APPENDIX A

GEOTECHNICAL REPORT

NORTHEAST
GEOTECHNICAL, INC.
Delivering Practical Engineering Solutions

September 19, 2019 Project No. H360.00

117 Union Street, LLC
c/o Michael Galasso
128 Union Street, Fourth Floor
New Bedford, MA 02740

SUBJECT: Geotechnical Engineering Report
Proposed Mixed-Use Redevelopment
117 Union Street
New Bedford, MA

Dear Michael:

Northeast Geotechnical, Inc. is pleased to present the attached report summarizing the results of our geotechnical engineering studies for the proposed mixed-use redevelopment building project at the subject site.

The objective of our studies has been to develop geotechnical engineering recommendations for use by the project team in design and construction of the foundations and ground floor basement slab for the proposed building.

We accomplished our objective in part by assessing the general subsurface soil, bedrock and groundwater conditions at the site by observing and logging exploratory test borings in accessible areas around the site.

We have developed geotechnical engineering recommendations for use by the project team in the design and construction of spread footings and a slab-on-grade for the new building. We also developed a recommended seismic site class. Test boring logs, laboratory soil testing results, and a subsurface exploration location plan are also included in the attached report.

We have enjoyed working with you on this phase of the project. If you have any questions or require additional information, please contact Jim Handanyan, P.E. at 401-808-0927 or at jhandanyan@northeastgeotechnical.com.

Sincerely,

Northeast Geotechnical, Inc.

James M. Handanyan, P.E.
Principal Engineer

Glenn A. Olson, P.E,
Principal Engineer

NORTHEAST
GEOTECHNICAL, INC.
Delivering Practical Engineering Solutions

GEOTECHNICAL ENGINEERING REPORT
PROPOSED MIXED-USE REDEVELOPMENT
117 UNION STREET
NEW BEDFORD, MASSACHUSETTS

Prepared For:
117 Union Street LLC
c/o Michael Galasso
128 Union Street, Fourth Floor
New Bedford, MA 02740

Prepared By:
Northeast Geotechnical, Inc.
166 Raymond Hall Drive
North Attleboro, MA 02760

Project No. H360.00
September 19, 2019

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NORTHEAST
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1.0 INTRODUCTION

The proposed redevelopment site is located at 117 Union Street at the corner of Union Street and North Second Street in New Bedford, Massachusetts. The site is bordered by Barkers Lane to the north, Union Street to the south and North Second Street to the east. An existing vacant building directly abuts the site to the west. The front three-story portion of this existing building is to remain while the back one-story portion is to be demolished and redeveloped by others. This building has a basement level reportedly about 7.5± feet below the first-floor level.

The site is approximately 8,200 square feet in area and is currently occupied by a number of existing one-story brick buildings. The buildings at the southeast corner of the site have basements reportedly about 6± to 7± feet below the first-floor level while the rest of the buildings do not have basements. A small open pavement area is located in the northeast portion of the site.

The proposed project includes demolition of the existing buildings on the site and construction of a mixed-use building that will cover essentially the entire site with five levels above grade and a potential below grade basement level. The first-floor level at the street grade will be for commercial use and the upper levels will be for residential use. The elevation of the basement is currently planned to be about 11± feet below existing grade.

This report has been prepared pursuant to our proposal to 117 Union, LLC dated March 13, 2019. The report is subject to the Limitations and Service Constraints appended to this report (Appendix A).

2.0 SUBSURFACE EXPLORATORY TEST BORINGS

Northeast Geotechnical observed and logged five subsurface exploratory test borings (B-1 to B-5) in accessible locations on and around the site on August 19 and September 11, 2019. The borings were performed by New England Boring Contractors of Brockton, Massachusetts to assess the existing subsurface soil, bedrock and groundwater conditions.

The approximate test boring locations are shown on the Subsurface Exploration Location Plan appended to this report as Figure No. 1. The borings were located in the field by line of sight from existing site and building features. The boring locations shown on the Subsurface Exploration Location Plan should be considered accurate only to the degree implied by the field method used to locate the borings.

The test borings were performed with a truck-mounted test boring rig and were generally advanced using 4± inch inside diameter flush joint steel casing to depths of about 8± to 18.5± feet below existing ground surface. The test borings were terminated in natural glacial till soils or in/on apparent bedrock.

Standard Penetration Testing (SPT) was generally performed at about 2± foot intervals or less. The SPT was conducted by driving a 2 inch outside diameter standard split spoon sampler a distance of up to 24 inches at each sampling depth by blows of a 140-pound automatic trip safety hammer falling a distance of 30 inches.

A 5-foot rock core was performed at boring B-3 at the northeast corner of the site from a depth of about 10± to 15± feet below existing ground surface.

A 2± inch diameter PVC groundwater observation well was installed in boring B-2 near the southeast corner of the site.

The soil samples retrieved in the split spoon sampler during SPT were visually described in the field using Burmister's soil descriptions. The visual descriptions, the hammer blow counts required to drive the split spoon sampler during the SPT and other observations are shown on our boring logs appended to this report in Appendix B. Note that the soil descriptions from the split spoon sampler are generally representative of the minus 1.4± inch size fraction of the overall soil deposits sampled.

The elevations shown on our boring logs and otherwise referenced in this report are based on the existing grading information shown on the plans provided to us for use during our studies. The referenced elevations are considered very approximate.

3.0 LABORATORY SOIL TESTING

Select samples collected from the test borings were submitted to a soil testing laboratory for analysis. Testing included gradation analyses on samples of existing fill, natural sand and natural glacial till deposits that were encountered. The testing was performed to assess the basic geotechnical engineering characteristics of the various soil deposits encountered. The test results are included in Appendix C of this report.

4.0 GENERAL SUBSURFACE CONDITIONS

The test borings Northeast Geotechnical observed and logged revealed existing fill deposits overlying natural sand to gravelly sand, natural glacial till and/or apparent bedrock to the depths explored.

The existing fill generally appeared granular with varying amounts of sand, gravel and silt as indicated on the boring logs. Some of the fill also appeared to contain some debris such as brick, concrete and glass and is indicated as "Urban Fill" on the boring logs. The fill appeared to vary in thickness from about 4± to 8± feet below existing ground surface and appeared very loose to dense based on the SPT.

An apparent natural sand to gravelly sand deposit was typically encountered below the existing fill except at boring B-4 where the fill appeared to extend to refusal (apparent bedrock) at a depth of about 8± feet below existing ground surface. This natural sand to gravelly sand deposit generally appeared medium dense to dense based on the SPT.

The natural sand to gravelly sand deposit appeared to generally be about 2± feet thick where encountered except at boring B-2 where the deposit may be closer to about 6± feet thick and appeared to contain boulders. The top 6± inches of the sand deposit at boring B-2 appeared slightly organic. The natural sand generally contained gravel and silt in varying proportions as indicated on the test boring logs.

The natural sand was underlain by a natural silty glacial till deposit at borings B-1, B-3 and B-5 as indicated on the boring logs. The glacial till deposit generally appeared to be dense to very dense based on the SPT. The glacial till appeared to vary in thickness from about 4± feet at boring B-3 to over 12.5± feet at boring B-1 where the boring terminated in the glacial till deposit at a depth of about 18.5± feet below existing grade.

Refusal to the test boring equipment was encountered in each boring except boring B-1 at depths of about 8± feet (B-4) to 14± feet (B-2) below existing ground surface upon apparent bedrock. An approximate 5± foot rock core was performed in boring B-3 from a depth of about 10± to 15± feet below existing ground surface. The recovered core sample appeared to consist of gneissic granite bedrock. The rock quality designation (RQD) of the core sample was measured to be about 33%. This classifies the general rock quality as poor at the location and depth of the core.

Refer to the appended boring logs and laboratory test results for more information regarding the variability in the thickness, gradation and density/consistency of the various deposits encountered.

Groundwater was generally encountered between about 9± to 10.5± feet below existing ground surface at the time of the borings. Possible perched groundwater near the silty glacial till surface was noted at a depth of about 6.5± feet below existing ground surface in boring B-5 and about 5± feet below existing ground surface in boring B-2. Note that groundwater levels will fluctuate due to variations in temperature, precipitation, tidal influences and other factors. Therefore, groundwater levels at any time could be different than those reported herein.

5.0 GEOTECHNICAL ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

The proposed basement level is planned to be located about 11± feet below existing ground surface and based on the test borings, may require excavation into bedrock especially at the north end of the site. Excavations may also encounter groundwater that will need to be managed during construction and beyond.

The proposed basement level will be about 3.5± feet below the existing basement level of the abutting building to the west. This may require underpinning of the existing building's foundations. Underpinning may require dewatering and bedrock excavation which will make the underpinning that much more difficult, time consuming and expensive.

The design team has indicated that the proposed basement level could be stepped up as it approaches the existing building to match the existing building's basement level in order to avoid underpinning the existing foundations. We recommend that this concept be incorporated into the design if possible. The step up should occur at least 10 feet from the abutting building.

Our geotechnical engineering recommendations for foundation design and construction, lateral earth pressures on basement foundation walls, slab design and construction, seismic site class and excavation support are presented in the following sections.

5.1 Foundation Design and Construction

We recommend spread footings to support the proposed building. Footings should bear on undisturbed natural sand/gravelly sand, natural glacial till or bedrock. Footings should not bear on the existing fill. Existing fill, if present at bottom of footing elevation, should be over-excavated and be replaced with controlled, compacted, 6-inch maximum thick lifts of structural fill. In a "wet" condition, compacted lifts of ¾ inch crushed stone may be required instead of structural fill for stability.

Lifts of structural fill placed below footings should be compacted to at least 95 percent of the material's maximum dry density and to a firm and stable condition. Structural fill should be free of ice and snow, roots, sod rubbish and any other deleterious or organic matter and it should conform to the following gradation requirements:

Structural Fill

Sieve Size	Percent Finer by Weight
2/3 the loose lift thickness	100
No. 10	30-95
No. 40	10-70
No. 200	0-12*

*less than 10 percent for "free draining" backfill.

Footings bearing on natural undisturbed soil or compacted structural fill should be over-excavated for the immediate placement of a 6-inch minimum thick lift of compacted ¾ inch stone to protect the soil subgrade during construction. Footings excavations where bedrock is encountered should be over-excavated for the placement of a 12-inch minimum thick layer of compacted ¾ inch crushed stone. This layer of crushed stone over bedrock is intended to mitigate differential settlement which might occur between footings bearing on bedrock and footings bearing on soil.

We recommend rock excavation be made using hydraulic hoe-rams as opposed to drilling and blasting to limit vibrations that could cause damage to adjacent property.

If groundwater is encountered during footing or basement excavations, the size of the excavations should be limited to that which can be handled by the contractor's chosen dewatering methods. Dewatering will be required to allow observation of the footing excavation bottoms, placement and compaction of structural fill/crushed stone "in the dry", placement of the footing concrete in the dry, and placement and compaction of backfill in the dry.

Soil bearing footings may be designed for a maximum net allowable bearing pressure of 3 tons per square foot when the subgrades are prepared as recommended herein. Rock bearing footings may be designed for a maximum net allowable bearing pressure of 8 tons per square foot. Rock bearing applies to footings where bedrock is over-excavated below the footings and replaced with compacted crushed stone as recommended herein.

5.2 Lateral Earth Pressures on Basement Foundation Walls

Assuming the basement walls will be restrained and not allowed to move during backfilling, at-rest conditions apply. A minimum equivalent fluid pressure equal to 65 pounds per square foot per foot height of wall can be used to calculate at-rest soil pressures. For sliding resistance, a maximum friction factor of 0.45 is recommended between the base of the footings and the crushed stone that we recommend be placed beneath the footings.

Free-draining granular backfill from off-site sources (less than 10 percent passing the number 200 sieve) should be used to backfill behind the basement walls. Only hand operated vibratory plate or drum compactors should be used to compact the backfill within 5 feet of the back of the walls. The backfill should be compacted to at least 90 percent of the material's maximum dry density determined in accordance with ASTM D-1557.

The walls should also be designed for appropriate surcharge loads, earthquake loads and other loads as appropriate. A backfill unit weight of at least 130 pcf should be used when calculating seismic forces in accordance with the Massachusetts State Building Code.

A perimeter foundation underdrain should also be installed around the outside of the proposed building adjacent to the exterior basement wall footings. The underdrain should consist of a 4-inch minimum diameter perforated PVC pipe placed level 6 inches above bottom of footing elevation with the perforations down. The pipe should be surrounded in at least 6 inches of ¾ inch crushed stone all around and the crushed stone should be completely wrapped in a geotextile filter fabric (Mirafi 140N or equivalent). The fabric should be overlapped full width along the top of the crushed stone.

5.3 Basement Slab Design and Construction

The basement slab may be designed as a slab-on grade. The slab should bear directly on at least 12 inches of 3/4 inch compaction crushed stone for drainage purposes. A layer of geotextile filter fabric should be placed on the excavation bottom before placing the crushed stone where soil is exposed at the slab subgrade elevation.

As with the footings, some bedrock excavation may be required which should be performed with hydraulic hoe-rams as recommended for the footings. Also dewatering may be required to keep the excavation dry to allow placement and compaction of the crushed stone layer below the slab and pouring of the basement slab to be performed "in the dry".

Underdrain pipes should be installed within the crushed stone layer beneath the slab. The pipes should consist of 4-inch minimum diameter PVC pipes placed at the bottom of the crushed stone layer. The pipes should be placed with the perforations down. At least 3 evenly spaced pipes should be installed in an east-west direction below the slab with the middle pipe located near the middle of

the building area and the other two pipes located roughly half way between the middle pipe and the outside building walls to the north and south.

5.4 Seismic Site Class

It is our opinion that the soils sampled during the test borings are not susceptible to liquefaction under moderate earthquake loading. Based on our interpretation of the Massachusetts State Building Code, it is our opinion that the site should be considered Site Class C for seismic design.

5.5 Excavation Support

Assuming the sidewalks around the site can be temporarily shut down during construction, there may be room to safely slope the excavation sides. Where there is insufficient room to safely slope the excavation sides, excavation support will be required.

One possible option is a soldier pile and lagging wall. Where the bedrock is shallow, the soldier piles will likely need to be grouted into holes drilled into the bedrock. Drilled mini-piles are generally suitable in this type of application.

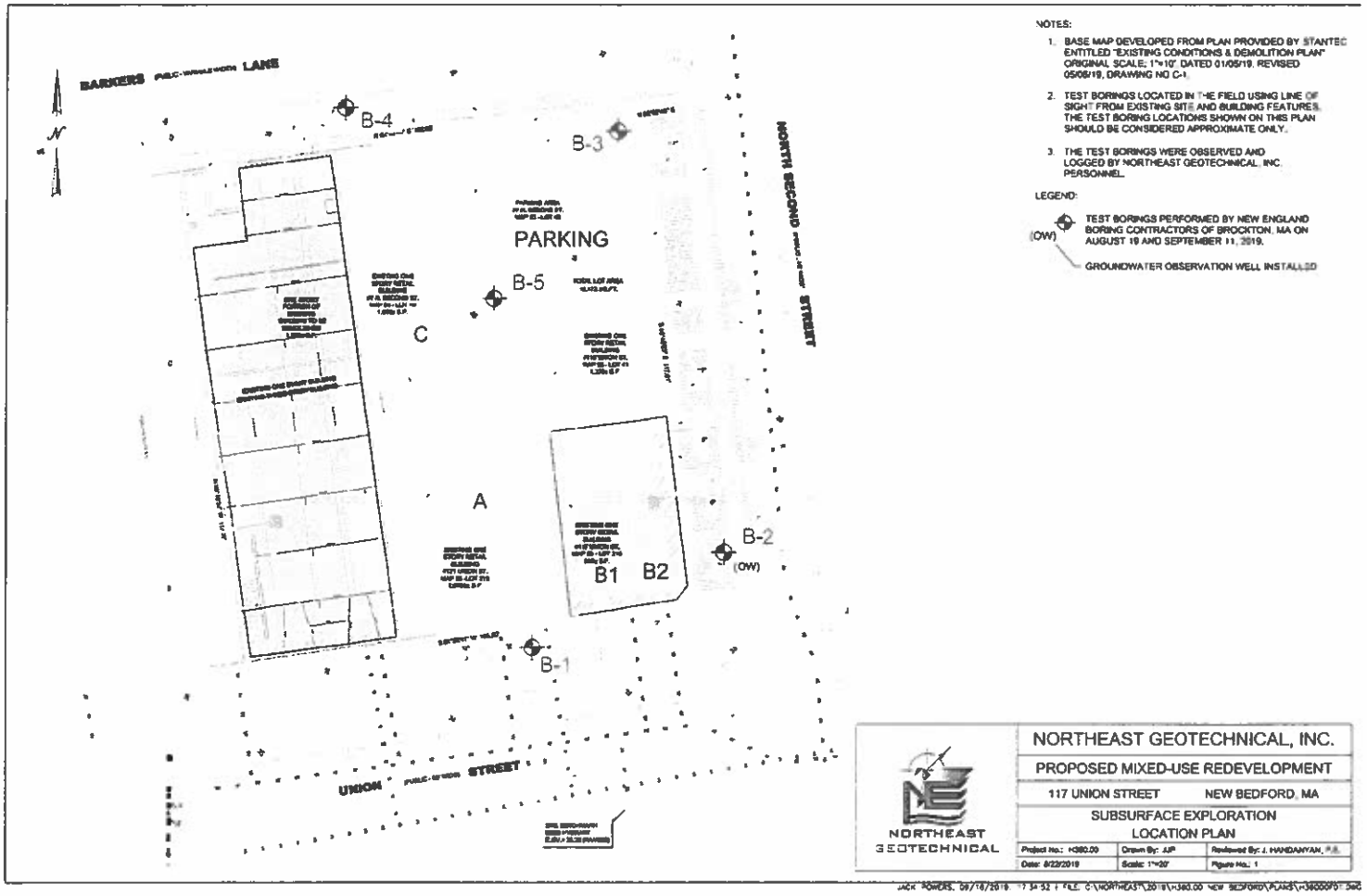
The design of excavation support system(s) that may be required should be performed by a professional engineer, licensed in Massachusetts, working for the contractor with review by Northeast Geotechnical and the structural engineer prior to construction.

6.0 CONSTRUCTION OBSERVATION, TESTING AND DESIGN REVIEW

Northeast Geotechnical should be retained to provide construction observation and soil testing services during the earthwork and foundation construction phase of this project. The purpose of our participation is to verify our design assumptions in the field, particularly those regarding foundation and slab subgrade preparation. In addition, we can provide engineering input in a timely manner if subsurface conditions are found to vary from those anticipated prior to construction and warrant a design change or a change in earthwork procedures.

We also recommend the opportunity to review the foundation and site plans and earthwork specifications prior to bidding for construction to see that our recommendations have been properly interpreted and included. We also recommend review of excavation support design submittals and other applicable submittals prior to construction.

FIGURE



NOTES:

1. BASE MAP DEVELOPED FROM PLAN PROVIDED BY STANTEC ENTITLED "EXISTING CONDITIONS & DEMOLITION PLAN" ORIGINAL SCALE: 1"=10', DATED 01/05/19, REVISED 05/08/19, DRAWING NO C-1.
2. TEST BORINGS LOCATED IN THE FIELD USING LINE OF SIGHT FROM EXISTING SITE AND BUILDING FEATURES. THE TEST BORING LOCATIONS SHOWN ON THIS PLAN SHOULD BE CONSIDERED APPROXIMATE ONLY.
3. THE TEST BORINGS WERE OBSERVED AND LOGGED BY NORTHEAST GEOTECHNICAL, INC. PERSONNEL.

LEGEND:

B-1 — TEST BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF BROCKTON, MA ON AUGUST 19 AND SEPTEMBER 11, 2019.

(OW) — GROUNDWATER OBSERVATION WELL INSTALLED

NORTHEAST GEOTECHNICAL

NORTHEAST GEOTECHNICAL, INC.

PROPOSED MIXED-USE REDEVELOPMENT

117 UNION STREET NEW BEDFORD, MA

SUBSURFACE EXPLORATION LOCATION PLAN

Project No.: 1360.00	Drawn By: JJP	Reviewed By: J. HANDANYAN, P.E.
Date: 8/23/2019	Scale: 1"=20'	Figure No.: 1

JACK POWERS, 09/18/2019 - 7:34:52 | FILE: C:\NORTHEAST\2019\1360.00 NEW BEDFORD\PLANS\1360001.dwg

APPENDIX A

Limitations and Service Constraints

LIMITATIONS AND SERVICE CONSTRAINTS
Geotechnical Engineering Consulting Services

The opinions, conclusions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by Northeast Geotechnical, Inc. and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the geotechnical consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that Northeast Geotechnical, Inc. relied upon any information prepared by other parties not under contract to Northeast Geotechnical, Inc. , Northeast Geotechnical, Inc. makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

Subsurface Explorations and Testing

Results of any observations, subsurface exploration or testing, and any findings presented in this report apply solely to conditions existing at the time when Northeast Geotechnical, Inc.'s exploratory work was performed. It must be recognized that any such observations and exploratory or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected and conditions can change with time. Northeast Geotechnical, Inc.'s ability to interpret exploratory and test results is related to the availability of the data and the extent of the exploratory and testing activities.

The findings, conclusions and recommendations submitted in this report are based, in part, on data obtained from subsurface borings, test pits, and specific, discrete sampling locations. The nature and extent of variation between these test locations, which may be widely spaced, may not become evident until construction. If variations are subsequently encountered, it will be necessary to re-evaluate the conclusions and recommendations of this report.

Correlations and descriptions of subsurface conditions presented in boring logs, test pit logs, subsurface profiles, and other materials are approximate only. Subsurface conditions may vary significantly from those encountered in borings and sampling locations and transitions between subsurface materials may be gradual or highly variable.

Conditions at the time water level measurements and other subsurface observations were made are presented in the boring logs or other sampling forms. These field data have been reviewed and interpretations provided in this report. However, groundwater levels may be variable and may fluctuate due to variation in precipitation, temperature, and other factors. Therefore, groundwater levels at the site at any time may be different than stated in this report.

Review

In the event that any change in the nature, design, or location of the proposed structure(s) is planned, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or verified in writing.

Northeast Geotechnical, Inc. should be provided the opportunity for a general review of final design plans and specifications to assess that our recommendations have been properly interpreted and included in the design and construction documents.

Construction

To verify conditions presented in this report and modify recommendations based on field conditions encountered in the field, Northeast Geotechnical, Inc. should be retained to provide geotechnical engineering services during the construction phase of the project. This is to observe compliance with design concepts, specifications, and recommendations contained in this report, and to verify and refine our recommendations as necessary in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX B

Test Boring Logs

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Redevelopment, 117 Union Street, New Bedford, MA

Test Boring No.: B-1
Page: 1 of 1
File No.: H360.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: New England Boring Contractors
Foreman: Jerry Voight
Boring Equipment: Truck-mounted Mobile B-53 drill rig, 2" (OD) split-spoon driven w/140# auto-trip hammer

Date/Weather: 9/11/19 - Mostly Sunny, 65 - 80 °F
Northeast Geotechnical Observer: Joseph Papandrea
Test Boring Location: See Exploration Location Plan
Ground Surface Elevation: 34± ft.
Depth to Water: 10.5 ± ft.

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Brick Paver 0.2'±	Red, clay BRICKS
							Urban Fill	Medium dense, brown to black to gray, fine to coarse SAND, some fine to coarse Gravel/Concrete/Brick Fragments, little Silt
	S-1	0.5'-2.5'	24"	8"	27-10-6-30			
	S-2A	2.5'-3.5'	12"	8"	13-8		3.5'±	Brown, f/c SAND, some Silt, little f Gravel, trace Roots
	S-2B	3.5'-4'	6"	4"	10		Org. Sand 4'±	Black, f/m SAND, some (-) Silt, trace (-) Roots
5'	S-2C	4'-4.5'	6"	6"	10		Natural Sand	Brown, f/m SAND, little Silt, trace f Gravel
						2		
	S-3	4.5'-6.5'	24"	18"	9-17-22-30		6'±	Dense, brown, fine to medium SAND, little fine Gravel, trace Silt
							Natural Glacial Till	
	S-4	6.5'-8.5'	24"	18"	25-36-37-30			Very dense, light brown, fine to coarse SAND, some (+) Silt, little fine Gravel
10'								Very dense, damp, light brown, fine to coarse SAND, some fine Gravel, some (-) Silt
	S-5	8.5'-10.5'	24"	15"	20-30-47-57	3,4		
								Very dense, wet, light brown, fine to coarse SAND, some fine to coarse Gravel, little (+) Silt
	S-6	10.5'-12.5'	24"	12"	10-38-38-31			
								Dense, wet, light brown, fine to coarse SAND, some fine to coarse Gravel, little Silt
15'	S-7	12.5'-14.5'	24"	12"	16-17-16-21			
								Dense, wet, light brown, fine to coarse SAND, some Silt, little fine Gravel
	S-8	14.5'-16.5'	24"	15"	20-22-26-45			
								Dense, wet, light brown, fine to coarse SAND, some fine to coarse Gravel, some Silt
	S-9	16.5'-18.5'	24"	15"	12-23-24-24	5	18.5'±	
20'								Boring terminated in natural glacial till at a depth of about 18.5± ft.
25'								

Notes:
1. Surface consisted of 2.5± inch brick sidewalk underlain by urban fill. Sampling with split-spoon sampler performed (S-1) at a depth of 0.5± to 2.5± ft.
2. Possible groundwater mottling observed in S-3 at a depth of about 6± ft.
3. Weathered rock (possible boulder) observed in tip of S-5 at a depth of 10.5± ft.
4. Apparent groundwater observed at a depth of about 10.5± ft. at time of boring.
5. Boring terminated in natural Glacial Till at a depth of about 18.5± ft.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Redevelopment
117 Union Street
New Bedford, MA

Test Boring No.: B-2
Page: 1 of 1
File No.: H360.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: New England Boring Contractors
Foreman: Jerry Voight
Boring Equipment: Truck-mounted Mobile B-53 drill rig, 4" (ID) FJC, 2" (OD) split-spoon driven w/140# auto-trip hammer

Date/Weather: 9/11/19 - Mostly Sunny, 65 - 80 °F
Northeast Geotechnical Observer: Joseph Papandrea
Test Boring Location: See Exploration Location Plan
Ground Surface Elevation: 33± ft.
Depth to Water: 5± ft. (perched) / 9± ft. (obs. well on 9-17-2019)

	Sample Data No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.	Strata Change	Sample Description
						1	Brick Paver 0.2'±	Red, clay BRICKS
							Urban Fill	Loose, dark brown to black, fine to coarse SAND, little fine to coarse Gravel/Concrete fragments, little Silt/Coal Ash
	S-1	0.5'-2.5'	24"	10"	3-4-5-6			
								Medium dense, dark brown to black, fine to coarse SAND, some fine Gravel/Asphalt fragments, little Silt/Coal Ash
	S-2	2.5'-4.5'	24"	12"	6-5-6-4			
5'	S-3A	4.5'-5'	6"	6"	6	2	5'±	Damp, brown, f/c SAND, little Silt, little f Gravel
							Possible Boulder (Nat.?)	Very dense, gray, fine to coarse GRAVEL, trace fine to coarse Sand, trace Silt (possible boulder fragments)
	S-3B	5'-6.5'	18"	12"	30-38-35			
	S-4A	6.5'-8'	18"	12"	22-22-28		8'±	V. dense, gray to white, f/c GRAVEL, tr. f/c Sand, tr. Silt (poss. Bldr. Frags.)
	S-4B	8'-8.5'	6"	6"	19		Nat. Sand	Damp, lt. brn., f/c SAND, little Silt, little fine Gravel
10'	S-5A	8.5'-9.5'	12"	8"	20-29		9.5'±	Damp, lt. brn., f/c SAND, some f Gravel, little Silt
	S-5B	9.5'-10.5'	12"	10"	50-24		Poss. Bldr 10.5'±	Dark brn./gray., f/c GRAVEL and f/c SAND, little Silt (poss. bldr. frags.)
							Natural Sand	Medium dense, wet, light brown, fine to medium SAND, some fine to coarse Gravel, little (-) Silt
	S-6	10.5'-12.5'	24"	15"	15-15-12-16			
						3,4		Medium dense, wet, light brown, fine to coarse SAND, little Silt, trace fine Gravel
15'	S-7	12.5'-14.3'	24"	15"	8-12-12-100/3"	5,6	14.3'±	
							//\\ //\\	Boring terminated upon REFUSAL (possible Bedrock) at a depth of about 14.3± ft.
20'								
25'								

Notes:
1. Surface consisted of 2.5± inch brick sidewalk underlain by urban fill. Sampling with split-spoon sampler (SSS) performed (S-1) at a depth of 0.5± to 2.5± ft.
2. Possible (perched) groundwater observed in S-3 at a depth of about 5± ft.
3. Refusal of SSS/casing (possible Bedrock) at a depth of 14.3± ft.
4. Boring terminated upon REFUSAL (possible Bedrock) at a depth of 14.3± ft.
5. Groundwater observation well installed (0'-3'± stemming; 3'-13'± sand-packed screen). Top of well = 0.45'± from ground surface.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Mixed-Use Redevelopment
117 Union Street
New Bedford, MA

Test Boring No.: B-3
Page: 1 of 1
File No.: H360.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: New England Boring Contractors
Foreman: Jerry Voight
Boring Equipment: Truck-mounted Mobile B-53 drill rig, 4" (ID) FJC, 2" (OD) split-spoon driven w/140# auto-trip hammer

Date/Weather: 8/19/19 - Mostly Sunny, 75 - 89°F
Northeast Geotechnical Observer: Joseph Papandrea
Test Boring Location: See Exploration Location Plan
Ground Surface Elevation: 35± ft.
Depth to Water: 10± ft. (perched)

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Asphalt 0.2'±	Black, fine-aggregate, BITUMINOUS CONCRETE
	S-1	0'-2'	24"	15"	6-6-3-2		Gran. Fill 2'±	Loose, lt. brn., f/c SAND, little (+) fine Gravel, trace (+) Silt
							Urban Fill	Very loose, dark brown to black, fine to coarse SAND, some (+) fine to
	S-2	2'-4'	24"	3"	3-1-1-8		4'±	coarse Gravel/Concrete, little Silt, trace Debris (glass, brick), trace Roots
5'							Natural Sand	Medium dense, grayish tan, fine to coarse SAND, little fine Gravel, little Silt
	S-3	4'-6'	24"	14"	12-10-8-17		6'±	
							Natural Glacial Till	
	S-4	8'-9.8'	21"	12"	17-16-23-50/3"			Dense, damp, gray, fine to coarse SAND, some (-) Silt, little (+) fine Gravel
10'						2,3	10'±	
	RC-1	10-15'	60"	50"	Min/ft: 2:30			Gray, Gneissic GRANITE containing Muscovite and Biotite, several seams/joints at about 15° inclination. Rock Quality Designation (RQD)=33%
					2:30		Bedrock	
					2:00			
					2:00			
15'					1:00	4,5	15'±	
							/\/\ /\/\	Boring terminated in probable BEDROCK at a depth of about 15± ft.
20'								
25'								

Notes:

1. Surface consisted of 2.5± inch asphalt layer underlain by granular fill. Sampling with split-spoon sampler performed (S-1) at a depth of 0± to 2± ft.
2. Refusal of split-spoon sampler at a depth of about 9.8± ft. Roller bit advanced to refusal at a depth of about 10± ft.
3. Apparent (perched) groundwater observed at a depth of about 10± ft. at time of boring.
4. Rock core run no. RC-1 performed with 2± inch (ID) core barrel from a depth of 10± to 15± ft. Penetration time (min.) recorded at 1± ft. increments.
5. Boring terminated in Bedrock at a depth of about 15± ft.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Mixed-Use Redevelopment
117 Union Street
New Bedford, MA

Test Boring No.: B-4
Page: 1 of 1
File No.: H360.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: New England Boring Contractors
Foreman: Jerry Voight
Boring Equipment: Truck-mounted Mobile B-53 drill rig, 4" (ID) FJC, 2" (OD) split-spoon driven w/140# auto-trip hammer

Date/Weather: 8/19/19 - Mostly Sunny, 75 - 89°F
Northeast Geotechnical Observer: Joseph Papandrea
Test Boring Location: See Exploration Location Plan
Ground Surface Elevation: 36.5± ft.
Depth to Water: not encountered

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1,2	0.4'±	Gray, granite COBBLESTONES
	S-1A	0.5'-1.5'	12"	8"	32-26		Gravel Fill 1.5'±	Gray to tan, f/c GRAVEL, some f/c Sand, trace Silt
	S-1B	1.5'-2.5'	12"	8"	13-11		Granular Fill	Dark brown, f/c SAND, some Silt, little f Gravel
	S-2	2.5'-4.5'	24"	12"	13-26-15-6	3		Dense, dark brown to brown, fine to coarse SAND, little to some Silt, little fine to coarse Gravel
5'							4.5'±	
	S-3	4.5'-6.5'	24"	2"	4-3-4-5		Urban Fill	Loose, brown, fine to coarse GRAVEL, some fine to coarse Sand, trace Silt (poor recovery-possible cobble fragment in tip, brick fragments in wash)
						4		
	S-4	8'-8.2'	2"	1"	100/2"	5.6	8.2'±	Very dense, gray, f/c GRAVEL and f/c SAND, trace Silt (poss. Weathered Rock)
							//\\ //\\	Boring terminated upon REFUSAL (possible bedrock) at a depth of about 8.2± ft.
10'								
15'								
20'								
25'								

Notes:

1. Surface consisted of 5± inch thick cobblestone pavers underlain by gravel fill. Sampling with split-spoon sampler performed (S-1) at a depth of 0.5± to 2.5± ft.
2. Groundwater was not encountered at time of borehole advancement.
3. Casing deflected approximately 5° off a possible boulder at a depth of about 3.5± ft. during advancement.
4. Possible cobble encountered with split-spoon sampler at a depth of 4.5± to 6.5± ft. Cobble fragment observed in tip of S-3 (poor recovery). Brick fragments observed in wash.
5. Refusal of casing/roller bit at a depth of about 8± ft. Split-spoon sampler advanced to refusal at a depth of about 8.2± ft. Possible weathered bedrock observed in tip of S-4.
6. Boring terminated upon REFUSAL (poss. bedrock) at a depth of about 8.2± ft.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Mixed-Use Redevelopment
117 Union Street
New Bedford, MA

Test Boring No.: B-5
Page: 1 of 1
File No.: H360.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: New England Boring Contractors
Foreman: Jerry Voight
Boring Equipment: Truck-mounted Mobile B-53 drill rig, 4" (ID) FJC, 2" (OD) split-spoon driven w/140# auto-trip hammer

Date/Weather: 8/19/19 - Mostly Sunny, 75 - 89°F
Northeast Geotechnical Observer: Joseph Papandrea
Test Boring Location: See Exploration Location Plan
Ground Surface Elevation: 36± ft.
Depth to Water: 6.5± ft. (perched)

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Asphalt 0.2'±	Black, fine-aggregate, BITUMINOUS CONCRETE
	S-1	0'-2'	24"	18"	8-6-5-6		Granular Fill	Medium dense, tan to light brown, f/c SAND, some f Gravel, trace Silt
								Medium dense, brown to dark brown, fine to coarse SAND and fine to coarse GRAVEL, trace Silt
	S-2	2'-4'	24"	6"	3-2-12-16		4'±	
5'							Natural Gravelly Sand 6'±	Dense, grayish light brown, fine to coarse SAND, some fine Gravel, trace Silt
	S-3	4'-6'	24"	18"	25-16-18-17			
						2	Natural Glacial Till	Dense, damp to wet, light brown, fine to coarse SAND, some fine Gravel, little (+) Silt
	S-4	6'-8'	24"	14"	17-22-16-18			
								Dense, damp, light brown, fine to coarse SAND, some Silt, trace fine Gravel
10'	S-5	8'-10'	24"	18"	8-18-14-12			
								Very dense, damp, light brown to gray, fine to coarse SAND and fine GRAVEL, some Silt
	S-6	10'-12'	24"	6"	12-25-50/3"	3,4	11.5'±	
							//\\ //\\	Boring terminated upon REFUSAL (possible bedrock) at a depth of about 11.5± ft.
15'								
20'								
25'								

Notes:

1. Surface consisted of 2.5± inch asphalt layer underlain by granular fill. Sampling with split-spoon sampler performed (S-1) at a depth of 0± to 2± ft.
2. Apparent (perched) groundwater observed at a depth of about 6.5± ft. at time of boring.
3. Refusal of split-spoon sampler/roller bit at a depth of about 11.5± ft. Possible weathered bedrock observed in tip of S-6.
4. Boring terminated upon REFUSAL (possible bedrock) at a depth of about 11.5± ft.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

APPENDIX C

Laboratory Soil Test Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
Let's Build a Solid Foundation

Client Information:
Northeast Geotechnical, Inc.
Georgetown, MA
PM: James Handanyan
Assigned By: James Handanyan
Collected By: Client

Project Information:
Mixed-Use Redevelopment
117 Union Street, New Bedford, MA
TEI Project Number: 74-19-0002.101
Summary Page: 1 of 1
Report Date: 09.16.19

LABORATORY TESTING DATA SHEET

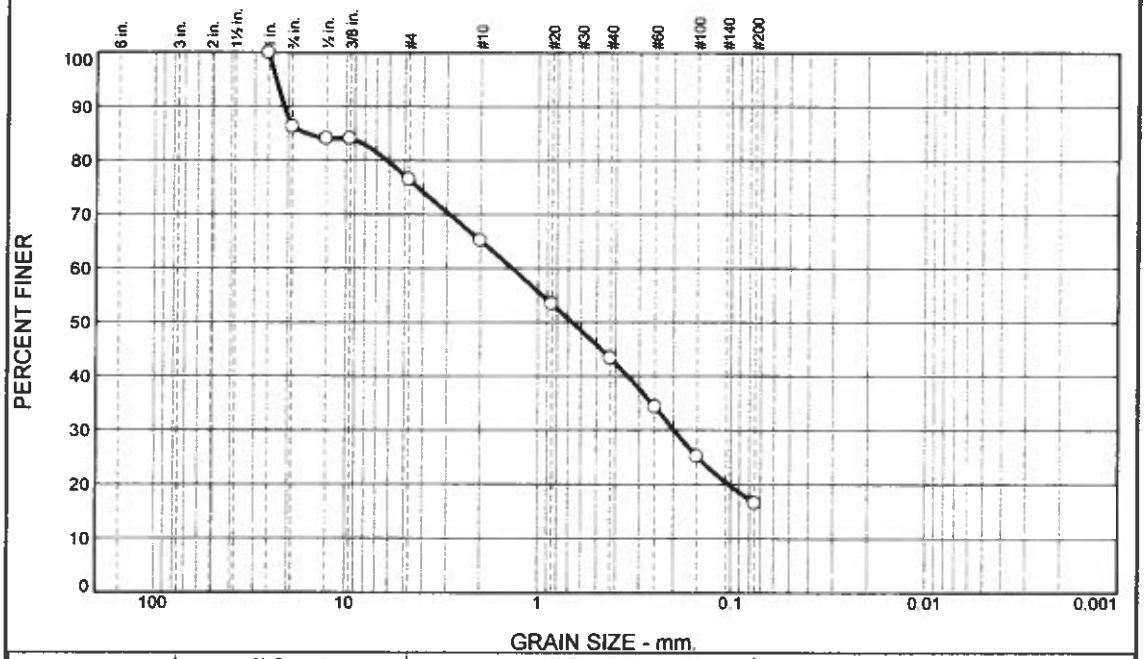
Boring ID	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Perme-ability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
B-1	S-7	12.5-14.5	19-S-1823				23.6	59.9	16.5											Gray silty sand with gravel
B-2	S-6	10.5-12.5	19-S-1824				22.6	67.3	10.1											Gray poorly graded sand with silt and gravel
B-3	S-3	4-6	19-S-1825				11.9	69.6	18.5											Gray silty sand
B-4	S-2	2.5-4.5	19-S-1826				16.9	63.1	20.0											Gray silty sand with gravel
B-5	S-5	8-10	19-S-1827				9.7	64.9	25.4											Gray silty sand

Date Received: *09.12.19*

Reviewed By:

Date Reviewed: *09.18.19*

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.7	9.9	11.3	21.7	26.9	16.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	86.3		
0.5"	84.0		
0.375"	84.0		
#4	76.4		
#10	65.1		
#20	53.4		
#40	43.4		
#60	34.3		
#100	25.1		
#200	16.5		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 21.0325 D_{85}= 16.0764 D_{60}= 1.3670
D_{50}= 0.6675 D_{30}= 0.1981 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.12.19 **Date Tested:** 09.16.19

Tested By: IA

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 12.5-14.5' **Date Sampled:**

Sample Number: B-1 / S-7

Thielsch Engineering Inc.

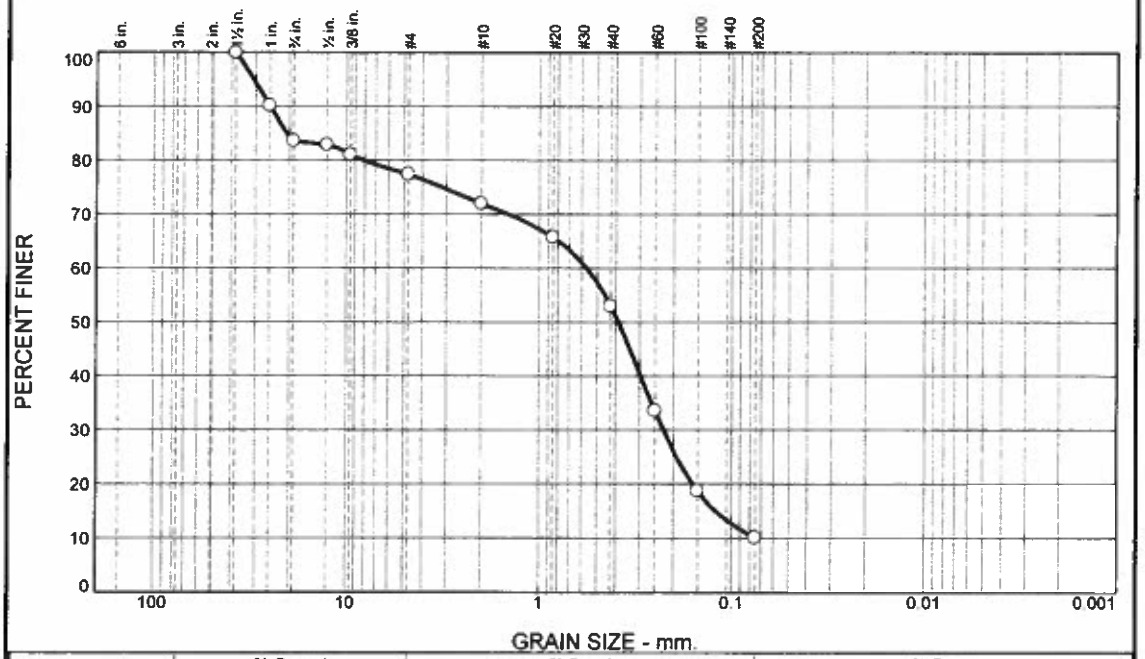
Cranston, RI

Client: Northeast Geotechnical

Project: Mixed-Use Redvelopment
New Bedford, MA

Project No: 74-19-0002.101 **Figure** 19-S-1823

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.4	6.2	5.5	19.0	42.8	10.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	90.1		
3/4"	83.6		
1/2"	82.9		
3/8"	81.1		
#4	77.4		
#10	71.9		
#20	65.7		
#40	52.9		
#60	33.5		
#100	18.7		
#200	10.1		

* (no specification provided)

Material Description

Gray poorly graded sand with silt and gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 25.2588 D_{85}= 20.6978 D_{60}= 0.5676
D_{50}= 0.3883 D_{30}= 0.2259 D_{15}= 0.1208
D_{10}= C_u= C_c=

Remarks

Date Received: 09.12.19 **Date Tested:** 09.16.19

Tested By: IA

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 10.5-12.5' **Date Sampled:**

Sample Number: B-2 / S-6

Thielsch Engineering Inc.

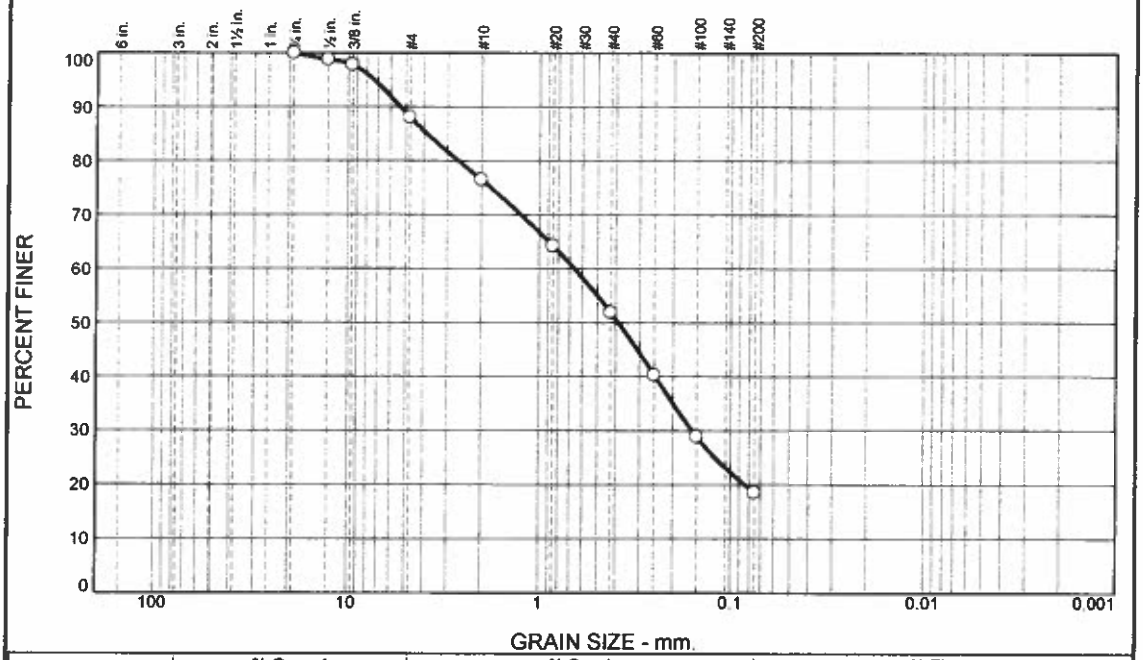
Cranston, RI

Client: Northeast Geotechnical

Project: Mixed-Use Redvelopment
New Bedford, MA

Project No: 74-19-0002.101 **Figure** 19-S-1824

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.9	11.6	24.7	33.3	18.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	98.8		
0.375"	97.8		
#4	88.1		
#10	76.5		
#20	64.2		
#40	51.8		
#60	40.3		
#100	28.9		
#200	18.5		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 5.3387 D_{85}= 3.8567 D_{60}= 0.6605
D_{50}= 0.3889 D_{30}= 0.1589 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.12.19 **Date Tested:** 09.16.19

Tested By: IA

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 4-6' **Date Sampled:**

Sample Number: B-3 / S-3

Thielsch Engineering Inc.

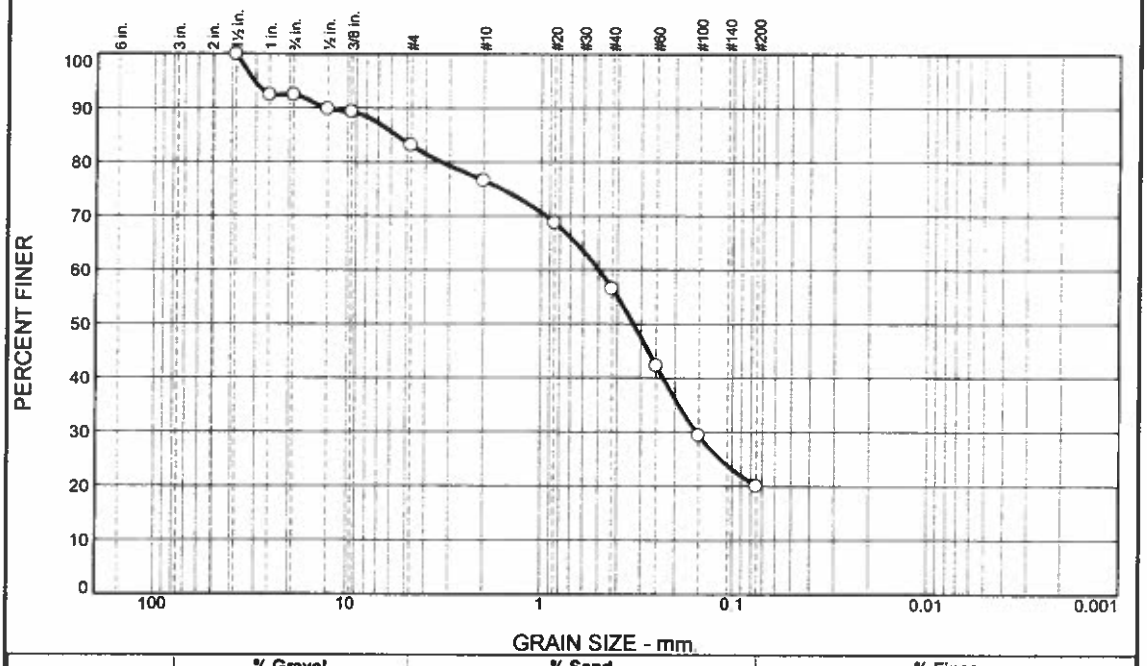
Cranston, RI

Client: Northeast Geotechnical

Project: Mixed-Use Redvelopment
New Bedford, MA

Project No: 74-19-0002.101 **Figure** 19-S-1825

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.6	9.3	6.5	20.1	36.5	20.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	92.4		
3/4"	92.4		
1/2"	89.8		
3/8"	89.3		
#4	83.1		
#10	76.6		
#20	68.7		
#40	56.5		
#60	42.3		
#100	29.4		
#200	20.0		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 13.1265 D_{85}= 5.6698 D_{60}= 0.4985
D_{50}= 0.3295 D_{30}= 0.1546 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.12.19 **Date Tested:** 09.16.19

Tested By: IA

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 2.5-4.5' **Date Sampled:**

Sample Number: B-4 / S-2

Thielsch Engineering Inc.

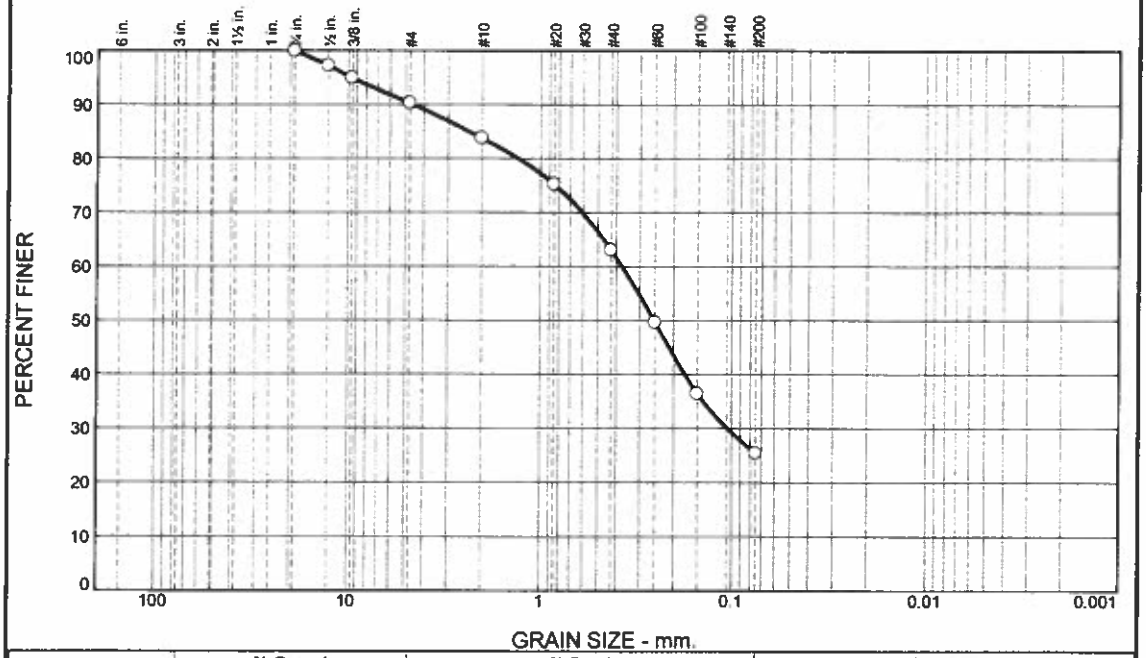
Cranston, RI

Client: Northeast Geotechnical

Project: Mixed-Use Redvelopment
New Bedford, MA

Project No: 74-19-0002.101 **Figure** 19-S-1826

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.7	6.5	20.8	37.6	25.4	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.2		
0.375"	94.9		
#4	90.3		
#10	83.8		
#20	75.2		
#40	63.0		
#60	49.6		
#100	36.4		
#200	25.4		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 4.5604 D_{85}= 2.3297 D_{60}= 0.3733
D_{50}= 0.2534 D_{30}= 0.1051 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.12.19 **Date Tested:** 09.16.19

Tested By: IA

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Borings **Depth:** 8-10' **Date Sampled:**
Sample Number: B-5 / S-5

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Geotechnical
Project: Mixed-Use Redvelopment
New Bedford, MA
Project No: 74-19-0002.101 **Figure** 19-S-1827