20. SOILS

In accordance of Section 7 of the City's Technical Manual, Level III Site Plan applications are required to submit a soil survey. The site is located in a developed area of urban fill. In lieu of a soil survey, we are submitting a geotechnical report that has been prepared and stamped by a professional engineer.

Geotechnical data has been collected at the site and a Preliminary Geotechnical Report has been prepared by S.W. Cole Engineering, Inc. A copy of the July 2017 report is attached. Eight test borings were completed in February and March of 2017, and these borings were supplemented by data collected from borings completed in 1995 and 1989. Additional borings are planned for the site to provide supplemental information for the final foundation design.

The geotechnical investigation found that beneath the existing paved surface of the parking lot are layers of urban fill, glaciomarine soils including sand, silt, and clay, and glacial till, with bedrock at depths ranging from 34 to 62 feet. Due to the soil conditions encountered on the site, the garage will be founded on piles.

20.1 Attachments

- Preliminary Geotechnical Report, dated July 11, 2017, by S.W. Cole Engineering, Inc.

REPORT

17-0103 S

July 11, 2017

Explorations and Preliminary Geotechnical Engineering Services

Proposed Parking Structure
222 St. John Street
Portland, Maine

Prepared For:
Cowcatcher, LLC
c/o East Brown Cow Management, Inc.
Attention: Denine Leeman
100 Commercial Street, Suite 306
Portland, Maine 04101

Prepared By:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039
T: 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

17-0103 S

July 11, 2017

Cowcatcher, LLC
c/o East Brown Cow Management, Inc.
Attn: Denine Leeman
100 Commercial Street, Suite 306
Portland, Maine 04101

Subject: Explorations and Preliminary Geotechnical Engineering Services
Proposed Parking Structure
222 St. John Street
Portland, Maine

Dear Denine,

In accordance with our Proposal, dated February 8, 2017, we have performed subsurface explorations and a geophysical survey for the subject project. This report summarizes our findings and preliminary geotechnical recommendations and its contents are subject to the limitations set forth in Appendix 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 provide a preliminary geotechnical assessment of feasible foundation types associated with the proposed construction. Our scope of services included a review of prior explorations, performing eight test boring explorations, soils laboratory testing, a geophysical survey, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The site is a rectangular parking lot at 222 St. John Street in Portland, Maine. Based on the information provided, we understand development plans call for construction of a new eight to ten-story parking structure. We understand the structure will be a pre-cast reinforced concrete frame with pre-cast concrete decks and an on-grade, asphalt paved level at approximately elevation 25 to 26 feet (project datum). Based on information provided by Becker Structural Engineers (project structural engineer), we understand the structure will have maximum column loading of about 2,465 kips.

Proposed and existing site features are shown on the "Exploration Location Plan" attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

S. W. Cole Engineering, Inc. (S.W.COLE) coordinated and logged a test boring exploration program at the site and reviewed prior site exploration data as follows:

2.1.1 Current Explorations

Eight test borings (B-201 through B-206, including B-203A and B-203B) were made at the site on February 27 through March 3, 2017 by S. W. Cole Explorations, LLC, a subsidiary of S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected in conjunction with Becker Structural Engineers and established in the field by S.W.COLE using measurements from existing site features. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the test borings and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the "Exploration Location Plan".

2.1.2 Prior Explorations

We reviewed explorations made at the site for previously proposed developments, including:

- Seven test borings (B-1 through B-5, including B-2A and B-5A) made in 1989;
- Eight test borings (B-101 through B-108) made in 1995

The approximate locations of these test borings are shown on the "Exploration Location Plan" attached in Appendix B. Logs of these prior explorations are also attached in Appendix C.

2.2 Testing

The test borings were drilled using a combination of solid stem auger and cased wash-boring techniques. The soils were sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. Pocket penetrometer testing (PPT) was performed on split spoon samples of stiffer silty clay soils, where encountered. Shelby tube sampling and Vane Shear Testing (VST) was performed where softer silty clay soils were encountered. SPT blow counts, as well as PPT and VST results, are shown on the logs.

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Atterberg Limits and moisture content test results are noted on the logs. The results of a one-dimensional laboratory consolidation test, performed as part of the prior 1990 study, are attached in Appendix D.

2.3 Geophysical Survey

Hager-Richter Geoscience, Inc. (Hager-Richter) of Salem, New Hampshire, working under subcontract to S.W.COLE, performed a geophysical survey at the site on June 3 and 4, 2017. The purpose of the survey was to assess shear wave velocities of soil and bedrock beneath the site for use in determining Seismic Soil Site Class per IBC, and to obtain additional depth to bedrock information. A geophysical survey report prepared by Hager-Richter is attached as Appendix E.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site is located at 222 St. John Street in Portland, Maine and currently consists of a large paved parking lot. Existing grade is relatively flat and level with existing ground surface varying from about elevation 26 to 27 feet. The site is located adjacent to an active railroad alignment and we understand portions of the site were historically used as a train yard. Existing site features are shown on the “Exploration Location Plan” attached in Appendix B.

3.2 Soil and Bedrock

Available soils mapping and the subsurface findings at the explorations indicate the site is located at the margin of Presumpscot Formation glaciomarine sands, silts, and clays and a marine fan deposit of primarily sand and gravel. Underlying a surficial layer of pavement, the borings generally encountered a thin layer of fill soils overlying the glaciomarine and marine fan deposits, overlying glacial till mantling bedrock at depth. The principal strata encountered are summarized below. Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

Fill: Underlying surficial pavement, the borings encountered fill consisting of brown and black sand with varying portions of silt, gravel, and ash-like material. The fill extended to depths varying from approximately 1.5 to 5 feet below the ground surface.

Glaciomarine Soils: Underlying the fill or interbedded in the marine fan sand and gravel, borings B-202, B-204, and B-206, as well as several prior borings made in the northwestern portion of the site, encountered varying thickness of glaciomarine soils consisting of gray to gray-brown sand, silt, and silty clay with some shells. The glaciomarine soils at boring B-202 consisted of relatively soft, compressible gray silty clay at depth intervals of about 2 to 13.5 feet and 30 to 36 feet.

Marine Fan Sand and Gravel: Underlying the fill and underlying or interbedded amongst the glaciomarine soils, the borings encountered brown sand with varying portions of silt, gravel, cobbles and boulders.

Glacial Till: A relatively thin layer of glacial till, up to about 5 feet in thick, was encountered mantling the bedrock surface at the borings. The glacial till consisted of gray sand with varying portions of silt and gravel.

Bedrock: Bedrock was encountered at depths varying from approximately 34 to 62 feet at the borings, and generally appears to be trending deeper to the south. A thin surficial layer of weathered bedrock was penetrated by the drill tooling at some locations. A rock core retrieved at boring B-206 indicates the bedrock consist of gray Phyllite with an RQD of 44.

The Hager-Richter geophysical survey findings generally concur with the depth to bedrock trends encountered at the borings; discussion of depth to bedrock, as well as a bedrock elevation plan (Figure 5) are included in the Hager Richter report, attached as Appendix E.

3.3 Groundwater

Saturated soils or free water were encountered at the borings at depths varying from about 3 to 15 feet. Groundwater likely becomes perched on the relatively impervious silty clay encountered beneath a portion of the site. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

3.4 Frost and Seismic

The 100-year Air Freezing Index for the Portland, Maine area is about 1,410-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the Hager-Richter geophysical survey findings, we interpret the site soils to correspond to Seismic Soil Site Class D according to 2009/2015 IBC (shear wave velocity method).

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 include:

- The proposed parking structure will need to derive support from deep foundations, such as driven H-piles or drilled shafts. Alternatively, the proposed structure may be supported on spread footings bearing on ground improved with rigid inclusions.

- The dead load of the foundation system may be used for uplift resistance. Additionally, rock anchors installed through pipe piles or steel casing may be used to resist structural uplift loading. Battered piles and drilled shafts may be used to resist lateral loads. Lateral earth pressures acting on the sides of foundations may also be used to resist lateral loads.

- The asphalt paved on-grade garage level may be supported on properly prepared soil subgrades using a conventional asphalt pavement section. If overhead clearance is tight on the ground level, we recommend installing insulation below the paved surface to mitigate potentially adverse frost heaving.

- The site was formerly used for rail operations and ash-like material was observed in the fills at some locations. We recommend the fill soils be characterized for environmental handling purposes prior to construction. As discussed, impacted soils may be able to be reused beneath the first floor ramp to avoid potentially costly export and off-site disposal.

- Imported materials, such as Crushed Stone, Structural Fill, and pavement gravels will be needed for construction.

4.2 Foundation and On-Grade Level Considerations

Given the magnitude of proposed structural loading and the subsurface findings, the parking structure will need to be supported on deep foundations, such as driven H-piles or drilled shafts. Alternatively, the structure may be supported on spread footings bearing on soils improved with rigid inclusions. Discussion of these foundation options follows:

4.2.1 Driven Piles

The proposed structure may be supported on steel H-piles fitted with cast driving tips, driven to end bearing on bedrock. Driven piles should ultimately be designed, sized and installed by a qualified design-build contractor. A driven pile submittal stamped by a Maine licensed professional engineer should be provided for review by the project team. We offer the following H-pile sizes and allowable axial compressive capacities for preliminary design consideration:

RECOMMENDED H-PILE CAPACITIES	
50 ksi Steel H-pile Section	Allowable Axial Compressive Capacity (kips)
HP 10 X 57	225
HP 12 X 84	345
HP 14 X 117	500
Notes: Piles driven to practical refusal on hard sound bedrock with cast driving tips and 0.0625-inch (1/16”) corrosion allowance.	

Pipe piles may be installed at discrete locations to allow for installation of drilled rock anchors for uplift resistance.

We recommend that pile caps for columns be supported by at least two piles if laterally tied together by grade beams or tie beams and three piles if laterally isolated. Grade beams supporting walls may be supported by a single line of alternating piles below the grade beam, as deemed necessary by the structural engineer.

Piles should be spaced a minimum center-to-center distance of at least 3 pile diameters, but no less than 30 inches. Pile caps and grade beams exposed to freezing temperatures should be covered with at least 4.5 feet of soil for frost protection.

Lateral Resistance: Battered piles may be driven to resist lateral loads. Alternatively, lateral resistance acting on the sides of grade beams and pile caps backfilled with compacted Structural Fill may provide some lateral resistance. Depending upon the amount of deflection, lateral earth resistance should consider a total unit weight of granular backfill (γt) of 125 pcf, an angle of internal friction of 30 degrees with an at-rest lateral earth pressure coefficient (Ko) of 0.5 and an ultimate passive lateral earth pressure coefficient (Kp) of 3.0. Additional resistance to lateral loads can be mobilized along the pile shafts, if needed. S.W.COLE can assist with lateral capacities, as deemed necessary by the structural engineer.

Pile Load Test: For piles with a capacity over 40 tons (80 kips), we recommend the contractor coordinate a test pile program including monitoring of several piles with a Pile Driving Analyzer (PDA) to determine pile and driving equipment compatibility as well as to define the “set” criteria and allowable pile capacity. The test pile program should include PDA monitoring of the test piles during re-strikes in order to assess pile capacity. The pile driving contractor should submit a WEAP analysis and information relative to pile driving equipment prior to beginning driving. S.W.COLE should be engaged to observe pile driving and pile load testing activities.

4.2.2 Drilled Shafts

The proposed parking structure may be supported on drilled shafts socketed into bedrock. Drilled shafts should be socketed at least 2 feet into competent bedrock. Deeper rock sockets may be required depending on the load requirements.

The base of the rock sockets should be leveled and cleaned of loose material and soil. We recommend deep foundations be drilled using steel casing within the overburden soils in order to maintain sidewall stability. Prior to installing reinforcing steel, S.W.COLE should observe the base of each drilled foundation. Temporary steel casings should be removed during concrete placement while maintaining a positive head of concrete above the casing bottom to maintain shaft sidewall stability.

Considering the subsurface conditions encountered, we anticipate drilled shaft axial capacity will be controlled by the concrete compressive strength. We recommend an allowable end-bearing pressure of 20 ksf utilizing a factor of safety of 2.0. For piers socketed deeper than two feet, additional axial compressive capacity can be mobilized from skin friction between the pier and rock socket. For a design concrete strength of 4,000 psi, a unit skin friction of 17 ksf is recommended for the portion of the pier socketed greater than two feet into bedrock. For a design concrete strength of 5,000 psi, a unit skin friction of 20 ksf is recommended for the portion of the pier socketed greater than two feet into bedrock.

Uplift resistance of drilled shafts can be developed from skin friction between the drilled shaft and soil and bedrock, as well as the dead weight of the drilled shaft. S.W.COLE can assist with uplift capacities as deemed necessary by the structural engineer.

4.2.3 Ground Improvement

The proposed structure may be supported on spread footing foundations bearing on soils improved by rigid inclusions. Rigid inclusions in granular soils consist of cast-in-place, grouted or cemented aggregate columns, typically installed by rammed or vibroflot methods. Rigid inclusions in clay soils consist of cast-in-place ready mix concrete installed by vibratory mandrel methods under positive pressure to create a concrete shaft. In both cases, load transfer platforms of compacted crushed gravel and geotextile are installed over the improved ground to support spread footings. The rigid inclusions stiffen the soils to reduce settlement and increase bearing capacity for spread footings. Rigid inclusions are designed and installed by a specialty geotechnical contractor. Based on preliminary discussion with a regional contractor, we understand that net allowable soil bearing pressures of 8 to 10 ksf may be feasible. If the ground improvement option is selected, we recommend a design-phase test program be implemented prior to construction, consisting of full scale installation and modulus testing of several rigid inclusions across the varied subsurface conditions encountered in the test borings drilled at the site.

4.2.4 On-Grade Level

The paved on-grade level may be supported on properly prepared soil subgrades using a conventional asphalt pavement section. Existing pavement, utilities, structures, and foundations will need to be completely removed and replaced with compacted Granular Borrow below new paved areas. Existing fills will need to be proof-rolled and soft areas repaired prior to placing pavement gravels. Woven geotextile will be needed over clayey pavement subgrades in the northwest portion of the garage footprint.

If overhead clearance is less than 6 inches on the ground level, we recommend installing insulation below the paved surface to help mitigate potentially adverse frost heaving.

4.3 Excavation and Dewatering Considerations

Excavation work will generally encounter granular fills with ash-like material, silty clay, sand and gravel. Care must be exercised during construction to reduce strength loss of the native soils from disturbance. Earthwork and grading activities should ideally occur during drier, non-freezing weather of Spring, Summer and Fall. Rubber tired construction equipment should not operate directly on the native clays. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce soil disturbance.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor.

The site was formerly used for rail operations and ash-like material was observed in the fills at several exploration locations. We recommend the fill soils be characterized for environmental handling purposes prior to construction. As discussed, impacted soils may be able to be reused beneath the first floor ramp to avoid potentially costly export and off-site disposal.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We recommend a design-phase geotechnical evaluation be undertaken once the site layout and structural layout has been further defined. We look forward to working with you as the project progresses.

Sincerely,

S. W. Cole Engineering, Inc.

Evan M. Walker, P.E.
Geotechnical Engineer

STATE OF MAINE
EVAN MICHAEL WALKER
No. 12847
LICENSED
PROFESSIONAL ENGINEER

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

STATE OF MAINE
TIMOTHY J. BOYCE
No. 9263
LICENSED
PROFESSIONAL ENGINEER

EMW:tjb

Appendix A - Limitations

This report has been prepared for the exclusive use of Cowcatcher, LLC for specific application to the proposed Parking Structure at 222 St. John Street in Portland, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services 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.

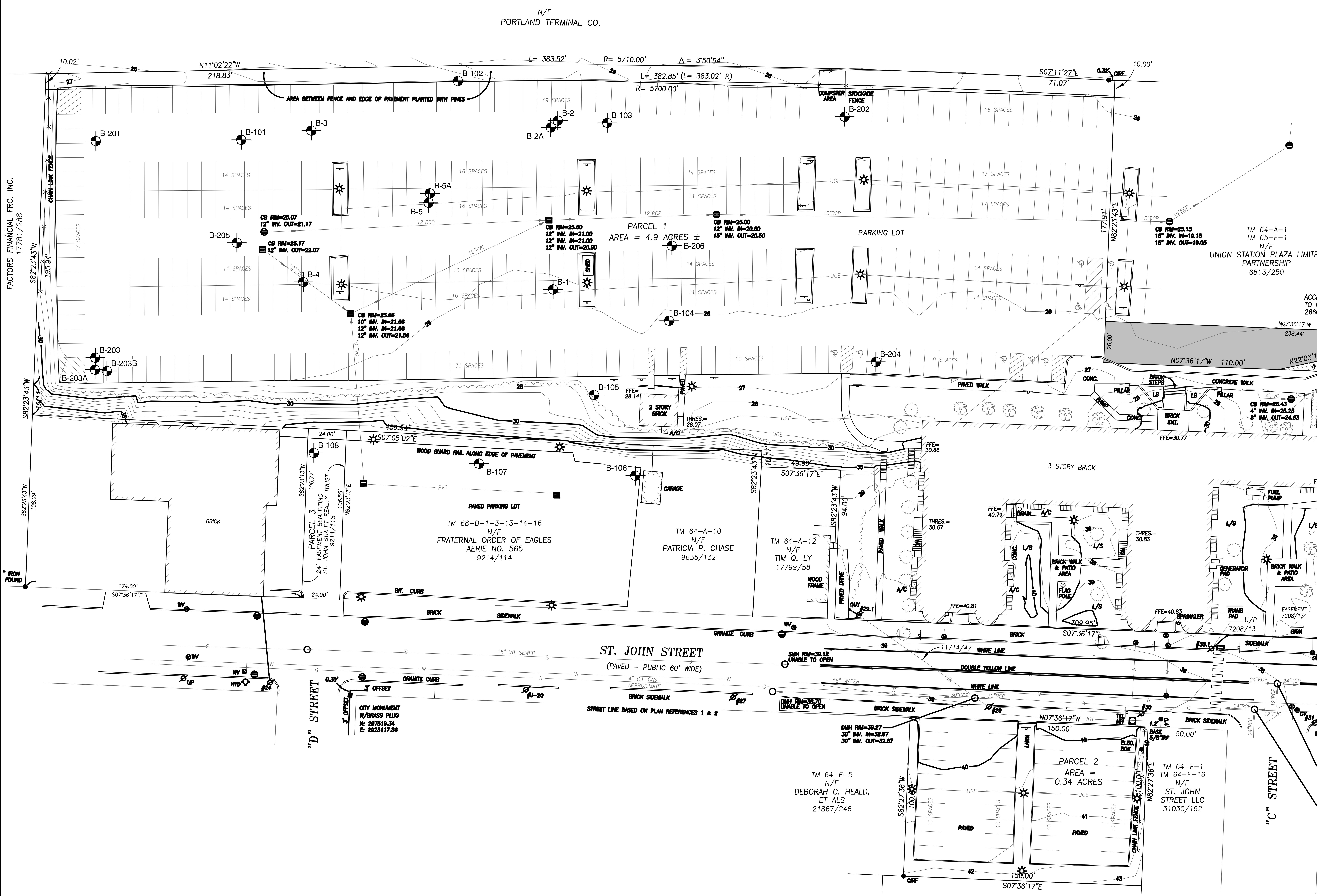
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services 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.

APPENDIX B

FIGURES



LEGEND:

⊕ APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=30' SCALE PLAN OF THE SITE ENTITLED "BOUNDARY SURVEY TOPOGRAPHIC SURVEY," PREPARED BY OWEN HASKELL, INC., DATED 11/16/2016.
5. THE BORINGS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
6. BORINGS B-1 THROUGH B-5 WERE COMPLETED BY S. W. COLE ENGINEERING, INC. (SWCOLE) IN 1989.
7. BORINGS B-101 THROUGH B-108 WERE CMPLETED BY SWCOLE IN 1995.
8. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
9. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 30 60 Feet

S.W.COLE
ENGINEERING, INC.

COWCATCHER, LLC

EXPLORATION LOCATION PLAN

PROPOSED PARKING STRUCTURE
222 ST. JOHN STREET
PORTLAND, MAINE

Job No.:	17-0103	Scale:	1" = 30'
Date :	03/15/2017	Sheet:	1

APPENDIX C

EXPLORATION LOGS AND KEY

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT:	Cowcatcher, LLC
PROJECT:	Proposed Parking Structure
LOCATION:	222 St. John Street, Portland, Maine
BORING NO.:	B-201
SHEET:	1 of 2
PROJECT NO.	17-0103
DATE START:	2/27/2017
DATE FINISH:	2/28/2017

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 26' +/- **TOTAL DEPTH (FT):** 64.0 **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic **HAMMER WEIGHT (lbs):** 140 / 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: **HAMMER DROP (inch):** 30 / 30
WATER LEVEL DEPTHS (ft): ∇ 10
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level: ∇ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Undisturbed Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
25			1D	D	0.5-2.5	24/16	4-6-11-12		0.3	Asphalt Pavement / Brown and Black Silty Gravelly SAND with Probable Ash (Fill)		
			2D	D	2.5-4.5	24/16	12-12-11-10		2.5	Brown Sand and GRAVEL, trace Silt		
20	5		3D	D	5-7	24/10	5-6-7-9			Brown Gravelly SAND, Some Silt		
15	10		4D	D	10-12	24/10	6-7-9-10				∇	
10	15		5D	D	15-17	24/12	6-5-6-7					
5	20		6D	D	20-22	24/8	10-9-8-9					
0	25		7D	D	25-27	24/8	5-4-5-7					
-5	30		8D	D	30-32	24/10	8-8-8-9					
-10	35		9D	D	35-37	24/20	5-5-8-9		35.0	Gray-Brown to Gray Sandy SILT, Some Clay		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-201
SHEET: 2 of 2
PROJECT NO. 17-0103
DATE START: 2/27/2017
DATE FINISH: 2/28/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
-15			10D		40-42	24/22	3-3-4-15			40.0 Gray with Black Layering Clayey Silt and SAND with Frequent Sand Layers		Gravelly Layer 41.8' - 43'
-20	45		11D		45-47	24/20	2-5-10-8			45.0 Brown Clayey SILT		
										46.0 Light Brown Fine to Medium SAND, Trace Silt		
-25	50		12D		50-52	24/22	9-11-21-35			50.0 Brown with Orange Staining Fine SAND with Trace to Some Silt		
-30	55		13D		55-57	24/22	11-14-15-17					
-35	60		14D		60-62	24/20	10-12-14-36			60.0 Gray Silty SAND, Some Gravel (Glacial Till)		
										61.6 Weathered Bedrock		
										62.0 Bedrock - Advance by Roller Cone		
										64.0 Bottom of Exploration at 64.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-202
SHEET: 1 of 2
PROJECT NO. 17-0103
DATE START: 2/28/2017
DATE FINISH: 2/28/2017

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 26' +/-
TOTAL DEPTH (FT): 47.0
LOGGED BY: Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted CME 850
AUGER ID/OD: N/A / N/A
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: 4 in / 4 1/2 in
CORE BARREL:
HAMMER EFFICIENCY FACTOR:
HAMMER DROP (inch): 30 / 30
WATER LEVEL DEPTHS (ft): ∇ 5
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Undisturbed Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Sample Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
25			1D	D	0.5-2.5	24/16	6-7-5-3			0.3 4" Asphalt Pavement Brown Gravelly SAND, Some Silt (Fill)		Soils Moist
			2D	D	2.5-4.5	24/20	3-4-3-4			2.2 Gray Clayey SILT, Some Sand, with Frequent Silty Sand Layers		Soils Wet
20	5		3D	D	5-7	24/20	WOH-WOH-WOH-WOH	q_P=0.5 ksf		5.0 Gray-Brown to Gray Silty CLAY with Occasional Sand Seams	∇	
15	10		1U	U	10-12	24/0						
			2U	U	12-14	24/14				13.5 Gray SAND, Trace Silt		
10	15		4D	D	15-17	24/6	4-4-5-6	w =27.5 %				
5	20		5D	D	20-22	24/16	1-1-1-1			20.0 Gray Silty SAND with Shells		
0	25		6D	D	25-27	24/14	4-6-7-7			25.0 Gray Medium to Coarse SAND, Trace Silt, Trace Fine Gravel		
-5	30		7D	D	30-32	24/14	1-2-2-2			30.0 Gray Silty CLAY		
-10	35		8D	D	35-37	24/16	2-2-12-9			36.0 Gray Silty Fine SAND with Frequent Clayey Seams		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING LOG

BORING NO.:	B-202
SHEET:	2 of 2
PROJECT NO.	17-0103
DATE START:	2/28/2017
DATE FINISH:	2/28/2017

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
-15			9D		40-42	24/24	1-2-3-6					
										41.5 Gray Gravelly Silt and SAND (Glacial Till)		
										44.0 Bedrock - Advance by Roller Cone		
	45											
-20												
										47.0 Bottom of Exploration at 47.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.: B-203
SHEET: 1 of 1
PROJECT NO. 17-0103
DATE START: 3/1/2017
DATE FINISH: 3/1/2017

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 26' +/- | **TOTAL DEPTH (FT):** 9.5 | **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted Mobile B-53 | **AUGER ID/OD:** N/A / 4 1/2 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Safety | **HAMMER WEIGHT (lbs):** 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No Free Water Observed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Undisturbed Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
25			1D	D	0.5-2.5	24/18	6-7-9-12			0.2 Asphalt Pavement 1.5 Black Silty SAND, Some Gravel (Fill) Brown Gravelly SAND, Some Silt		
			2D	D	2.5-4.5	24/14	12-20-16-15					
20	5		3D	D	5-7	24/15	7-17-20-30			5.0 Brown Sand and GRAVEL, Some Silt, with Cobbles		
										9.5		

Refusal at 9.5 feet
Refusal on Probable Boulder

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-203

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT:	Cowcatcher, LLC
PROJECT:	Proposed Parking Structure
LOCATION:	222 St. John Street, Portland, Maine

BORING NO.:	**B-203A**
SHEET:	1 of 1
PROJECT NO.	17-0103
DATE START:	3/1/2017
DATE FINISH:	3/1/2017

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 26' +/- **TOTAL DEPTH (FT):** 8.1 **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted Mobile B-53 **AUGER ID/OD:** N/A / 4 1/2 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Safety **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): No Free Water Observed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Undisturbed Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H₂0 Depth	Remarks
25										See Boring B-203 For Approximate Soil Strata Auger to 8.1' - No Sampling		
	5											
20												
										8.1 Refusal at 8.1 feet Refusal on Probable Boulder		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-203A**

BORING / WELL 17-0103.GPJ SWCE TEMPLATE.GDT 5/4/17

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.: B-203B
SHEET: 1 of 2
PROJECT NO. 17-0103
DATE START: 3/1/2017
DATE FINISH: 3/1/2017

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 26' +/- **TOTAL DEPTH (FT):** 62.0 **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Mobile B-53 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Safety / Safety **HAMMER WEIGHT (lbs):** 140 / 300 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): ∇ 15
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ∇ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Undisturbed Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H$_2$0 Depth	Remarks
25										See Boring B-203 for Approximate Soil Strata Auger to 10' - No Sampling		
20	5											
15	10		1D		10-12	24/15	7-9-7-8		10.0	Brown Gravelly SAND, Trace to Some Silt		Soils Damp
10	15		2D		15-17	24/14	8-8-8-10				∇	
5	20		3D		20-22	24/10	13-9-13-13					
0	25		4D		25-27	24/12	10-12-13-15					
-5	30								30.0	Brown SAND, Trace Gravel, Trace Silt		
									31.0	Brown Fine to Medium SAND, Some Silt		
-10	35								34.5	Gray Silty CLAY with Frequent Sand Seams and Layers		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203B
SHEET: 2 of 2
CLIENT: Cowcatcher, LLC
PROJECT NO. 17-0103
PROJECT: Proposed Parking Structure
DATE START: 3/1/2017
LOCATION: 222 St. John Street, Portland, Maine
DATE FINISH: 3/1/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Strata Depth	Sample Description & Classification	H_20 Depth	Remarks
-15										40.0	Brown Fine SAND, Trace Silt, With Occasional Clayey Silt Seams and Layers		
-20	45												
-25	50												
-30	55									55.0	Brown Silty Fine SAND with Occasional Clayey Silty Seams		
										56.0	Gray Silty CLAY with Frequent Sand Seams		
										58.0	Increased Drill Resistance - Probable Glacial Till		
-35	60									60.5	Probable Bedrock - Advance By Roller Cone		
										62.0	Bottom of Exploration at 62.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-203B

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-204
SHEET: 1 of 1
PROJECT NO. 17-0103
DATE START: 2/27/2017
DATE FINISH: 2/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | ELEVATION (FT): 27' +/- | TOTAL DEPTH (FT): 37.0 | LOGGED BY: Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC | DRILLER: Jeff Lee | DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted CME 850 | AUGER ID/OD: N/A / N/A | SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | HAMMER WEIGHT (lbs): 140 / 140 | CASING ID/OD: 4 in / 4 1/2 in | CORE BARREL:
HAMMER EFFICIENCY FACTOR: | HAMMER DROP (inch): 30 / 30
WATER LEVEL DEPTHS (ft): ∇ 5
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ∇ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Undisturbed Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Sample Depth (ft)	Pen./Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Strata Depth	Sample Description & Classification	H2O Depth	Remarks
										0.3	4" Asphalt Pavement		
25			1D	D	0.5-2.5	24/8	12-8-10-9				Black and Gray-Brown SAND, Some Gravel, Trace Silt (Fill)		
			2D	D	2.5-4.5	24/10	12-11-14-14				Gray to Gray-Brown Silty Gravelly SAND with Cobbles and Concrete (Fill)		Soils Moist
	5		3D	D	5-7	24/8	5-7-8-10			5.0	Brown Gravelly SAND, Some Silt	∇	
20													
	10		4D	D	10-12	24/14	5-5-4-2			10.0	Brown SAND, Some Gravel, Trace Silt, with Silty Seams		
15													
	15		5D	D	15-17	24/3	3-5-5-8			15.0	Brown Gravel and SAND, Some Silt		
10										18.0	Gray Silty CLAY with Frequent Sand Layers		Wash Turned Gray at 18'
	20		6D	D	20-22	24/22	WOH-WOH-3-4			21.0	Brown Silty Fine SAND with Frequent Silt and Clay Seams		
5													
	25		7D	D	25-27	24/18	5-5-3-4			25.0	Brown with Orange Staining Fine to Medium SAND, Trace Silt		
0													
	30		8D	D	30-32	24/12	4-5-11-9			29.0	Gray Silt and SAND, Some Gravel (Glacial Till)		Cobbles/Gravel at 29'
-5													
	35									34.0	Bedrock - Advance By Roller Cone		
-10										37.0	Bottom of Exploration at 37.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-204

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-205

PROJECT NO. 17-0103
DATE START: 3/2/2017
DATE FINISH: 3/2/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 25.5' +/- | **TOTAL DEPTH (FT):** 58.0 | **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Mobile B-53 | **AUGER ID/OD:** N/A / N/A | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Safety / Safety | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** 4 in / 4 1/2 in | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): ⊻ 10
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level: ⊻ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling. D = Split Spoon Sample; U = Undisturbed Tube Sample; R = Rock Core Sample; V = Field Vane Shear. Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot. WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector. S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
25			1D	D	0.5-2.5	24/18	10-12-12-13			0.3 Asphalt Pavement; 1.0 Black Silty SAND, Some Gravel (Fill); Brown Gravelly SAND, Trace Silt (Fill)		
			2D	D	2.5-4.5	24/18	9-10-9-10			2.5 Brown SAND, Some Gravel, Trace Silt		
20	5		3D	D	5-7	24/18	6-14-14-11			5.0 Brown Gravel and SAND, Trace Silt		Soils Damp
15	10		4D	D	10-12	24/10	4-9-7-8			Brown Gravelly SAND, Some Silt	⊻	
10	15		5D	D	15-17	24/6	5-7-17-11					
5	20		6D	D	20-22	24/0	8-11-12-20					
0	25		7D	D	25-27	24/3	10-9-10-11			Brown Silty Gravelly SAND with Cobbles		
-5	30		8D	D	30-32	24/12	12-14-13-19					
-10	35		9D	D	35-36.8	22/2	14-33-42-50-4"/4"					

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-205
SHEET: 2 of 2
PROJECT NO. 17-0103
DATE START: 3/2/2017
DATE FINISH: 3/2/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
-15			10D		40-42	24/20	9-8-7-10			40.0		
-20	45		11D		45-47	24/20	12-14-12-23			Brown Silty Fine SAND with Silt Seams		
										46.0 Gray Silty SAND with Frequent Silt Layers		
-25	50		12D		50-52	24/24	3-6-10-34			50.0 Gray Silty SAND, Some Gravel (Glacial Till)		
										53.9 Bedrock - Advance by Roller Cone		
-30	55											
										58.0 Bottom of Exploration at 58.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-206

PROJECT NO. 17-0103
DATE START: 3/3/2017
DATE FINISH: 3/3/2017

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 25.5' +/-
TOTAL DEPTH (FT): 45.9
LOGGED BY: Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted Mobile B-53
AUGER ID/OD: N/A / N/A
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Safety / Safety
HAMMER WEIGHT (lbs): 140 / 300
CASING ID/OD: 4 in / 4 1/2 in
CORE BARREL:
HAMMER EFFICIENCY FACTOR:
HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): ⊻ 3
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
⊻ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Undisturbed Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Sample Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Strata Depth	Sample Description & Classification	H_2O Depth	Remarks
25			1D	D	0.5-2.5	24/18	6-8-8-12			0.3	4" Asphalt Pavement		
											Black Silty SAND, Some Gravel (Fill)		
										1.8	Brown SAND, Some Gravel, Trace Silt (Probable Fill)	⊻	
			2D	D	2.5-4.5	24/18	10-13-15-13			2.5	Brown Medium to Coarse SAND, Trace Silt		
20	5		3D	D	5-7	24/22	6-6-7-9						
										6.0	Gray-Brown Silty SAND, Trace Gravel		
15	10		4D	D	10-12	24/14	3-8-7-8			10.5	Brown Medium to Coarse SAND, Trace Gravel, Trace Silt		
10	15		5D	D	15-17	24/6	4-9-9-12			15.0	Brown Gravelly SAND, Some Silt		
5	20		6D	D	20-22	24/10	5-5-4-7			20.0	Brown SAND, Some Silt, Trace Gravel		
0	25		7D	D	25-27	24/22	2-3-3-4			25.0	Gray Silty CLAY with Frequent Sand and Silt Seams		
-5	30		8D	D	30-32	24/15	3-4-19-34			30.0	Gray Medium to Coarse SAND, Trace Gravel, Trace Silt		
-10	35		9D	D	35-37	24/2	4-4-5-5			35.0	Gray Silty SAND, Some Gravel (Glacial Till)		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING NO.: B-206

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Cowcatcher, LLC
PROJECT: Proposed Parking Structure
LOCATION: 222 St. John Street, Portland, Maine

BORING NO.: B-206
SHEET: 2 of 2
PROJECT NO. 17-0103
DATE START: 3/3/2017
DATE FINISH: 3/3/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
-15			10D		40-40.8	9/9	8-50-3"/3"			40.8 Weathered Bedrock - Advance by Roller Cone		
			1R		40.9-45.9	60/60	44			40.9 Bedrock Gray PHYLLITE, medium hard, fine grained, closely spaced shallow to steep dipping fractures. Light oxidization.		
-20	45									45.9		

Bottom of Exploration at 45.9 feet

BORING / WELL 17-0103.GPJ SWCE TEMPLATE.GDT 5/4/17

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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+%

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to ½" 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.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-101
PROJECT NO. 94-716 S

DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 25.5'±

PROJECT/CLIENT: TRAIN STATION / CITY OF PORTLAND
LOCATION: 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORING, INC. DRILLER: DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"	ASPHALT
	1	24"	18"	2.5'	9	12	13	13		LIGHT BROWN SILTY FINE TO MEDIUM SAND W/SOME GRAVEL (FILL) ~~ MEDIUM DENSE ~~
									4.0'	
	2	24"	11"	6.5'	23	85	22	20		W= 2.4%
										BROWN GRAVELLY FINE TO COARSE SAND W/TRACE OF SILT ~~ DENSE TO MEDIUM DENSE ~~
	3	24"	8"	11.5'	7	9	10	13	11.5'	
										BOTTOM OF EXPLORATION AT 11.5'

SOIL CLASSIFIED BY:
- DRILLER-VISUALLY [X]
- SOIL TECHNICIAN-VISUALLY [X]
- LABORATORY TESTS [X]

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

2

BORING NO. B-101

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-102
PROJECT NO. 94-716 S
DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 26.0'±

PROJECT/CLIENT : TRAIN STATION / CITY OF PORTLAND
LOCATION 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM GREAT WORKS TEST BORING, INC. **DRILLER** DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	1	24"	16"	2.5'	3	7	7	6	4.0'	LIGHT BROWN MEDIUM TO COARSE SAND W/SOME GRAVEL AND TRACE OF SILT ~ MEDIUM DENSE ~ (FILL)
	2	12"	0	5.5'	1	1				GRAY SILTY CLAY
	1S	30"	30"	8.0'	HYD		PUSH			qu= 1.35 ksf W= 30.4% qp= 0.5-1.0 ksf
	2x3	VANE		8.5'						Sv= 1.38/0.40 ksf Wl= 30.1
	2x3	VANE		9.0'						Sv= 1.58/0.40 ksf Wp= 16.1
										~ MEDIUM ~
	3	24"	24"	11.5'	WOH/15"		1/3"	2	12'	W= 28.2%
	2x3	VANE		12.0'						Sv= 7.52/1.98 ksf
	2x3	VANE		12.5'						Sv= 8.01/2.77 ksf
										GRAY SILTY CLAY WITH FINE SAND LAYERS
	4	24"	24"	16.5'	WOIM/12"		2	2		W= 26.7% qp= 0.6 ksf
										~ MEDIUM ~
	5	24"	24"	21.5'	WOH/12"		WOH	WOIM		W= 26.9% qp= 1.0 ksf
									24'.	
										STIFFER SILTY CLAY OR MORE DENSE GRANULAR MATERIAL.
									29.5'	
										BOTTOM OF EXPLORATION AT 29.5'

ROD PROBE

DEPTH	BLOWS
21.5'-22.5'	2
22.5-23.5'	4
23.5'-24.5'	5
24.5'-25.5'	4
25.5'-26.5'	5
26.5'-27.5'	6
27.5'-28.5'	7
28.5'-29.5'	8

SOIL CLASSIFIED BY :

DRILLER-VISUALLY	X
SOIL TECHNICIAN-VISUALLY	X
LABORATORY TESTS	X

REMARKS :

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

3

BORING NO. B-102

S.W.COLE ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS
Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-103
PROJECT NO. 94-716 S
DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 26.0'±

PROJECT/CLIENT: TRAIN STATION / CITY OF PORTLAND
LOCATION 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM GREAT WORKS TEST BORING, INC. DRILLER DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
4.4' OPEN HOLE

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									3.5"	ASPHALT
	1	24"	11"	2.5'	7	8	7	8	4.0'	LIGHT BROWN MEDIUM TO COARSE SAND W/SOME GRAVEL AND TRACE OF SILT ~~MEDIUM DENSE~~ (FILL)
	2	24"	0	6.5'	1/12"		1	2	8.0'	GRAY SILTY CLAY W/SOME FINE SAND ~~MEDIUM~~
	3	24"	13"	11.5'	1	5	7	9	11.5'	BROWN FINE TO MEDIUM SAND W/SOME GRAVEL ~~MEDIUM DENSE~~
										BOTTOM OF EXPLORATION AT 11.5'

SOIL CLASSIFIED BY:
- DRILLER-VISUALLY [X]
- SOIL TECHNICIAN-VISUALLY [X]
- LABORATORY TESTS [ ]

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

4

BORING NO. B-103

S.W.COLE ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-104
PROJECT NO. 94-716 S

DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION

OJECT/CLIENT : TRAIN STATION / CITY OF PORTLAND
ATION 222 ST. JOHN STREET PORTLAND, MAINE
ILLING FIRM GREAT WORKS TEST BORING, INC. DRILLER DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
ING				
AMPLER				

WATER LEVEL INFORMATION
4.1' INSIDE AUGERS

SING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									5"	ASPHALT
									1.3'	BLACK GRAVELLY FINE TO MEDIUM SAND W/SOME SILT AND COAL ASH ~~ MEDIUM DENSE ~~ (FILL)
	1	24"	18"	2.5'	4	7	13	18		
										LIGHT BROWN GRAVELLY FINE TO COARSE SAND W/SOME SILT ~~ MEDIUM DENSE BECOMING DENSE ~~
									6.5'	
	2	24"	16"	6.5'	24	30	33	33		BOTTOM OF EXPLORATION AT 6.5'

SOIL CLASSIFIED BY :

DRILLER-VISUALLY	X
SOIL TECHNICIAN-VISUALLY	X
LABORATORY TESTS	

REMARKS :

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

5

BORING NO. B-104

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-105
PROJECT NO. 94-716 S

DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 27.0'±

PROJECT/CLIENT: TRAIN STATION / CITY OF PORTLAND
LOCATION 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM GREAT WORKS TEST BORING, INC. DRILLER DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
4.0'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	1	24"	17"	2.0'	3	4	6	9	1.3'	BLACK GRAVELLY FINE TO MEDIUM SAND W/SOME SILT AND COAL ASH (FILL) ~~LOOSE~~
	2	24"	14"	6.5'	7	15	15	11		LIGHT BROWN GRAVELLY FINE TO COARSE SAND W/SOME SILT W=14.1% ~~ MEDIUM DENSE ~~
	3	24"	15"	11.5'	10	12	13	9	11.5'	BOTTOM OF EXPLORATION AT 11.5'

SOIL CLASSIFIED BY:

- DRILLER-VISUALLY [X]
- SOIL TECHNICIAN-VISUALLY [X]
- LABORATORY TESTS [X]

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

6

BORING NO. B-105

S.W.COLE ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-106
PROJECT NO. 94-716 S
DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 38.0'±

PROJECT/CLIENT: TRAIN STATION / CITY OF PORTLAND
LOCATION: 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORING, INC. DRILLER: DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									3"	ASPHALT
	1	24"	16"	2.5'	6	8	9	12	3.2'	LIGHT BROWN FINE TO COARSE SAND W/SOME GRAVEL AND TRACE OF SILT ~~ MEDIUM DENSE ~~ (FILL)
	2	24"	11"	4.5'	15	19	14	16		TAN BROWN MEDIUM TO COARSE SAND W/SOME GRAVEL AND TRACE OF SILT ~~ DENSE TO MEDIUM DENSE ~~ (FILL)
	3	24"	0	6.5'	8	11	12	11	6.5'	
										BOTTOM OF EXPLORATION AT 6.5'

SOIL CLASSIFIED BY:

- DRILLER-VISUALLY [X]
- SOIL TECHNICIAN-VISUALLY [X]
- LABORATORY TESTS [ ]

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

7

BORING NO. B-106

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 370, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-107
PROJECT NO. 94-716 S
DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 36.0'±

ROJECT/CLIENT : TRAIN STATION / CITY OF PORTLAND
:ATION 222 ST. JOHN STREET PORTLAND, MAINE
RILLING FIRM GREAT WORKS TEST BORING, INC. DRILLER DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
ING				
AMPLER				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

ASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2.5"	ASPHALT
	1	24"	16"	2.5'	9	13	13	14	2.8'	LIGHT BROWN GRAVELLY FINE TO MEDIUM SAND W/TRACE OF SILT AND COBBLES (FILL) ~~MEDIUM DENSE~~
	2	24"	18"	4.5'	5	5	6	9	4.0'	LIGHT BROWN GRAVELLY MEDIUM TO COARSE SAND W/TRACE OF SILT AND COBBLES (FILL) ~~MEDIUM DENSE ~~
	3	24"	10"	6.5'	8	7	13	7		LIGHT BROWN MEDIUM TO COARSE SAND W/SOME GRAVEL AND SILT ~~ MEDIUM DENSE~~
	4	24"	8"	8.5'	8	12	14	13	8.5'	
										BOTTOM OF EXPLORATION AT 8.5'

SOIL CLASSIFIED BY :

DRILLER-VISUALLY	X
SOIL TECHNICIAN-VISUALLY	X
LABORATORY TESTS	

REMARKS :

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

8

BORING NO. B-107

S.W.COLE
ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Six Liberty Drive, Bangor, ME 04401 TEL (207) 848-5714 FAX (207) 848-2403
Gray Plaza, P.O. Box 378, Gray, ME 04039 TEL (207) 657-2866 FAX (207) 657-2840
161 Water St., P.O. Box 220, Caribou, ME 04736 TEL (207) 496-1511 FAX (207) 496-1501

BORING NO. B-108
PROJECT NO. 94-716 S

DATE START 7/27/95
DATE FINISH 7/27/95
SURFACE ELEVATION 36.0'±

PROJECT/CLIENT: TRAIN STATION / CITY OF PORTLAND
LOCATION 222 ST. JOHN STREET PORTLAND, MAINE
DRILLING FIRM GREAT WORKS TEST BORING, INC. DRILLER DAVE DIONNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING				
SAMPLER				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2.5'	ASPHALT
	1	18"	9"	2.0'	9	13	9			LIGHT BROWN GRAVELLY FINE TO COARSE SAND W/TRACE OF SILT AND COBBLES (FILL) ~~ MEDIUM DENSE ~~
									4.0'	
	2	24"	14"	5.5'	15	19	14	16	5.5'	LIGHT GRAY CLAYEY SILT ~~HARD~~ qp= 9.0+ ksf
	3	24"	15"	7.5'	8	15	15	20	7.5'	BROWN CLAYEY SILT ~~HARD~~ qp= 9.0+ ksf
										BOTTOM OF EXPLORATION AT 7.5'

SOIL CLASSIFIED BY:

DRILLER-VISUALLY	X
SOIL TECHNICIAN-VISUALLY	X
LABORATORY TESTS	

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, AND THE TRANSITION MAY BE GRADUAL.

BORING NO. B-108

MAINE TEST BORINGS, INC. **BREWER, MAINE 04412**	CLIENT FIRST ATLANTIC	SHEET 1 OF 1 HOLE NO. B-1
DRILLER DARREL MCKEEN	PROJECT NAME MEDICAL BUILDING	LINE & STATION
M.T.B. JOB NUMBER 89-232	LOCATION PORTLAND, MAINE	OFFSET

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HS	SS	
SIZE I.D.	2 1/2"	1 3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

DATE START	DATE FINISH
12/28/89	12/28/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.3	PAVEMENT
										2.0	BLACK GRAVELY SAND W/SILT
	1D	2"	18"		3.5	16	10	16			~ MEDIUM DENSE ~
										4.0	BROWN GRAVELY SILTY SAND
											~ DENSE ~
	2D	2"	18"		6.5	20	25	30			W=11.3 %
											BROWN GRAVELY SAND W/SOME SILT
										10.0	
	3D	2"	18"		11.5	15	20	25			~ DENSE ~
											BROWN COARSE SAND TRACE OF GRAVEL
	4D	2"	18"		16.5	10	20	25			
										20.0	
	5D	2"	18"		21.5	9	9	11		21.5	BROWN SILTY SAND TRACE OF GRAVEL ~ MEDIUM DENSE ~

BOTTOM OF BORING @ 21.5'
WATER @ 3.0'
HOLE CAVED @ 4.0'
RUNNING SAND IN AUGERS 10'- 20'

SAMPLES
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[X] LABORATORY TESTS

REMARKS:

2

HOLE NO. B-1

MAINE TEST BORINGS, INC.
BREWER, MAINE 04412

CLIENT: FIRST ATLANTIC

SHEET 1 OF 1

HOLE NO. B-2

DRILLER: DARREL MCKEEN

PROJECT NAME: MEDICAL BUILDING

LINE & STATION:

M.T.B. JOB NUMBER: 89-232

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BARREL
	TYPE	HS	SS	
AT 0.00 FT. AFTER 0.00 HOURS	SIZE I.D.	2 1/2"	1 3/8"	
	HAMMER WT.		140	
AT 0.00 FT. AFTER 0.00 HOURS	HAMMER FALL		30"	

DATE START: 12/29/89

DATE FINISH: 12/29/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.3	PAVEMENT
	1D	2"	18"		3.5	30	30	16			~ DENSE ~ BROWN GRAVELY SAND
										5.5	
	2D	2"	18"		6.5	6	5	3			W=26.8% GRAY SILTY CLAY W/ BLACK STREAKS qp=0.5 ksf ~ SOFT TO MEDIUM ~
										8.0	
	3D	2"	18"		11.5	8	12	15			~ MEDIUM DENSE ~ W=14.5%
											BROWN COARSE SAND TRACE OF GRAVEL AND SILT
	4D	2"	18"		16.5	10	18	12			
	5D	2"	18"		21.5	10	11	12		21.5	
											BOTTOM OF BORING @ 21.5' WATER @ 4.2' HOLE CAVED @ 8.2'

SAMPLES
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[X] LABORATORY TESTS

REMARKS:

HOLE NO. B-2

MAINE TEST BORINGS, INC. BREWER, MAINE 04412	CLIENT FIRST ATLANTIC	SHEET 1 OF 1 HOLE NO. B-2A
DRILLER DARREL MCKEEN	PROJECT NAME MEDICAL BUILDING	LINE & STATION
M.T.B. JOB NUMBER 89-232	LOCATION PORTLAND, MAINE	OFFSET

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HW	SS	
SIZE I.D.	4"	1 3/8"	
HAMMER WT.	300	140	
HAMMER FALL	16"	30"	

DATE START	DATE FINISH
01/02/90	01/02/90

SURFACE ELEVATION NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
AUGER										0.3	PAVEMENT
"										2.0	BLACK GRAVELY SAND
"											
9											BROWN GRAVELY SAND, TRACE OF COBBLES
10										5.5	
	1U	3 1/2"	24"		7.5	WT OF 1 MAN	WT OF 2 MEN			7.8	GRAY SILTY CLAY W=39.6% W_L=37.1 W_P=21.5
											BOTTOM OF BORING @ 7.8' NO PENATRATION ON VANE

SAMPLES

D = SPLIT SPOON

C = 2" SHELBY TUBE

S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:

[XX] DRILLER-VISUALLY

[X] SOIL TECHNICIAN-VISUALLY

[X] LABORATORY TESTS

REMARKS:

4

HOLE NO. B-2A

MAINE TEST BORINGS, INC.
BREWER, MAINE 04412

CLIENT: FIRST ATLANTIC

SHEET 1 OF 1

HOLE NO. B-3

DRILLER: DARREL MCKEEN

PROJECT NAME: MEDICAL BUILDING

LINE & STATION:

M.T.B. JOB NUMBER: 89-232

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HS	SS	
SIZE I.D.	2 1/2"	1 3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

DATE START	DATE FINISH
12/28/89	12/28/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.4	PAVEMENT
	1D	2"	6"		2.5	65					W = 5.7 % BROWN GRAVELY SAND TRACE OF COBBLES
										4.0	
											~ MEDIUM DENSE ~
	2D	2"	18"		6.5	10	19	17			W=3.5 %
	3D	2"	18"		11.5	4	8	18			W=5.9%
											~ LOOSE ~
	4D	2"	18"		16.5	3	3	3			BROWN COARSE SAND, TRACE OF GRAVEL
	5D	2"	18"		21.5	6	7	8			~ MEDIUM DENSE ~
	6D	2"	18"		26.5	4	5	9			~ LOOSE TO...
	7D	2"	18"		31.5	4	6	7		31.5	...MEDIUM DENSE ~

ROD PROBES

BLOWS	INTVL	BLOWS	INTVL	BLOWS	INTVL
32-33	7	38-39	51	44-45	28
33-34	15	39-40	45	45-46	36
34-35	16	40-41	52	46-47	64
35-36	17	41-42	38	47-48	80
36-37	24	42-43	32	48-49	97
37-38	40	43-44	26	49-50	112

SAMPLES
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[X] LABORATORY TESTS

REMARKS:
BOTTOM OF BORING @ 50.0'
HOLE CAVED @ 12.5'

5

HOLE NO. B-3

MAINE TEST BORINGS, INC.
BREWER, MAINE 04412

CLIENT: FIRST ATLANTIC

SHEET 1 OF 1

HOLE NO. B-4

DRILLER: DARREL MCKEEN

PROJECT NAME: MEDICAL BUILDING

LINE & STATION:

M.T.B. JOB NUMBER: 89-232

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HS	SS	
SIZE I.D.	2 1/2"	1 3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

DATE START	DATE FINISH
12/29/89	12/29/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.4	PAVEMENT
	1D	2"	6"		2.5	100				2.0	BLACK GRAVELY SAND
	2D	2"	18"		6.5	22	28	33			~ DENSE ~ W = 5.3 % BROWN GRAVELY SAND, TRACE OF COBBLES, TRACE OF SILT
	D	2"	0"		10.0	50				11.0	
	3D	2"	18"		16.5	10	15	13			~ MEDIUM DENSE ~ BROWN COARSE SAND, TRACE OF GRAVEL
	4D	2"	18"		21.5	10	15	15		21.5	
											BOTTOM OF BORING @ 21.5' HOLE CAVED @ 10.0' WET

SAMPLES
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[X] LABORATORY TESTS

REMARKS:

6

HOLE NO. B-4

MAINE TEST BORINGS, INC.
BREWER, MAINE 04412

CLIENT: FIRST ATLANTIC

SHEET 1 OF 1

HOLE NO. B-5

DRILLER: DARREL MCKEEN

PROJECT NAME: MEDICAL BUILDING

LINE & STATION:

M.T.B. JOB NUMBER: 89-232

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HS	SS	
SIZE I.D.	2 1/2"	1 3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

DATE START	DATE FINISH
12/28/89	12/28/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.5	PAVEMENT
										2.0	BLACK GRAVELY SAND
	1D	2"	18"		3.5	20	30	15			~ MEDIUM DENSE ~
										4.0	BROWN GRAVELY SAND
											REFUSAL @ 4.0'

SAMPLES
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[ ] LABORATORY TESTS

REMARKS:

7

HOLE NO. B-5

MAINE TEST BORINGS, INC.
BREWER, MAINE 04412

CLIENT: FIRST ATLANTIC

SHEET 1 OF 1

HOLE NO. B-5A

DRILLER: DARREL MCKEEN

PROJECT NAME: MEDICAL BUILDING

LINE & STATION:

M.T.B. JOB NUMBER: 89-232

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS

AT 0.00 FT. AFTER 0.00 HOURS

AT 0.00 FT. AFTER 0.00 HOURS

	CASING	SAMPLER	CORE BARREL
TYPE	HS	SS	
SIZE I.D.	2 1/2"	1 3/8"	
HAMMER WT.		140	
HAMMER FALL		30"	

DATE START	DATE FINISH
12/29/89	12/29/89

SURFACE ELEVATION: NOT AVAILABLE

CASING BLOWS PER FOOT	SAMPLE NO.	O.D.	PEN.	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	VANE READING	DEPTH	STRATUM DESCRIPTION
										0.5	PAVEMENT
										2.0	BLACK GRAVELY SAND
	1D	2"	18"		6.5	15	40	40		7.0	~ MEDIUM DENSE TO DENSE ~ BROWN GRAVELY SAND TRACE OF COBBLES AND SILT W=3.3%
	2D	2"	18"		11.5	11	21	32			~ MEDIUM DENSE ~
	3D	2"	18"		16.5	17	17	17			W=15.0% BROWN GRAVELLY COARSE SAND TRACE OF ~~GRAVEL~~ SILT
	4D	2"	18"		21.5	8	15	8			
	5D	2"	18"		26.5	9	10	14			
	6D	2"	18"		31.5	10	12	14		31.5	
											BOTTOM OF BORING @ 31.5'

SAMPLES

D = SPLIT SPOON
U = 2" SHELBY TUBE
S = 3" SHELBY TUBE
3½" SHELBY TUBE

SOIL CLASSIFIED BY:

[XX] DRILLER-VISUALLY
[X] SOIL TECHNICIAN-VISUALLY
[X] LABORATORY TESTS

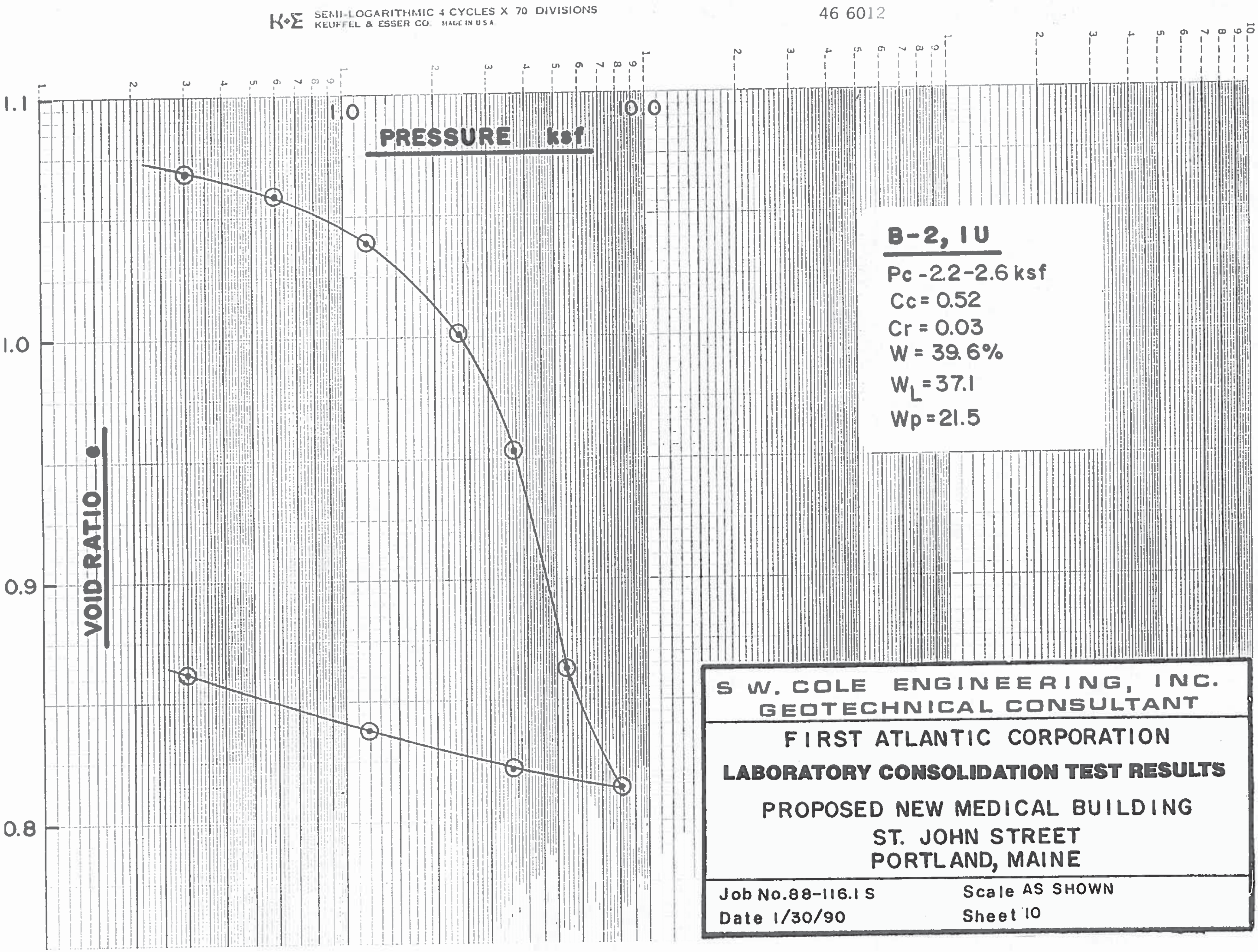
REMARKS:

8

HOLE NO. B-5A

APPENDIX D

LABORATORY TEST RESULTS



S. W. COLE ENGINEERING, INC.
GEOTECHNICAL CONSULTANT

FIRST ATLANTIC CORPORATION

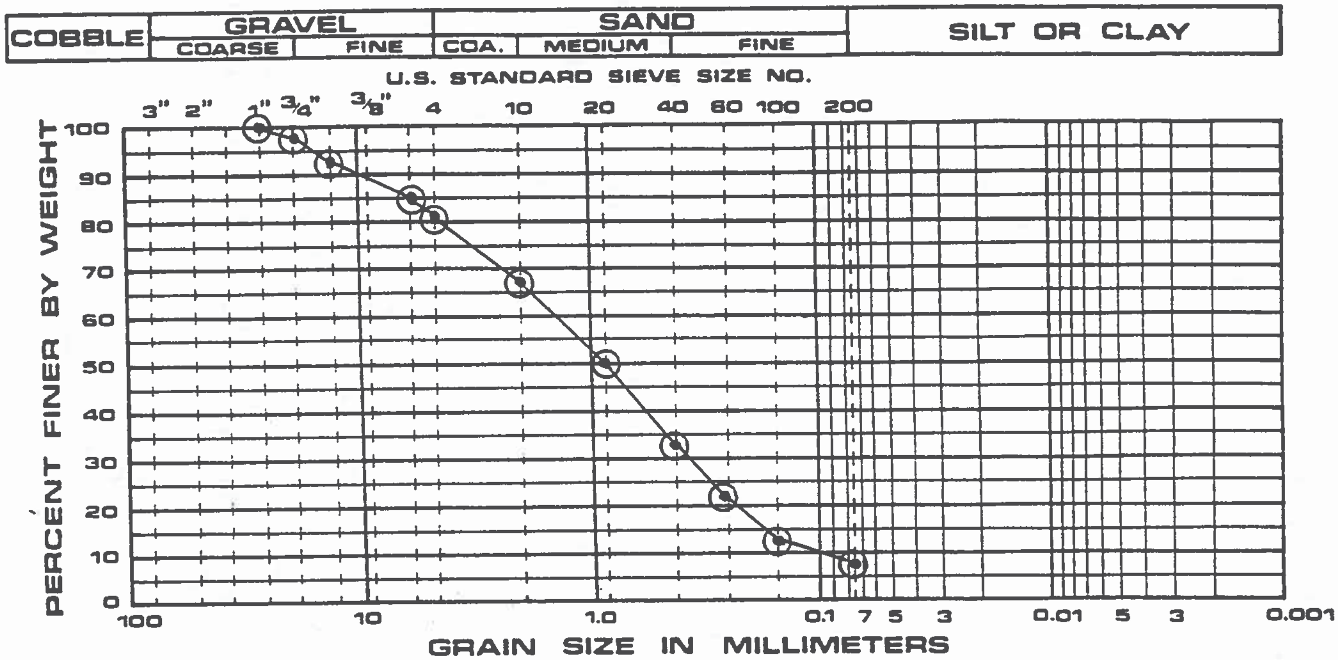
LABORATORY CONSOLIDATION TEST RESULTS

PROPOSED NEW MEDICAL BUILDING
ST. JOHN STREET
PORTLAND, MAINE

Job No. 88-116.1 S	Scale AS SHOWN
Date 1/30/90	Sheet 10

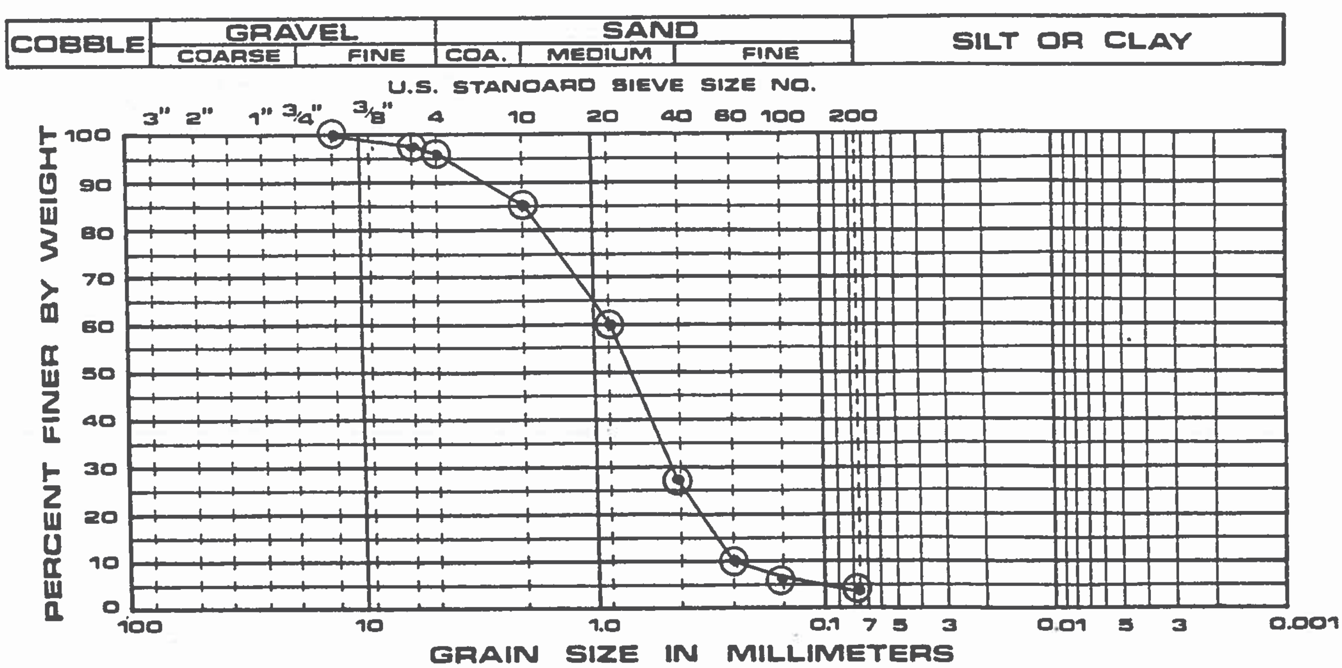
JOB NO: 88-116.1 S

GRAIN SIZE ANALYSIS



PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION		W
○	B-1	S-2	5'	Gravelly Sand w/some Silt		11.3%

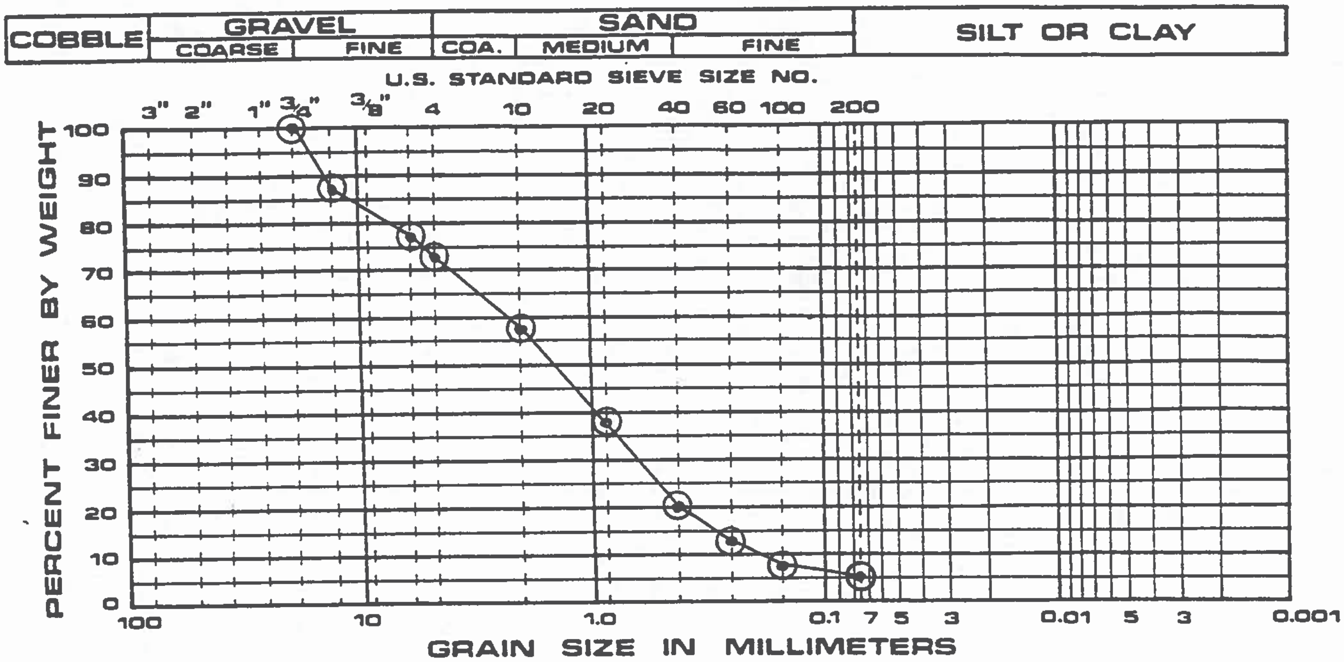
GRAIN SIZE ANALYSIS



PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION		W
○	B-2	S-3	10'	Sand w/trace Gravel and Silt		14.5%

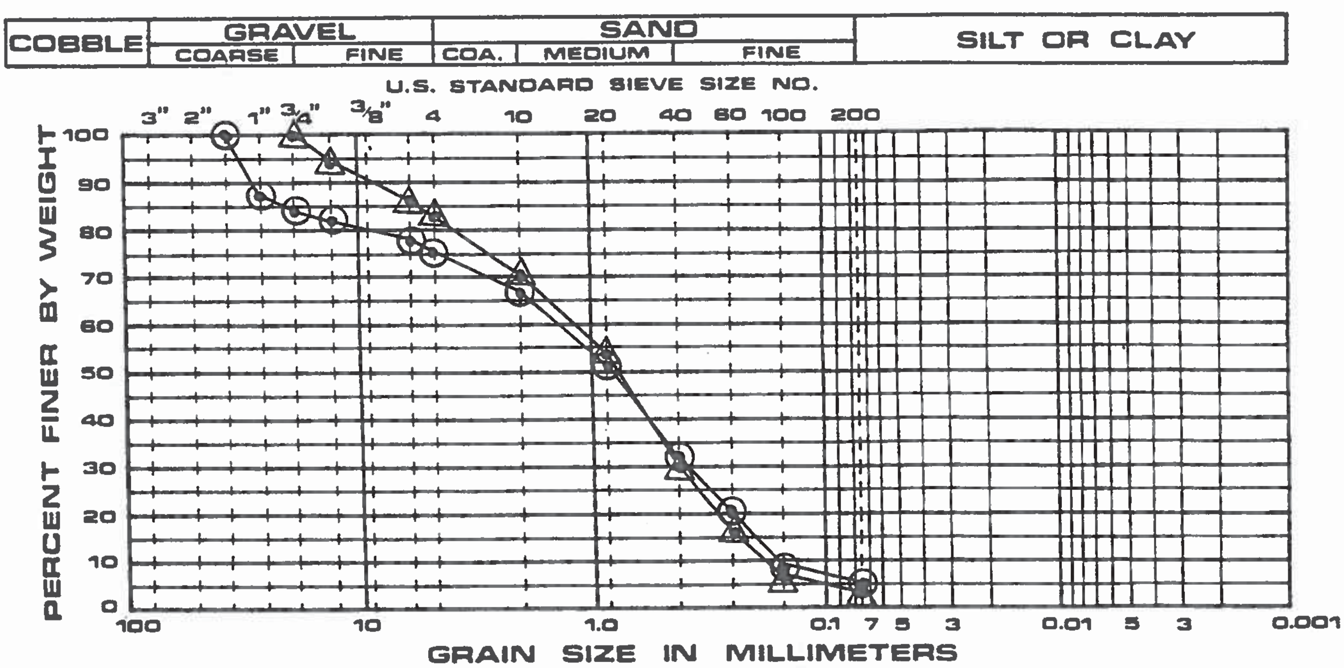
JOB NO: 88-116.1 S

GRAIN SIZE ANALYSIS



PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION		W
○	B-4	S-2	5'	Gravelly Sand w/trace of Silt		5.3 %

GRAIN SIZE ANALYSIS

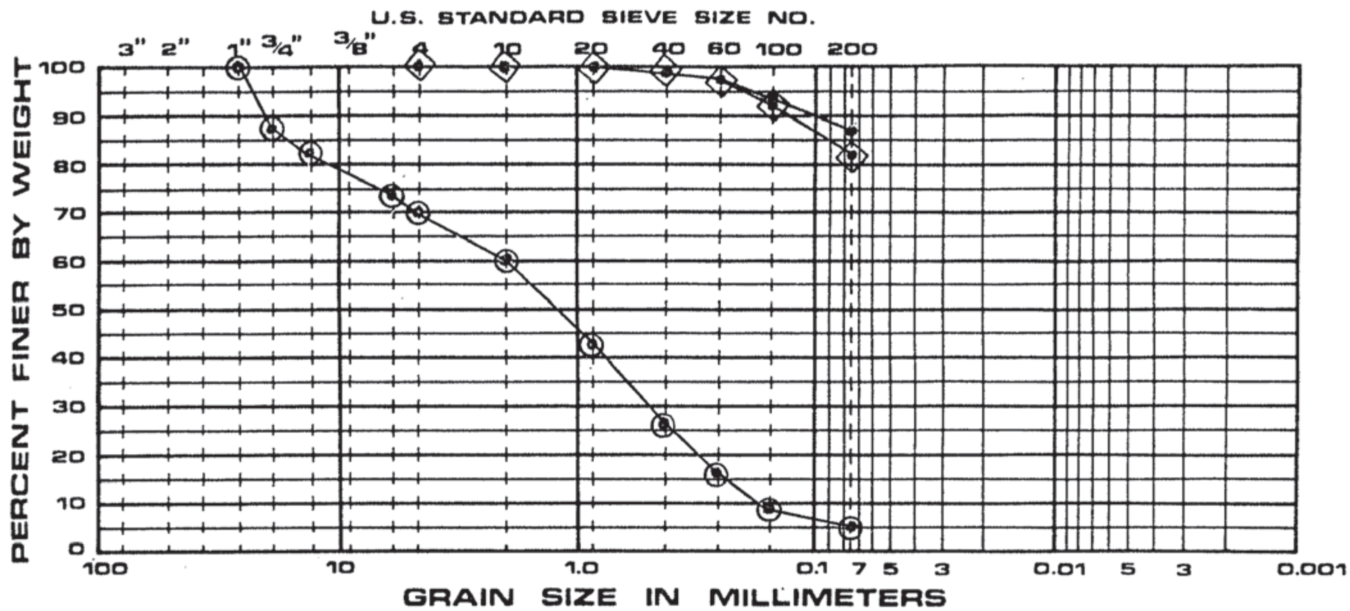


PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION		W
○	B-5A	S-1	5'	Gravelly Sand w/trace of Silt		3.3 %
△	B-5A	S-2	10'	Gravelly Sand w/trace of Silt		15.3%

JOB NO. : 94-716 S

GRAIN SIZE ANALYSIS

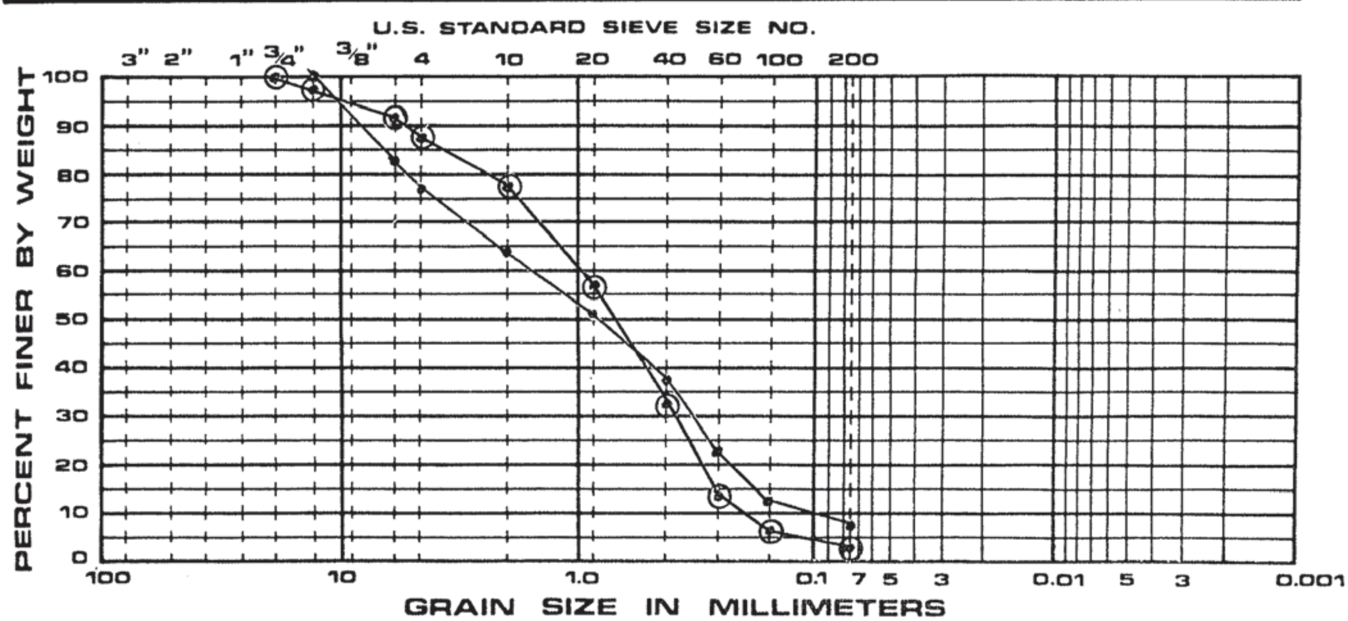
COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COA.	MEDIUM	FINE	



PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION	W%
⊙	B-101	2	4.5'-6.5'	GRAVELLY FINE TO COARSE SAND W/TRACE OF SILT	2.4
•	B-102	3	9.5'-11.5'	GRAY SILTY CLAY W/SOME FINE SAND LAYERS	28.2
◈	B-102	4	14.5'-16.5	GRAY SILTY CLAY W/FINE SAND LAYERS	26.7

GRAIN SIZE ANALYSIS

COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COA.	MEDIUM	FINE	



PLOT	SOURCE	SAMP.	DEPTH	CLASSIFICATION	W%
•	B-105	2	4.5'-6.5'	GRAVELLY FINE TO COARSE SAND W/SOME SILT	14.1
⊙	B-106	2	2.5'-4.5'	FINE TO COARSE SAND W/SOME GRAVEL AND TRACE	4.0
				OF SILT	

APPENDIX E

GEOPHYSICAL SURVEY

HAGER-RICHTER
GEOSCIENCE, INC.

GEOPHYSICAL SURVEY
PROPOSED PARKING STRUCTURE
222 ST. JOHN STREET
PORTLAND, MAINE

Prepared for:

S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039-9586

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way - D10
Salem, New Hampshire 03079

File 17J53
June 2017

HAGER-RICHTER
GEOSCIENCE,INC.

GEOPHYSICISTS FOR THE ENGINEERING COMMUNITY
8 INDUSTRIAL WAY - D10
SALEM, NEW HAMPSHIRE 03079-5820
TELEPHONE (603) 893-9944
FAX (603) 893-8313

June 27, 2017
File 17J53

Evan M. Walker, P.E.
Geotechnical Engineer
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039-9586

Phn: (207) 657-2866
Fax: (207) 657-2840
Email: ewalker@swcole.com

RE: Geophysical Survey
Proposed Parking Structure
222 St. John Street
Portland, Maine

Dear Mr. Walker:

In this letter, we report the results of a surface geophysical survey conducted by Hager-Richter Geoscience, Inc. (H-R) at the above referenced site in Portland, Maine in June, 2017. The survey was conducted to support a geotechnical investigation of the site by S.W. Cole Engineering, Inc. (SW Cole) for possible future development. The scope of the survey and the area of interest were specified by SW Cole.

INTRODUCTION

The Site is an active parking lot located on the west side of St. John Street in Portland, Maine. The general location of the Site is shown in Figure 1. The site is an existing parking lot measuring about 650 feet by 200 feet. According to information provided by S.W. Cole, the subsurface at the site consists of varying amounts of sand and silt over a thin layer of till and phyllite bedrock. The depth of bedrock varies from about 35 feet to about 65 feet across the site.

As part of a geotechnical investigation of the Site for possible future construction, S.W. Cole required a geophysical survey to provide information on site specific shear wave velocity information as a function of depth for the soil and rock to a depth of 100 feet, and the depth and configuration of the bedrock surface. The geophysical survey consisted of shear wave velocity testing and seismic refraction along five transects. The work was conducted over a weekend to minimize disruption to the parking lot and to minimize vehicular interference with the seismic testing.

OBJECTIVE

The objectives of the surface geophysical survey were to: 1) provide information on site specific shear wave velocity information as a function of depth for the soil and rock to a depth of 100 feet, and 2) determine the depth and configuration of the bedrock surface within the specified area of interest at the site.

THE SURVEY

Jeffrey Reid, P.G., and Bryan Carnahan of Hager-Richter conducted the seismic refraction survey on June 3-4, 2017. The fieldwork was coordinated with Evan M. Walker, P.E., of SW Cole who was present for the initiation of the field work. The locations of the seismic transects were selected in consultation with SW Cole. Data analysis and interpretation were completed at the Hager-Richter offices. Original data and field notes will be retained in the Hager-Richter files for a minimum of three years.

The geophysical survey consisted of passive shear wave velocity testing (pVs) and seismic refraction along five traverses totaling approximately 1,500 linear feet. The positions of the seismic transects were recorded using a Trimble Geo 7X CM GPS receiver outfitted with a Zephyr 2 external antenna. The locations of the transects are shown in Figure 2.

EQUIPMENT & PROCEDURES

pVs Survey. We used a 48-channel digital seismograph (Geometrics Geode) coupled to 48 low frequency (4.5 Hz) geophones to acquire the pVs data for the subject testing. pVs data were acquired along five transects. Lines 1 and 2 are composed of two segments or spreads and Lines 3-5 are composed of single spreads. The geophones are installed along a straight line and connected to a seismograph. A five-foot geophone spacing was used for Lines 1 and 2 and a four-foot spacing was sued for Lines 3-5.

Ambient noise is recorded for 30 seconds two or three times, and examined to be sure that noise of sufficiently low frequency is present. If the noise is sufficient, then 10 to 15 such records are acquired. If the noise spectra do not reach sufficiently low frequencies, then one walks or runs along the testing line during data acquisition to add low frequency noise to the ambient noise. The surface waves used in the pVs method, considered noise in seismic refraction and seismic reflection surveys, are enhanced during data acquisition and processing for the pVs method. The seismic data are analyzed using SeisOpt® ReMi™, a commercially licensed software package developed by Optim, Inc. located at the University of Nevada at Reno. Results are normally presented as 1-D plots or in tabular form showing shear wave velocity as a function of depth for the center point of the seismic line. The pVs method yields a simple vertical shear wave velocity profile for the mid point of each testing line.

Determination of Average Shear Wave Velocity for Building Code Purposes. The pVs method determines (a) the shear wave velocity at the mid point along a survey line for several layers, averaged over the length of the survey line, and (b) the average shear wave velocity V_{avg} for site classification for seismic design in accordance with building codes. Similar calculations can be performed with the results of the shear wave velocity survey. The average value V_{avg} is determined using the equation 16-44 of the IBC as follows:

$$V_{avg} = \left(\sum_{i=1}^{N} d_i\right) / \sum_{i=1}^{N} d_i / V_i$$

where d_i is thickness of layer I
V_i is shear wave velocity of layer I
N denotes the total number of layers

The Seismic Site Class, *based solely on average shear wave velocity*, is defined by the IBC as follows:

Site Class	Soil Profile Name	Soil Shear Wave Velocity (ft/s)
A	Hard rock	$V_s > 5000$
B	Rock	$2500 < V_s \leq 5000$
C	Very dense soil and soft rock	$1200 < V_s \leq 2500$
D	Stiff soil profile	$600 \leq V_s \leq 1200$
E	Soft soil profile	$V_s < 600$

Although the IBC provides other methods to determine the Site Class, such as standard penetration resistance (blow counts) and soil undrained shear strength, this report provides shear wave velocity data only. There is no consideration of other factors that may affect a site class such as liquefaction. The final determination of seismic site class should be made by the project engineer.

Seismic Refraction. For the seismic refraction survey, we used a 48-channel seismograph (two 24-channel Geometrics Geodes) coupled to 48 geophones to acquire seismic refraction records. The seismograph was connected to, and controlled by, a notebook PC computer. The software provides for the acquisition, display, plotting, filtering, and storage of seismic data. Seismic refraction data were acquired along five transects totaling approximately 1,500 linear feet. Geophone spacing was 5 feet for Lines 1 and 2 and was 4 feet for Lines 3-5. Line 1 and 2 consisted of two seismic spreads configured end to end and Lines 3-5 consisted of a single seismic spread. Seven shot points were used for most seismic spreads - three located internal to the spread, one at each end of the spread, and, where possible, two offset shots located in-line with but beyond the ends of the spread of geophones. This configuration allows for providing reversed profiles. The seismic source was a 12-pound sledgehammer striking a metal plate. The number of stacks per shot point was variable, and the quality of the stacked seismic signal for each shot point was verified in the field. The data were recorded digitally.

The seismic data were interpreted with the Generalized Reciprocal Method, commonly referred to as GRM. GRM allows the depth to bedrock to be determined for *each* geophone location (i.e., generally every 4 or 5 feet at this site), rather than only at the shot points as for most other methods, and it is less sensitive than are most other methods to the presence of dipping interfaces and hidden layers.

LIMITATIONS OF THE METHODS

pVs. As with all physical measurements, there is experimental error in the velocities that are determined using the passive shear wave velocity method. For the pVs method, the accuracy of V_{avg} is stated by Optim, Inc. to be 5-15%.

The depth of investigation is a function of the noise spectrum, and long wave lengths (low frequencies) are required to determine velocity at large depths. Noise levels can be improved by a person running along the seismic spread during data acquisition.

Seismic Refraction. As with all geophysical methods, the seismic refraction method is based on the assumption that the local geology is relatively uncomplicated. In particular, the seismic refraction method assumes that interfaces between geologic materials correlate with sharp increases in seismic velocity and that the interfaces between geologic units are relatively flat-lying. The method is not very sensitive to lateral variations within layers, and relatively subtle features such as fracture zones within bedrock generally cannot be detected unless there is a topographic expression of the feature and/or a significant drop in bedrock velocity. The accuracy of the method is degraded in areas with strong topographic relief and/or where the interfaces have apparent dips greater than about 20°. *In general, the accuracy of depths determined is stated to be about 10% or 2 feet, whichever is greater.*

Where two materials do not exhibit contrasting velocities, or where velocities gradually increase with depth, a clear refracted signal is not generated, and the seismic refraction method cannot be used to distinguish the two materials. In some cases, the "geophysical contact" between materials with contrasting velocities does not correlate exactly with the "geologic contact." For example, where a highly weathered bedrock is overlain by a dense material such as till, the velocity range of the weathered bedrock might overlap or approach the velocity range of the till, and the two materials cannot be distinguished seismically. In such cases, the depth determined by seismic refraction is the depth of *competent* bedrock, which might be located at some depth below the geologic contact.

The depth relations of the water table and bedrock may constitute a significant problem for the seismic refraction technique. This problem is that of a "blind layer." A blind layer occurs where the thickness of the saturated overburden is less than about half the depth of bedrock. In such cases, the water-saturated material immediately above bedrock is "blind" in the sense that no refracted seismic energy from it will be received as a first arrival of seismic energy, and all methods used to reduce the seismic data to determine the depth of bedrock, the objective of this survey, use *only* first arrivals. Thus, the saturated layer will not be detected where it is close to bedrock, and most methods of seismic data reduction will indicate that bedrock is considerably shallower than it actually is. Although GRM, the method used by Hager-Richter to reduce the seismic refraction data, does not use first arrivals through the water saturated zone (because there is none to use) in such cases, GRM determines the depth of bedrock correctly by using the *average* velocity of the saturated and unsaturated zones.

A "hidden layer" occurs where a lower velocity material underlies a higher velocity material, a common situation in stratified sediments. An example is where sands are present under layers of clay or till. As in the case of a "blind layer," most methods of seismic refraction data reduction will indicate that bedrock is deeper than it actually is, if a hidden layer is present but not detected. Internal tests in the seismic refraction data reduction software that we use (IXRefraX by Interpex) indicate that such layers might be present, and an average velocity of the two layers is used to determine the depth of bedrock.

RESULTS

The geophysical survey consisted of passive shear wave velocity testing (pVs) and seismic refraction along five traverses totaling approximately 1,500 linear feet. The positions of the seismic transects were recorded using a Trimble Geo 7X CM GPS receiver outfitted with a Zephyr 2 external antenna.

Figure 2 is a site plan showing the locations of the seismic refraction transects and center points for the shear wave velocity profiles. Figures 3 and 4 show the seismic refraction results in profile form and Figure 5 is a color contour model of bedrock topography compiled from the seismic refraction results and available boring information provided by SW Cole. Table 1 lists the results of the pVs survey and Table 2 lists the results of the seismic refraction survey.

pVs Survey. Based on boring logs provided by S.W. Cole, the subsurface at the site consists of varying amounts of sand and silt over a thin layer of till and phyllite bedrock. The depth of bedrock varies from about 35 feet to about 65 feet across the site. The locations of the borings are shown in Figure 2.

The quality for the pVs data at the subject site is judged to be very good. The results of the pVs testing are reported in Table 1. For modeling purposes, the subsurface stratigraphy was divided into four discrete units. The velocity units do not necessarily correlate with specific lithologic units identified in the boring log provided by S.W. Cole. The layer thicknesses that provide the best statistical fit to the dispersion curve are used for the seismic lines. No attempt was made to "force" a specific model to the boring data.

The shear wave velocities for the individual stratigraphic modeled units are provided in Table 1. The average values of the velocities of shear waves for the depth interval of 0-100 ft based on Equation 1 of the IBC , Vs_{100}, vary between 1,035 and 1,376 fps. The root mean square errors for the fit of the dispersion curves versus the measured data using the model velocities are also reported in Table 1 and vary between 1.8% and 3.8%.

Seismic Refraction Survey. The quality of the seismic refraction data ranges from very good to excellent. A measure of the accuracy of the data can be obtained by comparing the bedrock depths determined seismically with depths reported from nearby borings that encountered bedrock, or by comparing bedrock depths at the intersections of seismic refraction lines. Table 3 shows a comparison between bedrock elevations determined seismically and reported in nearby borings. For the present survey, six (6) borings that reported bedrock depths were located within 40 feet of a seismic line and were used for the comparison. An examination of Table 3 shows that the bedrock elevations determined for locations on seismic lines differ by an average of about 2 feet, or 5% from the bedrock elevations reported in boring logs. The standard deviation for the differences is about 1 foot or 2%.

Table 3 also shows a comparison of seismically determined bedrock elevations at six (6) seismic line intersections. Bedrock elevations determined at the seismic line intersections differ by an average of less than a foot, or 1% relative to bedrock depth. The standard deviation for the differences is about 1 foot or 1%. Based on the results of comparing seismically determined elevations at intersecting seismic lines and with nearby borings, and on the results from other similar seismic refraction surveys, we estimate the accuracy (standard deviation) of the *depths* of competent bedrock determined by the seismic refraction survey to be about ± 10% of the depth of bedrock, or ± 2 feet), whichever is greater.

The results of the seismic refraction survey for the site are shown in profile form in Figures 3 and 4 and in tabular form in Table 2. Materials with three distinct velocity ranges were detected at the Site. The upper material exhibits a velocity range of 1,100 to 1,750 feet per second (fps) and is interpreted to consist of unsaturated soil. The middle material exhibits a velocity range of 4,800 to 5,200 fps and is interpreted to be saturated soil. The lower material exhibits a velocity range of 10,500 to 14,100 fps and is interpreted to be bedrock. Where the top of bedrock is highly fractured and/or deeply weathered, it might exhibit lower velocities that cannot be detected as a distinct layer on the basis of the seismic refraction data. Thus, the top of rock determined on the basis of seismic refraction data generally is the top of competent bedrock, which might be located somewhat below the geologic contact between the overburden and bedrock.

The depth of competent bedrock along Seismic Lines 1 through 5 varies between about 36 feet and 67 feet below ground surface, and the elevation of competent bedrock varies between approximately -40 feet and -10 feet, an *apparent* total relief of 30 feet. Figure 5 is a color contour plot of the bedrock elevation model generated from the seismic refraction survey and the boring data provided by SW Cole. The contours shown on Figure 5 represent interpolations based on the seismic data and available boring information relative to NAVD88. The contours shown represent non-unique models for bedrock elevation (i.e., different valid conceptual models can be developed to fit the data set), and the elevation of competent bedrock at any particular location may differ from that shown. Bedrock elevations based on additional data, such as additional borings or seismic data, may differ significantly from those shown on Figure 5.

Examination of the seismic profiles and the bedrock topographic model shows that bedrock is generally deeper at the south end of the site and shallower to the north. A small N-S bedrock trough is present near the center of the site.

CONCLUSIONS

Based upon the results of geophysical survey conducted by Hager-Richter Geoscience, Inc. at 222 St. John Street, Portland, Maine in June, 2017, we conclude:

- The average values of the velocities of shear waves along Lines 1-5 for the depth interval of 0-100 ft based on Equation 1 of the IBC , Vs_{100}, vary between 1,035 and 1,376 fps.

- The root mean square errors for the fit of the dispersion curves versus the measured data vary between 1.8% and 3.8%.

- The depth of competent bedrock along Seismic Lines 1 through 5 varies between about 36 feet and 67 feet below ground surface, and the elevation of competent bedrock varies between approximately -40 feet and -10 feet, an *apparent* total relief of 30 feet.

- Materials with three distinct compressional wave velocity ranges were detected at the Site: an upper material exhibiting a velocity range of 1,100 to 1,700 fps and interpreted to consist of unsaturated sediments, a middle material exhibiting a velocity range of 4,800 to 5,200 fps and interpreted to consist of saturated sediments, and a lower material exhibiting a velocity range of 10,500 to 14,100 fps and interpreted to be bedrock.

- Bedrock is generally deeper at the south end of the site and shallower to the north.

- A small north-south bedrock trough is present near the center of the site.

LIMITATIONS

This report was prepared for the exclusive use of S. W. Cole Engineering, Inc. (Client). No other party shall be entitled to rely on this Report or any information, documents, records, data, interpretations, advice or opinions given to Client by Hager-Richter Geoscience, Inc. (H-R) in the performance of its work. The Report relates solely to the specific project for which H-R has been retained and shall not be used or relied upon by Client or any third party for any variation or extension of this project, any other project or any other purpose without the express written permission of H-R. Any unpermitted use by Client or any third party shall be at Client's or such third party's own risk and without any liability to H-R.

H-R has used reasonable care, skill, competence and judgment in the performance of' its services for this project consistent with professional standards for those providing similar services at the same time, in the same locale, and under like circumstances. Unless otherwise stated, the work performed by H-R should be understood to be exploratory and interpretational in character and any results, findings or recommendations contained in this Report or resulting from the work proposed may include decisions which are judgmental in nature and not necessarily based solely on pure science or engineering. It should be noted that our conclusions might be modified if subsurface conditions were better delineated with additional subsurface exploration including, but not limited to, test pits, soil borings with collection of soil and water samples, and laboratory testing.

Except as expressly provided in this limitations section, H-R makes no other representation or warranty of any kind whatsoever, oral or written, expressed or implied; and all implied warranties of merchantability and fitness for a particular purpose, are hereby disclaimed.

If you have any questions or comments on this report, please contact us at your convenience. It has been a pleasure to work with you on this project. We look forward to working with you again in the future.

Sincerely yours,
HAGER-RICHTER GEOSCIENCE, INC.

Jeffrey Reid, P.G.
Vice President/Senior Geophysicist

Dorothy Richter, P.G.
President

Attachments: Tables 1-3
Figures 1-5

HAGER-RICHTER GEOSCIENCE, INC.

TABLE 1
pVs RESULTS

Geologic Unit *	Depth Interval (ft)	Vs** (ft/s)
pVs Test Line 1A @ 1+15		
Soft Loam and Sand	0 - 10	966
Sand	10 - 20	520
Silty Sand	20 - 64	939
Till or Bedrock?	64+	2,714
Vs_{100} (ft/s)	1,035	
RMS	3.8%	
pVs Test Line 1B @ 3+50		
Soft Loam and Sand	0 - 10	388
Silty Sand	10 - 20	495
Silty Sand - More Dense	20 - 45	956
Till or Bedrock?	45+	2,948
Vs_{100} (ft/s)	1,096	
RMS	2.9%	
pVs Test Line 2A @ 1+15		
Soft Loam and Sand	0 - 10	846
Sand	10 - 29	645
Silty Sand	29 - 63	1,403
Till or Bedrock?	63+	2,837
Vs_{100} (ft/s)	1,274	
RMS	3.5%	

The pVs method yields a simple vertical shear wave velocity profile for the mid point of each testing line. Although the IBC provides other methods to determine the Site Class, such as standard penetration resistance (blow counts) and soil undrained shear strength, this report provides shear wave velocity data only. There is no consideration of other factors that may affect a site class such as liquefaction. The final determination of seismic site class should be made by the project engineer.

pVs Test Line 2B @ 3+50		
Soft Loam and Sand	0 - 53	583
Silty Sand	5 - 14	494
Silty Sand - More Dense	14 - 34	783
Till or Bedrock?	34+	3,240
Vs_{100} (ft/s)	1,376	
RMS	2.5 %	
pVs Test Line 3 @ 0+96		
Soft Loam and Sand	0 - 7	853
Silty Sand	7 - 22	540
Silty Sand - More Dense	22 - 50	929
Till or Bedrock?	50+	1,967
Vs_{100} (ft/s)	1,092	
RMS	2.0%	
pVs Test Line 4 @ 0+96		
Soft Loam and Sand	0 - 7	1,333
Sand	7 - 22	540
Silty Sand - More Dense	22 - 57	1,034
Till/Bedrock?	57+	2,356
Vs_{100} (ft/s)	1,175	
RMS	1.8%	
pVs Test Line 5 @ 0+96		
Soft Loam and Sand	0 - 7	853
Sand	7 - 22	540
Silty Sand - More Dense	22 - 50	929
Till/Bedrock?	50+	1,967
Vs_{100} (ft/s)	1,092	
RMS	2.0%	

The pVs method yields a simple vertical shear wave velocity profile for the mid point of each testing line. Although the IBC provides other methods to determine the Site Class, such as standard penetration resistance (blow counts) and soil undrained shear strength, this report provides shear wave velocity data only. There is no consideration of other factors that may affect a site class such as liquefaction. The final determination of seismic site class should be made by the project engineer.

HAGER-RICHTER GEOSCIENCE, INC.

TABLE 2
SEISMIC REFRACTION RESULTS

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 1							
2922775.0	297267.0	0	14.1	63.5	27.0	12.9	-36.5
2922774.0	297271.9	5	14.1	63.1	27.0	12.9	-36.1
2922773.2	297276.8	10	14.1	62.5	27.0	12.9	-35.5
2922772.2	297281.8	15	14.1	61.8	27.0	12.9	-34.8
2922771.5	297286.7	20	14.1	62.2	27.0	12.9	-35.2
2922770.5	297291.6	25	14.1	62.0	27.0	12.9	-35.0
2922769.8	297296.5	30	14.1	63.8	27.0	12.9	-36.8
2922768.8	297301.4	35	14.1	64.6	27.0	12.9	-37.6
2922767.8	297306.4	40	14.1	64.0	27.0	12.9	-37.0
2922767.0	297311.3	45	14.1	63.8	27.0	12.9	-36.8
2922766.0	297316.2	50	14.1	62.7	27.0	12.9	-35.7
2922765.2	297321.1	55	14.1	62.5	27.0	12.9	-35.5
2922764.2	297326.0	60	14.1	61.0	27.0	12.9	-34.0
2922763.5	297331.0	65	14.1	60.4	27.0	12.9	-33.4
2922762.5	297335.9	70	14.1	61.8	27.0	12.9	-34.8
2922761.8	297340.8	75	14.1	64.0	27.0	12.9	-37.0
2922760.8	297345.7	80	14.1	63.3	27.0	12.9	-36.3
2922759.8	297350.6	85	14.1	66.1	27.0	12.9	-39.1
2922759.0	297355.6	90	14.1	66.4	27.0	12.9	-39.4
2922758.0	297360.5	95	14.0	66.0	27.0	13.0	-39.0
2922757.2	297365.4	100	14.0	66.2	27.0	13.0	-39.2
2922756.2	297370.3	105	14.0	66.8	27.0	13.0	-39.8
2922755.5	297375.2	110	14.0	63.8	27.0	13.0	-36.8

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 1 (cont.)							
2922754.5	297380.2	115	14.1	63.4	27.0	12.9	-36.4
2922753.5	297385.1	120	14.1	62.7	27.0	12.9	-35.7
2922752.8	297390.0	125	13.8	62.5	27.0	13.2	-35.5
2922751.8	297394.9	130	13.3	63.3	27.0	13.7	-36.3
2922751.0	297399.8	135	13.2	62.9	27.0	13.8	-35.9
2922750.0	297404.8	140	12.8	61.4	27.0	14.2	-34.4
2922749.2	297409.7	145	12.9	62.7	27.0	14.1	-35.7
2922748.2	297414.6	150	13.1	60.9	27.0	13.9	-33.9
2922747.5	297419.5	155	13.9	61.6	27.0	13.1	-34.6
2922746.5	297424.4	160	14.6	60.3	27.0	12.4	-33.3
2922745.5	297429.3	165	14.9	60.5	27.0	12.1	-33.5
2922744.8	297434.3	170	15.4	58.8	27.0	11.6	-31.8
2922743.8	297439.2	175	16.2	58.6	27.0	10.8	-31.6
2922743.0	297444.1	180	16.1	56.8	27.0	10.9	-29.8
2922742.0	297449.0	185	16.6	55.8	27.0	10.4	-28.8
2922741.2	297454.0	190	16.6	52.7	27.0	10.4	-25.7
2922740.2	297458.9	195	14.8	53.0	27.0	12.2	-26.0
2922739.2	297463.8	200	14.9	51.0	27.0	12.1	-24.0
2922738.5	297468.7	205	15.1	49.1	27.0	11.9	-22.1
2922737.5	297473.6	210	15.2	47.1	27.0	11.8	-20.1
2922736.8	297478.6	215	15.1	47.1	27.0	11.9	-20.1
2922735.8	297483.5	220	15.1	46.0	27.0	11.9	-19.0
2922735.0	297488.4	225	15.1	45.0	27.0	11.9	-18.0
2922734.0	297493.3	230	15.1	45.0	27.0	11.9	-18.0

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 1 (cont.)							
2922733.0	297498.2	235	15.1	45.2	27.0	11.9	-18.2
2922732.2	297503.2	240	15.0	46.5	27.0	12.0	-19.5
2922731.2	297508.1	245	15.0	44.5	27.0	12.0	-17.5
2922730.5	297513.0	250	14.9	44.3	27.0	12.1	-17.3
2922729.5	297517.9	255	14.9	46.5	27.0	12.1	-19.5
2922728.8	297522.8	260	14.8	45.4	27.0	12.2	-18.4
2922727.8	297527.8	265	14.7	44.7	27.0	12.3	-17.7
2922727.0	297532.7	270	14.7	44.5	27.0	12.3	-17.5
2922726.0	297537.6	275	14.6	43.5	27.0	12.4	-16.5
2922725.0	297542.5	280	14.5	43.9	27.0	12.5	-16.9
2922724.2	297547.4	285	14.5	45.4	27.0	12.5	-18.4
2922723.2	297552.3	290	14.4	44.5	27.0	12.6	-17.5
2922722.5	297557.3	295	14.4	45.0	27.0	12.6	-18.0
2922721.5	297562.2	300	14.3	44.5	27.0	12.7	-17.5
2922720.8	297567.1	305	14.3	43.5	27.0	12.7	-16.5
2922719.8	297572.0	310	14.2	44.5	27.0	12.8	-17.5
2922718.8	297577.0	315	14.1	43.5	27.0	12.9	-16.5
2922718.0	297581.9	320	14.1	44.3	27.0	12.9	-17.3
2922717.0	297586.8	325	14.0	44.1	27.0	13.0	-17.1
2922716.2	297591.7	330	14.0	45.2	27.0	13.0	-18.2
2922715.2	297596.6	335	13.7	43.5	27.0	13.3	-16.5
2922714.5	297601.6	340	13.7	42.0	27.0	13.3	-15.0
2922713.5	297606.5	345	13.6	42.4	27.0	13.4	-15.4
2922712.5	297611.4	350	13.6	44.5	27.0	13.4	-17.5

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 1 (cont.)							
2922711.8	297616.3	355	13.6	43.2	27.0	13.4	-16.2
2922710.8	297621.2	360	13.5	45.4	27.0	13.5	-18.4
2922710.0	297626.2	365	13.5	45.8	27.0	13.5	-18.8
2922709.0	297631.1	370	13.5	43.5	27.0	13.5	-16.5
2922708.2	297636.0	375	13.4	44.3	27.0	13.6	-17.3
2922707.2	297640.9	380	13.4	45.8	27.0	13.6	-18.8
2922706.5	297645.8	385	13.3	44.5	27.0	13.7	-17.5
2922705.5	297650.8	390	13.3	45.0	27.0	13.7	-18.0
2922704.5	297655.7	395	13.2	45.8	27.0	13.8	-18.8
2922703.8	297660.6	400	13.2	46.3	27.0	13.8	-19.3
2922702.8	297665.5	405	13.1	46.9	27.0	13.9	-19.9
2922702.0	297670.4	410	13.1	45.6	27.0	13.9	-18.6
2922701.0	297675.3	415	13.0	46.3	27.0	14.0	-19.3
2922700.2	297680.3	420	13.0	45.8	27.0	14.0	-18.8
2922699.2	297685.2	425	12.9	45.4	27.0	14.1	-18.4
2922698.2	297690.1	430	12.9	46.9	27.0	14.1	-19.9
2922697.5	297695.0	435	12.9	44.7	27.0	14.1	-17.7
2922696.5	297700.0	440	12.8	45.8	27.0	14.2	-18.8
2922695.8	297704.9	445	12.8	44.3	27.0	14.2	-17.3
2922694.8	297709.8	450	12.7	43.7	27.0	14.3	-16.7
2922694.0	297714.7	455	12.7	42.6	27.0	14.3	-15.6
2922693.0	297719.6	460	12.6	43.3	27.0	14.4	-16.3
2922692.2	297724.6	465	12.6	43.2	27.0	14.4	-16.2
2922691.2	297729.5	470	12.6	43.2	27.0	14.4	-16.2

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 2							
2922962.2	297327.2	0	13.5	64.2	27.0	13.5	-37.2
2922961.2	297332.1	5	13.4	62.5	27.0	13.6	-35.5
2922960.2	297337.0	10	13.3	62.9	27.0	13.7	-35.9
2922959.2	297341.9	15	13.1	63.3	27.0	13.9	-36.3
2922958.2	297346.8	20	13.0	63.8	27.0	14.0	-36.8
2922957.2	297351.7	25	12.9	61.6	26.9	14.0	-34.7
2922956.2	297356.6	30	12.8	60.4	26.9	14.1	-33.5
2922955.5	297361.5	35	12.6	60.6	26.9	14.3	-33.7
2922954.5	297366.4	40	12.5	59.7	26.9	14.4	-32.8
2922953.5	297371.3	45	12.4	59.6	26.9	14.5	-32.7
2922952.5	297376.2	50	12.3	61.2	26.9	14.6	-34.3
2922951.5	297381.1	55	12.1	60.6	26.9	14.8	-33.7
2922950.5	297386.0	60	12.0	59.5	26.9	14.9	-32.6
2922949.5	297390.9	65	11.9	60.0	26.9	15.0	-33.1
2922948.5	297395.8	70	11.8	61.4	26.9	15.1	-34.5
2922947.5	297400.7	75	11.7	61.5	26.8	15.1	-34.7
2922946.5	297405.6	80	11.5	61.5	26.8	15.3	-34.7
2922945.5	297410.5	85	11.4	61.8	26.8	15.4	-35.0
2922944.5	297415.4	90	11.3	62.6	26.8	15.5	-35.8
2922943.5	297420.3	95	11.2	61.1	26.8	15.6	-34.3
2922942.8	297425.2	100	11.2	61.5	26.8	15.6	-34.7
2922941.8	297430.2	105	11.1	61.7	26.8	15.7	-34.9
2922940.8	297435.1	110	11.0	61.4	26.8	15.8	-34.6
2922939.8	297439.9	115	10.9	62.9	26.8	15.9	-36.1

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 2 (cont.)							
2922938.8	297444.8	120	10.8	63.5	26.7	15.9	-36.8
2922937.8	297449.8	125	10.7	64.3	26.7	16.0	-37.6
2922936.8	297454.7	130	10.6	65.1	26.7	16.1	-38.4
2922935.8	297459.6	135	10.5	65.9	26.7	16.2	-39.2
2922934.8	297464.5	140	10.4	66.9	26.7	16.3	-40.2
2922933.8	297469.4	145	10.4	65.7	26.7	16.3	-39.0
2922932.8	297474.3	150	10.3	62.9	26.7	16.4	-36.2
2922931.8	297479.2	155	10.2	62.9	26.7	16.5	-36.2
2922930.8	297484.1	160	10.1	63.3	26.7	16.6	-36.6
2922930.0	297489.0	165	10.0	63.8	26.6	16.6	-37.2
2922929.0	297493.9	170	9.9	63.8	26.6	16.7	-37.2
2922928.0	297498.8	175	9.6	64.2	26.6	17.0	-37.6
2922927.0	297503.7	180	9.3	62.5	26.6	17.3	-35.9
2922926.0	297508.6	185	9.1	62.0	26.6	17.5	-35.4
2922925.0	297513.5	190	8.8	60.5	26.6	17.8	-33.9
2922924.0	297518.4	195	8.5	59.8	26.6	18.1	-33.2
2922923.0	297523.3	200	8.3	55.2	26.6	18.3	-28.6
2922922.0	297528.2	205	8.0	53.5	26.6	18.6	-26.9
2922921.0	297533.1	210	7.8	51.0	26.6	18.8	-24.4
2922920.0	297538.0	215	7.7	48.6	26.5	18.8	-22.1
2922919.0	297542.9	220	7.7	44.9	26.5	18.8	-18.4
2922918.0	297547.8	225	7.7	41.3	26.5	18.8	-14.8
2922917.2	297552.7	230	7.6	39.3	26.5	18.9	-12.8
2922916.2	297557.6	235	7.6	39.6	26.5	18.9	-13.1

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 2 (cont.)							
2922915.2	297562.5	240	7.6	39.7	26.5	18.9	-13.2
2922914.2	297567.4	245	7.5	40.6	26.5	19.0	-14.1
2922913.2	297572.3	250	7.5	42.3	26.5	19.0	-15.8
2922912.2	297577.2	255	7.5	42.6	26.5	19.0	-16.1
2922911.2	297582.1	260	7.4	42.8	26.4	19.0	-16.4
2922910.2	297587.0	265	7.4	43.2	26.4	19.0	-16.8
2922909.2	297591.9	270	7.4	41.7	26.4	19.0	-15.3
2922908.2	297596.8	275	7.3	42.2	26.4	19.1	-15.8
2922907.2	297601.8	280	7.3	41.2	26.4	19.1	-14.8
2922906.2	297606.7	285	7.3	42.0	26.4	19.1	-15.6
2922905.2	297611.6	290	7.2	42.5	26.4	19.2	-16.1
2922904.5	297616.5	295	7.2	42.6	26.4	19.2	-16.2
2922903.5	297621.3	300	7.2	43.1	26.4	19.2	-16.7
2922902.5	297626.2	305	7.1	42.5	26.4	19.3	-16.1
2922901.5	297631.2	310	7.1	40.0	26.3	19.2	-13.7
2922900.5	297636.1	315	7.1	39.8	26.3	19.2	-13.5
2922899.5	297641.0	320	7.0	38.9	26.3	19.3	-12.6
2922898.5	297645.9	325	7.0	37.2	26.3	19.3	-10.9
2922897.5	297650.8	330	7.0	37.8	26.3	19.3	-11.5
2922896.5	297655.7	335	6.9	38.9	26.3	19.4	-12.6
2922895.5	297660.6	340	6.9	38.8	26.3	19.4	-12.5
2922894.5	297665.5	345	6.9	38.3	26.3	19.4	-12.0
2922893.5	297670.4	350	6.8	36.7	26.3	19.5	-10.4
2922892.5	297675.3	355	7.0	35.9	26.2	19.2	-9.7

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 2 (cont.)							
2922891.8	297680.2	360	7.1	36.8	26.2	19.1	-10.6
2922890.8	297685.1	365	7.3	38.7	26.2	18.9	-12.5
2922889.8	297690.0	370	7.4	39.5	26.2	18.8	-13.3
2922888.8	297694.9	375	7.6	41.3	26.2	18.6	-15.1
2922887.8	297699.8	380	7.8	40.7	26.2	18.4	-14.5
2922886.8	297704.7	385	7.9	41.3	26.2	18.3	-15.1
2922885.8	297709.6	390	8.1	41.2	26.2	18.1	-15.0
2922884.8	297714.5	395	8.2	42.6	26.2	18.0	-16.4
2922883.8	297719.4	400	8.4	42.9	26.1	17.7	-16.8
2922882.8	297724.3	405	8.5	42.5	26.1	17.6	-16.4
2922881.8	297729.2	410	8.7	41.9	26.1	17.4	-15.8
2922880.8	297734.1	415	8.8	43.3	26.1	17.3	-17.2
2922879.8	297739.0	420	9.0	42.8	26.1	17.1	-16.7
2922879.0	297743.9	425	9.1	41.7	26.1	17.0	-15.6
2922878.0	297748.8	430	9.2	40.2	26.1	16.9	-14.1
2922877.0	297753.8	435	9.3	42.0	26.1	16.8	-15.9
2922876.0	297758.6	440	9.5	40.0	26.1	16.6	-13.9
2922875.0	297763.5	445	9.6	41.4	26.1	16.5	-15.3
2922874.0	297768.4	450	9.8	40.0	26.0	16.2	-14.0
2922873.0	297773.3	455	9.8	39.3	26.0	16.2	-13.3
2922872.0	297778.2	460	9.7	38.5	26.0	16.3	-12.5
2922871.0	297783.2	465	9.7	38.1	26.0	16.3	-12.1
2922870.0	297788.1	470	9.7	36.6	26.0	16.3	-10.6

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 3							
2922754.8	297380.2	0	14.8	64.2	27.0	12.2	-37.2
2922758.8	297381.1	4	14.7	64.6	27.0	12.3	-37.6
2922762.5	297382.0	8	15.0	63.8	27.0	12.0	-36.8
2922766.5	297382.9	12	14.3	62.0	27.0	12.7	-35.0
2922770.2	297383.8	16	14.4	62.7	27.0	12.6	-35.7
2922774.2	297384.8	20	13.6	61.5	27.0	13.4	-34.5
2922778.0	297385.7	24	13.4	60.3	27.0	13.6	-33.3
2922782.0	297386.6	28	13.4	59.3	27.0	13.6	-32.3
2922786.0	297387.5	32	13.8	57.8	27.0	13.2	-30.8
2922789.8	297388.4	36	13.7	58.4	27.0	13.3	-31.4
2922793.8	297389.3	40	13.7	58.1	27.0	13.3	-31.1
2922797.5	297390.2	44	14.2	56.6	27.0	12.8	-29.6
2922801.5	297391.2	48	13.9	57.6	26.9	13.0	-30.7
2922805.2	297392.1	52	13.4	58.6	26.9	13.5	-31.7
2922809.2	297393.0	56	13.2	58.4	26.9	13.7	-31.5
2922813.2	297393.9	60	13.5	56.7	26.9	13.4	-29.8
2922817.0	297394.8	64	13.3	56.8	26.9	13.6	-29.9
2922821.0	297395.7	68	13.4	55.8	26.9	13.5	-28.9
2922824.8	297396.7	72	13.0	56.9	26.9	13.9	-30.0
2922828.8	297397.6	76	13.1	56.6	26.9	13.8	-29.7
2922832.8	297398.5	80	13.0	56.9	26.9	13.9	-30.0
2922836.5	297399.4	84	12.9	56.9	26.9	14.0	-30.0
2922840.5	297400.3	88	12.9	56.6	26.9	14.0	-29.7
2922844.2	297401.2	92	12.9	56.3	26.9	14.0	-29.4

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 3 (cont.)							
2922848.2	297402.1	96	12.6	57.1	26.9	14.3	-30.2
2922852.0	297403.0	100	12.6	56.8	26.9	14.3	-29.9
2922856.0	297404.0	104	12.7	56.2	26.9	14.2	-29.3
2922860.0	297404.9	108	12.4	57.1	26.9	14.5	-30.2
2922863.8	297405.8	112	12.1	57.6	26.9	14.8	-30.7
2922867.8	297406.7	116	11.9	58.1	26.9	15.0	-31.2
2922871.5	297407.6	120	13.0	57.0	26.9	13.9	-30.1
2922875.5	297408.5	124	13.2	55.9	26.9	13.7	-29.0
2922879.2	297409.4	128	13.3	56.1	26.9	13.6	-29.2
2922883.2	297410.3	132	14.2	57.5	26.9	12.7	-30.6
2922887.2	297411.3	136	15.0	57.5	26.9	11.9	-30.6
2922891.0	297412.2	140	15.9	57.3	26.9	11.0	-30.4
2922895.0	297413.1	144	15.9	57.4	26.8	10.9	-30.6
2922898.8	297414.0	148	15.9	57.2	26.8	10.9	-30.4
2922902.8	297414.9	152	15.8	58.9	26.8	11.0	-32.1
2922906.5	297415.8	156	15.7	58.1	26.8	11.1	-31.3
2922910.5	297416.8	160	15.6	58.5	26.8	11.2	-31.7
2922914.5	297417.7	164	15.5	58.9	26.8	11.3	-32.1
2922918.2	297418.6	168	15.4	59.9	26.8	11.4	-33.1
2922922.2	297419.5	172	15.3	61.2	26.8	11.5	-34.4
2922926.0	297420.4	176	15.2	60.9	26.8	11.6	-34.1
2922930.0	297421.3	180	15.1	61.6	26.8	11.7	-34.8
2922934.0	297422.2	184	15.0	60.7	26.8	11.8	-33.9
2922937.8	297423.2	188	14.9	60.5	26.8	11.9	-33.7

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 4							
2922732.5	297498.1	0	8.7	45.1	27.0	18.3	-18.1
2922736.5	297499.0	4	8.7	44.4	27.0	18.3	-17.4
2922740.2	297499.8	8	8.7	45.7	27.0	18.3	-18.7
2922744.2	297500.7	12	8.7	44.7	26.9	18.2	-17.8
2922748.0	297501.5	16	8.7	46.0	26.9	18.2	-19.1
2922752.0	297502.4	20	8.7	47.5	26.9	18.2	-20.6
2922756.0	297503.3	24	8.7	46.7	26.9	18.2	-19.8
2922759.8	297504.1	28	8.7	45.7	26.9	18.2	-18.8
2922763.8	297505.0	32	8.7	45.3	26.8	18.1	-18.5
2922767.8	297505.8	36	8.7	46.4	26.8	18.1	-19.6
2922771.5	297506.7	40	8.8	46.8	26.8	18.0	-20.0
2922775.5	297507.6	44	8.8	48.8	26.8	18.0	-22.0
2922779.2	297508.4	48	8.8	49.1	26.7	17.9	-22.4
2922783.2	297509.3	52	8.8	47.8	26.7	17.9	-21.1
2922787.2	297510.2	56	8.8	48.0	26.7	17.9	-21.3
2922791.0	297511.0	60	8.8	48.1	26.7	17.9	-21.4
2922795.0	297511.9	64	8.8	47.5	26.7	17.9	-20.8
2922799.0	297512.8	68	8.9	48.0	26.6	17.7	-21.4
2922802.8	297513.6	72	8.9	47.3	26.6	17.7	-20.7
2922806.8	297514.5	76	8.9	50.7	26.6	17.7	24.1
2922810.5	297515.3	80	8.9	49.6	26.6	17.7	-23.0
2922814.5	297516.2	84	8.9	51.5	26.6	17.7	-24.9
2922818.5	297517.1	88	8.9	49.3	26.5	17.6	-22.8
2922822.2	297517.9	92	9.0	49.1	26.5	17.5	-22.6

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 4 (cont.)							
2922826.2	297518.8	96	9.0	51.2	26.5	17.5	-24.7
2922830.2	297519.7	100	9.0	51.7	26.5	17.5	-25.2
2922834.0	297520.5	104	9.0	50.7	26.4	17.4	-24.3
2922838.0	297521.4	108	9.0	50.4	26.4	17.4	-24.0
2922841.8	297522.2	112	9.0	49.3	26.4	17.4	-22.9
2922845.8	297523.1	116	9.0	49.9	26.4	17.4	-23.5
2922849.8	297524.0	120	9.1	50.4	26.4	17.3	-24.0
2922853.5	297524.8	124	9.1	49.4	26.3	17.2	-23.1
2922857.5	297525.7	128	9.1	49.1	26.3	17.2	-22.8
2922861.5	297526.5	132	9.1	48.5	26.3	17.2	-22.2
2922865.2	297527.4	136	9.1	50.1	26.3	17.2	-23.8
2922869.2	297528.3	140	9.1	48.8	26.3	17.2	-22.5
2922873.0	297529.1	144	9.1	50.6	26.2	17.1	-24.4
2922877.0	297530.0	148	9.2	51.7	26.2	17.0	-25.5
2922881.0	297530.8	152	9.2	48.3	26.2	17.0	-22.1
2922884.8	297531.7	156	9.2	49.3	26.2	17.0	-23.1
2922888.8	297532.6	160	9.2	49.6	26.1	16.9	-23.5
2922892.8	297533.4	164	9.2	48.6	26.1	16.9	-22.5
2922896.5	297534.3	168	9.2	48.1	26.1	16.9	-22.0
2922900.5	297535.2	172	9.2	47.7	26.1	16.9	-21.6
2922904.2	297536.0	176	9.2	48.5	26.1	16.9	-22.4
2922908.2	297536.9	180	9.2	47.3	26.0	16.8	-21.3
2922912.2	297537.8	184	9.2	47.2	26.0	16.8	-21.2
2922916.0	297538.6	188	9.2	44.6	26.0	16.8	-18.6

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 5							
2922712.5	297611.4	0	7.7	44.1	27.0	19.3	-17.1
2922716.5	297612.2	4	7.7	45.5	27.0	19.3	-18.5
2922720.2	297613.0	8	7.7	45.5	27.0	19.3	-18.5
2922724.2	297613.8	12	7.7	45.4	26.9	19.2	-18.5
2922728.2	297614.6	16	7.8	45.5	26.9	19.1	-18.6
2922732.0	297615.3	20	7.8	43.8	26.9	19.1	-16.9
2922736.0	297616.1	24	8.3	45.4	26.9	18.6	-18.5
2922740.0	297616.9	28	8.8	45.2	26.9	18.1	-18.3
2922743.8	297617.7	32	8.0	46.0	26.8	18.8	-19.2
2922747.8	297618.5	36	8.3	46.4	26.8	18.5	-19.6
2922751.8	297619.3	40	8.5	47.2	26.8	18.3	-20.4
2922755.8	297620.1	44	8.0	47.9	26.8	18.8	-21.1
2922759.5	297620.8	48	7.8	48.6	26.7	18.9	-21.9
2922763.5	297621.7	52	8.7	49.5	26.7	18.0	-22.8
2922767.5	297622.4	56	8.7	48.6	26.7	18.0	-21.9
2922771.2	297623.2	60	8.7	49.0	26.7	18.0	-22.3
2922775.2	297624.0	64	9.1	48.1	26.7	17.6	-21.4
2922779.2	297624.8	68	9.3	50.3	26.6	17.3	-23.7
2922783.0	297625.6	72	9.4	50.4	26.6	17.2	-23.8
2922787.0	297626.4	76	8.9	51.3	26.6	17.7	-24.7
2922791.0	297627.2	80	8.2	51.5	26.6	18.4	-24.9
2922794.8	297627.9	84	8.3	48.6	26.6	18.3	-22.0
2922798.8	297628.7	88	8.4	47.6	26.5	18.1	-21.1
2922802.8	297629.5	92	8.5	44.9	26.5	18.0	-18.4

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

HAGER-RICHTER GEOSCIENCE, INC.

Easting (ft)	Northing (ft)	Station (ft)	Layer 1 Depth (ft)	Bedrock Depth (ft)	Surface Elevation (ft)	Layer 1 Elevation (ft)	Bedrock Elevation (ft)
Seismic Line 5 (cont.)							
2922806.5	297630.3	96	8.7	42.6	26.5	17.8	-16.1
2922810.5	297631.1	100	8.8	42.6	26.5	17.7	-16.1
2922814.5	297631.9	104	9.0	42.6	26.4	17.4	-16.2
2922818.5	297632.7	108	9.1	42.1	26.4	17.3	-15.7
2922822.2	297633.5	112	9.3	41.7	26.4	17.1	-15.3
2922826.2	297634.2	116	9.5	41.8	26.4	16.9	-15.4
2922830.2	297635.0	120	9.6	40.2	26.4	16.8	-13.8
2922834.0	297635.8	124	9.8	40.9	26.3	16.5	-14.6
2922838.0	297636.6	128	10.0	37.8	26.3	16.3	-11.5
2922842.0	297637.4	132	10.2	36.9	26.3	16.1	-10.6
2922845.8	297638.2	136	10.3	36.2	26.3	16.0	-9.9
2922849.8	297639.0	140	10.5	36.1	26.3	15.8	-9.8
2922853.8	297639.8	144	10.2	37.0	26.2	16.0	-10.8
2922857.5	297640.5	148	10.1	37.5	26.2	16.1	-11.3
2922861.5	297641.3	152	10.1	37.8	26.2	16.1	-11.6
2922865.5	297642.1	156	9.4	39.4	26.2	16.8	-13.2
2922869.2	297642.9	160	9.4	39.9	26.1	16.7	-13.8
2922873.2	297643.7	164	9.6	39.7	26.1	16.5	-13.6
2922877.2	297644.5	168	9.9	39.3	26.1	16.2	-13.2
2922881.2	297645.3	172	10.2	39.0	26.1	15.9	-12.9
2922885.0	297646.1	176	10.0	39.4	26.1	16.1	-13.3
2922889.0	297646.8	180	10.3	39.1	26.0	15.7	-13.1
2922893.0	297647.6	184	10.3	39.2	26.0	15.7	-13.2
2922896.8	297648.4	188	10.3	39.4	26.0	15.7	-13.4

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Maine West State Plane NAD83 (CORS96) in US survey feet. Elevations along the seismic lines were determined from plans provided by S.W. Cole.

TABLE 3
COMPARISON OF BEDROCK ELEVATIONS

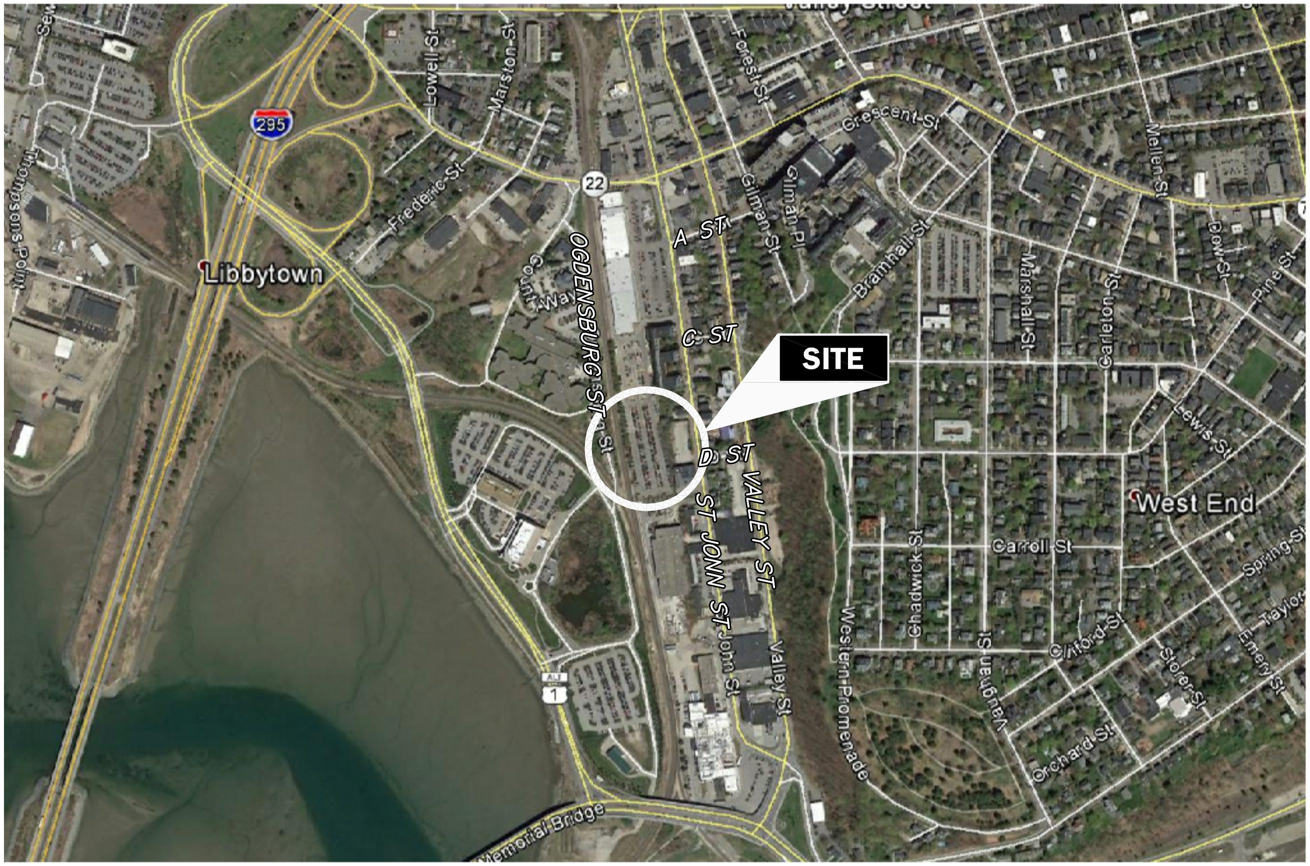
Comparison of Seismically Determined Bedrock Elevations with Bedrock Elevations Reported in Boring Logs

Seismic Line and Location	/	Boring	Distance from Seismic Line to Boring	Bedrock Depth (feet)		Difference	
				Seismic Line	Boring	Feet	Percent
SL1 0+30	/	B-201	32' E	64	62	2	3
SL1 4+70	/	B-202	40' NE	43	44	1	2
SL2 0+12	/	B-203B	15' W	63	61	2	3
SL2 4+70	/	B-204	27' N	37	34	3	9
SL3 0+99	/	B-205	1' S	57	54	3	6
SL5 1+02	/	B-206	41' N	43	41	2	5
					Average	2	5
					Standard Deviation	1	2

Comparison of Seismically Determined Bedrock Elevations at Seismic Line Intersections

Seismic Line A and Location	/	Seismic Line B and Location	Distance from Seismic Line A to Seismic Line B	Bedrock Depth (feet)		Difference	
				Seismic Line A	Seismic Line B	Feet	Percent
SL1 1+15	/	SL3 0+00	-	64	64	0	0
SL1 2+35	/	SL4 0+00	-	45	45	0	0
SL1 3+50	/	SL5 0+00	-	45	44	1	2
SL2 0+99	/	SL3 1+88	-	62	61	1	2
SL2 2+19	/	SL4 1+88	-	45	45	0	0
SL2 3+34	/	SL5 1+88	-	39	39	0	0
					Average	0	1
					Standard Deviation	1	1

Boring information provided by S.W. Cole. The absolute differences in feet reflect the absolute difference between bedrock depth determined for a location on a seismic line and bedrock depth reported for a nearby boring. The percentage differences were calculated by dividing the absolute differences in feet by the bedrock depth reported in the boring log.



N

APPROXIMATE SCALE (feet)

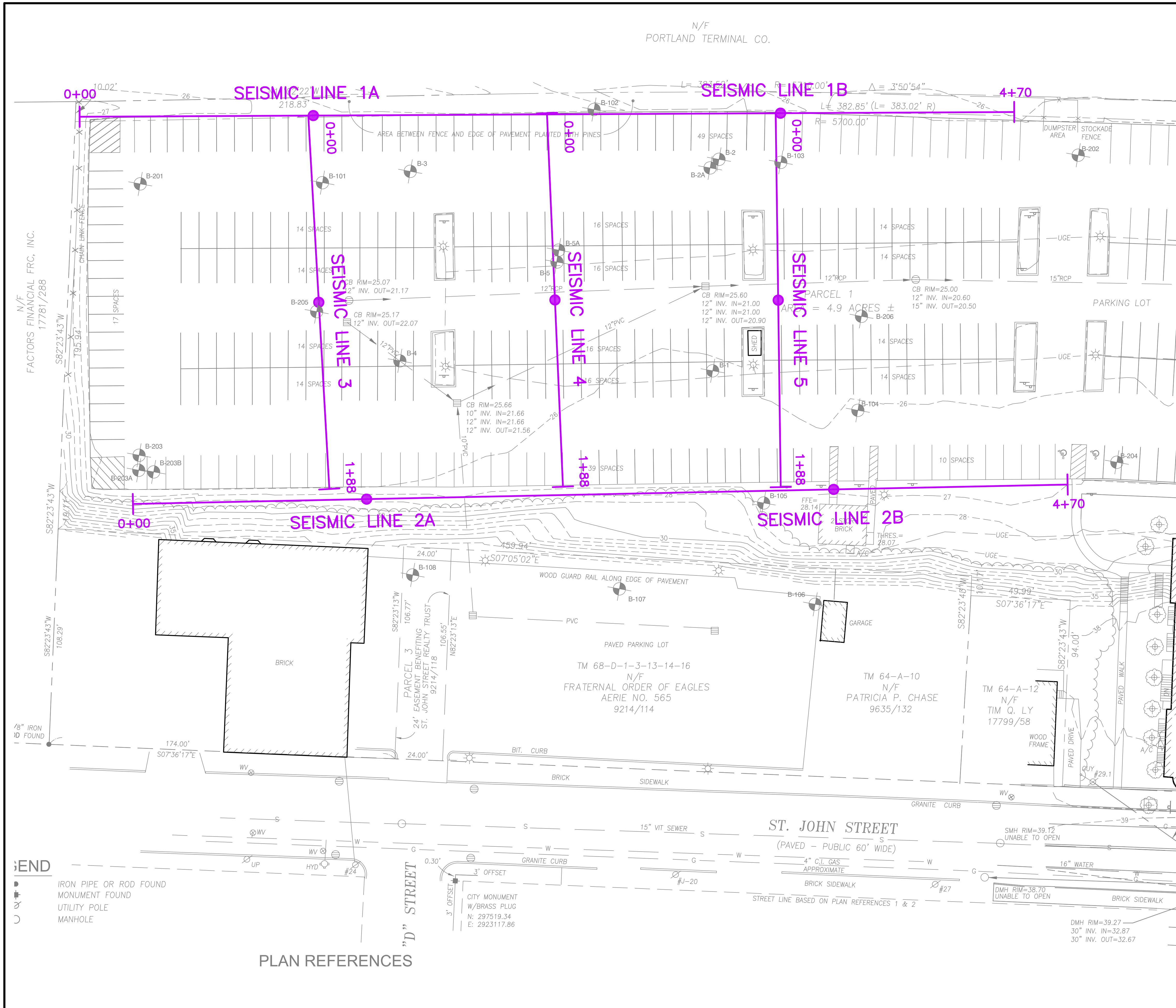
0 1000 2000

LOCATION

NOTE:

Modified from Google Earth Pro aerial photograph.

Figure 1 General Site Location Proposed Parking Structure Portland, Maine	
File 17J53	June, 2017
HAGER–RICHTER Salem, NH | Fords, NJ	



LEGEND

SEISMIC LINE WITH MIDPOINT

SCALE (feet)

0 50 100

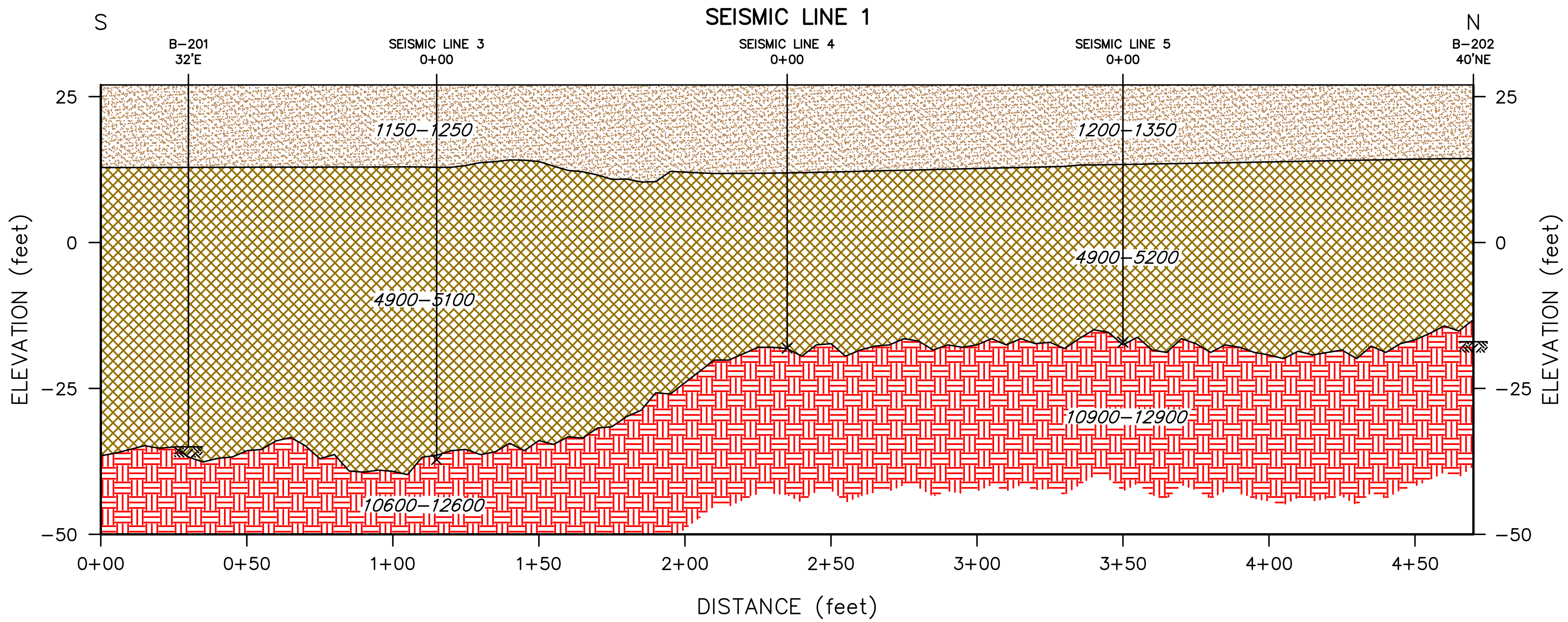
NOTE:

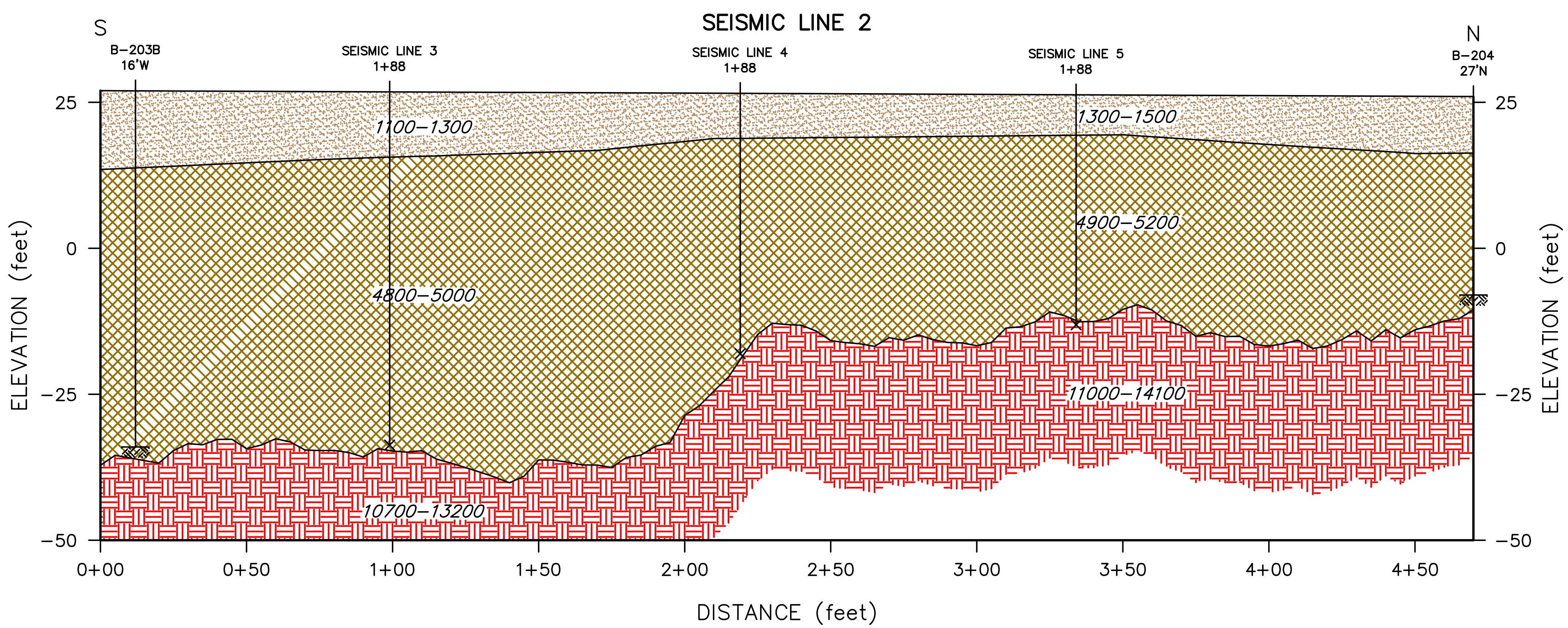
Modified from site plan provided by S.W. Cole Engineering, Inc., identified as 2016-343 USE THIS DWG.dwg.

Figure 2
Site Plan
Proposed Parking Garage
Portland, Maine

File 17J53	June, 2017

HAGER-RICHTER
Salem, NH | Fords, NJ





LEGEND

- Unsaturated soils
- Saturated soils
- Competent bedrock
- *10600–12600* Compression wave Velocity (fps)
- Interface determined from seismic refraction data
- SEISMIC LINE 3 0+00 — Intersecting seismic line with depth of bedrock
- B–203B 16'w — Boring with identification, distance from traverse, and depth of bedrock based on logs provided by S. W. Cole Engineering, Inc.

HORIZONTAL SCALE (feet)

0 50 100

Vertical Exaggeration = 2X

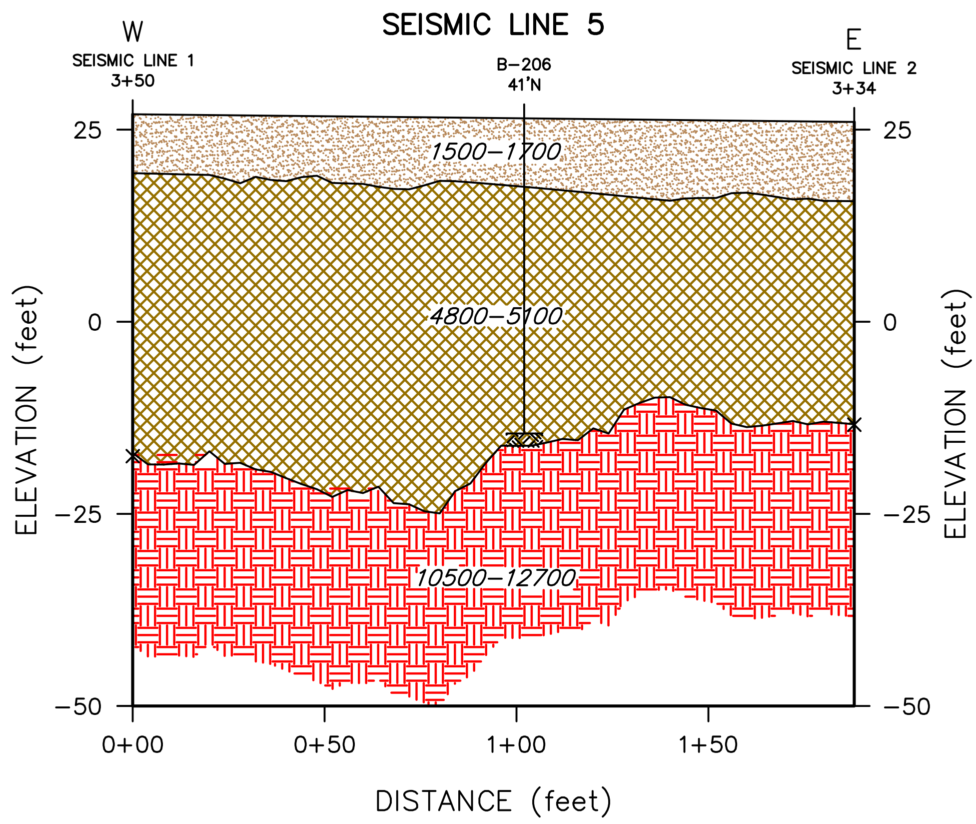
NOTES:

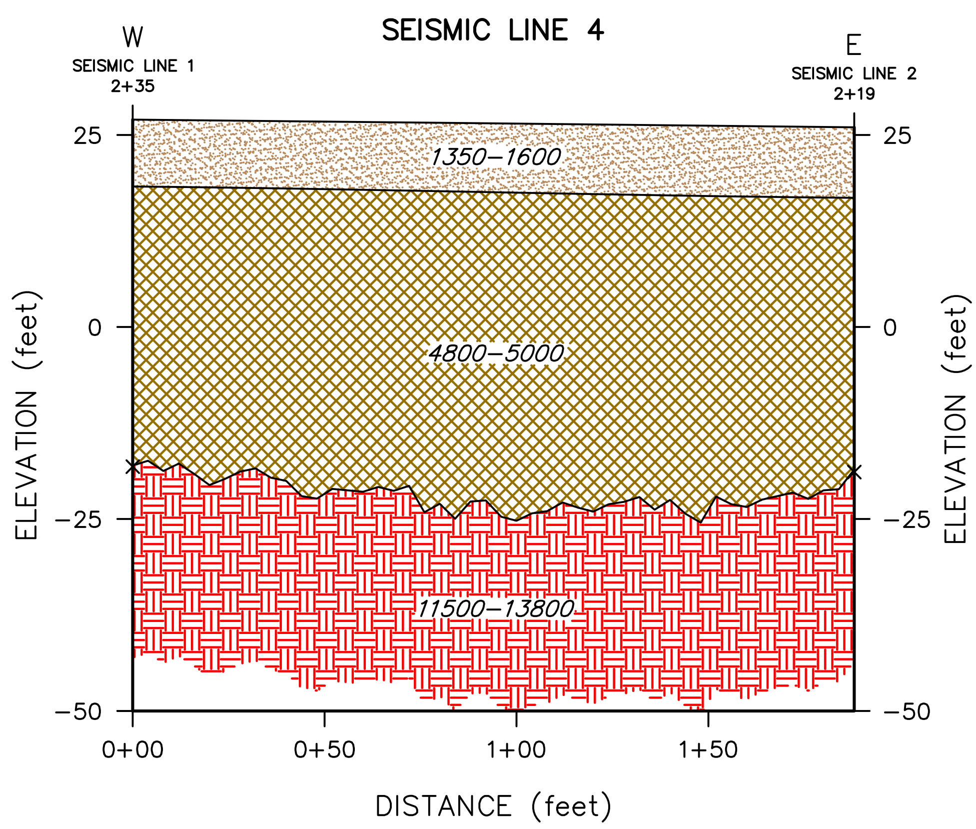
1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations determined from plans provided by S. W. Cole Engineering, Inc.
4. Data were analyzed using the Generalized Reciprocal Method.

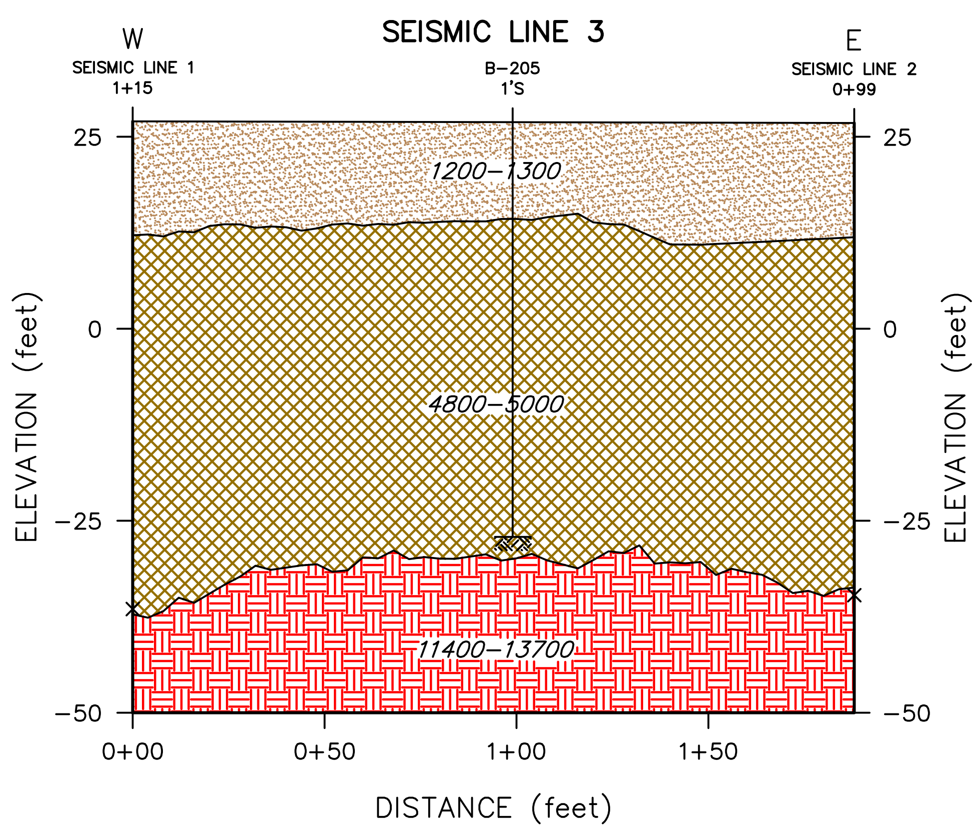
Figure 3
Seismic Lines 1 & 2
Proposed Parking Garage
Portland, Maine

File 17J53	June, 2017

HAGER–RICHTER
Salem, NH | Fords, NJ

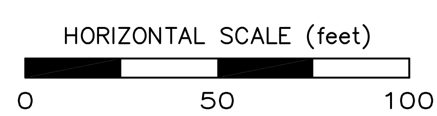






LEGEND

- Unsaturated soils
- Saturated soils
- Competent bedrock
- *10600–12600* Compression wave Velocity (fps)
- Interface determined from seismic refraction data
- SEISMIC LINE 3 0+00 — Intersecting seismic line with depth of bedrock
- B–203B 16'w — Boring with identification, distance from traverse, and depth of bedrock based on logs provided by S. W. Cole Engineering, Inc.



Vertical Exaggeration = 2X

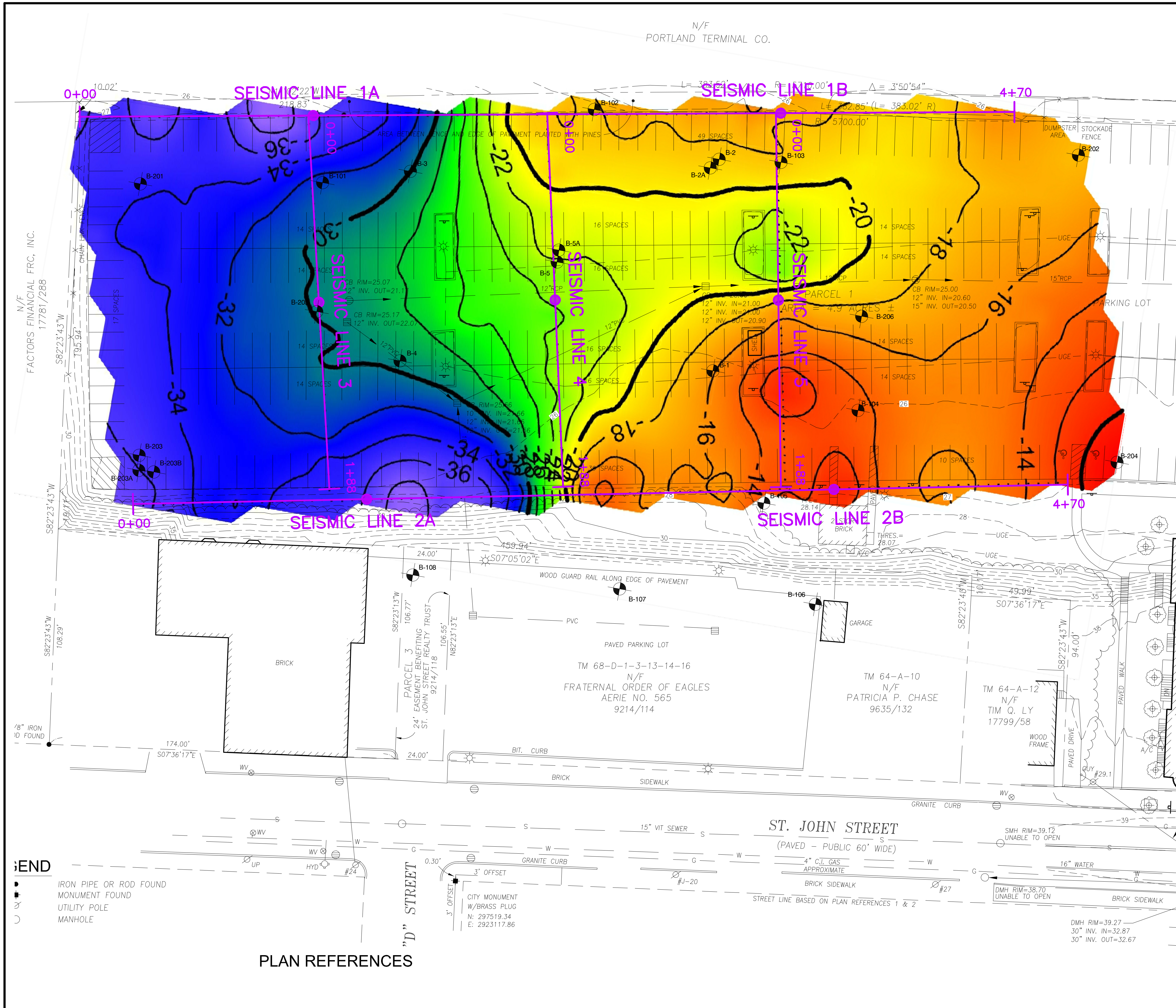
NOTES:

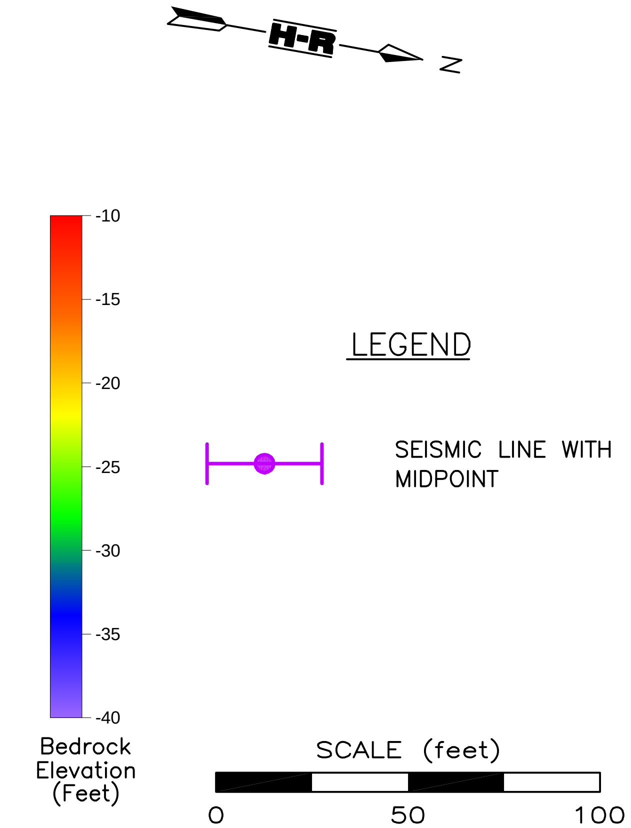
1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations determined from plans provided by S. W. Cole Engineering, Inc.
4. Data were analyzed using the Generalized Reciprocal Method.

Figure 4
Seismic Lines 3, 4, & 5
Proposed Parking Garage
Portland, Maine

File 17J53	June, 2017

HAGER–RICHTER
Salem, NH | Fords, NJ





NOTES:

1. Modified from site plan provided by S.W. Cole Engineering, Inc., identified as 2016-343 USE THIS DWG.dwg.
2. Contour Interval = 2 Foot.
3. The bedrock elevations shown on this plot are a non-unique model. The contours represent interpolations based on the available data, including seismic refraction data and boring information. The elevations of the bedrock surface at any particular location may differ from that shown. Bedrock elevations based on additional data may differ significantly.

Figure 5 Bedrock Elevation Proposed Parking Garage Portland, Maine	
File 17J53	June, 2017
HAGER-RICHTER Salem, NH | Fords, NJ	

WOODARD
&CURRAN

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS