patersongroup **memorandum**

consulting engineers

re: **Groundwater Review**
Proposed Residential Development
The Ridge (Brazeau Pit) - Borrisokane Road - Ottawa

to: Caivan Communities - **Mr. Andrew Finnson** - afinnson@caivan.com

date: October 9, 2019

file: PG4504-MEMO.08

Paterson Group (Paterson) has prepared the current memorandum, based upon the request at the City of Ottawa (City) meeting (October 4, 2019 at Ottawa City Hall), to provide clarification on the development extents within the local groundwater regime at the aforementioned site.

1.0 Background

The proposed development is located to the east of the Trail Road Landfill facility and maintains a buffer of no less than 500 m to the proposed residential area from the Trail Road Landfill property boundary. The buffer includes Highway 416, Borrisokane Road and some proposed commercial/industrial property. The property to the south is mostly undeveloped land (previously farmland) with proposed development to the southeast and existing development to the east. The property to the north is proposed to have future development.

The meeting with the City, Trail Road Landfill representatives, and Dillon Consulting Engineering indicated the main concern is that the long-term groundwater flow direction may become influenced by the proposed development in the area.

2.0 Geotechnical Summary

Paterson has completed a field program on site consisting of a geotechnical investigation and a fill delineation program. See Paterson Drawing PG4504-1 Rev. 3 - Test Hole Location Plan (Brazeau Pit).

The Brazeau Pit program consisted of 12 boreholes. The depth of investigation extended to 5.9 m below ground surface (bgs) for the Brazeau Pit.

Brazeau Pit (Subject Site)

The material to the east of the 500 m buffer in the proposed residential area consist of non-cohesive soils within the depth of investigation (up to 5.9 m below ground surface (bgs)) for BH 1 to BH 8. BH 9 also encountered only non-cohesive soils. BH 10 to BH 12 encountered a discontinuous layer of silty clay that ranged in thickness from 0.8 m at BH 10, 1.53 m at BH 12 to 2.89 m at BH 11. The elevations of the silty clay layer indicate the layer is sloping downward to the west to northwest.

BH 9 is within the area of the identified discontinuous silty clay layer, but did not encounter cohesive soils to a depth of 5.9 m bgs (96.2 m elevation). Cohesive soils may be encountered at depth, below the extent of the current investigation.

Groundwater Summary

The groundwater elevations at the borehole locations within the proposed residential development was encountered at elevations ranging between 98.5 to 95.5 m with higher groundwater elevations on the south portion of the property. One reading within the shallow aquifer to the west was at 100.6 m. Several piezometers were blocked/damaged at the time of measurement in the field and are noted in the Table 1 - Summary of Groundwater Level Readings (Brazeau Pit) attached to the memo. The piezometers that were blocked have approximate groundwater elevations provided based upon the field observations at the time of drilling.

3.0 Preliminary Development Plans

The proposed development will be municipally serviced with homes to consist of townhomes and singles/semi-detached residential. The municipal services will also include a distributed infiltration system known as the Etobicoke Exfiltration System (EES). It is expected that the EES will be placed on local roadways to allow for the infiltration of clean captured water, whereas arterial roadways will direct their flows to a SWMP or treatment unit prior to discharge to the Jock River.

Service Detail Summary

The municipal site services are anticipated to have the shallowest depths on the south side of the Brazeau Pit property with depth increasing to the north.

The EES system is typically installed below the elevation of the municipal storm sewer and above the sanitary sewer. The EES system is intended to be installed above the groundwater table to allow for re-infiltration of clean captured stormwater from local roadways. The EES system is not expected to encounter the groundwater elevation within the future designs.

The re-infiltration of clean captured water through the EES system is used to allow precipitation to be infiltrated as close to the source as possible. It is the intention of the system to mimic the pre-development conditions where possible. The alteration of the areal surface infiltration will provide some differential in flow conditions as the proposed infiltration will be in linear sources. However, the overall differential in the water budget system is intended to maintain the pre-development values. The depth of the EES may allow for the potential infiltration to reach a lower elevation faster than the surrounding area due to the piped system located below the storm sewer service as opposed to standard infiltration at ground surface.

The preliminary elevation of maximum sanitary service inverts in the south half of the Brazeau Pit area range approximately from 104.5 to 98.0 m. The sanitary service inverts in the northern portion of the subject site range approximately from 98.0 to 95.9 m.

The trench backfilling materials are anticipated to be completed in compliance with the most recent Material Specifications and Standard Detail Drawings from the City of Ottawa.

The pipe bedding for sewer and water pipes placed on a relatively dry, undisturbed subgrade surface should consist of at least 150 mm of OPSS Granular A material. If the bedding is located within a layer of firm grey silty clay, 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, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95%of its SPMDD.

The 95% SPMDD compaction requirement will typically reduce the hydraulic conductivity of the Granular A material to below the materials adjacent to the service trench with the exception of the discontinuous silty clay layer. Servicing areas that encounter silty clay should provide clay dykes to reduce potential alterations of the existing groundwater flow regime, however, it is expected that the silty clay may be encountered in limited locations.

It is expected that the proposed site services will be constructed within the groundwater table in certain portions of the subject site. The site services are not anticipated to alter the groundwater regime through alteration of groundwater flow directions.

Proposed Underside of Footing Elevation

The preliminary proposed underside of footing (USF) elevation ranges were provided by DSEL. The USF values in the south portion of the Brazeau Pit site ranged from 109 to 102 m. The northern portion of the Brazeau Pit site has values from 99 to 102 m. See Paterson Drawing PG4504-1 Rev.3 for a comparison of the proposed USF/Service elevations values adjacent to the test holes within the subject site.

All of the preliminary proposed USF values are well above the currently measured groundwater elevations encountered in proximity to the proposed building locations.

4.0 Inferred Groundwater Flow Directions

The groundwater flow is inferred to have different flow directions dependent upon the aquifer reviewed. The shallow aquifer overlying the discontinuous silty clay layer on the west side of the subject site is expected to transmit flows to the west to northwest based upon gravity flow while following the silty clay layer surface. The silty clay layer surface was observed to slope downward to the west toward the Trail Road landfill. Therefore, the shallow aquifer in the west portion of the site is aiding in limiting the movement of the potential leachate plume toward the subject site.

The aquifer below and to the east of the discontinuous silty clay layer shows higher groundwater elevations to the south with a general trend in a northerly direction. This northerly trend of the aquifer is consistent with observations noted during the Hydrogeological Study completed as part of the Barrhaven South CDP (Paterson Group - Existing Conditions Report - Proposed Barrhaven South Urban Expansion Area - Community Design Plan - 2017). The groundwater contours presented in the Dillon Consulting Report - Trail Road Landfill - Monitoring and Operating Program (2018) attached indicate groundwater flow toward the north and northwest direction. Therefore, the current groundwater data collected for the area does not show a connection between the Trail Road Landfill leachate plume and the subject site. The proposed development at the subject site will not change the groundwater flow direction from currently observed patterns as reported by Dillon Consulting (Trail Road Landfill Monitoring Report 2018) and Paterson (Existing Conditions Report - BSUEA - CDP - 2017).

Based on our review, the groundwater flow directions in the area of the Trail Road Landfill and the subject site will not be altered by the proposed development of the subject site.

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
October 9, 2019
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Michael S. Killam, P.Eng.

David J. Gilbert, P.Eng.

Attachments

Drawing PG4504-1 Rev.3 - Test Hole Location Plan (Brazeau Pit)

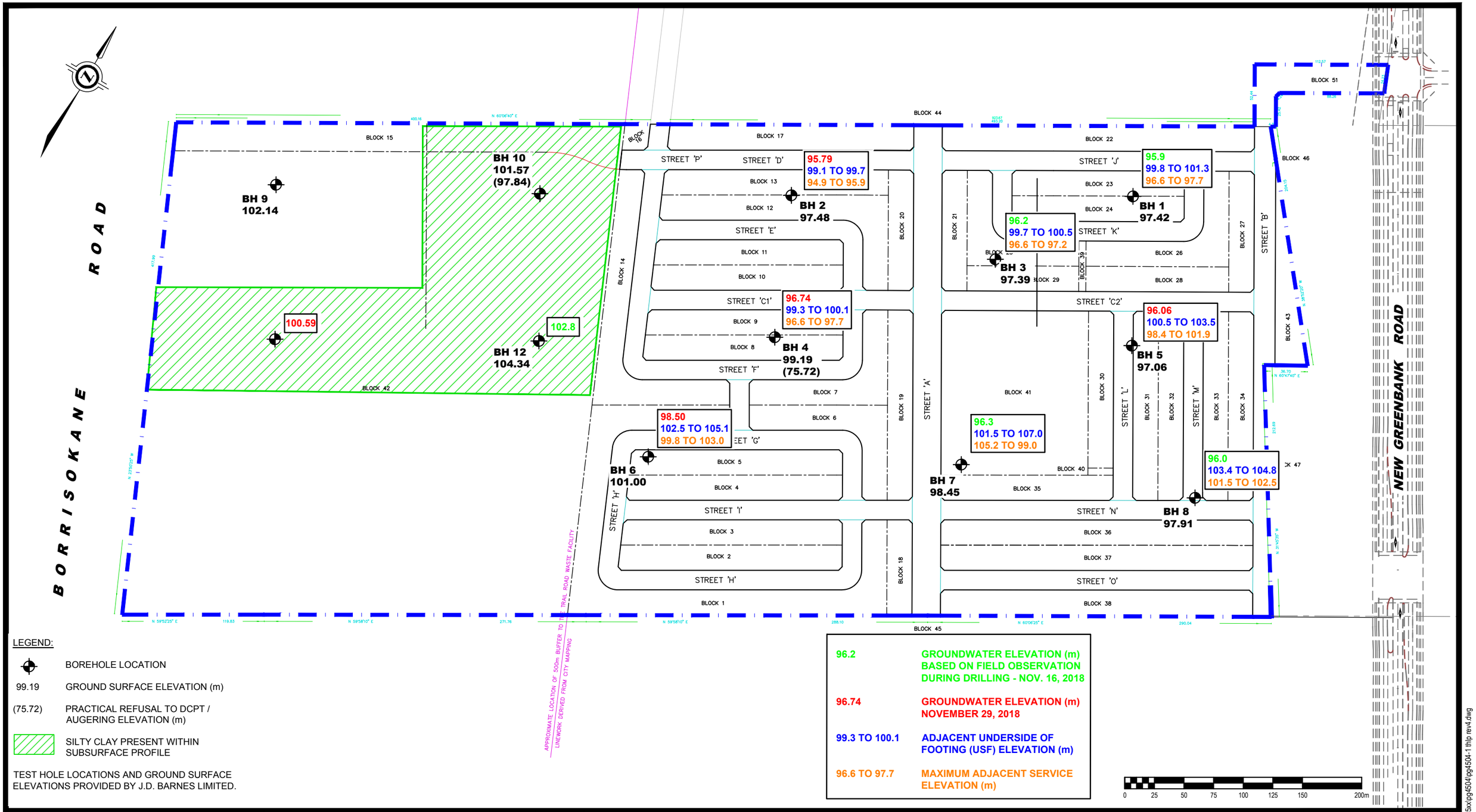
PG4504 - Soil Profile and Test Data

Groundwater Summary Table - Table 1

Dillon Consulting - Trail Road Landfill - Monitoring Report - Figure 3-5

Dillon Consulting - Trail Road Landfill - Monitoring Report - Figure 3-6

Dillon Consulting - Trail Road Landfill - Monitoring Report - Figure 3-7



LEGEND:

- BOREHOLE LOCATION
- 99.19 GROUND SURFACE ELEVATION (m)
- (75.72) PRACTICAL REFUSAL TO DCPT / AUGERING ELEVATION (m)
- SILTY CLAY PRESENT WITHIN SUBSURFACE PROFILE

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY J.D. BARNES LIMITED.

96.2	GROUNDWATER ELEVATION (m) BASED ON FIELD OBSERVATION DURING DRILLING - NOV. 16, 2018
96.74	GROUNDWATER ELEVATION (m) NOVEMBER 29, 2018
99.3 TO 100.1	ADJACENT UNDERSIDE OF FOOTING (USF) ELEVATION (m)
96.6 TO 97.7	MAXIMUM ADJACENT SERVICE ELEVATION (m)

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NO.	REVISIONS	DATE	INITIAL
4	UPDATED TO LATEST BASE PLAN	09/10/2019	MDJGK
3	USF, SERVICE AND GROUNDWATER ELEVATIONS ADDED	10/08/2019	MK
2	UPDATED TO LATEST BASE PLAN	10/01/2019	DJG
1	UPDATED TO LATEST BASE PLAN	09/01/2019	FA

CAIVAN BRAZEAU DEVELOPMENT CORPORATION

GEOTECHNICAL INVESTIGATION
PROP. RESIDENTIAL DEVELOPMENT - BORRISOKANE ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:6000	Date: 11/2018
Drawn by: RCG	Report No.: PG4504-1
Checked by: DJG	Dwg. No.: PG4504-1
Approved by: DJG	Revision No.: 4

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

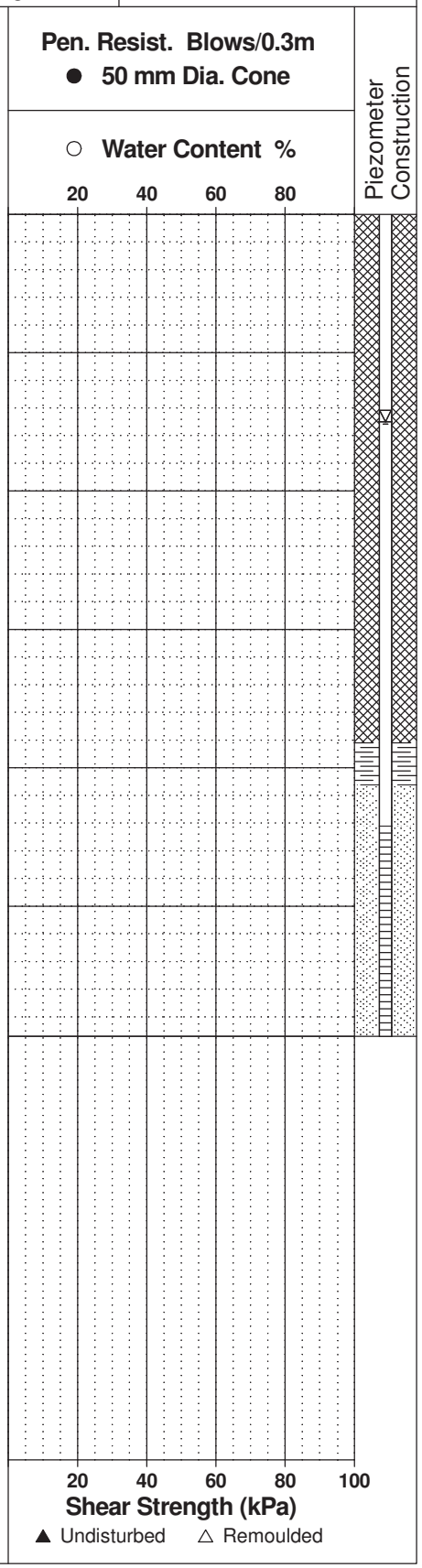
FILE NO. PG4504

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.42
Compact, brown **SILTY SAND,** trace gravel		AU	1				
0.76							
		SS	2	75	18	1	96.42
		SS	3	54	13	2	95.42
Compact, brown **SILTY SAND**		SS	4	58	16		
		SS	5	50	17	3	94.42
		SS	6	71	11	4	93.42
- some gravel by 4.9m depth							
- very dense by 5.3m depth		SS	7	71	18	5	92.42
		SS	8	88	57		
5.94							
End of Borehole							
(GWL @ 1.5m depth based on field observations)							
(Piezometer dry and blocked at 1.91m depth - Nov. 29, 2018)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.48
Brown **SILTY SAND** with organics		AU	1				
0.30							
		SS	2	96	18	1	96.48
		SS	3	83	11	2	95.48
Compact to loose, brown **SILTY SAND**		SS	4	62	12	3	94.48
		SS	5	67	11		
		SS	6	62	8	4	93.48
		SS	7	71	17	5	92.48
		SS	8	50	7		
5.94							
End of Borehole							
(GWL @ 1.0m depth based on field observations)							
(GWL @ 1.69m - Nov. 29, 2018)							

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

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

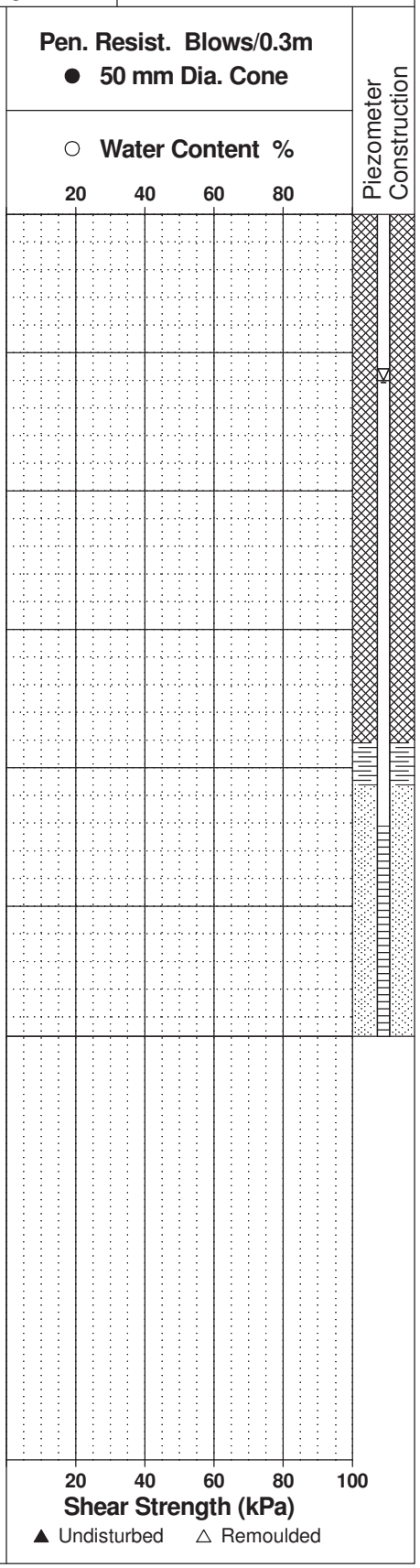
FILE NO. PG4504

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** November 20, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.39
Brown **SILTY SAND,** trace gravel, organics — 0.30		AU	1				
		SS	2	67	16	1	96.39
Compact to dense, brown **SILTY SAND**		SS	3	46	11	2	95.39
- silt content increasing with depth		SS	4	58	12		
		SS	5	50	4	3	94.39
4.27		SS	6	83	42	4	93.39
GLACIAL TILL: Dense to compact, brown silty sand with gravel, cobbles and boulders		SS	7	62	30	5	92.39
5.94		SS	8	54	28		
End of Borehole							
(GWL @ 1.2m depth based on field observations)							
(Piezometer dry and blocked at 0.56m depth - Nov. 29, 2018)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

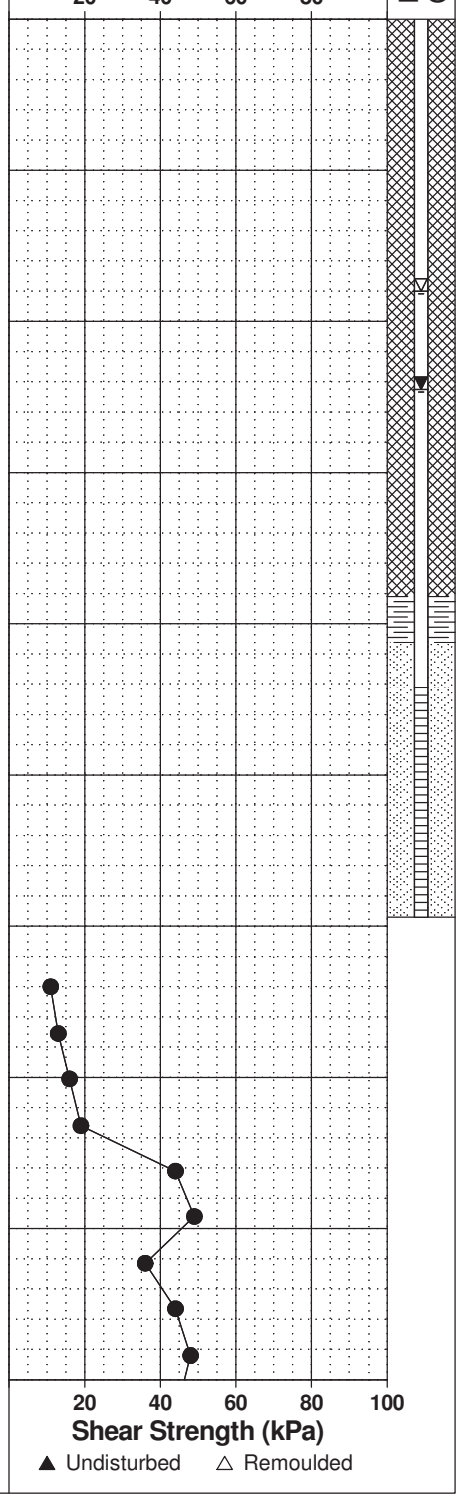
FILE NO. PG4504

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** November 19, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.19
		AU	1				
Dense to very dense, brown **SILTY SAND** with gravel and cobbles		SS	2	67	42	1	98.19
		SS	3	38	60	2	97.19
2.29							
Compact, brown **SILTY SAND** - silt content increasing with depth		SS	4	79	14		
2.90						3	96.19
		SS	5	58	28		
		SS	6	58	26	4	95.19
Compact, brown **SILTY SAND**							
		SS	7	62	29	5	94.19
		SS	8	62	26		
5.94						6	93.19
Dynamic Cone Penetration Test commenced at 5.94m depth.						7	92.19
						8	91.19
						9	90.19



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

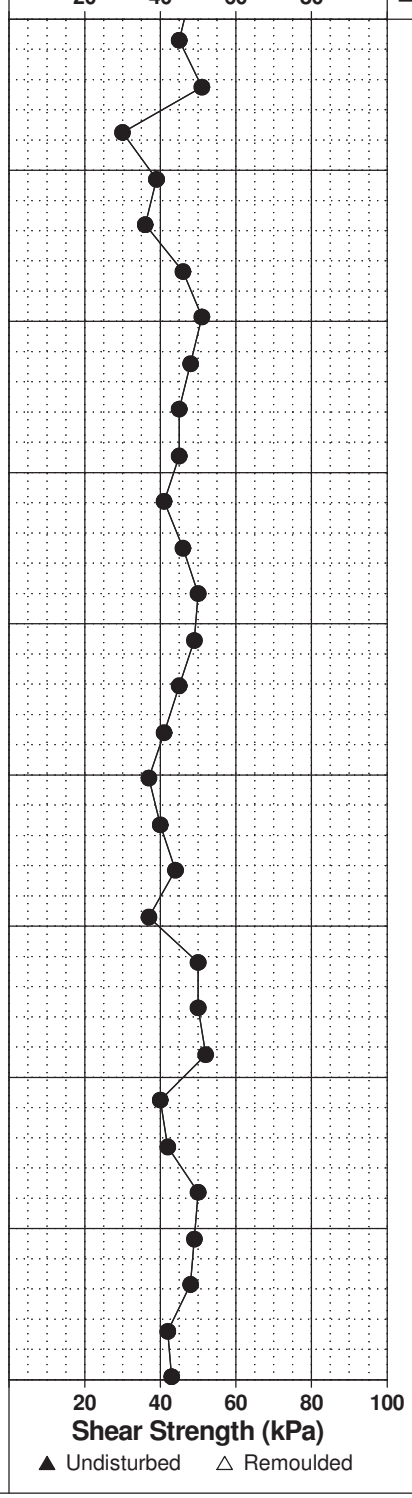
FILE NO. PG4504

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** November 19, 2018

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						9	90.19		
						10	89.19		
						11	88.19		
						12	87.19		
						13	86.19		
						14	85.19		
						15	84.19		
						16	83.19		
						17	82.19		
						18	81.19		



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
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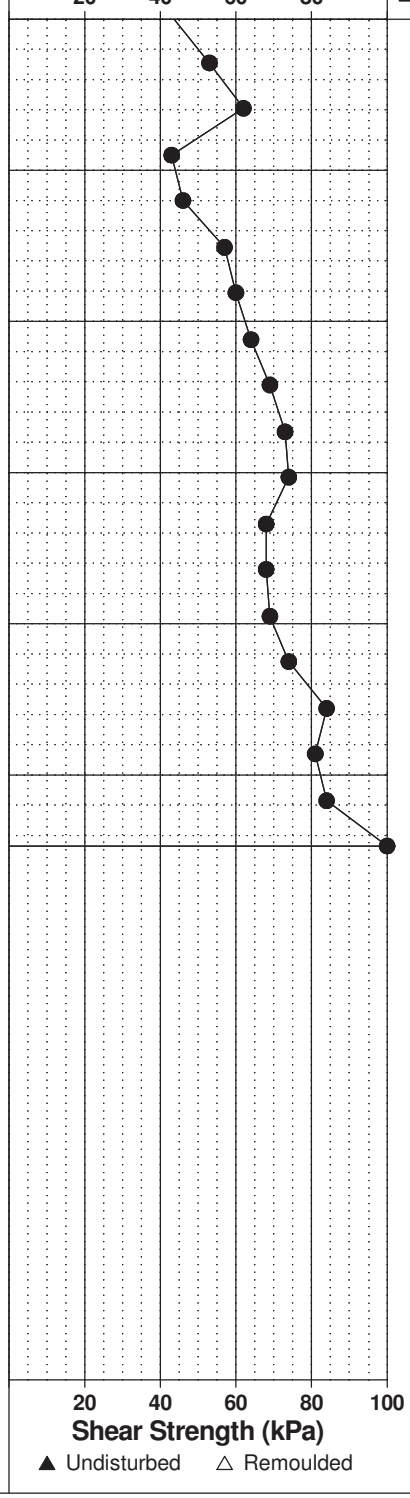
REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** November 19, 2018

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						18	81.19		
						19	80.19		
						20	79.19		
						21	78.19		
						22	77.19		
						23	76.19		
23.47									
End of Borehole									
Practical DCPT refusal at 23.47m depth									
(GWL @ 1.8m depth based on field observations)									
(GWL @ 2.45m - Nov. 29, 2018)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.06
Compact, brown **SILTY SAND,** trace gravel and organics		AU	1				
		SS	2	71	18	1	96.06
1.37							
		SS	3	54	9	2	95.06
Compact, brown **SILTY SAND**		SS	4	62	12		
3.05						3	94.06
		SS	5	62	20		
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders		SS	6	33	15	4	93.06
- silty sand seam at 4.75m depth		SS	7	58	11	5	92.06
		SS	8	42	24		
5.94							
End of Borehole							
(GWL @ 1.4m depth based on field observations)							
(GWL @ 1.00m - Nov. 29, 2018)							

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

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** November 19, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.00
Compact, brown **SILTY SAND,** trace gravel		AU	1				
0.84							
		SS	2	75	16	1	100.00
		SS	3	83	24	2	99.00
		SS	4	75	19		
Compact, brown **SILTY SAND**						3	98.00
		SS	5	67	15		
		SS	6	62	14	4	97.00
		SS	7	71	11	5	96.00
		SS	8	67	14		
5.94							
End of Borehole							
(GWL @ 2.9m depth based on field observations)							
(GWL @ 2.50m - Nov. 29, 2018)							

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

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** November 19, 2018

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	98.45		
Brown **SILTY SAND,** trace gravel and organics 0.30		AU	1						
Dense, brown **SILTY SAND,** some gravel		SS	2	67	32	1	97.45		
1.52		SS	3	71	30	2	96.45		
		SS	4	62	17				
Compact, brown **SILTY SAND**		SS	5	96	19	3	95.45		
		SS	6	50	6	4	94.45		
- grey by 4.6m depth		SS	7	54	13	5	93.45		
		SS	8	46	7				
5.94									
End of Borehole									
(GWL @ 2.2m depth based on field observations)									
(Piezometer dry and blocked at 1.55m depth - Nov. 29, 2018)									

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** November 20, 2018

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	97.91		
FILL: Brown silty sand with gravel and organics 0.30		AU	1						
		SS	2	54	48	1	96.91		
		SS	3	62	41	2	95.91		▽
Dense to compact, brown **SAND and GRAVEL,** some cobbles and boulders		SS	4	42	21	3	94.91		
- grey by 3.8m depth		SS	6	71	26	4	93.91		
		SS	7	58	28	5	92.91		
		SS	8	71	25				
5.94 End of Borehole									
(GWL @ 1.9m depth based on field observations)									

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

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.14
Brown **SILTY SAND** with organics		AU	1				
0.30							
		SS	2	79	10	1	101.14
		SS	3	71	15	2	100.14
Compact, brown **SILTY SAND**		SS	4	71	22		
		SS	5	67	14	3	99.14
		SS	6	67	15	4	98.14
						5	97.14
		SS	7	79	17		
5.94							
End of Borehole							
(GWL @ 1.5m depth based on field observations)							
(Piezometer dry and blocked at 1.79m depth - Nov. 29, 2018)							

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

20 40 60 80

Piezometer Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** November 20, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.57
Brown **SILTY SAND,** trace gravel and organics 0.30		AU	1				
Compact, brown **SILTY SAND**		SS	2	83	16	1	100.57
1.52							
Brown **SILTY CLAY,** some sand		SS	3	79	2	2	99.57
2.29							
GLACIAL TILL: Very dense, brown silty sand with gravel, cobbles, boulders and clay		SS	4	83	52	3	98.57
3.73							
End of Borehole							
Practical refusal to augering on possible large boulder at 3.73m depth							
(GWL @ 1.5m depth based on field observations)							
(Piezometer dry and blocked at 1.15m depth - Nov. 29, 2018)							

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

20 40 60 80

Piezometer Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

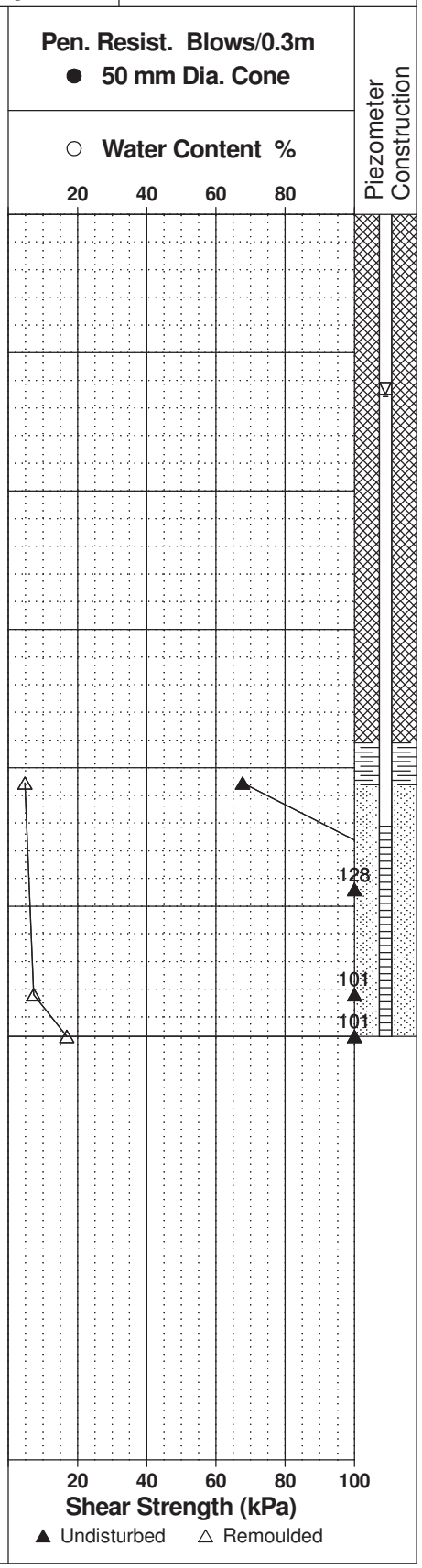
FILE NO. PG4504

REMARKS

HOLE NO. BH11

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.59
Brown **SILTY SAND** with gravel and organics 0.30		AU	1				
Compact to loose, brown **SILTY SAND**		SS	2	75	19	1	99.59
		SS	3	96	28	2	98.59
		SS	4	50	8		
3.05						3	97.59
Brown **SILTY CLAY** with sand		SS	5	75	2		
3.81						4	96.59
		SS	6	83	P		
Stiff to very stiff, grey **SILTY CLAY**						5	95.59
5.94							
End of Borehole							
(GWL @ 1.3m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Borrisokane Road
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Ltd.

FILE NO. PG4504

REMARKS

HOLE NO. BH12

BORINGS BY CME 55 Power Auger **DATE** November 16, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.34
Brown **SILTY SAND** with gravel		AU	1				
0.30							
Compact, brown **SILTY SAND**		SS	2	50	10	1	103.34
1.52							
		SS	3	96	2	2	102.34
Brown **SILTY CLAY,** some sand		SS	4	96	P		
3.05						3	101.34
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	5	79	8		
3.66							
		SS	6	96	40	4	100.34
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles and boulders		SS	7	83	75	5	99.34
		SS	8	67	50+		
5.94							
End of Borehole							
(GWL @ 1.5m depth based on field observations)							
(Piezometer dry and blocked at 4.73m depth - Nov. 29, 2018)							

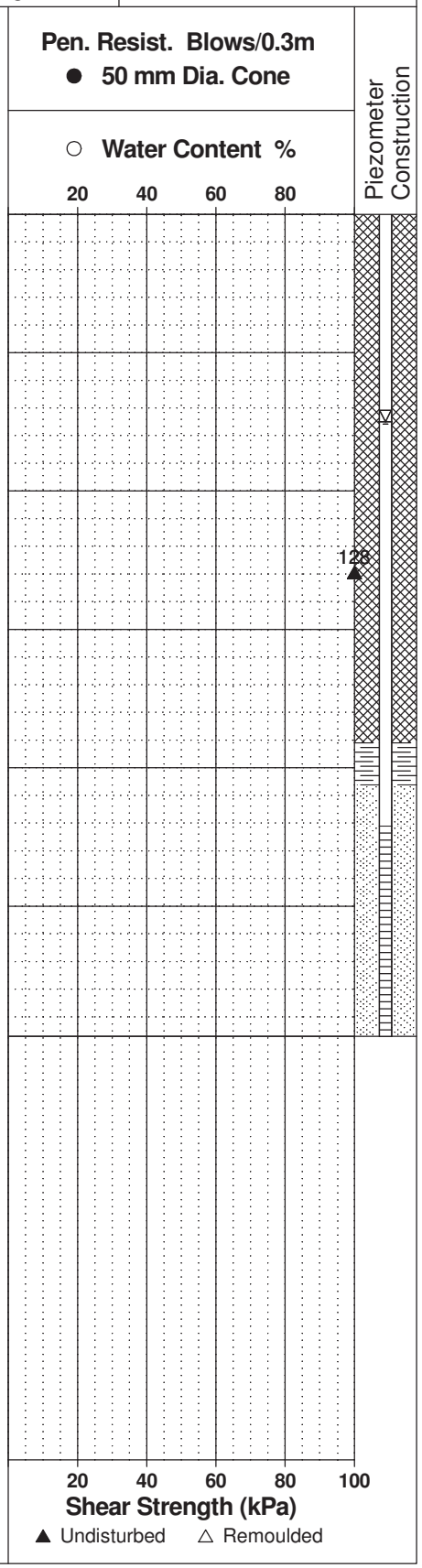
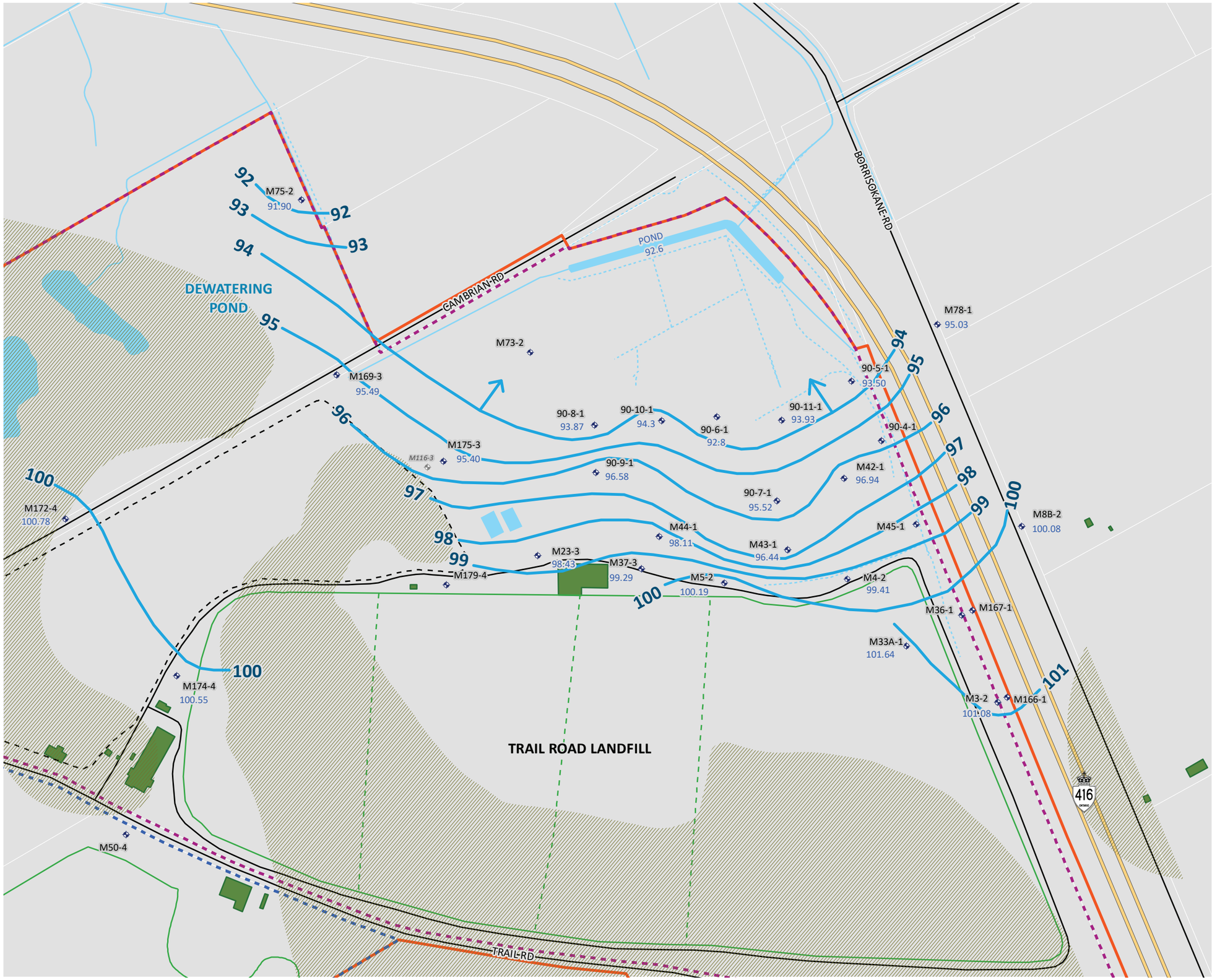


Table 1 - Summary of Groundwater Level Readings (Brazeau Pit)				
Borehole Number	**Ground Elevation (m)**	**Groundwater Levels (m)**		**Recording Date**
		Depth	**Elevation**	
BH 1	97.42	1.91	95.51	November 29, 2018
BH 2	97.48	1.69	95.70	November 29, 2018
BH 3	97.39	Blocked	n/a	November 29, 2018
BH 4	99.19	2.45	96.74	November 29, 2018
BH 5	97.06	1.00	96.06	November 29, 2018
BH 6	101.00	2.50	98.50	November 29, 2018
BH 7	98.45	Blocked	n/a	November 29, 2018
BH 9	102.14	Blocked	n/a	November 29, 2018
BH 10	101.57	Blocked	n/a	November 29, 2018
BH 11	100.59	0.00	100.59	November 29, 2018
BH 12	104.34	Blocked	n/a	November 29, 2018



TRAIL ROAD LANDFILL SITE

2018 MONITORING AND OPERATING PROGRAM

2018 INTERPRETED POTENTIOMETRIC SURFACE AND GROUNDWATER FLOW IN THE SHALLOW AQUIFER

FIGURE 3-5

- Approximate City of Ottawa Property Limits
- Future Stage 5 Area
- Landfill Footprint
- Roadway
- Provincial Highway
- Surface Water
- Surface Water (Seasonal)
- Waterbody
- Parcel Boundary
- Building
- Interpreted Groundwater Flow Direction
- 99.32 M5-2 Monitoring Well Location and Shallow Aquifer Water Level Elevation (m)
- Decommissioned Monitoring Well
- Interpreted Area Not Underlain by Clay
- Trail Road Landfill Site Boundary
- Nepean Landfill Site Boundary

Notes:
1. This drawing is to be read in conjunction with accompanying report
2. Monitoring wells associated with both the Nepean and Trail Road Landfills are shown

0 50 100 200 m SCALE 1:6,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, CITY OF OTTAWA

MAP CREATED BY: LK
MAP CHECKED BY: MM
MAP PROJECTION: NAD 1983 UTM Zone 18N

DILLON CONSULTING

PROJECT: 18-7333
STATUS: DRAFT
DATE: 2019-05-27

FILE LOCATION: I:\GIS\187333 - Trail Monitoring Program\MXD\Trail\Trail_Fig3-5.mxd

TRAIL ROAD LANDFILL SITE

2018 MONITORING AND OPERATING PROGRAM

2018 INTERPRETED POTENTIOMETRIC SURFACE AND GROUNDWATER FLOW IN THE UPPER/MIDDLE DEEP AQUIFER

FIGURE 3-6

- Approximate City of Ottawa Property Limits
- Future Stage 5 Area
- Landfill Footprint
- Roadway
- Provincial Highway
- Surface Water
- Surface Water (Seasonal)
- Waterbody
- Building
- Parcel Boundary
- Interpretted Groundwater Flow Direction
- 99.32 M5-2 Monitoring Well Location and Upper/Middle Aquifer Water Level Elevation (m)
- Decommissioned Monitoring Well
- Trail Road Landfill Site Boundary
- Nepean Landfill Site Boundary

Notes:
1. This drawing is to be read in conjunction with accompanying report
2. Monitoring wells associated with both the Nepean and Trail Road Landfills sites are shown

0 25 50 100 m

SCALE 1:9,500

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, CITY OF OTTAWA

MAP CREATED BY: LK
MAP CHECKED BY: MM
MAP PROJECTION: NAD 1983 UTM Zone 18N

DILLON CONSULTING

PROJECT: 18-7333
STATUS: DRAFT
DATE: 2019-05-27

FILE LOCATION: I:\GIS\187333 - Trail Monitoring Program\MXD\Trail\Trail_Fig3-6.mxd

TRAIL ROAD LANDFILL SITE

2018 MONITORING AND OPERATING PROGRAM

2018 INTERPRETED POTENTIOMETRIC SURFACE AND GROUNDWATER FLOW IN THE LOWER DEEP AQUIFER

FIGURE 3-7

- Approximate City of Ottawa Property Limits
- Future Stage 5 Area
- Landfill Footprint
- Roadway
- Provincial Highway
- Surface Water
- Surface Water (Seasonal)
- Waterbody
- Building
- Parcel Boundary
- Interpreted Groundwater Flow Direction
- 99.32 M5-2 Monitoring Well Location and Lower Aquifer Water Level Elevation (m)
- Decommissioned Monitoring Well
- Trail Road Landfill Site Boundary
- Nepean Landfill Site Boundary

Notes:
1. This drawing is to be read in conjunction with accompanying report
2. Monitoring wells associated with both the Nepean and Trail Road Landfills sites are shown

0 25 50 100 m

SCALE 1:8,500

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, CITY OF OTTAWA

MAP CREATED BY: LK
MAP CHECKED BY: MM
MAP PROJECTION: NAD 1983 UTM Zone 18N

DILLON CONSULTING

PROJECT: 18-7333
STATUS: DRAFT
DATE: 2019-05-27

FILE LOCATION: I:\GIS\187333 - Trail Monitoring Program\MXD\Trail\Trail_Fig3-7.mxd