REPORT

August 11, 2015
13-0912.3 S

Geotechnical Engineering Services

Proposed Buildings C & D
100 West Commercial Street
Portland, Maine

PREPARED FOR:
New Yard LLC
Attn: Phineas Sprague
40 West Commercial Street
Portland, Maine 04101

PREPARED BY:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039
207-657-2866

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

www.swcole.com

TABLE OF CONTENTS

S.W.COLE ENGINEERING, INC.
www.swcole.com

13-0912.3 S

August 11, 2015

New Yard LLC
Attn: Phineas Sprague
40 West Commercial Street
Portland, Maine 04101

Subject: Geotechnical Engineering Services
Proposed Buildings C & D
100 West Commercial Street
Portland, Maine

Dear Phin:

In accordance with our Contract Addendum, dated July 28, 2015, we have performed subsurface explorations for the subject project. This report presents our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed building construction. Our scope of services included observing six test pit explorations, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Proposed Construction

The site is situated along the northern bank of the Fore River on West Commercial Street in Portland, Maine. We understand a pre-engineered metal building is proposed along the northern edge of the site. According to plans prepared by FST (project civil engineer) the building will occupy a plan area of about 24,050 SF with a finished floor

elevation of 16.0 feet (project datum). Existing grades range from about elevation 13 to elevation 22 feet across the site. We understand the northern wall of the building will be notched into land rising toward West Commercial Street requiring a 6 to 7 foot tall retaining/foundation wall to accommodate the grade change. Additionally, we understand the southern wall of the building will have a truck dock raised above adjacent grades.

Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Six test pits (TP-101 through TP-106) were made at the site on August 4, 2015 by Gorham Sand & Gravel (GS&G) working under subcontract to New Yard, LLC. The exploration locations were selected and established by S.W.COLE based on measurements from proposed building corners established by others. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the explorations are attached as Sheets 2 through 4. A key to the notes and symbols used on the log is attached as Sheet 5. The ground surface elevations shown on the logs were estimated based on topographic information shown on Sheet 1.

2.2 Testing

The soils were visually classified as they were encountered in the explorations.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site is located on the southern side of West Commercial Street along the Fore River in Portland, Maine. The site slopes downward from about elevation 22 feet along West Commercial Street to a former rail yard at about elevation 13 feet. A recently constructed railroad track bisects the site before reaching the Fore River. Existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

3.2 Soil and Bedrock

Test pits TP-101, TP-102 and TP-106 were made in the area of the former rail yard and encountered 2 to 4 feet of uncontrolled fill overlying undisturbed native deposits of silty sand layered with silty clay between approximate elevations 9 to 10 feet. Test pits TP-103, TP-104 and TP-105 were made on the high side of the site along West Commercial Street and encountered 7 to 9 feet of uncontrolled fill overlying undisturbed deposits varying from stratified silty sand and silty clay to gray silty clay between elevations 12 to 14 feet.

Not all the strata were encountered at each of the explorations; refer to the attached logs for more detailed descriptions of the subsurface findings.

3.3 Groundwater Conditions

The soils encountered at the explorations were generally moist to wet. Free groundwater was not encountered at the time of exploration. Groundwater levels are anticipated to be tidally influenced from the nearby Fore River and will fluctuate in response to periods of snowmelt and precipitation, as well as changes in site use.

3.4 Seismic and Frost Conditions

Based on the subsurface findings and our experience on the adjacent site, we interpret the site soils to correspond to Seismic Soil Site Class E according to 2012 IBC. The 100-year Air Freezing Index for the Portland, Maine area is about 1,407-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations are:

- The existing fill must be removed beneath the proposed building foundations and replaced with compacted Structural Fill. The existing fills beneath the proposed retaining/foundation wall along the northern side of the building must be removed and replaced with crushed stone wrapped in non-woven geotextile fabric. The existing fills below slab areas should be densified prior to adding new fill.

- Spread footing foundations and on-grade floor slabs bearing on properly prepared subgrades appear appropriate for the proposed construction.

- Perimeter foundation underdrain pipes should be installed within the geotextile fabric wrapped crushed stone mat below the retaining/foundation wall along the northern side of the building.

- Imported Structural Fill, Crushed Stone and Subbase Gravel will be needed for construction. The existing ash-laden fills may be reused to raise site grades and backfill portions of the northern foundation/retaining wall. The existing sandy fills may be reused as Granular Borrow to raise building grades. The existing clay fills are unsuitable for building, pavement or gravel surfaced yard areas, but may be reused in landscape areas.

4.2 Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. All organics, topsoil, roots and railroad timbers must be removed from the site. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

Footing Subgrades: Existing uncontrolled fills must be completely removed from beneath the proposed building foundations until undisturbed native non-organic soils are encountered. Overexcavation of existing uncontrolled fills should extend 1-foot horizontally outward from outer edge of perimeter footings for each foot of excavation depth (1H:1V bearing splay). Overexcavations should be backfilled with compacted Structural Fill, except the northern foundation/retaining wall should be backfilled with at least 18 inches of Crushed Stone wrapped in non-woven geotextile fabric. S.W.COLE should observe exposed native soils prior to placement of compacted Structural Fill and geotextile wrapped crushed stone mats below the footings.

Slab Subgrades: We recommend the existing uncontrolled fills beneath slab areas be densified with 3 to 5 passes of a 10 ton vibratory roller compactor. Areas that become soft or yielding should be removed and replaced with compacted Granular Borrow.

4.3 Excavation and Dewatering

Excavation work will generally encounter existing fills, native layered silty sand and silty clay and native silty clays. Care must be exercised during construction to minimize disturbance of the bearing soils. We recommend that excavations be completed with a smooth-edged bucket to help lessen disturbance of native soils and foundation bearing surfaces.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. The layer of geotextile wrapped Crushed Stone recommended below northern foundation/retaining wall footing will provide a media from which to sump and pump, as needed. Controlling the water levels to below planned excavation depths will help stabilize subgrades during construction.

Excavations must be properly shored and/or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. The contractor is ultimately responsible for dewatering and stability of excavations.

4.4 Foundations

For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

Geotechnical Parameters for Spread Footings	
Design Frost Depth	4.5 feet
Net Allowable Soil Bearing Pressure	2.0 ksf
Base Friction Factor	0.35
Unit Weight of Backfill	130 pcf
At-Rest Lateral Earth Pressure Coefficient	0.5
Active Lateral Earth Pressure Coefficient	0.3
Internal Friction Angle of Backfill	30°
Seismic Soil Site Class (2015 IBC)	E

Footings should be at least 18-inches in width regardless of bearing pressure. We recommend design consider post-construction settlement of 1-inch total and ½-inch differential. Foundation and retaining walls that are restrained from rotation must be designed considering the at-rest lateral earth pressure.

4.5 Foundation Drainage

We recommend an underdrain pipe be installed within the geotextile fabric wrapped crushed stone mat below the northern foundation wall. The underdrain system should consist of a 4-inch diameter, perforated SDR-35 foundation drain pipe surrounded by at least 6-inches of Crushed Stone, fully enveloped in non-woven geotextile, such as Mirafi 180N or equivalent. The underdrain pipe must be connected to a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive drainage. General underdrain details are shown on Sheet 6.

4.6 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 100 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill overlying properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material shall be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.7 Entrance Slabs

Entrance slabs adjacent to buildings must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and sidewalks. We recommend that clean, non-frost susceptible sand and gravel meeting the requirements

of Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width of the entrance slabs and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement subbase gravel at a 3H:1V or flatter slope. General details of this frost transition zone are illustrated on Sheet 6.

4.8 Backfill and Compaction

We recommend the following fill and backfill materials for use during construction:

Granular Borrow: Sand or silty sand meeting the requirements of MDOT Standard Specification 703.19 Granular Borrow. Granular Borrow is recommended for use as:

- Fill to raise building grades and backfill overexcavations (dry and non-freezing conditions and over dry subgrades)

Structural Fill: Clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below.

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Structural Fill is recommended for use as:

- Backfill for overexcavations below footings
- Backfill for building foundations and below entrance slabs
- Base gravel below on-grade floor slabs

Crushed Stone: Crushed Stone used below the northern foundation/retaining wall footing and underdrain should consist of crushed rock meeting the gradation requirements of MDOT Standard Specifications 703.22 “Underdrain Backfill Type C”.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted in loose lifts not exceeding 12-inches with 2 to 3 passes of a vibratory plate compactor with a static weight of at least 600 lbs.

4.9 Weather Considerations

Construction activity should be limited during wet weather and the site soils may require drying before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE should be retained to review the foundation and earthwork construction documents to determine that our geotechnical recommendations have been properly interpreted and implemented.

A soils and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to provide earthwork observations as well as testing services for soils, concrete, asphalt, steel and spray-applied fireproofing construction materials.

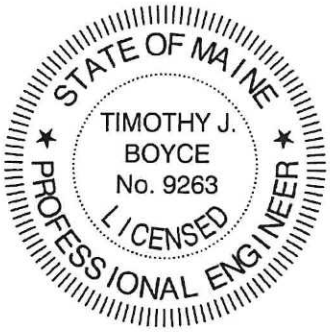
5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of your project.

Sincerely,

S. W. Cole Engineering, Inc.

Digitally signed by Timothy J. Boyce
Date: 2019.02.08 15:39:13 -05'00'



Timothy J. Boyce, P.E.
Senior Geotechnical Engineer

TJB:rec

Attachment A
Limitations

This report has been prepared for the exclusive use of New Yard, LLC for specific application to the proposed Buildings C & D at 100 West Commercial Street in Portland, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

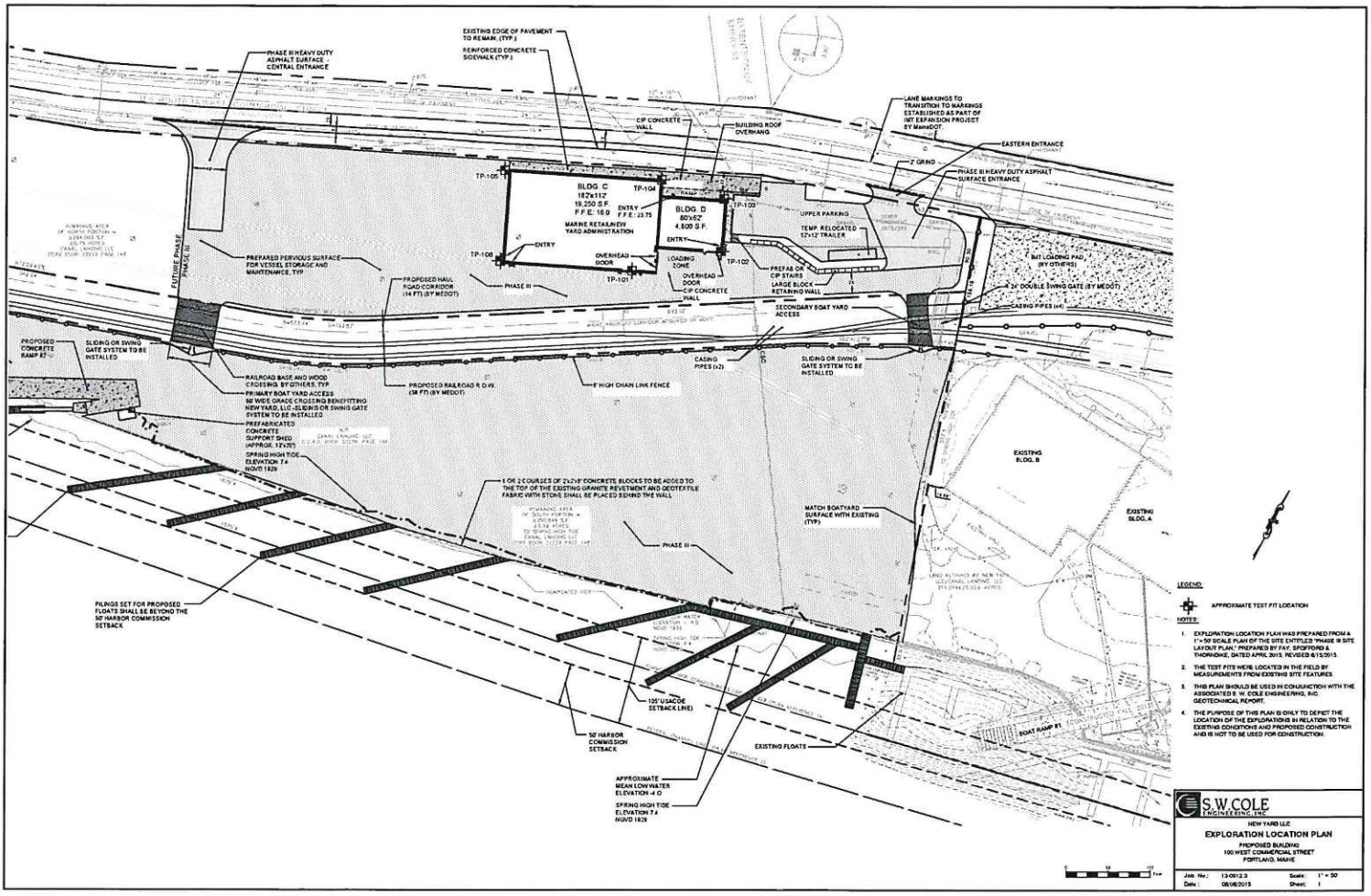
The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

Reviewed for Code Compliance
Permitting and Inspections Department
Approved with Conditions
02/21/2019



S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT/CLIENT: PROPOSED RETAILS BUILDINGS C & D / NEW YARD, LLC
LOCATION: 100 WEST COMMERCIAL STREET, PORTLAND, MAINE

PROJECT NO.: 13-0912.3
SWC REP.: TJB

TEST PIT TP-101

DATE: 8/4/2015 SURFACE ELEVATION: ~ 13' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		2'	BLACK COAL ASH (FILL)	
		3'	TAN-OXIDE GRAVELLY SAND SOME SILT (FILL)	
			LAYERED TAN-OXIDE MOTTLED SILTY SAND AND OLIVE BROWN SILTY CLAY	
			BOTTOM OF EXPLORATION @ 5'	

COMPLETION DEPTH: 5' DEPTH TO WATER: NO FREE GROUNDWATER

TEST PIT TP-102

DATE: 8/4/2015 SURFACE ELEVATION: ~ 13' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		2'	BLACK COAL ASH (FILL)	
		3'	TAN-OXIDE GRAVELLY SAND SOME SILT (FILL)	
			LAYERED TAN-OXIDE MOTTLED SILTY SAND AND OLIVE BROWN SILTY CLAY	
			BOTTOM OF EXPLORATION @ 6'	

COMPLETION DEPTH: 6' DEPTH TO WATER: NO FREE GROUNDWATER

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT/CLIENT: PROPOSED RETAILS BUILDINGS C & D / NEW YARD, LLC
LOCATION: 100 WEST COMMERCIAL STREET, PORTLAND, MAINE

PROJECT NO.: 13-0912.3
SWC REP.: TJB

TEST PIT TP-103

DATE: 8/4/2015 SURFACE ELEVATION: ~ 21' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		2'	BLACK COAL ASH (FILL)	
		7'	GRAY-BROWN SILTY CLAY (FILL)	
		9'	TAN FINE TO MEDIUM SAND TRACE SILT (FILL)	
			LAYERED TAN-OXIDE MOTTLED SILTY SAND AND OLIVE-BROWN SILTY CLAY	
			BOTTOM OF EXPLORATION @ 10'	

COMPLETION DEPTH: 10' DEPTH TO WATER: NO FREE GROUNDWATER

TEST PIT TP-104

DATE: 8/4/2015 SURFACE ELEVATION: ~ 22' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		3'	BROWN SILTY SAND AND BLACK COAL ASH (FILL)	
		4'	TAN SILTY FINE SAND (FILL)	
		8'	OLIVE-BROWN SILTY CLAY (FILL) BOTTOM OF EXPLORATION @ 6'	
			GRAY SILTY CLAY	
			BOTTOM OF EXPLORATION @ 11'	

COMPLETION DEPTH: 11' DEPTH TO WATER: NO FREE GROUNDWATER

S.W.COLE ENGINEERING, INC.

TEST PIT LOGS

PROJECT/CLIENT: PROPOSED RETAILS BUILDINGS C & D / NEW YARD, LLC
LOCATION: 100 WEST COMMERCIAL STREET, PORTLAND, MAINE

PROJECT NO.: 13-0912.3
SWC REP.: TJB

TEST PIT TP-105

DATE: 8/4/2015 SURFACE ELEVATION: ~ 21' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		4'	BROWN-BLACK SILTY SAND WITH BRICK AND ASH (FILL)	
		7'	TAN SILTY SAND (FILL)	
			LAYERED TAN-OXIDE MOTTLED SILTY SAND AND OLIVE BROWN SILTY CLAY	
			BOTTOM OF EXPLORATION @ 10'	

COMPLETION DEPTH: 10' DEPTH TO WATER: NO FREE GROUNDWATER

TEST PIT TP-106

DATE: 8/4/2015 SURFACE ELEVATION: ~ 13' LOCATION: SEE SHEET 1

SAMPLE NO.	SAMPLE DEPTH	DEPTH (FT)	STRATUM DESCRIPTION	TEST RESULTS
		4'	BLACK-BROWN ASH AND SAND WITH WOOD TIMBERS (FILL)	
			LAYERED TAN-OXIDE MOTTLED SILTY SAND AND OLIVE BROWN SILTY CLAY	
			BOTTOM OF EXPLORATION @ 6' NOTE: RELIC CLAY PIPE ON EDGE OF TEST PIT WITH CLEAR WATER	

COMPLETION DEPTH: 6' DEPTH TO WATER: NO FREE GROUNDWATER

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

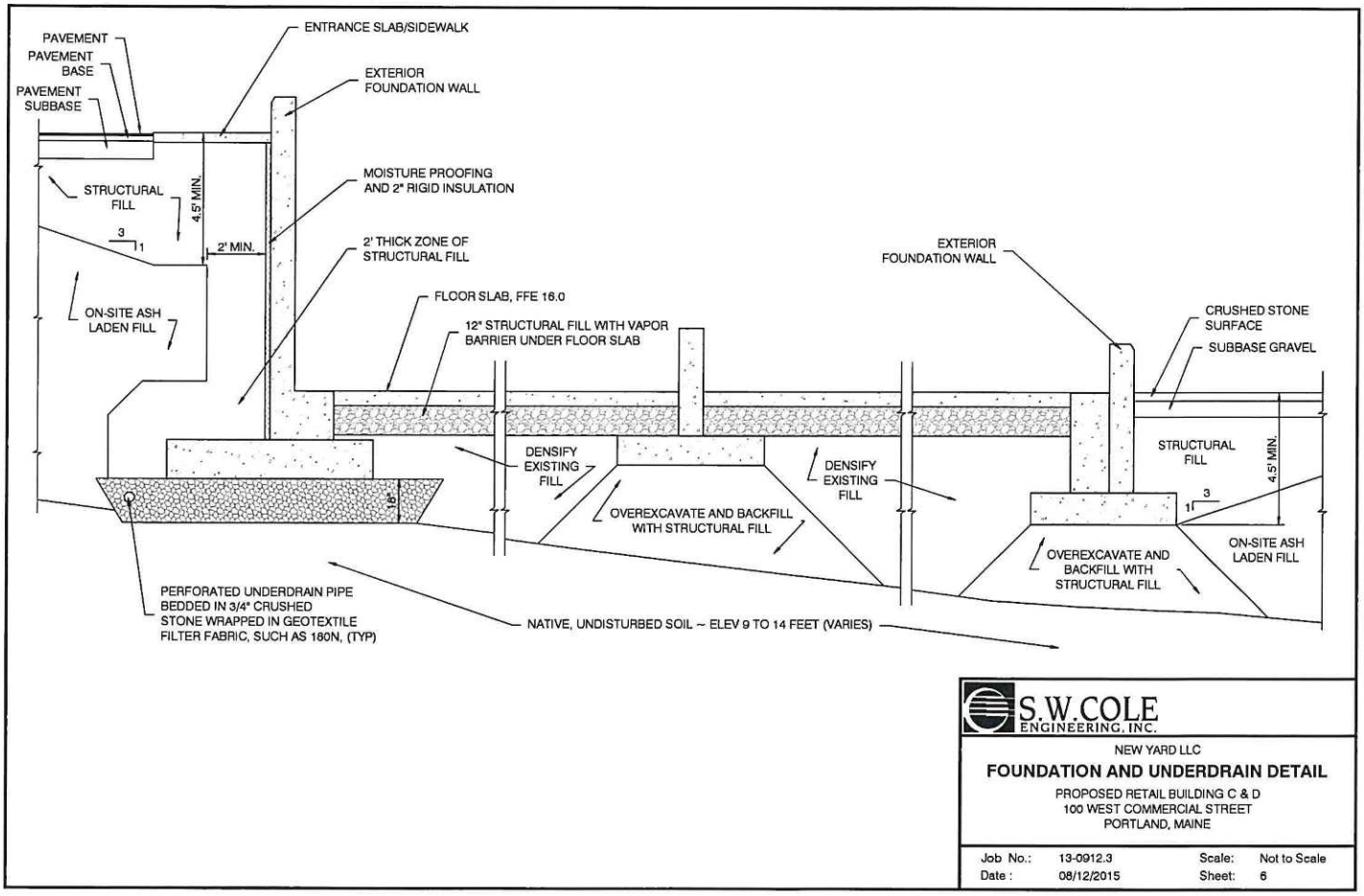
Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.



S.W.COLE ENGINEERING, INC.

NEW YARD LLC

FOUNDATION AND UNDERDRAIN DETAIL

PROPOSED RETAIL BUILDING C & D
100 WEST COMMERCIAL STREET
PORTLAND, MAINE

Job No.:	13-0912.3	Scale:	Not to Scale
Date :	08/12/2015	Sheet:	6