

The Municipality of Middlesex Centre

Geotechnical Investigation

Project Name Olalondo Gravel Pit – Underwater Extraction London, Ontario

Project Number LON-00015778-GE

Prepared By:

exp Services Inc. 15701 Robin's Hill Road London, Ontario, N5V 0A5

Date Submitted March 8, 2018

The Municipality of Middlesex Centre

Geotechnical Investigation

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Date Submitted: March 8, 2018

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1. Introduction

Exp Services Inc. (**exp**) was retained by the Municipality of Middlesex Centre (Municipality) to conduct a Geotechnical Investigation to assess the gravel quantity and quality at the existing pit located west of Olalondo Road, in the City of London, Ontario. Authorization for **exp** to proceed with the work was given by the Municipality. In preparing this report, the information provided by the client has been utilized.

1.1 **Project Description**

The gravel pit is located at 21515 Olalondo Road in Middlesex Centre (Concession 6 North Part Lot 1 former London Township, Registered Plan 33R392 Parts 1 and 3).

To support the application for a Category 1: Class "A" license for a pit operation which intends to extract aggregate material from below the established groundwater level, a Gravel Quantity / Quality Assessment, Hydrogeological Level 2 and Natural Environment Level 1 assessment needs to be completed. The pit is currently operating and extracting materials from above the groundwater table.

1.2 Terms of Reference

The purpose of the investigation was to examine the subsoil and groundwater conditions at the site by advancing nine (9) boreholes and eleven (11) test pits at the locations illustrated on the attached Location Plan, **Drawing 1**.

The investigation was carried out in general accordance with our proposal P17-351, dated October 4, 2017. Authorization to proceed was given by the Municipality of Middlesex Centre.

The objective of the Geotechnical Report is to summarize the results of the investigation, and provide information pertaining to the general quantity and quality of the aggregate materials encountered at the site.

Reference is made to **Appendix C** of this report, which contains further information necessary for the proper interpretation and use of this report.



2. Methodology

The fieldwork was conducted on November 9, 27, 28 and December 4, 2017 and consisted of advancing nine (9) boreholes and eleven (11) test pits at the approximate locations shown on **Drawing 1.** The boreholes are designated as BH 1 through BH 9 and the test pits as TP 1 through TP 11.

The boreholes were advanced using a locally subcontracted, track mounted drilling unit equipped with continuous flight hollow stem augers, soil sampling and soil testing equipment. The boreholes were terminated at depths of between about 3.1 and 11.3 m below the ground surface. Monitoring wells were installed in BH 1, BH 2, BH 6, BH 7 and BH 9.

The test pits were advanced using a locally subcontracted backhoe excavator. The test pits were terminated at depths of between about 1.1 and 3.8 m below the ground surface.

Within the boreholes, Standard Penetration Tests (SPTs) were performed to assess the compactness or consistency of the underlying soils and to obtain representative samples. During the field program, the soil samples obtained were examined and logged in the field by **exp** geotechnical personnel.

Soil stratigraphy and observations pertaining to groundwater seepage into the test holes are recorded in the logs found in **Appendix A.** Two subsurface profiles (sections) across the site are shown on **Drawings 2 and 3.**

Following the drilling, the boreholes were backfilled with the excavated materials and bentonite, to satisfy the requirements of Ontario Regulation 903. The test pits were backfilled with the excavated materials and nominally compacted with the excavator bucket.

Representative samples of the various soil strata encountered at the test hole locations were taken to our laboratory in London for further examination by a geotechnical engineer. Laboratory testing for this investigation included routine moisture content determinations and grain size distribution analyses. The results of the laboratory testing carried out are presented on the test hole logs found in **Appendix A** and the gradation figures in **Appendix B**.

Samples remaining after the laboratory testing will be stored for a period of three months following the issuance of the report. After this time, they will be discarded unless prior arrangements have been made for longer storage.

The test holes were surveyed in the field by a member of our geotechnical engineering staff. The benchmark used is described as "the northeast abutment of the weigh scale". The benchmark was assigned an elevation of 100 m referenced to local datum.



3. Site and Subsurface Conditions

3.1 Site Description

The subject site is located just west of Olalondo Road and south of Medway Road in the City of London. For the purpose of this report, the site can generally be divided into two regions as follows:

<u>West Portion:</u> This area includes the area of current pit operation and the farming area immediately to the west. There is about a 7.0 to 7.5 m difference in elevation along the bank that separates the farm land and the mining operation. The test holes included in the west portion of the site are boreholes BH 1, BH 2 and BH 4, and test pits TP 1, TP 2 and TP 3.

<u>East Portion:</u> The area east of the current pit operation which has been rehabilitated (capped) with fill soils. The topography of this area is variable, with a 2 m difference in elevation between lowest and highest elevations, with the site generally rising towards the northeast area. The test holes included in the east portion of the site are boreholes BH 3, BH 5 to BH 9, and test pits TP 4 to TP 11.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in each borehole and the results of routine laboratory tests carried out on representative samples of the subsoils are presented on the test hole logs found in **Appendix A.** It must be noted that boundaries of soil indicated on the logs are inferred from non-continuous sampling and observations during excavating. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

The subsurface soil conditions encountered in the test holes are summarized as follows.

3.2.1 West Portion

3.2.1.1 Topsoil and Silt

Boreholes BH 1 and BH 2 were advanced in the farm area west of the pit operations. From the ground surface, these boreholes encountered 280 and 350 mm of topsoil material, respectively.

Beneath the topsoil in BH 1 and BH 2, brown silt was encountered. The thickness of the silt varied from about 0.4 to 1.0 m at the borehole locations. The brown silt material was firm as indicated from SPT values of 5 and 6 blows per 0.3 m of penetration. The moisture content of a sample of the brown silt obtained was about 17 percent.



3.2.1.2 Sand and Gravel

Underlying the clayey silt in BH 1 and BH 2, and from the pit floor in BH 4, TP 1, TP 2 and TP 3, coarse grained materials ranging in gradation from sand and gravel, to sandy gravel, to sand, were encountered. The thickness of the unmined material in BH 1 and BH 2 was extensive, ranging from about 5.2 to 7.5 m. The thickness of the sand and gravel materials in TP 1, TP 2, TP 3 and BH 4 advanced in the current pit ranged between about 0.5 and 3.5 m. Measured 'N' values in the sand and gravel materials ranged from 17 to 61 blows per 0.3 m, with two values in excess of 50 blows per 0.15 m of penetration. These values indicate that the material is compact to very dense. The moisture content of the samples obtained varied from about 1 to 13 percent.

3.2.1.3 Silty Clay Till

Beneath the sand and gravel, grey silty clay till was encountered to the termination depth of the test holes. Measured 'N' values were typically in excess of 30 blows per 0.3 m, indicating a hard consistency. The moisture content of the samples of silty clay till obtained varied from about 8 to 15 percent.

3.2.1.4 Groundwater

Groundwater levels were noted in BH 4, TP 1 and TP 2 upon completion of drilling/ excavation, at depths of between about 1.2 and 1.8 m below grade. Test pit TP 3 was dry upon completion.

Monitoring wells were installed in BH 1 and BH 2. **Exp** attended the site to measure water levels in the wells on December 6 and 15, 2017 and January 16, 2018. On each date, no water level was observed in the monitoring wells.

3.2.2 East Portion

3.2.2.1 Fill Materials and Clayey Silt

The remaining boreholes and test pits were advanced in the east portion of the site that had been rehabilitated with surficial fill materials. With the exception of TP 4, fill materials comprised of silty clay, clayey silt, sandy silt and sand and gravel were encountered. The fill materials ranged in thickness from about 0.7 to 1.8 m at the test hole locations. Measured 'N' values obtained in the fill materials ranged from 6 to 20 blows per 0.3 m. The moisture content of the samples of fill materials obtained varied from about 13 to 29 percent.

Underlying the fill materials in TP 6 and TP 9, brown clayey silt was encountered. The thickness of the clayey silt was about 0.8 and 1.0 m at the test pit locations, respectively.



3.2.2.2 Sand and Gravel

Beneath the fill materials in BH 5, BH 6, BH 9, TP 5, TP 7, TP 8, TP 10 and TP 11, and the clayey silt in TP 6, coarse grained materials, predominantly made up of sand and sandy gravel were encountered. These materials ranged in thickness from about 0.6 to 1.6 m at the test hole locations. SPT 'N' values in these materials ranged from 25 to 56 blows per 0.3 m, indicating that the material is compact to very dense. The moisture content of the samples obtained varied from about 3 to 14 percent. It is noted that sand and gravel materials were not encountered in BH 3, BH 7, BH 8, TP 4 and TP 9.

3.2.2.3 Silty Clay Till

The boreholes and test pits were terminated in very stiff to hard, grey silty clay till. The moisture content of the samples of grey silty clay till obtained varied from about 5 to 14 percent.

3.2.2.4 Groundwater

Groundwater levels were noted in TP 6, TP 7, TP 8, TP 10 and TP 11 upon completion of excavation, at depths of between about 1.6 and 2.2 m below grade. A groundwater level was also noted in BH 8 at about 4.3 m below grade upon completion. The remaining test holes were dry upon completion.

Monitoring wells were installed in BH 6, BH 7 and BH 9. **Exp** attended the site to measure water levels in the wells on December 6 and 15, 2017 and January 16, 2018. The table below provides the water levels below ground surface recorded on each day.

	BH 6	BH 7	BH 9			
December 6, 2017	1.5 m	3.6 m	1.2 m			
December 15, 2017	1.4 m	3.1 m	1.2 m			
January 16, 2018	1.0 m	3.8 m	0.8 m			

It is noted that the depth to the groundwater table may vary in response to climatic or seasonal conditions, and, as such, may differ at the time of construction, with higher levels in wet seasons.



4. Discussion and Recommendations

4.1 General

As indicated previously, the gravel pit is located at 21515 Olalondo Road in Middlesex Centre.

To support the application for a Category 1: Class "A" license for a pit operation which intends to extract aggregate material from below the established groundwater level, a Gravel Quantity / Quality Assessment, Hydrogeological Level 2 and Natural Environment Level 1 assessment needs to be completed. The pit is currently operating and extracting materials from above the groundwater table.

4.2 Quantity and Quality of Material

The portion of the site east of the current production area was previously mined and has been rehabilitated to some extent by placing the unusable soils that had been extracted during mining over the sandy soils and native silty clay till.

Based on the results of this investigation, this portion of the site will likely not yield any worthwhile extraction value since the granular materials are comprised in a relatively thin layer, typically ranging from only about 1.0 to 1.5 m in thickness. Further, the overlying fill material would have to be excavated (peeled off) to reach the granular materials below. Also, some of these granular materials encountered during the field program would be classified as fine sand and silty sand, and would likely not meet the granular requirements of OPSS Granular 'B', Type I material. In addition, many of the granular materials extend below the groundwater level.

The west portion of the site which includes the current production area and the farm land (unmined area) immediately to the west has good potential for gravel extraction. Assuming a groundwater elevation of 96.5 m, it is understood that license limit is 1.5 m above this level (98.0 m). In the current production area, the floor of the pit is generally at this level and further extraction would be below the license limit. The farm land has extractable quantity above and below the current license limit.

The table below presents the available quantities (above and below the current license limit) by section of land. Reference can be made to **Drawing 4** which shows the different sections of land.

Section	1a	1b	2a	2b	TP1	TP2	TP3	BH4	Total Quantity (tonnes)	
Quantity*	220,000	10,000	110,000	4,500	9,000	-	-	-	353,500	
Quantity** 30,000 - - 80,000 30,000 7,500 28,000 175,500										
*above current license limit **below current license limit										

Table '	1 – Grave	el Quantities
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The above quantities assume a 15 m offset from the property line and that a 1 to 1 slope of the bank wall is maintained. It is also assumed that the gravel would only be extracted to a depth of 0.3 m above the elevation of natural silty clay till.

Grain size distribution analyses were carried out on select samples of the granular materials obtained from the test pits. As indicated on Figures 1 through 5, the materials are generally within or just marginally outside the gradation envelop of a Granular 'B', Type I material. Based on the gradations, the material can be classified as a Sandy Gravel.

A laboratory Standard Proctor test was carried out on a sample of the Sandy Gravel obtained from TP 11. The maximum dry density of the sample was 2050 kg/m³ at an optimum moisture content of 7.3 percent.



5. General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current geotechnical conditions within the subject property. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, **exp** Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. **Exp** has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

Exp Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, **exp** Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

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We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.



Drawings



1. The boundaries and soil types have been established only at test hole locations. Between test holes they are assumed and may be subject to considerable error.

2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required. 3. Topsoil quantities should not be established from the information provided

at the test hole locations.

4. The site plan was reproduced from Google Maps and should be read in conjunction with EXP Geotechnical Report LON-00015778-GE.

Geotechnical Investigation

Olalondo Pit Underwater Extraction

21515 Olalondo Road

Middlesex Centre, Ontario

exp.	EXP Services Inc.							
Prepared By: E.B.	Reviewed By: B.G.							
Borehole Location Plan								
The Municipality of Middlesex Centre								

scale NTS

DATE February 2018

15701 Robin's Hill Road, London, ON, N5V 0A5

project no. LON-00015778-GE

DWG.





Cross Section A - A'

Cross Section B - B'



-LEGEND- Groundwater Measurement Possible Fill Silt Gand/Sandy Gravel/Sand and Gravel Silty Sand	-NOTES- 1. The cross section should be read in conjunction with EXP Report LON-00015778-GE.	Olalon
Fr Fr Fr Fr Fr Fr Fr Fr Fr Fr Fr Fr Fr F	-LEGEND- oundwater Measurement essible Fill t und/Sandy Gravel/Sand and Gravel ty Sand ty Clay Till	-LEGEND- oundwater Measurement ssible Fill t und/Sandy Gravel/Sand and Gravel ty Sand ty Clay Till



2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.

3. The site plan has been reproduced from MNR Topographic Mapping and should be read in conjunction with EXP Geotechnical Report LON00015778-GE.

¢	BH4	
	TP1	

-LEGEND-

Approximate Borehole Location Approximate Test Pit Location

*e 15701 Robin's Hill Road London, ON, N5V 0A5 DATE PROJECT NO. FEBRUARY 2018 LON-00015778-GE

EXP Services Inc.

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Appendix A – Borehole and Test Pit Logs

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BH1 (MW)

Sheet 1 of 1

CLIENT		The Municipality of Middlesex Centre								PF	OJE	ст	NO)	LO	N-0	001:	5778	3-GE	
PR	OJECT	Olalondo Pit Underwater Extraction DATUM Assumed																		
LO	CATION	21515 Olalondo Road, Middlesex Centre, ON DATES: Bo							Boring December 4, 2017 Water Level											
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-		End of Borehole at 11.27 m bgs.																		-
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) B 2) b	orehole Lo as denotes	ogs must be read in conjunction with EXP Report LC s below ground surface.	DN-000	1577	8-G	iE.	GS	ER IE	Gravity	С	Conse	olida	tion							
3) * 4) W	denotes: 5	50 blows recorded before 150 mm spoon sampler pe l Readings:	enetrati	on.			H Hydrometer CD Consolidated Drained Triaxial													
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*exp) .
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BH2 (MW) Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre			PROJECT NO. LON-00015778-GE									
PR	OJECT	Olalondo Pit Underwater Extraction		DATUM Assumed										
LOCATION		_21515 Olalondo Road, Middlesex Centre, ON DA				Boring	De	cembe	1ber 4, 2017 Water Level					
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-1	104.17	organics, ioose, moist			s	5 S2	300	6	17					
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-7		SILTY CLAY TILL - grey, some sand, trace gravel, hard, moist												
-					77									
-8					S	5 S8	275	64	8	φ 64•				
-	96 55				s	S9	500	58	10	φ				
-9	00.00	End of Borehole at 8.99 m bgs.	0.11											
- 10														
-11										-				
-														
-12										-				
- 10										-				
-13														
NO						SAM		EGEND Ier Samr	ble 🕅	SS Split Spoon 📕 ST Shelby Tube				
1) B	orehole I o	og interpretation requires assistance by EXP before	use bv	others	S.		Rock C	ore (eg.	BQ, NC	a), etc.) Image: Construction of the second sec				
2) h	orehole Lo	ogs must be read in conjunction with EXP Report LC	DN-000	15778	3-GE.	OTH G S	ER TE	STS Gravitv	С	Consolidation				
3)*	denotes: 5	50 blows recorded before 150 mm spoon sampler pe	enetrati	on.		HH	ydrome	eter	Č	Consolidated Drained Triaxial				
4) V	ecember	6, 2017 - dry				γ υ	eve An nit We	iaiysis ight	U	J Unconsolidated Undrained Triaxial				
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						WAT	ERLE	VELS						
							Appare	nt	¥ Me	easured Ā Artesian (see Notes)				

BH3 Sheet 1 of 1

CI	CLIENT The Municipality of Middlesex Centre PROJECT NO. LON-00015778-GE																
	PROJECT Olalondo Pit Underwater Extraction DATUM Assumed																
LO	CATION	21515 Olalondo Road, Middlesex Centre, 0	ON	DAT	ES: B	Boring	No	vembe	r 28, 20	017 Water Level							
	Ę	F S							мс	SHEAR STRENGTH							
Þ	Ē	STRATA	Ť Ŗ	¥			Ŗ	N	ÖŎ	 S Field Vane Test (#=Sensitivity) A Penetrometer Torvane 							
P	Å		1 Î	Ē	т	N	Č	VALUE	IST ITE	100 200 kPa							
Ĥ	0 0	DESCRIPTION		L	P	M̃ B́	Ŭ		R T	Atterberg Limits and Moisture							
(h)			Ļ	Ğ		R	R			₩ _₽ ₩₩ _L							
(m bgs)	(~ ^{m)} 100.30		'				(mm)	(blows)	(%)	● SPT N Value × Dynamic Cone 10 20 30 40							
-0 -	99 54	FILL - sand, brown, some gravel, coarse grained, occasional silt pockets, compact, moist			ss	S1	450	20	13								
-1	00.04	SILTY CLAY TILL - brown to grey, some sand, trace gravel, occasional cobbles, hard, moist		*	ss	S2	375	31	10	●							
2				2	ss	S3	25	46	5	•							
-				Ś	ss	S4	600	35	9								
-3	96 64				ss	S5	600	27	12	► • • • • • • • • • • • • • • • • • • •							
-4	00.04	End of Borehole at 3.66 m bgs.															
-5																	
_6																	
7																	
_																	
_10																	
_11																	
-12																	
-																	
-13																	
						SAM		EGEND Ier Samr		SS Solit Spoon ST Shelby Tube							
1) B	<u>rES</u> orehole l a	og interpretation requires assistance by FXP before	use bv	others	i.		Rock C	ore (eg.	BQ, NG	Q, etc.)							
2) b	Borehole Lo	s below ground surface	DN-000)15778	3-GE.	OTHI G Si	ER TE	STS Gravity	С	Consolidation							
3) * 4) B	denotes: 5	50 blows recorded before 150 mm spoon sampler pe	enetrati	on.		HH	ydrome	eter alvsis	CI	D Consolidated Drained Triaxial U Consolidated Undrained Triaxial							
., 5							nit We	ight		U Unconsolidated Undrained Triaxial							
						K La	ab Perr	neability		S Direct Shear							
						WAT ⊈ A	WATER LEVELS ♀ Apparent ♀ Measured ★ Artesian										

[%] exp.	
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BH4 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre	PROJECT NO PROJECT NO										
PR	OJECT	Olalondo Pit Underwater Extraction		DATUM Assumed									
LO	CATION	21515 Olalondo Road, Middlesex Centre, O	DAT	Boring	No	vembei	[,] 28, 20	, 2017 Water Level					
	ELEVAT-OZ	STRATA DESCRIPTION	SFR4F4 P-10	₩⊔∟ ⊔ОС	ТҮРШ	SAM N U M B E R	RECOVER>	N VALUE	CONTENT MO-STURE	SHEAR STRENGTH ◆ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _P W W _L			
(m bgs)	(~m)		Ť	•			(mm)	(blowe)	(%)	● SPT N Value × Dynamic Cone			
-0 -	97.94	SAND AND GRAVEL - brown, occasional	0.00		Ass	S1	475	(blows)	(%)				
- 1		- becoming wet near 0.61 m bgs		Ţ	ss	S2	400	50	7				
-	05.91		0.000		ss	S3	450	17	13				
-	95.61	SILTY CLAY TILL - grey, some sand, trace gravel, occasional cobbles, hard, moist			ss	S4	400	44	11				
-3					ss	S5	550	46	11				
-4			A CHAR										
-5	92.76	End of Borehole at 5.18 m bos.	<u></u>		SS	S6	500	42	14				
-										-			
-													
-7										-			
-													
8 -										-			
-9										-			
-10										-			
- 11										-			
-										.			
- 12										-			
-13										-			
<u>NO1</u> 1) B 2) b(3) * 4) B	YOTES SAMPLE LEGEND I) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Logs must be read in conjunction with EXP Report LON-00015778-GE. SAMPLE LEGEND ST Shelby Tube I) Borehole Logs must be read in conjunction with EXP Report LON-00015778-GE. OTHER TESTS Specific Gravity C Consolidation 3) * denotes: 50 blows recorded before 150 mm spoon sampler penetration. Borehole open to 1.68 m bgs and ground water measured near 1.22 m bgs upon completion of drilling. C Consolidated Drained Triaxial CU Consolidated Undrained Triaxial Y Unit Weight UU Unconsolidated Undrained Triaxial V Unit Weight UC Unconfined Compression Y Anaperent X Anaparent Measured Artesian (see Notes)												

*exp).
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BH5 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre	_ PR	ROJECT NO												
PR	OJECT	Olalondo Pit Underwater Extraction							DATUM							
LO	CATION	_21515 Olalondo Road, Middlesex Centre, C	<u>N</u>	oring	No	vembei	r 28, 2017 Water Level									
	E		SAM	PLES	-	MC	SHEAR STRENGTH									
P	Ē		R R	WE			R	N	U O Į Ņ	S Field vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane						
P	A T	STRATA	Î	Ł	Ţ	NU	C	VALUE	T E	100 _ 200 kPa						
н	Ů N	DESCRIPTION	P	L L	P	B	Ě		ŘŤ	Atterberg Limits and Moisture						
(m has)	(m)		þ	Ğ	-	Ŕ	Ŷ									
(5go)	99.04						(mm)	(blows)	(%)	■ SPIN Value × Dynamic Cone 10 20 30 40						
-0-	98.69	FILL - silt, brown, trace to some clay, trace sand,			ss	S1	600	28	17	• • •						
-		SAND AND GRAVEL - possible fill, brown, trace	\bigotimes													
-1	97 52	moist			ss	S2	500	52	3							
-	01.02	SILTY CLAY TILL - brown, some sand, trace	Ň		ss	S3	300	30	13	•••••						
-2		gravel, hard, moist			A											
-		- becoming grey near 2.59 m bgs														
-3						64	250	E0*	11							
-					2 ³³	54	250	50	11							
-4																
-																
-5	93.86				ss	S5	400	39	10							
-		End of Borehole at 5.18 m bgs.														
-6																
-																
-7																
-																
-8																
-																
9																
_																
10																
_11																
10																
-12																
-																
-13																
			•		•	SAM										
	<u>reholo l</u>	or interpretation requires assistance by EVD before	ico hu	othora			Rock C	ore (eg.	ne ⊠ BQ, NC	So Spin SpoonSo Sheiby Tube0, etc.)Image: So Sheiby Tube						
	orehole Lo	by must be read in conjunction with EXP Report LC	N-000	15778	3-GE.	OTH	ER TE	STS Gravity	C	Consolidation						
∠) D 3) *	denotes: {	50 blows recorded before 150 mm spoon sampler pe	netrati	on.		Hydrometer CD Consolidated Drained Triaxial										
4) B	orenole op	ben and dry upon completion of drilling.				γ U	eve An nit Wei	iaiysis ight	U	J Consolidated Undrained Triaxial						
						P Fi K La	P Field Permeability			C Unconfined Compression S Direct Shear						
						WAT	ER LE	VELS	.	· · · · · · · ·						
						∣≚ A	Appare	nt	🗶 Me	easured Artesian (see Notes)						

BH6 (MW) Sheet 1 of 1

CLIENT The Municipality of Middlesex Centre										PR	ROJECT NO. LON-00015778-GE					
PR	OJECT	Olalondo Pit Underwater Extraction			DATUM Assumed											
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	Bo	oring	De	cember	4, 201	17 Water Level Jan 16/18	_							
_	EL		S	w			SAM	PLES		MCO	SHEAR STRENGTH S Field Vane Test (#=Sensitivity)	Γ				
DEP	V A		R A T	Ĕ			N	E E C	N	I N S T T E	▲ Penetrometer ■ Torvane					
Ť	I	STRATA DESCRIPTION	Å		ΙŢ		M	Ŏ ⊻	VALUE	Ů Ñ R T	100 200 kPa					
	Ň		[Ğ	E		В Н Ц	R		E	W _P W W _L					
(m bgs)	(~m)		¥				ĸ			(0)	• SPT N Value × Dynamic Cone					
-0 -	98.10	FILL - silt brown trace to some clay some				_		(mm)	(blows)	(%)		┝				
-		sand, trace gravel, trace topsoil, compact, moist			Øs	SS	S1	550	16	18	$[\bullet \bullet$	-				
-1				ΞŢ	\mathbb{Z}_{s}	ss	S2	300	18	14	••••••••••••••••••••••••••••••••••••••	_				
-	00.07		\bigotimes									-				
-2	96.27	SAND AND GRAVEL - brown, trace silt,	0.00		S	ss	S3	425	37	14	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ 	_				
_	95.66	occasional cobbles, dense, wet				~	64	FFO	20	10		-				
-3		gravel, very stiff to hard, moist	191			50	34	550	20	12		_				
-		- becoming grey near 3.05 m bgs			s	ss	S5	400	36	11	 	_				
1			<u>Í</u>													
-																
	00.00				Øs	ss	S6	500	50*	12	φ					
5	92.92	End of Borehole at 5.18 m bgs.	LATZE.													
-6																
0																
_																
-7																
_																
-8																
-																
-9																
-												-				
-10																
-												-				
-11																
-												-				
-12																
-																
-13												-				
							SAMF									
1) P	<u>rebola la</u>	a interpretation requires assistance by EVD before	ieo by	othere			⊠ A □ R	lock C	er Samp ore (eg.	ie ⊠ BQ, NQ	a ST Shelby Tube Q, etc.)					
	orehole Lo	below around surface	DN-000	15778	3-GE		OTHE	ER TE	STS Gravity	C	Consolidation					
∠) D(3) *	denotes: 5	50 blows recorded before 150 mm spoon sampler pe I Deodinar:	netrati	on.			HHy	/drome	eter	Č	D Consolidated Drained Triaxial					
4) Water Level December (6, 2017 - 1.49 m bgs, Elevation 96.61 m					3 5ιθ γ Ur	eve An hit Wei	alysis ight	UL	U Unconsolidated Undrained Triaxial					
J	anuary 16	, 2017 - 1.41 m bgs, Elevation 90.09 m , 2018 - 1.04 m bgs, Elevation 97.06 m					P Fi∉ K La	eld Per b Pern	meability	bility UC Unconfined Compression bility DS Direct Shear						
						Ņ	WATI	ER LE	VELS	V 14	· · · · · · · · · · · ·					
							÷A	vpharei	IL I	<u>-</u> ₹ IVI€	icasuicu 🔹 Aitesian (see Notes)					

[%] exp.

BH7 (MW)

Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre	PROJECT NO. LON-00015778-GE																		
PROJECT Olalondo Pit Underwater Extraction									DATUM Assumed												
LO	CATION	DAT	ES:	B	oring	No	vember	rember 27, 2017					_ Water Level Jan 16/18								
	E		Ş				SAM	PLES		MC		~	Ci e l	SHI	EAR	ST	REN	GTH	- 141-		Τ
P	Ē		RA	WE				R	N	U O I N S T		Pe	net	rom	ane neter		■ T	orva	ne	/ity)	
P	Î	STRATA	I	E	Ţ	ŗ	N U M	C O V	VALUE	ŤĖ ŲN			1		100		1		200	kPa	l
н	Ó N	DESCRIPTION	P	L Q	Ė	5	BE	ĚR		В Т Е		At	tert	perç	y Lir Wa	nits W	and W.	Moi	stur	'e	
(m bgs)	(~m)		D T	G			R	Y			•	SP	ΤN	Va	iue			- nami	c Cí	one	
-0-	99.53	OAND		• • • •				(mm)	(blows)	(%)			10		20		30		40	 	_
-		clay, compact, moist	\bigotimes			SS	S1	450	20						•				⊞		8
-1			\bigotimes		$\overline{\mathcal{A}}$	ss	S2	370	17										Ħ		Η_
-		- trace organics and wood encountered near 1.27	\bigotimes				02	0.0												\pm	-
-2	97.70	m bgs SILTY CLAY TILL - brown, some sand, trace	<u> <u>an</u> 2</u>			ss	S3	75	47										H		4_
-		gravel, occasional cobbles, very stiff to hard, moist				ee	S 1	450	30												8
-3						33	04	430	39												
-		- becoming grey near 3.05 m bgs			9	ss	S5	50	55										Ħ	5	5
-4				Ţ															⊞		8
-																			Ħ		Η_
5						ss	S6	450	34									•	⊞	⊞	8
-																			Ħ		H_
6			75																⊞	\mp	
-						ss	S7	100	69										Ħ		₽
-7																			\square	\pm	
-																			Ħ		╞┥╶
8					\mathbb{Z}	ss	S8	500	48										⊞		
_																			Ħ		╞┥╶
-9																			⊞	\pm	
-						ss	S9	400	17										Ħ		
-10																			\square		
- 10																			Ħ		╞┥╶
-11						ss	S10	550	27										\square	\mp	
																			H		
-12																			\square	\mp	
						ss	S11	400	30										Ħ		╞┥╶
-13	86.73	End of Borehole at 12.80 m bgs.	1916																Ш		Π_
								. –													
NOT	TES						SAMI	PLE LE S Aug	EGEND er Samp	le 🛛	SS	Sp	lit S	poc	n		I ST	- She	lby ⁻	Tube	
1) B	orehole Lo	og interpretation requires assistance by EXP before ι	use by	others				lock Č	ore (eg.	BQ, NG	, etc	c.)		•			I VN	l Var	ie Sa	ampl	е
B 2) bg	orehole Lo gs denotes	ogs must be read in conjunction with EXP Report LC below ground surface.	N-000	15778	3-GE	Ξ.	GSp	ecific	Gravity	C	Con	soli	idati	on							
3) * 4) M	denotes: 5 /ater Leve	00 blows recorded before 150 mm spoon sampler pe I Readings:	netratio	on.			H Hy S Sie	/drome eve An	eter alysis	CI	J Co	onso onso	olida	ated	l Ura	inec drair	ned T	axial Triaxia	al		
	ecember December	o, 2017 - 3.62 m bgs, Elevation 95.92 m 15, 2017 - 3.11 m bgs, Elevation 96.43 m					γ Unit Weight UU Unconsolidated Undrained Triaxi P Field Permeability UC Unconfined Compression							ixial							
J	anuary 16	, 2018 - 3.81 m bgs, Elevation 95.73 m					K La	b Pern	neability VELS	DS	S Dir	rect	Sh	ear							
			Σ A	pparer	v ELS nt	¥ Me	WATER LEVELS ♀ Apparent ♀ Measured ▲ Artesian (see №								ee N	lotes	3)				

BH8 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre		PF	ROJECT NO. LON-00015778-GE							
PR	OJECT	Olalondo Pit Underwater Extraction	DATUM Assumed									
LO	CATION	_21515 Olalondo Road, Middlesex Centre, C	Boring	No	vembe	r 27, 2017 Water Level						
D	ELE	STRATA	ST	w		SAM	PLES	PLES		SHEAR STRENGTH S Field Vane Test (#=Sensitivity)		
E P	A A		Â	E	₊	N	Ë	N VALUE	S T T E	▲ Penetrometer ■ Torvane		
H	ļ	DESCRIPTION		Ļ	Υ Ρ	MB	V V E		₽ ₽	Atterberg Limits and Moisture		
	N		ļĿ	Ğ	E	R	R Y			W _P W W _L		
(m bgs)	(~ ^{m)} 98.89						(mm)	(blows)	(%)	SPT N Value × Dynamic Cone 10 20 30 40		
		SAND AND GRAVEL - possible fill, brown, trace clay, occasional silt pockets, compact, moist to			ss	S1	550	6				
_1		wet		2		0	400	00				
_ '						52	400	20				
-2	97.06	SILTY CLAY TILL - grey, some sand, trace			ss	S3	300	46		••••••••••••••••••••••••••••••••••••••		
-		gravel, occasional cobbles, hard, moist				64	400	16				
-3						- 34	400	40				
-					ss	S5	300	39		•		
-4												
-				Ľ	77							
5	93.71				ss	S6	75	79		79		
-		End of Borehole at 5.18 m bgs.										
-6												
-												
-7												
-												
-8												
-												
-9												
-												
-10												
-												
-11												
40												
_13												
10												
NOT	TES					SAM	PLE LI	EGEND ger Samp	ole 🛛	SS Split Spoon 🛛 ST Shelby Tube		
1) B	orehole Lo	og interpretation requires assistance by EXP before	use by	others			Rock Č =R ⊤⊏	ore (eg. STS	BQ, NC	≀, etc.)		
2) b	orehole Lo gs denotes	ogs must be read in conjunction with EXP Report L0 s below ground surface.	JN-000	15778	S-GE.			Gravity	C	Consolidation		
3) B C	orenole op ompletion	ben to 4.57 m bgs and ground water measured near of drilling.	4.27 m	i bgs i	ipon	S Si	eve An	alysis	Cl	J Consolidated Undrained Triaxial		
						P Fi	eld Per	ignt rmeability	y U	C Unconsolidated Undrained Triaxial		
			K Lab Permeability DS Direct Shear									
			VVATER LEVELS ♀ Apparent ♀ Measured ▲ Artesian (see Note									

BH9 (MW) Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre					PR	ROJECT NO.	LON-00	015778-G	<u>E</u>		
PR	OJECT	Olalondo Pit Underwater Extraction							DA	TUM Assum	ed		
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	N	DAT	ES: E	oring	No	vembei	[.] 28, 20	017 Wate	er Level	<u>Jan 16/1</u>	8
	Ę		s			SAM	PLES		мс	SHEAR	STREN	GTH	
Ð	Ē		T R	¥			R	N	0 Ŏ Į Ŋ	S Field Vane A Penetrometer	Test (#= · ■ To	Sensitivity	y)
P	A T	STRATA	Î	E	ĩ	NU	Č	VALUE		100		200 kF	Pa
н	o N	DESCRIPTION	P	۲ ۲	P	B	Ĕ		ŘŤ	Atterberg Lir	nits and	Moisture	
(m bas)	(m)		þ	Ğ	-	Ŕ	Ŷ						
(5go)	98.29		•				(mm)	(blows)	(%)		× Dyr 30		Ð
-0-		CLAYEY SILT - possible fill, brown, some sand, some gravel, trace organics, moist	\bigotimes		ss	S1	250		29		o		
_	97.29		\bigotimes	Y									
-1		SANDY GRAVEL - brown, some silt to silty,	0.0.0		ss	S2	400	25	9	0			
-		- becoming wet near 1.52 m bgs			ss	S3	350	56	9				56 •
-2	95.85		0.0.0.0										
-		SILTY CLAY TILL - grey, some sand, trace	194		ss	S4	550	26	14	<u> </u>	+		
-3		gravel, occasional cobbles, very still to hard, moist				85	350	24	10				
-						00	330	24	10				·
-4										╏┼┼┼┼┼┼┼┼			
-			J.			<u> </u>	400	04	10				-
-5	93.11	End of Porcholo at 5.18 m bas			100	50	400	81	10	<u> </u>			
-		End of Dorenole at 5. to 11 bys.											· ·
-6													-
-													
-7													-
-													-
-8													-
-													-
-9													-
-													·
-10													-
-													· .
-11													-
-													
-12													-
-													
-13													-
						SAM							
NO	TES							er Samp		SS Split Spoon		Shelby Tub	oe nlc
1) B B	orehole Lo	og interpretation requires assistance by EXP before u	use by	others	-GF		ER TE	ore (eg. STS	טע, ואט	<i>ι</i> , τι υ. <i>)</i>	LU VIN	i vane oam	pie
2) bi	gs denotes	s below ground surface. I Readings:			<u>с</u> .	G S H H	oecific /drome	Gravity eter	C CI	Consolidation	ined Tria	xial	
	ecember	6, 2017 - 1.18 m bgs, Elevation 97.11 m 15, 2017 - 1.24 m bgs, Elevation 97.05 m				S Si	eve An	alysis	Cl	U Consolidated Uno	drained T	riaxial Triavial	
J	anuary 16	, 2018 - 0.75 m bgs, Elevation 97.54 m				PFi	eld Per	meability	/ U(C Unconfined Com	pression		
						WAT	ພ Perr ER LE	VELS	D	S Direct Snear			
							ppare	nt	¥ Me	easured 👗	Artesia	an (see Not	es)

Ŷ	ex	Ο. ΤΙ	ES	ΤP	TI	LO	G										Sł	ieet	ΤF t 1 (P1 of 1
CL	IENT	The Municipality of Middlesex Centre							PF	20	JEC	.т	NO.	!		1-00	015	5778	3-GI	
PR	ROJECT	Olalondo Pit Underwater Extraction							DA	٩ΤI	JM	_	Ass	sum	ed					
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	DN	DAT	ES: E	Boring	No	vembe	r 9, 201	17			_ v	Vate	r Le	vel	_			
	Е		6		Γ	SAM	IPLES		мс	Γ			SH	EAR	STF	RENG	GTH	I		Т
D	L E,		Ť R	Ψ			R		10° N		⊧S	Fie	ld V	'ane	Tes	t (#=	-Sei	nsiti	ivity	0
Ē	Å	STRATA	A	-	-	N	L C	N VALUE	S T T E	'	• • •			100			ЛУС	200	0 kE	
Н	İ	DESCRIPTION			Ý	M	ĮŽ		I ₩ ₽	⊢	A	tter	berg	g Lin	nits	and	Мо	istu	ire	<u>а</u>
	Ň		Ϊ	Ğ	E	Ē	Ř						-	W _P	W	WL	-			
(m bgs)	(~m)		Ť				(mm)	(blowo)	(%)) SF	א די	N Va	lue	×	Dyr	nam		one	,
-0 -	90.32	SANDY GRAVEL - brown, fine to coarse grained	0.00					(biows)	(70)	\mathbf{h}	τ'Γ-		ΠŤ	Ť				40	\Box	╈
			0.0.0 0.0							H			\square					+	H	+
-			0.0.0																	
			000							\square		\square	Ш	$\parallel \parallel$		\square		\parallel		
-1			0.0.0 0.0.0	1						\mathbb{H}	\square	╟	+++	+++	++	+++	\square	₩	₩	
	97.12	SILTY SAND - brown	D = 6							\mathbb{H}	+	\vdash	$\left \right \right $	+++	++	+++	.++	╫	┼┼┦	+
-										H		\square						+	$\left \cdot \right $	+
				∇																
-2				-						\square		Ш	\square	$\downarrow\downarrow\downarrow$		\square		Щ	Ш	4
	96.12									\parallel	\square	⊢	$\left \right \right $	+++		+++	┝┿┽	$+\!\!+$	++	
_		SAND AND GRAVEL - dense, wel	0.00	1						\mathbb{H}	╢	\vdash	+++	+++	++-	+++		╈	┼┼┤	+
			0.00							H		\vdash	$\left \right $	+++		+++		++	++	+
2			0.0.0							Ħ	Ħ		Ħ			+++		Ħ	Ħ	
-3			0 0 0 0 0 0 0							\square				Ш						
	94.82		0000							\parallel		\square	\square	+++	++	+++	╞┼┼	\parallel	$\parallel \mid$	\parallel
-	94.52	SILTY CLAY TILL - grey, some sand, trace gravel	19							╟		\vdash	$\left \right \right $	+++	++	+++		+	$\left \right $	+
-4		End of Test Pit at 3.8 m bgs.								Γ										1

-5											-
-6											_
											-
NOTES Test Pit Log interpretation requires assistance by EXP before use Pit Log must be read in conjunction with EXP Report LON-00015 Groundwater measured near 1.8 m bgs after 3 hours. bgs denotes below ground surface. 	e by othe	ers. Te	est	SAMF ⊠ A OTHE G Sp H Hy S Sie Y Un P Fie K Lat WATE Z A	PLE LE S Aug ock Co R TES ecific drome eve An it Wei eld Per b Pern ER LE pparer	GEND er Samp ore (eg. I STS Gravity ter alysis ght meability neability VELS nt	le ⊠ 3Q, NQ CC CC UU 00 05 ▼ Me	SS Split Spoo , etc.) Consolidation O Consolidated J Consolidated J Unconsolida O Unconsolida D Unconfined 0 Direct Shear	Dn d Drain d Undi ted Un Comp	ST Shelby Tub VN Vane Samp ned Triaxial ndrained Triaxial netrained Triaxial ression Artesian (see Note	e ble es)

	ex	О. Т І	ES	ΓΡ	ΡIT	LC	G										ļ	She	T et 1	P2	2 1
CL	IENT	The Municipality of Middlesex Centre							PF	lo'	IEC	Т	NO.		LC)N-I	000	157	78-0	GE	
PF	OJECT	Olalondo Pit Underwater Extraction							DA	ιTL	JM		Ass	sum	ned						
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	<u>N</u>	DAT	ES:	Boring	No	vembei	r 9, 201	7			<u> </u>	late	er L	eve	el .				
DEPTH	ULE> AT−−OZ	STRATA DESCRIPTION	STRATA PL	Wmrr ro	TYPE	SAN N U M B E	IPLES RECOVER	N VALUE		•	S Pe	Fie enet	SHI Id V rom berg	EAR ane nete 100 J Lin W ₂	R ST P Te r D mit	rRE est(■ sai	NG #=S Tor nd N	TH Sens Van 2 Nois	e 200 I sture	i ty) ∢Pa	
1 bgs)	(~m)		P	G		R	Y			•	SF	PT N	l Va	⊢ lue	-	× D	⊣ [∟] yna	mic	: Co	ne	
0 -	97.97	CANDY CDAVEL brown find to coorde argined	9 0			_	(mm)	(blows)	(%)	 		10		20	, '	3	Ó	· · · ·	40	r '	╡
-1		Grain Size Analysis Gravel Sand Silt 74% 24% 2%																			
-2	96.17	SILTY CLAY TILL - brown, some sand, trace gravel		Ā																	
-3	04 77	- becoming grey near 2.4 m bgs																			
	94./7	End of Test Pit at 3.2 m bgs.				+				⊢⊢											+
-4																					-
-5																					
-6 -7																					
NO	TES					SAM	PLE LI AS Aug	EGEND Jer Samp	ole 🛛	SS	S Sp	olit S	Spoc	n	I		ST S	Shell	by T	ube	
1) T F 2) G 3) b	est Pit Log it Log mus roundwate gs denotes	interpretation requires assistance by EXP before us st be read in conjunction with EXP Report LON-0007 er measured near 1.5 m bgs. s below ground surface.	U OTH GS HH SSi YU PFi KLa WAT Z	Rock C ER TE pecific ydrome eve An nit We eld Per ab Perr ER LE Appare	ore (eg. STS Gravity eter halysis ight meability NELS nt	BQ, NC CI CI UI y UC DS	, et Cor J C J C J U S Di Eas	c.) nsol ons ons ncc ncc irec	idat olida olida nso nfin t Sh	ion ated lidat ed (I Dra I Un ted I Com	aine dra Unc ipre	ed T inec Irair essic	riaxi I Tri ied on	/ane al axia Triax	e Sa I kial	otes)			

*	ex	О. Т І	ES	ΓΡ	IT	LO	G			TP3 Sheet 1 of	; 1
CLI	ENT	The Municipality of Middlesex Centre							PF	ROJECT NO. <u>LON-00015778-GE</u>	
PR	OJECT	Olalondo Pit Underwater Extraction							DA	ATUM Assumed	
LO	CATION	21515 Olalondo Road, Middlesex Centre, O	N	DAT	ES: E	Boring	No	vembe	r 9, 201	17 Water Level	_
Ē	E L E V		ST R	W		SAM	IPLES R	N		SHEAR STRENGTH ◆ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane	Γ
P T H	A T O N	STRATA DESCRIPTION	ÎTA Pl		TYPE		CO V LLRV	VALUE		100 200 kPa Atterberg Limits and Moisture W _P W W _L	
n bgs) -() -	(~m) 98.00		O T	Ŭ			r (mm)	(blows)	(%)	• SPT N Value × Dynamic Cone 10 20 30 40	
Ŭ		SANDY GRAVEL - brown, fine to coarse grained, occasional cobbles	0.00							[+ + + + + + + + + + + + + + + + + + +	
-1	97.50	Grain Size Analysis Gravel Sand Silt 66% 26% 8% SILTY CLAY TILL - grey, some sand, trace gravel									
	96.40	gi avei									
-2		End of Test Pit at 1.6 m bgs.									-
-3											
-4											-
-5											-
-6											-
7 NOT 1) Te 2) Te 3) bg	ES est Pit Log t Log mus est pit dry s denotes	interpretation requires assistance by EXP before us t be read in conjunction with EXP Report LON-0001 at completion. below ground surface.	e by o 5778-	Test	SAMI ⊠ A ⊡ F OTHI G SI H Hy S Si Y U	PLE LE AS Aug Rock C ER TE pecific ydrome eve An nit Wei	EGEND ger Samp ore (eg. STS Gravity eter nalysis ight	I BQ, NC CI CI CI UI	SS Split Spoon a, etc.) ST Shelby Tube VN Vane Sample Consolidation D Consolidated Drained Triaxial U Consolidated Undrained Triaxial U Unconsolidated Undrained Triaxial	L	
				P Fi	eid Per ab Perr	neability	y U(D(S Direct Shear			

WATER LEVELS ⊈ Apparent

▼ Measured

▲ Artesian (see Notes)

	ex	р. т	ES	ΓΡ	T	LC	G			TP4 Sheet 1 of 1
CL	ENT	The Municipality of Middlesex Centre							PF	ROJECT NO. LON-00015778-GE
PR	OJECT	Olalondo Pit Underwater Extraction							DA	TUM Assumed
LO	CATION	21515 Olalondo Road, Middlesex Centre, (DATI	ES:	Boring	No	vembei	r 9, 201	7 Water Level
	ZOI> <≣L	STRATA DESCRIPTION	STRATA PL	or rrm&	ТҮРШ	SAN NUM BE	IPLES RECOVER	N VALUE		SHEAR STRENGTH ◆ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture Wo W Wi
(m bgs)	(~m) 99 41		የ	6		R	Y (mm)	(blows)	(%)	► SPT N Value × Dynamic Cone 10 20 30 40
0 -	98.31	SILTY CLAY TILL - brown, some sand, trace gravel - becoming grey and hard near 0.3 m bgs							(70)	
-1 -2 2 3 4 5 6 6 7	98.31	End of Test Pit at 1.1 m bgs.								
7 1) Te 2) Te 3) bç	ES est Pit Log it Log mu est pit dry gs denoted	g interpretation requires assistance by EXP before u st be read in conjunction with EXP Report LON-000 at completion. s below ground surface.	use by o 15778-	thers. GE.	Test	SAM □ F OTH GS HH SSi YU PFi KLa	PLE LI AS Aug Rock C ER TE pecific ydrome eve An nit We eld Per ab Perr	EGEND ore (eg. STS Gravity eter nalysis ight meability	He Ø BQ, NG CI CI UI Y UC	SS Split Spoon ST Shelby Tube S, etc.) ST Shelby Tube Consolidation Consolidated Drained Triaxial J Consolidated Undrained Triaxial J Unconsolidated Undrained Triaxial C Unconfined Compression S Direct Shear

WATER LEVELS ⊈ Apparent

▼ Measured

▲ Artesian (see Notes)

TEST PIT LOG

TP5 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre							PF	RO	JE	СТ	. N	О.		LO	N-0)00	157	78	-GE	
PR	OJECT	Olalondo Pit Underwater Extraction							DA	١T	UN	1 _	A	SSI	umo	ed						
LO	CATION	_21515 Olalondo Road, Middlesex Centre, C	<u>N</u>	DAT	ES: E	Boring	No	vembe	r <mark>9, 20</mark> 1	17				W	ate	r L	eve	el				
	E		s			SAN	IPLES		мс				S	HE	AR	ST	RE	NG	ΤН			
п	Ē		Ĭ	w			R		lö ö	•	Þ S	Fi	eld	l Va	ine	Те	st (i	#=\$ 	Sen	siti	vity)	
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Ţ	T	STRATA	Å		Ϋ́	Ŭ	Ŏ	VALUE	ÿ ₽						100					200	kPa	
	O N	DESCRIPTION	P	۲, D	E	BE	Ê		Ë		F	ATTE	erbe	ərg	LIN Wa	nits W	san / W	1a 1 V.	VIOIS	stui	е	
(m bgs)	(~m)		ļ	G		R	Ŷ					от	NI 1		H	-0	/ D					
0	98.13		· ·				(mm)	(blows)	(%)	`	- 3	1	0	1 ai	20		3	911e 0	1	40		
-0-		SILTY CLAY - possible fill, brown, with sand and	\bigotimes																			
		yi avei	\bigotimes							Ц												
-			\bigotimes																			
			\bigotimes							\mid												Ц
-1	97.13		XX							μ			+			_				+		
	96.93	SANDY SILT brown	1 - 0							\vdash	+		+	_		+		-		+		H
		SAND F SILT - DIOWIT								\vdash	+		+	-		+		+		+	++-	H
	96.43									\mathbb{H}			+			+				+		\square
	06.13	SILTY CLAY TILL - grey, some sand, trace	194							H						+		+				
-2	30.13	End of Test Pit at 2.0 m bgs.	· 201 20.																			4-
-																						-
-3																						_
Ŭ																						
-																						-
-4																						-
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-5																						-
-																						-
-6																						-
_																						
7				1		SAM	- PLE LE	EGEND		-												_
NOT	TES						AS Aug	er Samp		S	S S	Split	Sp	oor	ר	F		ST S	Shel	by .	Tube	
1) To	est Pit Log	g interpretation requires assistance by EXP before us	se by o	thers.	Test	ОТН	ER TE	STS	DQ, NG	ζ, Ο		,				L	= v	11	vail	0	anp	G
2) 1	est pit dry	at completion.	5110-	GE.		GS	pecific	Gravity	C	Co	nso	bilc	atio	n					:_/			
3) b(gs denotes	s below ground surface.				SSi	yarome eve An	eter Ialysis	CL) () (Jon Con	sol sol	idat idat	ed ed	∪ra Unc	ine Irai	a Ir ned	nax Tri	iai iaxia	ıl		
						Ϋ́́́	nit We	ight	Ŭ	J	Jnc	ons	solic	late	ed U	Ind	rain	ed	Tria	xial		
						P Fi K La	eid Per ab Perr	meability	y U(D(S E	unc Dire	onf ct S	ine She	a C ar	omp	ore	SSIO	n				
						WAT	ER LE	VELS			2	-	2.									
						⊻ /	Appare	nt	¥ M	eas	sure	ed			Ā	ŀ	\rte	sia	n (se	ee N	lotes	5)

TEST PIT LOG

TP6 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre							PR	ROJE	ЕСТ	N	0.		LO	N-0	000	157	78-	GE	
PF	ROJECT	Olalondo Pit Underwater Extraction							DA	TUI	۸ _	A	ડડા	um	ed						
LC	CATION	21515 Olalondo Road, Middlesex Centre, C	N	DAT	ES: E	Boring	No	vembe	r 9, 201	17			W	ate	er L	eve	el .				
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D	Ŀ		Ť R	w			R		I M C	•	S Fi	eld	l Va	ine	Те	st (i	#=S	Sens	sitiv	/ity)	
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Ť		DESCRIPTION	Á		¦	M	l⊻	VALUE	İ İR İ	<u> </u>	Δtte	rhe	- Pra	100 I in	nite	an	d N	Z	200 stur	kPa a	
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(m bgs)	(~m)		¥	Ŭ			T			•	SPT	N١	/alı	ue ue	- 0 >	< D	i yna	mic	: Co	one	
-0-	97.85						(mm)	(blows)	(%)	╏╌╌╵	1	0	<u>.</u>	20		3	Ō	4	40		
		and gravel	\bigotimes							\vdash	\square	+			_						
-			\bigotimes							\vdash					-				++		.
			\bigotimes																		
_1	96.85		\bigotimes																		
		CLAYEY SILT - brown, some sand, trace gravel																			
			1212							\square											
-	06.05		KK							\mathbb{H}		+							++		+
	96.05	SAND - brown, fine to medium grained, trace																			
-2		- some water seepage near 1.8 m bos		<u> </u>																	
										Ш											
-																					-
	04.05									\vdash	\square	+			_						
-3	94.85	SILTY CLAY TILL - grey, some sand, trace	911							\vdash											
	94.45	gravel]																	
-		End of Test Pit at 3.4 m bgs.																			•
-4																					-
-																					
5																					_
-																					
0																					
_																					
7						SAM		EGEND			o	~									
NO	TES			4 1	T (AS Aug Rock C	jer Samp ore (eg.	bie ⊠ BQ, NG	SS), etc	Split .)	Sp	oor	ר	٥		51 S /N \	onell √ane	by 1 e Sa	i ube ampl	e
	Pit Log mus	t be read in conjunction with EXP Report LON-000	se by o 15778-	GE.	Iest	OTH	ER TE	STS	~	C		ot: -	5							-	
2) G 3) b	Froundwate	er measured near 2.0 m bgs. s below ground surface.					pecific ydrome	eravity	C	Cons D Co	nsoli	idat	n ed l	Dra	ine	d Tr	iaxi	ial			
			SSi YU	eve An nit We	ialysis iaht	Cl	J Co J Un	nsoli cons	idat solic	ed I date	Unc ed l	drai Indi	ned rain	Tria ed ⁻	axia Triav	l xial					
						PFi	eld Per	rmeabilit	y UC		conf	ine	d C	om	pre	ssio	n				
						WAT	ER LF	VELS	D	5 DIr	BOUS	or 10	aſ								
						⊻ /	Appare	nt	¥ Me	easu	ed			Ā	A	Artes	siar	ı (se	e N	lotes	5)

*exp.

TEST PIT LOG

TP7 Sheet 1 of 1

		The Municipality of Middlesey Centre							DE			<u>т</u> •					10	00	157	79	GE	
		Olalondo Pit Underwater Extraction							יייי 4ס	λ UTU	LС М		٥	 sur	ne	<u></u> d	1-0	00	13/	10	0	
LO		21515 Olalondo Road, Middlesex Centre, C	DN	DAT	ES: E	Borina	No	vembe	r 9. 201	17			V	Va	ter	<u>∽</u> Le	ve					
	F					SAN							SH	EA	RS	STR	REN	IG	гн			T
DEP	ILW> 4	STRATA	ST R A T	W E L		N	REC		M C O O S T E	•	S I Pei	Fiel net	ld \ ron	/an net	er	es	t (#	ŧ=S Γor	Sens van	sitiv e	vity)	
H		DESCRIPTION			Ý	M	₽		Ŭ Ñ ₿ T	-	At	terl	ber	g L	.im	its	an	d N	Nois	200 stur	кРа 'е	
	Ň		ΙĽ	Ō G	Ē	Ë	Ř							Ň	I _P	Ŵ	W	'L				
(m bgs)	(~m)		Ť				(mm)	(blowe)	(%)	•	SP		l Va	lue	•	x	Dy	/na	mic	; C(one	
-0 -	97.60	SAND AND GRAVEL - possible fill, brown, with						(biows)	(70)		Т			Ť		╓		, 	ΤŤ	+0		
		clay and silt	\bigotimes								T											H
-			\bigotimes]-
	96.70										+											H
-1		SILTY SAND - brown to grey								$\left \right $	+						+		+	+		+
				·							+											
-				⊒] -
		- becoming wet near 1.6 m bgs																				
-2										\mathbb{H}	+			-			+					+ -
	95.20			1																		
-		SILTY CLAY TILL - grey, some sand, trace	96K	*] -
		giavoi																				
-3	94.60	End of Test Pit at 3.0 m bos.	r.kafis																			4
-																						-
-4																						-
-																						-
5																						-
-																						-
-6																						-
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7			I	L		SAM	i Ple Le	l EGEND	I	L												
NOT	<u>ES</u>		AS Aug Rock C	jer Samp ore (eq	BQ NC	SS et/	Sp	lit S	spo	on		m	S V	T S N N	Shel /an4	by -	Tube	e le				
1) T P	est Pit Log it Loa mu	g interpretation requires assistance by EXP before us st be read in conjunction with EXP Report LON-0007	ОТН	ER TE	STS		, 00	.,					لیے	v			. 0	anp				
2) G 3) h	roundwate	er measured near 1.6 m bgs. s below ground surface.	G S H H	pecific ydrome	Gravity eter	C CI	Con	soli onso	dat olida	ion ateo	d D	rair	ned	Tri	iaxi	al						
-, -,		· g				S Si	eve An	alysis	Cl	JCo	onso	blida	ateo	U bet	ndr	ain	ed	Tri	axia Tria	 xiəl		
				PFi	eld Per	meabilit	y U		ICOL	fin	ed	Col	mpi	res	sior	n	n id.	ndí				
						K La	ad Perr ER I F	neability	DS	5 Di	rect	Sh	ear									
						⊻ /	Appare	nt	¥ M	eası	ired			7	Ċ	A	rtes	siar	ı (se	e١	lote	s)

TEST PIT LOG

TP8 Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre							_ PR	OJE		D	LO	N-00	0157	78-0	ε	_
PR	OJECT	Olalondo Pit Underwater Extraction							_ DA	TUM	A	sum	ed					_
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	DN	DAT	ES:	Boring	No	vember	[.] 9, 201	7		Wate	er Le	evel				_
	ビードンタナーのス	STRATA DESCRIPTION	STRATA PL	WWLL LO	TYPE	SAM N U B E	PLES RECOVER	N VALUE	CON⊢≣NL NO−⊗⊢DR⊟	SHEAR STRENGTH ◆ S Field Vane Test (#=Sensitivity ▲ Penetrometer ■ Torvane 100 200 kP Atterberg Limits and Moisture Wo W W:							ty) Pa	
(m bgs)	(~m)		P	G		R	Y	<i>.</i>	(0()	• SI	PT N V	¦≓ ∕alue	×	Dyn	amic	Cor	ne	
0 - - 1	97.28	SILTY SAND - possible fill, brown, with clay and gravel SANDY GRAVEL - brown, fine to coarse grained Grain Size Analysis Gravel Sand Silt					((((((((((((((((((((((((((((((((((((((((DIOWS)	(70)									
-2	96.28	76% 18% 6%		Ϋ́														-
_	95.78	SILIY CLAY TILL - grey, some sand, trace gravel		2														
	95.78	End of Test Pit at 2.6 m bgs.	J9¥1]¥-			SAMF	PLE LE	EGEND										
<u>NO1</u> 1) Tr 2) G 3) b	TES est Pit Log it Log mu: roundwate roundwate gs denotes	g interpretation requires assistance by EXP before us st be read in conjunction with EXP Report LON-000 er measured near 1.7 m bgs. s below ground surface.	se by o 15778-	thers. GE.	Test	OTHE G Sp H Hy S Sie Y Ur P Fie K Lal WATE ⊻ A	S Aug ock C ER TES becific drome eve An hit Wei bld Per b Pern ER LE ppare	er Samp ore (eg. l STS Gravity eter alysis ight meability neability VELS nt	ie ⊠ BQ, NQ CC CL UL 0 DS ¥ Me	SS S , etc.) Conso Conso Conso Conso Uncc Uncc Direc	lidation colidate colidate onsolid onfinec t Shea d	oon ed Dra ed Und ated L I Com ar	ainec drair Jndra pres	I ST I VN I Tria ned T ained sion	Shel Vane xial riaxia Tria: an (se	by Tu e Sar I xial	ibe nple otes)	

TEST PIT LOG

TP9 Sheet 1 of 1

		The Municipality of Middlesex Centre							DE	201		<u>т</u> м						015	78	GE	
		Olalondo Pit Linderwater Extraction							רי 4ח	UJ UTI	сс м		۵۵ مە	' sur	ne	d d	-00	015	10	- <u>GE</u>	
LO		21515 Olalondo Road, Middlesex Centre, O	N	DAT	ES: E	Boring	No	vembei	r 9, 201	17			V	Va	ter	۲e	/el				
	E			[SAM	PLES						SH	EA	RS	TR	ENC	тн			Τ
D	Ē		T R	w			R			•	SI	Fiel	ld \	/an	ie T	est	(#=	Sen	siti	vity)	
E P	Ă	STRATA	Â		т	N	EC	N VALUE	ŚŤ ŢĘ		rei	iet	ron	10	90 10			лvai	1 0 200) kPa	
н	i g	DESCRIPTION	A P	Ļ	Ý	M B	Ĕ		P P		At	teri	ber	g L	.imi	its a	ind	Moi	stu	re	
	N		L D	Ğ	Е	R	R Y							N	P	W 0	w∟ ⊣				
(m bgs)	(~m) 98.85		Т				(mm)	(blows)	(%)	•	SP	TN 1 <u>0</u>	l Va	alue 2	e 0	×	Dyn 30	ami	c Co 40	one	
-0 -		Silty SAND AND GRAVEL - possible fill, brown,									Π	Í								Ť	
		Some day									\parallel										
-	98.15									$\left \right $	+	+					+	+			
		CLAYEY SILT - brown, some sand, trace gravel																			
-1																					
											+										
-	97.15										+	+	+				+	++			
		SILTY CLAY TILL - grey, some sand, trace gravel																			
2	96 55																				
_	00.00	End of Test Pit at 2.3 m bgs.																			
-3																					_
Ű																					
_																					
-4																					_
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5																					-
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-6																					-
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7						SAM	I PLE LE	EGEND	I												
NOT	TES				- ·	⊠ A □ F	AS Aug Rock C	er Samp ore (eq.	le ⊠ BQ, NG	SS , etc	Sp .)	lit S	Spoo	on			ST VN	She Van	lby [.] e S	Tube ampl	e
1) T	est Pit Log it Log mus	g interpretation requires assistance by EXP before us at be read in conjunction with EXP Report LON-0001	se by o 15778-	thers. GE.	lest	ОТН	ER TE	STS		0.00	, 	ماحة				_	-				
2) T 3) b	est pit dry gs denotes	at completion. s below ground surface.				HH	drome	Gravity	C	Con D Co	soli Insc	olida	ion ateo	d D	rair	ied ⁻	Tria	xial			
						S Si Y U	eve An nit Wei	alysis ight	CL UL	J Cc J Ur	nso ncor	olida 1sol	ateo lida	d U ted	ndr Un	aine Idrai	d T nec	riaxia I Tria	al ixial		
						P Fi K La	eld Per b Pern	meability	y UC DS	C Ur S Dir	icor ect	nfin Sh	ed (ear	Cor	mpr	ess	ion				
						WAT	ER LE	VELS	.			_···			-					1.4	
						¥ A	Appare	nt		easu	ired			7	•	Art	esia	an (s	ee N	votes	5)

TEST PIT LOG

TP10

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CL	IENT	The Municipality of Middlesex Centre							PF	20	JE	C	тι	NC).		Ŀ	10	1-0	00)15	77	8-0	ΞE	
PR	OJECT	Olalondo Pit Underwater Extraction							DA	ιΤ	JN	۸.		As	કડા	Jm	100	d							_
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	<u>N</u>	DAT	ES:	Boring	No	vembe	r 9, 201	17				_ `	w	ate	er	Le	eve	ł					
	Ē		s			SAM	IPLES		мс					Sł	ΗE	AF	٢S	TF	REM	١G	тн				Τ
p	Ē		Ť Ŗ	¥			R		ÖŎ) S F	6 F Per	ie et	ld ro	Va me	ine ete) T ar	es	t (#	#=: То	Ser rva	nsi ne	tivi	ty)	
P	Å	STRATA	Î	Ē	Т	N	E O	VALUE	IST ITE			•.				100	- 0					20	0 F	(Pa	
Ĥ	0 0	DESCRIPTION	P	Ļ	P	₿	Ŭ		R T	F	1	4tt	er	be	rg	Li	mi	ts	an	dl	Mo	ist	ure)	1
(m.has)	(m)		<u>b</u>	Ğ		Ē	Ϋ́									w _I ⊢	<u>، م</u>	₩ 0		Ľ			_		
(bgs)	98.15						(mm)	(blows)	(%)			5 P 1	I N I O	1 1	ali	ue 20)	×	Dy 3(yna 0	am	1C (4(00))	ne	
0-		SANDY SILT - possible fill, brown, with clay and gravel										_						\square							
_		5								\vdash	-	+			-	_	+	\vdash		+			+	_	Η.
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-	06 55									╟	-	+					+	-		+			-		Η.
	90.55	SANDY GRAVEL - brown, fine to coarse	0.0.0																						
-2		grained, wet	0.0.0															\square]_
	05.75	Gravel Sand Silt	.0.0.0	ĮΫ						⊢		-					Η	-		-			-		
-	95.75	69% 27% 4% \- caving near 2.3 m bgs	91							╟		+					+	\vdash		+		+			
	95.35	SILTY CLAY TILL - grey, some sand, trace															Π								
-3		End of Test Pit at 2.8 m bgs.																							-
-																									-
-4																									-
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-5																									-
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NOT	TES						AS Aug	±GEND ler Samp	ole 🛛	S	SS	Spl	it S	Spo	oor	ı			S	T	She	elby	/ Ti	ube	
1) T	est Pit Log	interpretation requires assistance by EXP before u	se by c	thers.	Test		≺ock C ER TF	ore (eg. STS	BQ, NG	≀, e	tc.)						۵	V	'N	Va	ne	Sai	mpl	е
2) G	Froundwate	er measured near 2.2 m bgs.	13770-	GE.		G S	pecific	Gravity	C		ns	olio	dat Jid	ior	ן אק	Dre	ain	hed	Tr	iav	rial				
	ys ucholes	s bolow ground sundoe.				SS V	ieve An	alysis	CI	ĴĊ	or	ISO	lid	ate	ed l	Un	dra	ain	ed	Tr	iaxi	al	-		
						PF	ield Pe	meabilit	y U		Inc	ion	fin	ied		om	חכ וpr	es	sio	eu n	1 fl	aXlâ	11		
						WA1	ab Perr ER LE	neability VELS	D	5 D	ire	ect	Sh	iea	r										
						Σ.	Appare	nt	¥ M	eas	ur	ed				Ā		A	rtes	sia	n (s	see	No	otes	5)

[%] exp.

TEST PIT LOG

TP11

Sheet 1 of 1

CL	IENT	The Municipality of Middlesex Centre							_ PR	ROJECT NO. LON-00015778-GE							
PR	OJECT	Olalondo Pit Underwater Extraction					DATUM <u>Assumed</u>										
LO	CATION	21515 Olalondo Road, Middlesex Centre, C	<u>N</u>	DAT	ES:	Boring	No No	vembe	[.] 9, 201	17 Water Level							
	Ⅲ ┛┛	STRATA DESCRIPTION	STRATA PL	WELL LOG	ТҮРШ	SAN N M B E	IPLES RECOVER	N VALUE	COZ⊢≡Z⊢ MO-⊗⊢JR≣	SHEAR STRENGTH ◆ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _P W W _L							
(m bgs)	(~m)		P	G		R	Y			● SPT N Value × Dynamic Cone							
0 -	98.23	SANDY SILT - possible fill, brown, with clay and gravel					(mm)	(blows)	(%)								
-1	96.83																
- 2		SANDY GRAVEL - brown, fine to coarse grained Grain Size Analysis Gravel Sand 73% 24% 3%		Ţ													
-		- caving near 2.2 m bgs															
-3	95.23	SILTY CLAY TO CLAYEY SILT - grey, some sand, trace gravel															
-	94.73	End of Test Pit at 3.5 m bgs.	<u> X_X</u>														
-4										-							
-																	
5 -										-							
-6										-							
-																	
7 1) To 2) G 3) bo	ES est Pit Log it Log mus roundwate js denotes	interpretation requires assistance by EXP before us t be read in conjunction with EXP Report LON-000° er measured near 1.9 m bgs. s below ground surface.	se by o 15778-	thers. GE.	Test	SAM □ I OTH GS HH SS Y U PFi KLa WI	L PLE LI AS Aug Rock C ER TE pecific ydrome ieve Ar nit We eld Perr ER LE	EGEND ger Samp ore (eg. STS Gravity eter nalysis ight rmeability webility	le Z BQ, NQ C C C U U U U V DS	ST Shelby Tube Q, etc.) ST Shelby Tube Consolidation D Consolidated Drained Triaxial U Consolidated Undrained Triaxial U Unconsolidated Undrained Triaxial C Unconfined Compression S Direct Shear							



NOTES ON SAMPLE DESCRIPTIONS

 All descriptions included in this report follow the 'modified' Massachusetts Institute of Technology (M.I.T.) soil classification system. The laboratory grain-size analysis also follows this classification system. Others may designate the Unified Classification System as their source; a comparison of the two is shown for your information. Please note that, with the exception of those samples where the grain size analysis has been carried out, all samples are classified visually and the accuracy of the visual examination is not sufficient to differentiate between the classification systems or exact grain sizing. The M.I.T. system has been modified and the **exp** classification includes a designation for cobbles above the 75 mm size and boulders above the 200 mm size.

	H (3) 1	• `			Sand		Gra	avel	Cabbles					
CLASSIFICATION	Fines (silt and c	lay)		Fine	Medium	Coarse	Fine	Coarse	Coopies					
MITSON	~1	att		Sa	nd		~							
CLASSIFICATION	Clay	Silt	Fin	e Medi	ium Coarse		Gr	Gravei						
	Sieve Sizes	1	-200		-40	5 7 2 7		- 3/4						
	Particle Size (mm)	- 200.0	0.06 -	02-	- 9.0	2.0- 5.0-		20-	- 08					

- 2. Fill: Where fill is designated on the testhole log, it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The testhole description therefore, may not be applicable as a general description of the site fill material. All fills should be expected to contain obstructions such as large concrete pieces or subsurface basements, floors, tanks, even though none of these obstructions may have been encountered in the testhole. Since testholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact and correct composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. The fill at this site has not been monitored for the presence of methane gas. Some fill material may be contaminated by toxic waste that renders the material unacceptable for deposition in any but designated land fill sites; unless specifically stated, the fill on the site has not been tested for contaminants that may be considered hazardous. This testing and a potential hazard study can be carried out if you so request. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common, but not detectable using conventional geotechnical procedures.
- 3. Glacial Till: The term till on the testhole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process, the till must be considered heterogeneous in composition and as such, may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm in diameter) or boulders (greater than 200 mm diameter) and therefore, contractors may encounter them during excavation, even if they are not indicated on the testhole logs. It should be appreciated that normal sampling equipment can not differentiate the size or type of obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with sensitive excavations or dewatering programs in till material.



Appendix B – Laboratory Test Results



MECHANICAL GRAIN SIZE ANALYSIS











Appendix C – Limitations and Use of Report



LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to exp by its client ("Client"), communications between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.