
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

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PROJECT No.: SM 114139-G

August 18, 2020

URBEX ENGINEERING LIMITED
161 Rebecca Street
Hamilton, Ontario
L8R 1B9

Attention: Mr. Chris Ridd

**SUPPLEMENTAL GEOTECHNICAL ASSESSMENT
SWM POND DESIGN CONSIDERATIONS
SPRINGBROOK AVENUE AND GARNER ROAD EAST
HAMILTON [ANCASTER], ONTARIO**

Dear Mr. Ridd,

Further to your request, SOIL-MAT ENGINEERS & CONSULTANTS LTD. is pleased to provide the following supplemental hydrogeological and geotechnical comments with respect to the design and construction of the Stormwater Management [SWM] Pond for the proposed residential development. Our office previously conducted a site geotechnical investigation [SM 114139-G, dated October 3, 2012]. This information is referenced in preparing these hydrogeological comments, and so should be read in conjunction with our previous report.

1. INTRODUCTION

We understand that the project will consist of the construction of a residential subdivision, featuring single family dwellings and townhouse structures, along asphalt paved roadways and associated underground municipal services. Our office has previously completed a geotechnical investigation of the site, including the installation of groundwater monitoring wells. The purpose of this supplemental report is to review the subsurface soil and groundwater conditions, and provide our comments and recommendations for the design and construction of the SWM pond, from a geotechnical point of view.

Our office has been provided the most recent General Servicing and Grading Plans for the site, as well as topographic survey plan, for reference in preparing the report.

This report is based on the above summarised project description and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project may void the recommendations given in this report. If significant changes are made to the proposed design, then this office must be consulted to review the new design with respect to the results of this investigation. The information contained in this report does not reflect upon the environmental aspects of the site and therefore have not been addressed in this document, other than comments pertaining to a single analytical test result.

2. PROCEDURE

The investigation work in 2011 consisted of the advancement of a total of ten [10] sampled boreholes at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The boreholes extended to depth of approximately 2 to 5 metres below the existing grade. In addition, groundwater monitoring wells were installed in Borehole Nos. 3 and 6 to allow for long-term monitoring of the groundwater level.

The boreholes were located in the field by representatives of SOIL-MAT ENGINEERS & CONSULTANTS LTD. The ground surface elevations at the borehole locations were referenced to a temporary benchmark described as the fire hydrant located in front of 460 Springbrook Avenue, just north of the subject property [conveniently assigned Elevation 100.00 metres]. The topographic survey plan provided to our office provided an elevation for the installed monitoring wells [BH3 at 245.17m], which has been used to updated the borehole logs to reflect geodetic elevations.

Details of the condition encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Borehole Log Nos. 1 to 10 inclusive, following the text of this report. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact planes of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site includes the entire northeast lot at the intersection of Springbrook Avenue and Garner Road East in Hamilton [Ancaster], Ontario. The site is bounded to the south by Garner Road East [with side ditch], to the north and east by residential properties or vacant fields and to the west by Springbrook Avenue [with side ditch]. There are presently two single family dwellings on the site, one located in the northwest corner and the second in the south-central portion. A hydro corridor is noted to diagonally bisect the subject site from the southwest to northeast corners. The southwest corner of the subject site has a 'low-lying' marshy area, with some 'bull rush' vegetation. The remainder of the property is a relatively flat vacant field covered with 'high' grasses with overall surface drainage into the southeast.

The current plan drawings show the SWM pond to be located towards the southeast of the property. Borehole Nos. 4 and 5 are located in the area of the SWM pond. Monitoring wells installed in Borehole Nos. 3 and 6, while not directly in the proposed SWM pond location, do provide applicable groundwater information for the site.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Topsoil

A layer of topsoil approximately 150 to 200 millimetres was found at the borehole locations. It is noted that the depth of topsoil may vary across the site and from the depths encountered at the borehole locations and therefore additional test pits could be advanced to allow for use in the tender documents. It is noted too that the term "topsoil" has been used from a geotechnical point of view and does not necessarily reflect the suitability of the material to support plant growth.

Gravel and Clayey Silt Fill

A black gravel fill was found in Borehole Nos. 3, 8, and 10 to depths of about 1.80, 2.25 and respectively. The gravel fill was found to be in a compact to dense state. We would recommend that a test pit investigation be undertaken to assess the lateral and horizontal extent of the gravel fill material in order to estimate a volume for the tender documents. A loose clayey silt fill material, with some cobbles and gravel, was found to topsoil in Borehole No. 7.

Clayey Silt

A brown native clayey silt was found to underlie the topsoil in Borehole Nos. 1, 2, 4, 5, 6 and 9, the clayey silt fill in Borehole No. 7, and to underlie the gravel fill in Borehole Nos. 8 and 10. The clay silt was found to contain a trace of sand and was general firm to stiff in consistency. There was noted to be some rootlets and organic staining in the upper level of the clayey silt in Borehole No. 10. The clayey silt was proven to termination in Borehole Nos. 2, 8, 9 and 10 at depths of between about 2.1 and 5.0 metres below grade.

Sand/Silty Sand

A native sandy silt was found to underlie the clayey silt in Borehole Nos. 1 to 6, inclusive. The sandy silt was found to contain a trace to some clay and gravel and was generally in a compact to dense state. The sandy silt was found to depths of between about 3.0 to 4.7 metres below grade.

A native sand was found to underlie the sandy silt in Borehole Nos. 1, 3, 5 and 6 at depths of about 3.8 to 4.7 metres below grade. The sand was found to contain a trace of clay and gravel and to be in a compact to dense state. The sand was proven to termination at depths of about 5.0 metres below grade. A silt seam, about 0.5 metres in thickness, was found in Borehole No. 4 at a depth of about 3.0 metres below grade. The silt was found to be in a dense state.

Groundwater Observations

Upon completion of drilling each borehole, groundwater was found at depths of about 3.0 to 4.5 metres below the existing surface. Groundwater monitoring wells were installed in Borehole Nos. 3 and 6 to allow for long-term monitoring of the groundwater level. The groundwater levels were found to be at depths of about 3.04 and 3.93 metres in Borehole Nos. 3 and 6, respectively on October 3, 2012. These levels would be considered indicative of the static groundwater level, and given time of year would be like to be near the seasonal high groundwater level. However, the groundwater level in the area is noted to have potential seasonal fluctuations and so the seasonal high groundwater level may somewhat shallower.

Well	Surface Elev. [m]	Groundwater Depth [m]	Groundwater Elev. [m]	Estimated Seasonal High
3	245.17	3.04	242.15	242.5
6	245.66	3.93	241.73	242.1

Given the potential for wet conditions/static groundwater levels above the anticipated depths of construction it is recommended that a test excavation be conducted on the property. This will allow tendering contractors to observe the conditions first hand and allow them to assess how they will affect their operations.

4. SWM POND DESIGN CONSIDERATIONS

The subsurface soil conditions in the area of the SWM pond, based on the conditions encountered in the boreholes as described above, generally consist of a layer of clayey silt in the upper about 1.5 to 2.0 metres, transitioning to sandy silt and sand. Considering the site topography and the monitoring well measurements, the high static groundwater level in the area of the SWM pond should be considered at an elevation of approximately 242.1 to 242.5 metres. These conditions will present some difficulty with the construction of the pond, with respect to base stability and temporary groundwater control. However the long-term function of the SWM pond should be readily achievable.

The following comments and recommendations should be considered in the design and construction of the storm water management for the site:

- Given the relative moderate permeability of the sandy silt and sand overburden deposits the use of on-site storm water infiltration methods may be considered feasible for the property. However, these will be impaired by the relatively shallow groundwater conditions across much of the site, and would be most effective as infiltration trench systems extending just through the upper clayey silt layer into the sandy silt at a depth on the order of about 2 metres. The design of such systems, if considered, should be in accordance with the CVCA LID Guideline documents. On a preliminary basis a conservative infiltration rate of 20 mm/hr could be considered. However, it is recommended that further detailed assessment including laboratory grain size analyses and possible in-situ testing be conducted to support the detailed design of any stormwater infiltration systems that might be considered.
- The site grading is shown to accommodate storm water surface flow in similar fashion to the present topography, i.e. general overall surface flow to the southeast, with a SWM pond facility at the southeast portion of the site. Subsurface infrastructure is also proposed convey storm flows by sewers to Springbrook Avenue and then east along and easement on the south end of the site to the proposed SWM pond. This is appropriate from a hydrogeological point of view. Where feasible, raising of the grade site as much as possible, while still maintaining the overall topographic fall to the southeast, would be beneficial to the construction of site services and the SWM pond.

- The proposed SWM pond facility is located at the southeast of the site, within the area of lowest topography. This will readily accommodate storm water flow consistent with the existing topography. The interior pond slopes are shown at 4 to 5 horizontal to 1 vertical, and limited or relatively flat exterior slopes. Such slopes would be considered stable from a geotechnical point of view, however the face of all slopes should be protected from erosion such as with the establishment of suitable vegetative cover. It is noted that, given the proposed grading, the majority of the pond will be cut into the native soils, which are generally noted to be in a compact to dense state. Some disturbance should be anticipated during the excavation and shaping of the pond, possibly requiring supplemental compaction and other stabilisation efforts, especially in the lower levels.
- The SWM pond is indicated with the following elevations:

Top of Pond:	244.50m
100-yr Event:	243.78m
5-yr Event:	243.32m
Permanent Pool:	242.50m
Bottom of Pond:	240.80m

The seasonal high groundwater level is noted to be at approximately 242.1 to 242.5 metres. This is roughly at to below the noted level of the permanent pool elevation.

The inverts of inlet and outlet structures are noted to range from 242.617 to 242.95 metres, which are above the permanent pool elevation, as well as above the high seasonal groundwater level.

The bottom of the pond at 240.80 metres is as much as 1.3 to 1.7 metres below the seasonal high groundwater level.

With the pond base below the established static groundwater level, natural infiltration of groundwater into the pond should be expected. This would be expected to drive a pool elevation following the static groundwater level, along with seasonal fluctuation. However, given the level of the permanent pool at 242.5 is at or above the seasonal high groundwater level, this natural infiltration and seasonal fluctuation would not negatively impact the function of the SWM pond. It would tend to result in seasonal variation of the permanent pool elevation, with the elevation being lower than the current noted design. This would in fact afford a potential increase in available storage volume in the pond during much of the year.

Seasonal fluctuations are not expected to result in water level below the proposed base of 240.80 metres, such that the pond would have water present for the majority, and likely entirety, of the year. The exception would be possibly

during extended periods of draught condition in the summer months resulting in an extreme seasonal low groundwater level. However, considering the nature of the in-situ sandy silt soils, being prone to significant capillary action, the pond base would be expected to be in a near continuous damp state even in seasonal dry conditions.

- If it is critical to maintain the permanent pool elevation at 242.50 metres, it would be necessary to provide a liner to restrict both infiltration and exfiltration below the permanent pool elevation. This could be achieved with a recompacted clay liner, with a thickness of 0.5m metres, over the base and sides of the pond up to the permanent pool elevation. The material for the clay liner should be sufficiently clayey, typically greater than 15 to 20% clay content and plasticity index [PI] of 7 or greater. The liner material should be well worked to destroy any natural structure, moisture conditioned to -2 to +4% of optimum, and nominally compacted to 95% of standard Proctor density. The use of proprietary geosynthetic liner systems could also be considered. The product manufacturer's should be consulted on the specific design and installation requirements.

It is noted that the construction of a recompacted clay liner, or installation of a geosynthetic liner, will pose greater difficulties with respect to temporary dewatering requirements, need to have construction equipment travel over the base of the pond, etc. Provided the permanent pool elevation can be allowed to fluctuate, as discussed above, it would be perhaps preferred to not provide a liner.

- Construction of the pond base will pose some difficulty, with the sides and base sensitive to disturbance from construction traffic, wet conditions, etc. In this regard it is noted that excavation of the pond should ideally be done conducted during the dry summer months [July and August] during a seasonal low groundwater condition. Pond construction could be conducted during other times of the year, however greater temporary dewatering efforts and working in 'wet' conditions would be expected to impact the contractors work. In this regard, the advancement of a number of test pits within the area of the SWM pond would be beneficial to allow the contractor to observe conditions first hand and best assess how they will impact their operations.

Regardless of time of year, excavations should be made working 'out' of the pond area, ideally with excavator equipment working from a level of about 1.5 metres above the base of the pond, in order to restrict the travel of heavy construction equipment over the base.

- The interior side slopes of the pond below the permanent pool elevation are shown at 4 horizontal to 1 vertical. Such slopes below the water level in the native sandy silt and sand soils will have a tendency to slump in to even flatter inclinations. It may be prudent to flatten the slope inclination below the permanent pool elevation to 5 horizontal to 1 vertical, or flatter. Above the permanent pool elevation slopes of up to 4 horizontal to 1 vertical would be appropriate.

It is recommended that the provision of a stabilising layer of coarse stone be provided over the base and sides of the pond, such as 100 to 200-millimetre rip rap or gabion stone 'punched' into the sides and base of the pond. This would serve to stabilise the base and side slopes up to the permanent pool elevation. This would also act as a 'tell tale' layer for future dredging of the sediment from the pond base. Above the permanent pool elevation the side slope may be stabilised with the establishment of suitable vegetation.

- While the inlet and outlet structures are noted to be above the level of the permanent pool and seasonal high groundwater level, given the nature of the native soils consideration should be given to the provision of impermeable seals around inlet and outlet structures in the pond, in order to avoid the potential for piping due to groundwater flow around such structures which could eventually lead to loss of ground with attendant settlements of effected structures. This could be readily accomplished with the provision of a more clayey soil as backfill, or by using a mixture of soil and/or aggregate and bentonite clay 'gravel' material, or the use of an unshrinkable fill [U-fill] cemented aggregate product.

5. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The material in it reflects SOIL-MAT ENGINEERS' best judgment in light of the information available to it at the time of preparation. The information presented concerning subsurface soil and groundwater conditions are descriptive of conditions at the borehole/monitoring well locations only. There may be conditions in the study area which are not represented by these investigations. Contractors placing bids or undertaking this project should carry out the due diligence in order to verify the results of this investigation and to determine for the subsurface conditions will effect their operations.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

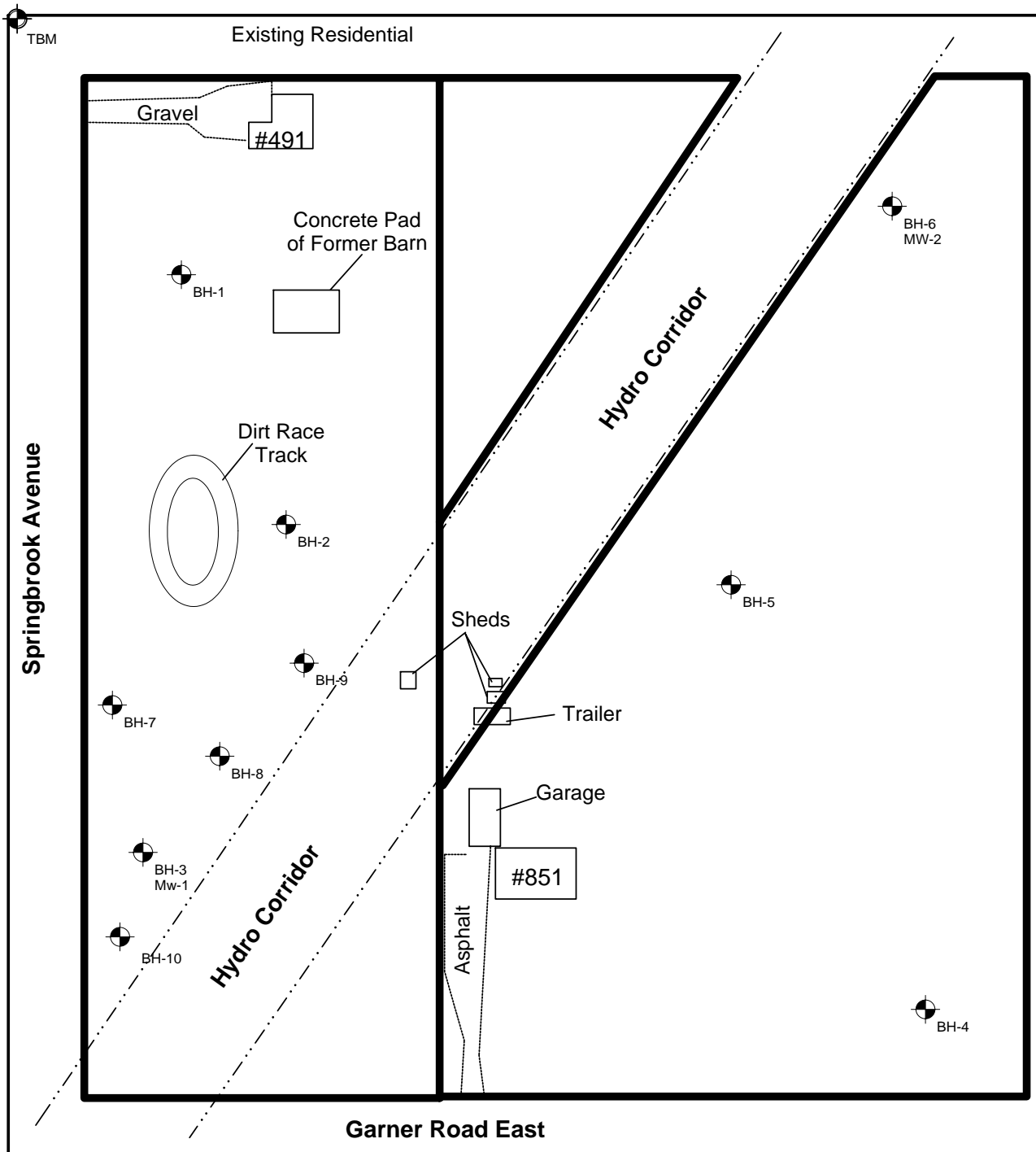


Ian Shaw, P. Eng., QP_{ESA}
Senior Engineer






Enclosures: Drawing No. 1, Borehole Location Plan
Borehole Log Nos. 1 to 10, inclusive

Distribution: Urbex Engineering Limited [1, plus pdf]



LEGEND

-  Borehole
BH-#
-  Subject Site Boundary
-  Temporary Benchmark
TBM Top nut of fire hydrant located at 460 Springbrook Ave. Assumed elevation 100.00 metres.

NOTES:

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. report number SM 114139.
2. Borehole locations are approximate.
3. Soil samples will be discarded after 3 months unless directed otherwise by client.

Soil-Mat

Engineers & Consultants Ltd.

CLIENT
Urbex Engineering Ltd.

PROJECT TITLE
Geotechnical Investigation
Springbrook and Garner
Hamilton, Ontario

DRAWING TITLE
Borehole Location Plan

PROJECT No. SM 114139

SCALE N.T.S.

DATE July 2011

CHECKED

DRAWN

FILENAME
114139 Borehole Location Plan.kcw

DRAWING No. 1

Existing Residential / Vacant Land

Project No: SM 114139-G

Log of Borehole No. 1

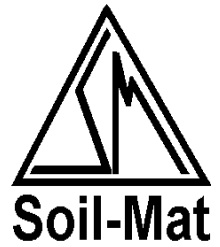
Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content					
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt. (kN/m3)	w%			
												▲	▲		
												Standard Penetration Test			
												● blows/300mm ●			
												20	40	60	80
0	99.65		Ground Surface												
0			Topsoil Approximately 150 mm of topsoil												
2			Clayey Silt Brown, trace of sand, stiff		SS	1	4 8 9	17							
4															
6	97.85		Sandy Silt Brown, trace to some clay, increasing clay content with depth, compact to dense		SS	2	3 5 9	14							
8															
10															
12	95.90				SS	3	4 6 10	16							
14															
16	94.65		Sand Brown, wet, compact		SS	4	8 21 18	39							
18															
20			End of Borehole												
22															
24			NOTES:												
26			1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 5.0 metres.												
28			2. Borehole 'wet' at a depth of 3.45 metres below surface on completion and backfilled as per Ontario Regulation 903.												
30			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.												
32															

Drill Method: Solid Stem Augers

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Datum: Temporary Benchmark

Drill Date: June 27, 2011

130 Lancing Drive, Hamilton, ON L8W 3A1

Checked by: JM

Hole Size: 150 mm

Phone: (905) 318-7440 Fax: (905) 318-7455

e-mail: info@soil-mat.on.ca

Sheet: 1 of 1

Project No: SM 114139-G

Log of Borehole No. 2

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng

Location: Springbrook and Garner

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content w%			
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm ²)	U.Wt. (kN/m ³)	▲ 10 20 30 40 ▲	● 20 40 60 80 ●
0	99.83		Ground Surface										
0			Topsoil Approximately 175 mm of topsoil										
2			Clayey Silt Brown, trace of sand, stiff.		SS	1	3 5 7	12					
4	98.33												
6			Sandy Silt Brown, trace of clay and gravel, compact.		SS	2	4 5 6	11					
8													
10	96.53				SS	3	6 10 12	22					
12			Clayey Silt Grey, wet, trace of sand and gravel, sand seam at 4.75 metre depth, compact		SS	4	7 12 17	19					
14													
16	94.83				SS	5	5 6 6 Wet Spoon	12					
18			End of Borehole										
20													
22			NOTES:										
24			1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 5.0 metres.										
26			2. Borehole 'wet' at a depth of 2.7 metres below surface on completion and backfilled as per Ontario Regulation 903.										
28			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.										
30													
32													

Drill Method: Solid Stem Auger

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Datum: Temporary Benchmark

Drill Date: June 27, 2011

130 Lancing Drive, Hamilton, ON L8W 3A1

Checked by: JM

Phone: (905) 318-7440 Fax: (905) 318-7455

Hole Size: 150 mm

e-mail: info@soil-mat.on.ca

Sheet: 1 of 1

Project No: SM 114139-G

Log of Borehole No. 3

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content			
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt. (kN/m3)	Standard Penetration Test	
												▲ 10 20 30 40 ▲	● 20 40 60 80 ●
0	99.15		Ground Surface										
	98.95		Topsoil Approximately 200 mm of topsoil over native brown sandy silt with occasional clayey silt seams										
2			Gravel Fill Black, compact.		SS	1	13 22 8	30					
4													
6	97.35		Clayey Silt Dark grey, organic stained, trace to some organics, firm.		SS	2	7 6 8	14					
8	96.72		Sandy Silt Brown and grey, trace of rootlets, trace of clay and gravel, occasional clayey silt seams, compact.		SS	3	3 3 4	7					
10													
12													
14	94.65		Sand Brown, saturated, trace of clay and gravel, compact		SS	4	2 3 7	10					
16	94.15												
18			End of Borehole		SS	5	5 6 9	15					
20													
22													
24			NOTES: 1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 5.0 metres. 2. Borehole 'wet' at a depth of 3.45 metres below surface on completion and backfilled as per Ontario Regulation 903. 3. Water level was recorded at 3.04 metres on October 4, 2012. 4. Soil samples will be discarded after 3 months unless otherwise directed by our client.										
26													
28													
30													
32													

Drill Method: **Solid Stem Auger**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Datum: **Temporary Benchmark**

Drill Date: **June 27, 2011**

130 Lancing Drive, Hamilton, ON L8W 3A1

Checked by: **JM**

Hole Size: **150 mm**

Phone: (905) 318-7440 Fax: (905) 318-7455

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Sheet: **1 of 1**

Project No: SM 114139-G

Log of Borehole No. 4

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content					
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kg/cm2)	U.Wt. (kN/m3)	w%			
												▲	▲		
												Standard Penetration Test			
												● blows/300mm ●			
												20	40	60	80
0	99.25		Ground Surface												
0			Topsoil Approximately 150 mm of topsoil												
2			Clayey Silt Brown, trace of sand, stiff.		SS	1	1 3 7	8							
4	97.75														
6			Sandy Silt Brown, grey below approximately 4.0 metres, trace of clay and gravel, occasional clayey silt seams, occasional thin oxidised seams in upper level,, compact to dense.		SS	2	6 10 13	23							
8					SS	3	10 15 18	33							
10					SS	4	14 18 28	46							
12															
14															
16	94.25				SS	5	14 15 18 Wet Spoon	33							
18			End of Borehole												
20															
22															
24			NOTES:												
26			1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 5.0 metres.												
28			2. Borehole 'wet' at a depth of 4.5 metres below surface on completion and backfilled as per Ontario Regulation 903.												
30			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.												
32															

Drill Method: Solid Stem Auger

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Datum: Temporary Benchmark

Drill Date: June 27, 2011

130 Lancing Drive, Hamilton, ON L8W 3A1

Checked by: JM

Phone: (905) 318-7440 Fax: (905) 318-7455

Hole Size: 150 mm

e-mail: info@soil-mat.on.ca

Sheet: 1 of 1

Project No: SM 114139-G

Project: Springbrook and Garner

Location: Hamilton, Ontario

Client: Urbex Engineering Ltd.

Log of Borehole No. 5

Project Manager: John Monkman, P. Eng

Borehole Location: See Drawing No. 1



SUBSURFACE PROFILE					SAMPLE					Moisture Content					
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt. (kN/m3)	w%			
												▲	▲		
												Standard Penetration Test			
												● blows/300mm ●			
												20	40	60	80
0	99.84		Ground Surface												
0			Topsoil Approximately 150 mm of topsoil												
2			Clayey Silt Brown, trace of gravel, stiff.												
6	97.74				SS	2	4 7 8	15							
8			Sandy Silt Brown, trace of clay and gravel, compact to dense.												
10					SS	3	8 31 14	45							
12															
14	95.84				SS	4	10 15 22	37							
16	94.84		Sand Brown, saturated, trace of clay and gravel, compact.												
16					SS	5	4 6 8 Wet Spoon	14							
18			End of Borehole												
20															
22			NOTES:												
24			1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 4.95 metres.												
26			2. Borehole 'wet' at a depth of 1.8 metres below surface on completion and backfilled as per Ontario Regulation 903.												
28			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.												
30															
32															

Drill Method: Solid Stem Auger

Drill Date: June 27, 2011

Hole Size: 150 mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
 130 Lancing Drive, Hamilton, ON L8W 3A1
 Phone: (905) 318-7440 Fax: (905) 318-7455
 e-mail: info@soil-mat.on.ca

Datum: Temporary Benchmark

Checked by: JM

Sheet: 1 of 1

Project No: SM 114139-G

Project: Springbrook and Garner

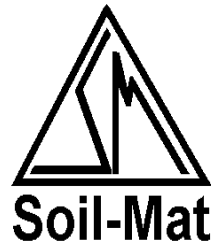
Location: Hamilton, Ontario

Client: Urbex Engineering Ltd.

Log of Borehole No. 6

Project Manager: John Monkman, P. Eng

Borehole Location: See Drawing No. 1



SUBSURFACE PROFILE					SAMPLE					Moisture Content				
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm ²)	U.Wt. (kN/m ³)	w%		
												Standard Penetration Test blows/300mm		
												▲	●	
0	99.64		Ground Surface											
0			Topsoil Approximately 175 mm of topsoil											
2			Clayey Silt Brown, trace of gravel, firm to very stiff.		SS	1	2 2 4	6						
4														
6					SS	2	4 4 7	11						
8														
10	96.74		Sandy Silt Brown, compact to dense.		SS	3	5 9 11	20						
12														
14														
16	94.99													
16	94.64		Sand Brown, trace of clay and gravel, dense.		SS	5	14 18 20	38						
18			End of Borehole											
20														
22														
24														
26														
28														
30														
32														
NOTES: 1. Borehole was advanced using solid stem auger equipment on June 27, 2011 to termination at a depth of 4.95 metres. 2. Borehole 'wet' at a depth of 4.2 metres below surface on completion and backfilled as per Ontario Regulation 903. 3. Water level was recorded at 3.93 metres on October 3, 2012. 4. Soil samples will be discarded after 3 months unless otherwise directed by our client.														

Drill Method: **Solid Stem Auger**

Drill Date: **June 27, 2011**

Hole Size: **150 mm**

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 e-mail: info@soil-mat.on.ca

Datum: **Temporary Benchmark**

Checked by: **JM**

Sheet: **1 of 1**

Project No: SM 114139-G

Log of Borehole No. 7

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng.

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content			
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kg/cm ²)	U.Wt. (kN/m ³)	w%	
												10	40
												Standard Penetration Test	
												20	80
0	99.22		Ground Surface										
0			Topsoil Approximately 150 millimetres of topsoil										
2			Clayey Silt Fill Brown, some gravel, cobble encountered at approximately 1.7 metres, loose.		SS	1	2 3 2 2	5					
4													
6	96.97				SS	2	8 50/0" Bouncing						
8			Clayey Silt Brown, moist to wet, trace of sand, firm.		SS	3	2 2 3 2	5					
10													
12	95.62				SS	4	4 9 12 14	4					
12			End of Borehole										
14													
16													
18													
20													
22													
24													
26													
28													
30													
32													

NOTES:

- Borehole was advanced using solid stem auger equipment on July 4, 2011 to termination at a depth of 3.6 metres.
- Borehole 'wet' at a depth of 2.65 metres on completion and backfilled as per Ontario Regulation 903.
- Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger	SOIL-MAT ENGINEERS & CONSULTANTS LTD. 130 Lancing Drive, Hamilton, ON L8W 3A1 Phone: (905) 318-7440 Fax: (905) 318-7455 e-mail: info@soil-mat.on.ca	Datum: Temporary Benchmark
Drill Date: July 4, 2011		Checked by: JM
Hole Size: 150 mm		Sheet: 1 of 1

Project No: SM 114139-G

Log of Borehole No. 8

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng.

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content w%			
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kg/cm ²)	U.Wt. (kN/m ³)	▲ 10 20 30 40 ▲	Standard Penetration Test blows/300mm ● 20 40 60 80 ●
0	99.21		Ground Surface										
0			Topsoil Approximately 150 millimetres of topsoil										
2			Gravel Fill Black, compact.		SS	1	8 10 16 11	26					
4													
6	96.96				SS	2	12 13 12 3	25					
8			Clayey Silt Brown, traces of sand in lower level, stiff.										
10					SS	3	4 5 8 8	13					
12	95.61				SS	4	3 5 9 14	14					
12			End of Borehole										
14													
16													
18													
20													
22													
24													
26													
28													
30													
32													

NOTES:

- Borehole was advanced using solid stem auger equipment on July 4, 2011 to termination at a depth of 3.6 metres.
- Borehole 'wet' at a depth of 2.7 metres on completion and backfilled as per Ontario Regulation 903.
- Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: **Solid Stem Auger**

Drill Date: **July 4, 2011**

Hole Size: **150 mm**

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Sheet: **1 of 1**

Project No: SM 114139-G

Log of Borehole No. 9

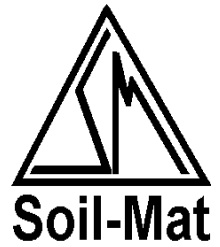
Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng.

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content			
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt. (kN/m3)	Standard Penetration Test	
												▲ 10 20 30 40 ▲	● 20 40 60 80 ●
0	99.41		Ground Surface										
0			Topsoil Approximately 150 millimetres of topsoil										
2			Clayey Silt Brown, trace of sand, firm.		SS	1	4 2 2 2	4					
4													
6	97.31				SS	2	2 6 4 7	7					
2.1			End of Borehole										
8													
10													
12													
14													
16													
18													
20													
22													
24													
26													
28													
30													
32													

NOTES:

- Borehole was advanced using solid stem auger equipment on July 4, 2011 to termination at a depth of 2.1 metres.
- Borehole 'dry' on completion and backfilled as per Ontario Regulation 903.
- Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger

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Datum: Temporary Benchmark

Drill Date: July 4, 2011

Checked by: JM

Hole Size: 150 mm

Sheet: 1 of 1

Project No: SM 114139-G

Log of Borehole No. 10

Project: Springbrook and Garner

Project Manager: John Monkman, P. Eng.

Location: Hamilton, Ontario

Borehole Location: See Drawing No. 1

Client: Urbex Engineering Ltd.



SUBSURFACE PROFILE					SAMPLE					Moisture Content ▲ 10 20 30 40 ▲ w%				
Depth	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Standard Penetration Test ● 20 40 60 80 ● blows/300mm		
0	0.00		Ground Surface											
0			Topsoil Approximately 150 millimetres of topsoil											
2			Gravel Fill Black, pieces of styrofoam encountered in upper level, compact to dense.		SS	1	13 8 15 18	23						
4														
6	-2.10				SS	2	12 23 12 4	35						
8			Clayey Silt Black with trace of rootlets in upper level, brown with trace of sand in lower level, firm to stiff.		SS	3	2 3 3 4	6						
10														
12	-3.60				SS	4	2 2 7 9	9						
12			End of Borehole											
14														
16														
18														
20	6													
22														
24														
26	8													
28														
30														
32														
NOTES: 1. Borehole was advanced using solid stem auger equipment on July 4, 2011 to termination at a depth of 3.6 metres. 2. Borehole 'dry' on completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.														

Drill Method: Solid Stem Auger

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Datum: Temporary Benchmark

Drill Date: July 4, 2011

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Checked by: JM

Phone: (905) 318-7440 Fax: (905) 318-7455

Hole Size: 150 mm

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