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March 20, 2017
File: PG0811-LET.01

SmartReit
700 Applewood Crescent
Suite 200
Vaughan, Ontario
L4K 5X3

Attention: **Mr. Aaron Clodd**

Subject: **Geotechnical Investigation**
Proposed Roadway Service Alignment
2025 Mer Bleue Road - Ottawa

Dear Sir,

Further to your request and authorization, Paterson Group (Paterson) completed a geotechnical investigation for the proposed roadway service alignment within Phase 1 of the proposed commercial development to be located at the southeast corner of Innes Road and Mer Bleue Road, in the City of Ottawa, Ontario.

1.0 Field Investigation

The fieldwork for the current geotechnical investigation was carried out between January 25 and 26, 2017. At that time, five (5) boreholes were drilled to a maximum depth of 7.9 m and eleven (11) probeholes were drilled to a maximum depth of 7.6 m below existing ground surface. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The drilling procedure consisted of augering to the required depths, sampling and testing the overburden at selected locations.

The test holes were located in the field by Paterson field personnel. The test hole locations and ground surface elevation at the test hole locations were provided by Annis O'Sullivan Vollebekk Ltd. The approximate location of the test holes were presented on Drawing PG0811-2 - Test Hole Location Plan attached to the present report.

2.0 Observations

Surface Conditions

At the time of our field program, the subject site consisted of agricultural fields with some mature trees and a grassed area within the northwest corner of the site. It should be noted that two existing ditches were observed running along the south and east border lines of Phase 1 of the proposed development. An existing sanitary line is present along the east-west alignment of the proposed service line. The subject site is relatively flat and slightly lower than Innes Road and Mer Bleue Road.

Subsurface Profile

Generally, the subsurface soil profile encountered at the test hole locations consists of topsoil overlying a hard to firm silty clay crust layer followed by a firm grey silty clay deposit. A layer of fill was observed overlying the grey silty clay at BH 1-17 which was noted to be in close proximity to an existing service alignment. Glacial till was encountered below the grey silty clay deposit at BH 3-17. Practical refusal to augering was encountered at depths ranging from 1.7 m to 5.7 m.

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

Based on available geological mapping, the bedrock consists of interbedded limestone and dolomite of the Gull River Formation and is expected to be encountered at depths ranging from 5 to 15 m.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed roadway service alignment. Bedrock removal will be required prior to installation for portions of the proposed service alignment. Precautions should be taken during excavation for the proposed service alignment adjacent to the existing service pipe.

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

Site Grading and Preparation

Topsoil and deleterious fill, such as those containing organic material, should be stripped from under any paved areas or other settlement sensitive structures prior to placing fill.

Fill used for grading beneath the pavement granulars should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular B Type I or Type II or select subgrade material placed under dry conditions and in above freezing temperatures. These materials should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm in thickness and compacted using suitable compaction equipment for the lift thickness. Fill placed below the pavement subgrade level, beneath the paved areas, should be compacted to at least 95% of its standard Proctor maximum dry density (SPMDD). The upper 1 m of the subgrade fill should be compacted to a minimum of 98% of the material's SPMDD.

Bedrock Removal

Consideration should be given to controlled blasting where significant amounts of bedrock are required to be removed. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by 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 as much as possible should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the City of Ottawa. These recommendations are for standard, open cut excavation placed services.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A crushed stone. Where the bedding is located within the firm grey silty clay or directly over the bedrock surface, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A crushed stone from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of the SPMDD.

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

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

It is recommended that the subgrade medium be inspected in the field to determine how steeply the bedrock surface, where encountered, drops off. A transition treatment should be provided where the bedrock slopes at more than 3H:1V. At these locations, the bedrock should be excavated and extra bedding be placed to provide a 3H:1V (or flatter) transition from the bedrock subgrade towards the soil subgrade. This treatment reduces the propensity for bending stress to occur in the service pipes.

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

Maintenance Holes

Maintenance holes or chambers may be founded on engineered fill placed on an undisturbed, firm silty clay and can be designed using an allowable bearing pressure of 100 kPa. Engineered fill under maintenance holes or chambers should consist of OPSS Granular A (crushed stone) or Granular B Type II material placed in maximum 300 mm thick layer and compacted to a minimum of 98% of its SPMDD.

Pavement Structure

For design purposes, the pavement structure presented in the following table should be used for the design of local roadways with bus and heavy truck traffic.

Table 1 - Recommended Pavement Structure - Local Roadways with Bus and Heavy Truck Traffic

Thickness mm	Material Description	
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete	**Ontario Traffic Category D**
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete	
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete	
150	**BASE** - OPSS Granular A Crushed Stone	
500	**SUBBASE** - OPSS Granular B Type II	
SUBGRADE - Either in situ soil or OPSS Granular B Type II material placed over in situ soil		

Provisions should be made for the excavation of unsuitable materials (i.e. deleterious fill and/or organics) from below the subbase level, if encountered. The use of a geotextile may also be warranted if onerous conditions prevail. This could be determined at the time of construction.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

Minimum Performance Graded (PG) 64-34 asphalt cement should be used for this project.

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.

Where the proposed pavement structure meets the existing asphalt surface, the following recommendations should be followed:

- ❑ A 300 mm wide section of the existing asphalt roadway should be saw cut from the existing pavement edge to provide a sound surface to abut the proposed pavement structure.
- ❑ It is recommended to mill a 300 mm wide and 40 mm deep section of the existing asphalt at the saw cut edge.
- ❑ The proposed pavement structure subbase materials should be tapered no greater than 3H:1V to meet the existing subbase materials.
- ❑ Clean existing granular road subbase materials can be reused upon assessment by the geotechnical consultant at the time of excavation (construction) as to its suitability.

Pavement Structure Drainage

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

Where silty clay is anticipated at subgrade level, consideration should be given to installing sub-drains at the catch basin locations during the pavement construction. The sub-drain inverts should be approximately 300 mm below subgrade level and extend 3 m along the curblines in both directions. The subgrade surface should be crowned to promote water flow to the drainage lines.

Winter Construction Precautions

If winter construction is considered for this assignment, the following precautions must be taken:

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

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw or insulated 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 sufficient soil cover is provided to prevent freezing at the subgrade level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. Also, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure.

Corrosion Potential and Sulphate

The analytical test results are attached to the present report. 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 corrosive environment.

4.0 Recommendations

It is a requirement for the design data provided herein to be applicable that a suitable materials testing and observation program, including the following aspects, be performed by the geotechnical consultant.

- ❑ Observation of all bearing surfaces prior to the placement of bituminous concrete.
- ❑ Sampling and testing of the bituminous concrete and fill materials used including mix design reviews.
- ❑ 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.

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.

5.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete.

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. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified 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 SmartReit 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.

We trust that this information satisfies your immediate request.

Best Regards,

Paterson Group Inc.

Faisal Abou-Seido, P.Eng.

David J. Gilbert, P.Eng

Attachments

- ❑ Soil Profile and Test Data sheets
- ❑ Symbols and Terms
- ❑ Drawing PG0811-2 - Test Hole Location Plan

Report Distribution

- ❑ SmartReit (3 copies)
- ❑ Paterson Group (1 copy)

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

FILE NO. PG0811

REMARKS

HOLE NO. BH 1-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

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 0.25						0	88.17		
		AU	1			1	87.17		
FILL: Brown silty clay, trace gravel						2	86.17		
		SS	2	8		3	85.17		
4.78						4	84.17		
Stiff, grey **SILTY CLAY,** trace sand		SS	3	83	4	5	83.17		
5.18 End of Borehole									
(GWL @ 1.8m depth based on field observations)									

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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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

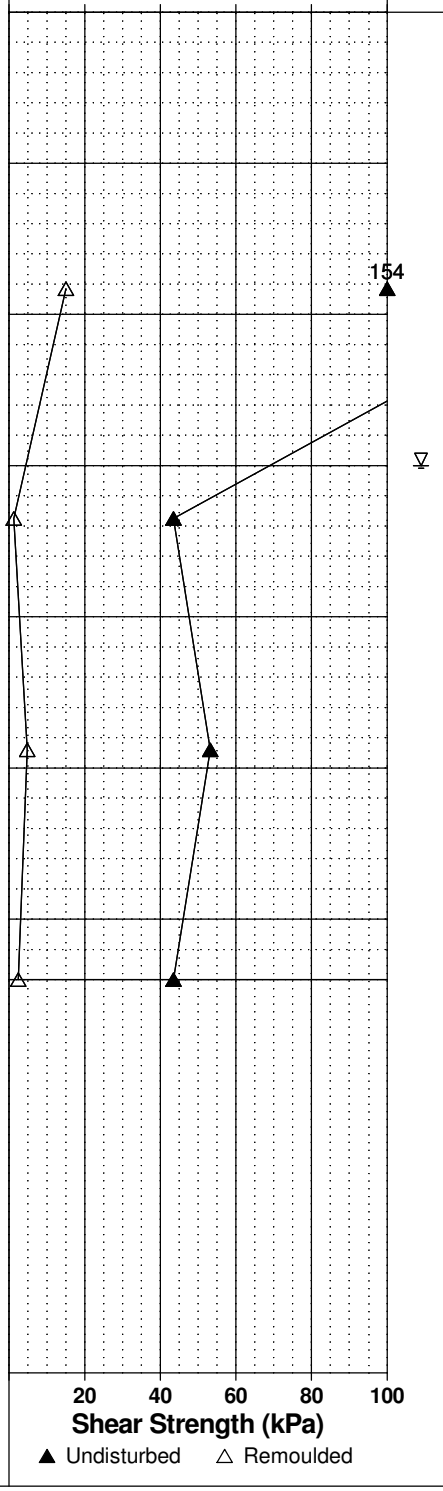
FILE NO. PG0811

REMARKS

HOLE NO. BH 2-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.35
TOPSOIL 0.28		AU	1			1	87.35
		SS	2	92	P	2	86.35
Very stiff to firm, brown **SILTY CLAY,** trace sand						3	85.35
- grey by 4.6m depth						4	84.35
						5	83.35
						6	82.35
6.40 End of Borehole							
(GWL @ 3.0m depth based on field observations)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

FILE NO. PG0811

REMARKS

HOLE NO. BH 3-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	88.60		
TOPSOIL 0.33									
Hard to very stiff, brown **SILTY CLAY,** trace sand						1	87.60	249	
								120	
						2	86.60		
3.05						3	85.60		
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders		SS	1	100	11				
4.52						4	84.60		
End of Borehole Practical refusal to augering at 4.52m depth (GWL @ 2.3m depth based on field observations)									

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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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

FILE NO. PG0811

REMARKS

HOLE NO. BH 4-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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 0.30						0	88.24		
Very stiff, brown **SILTY CLAY,** trace sand						1	87.24		
2.39						2	86.24		
End of Borehole Practical refusal to augering at 2.39m depth (BH dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80
164
20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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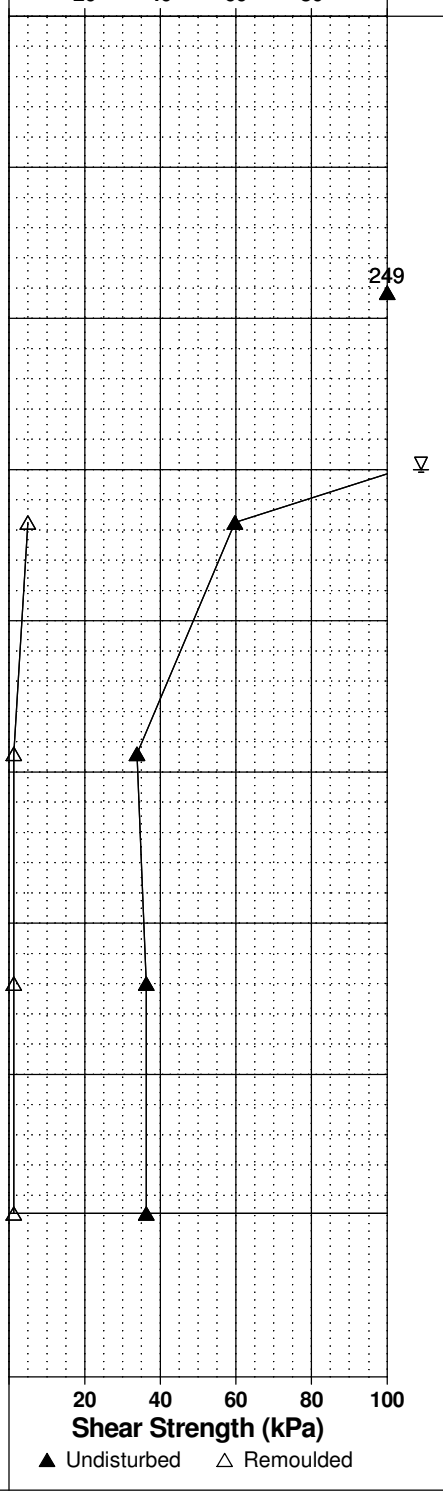
REMARKS

HOLE NO. BH 5-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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 0.27						0	88.11		
Hard to stiff, brown **SILTY CLAY,** trace sand						1	87.11		
						2	86.11		
						3	85.11		
						4	84.11		
- firm and grey by 4.6m depth						5	83.11		
						6	82.11		
						7	81.11		
7.92									
End of Borehole									
(GWL @ 3.0m depth based on field observations)									



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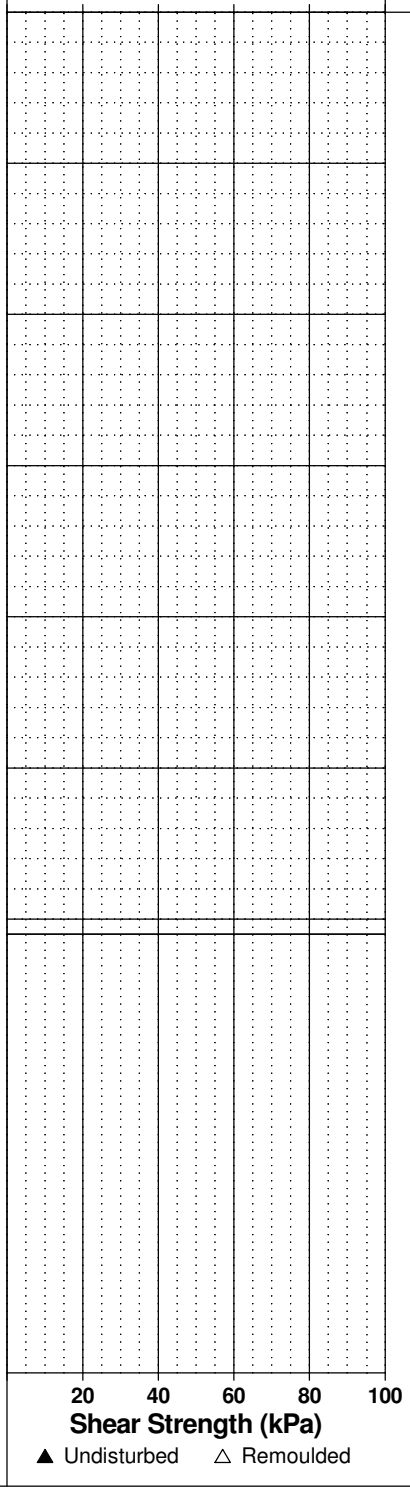
FILE NO. PG0811

REMARKS

HOLE NO. PH 1-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

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	88.32		
						1	87.32		
						2	86.32		
OVERBURDEN						3	85.32		
						4	84.32		
						5	83.32		
6.10						6	82.32		
End of Probehole									



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SOIL PROFILE AND TEST DATA

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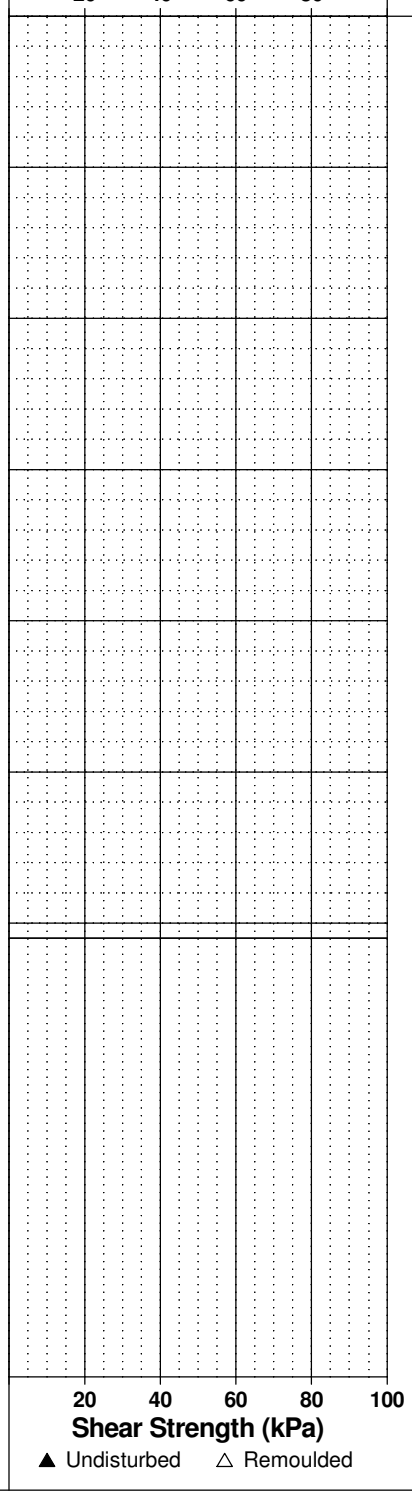
FILE NO. PG0811

REMARKS

HOLE NO. PH 2-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

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	88.02		
						1	87.02		
						2	86.02		
OVERBURDEN						3	85.02		
						4	84.02		
						5	83.02		
6.10						6	82.02		
End of Probehole									



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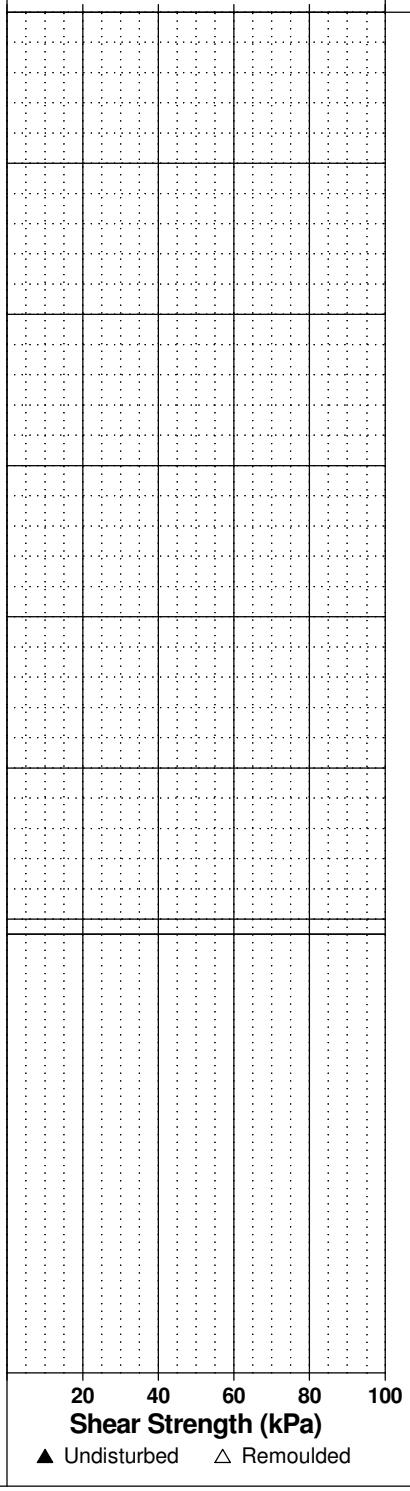
REMARKS

HOLE NO. PH 3-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	88.53		
						1	87.53		
						2	86.53		
OVERBURDEN						3	85.53		
						4	84.53		
						5	83.53		
6.10						6	82.53		
End of Probehole									



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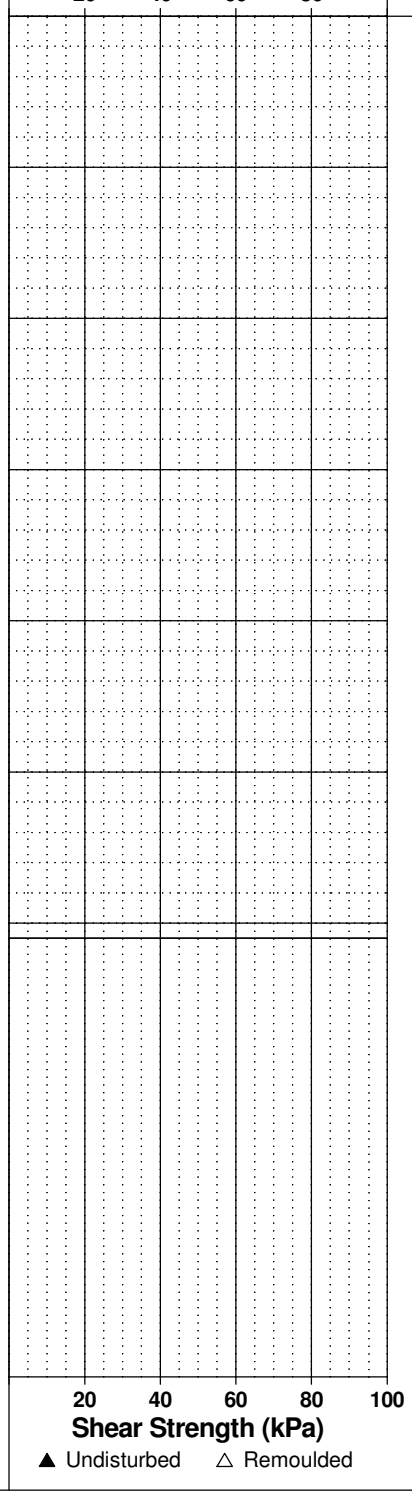
GROUND SURFACE						0	88.53		
						1	87.53		
						2	86.53		
OVERBURDEN						3	85.53		
						4	84.53		
						5	83.53		
6.10						6	82.53		
End of Probehole									



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REMARKS

HOLE NO. PH 5-17

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GROUND SURFACE						0	88.66	20 40 60 80	
OVERBURDEN						1	87.66		
1.75									
End of Probehole									
Practical refusal to augering at 1.75m depth									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
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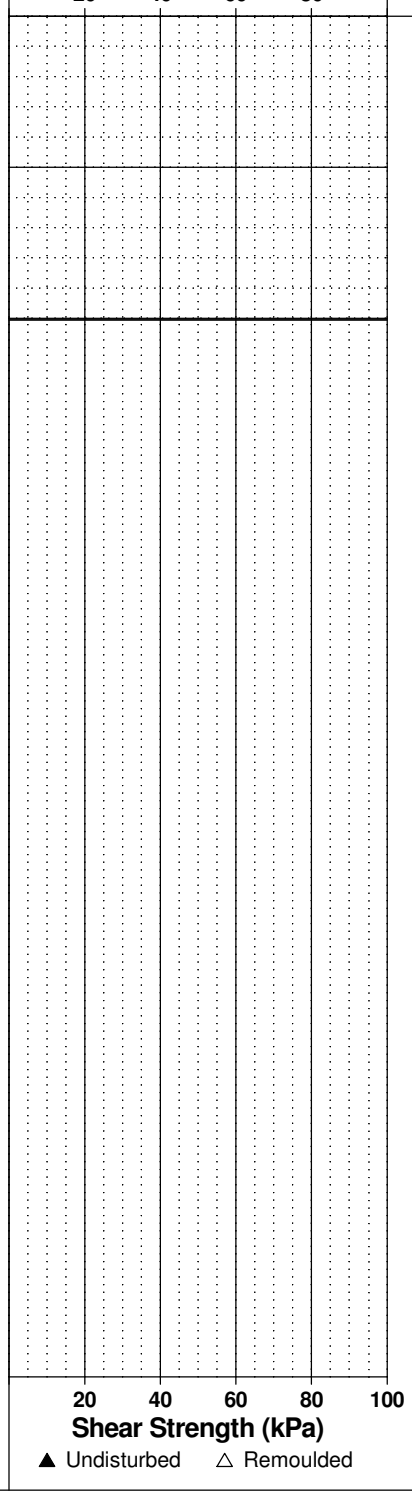
FILE NO. PG0811

REMARKS

HOLE NO. PH 6-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	88.52		
OVERBURDEN						1	87.52		
2.01						2	86.52		
End of Probehole Practical refusal to augering at 2.01m depth									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

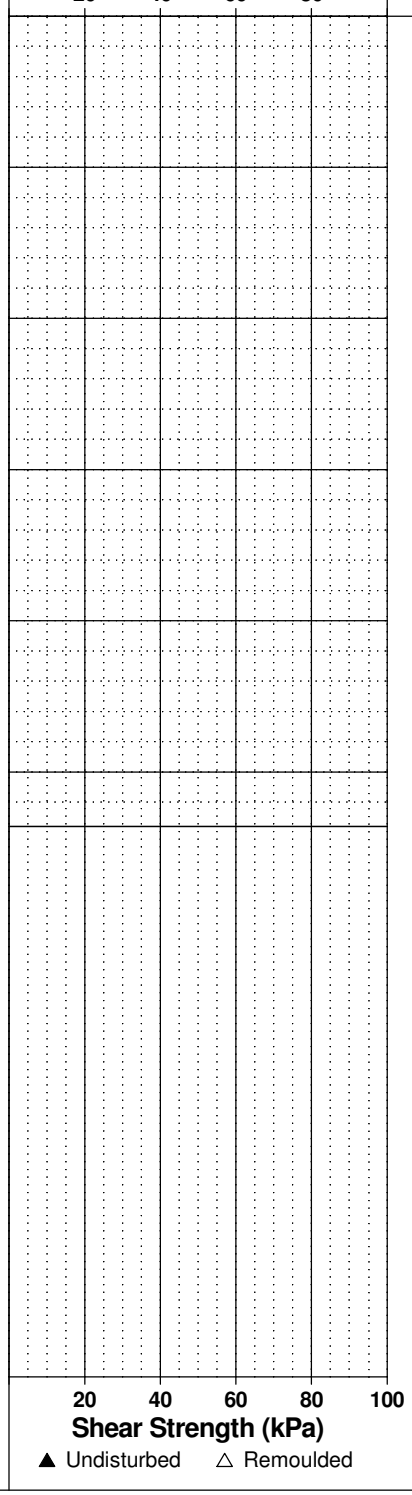
FILE NO. PG0811

REMARKS

HOLE NO. PH 7-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	87.89		
						1	86.89		
						2	85.89		
OVERBURDEN						3	84.89		
						4	83.89		
						5	82.89		
5.36									
End of Probehole									
Practical refusal to augering at 5.36m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

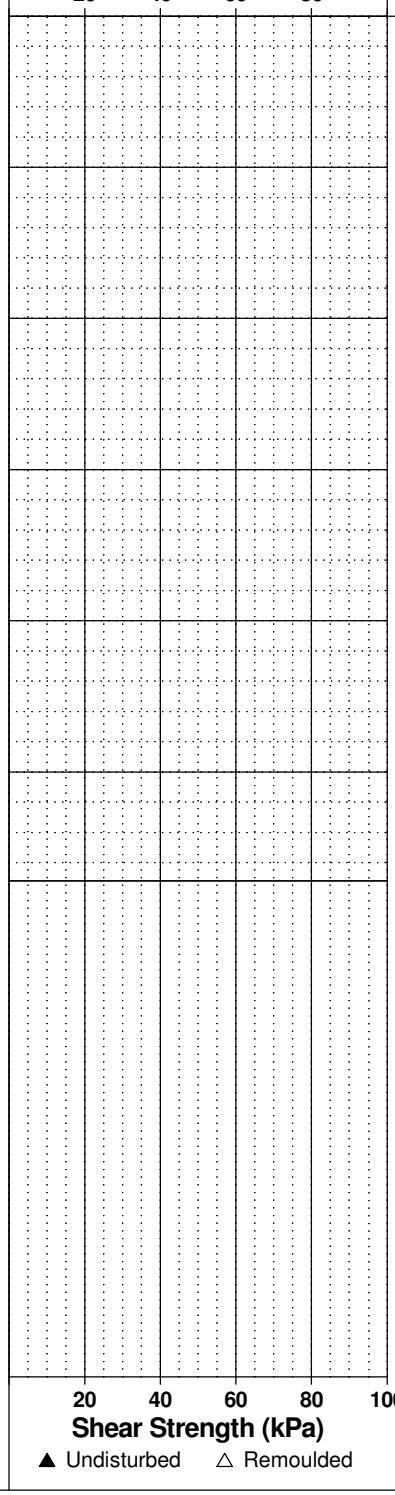
FILE NO. PG0811

REMARKS

HOLE NO. PH 8-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	88.13		
						1	87.13		
						2	86.13		
OVERBURDEN						3	85.13		
						4	84.13		
						5	83.13		
5.72									
End of Probehole Practical refusal to augering at 5.72m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

FILE NO. PG0811

REMARKS

HOLE NO. PH 9-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

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	87.72		
						1	86.72		
						2	85.72		
						3	84.72		
OVERBURDEN						4	83.72		
						5	82.72		
						6	81.72		
						7	80.72		
7.62									
End of Probehole									

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

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

FILE NO. PG0811

REMARKS

HOLE NO. PH10-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

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	87.95	20 40 60 80	
						1	86.95		
OVERBURDEN						2	85.95		
						3	84.95		
						4	83.95		
4.57									
End of Probehole									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

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

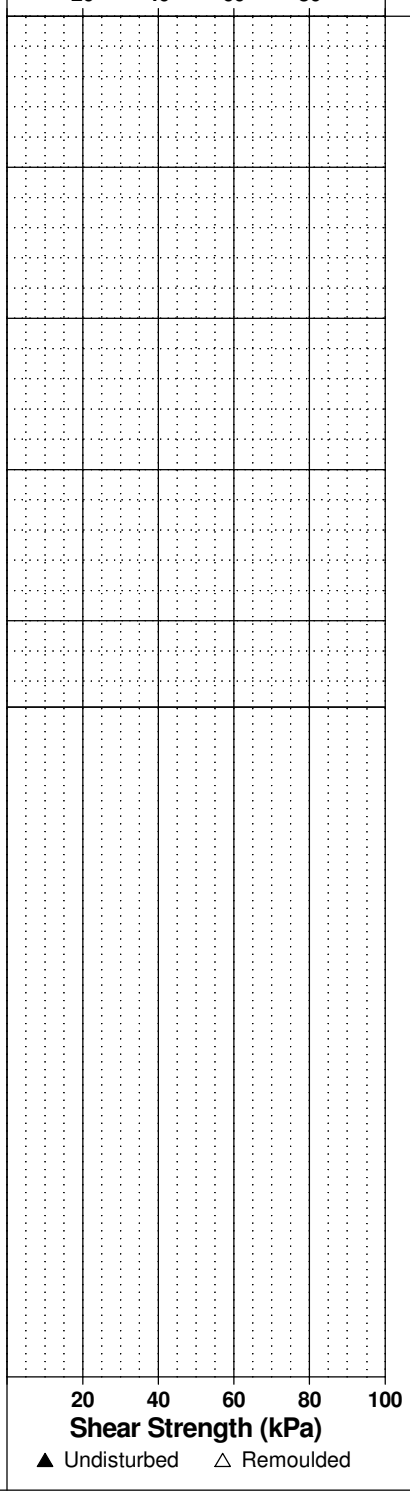
FILE NO. PG0811

REMARKS

HOLE NO. PH11-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

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	88.38		
						1	87.38		
						2	86.38		
OVERBURDEN						3	85.38		
						4	84.38		
4.57									
End of Probehole									



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

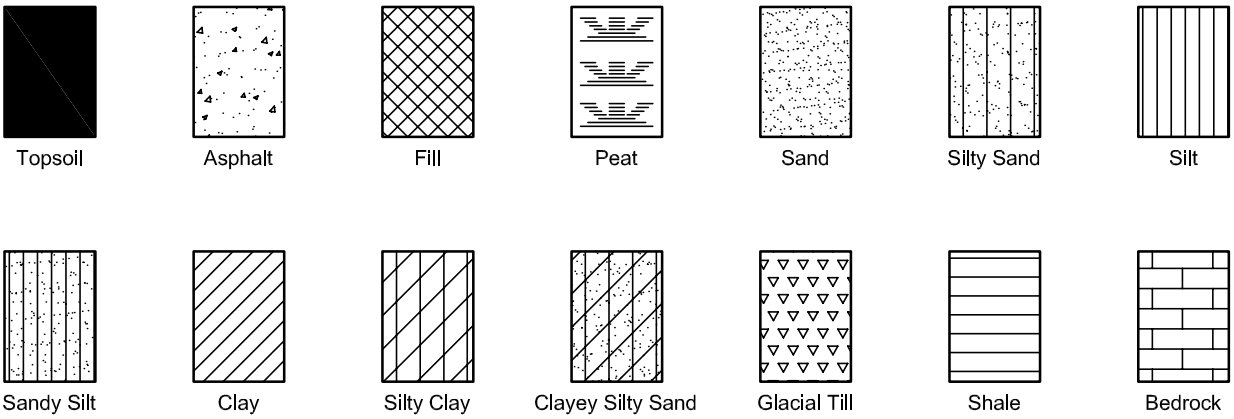
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

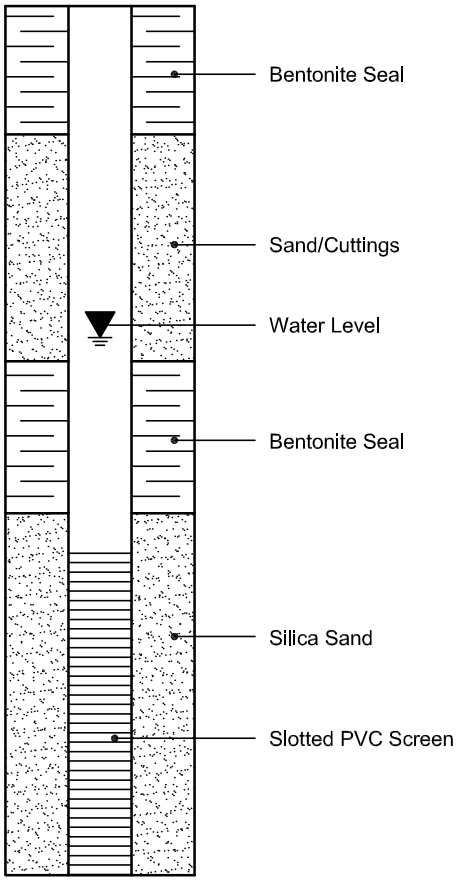
SYMBOLS AND TERMS (continued)

STRATA PLOT

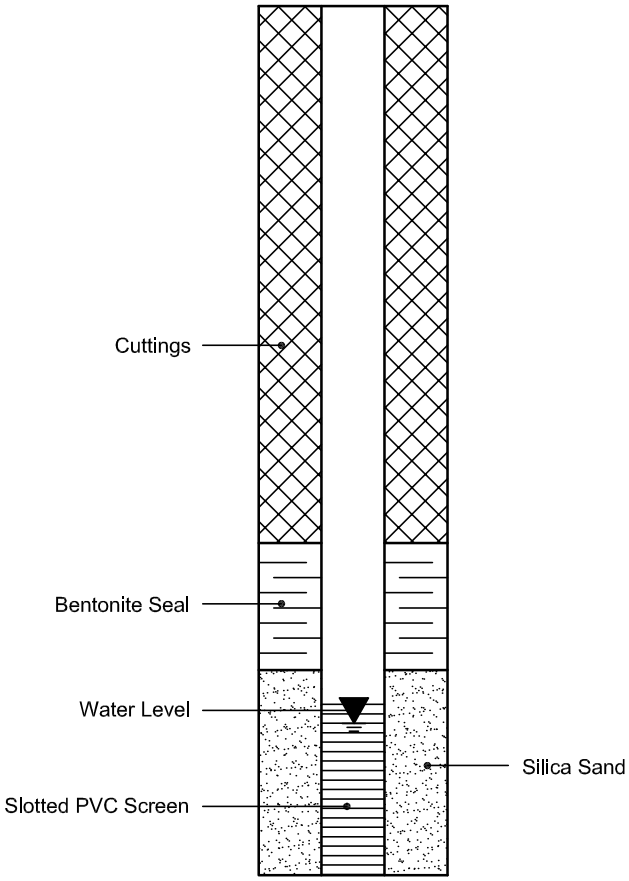


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



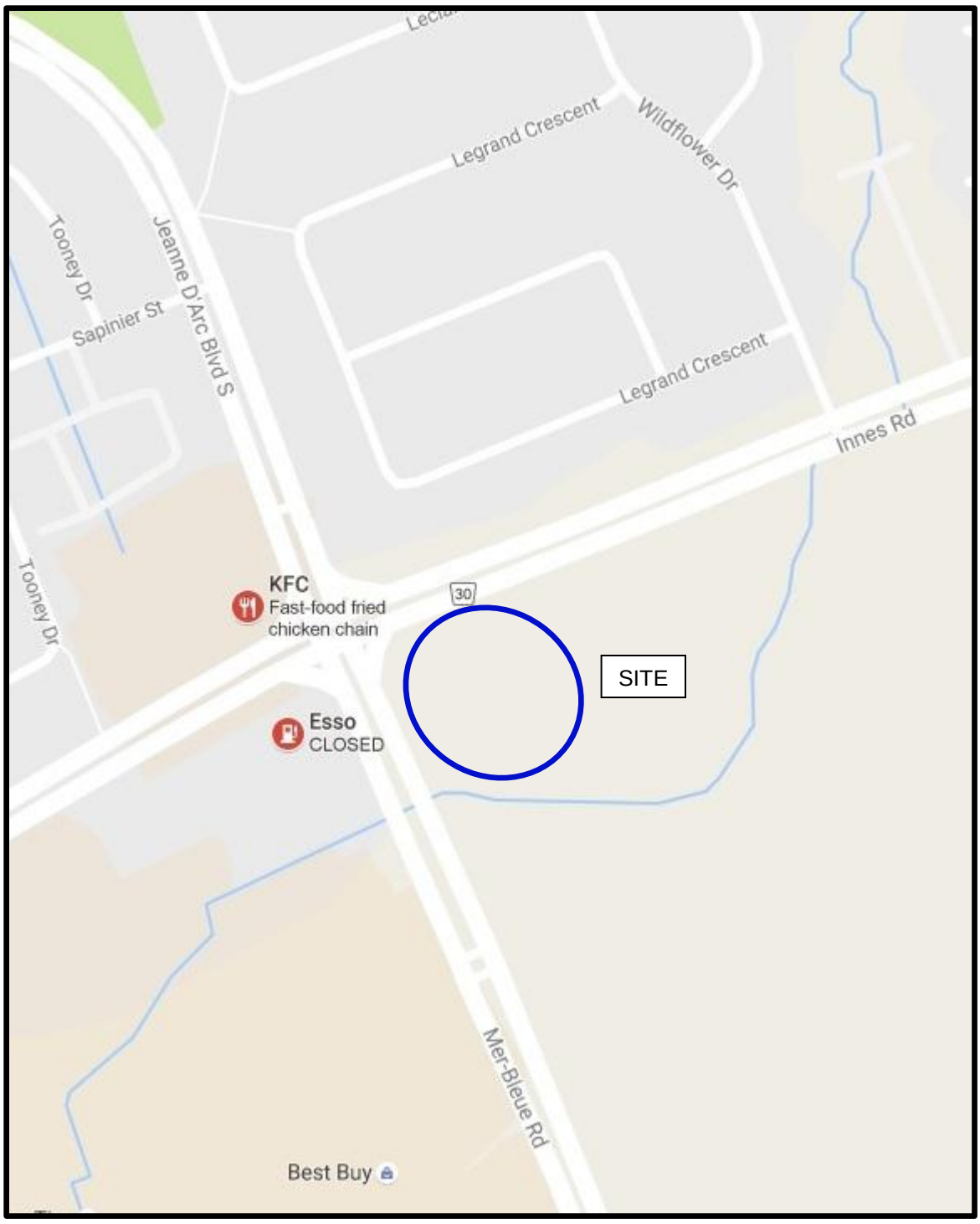
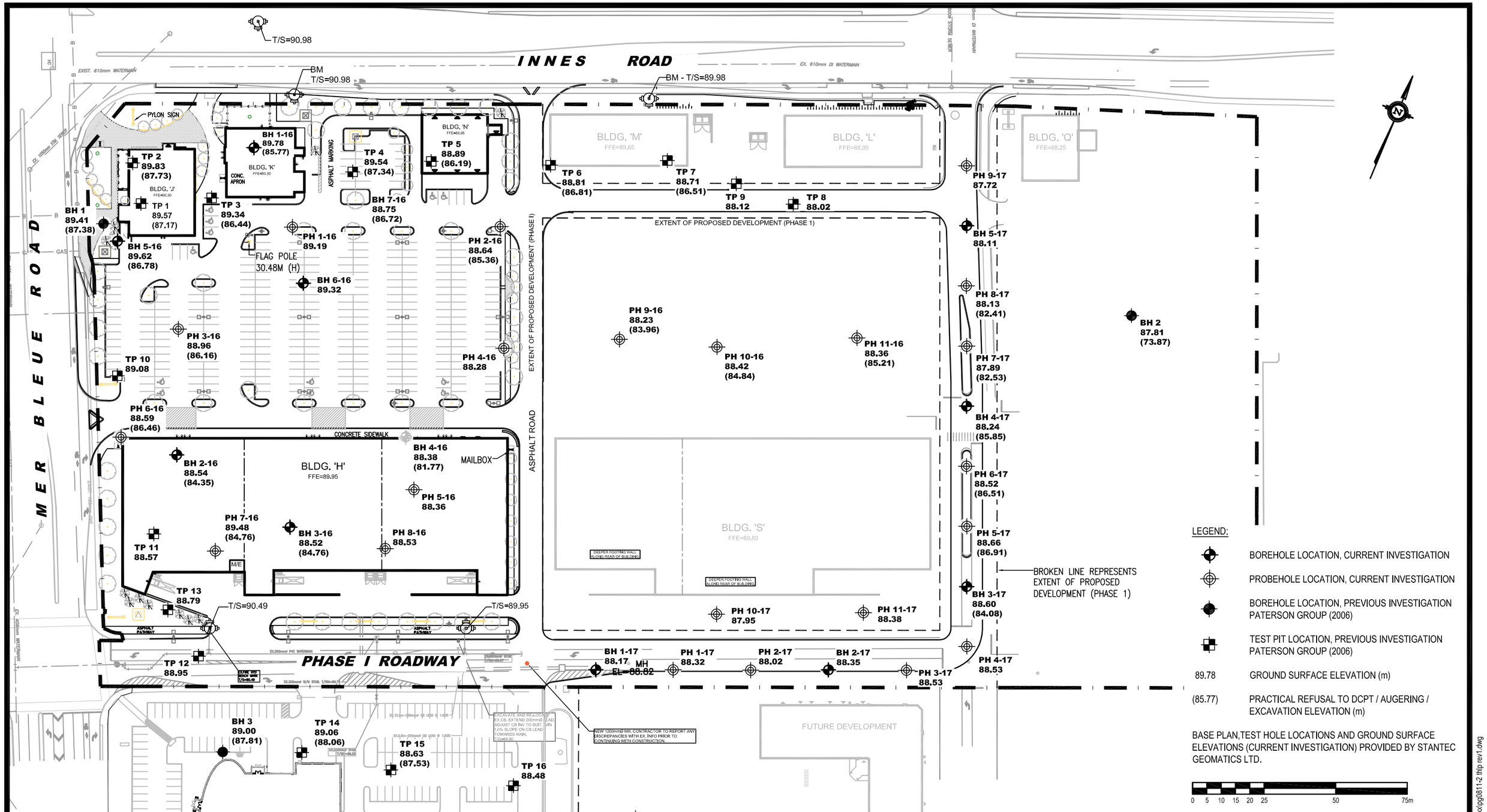


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION, CURRENT INVESTIGATION
- PROBEHOLE LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP (2006)
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP (2006)
- 89.78 GROUND SURFACE ELEVATION (m)
- (85.77) PRACTICAL REFUSAL TO DCPT / AUGERING / EXCAVATION ELEVATION (m)

BASE PLAN,TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS (CURRENT INVESTIGATION) PROVIDED BY STANTEC GEOMATICS LTD.

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NO.	REVISIONS	DATE	INITIAL

SMART REIT

ORLEANS II COMMERCIAL DEVELOPMENT - PROPOSED SERVICING ALIGNMENT
MER BLEUE ROAD AND INNES ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1250	Date: 11/2016
Drawn by: RCG	Report No.: PG0811-LET.01
Checked by: FA	Dwg. No.: PG0811-2
Approved by: DJG	Revision No.: 0

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