

GEOTECHNICAL REPORT

New Apartment Building 665 Congress Street Portland, Maine

Prepared for:

Redfern Properties P.O. Box 8816 Portland, Maine 04104

Prepared by:

Summit Geoengineering Services 145 Lisbon St. Lewiston, Maine

> Project #15040 May 2015



May 1, 2015 SGS #15040

Jonathan Culley Redfern Properties P.O. Box 8816 Portland, Maine 04104

Reference: Geotechnical Report, New Apartment Building 665 Congress Street, Portland, Maine

Dear Jonathan;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed apartment building at the site reference above. Our scope of services included the drilling of 13 borings and 9 probes and preparing this geotechnical report summarizing our findings and providing geotechnical recommendations.

1.0 Project Description

We understand that the project consists of the construction of an 8 story building at the site referenced above. The existing site contains Joe's Smoke Shop abutting Congress Street with a paved parking lot behind. The grade at the site slopes gently down towards the back of the parking lot. The site is bordered by Avon Street on the east and Vernon Street on the west. There used to be a church at the southern portion of the site which was demolished in 1965.

We understand that the newly proposed 8 story building is a steel framed structure which will consist of combined retail space and parking on the first floor and apartment living spaces in the top 7 floors. We also understand there is a proposed full basement for parking. We further understand that the proposed finish floor elevation of the first floor is near existing grade. There will be two elevator shafts on either end of the building (north and south).

We have been provided with preliminary structural loads which include the following:

Columns loads: 200 – 350 kip Line loads: 2 – 15 k/lf Uplift load: 100 kips

2.0 Exploration

2.1 Exploration

Summit Geoengineering Services (SGS) observed the subsurface conditions at the site with the drilling of 5 borings and six probes (B-1 through B-5 and P-1 through P-6) on March 31, 2015. All of the borings and probes were drilled to refusal, ranging in depth from 0.8 to 15.8 feet below ground surface. Borings and probes were advanced using 2-1/2" hollow stem augers. During the borings, split spoon sampling was conducted in general accordance with ASTM D1586 to collect blow counts and soil samples. Probes were advanced to refusal in order to document the bedrock topography throughout the site. Auger cuttings (if present) and relative drilling resistance were used to estimate the soil types in absence of soil sampling.

SGS performed a second investigation on April 15, 2015 with the drilling of 8 borings and 3 probes (B-101 through B-108 and P-101 through P-103). The drilling was conducted by Great Works Test Boring of Berwick, Maine under the supervision of SGS. All of the borings and probes were drilled to refusal using a Mobile B-53 tracked rig and 4" hollow stem augers. Borings B-105 and B-106 were pre-augered and then cased washed to refusal where rock core samples were collected. Split spoon sampling was conducted in general accordance with ASTM D1586 to collected blow counts and soil samples. Probes were advanced to refusal in order to further document the bedrock topography throughout the site. Auger cuttings (if present) and relative drilling resistance were used to estimate the soil types in absence of soil sampling.

Locations of the borings and probes were marked by SGS prior to drilling by measuring from the existing building and surrounding landmarks. These locations can be seen in the SGS Exploration Plan in Appendix A. The boring and probe logs can be found in Exploration Logs in Appendix B.

3.0 Subsurface Conditions

3.1 Soil

The soil at the site generally consists of *pavement* overlying *fill* overlying *glacial till* overlying *weathered bedrock* overlying *bedrock*.

The *pavement* at the site was present at the location of all drilled borings and probes. It ranged from 2.5" to 4.0" in thickness.

The *fill* layer was encountered in all borings directly below the pavement and ranged from 4.3 feet to 8.8 feet in thickness, generally increasing in thickness towards the end of the site containing Joe's Smoke Shop. The *fill* is described as dark brown gravelly sand to brown and black sandy silt with varying amounts of ash and brick fragments. It is very loose to compact and humid to frozen. The *fill* located at the southern end of the site nearer to Joe's Smoke Shop

contained large voids and frequent rubble apparent from inspection of the open bore hole and difficult drilling conditions. The *fill* classifies as ML, SP, GP, SM, or SP-SM, in accordance with the Unified Soil Classification System.

The *glacial till* was encountered in borings B-1, B-2, B-3, B-101, B-103, B-104, B-107, and probe P-3 and P-101. *Glacial till* may also be present at the locations of other probes but the cuttings from the layer did not make it to the ground surface for visual inspection. The *glacial till* is described as olive green silt with trace to little clay, sand, and gravel. It is humid to damp, compact to dense, and ranges in thickness from 1.2 feet to 6.8 feet. Standard Penetration Test (SPT-N) blow counts in this layer ranged from 18 to 44 with an average of 28. Pocket penetrometer measurements (a rough estimate of unconfined compressive strength) ranged from 4,000 psf to greater than 9,000 psf. It classifies as ML in accordance with the Unified Soil Classification System.

The *weathered bedrock* was encountered in borings B-4, B-104, B-105, and B-107 and probes P-1, P-2, and P-3. It ranged in thickness from 1.0 feet to 2.9 feet.

Soil profile cross sections of the site can be found in Appendix A titled "Interpretive Soil Profiles".

3.2 Groundwater

Groundwater was not encountered in any of the borings or probes. The glacial till recovered in borings B-1, B-2, B-101, B-104, and B-107 from depth 5 feet to 15 feet was slightly to heavily mottled, indicating that groundwater may be confined in this layer during wet periods.

3.3 Bedrock

Bedrock was encountered at the site ranging from 4.8 feet to 15.8 feet below existing ground surface. The bedrock elevation ranges from 99.8 feet to 107.3 feet. The table below summarizes the depth to bedrock encountered in the borings and probes and the approximate elevation at each location. Bedrock mapping by the Maine Geologic Survey classifies the bedrock at the site as the Precambrian Z Spring Point Formation consisting of green schist and amphibolites facies ranging from and mafic to felsic volcanic rock.

BEDROCK DEPTH & ELEVATION									
Boring/Probe	Depth (ft)	Elevation (ft)							
B-1	15.8	100.1							
B-2	11.6	102.4							
B-3	6.2	106.7							
B-4	7.2	105.3							
B-5	4.8	107.7							
B-101	11.9	106.6							
B-102	-	-							
B-103	14.5	100.5							
B-104	9.5	103.6							

10.0	103.8		
10.0	102.0		
10.5	102.4		
8.5	101.7		
10.0	104.9		
10.0	103.9		
9.9	102.9		
-	-		
-	-		
5.0	107.3		
10.8	105.6		
12.1	99.8		
9.6	102.7		
	10.0 10.0 10.5 8.5 10.0 10.0 9.9 - - 5.0 10.8 12.1 9.6		

* = Core samples obtained

Three rock core samples were obtained, one from B-105 and two from B-106. The recovered samples are classified as moderately weathered, very thinly spaced joints/fractures, medium to light gray schist. Rock Quality Designation (RQD) of the samples ranged from 0% (very poor) to 80% (good), increasing in quality as the sample depth increased. A majority of the joints and fractures were 45° to vertical. A photograph log of the collected sample can be found in Appendix C.

4.0 Evaluation

The key geotechnical issues at the site include the following:

- Potential for differential settlement of the building supported partially by bedrock and partially by native soil (glacial till)
- Presence of rubble fill in the southern portion of the site presenting excavation difficulty and poor foundation and slab support
- Large uplift loads requiring the use of grouted rock anchors

Based on the preliminary design loads and the proposed building layout, we believe that the new building can be adequately supported by a conventional frost wall on continuous spread footing foundation. The interior columns can be supported by isolated column footings. Based on the finish floor elevations, interior and exterior footings will likely be supported by a combination of glacial till and bedrock. There is also a chance that existing rubble fill will be present at the bottom of footing elevation (near the southern portion of the building). It will be critical to remove all rubble fill from below the footings to ensure that tolerable settlements are not exceeded.

Uplift loading on the new building appears to be significant. We anticipate that rock anchors will be necessary to support the uplift loading on the foundation.

5.0 Foundation Recommendations

5.1. Allowable Bearing Pressure

We recommend that footings be proportioned using an allowable bearing pressure of 10,000 psf for foundations constructed on bedrock and an allowable bearing pressure of 4,000 psf for footings constructed on glacial till and Structural Fill (SF, see Section 5.2). Total settlement is expected to be less than 1.0" for footings constructed on glacial till and SF. Total settlement will be negligible for footings constructed on bedrock. Differential settlement is not anticipated to exceed 1.0" between footings on bedrock and footings on the native glacial till soil. The allowable bearing pressures above are based on the following conditions:

- All rubble and debris is removed from beneath the footings
- Footings are constructed on glacial till, placed Structural Fill (SF, see Section 5.2), or bedrock. If existing fill is exposed at the bottom of the footing excavation, it should be removed in its entirety down to the glacial till layer and laterally equal to a distance of the footing width on each side of the footing.
- All placed fill within the building footprint consist of SF placed in a maximum of 12" lifts and compacted to 95% of its optimum dry density in accordance with ASTM D1557.
- For footings supported on bedrock, any loose or weathered bedrock is removed to expose hard bedrock.
- Transition zones for footings spanning bedrock to native soil/placed fill be constructed in accordance with the Transition Zone Construction Detail provided in Appendix D.
- Exposed native soil is proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5 ton minimum (operating weight) vibratory roller or a large vibratory plate compactor. Any soft or unsuitable soil is removed and replaced with ³/₄" crushed stone or SF.

5.2 Slabs-on-grade

Based on a finish floor elevation of 108 feet for the basement level parking, the slab-on-grade will be supported by a combination of existing rubble fill, glacial till (native), and existing sandy silt fill. Although unlikely, the bedrock surface may rise up to this elevation in some isolated locations. To avoid differential settlement of the slab, we recommend a minimum of 12" of Structural Fill (SF, see table below) be placed under the slab for the entire building footprint to act as a cushion between the slab and underlying soil/bedrock.

Any exposed native soil should be proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5 ton minimum (operating weight) vibratory roller. Any exposed rubble, debris, or other non-soil materials should be removed and replaced with SF. Any loose or weathered bedrock should be removed to expose a hard bedrock surface.

The slab subgrade soil should be observed by SGS after proofrolling and prior to the placement of SF. A layer of geotextile or other subgrade improvement method may be necessary.

STRUCTURAL FILL (SF)							
Sieve Size	Percent finer						
3 inch	100						
¹ /2 inch	38 to 80						
¹ /4 inch	25 to 65						
No. 40	0 to 30						
No. 200	0 to 7						

The portion of SF passing the 3" sieve shall meet the following gradation requirements.

Reference: MDOT Specification 703.06, Type D

The maximum particle size should be limited to 6 inches. Structural Fill 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.

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

We anticipate that the existing rubble fill in the southern portion of the site will be difficult to compact and place fill on. Our experience from the geotechnical investigation indicates that there are frequent large voids and large rubble pieces throughout the layer. Flowable fill and/or ³/₄" crushed stone can be used to fill the voids and create a flat surface on which to place the SF for the building slab if needed.

5.3 Frost Protection and Foundation Backfill

Based on a 10-year design air freezing index of 1,200 degree F days for the Portland, Maine region, all foundation walls exposed to freezing temperatures should be constructed at a minimum depth of 4 feet below finish basement floor grade. However, in locations where the footing is supported by bedrock, footings may be constructed at a minimum depth of 2 feet below finish basement floor grade. We recommend that these elements be backfilled with Foundation Backfill (FB). The portion of FB passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL (FB)							
Sieve Size	Percent finer						
3 inch	100						
¹ /4 inch	25 to 100						
No. 40	0 to 50						
No. 200	0 to 7						

Reference: MDOT Specification 703.06, Type E

Maximum particle size should be limited to 6 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.

5.4 Seismic Site Class and Design Criteria

Based on the blow counts collected during split spoon sampling and the fractured/jointed condition of the bedrock surface, the site classifies as Site Class C "very dense soil and soft rock" for footings constructed on glacial till and Site Class B "rock" in accordance with the 2009 International Building Code. The site can be conservatively classified entirely as site class C if desired. The following seismic site coefficients should be used:

SEISMIC DESIGN COEFFICIENTS									
Seismic Coefficient	Site Class B	Site Class C							
Short period spectral response (S_S)	0.315	0.315							
1 second spectral response (S_1)	0.077	0.077							
Maximum factored spectral response (S_{MS})	0.315	0.378							
1 second factored spectral response (S_{M1})	0.077	0.131							
Design short period spectral response (S _{DS})	0.210	0.252							
Design 1 second spectral response (S _{D1})	0.051	0.087							

No liquefiable soils were encountered in the investigation.

5.4 Groundwater Considerations

Groundwater was not encountered in the borings. However, apparent from the mottling of the native glacial till, groundwater is anticipated to fluctuate within the glacial till layer on a seasonal basis. Based on this, we recommend that perimeter underdrains be installed along the entire perimeter of exterior foundations. We recommend that underdrains consist of 4-inch diameter, perforated PVC pipe surrounded by a minimum of 6 inches of crushed stone wrapped in filter fabric. The underdrains should be placed at the base of the foundation and outlet to a free draining location or pumped if necessary. An underdrain or sump pump is highly recommended for the elevator shaft foundation.

5.5 Foundation Uplift and Sliding Capacity

Uplift capacity of the foundation includes the dead weight of the foundation, skin friction of the mobilized soil, and weight of soil above the footings. Sliding resistance of the foundation includes the passive resistance of the soil against the side of the foundation wall and the friction between the bottom of the footing and the underlying soil/bedrock. We recommend that the following coefficients be used in the uplift and sliding capacity of the foundation.

PARAMETER	FOUNDATION BACKFILL	BEDROCK	GLACIAL TILL (NATIVE)
Total Natural (moist) Unit Weight (γ_t)	130 pcf ⁻¹	150 pcf	135 pcf
Saturated (buoyant) Unit Weight (γ_s)	68 pcf ¹	-	73 pcf
Friction Coefficient (f)	0.55	0.65	0.45
Active Earth Pressure Coefficient (K _a)	0.28	-	0.25
Passive Earth Pressure Coefficient (K _p)	3.57	-	4.0
At Rest Earth Pressure Coefficient (K _o)	0.47	-	0.41
Uplift Earth Pressure Coefficient (K _u)	0.92	-	0.94
Friction Angle (ϕ_c)	34 ⁰	37 ⁰	36 ⁰
Cohesion (c)	0	1000 psi ²	5.2 psi (750 psf)

¹ Based on 95% compaction of Foundation Backfill by ASTM D1557, Modified Proctor Test Method

² For near surface localized shear (i.e., bearing capacity, uplift, and sliding), the rock should be assumed to be cohesionless.

5.5.1 Rock Anchors

If additional foundation uplift capacity is needed, rock anchors can be used. Based on the recovered rock core samples at the site, we recommend an ultimate rock-grout bond stress of 120 psi be used in the design of the rock anchors. We recommend that the bonded zone start at a minimum length of 10 feet below the bedrock surface to allow for a free stressing zone. We further recommend that the rock anchors be installed with a Class 1 corrosion protection system. A minimum factor of safety of 2.5 should be used in bond stress calculations. If a 6" diameter hole is used for an anchor, this provides approximately 16 kips of uplift resistance per foot of bonded length.

To ensure adequate rock breakout capacity, we recommend that bond length of the anchors be a minimum of 5 feet. The calculation of the rock breakout was based on a failure cone projected 45° from the midpoint of the bonded zone, using a rock unit weight of 150 pcf and a factor of safety of 1.0 on the rock weight resistance. Based on this, we recommend a minimum rock anchor spacing of 5 feet. We recommend a maximum of two rock anchors per footing. In total, the rock anchor tendons should extend a minimum of 15 feet below bedrock surface (free stress zone + bond zone). Centralizers should be used for all installed anchors.

Due to the potential presence of joints in the rock, we recommend that grouting be conducted in two stages. The first stage would comprise pressure grouting in the bond zone to fill in open joints and fractures. Final grouting of the bond zone would occur when pressure grouting had been shown to seal off the bond zone. All installed anchors should be proof tested to a minimum of 120% of the design load, not to exceed 60% of the tensile strength of the steel. We

recommend that the proof testing of all of the anchors be performed in accordance with the Post Tensioning Institute 2014 recommendations.

6.0 <u>Construction Consideration</u>

Based on proposed basement floor elevations, we anticipate that shoring will be necessary to excavate for footings and the basement slab. Due to the presence of shallow bedrock, we believe that installed sheeting will need to be braced with either a tie-back system or raker. Steel H-piles socketed into bedrock with timber lagging is also an option. The design of the temporary shoring system should be performed by the shoring contractor.

Based on the groundwater levels observed from our explorations, we do not anticipate that groundwater will be encountered within the building excavations. Diversion and control of surface water should be performed to prevent water flow from adjacent wet areas or from rain or snowmelt from entering the excavations.

All exposed native soil which will be load bearing should be proofrolled with a minimum of 2 passes in each of two perpendicular directions with a 5-ton (operating weight) vibratory roller. All exposed load bearing bedrock surface should be cleared of loose and weathered rock to expose hard, competent bedrock.

All exposed rubble fill below footings should be removed in its entirety down to the native glacial till soil and outwards equal to a distance of the footing width on each side of the footing. Exposed rubble fill below the basement slab should be removed a minimum of 12" below the finished slab elevation. Voids in the rubble fill can be filled with ³/₄" crushed stone or flowable fill.

All installed rock anchors will need to be proof tested to 120% of the design uplift load. The procedure for the proof testing is outlined in the Post Tensioning Institute 2014 recommendations.

If controlled blasting is required to construct the building foundations, we recommend that blasting be performed in accordance with the General Blasting Criteria included in Appendix F.

7.0 <u>Closure</u>

Our recommendations are based on professional judgment and generally accepted principles of geotechnical engineering. Some changes in subsurface conditions from those presented in this report may occur. Should these conditions differ materially from those described in this report, or should building loads and configurations change significantly, SGS should be notified so that we can re-evaluate our recommendations.

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.

Matter Hardesan

Mathew Hardison, EI Geotechnical Engineer



Withers MRtule

William M. Peterlein, PE Principal Geotechnical Engineer

APPENDIX A

EXPLORATION PLAN





APPENDIX B

EXPLORATION LOGS



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 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

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 C	OHESIVE 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				

				SOIL BORING LOG			Boring #: B-1			
SIINANIT				Project: Proposed Apartment Building			Project #:	Project #: 15040		
CEDENGINEEPING SERVICES				Location:	665 Congress S		Sheet:	1 of 1		
SEGENGINEEKING SERVICES				City, State:	Portland, ME		Chkd by:			
Drilling Co: Summit Geoengineering Services						Boring Elevation:		115.9'		
Driller:	Stoff.	C. Coolidge, P.	E.			Reference:	Site Survey by	Litcomb Associates	2/21/2015	
						Date starteu.	3/31/2013			
Vehicle	Tracker		Lenath.	24" SS		Date	Depth	Flevation	REKDELTT	ference
Model:	AMS Po	wer Probe	Diameter:	2"OD/1.5"	ID	3/31/2015	-	Elevation	None observed	
Method:	2-1/2	" H.S.A.	Hammer:	140 lb						
Hammer	Style: /	Auto	Method:	ASTM D15	86					
Depth		1		I.			SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀		DESCRIP	TON	Test Data	Stratum
1						2" to 2.5" of Pave	ement			PAVEMENT 0.2'
I '-	S-1	24/4	1 to 3	6		Dark tan Gravelly	SAND, little Sili	, compact, humid,		FILL
2				11		SP-SM			_	
3				*		* Spoon sampler blow counts. Like	skewed horizor	tally, unable to collect		2.0'
						blow counts. Elice				
4						Auger advanceme	ent produced no	cuttings, likely rubble		
5						fill with large voic	ds			
- ⁻	S-2	24/3	5 to 7	WH		Light gray Sandy	GRAVEL, cobble	e pieces, little white Ash		
6				1		trace Silt, very loo	ose, humid, GP			
7				3		-				
· -						ł				
8						1				
0										
9_										9.0'
10						İ				GLACIAL TILL
11	S-3	24/20	10 to 12	6		Olive green SILT,	, little Clay and S	Sand, trace Gravel,		
· · · -				8		compact, numid,	IVIL		PP = 8,000 to 9.000 psf	
12				12		İ			.,	
10						l				
13						ł				
14										
45						Į				
15	S-4	24/9	15 to 17	6		Same as above	slightly mottled			
16	54	24/7	13 (0 17	50/3"			signity motieu			
I						End of Exploratio	n at 15.8', Auge	r and Spoon refusal		15.8'
17_						-				BEDROCK
18						ł				
19						ł				
20						t				
l						Į				
21						ł				
22						t				
						Į				
23						ł				
24						t				
						Į				
25						ł				
26						t				
I						Į				
27_						ł				
Granula	ar Soils	Cohesiv	ve Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	2487]	LL = Liquid Limit	, PI = Plastic Index	-	Dry: S = 0%
0-4	V. Loose	<2	V. soft			Bedrock Joints				Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5%	Frace	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: $S = 51 \text{ to } 75\%$
≥50	V Dense	9-15 16-30	SUIT V Stiff	> 30%	Some With	Sieeh = 22 10 A0 q	legrees			vvet: S = 70 t0 99% Saturated: S = 100%
200		>30	Hard	- 5070		Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	001010100. 0 = 10070
						Gravel = < 3 inch a	and > No 4, Sand	= < No 4 and >No 200, Silt/	/Clay = < No 200	

				SOIL BORING LOG			Boring #: B-2			
SIINANAIT				Project: Proposed Apartment Building			Project #:	15040		
					Location:	665 Congress S	it.	Sheet:	1 of 1	
	GEOENGINEERING SERVICES				City, State:	Portland, ME		Chkd by:		
Drilling Co: Summit Geoengineering Services				Boring Elevation:		114 ft				
Driller:		C. Coolidge, P.	Ε.			Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.1.			Date started:	3/31/2015	Date Completed:	3/31/2015	
DF	RILLING	METHOD	S	AMPLER			r	ESTIMATED GROUND W	ATER DEPTH	
Vehicle:	Tracked		Length:	24" SS		Date	Depth	Elevation	Re	eference
Model:	AMS Pov	wer Probe	Diameter:	2"0D/1.5"	ID	3/31/2015	-		None observed	
Method:	2-1/2	H.S.A.	Hammer:		07					
Hammer	Style: I	4010	method:	ASTIVI DT5	80		CAMPI		Coological/	Coological
Depth (ft)	No	Don/Doc (in)	Dopth (ft)	blowc/4"	N.,	+	DESCRIPT		Tost Data	Stratum
(11.)	NO.	Pen/Rec (III)		DIOWS/0	1460	2" to 2.5" of Pave	ement	TON	Test Data	PAVEMENT
1						2 10 2.0 011 01				0.2'
-	S-1	24/20	1 to 3	3		Dark brown Grav	elly SAND, little	Silt and black/white Ash,		FILL
2				6		loose to compact	, frozen, SP-SM			
3				5		ł				
				5		ł				
4						1				
-						4				
5_	S-2	24/22	5 to 7	10		Same as above				
6	5-2	27/22	5107	13		Olive green slight	tly mottled SILT	, little Sand, trace Clay		5.2'
-				13		and Gravel, comp	pact, damp, ML	,		GLACIAL TILL
7				14]				
0						+				
8						ł				
9						+				
-						1				
10	6.0	04/1/	10 1 . 10			C				
11	5-3	24/16	10 to 12	8		Same as above, i	neavily mottled	seam at 10.8', dense	PP = 4,000 to 7,000 psf	
- ''				32		ł			to 7,000 psi	
12				50/1"		End of Exploratio	n at 11.6', Spoc	n refusal		11.6'
]				BEDROCK
13						1				
14						ł				
· · · -						t				
15]				
14						+				
10						ł				
17						t				
]				
18						ł				
19						ł				
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Granul	ar Soils	Cohesiv	e Soils	% Compo	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft	50/ -		Bedrock Joints	1			Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	< 5% T	race	Shallow = 0 to 35	aegrees			Damp: $S = 26 \text{ to } 50\%$
11-30	Compact	5-8 0.15	FIRM Stiff	5-15%	LILLIE Somo	Dipping = 35 to 55	uegrees			Wot: $S = 51 \text{ to } /5\%$
>50	V Dense	16-30	V Stiff	> 30%	With	Siech = 32 10 40 0	1041003			Saturated: S = 1010 99%
200	V. Denst	>30	Hard	- 3070		Boulders = diameter	er > 12 inches C	obbles = diameter < 12 inche	s and > 3 inches	Saturateu. 5 - 10070
						Gravel = < 3 inch	and > No 4, Sanc	$I = \langle No 4 and \rangle No 200, Silt/$	Clay = < No 200	

				S	OIL BORI	NG LOG	Boring #: B-3			
SILAAAIT			Project: Proposed Apartment Building			Project #:	15040			
SUIVIIVII				Location:	665 Congress S	it.	Sheet:	1 of 1		
		GEOENGINEERI	NGINEERING SERVICES			City, State:	City, State: Portland, ME Chkd by:			
Drilling C	0:	Summit Geoen	gineering Ser	vices		Boring Elevation:		112.9 ft		
Driller:		C. Coolidge, P.	E.			Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.l.			Date started:	3/31/2015	Date Completed:	3/31/2015	
DF	RILLING	METHOD	S	AMPLER				ESTIMATED GROUND W	ATER DEPTH	
Vehicle:	Tracked		Length:	24" SS		Date	Depth	Elevation	Re	eference
Model:	AMS Pov	wer Probe	Diameter:	2"OD/1.5"	ID	3/31/2015	-		None observed	
Method:	2-1/2"	' H.S.A.	Hammer:	140 lb						
Hammer	Style: A	Auto	Method:	ASTM D15	86			_		
Depth					N	+	SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	21 to 2 Ell of Down	DESCRIP	ION	Test Data	Stratum
1						3 10 3.5 01 Pave	ement			0.3'
· ·-	S-1	24/12	1 to 3	4		Dark brown SILT	, large brick frac	ment in spoon, small		FILL
2				11*		brick fragment in	spoon tip, loos	e, humid, ML		
				4						
3				2		* blow count due	e to brick fragme	ent		
4						ł				
· -						+				
5										
,	S-2	24/12	5 to 7	12		Olive green SILT,	little Sand, trac	e Clay and Gravel,		5' +/-
6				18		compact, numid,	ML		PP = 5,000 psr	GLACIAL TILL
7				00/0		End of Exploratio	n at 6.2'. Spoon	and Auger refusal		6.2'
-								5		BEDROCK
8]				
0						1				
9-						ł				
10						+				
-						1				
11						+				
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Grapula	ar Soile	Cohoch	e Soils	% Comp	osition	NOTES	PD - Pockot Don	etrometer MC - Moisture Co	ntent	Soil Moisture Condition
Blows/ft	n JUIIS Density	Blows/ft	Consistency	ло сотпр ⊿стм г	03110f1)2487	NUTES.	rr = rouket ren	PI = Plastic Index	ment	Drv: $S = 0\%$
0-4	V. Loose	<2	V, soft		270/	Bedrock Joints				Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	< 5%	Trace	Shallow = 0 to 35	degrees			Damp: $S = 26$ to 50%
11-30	Compact	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: $S = 51 \text{ to } 75\%$
31-50	Dense	9-15	Stiff	15-30%	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30%	With		-			Saturated: S = 100%
		>30	Hard			Boulders = diameter	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
						Gravel = < 3 inch	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt$	/Clay = < No 200	

				S	OIL BORI	NG LOG	Boring #:	B-4		
SIIMMI			Project: Proposed Apartment Building			Project #:	15040			
					Location:	665 Congress S	St.	Sheet:	1 of 1	
GEOENGINEERING SERVICES				City, State:	Portland, ME		Chkd by:			
Drilling C	0:	Summit Geoen	gineering Ser	vices		Boring Elevation:		112.5 ft		
Driller:	Stoff.	C. Coolidge, P.	E.			Reference:	Site Survey by	Titcomb Associates	2/21/2015	
Summit			.i. s			Date started:	3/31/2015		3/31/2015 ATED DEDTH	
Vehicle:	Tracked		Lenath.	24" SS		Date	Depth	ESTIMATED GROUND W		ference
Model:	AMS Po	wer Probe	Diameter:	2"OD/1.5"	ID	3/31/2015	-	Elevation	None observed	
Method:	2-1/2'	' H.S.A.	Hammer:	140 lb						
Hammer	Style: A	Auto	Method:	ASTM D15	86					
Depth				1		+	SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	2 F" of Dovomont	DESCRIPT	FION	Test Data	Stratum
1						2.5 OF Pavement	L			0.2'
-	S-1	24/10	1 to 3	2		Brown Sandy SIL	T, little fine Gra	vel and black Ash, loose,		FILL
2_				2		humid, ML				
3				2		ł				
-						Auger cuttings sh	now increasing a	ash content with depth		
4_	6.0	24/2	4 E to 4 E	E0/E"		and some brick fi	ragments	aan tin		
5	3-2	24/2	4.5 10 0.5	50/5		Weathered Tock I	ragments in spo			4.5'
-						Augered through	weathered rock	to competent refusal		WEATHERED ROCK
6_						+				
7						ł				
-						End of Exploratio	n at 7.2', Auger	refusal		7.2'
8_						+				BEDROCK
9						ł				
-						1				
10_						+				
11						ł				
-						1				
12_						+				
13						ł				
-						1				
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27						1				
0	r C-!!	0.1	io Soil-	01.0	oolt!	NOTES	DD DID	stromotor MC Malala a	ntant	Soil Maintern Country
Granula Blows/ft	II SOIIS	Cohesiv Blows/ft	Consistency	% Comp дстм г	051(10N)2487	NUTES:	rr = Pocket Pen	enometer, MC = Moisture Co PI = Plastic Index	ment	Sui involsture Condition Drv: $S = 0\%$
0-4	V. Loose	<2	V. soft	AJ TIVI L	/UTU/	<u>Bedroc</u> k Joints	בב – בוקטוט בווחונ			Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	< 5%	Trace	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30%	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30%	With	Pouldoro - Harra I	or > 10 inch 0	obbloc - diamotor - 10 in the	and > 2 instra	Saturated: S = 100%
		>30	naru			Gravel = < 3 inch	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt/$	Clay = < No 200	

		\wedge				S	OIL BORI	NG LOG	Boring #:	B-5
		SIIN	INAN			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI				Location:	665 Congress S	St.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	Co:	Summit Geoen	gineering Ser	vices		Boring Elevation:		112.5 ft		
Driller:		C. Coolidge, P.	E.			Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.l.			Date started:	3/31/2015	Date Completed:	3/31/2015	
DE		METHOD	5/	AMPLER		Data	D. U	ESTIMATED GROUND W		
Venicie:		wor Probo	Length: Diamotor:	24" 55	חוי	Date 2/21/2015	Depth	Elevation	None observed	sterence
Method:	2-1/2		Hammer:	2 UD/1.5	ID	3/31/2015	-		None observed	
Hammer	Style:	Auto	Method:	ASTM D15	86					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	+	DESCRIP	LION	Test Data	Stratum
. ,						2.5" of Pavement				PAVEMENT
1										0.2'
2	S-1	24/8	1 to 3	15		Dark brown to bl	ack Sandy SILT, II	, little Gravel and black		FILL
2				6		and write Ash, w	IL.			
3				2		1				
						Į				
4_						Dense drilling at	4 8'			
5	S-2	24/1	4.8 to 6.8	50/3"		Rock in spoon tip	4.0			
-						End of Exploratio	n at 4.8', Spoor	and Auger refusal		4.8'
6						ł				BEDROCK
7						ł				
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Granula	ar Soils	Cohesiv	e Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ontent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	02487	1	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft		-	Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	< 5%	Irace	Shallow = 0 to 35	degrees			Damp: $S = 26$ to 50%
11-30 31 EO	Dorse	5-8 0.1F	F IFM Stiff	5-15%	LITTIE	Dipping = 35 to 55	uegrees			Wolst: $S = 51 \text{ to } /5\%$
>50	V. Dense	16-30	V. Stiff	> 30%	With	Siech = 32 10 40 0	icyi ees			Saturated: S = 100%
		>30	Hard	. 5570		Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
						Gravel = < 3 inch	and > No 4, Sand	$I = \langle No 4 and \rangle No 200$, Silt	/Clay = < No 200	

SUMMIX GEOENGINEERING SERVICES						S		NG LOG	Boring #:	B-101
		SIINA	INAN			Project:	Proposed Apart	ment Building	Project #:	15040
		SUN				Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	ING SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	:o:	Great Works T	est Boring			Boring Elevation:		118.5 ft		
Driller:		Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E				Date started:	4/15/2015	Date Completed:	4/15/2015	
DF	RILLING	METHOD	Si	AMPLER		_		ESTIMATED GROUND W	ATER DEPTH	-
Vehicle:	Tracked	1	Length:	24" SS	15	Date	Depth	Elevation	Re	eference
Model:	Mobile E	Stom Augor	Diameter:	2"0D/1.5"	ID	4/15/2015	-		None observed	
Hammer	4 50110 Style: 1		Method:		86					
Denth	Style. I	Nac -	metriou.	ASTIMUDIS	00		SAMDI	F	Geological/	Geological
(ft)	No	Pen/Rec (in)	Denth (ft)	blows/6"	Neo	ł	DESCRIPT		Test Data	Stratum
(11.)	110.		Doptil (ity	510113/0	00	3" Pavement	DECONT		TOST Data	PAVEMENT
1	S-1	24/4	0.5 to 2.5	4		Brown Silty SAND), loose, humid,	SM		0.25'
				3		+				FILL
2_				3		+				
3	-			5		ł				
-						1				
4						Possible rubble e	ncountered at 4	' during drilling		
5						ł				
5_	S-2	24/4	5 to 7	7		Brown Silty SAND), trace Gravel,	compact humid, SM		
6				7		1	1			
-				7		+				
				/		ł				
8						ł				
-						1				
9_						+				
10						+				
10	S-3	24/12	10 to 12	4		Dark olive green	SILT, little Sand		10.0' +/-	
11				8		dense/very stiff,	slightly mottled,	PP = *1,000 to	GLACIAL TILL	
12				30		* – Specimen fai	led via tension (crack low clay content	*3,000 psf	
12				50/5		End of Exploratio	n at 11 9'. Auge	er and Spoon refusal		11 9'
13							in dr. i i i i i i i i i i i i i i i i i i i			BEDROCK
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Granula	ar Soils	Cohesiv	ve Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	2487	4	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	Loose <2 V. soft				Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	< 5% 1	race	Shallow = 0 to 35	aegrees			Damp: $S = 26 \text{ to } 50\%$
11-30	Lompac	5-8 0.1F	Firm Stiff	5-15%	LITTLE	Dipping = $35 \text{ to } 55$	uegrees			Moist: $S = 51$ to 75%
>50	V Dense	9-10 16-30	Suil V Stiff	10-30% > 30%	Some Steep = 55 to 90 degrees Wet: S = 76 to 99% With Some Some Some				vvei. S = 70.00.99% Saturated: S = 10.0%	
230	. Dense	>30	Hard	- 3070		Boulders = diameter	er > 12 inches. C	obbles = diameter < 12 inche	es and > 3 inches	Saturateu. 5 - 10070
						Gravel = < 3 inch	and > No 4, Sanc	$I = \langle No 4 and \rangle No 200$, Silt	/Clay = < No 200	

		\wedge				S	OIL BORI	NG LOG	Boring #:	B-102
		SIINA	INANT			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI	IVIII			Location:	665 Congress S	St.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Great Works T	est Boring			Boring Elevation:		118.7 ft		
Driller:		Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.l.			Date started:	4/15/2015	Date Completed:	4/15/2015	
DF	RILLING	METHOD	S	AMPLER				ESTIMATED GROUND W	ATER DEPTH	
Vehicle:	Tracked		Length:	24" SS		Date	Depth	Elevation	Re	eference
Model:	Mobile E	8-53	Diameter:	2"OD/1.5"	ID	4/15/2015	-		None observed	
Method:	4" Solic	l Stem Auger	Hammer:	140 lb						
Hammer	Style: F	7&C	Method:	ASTM D15	86					1
Depth				.		-	SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	2" Deversert	DESCRIP	FION	Test Data	Stratum
1	S 1	24/4	0.5 to 2.5	4		3 Pavement	SAND little Cra	vol. Gravol piecos in		
'-	3-1	24/4	0.5 10 2.5	4		spoon tip, loose.	drv. SM	ver, Graver pieces in		0.25 FILI
2				5						
-				3		1				
3						Rubble fill, large	voids apparent	from open hole inpection		
4						Augor opeounter	ad rational at 1.0) during drilling Moved		
4_						Auger encountere	ed refusal at 4.9	auring arilling. Novea		
5						in second hole at	3.2'	st, refusal encountered		
- ⁻						End of Exploratio	n at 4.9', Auger	refusal on rubble		4.9'
6] .	5			
I _						4				
7						+				
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Granula	ar Soils	Cohesiv	re Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft			Bedrock Joints	-			Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5%	race	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30%	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30%	With					Saturated: S = 100%
1		>30	Hard			Boulders = diameter	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
>30 Hard						Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No \ 4 \text{ and } \rangle No \ 200$, Silt	/Clay = < No 200	

SUMMIT. GEOENGINEERING SERVICES						S		NG LOG	Boring #:	B-103
		SIINA	INAN			Project:	Proposed Apart	ment Building	Project #:	15040
						Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	ING SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	:0:	Great Works T	est Boring			Boring Elevation:		115.0 ft		
Driller:	o	Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.l. -			Date started:	4/15/2015	Date Completed:	4/15/2015	
Dh			Longth:	AIVIPLEK		Data	Donth	ESTIMATED GROUND WA		foronco
Model·		ı 3-53	Lengin: Diameter	24 35 2"0D/1 5"	ID	4/15/2015	Depin	Elevation	Ke None observed	rerence
Method:	4" Solid	Stem Auger	Hammer:	140 lb		4/13/2013				
Hammer	Style: I	R&C	Method:	ASTM D15	86					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀		DESCRIPT	TION	Test Data	Stratum
1	C 1	24/0	0 E to 2 E	4		3" Pavement	our CAND troo	o oilt lorgo briek frogmont		PAVEMENT
'-	2-1	24/8	0.5 10 2.5	4		in top 4" of samp	own SAND, trac	e sin, large blick fragment ent in spoon tip, loose.		0.25 FILL
2				7		humid, SP		···· ··· ··· ··· ··· ··· ··· ··· ··· ·		
2				9		Į				
3-						+				
4						1				
_						ļ				
5_	S_2	24/6	5 to 7	5		same as above in	no brick fragmer	nt. some white Ash		
6	5-2	27/0	5.07	7			io briok irayifici	R, SOME WHILE ASH		
_				15		1				
7				15		ł				
8						ł				
						1				
9_										
10						ł				9.0 +/- GLACIAL TILL
	S-3	24/20	10 to 12	14		Olive green SILT,				
11				24		pieces fro 10.5 to	o 11.0', humid, o	lense/hard, ML	> 9,000 psf	
12				20		ł				
12				20		+				
13						1				
14						+				
14_						ł				
15						End of Exploratio	n at 14.5', Auge	er refusal		14.5'
16						+				BEDROCK
10						ł				
17						1				
10	-					+				
18						ł				
19						1				
20						ł				
20						ł				
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Granular Soils Cohesive Soils % Composition					osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Cor	ntent	Soil Moisture Condition
Blows/ft. Density Blows/ft. Consistency ASTM D2487					2487	Deducation in the	LL = Liquid Limit	, PI = Plastic Index		Dry: $S = 0\%$
0-4 V. Loose <2 V. soft					Traco	Bedrock Joints	dogroos			Humid: $S = 1 \text{ to } 25\%$
5-10 11-30	LUUSE	2-4 5-8	SUIT	< 5% 5_15%	i ace Littlo	Dipping $= 35 \text{ to } 55$	dearees			Damp: $S = 20 \ 10 \ 50\%$ Moist: $S = 51 \ to \ 75\%$
11-30 Compact 5-8 Firm 5-15% Little 31-50 Dense 9-15 Stiff 15-30% Some					Some	ttle Dipping = 35 to 55 degrees Moist: S = 51 to 75% ome Steep = 55 to 90 degrees Wet: S = 76 to 99%				Wet: $S = 76 \text{ to } 99\%$
>50	31-50 Dense 9-15 Stiff 15-30% Some >50 V. Dense 16-30 V. Stiff > 30% With						Steep = 55 to 90 degrees Wet: S = 76 to 99% Vith Saturated: S = 100%			
		>30	Hard			Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	s and > 3 inches	
						Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt/$	Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES						S		NG LOG	Boring #:	B-104
		SIINA	INANT			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI	IVIIA			Location:	665 Congress S	jt.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	co:	Great Works T	est Boring			Boring Elevation:		113.1 ft		
Driller:		Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.l.			Date started:	4/15/2015	Date Completed:	4/15/2015	
Ur	Trackod		Jonath:	AIVIPLER		Data	Dopth	ESTIMATED GROUND W		foronco
Model.	Mobile B	1	Lengin: Diameter:	24 33 2"0D/1 5"	ID	4/15/2015	Depth	Elevation	None observed	ererence
Method:	4" Solid	Stem Auger	Hammer:	140 lb		4/13/2013			None observed	
Hammer	Style: F	7&C	Method:	ASTM D15	86					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀		DESCRIP	TION	Test Data	Stratum
1						4" Pavement				PAVEMENT
'-						Augered to 5', re	lativelv easv dril	llina (no rubble)		0.3 FILL
2							, i j i i j i	5 ()		
2						1				
3_						ł				
4						t				
_]				
5_	S-1	24/18	5 to 7	7		Olive green SILT	little Gravel Sa	and and Clay mottled	PP - 5 000 to	5.0' +/-
6	3-1	24/10	5107	7		damp, compact/\	ery stiff, cobble	pieces at 6.5', ML	7,000 psf	GLACIAL TILL
	ļ			17			3	•	•	
7_				23		+				
8						ł				
9_						+				8.5'
10						End of Exploratio	n at 9.5'. Auger	refusal		9.5'
							in at the things			BEDROCK
11]				
12						ł				
12						+				
13						1				
14						+				
14_						ł				
15						1				
14						+				
10						ł				
17						İ				
10]				
18_						ł				
19						ł				
I						Į				
20						ł				
21						t				
						Į				
22						ł				
23						ł				
I –						1				
24						ł				
25						ł				
I						1				
26						ł				
27						ł				
						<u>†</u>				
Granula	ar Soils	Cohesiv	e Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D	2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft		F	Bedrock Joints				Humid: $S = 1$ to 25%
5-10	LOOSE	2-4 5 0	Soft	< 5%	i race	Snallow = 0 to 35 Dipping = 25 to 55	uegrees			Damp: $S = 26 \text{ to } 50\%$
31-50	Dense	9-15	Stiff	5-15% 15-30%	Some	Steep = $55 \text{ to } 90 \text{ d}$	learees			Wet: $S = 76 \text{ to } 99\%$
>50	V. Dense	16-30	V. Stiff	> 30%	With					Saturated: S = 100%
		>30	Hard			Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inch	es and > 3 inches	
						Gravel = < 3 inch	and > No 4, Sand	$I = \langle No 4 and \rangle No 200$, Silt	/Clay = < No 200	

		\sim				S	OIL BORI	NG LOG	Boring #:	B-105
		SIINA	AAN			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI				Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	co:	Great Works T	est Boring			Boring Elevation:		113.8 ft		
Driller:		Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.1.			Date started:	4/15/2015	Date Completed:	4/15/2015	
DF	RILLING	METHOD		SAMPLER		_		ESTIMATED GROUND W	ATER DEPTH	-
Vehicle:	Tracked		Length:	24" SS		Date	Depth	Elevation	Re	eference
Mothod:		sod Wash	Diameter:	2 UD/1.5 ID		4/15/2015	-		None observed	
Hammer	Style: I		Method [.]	ASTM D1586						
Depth	etjier i		motriour	10111101000			SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀		DESCRIP	TION	Test Data	Stratum
			,			3" Pavement				PAVEMENT
1										0.25'
2						Augered to refuse	al for Rock Core			
<u> </u> _						-				
3										
4						-				
4										
5										
,						4				
°_						1				
7										
8_						-				
9						-				
				-						9.1' +/-
10	DUN	ROC								WEATHERED ROCK
11	C-1a	10 to 13.3	40"	70%	0%	Moderately weath	nered, verv thin	v spaced vertical joints.	_	BEDROCK
-						very hard, light to	o medium gray	SCHIST		
12						-			1	
13						-			N.	
	C-1b	13.3 to 15	20"	100%	80%	Same as above, r	noderately space	ed joints		
14									E	
15						-				
						End of Exploratio	n at 15.0', rock	core terminated		15.0'
16										
17						-				
18										
19						-				
-						1				
20						4				
21						1				
<u> </u>						1				
22						4				
23						1				
						1				
24										
25						1				
20						1				
26										
27						4				
27						-				
Granula	ar Soils	Cohesive	Soils	% Compos	sition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2	487	1	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft			Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	< 5% Tr	ace	Shallow = 0 to 35	degrees			Damp: $S = 26 \text{ to } 50\%$
11-30 31 EO	Compac	5-8 0.1F	Firm Stiff	5-15% L	ome	Dipping = 35 to 55	uegrees			Moist: $S = 51 \text{ to } 75\%$
>50	V. Dense	16-30	V. Stiff	> 30% V	Vith	Siech = 22 10 40 0	icyi ees			Saturated: S = 100%
		>30	Hard	- 5070 V		Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
						Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt$	/Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES						S	OIL BORII	NG LOG	Boring #:	B-106
		SIINA	AAIT			Project:	Proposed Apart	ment Building	Project #:	15040
		CEOENCIPEE				Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	Co:	Great Works T	est Boring			Boring Elevation:		112.0 ft		
Driller:	01.00	Jeff Lee				Reference:	Site Survey by	Titcomb Associates	1/15/05:5	
Summit	Staff:	M. Hardison, E	l. I			Date started:	4/15/2015	Date Completed:	4/15/2015	
Dh	Trookod	METHOD	Longth.	SAMPLER		Data	Donth	ESTIMATED GROUND W		foronoo
Venicie: Model:	Mobile F	1	Lengin: Diamotor:	24 55	1	Date 4/15/2015	Depth	Elevation	None observed	erence
Method:	4" Cas	sed Wash	Hammer:	140 lb		4/13/2013			None observed	
Hammer	Style: I	R&C	Method:	ASTM D1586)					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	-	DESCRIPT	ION	Test Data	Stratum
						3" Pavement				PAVEMENT
1_						Augered to refus	al for Pock Core			0.25'
2						Augered to reluse				
-										
3_										
4						Dense drilling from	m approximatel	y 2' to 8', frequent		
-										
5										
,						4				
6_						-				
7										
-										
8						-				
9						-				
í –										
10		ROC	ck core da	TA						
11	RUN	DEPTH	RUN	RECOVERY	RQD	Madaratak	arad yory think	wannaad lainta warv		10.0'
- ''	C-2	10 10 15	60	66%	33%	hard light gray to	blue SCHIST	ly spaced joints, very	1	BEDROCK
12						nara ngitt gray to	5100 0011101			
						most fractures ra	nge from 45° to	vertical		
13						-			A	
14									M	
· · · -										
15										
14	C-3	15 to 19	48"	96%	65%	Same as above, r	nost joints and	fractures are vertical		
10										
17						-			~	
10									2	
18						-				
19						1				
-						End of Exploratio	n at 19.0', rock	core terminated		19.0'
20						4				
21						4				
l - '-	L]				
22										
22						-				
23	-					1				
24						1				
						4				
25						4				
26						1				
-]				
27						-				
Granula	ar Soils	Cohosive	Soils	% Compo	sition	NOTES	PP = Pocket Pop	etrometer MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft	Densitv	Blows/ft.	Consistency	ASTM D2	487		LL = Liquid Limit	, PI = Plastic Index	mont	Drv: $S = 0\%$
0-4	V. Loose	<2	V. soft			Bedrock Joints		,		Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	< 5% Tr	ace	Shallow = 0 to $35 \circ$	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15% L	ittle	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30% S	ome	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30% V	Vith					Saturated: S = 100%
1		>30	Hard			Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
		1		1		Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No \ 4 \text{ and } \rangle No \ 200, \ Silt/$	/Clay = < No 200	1

SUMMIT GEOENGINEERING SERVICES						S		NG LOG	Boring #:	B-107
		SIINA	INAN			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI				Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	ING SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	co:	Great Works T	est Boring			Boring Elevation:		112.9 ft		
Driller:	a	Jeff Lee				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	l. -			Date started:	4/15/2015	Date Completed:	4/15/2015	
DF	Track	METHOD	S.	AMPLER		Dete	Deville	ESTIMATED GROUND W		f
venicle:	Mobilo F	ı 2-53	Length: Diameter	24 55	חו	Date 4/15/2015	Depth	LIEVATION	None observed	ererence
Method.	4" Solid	Stem Auger	Hammer:	140 lb		TI 13/2013	-			
Hammer	Style: I	R&C	Method:	ASTM D15	86					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀	Ť	DESCRIPT	TION	Test Data	Stratum
1	6.1	0.4.1/	0.5.1.0.5	2		4" Pavement				PAVEMENT
'-	5-1	24/6	0.5 10 2.5	3 4		Dark brown Sand	IY SILL, trace As	sh and Brick Tragments,		0.3 FILI
2				4		10000, a. j.				
-				3]				
3_						ł				
4						+				
						Į				
5	S_2	24/24	5 to 7	7		Olive green SILT	slight mottling	litte fine Sand trace		5 0' +/-
6	52	27/29	5.07	10		Gravel and Clay,	compact/very s	tiff, humid, ML		GLACIAL TILL
				14		1				
7_				14	-	+				
8						+				
-						1				
9_										0.0'/
10	10					Soft rock encount	tered during au		WEATHERED ROCK	
-	11					rock to hard refu	sal	5.5.		
11_						End of Exploratio	n at 10.5', Auge	er refusal		10.5'
12						ł				DEDRUCK
-						1				
13				-		+				
14						+				
						1				
15						+				
16						ł				
-						1				
17				-		+				
18						ł				
						1				
19						ł				
20				+		ł				
l						Į				
21_						ł				
22	E					İ				
~~						Į				
23						ł				
24						t				
						Į				
25						ł				
26						İ				
						Į				
27						ł				
Granular Soils Cohesive Soils % Composition					osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Granular Solis Conesive Solis % composition Blows/ft. Density Blows/ft. Consistency ASTM D2487					LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%		
0-4	V. Loose	<2	V. soft			Bedrock Joints				Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 5% 1	race	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compac	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: $S = 51 \text{ to } 75\%$
31-50 >50	Vense V Dense	9-15 16-30	SUIT V Stiff	15-30%	SOME With	Sieep = 55 to 90 d	legrees			wet: $S = 76 \text{ to } 99\%$ Saturated: $S = 100\%$
230	. Dense	>30	Hard	- 3070		Boulders = diamete	er > 12 inches. C	obbles = diameter < 12 inche	es and > 3 inches	Sataratea. 5 - 10070
						Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt$	/Clay = < No 200	

SUMMIT GEOENGINEERING SERVICES						S		NG LOG	Boring #:	B-108
		SIINA	INAN			Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI	IVIIA			Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	ING SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	co:	Great Works T	est Boring			Boring Elevation:		110.2 ft		
Driller:	01.00	Jeff Lee				Reference:	Site Survey by	Titcomb Associates	4/45/0045	
Summit	Staff:	M. Hardison, E	l.			Date started:	4/15/2015	Date Completed:	4/15/2015	
Ur	Trackor		J.	AIVIPLER		Data	Dopth	ESTIMATED GROUND W		foronco
Model.	Mohile F	1 3-53	Length: Diameter	24 33 2"0D/1 5"	ID	4/15/2015	Depth	Elevation	None observed	ererence
Method:	4" Solid	Stem Auger	Hammer:	140 lb		4/13/2013			None observed	
Hammer	Style: I	R&C	Method:	ASTM D15	86					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N ₆₀		DESCRIP	TION	Test Data	Stratum
1	C 1	24/10		0		4" Pavement		t company humid		PAVEMENT
· -	5-1	24/10		8 9		SW-SM	e sand, iittie si	t, compacy, numid,		0.3
2				8		large Brick fragm	ent and white A	SH	F	1.1' +/-
2				3		+				E 111
3_						+				FILL
4						1				
- F						4				
5_	S-2	24/4		*50/6"		l ight brown Grav	elly SAND, cobb	ble piece in spoon tip.		
6		2.0.1		00/0		humid, SP	0	no piece in speen up;		
_						* high blow coun	t due to cobble	in fill		
/_						4				
8						1				
9_						End of Exploratio	n at 8.5', Auger	refusal		8.5' BEDDOCK
10						4				DEDROCK
11						+				
12						4				
-						1				
13						+				
14						4				
15						+				
16						4				
17						+				
18						4				
l]				
19						4				
20						1				
I]				
21_						4				
22						1				
						4				
23						4				
24						1				
I]				
25						4				
26						1				
]				
27	27					4				
Granular Soils Cohesive Soils % Composition					osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft. Density Blows/ft. Consistency ASTM D2487					2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft			Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	< 5% 1	race	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compac	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: $S = 51 \text{ to } 75\%$
31-50 Dense 9-15 Stiff 15-30% Some						sieep = 55 to 90 d	legrees			wet: $S = 76 \text{ to } 99\%$ Saturated: $S = 100\%$
230	. Denst	>30	Hard	- 3070		Boulders = diamete	er > 12 inches. C	obbles = diameter < 12 inche	es and > 3 inches	Saturatea. 5 - 10070
						Gravel = < 3 inch a	and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Silt$	/Clay = < No 200	

SUMMIX GEOENGINEERING SERVICES								SOIL PROP	BE LOG	Boring #:	P-1
		SIINA	MAN				Project:	Proposed Apart	ment Building	Project #:	15040
		GEOENGINEED					Location:	665 Congress S		Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Summit Geoen	gineering Ser	vices			Boring Elevation:		114.9 ft		
Driller:	Stoff.	C. Coolidge, P.	E.				Reference:	Site Survey by	Titcomb Associates	2/21/2015	
Summit			.i. s		FD		Date started:	3/31/2015		3/31/2015 ATED DEDTH	
Vehicle:	Tracked		Lenath:		LK		Date	Denth	ESTIMATED GROUND W		eference
Model:	AMS Pov	wer Probe	Diameter:	N/A			3/31/2015	Deptil	Elevation		
Method:	2-1/2"	' H.S.A.	Hammer:	N/A							
Hammer	Style: A	Auto	Method:	N/A							
Depth			1					SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blov	vs/6"	N ₆₀		DESCRIP	TION	Test Data	Stratum
1				PR	OBF		2.5" of Pavement	t			PAVEMENT
- '-							1				FILL
2											
3							Dense drilling at	3' likely rubble			
							Dense unning at	s, intery rubble			
4							Auger advancem	ent produced no	cuttings, large voids		
5				<u> </u>			apparent from ho	pie inspection, li	kely rubble fill		
- ⁻							ł				
6]				
7							-				
· -							ł				
8											
0											
9-											9.0' +/-
10				Ň	/						WEATHERED ROCK
11							End of Probe at 1	10.0', Auger Ref	usal		10.0'
···-							•				DEDRUCK
12							1				
12											
13							•				
14							1				
15											
15											
16											
17											
							•				
18							1				
10				<u> </u>			ł				
19				<u> </u>			ł				
20							1				
21							ł				
<u></u>				-			t				
22							Į				
23				<u> </u>			ł				
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24							Į				
25				-			ł				
23				L			İ				
26							Į				
27							ł				
				L			<u> </u>				
Granula	ar Soils	Cohesiv	e Soils	%	Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	A	STM C	2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft		. 50/ -	Frace	Bedrock Joints	dograa-			Humid: $S = 1$ to 25%
5-10 11-20	LOOSE	2-4 5.9	SOIT		5%	Little	Snallow = 0 to 35 Dipping = 25 to 55	uegrees degrees			Damp: $S = 26 \text{ to } 50\%$
31-50	Dense	9-15	Stiff	15	5-30%	Some	Steep = 55 to 90 c	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	>	· 30%	With					Saturated: S = 100%
		>30	Hard				Boulders = diameter	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
	>30 Hard						Gravel = < 3 inch	and > No 4, Sand	= < No 4 and >No 200, Silt/	/Clay = < No 200	

		\wedge						SOIL PRO	BE LOG	Boring #:	P-2
		SIINA	MAN				Project:	Proposed Apar	ment Building	Project #:	15040
		GEOENGINEED					Location:	665 Congress S	St	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Summit Geoen	gineering Ser	vices			Boring Elevation:	au 6	113.9 ft		
Driller:	Staff.	C. Coolidge, P.	۲. ۲				Reference:	Site Survey by	Litcomb Associates	2/21/201E	
Summit			.I. S		FD		Date started:	3/31/2015		3/31/2015	
Vehicle:	Tracked		Lenath:		LK		Date	Denth	ESTIMATED GROUND W		ference
Model:	AMS Pov	wer Probe	Diameter:	N/A			3/31/2015	Deptil	Elevation		
Method:	2-1/2"	' H.S.A.	Hammer:	N/A							
Hammer	Style: A	Auto	Method:	N/A							
Depth			1					SAMPL	.E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blov	vs/6"	N ₆₀		DESCRIP	ΓΙΟΝ	Test Data	Stratum
1				PR	I ORF		2.5" of Pavement	t			PAVEMENT 0.2'
'-							ł				FILL
2							Auger cuttings: ta	an Sandy SILT,	some brick fragments,		
3							+				
							+				
4							1				
5				<u> </u>			ł				
-				-			ł				
6							Į				
7				<u> </u>			ł				
· -							+				
8							1				
0							+				
9-											9.0' +/-
10				Ň	/						WEATHERED ROCK
11							End of Probe at 1	10.0', Auger refu	isal		10.0'
···-							ł				DEDRUCK
12							1				
12							+				
13							ł				
14							1				
15							+				
15							ł				
16							1				
17							+				
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26							Į				
27				<u> </u>			ł				
				L			<u>†</u>				
Granula	ar Soils	Cohesiv	e Soils	%	Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	A	STM C	2487		LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft		. 50/ -	Frace	Bedrock Joints	dogroc-			Humid: $S = 1$ to 25%
5-10 11-20	LOOSE	2-4 5.9	SOIT		5%	Little	Snallow = 0 to 35				Damp: $S = 26 \text{ to } 50\%$
31-50	Dense	9-15	Stiff	15	5-30%	Some	Steep = 55 to 90 d	legrees			Wet: $S = 76 \text{ to } 99\%$
>50	V. Dense	16-30	V. Stiff	>	· 30%	With					Saturated: $S = 100\%$
		>30	Hard				Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
	>30 Hard						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				

		\wedge						SOIL PRO	BE LOG	Boring #:	P-3
		SIINA	INAN				Project:	Proposed Apar	ment Building	Project #:	15040
		GEOENCINEED					Location:	665 Congress S	St.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Summit Geoen	gineering Ser	vices			Boring Elevation:		112.8 ft		
Driller:	-toff	C. Coolidge, P.	E				Reference:	Site Survey by	Titcomb Associates	2/21/2015	
		wi. maraison, E	.1.		FD		Date started:	3/31/2015		3/31/2015 ATED DEDTU	
Ur Vehicle:	Tracked		ک ۱ enath		∟r∖		Date	Denth	ESTIMATED GROUND W		ference
Model:	AMS Pou	wer Probe	Diameter:	N/A			3/31/2015	Deptil		K	
Method:	2-1/2"	' H.S.A.	Hammer:	N/A							
Hammer	Style: A	Auto	Method:	N/A							
Depth								SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blov	ws/6"	N ₆₀		DESCRIP	ΓΙΟΝ	Test Data	Stratum
1				PR	OBE		3.5" of Pavement	t			PAVEMENT
·-							Dense drilling at	8", moved over	and started new hole		FILL
2											
3							Auger cuttings: L	Dark tan SAND,	little Silt and Gravel		
- J							ł				
4							1				
5							+				
°-				<u> </u>							5.0' +/-
6							Auger cuttings: s	imilar to above,	little Clay		GLACIAL TILL
7				-			ł				
											7.0' +/-
8							1				WEATHERED ROCK
0							Auger cuttings: li	ight tan fine SAI	ND (rock dust)		
9-							ł				
10				N	\checkmark		ł				
11							End of Probe at 9	9.9', Auger refus	al		9.9'
- ''							ł				BEDRUCK
12							1				
10							+				
13							ł				
14							1				
15							+				
15							+				
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24							1				
25				<u> </u>			ł				
25				-			ł				
26							1				
77							ł				
<i>21</i>				<u> </u>			ł				
Granula	r Soils	Cohesiv	e Soils	%	Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	A	STM D	02487	1	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft			_	Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	-	< 5%	I race	Shallow = 0 to 35	degrees			Damp: $S = 26$ to 50%
11-30 31.50	Lompact	5-8 0,15	Firm Stiff	10	5-15%	LITTIE	Dipping = 35 to 55	o uegrees			Moist: $S = 51 \text{ to } 75\%$
>50	V. Dense	16-30	V. Stiff	10		With	5100p - 55 10 90 0	acgrees			Saturated: S = 100%
		>30	Hard				Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inche	es and > 3 inches	
	>30 Hard						Gravel = < 3 inch	and > No 4, Sand	$I = \langle No 4 and \rangle No 200$, Silt	/Clay = < No 200	

						SOIL PROBE LOG			Boring #:	P-4	
		SIINA	INANT				Project:	Proposed Apart	ment Building	Project #:	15040
		SUIVI	IVIII				Location:	665 Congress S	St.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling (Co:	Summit Geoen	gineering Ser	vices			Boring Elevation:		112.9 ft		
Driller: C. Coolidge, P.E.			Reference:	Site Survey by	Titcomb Associates						
Summit Staff: M. Hardison, E.I.			Date started:	3/31/2015	Date Completed:	3/31/2015					
DRILLING METHOD SAMPLER					ESTIMATED GROUND V	VATER DEPTH					
Vehicle:	Tracked		Length:	N/A			Date	Depth	Elevation	R	eference
Model:	AMS Pov	wer Probe	Diameter:	N/A			3/31/2015				
Method:	2-1/2"	' H.S.A.	Hammer:	N/A							
Hammer	Style: A	Auto	Method:	N/A							
Depth							-	SAMPL	.E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blow	s/6"	N ₆₀		DESCRIP	FION	Test Data	Stratum
1				PRC	DRF		3.5" of Pavement	I			PAVEMENT
'-							Auger refusal at 3	2' moved over a	and started new hole		0.3 FILL
2											
_							Encountered den	se drilling at 2'	again in second hole,		
3_							drilled past it. De	nse driilling eco	untered again at 4'.		
4					,		Likely rubble				
4-				v v			End of Probe at 4	1.0'. Auger refus	al		4.0'
5								,			RUBBLE
1 -							Į				
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8											
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26							ł				
27							ł				
L					_ †		<u>t </u>				
Granula	ar Soils	Cohesiv	e Soils	%	Compo	sition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture C	ontent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	AS	STM D2	2487	ļ	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft				Bedrock Joints				Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	<	5% Tr	race	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-	15% L	ittle	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15	30% S	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	>	30% V	Nith					Saturated: S = 100%
1		>30	Hard	1			Boulders = diamete	er > 12 inches, C	obbles = diameter < 12 inch	nes and > 3 inches	
				1			Gravei = < 3 inch	ano > No 4, Sano	a = < NO 4 and >No 200, Si	u/clay = < No 200	1

						SOIL PROBE LOG			Boring #:	P-5
SIINANIT		Project:	Proposed Apart	ment Building	Project #:	15040				
		GEOENGINEEDI				Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Summit Geoen	gineering Ser	vices		Boring Elevation:		112.3 ft		
Driller: C. Coolidge, P.E. Summit Staff: M. Hardison, F.I.			Reference:	Site Survey by	Date Completed:	3/31/2015				
			Date started.	3/31/2013	ESTIMATED GROUND W	ATER DEPTH				
Vehicle:	Tracked		Lenath:	N/A		Date	Depth	Elevation	Re	eference
Model:	AMS Pov	wer Probe	Diameter:	N/A		3/31/2015				
Method:	2-1/2"	' H.S.A.	Hammer:	N/A						
Hammer	Style: /	Auto	Method:	N/A						
Depth		D (D (I))			NI	+	SAMPL	E	Geological/	Geological
(11.)	NO.	Pen/Rec (In)	Depth (It)	DIOWS/6	IN ₆₀	3" of Pavement	DESCRIP	TON	Test Data	
1						Auger refusal at 9	9"', moved over	and started new hole,		0.3'
_				V		encounered same	e refusal. Likely	cobble		
2_						End of Probe at C	0.8°, Auger refus	al		0.8" COBBLE
3						ł				OODDEL
	-					Į				
4_						ł				
5						1				
,						ł				
°_						ł				
7						1				
8						+				
- ⁰						+				
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10						ł				
10_						+				
11						1				
12						+				
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23						ł				
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25						ł				
l						1				
26	<u> </u>					ł				
27	<u> </u>					ł				
Granula	ar Soils	Cohesiv	e Soils	% Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ontent	Soil Moisture Condition
BIOWS/ft.	V Looso	BIOWS/ft.	Consistency	ASTMIC	2487	Bedrock loints	LL = LIQUID LIMIT	, PI = Plastic Index		Ury: $S = 0\%$ Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	< 5%	Trace	Shallow = 0 to 35	degrees			Damp: $S = 26$ to 50%
11-30	Compact	5-8	Firm	5-15%	Little	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-30%	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 30%	With	Douldors	or . 10 last	abblaa diamatar 10 '	on and a Directory	Saturated: S = 100%
		>30	naru			Gravel = < 3 inch	er > 12 incries, 0 and > No 4, Sand	$I = \langle No 4 and \rangle No 200, Sil$	t/Clay = < No 200	

						SOIL PROBE LOG			Boring #:	P-6
SIINANIT		Project:	Proposed Apart	tment Building	Project #:	15040				
		GEOENGINEERI				Location:	665 Congress S	St.	Sheet:	1 of 1
		GEOENGINEERI	NO SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Summit Geoen	gineering Ser	vices		Boring Elevation:		112.3 ft		
Driller: C. Coolidge, P.E.			Reference:	Site Survey by	Date Completed:	2/21/2015				
			Date started.	3/31/2015	ESTIMATED GROUND W	ATER DEPTH				
Vehicle:	Tracked		Lenath:	N/A		Date	Depth	Elevation	Re	ference
Model:	AMS Pov	wer Probe	Diameter:	N/A		3/31/2015				
Method:	2-1/2"	' H.S.A.	Hammer:	N/A						
Hammer	Style: A	Auto	Method:	N/A						
Depth	NL.		Durille (ft)	L.L		4	SAMPL	E	Geological/	Geological
(11.)	NO.	Pen/Rec (In)	Depth (It)	DIOWS/	6 N ₆₀	2.5" of Pavemen	DESCRIP	TION	Test Data	PAVEMENT
1					L .	2.5 of Favement	ι.			0.2'
_]				FILL
2_						Auger cuttings: E	Black Sandy SIL Clav and black A	l , frequent brick Ash		
3						inuginentis, intie				
]				
4_						4				
5				\vee						
4						End of Probe at S	5.0', Auger refus	sal		5.0'
°_						+				DEDKUCK
7						1				
0						4				
°-						-				
9						1				
10						4				
10						1				
11						1				
12						4				
						1				
13						4				
14						-				
						1				
15_						4				
16						1				
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17_						4				
18						1				
10						4				
19						+				
20						1				
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22						4				
23						+				
						1				
24				<u> </u>	_	4				
25						1				
						1				
26						4				
27						1				
			0.11			NOTEC	DD - · ·		<u> </u>	
Granula Blowc /ft	or Soils	Cohesiv Blows /ft	e Soils	% Co	mposition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ontent	Soil Moisture Condition
0-4	V. Loose	<2	V. soft	AST	vi UZ40/	Bedrock Joints	LL = LIQUIO LIMI	, FT = FIASUC HIUEX		Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	< 5	% Trace	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15	% Little	Dipping = 35 to 55	5 degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15-3	% Some	Steep = 55 to 90 c	degrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	> 3	0% With	Pouldoro -l'arrest	or > 10 inch 0	obbloc - diamotor - 10 in th	and > 2 inch	Saturated: S = 100%
		>30	mai û			Gravel = < 3 inch	and > No 4, Sand	$d = \langle No 4 \text{ and } \rangle No 200, Silt$	-> anu > > mones /Clay = < No 200	

						SOIL PROBE LOG			Boring #:	P-101	
	SIIMMI			Project: Proposed Apartment Building			Project #:	15040			
	GEOENGINEEDING SERVICES			Location:	665 Congress S	it.	Sheet:	1 of 1			
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling C	Drilling Co: Great Works Test Boring			Boring Elevation:		116.4 ft					
Driller:	Stoff.	Jeff Lee	1				Reference:	Site Survey by	Titcomb Associates	4/15/2015	
			.1.	ΔΜΡΙ	FR		Date started.	4/15/2015			
Vehicle:	Tracked		Lenath.				Date	Depth	Flevation	Re	ference
Model:	Mobile B	8-53	Diameter:	N/A			4/15/2015	-	Lioration	None observed	
Method	4" Solid	Stem Auger	Hammer:	N/A							
Hammer	Style: F	R&C	Method:	N/A							
Depth						N	+	SAMPL	E	Geological/	Geological
(ft.)	NO.	Pen/Rec (in)	Depth (ft)	blov PR	NS/6" OBE	IN ₆₀	3" Pavement	DESCRIP	ION	Test Data	Stratum
1							5 Tavement				0.25' +/-
							Very difficult drilli	ng, frequent ru	bbe encountered, refusal		FILL
2_							encountered in fi	rst hole at 4.5',	moved over 1' to start		
3							new noie				
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5							1				
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7							1				
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10							Smoother drilling	started around	9°, assumed transizion		9' +/- GLACIAL TILL
				\	/						
11							End of Probe at 1	0.8', Auger refu	isal		10.8' BEDROCK
12							ł				DEDROCK
10	-						1				
13_							-				
14							1				
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27				L			İ				
							NOTES				
Granula Blowc /ft	ar Soils	Cohesiv Blows /ft	e Soils	%	Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
0-4	V. Loose	<2	V, soft	A	JIVIL	/240/	Bedrock Joints	LL = LIQUIO LIMIT	, FI = Plastic Index		Humid: $S = 1 \text{ to } 25\%$
5-10	Loose	2-4	Soft	<	< 5%]	Frace	Shallow = 0 to 35	degrees			Damp: $S = 26 \text{ to } 50\%$
11-30	Compact	5-8	Firm	5	6-15%	Little	Dipping = 35 to 55	degrees			Moist: S = 51 to 75%
31-50	Dense	9-15	Stiff	15	5-30%	Some	Steep = 55 to 90 d	legrees			Wet: S = 76 to 99%
>50	V. Dense	16-30	V. Stiff	>	> 30%	With	Boulders - diametr	ar > 12 inches C	obbles - diamotor - 12 incha	s and > 3 inches	Saturated: S = 100%
		~30	naru				Gravel = < 3 inch a	and $> No 4$, Sance	$I = \langle No \ 4 \ and \ \rangle No \ 200, \ Silt/$	Clay = < No 200	

						SOIL PROBE LOG			Boring #:	P-102
		SIINA	INANT			Project:	Project: Proposed Apartment Building Pro			15040
			Location:	665 Congress S	it.	Sheet:	1 of 1			
		GEOENGINEERI	NG SERVICES			City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Great Works T	est Boring			Boring Elevation:		111.9 ft		
Driller: Jeff Lee			Reference:	Site Survey by	Titcomb Associates					
Summit S	Staff:	M. Hardison, E	.l.			Date started:	4/15/2015	Date Completed:	4/15/2015	
DF		METHOD	S.	AMPLER		.		ESTIMATED GROUND W		<u>,</u>
Vehicle:	I racked	52	Length:	24" SS		Date	Depth	Elevation	Re None cheering	ference
Method		Stem Auger	Hammer:	2 0D/1.	5 10	4/15/2015	-		None observed	
Hammer	Style: F	R&C	Method:	ASTM D	1586					
Depth							SAMPL	E	Geological/	Geological
(ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/	" N ₆₀	1	DESCRIP		Test Data	Stratum
				PROB		3" Pavement				PAVEMENT
1_										
2						4				
2-						Smooth drilling th	nroughout fill la	ver (no rubble/cobbles)		
3]	5	(
]				
4_						4				
5						4				
_						Increased resista	nce at 4.8, pote	ntial till or soft rock		
6						4				
7						4				
· -						4				
8]				
0						4				
9-						+				
10						1				
]				
11 -						4				
12						4				
_						End of Probe at 1	12.1', Auger refu	Isal		12.1'
13						4				BEDROCK
14						+				
· · · -						1				
15]				
16						4				
10						4				
17						1				
10						4				
18						4				
19						1				
						4				
20						4				
21						1				
I]				
22						+				
23						1				
-						1				
24_						4				
25						+				
I						1				
26						4				
27						+				
<i>2'</i> -						1				
Granula	ar Soils	Cohesiv	e Soils	% Cor	nposition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	ASTN	D2487	1	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft			Bedrock Joints				Humid: S = 1 to 25%
5-10	Loose	2-4	Soft	< 59	6 Trace	Shallow = 0 to 35	degrees			Damp: S = 26 to 50%
11-30	Compact	5-8	Firm	5-15	% Little	Dipping = 35 to 55	degrees			Moist: $S = 51 \text{ to } 75\%$
31-50	Dense	9-15	Stiff	15-30	% Some	Steep = $55 \text{ to } 90 \text{ d}$	legrees			Wet: $S = 76 \text{ to } 99\%$
>50	v. Dense	05-01 _20	V. SUIT Hard	> 30	70 VVITN	Boulders - diamote	er > 12 inches C	hhles = diamator < 12 incho	is and > 3 inchos	Saturated: $S = 100\%$
		/30	Haru			Gravel = < 3 inch	and > No 4, Sand	$ = \langle \text{No 4 and } \rangle \text{No 200, Silt/}$	Clay = < No 200	

						SOIL PROBE LOG			Boring #:	P-103	
		SIINA	INAN				Project:	Proposed Apart	ment Building	Project #:	15040
		SUN					Location:	665 Congress S	it.	Sheet:	1 of 1
		GEOENGINEERI	NG SERVICES				City, State:	Portland, ME		Chkd by:	
Drilling C	0:	Great Works T	est Boring				Boring Elevation:		112.3 ft		
Driller:		Jeff Lee	-				Reference:	Site Survey by	Titcomb Associates		
Summit	Staff:	M. Hardison, E	.1.				Date started:	4/15/2015	Date Completed:	4/15/2015	
DF		METHOD	S.	AMPLI	ER			-	ESTIMATED GROUND W	ATER DEPTH	
Vehicle:	Tracked		Length:	24" \$	SS	10	Date	Depth	Elevation	Re	ference
Mothers'	Nobile B	5-53	Diameter:	2"00	<u>ו/1.5"</u> ש	ID	4/15/2015	-		None observed	
Hammor	4 SOIID	Ren Auger	Method:	140 I	וט 1_ח 1_	86					
Denth	June. P	100		LO III	טוס א	00		SUMDI	F	Geological/	Geological
(ft)	No	Pen/Rec (in)	Depth (ft)	blow	vs/6"	Neo	ł	DESCRIPT	. <u> </u>	Test Data	Stratum
			5 opti (it)	PR	OBE	00	4" Pavement	SCONT			PAVEMENT
1							l				0.3'
							ļ				
2							Relatively easy d	rilling no rubbo	(cohhles encountered		
3							inclutively easy u	ming, no rubbe			
-							1				
4							ļ				
5							ł				
- ³				-	-		ł				
6							1				
							ļ				
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8							t				
-							1				
9							1				
10				\vdash	V		End of Probe at C	6'. Auger refus	al		9.6'
											BEDROCK
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10							ł				
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							<u> </u>				
Granula	ar Soils	Cohesiv	e Soils	%	Comp	osition	NOTES:	PP = Pocket Pen	etrometer, MC = Moisture Co	ntent	Soil Moisture Condition
Blows/ft.	Density	Blows/ft.	Consistency	A	STM D	2487	4	LL = Liquid Limit	, PI = Plastic Index		Dry: S = 0%
0-4	V. Loose	<2	V. soft		F 0.	-	Bedrock Joints				Humid: $S = 1$ to 25%
5-10	Loose	2-4	Soft	<	5% ⁻	race	Shallow = 0 to 35	aegrees			Damp: $S = 26 \text{ to } 50\%$
11-30	Compact	5-8	Firm Stiff	15	-15%	Little	Dipping = $35 \text{ to } 55$	aegrees			Moist: $S = 51$ to 75%
>50	V Dense	9-15 16-30	SUII V Stiff	15	-30% 30%	With	Sieep = 55 10 90 0	iegi ees			saturated: S = 10 10 99%
> 30	•. Dense	>30	Hard		5070	vvitil	Boulders = diameter	er > 12 inches. C	obbles = diameter < 12 inche	s and > 3 inches	Saturateu. 5 - 10070
							Gravel = < 3 inch	and > No 4, Sanc	$I = \langle No 4 and \rangle No 200$, Silt/	Clay = < No 200	

APPENDIX C

ROCK CORE PHOTOS



PHOTOGRAPHIC LOG

Project:		Project No.
Proposed Apartment Build	ding – 665 Congress St., Portland ME	15040
Photo No. 1		
Date: 4-16-2015		
Site Location:		
665 Congress Street Portland, Maine		
Description:		
Rock Core C-1 in Boring B-105 from depth 10 feet to 15 feet		
Elevation 103.8 feet to Elevation 98.8 feet		
Description:		
Schist	Bottom Bottom Construction Construction Construction Construction	



PHOTOGRAPHIC LOG

Project:		Project No.
Proposed Apartment Build	ding – 665 Congress St., Portland ME	15040
Photo No. 1		
Date: 4-16-2015		
Site Location:		
665 Congress Street Portland, Maine		
Description:		
Rock Core C-2 in Boring B-106 from depth 10 feet to 15 feet		
Elevation 102 feet to Elevation 97 feet		
Description:		
Schist	<image/>	



PHOTOGRAPHIC LOG

Project:		Project No.
Proposed Apartment Build	ding – 665 Congress St., Portland ME	15040
Photo No. 1		
Date: 4-16-2015		
Site Location:		
665 Congress Street Portland, Maine		
Description:		
Rock Core C-3 in Boring B-106 from depth 15 feet to 19 feet		
Elevation 97 feet to Elevation 93 feet		
Description:		
Schist	<image/>	

APPENDIX D

TRANSITION ZONE CONSTRUCTION DETAIL



APPENDIX E

GENERAL BLASTING CRITERIA

GENERAL BLASTING RECOMMENDATIONS

Introduction

Blasting operations will be performed in general accordance with the applicable Maine Revised Statute Title 125 and Title 38, U.S. Department of the Interior Rules, the recommendations provided below, and a normal standard of care.

<u>Blast Design</u>

The blasting contractor shall submit a blasting plan to the Owner for approval prior to blasting operations. The blasting plan shall include a schedule, sketches of the drill patterns (hole spacing and depth), type and amount of explosives, number and sequence of delays, methods for minimizing flyrock, and any other information pertinent to demonstrating compliance with the applicable U.S. Department of the Interior Rules and the requirements of the applicable Statute requirements of 38 MRSA.

Notification

Oral notification to the abutters within one-half mile of the blast area shall be provided prior to blasting. Warning and all clear signals of different character or pattern that are audible within one-half mile from the point of the blast shall be given. The meaning of the signals shall be conveyed to the abutters at the time they are notified.

Pre-blast Surveys

All blasting operations are the direct responsibility of the Blasting Contractor. Reports of damage to structures caused by blasting operations are the sole responsibility of the Blasting Contractor. Therefore, it is incumbent upon the Blasting Contractor to perform pre-blast surveys as they deem necessary.

Airblast Limits

Airblast overpressure shall not exceed the limits stipulated in 38 MRSA 490-Z(14)(H) at the nearest structure. This currently requires sound from blasting to not exceed 129 decibels peak at inhabited structures and 140 decibels peak at uninhabited structures.

Ground Vibration Limits

The maximum ground vibration at any structure shall not exceed the limits presented in the following chart:



REFERENCE: OSM alternative blasting criteria (Modified from figure B-1, Bureau of Mines, RI 8507)

The Blasting Contractor shall provide a seismographic record to the Owner for each blast event at the nearest off-site structure. The record shall include the date and time of the blast, peak and resultant particle velocities and associated frequencies, and the airblast overpressure.

<u>Flyrock</u>

Sufficient stemming, matting, or natural protective cover shall be provided to prevent flyrock from leaving property owned or under control of the operator or from entering protected natural resources or natural buffer strips.

Records

Records of blasts shall be recorded in accordance with Maine Statute 38 MRSA 490-Z(14)(L). The current requirements are as follows.

- Name of blasting company or blasting contractor
- Location, date and time of blast
- Name, signature and social security number of blaster
- Type of material blasted
- Number and spacing of holes and depth of burden or stemming
- Diameter and depth of holes
- Type of explosives used
- Total amount of explosives used
- Maximum amount of explosives used per delay period of 8 milliseconds or greater
- Maximum number of holes per delay period of 8 milliseconds or greater
- Method of firing and type of circuit
- Direction and distance in feet to the nearest dwelling, public building, school, church or commercial or institutional building neither owned nor controlled by the developer
- Weather conditions, including factors such as wind direction and cloud cover
- Height or length of stemming
- Amount of mats or other protection used
- Type of detonators used and delay periods used
- The exact location of each seismograph and the distance of each seismograph from the blast
- Seismographic readings
- Name and signature of the person operating each seismograph
- Names of the person and the firm analyzing the seismographic data

MAXIMUM PARTICLE VELOCITY/DISTANCE CRITERIA FOR BLASTING NEAR UNCURED CONCRETE

Time From Batching (hr)	Non-Structural Concrete	Structural Concrete
0-4	4D	2D
4 – 24	1D	0.25D
24 – 72	1.5D	1D
72 – 168	3D	2D
168 - 240	8D	5D
Over 240	15D	10D

Distance (ft)	D (in/sec)
0 to 50	1.0
50 to 150	0.8
150 to 250	0.7
Over 250	0.6

<u>NOTE</u>: Allowable vibration levels are reduced with increasing distance since concrete can withstand higher vibration levels at higher frequencies. Vibration frequencies decrease as the distance from the blast increases because there is an attenuation of frequency with distance.

Reference: Wyllie, Duncan C. <u>Foundations on Rock</u>, 1st Ed, Chapman & Hall, London, 1992