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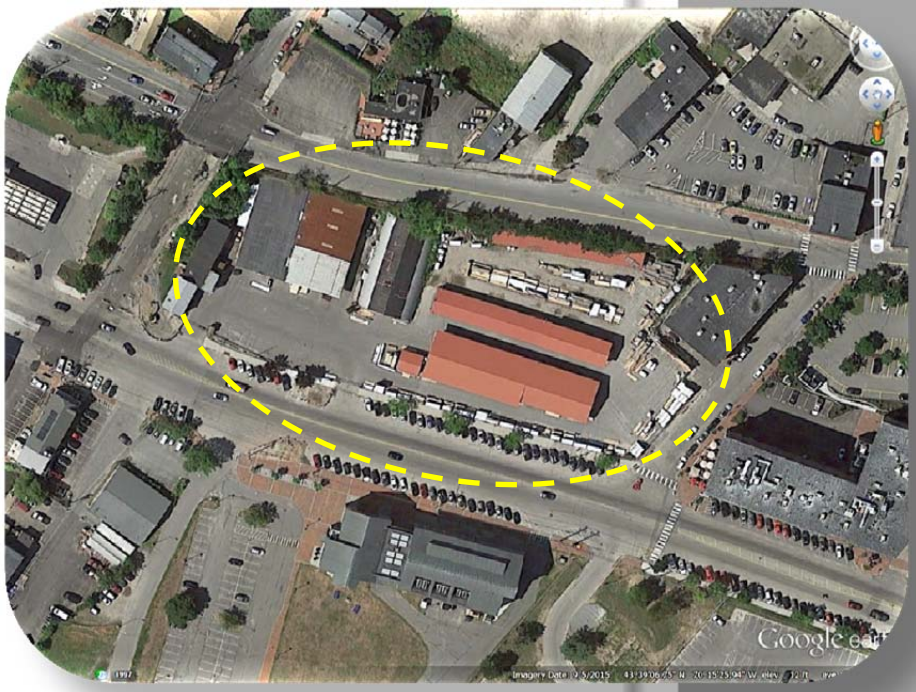
Final Geotechnical Report

Proposed Development

383 Commercial Street, Portland, Maine



Client
Reger Dasco Properties
15 Middle Street, Suite A2
Portland, ME 04101

SUMMIT
GEOENGINEERING SERVICES

Project #: 16158.1
Date: 2/6/18

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February 6, 2018
Summit #16158.1

Reger Dasco Properties
15 Middle Street, Suite A2
Portland, ME 04101
Attn: Joe Dasco

Reference: Geotechnical Engineering Report – Proposed Development
383 Commercial Street, Portland, Maine

Dear Joe;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed development at the site referenced above. Our scope of services included the excavation of 10 test pits, the drilling of 7 borings, 3 probes, and 1 cone penetration test (CPT) within the proposed development area, performing laboratory testing on collected samples, and preparing this geotechnical report summarizing our findings and providing geotechnical recommendations. SGS previously prepared a preliminary geotechnical report dated August 29, 2016 which provided preliminary discussions for the proposed development concept at that time.

This report covers building Phase 1 and Phase 2. Additional explorations will be required to provide foundation design and construction recommendations for Phase 3. Our scope of services for this project did not include an environmental site assessment or further investigation for the presence or absence of hazardous or toxic material on, below, or around the site. Any statements in this report or on the soil boring logs or test pit logs regarding odors or unusual and suspicious conditions observed are for informational purposes and are not intended to constitute an environmental assessment.

The subsurface conditions encountered in our explorations generally consist of existing fill overlying glacial marine or glacial till soil. Where encountered, bedrock ranged in depth from 10.5 feet to 28.5 feet below ground surface.

Based on the findings from our geotechnical exploration, engineering analyses, and discussions with you and the design team, we recommend that the foundations for the new buildings within the proposed development be supported on ground improvement (i.e. stone columns, aggregate piers, or rigid inclusions) or deep foundations extending to bedrock.

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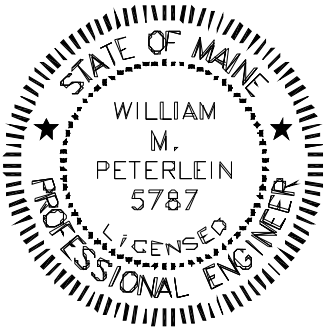
Discussions and recommendations for other geotechnical considerations such as subgrade preparation, pile design, allowable bearing pressure, retaining wall design, pavement sections, and construction considerations are presented in this report.

We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

Sincerely,

Summit Geoengineering Services, Inc.

Mathew Hardison, PE
Senior Geotechnical Engineer



William M. Peterlein, PE
President & Principal Engineer

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1.0 Project and Site Description

We understand that the project consist of the construction of 3 primary buildings and various parking areas and landscaped areas at the proposed development site. We further understand that the project will be divided into 3 phases, each phase assigned to one of the proposed buildings. The 3 phases and associated buildings are described as follows:

1.1 Phase 1

Phase 1 will encompass the eastern portion of the site adjacent to the existing Baxter School Building and Maple Street. The proposed building will be a 6-story, steel framed structure and will be "L" shaped with the short leg of the L parallel to Commercial Street. We understand that the proposed building will be used a hotel with the lobby, kitchen, restaurant, and fitness areas on the first floor with guest rooms above. The 2nd through 6th floor will span over an opening in the center of the first floor footprint which will be used for vehicle loading/unloading. A portion of the first floor will also include enclosed parking area (which will eventually connect to the Phase 2 structure). We understand that the first floor will be constructed at or near elevation 12.0 feet.

At the time of preparing this report, SGS was provided with structural loads for the Phase 1 and Phase 2 structures and not for the Phase 3 building. We understand that loads are anticipated to be approximately the same order of magnitude for this structure.

Anticipated structural loads were provided to us by Veitas & Veitas Engineers, Inc. (V&V) for the proposed Phase 1 building. We understand that isolated column loads are anticipated to range from 382 kips to 683 kips for exterior and interior footings, respectively. Dead load accounts for approximately 80% of the total load. At the time of preparing this report, uplift and lateral loads were not available to SGS.

1.2 Phase 2

Phase 2 is located in the middle portion of the property and will be a 7-story steel framed building and will be "U" shaped with the base of the "U" parallel to York Street. The first two floors will consist of mostly parking areas with some residences and retail space. The first floor parking will connect to the Phase 1 building and the vehicle passage areas of Phase 1. The second floor will connect to York street. The 3rd through 7th floor will be residential units. We understand that the first floor will be constructed at or near elevation 12.0 feet. Phase 1 and Phase 2 buildings will be connected with a walking bridge between the second floors.

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Anticipated structural loads were provided to us by Veitas & Veitas Engineers, Inc. (V&V) for the proposed Phase 2 building. We understand that isolated column loads are anticipated to range from 447 kips to 800 kips for exterior and interior footings, respectively. Dead load accounts for approximately 80% of the total load. At the time of preparing this report, uplift and lateral loads were not available to SGS.

1.3 Phase 3

The Phase 3 building will be a similar concept to Phase 2 and will include parking on the first two floors with residential units above. The building will be a "U" shaped structure with the base of the "U" parallel to High Street. We understand that the Phase 3 area will be used as paved parking prior to constructing the building. An additional geotechnical investigation and report will be required for Phase 3.

1.4 Site Features

The proposed development is located at 383 Commercial Street in Portland, Maine. The site is bordered by Commercial Street to the east, High Street to the south, York Street to the west, and Maple Street to the north. The site was previously used as an operating and materials storage facility for Rufus Deering Lumber. Existing structures at the site consist of a two-story retail building and various Quonset hut and open-sided storage buildings.

Existing grades within the proposed building footprint are relatively flat, ranging in elevation from 12.0 feet to 16.0 feet. The proposed finished floor elevation of the Phase 1 and Phase 2 buildings will be at approximately elevation 12 feet. Based on this, we anticipate up to 4 feet of cut will be required at the western end of the site (near the existing retaining wall) for the construction of the Phase 1 and Phase 2 slabs. Deeper cuts will be necessary for the footing construction.

There is an existing rock retaining wall oriented north-south along the western edge of the site which retains York Street above. The wall is partially dry-stacked and partially mortared. The retaining wall has an approximate maximum height of 14 feet.

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Figure 1: Existing rock retaining wall

2.0 Subsurface Explorations and Laboratory Testing

Summit Geoengineering Services (SGS) performed subsurface explorations at the site in two phases. The initial phase was conducted on August 14th, 2016 and included 3 borings (B-1 thru B-3) and one cone penetration test (CPT-1). The second phase was performed from April 13th to March 20th, 2017 and included 4 borings (B-101 thru B-104), 10 test pits (TP-1 thru TP-10), and 3 probes (P-101 thru P-103). The explorations from both phases are summarized below.

2.1 Subsurface Explorations

Test pits were excavated by Eastern Excavation, Inc. using a tracked Linkbelt 160x excavator under supervision of SGS. Test pits were excavated to depths ranging from 2.0 feet to 12.0 feet and were terminated in the fill layer, glacial till, or on bedrock where encountered.

The 7 borings, 3 probes, and 1 cone penetration test (CPT) were performed by Summit Geoengineering Services (SGS) using a rubber track mounted Power Probe 9500 VTR. All borings and CPTs were advanced to refusal, ranging in depth from 10.5 feet to 28.5 feet below ground surface. Borings were advanced using 3-inch direct push steel casing. Soils were visually classified (*ASTM D2488*) using SPT split spoon sampling (*ASTM D1586*) and thin wall tube sampling (*ASTM D1587*). An observation well was installed in Boring B-101.

One cone penetration test (*ASTM D5778*) was performed using a 5-ton digital cone anchored using a single-point hollow stem auger system. Parameters obtained include cone resistance

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(q_c), sleeve friction (f_s), and piezocone pore pressure (u). Shear wave velocity testing (*ASTM D7400*) was also performed during the CPT.

The explorations were located by SGS on the day of drilling by taping/pacing from existing features. These locations can be seen in the SGS Exploration Plan in Appendix A. The boring logs, test pit logs, CPT logs, and probe logs can be found in Appendix B.

2.2 Laboratory Testing

Laboratory testing was performed on a collected sample of the native glacial marine soil in order to characterize the deposit and determine engineering properties. The Shelby Tube collected in Boring B-102 at a depth of 10' to 12.5' was transported to and tested at the Summit Geoengineering Services Laboratory. Testing consisted of moisture contents (*ASTM D2216)*, and lab torvane testing. Detailed results of the laboratory tests can be found in Appendix C.

3.0 Subsurface Conditions

3.1 Soil

The following subsurface layers and thicknesses were encountered in our geotechnical investigation, starting from the ground surface:

- ***Pavement***, 4 inches to 9 inches (where present)
- ***Fill/Reworked Native,*** 2.0 feet to 18.5 feet
- ***Glacial Marine,*** greater than 2.0 feet to 11.0 feet (where present)
- ***Glacial Till***, 0.5 feet to 11.5 feet (where present)
- ***Bedrock,*** depth of 10.5 feet to 28.5 feet.

The table below summarizes the thickness of each soil layer and depth to refusal encountered at each exploration location.

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Table 1: Exploration Results

SUMMARY OF EXPLORATIONS AND SOIL LAYERING					
Exploration	**[1]Ground Surface Elevation (ft)**	**Refusal Depth (ft)**	Fill Thickness (ft.)	Glacial Marine Thickness (ft.)	Glacial Till Thickness (ft.)
B-1	13.5' +/-	20.8'	14.5'	NE	6.3'
B-2	13.0' +/-	24.5'	13.0'	NE	11.5'
B-3	12.5' +/-	18.1'	13.2'	NE	4.6'
B-101	15.0' +/-	10.5'	9.5'	NE	0.5'
B-102	12.0' +/-	28.5'	14.3'	11.0'	2.5'
B-103	12.1' +/-	19.0'	18.5'	NE	NE
B-104	12.4' +/-	24.1'	13.5'	10.1'	NE
CPT-1	13.5' +/-	16.0'	15.0'	NE	1.0'
TP-1	16.0' +/-	NE	4.5'	NE	NE
TP-2	14.0' +/-	2.0'	2.0'	NE	NE
TP-3	14.0' +/-	NE	5.0'	> 2.0'	NE
TP-4	12.0' +/-	NE	12.0'	NE	NE
TP-5	14.0' +/-	NE	8.0'	NE	> 1.0'
TP-6	13.0' +/-	NE	5.0'	NE	> 3.0'
TP-7	13.0' +/-	NE	10.0'	NE	NE
TP-8	13.0' +/-	NE	8.0'	NE	NE
TP-9	12.0' +/-	NE	9.5'	NE	> 0.5'
TP-10	12.0' +/-	NE	9.0'	NE	NE

[1]**Note:** Elevations are based on an interpolation of the site contours provided in the Site Plan
NE = Not Encountered

Pavement. The pavement at the site was encountered in Borings B-3, B-101, B-102, B-103, and B-104 and is 4" to 9" thick. The pavement is poor to moderate condition.

Fill/Reworked Native. The fill was encountered in all of the explorations at the site and ranges in thickness from 2.0 feet to 18.5 feet. In general, the fill is variable across the site, ranging in composition from silty sand, to sandy gravel, to silty clay. The fill contains an assortment of man-made materials including coal, bricks, ash, timber pieces, and concrete. The fill has a petroleum odor at select locations. Blow counts from Standard Penetration Testing (SPT-N) split spoon sampling in the fill ranged from 1 to 47 and averaged 13 blows per foot (bpf). SPT-N can also be correlated from the tip resistance measured from the CPT sounding (SPT-N_{CPT}). SPT-N_{CPT} within the fill layer correlated from CPT-1 is approximately 11 blows per foot. The fill is loose to

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dense, dry to wet, and visually classifies as SP-SM, SP, GP, GP-SM, CL, or ML in accordance with the Unified Soil Classification System.

Glacial Marine. The glacial marine soil was encountered in Borings B-102 and B-104 and Test Pit TP-3 directly below the fill layer. It ranges in thickness from greater than 2.0 feet to 11.0 feet. The glacial marine soil is described as black sand with little silt or silty clay with trace sand and gravel. The layer is loose, moist to wet, and is moderately mottled and contains organics in some locations. Laboratory testing of the silty clay portion of the layer resulted in moisture contents ranging from 36.9% to 47.8% with an average of 43.6%. SPT-N in the glacial marine ranges from 4 to 9 with an average of 6 blows per foot. The glacial marine classifies as SP, ML, CL, or OL in general accordance with USCS.

Glacial Till. The glacial till soil was encountered in all of the Borings except for B-103 and B-104, and was encountered in Test Pits TP-5, TP-6, and TP-9. It ranges in thickness from 0.5 feet to 11.5 feet. The glacial till is described as gray fine to coarse sand with trace to little gravel, little to some silt, and no to little clay. The layer is compact to dense and moist to wet. SPT-N in the glacial till ranges from 12 to 71 with an average of 32 blows per foot. The glacial till classifies as SP, SP-SM, or ML in general accordance with USCS.

3.2 Groundwater

On the day of the explorations, groundwater was encountered in all of the borings, the CPT, and four of the test pits (TP-1, TP-8, TP-9, and TP-10) at depths ranging from 2.9 feet to 9.5 feet below ground surface, depending on the time of measurements. In general, groundwater appears to fluctuate (with the tide) within the existing fill soil. Table 2 presents the depth and approximate elevation of the groundwater measured on the days of the explorations.

A monitoring well was installed in Boring B-101 to a depth of 10.0 feet below ground surface. The well consists of 1" PVC screen for the bottom 5 feet and 1" PVC riser from the top of the screen extending up to the ground surface. A groundwater measurement was collected in the monitoring well on the days of drilling (April 13th, 2017) and on July 28th, 2017.

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Table 2: Groundwater Depths and Approximate Elevations

GROUNDWATER DEPTHS and ELEVATIONS		
Exploration	**Depth (ft.)**	**Approximate Elevation (ft.)**
B-1	5.3’	8.2’ +/-
B-2	7.5’	5.5’ +/-
B-3	6.2’	6.3’ +/-
*B-101	2.9’ to 3.9’	12.1’ +/- to 11.1’ +/-
B-102	4.1’ to 8.1’	7.9’ +/- to 3.9’ +/-
B-103	6.0’ to 6.5’	5.6’ +/- to 6.1’ +/-
B-104	5.9’	6.5’ +/-
CPT-1	5.0’	8.0’ +/-
TP-1	3.5’	12.5’ +/-
TP-8	6.0’	7.0’ +/-
TP-9	9.5’	2.5’ +/-
TP-10	7.0’	5.0’ +/-

Note: All elevations are approximate and were interpolated from the Site Plan.
* = Measured in monitoring well.

3.3 Bedrock

Bedrock was encountered at the depths and approximate elevations shown in Table 3. Mapping by the Maine Geological Survey indicates the bedrock at the site is of the Precambrian Z Spring Point Formation consisting of green schist and amphibolite facies ranging from mafic to felsic volcanic rock.

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Table 3: Bedrock Depths and Approximate Elevations

BEDROCK DEPTHS and ELEVATIONS		
Exploration	**Depth (ft.)**	**Approximate Elevation (ft.)**
B-1	20.8’	-7.3’ +/-
B-2	24.5’	-11.5’ +/-
B-3	18.1’	-5.6’ +/-
*B-101	10.5’	4.5’ +/-
B-102	28.5’	-16.5’ +/-
B-103	19.0’	-6.9’ +/-
B-104	24.1’	-11.7’ +/-
CPT-1	16.0’	-2.5’ +/-

Note: All elevations are approximate and were interpolated from the Site Plan

4.0 Geotechnical Evaluation

We have identified the following geotechnical considerations in regard to the construction of the proposed building foundations:

- Potential for excessive total and differential settlements of footings with large loads constructed on loose, existing fill and native glacial marine soil.
- Potential for excessive total and differential settlements of slabs-on-grade constructed on loose, existing fill and native glacial marine soil.
- Presence of existing foundations within areas of proposed buildings.

Based on discussions with the design team, we understand that maximum settlement criteria for the proposed structures are 1.0” of total settlement and 0.50” of differential settlement between two adjacent columns. We further understand that the allowable slab settlement is 0.50”. If these settlement criteria change, if the proposed fill heights exceed 2 feet, or the proposed building loads vary from those presented in Section 1.0, SGS should be contacted in order to re-evaluate our recommendations.

The feasibility of following foundation types were evaluated for construction of the new buildings:

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- Shallow Foundations
  - Spread Footings
  - Structural Mat
- Deep Foundations
  - End Bearing Piles
- Ground Improvement
  - Preloading
  - Overexcavation and Replacement
  - Stone Columns/Aggregate Piers
  - Rigid Inclusions

The spread footing options was eliminated due to excessive settlement and inadequate bearing capacity based on the given structural loads. Even with localized improvement methods (i.e. proofrolling and/or including geotextile fabric), the variable composition of the fill and the compressibility of the underlying glacial marine soil resulted in unacceptable foundation settlements. The footing loads are simply too high to meet total settlement requirements and too variable to meet differential settlement requirements.

A structural mat foundation option was eliminated due to the potential for excessive total settlements beneath a mat with a large contact pressure which would likely be required for the loads provided to us. Additionally, the structural mat option would likely be uneconomical due to the required thickness and reinforcing of a thick mat.

The ground improvement options of preloading and overexcavation/replacement were eliminated. Preloading, even at large fill heights, would not provide adequate improvement to the fill and glacial marine soils layers to reduce long term settlements to the criteria stated above. Overexcavation/replacement would be prohibitively expensive due to the thickness of fill and glacial marine soil as well as the cost of disposal due to the potential for environmental contaminants.

Consequently, the remaining feasible foundations options include end bearing piles, stone columns/aggregate piers, and rigid inclusions. The rigid inclusion option also includes the option for a pile-supported load transfer platform (LTP). The table below summarizes the advantages and disadvantages of ground improvement and pile options for the proposed building.

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Table 4: Ground Improvement and Pile Comparison

GROUND IMPROVEMENT AND PILE FOUNDATION OPTIONS		
Method	**Pros**	**Cons**
Stone Columns / Aggregate Piers	• Possibly less expensive than alternatives. • Pile caps not needed	• Large number needed due to high loads. • No uplift capacity • Lower capacity than other options
Rigid Inclusions / Pile-Supported LTP	• Possibly less expensive than deep foundations • Pile caps not needed • Higher capacity than stone columns/agg. piers	• Load transfer platform may increase excavation depth • No uplift capacity • Lower capacity than piles
Steel H-Piles or Pipe Piles	• High Capacity, Fewer Needed • Capacity confirmed with PDA testing	• Pile caps needed • Corrosion Potential

In all cases of the deep foundations or ground improvement methods, the load bearing elements should extend to bedrock or the dense glacial till.

5.0 Geotechnical Recommendations – Foundation Support Systems

This section provides geotechnical recommendations for the design and construction of the ground improvement options and for deep foundations.

5.1 Ground Improvement (Stone Columns/Aggregate Piers or Rigid Inclusions)

Stone columns/aggregate piers are considered a vibro-replacement type ground improvement intended to increase the stiffness and bearing capacity of the supporting soil. Well-graded gravel or ¾" crushed stone is placed into holes which are either pre-drilled or punched with a hollow mandrel. The gravel or stone is compacted and densified in lifts to reinforce the existing soils and increase the net modulus to reduce settlement and increasing bearing capacity.

Rigid inclusions (RI) typically consist of concrete, grouted elements, or piles extending to a dense stratum or refusal to support foundation loads. The foundation loads are transferred to the stiff RI elements using a Load Transfer Platform (LTP) constructed between the top of the RI elements and the bottom of footings. LTPs may consist of engineered fill (sand and/or gravel)

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with possible layers of geogrid within the fill to ensure complete load transfer to the RI elements.

If ground improvement is selected to support the new building(s), we recommend that the stone columns/aggregate piers or rigid inclusion element be extended through the existing fill and native soil deposits and bear directly on the bedrock surface or the dense glacial till.

Ground improvement is typically provided as a design/build package. We recommend that the ground improvement design be performed to meet the following criteria:

- Maximum Allowable Bearing Pressure: 5,000 psf
- Maximum Total Long-Term Settlement: 1.0 inches
- Maximum Differential Long-Term Settlement: 0.5 inches between adjacent columns

If stone columns/aggregate piers are selected, we do not anticipate that they will need to be grouted.

Designs and drawings for ground improvement systems, and all ground improvement component (e.g., load transfer platforms), should be designed and stamped by a qualified Maine Licensed Professional Engineer. The contractor submittal shall include detailed design computations and construction installation drawings. SGS should be retained to review the contractor submittal on behalf of our client.

We recommend that a minimum of 1 load test be performed per building for stone columns/aggregate piers or rigid inclusions. Additional load tests and/or proof tests will be at the discretion of the ground improvement designer.

Any rubble/debris encountered in the upper fill layer that restricts installation will need to be removed or the hole will need to be pre-augered. Soil parameters used in the design of the ground improvement systems are at the discretion of the designer.

Based on preliminary stone column/aggregate pier calculations, we estimate that an area replacement ratio of 30% or higher may be required to obtain the allowable bearing pressure of 5,000 psf. The working pad from which the stone columns are installed should be the elevation of the bottom of the 12” slab subgrade (1.0 feet below bottom of slab). Imported fill within the project area should be minimal. All fill placed within the proposed building footprint should consist of Structural Fill (SF, see Section 6.4). Fill outside of the building footprint can consist of SF or Gravel Borrow (GB). The portion of GB passing the 3” sieve size should meet the following gradation requirements:

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Table 5: Gravel Borrow Gradation

GRAVEL BORROW (GB)	
Sieve Size	**Percent finer**
¼ inch	0 to 70
No. 200	0 to 10.0

Reference: MDOT Specification 703.19, Gravel Borrow

The maximum GB particle size should be limited to 6 inches. GB should be placed in 6 to 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557.

Assuming that the subgrade preparation recommendations contained herein are followed, the proposed slab can be constructed as a slab-on-grade on the existing proofrolled fill without the need for ground improvement.

If an alternative ground improvement type besides stone columns/aggregate piers or rigid inclusions is selected for this site, SGS should be notified so that we can evaluate the alternatives.

5.2 Pile Foundations

End bearing piles for this site would consist of H-Piles or steel pipe piles driven to refusal. We anticipate that the settlement of footings supported with end bearing piles will be negligible. To support the high column loads and assist in making the pile option economical, we recommend that consideration be given to high capacity piles (e.g. 100 tons).

We recommend that piles consist of Grade 50 steel and that all piles be vibrated or driven to bedrock, which is anticipated to range from 10 feet to 30 feet below the current ground surface.

To provide pile design recommendations, we have preliminarily assumed that the piles will have a minimum diameter of 10”. SGS should be notified in order to provide updated recommendations if smaller piles are selected for design. We recommend that the pile design be performed and stamped by a qualified Maine Licensed Professional Engineer and the design be made available to Summit Geoengineering Services, Inc. for review.

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We recommend that piles be designed and installed in accordance with the International Building Code 2015 (IBC 2015), Section 1810. The designed piles should be verified with a WEAP analysis to ensure that driving stresses do not exceed the allowable capacity of the piles. We recommend that end bearing piles be driven to a minimum allowable capacity of 100 tons.

Based on the shallow bedrock encountered in Boring B-101, bedrock may be encountered at depths of approximately 5 to 6 feet below bottom of footing. If the pile installation contractor encounters difficulty in installing piles this short due to limited confining soil and sloping bedrock, the soil can be removed and the footing cast directly on bedrock. If this occurs, SGS should be contacted to perform a subgrade inspection of the exposed bedrock and provide subgrade preparation recommendations for the footings extending to bedrock.

5.2.1 Lateral Support

We recommend that the allowable lateral capacity of the installed piles be taken as a maximum of 4 kips per pile in the direction of the major principle axis. If a higher lateral capacity is desired, the pile designer shall submit a lateral capacity computation, stamped by a qualified Maine Professional Engineer, for review by SGS. All soil within a 3 foot width beyond the edge of the pile in all directions should be proofrolled with a minimum of 4 passes in each of two perpendicular directions with a 5-ton (operating weight) vibratory roller. Any unsuitable soils exposed at the ground surface around the pile should be removed and replaced with SF or ¾" Crushed Stone. If fill is required to raise the grade around the pile, it should consist of SF placed in 12" lifts and compacted to 95% of the dry density in accordance with ASTM D1557. Lateral capacity of piles which are spaced closer than 8 pile diameters center-to-center in the direction of loading should be reduced using the following table:

Table 6: Lateral Capacity Reduction

LATERAL CAPACITY REDUCTION	
Pile Spacing (in direction of loading)	**Capacity Reduction**
8D	1.00 (None)
6D	0.70
4D	0.40
3D	0.25

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5.2.2 Corrosion Protection

We recommend that corrosion resistance measures be taken to protect the long-term integrity of the piles. In the order of preference, these measures include:

- If pipe piles are used, filling the piles with concrete
- Increasing the size of the steel pile to account for area loss over time
- Coating the pipe pile with a corrosion inhibitor

To increase the corrosion protection, more than one of the above mentioned methods can be used. The corrosion rate of an uncoated steel pile at this site is estimated to be in the order of 0.002 in/year.

5.2.3 Uplift Resistance

We recommend that the ultimate uplift capacity of the H-piles or pipe piles be taken as the dead weight of the pile, pile cap, soil above the pile cap, friction of the mobilized soil, and soil friction resistance along the length of the pile. We recommend that factor of safety of 1.0 be used for the dead weight calculations, and a factor of safety of 2.5 be used for the mobilized soil and soil friction resistance along the pile.

5.2.4 Pile Splices

We anticipate that pile splices will not be required for the installed piles.

5.2.5 Downdrag

Assuming that the proposed fill height (including slab) is 2.5 feet or less, we anticipate that consolidation of the glacial marine soil will be negligible and downdrag force along the length of the pile embedded in the clay can be ignored in the pile design.

5.2.6 Pile Testing and Field Monitoring

All piles should be installed to an ultimate capacity equal to the allowable axial capacity multiplied by a factor of safety of 2.5. To ensure that this capacity is developed, and to avoid over-stressing of the installed piles, we recommend dynamic pile testing (PDA) be performed on select piles in accordance with ASTM D4945. We further recommend that a specialty consultant be used to perform these tests.

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In addition to the PDA testing, we also recommend that a detailed pile-driving log for each pile be performed and reviewed to evaluate pile installation and consistency. The contractor or a qualified technician can record the pile-driving logs. If the contractor is selected to record the pile driving logs, we recommend that SGS review the logs and verify that the piles are being installed within the design recommendations.

We recommend that the skin friction values generated by the compressive load test (ASTM D4945) be evaluated to verify the field uplift capacity.

Field testing for lateral capacity is not required.

6.0 Geotechnical Recommendations – General

6.1 Non-Bearing Footings and Pile Caps

Assuming that the recommendations below are followed, we recommend that non-bearing foundation elements for the proposed structure such as grade beams and non-load bearing foundation walls be proportion using an allowable bearing pressure of 1,000 psf. The following subgrade preparation recommendations also apply to pile caps.

- All footings exposed to freezing temperatures are constructed at the recommended frost protection depth of 4.0 feet below exterior finish grade. Interior footings should be constructed at a minimum depth of 2.0 feet below finish floor elevation (FFE) in heated areas and 4.0 feet below FFE in non-heated areas.
- Non-bearing footing elements and pile caps are constructed on a minimum of 6" of ¾" crushed stone. The ¾" crushed stone should be compacted with a walk-behind plate compactor.
- All placed fill within the building footprint consists of Structural Fill (SF, see Section 6.4 for gradation and compaction requirement) or ¾" crushed stone.

If ground improvement is selected to support the new foundation, any additional subgrade improvements required beneath footings (i.e. proofrolling, over-excavation and replacement, etc.) should be provided by the ground improvement designer and reviewed by Summit Geoengineering Services.

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6.2 Frost Protection

The design air freezing index for the Portland area is approximately 1,200 degree F days (10 year, 90% probability). Based on this, a total of 4.0 feet of frost protection should be provided for the exterior footings and interior footings exposed to freezing temperatures. Interior footings constructed in continuously heated areas can be constructed at a depth of 2.0 feet below interior grade.

We recommend that the exterior of all foundation elements exposed to freezing temperatures be backfilled with Foundation Backfill (FB). The portion of FB passing the 3" sieve size should meet the following gradation requirements:

Table 7: Foundation Backfill Gradation

FOUNDATION BACKFILL	
Sieve Size	**Percent Finer**
3 inch	100
¼ inch	25 to 100
No. 40	0 to 50
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type E (2014)

Maximum particle size should be limited to 4 inches. Foundation backfill should be placed in 6 to 12 inch lifts and compacted to 95% of its optimum dry density determined in accordance with ASTM D1557.

6.3 Seismic Design

Based on the summary of field results we recommend Site Class D be used in accordance with the 2012 or 2015 International Building Code. The following seismic site coefficients should be used:

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Table 8: Seismic Design Parameters

SUBGRADE SITE SEISMIC DESIGN COEFFICIENTS – 2012/2015 IBC	
Seismic Coefficient	**Site Class D**
Short period spectral response (S_S)	0.241
1 second spectral response (S_1)	0.078
Maximum short period spectral response (S_{MS})	0.385
Maximum 1 second spectral response (S_{M1})	0.187
Design short period spectral response (S_{DS})	0.257
Design 1 second spectral response (S_{D1})	0.125

6.4 Ground Floor Slab-on-Grade and/or Pavement

This section provides recommendations for a concrete slab-on-grade or pavement surface in the event that both types of surface are used for the ground floor area. Additionally, this section will provide recommendations for both heated and unheated conditions.

6.4.1 Concrete Slab-on-Grade

We recommend that the slab for the new building in heated areas be constructed on a minimum of 12" of Structural Fill (SF, see table below) or ¾" crushed stone overlying a non-woven geotextile such as Mirafi 600x or approved equivalent. If ¾" crushed stone is used, it should be placed in 12" lifts and be compacted with a minimum of 4 passes in each of two perpendicular directions with a vibratory roller. If the slab is constructed in unheated building areas or is an exterior slab, the slab subgrade thickness should be increased to 24" and the slab should be constructed on 1.5" of rigid insulation. Alternatively, the subgrade soil thickness could be increased to 48" (including the slab) if rigid insulation is not used to provide adequate frost heave protection. The portion of SF passing the 3" sieve shall meet the following gradation requirements.

Table 9: Structural Fill Gradation

STRUCTURAL FILL (SF)	
Sieve Size	**Percent finer**
3 inch	100
½ inch	35 to 80
¼ inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type D

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For the conditions described above, the slab can be designed using a subgrade modulus value of 150 pci.

6.4.2 Pavement

The mean annual freezing index for the Portland area is estimated at 900 degree days. Based on the subgrade and mean annual freezing index, the anticipated mean annual frost penetration depth is 36 inches.

We recommend a minimum total section thickness of 18 inches for pavement in unheated areas. We further recommend that the pavement section consist of the following materials:

Table 10: Pavement Section Recommendations

MATERIAL	THICKNESS (in)	SPECIFICATION
Asphalt Surface Course	1	MDOT 703.09 Type 9.5 mm or Type 12.5 mm
Asphalt Binder Course	2	MDOT 703.09 Type 19 mm
Base Soil	3	MDOT 703.06 Type A
Subbase Soil	12	MDOT 703.06 Type D

The Subbase soil thickness can be reduced to 6" if the area is continuously heated. For portions of the pavement subjected to light traffic loads of cars and light trucks we recommend MDOT Type 9.5mm surface course. The following specifications are for MDOT base and subbase gravel:

Table 11: Pavement Section Materials

SIEVE SIZE	Percent Passing a 3-inch Sieve	
	MDOT Type A (Base)	MDOT Type D (Subbase)
3 Inch	100	100
2 Inch	100	--
½ Inch	45 – 70	35 – 80
¼ Inch	30 – 55	25 – 65
No. 40	0 – 20	0 – 30
No. 200	0 – 6	0 – 7

Reference: MDOT Specification 703.06, Aggregate for Base and Subbase (2014)

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The recommendations above can be used for exterior pavement areas.

6.5 Groundwater Control

Based on observed groundwater levels, groundwater is anticipated to be at or near proposed first floor elevation. Based on this we recommend perimeter underdrains be installed along the exterior foundation walls. In addition, we recommend exterior grades slope away from the building footprint to reduce runoff water from infiltrating the foundation backfill soils.

Perimeter underdrains should consist of 4 inch rigid perforated PVC placed adjacent to the exterior footings and surrounded by a minimum of 6 inches of crushed stone wrapped in filter fabric to prevent clogging from the migration of the fine soil particles in the foundation backfill soils. The underdrain pipe should be outlet to a location where it will be free flowing. If the grades do not allow a gravity outlet, a sump and pump would be required.

6.6 Retaining Walls

Based on the current site development concept, there will be retaining walls along the western portions of the proposed buildings near York Street. A portion of these retaining walls will be in front of the existing dry-stacked and mortared rock retaining wall along the western boundary of the site.

We recommend that the gap in between the existing rock retaining wall and new cast-in-place retaining wall be filled with ¾" crushed stone to reduce the load applied to the new wall and to provide free drainage for any surface water. The upper portion of this backfill zone (24" to 48" thick) can be filled with finer-grained material to construct landscaping or walkways, if desired. We recommend a geotextile be installed at the surface of the ¾" crushed stone layer to eliminate the migration of fine particles into the stone.
We recommend that all other retaining walls be backfilled with Foundation Backfill (FB, see Section 6.2 for gradation analysis).

The following table can be used to design structural components of cast-in-place concrete retaining walls with the equivalent fluid pressure method of soil. Note that these values assume a flat backslope or toeslope and will require a modification if there is a slope.

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Table 12: Equivalent Fluid Pressure

EQUIVALENT FLUID PRESSURE (EFP)			
SOIL	**ACTIVE EFP**	**AT-REST EFP**	**PASSIVE EFP**
¾" Crushed Stone	23 psf	38 psf	550 psf
Foundation Backfill	38 psf	60 psf	475 psf

A sliding coefficient of 0.60 can be used for cast-in-place concrete on ¾" crushed stone. Retaining walls should be designed to accommodate traffic and construction surcharge loads. Subgrade preparation methods, frost protection depth, and underdrain requirements for permanent retaining walls are provided in Section 6.1, 6.2, and 6.5 respectively.

7.0 Earthwork Considerations

Caution should be used for any excavations performed near the toe of the existing dry-stacked rock retaining wall. Test Pit TP-1 was performed at the toe of the wall to a depth of 4.5 feet below ground surface and the base of the wall was below this. Heavy groundwater seepage should be anticipated in excavations at the toe of the wall. It may be desirable to excavate test pits in select sections at the toe of the wall to determine the base of wall depths. If the base of the wall is above the proposed foundation excavations, these areas will require temporary support of the existing wall. The contractor should submit a means and methods plan for SGS to review if shoring is required.

Vibrations are anticipated during construction of the ground improvement or pile foundation installation. We believe that the existing wall is massive enough to withstand the anticipated vibrations. However, the contractor should take the necessary precautions for monitoring vibrations and/or adjacent structures, as necessary based on the anticipated vibrations.

All existing foundation elements should be removed from their entirety from within proposed building footprints.

The table below summarizes the OSHA general excavation guidelines for occupied excavations for the soils encountered in our geotechnical explorations. All permissible slopes below apply to soil above groundwater table:

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Table 13: OSHA Permissible Slopes

OSHA Excavation Slopes		
Soil	**OSHA Classification**	**Permissible Slope**
Existing Fill	Type C	1.5H:1V
Marine Sand	Type C	1.5H:1V

Any excavations greater than 20 feet should be designed by a qualified Maine Licensed Professional Engineer.

We do not anticipate that the existing fill soil will meet the gradation requirements for Foundation Backfill (FB) or Structural Fill (SF).

Surface water should be redirected from excavation areas. Where softened, we recommend the subgrade at the base of the excavation be over-excavated and replaced with a minimum of 12 inches of Crushed Stone. Crushed Stone should be should be tamped to lock the stone structure together. Crushed Stone should meet the following gradation specification:

Table 14: 3/4" Crushed Stone – Soil Gradation

CRUSHED STONE ¾ INCH	
Sieve Size	**Percent finer**
1 inch	100
¾ inch	90 to 100
⅜ inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

Reference: VTRANS Specification 704.02B, ¾" Crushed Stone

We recommend that a qualified geotechnical consultant be retained to monitor and test soil materials used during construction and confirm that soil conditions and construction methods are consistent with this report.

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8.0 Closure

Our recommendations are based on professional judgment and generally accepted principles of geotechnical engineering and project information provided by others. Some changes in subsurface conditions from those presented in this report may occur. Should these conditions or the proposed development (i.e. building configurations, foundation loads, proposed grades, etc.) differ from those described in this report, SGS should be notified so that we can re-evaluate our recommendations.

This report covers building Phase 1 and Phase 2. Additional explorations will be required to provide foundation design and construction recommendations for Phase 3.

We highly recommend that the ground improvement design and pile design be made available to SGS for review in order to verify that the design conditions are consist with the recommendations provided in this report.

It is recommended that this report be made available in its entirety to contractors for informational purposes and be incorporated in the construction Contract Documents. We recommend that SGS be retained to review final construction documents relevant to the recommendations in this report. We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

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APPENDIX A

EXPLORATION LOCATION PLAN

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YORK STREET — PAVED – PUBLIC – VARIABLE WIDTH

HIGH STREET — PAVED – PUBLIC 66' WIDE

COMMERCIAL STREET — PAVED – PUBLIC – VARIABLE WIDTH

MAPLE STREET — PAVED – PUBLIC

AREA UNDER CONSTRUCTION

JERSEY BARRIERS

DOUBLE YELLOW LINE

30"SEWER

BRICK SIDEWALK

STONE MASONRY RETAINING WALL

RET. WALL WITH CONC. ON TOP

CHAIN LINK FENCE

GR. BLOCK RET. WALL

GUARDRAIL & FENCE

END OF CONCRETE WALL

STOP LINE

SIGNAL POLE

SIGNAL BOX

PED. SIGNAL

N21°56'35"E 83.78'

N18°56'35"E 48.75'

N13°23'35"E 105.42'

N11°08'35"E 284.34'

COVERED LUMBER STORAGE

1 STORY METAL STORAGE BUILDING

QUONSET STORAGE BUILDING

CONTAINER

OVERHANG

FFE= 15.77

FFE= 13.52

FFE= 13.32

FFE= 13.04

FFE= 11.91

LPG

2 STORY WOOD FRAME

COVERED PORCH

SIGN

DIV. FILL

THRES.= 14.94

FFE= 14.87

THRES.= 15.14

N64°18'35"W 175.07'

COVERED LUMBER STORAGE

OPEN ENDED LUMBER STORAGE BUILDING

CONCRETE

OVERHANG

FFE= 12.55

THRES.= 12.81

METAL BUILDING

PAVED

LOT AREA = 112,647 S.F. 2.586 ACRES

TM 42-A-7-1 N/F RUFUS DEERING CO 14115/13

3 – STORY BRICK

ACCESS EASEMENT 1555/24

STOCKADE FENCE

BOULDERS

N42°18'25"E 85.00'

S47°41'35"E 88.59'

S47°41'35"E 126.86'

GATE

GATE HOUSE

98.29' N35°41'25"E

72.37' N21°58'10"E

395.85' N17°07'10"E

CONCRETE SIDEWALK

BRICK

LAWN

BM 1= TOP HYDRANT SPINDLE ELEV. 15.36

BM 2= TOP HYDRANT SPINDLE ELEV. 14.50'

TP-1 TP-2 TP-3 TP-4 TP-5 TP-6 TP-7 TP-8 TP-9 TP-10

B-1 B-2 B-3 B-101 B-102 B-103 B-104

CPT-1

P-101 P-102 P-103

NORTH

SCALE: 1" = 60'

0 30 60 120 180

LEGEND

B-1	SUMMIT TEST BORING (AUGUST 14, 2016)
B-101	SUMMIT TEST BORING (APRIL 13, 2017)
CPT-1	SUMMIT CONE PENETRATION TEST (AUGUST 14, 2016)
TP-1	SUMMIT TEST PIT (MARCH 20, 2017)
P-101	SUMMIT TEST PROBE (APRIL 13, 2017)

PLAN REFERENCE

"BOUNDARY & TOPOGRAPHIC SURVEY", DATED SEPTEMBER 6, 2015, PREPARED BY OWEN HASKELL, INC.

REVISED: JULY 10, 2017 - ADD 4 BORINGS, 3 PROBES

PROJECT: 383 COMMERCIAL STREET
PORTLAND, MAINE

CLIENT: REGER DASCO PROPERTIES

TITLE: EXPLORATION LOCATION PLAN

SCALE: AS NOTED

DATE: MARCH 21, 2017

DRAWN BY: KRF

APPR. BY: WMP

SUMMIT GEOENGINEERING SERVICES
173 PLEASANT STREET
ROCKLAND, ME 04841
Tel: (207) 318-7761
145 LISBON ST. - SUITE 601
LEWISTON, ME 04240
Tel: (207) 576-3313

PROJ.#: 16158.1

FIGURE: 1

APPENDIX B

EXPLORATION LOGS

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
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EXPLORATION COVER SHEET

The exploration logs are prepared by the geotechnical engineer from both field and laboratory data. Soil descriptions are based upon the Unified Soil Classification System (USCS) per ASTM D2487 and/or ASTM D2488 as applicable. Supplemental descriptive terms for estimated particle percentage, color, density, moisture condition, and bedrock may also be included to further describe conditions.

Drilling and Sampling Symbols:

SS = Split Spoon Sample
UT = Thin Wall Shelby Tube
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RW = Rotary Wash
SV = Shear Vane
PP = Pocket Penetrometer
RC = Rock Core Sample
FV = Field Vane Shear Test
PS = Concrete Punch Sample
Hyd = Hydraulic Advancement of Drilling Rods
Push = Direct Push of Drilling Rods
WOH = Weight of Hammer
WOR = Weight of Rod
PI = Plasticity Index
LL = Liquid Limit
W = Natural Water Content
USCS = Unified Soil Classification System
Su = Undrained Shear Strength
Su(r) = Remolded Shear Strength

Water Level Measurements:

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations. Groundwater monitoring wells may be required to record accurate depths and fluctuation.

Gradation Description and Terminology:

Boulders:	Over 12 inches	Trace:	Less than 5%
Cobbles:	12 inches to 3 inches	Little:	5% to 15%
Gravel:	3 inches to No.4 sieve	Some:	15% to 30%
Sand:	No.4 to No. 200 sieve	Silty, Sandy, etc.:	Greater than 30%
Silt:	No. 200 sieve to 0.005 mm		
Clay:	less than 0.005 mm		

Density of Granular Soils and Consistency of Cohesive Soils:

CONSISTENCY OF COHESIVE SOILS		DENSITY OF GRANULAR SOILS	
SPT N-value blows/ft	**Consistency**	**SPT N-value blows/ft**	**Relative Density**
0 to 2	Very Soft	0 to 4	Very Loose
2 to 4	Soft	5 to 10	Loose
5 to 8	Firm	11 to 30	Compact
9 to 15	Stiff	31 to 50	Dense
16 to 30	Very Stiff	>50	Very Dense
>30	Hard		

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	Proposed Development	Boring #:	B-1
Location:	383 Commercial Street	Project #:	16158
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	13.5 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	"Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Summit Staff:	M. Hardison, E.I.	Date started: 8/14/2016	Date Completed: 8/14/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
8/14/2016	5.3 ft	8.2 ft +/-	Measured in casing

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/22	0 to 2	15		Gray to black Gravelly SAND, little to some Silt,		
1				20		trace brick and ash, dry, dense, SW		
				18				FILL
2				13				
	S-2	24/3	2 to 4	11		Brown Gravelly SAND, similar to above (based on		
3				11		minimal sample recovery)		
				8				
4				9				
5								
	S-3	24/20	5 to 7	9		Dark gray fine to coarse SAND, little Silt and	▽ Groundwater	
6				9		Gravel, few small wood pieces, moist, compact, SW		
				6				
7				4				
	S-4	24/16	7 to 9	10		Same as above, white and black Ash in bottom 6",	PP = 4,000 psf	
8				6				
				8				
9				6		Gray Silty CLAY intermixed with white and black ash		
						and Sand, moist, soft, ML or CL		
10								
	S-5	24/16	10 to 12	1		Gray Silty CLAY, intermixed ash and Sand, Brick		
11				1		fragments at bottom, wet, soft, CL		
				2				
12				3				
	S-6	24/14	12 to 14	1		Similar to above with more Sand content	PP = 1,500 psf	
13				2				
				1				
14				3				
					-1.0			
15						Gray fine to coarse SAND, little Silt, trace fine		
	S-7	24/22	15 to 17	4		Gravel, wet, compact, SM		GLACIAL TILL
16				7				
				10				
17				7				
18								
19								
20								
	S-8	24/20	20 to 22	21		Same as above, Rock fragments in bottom, SM		
21				50 / 4"	-7.3			
						Refusal at 20.8', End of Boring. Likely bedrock		
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: B-2
Project: Proposed Development
Project #: 16158
Location: 383 Commercial Street
Sheet: 1 of 1
City, State: Portland, Maine
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.
Boring Elevation: 13.0 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 8/14/2016 Date Completed: 8/14/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
8/14/2016	7.5 ft	5.5 ft +/-	Measured after completion

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/20	0 to 2	12		Dark gray Silty medium to coarse SAND, little		
1				24		Gravel and Brick pieces, trace ash, dry, dense, SM		
				23				FILL
2				15				
	S-2	24/18	2 to 4	14		Same, as above, brown, compact, dry, SM		
3				13		(no ash or brick in sample)		
				13				
4				12				
5								
	S-3	24/16	5 to 7	3		Light gray SILT intermixed Sand and Gravel, trace		
6				9		Clay, humid, compact, ML (no brick or ash in sample)		
				9				
7				10				
	S-4	24/18	7 to 9	5		Gray to black SAND, little to some Silt, trace Gravel,	▽	
8				8		trace Brick, and Rock fragments, humid to damp,	Groundwater	
				5		compact, SM		
9				2				
10								
	S-5	24/12	10 to 12	7		Brown to dark gray SAND, little to some Silt, trace		
11				8		to little fine Gravel, wet, compact, SP		
				11				
12				9				
13					0			
14								
								GLACIAL TILL
15								
	S-6	24/8	15 to 17	10		Gray Gravelly SILT, little to some Sand, moist,		
16				13		very stiff, ML		
				13				
17				10				
18								
19								
20								
	S-7	24/12	20 to 22	4		Similar to above, little Clay, Silt seam from 20' to	PP = 2,000 psf	
21				6		21.3', ML	to 3,000 psf	
				6				
22				7				
					-11.5			
						Casing refusal at 24.5', End of Boring		

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SOIL BORING LOG

SUMMIT GEOENGINEERING SERVICES

Project:	Proposed Development
Location:	383 Commercial Street
City, State:	Portland, Maine
Boring #:	B-3
Project #:	16158
Sheet:	1 of 1
Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	12.5 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	"Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Summit Staff:	M. Hardison, E.I.	Date started: 8/14/2016	Date Completed: 8/14/2016

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
8/14/2016	6.2 ft	6.3 ft +/-	Measured after completion

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	PS-1		0 to 1			4" pavement		PAVEMENT
1								
	S-1	24/20	1 to 3	15		Brown to black Silty SAND, little to some Gravel,		
2				14		trace brick, humid, compact to dense, SM		FILL
				13				
3				13				
	S-2	24/18	3 to 4.5	7		Brown to black Silty SAND, little Gravel, humid		
4				6		compact to dense, SM		
				5				
5								
	S-3	24/10	5 to 7	5		Brown Silty medium to coarse SAND, trace fine		
6				7		Gravel, humid to moist, SM		
				6			▽ Groundwater	
7				3				
	S-4	24/0	7 to 9	2		No recovery, presumed loose SAND		
8				2				
				3				
9				3				
	S-5	24/6	9 to 11	3		Light brown fine to coarse SAND, little Silt, trace		
10				3		fine Gravel, moist, loose, SW		
				2				
11				3				
	S-6	24/10	11 to 13	4		Same as above		
12				13				
			ROD	12 / 5"		Black SAND, little to some Silt, Brick fragments,		
13			PROBE			black staining, moist, SP		
					-1.0			
14				13		Spear tip probe in blows / foot		GLACIAL TILL
15				10				
16				10				
17				11				
18				28 / 10"	-5.6			
						Refusal at 18.1', End of Boring. Likely bedrock		
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT
GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	Proposed Development	Boring #:	B-101
Location:	383 Commercial Street	Project #:	16158.1
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	15.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	"Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Summit Staff:	M. Hardison, E.I.	Date started: 4/13/2017	Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	2.9 ft.	12.1 ft.	13:30, In Well
7/28/2017	3.9 ft.	11.1 ft.	11:00, In Well

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						5.5" pavement, poor condition		PAVEMENT
1						Drove Casing to 5', no sample collected		
2								FILL
3							Groundwater	
4								
5								
	S-1	24/16	5 to 7	2		Black fine Gravelly medium to coarse SAND, slight odor,		
6				1		very loose, wet, SP		
				6		Black to olive brown Silty CLAY, little Gravel and Sand		PP = 2,000 psf to
7				4		intermixed, stiff, moist, CL		4,000 psf
8								
9								
10					5.0'			
	S-2	24/8	10 to 10.5	7/5"		Gray fine to coarse SAND, little to some Silt, little Clay	PP = 5,000 psf	GLACIAL TILL
11				50/1"	4.5'	and Gravel, dense, wet, SP-SM		
						Spoon refusal at 10.5' on likely bedrock		BEDROCK
12								
13						Installed Monitoring Well in Hole		
14						1" Dia. PVC Screen from 10' depth up to 5'		
15						1" Dia. PVC Riser from 5' depth to ground surface		
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: B-102

Project: Proposed Development
Location: 383 Commercial Street
City, State: Portland, Maine

Project #: 16158.1
Sheet: 1 of 2
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.

Boring Elevation: 12.0 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	8.1 ft	3.9 ft	Measured after casing pulled 10:30
4/13/2017	4.1 ft	7.9 ft	13:30

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						9" Pavement Gravelly and poor condition		PAVEMENT
1								
	S-1	12-Dec	1 to 2	12				
2				6				FILL
	S-1A	24/24	2 to 4	6		Brown to black coarse Sandy GRAVEL, Cobble pieces,		
3				5		little Silt, loose to compact, humid, GP-GM		
				5				
4				4		6" Wood (timber) pieces, moist	▽	
					7.5'		Groundwater	
5								
	S-2	24/6	5 to 7	2		Gray Silty fine SAND, little Clay, trace fine Gravel,		FILL/ REWORKED
6				2		very loose to loose, moist to wet, SM		NATIVE
				2				
7				2				
8								
9								
10								
	S-3	24/20	10 to 12	1		Similar to above, trace to no Clay, very loose, wet		
11				1				
				WH				
12				1				
13						Minimal resistance to casing advance from 10' to 15'		
						depth		
14								
15					-3.0'			
	UT-1	30/30	15 to 17.5	Push		Collected Shelby Tube sample		GLACIAL MARINE
16								
17								
18						Increased resistance to casing advance at 18'		
19								
20								
	S-4	24/12	20 to 22	1		Gray medium SAND, trace to little Silt, very loose, wet		
21				2				
				2				
22				3				

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: B-102
Project: Proposed Development
Project #: 16158.1
Location: 383 Commercial Street
Sheet: 2 of 2
City, State: Portland, Maine
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.
Boring Elevation: 12.0 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	8.1 ft	3.9 ft	Measured after casing pulled 10:30
4/13/2017	4.1 ft	7.9 ft	13:30

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23				4				GLACIAL MARINE
24				12				
25				17				
26				14	-14.0'			
27				44		Dense at 26'		GLACIAL TILL
28				36				
				65/6"	-16.5'			
29						Refusal at 28.5'		PROBABLE BEDROCK
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: B-103
Project: Proposed Development
Project #: 16158.1
Location: 383 Commercial Street
Sheet: 1 of 1
City, State: Portland, Maine
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.
Boring Elevation: 12.1 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	6.5 ft	5.6 ft	Measured after casing pulled 12:00
4/13/2017	6.0 ft	6.1 ft	1.5 hours after completion 13:30

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
						Pavement 6"		PAVEMENT
1								
2								FILL
	S-1	24/16	2 to 4	7		Brown-red Silty fine to coarse SAND, little Gravel,		
3				5		trace Clay, little black Ash and brick pieces, compact,		
				6		humid, SM		
4				6				
5								
	S-2	24/22	5 to 7	7		Brown Silty fine SAND, trace Clay, loose, damp, SM		
6				5			▽ Groundwater	
				3				
7				7		Increased Clay at bottom 6"	PP = 5,000 psf	
8								
9								
10								
	S-3	24/10	10 to 12	1		Gray Clayey SAND, little to some Silt, intermixed coal		FILL/ REWORKED
11				2		Ash, very soft, wet, SC		NATIVE
				WH				
12				1				
13								
14								
15								
	S-4	24/12	15 to 17	1		Similar to above, trace fine Gravel, trace brick and		
16				3		white Ash		
				1				
17				2				
18								
19					-6.9'			
						Casing refusal at 19.0', end of boring		PROBABLE BEDROCK
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: B-104

Project: Proposed Development
Location: 383 Commercial Street
City, State: Portland, Maine

Project #: 16158.1
Sheet: 1 of 2
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.

Boring Elevation: 12.4 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	5.9 ft	6.5 ft	After Casing Pulled, 1:00 PM

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1						6" Pavement		
2	S-1	24/20	1.5 to 3.5	2		Black Coal/Ash, Little Brick pieces and Sand, trace Gravel and Silt, loose, humid		FILL
				3				
3				3				
				4				
4								
5								
	S-2	24/14	5 to 7	3		Brown-tan medium to coarse SAND, little Gravel and Silt,		
6				5		trace brick and ash, humid, moist, SP-SM	▽ Groundwater	
				7				
7				7				
8								
9								
10						Easy casing advance to 10'		
	S-3	24/6	10 to 12	2		Brown fine to medium SAND, little Gravel and Silt,		
11				1		very loose, wet, SP-SM		
				WH				
12				1				
13								
14					-1.6'			
	S-4	24/24	15 to 17	2		Dense drilling and 14'		
15				3				
				6		Brown-gray fine to coarse SAND, trace Silt, loose to		GLACIAL MARINE
16				7		compact, wet		
17						Running Sands, finished with speartip probe		
18				9**		**=Blows/12"		
19				5**				
20				4**				
21				5**				
22				4**				

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-104**

Project: Proposed Development | Project #: 16158.1
Location: 383 Commercial Street | Sheet: 2 of 2
City, State: Portland, Maine | Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.

Boring Elevation: 12.4 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Automatic	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
4/13/2017	5.9 ft	6.5 ft	After Casing Pulled, 13:00

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23				2				GLACIAL MARINE
24				3	-11.7			
25				5/0.5"		Refusal at 24.1'		PROBABLE BEDROCK

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Probe #: P-101

Project: Proposed Development
Location: 383 Commercial Street
City, State: Portland, Maine

Project #: 16158.1
Sheet: 1 of 2
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.

Boring Elevation: 12.8 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	
Model:	AMS Power Probe	Diameter:	
Method:	Speartip	Hammer:	
Hammer Style:	Automatic	Method:	

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1								
2				12				
3				10				
4				4		Very loose 4'-5'		FILL
5				5				
6				14				
7				6				
8				4		Very loose 8'-11'		
9				4				
10				4				
11				5				
12				11				
13				15				GLACIAL MARINE
14				10				
15				9				
16				7				
17				8				
18				14				
19				22				
20				16				
21				13				
22				13				

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Probe #: P-101

Project: Proposed Development
Location: 383 Commercial Street
City, State: Portland, Maine

Project #: 16158.1
Sheet: 2 of 2
Chkd by:

Drilling Co: Summit Geoengineering Services
Driller: C. Coolidge, P.E.
Summit Staff: M. Hardison, E.I.

Boring Elevation: 12.8 ft. +/-
Reference: "Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Date started: 4/13/2017 Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	
Model:	AMS Power Probe	Diameter:	
Method:	Speartip	Hammer:	
Hammer Style:	Automatic	Method:	

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23				18		**=Blows/12" Dense at 22.8'		GLACIAL MARINE
24				18		Very dense at 24.0'		
25				42				GLACIAL TILL
26				28/6"	-12.7	Refusal at 25.5'		PROBABLE BEDROCK
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Probe #: P-102

Project:	Proposed Development	Project #:	16158.1
Location:	383 Commercial Street	Sheet:	1 of 1
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	14.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	"Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Summit Staff:	M. Hardison, E.I.	Date started: 4/13/2017	Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	
Model:	AMS Power Probe	Diameter:	
Method:	2.5" SSA	Hammer:	
Hammer Style:	Automatic	Method:	

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		Solid Stem Auger Probe		
1								
2								
3								
4								FILL
5								
6								
7								
8								
9								
10						End of Probe at 10 feet, no refusal		
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Probe #: P-103

Project:	Proposed Development	Project #:	16158.1
Location:	383 Commercial Street	Sheet:	1 of 1
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	14.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	"Boundary and Topographic Survey" September 6, 2015, Owen Haskell, Inc.
Summit Staff:	M. Hardison, E.I.	Date started: 4/13/2017	Date Completed: 4/13/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	
Model:	AMS Power Probe	Diameter:	
Method:	2.5" SSA	Hammer:	
Hammer Style:	Automatic	Method:	

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/12"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE		Solid Stem Auger Probe		
1								
2								
3								FILL
4								
5								
6								
7								
8								
9								
10						End of Probe at 10 feet, no refusal		
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

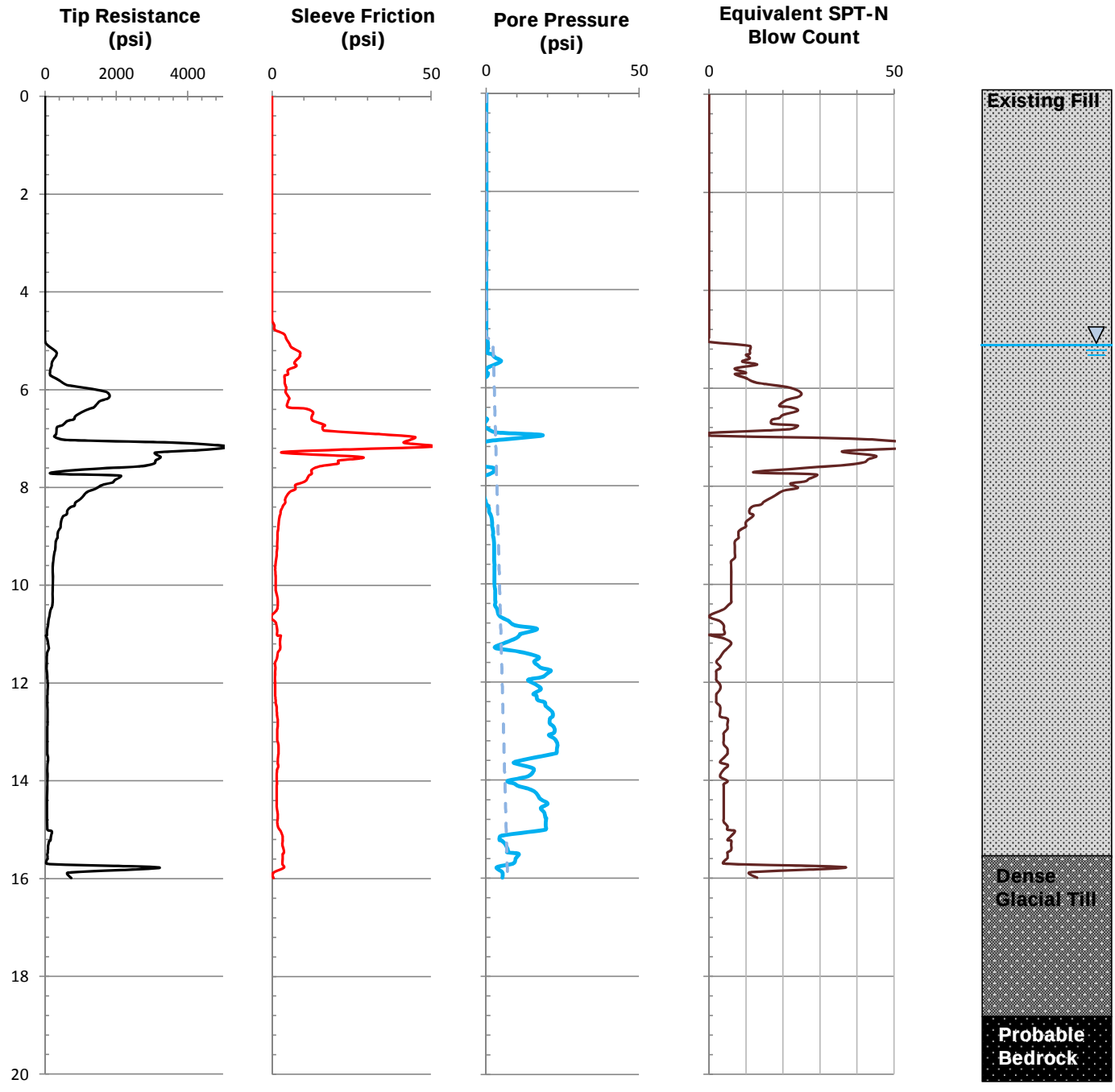
Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

PIEZOCONE PENETRATION LOG

Project:	New Building	Test Number:	CPT-1
Location:	383 Commercial Street	Sheet:	1 of 1
City, State	Portland, Maine	Project Number:	16158
		Method:	ASTM D5778
		Weather:	80° Sunny

Cone ID:	Vertek #4644.101xx	Test Elevation:	13.5 ft. +/-
Cone Type:	VTK 5 Ton Digital Cone	Reference:	Interpolated from City of Portland GIS
Piezocone:	Silicone Single Filter	Date started:	8/14/2016 Date Completed: 8/14/2016
Push Rig:	AMS Power Probe 9500 VTR	ESTIMATED GROUND WATER DEPTH	
Anchor Style:	Single Point Hollow Stem Anchor	Date	Depth / Elevation / Reference
Performed By:	Craig Coolidge, P.E.	8/14/2016	5.0 ft. / 8.5 ft. +/- / Interpreted from pore pressure



NOTES:

Soil Profile based on interpretation of CPT measurements and nearby borings

Abrupt push refusal encountered at depth of 16.0 feet

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-1

Project: 383 Commercial Street
Portland, Maine

Project #: 16158.1

Groundwater:
Heavy Seepage at 3.5 ft

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 16 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	GEOLOGIC/GENERAL
1	Black Silty SAND mixed with ash, brick, loose, slightly, cohesive, wet, loose, SM	FILL
2		Petroleum sheen, strong odor
3		
4	Seepage rapid at 40 inches (see photo below)	
5	End of Test Pit at 4.5 ft	
6		
7	Note: Retaining wall base > 4.5 feet below grade	
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-2
Project: 383 Commercial Street, Portland, Maine
Project #: 16158.1
Groundwater:

Contractor: Eastern Excavation, Inc.
Ground Surface Elevation: 14 ft +/-
Equipment: Linkbelt 160x Tracked
Reference: Existing Condition Plan, Undated, Sebago Technics
Summit Staff: B. Peterlein, P.E.
Date: 3/20/2017
Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	GEOLOGIC/GENERAL
1	Black Silty SAND, little Gravel, Cobbles, loose, SM	FILL
2		
3	End of Test Pit at 2 ft on Refusal	POSSIBLE BOULDER
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-3
Project: 383 Commercial Street, Portland, Maine
Project #: 16158.1
Groundwater:

Contractor: Eastern Excavation, Inc.
Equipment: Linkbelt 160x Tracked
Summit Staff: B. Peterlein, P.E.
Ground Surface Elevation: 14 ft +/-
Reference: Existing Condition Plan, Undated, Sebago Technics
Date: 3/20/2017
Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	Brown Gravelly SAND, trace Silt, compact, moist, many rounded cobbles, SM	FILL
2		
3	Seepage at 3 ft	
4		
5		
6	Olive-brown Silty CLAY, trace Sand, blocky, firm, moist, blocky, ML or CL	GLACIAL MARINE
7		
8	End of Test Pit at 7 ft	
9		
10		
11		
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-4

Project: 383 Commercial Street, Portland, Maine

Project #: 16158.1

Groundwater: None Observed

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 12 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	2" Pavement Olive-brown Silty SAND, little Gravel, bricks, cobbles, dry, loose, SM	FILL
2		Concrete pier, 8" diameter x 4 feet long, isolated
3		
4		
5	Olive-gray Sandy SILT, trace Gravel, mixed with clods of gray silty clay, firm, moist, ML	Sidewalls collapsing at 4 ft
6		
7		
8		
9		
10		
11	Becomes very soft and wet at 10 ft	
12		
13	End of Test Pit a 12 ft	
14		
15		
16		
17		

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TEST PIT LOG

Test Pit # TP-5
Project: 383 Commercial Street, Portland, Maine
Project #: 16158.1
Groundwater: None Observed

Contractor: Eastern Excavation, Inc.
Ground Surface Elevation: 14 ft +/-
Equipment: Linkbelt 160x Tracked
Reference: Existing Condition Plan, Undated, Sebago Technics
Summit Staff: B. Peterlein, P.E.
Date: 3/20/2017
Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	2" Pavement Black Silty SAND, trace ash and brick, mixed with clods of reworked silty clay, moist, loose, SM	FILL
2		
3	Pocket Penetremeter Resistance > 4.5 tsf at 2 ft Olive-brown Sandy SILT with bicks	
4	Gray Sandy SILT, some Gravel, little black ash, some bricks, moist, firm, ML	
5		
6		
7	Olive-brown Silty CLAY, little Sand, firm, damp, CL	REWORKED FILL
8		
9	Olive-brown to gray SAND, little Silt, wet, compact, SM	GLACIAL TILL
10	End of Test Pit at 9 ft	
11		
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-6

Project: 383 Commercial Street
Portland, Maine

Project #: 16158.1

Groundwater: None Observed

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 13 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	2" Pavement Olive-brown Silty CLAY mixed with reworked silty sand, trace ash, moist, compact, ML	REWORKED FILL
2		
3		
4		
5		Sidewalls collapsing at 5 feet
6	Olive-gray SILT, little Sand, trace Clay, wet, firm, ML	GLACIAL TILL
7		
8		
9	End of Test Pit at 8 ft	
10		
11		
12		
13		
14		
15		
16		
17		

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GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-7

Project: 383 Commercial Street
Portland, Maine

Project #: 16158.1

Groundwater: None Observed

Contractor: Eastern Excavation, Inc.	Ground Surface Elevation: 13 ft +/-	
Equipment: Linkbelt 160x Tracked	Reference: Existing Condition Plan, Undated, Sebago Technics	
Summit Staff: B. Peterlein, P.E.	Date: 3/20/2017	Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	2" Pavement Dark brown Silty SAND, little Gravel, trace ash, moist, compact, SM	FILL
2		
3	Brown Silty SAND, trace Gravel, moist, compact, SM	
4	6" brick layer mixed with Silty SAND, moist, loose	
5	Brown Gravelly SAND, little Silt, few Cobbles, compact, moist, SM	Sidewalls are vertical for entire depth of test pit
6		
7		
8		
9		
10		
11	End of Test Pit at 10 ft	
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-8

Project: 383 Commercial Street
Portland, Maine

Project #: 16158.1

Groundwater:
Seepage at 6 ft

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 13 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	Black Silty SAND, little Gravel, occasional Cobbles, frozen, SM	FILL
2	Black SILT, trace Sand mixed with ash, ML	
3	Brown Silty SAND, trace to little Gravel, compact, moist, mixed with coarse gravel and cobbles, SM	
4		
5		
6	Water seepage moderate	
7		
8		
9	End of Test Pit at 8 ft	
10		
11		
12		
13		
14		
15		
16		
17		

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GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-9

Project: 383 Commercial Street
Portland, Maine

Project #: 16158.1

Groundwater:
Seepage at 9.5 ft

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 12 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	3" Pavement Brown Gravelly SAND, little Silt, dry, compact, SM	FILL
2	Black Silty SAND mixed with ashes, bricks, cobbles, small wood pieces, firm to compact, moist, SM	
3		
4		
5		
6	Brown Silty SAND, little Gravel, trace of Silty Clay in pockets, wet, loose, SM	
7		
8		
9	Seepage moderate at 9.5 ft	
10	Gray SAND, little Silt and Gravel, wet, loose, SM	GLACIAL TILL
	End of Test Pit at 10 ft	
11		
12		
13		
14		
15		
16		
17		

SUMMIT
GEOENGINEERING SERVICES

TEST PIT LOG

Test Pit # TP-10

Project: 383 Commercial Street, Portland, Maine

Project #: 16158.1

Groundwater: Seepage at 7 ft

Contractor: Eastern Excavation, Inc.

Ground Surface Elevation: 12 ft +/-

Equipment: Linkbelt 160x Tracked

Reference: Existing Condition Plan, Undated, Sebago Technics

Summit Staff: B. Peterlein, P.E.

Date: 3/20/2017

Weather: Sunny

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	4" Pavement Dark brown Gravelly SAND, little Silt, few Cobbles, compact, moist, SM	FILL
2		
3		
4		
5	Olive-brown Silty SAND, little Gravel, damp, loose, SM	
6		
7	Seepage heavy at 7 ft Wood pieces, decayed organics, rags, bricks (wood pieces are small but numerous)	
8		
9		
10	End of Test Pit at 9 ft	
11		
12		
13		
14		
15		
16		
17		

APPENDIX C

LABORATORY TEST RESULTS

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

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THIN WALLED TUBE SAMPLING

PROJECT NAME:	383 Commercial Street	PROJECT #:	16158.1
PROJECT LOCATION:	383 Commercial St, Portland, ME	CLIENT:	Reger Dasco Properties
COLLECTION DATE:	7/10/2017	SAMPLE #:	UT-1
TEST DATE:	7/17/2017	TECHNICIAN:	Preston Spicer

Test Boring Information

Boring Number: B-102
Drilling Method: Direct push
Drilling Tooling: 3-inch casing
Sampling Method: Direct push

Sample Information

Tube Length: 30"
Recovery: 28"
Tube Diameter: 2.5"
Depth: 15' to 17.5'

Trial / Specimen Number	Moisture Content	Unit Weight	Torvane
1	36.9%	95 pcf	200 psf
2	45.9%	95 pcf	400 psf
3	47.8%	92 pcf	200 psf
Average	43.6%	94 pcf	260 psf

Visual Description (ASTM D2488):

8" of Black organic CLAY, trace Sand, firm, humid, OL

Photograph of cross sectional sample view.

Photograph of longitudinal sample view.

REMARKS:
Top 10" of tube: Gray fine SAND, little Gravel, some Silt, compact, humid, SM
Bottom 10" of tube: Dark gray SILT, little Sand, trace Clay and Gravel, black organic streaks, compact, humid, ML