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GEOTECHNICAL INVESTIGATION

PROPOSED NEW DEVELOPMENT, 3455 HAWTHORNE ROAD, OTTAWA, ONTARIO

Prepared for:

Dymon Group of Companies

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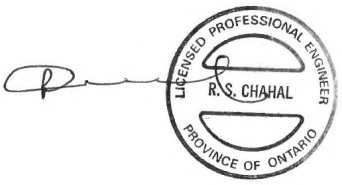
Project No. FE-P 19-9555Geo.

July 9, 2019

Issued to:	Dymon Group of Companies
Contact:	Stephen Creighton
Project Name:	Proposed New Development
Project Address:	3455 Hawthorne Road, Ottawa, Ontario
Project Number:	FE-P 19-9555Geo
Issued on:	July 9, 2019



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1. INTRODUCTION

Fisher Environmental Limited was retained by Dymon Group of Companies to carry out a geotechnical subsurface investigation for the proposed new development at 3455 Hawthorne Road in Ottawa, Ontario.

The purpose of the geotechnical investigation was to determine the general subsurface conditions at the site and to provide geotechnical recommendations for the design/construction of the proposed building by means of six (6) boreholes.

This report presents the results of the tests performed in accordance with the general terms of reference outlined above.

The report has been prepared specifically and solely for the due diligence in regards to geotechnical aspects of design & construction of the proposed development at the site.

2. SITE AND PROJECT DESCRIPTION

The subject property is located on the east side of Hawthorne Road, to the immediate north of the existing gas station at the north-east corner of intersection with Hunt Club Road in the City of Ottawa.

Industrial buildings were observed toward north and east sides. Residential dwellings exist on the west side of Hawthorne Road.

The subject property was currently being used for outdoor storage with granular materials coverage across the site.

Site grades were dropping gently in northerly/north-easterly direction.

We understand that a self-storage facility is proposed for the site investigated herein. Details of the proposed building such as location, type/size, finished floor/grade elevation etc. were not available at the time of our investigation.

3. SCOPE OF GEOTECHNICAL WORK

The geotechnical scope of work includes the following:

- Investigation of the subsurface conditions at the site by advancing boreholes, soil sampling and visual evaluation.

- Prepare a geotechnical report with comments and recommendations regarding:
  - Appropriate foundation depth, type and bearing capacity, and seismic classification.
  - Slab-on-grade design and construction.
  - Parking area and driveway pavement structure.
  - Excavation etc.

4. METHOD OF INVESTIGATION

The field work for this investigation was carried out on June 18 2019, in which a total of six (6) boreholes (BH1 – BH6), were drilled to approximate depths ranging between 2.13m & 4.88m below prevailing grades. The approximate locations of the boreholes and elevations are shown on the attached Borehole Location Plan in Appendix A.

The ground surface elevation at each borehole was surveyed by Fisher representative using a temporary benchmark (TBM) "TOP OF MANHOLE ON HAWTHORNE ROAD NORTH OF PROPERTY ENTRANCE" as datum having an assumed elevation of 100.00m.

All boreholes were advanced using solid stem auguring. The subsurface strata were sampled at regular intervals of depth using a split-spoon sampler following the procedure as detailed in the ASTM Standard specification D1586 for the Standard Penetration Test. Field tests to determine the engineering parameters of the soil were carried out during drilling, which included Standard Penetration Tests (SPT).

Water level observations were made in each borehole upon its completion. In addition, monitoring wells were installed in boreholes 1 to 3 for groundwater observations/sampling. Boreholes 4 to 6 were backfilled with bentonite/soil cuttings upon completion.

All soil samples were taken to our accredited laboratory for final visual assessment, classification and selected moisture content testing. The samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soil for Engineering Purposes.

Soil Description and test results are given in the borehole Records attached to this report.

The soil samples recovered during the investigation will be stored in our laboratory for a period of 30 days after which they will be discarded unless further instructions are received.

5. SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are shown on the Borehole Log Sheets provided in Appendix B.

The boreholes logs include soil stratification at the borehole locations along with detailed soil descriptions. Variations in the soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

Fill soils were found at the surface of all boreholes.

Fill extended to the following approximate depths below the prevailing grades.

BH No.	1	2	3	4	5	6
Depth of Fill, m	0.91	0.76	0.76	1.52	1.52	1.37

The fill generally consisted of dark brown to brown silty sand to sandy silt with some to trace of topsoil/roots/gravel and occasional cobbles.

A thin layer of compact brown silty sand was encountered below the fill of borehole 3.

Native soils of greyish brown silt to sandy silt with seams/layers/pieces of shale were found underlying the fill soils of boreholes 1, 2, 4 & 5 and brown silty sand of borehole 3. Relative density of this silt/sandy silt was found to be compact to very dense and it extend3ed to the depths of 2.13m to 2.59m.

Grey shale was found underlying the above greyish brown silt/sandy silt to weathered shale. The shale bedrock was generally weathered in upper portion as it was augerable. Refusal to augering was generally encountered at depths varying from 2.13m (no. 6) to 4.88m (nos. 1 & 3) possibly due to sound bedrock and/or limestone seams/layers.

6. GROUNDWATER CONDITIONS

The boreholes were advanced using dry auguring and boreholes were found to be dry on completion of the respective soil borings. Monitoring wells were installed in boreholes 1 to 3 and ground water developed to the depth of 2.1m in borehole 3 by June 19.

Based on the above information and visual examination of the soil samples, we conclude that water bearing aquifer was not encountered within the depths penetrated by boreholes. However, perched water may be encountered from the wet seams/pockets/layers trapped inside the fill and/or native soils overlying the bedrock.

7. GEOTECHNICAL DISCUSSIONS AND RECOMMENDATIONS

7.1 General Discussion

- The proposed development will comprise the construction of industrial/warehouse building with associated parking areas and driveways.

- At the time of preparing this report, details such as building type/location; finished floor levels/grades etc. were not available.

The following sections provide general geotechnical recommendations for design and construction.

7.2 Foundation Considerations

Boreholes indicate that natural soils can be used for foundation support using conventional strip and/or spread footing foundations.

For footings placed over undisturbed native soils at/below the approximate minimum depths/elevations presented in the following table, factored geotechnical resistance at ULS of 750kPa and geotechnical reaction at SLS of 500kPa can be used for the foundation design purposes.

Existing Grade and Approximate Minimum Footing Founding Depths/Elevations

B.H. No.	EXISTING GRADE/ ELEVATION, m	APPROX. FOOTING FOUNDING	
		DEPTH, m	ELEV., m
1	99.99	1.11	98.88
2	99.49	0.96	98.53
3	100.61	1.30	99.31
4	100.66	1.72	98.94
5	100.31	2.13	98.18
6	100.20	1.57	98.63

For footings placed over grey shale encountered around the depth of 2.13m, increased soil bearing pressures of 1000kPa (SLS) and 1500kPa (ULS) can be used.

For footings founded at different levels in the vicinity of each other or located adjacent to excavated and backfilled areas, such as sewer trenches/other excavations etc., the slope of the imaginary line joining the bottom of two footings or the bottom of footing and excavation should not be steeper than 10 horizontal to 7 vertical.

The subsoil conditions at the footing founding levels should be inspected by a soils engineer from our office prior to pouring concrete, to ensure that the design soil bearing pressures are being attained.

Footings subjected to seasonal winter weather, such as exterior wall and column footings, should be founded at least 1.5m below the adjacent finished grades to prevent any damage due to frost penetration.

7.3 Earthquake Consideration

The 2012 OBC Subsection 4.1.8 stipulates that a building should be designed to meet the requirements of the Earthquake Load and Effects. The Site Classification for Seismic Site Response (Table 4.1.8.4.A) is determined from the average Standard Penetration Resistance (N_{60}) and/or the undrained shear strength (Su) of the soils within upper 30 m.

Based on the results of standard penetration tests i.e. “N” values from the geotechnical investigation, the site designation for seismic analysis applicable for the proposed building is **"Class C"**.

The seismic parameters and analysis requirements are detailed in Subsection 4.1.8 of the 2012 OBC.

7.4 Slab-On-Grade Construction

We recommend that the existing fill should be further evaluated at the time of construction. All the compressible organic/topsoil mixed fill soils (if any) should be removed from the areas to be slabbed.

Exposed subgrade should be proof rolled in the presence of our soils personnel to detect any compressible, spongy or unstable areas. If any isolated pockets of such materials are detected, they should be sub-excavated to competent subsoils and backfilled with approved inorganic materials compacted to at least 95% of their Standard Proctor Maximum Dry Density (S.P.M.D.D.) in thin layers.

Any new fill should consist of approved compactable inorganic soils, placed in thin layers (not exceeding 300mm), and each layer should be compacted to at least 95% of its S.P.M.D.D. under dry and frost free conditions.

For normal light duty slab-on-grade construction, a 200mm thick bedding layer consisting of granular 'A' or 20mm crusher run material should be specified under the slab-on-grade to serve as a moisture barrier. The bedding layer should be compacted to a minimum of 98% of its S.P.M.D.D.

7.5 Pavement Design

The functional life of a pavement depends directly on the subgrade conditions and the load carrying capacity of the pavement structure. The following minimum flexible pavement structure thicknesses are recommended.

Minimum Flexible Pavement Structure Thicknesses

PAVEMENT LAYER	COMPACTED THICKNESSES	
	LIGHT DUTY PARKING	DRIVEWAYS & HEAVY DUTY PARKING
Asphalt top course, HL-3	40mm	40mm
Asphalt base course, HL-8	40mm	60mm
Granular 'A' or 20mm crusher run limestone base	150mm	150mm
Granular 'B' or 50mm crusher run limestone sub-base	200mm	350mm

The pavement structure should also meet the minimum municipal design requirements, if any, for the proposed development.

The above thicknesses are applicable for dry and stable subgrade conditions during summer season construction only. If the construction is carried out during winter and for unstable subgrade conditions, the thicknesses of granular materials may have to be increased.

The granular base materials should conform to O.P.S.S. Form 1010 specifications and be compacted to at least 98% of their SPMDD's. Similarly, asphaltic concretes should meet the O.P.S.S. Form 1150 requirements for specified grades and be compacted to at least 97% of their Marshall Densities.

The subgrade should be prepared as described previously in subsection 7.4. Prior to placement of granular bases, the finished sub-grade should be contoured to eliminate depressions and sloped at a minimum of 2% towards the catch basins or perimeter ditches to facilitate drainage of subgrade and base materials.

Water should not be allowed to accumulate at/near the pavement edges. The importance of sub-grade drainage and regular maintenance and repairs cannot be over-emphasized.

7.6 Excavation

The excavation of the soil material is expected to be achieved easily using a backhoe. Temporary excavations for footings or underground services must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA).

According to OHSA, if the excavation is deeper than 1.2 m, the excavation sides should be sloped. The slope of the sides depends on the type of the excavated materials.

Loose to compact fill soils encountered below the ground surface up to the depth of 2.0m± may be classified as **Type 3 Soil** in moist condition. In accordance with the OHSA, the excavation side slope for this type of soil is 1H:1V from the bottom of the trench or flatter. Very dense greyish brown silt/sandy silt/weathered shale can be considered as **Type 2 Soil**.

Presence of wet seams/layers/pockets may require flattening of the slopes.

8. GENERAL CONSIDERATIONS

This report is limited in scope to those items specifically referenced in the text. No other testing and design calculations have been performed except as specifically reported.

The discussions and recommendations presented in this report are intended for the sole guidance of the client named and the design consultants. It should not be relied upon for any other purpose.

The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction.

The fact that localised variations in the subsurface conditions may be present between and beyond the boreholes and that those conditions may be significantly different from the general description provided for design purposes should be understood.

Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soils and the potential reuse of these soils on/off Site. Contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

It is strongly urged that Fisher be contacted to provide assistance in the interpretation of the borehole records by anyone undertaking work on/or below the ground surface at this site prior to this work being carried out.

The client expressly agrees that it has entered into this agreement with Fisher, both on its own behalf and as agent on behalf of its employees and principals.

The client expressly agrees that Fisher's employees and principals shall have no personal liability to the client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Fisher's employees or principals in their personal capacity.

9. CLOSING

We trust that the foregoing information is sufficient for your present needs and will be pleased to review the contents of this report in greater detail should you so require. Should you require our services further in this regard, please do not hesitate to contact our office.

APPENDIX A – SITE PLAN

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NORTH

LEGEND

- MONITORING WELL
- BOREHOLE
- SITE BOUNDARY
- BENCHMARK

PROJECT NAME AND ADDRESS

GEOTECHNICAL INVESTIGATION AND PHASE II ESA

3455 HAWTHORNE ROAD, OTTAWA, ONTARIO

FIGURE 1:

SITE PLAN WITH BOREHOLE AND MONITORING WELL LOCATIONS

PROJECT NO.	SHEET NO.
FE-P 19-9555	1
DATE: JUNE 2019	
SCALE: AS SHOWN	

APPENDIX B – LOG OF BOREHOLES

FISHER ENVIRONMENTAL LTD.

LOG OF BOREHOLE NO. BH1(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)		99.99			
0	0	FILL: dark brown to greyish brown silty sand, trace to some gravel, some to trace of topsoil/roots, moist.			1	SS	9
2							
		0.91m		99.08	2	SS	>100
4	1	GREYISH BROWN SILT: some clay, seam/layer/pieces of shale, moist, very dense.					
6					3	SS	>100
	2	2.13m		97.86			
8		GREY SHALE: weathered in upper portion, dry, hard.			4	SS	>100
10	3						
					5	SS	>100
12							
	4						
14							
16		4.88m		95.11			
	5	End of Borehole					
18							
		Refusal to augering at 4.88m,					
20	6	Monitoring well installed at 4.88m.					
22							
	7	Dry on June 19, 2019.					
24							
26	8						
28							
	9						
30							
32	10						

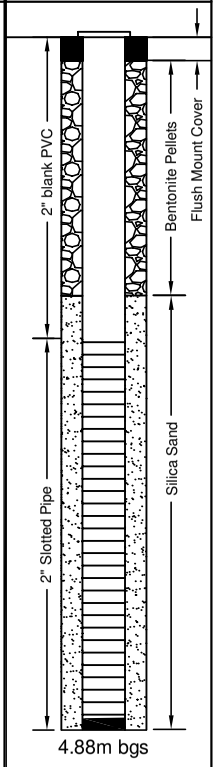
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✤ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ○ 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



FISHER ENVIRONMENTAL LTD.

LOG OF BOREHOLE NO. BH2(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)		99.49			
0	0	FILL: dark brown to greyish brown silty sand, trace to some gravel, some to trace of topsoil/roots, moist.			1	SS	11
2		0.76m		98.73			
4	1	GREYISH BROWN SILT: some clay, seam/layer/pieces of shale, moist, very dense.			2	SS	>100
6					3	SS	>100
	2	2.13m		97.36			
8		GREY SHALE: weathered in upper portion, dry, hard.			4	SS	>100
10	3				5	SS	>100
12							
14	4	4.57m		94.92			
16	5	End of Borehole					
18		BH dry on completion.					
20	6	Monitoring well installed at 4.57m.					
22		Dry on June 19, 2019.					
24	7						
26	8						
28							
30	9						
32	10						

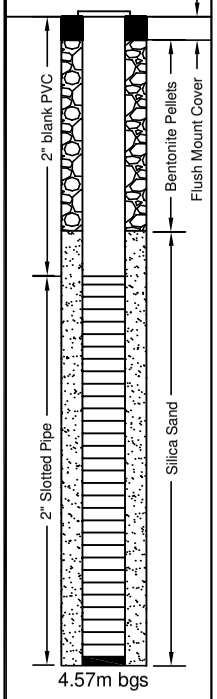
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ○ 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



FISHER ENVIRONMENTAL LTD.

LOG OF BOREHOLE NO. BH3(MW) SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)		100.61			
0	0	FILL: dark brown to greyish brown silty sand, trace to some gravel, some to trace of topsoil/roots, moist.			1	SS	17
		0.76m		99.85			
2		BROWN TO GREYISH BROWN SILTY SAND: trace of gravel, moist, compact.			2	SS	12
4	1	1.22m		99.39			
		GREYISH BROWN SILT: some clay. seam/layer/pieces of shale, moist, very dense.			3	SS	65
6	2	2.13m		98.48			
8		GREY SHALE: weathered in upper portion, dry, hard.			4	SS	>100
10	3				5	SS	>100
12							
14	4						
16		4.88m		95.73			
	5	End of Borehole					
18							
20	6	Monitoring well installed at 4.88m.					
		WL at 2.1m on June 19, 2019.					
22	7						
24							
26	8						
28							
30	9						
32							
	10						

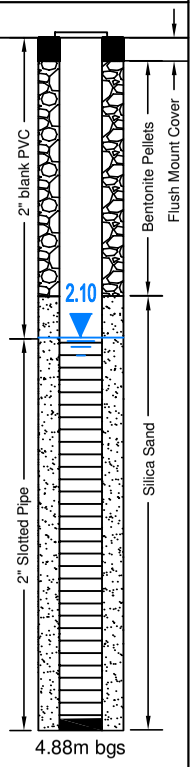
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ○ 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



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LOG OF BOREHOLE NO. BH4 SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)		100.66			
0	0	FILL: dark brown silty sand, some gravel, occasional cobbles, some to trace of topsoil, roots, moist.			1	SS	26
		0.76m		99.90			
4	1	FILL: greyish brown silt to sandy silt, trace topsoil/roots, pieces of shale, moist.			2	SS	16
		1.52m		99.14			
6	2	GREYISH BROWN TO BROWN GREY SILT TO SANDY SILT: some clay, pieces of shale, moist, compact to dense.			3	SS	45
8		2.59m		98.07	4	SS	70
10	3	GREY SHALE: seam of limestone, weathered in upper portion, dry, hard.			5	SS	>100
		3.35m		97.31			
12	4	End of Borehole					
14		Refusal to augering at 3.35m.					
16	5	BH dry on completion.					
18							
20	6						
22							
24	7						
26	8						
28							
30	9						
32							
	10						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ○ 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION

FISHER ENVIRONMENTAL LTD.

LOG OF BOREHOLE NO. BH5 SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

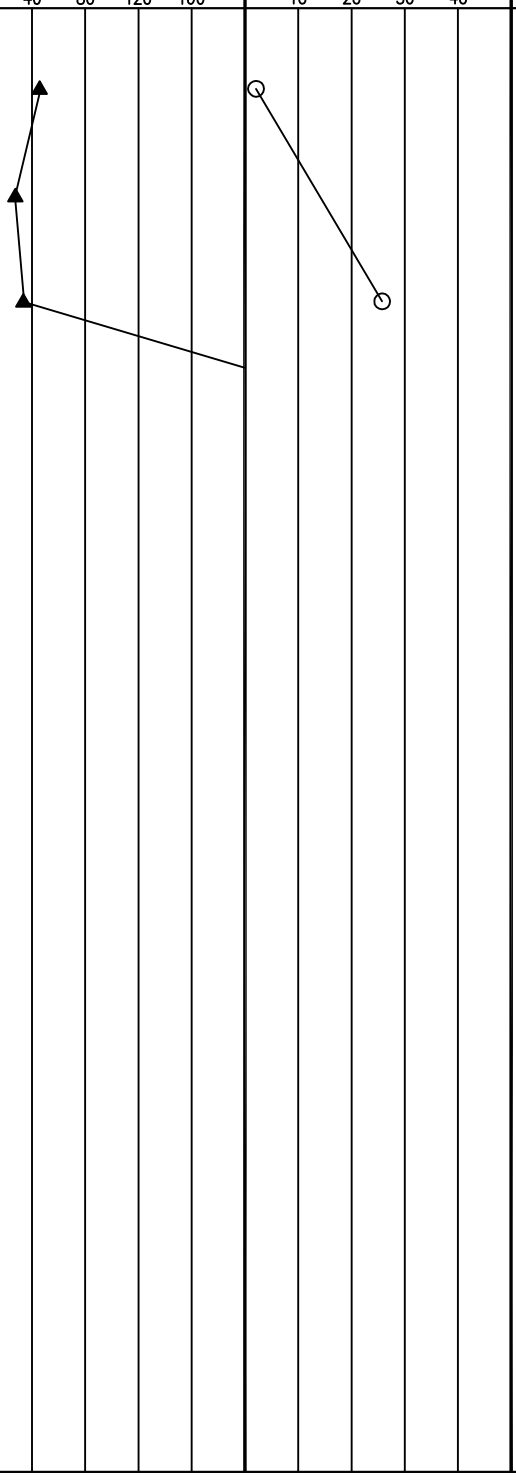
PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)		100.31			
0	0	FILL: greyish brown sand, some silt & gravel, moist.			1	SS	23
0.61m				99.70			
2	1	FILL: greyish brown silt to sandy silt, trace topsoil/roots, pieces of shale, moist.			2	SS	13
1.52m				98.79			
4	2	GREYISH BROWN TO BROWN GREY SILT TO SANDY SILT: some clay, pieces of shale, moist, compact.			3	SS	16
2.13m				98.18			
2.44m		GREY SHALE: dry, hard.		97.87	4	SS	>100
8		End of Borehole					
10	3	Refusal to augering at 2.44m.					
12		BH dry on completion.					
14	4						
16	5						
18							
20	6						
22	7						
24							
26	8						
28							
30	9						
32	10						



PIEZOMETER OR WELL CONSTRUCTION

FISHER ENVIRONMENTAL LTD.

LOG OF BOREHOLE NO. BH6 SHEET. 1 of 1

PROJECT NO.: FE-P 19-9555

PROJECT NAME: Geotechnical Investigation

LOCATION: 3455 Hawthorne Road, Ottawa, ON

DRILLING METHOD: Diedrich D-50

DRILLING DATE: 18 June 2019

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES P.I.D. Reading	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ / SHEAR STRENGTH (Kpa) ✚	VAPOUR READING (ppm) □ / MOISTURE CONTENT (%) ○	PIEZOMETER OR WELL CONSTRUCTION
		GROUND SURFACE (m asl)		100.20						
0	0	FILL: dark brown silty sand, some gravel, occasional cobbles, some to trace of topsoil, roots, occasional cobbles, moist.			1	SS	18			
2										
4	1				2	SS	57			
		1.37m		98.83						
6	2	GREYISH BROWN SILT TO WEATHERED SHALE: some clay, moist, hard.			3	SS	>100		○	
		2.13m		98.07						
8		End of Borehole								
10	3	Refusal to augering at 2.13m.								
12		BH dry on completion.								
14	4									
16	5									
18										
20	6									
22	7									
24										
26	8									
28										
30	9									
32	10									

PENETRATION TESTING (SPT) ▲ / SHEAR STRENGTH (Kpa) ✚: 20 40 60 80 / 40 80 120 160

VAPOUR READING (ppm) □ / MOISTURE CONTENT (%) ○: 20 40 60 80 / 10 20 30 40