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GEOTECHNICAL CONSULTANTS INC.

July 11, 2019

Mr. Jason Francis M/I Homes of Central Ohio, LLC 3 Easton Oval, Suite 340 Columbus, Ohio 43219

### Reference: Kahler Tile Storm Sewer Project Cubbage Road – Columbus (Franklin County), Ohio GCI Project No. 19-G-23047

Dear Mr. Francis:

As you requested and authorized, Geotechnical Consultants, Inc. (GCI) completed borings for the proposed Kahler Tile Storm Sewer project on Cubbage Road in Columbus (Franklin County), Ohio. We performed our work in accordance with our proposal dated June 4, 2019 (GCI Proposal number 19G0328).

The purpose of this letter is to summarize the results of our boring program and to discuss the impact of the encountered soil and groundwater conditions on the proposed storm sewer project.

## **PROJECT DESCRIPTION**

The project consists of installing a storm sewer line from Cubbage Road on the west side of the project to about 1,950 feet east of Cubbage Road. The alignment begins west of Cubbage Road, crosses Cubbage, and runs on the east side of Cubbage for about 375 feet, before turning east. EMH&T, Inc. provided a boring plan (prepared by EMH&T, Inc., dated May 2019) showing requested locations for 13 borings, and requested depths which ranged from 6 feet to 16 feet below existing grades.

EMH&T, Inc. field staked the requested boring locations. We could not perform boring B-9 (B-ST09 as staked) due to restrictions from trees.

The attached boring location plan shows the approximate boring locations.

## SUBSURFACE CONDITIONS

On July 1, 2019, GCI mobilized an ATV-mounted, rotary drill rig (CME 750 with automatic sampling hammer) to complete the test borings. Boring logs, a boring location plan, and a summary table of encountered subsurface conditions are attached in the appendix. In addition, we summarize the subsurface findings below. Refer to the individual boring logs for more detailed subsurface information at specific boring locations.

## Surface Cover

Borings B-1 to B-6 and B-8 to B-13 encountered surface topsoil ranging in thickness from 0.2 to 0.7 feet below grade.

At the surface of B-7, we encountered fill materials consisting of a mixture of lean clay, topsoil, sand, gravel, and pieces of brick. The fill in B-7 extended to about 3 feet below grade. The drillers also noted possible fill below the topsoil in boring B-1. The possible fill consisted of a mixture of brown and gray lean clay, sand, and gravel, and extended to about 6 feet below grade.

### **Natural Soils**

Below the surface cover, we encountered moderately plastic, soft to medium stiff, brown lean clay with sand (classified as CL in the Unified/ASTM Soils Classification System). The drillers noted varying sand and gravel lenses and random shale and sandstone fragments in the lean clay soils.

### Bedrock

At depths of 3 to 7 feet below grade in borings B-1 to B-4, we encountered brown weathered to intact shale. The shale was highly fractured to intact, with horizontal layers. We noted random sandstone fragments and layers within the shale. At depths of 2.3 to 6 feet below grade in borings B-5 to B-8 and B-10 to B-13, we encountered brown sandstone. We noted random shale layers within the sandstone.

We were able to obtain split spoon samples in the more weathered portions of the shale and sandstone, but sampling became more limited with depth. We terminated these borings within the shale or sandstone at depths of 6 feet to 16 feet below grade. We did not record auger refusal in the borings.

### Groundwater Seepage

We encountered groundwater seepage in borings B-1, B-3, B-5, B-8, and B-9 at depths ranging from 5.5 to 13 feet below grade during the drilling process. By completion of drilling, the water had dissipated in the borings.

The soil samples were characterized as moist to very moist, while the rock was generally characterized as damp, with some very moist to wet samples noted. Note that groundwater levels and moisture conditions can vary with seasonal changes and in response to precipitation events.

## **CONSTRUCTION COMMENTS AND RECOMMENDATIONS**

Based on our boring findings, it is GCI's opinion that the proposed sewer line can be constructed with some geotechnical considerations, as discussed below.

### Excavations

The existing fill and natural site soils can be excavated with conventional track hoe equipment. Excavations extending through any granular layers will require layback or trench box use to prevent sidewall collapse. Groundwater seepage will exacerbate side wall instability.

We would classify the site as having OSHA Type C soils; therefore the maximum/steepest slope allowable per OSHA is 1.5H: 1V without excavation support. All site excavations should comply with current OSHA regulations with regards to layback geometry and benching.

We encountered bedrock in the borings at depths of 2.3 to 7 feet below grade. As such, rock excavation will be required to complete the project. We found the upper part of the

bedrock to be highly weathered, and as such we are of the opinion that the upper part of the rock should be able to be excavated with a large track hoe. The rock becomes harder with depth and specialty rock excavation methods such as a hoe-ram/pneumatic hammer may be needed to remove more intact rock to achieve design subgrades.

### Groundwater

We encountered groundwater seepage in 5 of the 12 borings at depths varying from 5.5 feet to 13 feet below existing grade. By the completion of drilling, the water had dissipated in the borings. Note that seepage and moisture conditions may change from those encountered during drilling, in response to seasonal changes, and in response to precipitation events.

The bottoms of some of the excavations will be below the noted seepage depths in areas. Therefore, the contractor should expect to encounter groundwater during sewer construction.

Excavations should be dewatered to allow utility construction and trench backfilling in dry conditions. We expect the anticipated groundwater seepage flows in the shallow portions of the excavations can be handled with portable sump pumps and working mats of crushed stone. The purpose of the working mat is to protect soil subgrades from disturbance during construction and to act as a drainage layer to help control groundwater seepage. The granular bedding layer can be thickened to help control seepage, as needed.

More sophisticated dewatering methods may be needed (e.g., well points or deep sumps) for the deepest excavations if increased water flow is encountered.

### Trench Backfill Compaction

Properly placing and compacting trench backfill will be critical where pavement will be placed over utility lines. Settlement of trench backfill, due to improper compaction or substandard backfill materials, will likely result in pavement problems and the need for pavement repairs at a future date. Note that wet soils that prevent proper compaction are often the cause of many backfill related problems; this will be the case with some of the excavated trench materials. For this reason, excavated trench spoils are usually discarded and replaced with imported aggregate fill where the sewer is below or near roads and pavements.

We recommend that the contractor place trench backfill materials in maximum 8-inch thick loose lifts and compact each lift to a minimum of 98% Standard Proctor dry densities. Backfill outside the influence of pavement and structures should be compacted to a minimum of 95% Standard Proctor dry densities. We expect that the contractor will need to use remotely operated compaction equipment or track hoe compactor attachments within the lower depths of the excavations.

Utility trench backfill should be properly keyed into the sidewalls of the excavations to tie the new fill mass into the adjacent natural soils. The 'keying' process will also eliminate the potential for a vertical seam (shear plane) of loose, un-compacted soil between the trench backfill and the adjacent natural soils.

### **Trench Backfill Materials**

Within the influence of roadways and/or if required by municipal regulations, use imported, granular materials, such as AASHTO #57 stone, ODOT Item 304 stone, or ODOT Item 411 stone to backfill the trench. These granular materials would compact best using vibratory compactive effort, such as a vibratory smooth drum roller or vibratory hoe-pack attached to a track hoe.

In green areas, the backfill can consist of excavation spoils, provided these materials are placed at suitable moisture contents and properly compacted. Based on our borings, generated trench spoils will primarily consist of clay-based soils and mixtures of shale and sandstone. Some drying of these materials could be needed to be able to achieve compaction.

### **FINAL**

The recommendations contained in this report are the opinion of GCI based on the subsurface conditions found in the borings and available development information. It should be noted that the nature and extent of variations between borings might not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

This report has been prepared for design purposes only and may not be sufficient to prepare an accurate bid document. If you have any questions or need for any additional information, please contact our office. It has been a pleasure to be of service to you on this project, and we hope to continue our services through construction.

Respectfully submitte	ed, with a first of the second se
Geotechnical Const	ultants fine of
Curto 2. Milles	CURTIS L.
Curtis L. Miller, P.E. Principal	B E-58404 E

Todd R. Meek, P.E., LEED AP In-House Reviewer

Distribution: Mr. Jason Francis @ M/I Homes of Central Ohio – pdf via email GCI Project File 19-G-23047

Attachments: General Notes for Soil Sampling and Classifications General Site Location Map Boring Location Plan Summary of Encountered Subsurface Conditions Test Boring Logs (B-1 to B-8 and B-10 to B-13)





ATTACHMENTS



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### **GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS**

#### BORINGS, SAMPLING AND GROUNDWATER OBSERVATIONS:

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standard methods of exploration of subsurface conditions. The borings were drilled using a truck-mounted drill rig using auger boring methods with standard penetration testing performed in each boring at intervals ranging from 1.5 to 5.0 feet. The stratification lines on the logs represent the approximate boundary between soil types at that specific location and the transition may be gradual.

Water levels were measured at drill locations under conditions stated on the logs. This data has been reviewed and interpretations made in the text of the report. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time the measurements were made.

The Standard Penetration Test (ASTM-D-1586) is performed by driving a 2.0 inch O.D. split barrel sampler a distance of 18 inches utilizing a 140 pound hammer free falling 30 inches. The number of blows required to drive the sampler each 6 inches of penetration are recorded. The summation of the blows required to drive the sampler for the final 12 inches of penetration is termed the Standard Penetration Resistance (N). Soil density/consistency in terms of the N-value is as follows:

COHESIO	NLESS DENSITY	COHESIVE	CONSISTENCY
0-10	Loose	0-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	Very Stiff
	2	30 +	Hard

#### SOIL MOISTURE TERMS

Soil Samples obtained during the drilling process are visually characterized for moisture content as follows:

MOISTURE CONTENT	DESCRIPTION
Damp	Soil moisture is much drier than the Atterberg plastic limit (where soils are cohesive) and generally more than 3% below Standard Proctor "optimum" moisture conditions. Soils of this moisture generally require added moisture to achieve proper compaction.
Moist	Soil moisture is near the Atterberg plastic limit (cohesive soils) and generally within ±3% of the Standard Proctor "optimum" moisture content. Little to no moisture conditioning is anticipated to be required to achieve proper compaction and stable subgrades.
Very Moist	Soil moisture conditions are above the Atterberg plastic limit (cohesive soils) and generally greater than 3% above Standard Proctor "optimum" moisture conditions. Drying of the soils to near "optimum" conditions is anticipated to achieve proper compaction and stable subgrades.
Wet	Soils are saturated. Significant drying of soils is anticipated to achieve proper compaction and stable subgrades.

#### SOIL CLASSIFICATION PROCEDURE:

Soil samples obtained during the drilling process are preserved in plastic bags and visually classified in the laboratory. Select soil samples may be subjected to laboratory testing to determine natural moisture content, gradation, Atterberg limits and unit weight. Soil classifications on logs may be adjusted based on results of laboratory testing.

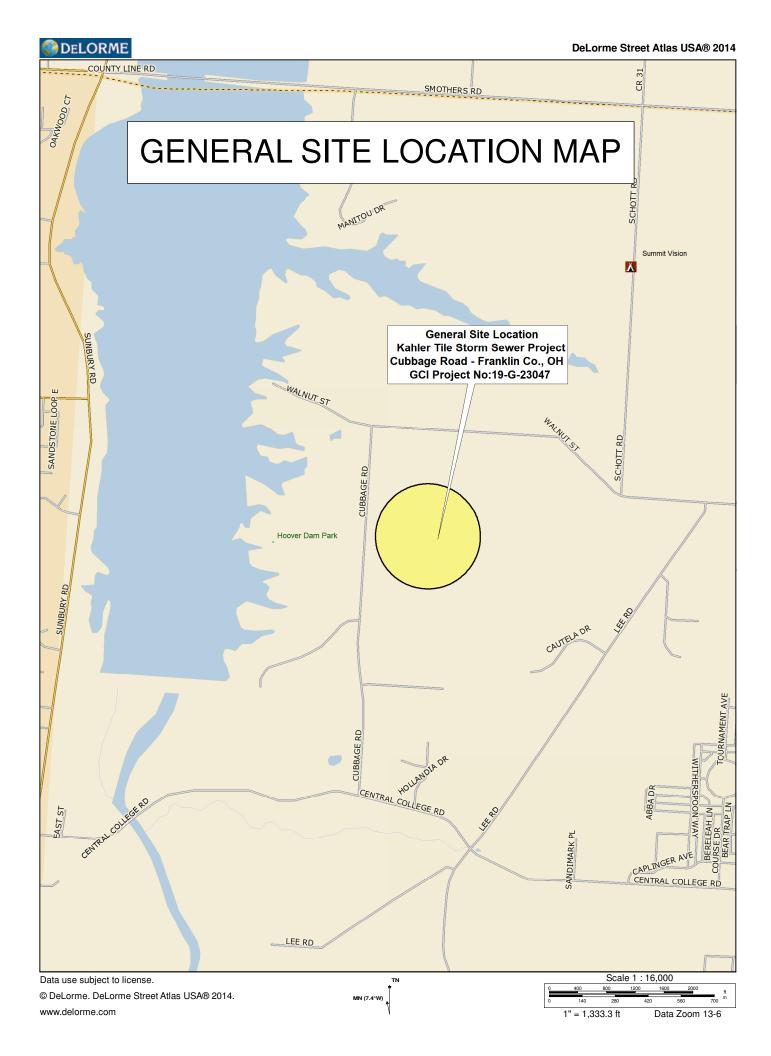
Soils are classified in accordance with the ASTM version of the Unified Soil Classification System. ASTM D-2487 "Classification of Soils for Engineering Purposes (Unified Soil Classification System) describes a system for classifying soils based on laboratory testing. ASTM D-2488 "Description and Identification of Soil (Visual-Manual Procedure) describes a system for classifying soils based on visual examination and manual tests.

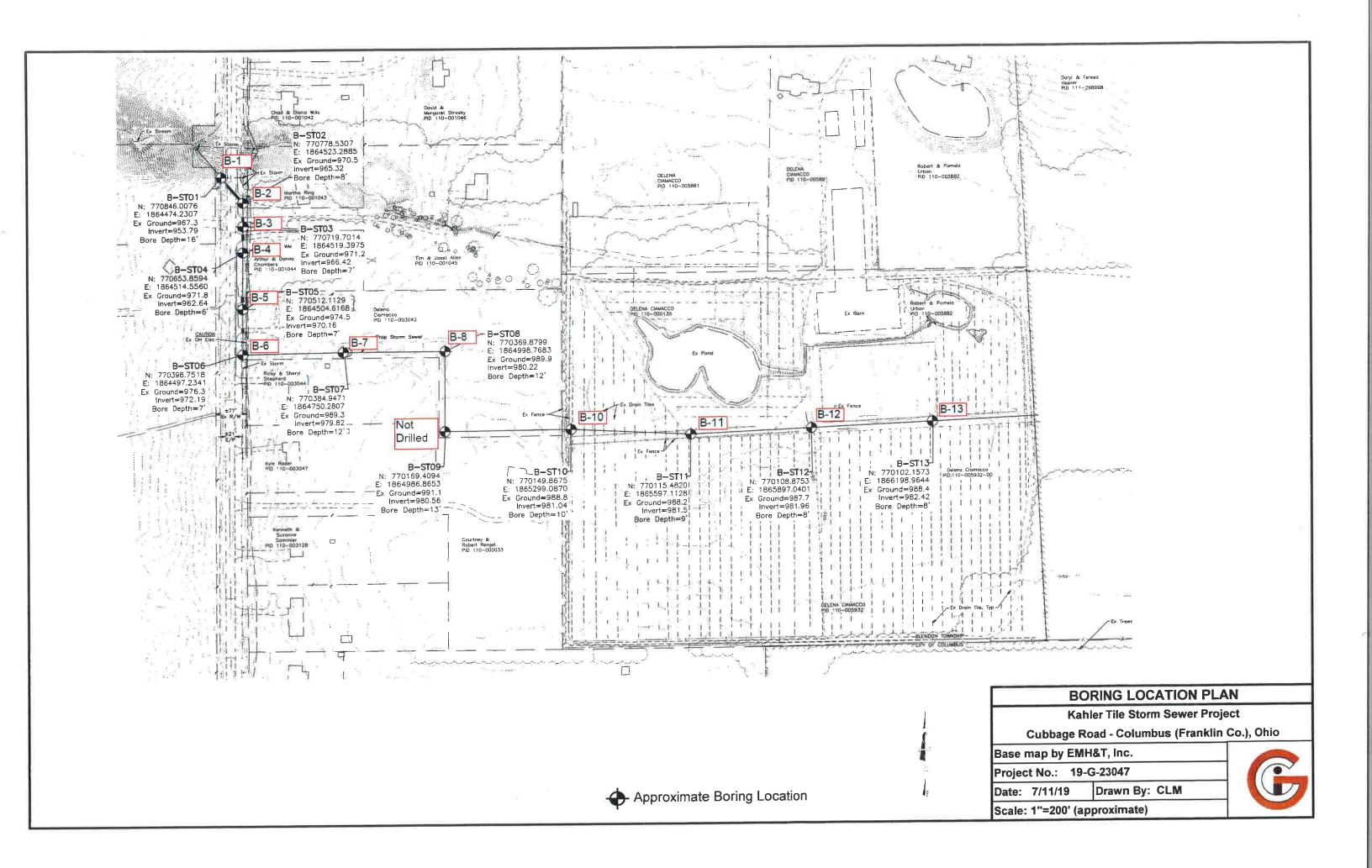
Soil classifications are based on the following tables (see reverse side):

		PARTICLE SIZE DEFINITION	CONSTITUE	ENT MODIFIERS
Boulders:		>12"	_	
Cobbles:		3" to 12"	Trace	Less than 5%
Gravel:	Coarse:	3/4" to 3"	Few	5-10%
	Fine:	No. 4 (3/16") to 3/4"	Little	15-25%
Sand:	Coarse	No. 10 (2.0mm) to No. 4 (4.75mm)	Some	30-45%
	Medium	No. 40 (0.425mm) to No. 10 (2.0mm)	Mostly	50-100%
	Fine	No. 200 (0.074mm) to No. 40 (0.425mm)	,	
Silt & Clay		<0.074mm; classification based on overall plasticity; in general clay particles <0.005mm.		

### GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

	ASTM/UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART												
		RSE-GRAINED SOILS											
(more than	50% of ma	aterials is larger than No. 200 sieve size)											
		Clean Gravel (less than 5% fines)											
	GW	Well-graded gravel, gravel-sand mixtures, little or no fines											
GRAVELS	GP	Poorly-graded gravels, gravel sand mixtures, little or no fines											
More than 50% of coarse fraction larger		Gravels with fines (more than 12% fines)											
than No. 4 sieve size	GM	Silty gravels, gravel-sand-silt mixtures											
	GC	Clayey gravels, gravel-sand-clay mixtures											
		Clean Sands (Less than 5% fines)											
	SW	Well-graded sands, gravelly sands, little or no fines											
SANDS	SP	Poorly-graded sands, gravelly sands, little or no fines											
More than 50% of coarse fraction smaller		Sands with fines (More than 12% fines)											
than No. 4 sieve size	SM	Silty sands, sand-silt mixtures											
	SC	Clayey sands, sand-clay mixtures in No. 200 sieve size), coarse-grained soils are classified as follows:											
Less than 5 percentGW, GP, SW, SP Greater than 12 percentGM, GC, SM, SC 5 to 12 percentBorderline cases requiring dual symbols: SP-SM, GP-GM, etc.													
Greater than 12 percent 5 to 12 percent		GM, GC, SM, SC											
5 to 12 percent	Fli	GM, GC, SM, SC											
5 to 12 percent	Fli	GM, GC, SM, SC Borderline cases requiring dual symbols: SP-SM, GP-GM, etc. NE-GRAINED SOILS erial is smaller than No. 200 sieve size) Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity											
5 to 12 percent	FII ore of mat												
5 to 12 percent	FII ore of mat ML CL												
5 to 12 percent	FII ore of mat	GM, GC, SM, SC GM, GC, SM, SC Borderline cases requiring dual symbols: SP-SM, GP-GM, etc. NE-GRAINED SOILS erial is smaller than No. 200 sieve size) Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays Inorganic silty clay of slight plasticity, P.I. between 4 and 7											
5 to 12 percent	FII ore of mat ML CL CL-ML												
5 to 12 percent	FII ore of mat ML CL CL-ML OL	GM, GC, SM, SC GM, GC, SM, SC Borderline cases requiring dual symbols: SP-SM, GP-GM, etc. NE-GRAINED SOILS erial is smaller than No. 200 sieve size) Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays Inorganic silty clay of slight plasticity, P.I. between 4 and 7 Organic silts and organic silty clays of low plasticity Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts											
5 to 12 percent(50% or m SILTS AND CLAYS Liquid Limit less than 50%	FII ore of mat ML CL CL-ML OL MH	GM, GC, SM, SC GM, GC, SM, SC Borderline cases requiring dual symbols: SP-SM, GP-GM, etc. NE-GRAINED SOILS erial is smaller than No. 200 sieve size) Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays Inorganic silty clay of slight plasticity, P.I. between 4 and 7 Organic silts and organic silty clays of low plasticity Inorganic silts, micaceous or diatomaceous fine sandy or silty soils,											





Summary of Encountered Subsurface Conditions

Kahler Tile Storm Sewer Project Cubbage Road - Franklin County, Ohio GCI Job Number: 19-G-23047

Borehole	Surface	Topsoil Thickness	Bottom of Fill Cover	Groundwater: Level Encountered (ft)	Groundwater: Level at Completion (ft)	Depth to Lean Clav	Depth to Bedrock	Bottom of Boring
	Layer	(ft.)		Depth	Depth	( <del>II</del> )	(#)	Depth (ft)
В- 1	Topsoil	0.2	6.0	13	1	6.0	7 SH	16.0
B-2	Topsoil	0.4	I	1	I	0.4	3 SH	8.0
в-3	Topsoil	0.6	ī	Q	je Us	0.6	3 SH	7.0
B-4	Topsoil	0.4	I	1	I	0.4	4 SH	6.0
<u></u> в-5	Topsoil	0.7	1	5.5	1	0.7	2.3 SS	7.0
в-6	Topsoil	0.5	1	<u>3</u>		0.5	3 SS	7.0
B- 7	Ē	3	3.0	I	1	3.0	3.5 SS	12.0
ъ 8	Topsoil	0.3	1	10	I	0.3	4 SS	12.0
B-10	Topsoil	0.2	Ē	б	I	0.2	3 SS	10.0
B-11	Topsoil	0.3	ł	I.	ł	0.3	5 SS	9.0
B-12	Topsoil	0.5	ો			0.5	3.7 SS	8.0
B-13	Topsoil	0.7	I		1	0.7	6 SS	8.0
						0,0,	SS - Sandstone SH - Shale	stone

 ${\bf G}$ 

Sheet 1 of 1

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PRC	JECT NAM	ME Kahler	Tile S	torm	Sew	er Pi		Cubbag		load - Frank	din County PROJ.	, Ohio			B- 1
CLI	ENT	M/I Ho	omes of	f Cen	tral	Ohio						-G-23047			7/1/2019
	GROU	JND WAT	ER OB	SER	VAT	ION		Propo	rtio	ons Used	140 lb	Wt. x 30" f	all on 2'		
	None FEE	T BELOW SU	JRFACE	AT C	OMPL	ETIOI	N Fe	race ew		Less than 5% 5 to 10%	0 😁 10	lless Densit	se 0	- 4 - 8	Consistency Soft Medium Stiff
		T BELOW SU					S	ittle		15 to 25% 30 to 45%	10 - 30 30 - 50	Medium Den Den	se 8 se 15	- 15 - 30 +	Stiff Very Stiff
		T BELOW SU					ring Loc	lostly cation P	lar	50 to 100%	50 +	Very Den	se 30 -	+	Hard
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	on Fro	ws pe Samp om 6-12	ler	Moisture Density or Consist.	Strata Change Depth*			Remarks in	L IDENTIFIC clude color, ty or, type, condit	pe of soil,		
	3	0.0-1.5	SS	1	2	1	Moist	0.2	$\otimes$	Topsoil Possible Fill	consisting	of a mixture	ofbrou	n and o	rav lean
									$\otimes$	clay, sand, g	gravel, and s	stone	. 01 010 10	n and g	stay ican
	3	2.0-3.5	SS	2	2	3	Moist		$\otimes$						
									$\otimes$						
	2	4.0-5.5	SS	3	4	4	Moist		$\otimes$						
5									$\otimes$						
								6.0		Duoun Loor	Claywith	Sand (CL)	moderat	alv plac	tio little
								7.0		fine to coars	se sand (Gla	acial Till); ra	ndom sh	ale frag	stic, little gments noted
										Brown Wea noted, horiz	thered to In ontally bed	itact Shale - ded, random	sandstoi	actured	zones nents noted
		8.5-10.0	SS	19	27	50/5'	Damp								
10															
		13.5-14.1	SS	43	50/1'		Damp			Water Seep	age at 13'				
		15.5-14.1			50/1		Dump								
15															
12		15.0-15.1	SS	50/1"			Damp	16.0							
											BOT	TOM OF BO	ORING:	16'	
							-								



PRO	JECT NAN	AE Kahler	Tile S	torm	Sew	er Pr	oject - C	Cubbage	R	load - Frank	lin Cou	unty, Ohio	BORING NO.	
		N. / T. T. T.				01.1					PRO.		SURF. ELEV.	
CLII		M/I Ho							_				DATE DRILLED	
	GROU	UND WAT	ER OB	SER	VAT	ION		-	rtic	ons Used		0 lb Wt. x 30" sionless Densi	fall on 2" O.D.	Sampler Consistency
<u>1</u> -	FEE	ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE	AT 24	4 HOU	RS	N Fe Li So	race ew ittle ome lostly		Less than 5% 5 to 10% 15 to 25% 30 to 45% 50 to 100%	0 -	10 Lo 30 Medium De	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Soft Medium Stiff Stiff Very Stiff Hard
		ION OF BC			_		ring Loc		lar	1				
DEPTH	Pocket Penetrometer (tsf)	Sample Depths	Type of Sample	Blo on Fre	ows pe Samp om	r 6" der To	Moisture Density or Consist.				Remar	SOIL IDENTIFIC ks include color, t -color, type, cond	type of soil, etc.	
		0.0-1.5	SS	2	2	2	Moist	0.4	12.2	Topsoil and	Lean C	lay Mixture		
	4	2.0-3.5	SS	5	11	23	Moist	3.0		Brown Lean fine to coars	Clay w	vith Sand (CL) (Glacial Till); r	- moderately pla andom shale fra	stic, little gments noted
5		4.0-5.5	SS	30	28	32	Damp			Brown Wea noted, horiz	thered t ontally	to Intact Shale - bedded, randor	highly fractured n sandstone frag	l zones ments noted
		6.5-7.8	SS	38	40	50/3"	Damp	8.0						
10											E	BOTTOM OF F	30RING: 8'	
15														



PRO	)JECT N	JAN	1E Kahler	Tile S	torm	Sew	er Pi	<u>oject - C</u>	Cubbage	e R	toad - Franklin		, Ohio		
CLI	ENT 🚬		M/I Ho	omes of	f Cen	tral	Ohio					proj. No. <u>19</u> .	-G-23047_	SURF. ELEV DATE DRILLEI	
-	None	FEE FEE	J <b>ND WAT</b> I T BELOW SU T BELOW SU	JRFACE JRFACE	AT C AT 24	ompl 4 hou	ETIOI	N Fe Li Sc	race ew ittle	rtio	5 to 10% 15 to 25% 1 30 to 45% 3	Cohesion           0         -         10           10         -         30           30         -         50	lless Densit Loc Medium Den Den	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	. Sampler Consistency Soft Medium Stiff Stiff Very Stiff Hard
		_	T BELOW SU		AI			ring Loc	lostly	lar			Very Den	180 50 -	riard
DEPTH	Pocke Penetrom (tsf)	eter	Sample Depths From To	Type of Sample	on Fr	ows pe Samp om 6-12	r 6" oler To 12-18	Moisture Density or Consist.	Strata Change Depth*		R	Remarks in		CATION ype of soil, etc. tion, hardness	
		3	0.0-1.5	SS	1	1	3	Moist	0.6		Topsoil Brown Lean C fine to coarse s fragments note	Clay with S sand (Gla	Sand (CL) - cial Till); ra	• moderately pla andom shale an	astic, little d sandstone
			2.0-3.5	SS	18	23	23	Moist to Damp	3.0		Brown and Gra zones noted, ho		ered to Inta	ct Shale - highl	y fractured
		-225	4.0-5.3	SS	23	38	50/3"	Damp			zones noted, he noted	orizontall	ly bedded, r	andom sandsto	he fragments
			5.5-6.6	SS	21	33	50/1"	Damp	7.0		Water Seepage				
1(	)											BOT	TOM OF B	ORING: 7'	
1:													ů.		



PRO	JECT NAM	ME Kahler	Tile S	torm	Sew	er Pı	<u>·oject - (</u>	Cubbage	R	toad - Frank		ity, Ohio			
CLIF	ENT	M/I Ho	mes of	f Cen	tral (	Ohio					PROJ. NO.	19-G-23047	SURF. ELE DATE DRI		
1	None FEE	J <b>ND WAT</b> ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE JRFACE	AT C AT 24	OMPL 4 HOU	ETIO RS	N Fe Li So	Propos race ew ittle ome lostly		ons Used Less than 5% 5 to 10% 15 to 25% 30 to 45% 50 to 100%		0 Medium Der	ty Cohes ose 0 - nse 4 - 8 - nse 15 -	sive C	Sampler Consistency Soft Medium Stiff Stiff Very Stiff Hard
	LOCAT	ION OF BO	RING		Se	e Bo	ring Loc	cation P	lar	n					
DEPTH	Pocket Penetrometer (tsf)	Sample Depths	Type of Sample	on Fr	ows pe Samp om 6-12	ler To	Moisture Density or Consist.	Strata Change Depth*			Remarks	OIL IDENTIFIC include color, t olor, type, condi	ype of soil, et		
	3	2.0-3.5	SS	1	1 6	2	Moist Moist			Topsoil Brown Lear fine to coars	n Clay wi se sand (C	th Sand (CL) - Hacial Till); ra	- moderatel andom shal	y plas e frag	tic, little ments noted
5		4.0-5.5	SS	12	24	50	Damp	4.0		Brown and zones noted noted	Gray We , horizon	athered to Inta tally bedded, 1	act Shale - h andom san	nighly dstone	fractured e fragments
10		5.5-6.0		38			Damp_	6.0				OTTOM OF B			



PRC	JECT NAM	ME Kahler	Tile S	torm	Sew	er Pı	·oject - (	Cubbage	e R	Road - Frank	lin County, Ohio BOR		
CLII	ENT	M/I Ho	omes of	f Cen	tral	Ohio					10 0 03040 0	RF. ELEV TE DRILLED	
1	None FEE	U <b>ND WAT</b> ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE JRFACE	AT C AT 24	OMPL 4 HOU	ETIO RS	N Fe	Proport race ew ittle come lostly	rtio	ons Used Less than 5% 5 to 10% 15 to 25% 30 to 45% 50 to 100%	140 lb Wt. x 30" fall o           Cohesionless Density           0 - 10         Loose           10 - 30         Medium Dense           30 - 50         Dense           50 +         Very Dense	on 2" O.D. S Cohesive C 0 - 4 4 - 8 8 - 15 15 - 30 30 +	Sampler onsistency Soft Medium Stiff Stiff Very Stiff Hard
		ION OF BC					ring Loc		laı			W0 <u>5</u>	
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	on Fr		ler To 12-18	Moisture Density or Consist.	Change Depth*		,	SOIL IDENTIFICATIC Remarks include color, type of Rock-color, type, condition, h	f soil, etc.	
	4	0.0-1.5	SS	1	2	2	Moist	0.7	***	Topsoil			
		2.0-2.7	SS	16	50/2"		Moist to			Brown Lear fine to coars fragments n			tic, little sandstone
		2.0-2.7	33	10	50/2		Damp			Brown Sand	lstone - random shale layers	noted	
5		4.0-5.5	SS	31	24	31	Damp		<b>HEAT</b>				
0		5.5-5.8	SS	50/3'	·		Damp	7.0	A PERSONAL PROPERTY OF A PERSON AND A PERS	Water Seep	age at 5.5'		
10								7.0			BOTTOM OF BORI	NG: 7'	



PRO	JECT NAM	ME Kahler	· Tile S	storm	I Sew	er Pi	roject - (	Cubbag	e F	Road - Frank			Ohio	BOF	RING NO.	<u>B- 6</u>
						<b></b>					PROJ				RF. ELEV.	
CLIE	ENT	M/I Ho	omes o	f Cen	itral	<u>Ohio</u>	Q				NO.	19-	<u>G-23047</u>	DAT	TE DRILLED	7/1/2019
	GROU	UND WAT	ER OF	BSER	VAT	ION		Propo	rti	ons Used			Wt. x 30" f			
							Т	race		Less than 5%			ess Densit			Consistency
	lone FEB	ET BELOW SU	JRFACE	E AT C	OMPL	ETIO		ew		5 to 10%	0 -		Loo	se	0 - 4	Soft Medium Stiff
-	FEE	ET BELOW SU	JRFACE	EAT 24	4 HOU	IRS		ittle ome		15 to 25% 30 to 45%	10 - 30 -		Medium Den Den	ise	8 - 15	Stiff
	FEB	ET BELOW SU	JRFACE	EAT		HOUR		lostly		50 to 100%	50 +	50	Very Den	ise	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	Very Stiff Hard
	LOCAT	ION OF BC	RING		S	ee Bo	ring Lo	eation P	la	n	1,					
-	Pocket				ws pe		Moisture	1	Γ			0.017				
DEPTH	Penetrometer	Sample Depths	Type of		Samp		Density	Strata Change					IDENTIFIC lude color, ty			
DEI	(tsf)	From To	Sample	Fr	om	To	or	Depth*					, type, condit			
	3	0.0-1.5	SS	0-6	6-12	12-18	Consist. Moist	· · · ·	10.00	Topsoil						
		0.0-1.5	00		4	2	IVIOISU	0.5	ĥ	Brown Lear	ı Clav w	vith S	and (CL) -	mod	lerately pla	stic. little
										fine to coars	se sand (	(Glac	ial Till); ra	indor	n sandston	e fragments
										noted						
	3	2.0-2.7	SS	8	50/2'	1	Moist to		1							
							Damp	3.0	122	Brown Sand	datama	nond	am shala la	1.040	noted	
2				-		<u> </u>			Ē	DIOWII Salic	ustone -	Tanuo		lyers	noted	
1		4.0-4.2	SS	50/2'	-	<u> </u>	Damp									
5							1		1999 PARTICIPATION OF THE P							
		5.5-5.6	SS	50/1'	1		Damp									
								7.0	12							
				-	-	<u> </u>		1.0								
ļ																
											D	OTT				
				-							В	SOLL	OM OF B	ORI	NG: /	
10																
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15																
15																
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PRO	DJECT N	AM	E <u>Kahler</u>	Tile S	torm	Sew	er Pi	roject - (	Cubbage	R	load - Frank			, Ohio		
CLI	ENT		M/I Ho	omes o	f Cer	itral	<u>Ohio</u>						ој. 19	-G-23047	SURF. ELEV DATE DRILI	LED <u>7/1/2019</u>
	GRO	DU	ND WAT	ER OF	BSER	VAT	TION		Proportions Used Trace Less than 5%					Wt. x 30" lless Densit		.D. Sampler ve Consistency
1 A A	None       FEET BELOW SURFACE AT COMPLETION          FEET BELOW SURFACE AT 24 HOURS          FEET BELOW SURFACE AT										5 to 10% 15 to 25% 30 to 45% 50 to 100%	10 -	10 30 50	Loo Medium Der Der Very Der	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	4 Soft 8 Medium Stiff 5 Stiff 0 Very Stiff Hard
	LOCA	TI	ON OF BO	RING		Se	ee Bo	ring Lo	cation P	lar	n					
DEPTH	Pocket Penetrome (tsf)	- L	Sample Depths From To	Type of Sample	on Fr	ows pe Samp om 6-12	oler To 12-18	Moisture Density or Consist.	Change			Roc	arks in k-colo	r, type, condi	ype of soil, etc. tion, hardness	
		4	0.0-1.5	SS	2	2	3	Moist		$\bigotimes$	Fill consisting sand, and gr	ng of avel	a mix	ture of lean	clay, topsoil	, brick pieces,
										$\otimes$						
		4	2.0-2.6	SS	12	50/1'		Moist		$\otimes$						
			2.0 2.0					1.1.0.00	3.0	$\bigotimes$	<b>D</b>	01		0 1/01)		1
		-	1		-				3.5		Brown Lean	e sanc	with i (Gla	sand (CL) - icial Till); ra	andom shale	plastic, little fragments noted/
			4.0	SS	50/0'	-		Damp			Brown Sand	lstone	- rano	dom shale la	ayers noted	
:	5					-				111						
		_								ընդ նդներնդներնդներնդներնդներներն						
										田田						
			8.5-8.9	SS	50/4"	1		Damp								
		+														
1								D								
			10.5-10.7	SS	50/2'			Damp								
		_							10.0							
									12.0							
		_										]	BOT	FOM OF B	ORING: 12	
1:	5															
		_														
		_			-			-								
		-														



PRC	JECT NAN	AE Kahler	Tile S	storm	Sew	er Pi	roject - C	Cubbage	e R	oad - Frank			, Ohio	BORING NO		
CLII	ent	M/I Ho	omes o	<u>f Cen</u>	itral	<u>Ohio</u>					PRO NO		-G-23047	SURF. ELEV DATE DRILLED		
	GROU	JND WAT	ER OF	BSER	VAT	TION		Proportions Used Trace Less than 5%					Wt. x 30" less Densit	fall on 2'' O.D. ty   Cohesive	Sampler Consistency	
-	FEE	ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE	E AT 24	4 HOU	JRS	N Fe L Se	ew ittle ome lostly		5 to 10% 15 to 25% 30 to 45% 50 to 100%	0 - 10 - 30 - 50 +	50	Loo Medium Der Der Very Der	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Soft Medium Stiff Stiff Very Stiff Hard	
	LOCAT	ION OF BC	RING				ring Loo		lan	1						
DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	on Fr 0-6		oler To 12-18	Moisture Density or Consist.	Change Depth*				arks in		CATION ype of soil, etc. tion, hardness		
	3	0.0-1.5	SS	2	3	3	Moist	0.3	ÊÛ	Topsoil	Clau	ith	Sand (CL)	moderately pla		
										fine to coars	se sand	l (Gla	cial Till); r	andom shale frag	gments noted	
-	4.5	2.0-3.4	SS	8	9	50/4''	Moist									
	4	4.0-4.4	SS	50/4'			Damp	4.0		Brown Sand	lstone	- rand	iom shale la	avers noted		
5							5									
		8.5-8.6	SS	50/1'			Damp									
10							111			Wet Group	( 10)					
		10.5-10.9	SS	50/4'			Wet		and a lot	Water Seepa	age at	10				
5								12.0								
											Ι	30T]	TOM OF B	ORING: 12'		
15																



PRC	PROJECT NAME Kahler Tile Storm Sewer Project - Cubbage Road - Franklin County, Ohio BORING NO. B-10 PROJ. SURF. ELEV.													
CLII	ent	M/I Ho	omes of	f Cen	itral	<u>Ohio</u>					NO. <u>19-G-23047</u>			
1	None FEE	J <b>ND WAT</b> ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE JRFACE	AT C AT 24	OMPL 4 HOU	ETION	N F L S	Propol race ew .ittle ome fostly	·tio	ons Used Less than 5% 5 to 10% 15 to 25% 30 to 45% 50 to 100%	140 lb Wt. x 30"           Cohesionless Densit           0 - 10         Loc           10 - 30         Medium Den           30 - 50         Den           50 +         Very Den	ty Cohesive C 0 - 4 4 - 8 8 - 15 15 - 30	Sampler Consistency Soft Medium Stiff Stiff Very Stiff Hard	
	LOCAT	ION OF BC	RING					cation P	laı	n				
DEPTH	Pocket Penetrometer (tsf)		Type of Sample	on Fr 0-6	-	oler To 12-18	Moisture Density or Consist.	Change Depth*			SOIL IDENTIFIC Remarks include color, t Rock-color, type, condi	ype of soil, etc.		
	3		SS	3	4	2	Moist	0.2		Topsoil Brown Lear fine to coars	n Clay with Sand (CL) - se sand (Glacial Till); ra	- moderately plas andom shale frag	tic, little ments noted	
		4.0-4.8	SS SS	8 38	27 50/4"	24	Moist Damp	3.0		Brown Sand	dstone - random shale la	ayers noted		
5									and a data taking to					
10		8.5	SS	50/0'			Damp	10.0		Water Seep	age at 9'			
10											BOTTOM OF B	ORING: 10'		
15														



PF	PROJECT NAME Kahler Tile Storm Sewer Project - Cubbage Road - Franklin County, Ohio BORING NO. B-11 PROJ. SURF. ELEV.																	
CI	JE	NT	M/I Ho	omes of	f Cen		DATE DRILLED <u>7/1/2019</u>											
Γ		GROU	JND WAT	ER OB	BSER		fall on 2" O.D. Sampler ty   Cohesive Consistency											
	N		T BELOW SU					N Fo	race ew ittle ome		Less than 5% 5 to 10% 15 to 25% 30 to 45%	0 - 10 Loose 0 - 4 Sof 10 - 30 Medium Dense 4 - 8 Medium Stift 8 - 15 Stift						
	_		T BELOW SU					S M	lostly		50 to 100%	50 + Very De	nse 15 - 30 Very Stiff nse 30 + Hard					
_	I		ION OF BO	RING	70			ring Loo		lar	n							
NEDTU		Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	on Fr	ows pe Samp om 6-12	oler To	Moisture Density or Consist.	Strata Change Depth*			SOIL IDENTIFIC Remarks include color, † Rock-color, type, cond	ype of soil, etc.					
		3	0.0-1.5	SS	1	1	2	Moist	-0.3	Î	Topsoil Brown Loon	Clay with Sand (CI)	moderately plastic little					
											fine to coars	se sand (Glacial Till); r	- moderately plastic, little andom shale fragments noted					
		4	2.0-3.5	SS	4	5	5	Moist										
	$\left  \right $																	
	-	3.5	4.0-5.5	SS	4	5	26	Moist to	)									
	5							Damp	5.0		Brown Sand	istone - random shale l	avers noted					
	-										DIOWII Saile		ayers noted					
	$\left  \right $																	
	F		7.5-7.9	SS	50/4'	-		Damp										
	ļ								9.0	1								
									9.0									
	10																	
												BOTTOM OF F	BORING: 9'					
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	ł																	
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GROU Le FEI FEI FEI CAT	ET BELOW SU	ER OB								PRO NO		G-23047			ED <u>7/1/2019</u>
GROU Le FEI FEI FEI CAT	U <b>ND WATI</b> ET BELOW SU ET BELOW SU	ER OB									19-	G-2304/	1) A		1/1/2019
le FEI FEI FEI	ET BELOW SU ET BELOW SU		SER	VAT											
FEI FEI CAT	ET BELOW SU	JRFACE			ION		Propor race	ns Used Less than 5%						D. Sampler e Consistency	
	ET BELOW SU	None       FEET BELOW SURFACE AT COMPLETION          FEET BELOW SURFACE AT 24 HOURS          FEET BELOW SURFACE ATHOURS									10 30 50	Medium De	ense ense	$\begin{array}{c} 0 & - & 4 \\ 4 & - & 8 \\ 8 & - & 15 \\ 15 & - & 30 \\ 30 & + \end{array}$	Sof
	ION OF BO	RING		Se	e Bo	ring Loo	cation P	lan							
ocket etrometer (tsf)	ler To 12-18	Density or	Change Depth*	Strata SOIL IDENTIFICATION Change Remarks include color, type of soil, etc.											
2	0.0-1.5	SS	1	1	2	Moist	0.5		Topsoil						
4	2.0-2.6	SS	4	6	8	Moist	3.7		Brown Lean fine to coars	n Clay v se sand	vith S (Glao	Sand (CL) cial Till); 1	- mo randc	oderately pom shale i	lastic, little ragments noted
	4.0-4.1	SS	50/1"			Damp			Brown Sand	lstone -	rand	om shale	layer	s noted	
	6.0	SS	50/0"			Damp	8.0								
										E	зотт	fom of I	3ORI	ING: 8'	
etr	sf)	Sample Depths From To 2 0.0-1.5 4 2.0-2.6 4.0-4.1	Sample Type Depths of From To Sample 2 0.0-1.5 SS 4 2.0-2.6 SS 4.0-4.1 SS	$ \begin{array}{c} \text{sample} & \text{Type} \\ \text{Depths} & \text{of} \\ \text{From To} & \text{Sample} \\ \hline 0.6 \\ \hline 2 & 0.0-1.5 & \text{SS} & 1 \\ \hline 0.6 \\ \hline 2 & 0.0-1.5 & \text{SS} & 1 \\ \hline 0.6 \\ \hline 0$	$ \begin{array}{c} \text{sample} \\ \text{Depths} \\ \text{From To} \\ \end{array} \begin{array}{c} \text{Sample} \\ \text{of} \\ \text{Sample} \\ \hline \\ \text{Sample} \\ \hline \\ 0-6 \\ 6-12 \\ \hline \\ 0-6 \\ \hline \\ 0-6 \\ 6-12 \\ \hline \\ 0-6 \\ \hline 0-6 \\ \hline \\ 0-6 \\ \hline $	$ \begin{array}{c} \mbox{Sample} & \mbox{Type} \\ \mbox{Depths} \\ \mbox{From To} & \mbox{Sample} & \mbox{of} \\ \mbox{Sample} & \mbox{Odd} \\ \mbox{From To} & \mbox{Sample} \\ \mbox{Odd} \\ $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Sample Depths st)       Type of Sample O-6       on Sample D-6       Density or Consist.       Strata Change Depth*       Remarks inc Remarks inc Rock-color         2       0.0-1.5       SS       1       1       2       Moist       0.5       Topsoil       Brown Lean Clay with S fine to coarse sand (Glad         4       2.0-2.6       SS       4       6       8       Moist       0.5       Topsoil       Brown Lean Clay with S fine to coarse sand (Glad	Sample     Type of Sample     on Sampler From To 0-6     Density or 0-6     Strata     Strata       2     0.0-1.5     SS     1     1     2       2     0.0-1.5     SS     1     1     2       4     2.0-2.6     SS     4     6     8       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -     -       -     -     -       -     -     - </td <td>Sample Depths st)       I ppe of From To       on Sample From To       Density or 0-6       Stata Change Opth*       Stata Remarks include color, type of Rock-color, type, condition,         2       0.0-1.5       SS       1       1       2       Moist       0.5       Topsoil         2       0.0-1.5       SS       1       1       2       Moist       0.5       Topsoil         4       2.0-2.6       SS       4       6       8       Moist       0.5       Topsoil         4       2.0-2.6       SS       4       6       8       Moist       3.7       Brown Lean Clay with Sand (CL) - mo fine to coarse sand (Glacial Till); rando        </td> <td>Sample Depths     Or Sample of Sample From To     On Sample From To     Density or Consist.     Strata Change Depth*     Strata Change Depth*     Remarks include color, type of soil, etc. Rock-color, type, condition, hardness       2     0.0-1.5     SS     1     1     2     Moist     0.5     Topsoil       4     2.0-2.6     SS     4     6     8     Moist     0.5     Topsoil       4     2.0-2.6     SS     4     6     8     Moist     3.7     Brown Lean Clay with Sand (CL) - moderately p fine to coarse sand (Glacial Till); random shale layers noted                                                                               &lt;</td>	Sample Depths st)       I ppe of From To       on Sample From To       Density or 0-6       Stata Change Opth*       Stata Remarks include color, type of Rock-color, type, condition,         2       0.0-1.5       SS       1       1       2       Moist       0.5       Topsoil         2       0.0-1.5       SS       1       1       2       Moist       0.5       Topsoil         4       2.0-2.6       SS       4       6       8       Moist       0.5       Topsoil         4       2.0-2.6       SS       4       6       8       Moist       3.7       Brown Lean Clay with Sand (CL) - mo fine to coarse sand (Glacial Till); rando	Sample Depths     Or Sample of Sample From To     On Sample From To     Density or Consist.     Strata Change Depth*     Strata Change Depth*     Remarks include color, type of soil, etc. Rock-color, type, condition, hardness       2     0.0-1.5     SS     1     1     2     Moist     0.5     Topsoil       4     2.0-2.6     SS     4     6     8     Moist     0.5     Topsoil       4     2.0-2.6     SS     4     6     8     Moist     3.7     Brown Lean Clay with Sand (CL) - moderately p fine to coarse sand (Glacial Till); random shale layers noted                                                                               <



PRO	JECT NAM	ME Kahler	Tile S	torm	lin Co PRC		, Ohio	BORING NO.							
CLIENT M/I Homes of Central Ohio													-G-23047	SURF. ELEV DATE DRILLED	
	GROU	UND WAT	ER OB	SER	VAT	ION		Proportions Used				0 lb	Wt. x 30" : less Densit	fall on 2'' O.D.	Sampler Consistency
  -	FEI	ET BELOW SU ET BELOW SU ET BELOW SU	JRFACE	AT 24	4 HOU	RS	N Fo	race ew ittle ome lostly	Less than 5 to 10 15 to 20 30 to 40 50 to 100	.0% 25% 5%	0 -	10 30 50	Loc Medium Der Der Very Der	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Soft Medium Stiff Stiff Very Stiff Hard
	LOCAT	ION OF BO	RING	1				cation P	an						
DEPTH	Pocket Penetrometer (tsf)		Type of Sample	on Fr		oler To	Moisture Density or Consist.	Change Depth*				rks in		CATION ype of soil, etc. tion, hardness	
	2.5	0.0-1.5	SS	1	1	1	Moist	0.7	Topsoil						
	4	2.0-3.5	SS	3	4	6	Moist		Brown I fine to c	Lean coarso	Clay v e sand	with (Gla	Sand (CL) - cial Till); ra	moderately pla indom shale fra	stic, little gments noted
5	3.5	4.0-5.5	SS	2	3	4	Moist	6.0							
		6.0-6.1	SS	50/1"			Damp	8.0	Brown S	Sands	stone -	- ranc	lom shale la	ayers noted	
10								8.0			]	BOT	ΓOM OF Β	ORING: 8'	

