Geotechnical Engineering

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Geotechnical Investigation

Proposed Mixed-Use Development
1518-1526 Stittsville Main Street
Ottawa, Ontario

Prepared For

Inverness Homes

October 11, 2024

Report: PG5418-1
Revision 4

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Inverness Homes to conduct a geotechnical investigation for the proposed mixed-use development to be located at 1518-1526 Stittsville Main Street in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation were to:

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

The following report has been prepared specifically and solely for the aforementioned project. This report contains geotechnical findings and includes recommendations pertaining to the design and construction of the proposed development as they are understood at the time of writing this report.

2.0 Proposed Development

Based on the available conceptual drawing, it is understood that the proposed development will consist of a 4-storey residential building and a 2-storey mixed-use building, each with a slab-on-grade (no below-grade space). The proposed buildings will be surrounded by asphalt-paved access lanes and parking areas with landscaped margins.

It is also understood that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the investigation was carried out on July 22 and 23, 2020. At that time, twelve (12) boreholes were advanced to a maximum depth of 9.0 m below the existing ground surface. Previous geotechnical investigations were also undertaken by Paterson at the subject site, which included advancing 5 and 3 boreholes in 2011 and 2019, respectively, to a maximum depth of 9.6 m. The test hole locations were distributed across the site in a manner to provide general coverage of the subject site. The locations of the test holes are shown on Drawing PG5418-1 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In Situ Testing

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

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.

Diamond drilling was carried out at BH 1-19, BH 2-19, BH 3-19, and BH 3-20 to assess the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock.

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

Groundwater

A 32 mm diameter PVC groundwater monitoring well was installed at BH 3 and a 51 mm diameter PVC groundwater monitoring well was installed at BH 1, BH 2, and BH 12. Flexible polyethylene standpipes were installed at the remaining boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

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

3.2 Field Survey

The borehole locations were selected by Paterson personnel to provide general coverage of the site. The boreholes were located in the field by Paterson. The ground surface elevations at the test hole locations were determined by Paterson and are referenced to a geodetic datum. The test hole locations and the ground surface elevation at each test hole location are presented on Drawing PG5418-1 - Test Hole Location Plan included in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging. A grain size distribution analysis was completed on 1 sample of the on-site silty sand prior to its reuse as backfill material. The result of this test is provided in Appendix 1.

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 Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a an abandoned 2-storey building located at the northwest end of the site, and a 1-storey building located in the central portion of the site. The remainder of the site consists of a gravel parking area of the eastern portion of the site.

The subject site is bordered to the north, northwest, and south by commercial properties, to the southwest by residential properties, and to the east by Stittsville Main Street. The existing ground surface across the site is relatively level at approximate geodetic elevation 121.5 m.

Based on available historical photographs of the subject site, a building was located in the northeast portion of the site fronting onto Stittsville Main Street as recently as 2014, and was no longer present in 2017. Reference should be made to the aerial photographs in Figure 2 - Aerial Photograph - 2014 and Figure 3 - Aerial Photograph - 2017 which illustrate the former and present site conditions, respectively.

4.2 Subsurface Profile

Overburden

Generally, the soil conditions encountered at the test hole locations consist of topsoil or a 0.4 to 2.3 m thick layer of fill underlying the ground surface. The fill was generally observed to consist of a loose to dense, brown silty sand with varying amounts of crushed stone, brick, concrete, wood and coal.

Underlying the topsoil and/or fill, a sand to silty sand/sandy silt deposit was encountered, which was generally loose in the upper portion of the deposit, becoming compact to dense at approximate depths of 2 to 3 m.

A glacial till deposit was encountered underlying the silty sand/sandy silt at approximate depths of 3.7 to 5.3 m. The glacial till was generally observed to consist of a dense, brown silty sand with gravel, cobbles, and boulders.

Practical refusal to the augers was encountered at approximate depths ranging from 4.2 to 7 m, generally increasing west to east across the site.

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.

Grain Size Distribution Testing

Grain size distribution was also completed on 1 selected soil sample. The result of the grain size analysis is summarized in Table 1 below, and is presented on the Grain Size Distribution Results sheet in Appendix 1.

Table 1 - Summary of Grain Size Distribution Analysis

Source	Sample	Gravel (%)	Sand (%)	Silt (%) & Clay (%)
Site	Stockpile	5.0	91.6	3.4

Based on the grain size distribution testing results, this material can be described as sand with trace gravel, silt, and clay.

In summary, the native sand deposit was observed to be fairly consistent across the site, therefore one grain size distribution test was considered sufficient in order identify this soil and determine its percolation rate.

Bedrock

Bedrock was cored at BH 3-20, BH 1-19, BH 2-19, and BH 3-19 to depths of up to 9.6 m, and was observed to consist of grey limestone with interbedded shale. Based on the RQD values, the upper portion of the bedrock core was generally noted to be of very poor to fair quality, becoming good to excellent quality with depth.

Based on available geological mapping, the bedrock in this area consists of interbedded limestone and dolostone of the Gull River Formation with an overburden drift thickness of 5 to 6 m depth.

4.3 Groundwater

The measured groundwater levels in the boreholes are presented in Table 2 and are also shown on the Soil Profile and Test Data sheets in Appendix 1.

Table 2 - Summary of Groundwater Level Readings

Borehole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH 1-20	121.77	5.39	116.38	August 6, 2020
BH 2-20	121.23	5.42	115.81	August 6, 2020

Table 2 - Summary of Groundwater Level Readings [continued]				
BH 3-20	121.78	5.10	116.68	August 6, 2020
BH 4-20	121.61	Dry	-	August 11, 2020
BH 5-20	121.47	Dry	-	August 11, 2020
BH 6-20	121.52	Dry	-	August 11, 2020
BH 7-20	121.71	Dry	-	August 11, 2020
BH 8-20	121.50	Dry	-	August 11, 2020
BH 9-20	121.23	3.41	117.82	August 11, 2020
BH 10-20	121.46	Dry	-	August 11, 2020
BH 11-20	121.03	2.42	118.61	August 11, 2020
BH 12-20	121.14	Dry	-	August 11, 2020
BH 1-19	121.82	5.07	116.75	August 6, 2020
BH 2-19	121.53	5.15	116.38	August 6, 2020

Long-term groundwater level can also be estimated based on the observed moisture levels, colour and consistency of the recovered soil samples. Based on these observations, it is estimated the long-term groundwater table can be expected between between an approximate 4 to 5 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Percolation Rate

Based on our grain size testing results and our experience with the encountered soils, a conservative percolation rate of **30 mm/hr** can be used for the sand to silty sand/sandy silt deposit at this site.

As noted above, the native sand deposit was observed to be fairly consistent across the site, therefore one grain size distribution test was considered sufficient in order to determine its percolation rate.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that the proposed buildings be founded on conventional spread footings bearing on the undisturbed, compact to dense sand to silty sand/sandy silt.

Where uncontrolled fill material is encountered at the underside of footing (USF) elevation, it should be sub-excavated to the undisturbed, compact to dense silty sand/sandy silt. Engineered fill should then be placed and compacted up to the USF elevation.

As part of an environmental remediation in 2022 and 2023, some soils were excavated in the central portion of the site. The excavated soils which remained on-site were then used to backfill the remedial excavation, and were placed and compacted to 98% of the material's standard Proctor maximum dry density (SPMDD), under inspection from Paterson. The site memorandum documenting this compaction testing is provided in Appendix 3.

As a silty clay deposit was not encountered at the subject site, a permissible grade raise restriction is not required for the proposed development. Further, clay seals are not required for the proposed site servicing pipes.

Dependent on the founding depths of the site services, bedrock removal may be required. The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill within the proposed building footprints, free of deleterious material and significant amounts of organics, can be left in place below the proposed building slabs-on-grade, outside of the lateral support zones for the footings. However, it is recommended that the existing fill layer be proof-rolled several times under dry conditions and above freezing temperatures and approved by Paterson personnel at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved fill.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

Should it be required dependent on the depth of the proposed site servicing, bedrock removal can be accomplished by hoe ramming where the bedrock is weathered and/or where only small quantities of the bedrock need to be removed. Sound bedrock may be removed by line drilling, 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 carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm per second during the blasting program to reduce the risks of damage to the existing structures.

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

Vibration Considerations

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

The following construction equipment could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz.

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

Fill Placement

Fill placed for grading beneath the structure(s) or other settlement sensitive 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. This material should be tested and approved prior to the delivery to the site. The engineered fill should be placed in maximum 300 mm thick lifts and compacted to 98% of the materials Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavate soil can be placed as general landscaping fill where surface settlement is a minor concern. The backfill should be spread in thin lifts and, at minimum, compacted by the tracks of the spreading equipment to minimize voids. If the non-specified fill is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundations walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on the undisturbed, compact to dense silty sand/sandy silt can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**, incorporating a geotechnical resistance factor of 0.5.

Where the silty sand/sandy silt is observed to be in a loose state of compactness at the USF elevation, it should be proof-compacted using several passes of vibratory plate compactor, under the inspection of Paterson.

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

Footings placed on a soil bearing surface and designed using the bearing resistance values at SLS given 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.

Adequate lateral support is provided to a compact to dense silty sand/sandy sit bearing surface above the groundwater table when a plane extending horizontally and vertically from the underside of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher bearing capacity as the bearing medium soil.

Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A heavily fractured, weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered at this site. A higher seismic site class may be applicable, such as Class A or B, provided the footings are within 3 m of the bedrock surface. However, this would need to be confirmed by performing a seismic shear wave velocity test at the subject site. 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 undisturbed, existing fill or silty sand/sandy silt subgrade, approved by the geotechnical consultant at the time of excavation, will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction.

A vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. 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 Structure

The recommended pavement structures for the subject site are shown in Tables 3 and 4 below.

Table 3 - Recommended Flexible Pavement Structure - At-Grade 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 - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil	

Table 4 - Recommended Flexible 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
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - 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. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be sub-excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the SPMDD with suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free draining, non-frost susceptible granular materials. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, can be used for this purpose.

Excavated on-site fill and/or silty sand to sandy silt could also be re-used for backfilling the exterior sides of 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 on-site.

6.2 Protection Against Frost Action

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

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure. Such exterior structures require additional frost protection, such as 2.1 m of soil cover, or a reduced thickness of soil cover if rigid insulation is used.

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 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. The subsurface soil 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 maintain safe working distance 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.

A trench box is recommended to be installed at all times to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not remain exposed for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should be increased to a thickness of 300 mm of Granular A where bedrock is encountered at the subgrade level. 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 loose lifts and compacted to a minimum of 99% of the SPMDD.

The site excavated silty sand may be placed above cover material if the excavation operations are completed in dry weather conditions and the site excavated material is approved by the geotechnical consultant.

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

6.5 Groundwater Control

Infiltration levels are anticipated to be low through the sides of the excavation and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) Category 3 may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, anticipated 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, where excavations are completed in proximity of existing structures which may be adversely affected due to the freezing conditions.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and tarpaulins or other suitable means. 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

The results on analytical testing show that the sulphate content is less than 0.1%. The results are 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 slightly aggressive corrosive environment.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ A review of architectural and structural drawings to ensure adequate frost protection is provided to the subsoil.
- ❏ Inspection of all 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 request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

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 Inverness Homes or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Owen Canton, E.I.T.

Scott Dennis, P. Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN SIZE DISTRIBUTION ANALYSIS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 1-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	121.77		
FILL: Brown silty sand with crushed stone (0.66)		AU	1						
FILL: Red-brown silty sand, trace organics (1.37)		SS	2	54	5	1	120.77		
		SS	3	46	12	2	119.77		
		SS	4	54	17				
Compact, brown **SILTY SAND**		SS	5	58	33	3	118.77		
		SS	6	50	28	4	117.77		
(5.18)		SS	7	67	24	5	116.77		
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders (5.94)		SS	8	67	55				
End of Borehole									
Practical refusal to augering at 5.94m depth.									
(GWL @ 5.39m - Aug. 6, 2020)									

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

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 2-20

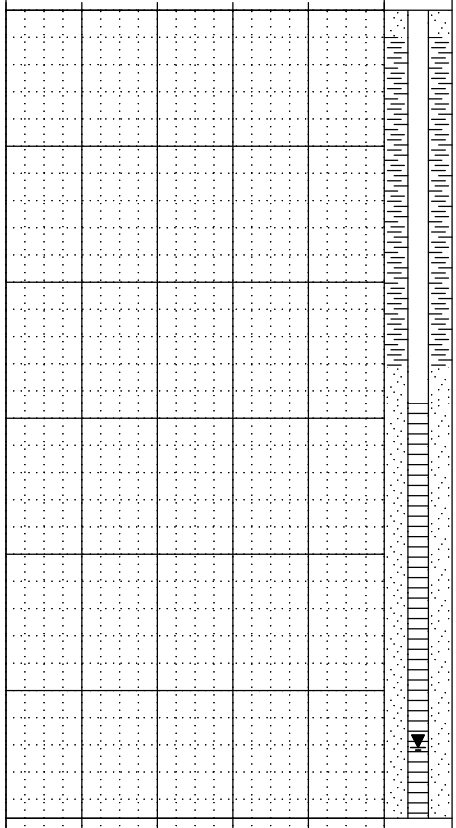
BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	121.23
TOPSOIL 0.18		AU	1				
		SS	2	54	6	1	120.23
Loose to compact, brown **SILTY SAND**		SS	3	46	4	2	119.23
		SS	4	58	14		
		SS	5	79	18	3	118.23
3.80		SS	6	67	45	4	117.23
Dense, brown **SANDY SILT**		SS	7	62	40	5	116.23
5.77		SS	8	76	50+		
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders 5.94							
End of Borehole							
Practical refusal to augering at 5.94m depth.							
(GWL @ 5.42m - Aug. 6, 2020)							

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

20 40 60 80

Monitoring Well Construction



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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 3-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	121.78
		AU	1				
FILL: Brown silty sand with crushed stone		SS	2	17	10	1	120.78
		SS	3	25	6	2	119.78
2.29							
		SS	4	42	23	3	118.78
		SS	5	75	24		
Compact, brown **SILTY SAND**		SS	6	58	22	4	117.78
		SS	7	71	24	5	116.78
5.49							
		RC	1	100	56	6	115.78
BEDROCK: Very poor to fair quality, grey limestone with interbedded shale		RC	2	60	0	7	114.78
		RC	3	100	60	8	113.78
9.04						9	112.78
End of Borehole							
(GWL @ 5.10m - Aug. 6, 2020)							

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

Monitoring Well Construction

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 4-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	121.61		
FILL: Brown sand with gravel (0.53)		AU	1						
FILL: Brown silty sand with gravel, some cobbles, concrete, trace brick, wood		SS	2	29	23	1	120.61		
(2.13)		SS	3	12	50+	2	119.61		
Compact, brown **SILTY SAND**		SS	4	58	16	3	118.61		
		SS	5	54	21				
		SS	6	62	27	4	117.61		
(5.18)		SS	7	75	21	5	116.61		
End of Borehole									
(Piezometer blocked at 3.94m depth - August 11, 2020)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

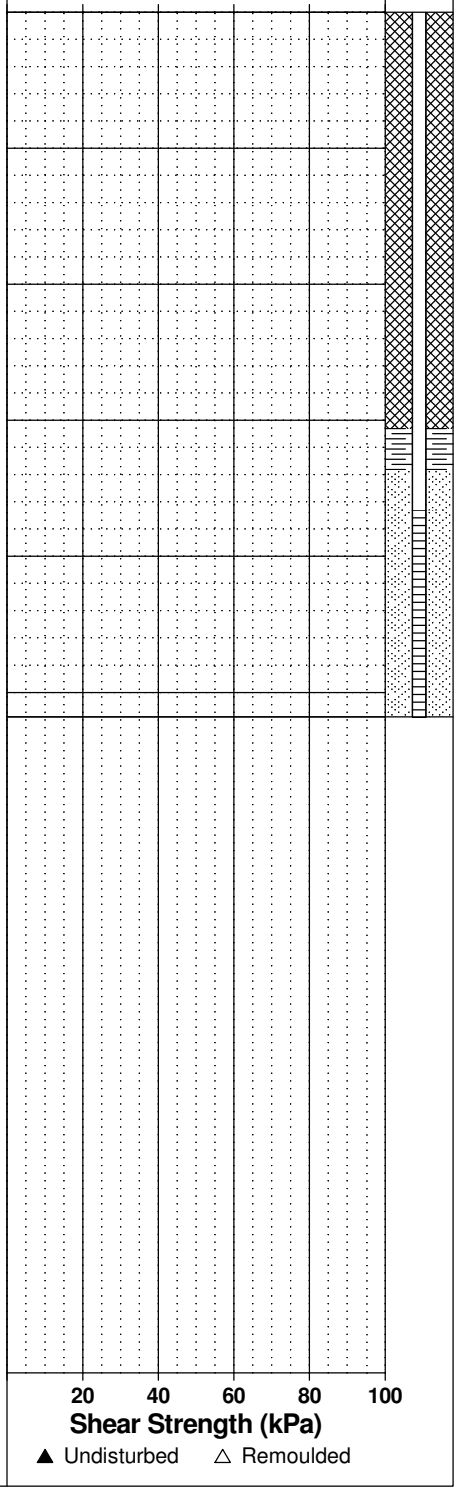
FILE NO. PG5418

REMARKS

HOLE NO. BH 5-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
FILL: Brown silty sand with gravel, trace organics 0.38		AU	1			0	121.47		
		SS	2	54	6	1	120.47		
		SS	3	50	13	2	119.47		
Compact, brown **SILTY SAND**		SS	4	54	20	3	118.47		
		SS	5	79	33	4	117.47		
		SS	6	58	33				
5.18		SS	7	79	28	5	116.47		
End of Borehole									
(Piezometer blocked at 4.26m depth - August 11, 2020)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 6-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
FILL: Brown silty sand with gravel, trace organics		AU	1			0	121.52		
		SS	2	54	9	1	120.52		
		SS	3	67	18	2	119.52		
Compact to dense, brown **SILTY SAND**		SS	4	71	28	3	118.52		
		SS	5	62	26	4	117.52		
		SS	6	79	25				
		SS	7	62	31	5	116.52		
5.11									
End of Borehole									
Practical refusal to augering at 5.11m depth.									
(Piezometer blocked at 4.12m depth - August 11, 2020)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 7-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.10		AU	1			0	121.71		
Loose to dense, brown **SILTY SAND**		SS	2	50	5	1	120.71		
		SS	3	50	8	2	119.71		
		SS	4	75	26	3	118.71		
		SS	5	75	28	4	117.71		
		SS	6	83	33				
4.57									
Compact, brown **SANDY SILT**		SS	7	92	28	5	116.71		
5.18									
End of Borehole									
(Piezometer blocked at 4.23m depth - August 11, 2020)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 8-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	121.50		
FILL: Topsoil with sand, some gravel, organics and boulders		AU	1						
0.51									
		SS	2	50	5	1	120.50		
Loose to compact, brown **SILTY SAND**		SS	3	42	3	2	119.50		
		SS	4	50	18	3	118.50		
		SS	5	58	23				
3.81									
Dense, brown **SANDY SILT**		SS	6	75	50+	4	117.50		
4.19									
GLACIAL TILL: Brown silty sand with weathered bedrock									
4.22									
End of Borehole									
Practical refusal to augering at 4.22m depth.									
(Piezometer blocked at 4.02m depth - August 11, 2020)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH 9-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15		AU	1			0	121.23		
		SS	2	50	6	1	120.23		
		SS	3	75	8	2	119.23		
Loose to compact, brown **SILTY SAND**		SS	4	62	13	3	118.23		
		SS	5	54	18				
		SS	6	58	32	4	117.23		
4.57									
Dense, brown **SANDY SILT,** trace gravel		SS	7	79	31	5	116.23		
5.18									
End of Borehole									
(GWL @ 3.40m - Aug. 11, 2020)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

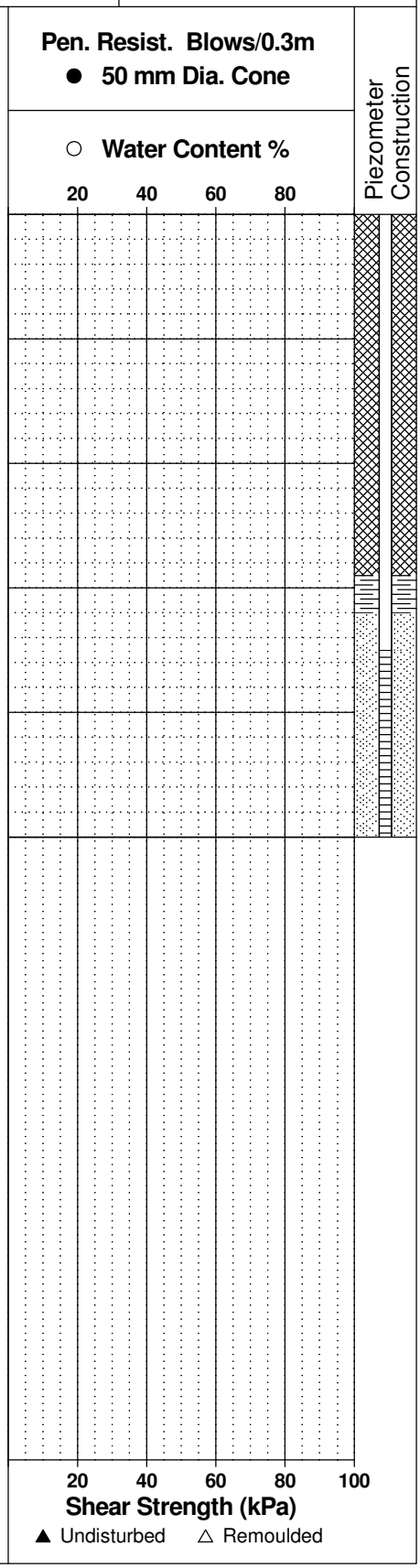
FILE NO. PG5418

REMARKS

HOLE NO. BH10-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	121.46
TOPSOIL 0.13		AU	1				
Loose, red-brown **SILTY SAND,** trace gravel		SS	2	58	6	1	120.46
1.37		SS	3	50	4	2	119.46
Loose to compact, brown **SILTY SAND**		SS	4	58	8	3	118.46
		SS	5	79	28	4	117.46
		SS	6	67	30		
4.57							
Dense, brown **SANDY SILT,** trace clay 5.00		SS	7	59	50+	5	116.46
End of Borehole							
Practical refusal to augering at 5.00m depth.							
(Piezometer blocked at 4.43m depth - August 11, 2020)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

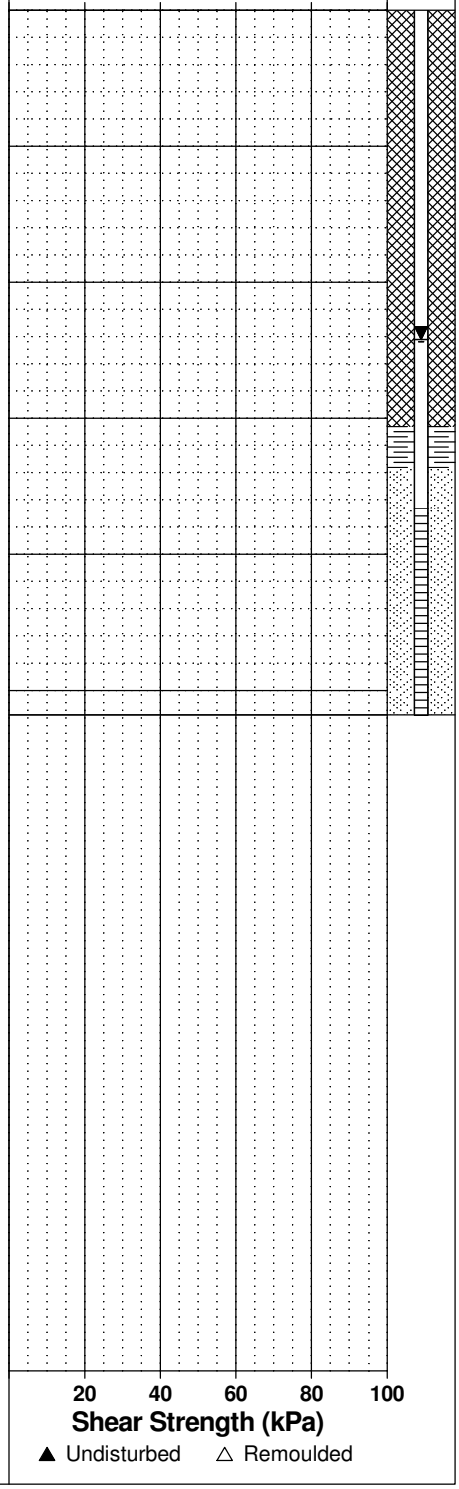
FILE NO. PG5418

REMARKS

HOLE NO. BH11-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.18		AU	1			0	121.03		
Loose to compact, red-brown **SILTY SAND**		SS	2	42	5	1	120.03		
- brown by 1.4m depth		SS	3	75	10	2	119.03		
		SS	4	75	14				
3.05						3	118.03		
Compact to dense, grey **SANDY SILT,** trace clay		SS	5	71	27				
		SS	6	58	32	4	117.03		
4.57									
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders 5.18		SS	7	46	31	5	116.03		
End of Borehole									
(GWL @ 2.42m - Aug. 11, 2020)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1520, 1524 and 1526 Stittsville Main Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5418

REMARKS

HOLE NO. BH12-20

BORINGS BY CME-55 Low Clearance Drill **DATE** July 22, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	121.14		
TOPSOIL 0.20		AU	1						
Loose, brown **SILTY SAND,** some gravel		SS	2	8	8	1	120.14		
1.52		SS	3	50	5	2	119.14		
Loose to compact, brown **SILTY SAND**		SS	4	58	10	3	118.14		
		SS	5	62	18				
3.81 **GLACIAL TILL:** Dense, brown silty sand with weathered bedrock 4.22		SS	6	50	50+	4	117.14		
End of Borehole									
Practical refusal to augering at 4.22m depth.									
(Piezometer blocked at 4.44m depth - August 11, 2020)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1520 Stittsville Main Street
Ottawa, Ontario

DATUM TBM - Top of Bell Canada manhole cover located on sidewalk, east side of Stittsville Main Street. Assumed elevation = 100.00m.

FILE NO. PE4629

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2019 June 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.14
FILL: Brown sand with cobbles		AU	1				
		SS	1	58	2	1	99.14
		SS	2	38	2	2	98.14
2.29							
		SS	3	67	11	3	97.14
Compact, light brown **SAND**		SS	4	83	17		
		SS	5	67	18	4	96.14
		SS	6	79	15	5	95.14
5.30							
Compact, grey-brown **SILTY SAND**		SS	7	83	26		
6.25		SS	8	8	50+	6	94.14
		RC	1			7	93.14
BEDROCK: Grey limestone with shale		RC	2			8	92.14
		RC	3	94	82	9	91.14
9.63							
End of Borehole							
(GWL @ 5.60m - June 11, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1520 Stittsville Main Street
Ottawa, Ontario

DATUM TBM - Top of Bell Canada manhole cover located on sidewalk, east side of Stittsville Main Street. Assumed elevation = 100.00m.

FILE NO. PE4629

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2019 June 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.86
FILL: Brown sand with brick		SS	1	42	2	1	98.86
		SS	2	12	5	2	97.86
2.13							
		SS	3	75	8	3	96.86
		SS	4	67	13		
Loose to compact, light brown **SAND**		SS	5	58	19	4	95.86
		SS	6	71	18		
5.61		SS	7	100	50+	5	94.86
		RC	1	82	60	6	93.86
BEDROCK: Grey limestone with shale						7	92.86
		RC	2	100	97	8	91.86
9.07		RC	3	100	100	9	90.86
End of Borehole							
(GWL @ 4.56m - June 11, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1520 Stittsville Main Street
Ottawa, Ontario

DATUM TBM - Top of Bell Canada manhole cover located on sidewalk, east side of Stittsville Main Street. Assumed elevation = 100.00m.

FILE NO. PE4629

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2019 June 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.85
		SS	1	62	11	1	98.85
		SS	2	62	16	2	97.85
Compact, light brown **SAND**		SS	3	79	20	3	96.85
		SS	4	62	21	4	95.85
- grey-brown by 3.8m depth		SS	5	71	24	5	94.85
		SS	6	79	25		
5.84						6	93.85
		RC	1	100	71	7	92.85
BEDROCK: Grey limestone with shale		RC	2	100	73	8	91.85
		RC	3	100	92	9	90.85
9.32							
End of Borehole							
(GWL @ 4.24m - June 11, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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Consulting Engineers

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

SOIL PROFILE AND TEST DATA

Phase I - II Environmental Site Assessment
1524 and 1526 Main Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 75 Power Auger **DATE** 9 Nov 11

FILE NO. PE2459

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel, occasional pieces of coal		SS	1	25	16	1	
1.45		SS	2	33	5	2	
Loose to compact, brown **SILTY SAND**		SS	3	50	7	3	
		SS	4	58	25		
		SS	5	50	21	4	
		SS	6	58	32	5	
5.26		SS	7	67	42		
Dense to very dense, grey-brown **SILTY SAND-GRAVEL** with cobbles		SS	8	82	50+	6	
6.96		SS	9	75	50+		
End of Borehole							
Practical refusal to augering @ 6.96m depth							

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

○ Lower Explosive Limit %
20 40 60 80

Monitoring Well Construction

100 200 300 400 500
Photo Ionization Detector
△ Volatile Organic Rdg. (ppm)

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Consulting Engineers

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

SOIL PROFILE AND TEST DATA

Phase I - II Environmental Site Assessment
1524 and 1526 Main Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 75 Power Auger **DATE** 9 Nov 11

FILE NO. PE2459

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel		SS	1	33	17	1	
		SS	2	17	12	2	
2.21							
Compact, brown **SILTY SAND**		SS	3	67	14	3	
		SS	4	58	20		
		SS	5	58	18	4	
		SS	6	67	26	5	
5.26							
Very dense, grey **SILTY SAND-GRAVEL** with cobbles		SS	7	67	50+		
		SS	8	100	50+	6	
6.71							
End of Borehole							
Practical refusal to augering @ 6.71m depth							
(GWL @ 6.14m-Nov. 14/11)							

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

○ Lower Explosive Limit %

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

Photo Ionization Detector

△ Volatile Organic Rdg. (ppm)

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Consulting Engineers

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

SOIL PROFILE AND TEST DATA

Phase I - II Environmental Site Assessment
1524 and 1526 Main Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 75 Power Auger **DATE** 9 Nov 11

FILE NO. PE2459

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel							
0.60							
		SS	1	50	6	1	
		SS	2	42	2	2	
Loose to compact, brown **SILTY SAND**		SS	3	67	6	3	
		SS	4	67	15	4	
		SS	5	58	21		
4.50							
Very dense, grey-brown **SILTY SAND-GRAVEL** with cobbles		SS	6	80	50+	5	
5.49							
End of Borehole							
Practical refusal to augering @ 5.49m depth							

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

○ Lower Explosive Limit %
20 40 60 80

Monitoring Well Construction

100 200 300 400 500
Photo Ionization Detector
△ Volatile Organic Rdg. (ppm)

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Consulting Engineers

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

SOIL PROFILE AND TEST DATA

Phase I - II Environmental Site Assessment
1524 and 1526 Main Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 75 Power Auger **DATE** 9 Nov 11

FILE NO. PE2459

HOLE NO. BH 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand, trace gravel and boulders		SS	1	33	7	1	
1.45							
Compact, brown **SILTY SAND**		SS	2	67	13	2	
		SS	3	67	16		
		SS	4	75	21	3	
3.73							
Dense to very dense, brown **SILTY SAND-GRAVEL** with cobbles		SS	5	58	46	4	
		SS	6	75	37		
		SS	7	59	50+	5	
		SS	8	75	50+	6	
6.32							
End of Borehole							
Practical refusal to augering @ 6.32m depth							
(GWL @ 5.12m-Nov. 9/11)							

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

○ Lower Explosive Limit %

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

Photo Ionization Detector

△ Volatile Organic Rdg. (ppm)

patersongroup

Consulting Engineers

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

SOIL PROFILE AND TEST DATA

Phase I - II Environmental Site Assessment
1524 and 1526 Main Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 75 Power Auger **DATE** 9 Nov 11

FILE NO. PE2459

HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.25							
Loose to compact, brown **SILTY SAND**		SS	1	42	3	1	
		SS	2	42	5	2	
		SS	3	92	21		
- grey-brown by 3.0m depth		SS	4	75	22	3	
4.50		SS	5	67	20	4	
Dense to very dense, grey **SILTY SAND-GRAVEL** with cobbles and shale fragments		SS	6	75	32	5	
		SS	7	67	50		
		SS	8	44	50+	6	
6.81							
End of Borehole							
Practical refusal to augering @ 6.81m depth							

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

○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

Photo Ionization Detector

△ Volatile Organic Rdg. (ppm)

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

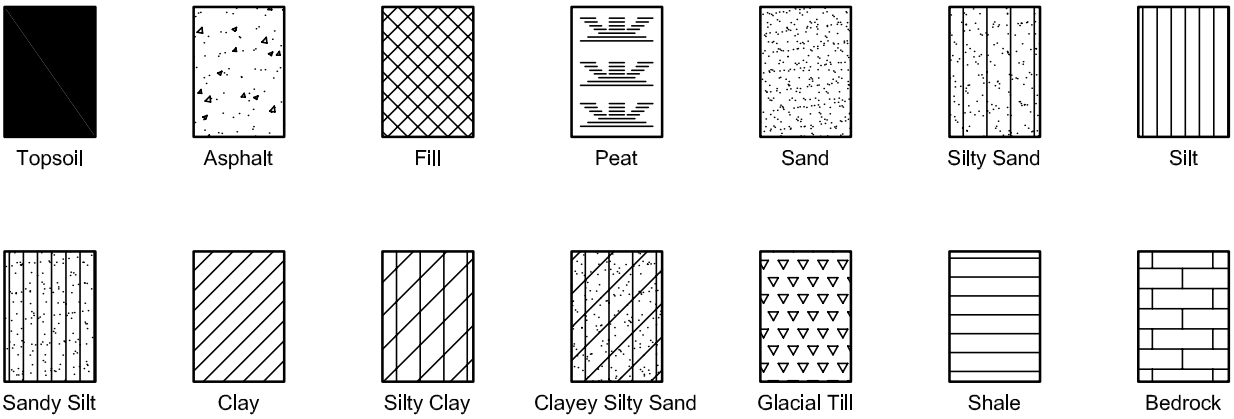
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

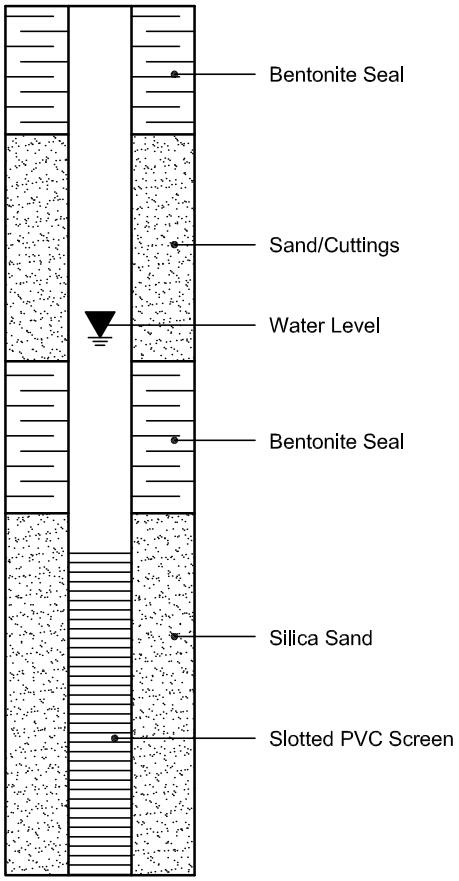
SYMBOLS AND TERMS (continued)

STRATA PLOT

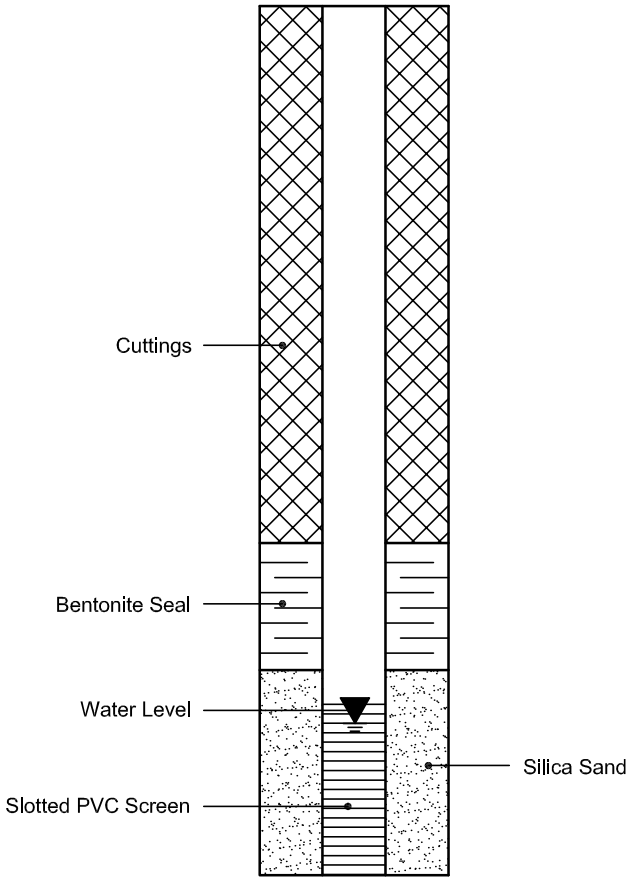


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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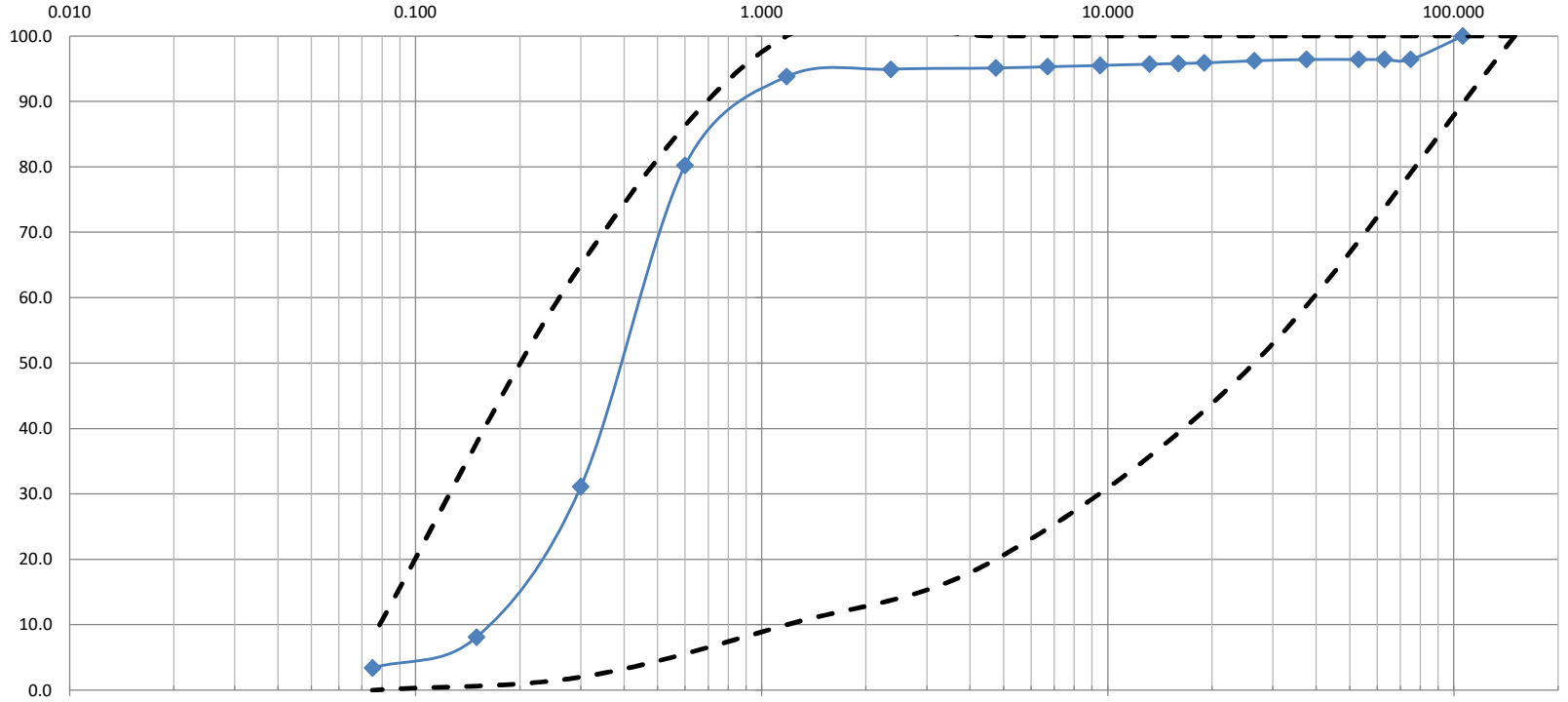
consulting engineers

SIEVE ANALYSIS
ASTM C136

CLIENT:	Inverness Homes	DESCRIPTION:	Sand	FILE NO:	PM14602
CONTRACT No.:	-	SPECIFICATION:	**Granular B Type I**	LAB NO:	41079
PROJECT:	1518 Stittsville Main	INTENDED USE:	Backfill	DATE RECEIVED:	16-Nov-22
		PIT OR QUARRY:	-	DATE TESTED:	17-Nov-22
DATE SAMPLED:	16-Nov-22	SOURCE LOCATION:	Site Excavated	DATE REPORTED:	18-Nov-22
SAMPLED BY:	M. Iskandar	SAMPLE LOCATION:	Stockpile	TESTED BY:	CP/AL



Comments: **This material conforms to the OPSS 1010 grading envelope for Granular B Type I**

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

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consulting engineers

SIEVE ANALYSIS
ASTM C136

CLIENT:	Inverness Homes	DESCRIPTION:	Sand	FILE NO.:	PM14602
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SAMPLED BY:	M. Iskandar	SAMPLE LOCATION:	Stockpile	TESTED BY:	CP/AL

WEIGHT BEFORE WASH	24339.6
WEIGHT AFTER WASH	

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	LOWER SPEC	UPPER SPEC	REMARK
150				100.0	100.0	
106	**0.0**	0.0	**100.0**			
75	**888.3**	3.6	**96.4**			
63	**888.3**	3.6	**96.4**			
53	**888.3**	3.6	**96.4**			
37.5	**888.3**	3.6	**96.4**			
26.5	**932.2**	3.8	**96.2**	50.0	100.0	
19	**1004.0**	4.1	**95.9**			
16	**1028.8**	4.2	**95.8**			
13.2	**1040.1**	4.3	**95.7**			
9.5	**1096.8**	4.5	**95.5**			
6.7	**1146.0**	4.7	**95.3**			for physicals only
4.75	**1196.7**	4.9	**95.1**	20.0	100.0	
PAN	**23101.7**					
SIEVE CHECK COARSE		0.17	0.3% max.			

WEIGHT FINE SIEVE (Before Wash)	295
WIEGHT FINE SIEVE (After Wash)	286.7

SIEVE SIZE (mm)	WEIGHT RETAINED	PERCENT RETAINED	PERCENT PASSING	PERCENT PASSING COMBINED	LOWER SPEC	UPPER SPEC	REMARK
2.36	**0.5**	0.2	99.8	**94.9**			
1.18	**3.9**	1.3	98.7	**93.8**	10.0	100.0	
0.6	**46.2**	15.7	84.3	**80.2**			
0.3	**198.6**	67.3	32.7	**31.1**	2.0	65.0	
0.15	**269.8**	91.5	8.5	**8.1**			
0.075	**284.3**	96.4	3.6	**3.4**	0.0	8.0	
PAN	**286.7**						
SIEVE CHECK FINE		0.00	0.3% max.				

OTHER TESTS		**RESULT**	**REFERENCE MATERIAL** LAB NO.	RESULT
ASTM D698	Corrected Dry Density kg/m3	**1790**		
ASTM D698	Corrected Moisture Content	**14.3%**		

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

Certificate of Analysis

Report Date: 29-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 23-Jul-2020

Client PO: 30462

Project Description: PE4767

	Client ID:	BH10-20-SS5	-	-	-
	Sample Date:	23-Jul-20 09:30	-	-	-
	Sample ID:	2030452-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	92.4	-	-	-
General Inorganics					
pH	0.05 pH Units	7.80	-	-	-
Resistivity	0.10 Ohm.m	125	-	-	-
Anions					
Chloride	5 ug/g dry	11	-	-	-
Sulphate	5 ug/g dry	<5	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 - AERIAL PHOTOGRAPH - 2014

FIGURE 3 - AERIAL PHOTOGRAPH - 2017

DRAWING PG5418-1 - TEST HOLE LOCATION PLAN

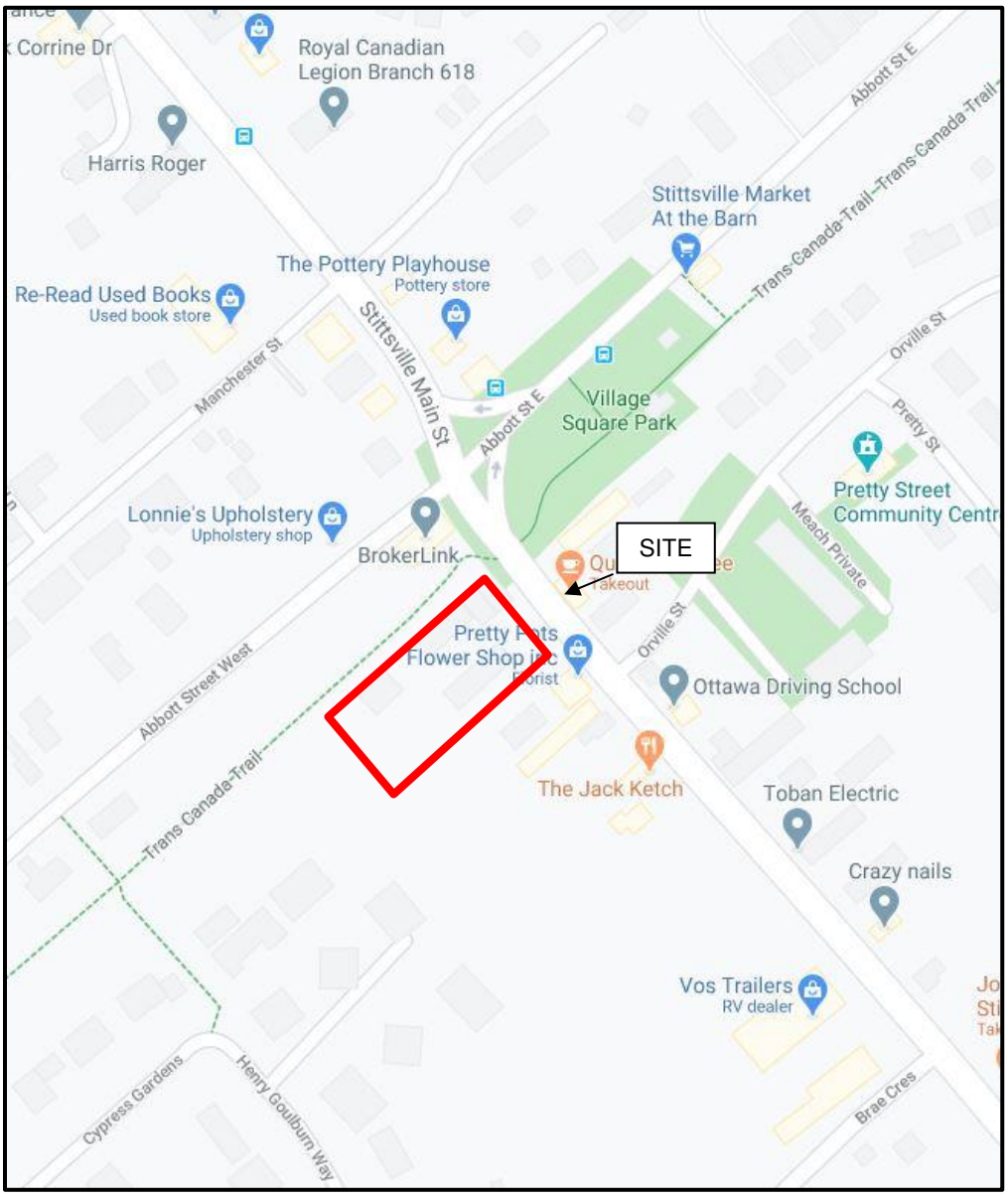


FIGURE 1

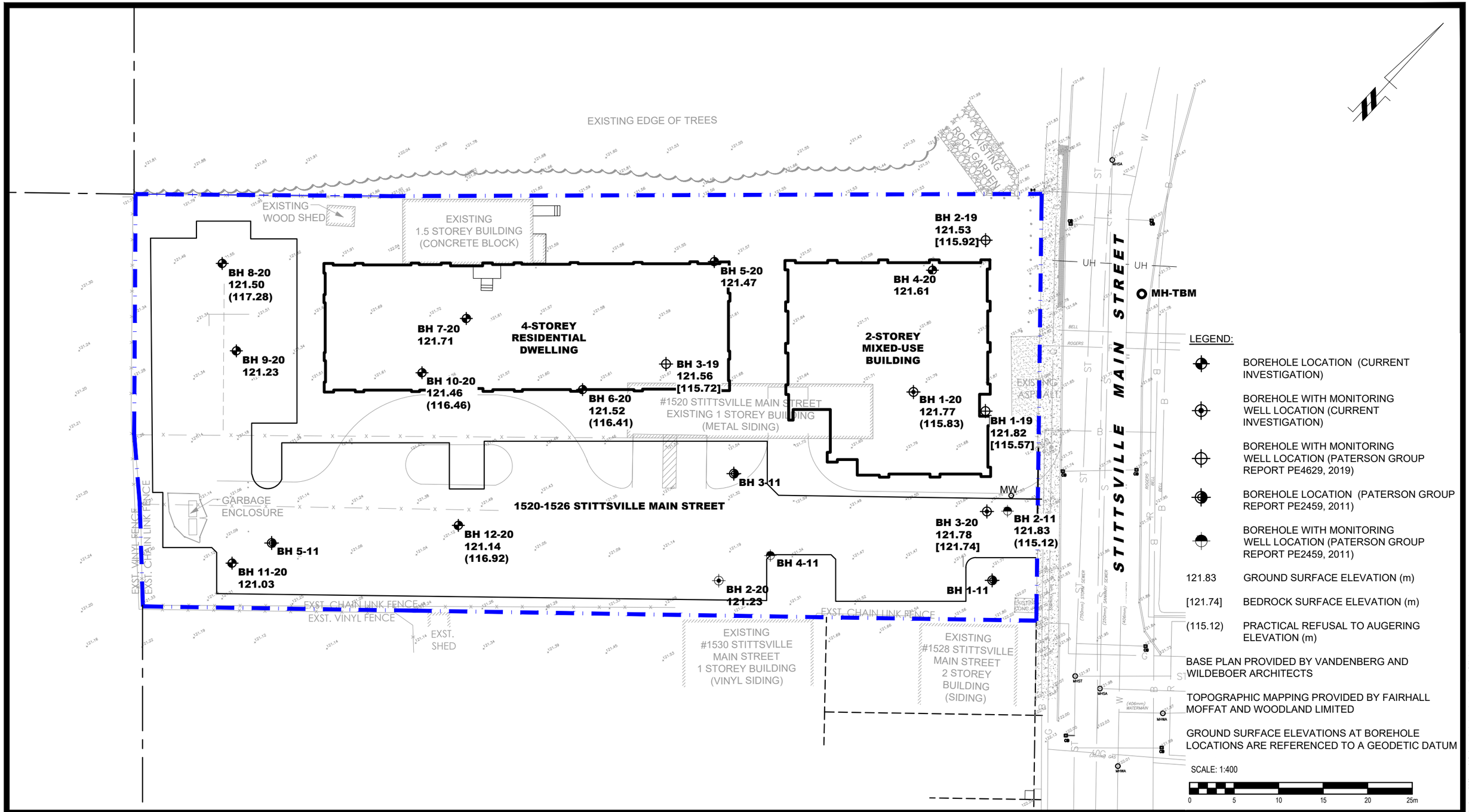
KEY PLAN

FIGURE 2

Aerial Photograph - 2014

FIGURE 3

Aerial Photograph - 2017



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

NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	14/12/2023	SD

INVERNESS HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY BUILDING
1520-1526 STITTSVILLE MAIN STREET
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 08/2020
Drawn by: YA	Report No.: PG5418-1
Checked by: DP	Dwg. No.: PG5418-1
Approved by: SD	Revision No.: 1

p:\autocad drawings\geotechnical\pg54xx\pg5418\pg5418-1-test hole location plan (rev.01).dwg

APPENDIX 3

SITE MEMORANDUM DOCUMENTING FIELD DENSITY TESTING

MEMO PG5418-MEMO.04 REVISION 1 DATED AUGUST 20, 2024

9 Auriga Drive
Ottawa, Ontario. K2E 7T9
Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

Site Memorandum: Field Density Testing

TO: Inverness Homes Inc. DATE: Jun 05.2023 8:00 AM FILE: PM14602

PROJECT: 1518 Stittsville Main Street - Excavation Backfill

ADDRESS: 1518 Stittsville Main Street, Stittsville

LOCATION: **Sand Backfill - for the location see the sketch marked as Excavation Location**

AUTHOR: Mohit Taheliyani

Note: If any recommendations provided by the Paterson Group result in an additional cost, the contractor shall obtain authorization from the owner directly, prior to undertaking the work.

COMMENTS:

Further to your request, Paterson Group (Paterson) carried out a site visit to conduct a field density testing at the aforementioned location.

Field Density Test: Engineered Fill : Sand Backfill - for the location see the sketch marked as Excavation Location
A total of flirty eight (48) field density tests were conducted on a native sand.

Conforming:
Those results conform to the minimum required 98.0% SPMDD.

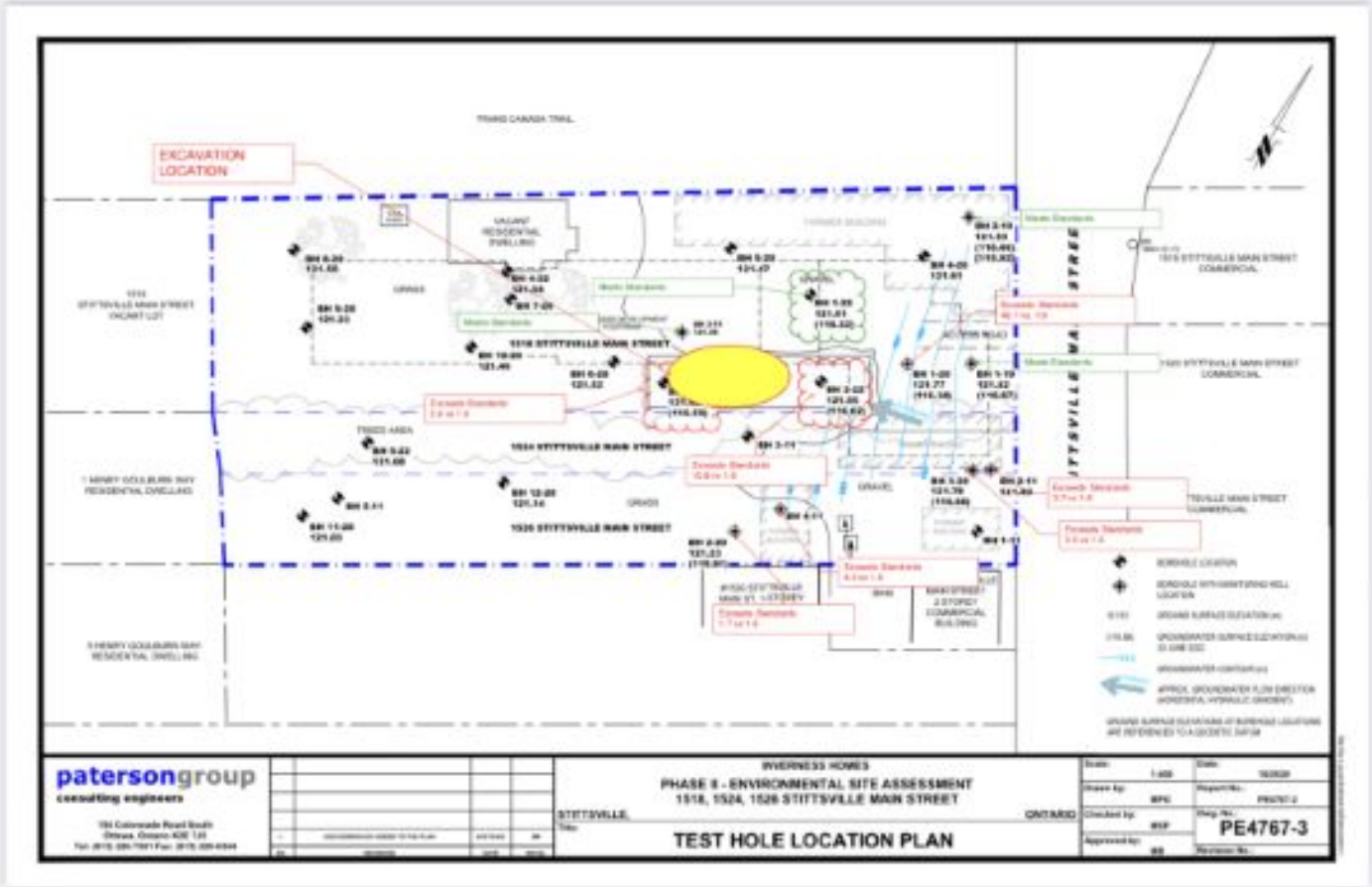
TEST RESULTS AVAILABLE UPON REQUEST

MOHIT TAHELIYANI

9 Auriga Drive
Ottawa, Ontario. K2E 7T9
Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

Site Memorandum: Field Density Testing

TEST LOCATION PLAN



9 Auriga Drive
Ottawa, Ontario. K2E 7T9
Tel: (613) 226-7381
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Site Memorandum: Field Density Testing

PHOTO 1

PHOTO 2

PATERSON GROUP

memorandum

re: **Geotechnical Investigation – Responses to City Comments**
Proposed Mixed-Use Development
1518-1526 Stittsville Main Street
Ottawa, Ontario

to: Inverness Homes - **Mr. Joshua Laginski –** joshua@invernesshomes.ca
date: August 20, 2024
file: PG5418-MEMO.04 Revision 1

Further to your request and authorization, Paterson Group (Paterson) prepared this memorandum to provide responses to the geotechnical-related comments from the City of Ottawa listed in the letter dated June 20, 2024 (File No. PC2024-0216). This memorandum should be read in conjunction with the updated Geotechnical Investigation Report (Paterson Group Report PG5418-1 Revision 3 dated July 24, 2024).

Geotechnical Investigation Comments

Comment 3a: *The report should discuss the results obtained for the grain size distribution test. Additionally, please confirm why only one sample has been tested for grain size distribution analysis, when the entire site is mostly made of sand.*

Response: A sub-heading has been added under Section 4.2 of the updated Geotechnical Investigation Report, referenced above, to provide and discuss the results of the grain size distribution test.

In summary, the native sand deposit was observed to be fairly consistent across the site, therefore one grain size distribution test was considered sufficient in order identify this soil and determine its percolation rate.

Comment 3b: *It is Development Review's understanding that the geotechnical engineer should comment on the percolation rate introduced in the infiltration calculations of the stormwater management report, as it is selected based on the type of soil for this site. The geotechnical consultant is encouraged to consult pages 77 and 99-100 of the servicing and stormwater management report for reference. This percolation should be discussed in the geotechnical report.*

Response: A sub-heading has been added under Section 4.3 of the updated Geotechnical Investigation Report, referenced above, to provide the percolation rate. In summary, a conservative percolation rate of 30 mm/hr is suitable for the subsurface soils at the subject site. It is understood that this is the value that has been used in the Stormwater Management Report, by others.

Comment 15: *It is Development Review's understanding that the "foundation walls" mentioned in Section 6.1 of the geotechnical report refer to the footings of the slab on grade foundation. Please confirm.*

Response: In this context, "foundation walls" refer to the perimeter concrete walls located below the slab on grade level, and the footings supporting these perimeter concrete walls.

We trust that this information satisfies your immediate requirements.

Paterson Group Inc.

Scott S. Dennis, P.Eng.