be placed at the footing level around the exterior perimeter of the structure or a minimum of 300 mm below the subgrade level for overlying hardscaped surfaces, such as sidewalks and paved areas abutting the structure. The clear stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or adjacent ditch.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite drainage membrane, such as CCW MiraDRAIN 2000 or Delta-Teraxx, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand, OPSS Granular B Type I granular material, or crushed site-generated blast-rock meeting an OPSS Granular B Type I gradation envelope, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

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

However, foundations which are founded directly on clean, surface-sounded bedrock with no cracks or fissures, and which is approved by Paterson at the time of construction, is not considered frost susceptible and does not require soil cover.

Where the bedrock is considered frost susceptible, foundation insulation will need to be provided or the frost susceptible bedrock will need to be removed and replaced with lean concrete (minimum 15 MPa 28-day strength).

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available in selected areas 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. 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. In bedrock, almost vertical side slopes can be used provided that all loose rock and blocks with unfavourable weak planes are removed prior to workers entering the associated trenches. Slopes in excess of 3 m in height should be periodically inspected by Paterson personnel 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

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding layer should be increased to 300 mm where the subgrade consists of bedrock. The bedding should extend to the spring line of the pipe.

Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

Well fractured bedrock should be acceptable as backfill for the lower portion of the trenches when the excavation is within bedrock provided the rock fill is placed only from at least 300 mm above the top of the service pipe and that all stones are 150 mm or smaller in their longest dimension.

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

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

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR).

A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

6.6 Winter Construction

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

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

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

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

6.7 Corrosion Potential and Sulphate

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

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 preliminary and detailed grading, servicing and structural plan(s) 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 Paterson personnel. 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 and follow-up field density tests to determine the level of compaction achieved.
- 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 Greg Clarke/Valley Utilities 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.

KBell

Killian Bell, B.Eng.

LICENSED PROFESSIONAL ENGINEER
April 3, 2024
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Report Distribution:

- ☐ Greg Clarke/Valley Utilities (1 email copy)
- ☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407484.467 **NORTHING:** 5009685.131 **ELEVATION:** 139.45
DATUM: Geodetic
REMARKS:
BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058
HOLE NO. TP 1-24

SAMPLE 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	139.45		
TOPSOIL and organics 0.30	■	G	1						
GLACIAL TILL: Dense, brown silty sand to sandy silt, trace gravel, cobbles and boulders 0.50	^^^	G	2						
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.50m depth (Test pit dry upon completion)									

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

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407458.205 **NORTHING:** 5009722.561 **ELEVATION:** 139.59

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP 2-24

SAMPLE 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	139.59		
TOPSOIL and organics 0.25		G	1						
GLACIAL TILL: Dense, brown silty sand to sandy silt, some gravel, cobbles and boulders 0.68		G	2						
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.68m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407450.486 **NORTHING:** 5009749.675 **ELEVATION:** 139.44
DATUM: Geodetic
REMARKS:
BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058
HOLE NO. TP 3-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	PIEZOMETER CONSTRUCTION
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
Ground Surface						0	139.44		
TOPSOIL and organics 0.21	■	G	1						
GLACIAL TILL: Dense, brown silty sand to sandy silt, trace gravel, cobbles and boulders 0.53	^^^	G	2						
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.53m depth (Test pit dry upon completion)									

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

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407429.037 **NORTHING:** 5009756.13 **ELEVATION:** 139.22

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP 4-24

SAMPLE DESCRIPTION Ground Surface	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	PIEZOMETER CONSTRUCTION
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
TOPSOIL with organics and brown silty clay, some sand	■					0	139.22		
		G	1						
		G	2						
0.76									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.76m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407466.743 **NORTHING:** 5009788.937 **ELEVATION:** 139.53

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP 5-24

SAMPLE 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	139.53		
TOPSOIL and organics	■	G	1						
0.40									
GLACIAL TILL: Dense, brown silty sand to sandy silt, some gravel and cobbles	^ ^ ^	G	2						
0.50									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.50m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407508.689 **NORTHING:** 5009809.183 **ELEVATION:** 139.94

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP 6-24

SAMPLE 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	139.94		
TOPSOIL and organics with gravel		G	1						
0.78									
GLACIAL TILL: Compact, brown sandy silt, trace clay, gravel and cobbles		G	2						
0.94									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.94m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407507.282 **NORTHING:** 5009785.351 **ELEVATION:** 139.59
DATUM: Geodetic
REMARKS:
BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058
HOLE NO. TP 7-24

SAMPLE DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface					0	139.59
TOPSOIL and organics	G	1				
0.28						
Compact, brown **SILTY SAND** to **SANDY SILT**	G	2				
0.57						
GLACIAL TILL: Compact, greyish brown sandy silt, some gravel and cobbles, trace clay	G	3				
0.90						
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.90m depth (Test pit dry upon completion)						

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

○ Water Content %
20 40 60 80

PIEZOMETER CONSTRUCTION

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407510.869 **NORTHING:** 5009795.574 **ELEVATION:** 139.50

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

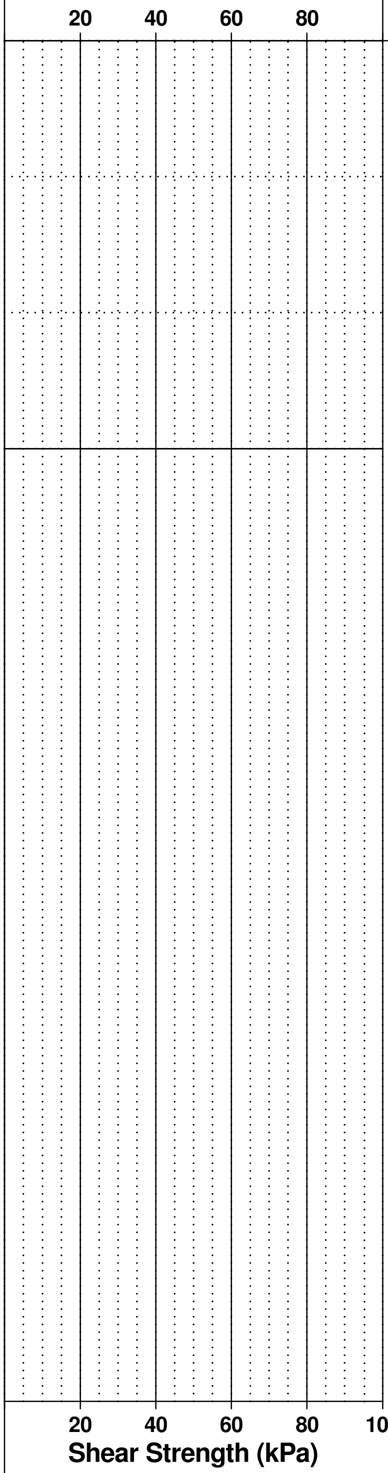
FILE NO. PG7058

HOLE NO. TP 8-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	PIEZOMETER CONSTRUCTION
Ground Surface						0	139.50	
TOPSOIL and organics 0.25		G	1					
Compact, brown **SILTY SAND** to **SANDY SILT**, some organics 0.40		G	2					
GLACIAL TILL: Dense, brown silty sand to sandy silt, trace clay, gravel, cobbles and boulders 0.60		G	3					
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.60m depth (Test pit dry upon completion)								

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

○ **Water Content %**



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407516.086 **NORTHING:** 5009768.912 **ELEVATION:** 139.43

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP 9-24

SAMPLE 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	139.43		
TOPSOIL and organics 0.25	■	G	1						
GLACIAL TILL: Dense, brown silty sand to sandy silt, trace gravel and cobbles 0.45	▨	G	2						
GLACIAL TILL: Dense, grey silty sand to sandy silt, some clay, gravel and cobbles 0.61	▨	G	3						
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.61m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407517.817 **NORTHING:** 5009759.826 **ELEVATION:** 139.45

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP10-24

SAMPLE 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	139.45		
TOPSOIL and organics 0.22		G	1						
GLACIAL TILL: Dense, brown silty sand to sandy silt, some gravel and cobbles, trace clay 0.43		G	2						
BEDROCK 0.50									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.50m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407474.781 **NORTHING:** 5009757.581 **ELEVATION:** 139.67

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP11-24

SAMPLE 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	139.67		
TOPSOIL and organics		G	1						
0.42									
BEDROCK									
0.47									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.47m depth (Test pit dry upon completion)									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407495.485 **NORTHING:** 5009723.075 **ELEVATION:** 139.56

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP12-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Ground Surface						0	139.56
TOPSOIL and organics 0.25		G	1				
Compact, brown **SILTY SAND** to **SANDY SILT** 0.42		G	2				
GLACIAL TILL: Dense, grey and brown silty sand to sandy silt, some gravel and cobbles 0.57		G	3				
BEDROCK 0.65							

End of Test Pit

Practical refusal to shovel advancement on bedrock surface at 0.65m depth

(Test pit dry upon completion)

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

○ **Water Content %**

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)

▲ Undisturbed △ Remoulded

PIEZOMETER CONSTRUCTION

patersongroup Consulting Engineers

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Industrial Dev. - 5 & 6 Frank Davis Street
Almonte, Ontario

EASTING: 407530.221 **NORTHING:** 5009716.293 **ELEVATION:** 139.87

DATUM: Geodetic

REMARKS:

BORINGS BY: Backhoe **DATE:** March 20, 2024

FILE NO. PG7058

HOLE NO. TP13-24

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	PIEZOMETER CONSTRUCTION
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
Ground Surface						0	139.87		
TOPSOIL and organics	■	G	1						
0.40									
BEDROCK	▤								
0.55									
End of Test Pit Practical refusal to shovel advancement on bedrock surface at 0.55m depth (Test pit dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the 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 = $(D30)^2 / (D10 \text{ x } D60)$
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)

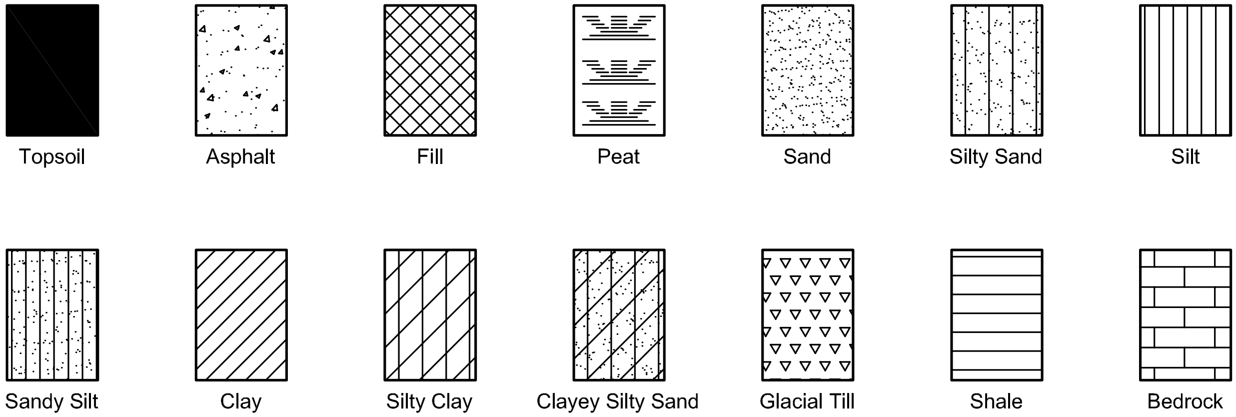
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

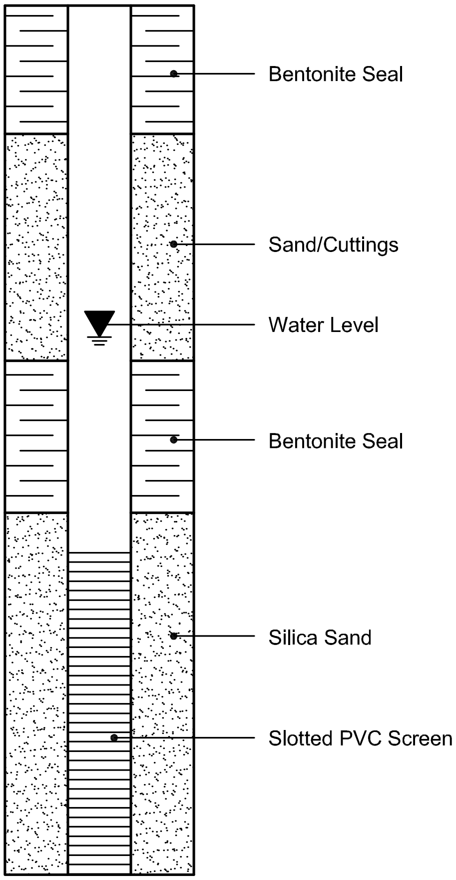
SYMBOLS AND TERMS (continued)

STRATA PLOT

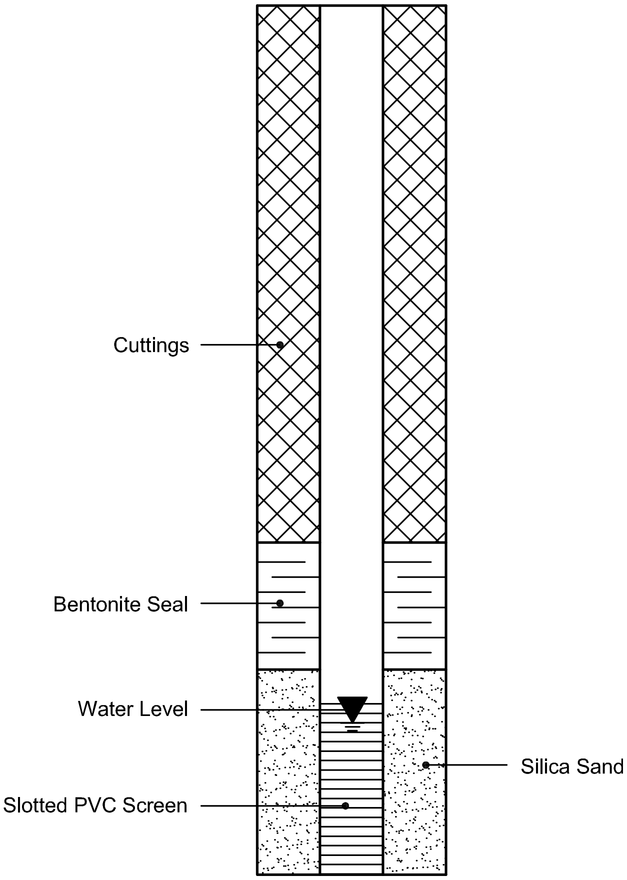


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Report Date: 26-Mar-2024

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

Order Date: 21-Mar-2024

Client PO: 59711

Project Description: PG7058

Client ID:		TP3-24 G2	-	-	-		
Sample Date:		20-Mar-24 09:00	-	-	-	-	-
Sample ID:		2412330-01	-	-	-		
Matrix:		Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	88.4	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.05	-	-	-	-	-
Resistivity	0.1 Ohm.m	79.8	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	<10	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

DRAWING PG7058-1 – TEST HOLE LOCATION PLAN

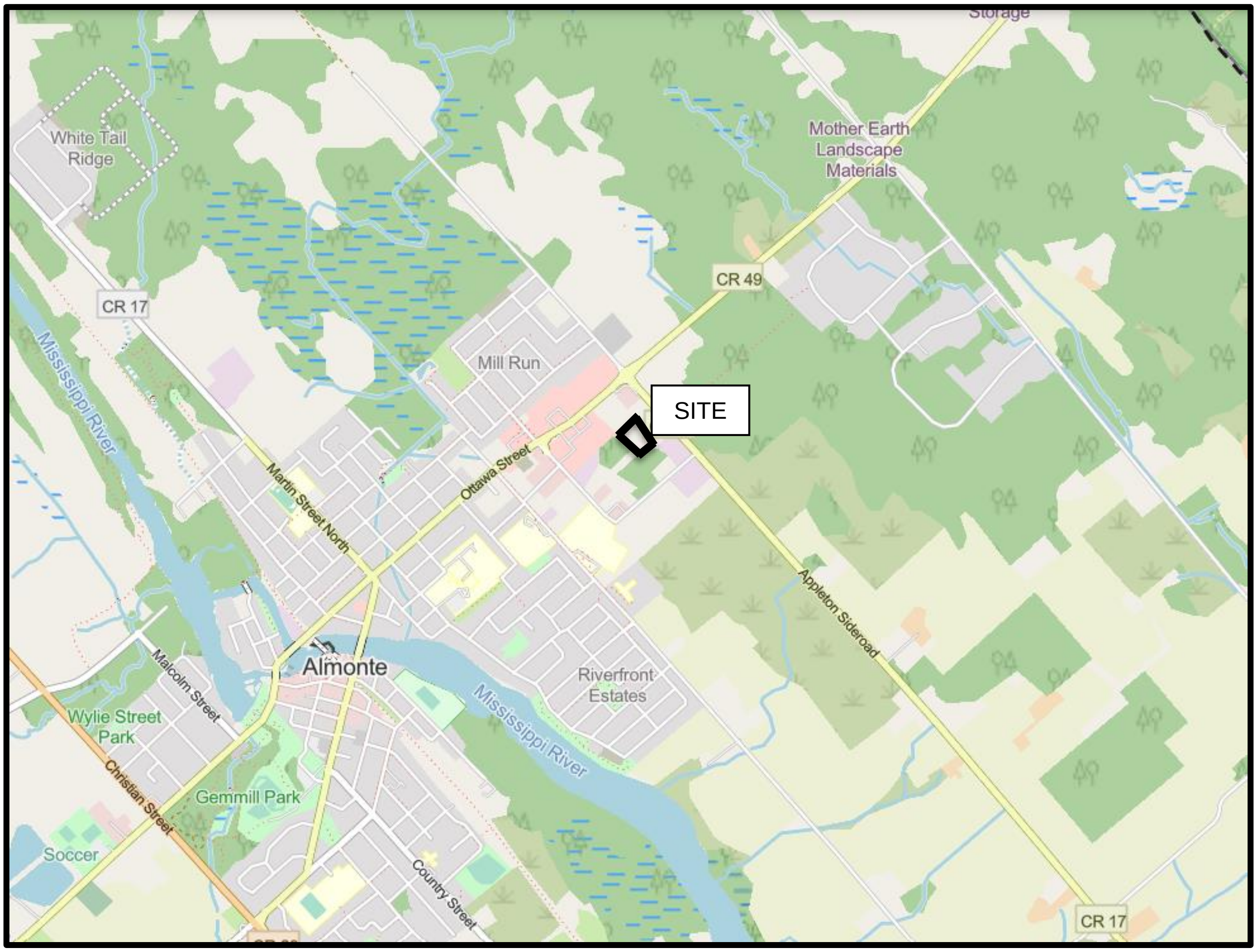
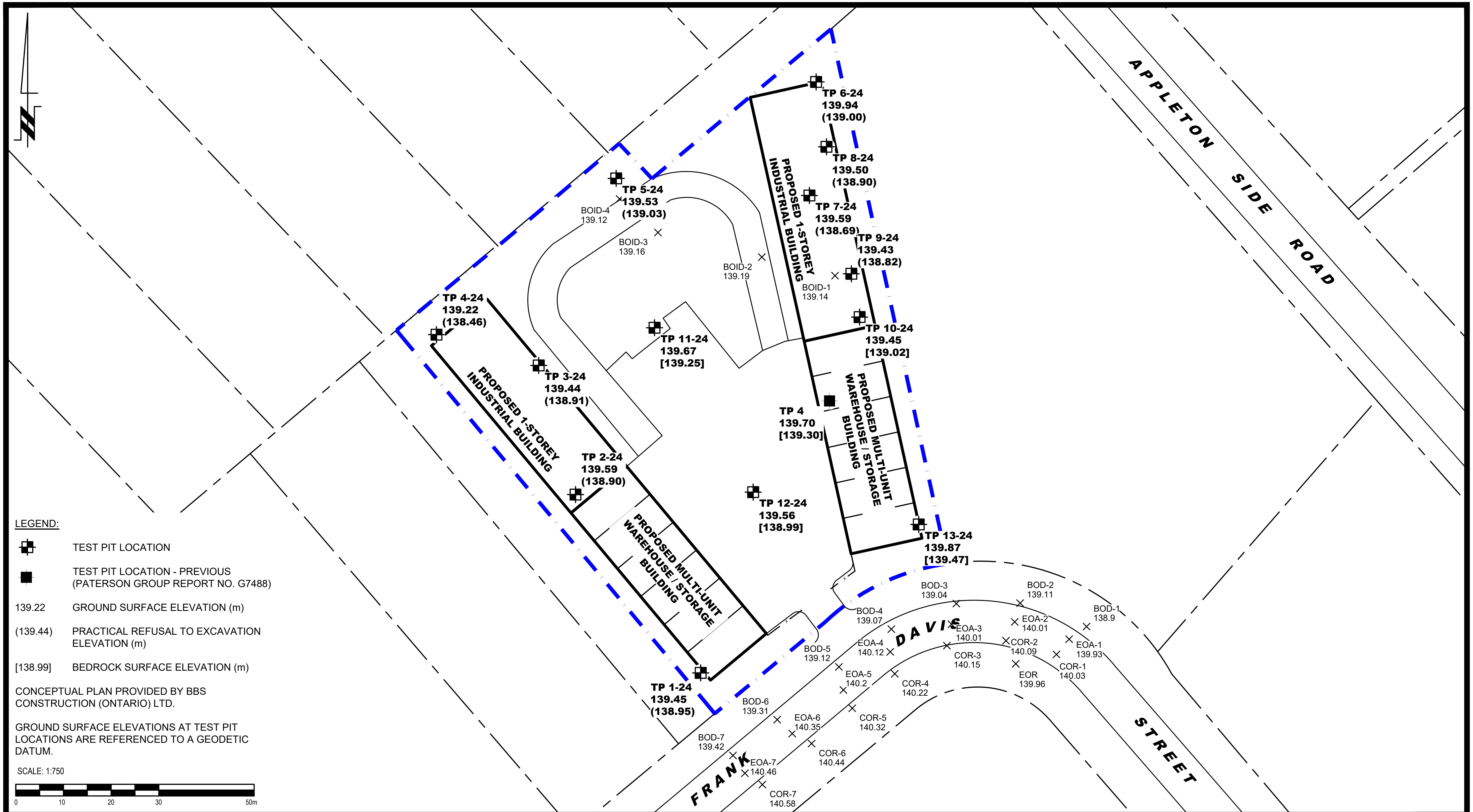


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

✚	TEST PIT LOCATION
■	TEST PIT LOCATION - PREVIOUS (PATERSON GROUP REPORT NO. G7488)
139.22	GROUND SURFACE ELEVATION (m)
(139.44)	PRACTICAL REFUSAL TO EXCAVATION ELEVATION (m)
[138.99]	BEDROCK SURFACE ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY BBS CONSTRUCTION (ONTARIO) LTD.

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

SCALE: 1:750

0 10 20 30 50m

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

NO.	REVISIONS	DATE	INITIAL

GREG CLARKE / VALLEY UTILITIES
GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT
5 & 6 FRANK DAVIS STREET

MISSISSIPPI MILLS, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750
Drawn by: ZS
Checked by: KB
Approved by: DP
Date: 03/2024
Report No.: PG7058-1
Dwg. No.: PG7058-1
Revision No.:

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