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То:	Ms. Rose Tilley (RXR Development Services)
From:	Jared Green, Sukh Gurung, Karmen Chong, Terrence Cheung
Info:	Chris Vitolano
Date:	28 March 2018 (revised 18 April 2018)
Re:	Preliminary Geotechnical Engineering Memorandum 42-11 9th Street Queens, NY Langan Project No.: 170514701

This memorandum summarizes the results of our preliminary subsurface investigation and presents our conceptual schemes for foundations and other geotechnical aspects of design and construction. We performed our services in accordance with our authorized proposal (12 February 2018) to RXR Development Services.

Our understanding of the project was based on our site investigation and the zoning study (11 October 2018) by Perkins Eastman. Topographic information was taken from the Boundary & Topographic survey (14 March 2018) prepared by Control Point Associates, Inc. All elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD88).

Analyses and recommendations presented here are in accordance with the 2014 New York City Building Code.

SITE DESCRIPTION

The site (Block 461, Lot 16) is at the northern part of the city block, bounded by Queens Plaza South on the north, 10th Street on the east, 43rd Avenue on the south, and 9th Street on the west. The footprint of the site is about 49,400 square feet. The site is occupied by a 1- to 2-story commercial building (built around 1939) without below-grade levels with a footprint of about 39,000 square feet at the north, a 1.5-story metal commercial building (built around 1939) without below-grade levels with a footprint of about 4,900 square feet at the southeast, and an enclosed 4,000-square-foot at-grade concrete parking area at the southwest. The top of the existing ground-floor slab of the main building is at about el 15.

The sidewalk grade fronting the site along Queens Plaza South slopes down from the east (el 18) to the west (el 13), along 10th Street slopes down from the north (el 18) to the south (el 14), and along 9th Street slopes down from the south (el 15) to north (el 13). A site location map is presented as Figure No. 1.

Adjacent Building

One lot borders the site on the south:

• <u>42-25 9th Street (Block 461, Lot 13)</u>: A three-story building with two below-grade levels, built in about 1919, abuts the site at the south. The building occupies the western half of the lot, and an at-grade asphalt parking area covers the other half of the lot.

No existing foundation drawings for this building were available to Langan at the time of writing this memorandum. The number of stories and the number of cellars in this adjacent building were obtained from city Department of Building records¹.

Adjacent DOT and NYCT Structures

A New York City Department of Transportation (DOT) bridge abutment is about 80 feet from the site's north property line. The Queensboro Bridge runs directly above Queens Plaza South. Interaction with the DOT should be expected during the project permitting phase, and possibly during foundation construction.

A New York City Transit (NYCT) building is about 80 feet to the northwest of the site. Additionally, an NYCT manhole was observed about 200 feet to the north of the site on the opposite side of the Queensboro Bridge. The exact locations and extents of the NYCT tunnel (N, Q, and R subway lines) and other below-grade structures will require additional research.

Design and construction of the proposed building must conform to NYCT requirements and restrictions due to the proximity to the NYCT structures. The Department of Buildings (DOB) protocol will require a Letter of No Impact from NYCT before issuing building permits.

¹ New York City Department of Buildings website property profile and certificate of occupancy (www.nyc.gov)

FEMA Flood Insurance Rate Map

We have reviewed the Preliminary Flood Insurance Rate Maps (FIRM) for the City of New York published by the Federal Emergency Management Agency (FEMA). The site is within Community Panel No. 3604970089G (5 December 2013). The Preliminary FIRM shows the majority of the site within the unshaded area of Flood Hazard Zone X: "areas determined to be outside the 0.2 percent annual chance floodplain." A hatched portion of Flood Hazard Zone X, "areas of 0.2 % annual chance of flood," directly borders the site at the southeast. The relevant portion of the FEMA FIRM is provided as Figure No. 2.

PROPOSED DEVELOPMENT

The proposed development options presented by Perkins Eastman include the construction of a new 12- or 13-story building with a full cellar level. The top of the proposed cellar slab is assumed to extend to about 15 feet (el 0) below sidewalk grade. From our discussion, we understand that partial- or no-cellar options are being considered. The structural information was not available at the time of this memorandum.

PRELIMINARY SUBSURFACE INVESTIGATION

Our preliminary subsurface investigation consisted of drilling two borings, B-1(OW) and B-2(OW) and installing two monitoring wells within the completed borings. A boring location plan is provided as Figure No. 3. Copies of the installation logs are included in Appendix A. To comply with Building Code requirements, ten additional borings that will be needed can be performed after the demolition of the existing buildings. If needed, interior borings can be performed before to the building demolition by a portable limited-access drill rig.

Laboratory Testing

Geotechnical laboratory tests were conducted on representative soil samples to confirm visual field classifications and to define index properties (physical and mechanical) for use in evaluating and designing the foundation system. The laboratory tests consisted of:

- Five mechanical grain-size determinations (sieve analysis; ASTM D422); and
- Five natural water content determinations (ASTM D2216)

The laboratory test results are included in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions generally consist of uncontrolled fill underlain by a layer of mediumdense to dense sand, and finally bedrock at 15 to 19 feet below sidewalk grade. Groundwater was encountered at about 9 to 10 feet below sidewalk grade. The subsurface profile is included as Figure No. 4.

SEISMIC EVALUATION

This section presents the results of our seismic evaluation for the site relative to the provisions outlined in the 2014 NYC Building Code. The following subsections provide recommended parameters for use in the seismic design of the proposed structure. Our seismic evaluation is based on the two sidewalk borings performed at the site. This evaluation will need to be performed again after the balance of the borings is performed.

NYC Building Code Seismic Design Parameters

The recommended Building Code seismic parameters are based on the average N-value in the soil. The soil profile below the foundation level is consistent with Site Class C "Soft Rock Profile," and we assumed that the structure is Structural Occupancy/Risk Category II (to be confirmed by the structural engineer). For Structural Occupancy II and Site Class C, the design spectral accelerations result in Seismic Design Category (SDC) B. The seismic design parameters are presented in Table 1. If the additional subsurface investigation reveals different subsurface conditions or elevation of bedrock, these parameters will be updated accordingly.

Description	Parameter	Recommended Value	Building Code Reference
Mapped Spectral Acceleration for short periods:	S₅	0.281 g	Section 1613.5.1
Mapped Spectral Acceleration for 1-sec period:	S ₁	0.073 g	
Site Class	Soft Rock Profile	С	Table 1613.5.2
Site Coefficient:	F _a	1.20	Table 1613.5.3(1)
Site Coefficient:	F _v	1.70	Table 1613.5.3(2)
5 percent damped design spectral response acceleration at short periods:	S _{DS}	0.225 g	Section 1613.5.4
5 percent damped design spectral response acceleration at 1-sec period:	S _{D1}	0.083 g	0001011010.0.4
SDC for Structural Occupancy II		В	Table 1613.5.6
Peak Ground Acceleration	PGA	0.20	Table 1813.2.1

Table 1 – Seismic Design Parameters

Liquefaction Evaluation

Soil liquefaction is a phenomenon primarily associated with saturated, loose, cohesionless soils near the ground surface at depths less than 50 feet. The liquefaction potential was evaluated using both the 2014 Building Code.

In accordance with the Building Code screening process, N-values versus depth are plotted on the Building Code Liquefaction Assessment Chart in Figure No. 5. The majority of N-values fall within "Liquefaction Evaluation Not Required." Based on these results, our opinion is that liquefaction need not be considered for foundation design.

FOUNDATION RECOMMENDATIONS

Shallow Foundations

We recommend shallow foundations consisting of conventional spread footings bearing on Class 1b bedrock to be used for the cellar-level option. The recommended allowable bearing pressure is 40 tons per square foot (tsf). The minimum side dimension should not be less than

3 feet for spread footings and not less than 2 feet for continuous footings. All footings should be protected from frost by extending to a minimum of 4 feet below the lowest adjacent permanent exposed grade.

Settlement Evaluation

Total settlements are not expected to exceed 1/2 inch for footings bearing on bedrock. The majority of the settlement will occur as the dead load of the building superstructure is applied to the foundation system.

Lateral Resistance

Lateral loads can be resisted by friction along the bottom of the footings. The recommended sliding friction coefficient, with a factor of safety of 1.5, is 0.2 for waterproofed surfaces and 0.6 for concrete cast on the rock subgrade. Passive pressure may be used in combination with friction to resist lateral loading on the footings.

Deep Foundations

For any portions of the building with no cellar – we recommend a deep foundation system consisting of caisson piles socketed into the Class 1b bedrock for foundation support.

Caisson Piles

A caisson pile consists of an open-ended steel pipe drilled into the top of the rock and an uncased rock socket. The steel pipe should be advanced using duplex-drilling techniques with internal water flushing through the overburden material with a soil plug above the tip of casings. The rock socket is often drilled into the bedrock using a down-the-hole hammer. After drilling, both the steel pipe and the rock socket are installed with steel reinforcement and filled with grout.

The allowable capacity of the caisson pile is derived from the peripheral shear between the concrete fill and the side of the rock socket. The recommended peripheral shear resistance for is 200 pounds per square inch (psi) in Class 1b or better rock.

Casing lengths to the top of the rock will be about 15 feet to 20 feet bgs. The balance of the caisson-pile design is presented below:

Caisson Pile – Design Parameters

			-			
Design	Design	Casing	Casing	Rock	Cement	Reinforcing
Compressive	Tensile	Outside	Wall	Socket	Grout 28-day	(Grade 75)
Capacity (tons)	Capacity (tons)	Diameter (inch)	Thickness (inch)	Length (feet)	Strength (psi)	
175	75	9.625	0.5	10	6,000	1 #24

Load tests are not required to substantiate the caisson pile capacity; however, video inspection is required by the Building Code for each of the rock sockets.

Pile Spacing

We recommend that the center-to-center spacing of caisson sockets shall be at least two and one-half times the outside diameter of the steel casing, but not less than 4 feet.

Lateral Pile Capacity

Lateral load tests will be required by the Building Code to substantiate a lateral pile capacity of more than 1 ton. The lateral load tests shall be performed in accordance with ASTM D3966. The maximum allowable lateral capacity shall not be more than one-half the test load producing a gross lateral movement of 1 inch at the ground surface.

Piles located near a lot line shall be designed on the assumption that the adjacent lot will be excavated to a depth of about 10 feet below the nearest legally established curb level. The portion of the pile exposed shall be deemed to provide no lateral support. This should be considered when finalizing the design of the sub-structure and choosing pile locations.

Permanent Groundwater Control

The measured static groundwater level was about 9 feet below grade, corresponding to el 7. We recommend a design groundwater level of about 3 feet above the measured groundwater level to account for periods of prolonged precipitation events, utility breaks, etc. Therefore, the recommended design groundwater level is at el 10.

Pressure Slab

Walls and slabs that extend below the groundwater level will be subject to lateral and uplift hydrostatic pressures, as well as the potential for water seepage into the occupied spaces. The

proposed cellar level extends to about el 0, about 10 feet below the design groundwater level. We recommend that the cellar slab extending below the design groundwater level be constructed as a structural pressure slab designed to resist a hydrostatic uplift pressure from the design groundwater level. The foundation walls must also be proportioned to resist the hydrostatic pressures. Foundation walls should be keyed into the slab and poured integrally with a water stop.

Uplift Forces

The uplift forces from wind or earthquake loading can be resisted by using tie-down rock anchors. We recommend that the rock anchors consist of double corrosion-protected threaded bars, each having a yield strength of 150 kips per square inch. The bars should be secured into 5-inch-nominal-diameter drill holes using neat cement grout having a 28-day compressive strength of at least 6,000 psi.

Waterproofing

We recommend installing exterior waterproofing below the pressure slab and behind the cellar walls up to the ground surface. We recommend a membrane type waterproofing, such as Preprufe[™] and Bituthene[™] products, and post-injectable water stop (i.e., TRIOject) by Grace Applied Technologies. The use of bentonite waterproofing or negative side crystalline waterproofing as the primary barrier is not recommended.

Permanent Below-Grade Walls

Permanent below-grade foundation walls should be designed to resist static lateral earth pressures, hydrostatic pressures (if not drained), and surcharge loads. Backfill should not be placed against below-grade walls until the wall concrete attains its 28-day compressive design strength, and temporary lateral bracing has been provided to prevent rotation of the wall. Additional recommendations on the support of below-grade walls may be required by the structural engineer.

The lateral pressure diagram is presented as Figure No. 6.

GENERAL CONSTRUCTION RECOMMENDATIONS

The following sections present recommendations that are relative to below-grade construction within the site.

Support of Excavation

The contractor must take appropriate measures to stabilize the work area and prevent lateral movement of the adjacent areas during the excavation. Temporary below-grade walls should be designed to resist static earth pressures, pavement, and construction surcharges. All adjacent utilities must also be protected and supported as needed.

Underpinning

The Department of Buildings (DOB) records for the adjacent building to the south indicate two below-grade levels. This building is likely bearing on bedrock. However, test pits will be required to confirm the existing foundations of this neighboring building. If the test pits reveal that the building rests on the native sand, then underpinning piers to the bedrock will be required along the foundation wall.

Temporary Construction Dewatering

We expect the general excavation will be at about el -2, which is about 8 feet below the measured groundwater level. Controlling the groundwater will be critical for foundation construction. Lowering of the groundwater table a minimum of 2 feet below the bottom of excavation will be necessary to provide a dry working surface.

Fill Material, Placement, and Compaction Criteria

Structural fill placed to establish the finished subgrade beneath floor slabs or as backfill behind walls should consist of a well-graded durable granular material having no more than 10% fines passing the No. 200 sieve and a maximum particle size less than 4 inches. All fill materials should be free of trash, debris, roots, vegetation, peat, or other deleterious materials and should be approved by the geotechnical engineer before placement. Natural soil materials excavated from within the site conforming to the above gradation criteria can be re-used as structural fill.

Department of Transportation and New York City Transit Approvals

Approval will be required from the Department of Transportation (DOT) for the development, because of the proximity to the Queensboro Bridge. The DOT may request monitoring of their structures during the foundation construction. Interacting with the DOT and satisfying the requirements for project insurance must be considered during the planning, permitting, and

construction phases of the project. The review process may take up to six months or more and should be considered in the project schedule.

The design and construction of the building are also subject to NYCT review and approval. The Department of Buildings will require a letter of no impact from NYCT before issuing building permits.

ADDITIONAL INVESTIGATION

Ten additional borings will be required to comply with Building Code requirements. We also recommend installing at least one additional groundwater observation well within the building footprint after building demolition. If needed, interior borings can be performed by a portable limited-access drill rig before building demolition.

To better determine the underpinning and support of excavation scope, we also recommend excavating two test pits along the adjacent building to the south. These test pits will help to determine the type, condition, and configuration of the foundations of the adjacent building.

LIMITATIONS

The conclusions and recommendations provided in this memorandum result from our interpretation of the geotechnical conditions existing at the site inferred from a limited number of borings, and from the architectural information prepared by Perkins Eastman. Actual subsurface conditions may vary. Recommendations provided are dependent upon one another, and no recommendation should be followed independently of the others.

Any proposed changes in structures or their locations should be brought to Langan's attention as soon as possible so we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of the investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation because they may affect our recommendations.

This report has been prepared to assist the owner, architect, and structural engineer in the design process and is only applicable to the design of the specific project identified. The information in this report cannot be used or depended on by engineers or contractors involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties beyond the limits of that which is the specific subject of this report.

Environmental issues (such as permitting or potentially contaminated soil and groundwater) are outside the scope of this study and should be addressed in a separate evaluation.

LIST OF FIGURES

- Figure 1 Site Location Map
- Figure 2 Preliminary Flood Insurance Rate Map
- Figure 3 Boring Location Plan
- Figure 4 Subsurface Profile A
- Figure 5 NYCBC Liquefaction Assessment Chart
- Figure 6 Lateral Earth Pressure Diagram
- LS-1 Langan Standards

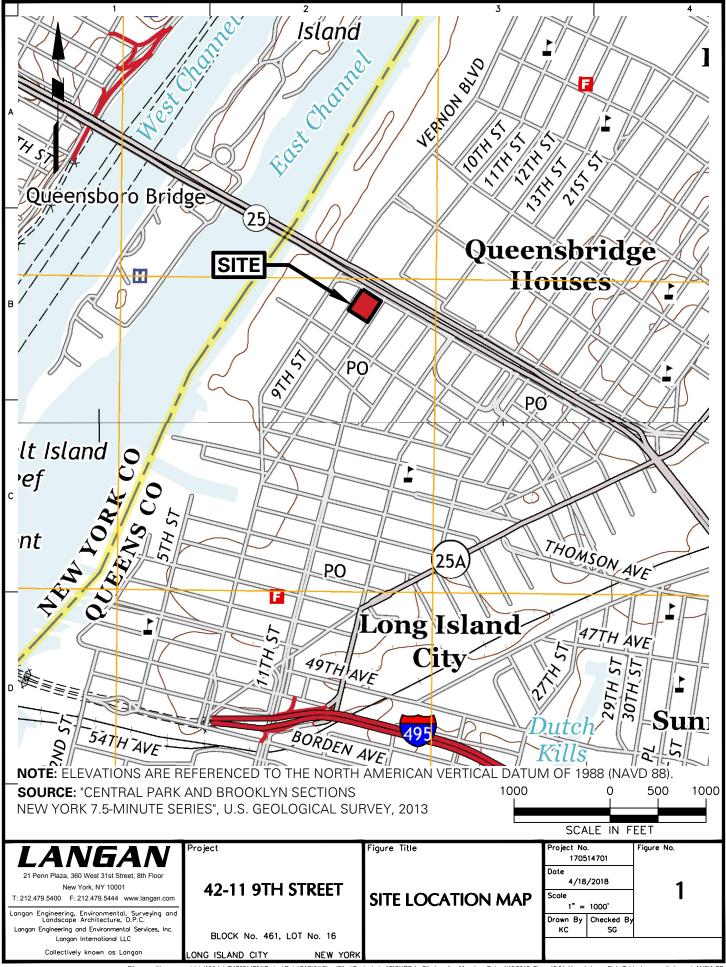
APPENDICIES

- Appendix A Boring Logs and Observation Well Construction Logs
- Appendix B Laboratory Data Results

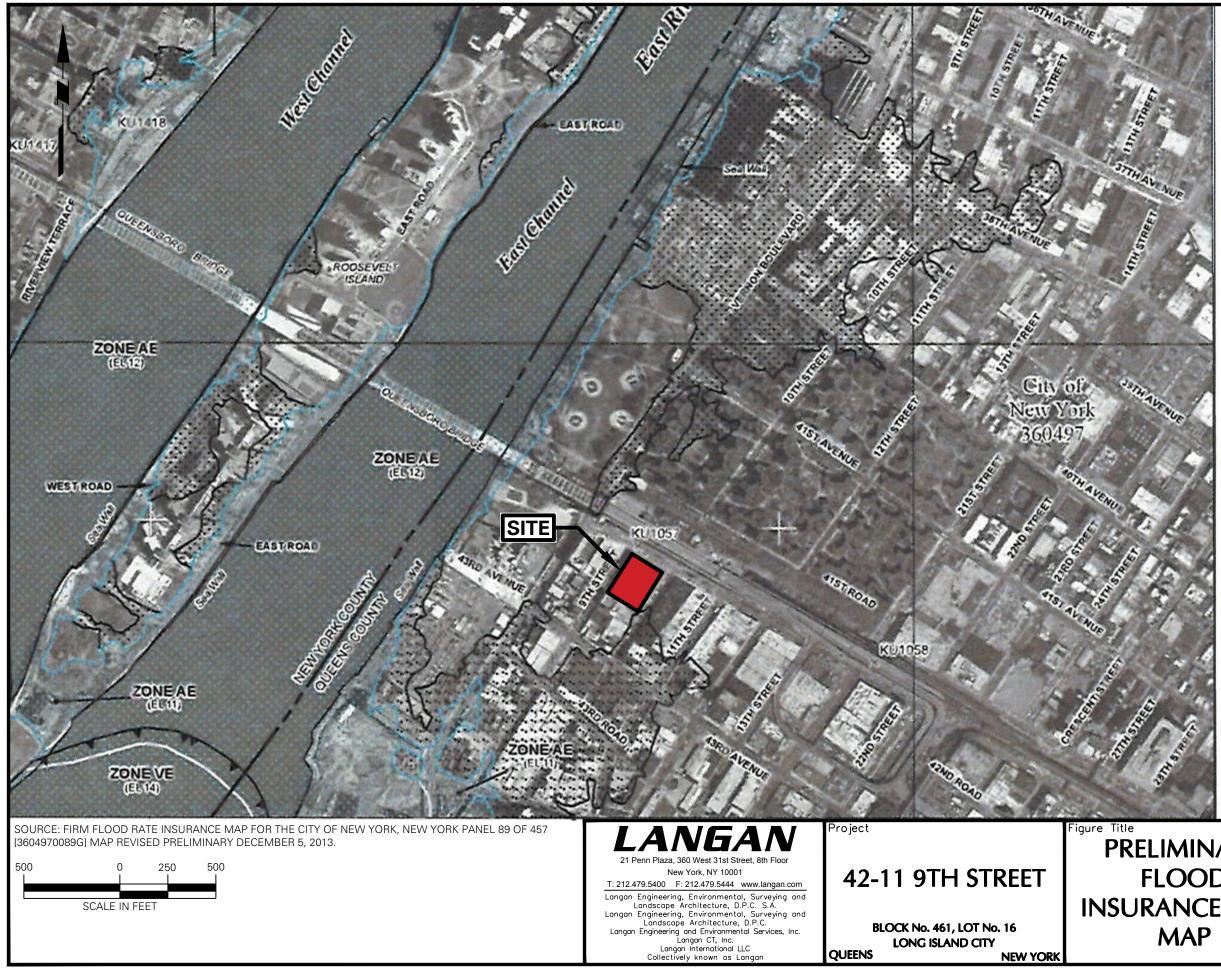
Preliminary Geotechnical Engineering Memorandum 42-11 9th Street Queens, NY Langan Project No.: 170514701

FIGURES

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Filename: \\langan.com\data\V\data7\170514701\Project Data\CADI01\SheetFiles\Geotechnical\FIGURE 1 - Site Location Map.dwg Date: 4/18/2018 Time: 15:04 User: kchong Style Table: Langan.stb Layout: ANSIA-BF

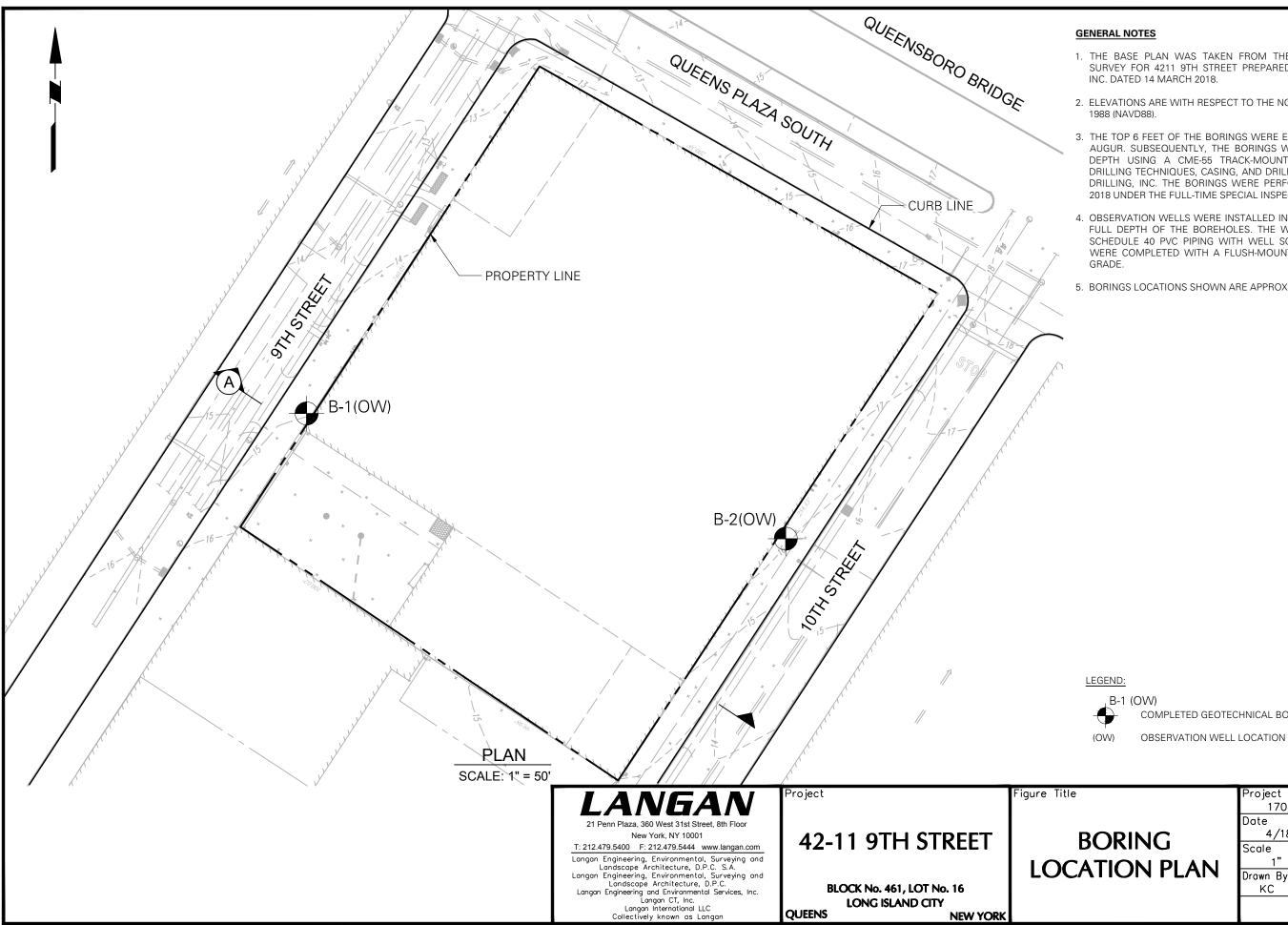


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1. THE BASE PLAN WAS TAKEN FROM THE BOUNDARY AND TOPOGRAPHICAL SURVEY FOR 4211 9TH STREET PREPARED BY CONTROL POINTS ASSOCIATES,

2. ELEVATIONS ARE WITH RESPECT TO THE NORTH AMERICAN VERTICAL DATUM OF

3. THE TOP 6 FEET OF THE BORINGS WERE EXCAVATED USING A HAND-OPERATED AUGUR. SUBSEQUENTLY, THE BORINGS WERE DRILLED TO THE TERMINATION DEPTH USING A CME-55 TRACK-MOUNTED DRILL RIG WITH MUD-ROTARY DRILLING TECHNIQUES, CASING, AND DRILLING FLUID BY CRAIG GEOTECHNICAL DRILLING, INC. THE BORINGS WERE PERFORMED BETWEEN 9 AND 12 MARCH 2018 UNDER THE FULL-TIME SPECIAL INSPECTION OF A LANGAN ENGINEER.

4. OBSERVATION WELLS WERE INSTALLED IN BOTH COMPLETED BORINGS TO THE FULL DEPTH OF THE BOREHOLES. THE WELLS CONSIST OF 2-INCH-DIAMETER SCHEDULE 40 PVC PIPING WITH WELL SCREEN AND RISER PIPE. THE WELLS WERE COMPLETED WITH A FLUSH-MOUNTED STEEL WELL CAP AT SIDEWALK

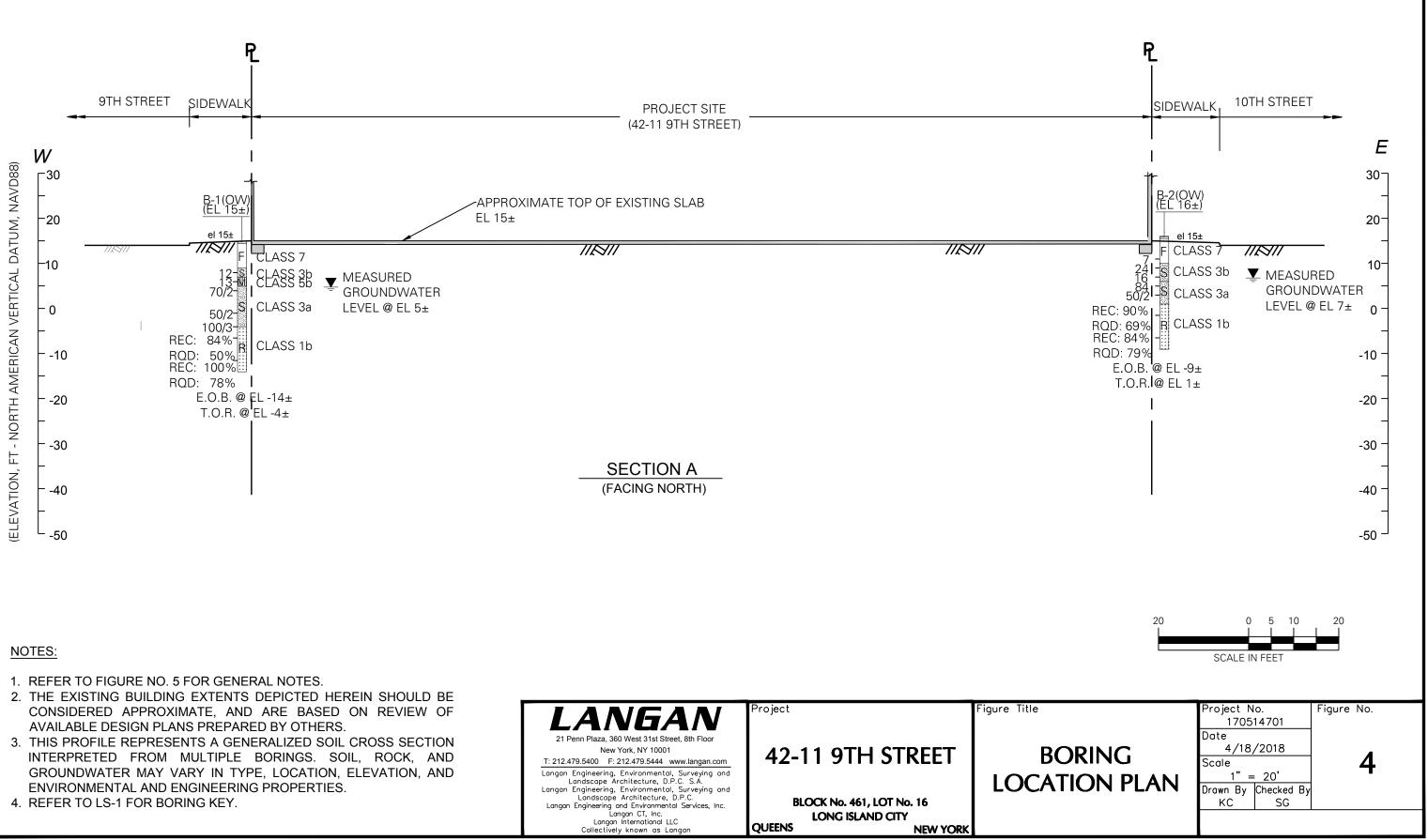
5. BORINGS LOCATIONS SHOWN ARE APPROXIMATE AND MEASURED IN THE FIELD.

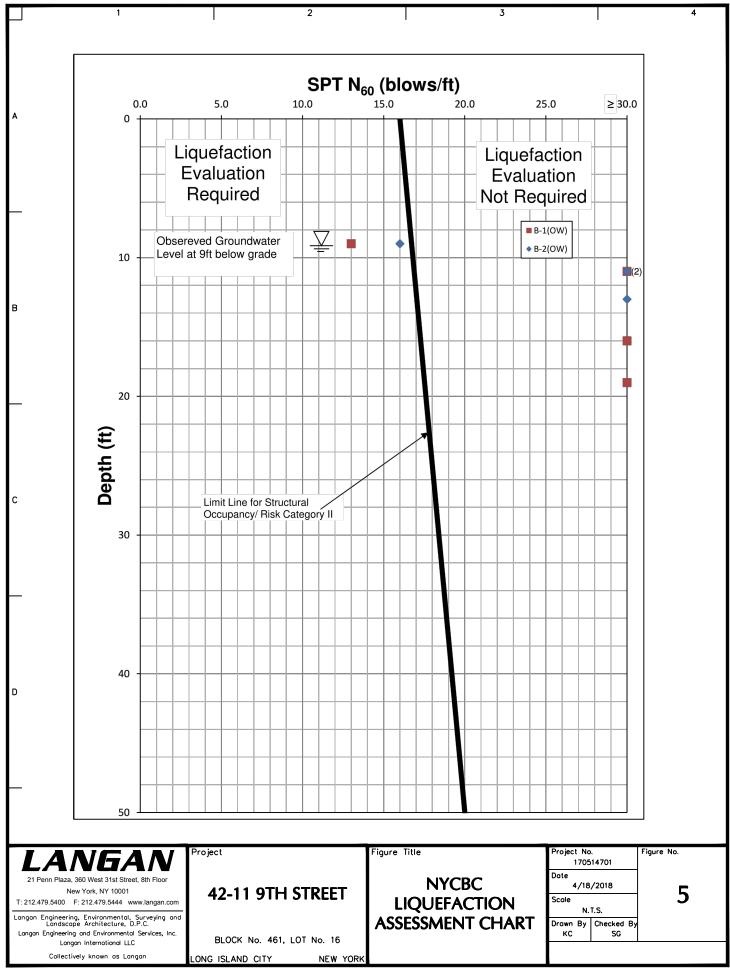
COMPLETED GEOTECHNICAL BORING

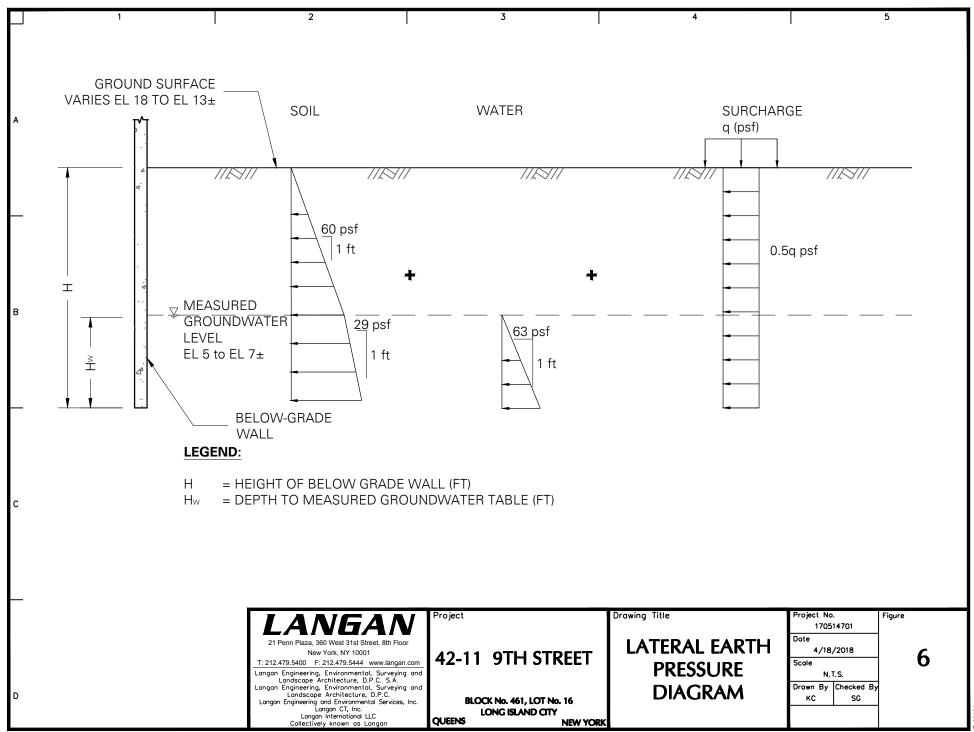
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1705	14701	
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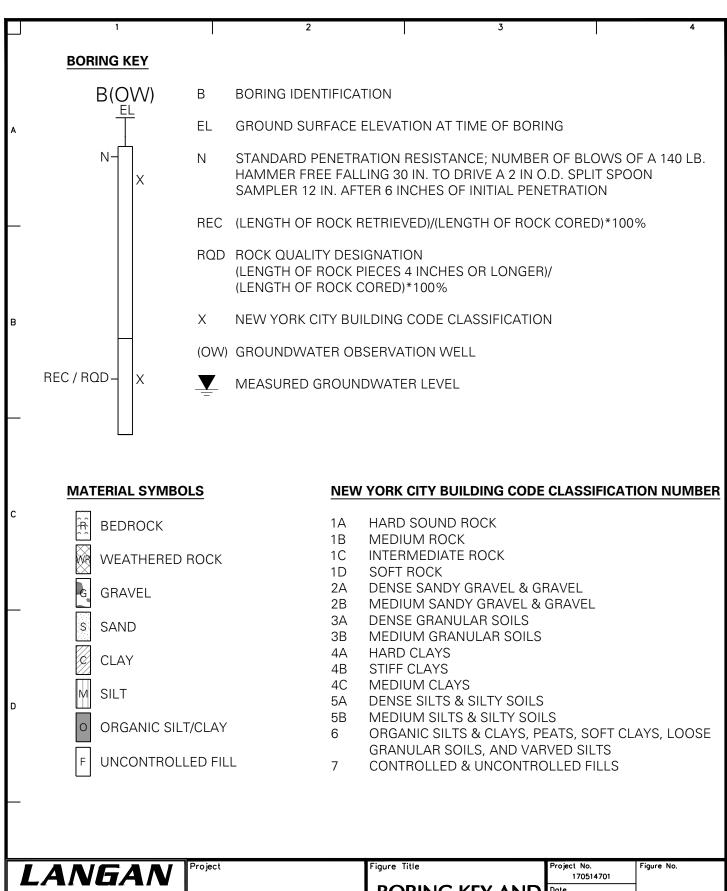
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					514701	1
21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001	40.11.0711.07	DEET	BORING KEY AND	Dote 4/18	/2018	LS-1
T: 212.479.5400 F: 212.479.5444 www.langan.com	42-11 9TH S1	KEEI	LANGAN	Scale	.T.S.	LJ-I
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. Langan Engineering and Environmental Services, Inc.			STANDARDS	Drawn By SP	Checked By	
Longan International LLC Collectively known as Langan	BLOCK No. 461, LOT LONG ISLAND CITY	No. 16 NEW YORK				
			Filename: \\langan.com\data\\\Y\data7\170514701\Project Da	alCAD/01/Snee	triles\Geotecnnica	INLS-1 Boring Key and L

Preliminary Geotechnical Engineering Memorandum 42-11 9th Street Queens, NY Langan Project No.: 170514701

APPENDIX A

BORING LOGS AND OBSERVATION WELL CONSTRUCTION LOGS

LANGAN

							Dee	a at Mia										2
Project		42-11	9th Street				Pro	ject No.			1705	1470	1					
_ocation		- 72 -11					Ele	vation a	nd Da		1100	- 1- 1 7 U						
			9th Street, Lon	ig Island City, N	lew York						El. 1	5 +/- I	NAVD					
Drilling C	Compa		Geotechnical D	rilling			Dat	e Starte	ed		2	/9/18		Date I	inished	2/-	12/18	
Drilling E	quipm		Geolechnical L	ming			Cor	npletion	Dept	h	3	0/9/10		Rock	Depth	3/	12/10	
		CME	55 Track Rig									29 ft					19 ft	
Size and	І Туре		n Tricone Rolle	r Bit			Nur	nber of	Samp	les	Distu	rbed	5	Un	disturbed	- C	ore	3
Casing D	Diame	er (in)			C	asing Depth (ft)	Wa	ter Leve	el (ft.)		First		-		mpletion		4 HR.	0
Casing F	lamm	4-in Fl ^{er} Autom	ush Joint Steel	Casing Weight (lbs)		15 Drop (in)		ling For			$\overline{\Delta}$		14.5		10.	2	Ā	
Sampler					140	30 Drop (III)	-	Ū		Μ	ike T	artar						
Sampler		oor	Split Spoon	Weight (lbs)		Drop (in)	Fiel	d Engin	eer									
•			Automatic		140	Biop (iii) 30	1,		_	Ve		ca Zu nple Da			1			
MATERIAL SYMBOL	Elev.	NYCBC		Sample De	scrintio	n		Depth	ber	e		· · ·	N-V	alue		Remai	r ks th of Casing	
SYA	(ft) +15.0	≿						Scale	Number	Type	(ji, Reo	Penetr. resist BL/6in		vs/ft) 30 40	Fluid Loss,	Drilling R	esistance, e	etc.)
Ь.Я.р.	+14.7		6" CONCRE	TE Slab				- 0 -	-						Begin Co Sidewalk	oring th	rough	Q.21
							Ē	- 1 -	=						AM	. at 03/	00/2010	0.20
							ŀ											
								2 -	-									
								-	1_	JGEF								
		CLASS 7				fine gravel, trace	e	- 3 -	S-	HAND AUGER								
			Drick, trace c	oal (dry) [SM/FI	ILLJ			-	-	HAN								
							F	- 4 -	-									
								- - 5 -	-									
								-	-									
	+9.0							6 -	1			5			S-2 at 6f	t.		
		CLASS						_			1	6						
		3B		um dense, fine	SAND, s	ome silt		- 7 -	S-2	SS	20	6	12					
	+7.0		(moist)[SM]				-	- - 8 -	-			13						
									-	SS		5			S-3 at 8f	t.		
		CLASS 5B	Reddish-brov	vn, medium der		some fine	ł	- - 9 -	S-3	SS	20	6	13					
			sand (moist)		13C, OIL I		ł	-	-			′ 7		\searrow				
	+5.0						_₹	- 10 -				4			S-4 at 10		e Casin	g
							F		S-4	SS	9	20			9:40 AM			
				coarse to fine s		ome silt, some	F	- 11 -	1		┝─┤	70/2"		70/2"	Refusal, Drive cas	probat	ble bould	ler.
]		nne graver, li	ace glass (mois			F	- 12 -	-						Cleanou	thole		
		CLASS 3A					F	-	-									
							ļ	- 13 -	-									
	1						ļ		-									
								- 14 -										
	0.0	$\lfloor _ \rfloor$						- 15 -	1								01-11	
							ł		1			50/2"		50/2"	C-1 at 15 refusal. I			,
]						ŀ	- 16 -	-									
							F	-	5	XN								
	1	CLASS 3A				e SAND, some	F	- 17 -										
••••••	1			ne gravel (Wet)			Ē	40	-									
							Ē	- 18 -	2			59			S-5 at 18	3.2ft.		
	1							- - 19 -	S-5	SS	9	100/3"		100/3"	l			
	-4.0							- 19 -	_		, , ,			100/0	T			

LANGAN

roject	42-11	9th Street	Project No.			170	51470 [.]	1	
ocation	72-11		Elevation ar	nd Da	atum		51470	1	
	42-11	9th Street, Long Island City, New York				EI. 1	5 +/- 	NAVD88	
	ų			<u> </u>	1		mple Da		Remarks
	t)	Sample Description	Depth Scale	Number	Type	(in)	Penetr. resist BL/6in	N-Value (Blows/ft)	(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
. >	5.0	Gray GNEISS, medium grained, interlayed with	20	Z				10 20 30 40	C-2 at 19ft. Core drill
		quartz, slightly weathered to moderately weathered rock, medium hard rock				34%	=50%		through 4-inch casing, losin a lot of water
		[BEDROCK]	- 21 -			۳ ۳	=2(
,			- 22 -	C-2	XN	5"/6("/60		
			E			REC=50.5"/60" =84%	RQD=30"/60"		
			- 23 -			Ű S	RQI		
			- 24 -						
	CLASS 1B	Gray GNEISS, medium grained gneiss, interlayed with quartz, slightly weather to fresh, medium hard							C-3 at 24ft.
, / >		rock. [BEDROČK]	- 25 -			%	3%		
, L						=100	.=78		
1_>			- 26 -	C-3	XN	. "09	./60		
< ً د			- 27 -	0	2	09=	46.5		
J _ >						REC=60"/60" =100%	RQD=46.5"/60" =78%		
J _>			- 28 -				8		
	4.0		29 -	1					End of Poring at 20ft Instal
		Bottom of boring at 29ft - 03/12/2018							End of Boring at 29ft. Instal observation well, screened
			- 30 -						from 19ft to 29ft and 19ft of solid PVC riser. Install
			- 31 -						flush-mounted 4inch well cap.
			- 32 -						
			- 33 -						
			- 34 -						
			- 35 -						
			- 36 -						
			- 35 - 36 - 37 - 38 - 39 - 39 - 40 - 41 - 41 - 42 - 43 - 43 - 44 - 44						
			- 38 -						
			- 39 -	1					
			- 40 -						
			41 -	1					
				1					
			- 42 -						
			43 -						
			- 44 -						
			45	1					

Project				Pr	oject No.										
		42-11	9th Street		-			170	51470	1					
ocation		10 14	Oth Street Long Joland City New York	Ele	evation ar	nd Da	tum		6		00				
Drilling C	compa		9th Street, Long Island City, New York	Da	ate Starte	d		⊏I. 1	6 +/-	NAVL		Finished			
		Craig	Geotechnical Drilling			D			3/9/18		D I	Death	3/12/	18	
Drilling E	quipm		55 Track Rig		ompletion	Depti	n		25 ft		ROCK	Depth	15	5 ft	
Size and	Туре	of Bit		NL	Imber of S	Samp	les	Dist	urbed		Ur	disturbed	Core		•
Casing D	Diamet		n Tricone Roller Bit Casing Depth (ft)	1.0/	ater Leve	1/#)		First		5	Cc	- mpletion	24 H		2
`asing H	Jamm	4-in Fl	ush Joint Steel Casing 15 Weight (lbs) 110 Drop (in)		illing Fore	. ,		$ \nabla$		15		9.2	Ţ		
Sampler		^{er} Autom			5	-	N	1ike T	Fartar						
Sampler	Hamr	oor	Split Spoon Automatic Weight (lbs) 440 Drop (in) 20	Fi€	eld Engine	er		,							
-			Automatic 140 Diop (iii) 30				V		ica Zu mple Da			_			
MATERIAL SYMBOL	Elev. (ft)	NYCBC	Sample Description		Depth Scale	Number	Type	in) .	Penetr. resist BL/6in	N-\ (Blo	/alue ws/ft)	(Drilling Fluid Fluid Loss, Drilli	, Depth o		,
¥6 S	+16.0					Nur	Ê	, Ee	Pe BL	10 20	30 40	Fluid Loss, Drill			
P.	+15.7		6" CONCRETE Slab			1						2:25 PM	my at	03/09/	20 I
					- 1 -							S-1 at 0.3ft			
			Dark gray, loose, fine SAND, trace fine gravel, brick, coal [dry][SP/FILL]		- 2 -	- -	₽								
					ŧ -	S-	HA								
		CLASS			- 3 -										
					4										
			Dark gray, medium dense, coarse to fine SAND, some silt, some medium to fine gravel, trace brick,			1			11			S-2 at 4ft.			
			trace coal, trace coal ash, trace glass [dry][SM/FILL]		5 -	S-2	SS	~	4 3	7•					
	+10.0					1	SS		6						
					6 -			1	68			S-3 at 6ft.			
			Brown, very dense, fine SAND, trace fine gravel		- 7 -	S-3	SS	7	17 7	24	}				
			[dry][SP]			1			, 7						
		CLASS			- 8 -				5			S-4 at 8ft. Install Casi	na		
		3B	Brown, medium dense, coarse to fine SAND, some	▼	- 9 -	8-4 4-2	SS	6	8	16		install Oddi	iig		
			silt, trace fine gravel [dry][SP-SM]	-					8		\mathbb{N}				
					- 10 -				26			S-5 at 10ft.			
	+5.0	\mid \mid \mid \mid			- 11 -	S-5	SS	20	40		84	 •			
					Ē	1		1	44 50/2"						
			Mottled gray over white, very dense, coarse to fine		- 12 -	S-6	SS	0	50/2"		50/2"		10#		
		CLASS	SAND, trace fine gravel [dry][SP]		- 13 -	1						Refusal at 4:20 PM - N	lo retu	rn driv	е
		3A			Ę	1						casing to 12 Resume Mo	onday	03/12/2	201
					- 14 -							Monday 03/ 8:12 AM Be	/12/20 [·]	18	
	+1.0			∇	, - 15 -	1						hole	-	-	
~ _ ^{>}			Y Y Y	-	ŧ '							8:30 AM Be at 12ft, no r	ecover	ry, Driv	/e
			Gray GNEISS, medium grained, interlayed with		- 16 -	1		%	=69%			casing to 18 coring	oft and	begin	
1 L >			quartz; slightly weathered to fresh; medium hard rock [BEDROCK]	¢	- 17 -			%06=				C-1 at 15ft. Cleanout bo	orehole	to he	ain
~		CLASS 1B				5	XN	REC=54"/60"	RQD=41.5"/60"			coring			3
·					- 18 -			=54	-41.5			8:50 AM be Losing wate	er, pau		jet
12						1		REC	² 0D=			more water 9:10 AM Fir		corino	g fir:
111					- 19 -	1			ĽĽ.			5ft of bedro			

LANGAN

oject				Project No.						
		42-11	9th Street					51470	1	
cation		40.44		Elevation a	nd Da	itum				
		42-11	9th Street, Long Island City, New York						NAVD88	Ŷ
	Elev.	ပ္က		Depth	<u>بر</u>			mple Da	N-Value	Remarks
MATERIAL SYMBOL	(ft)	NYCBC	Sample Description	Scale	Number	Type	(ii)	Penetr. resist BL/6in	(Blows/ft)	(Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
<u>1 ` ></u> >	-4.0	_	Grav GNIESS medium grained interlayed with	20 -	ž		£	<u> </u>	10 20 30 40	C-2 at 20ft.
L			Gray GNIESS, medium grained, interlayed with quartz; slightly weathered to fresh; medium hard rock	E						9:26 AM Begin coring
L			[BEDROCK]	- 21 -	1		=84%	=79%		Losing water, pause to get
12>				- 22 -			8 			more water
1 L>		CLASS		- 22 -	C-2	XN	./60	./60		
1 L >		1B		- 23 -			50.5	47.5		
12>							REC=50.5"/60"	RQD=47.5"/60"		
12>				- 24 -	-		R	м М		
12>	-9.0									
]		End of Boring @ 25ft - 03/12/2018							End of Boring at 25ft. Instal observation well, screened
				- 26 -	1					from 15ft to 25ft and 15ft of
				E	-					solid PVC riser. Install flush-mounted 4inch well
				- 27 -	1					cap.
				-	-					
				- 28 -	1					
				- 29 -	1					
				Ē	1					
				- 30 -	-					
					1					
				- 31 -	-					
				- 32 -						
				E						
				- 33 -						
				- 34 -						
				- 34						
				- 35 -						
				-						
				- 36 -						
				- 37 -						
				- 38 -						
				0.0						
				40						
				- 42 -						
				- 43 -	1					
				- 43 -						
				- 44 -						
				L I	1	1	1			

WELL CONSTRUCTION LOG

Well No. B-1(OW)

PROJECT	PROJECT NO.	
42-11 9TH STREET	170514701	
LOCATION	ELEVATION AND DATUM	
LONG ISLAND CITY, QUEENS, NY	$15 \pm NAVD$	88
DRILLING AGENCY	DATE STARTED	DATE FINISHED
CRAIG GEOTECHNICAL BORING, INC.	3/9/2018	3/12/2018
DRILLING EQUIPMENT	DRILLER	
CME 55 Track Rig	Mike Tartar	
SIZE AND TYPE OF BIT	INSPECTOR	
3-7/8" Roller Bit	Veronica Zuluaga	

METHOD OF INSTALLATION

The boring was drilled by a 3 7/8" tri-cone roller bit to approximately 29 ft below existing sidewalk grade.

A 2-inch diameter slotted PVC screen 10 ft long and a 19 ft long riser was installed.

The annulus between the borehole and the pipes was backfilled with No. 2 filter sand.

Approximately 2 feet of bentonite pellets were placed above the filter sand

The remainder of the annulus was backfilled and a cap was used to cover the well.

METHOD OF WELL DEVELOPMENT

The observation well was flushed by pumping clean water into the borehole until the return water was clear. The well was not bailed at the time of the initial well reading.

TYPE OF CASING		DIAMETER	TYPE OF BACKFILL MATERIAL		
PVC		2"	#2 Filter Clean Sand/Soil Cuttings		
TYPE OF SCREEN		DIAMETER	TYPE OF SEAL MATERIAL		
PVC		2"	Bentonite Pellets		
BOREHOLE DIAMETER			TYPE OF FILTER MATERIAL		
4"			#2 Filter Clean Sand		
TOP OF CASING	ELEVATION	DEPTH (ft)	WELL DETAILS		DEPTH
	15.0	0		SUMMARY SOIL	(FT)
				CLASSIFICATION	
TOP OF SEAL	ELEVATION	DEPTH (ft)	Cover —		0.0
	7.0	8		0-6ft: FILL	
TOP OF FILTER	ELEVATION	DEPTH (ft)		6-8ft: SAND	
	6.0	9	Riser —	8-10ft: SILT	
TOP OF SCREEN	ELEVATION	DEPTH (ft)	Backf	ill 10-12ft: SAND	
	-4.0	19		19-29ft: ROCK	
BOTTOM OF BORING	ELEVATION	DEPTH (ft)			
	-14.0	29			
SCREEN LENGTH	1 1.0	25			8.0
SCREEN LENGTH	10 ft				9.0
SLOT SIZE	TOIL				9.0
SLOT SIZE	.02 inches				
CDOU	NDWATER ELE				
ELEVATION	DATE	DEPTH TO WATER			
0.5	3/12/2018	14.5			
ELEVATION	DATE	DEPTH TO WATER			
4.8	3/23/2018	10.2	Filt	er	
ELEVATION	DATE	DEPTH TO WATER	Materi	al	19.0
4.7	3/28/2018	10.3			
ELEVATION	DATE	DEPTH TO WATER	PVC		
			Screen		
ELEVATION	DATE	DEPTH TO WATER			
ELEVATION	DATE	DEPTH TO WATER			
ELEVATION	DATE	DEPTH TO WATER			
					29.0
					1
	LANGAN Eng	gineering, Environmental,	Surveying and Landscape A	Architecture, D.P.C.	
		za, 360 West 31st Stree			

WELL CONSTRUCTION LOG

Well No. B-2(OW)

PROJECT	PROJECT NO.	
42-11 9TH STREET	170514701	
LOCATION	ELEVATION AND DATUM	
LONG ISLAND CITY, QUEENS, NY	16 ± NAVD88	
DRILLING AGENCY	DATE STARTED DATE FINISHED	
CRAIG GEOTECHNICAL BORING, INC.	3/9/2018 3/12/2018	
DRILLING EQUIPMENT	DRILLER	
CME 55 Track Rig	Mike Tartar	
SIZE AND TYPE OF BIT	INSPECTOR	
3-7/8" Roller Bit	Veronica Zuluaga	

METHOD OF INSTALLATION

The boring was drilled by a 3 7/8" tri-cone roller bit to approximately 25 ft below existing sidewalk grade.

A 2-inch diameter slotted PVC screen 10 ft long and a 15 ft long riser was installed.

Clean filter sand was backfilled into the hole around the screen. A bentonite seal was placed above the clean sand.

METHOD OF WELL DEVELOPMENT

The observation well was flushed by pumping clean water into the borehole until the return water was clear. The well was not bailed at the time of the initial well reading.

TYPE OF CASING		DIAMETER	TYPE OF BACKFILL MATERIAL			
PVC		2"	#2 Filter Clean Sand/Soil Cuttings			
TYPE OF SCREEN		DIAMETER	TYPE OF SEAL MATERIAL			
PVC		2"	Bentonite Pellets			
BOREHOLE DIAMETER			TYPE OF FILTER MATERIAL			
4"			#2 Filter Clean Sand			
TOP OF CASING	ELEVATION	DEPTH (ft)	WELL DETAILS		DEPTH	
	15.0	0		SUMMARY SOIL CLASSIFICATION	(FT)	
TOP OF SEAL	ELEVATION	DEPTH (ft)	Cover —		0.0	
	11.0	4		0-6ft: FILL		
TOP OF FILTER	ELEVATION	DEPTH (ft)		6-15ft: SAND		
	10.0	5	Riser —	15-25ft: ROCK		
TOP OF SCREEN	ELEVATION	DEPTH (ft)	Backfi	11	4.0	
	0.0	15			5.0	
BOTTOM OF BORING	ELEVATION	DEPTH (ft)				
	-10.0	25				
SCREEN LENGTH	10 ft					
SLOT SIZE						
	.02 inches					
GROU	NDWATER ELE	EVATIONS				
ELEVATION	DATE	DEPTH TO WATER				
1.0	3/12/2018	15.0				
ELEVATION	DATE	DEPTH TO WATER				
6.8	3/23/2018	9.2	Filte	er		
ELEVATION	DATE	DEPTH TO WATER	Materia	al	15.0	
6.8	3/28/2018	9.2				
ELEVATION	DATE	DEPTH TO WATER	PVC Screen			
ELEVATION	DATE	DEPTH TO WATER				
ELEVATION	DATE	DEPTH TO WATER				
ELEVATION	DATE	DEPTH TO WATER			25.0	
		gineering, Environmental, za, 360 West 31st Street	Surveying and Landscape A	rchitecture, D.P.C.		

Preliminary Geotechnical Engineering Memorandum 42-11 9th Street Queens, NY Langan Project No.: 170514701

APPENDIX B LABORATORY DATA RESULTS

LANGAN



Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:				Project No:	GTX-307810
Boring ID:		Sample Type:		Tested By:	jbr
Sample ID	:	Test Date:	03/16/18	Checked By:	emm
Depth :		Test Id:	446102		

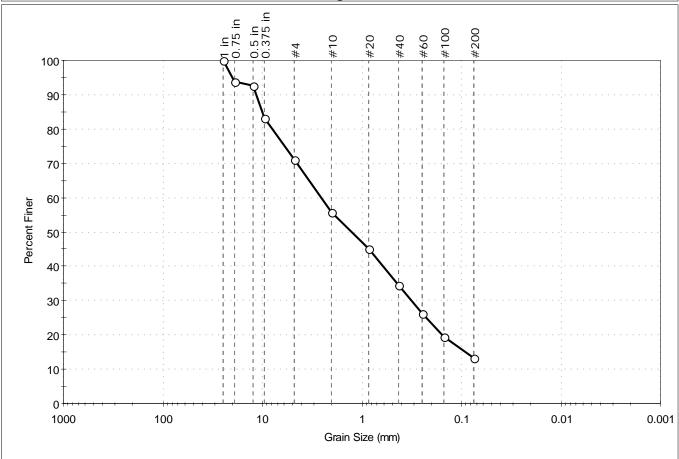
Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
B-2	\$2	4-6 ft	Moist, dark brown silty sand with gravel	12.9
B-1	S3	8-10 ft	Moist, yellowish brown clay with sand	18.2
B-2	S4	8-10 ft	Moist, brown silty sand	10.3
B-1	S4	10-12 ft	Moist, brown silty sand with gravel	16.7
B-2	S5	10-12	Moist, brown sand with silt and gravel	6.0



	Client:	Langan En	gineering				
	Project:	42-11 9th	Street				
na	Location:					Project No:	GTX-307810
ng	Boring ID:	B-2		Sample Type:	jar	Tested By:	jbr
	Sample ID:	S2		Test Date:	03/19/18	Checked By:	emm
	Depth :	4-6 ft		Test Id:	446095		
	Test Comm	ent:					
	Visual Desc	ription:	Moist, dark bro	own silty sand	with gravel		
	Sample Cor	mment:	Sample contai	ns glass			

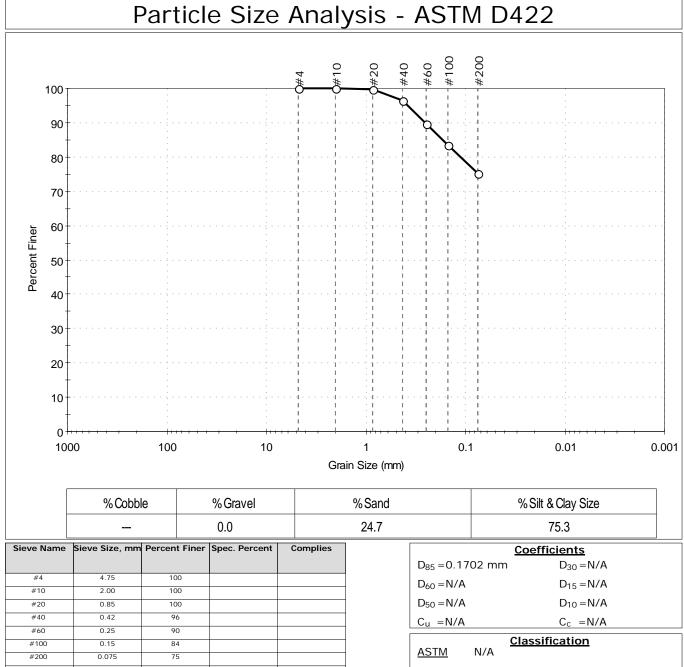




	% Cobb	% Cobble % Gravel % Sand		%S	% Silt & Clay Size					
				28.8		57.8		13.4		
Sieve Name	e Sieve Size, mm Percent Finer Spec. Percen		Spec. Percent	Complies			Coe	fficients		
							D ₈₅ = 9.99	32 mm	D ₃₀ =0.3173 mm	
1 in	25.00	10					$D_{60} = 2.53$	03 mm	D ₁₅ =0.0906 mm	
0.75 in	19.00	94	-			_	D ₅₀ = 1.25	62 mm	$D_{10} = N/A$	
0.5 in 0.375 in	9.50	83				_		03 11111		
0.375 IN #4	4.75	71	-			_	$C_u = N/A$		C _c =N/A	
#4	2.00	56				-		Class	sification	
#20	0.85	45				-	<u>ASTM</u>	N/A		
#40	0.42	35	5			-				
#60	0.25	26	5				AASHTO	Stopo Eroan	nents, Gravel and Sar	nd
#100	0.15	19	9			1	AASHIO	(A-1-b (0))	nents, Graver and Sar	iu
#200	0.075	13	3			1	(A-1-b (0))			
								Sample/Te	est Description	
							Sand/Gra	vel Particle S	hape : ANGULAR	
							Sand/Gra	vel Hardness	: HARD	



	Client:	Langan En	gineering				
	Project:	42-11 9th	Street				
	Location:					Project No:	GTX-307810
9	Boring ID:	B-1		Sample Type:	jar	Tested By:	jbr
	Sample ID:	S3		Test Date:	03/19/18	Checked By:	emm
	Depth :	8-10 ft		Test Id:	446093		
	Test Comm	ent:					
	Visual Desc	ription:	Moist, yellowi	sh brown clay v	vith sand		
	Sample Cor	mment:					



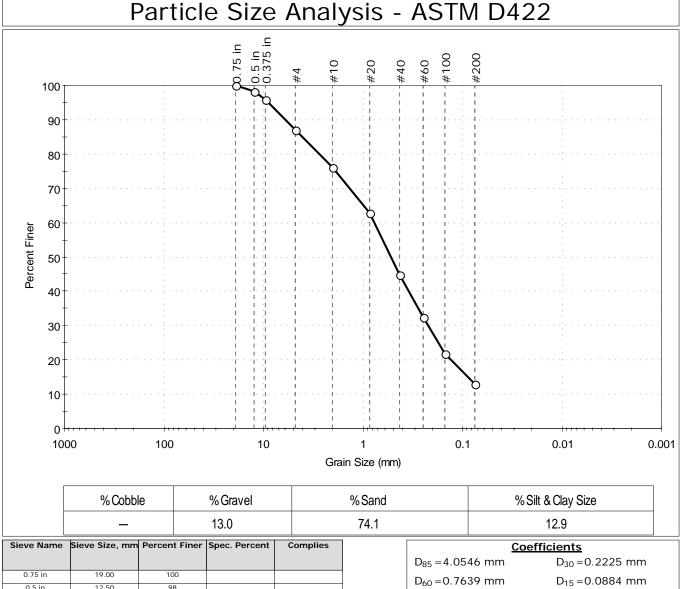
AASHTO Silty Soils (A-4 (0))

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---



	Client:	Langan En	gineering				
	Project:	42-11 9th	Street				
	Location:					Project No:	GTX-307810
9	Boring ID:	B-2		Sample Type:	jar	Tested By:	jbr
	Sample ID:	S4		Test Date:	03/19/18	Checked By:	emm
	Depth :	8-10 ft		Test Id:	446096		
	Test Comm	nent:					
	Visual Desc	cription:	Moist, brown	silty sand			
	Sample Co	mment:					
_		0	Analy				



0.75 111	19.00	100	
0.5 in	12.50	98	
0.375 in	9.50	96	
#4	4.75	87	
#10	2.00	76	
#20	0.85	63	
#40	0.42	45	
#60	0.25	32	
#100	0.15	22	
#200	0.075	13	

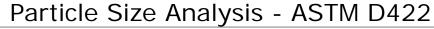
		12.0	
	C	<u>oefficients</u>	
$D_{85} = 4.05$	46 mm	D ₃₀ =0.2225 mm	
D ₆₀ =0.76	39 mm	$D_{15} = 0.0884 \text{ mm}$	
$D_{50} = 0.51$	70 mm	$D_{10} = N/A$	
$C_u = N/A$		C _c =N/A	
	CI	assification	

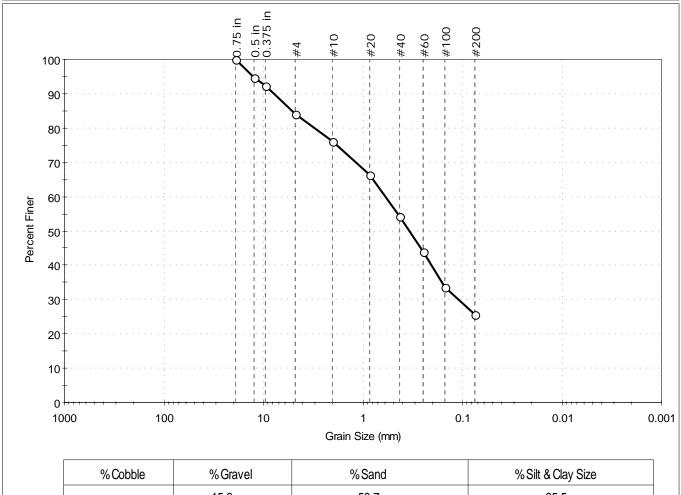
<u>ASTM</u>	N/A
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sand/Gravel Particle Shape : ANGULAR Sand/Gravel Hardness : HARD



	Client:	Langan En	gineering							
	Project:	42-11 9th	Street							
nd	Location:					Project No:	GTX-307810			
ng	Boring ID:	B-1		Sample Type:	jar	Tested By:	jbr			
	Sample ID:	S4		Test Date:	03/19/18	Checked By:	emm			
	Depth :	10-12 ft		Test Id:	446094					
	Test Comm	ent:								
	Visual Desc	ription:	Moist, brown silty sand with gravel							
	Sample Cor	mment:	Sample contai	ins glass						
			^							

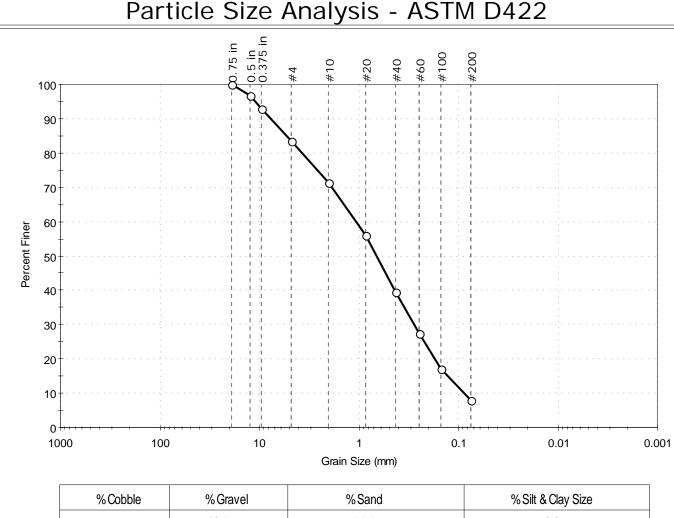




			15.8		58.7		25.5		
Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies	Complies		<u>Coefficients</u>		
						$D_{85} = 5.08$	46 mm	$D_{30} = 0.1104 \text{ mm}$	
0.75 in	19.00	100				$D_{60} = 0.58$	68 mm	$D_{15} = N/A$	
0.5 in	12.50	95				$D_{50} = 0.34$	0.0 mm	$D_{10} = N/A$	
0.375 in	9.50	92				$D_{50} = 0.34$	06 11111	$D_{10} = N/A$	
#4	4.75	84				$C_u = N/A$		$C_c = N/A$	
#10	2.00	76							
#20	0.85	66			1	<u>Classification</u>			
#40	0.42	54			1	<u>ASTM</u> N/A			
#60	0.25	44			1				
#100	0.15	34					Silty Croyal and Sand (A. 2. 4.(
#200	0.075	26			1	AASHTO Silty Gravel and Sand (A-2-4 (0))			
						Sand/Grav		<u>est Description</u> Shape : ANGULAR	
						Sand/Grav	vel Hardness	s : HARD	



	Client:	Langan Engineering								
ing	Project:	42-11 9th Street								
	Location:					Project No:	GTX-307810			
	Boring ID:	B-2		Sample Type:	jar	Tested By:	jbr			
	Sample ID:	S5		Test Date:	03/19/18	Checked By:	emm			
	Depth :	10-12		Test Id:	446097					
	Test Comm	ent:								
	Visual Desc	ription:	Moist, brown sand with silt and gravel							
	Sample Co	mment:	Sample conta	ins glass						
		01	A 1							



			% Gravel % Sand			% Silt & Clay Size			
			16.5		75.5		8.0		
Sieve Name	Sieve Size, mm Percent Finer Sp		r Spec. Percent	Complies			<u>Coefficients</u>		
						$D_{85} = 5.31$	49 mm	D ₃₀ =0.2791 mm	
0.75 in	19.00	100				$D_{60} = 1.0616 \text{ mm}$		D ₁₅ =0.1275 mm	
0.5 in	12.50	97				200 1.00	10 11111	515 0.1270 1111	
0.375 in	9.50	93				$D_{50} = 0.6600 \text{ mm}$		D ₁₀ =0.0872 mm	
#4	4.75	83				$C_{\mu} = 12.174$		C _c =0.841	
#10	2.00	71							
#20	0.85	56				ASTM N/A		<u>Classification</u>	
#40	0.42	40							
#60	0.25	28							
#100	0.15	17				AASHTO Stone Frac		Fragments, Gravel and Sand	ł
#200	0.075	8.0			_		(A-1-b	5	
						Sand/Gray	Samp	Ie/Test Description ticle Shape : ANGULAR	
								dness : HARD	