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*GEOTECHNICAL INVESTIGATION
PROPOSED AVID HOTEL
KERR STREET NORTH/QEW OFF RAMP
OAKVILLE, ONTARIO*

Ref. No. 7320-18-1

March 2018

Prepared for:

*Empress Capital Group Ltd.
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1.0 **INTRODUCTION**

V.A. Wood Associates Limited was retained by API Development Consultants Inc., on behalf of Empress Capital Group Ltd., to carry out a geotechnical investigation for the proposed Avid Hotel at the southwest corner of Kerr Street North and the Queen Elizabeth Way off ramp in Oakville, Ontario.

The proposed hotel will have a footprint of 1,100 m², and have seven storeys and a slab on grade. An entrance driveway from Kerr Street North and extensive paved areas are also proposed. The subsoil permeability is also to be assessed.

The purpose of the investigation was to reveal the subsurface conditions and determine the soil parameters for the design and construction of the foundation of the structure, the associated site services and the paved areas, and to provide a recommendation on the soil permeability.

2.0 **FIELDWORK**

The fieldwork was carried out on February 16, 2018 and consisted of seven boreholes at the locations shown on Enclosure 1. The boreholes were advanced to the sampling depths by means of a power-auger machine, equipped for soil sampling. Standard Penetration tests were carried out at frequent intervals of depth and the results are shown on the Borehole Logs as N-values.

The fieldwork was supervised by a soils technician and the soil samples were transported to our laboratory for further examination, classification and testing.

3.0 **SUBSURFACE CONDITIONS**

Full details of the soils encountered in each borehole are given on the Borehole Logs, Enclosures 2 to 7 inclusive, and the following notes are intended to summarize these data.

All of the boreholes encountered a surficial layer of topsoil 50 to 200± mm thick.

The topsoil was underlain by fill, which extended to a depth of between 0.7 and 1± m below grade. This fill is comprised of generally of clayey silt with traces of organics. Standard Penetration tests in the fill gave N-values between 2 and 9 blows/300mm, and its moisture content varied between 12 and 22%

Based on the test results, the fill is considered to be in a loose to very loose condition.

The fill was underlain by a native deposit of silt, which extended to a depth of between 1.8 and 2.7± m below grade. This deposit contained some sand and clay and is brick red to grey in colour. Standard Penetration tests in this deposit gave N-values between 15 and more than 100 blows/300mm, and its moisture content varied between 7 and 11%.

Based on the test results, together with a visual and tactile examination, the silt is considered to have a very stiff to hard consistency. The grain size distribution of a representative sample of the silt is shown in Enclosure 8.

*The silt in Boreholes 1, 2 and 3 were underlain by a deposit of **shaley till**, which extended to a depth of more than 4.8 m below grade (maximum depth investigated). This glacial till deposit is comprised of a sandy silt matrix which contained fragments of weathered shale. Standard Penetration tests in this deposit gave N-values of more than 100 blows/300mm, and its moisture content varied between 4 and 7%.*

Based on the test results, the shaley till is considered to have a very dense relative density. The grain size distribution of representative samples of the shaley till are shown in Enclosures 9 and 10.

4.0 **GROUNDWATER CONDITIONS**

No free water was encountered in any of the boreholes, which were all open and dry to the full depth upon completion of the fieldwork. It is noted that the water measurements were carried out immediately after drilling, and it is possible that the ground water had not yet stabilized in the boreholes.

An examination of the samples revealed that they were generally moist (wet at the top in some of the boreholes), and the native subsoils had a brick red colour for the full depth of the boreholes.

Based on the findings, the groundwater table is considered to be located below the maximum depth investigated (i.e., more than 4.8 m below grade). However, perched water conditions may occur within the fill and on top of the low permeability native silt deposit.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The boreholes encountered 50 to 200± mm thick topsoil, followed by 0.5 to 0.9± m of loose to very loose fill, then competent deposits of silt and shaley till. The groundwater table is considered to be located at a depth of at least 4.8 m below grade, although perched water conditions may occur within the fill and on top of the native clayey silt.

The proposed hotel will have seven storeys and a slab on grade. It is anticipated that the structure will have a steel frame and reinforced concrete shear wall, and load bearing masonry walls supported on shallow spread foundations and strip footings.

Full details of the proposed structure were not available at the time of this report, and therefore the following recommendations should be reviewed when these details are available.

5.2 Foundations

The footings of the structure should extend through the loose fill and onto the hard native silt or very dense shaley till, which were encountered from a depth of 1.5 m in the boreholes within the building area. These strata are considered capable of supporting normal footings designed to an SLS bearing pressure of up to 400 kPa (600 kPa in ULS).

It is estimated that the total and differential settlements of footings designed to the above bearing pressure will be less than 25 and 20 mm respectively. These are normally acceptable for the proposed structure.

All exterior footings or footings in unheated areas should be located at least 1.2 m below finished grade for adequate frost protection.

The minimum footing sizes should not be less than those specified in the National Building Code of Canada. The slopes between footings should be inclined such that elevation differences between adjacent footings are not more than one half of the horizontal distance between them.

All foundation excavations should be inspected by geotechnical personnel from VA Wood Associates Limited to ensure the founding soils are similar to those identified in the Borehole Logs and that they are capable of supporting the design loads.

Based on the Ontario Building Code of 2012, the seismic site classification should be based on the average soil properties of the top 30 m of the soil profile. The deepest boreholes were less than 5 m deep and encountered very dense shaley till. The very dense deposits are likely to extend to depth and, in this case, a Site Class 'C' classification may be used for this site.

For the design of members resisting lateral loads the recommended soil parameters are as follows:

<i>Soil Parameter</i>	<i>Loose Fill</i>	<i>Very Stiff to Hard Silt</i>
<i>Unit Weight</i>	<i>19 kN/m³</i>	<i>21 kN/m³</i>
<i>Friction Angle</i>	<i>27°</i>	<i>30°</i>
<i>Cohesion</i>	<i>0</i>	<i>10 kPa</i>
<i>Coeff. of Earth Pressure at Rest</i>	<i>0.55</i>	<i>0.5</i>
<i>Coeff. of Active Earth Pressure</i>	<i>0.38</i>	<i>0.33</i>
<i>Coeff. of Passive Earth Pressure</i>	<i>2.6</i>	<i>3.0</i>
<i>Coefficient of Friction</i>	<i>--</i>	<i>0.4</i>

5.3 Slab On Grade

It is anticipated that the finished floor of the structure will be close to the existing grade.

Based on the Borehole Logs, the surficial fill is loose to very loose.

All topsoil, organics, very loose fill and any deleterious fill material should be removed from within the building area. The exposed subgrade should be compacted from the surface and proof-rolled, and any soft or wet areas identified should be sub-excavated and replaced with approved compacted fill. Any new fill required should be composed of approved on-site or imported material (preferably granular soil) placed in not more than 150 to 200 mm thick loose lifts and compacted to at least 98% of its Proctor maximum dry density (SPMDD).

A layer of well-graded free-draining granular material at least 150 mm thick and compacted to 98% SPMDD should be placed under the floor slab to provide a uniform bearing surface and to act as a vapour barrier.

Surface drainage should be directed away from the building.

5.4 Elevator Pit

The elevator pit walls and other earth retaining structures should be designed to resist lateral earth pressures, the magnitude of which can be determined from:

$$p = K (\gamma d + q)$$

where

p	=	earth pressure, kN/m^2
K	=	earth pressure coefficient, 0.5 for sand fill
γ	=	unit weight of backfill, 20 kN/m^3 for sand
d	=	depth below finished grade, m
q	=	surcharge on backfill, kN/m^2

Water will tend to collect around and under the elevator pit which, therefore, should be designed to resist hydrostatic pressures unless a perimeter drainage system is installed.

Water collected in this system should be connected to the local storm drainage system either by gravity or by a permanent sump pump.

The floor of the elevator pit will likely be located at least 2.4 m below existing grade. Based on the Borehole Logs, the subgrade of the elevator pit slab will likely be comprised of hard silt or very dense shaley till, which are considered to be generally suitable subgrade materials.

The exposed subgrade should be inspected and any loose or wet areas identified should be sub-excavated and replaced with approved compacted fill. Any new fill required should be composed of approved on-site or imported material (preferably granular soil) placed in not more than 150 to 200 mm thick loose lifts and compacted to at least 98% SPMDD.

A layer of well-graded free-draining granular material at least 150 mm thick and compacted to 98% SPMDD should be placed under the pit slab to provide a uniform bearing surface and to act as a vapour barrier.

5.5 Service Trenches

It is anticipated that the service trenches will generally be less than $2.5 \pm$ m below finished grade. Reference to the Borehole Logs indicates that the subgrade will likely be composed of hard silt or very dense shaley till, which will generally provide adequate support for the pipes and allow the use of normal Class 'B' bedding using Granular 'A' material.

Clear crushed stone should not be used as bedding otherwise the fines from the surrounding subsoil may migrate into the voids of the stone and cause undesirable settlements.

If there is local softening of the trench grade, then the bedding thickness may have to be increased.

5.6 Excavation and Groundwater Control

No major construction problems, due to water, are anticipated with excavations not exceeding 2.5 m deep. Provision should, however, be made for the control of surface water run-off or sub-surface seepage from perched water, which will likely be controlled by pumping from local sumps as and where required.

Excavations more than 1.2 m deep should be cut back to a side slope of 1:1. Sub-vertical excavations within the hard silt and very dense shaley till are expected to be stable in the short term as long as the excavation is kept dry and free of surcharge loads. Alternatively, the excavation should be supported using adequately braced sheeting.

The excavated topsoil, fill and clayey silt should be used only for landscaping purposes.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench slope is exposed.

Should construction be carried out in winter, particular attention should be given to make sure frozen material is not used as backfill.

5.7 Pavements

It is anticipated that the finished grade of the paved areas will be close to the existing grade. All topsoil, vegetation remains, loose or wet soil, and any deleterious materials should be removed from the areas to be paved. Any backfill required should be comprised of approved on-site or imported material and placed in horizontal lifts not exceeding 200 mm thick and compacted to at least 98% SPMDD.

Considering the traffic requirements and subsoil conditions, the following pavement designs are recommended:

	<i>Car Parking (Light Duty Asphalt)</i>	<i>Fire Route/Driveways (Heavy Duty Asphalt)</i>
	<u>(mm)</u>	<u>(mm)</u>
<i>HL-3 Asphaltic Concrete</i>	50	50
<i>HL-8 Asphaltic Concrete</i>	--	75
<i>Granular 'A' or 20 mm crusher run limestone</i>	150	150
<i>Granular 'B' or 50 mm crusher run limestone</i>	200	300

The base and sub-base granular materials should be compacted to at least 98% SPMDD and the asphaltic concrete to 96% Marshall density. The thicknesses shown above are compacted thicknesses of the materials. We recommend that the top course asphalt not be placed until the base course asphalt has been in place for one winter season.

Frequent inspection by geotechnical personnel from V.A. Wood Associates Limited should be carried out during construction to verify the compaction of the subgrade, base courses and asphaltic concrete by in-situ density testing using nuclear gauges.

5.8 Soil Permeability

For the design of storm water management systems, the permeability and infiltration rate of the subsoils were determined based on the grain size distribution and the soil consistency or density. The grain size distribution of representative samples of the silt and shaley till are shown in Enclosure 9, 10 and 11, and reference to this indicates that clayey silt may be classified under the USCS system as ML and the shaley till as ML to SM. The silt has a very stiff to hard consistency, and the shaley till has a very dense relative density.

Based on the findings the estimated soil permeability and infiltration rate for the subsoils are as follows:

Depth	Soil Description (USCS Classification)	Permeability, k	Infiltration Rate
1.5 m	SILT, some sand, trace clay (ML)	1×10^{-6} cm/sec	12 mm/hr
2 m	SILT and Fine SAND, trace gravel (ML)	1×10^{-5} cm/sec	30 mm/hr
3 m	SILT and SAND, some gravel (SM)	1×10^{-5} cm/sec	30 mm/hr

The groundwater level may be assumed to be located at least 4.8 m below grade.

If in-situ permeability tests are required, these may be carried out using a Guelph Permeameter. The test will require test pits to be excavated by backhoe extending to the depths where the permeability/infiltration data are required.

6.0 **STATEMENT OF LIMITATIONS**

The Statement of Limitations presented on Appendix 'A' is an integral part of this report.

V.A. WOOD ASSOCIATES LIMITED


Prepared by:


Rene Quiambao, P. Eng.



Reviewed by:



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RQ/VW

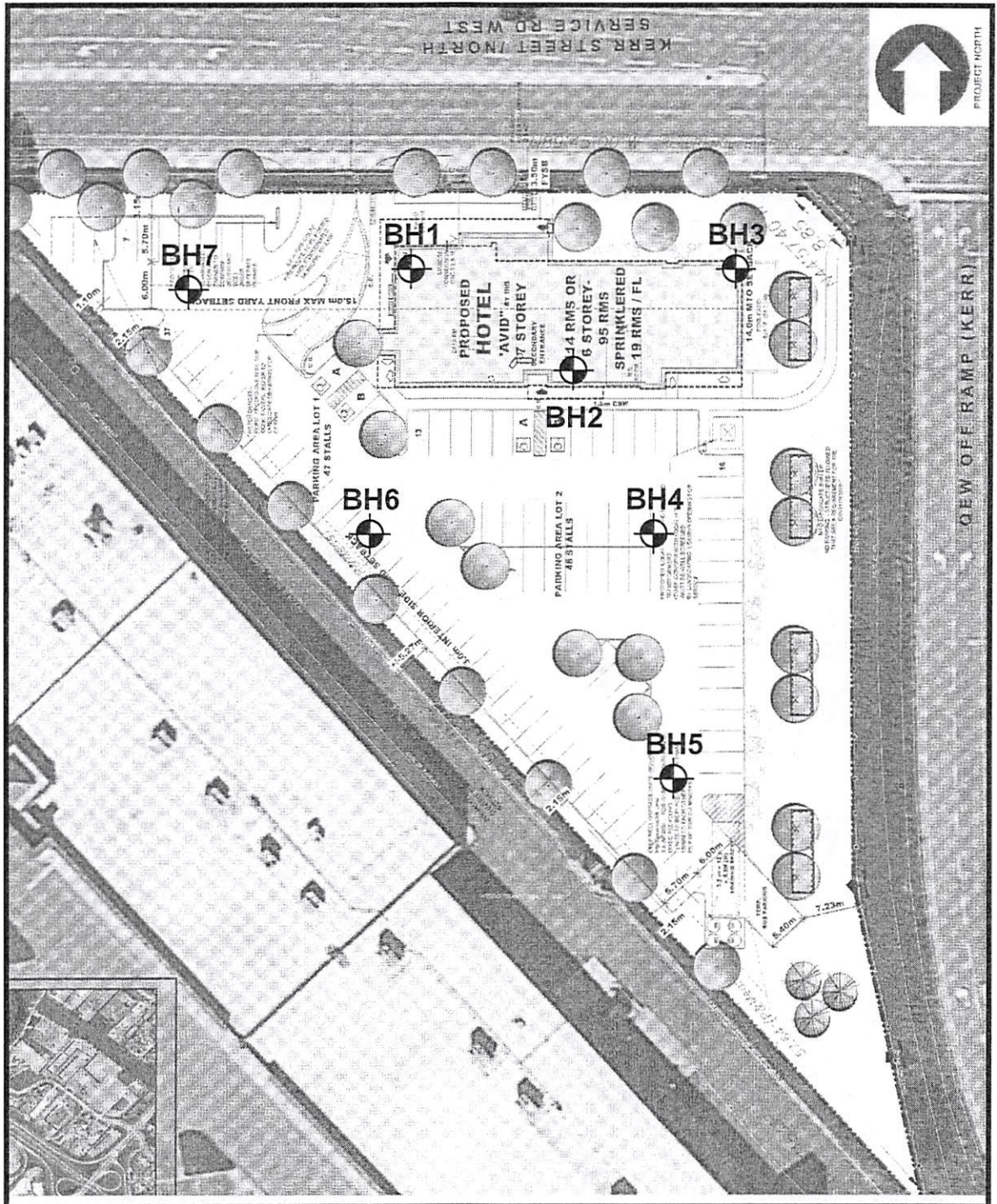
APPENDIX

STATEMENT OF LIMITATIONS

The conclusions and recommendations in this report are based on information determined at the borehole locations and on geological data of a general nature which may be available for the area investigated. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations and conditions may become apparent during construction which would not be detected or anticipated at the time of the soil investigation.

We recommend that we be retained to ensure that all necessary stripping, subgrade preparation and compaction requirements are met, and to confirm that the soil conditions do not deviate materially from those encountered in the boreholes. In cases where this recommendation is not followed, the company's responsibility is limited to interpreting accurately the information encountered at the borehole locations.

This report is applicable only to the project described in the introduction, constructed substantially in accordance with details of alignment and elevations quoted in the text.



BOREHOLE LOCATION PLAN

Reference No : 7320-18-1

Borehole No : 1

Enclosure No : 2

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE				SAMPLE							Remarks				
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm				Moisture Content, %			
								20	40	60		80	10	30	50
	0	Ground Surface													
	0.05	Topsoil 50 mm thick FILL Clayey silt, trace organics, dark red to grey, wet, very loose to loose			1	SS	3								Borehole open and dry on completion
	0.9				2	SS	15								
	1.9	SILT Very stiff to hard, some sand and clay, brick red to grey, moist		D R Y	3	SS	100+								
	2.9				4	SS	100+								
	3.9	SHALEY TILL Very dense, clayey sandy silt with weathered shale fragments, brick red, moist			5	SS	100+								
	4.9				6	SS	100+								
	5.0	End of Borehole													
	6.0														

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Disk :

Sheet : 1 of 1

Reference No : 7320-18-1

Borehole No : 2

Enclosure No : 3

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE				SAMPLE			Standard Penetration Test blows/300mm				Moisture Content, %			Remarks		
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	20	40	60	80	10	30		50	
	0	Ground Surface														
		Topsoil 125 mm thick FILL Clayey silt, trace organics, dark red, moist, very loose			1	SS	3								Borehole open and dry on completion	
	1	SILT Hard, some sand and clay, brick red to grey, moist		D R Y	2	SS	51									
	2				3	SS	66									
	3				4	SS	100+									
	4	SHALEY TILL Very dense, clayey sandy silt with weathered shale fragments, brick red, moist		D R Y	5	SS	100+									
	5				6	SS	100+									
	5	End of Borehole														
	6															

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Disk :

Sheet : 1 of 1

Reference No : 7320-18-1

Borehole No : 3

Enclosure No : 4

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel




Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE				SAMPLE							Remarks								
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm				Moisture Content, %							
								20	40	60		80	10	30	50				
	0	Ground Surface																	
		Topsoil 75 mm thick FILL Clayey silt, trace organics, dark red, moist, loose			1	SS	6	○									Borehole open and dry on completion		
	1	<i>SILT</i> Very stiff to hard, some sand and clay, brick red to grey, moist		D R Y	2	SS	20	○											
	2				3	SS	100+	○	●										
	3				4	SS	100+	○											
	4				5	SS	100+	○	●										
	5	<i>SHALEY TILL</i> Very dense, clayey sandy silt with weathered shale fragments, brick red, moist			6	SS	100+	○											
	6				End of Borehole														

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Disk :

Sheet : 1 of 1

Reference No : 7320-18-1

Borehole No : 4

Enclosure No : 5

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE				SAMPLE							Remarks		
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm					
								20	40	60		80	10
	0	Ground Surface											Borehole open and dry on completion
		Topsoil 200 mm thick			1	SS	4						
		FILL Clayey silt, trace organics, dark red, moist, loose											
	1	SILT Hard, some sand and clay, brick red to grey, moist		D R Y	2	SS	50						
					3	SS	100+						
	2	End of Borehole											
	3												
	4												

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Reference No : 7320-18-1

Borehole No : 5

Enclosure No : 6

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE					SAMPLE							Remarks			
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm					Moisture Content, %		
								20	40	60	80		10	30	50
	0	Ground Surface													
		Topsoil 100 mm thick			1	SS	2								Borehole open and dry on completion
		FILL Clayey silt, trace organics, dark red to grey, wet, very loose to loose		D R Y											
	1	SILT Very stiff to hard, some sand and clay, brick red to grey, moist			2	SS	32								
					3	SS	100+								
	2	End of Borehole													
	3														
	4														

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Sheet : 1 of 1

Reference No : 7320-18-1

Borehole No : 6

Enclosure No : 7

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

Date : February 16, 2018

SUBSURFACE PROFILE					SAMPLE							Remarks			
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm					Moisture Content, %		
								20	40	60	80		10	30	50
	0	Ground Surface												Borehole open and dry on completion	
		Topsoil 75 mm thick			1	SS	9	○							
		FILL Clayey silt, trace organics, dark red to grey, wet, loose		D R Y											
	1	SILT Hard then very stiff, some sand and clay, brick red to grey, moist			2	SS	45	○		●					
	2	End of Borehole			3	SS	18	○							
	3														
	4														

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Sheet : 1 of 1

Reference No : 7320-18-1

Borehole No : 7

Enclosure No : 8

Client : Empress Capital Group Ltd. c/o API

Project : Proposed Hotel

Method : Auger

Location : Kerr Street/QEW, Oakville, ON

Diameter : 110 mm

Datum Elevation :

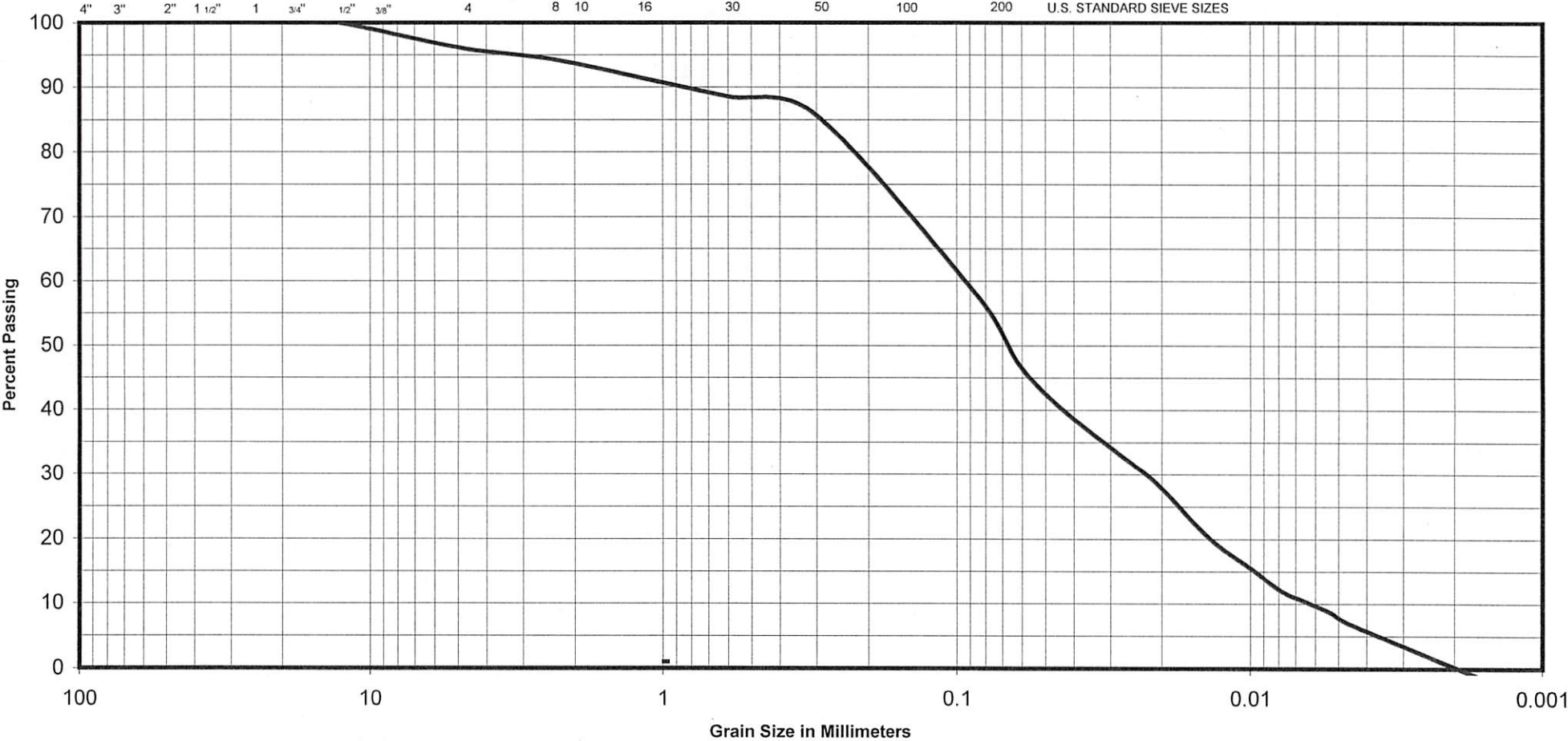
Date : February 16, 2018

SUBSURFACE PROFILE					SAMPLE							Remarks			
Elevation m	Depth m	Description	Symbol	Water	Number	Type	N-value	Standard Penetration Test blows/300mm					Moisture Content, %		
								20	40	60	80		10	30	50
	0	Ground Surface													
		Topsoil 50 mm thick													
		FILL Clayey silt, trace organics, dark red, moist, loose			1	SS	6								
	1	SILT Hard, some sand and clay, brick red to grey, moist		D R Y	2	SS	76								
					3	SS	100+								
	2	End of Borehole													
	3														
	4														

GRAIN SIZE DISTRIBUTION

OUR REFERENCE No.: 7320-18-1

GRAVEL				SAND					SILT & CLAY		UNIFIED SOIL CLASSIFICATION SYSTEM
COARSE		FINE		COARSE	MEDIUM		FINE				



PROJECT: Proposed AVID Hotel
LOCATION: Kerr St. North/QEW Off Ramp, Oakville, ON
BOREHOLE NO.: 2
SAMPLE NO.: 4
DEPTH: 2.3 m
DATE: March 2018

SILT and Fine SAND, trace gravel (ML)

ENCLOSURE No. 10

GRAIN SIZE DISTRIBUTION

OUR REFERENCE No.: 7320-18-1



PROJECT: Proposed AVID Hotel
LOCATION: Kerr St. North/QEW Off Ramp, Oakville, ON
BOREHOLE NO.: 2
SAMPLE NO.: 5
DEPTH: 3.1 m
DATE: March 2018

SILT and SAND, some gravel (SM)

ENCLOSURE No. 11