## **DESIGN LOADS:**

70 Tons Compression 25 Tons Tension 4 Tons Lateral

## PILE DETAIL:

STELCOR 1600 18" Drive Plate 16" Corrugated Grout Column 11" Reverse Grout Auger 7.00" O.D. X 0.408" W.T. – 80 ksi Central Shaft

PILE LENGTH: 60'

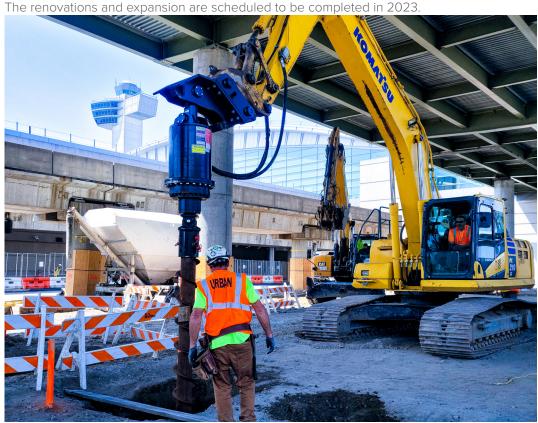
## NUMBER OF PILES: 178 GEOLOGY:

Subsurface explorations at this site encountered a layer of hydraulic fill, marsh deposits, and sands. The upper layer of hydraulic fill ranged from 3-14 feet deep and was underlain by native marsh deposits consisting of gray organic clay and peat. Glacially deposited medium-grained sands extended from the march deposit layer to where borings were terminated at 102' and ranged from loose to medium dense.



## **OVERVIEW:**

Another successful STELCOR install at JFK Airport in New York City. This time around, we had the opportunity to provide a deep foundation solution for the expansion of the terminal 4 headhouse. In layman's terms, the part of the airport where you get tickets, drop off baggage, stand in long lines, or wait for bags that may or may not arrive. The terminal 4 project results from the partnership between Delta airlines and PANYNJ, the Port Authority of New York and New Jersey. The \$1.5 billion transformation will allow Delta airlines to consolidate its operations at JFK into one terminal while also updating and expanding its current facilities. The expansion will include additional self-serve kiosks and updates to the baggage claim and arrival areas. In addition to the changes in the headhouse, there will also be ten new gates and additional seating added to the terminal.



THE PROCEDURE C TESTS ATTEMPTED TO REACH PILE FAILURE BY APPLYING 300% OF THE DESIGNED LOAD. EVEN AT THE MAX LOAD OF 225 TONS IN COMPRESSION, THE PILE TOP DISPLACEMENT WAS JUST OVER 1/2".

Load Test Results	Max Applied Load(Tons)	Pile Top Displacement at Max Applied Load(in)	Net Pile Settlement(in)
Compression B	170	.376	.135
Compression C	255	.504	.084
Tension B	52.7	.104	.008
Tension C	75	.190	.071
Lateral B	8.3	.508	.151
Lateral C	12	.756	.158

## **CHALLENGES:**

The most significant challenge on this site was the headroom restrictions. The headhouse expansion extends under the existing elevated 4-lane departures roadway and the parallel AirTrain. The majority of the piles were to be installed under the roadway, and a few were required under the Airtrain. Both the overpass and AirTrain had to remain operational during the installation. With as little as 12 feet of overhead clearance in areas, traditional driven pile methods were deemed unsafe to install.

Equipment necessary needed to be compact as there was limited site space. The restricted site space also created concerns about managing spoils. Spoils would have to be contained and then trucked away from the site, which would be costly and time-consuming. Lastly, vibrations from installation also need to be considered due to the surrounding structures.



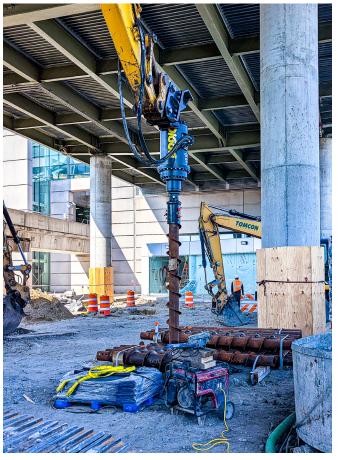


Drilled displacement micropiles were specified for this project by ARUP. DDMs were specified as they worked well within the confines of the project and could be installed with relatively minimal and readily available construction equipment. The ease and speed of installation, even with the overhead restrictions, was another advantage of using STELCOR for this project. A further advantage was the vibrationless installation which would not disrupt the surrounding properties or utilities. Using a displacement pile also saved time and money by eliminating spoils. With the above elements considered, STELCOR DDMs proved the ideal solution for supporting the headhouse expansion.

A STELCOR SC1600 pile was designed to resist the required 70 tons in compression, 25 tons in tension, and 4 tons in lateral. It was then tested to 255 tons in compression, 75 tons in tension, and 12 tons in lateral and passed with flying colors. The Procedure C tests attempted to reach pile failure by applying 300% of the design load. Even at the max load of 225 tons in compression, the pile top displacement was just over 1/2". STELCOR was approved by the Port Authority of New York and New Jersey. Urban Foundation/Engineering, LLC, a certified STELCOR installer, was contracted to perform the Deep foundation installation. In total, 178 STELCOR piles were installed to 60 feet, and the AirTrains remained fully operational throughout the project.



THE HEADHOUSE EXPANSION **EXTENDS UNDER THE EXISTING ELEVATED 4-LANE DEPARTURES ROADWAY AND THE PARALLEL** AIRTRAIN, BOTH OF WHICH HAD TO REMAIN OPERATIONAL **DURING INSTALLATION.** 



	GED BY Ficarra	BEGIN DATE Nov-02-10	COMPLETION DATE															PROJECT NUMBER 132040 HOLE ID HHE-01-MW	
	ING CONTRACTO		1107-03-10	IN	-SIT	U T	EST	ING										SURFACE ELEVATION	$\dashv$
	rren George ind	;																11.9 ft (NAVD88)	
	LING METHOD RE(0'-5'), ROTA	ΔRY(5'-102')			RILL			135G										BOREHOLE DIAMETER 4 in	١
	PLER TYPE(S) AN							R TYPE	<u> </u>									HAMMER EFFICIENCY, ERI	-
	Γ(1-3/8"), ST(2-			1	Auto	ma	atic,	140 I	bs,	30-i	nch	dro	р					65%	
		AND COMPLETION	N een Depth: 70-80 ft		ROU EADI			TER D	OURI					TER feet				TOTAL DEPTH OF BORING 102 ft	٦
	na. Gtarrapipo i	TOZOMOTO! (CON		<u>/</u>				- 11	OUT	CCC	nuc	<u>u</u>		1001			310)	10211	П
ODEPTH (ft)		Description		Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
5	Boring cleared to	5.0' prior to drilling																	
5	(SP) POORLY GI moist. NYCBC (C		y, medium dense, fine		SPT	I	5	19-15 -11-15	100										
	Grades loose. N	IYCBC (Class 7)			SPT	I	7.5	6-5-4 -3	100										
10					SPT	I	10	2-2-1 -4	100						21.4				
	(SP-SM) POORL - moist. NYCBC	Y GRADED SAND (Class 7)	WITH SILT, gray, loose		SPT	<b>\</b>	12.5	3-4-4 -4	100						32.1			PP:S <sub>u</sub> < 250 psf	
15	(OH) ORGANIC ( [MARSH DEPOS	CLAY, gray, soft - m ITS]	oist. NYCBC (Class 6				15 17		42 100										
	NYĆBC (Class 6)	RADED SAND, gray ) [GLACIAL SAND]	y, loose, fine - wet.	××	_														
20	Grades medium	dense. NYCBC (Cl	ass 3b)		U		20	6-8-12 -16	100					130.3	17.1				
20	Grades very den	se. NYCBC (Class	3a)		SPT		22.5	14-26 -32-37	100						30.1				
25	medium dense - v	Y GRADED SAND wet. NYCBC (Class	s 3b)		SPT		25	7-8-8 -7	100					119.4 120.9 121.9					
	(SP) POORLY GI dense - wet. NY(	RADED SAND WITH CBC (Class 3b)	H SILT, gray, medium		SPT		27.5	7-10 -10-13	100										
-30	ı	(continue	d)		I														┫
_																			-



																PROJECT NUMBER 132040	٦
	ED BY BEGIN DATE COMPLETION DATE icarra Nov-02-10 Nov-03-10															HOLE ID HHE-01-MW	
DRILL	ING CONTRACTOR	IN	-SIT	U T	ES1	ΓING										SURFACE ELEVATION	$\dashv$
	ren George inc	ח	RILL	DI'												11.9 ft (NAVD88)  BOREHOLE DIAMETER	4
	RE(0'-5'), ROTARY(5'-102')					135G										4 in	١
	LER TYPE(S) AND SIZE(S) (ID)					R TYPE , 140 l		30_i	nch	dro	าท					HAMMER EFFICIENCY, ERI 65%	
BORE	(1-3/8"), ST(2-7/8"), U(2-3/8") HOLE BACKFILL AND COMPLETION	GI	ROU	JND	)WA	TER C					-	TER	DRILI	ING (	DATE		-
2" D	ia. Standpipe Piezometer (Screen Depth: 70-80 f	() RE	EADI	NG	S	N	lot F	Reco	rde	d	9.7	feet	(11/	15/20	010)	102 ft	4
		SS		ou	æ						in/ft)	ct)	Moisture Content (%)	(%)			
(F)		Material Graphics	,be	Locatio	epth (	0 E	(%)		يا	pth	te (m	Wt (p	onte	Plasticity Index (%)	(Jsc		
HT.		rial G	ole Ty	ole Lc	ole De	s per	very	(%)	nres/	Jg De	ig Rai	Unit	inre C	icity I	Strength (psf)		
DEP	Description	Mate	Sample Type	Sample	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moist	Plasti	Stren	Remarks	
30			SPT		30	10-12 -11-13	100										
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35			SPT		35	10-12	100						29.3				╡
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40	Grades loose. NYCBC (Class 6)		SPT	T	40	2-4-5 -5	100										▤
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																	▤
																	₫
45	Grades medium dense. NYCBC (Class 3b)		SPT		45	4-4-7	100										∄
▎∄	Grades medium dense. NYCBC (Class 3b)		3F1	N	40	-14	100										∄
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50-			SPT	T	50	6-8-11 -14	100										▤
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55																	∄
			SPT		55	4-12 -13-15	100										▋
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-60 <u>-</u>	(continued)			ш					I								╡
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																		PROJECT NUMBER 132040	
K. F	icarra	Nov-02-10	Nov-03-10															HOLE ID HHE-01-MW	
	ING CONTRAC			TIN	-511	JII	EST	ING										SURFACE ELEVATION	┪
	rren George i	IIIC			RILL	RIG												11.9 ft (NAVD88)  BOREHOLE DIAMETER	$\dashv$
CO	RE(0'-5'), RO	TARY(5'-102')						135G										4 in	
		AND SIZE(S) (ID) (2-7/8"), U(2-3/8")						140 I		30-i	nch	dro	ac					HAMMER EFFICIENCY, ERI 65%	
BORE	HOLE BACKFI	LL AND COMPLETIO		GI	ROU	ND۱	WAT	TER D	URII	NG E	DRIL	LIN	G AF					TOTAL DEPTH OF BORING	
2" [	Dia. Standpipe	e Piezometer (Scr	een Depth: 70-80 t	t)   RI	EADI	NG:	$\frac{s}{}$	N	lot R	teco	rde	d	9.7	feet		15/2	010)	102 ft	$\dashv$
				S		uo	£						in/ft)	ct)	Moisture Content (%)	(%)			
<b>₽</b>				Material Graphics	/be	Locatio	Sample Depth (ft)	e In	(%)		<u>_</u>	pth	Coring Rate (min/ft)	Total Unit Wt (pcf)	onte	Plasticity Index (%)	osf)		
H				rial G	Sample Type	ole Lo	Se D	s per	Recovery (%)	(%)	Fractures/ft	Casing Depth	ıg Ra	Unit	inre	icity I	Strength (psf)		
DE P		Description		Mate	Samp	Sample	Samp	Blows per 6 I Resistance	Reco	RQD (%)	Fract	Casir	Corin	Total	Moist	Plast	Stren	Remarks	
(#) HLd300 65 70 75 75 75 75 75 75 75 75 75 75 75 75 75		•			SPT		_	6-9-14 -17	100										目
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65-					SPT		65	8-14	100										Ħ
=						N		8-14 -13-13											
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70 =					SPT	T	70	8-11 -14-19	100										Ħ
						N		-14-15											
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75-					]														
					SPT	N	75	7-12 -12-15	100										
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80 =	(SP) POORLY	GRADED SAND WIT			U		80	36-40	100										Ħ
1 =	dense, fine to	coarse - wet. NYCBC	(Class 3a)					-39-49											Ē
85	(SP) POORLY wet. NYCBC (	GRADED SAND, gra	y, very dense, fine -		SPT		85	18-23 -29-40	100										
		(- === =#/																	
85																			
-90 <u> </u>							$\perp$												耳
<u> </u>		(continue	ed)																



	EED BY BEGIN DATE COMPLETION DATE icarra Nov-02-10 Nov-03-10															PROJECT NUMBER 132040 HOLE ID HHE-01-MW	$\exists$
DRILL	ING CONTRACTOR	IN-	SIT	U T	ES	TING										SURFACE ELEVATION	
	ren George inc ING METHOD	DF	RILL	RIC	3											11.9 ft (NAVD88)  BOREHOLE DIAMETER	-
	RE(0'-5'), ROTARY(5'-102') LER TYPE(S) AND SIZE(S) (ID)					135G R TYPE	-									4 in HAMMER EFFICIENCY, ERI	_
	(1-3/8"), ST(2-7/8"), U(2-3/8")					, 140 l		30-i	nch	dro	р					65%	
	HOLE BACKFILL AND COMPLETION ia. Standpipe Piezometer (Screen Depth: 70-80 ft)		ROU			TER D			RILL					.ING ( 15/2(		TOTAL DEPTH OF BORING 102 ft	
DЕРТН (ft)		Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)		Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	102 10	
<b>_</b> a∩	-	Mate		_		Blow		RQ	Frac	Cas	Cori	Tota	Mois	Plas	Stre	Remarks	Ш
90	Grades dense. NYCBC (Class 3a)		SPT		90	20-22 -16-32	100										
95	Grades medium dense. NYCBC (Class 3b)		SPT		95	10-11 -14-16	100										
	Grades dense. NCYBC (Class 3a)  Drilling not observed by Arup. Log based on samples and field log prepared by Pillori Associates.		OF I			-18-23	100										
105	See Borehole Log Legend for soil classification chart and key to test data and sampler type.																
110																	
110																	



LOGGED BY BEGIN DATE COMPLETION DATE A. Littlejohn Oct-14-10 Oct-16-10  DRILLING CONTRACTOR Warren George inc  DRILLING METHOD CORE(0'-5'), ROTARY(5'-102')  SAMPLER TYPE(S) AND SIZE(S) (ID) SPT(1-3/8"), ST(2-7/8"), U(2-3/8")  BOREHOLE BACKFILL AND COMPLETION Neat Cement Grout	IN  DF  A  SF  GF	RILL Acke PT H Auto	RIC er A IAM oma	G AK MER atic,		lbs,	NG E	RILI	LING	•		DRILL			PROJECT NUMBER 132040 HOLE ID HHE-02 SURFACE ELEVATION 12.3 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 65% E) TOTAL DEPTH OF BORING 102 ft
(¥) H L G Description	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
Boring cleared to 5.0' prior to drilling.  5		_ U  SPT		5 7.5	9-10 -12-12 5-6-7 -10	100 54 67						21.7			Concrete/gravel obstruction, sample collected in jar
(SP) POORLY GRADED SAND, yellow brown, medium dense, fine - moist. NYCBC (Class 7)  Trace silt.  Grades loose. NYCBC (Class 7)  (OH) ORGANIC CLAY, dark brown, soft, with strong organic odor, decomposing vegetative matter - moist. NYCBC (Class 6) [MARSH DEPOSITS]  (SP) POORLY GRADED SAND, yellow brown to gray, loose, fine, trace silt - moist. NYCBC (Class 6) [GLACIAL SAND]	<b>***</b>	ST ST - SPT		15 17 19	4-4-4 -4 3-4-6 -7	100 100 67					97.3 97.2 96.6 99.8 100.5	71.3 62.2 24.1	103		UU = 300
(SP) POORLY GRADED SAND, yellow brown to gray, loose, fine, trace silt - moist. NYCBC (Class 6) [GLACIAL SAND]  (SM) SILTY SAND, yellow brown to gray, medium dense, fine - moist. NYCBC (Class 3b)  (SP) POORLY GRADED SAND, yellow brown to gray, medium dense, fine - moist. NYCBC (Class 3b)  Grades loose. NYCBC (Class 6)		SPT		21.5 24 26.5	8-17 -37-45 8-10 -11-12 4-5-4 -5	79 71					123.4 122.5 119.7				UU = 300
Grades medium dense. NYCBC (Class 3b) (continued)		SPT	Ī	29	6-10 -14-18	58									



																PROJECT NUMBER 132040
A. Li	ttlejohn Oct-14-10 Oct-16-10															HOLE ID HHE-02
DRILLI	NG CONTRACTOR	IIV-	SIT	J I	ESI	ING										SURFACE ELEVATION
DRILLI	en George inc NG METHOD		RILL													12.3 ft (NAVD88)  BOREHOLE DIAMETER
	E(0'-5'), ROTARY(5'-102')  LER TYPE(S) AND SIZE(S) (ID)					135G R TYPE										4 in HAMMER EFFICIENCY, ERI
SPT	(1-3/8"), ST(2-7/8"), U(2-3/8")	A	uto	ma	atic,	, 140 I	bs,				-					65%
	HOLE BACKFILL AND COMPLETION Cement Grout	GR RE	ROUI	ND NG	WA <sup>-</sup> SS	TER C			ORILI orde		G AF			LING ( orded		TOTAL DEPTH OF BORING 102 ft
		•									ſŧ)					
		Material Graphics	Sample Type	ation	Sample Depth (ft)	u	(9			ا ج	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	æ	
H (ft)		al Gra	е Тур	e Loc	е Dер	per 6 ance	ery (%	(%	res/ft	) Dep	Rate	Jnit W	e S	ity Inc	th (ps	
JEPI	Description	//ateri	ampl	ampl	ampl	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	oring	otal L	Aoistu	lastic	Strength (psf)	Remarks
30	Description :	_	0)	0)	0)	шш	ш.	<u> </u>	ш	U	0				0)	
	[:															From Pillori log
	Į.															
▎∄																
35-=	<u> </u> }		SPT	N	35	4-6-7	67									
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▮▮																
40			SPT		40	6-11-8	67									
▎∄	:		SF I	N	40	-10	07									
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			SPT	N	45	5-7-8 -11	100									From Pillori log
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50-			SPT	V	50	3-4-10 -17	100						24.9			
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(#) HIABOO 35 55 55 55 55 55 55 55 55 55 55 55 55						ļ										
55	·		SPT		55	7-8-11	100									
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_ <sub>60</sub> _∄	į.															
	(continued)															



															PROJECT NUMBER . <b>132040</b>
LOGGED BY BEGIN DATE COMPLETION DATE A. Littlejohn Oct-14-10 Oct-16-10	1														HOLE ID HHE-02
DRILLING CONTRACTOR	IN-	SITU	J TI	EST	ING										SURFACE ELEVATION
Warren George inc	<u> </u>														12.3 ft (NAVD88)
DRILLING METHOD CORE(0'-5'), ROTARY(5'-102')		RILL Icke			135G										BOREHOLE DIAMETER 4 in
SAMPLER TYPE(S) AND SIZE(S) (ID)					R TYPE										HAMMER EFFICIENCY, ERI
SPT(1-3/8"), ST(2-7/8"), U(2-3/8") BOREHOLE BACKFILL AND COMPLETION					140 I TER D					•	TED	ו וופח	ING (		65%  TOTAL DEPTH OF BORING
Neat Cement Grout		ADII				lot R				G Ar			ordec		102 ft
										ft)		(%)	(6		
	Material Graphics		tion	Sample Depth (ft)	_				اےا	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)		
(#) - (#)	Grap	Sample Type	Locati	Dept	Blows per 6 In Resistance	Recovery (%)	<u> </u>	ss/ft	Casing Depth	Rate	it W	Cor	y Ind	Strength (psf)	
(#) H L L L L L L L L L L L L L L L L L L	terial	mple	Sample	mple	ws p	cove	RQD (%)	Fractures/ft	sing l	ring F	al Ur	isture	sticit	ength	
60 (OD CM) DOODLY ODADED CAND WITH OUT TO INSTRU	_			S 60	9 8 4-5-8	2 100	RG	Fra	S	ပိ	ToT	<u>S</u> 23.9	Pla	Str	Remarks
brown to gray, medium dense, fine - moist. NYCBC (Class		SPT	N.	60	-10	100						23.9			
3b)			Щ												
<b>│</b>															
	Щ	SPT		65	5-6-6	100									
gray, medium dense, fine - moist. NYCBC (Class 3b)			N		-6										
=			Щ												
<b>│</b>															
70-		SPT	1	70	8-10 -11-16	100									
			N		-11-16										
			П												
<u></u>															
[:		U		75	13-27 -30-33	100									
80=															
		SPT	M	80	7-11 -15-18	100									
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I 4															
85-		SPT		85	10-14	100									
		J1 1		"	-14-20	100									
<b>│</b>			Щ												
<b>I</b> ∃															
(SP) POORLY GRADED SAND WITH SILT, yellow brown to gray, medium dense, fine - moist. NYCBC (Class 3b)															
_ <sub>90</sub> .⊒ (continued)															
(**************************************															



																		PROJECT NUMBER 132040	
	ED BY .ittlejohn	BEGIN DATE Oct-14-10	Oct-16-10															HOLE ID HHE-02	
DRIL	ING CONTRAC	TOR	JOC 10-10	IN	-SITI	J TI	EST	ING										SURFACE ELEVATION	_
DRIL	ING METHOD				RILL			1050										12.3 ft (NAVD88)  BOREHOLE DIAMETER	
		TARY(5'-102') .ND SIZE(S) (ID)						135G R TYPE										4 in HAMMER EFFICIENCY, ERI	
SP	Γ(1-3/8"), ST(2	2-7/8"), U(2-3/8")		A	uto	ma	itic,	140	bs,				-					65%	
	HOLE BACKFIL It Cement Gro	L AND COMPLETION	N		ROU EADI			TER D	ot R				3 AF			.ING ( ordec		TOTAL DEPTH OF BORING 102 ft	
э́рертн (ft)		Description		Material Graphics			Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
	(SP) POORLY dense, fine to c	GRADED SAND WIT oarse - wet. NYCBC	H GRAVEL, gray, (Class 3a)		SPT		90	11-19 -22-26	100										
95	Grades very de	ense. NYCBC (Class	3a)		SPT		95	23-31 -36-38	100										
100		erved by Arup from de	enth 45' to end of		SPT	1	100		100										
	borehole. For d	epths greater than 45 eld log prepared by Pi	5', log is based on																
105	key to test data	og Legend for soil cla and sampler type.	assification chart and																
110																			
1110																			
120-																			



																PROJECT NUMBER	٦
LOGG Z. K	SED BY BEGIN DATE COMPLETION DATE (han Oct-13-10 Oct-14-10															HOLE ID HHE-03-PS	$\exists$
DRILL	ING CONTRACTOR	- 1				ING										SURFACE ELEVATION	$\dashv$
	ren George inc ING METHOD		SILL		•	ension	Log	ggin	g							10.5 ft (NAVD88)  BOREHOLE DIAMETER	$\dashv$
	RE(0'-5'), ROTARY(5'-102')				3 AD I	ıl										4 in	
	PLER TYPE(S) AND SIZE(S) (ID)					140 I		20 i	noh	dra	<b>.</b>					HAMMER EFFICIENCY, ERI	
	(1-3/8"), ST(2-7/8"), U(2-3/8") HOLE BACKFILL AND COMPLETION					TER D						TER	DRILL	ING (	DATE	81%  TOTAL DEPTH OF BORING	_
	d & Blacktop	RE	ADI	NG	s	N	ot F	Reco	rde	d		Not	Reco	ordec	i	102 ft	$\sqcup$
		Material Graphics	ø	ation	Sample Depth (ft)	드	(%)			‡	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	sf)		
'Н (ft		al Gra	е Тур	e Locati	e De	per 6 ance	ery (9	(%	res/ft	) Dep	Rate	Jnit V	re Cc	ity In	th (ps		
DEPTH (ft)	Description	lateri	Sample Type	Sample	ampl	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	oring	otal L	loistu	lastic	Strength (psf)	Remarks	
<b>—</b> 0 <b>—</b>	Description Hand augered to 5.0'.	2	ഗ	S	S	<u> </u>	м.	<u>~</u>	ш	O	O	Ĺ	2		S	кешагкѕ	∦
1 =																	
5																	
																	E
5	(SP) POORLY GRADED SAND WITH SILT, gray, medium dense, fine to medium - moist. NYCBC (Class 7) [FILL]		U		5	13-21 -24-29	75										
	:																
	:		SPT	N	7	6-6-13 -17	75						25.9				Ħ
	:			Н													
	(OD CAN DOODLY ODADED CAND	111	SPT		10	2.5.4	F0						20.2				
=	(SP-SM) POORLY GRADED SAND, gray, loose, fine to medium - wet. NYCBC (Class 7)		3P1	М	10	3-5-4 -5	50						28.3				
				Н													
	(OH) ORGANIC CLAY, dark gray, soft, strong organic odor, with decaying vegetative matter - moist. NYCBC (Class 6)	×	SPT		12.5	2-2-1 -4	75									PP:S <sub>u</sub> = 500 psf	Ħ
		×		Щ													
15-			ST	Ш	15		NR										Ħ
1		<b>※</b>															Ħ
		$\approx$	ST	Ш	17		NR										
		$\approx$															Ħ
20		$\otimes$		П													
	(SP) POORLY GRADED SAND, gray, medium dense, fine to medium - moist. NYCBC (Class 7) [GLACIAL SAND]		SPT	N	20	9-11 -14-18	75										
I⊒	`			Ш													
			SPT	1	22.5		50										
=				H		-15-16											
25-	:		SPT		25	5-7-9	50										Ħ
=			J. 1	Щ	-5	-13											
				Щ													
=	Grades dense. NYCBC (Class 3a)		SPT		27.5	7-12 -20-22	50										Ħ
10-11-11-11-11-11-11-11-11-11-11-11-11-1	,,			Щ													Ħ
_ <sub>30</sub> _=	(continued)	· .: .		Ш													뒥
	(				—												4



LOGGED BY Z. Khan Oct-13-10 Oct-14-10  DRILLING CONTRACTOR Warren George inc  DRILLING METHOD CORE(0'-5'), ROTARY(5'-102')  SAMPLER TYPE(S) AND SIZE(S) (ID) SPT(1-3/8"), ST(2-7/8"), U(2-3/8")  BOREHOLE BACKFILL AND COMPLETION Sand & Blacktop	P- DR Ad SP- Ad	ILL I cke T HA utor	RIG r A AMI ma	Spe ND I MEF Itic,	nsion I R TYPE 140 I	bs,	30-i	nch	LINC				LING (		PROJECT NUMBER 132040 HOLE ID HHE-03-PS SURFACE ELEVATION 10.5 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 81% TOTAL DEPTH OF BORING 102 ft
(₹) H L L L L L L L L L L L L L L L L L L L	_	Sample Type		© Sample Depth (ft)	9 Blows per 6 In 6 Resistance	S Recovery (%)	RQD (%)		Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
Grades medium dense. NYCBC (Class 3b)  35  Grades light gray - wet		SPT		35	-14 5-6-7 -8	NR									No recovery (1" collected in sample jar)
40-		U		40	12-19 -20-22	NR									Finished drilling for day at 4:30 am on 10/13/2010; Started drilling at 12:00 am on 10/14/2010
45—Grades light gray - wet	s	SPT	N 	45	4-5-6 -9	50						28.2			
Grades very dense. NYCBC (Class 3a)		SPT		50	16-26 -28-32	100									
Grades very dense. NYCBC (Class 3a)  Grade medium dense, layer 1" thick with black staining. NYCBC (Class 3b)	\$	SPT		55	4-4-10 -25	75									
_ <sub>60</sub> _⊒ [· (continued)															



																PROJECT NUMBER
LOGG Z. K	EED BY BEGIN DATE COMPLETION DATE han Oct-13-10 Oct-14-10															HHE-03-PS
	ING CONTRACTOR	IN-	-SIT	U T	ES1	ΓING										SURFACE ELEVATION
War	ren George inc	F	P-S	Su	spe	ension	Log	ggin	g							10.5 ft (NAVD88)
	.ING METHOD RE(0'-5'), ROTARY(5'-102')		RILL			п										BOREHOLE DIAMETER
	PLER TYPE(S) AND SIZE(S) (ID)					'' R TYPE	=									4 in HAMMER EFFICIENCY, ERI
SPT	(1-3/8"), ST(2-7/8"), U(2-3/8")	1				, 140 I					-		DD!! !	INIO (	DATE	81%
	d & Blackfop		ADI			TER D	lot F				A۱ ن			ordec		TOTAL DEPTH OF BORING 102 ft
											ítt)	)	(%)	6)		
		Material Graphics	4)	ation	Sample Depth (ft)	드				اءا	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)		
DEPTH (ft)		Gra	Sample Type	Locati	Dept	Blows per 6 I Resistance	Recovery (%)		s/ft	Casing Depth	Rate	it	Cor	/ Ind	Strength (psf)	
ᆸ		erial	nple	Sample	ple	vs pr	over	RQD (%)	Fractures/ft	ing [	ing F	۳ L	sture	sticity	ngth	
30E	Description	Mat	San	San	San	Res Res	Rec	RQ	Fra	Cas	Cor	Tota	Moi	Plas	Stre	Remarks
65	Grades without black staining		SPT		60	8-10 -14-16	50									
				$\prod$												
l 🏻				П												
▎▔▋	i i i i i i i i i i i i i i i i i i i															<b>=</b>
65-			SPT	N	65	6-7-10 -15	50									
=	<u>:</u>			Н		-15										
=	[:			Н												
▎╡																
▎∄	<u>:</u>															
70-	(SP-SM) POORLY GRADED SAND WITH SILT, gray,	111	U		70	22-35	100					124.4	24.2			
▎∄	dense, fine to medium - moist. NYCBC (Class 3a)					-40-44										
╽╶╡																
▎∄	į:															
75	(2D) DOOD WOOD DE DOM DE TOUR	Щ	- ODT		7.	40.44	50						00			
▎∄	(SP) POORLY GRADED SAND, gray, medium dense, fine to medium - moist. NYCBC (Class 3b)		SPT	Ц	75	10-11 -15-15	50						28			
	i:			Ш												
	ļ:															
Ē																
90.	:															
00	(SP) POORLY GRADED SAND WITH GRAVEL, yellowish brown, very dense, fine to coarse, gravel is subangular,		SPT	V	80	26-51 -42-43	75									Ē
	about 1/4" in diameter - moist. NYCBC (Class 3a)			Щ												
	li de la companya de			Щ												
	ļ:															
85	<u> </u> ;		SPT		85	8-35	75									
∄	(SP) POORLY GRADED SAND, dense, fine to medium -		-	Щ		-10-89										
▎∄	moist. NYCBC (Class 3a)			Н												
▎∄	ļ:															
80 85 85	<u> </u> ;															
<sub>90</sub> =	(continued)			Ц												
<u> </u>	(continued)			_												



CONTRACTOR George inc  METHOD I'-5'), ROTARY(5'-102')  TYPE(S) AND SIZE(S) (ID) /8"), ST(2-7/8"), U(2-3/8")  E BACKFILL AND COMPLETION Blacktop  Description	F DI A	RILL Acke PT HA Auto ROU EADI	RIG AMI MD ND	Spe AD I MEF atic,	nsion I R TYPE 140 I	bs,	30-iı	nch (		p					HHE-03-PS SURFACE ELEVATION 10.5 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI
METHOD '-5'), ROTARY(5'-102') TYPE(S) AND SIZE(S) (ID) /8"), ST(2-7/8"), U(2-3/8") E BACKFILL AND COMPLETION Blacktop	SI A	RILL Acke PT HA Auto ROU EADI	AMI MD ND	MEF	I TYPE 140 I	bs,	30-iı	nch (		p					BOREHOLE DIAMETER 4 in
I'-5'), ROTARY(5'-102') TYPE(S) AND SIZE(S) (ID) /8"), ST(2-7/8"), U(2-3/8") E BACKFILL AND COMPLETION Blacktop	SI A GI RI	Acke PT HA Auto ROU EADI	AMI Ma ND' NG	MEF atic,	TYPE 140 I	bs, URII				р					4 in
/8"), ST(2-7/8"), U(2-3/8") E BACKFILL AND COMPLETION Blacktop	G RI	Auto ROU EADI	MD' NG:	atic, WA7	140 I	bs, URII				р					HAMMED EFFICIENCY EDI
E BACKFILL AND COMPLETION Blacktop	GI RI	ROU	ND'	WA1	TER D	URII				Ρ					81%
·				s	N	ot R			ING	AF	TER [	DRILL	.ING (	DATE	TOTAL DEPTH OF BORING
Description	Graphics					<del></del>	eco	rdec	1		Not	Reco	orded	<u> </u>	102 ft
CLAYEY SAND, dark gray, loose - moist. NYCBC	Materia	Sample Type	_	Sample Depth (ft)	Blows per 6 In Resistance	G Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
ss 6)			<u> </u>		-11										
POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)		SPT	N	95	11-14 -30-41	75									
Borehole Log Legend for soil classification chart and		SPT		100	15-21 -28-39	50									
7,6															
i	POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)	POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)	POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)  SPT  SPT	POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)  SPT  SPT  SPT  SPT	POORLY GRADED SAND, gray, dense, fine to ium - moist. NYCBC (Class 3a)  SPT 95  SPT 100  Borehole Log Legend for soil classification chart and	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 -30-41	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41 7	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 111-14 -30-41 75	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41 7	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41 75 -30-41 75 -30-41 50 -28-39 50 -30-50 50 50 50 50 50 50 50 50 50 50 50 50 5	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41 75 -30-41 100 15-21 50 -28-39 50	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 30-41	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 1114 75 -30-41	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41  SPT 100 15-21 50 -28-39  Borehole Log Legend for soil classification chart and	POORLY GRADED SAND, gray, dense, fine to jum - moist. NYCBC (Class 3a)  SPT 95 11-14 75 -30-41 75 -30-41 100 15-21 50 -28-39 50



Description  Description  Description  Description  Description  Description  Description  Description  Sample Location  Sample Location  Sample Depth (ft)  Recovery (%)  Recovery (%)  Plasticity Index (%)  Plasticity Index (%)  Sequence of the property	
Hand augered to 5.0'.	
(SP-SM) POORLY GRADED SAND WITH SILT, grayish brown, medium dense, fine to medium - moist. NYCBC (Class 7) [FILL]  (SP) POORLY GRADED SAND, grayish brown, medium dense, fine to medium, moist. NYCBC (Class 7)  (SP) POORLY GRADED SAND, grayish brown, medium dense, fine to medium, moist. NYCBC (Class 7)  (OH) ORGANIC CLAY, dark gray, medium stiff, strong organic odor, with decaying vegetative matter - moist. NYCBC (Class 4c) [MARSH DEPOSITS]	II; High
ST 15 100 106.9 74.7 41.7 32.8 95.8 41.7 93 93 93.7 74.7 92.7 74.2 95.3 70.1 100 100 100 100 100 100 100 100 100	
Grades very dense. NYCBC (Class 3b)  [GLACIAL SAND]  SPT 21 4-9-12 50 75 80 71.1 74.5  Grades very dense. NYCBC (Class 3a)  SPT 21 4-9-12 50 75 -32-47	N-value
Grades light gray, medium dense. NYCBC (Class 3b)  SPT 25 11-12 50 -12-15 50 -12-15 75	N-value



Z. K DRILL War DRILL COF SAME SPT BORE	LING CONTRAC ren George in LING METHOD RE(0'-5'), RO PLER TYPE(S) A (1-3/8"), ST(2	TARY(5'-102')  IND SIZE(S) (ID) 2-7/8"), U(2-3/8")  LL AND COMPLETION	COMPLETION DATE Oct-21-10	IN DI A	Auto	RIG er A AMI oma	MEF	I R TYPE 140 I	bs, DURI	NG E		LINC	-		Reco			PROJECT NUMBER 132040 HOLE ID HHE-04 SURFACE ELEVATION 12.2 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 81% TOTAL DEPTH OF BORING 102 ft	
Ф ОБРТН (ft)	Grades mediu	Description m dense - wet. NYCE	BC (Class 3b)	Material Graphics	Sample Type		Sample Depth (ft)	Blows per 6 In Blows per 6 In Bob Resistance	S Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
(#) ATHER OF THE STATE OF THE S					SPT		35	8-10 -11-13	50										
40	Grades dense.	NYCBC (Class 3a)			U		40	20-22 -40-100	75					116.4 117.7 112.8	25.5				
45	Grades mediu	m dense. NYCBC (Cl	lass 3b)		SPT	N T	45	6-5-5 -7	50										
55 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					SPT		50	6-6-6	75										
-60		(continue	d)		SPT		55	9-9-9 -11	75										



																PROJECT NUMBER	٦
LOGG Z. K	BEGIN DATE COMPLETION DATE han Oct-15-10 Oct-21-10															HOLE ID HHE-04	$\dashv$
DRILL	ING CONTRACTOR	IN-	SITU	UΤ	EST	ING										SURFACE ELEVATION	$\dashv$
	ren George inc	DB	RILL	Bic												12.2 ft (NAVD88) BOREHOLE DIAMETER	4
COF	RE(0'-5'), ROTARY(5'-102')	Α	cke	er A	AD I											4 in	
	EER TYPE(S) AND SIZE(S) (ID) (1-3/8"), ST(2-7/8"), U(2-3/8")					7 TYPE 140 I		30-i	nch	dro	ac					HAMMER EFFICIENCY, ERI 81%	
BORE	HOLE BACKFILL AND COMPLETION	GR	ROU	ND۱	WA1	TER D	URI	NG E	DRIL	LIN	-					TOTAL DEPTH OF BORING	$\dashv$
Nea	t Cement Grout	KE	ADII	NG:	<u>s</u>	N	lot F	Reco	rde	d 		Not		ordec	i T	102 ft	$\dashv$
		S		ڃ	(£)						in/ft)	oct)	Moisture Content (%)	(%)			
Œ		Material Graphics	ype	Location	Sample Depth (ft)	Blows per 6 In Resistance	(%)		¥	epth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Sonte	Plasticity Index (%)	psf)		
PTH		erial	Sample Type	Samble L	ple D	vs per istanc	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	ng Re	Unit	sture (	ticity	Strength (psf)		
DEF	Description					Blow Resi		RQ	Frac	Casi	Cori	Tota	Mois	Plas	Stre	Remarks	Ш
			SPT		60	10-8-8 -13	50										
	[:]			Щ													
1 🖥																	
65-=			SPT	N	65	16-15 -10-15	75										Ħ
				Щ		-10-15											
				П													
70																	
			SPT	N	70	12-15 -14-13	100										
╽-릨				Щ													
╽᠊᠊᠊᠊																	Ħ
																	Ħ
75			SPT	N	75	11-11 -16-20	50										
	it.					. =3											
80=	(SP) POORLY GRADED SAND WITH GRAVEL, gray, very	Щ	U		80		25					134.5	12.4				
	dense, fine to medium, gravel is subrounded - wet. NYCBO (Class 3a)		-														Ħ
				Н													
ا ا																	
85	(SP-SM) POORLY GRADED SAND WITH SILT, gray, very dense, fine to medium - wet. NYCBC (Class 3a)		SPT	N	85	41-39 -57-87	75						15.8				
				Ш													
(#) H_Ld3QQ 65 65 70 75 80 85 85 85 85 85 85 85 85 85 85 85 85 85																	
_ <sub>90</sub> _=	(continued)	.		Щ			<u> </u>										튁
<u> </u>	(																4



LOGGED BY BEGIN DATE COMPLETION DATE															PROJECT NUMBER 132040 HOLE ID
Z. Khan Oct-15-10 Oct-21-10															HHE-04
	IN	-SIT	UΊ	ES	ΓING										SURFACE ELEVATION
Warren George inc															12.2 ft (NAVD88)
DRILLING METHOD CORE(0'-5'), ROTARY(5'-102')		RILL			п										BOREHOLE DIAMETER
					II R TYPE										4 in HAMMER EFFICIENCY, ERI
SPT(1-3/8"), ST(2-7/8"), U(2-3/8")					, 140		30-i	nch	dro	ор					81%
BOREHOLE BACKFILL AND COMPLETION	GF	ROL	JND	WA						-	TER	DRILI	LING (	DATE	TOTAL DEPTH OF BORING
Neat Cement Grout	RE	AD	ING	SS	N	ot F	Reco	rde	d		Not	Rec	ordec	t	102 ft
90	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In 11-15 Resistance	S Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
(SM) SILTY SAND, dark gray, medium dense, trace clay - moist. NYCBC (Class 3b)  (ML) INORGANIC SILT, dark gray, medium dense, moist. NYCBC (Class 3b)  (SP) POORLY GRADED SAND, gray, medium dense, fine to medium - moist. NYCBC (Class 3b)		SPT		95	7-5-13 -25	100									
		SPT		100	14-11 -7-15	100									
See Borehole Log Legend for soil classification chart and key to test data and sampler type.															



																PROJECT NUMBER 132040
	ED BY BEGIN DATE COMPLETION DATE															HOLE ID
	icarra Oct-18-10 Nov-02-10 ING CONTRACTOR	IN	-SIT	'	EST	INIC										HHE-05 SURFACE ELEVATION
	ren George inc	"	-311	Ui	EUI	livG										11.3 ft (NAVD88)
DRILL	ING METHOD		RILL													BOREHOLE DIAMETER
	RE(0'-5'), ROTARY(5'-102')					135G										4 in
	LER TYPE(S) AND SIZE(S) (ID)					140 I		ა∪-! _	- 'nch	٦	-	_		_		HAMMER EFFICIENCY, ERI 65%
	(1-3/8"), ST(2-7/8"), U(2-3/8") HOLE BACKFILL AND COMPLETION	- 1									-	TER	וואט	ING (	υΔΤΕ	) TOTAL DEPTH OF BORING
	t Cement Grout	RE	EADI	NG	S.				orde		 		Reco			102 ft
				П							(					
		iics		E	Œ						nin/ff	(bct)	ant (	(%) <b>&gt;</b>		
(ft)		raph	/be	cati	epth	e In	(%)		پ	ξ	te (n	Wt (	)ontr	nde	psf)	
<u> </u>		al G	e T	e Lc	e D	per	/ery	(%)	res/	g De	j Ra	Unit	Jeur	city I	Jth (i	
DEPTH	S	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	D :
-0	Description  Borehole cleared to 5.0' prior to drilling.	Σ	S	S	S	፵ፚ	ď	ď	ш	O	O	Ĺ	Σ	Ġ	Ó	Remarks
5 10 10 11 15 11 11 11 11 11 11 11 11 11 11 11	Difference dealed to 0.0 prior to driving.															
l																<b> </b>
Ι₫																
ًا ا																
<u> </u>																
"	(SP) POORLY GRADED SAND, yellowish brown, medium dense, fine to medium. NYCBC (Class 7) [FILL]		SPT		5	6-10 -11-13	100						16.7			
ΙŢ	dense, fine to medium. INTODO (Class 1) [1 ILL]					-11										
ΙĦ						2.1						- 1				
Ιđ	Grades gray, fine to coarse.		U		7.5	13-21 -21-23	100					120.2 125.9				
-	į:											121.4				
10-			SPT		10		400						26.3			
Ι₫	Grades fine to medium.		SFi		10	5-6-6 -9	100						20.3			
Ιġ	<u> </u> -			Щ												
∥ <u>∃</u>	ŀ		SPT		12.5	4-4-4 -3	100									
						-3										
	(OH) ORGANIC CLAY, gray, medium stiff. NYCBC (Class	XX	ST	Щ.	14.5		100									
15	4c) [MARSH DEPOSITS]	88	5,	Ħ	14.0		100									
╽┪	<b>8</b>	88		Ħ												
▋∃			ST	Ħ	16.5		100									E E
╽╶┋	(SP) POORLY GRADED SAND, gray, medium dense, fine	<b>XX</b>	-	Ħ												
∥ ∄	to medium. NYCBC (Class 3b) [GLACIAL SAND]		SPT		19	4-8-11	100									<b>⊨</b>
20	:		Sr-1		15	-16	100									
l ∄				Щ												
<u> </u>	(SP-SM) POORLY GRADED SAND WITH SILT, gray,	П	SPT	:	21.5	9-16	100						28.7			
	dense, fine to medium. NYCBC (Class 3a)					-22-24										E
20-11-11-11-11-11-11-11-11-11-11-11-11-11				Щ												
╽╡	(SP) POORLY GRADED SAND WITH SILT, gray, dense,	-111	U		24	59-78	75					122.9	22.1			
25=	fine to medium. NYCBC (Class 3a)					-100/3										F
∥∄	·			Н												
╽╶╡			SPT	1	26.5	10-10 -16-22	100									
∥∄						-10 22										
▋∄				Щ												
30																
_30	(continued)															
				—												



K. F DRILL War DRILL COI SAMF SPT BORE	PLER TYPE(S) A (1-3/8"), ST(	TARY(5'-102')  IND SIZE(S) (ID) 2-7/8"), U(2-3/8")  LL AND COMPLETION	COMPLETION DATE Nov-02-10	IN DF A	RILL Acke PT H. Auto	RIC er A AM oma	G AK ' MEF atic,	135G R TYPE , 140 I TER D	E Ibs,	NG [	DRILL	INC	-		Rec	LING (		PROJECT NUMBER 132040 HOLE ID HHE-05 SURFACE ELEVATION 11.3 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 65% ) TOTAL DEPTH OF BORING 102 ft	
© ODEPTH (ft)	Grades dense	Description fine to medium, NV(	PRC (Class 3h)	Material Graphics			Sample Depth (ft)	Blows per 6 In Resistance	B Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
30   1   1   1   1   1   1   1   1   1	Grades mediu	'CBC (Class 3b)	ass 3b)  WITH SILT, gray, CBC (Class 3b)		SPT SPT SPT		35 40 45	9-15 -23-23 4-5-9 -10 2-5-5 -6 5-6-9 -10	100						25.6				
		(continue	u)																Ш



(a) Hard of Section (b) Applied (c) (c) (c) Applied (c)	Warren DRILLING CORE( SAMPLEF SPT(1- BOREHOL		COMPLETION DATE Nov-02-10	IN- DR A SP A GF	RILL Acke PT HA	RIC er A AMI ma	AK ^ MEF atic,		bs, DURI	NG E		INC			Rec	LING (		PROJECT NUMBER 132040 HOLE ID HHE-05 SURFACE ELEVATION 11.3 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 65% ) TOTAL DEPTH OF BORING 102 ft	
Grades dense. NYCBC (Class 3a)  SP7 65 9-16 100  -18-20 100  Grades medium dense. NYCBC (Class 3b)  SP7 70 46-13 100  SP7 75 8-11 100  SP7 75 8-11 100  SP7 80 26-28 100  32-37 100  SP7 80 26-28 100  32-37 100	Э́DЕРТН (ft)	Description			Sample			Blows per 6 Resistance		RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%	Plasticity Index (%)	Strength (psf)	Remarks	
Grades medium dense. NYCBC (Class 3b)  SPT 70 4-8-13 1000  SPT 75 8-11 100  18-28 100  SPT 80 32-37 100	65 Gr				SPT		65	9-16 -18-20	100										
(SP) POORLY GRADED SAND WITH GRAVEL, gray, very dense, fine to coarse. NYCBC (Class 3a)  85 (SP) POORLY GRADED SAND, gray, very dense, fine. SPT 85 22-24 100 30-31 10	75——	rades medium dense. NYCBC (Cla	ss 3b)					8-11											
85 (SP) POORLY GRADED SAND, gray, very dense, fine. NYCBC (Class 3a)  85 22-24 -30-31	80 (SF	P) POORLY GRADED SAND WITH nse, fine to coarse. NYCBC (Class	GRAVEL, gray, very 3a)		SPT		80	26-28	100										
(continued)	85 (SF NY	'CBC (Class 3a)			SPT		85	22-24 -30-31	100										



																		PROJECT NUMBER 132040	
	icarra	BEGIN DATE Oct-18-10	COMPLETION DATE Nov-02-10															HOLE ID HHE-05	
	ING CONTRAC		1404-02-10	IN	-SIT	U TI	EST	ING										SURFACE ELEVATION	_
	ren George ir	nc																11.3 ft (NAVD88)	
	ING METHOD RE(0'-5'), RO	TARY(5'-102')			RILL Acke			135G										BOREHOLE DIAMETER 4 in	
SAMF	LER TYPE(S) A	ND SIZE(S) (ID)						RTYPE				_						HAMMER EFFICIENCY, ERI	
		2-7/8"), U(2-3/8") L AND COMPLETION	J	- 1				140   TER [					-	TED	<u>DBILI</u>	ING (	DATE	65% TOTAL DEPTH OF BORING	
	t Cement Gro				ADI				ot F				<i>-</i> 711			ordec		102 ft	
													£		(%)	(%)			
				phics	a)	ocation	f) (f)	드	<u>(6</u>			ج	(min,	ť (pcf	ntent	lex (%	£		
H (ft)				l Gra	Typ	Loc	Dep	ber 6 Ince	%) (w	(%	es/ft	Dept	Rate	nit W	e Co	ty Inc	y (ps		
DEРТН (ft)				Material Graphics	Sample Type	Sample L	Sample Depth (ft)	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)		
-90 =	Grades mediur	Description n dense. NYCBC (Cla	ass 3b)	Σ	ഗ് SPT	_	ഗ് 90	面 企 10-11	يخ 100	Ř	ш	Ö	ŏ	Ĕ	Ž		Š	Remarks	∦
₹						N		-13-18											E
						Щ													
=																			E
95																			
95-					SPT	T	95	9-13 -16-19	100										
						I		10 10											E
						П													E
Ξ			ŀ																E
100																			E
					SPT	1	100	7-7-14 -20	100										
						Ш													Ē
	Drilling not obse	erved by Arup. Log ba ed by Pillori Associate	sed on samples and s.																
=	O - B b - b - b																		E
105-	key to test data	og Legend for soil cla and sampler type.	ssification chart and																
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T. C DRILL War	ED BY BEGIN DATE COMPLETION DATE arroll Nov-03-10 Nov-03-10 ING CONTRACTOR ren George inc	IN	-SIT			ING										PROJECT NUMBER 132040 HOLE ID HHE-06 SURFACE ELEVATION 12.0 ft (NAVD88) BOREHOLE DIAMETER
	RE(0'-5'), ROTARY(5'-102')		Acke			I										4 in
SPT	LER TYPE(S) AND SIZE(S) (ID) (1-3/8"), ST(2-7/8"), U(2-3/8")	A	Auto	ma	atic,	140 I	bs,				•					HAMMER EFFICIENCY, ERI 81%
	HOLE BACKFILL AND COMPLETION d & Blacktop		ROU EADI			TER D	ot F				3 AF		DRILL Reco	-		TOTAL DEPTH OF BORING 102 ft
DEPTH (ft)	Description Previously hand augered to 5.0'.	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
	Previously nand augered to 5.0°.															
	Undefined		U		5	6-3-2 -4	NR									At 5' - 7' no recovery
	(SP) POORLY GRADED SAND WITH GRAVEL, brownish gray, medium dense, sand is fine, gravel is coarse to fine (subangular) - moist. NYCBC (Class 7) [FILL]		SPT	N	7	1-1-4 -6	33						16.8			First 2 blows set SPT to correct depth, i.e., only 18" done 1-4-6 with N=10
10	(SP) POORLY GRADED SAND, brownish gray, medium dense, fine - moist.		SPT	N	10	7-8-10 -11	58						24.8			
15				I	12.5	-18-29	100									
	(PT) PEAT, dark brown, soft to stiff, with organic clay, roots and decomposed vegetation are up to 1/8" thick - moist. NYCBC (Class 6) [MARSH DEPOSITS]	<u> </u>	SPT	N	15	1-2-2 -3	75									PP:S <sub>u</sub> = 750, 1,000 psf
	(OH) ORGANIC CLAY, dark gray, medium stiff, trace fine sand, with decomposed vegetation up to 1/8" thick - moist. NYCBC (Class 4c)	***	ST	Ħ	17		100									PP:S <sub>u</sub> = 750, 1,000, 750 psf TV:S <sub>u</sub> = 600, 600 psf
20			ST		19		NR									
	21.0', grades to dark brown SANDY CLAY, sand is fine, clay is organic, medium dense - wet.  (SP) POORLY GRADED SAND, grayish brown, medium dense, fine, trace silt, decayed vegetation - wet. NYCBC (Class 3b) [GLACIAL SAND]	<b>※</b>	SPT - SPT		21	2-5-9 -12 8-12 -12-13	100						26.2			
25	Grades trace coarse sand, strong sulfur odor.  Grades gray, without coarse sand.		SPT	N	25	6-8-10 -18	100									
25	Grades without sulfur odor, with coarse sand.		SPT		27.5	1-4-10 -13	75									
_30	(continued)		I	Ш												



LOGGED BY BEGIN DATE COMPLETION DATE T. Carroll Nov-03-10 Nov-03-10  DRILLING CONTRACTOR Warren George inc  DRILLING METHOD CORE(0'-5'), ROTARY(5'-102')  SAMPLER TYPE(S) AND SIZE(S) (ID) SPT(1-3/8"), ST(2-7/8"), U(2-3/8")  BOREHOLE BACKFILL AND COMPLETION Sand & Blacktop	IN- DF A SP A GF	RILL Acke PT H	RIC er A AM oma	G AD I MEF atic,	R TYPE 140 I TER D	bs,	NG E	RILI	LINC	-		Reco			PROJECT NUMBER 132040 HOLE ID HHE-06 SURFACE ELEVATION 12.0 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 81% TOTAL DEPTH OF BORING 102 ft
Description  Grades without coarse sand.	Material Graphics			Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
Grades without coarse sand.  Grades loose, with sulfur odor. NYCBC (Class 6)  Grades medium dense, with coarse sand, without sulfur odor. NYCBC (Class 3b)  Grades loose, without coarse sand. NYCBC (Class 6)		SPT		35	14-18 -26-30 2-3-3 -5	83					122	23			
Grades medium dense, with coarse sand, without sulfur odor. NYCBC (Class 3b)		SPT	1	40	5-6-8 -12	75						30.5			
∃  :		SPT		45	3-5-3 -6	67									
50————————————————————————————————————		SPT	\\ \	55	4-4-4 -6 6-7-6 -8	75									
-60															



T. CODRILLI Wall DRILLI COL SAME SPO	BED BY BEGIN DATE COMPLETION DATE Carroll Nov-03-10 Nov-03-10  LING CONTRACTOR TOTEL GEORGE INC  LING METHOD RE(0'-5'), ROTARY(5'-102') PLER TYPE(S) AND SIZE(S) (ID) T(1-3/8"), ST(2-7/8"), U(2-3/8") EHOLE BACKFILL AND COMPLETION d & Blacktop	IN  DF  A  SF  GF	RILL Acke PT H Auto	RIC er A IAM oma	G AD IMEI atic	R TYPE , 140   TER [	lbs, DURI	NG [	INC				LING (		PROJECT NUMBER 132040 HOLE ID HHE-06 SURFACE ELEVATION 12.0 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 81% TOTAL DEPTH OF BORING 102 ft
	·	Material Graphics		_		Blows per 6 In Resistance	Recovery (%)	RQD (%)	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
(#) H_Ld3Q_60 65 70 75 75 75 75 75 75 75 75 75 75 75 75 75	Grades fine to medium.		SPT		60 65 70	3-4-7 -8 12-13 -8-10 7-8-9 -14	92								
			U		75	59-89	NR				122.9 123.5 119.6	21.3			
85-	(SP) POORLY GRADED SAND WITH GRAVEL, light yellowish brown, very dense, sand is coarse to fine (quartz, subrounded) - wet. NYCBC (Class 3a)		SPT		80		75								Automatic hammer malfunction and blow counts are approximately 29-55-40-15
85	(SP) POORLY GRADED SAND, brownish gray, very dense fine to medium, trace silt, fine gravel - moist. NYCBC (Class 3a)		SPT		85	16-20 -31-29	75								



	ED BY BEGIN DATE COMPLETION DATE															PROJECT NUMBER _132040 HOLE ID
DRILL	arroll Nov-03-10 Nov-03-10 ING CONTRACTOR	IN-S	SITU	J TE	ST	ING										HHE-06 SURFACE ELEVATION
	ren George inc ING METHOD	DRI	11 1	RIG	i											12.0 ft (NAVD88) BOREHOLE DIAMETER
COF	RE(0'-5'), ROTARY(5'-102')	Ad	cke	r A	DΙ											4 in
SPT	LER TYPE(S) AND SIZE(S) (ID) '(1-3/8"), ST(2-7/8"), U(2-3/8")	Αι	utoı	ma	tic,	140 I	bs,				-					HAMMER EFFICIENCY, ERI 81%
	HOLE BACKFILL AND COMPLETION d & Blacktop	GR RE				ER D	ot F				3 AF			ING ( ordec		102 ft
з DЕРТН (ft)	Description	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
90	Grades medium dense, without gravel. NYCBC (Class 3b)	S	SPT		90	17-14 -16-23	75									
95		S	SPT		95	12-14 -14-15	75									
100		S	SPT	1	00	8-12 -17-25	75									
105	See Borehole Log Legend for soil classification chart and key to test data and sampler type.															
110																
115																
110																



	SED BY		BEGIN DATE	COMPLETION DATE															PROJECT NUMBER 132040 HOLE ID
Z. K			Nov-03-10	Nov-03-10															HHE-PC-01
		NTRACTO			IN	-SIT	U T	EST	ING										SURFACE ELEVATION
		eorge inc	•																11.7 ft (NAVD88)
	ING ME		ARY(5'-17')			RILL			п										BOREHOLE DIAMETER 4 in
	-	-	D SIZE(S) (ID)						R TYPE	E									HAMMER EFFICIENCY, ERI
	(1-3/8"		_ (-, (-,						140		30-i	nch	dro	ор					81%
BORE	HOLE B	BACKFILL	AND COMPLETION	ON					TER [					G AF					
San	d & Gra	avel			KE	ADI	ING	5	N	lot F	Reco	rde	d		Not		orded		17 ft
ODEPTH (ft)	Hand a	augered to	Description	1	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
	(SP) PC	OORLY G	RADED SAND. ve	ellowish brown, loose, fin 7) [HYDRAULIC FILL]	٥	_ SPT	N	5	2-4-5 -8	25									
5 10 10 11 11 11 11 11 11 11 11 11 11 11			y, trace silt - wet.	7) [11510 0210 1122]		SPT		7.5	4-5-3 -13 2-4-4 -5	NR 50									Driving 10' of casing before take Sample 10 - 12 - 1' is above ground
15	(OH) OI with dec	grades ver RGANIC ( caying roo 6) [MARS	ery loose. CLAY, dark gray, sots (1/8") and vege SH DEPOSITS]	soft, strong organic odor, etation - moist. NYCBC	****	SPT SPT	1	12.5	-3 2-2-2	75 100									
=					<b>***</b>				-4										
25—————————————————————————————————————	See Bookey to to		g Legend for soil ond sampler type.	classification chart and															



LOGG Z. KI																PROJECT NUMBER 132040 HOLE ID HHE-PC-02
	NG CONTRACTOR ren George inc	IN-	-SIT	U TI	EST	ING										SURFACE ELEVATION 11.3 ft (NAVD88)
DRILL	NG METHOD		RILL													BOREHOLE DIAMETER
	RE(0'-5'), ROTARY(5'-17')  LER TYPE(S) AND SIZE(S) (ID)		cke			I R TYPE	=									4 in HAMMER EFFICIENCY, ERI
	(1-3/8")	A	uto	ma	itic,	140 I	bs,				-					81%
	HOLE BACKFILL AND COMPLETION  Cement Grout		ROU					NG E			G AF			ING (		TOTAL DEPTH OF BORING 17 ft
1100	- Coment Groat			П		- 11	Ot 1	\ <del>C</del> CC	nue	u 	t)				<u></u>	17 10
ODEPTH (ft)	Description  Hand augered to 5.0'.	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
	Traina daggica to 5.0.															PP:S <sub>u</sub> = 500 psf
5	(SP) POORLY GRADED SAND, gray, medium dense, fine to medium - dense. NYCBC (Class 7) [FILL]		SPT SPT			4-9-11 -11 4-7-12 -15	50									
10			SPT		10	5-6-8 -10	50									
15	(OH) ORGANIC CLAY, dark gray, soft, with decaying vegetative matter - moist. NYCBC (Class 6) [MARSH DEPOSITS]		SPT	1		3-1-2 -3	75									PP:S <sub>u</sub> = 500 psf
			SPI		15	2-1-3 -4	100									
20 20 21 21 21 21 21 21 21 21 21 21 21 21 21	See Borehole Log Legend for soil classification chart and key to test data and sampler type.															
20																
25																
30 <u> </u>																



Z. K DRILL War DRILL COI SAME SPT BORE	ING CONTRA Tren George LING METHOD RE(0'-5'), RO PLER TYPE(S) (1-3/8") EHOLE BACKF	DTARY(5'-17') AND SIZE(S) (ID)	COMPLETION DAT Oct-20-10	IN DI	∖uto	RIC er A AM oma	G AD I MEF atic,	II R TYPE 140 I	bs, DURI	NG E	RILI	LIN						·
эрертн (ft)	d & Blackto	Description		Material Graphics			<u></u>	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft a	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
5 10 10 15 15 15 15 15 15 15 15 15 15 15 15 15	(SP) POORLY dense, fine to Grades very  11.5', grades  (OH) ORGAN vegetative man DEPOSITSI	Y GRADED SAND, gra medium - moist. NYC	BC (Class 7) [FILL]  ack staining.		SPT SPT SPT			8-11 -13-22 10-21 -30-30 3-7-9 -19 1-1-1 -3 1-WOH	50 50 75									Each time hole was cleared before next continuous sample
25	See Borehole key to test da	Log Legend for soil class and sampler type.	assification chart and															



Z. K DRILL War DRILL COF SAMP SPT BORE	BED BY BEGIN DATE COMPLETION DATE han Sep-24-10 Sep-30-10  ING CONTRACTOR  ren George inc  ING METHOD  RE(0'-5'), ROTARY(5'-102')  LER TYPE(S) AND SIZE(S) (ID)  '(1-3/8"), ST(2-7/8")  HOLE BACKFILL AND COMPLETION  ia. Standpipe Piezometer (Screen Depth: 70-80 ft)	DR A SP A	uto	RIG r A AMM ma	MER tic,		bs, URI	NG E	RILI	LING	G AF		Reco			PROJECT NUMBER 132040 HOLE ID HHW-01-MW SURFACE ELEVATION 11.7 ft (NAVD88) BOREHOLE DIAMETER 4 in HAMMER EFFICIENCY, ERI 81% TOTAL DEPTH OF BORING 102 ft
р БЕРТН (#)	·	Material Graphics	Гуре	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
15 15 15 15 15 16 17 17 17 17 17 17 17 17 17 17 17 17 17	(SP) POORLY GRADED SAND, yellowish brown, loose, fine to medium, grades reddish brown at tip - moist. NYCBC		- SPT	Ņ	5	2-3-4 -4	50						17			
10	(Class 7) [HYDRAULIC FILL]  Grades wet.  Grades grayish brown, medium dense. NYCBC (Class 7)		SPT	1	7.5	3-3-7 -8	50						21.2			
	(OH) ORGANIC CLAY, dark gray, very soft, slight organic odor, with decomposed vegetative matter - moist. NYCBC (Class 6) [MARSH DEPOSITS]		SPT	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	2.5	3-2-2	50									PP:S <sub>u</sub> = 500 psf
15		& & & & & & & & & & & & & &	ST		15		NR 100									No recovery, direct push
20-	(SP) POORLY GRADED SAND, gray, medium dense, fine to medium - moist. NYCBC (Class 3b) [GLACIAL SAND]  (SP-SM) POORLY GRADED SAND WITH SILT, gray,		SPT		19	8-11 -15-17 9-11	50						26			
25	medium dense, fine to medium - moist. NYCBC (Class 3b)  (SP) POORLY GRADED SAND, gray, medium dense, fine to medium - moist. NYCBC (Class 3b)		SPT			7-7-10 -11	50						30.7			
-30	Grades very loose - wet. NYCBC (Class 6)  (continued)		SPT	2	7.5	3-2-2 -6	42									



DRILLING CONTRACTOR Warren George Inc DRILLING METHOD WARRY GEORGE INC DRILL RIG ACKER AD II ALTOMAKER TYPE AUtomatic, 140 lbs, 30-in-ch drop SPTI(-38°), ST(2-78°) PIRAMER TYPE AUtomatic, 140 lbs, 30-in-ch drop SPTI(-38°), ST(2-78°) PIRAMER TYPE AUtomatic, 140 lbs, 30-in-ch drop PIRAMER TYPE AUtomatic, 140 lbs, 30-in-ch drop PIRAMER SPTI(-38°), ST(2-78°) PIRAMER	LOGG	ED BY BEGIN DATE	COMPLETION DATE															PROJECT NUMBER 132040 HOLE ID	$\neg$
Marrier George inc		· ·	Sep-30-10																
DRILLING CORE(0-5), ROTARY(5-102)  SAMPLER TYPE(9) AND SIZE(9) (ID)  SAMPLER TYPE(9) AND SIZE(9) (ID)  SAMPLER TYPE(9) AND SIZE(9) (ID)  SORT HAMMER TYPE  BORENDLE BACKFILL AND COMM-ETION  2" DIa. Standpipe Piezometer (Screen Depth: 70-80 ft)  Piezometer (Screen Depth: 70-80 ft)  Description  Description  Description  Orades reedium dense. NYCBC (Class 3b)  Orades light gray, medium dense, fine. NYCBC (Class 3b)  Orades sight gray, medium dense, fine. NYCBC (Class 3b)  Orades sight gray, medium dense, fine. NYCBC (Class 3b)  Orades sight gray, medium dense, fine. NYCBC (Class 3b)  Orades sight gray, medium dense, fine to medium.  SPT # 45 6.4-7 50 13.3 50 11.3 5				IN-	-SITU	J TE	EST	ING											
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1-38") ST (2-78")  BOREHOVE BACKFILL AND COMMETION 2" Dia: Standpipe Piezometer (Screen Depth: 70-80 ft)  BOREHOVE BACKFILL AND COMMETION 2" Dia: Standpipe Piezometer (Screen Depth: 70-80 ft)  BERADINGS 9.6 feet (10/27/2010)  Not Recorded  10.2 ft  10.2 ft  10.4	DRILL	ING METHOD																BOREHOLE DIAMETER	┪
### Automatic, 140 lbs, 30-inch drop  ### Automatic, 140 lbs, 30-inch drop  ### To lbs, Standpipe Piezometer (Screen Depth: 70-80 ft)  ### Automatic, 140 lbs, 30-inch drop  ### To lbs, Standpipe Piezometer (Screen Depth: 70-80 ft)  ### Automatic, 140 lbs, 30-inch drop  ### To lbs, Standpipe Piezometer (Screen Depth: 70-80 ft)  ### Automatic, 140 lbs, 30-inch drop  ### Aut									_										4
BOREHOLE BACKFILL AND COMPLETION 2" Dia: Standpipe Piezometer (Screen Depth: 70-80 ft)    BEADINGS   96 feet (10/27/27010)   More production   Feed of the production   Fee										30-i	nch	dro	ор						
### Description    Consider Market   Consider Ma	BORE	HOLE BACKFILL AND COMPLETIC																	
Grades medium dense. NYCBC (Class 3b)  SPT 35 10-17 100  SPT 45 6-4.7 50  SPT 50 7-13 50  SPT 75 100	2 0	ia. Standpipe Plezometer (Sc	reen Deptin. 70-80 it;	)  \\	., (	T	<u> </u>	9.6 16	eet (	10/2	2712	2010	0)	Not		orded		102 π	Н
Grades ight gray, medium dense, fine. NYCBC (Class 3b)  SPT 35 10-17 100 28-32 100 38-31 100 38-	ဗို့ DЕРТН (ft)	<u> </u>		_	Sample 1			Blows per 6 Resistance		RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%	Plasticity Index (%)	Strength (psf)	Remarks	
50 7-13 50 7-13 50 55 16-8-7 75 8 75 8 75 8 75 8 75 8 75 8 75 8		Grades medium dense. NYCBC (C	Class 3b)		SPT	<b>\</b>	30		50										
50 7-13 50 7-13 50 55 16-8-7 75 8 75 8 75 8 75 8 75 8 75 8 75 8	35	Grades dense. NYCBC (Class 3a)			SPT		35	10-17	100										
50 7-13 50 7-13 50 55 16-8-7 75 8 75 8 75 8 75 8 75 8 75 8 75 8	▎∄	Grades derise. 141 GDG (Grass Ja)	'  -  -			1		-26-32	100										
50 7-13 50 7-13 50 55 16-8-7 75 8 75 8 75 8 75 8 75 8 75 8 75 8	40	Grades light gray, medium dense, t	fine. NYCBC (Class 3b)		SPT	N '	40	11-13 -11-11	50										
	45	Grades yellowish brown, fine to me	edium.		SPT.	N ·	45		50										
	50				SPT	N :	50	7-13 -13-32	50										
	55				SPT	•	55	16-8-7 -8	75										
	-60 <u>-∃</u>	(continu	<u> ·</u> ed)						I		<u> </u>								╡



Z. K	SED BY BEGIN DATE COMPLETION DATE Chan Sep-24-10 Sep-30-10 LING CONTRACTOR	IN-	-SIT	UT	FST	ΓING										PROJECT NUMBER  .132040  HOLE ID HHW-01-MW  SURFACE ELEVATION
	ren George inc	1114	JII	U I	LO	UNG										11.7 ft (NAVD88)
	ING METHOD RE(0'-5'), ROTARY(5'-102')		RILL			II										BOREHOLE DIAMETER 4 in
SAME	PLER TYPE(S) AND SIZE(S) (ID)	SF	тΗ	ΑM	MEI	R TYPE		00:		.1						HAMMER EFFICIENCY, ERI
	(1-3/8"), ST(2-7/8") HOLE BACKFILL AND COMPLETION	1				, 140 I TER D						TFR	DRILI	ING (	DATE	81% ) TOTAL DEPTH OF BORING
	ia. Standpipe Piezometer (Screen Depth: 70-80 ft)		ADI			9.6 fe							Rec			102 ft
роертн (ft)	Description	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
	Grades dense - moist. NYCBC (Class 3a)		SPT	N	60	10-12 -30-54	75						22.8			
60 65			<del>-</del>	<u> </u>												
70	Grades medium dense. NYCBC (Class 3b) (SP-SM) POORLY GRADED SAND WITH SILT, gray, medium dense - moist. NYCBC (Class 3b)		SPT	1	65	6-11 -15-15	75						25.9			
75-	(SP) POORLY GRADED SAND gray, medium dense - moist. NYCBC (Class 3b)		SPT		70	10-15 -15-16	50									
			SPT	<b>N</b>	75	15-18 -21-25	50									
80	Grades gray, trace gravel.		SPT		80	6-13 -29-41	50									
85	(SP) POORLY GRADED SAND WITH GRAVEL, yellow brown, very dense - wet. NYCBC (Class 3a)		SPT	N	85	28-41 -40-63	83									
	(continued)															



																		PROJECT NUMBER . 132040	
	SED BY	BEGIN DATE	COMPLETION DATE															HOLE ID	
Z. K		Sep-24-10	Sep-30-10	INI	CITI		ОТ	INIO										HHW-01-MW	
	ING CONTRAC rren George i			IIN-	SITU	)   E	51	ING										SURFACE ELEVATION 11.7 ft (NAVD88)	
DRILI	ING METHOD				ILL I													BOREHOLE DIAMETER	
		TARY(5'-102')			cke													4 in	
	лек түре(s) <i>г</i> Г(1-3/8"), ST(	AND SIZE(S) (ID)						140 I		30-i	nch	dro	ac					HAMMER EFFICIENCY, ERI 81%	
BORE	HOLE BACKFII	LL AND COMPLETIO		GR	1UO	VDV	VAT	ER D					-	TER	DRILL	ING (	DATE		
2" [	ia. Standpipe	e Piezometer (Scr	een Depth: 70-80 ft)	RE	ADI	NGS	3	9.6 fe	eet (	10/2	27/2	010	0)	Not	Rec	orded	t	102 ft	_
				Material Graphics	e e	ocation	Sample Deptn (Tt)	드	(%)			t)	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	sf)		
H (ft				al Gre	Tyk		E Ce	per 6 ance	ery (9	(%	es/ft	Dep	Rate	nit V	e C	ıt	ih (p		
DEРТН (ft)				ateria	Sample Type	Sample L	<u>m</u>	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	oring	tal U	oistur	astici	Strength (psf)		
-90 <u>-</u>		Description		_	SPT	_	_		33 Re	R	Fr	ပိ	ပိ	٥	ğ	<u>E</u>	Str	Remarks	╝
			<u>:</u>		511	<b>I</b> II <sup>§</sup>		18-23 -34-53	33										E
					-	Ц													
			:																
																			E
95—			: 																
					SPT	9	95	16-40 79-100	83										
			Ľ.		-	Щ													
			<u> </u> :-																E
																			E
100			:i																E
100					SPT	1	00 :	36-100	100										E
			·			۱													
	Coo Porobolo I	Log Legend for soil cla	position short and																Ī
	key to test data	a and sampler type.	assilication chart and																E
105																			
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115 <del></del>																			
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95																			
120																			
120-																			



LOGG	SED BY	BEGIN DATE	COMPLETION DATE														PROJECT NUMBER 132040 HOLE ID
A. L	ittlejohn	Oct-08-10	Oct-13-10														HHW-02-MW
	ING CONTR			IN-	SITU	J TES	TING										SURFACE ELEVATION 12.6 ft (NAVD88)
	ING METHO			DR	ILL F	RIG											BOREHOLE DIAMETER
		ROTARY(5'-102')					135G										4 in
		S) AND SIZE(S) (ID)					R TYPE ; 140		3∩_i	nch	dro	n					HAMMER EFFICIENCY, ERI 65%
		ST(2-7/8"), U(2-3/8") KFILL AND COMPLETIO		1			TER [					•	TER	DRILL	ING (	DATE	
2" D	ia. Standp	ipe Piezometer (Scr	reen Depth: 70-80 ft)		ADIN			lot F								010)	
DЕРТН (ft)				Material Graphics	Sample Type	Sample Location Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	
-0 DE	<u> </u>	Description		Σ	Sa	Sa	R B	Re	8	Fra	ပိ	ပိ	ΔL	Mo	Ple	Str	Remarks
5 10 11 11 11 11 11 11 11 11 11 11 11 11	(SP-SM) PC brown, loos (SP) POOR fine - moist.	DORLY GRADED SAND e, fine - moist. NYCBC ( RLY GRADED SAND,dard NYCBC (Class 7) rk yellow brown.	WITH SILT, light yellow (Class 7) [FILL]		U SPT	9.5	-2 5 0-1-6 -6	100 86 NR 63						22.7			
			:	\$	SPT	16.5	6-5-5	75									
. ∃	(Class 4c) (PT) PEAT,	ANIC CLAY, black, medit [MARSH DEPOSITS] light yellow brown, soft -	um stiff - moist. NYCBC  - moist. NYCBC (Class)	XXX XXX	SPT	19	2-3-3 -2	100									
	∖(Class 4c) (SM) SILTY	′ SAND, gray, medium de	um stiff - moist. NYCBC	OXX		21		100					117.2	19.8 21.3			
25	moist. NYC	CBC (Class 3b) [GLACIAI RLY GRADED SAND, gra moist. NYCBC (Class 3t	L SAND]		ST		4-12 -12-14	63					116.8	37.3 26.9 24.7			Sand at bottom of tube at depth 25' - 27'
30		OORLY GRADED SAND nse, fine to coarse - mois			U	27	11-16 -23-25	100					127.3 125.1 124.8	20.8			
		(continue	ed)														



	BEGIN DATE COMPLETION DATE ittlejohn Oct-08-10 Oct-13-10															PROJECT NUMBER 132040 HOLE ID HHW-02-MW	
DRILL	ING CONTRACTOR	IN-	SIT	U T	EST	ING										SURFACE ELEVATION	1
	ren George inc ING METHOD	DR	RILL	RIC												12.6 ft (NAVD88)  BOREHOLE DIAMETER	+
COL	RE(0'-5'), ROTARY(5'-102')	Α	cke	er A	٩K ′	135G										4 in	
	LER TYPE(S) AND SIZE(S) (ID) [(1-3/8"), ST(2-7/8"), U(2-3/8")					140 I		30-i	nch	dro	р					HAMMER EFFICIENCY, ERI 65%	
	HOLE BACKFILL AND COMPLETION ia. Standpipe Piezometer (Screen Depth: 70-80 ft)		ROU			TER D N		NG E					DRILL et (10			1	
I (ft)		Material Graphics	Type	Location	Sample Depth (ft)	L					Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)			
DEPTH (ft)	Description	aterial	Sample Type	Sample I	ample	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	oring F	otal Un	loisture	lasticity	Strength (psf)	Damada	
-30-=	(SP) POORLY GRADED SAND, gray, loose, fine to coarse	_	ഗ് SPT	_	30	3-3-5 -5	67	ά	Ē	ŭ	Ű	ĭ	Ž 24.3	<u>ā</u>	Š	Remarks	╡
35 40 45 45 45 45 45 45 45 45 45 45 45 45 45	moist. NYCBC (Class 6)			Ц		-5											∄
$  \  \  ]$																	∄
																	∄
35-	Grades medium dense. NYCBC (Class 3b)		SPT		35	6-6-6	75						24.8				▋
=	:			N		-9											╡
=	[:			Н													╡
=	<u>{</u> :																▋
																	∄
			SPT	١	40	7-12 -12-14	67										∄
J ₫				Щ													∄
▎▗▋																	╡
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45			SPT	N	45	4-4-8	71										∄
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50-			CDT		<u> </u>	470	67										$\exists$
	ļ.		SPT	N	50	4-7-8 -9	67									•	1
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55-=			SPT	N	55	3-5-13 -21	67										1
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50 1 55 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1																	
_ <sub>60</sub> _∃	(continued)			Ц													4
	(continueu)																-



A. I DRIL Wa DRIL CO SAM SP	GED BY  BEGIN DATE  COMPLETION DAT  Oct-08-10  Oct-13-10  LING CONTRACTOR  rren George inc  LING METHOD  RE(0'-5'), ROTARY(5'-102')  PLER TYPE(S) AND SIZE(S) (ID)  T(1-3/8"), ST(2-7/8"), U(2-3/8")  EHOLE BACKFILL AND COMPLETION  Dia. Standpipe Piezometer (Screen Depth: 70-80	IN D /	RILL Acke PT H Auto	RIO er A IAM oma	G AK IME atic	TING  135G R TYPE , 140	lbs,	NG [	DRIL	LIN	G AF				(DATE	PROJECT NUMBER  132040  HOLE ID  HHW-02-MW  SURFACE ELEVATION 12.6 ft (NAVD88)  BOREHOLE DIAMETER 4 in  HAMMER EFFICIENCY, ERI 65% ) TOTAL DEPTH OF BORING 102 ft
DЕРТН (ft)	Description	Material Graphics	Sample Type	_	Sample Depth (ft)	Blows per 6 In Resistance	25 Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	nin/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
65	Grades dark brown, dense. NYCBC (Class 3a)		SPT		65	6-18 -18-17	75									
65	Grades medium dense. NYCBC (Class 3b)		U		70	15-24 -25-32 7-10 -12-16	100					119 116.8 117.4	1			
80			SPT		80	7-10 -18-10	63									
85	(SP) POORLY GRADED SAND WITH GRAVEL, gray to yellow brown, very dense - moist. NYCBC (Class 3a)		SPT		85	21-24 -28-32	63									
	(continued)															



	GED BY	BEGIN DATE	COMPLETION	DATE														PROJECT NUMBER 132040 HOLE ID	
	ittlejohn ING CONTRAC	Oct-08-10	Oct-13-10		IN-S	ITU '	TES	ΓING										HHW-02-MW SURFACE ELEVATION	4
War	ren George i																	12.6 ft (NAVD88)	
	ING METHOD RE(0'-5'), RO	TARY(5'-102')			DRIL Ac			135G										BOREHOLE DIAMETER 4 in	١
		AND SIZE(S) (ID)						R TYPE		30 i	noh	dra	n					HAMMER EFFICIENCY, ERI	
		2-7/8"), U(2-3/8") LL AND COMPLETIO	N		GRC	UNI	DWA	TER D					•	TER	DRILI	_ING (	DATE	65% ) TOTAL DEPTH OF BORING	
2" 🗅	ia. Standpipe	e Piezometer (Scr	een Depth: 70-	-80 ft)	REA	DING	GS		lot F						t (10		010)	102 ft	Н
Ф ОЕРТН (ft)		Description			Material Glapines		Sample Depth	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
95	Grades dense (SM) SILTY SA NYCBC (Class	. NYCBC (Class 3a) ND, dark brown, den 3a)	se, fine - moist.		SF		90	16-17 -19-28	58										
95	(ML) SANDY S - moist. NYCB	sILT, dark brown to gr C (Class 5b)	ay, medium dense	, fine	SF	Т	95	9-12 -13-16	100										
	fine, trace fine	GRADED SAND, gra gravel, trace silt - moi	ist. NYCBC (Class	s 3a)	SF	РТ	100	19-27 -37-54	71										
105	key to test data	a and sampler type.																	
110																			
1110																			
120																			튁



																PROJECT NUMBER	٦
	ED BY BEGIN DATE COMPLETION DATE ittlejohn Oct-02-10 Oct-07-10															HOLE ID HHW-03-PS	7
DRILL	ING CONTRACTOR	- 1				ING										SURFACE ELEVATION	┪
	ren George inc					nsion	Lo	ggin	g							11.8 ft (NAVD88)	_
	.ING METHOD RE(0'-5'), ROTARY(5'-102')	- 1	RILL			135G										BOREHOLE DIAMETER 4 in	
SAMF	LER TYPE(S) AND SIZE(S) (ID)					R TYPE										HAMMER EFFICIENCY, ERI	1
	(1-3/8"), ST(2-7/8"), U(2-3/8")					140					•		DDILL	INIO /		65%	
	HOLE BACKFILL AND COMPLETION d & Blacktop		EADI			TER D	ot F				A۱ و		Reco			TOTAL DEPTH OF BORING 102 ft	
		•									£		(%)				П
		hics		io	Œ(#)	_	_				Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	_		П
(#)		Grap	Гуре	ocati	Septi	r 6 In ce	(%)/		s/ft	epth	ate (	t Wt	Con	Inde	(bst)		
DEPTH (ft)		Material Graphics	Sample Type	Sample	Sample Depth (ft)	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	ng R	Ü	sture	ticity	Strength (psf)		
DE	Description	Mate	San	San	San	Blov Res	Rec	RQ	Frac	Cas	Cori	Tota	Mois	Plas	Stre	Remarks	Ш
	Boring cleared to 5.0' prior to drillilng.																
5																	
1 🗏																	
ΙĪ																	
	(SP) POORLY GRADED SAND, dark yellow brown, medium dense, fine to medium - moist. NYCBC (Class 7) [FILL]		U		5	9-11 -16-17	100										
ΙΞ																	
1 🗏	(SP-SM) POORLY GRADED SAND WITH SILT, dark yellow brown, medium dense, fine to medium - moist. NYCBC		SPT		7	4-4-6 -7	79						41.6				
10	(Class 7)			Щ													I
				П													目
10-			U		10	8-16 -13-10	33						67.6				
=																	I
▋▐	(OH) ORGANIC CLAY, dark brown, medium stiff, strong organic odor - moist. NYCBC (Class 4c) [MARSH		SPT	I	12	3-4-3 -4	100										目
	DEPOSIT]			N													
15				П													I
15-		$\otimes$	ST	Ħ	15		100					115	26				
		88		Ħ									25.8 26.8				
			ST	Ħ	17		83					122.9					I
	(SP-SM) POORLY GRADED SAND WITH SILT, yellow brown, medium dense, fine to medium - moist. NYCBC			Ħ								125	20.8 25.4				目
	(Class 3b) [GLACIAL SAND]	<u> </u>	SPT	N	19	3-5-10 -10	54										目
20-	(SP) POORLY GRADED SAND, yellow brown, medium dense, fine to medium - moist. NYCBC (Class 3b)			Ш		.0											目
			U		21	6-16 -19-23	54										目
						10-20											
			SPT	<b>,</b>	,3 5	4-4-6	75										
			OF 1		.5.5	-10	, 5										Ħ
25				Щ													
			SPT	N	26	2-4-7 -9	63										Ħ
				H		-0											目
∥ੂ			SD7	Ħ,	ام د	3 F G	50										目
25			1071	2	.0.5	3-5-6 -7	58										目
30	(continued)	• •		ш								<u> </u>					┪
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																PROJECT NUMBER 132040
	ittlejohn Oct-02-10 Oct-07-10															HOLE ID HHW-03-PS
DRILL	ING CONTRACTOR					ING										SURFACE ELEVATION
	ren George inc ING METHOD		P-S :			nsion	Lo	ggin	g							11.8 ft (NAVD88)  BOREHOLE DIAMETER
CO	RE(0'-5'), ROTARY(5'-102')	Α	Acke	er A	۱ ۸K	135G										4 in
	LER TYPE(S) AND SIZE(S) (ID) (1-3/8"), ST(2-7/8"), U(2-3/8")					140 I		30-i	nch	dro	ac					HAMMER EFFICIENCY, ERI 65%
BORE	HOLE BACKFILL AND COMPLETION	GF	ROU	ND'	WAT	TER D	URI	NG E	DRILI	LING	•					TOTAL DEPTH OF BORING
San	d & Blacktop	KE	ADI	NG	$\frac{s}{}$	N	ot F	Reco	orde	d 		Not		ordeo	t	102 ft
		ics		L L	(£)						Coring Rate (min/ft)	)cd)	Moisture Content (%)	(%)		
(#)		Material Graphics	ype	Sample Location	Sample Depth (ft)	.6 In	(%)		#	abth	ite (m	Total Unit Wt (pcf)	Sonte	Plasticity Index (%)	psf)	
TH.		erial G	Sample Type	ble L	ple D	stanc	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	ng Re	Unit	ture (	ticity	Strength (psf)	
SDEF	Description	Mate	Sam	Sam	Sam	Blows per 6 I Resistance	Reco	RQD	Frac	Casi	Corir	Tota	Mois	Plas	Strer	Remarks
30	·			H												
	:															
	<u> </u>															
35=			U		35		42									
=																
				Н												
	<u> </u>															
40-	Grades loose. NYCBC (Class 6)		SPT	N	40	3-5-4 -5	63									
	:			Щ												
	:															
45			ODT		45	0.0.5										
▎∄			SPT	N	45	2-3-5 -9	63									
				Щ												
	<u>.</u>															
50	į.		SPT		50	2-3-4 -5	71									
	į:			Щ		-5										
				Н												
	ŀ															
55	<u> </u> :															
55	Grades medium dense. NYCBC (Class 3b)		SPT		55	5-5-6 -7	75									
	<u> </u>			Щ												
	:															
(#) H_Ld=30 \(\frac{2}{3}\) \(\frac{4}{3}\) \(\frac{4}3\)	:															
-60 <u> </u>	/oprii:															
L	(continued)															



																PROJECT NUMBER
	ED BY BEGIN DATE COMPLETION DATE ittlejohn Oct-02-10 Oct-07-10	IN-SITU TESTING												HOLE ID HHW-03-PS		
	ING CONTRACTOR	IN	I-SIT	T U	res7	TING										SURFACE ELEVATION
	ren George inc	- 1				ension	Log	ggin	g							11.8 ft (NAVD88)
	ING METHOD RE(0'-5'), ROTARY(5'-102')		RILL Acke			135G										BOREHOLE DIAMETER 4 in
SAMP	LER TYPE(S) AND SIZE(S) (ID)	SF	PT H	IAM	1MEF	R TYPE		20:	nah	dra						HAMMER EFFICIENCY, ERI
	(1-3/8"), ST(2-7/8"), U(2-3/8") HOLE BACKFILL AND COMPLETION	- 1				, 140 I TER D						TFR	DRILI	ING (	DATE	65%  TOTAL DEPTH OF BORING
	d & Blacktop		EADI				lot F						Rec	orde		102 ft
		S		c c	æ						in/ft)	cf)	Moisture Content (%)	(%)		
ı 🗐		Material Graphics	be a	ocation	Sample Depth (ft)	밀	(%		با	pth	Coring Rate (min/ft)	Total Unit Wt (pcf)	onte	Plasticity Index (%)	sf)	
프		a G	e Ty	e Lo	e D	per	ery (	(%	res/f	g De	l Rat	Juit	le C	ity :	th (F	
EP	Description	lateri	Sample Type	Sample	ampl	Blows per 6 I Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	oring	otal (	loistu	lastic	Strength (psf)	Demode
(#) HIGHOUS 65 TO TO TO TO THE TOTAL THE TOTAL TO THE TOTAL THE TOTAL TO THE TOTAL THE TOTAL TO THE TOTAL TOT	Description	≥	SPT	S	60	6-6-9 -7	83	м_	Ш	O	O	F	≥		S	Remarks
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I∄			SPT	N	65	8-11 -11-10	88									
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<b> </b>			1													
<sup>70</sup>	Grades dense. NYCBC (Class 3a)		U	П	70	27-40 -33-35	50									
l 🗏				П												
1 🗏				П												
75-	Grades medium dense. NYCBC (Class 3b)		SPT		75	9-10	63									
				Щ		-18-16										
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80=	(SD) DOODLY CRADED SAND WITH CRAVEL STORY		SPT		80	17 22	71									
I∄	(SP) POORLY GRADED SAND WITH GRAVEL, gray brown, dense, fine to coarse - moist. NYCBC (Class 3a)		1251		80	17-23 -20-27	71									
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00	Grades very dense. NYCBC (Class 3a)		SPT		85	19-26 -34-31	67									
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_90	(continued)	٠.		щ					<u> </u>					<u> </u>		
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															PROJECT NUMBER 132040
	GED BY BEGIN DATE COMPLETION DATE ittlejohn Oct-02-10 Oct-07-10														HOLE ID HHW-03-PS
	ING CONTRACTOR				TING										SURFACE ELEVATION
	ren George inc ING METHOD	P- DRI			ensior	ı Lo	ggın	g							11.8 ft (NAVD88)  BOREHOLE DIAMETER
	RE(0'-5'), ROTARY(5'-102')				135G										4 in
	PLER TYPE(S) AND SIZE(S) (ID) [(1-3/8"), ST(2-7/8"), U(2-3/8")		SPT HAMMER TYPE Automatic, 140 lbs, 30-inch drop											HAMMER EFFICIENCY, ERI 65%	
BORE	HOLE BACKFILL AND COMPLETION		GROUNDWATER DURING DRILLING AFTER DRILLING (DATE READINGS Not Recorded Not Recorded												
Sar	d & Blacktop	INL	\OIIV	T	<u>N</u>	lot F	Reco	orde	d 		Not		orded	1	102 ft
Ф ОБРТН (ft)	Description	Material Graphics	Sample Type	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
95	•	S	PT	90	19-14 -24-38	75 67					•				
95	(SP) POORLY GRADED SAND, yellowish brown to gray, dense, fine to coarse. NYCBC (Class 3a)	S	PT	100	-18-30 14-17 -17-14	71									
110-															



BOREHOLE NO. HHW-03-PS SHEET 4 OF 4

LOGG	ED BY	BEGIN DATE	COMPLETION DATE															PROJECT NUMBER 132040 HOLE ID	
Z. K		Oct-05-10	Oct-05-10															HHW-PC-01	
	ING CONTRACTION TO THE CONTRACTION OF THE CONTRACTI			IN-	SITU	J TE	EST	ING										SURFACE ELEVATION	
	ING METHOD	iii C		DR	ILL	RIG	<u> </u>											11.2 ft (NAVD88)  BOREHOLE DIAMETER	$\dashv$
COF	RE(0'-5'), RO	TARY(5'-17')		Α	cke	r A	D I											4 in	
		AND SIZE(S) (ID)						140 I		20 i	noh	dra	<b>n</b>					HAMMER EFFICIENCY, ERI 81%	
	(1-3/8") HOLE BACKEL	LL AND COMPLETIC	N	- 1				ER D					-	TFR	DRILI	ING (	DATE		$\dashv$
	d & Blacktop				ADII				ot F							orde		17 ft	┙
эрертн (ft)		Description		Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks	
5 10 10 11 11 11 11 11 11 11 11 11 11 11	Hand-augered	d to 5.0'.																	
5	(SP) POORLY to medium - m	GRADED SAND, yel oist. NYCBC (Class	lowish brown, loose, fine 7) [FILL]		SPT	N	5	4-4-6 -7	50										
	Grades grayis	h brown.			SPT	7	7.5	2-4-5 -9	75										
10	Grades gray.				SPT	1	10	4-4-5 -4	75										
	(OL) ORGANIO with decompos [MARSH DEPO	sed vegetation - moist	oft, strong organic odor, . NYCBC (Class 6)		SPT	1:	2.5	2-2-2 -4	100									PP:S <sub>u</sub> = 500 psf	
15	to medium - m	GRADED SAND, gra oist. NYCBC (Class 6	yish brown, loose, fine (S) [GLACIAL SAND]	****	SPT		15	1-3-4 -6	75										
20	See Borehole key to test data	Log Legend for soil cl a and sampler type.	assification chart and																
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																PROJECT NUMBER 132040
LOGG	SED BY BEGIN DATE COMPLETION DATE (han Oct-05-10 Oct-05-10															HOLE ID HHW-PC-02
	ING CONTRACTOR	IN	-SITI	U T	EST	ING										SURFACE ELEVATION
	ren George inc	DE	RILL	RIG	<u> </u>											11.6 ft (NAVD88)  BOREHOLE DIAMETER
COI	RE(0'-5'), ROTARY(5'-17')	A	Acke	er A	ΝDΙ											4 in
	PLER TYPE(S) AND SIZE(S) (ID) (1-3/8")					TYPE		30-i	nch	dro	าท					HAMMER EFFICIENCY, ERI 81%
	HOLE BACKFILL AND COMPLETION	GF	Automatic, 140 lbs, 30-inch drop  GROUNDWATER DURING DRILLING AFTER DRILLING (DAT READINGS Not Recorded Not Recorded										DATE			
San	d & Blacktop	RE	ADI	NG:	S	N	ot F	eco	rde	d	-	Not		orded	d	17 ft
DЕРТН (ft)	Description	Material Graphics	Sample Type	Sample Location	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
_0_	Hand-augered to 5.0'.		0)	(0)	0)	шш	ш	ш.	ш.		0	_		ш	0)	
5 10 11 11 11 11 11 11 11 11 11 11 11 11	(SP) POORLY GRADED SAND, yellowish brown, loose, fine		QDT		5	2-3-3	50									
	to medium - moist. NYCBC (Class 7) [FILL]		OF I	Ц	٦	2-3-3 -5	30									
			SPT		7.5	5-6-9 -15	75									
10	Grades grayish brown/gray.		SPT	1	10	2-3-3 -4	50									
15	(OH) ORGANIC CLAY, dark gray, medium stiff - moist. NYCBC (Class 4c) [MARSH DEPOSITS]		SPT			4-3-3 -10	10									
2	(SP) POORLY GRADED SAND, grayish brown, very loose, fine to medium - moist. NYCBC (Class 6) [GLACIAL SAND]	<b>***</b>	SPT		15	2-1-2 -4	100									
20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	See Borehole Log Legend for soil classification chart and key to test data and sampler type.															
25																
-30 <del>-</del>																
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BOREHOLE NO. HHW-PC-02 SHEET 1 OF 1

Z. K DRILLI Wal DRILLI COI SAME SPI BORE	ED BY BEGIN DATE COMPLETION D han Oct-05-10 Oct-05-10  ING CONTRACTOR ren George inc  ING METHOD RE(0'-5'), ROTARY(5'-17')  LER TYPE(S) AND SIZE(S) (ID) (1-3/8")  HOLE BACKFILL AND COMPLETION dd & Blacktop		DRI Ac SPT Au	LL R ker HAI	RIG AD MME natio	R TYP c, 140 ATER	lbs,	NG	DRIL	LIN				LING (		PROJECT NUMBER  132040  HOLE ID  HHW-PC-03  SURFACE ELEVATION  7.8 ft (NAVD88)  BOREHOLE DIAMETER  4 in  HAMMER EFFICIENCY, ERI  81%  TOTAL DEPTH OF BORING  17 ft
ODEPTH (ft)	Description	Material Granhics		Sample Type	Sample Depth (ft)	Blows per 6 In Resistance	Recovery (%)	RQD (%)	Fractures/ft	Casing Depth	Coring Rate (min/ft)	Total Unit Wt (pcf)	Moisture Content (%)	Plasticity Index (%)	Strength (psf)	Remarks
10	(SP) POORLY GRADED SAND, gray, medium dense, fit to coarse, with gravel - moist. NYCBC (Class 7) [FILL]  Grades dense. NYCBC (Class 7)  (OH) ORGANIC CLAY, grayish brown, hard, strong orga odor, with decomposed vegetation - moist. NYCBC (Class 4a) [MARSH DEPOSITS]  Grades soft. NYCBC (Class 6)  Grades medium stiff. NYCBC (Class 4c)  (SP) POORLY GRADED SAND, gray, medium dense, fit to medium - moist. NYCBC (Class 3b) [GLACIAL SANI	anic ass	\$ \$ \$	PT	7.5 10 12.	2-1-2 -3 5 4-3-4 -5	75 100									PP: S <sub>u</sub> = 500 psf
20-	See Borehole Log Legend for soil classification chart an key to test data and sampler type.	id														



## ogBIK!SOIL KEY 1/18/2011 6:52

## **INDEXED SOIL CLASSIFICATIONS**

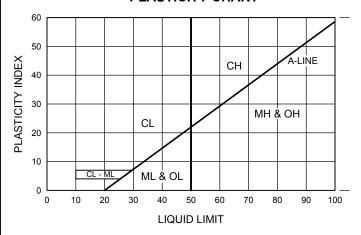
GRAPHIC	SYMBOL	DESCRIPTION	ı	MAJOR DIV	ISION	s	
ZZ	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLEAN GRAVELS	: OF N IS O.4	MAY BE SIZE		
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	(LITTLE OR NO FINES)	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE	SIZE M SIEVE S	L IS	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	GRAVELS WITH FINES	GRAVEL RE THAN HARSE FRACT RGER THAN SIEVE SIZI	FOR VISUAL CLASSIFICATION, THE 1/4" SIZE I USED AS EQUIVALENT TO THE NO.4 SIEVE	COARSE-GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO.200 SIEVE SIZE	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	( APPRECIABLE AMOUNT OF FINES )	MOF	TO THE	<b>COARSE-GRAINED</b> ORE THAN HALF OF MA' ARGER THAN NO.200 SII	를 다
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	CLEAN SANDS	- OF N IS 10.4	SIFICAT	E-GR N HALI HAN N	THE NO.200 U.S. STANDARD SIEVE IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	( LITTLE OR NO FINES )	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE	CLASS	OARS RETHA RGER T	SVE IS A
	SM	SILTY SANDS, SAND-SILT MIXTURES	SANDS WITH FINES	SAN RETHAN RSEFR ALLER TI SIEVE	VISUAL ED AS	O O S	RD SIE
	sc	CLAYEY SANDS, SAND-CLAY MIXTURES	( APPRECIABLE AMOUNT OF FINES )	MOF SMA	FOR		TANDA
	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY				SIZE	DU.S. S
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS		& CLAYS LESS THAN 50	)	SOILS NATERIA SIEVE 3	NO.200
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY				NED S - OF M/ 10.200 \$	THE
	МН	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF HIGH PLASTICITY				FINE-GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO.200 SIEVE SIZE	
	СН	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	SILTS LIQUID LIMIT G	& CLAYS REATER THAN	50	FINE- RETHA VLLER 1	
	ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS				MOF	
<u> </u>	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	ніс	GHLY ORGA	NIC SC	OILS	
	os	OILY SEDIMENTS					

## **KEY TO TEST DATA**

TV = POCKET TORVANE

PP = POCKET PENETROMETER

## **PLASTICITY CHART**



### **KEY TO SAMPLER TYPE**

BULK

P/S P = PISTON SAMPLER

PS = PITCHER SAMPLER

SPT = STANDARD PENETRATION TEST SAMPLER

ST - SHELBY TUBE SAMPLER

U = DAMES & MOORE "U" SAMPLER

NO RECOVERY

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA A RIJP

Job Number: 132040-36.0

# LogBIK!ROCK KEY PG 1 1/18/2011 6:52:45 PM

## INDEXED ROCK CLASSIFICATION



SANDSTONE



SANDSTONE BRECCIA



SHALE



SHALE BRECCIA



SILTSTONE



SILTSTONE BRECCIA



**BRECCIA** 



**MELANGE** 



**GREENSTONE** 



SILTSTONE CONGLOMERATE

## **KEY TO ROCK CORE LOGS**

## **Fracture Spacing**

## Bedding Spacing

Crushed	less than 1/4 inch (may be clayey)	Laminated	less than ½ inch
Intensely Fractured	1/4 to 3/4 inch	Very Thin Bedded	½ to 1 inch
Very Closely Fractured	3/4 inch to 2.5 inches	Thin Bedded	1 to 4 inches
Closely Fractured	2.5 to 8 inches	Medium Bedded	4 to 12 inches
Medium Fractured	8 inches to 2 feet	Thick Bedded	1 to 3 feet
Widely Fractured	2 to 6 feet	Very Thick Bedded	3 to 10 feet

Very Widely Fractured greater than 6 feet Massive greater than 10 feet

## **Hardness**

Friable Easily crumbled, or deformed by hand if plastic; can cut through core with knife

Low Hardness Can be gouged deeply and carved with knife; dull thud when struck with hammer

Moderately Hard

Can be scratched, and gouged with difficulty, with knife

Hard

Can be scratched by knife only with considerable effort

Very Hard Cannot be scratched with knife; streak of knife metal left on core;

sharp ring when struck

ROCK CLASSIFICATION CHART AND KEY TO DATA AND SYMBOLS \$\Lambda\$ D I I D

Job Number: 132040-36.0

## **INDEXED ROCK CLASSIFICATION (CONT.)**

## KEY TO ROCK CORE LOGS (CONT.)

**Strength** 

Plastic Can be deformed or molded by hand; usually very clayey

Very Weak\* Can be crumbled by hand and easily pulverized with hammer;

commonly crushed, sheared, or severely weathered

Weak Outcrop would crumble under light hammer blows;

core (2-inch + diameter) can be broken by hand; does not qualify for RQD

Moderately Strong Several firm hammer blows required to break outcrop; core cannot be broken

by hand but will generally break with a single light hammer blow; qualifies for RQD

Strong Outcrop can be broken by several heavy hammer blows and will yield

larger fragments; core usually breaks with single strong hammer blow

Very Strong Many heavy hammer blows required to chip outcrop or produce only

small fragments; several strong hammer blows may be required to break core

\* This strength category was referred to as "friable" on the 2003 boring logs, and was changed to "very weak" on the 2005 logs for the purpose of not confusing "friable" strength with "friable" hardness; both "friable" strength and "friable" hardness are categories used on the 2003 logs.

## Weathering

Severely Weathered Very heavily Fe (iron oxide) stained throughout the rock mass and

along fractures; usually significantly weakened as compared to fresh condition; can be soil-like but with recognizable rock fabric

Moderately Weathered Considerable Fe-staining within the rock mass and

on fracture surfaces, but less weakened

Slightly Weathered Little or no Fe-staining within the rock mass, with stains limited

to fracture surfaces; the rock mass is not noticeably weakened

Fresh No Fe-staining within the rock mass or along fractures

**Fracture Frequency** The average number of fractures per foot within the specified interval

(excluding mechanical breaks). CR indicates crushed intervals, with fracture spacing less than ¼ inch and usually some amount of clay. "+" suggests some greater amount of fracturing beyond the indicated minimum number of natural core breaks (e.g., "10+"), due either to the presence of variably healed microfractures (typically tension cracks) that are common within Franciscan Complex rock units, or to some uncertainty that exists because of possible mechanical breakage.

RQD - Rock
Quality Designation

The percent of each run recovered as intact lengths of sound rock core greater than 4 inches, between naturally-occurring fractures and measured along the core centerline. N/A indicates that none of the run meets the soundness criteria, and thus RQD is not applicable for the entire run length.

**Recovery** The length of recovered core divided by the length

of the run, expressed as a percentage.

**Drill Rate** The time required to core the run, in minutes, divided by the length of the run, in feet.

Field Notes Notes on drilling characteristics and problems, core losses, etc.

ROCK CLASSIFICATION CHART AND KEY TO DATA AND SYMBOLS

Job Number: 132040-36.0