SUMMIT
GEOENGINEERING SERVICES

Geotechnical Report

Building Expansion
Old Dominion Freight Line
Portland, Maine

Prepared for:

Sitelines, PA
8 Cumberland Street
Brunswick, Maine 04011

Prepared by:

Summit Geoengineering Services

Project #14034
March 2014

2002 Atlantic Highway (PO Box 838), Camden, Maine 04843, (207) 318-7761
145 Lisbon Street (PO Box 7216), Lewiston, Maine 04243, (207) 576-3313

March 24, 2014
Summit #14034

Kevin Clark
Sitelines, PA
8 Cumberland Street
Brunswick, Maine 04011

Reference: Geotechnical Engineering Investigation, Proposed Building Expansion
Old Dominion Freight Line - 185 Rand Road, Portland, Maine

Dear Kevin;

We have completed the geotechnical investigation for the proposed expansion of the Old Dominion Freight Line building in Portland, Maine. Our scope of services included performing 5 test borings at the site and preparing this report summarizing our findings and geotechnical recommendations.

1.0 Project Description

Summit Geoengineering Services (SGS) was asked by Sitelines to conduct a geotechnical investigation for the expansion being proposed at the existing Old Dominion Freight Line facility in Portland. The project consists of the construction of an addition to the existing building with a footprint of approximately 5,600 square feet. Consideration is being given to a pre-engineered metal building to match the existing building. The building will feature truck-loading docks along the northeastern, northwestern, and southwestern sides of the building. Exterior concrete slabs will be located within these locations. Expansion of the parking, driveway, and other pavement areas are also proposed as part of the project.

The site currently consists of a fenced in lot containing the existing building and parking lot surrounded by a lightly wooded area. The existing grades in the proposed addition footprint range from elevation 58 feet at the east end to elevation 55 at the west end of the proposed building addition. Based on a proposed loading dock finished floor elevation of approximately 63 feet, we anticipate up to 4 feet of fill will be required to accommodate finished grades within the building footprint.

2.0 Subsurface Exploration

Summit Geoengineering Services (SGS) explored the subsurface conditions with the drilling of 5 borings on March 12, 2014. The explorations were located by taping from existing site features. The explorations were advanced using 2-1/4 inch hollow stem augers using a rubber track mounted PowerProbe 9500 VTR. Test borings B-1 and B-2 were drilled to a depth of 16 feet below the existing ground surface (bgs) with no refusal. Borings B-3, B-4, and B-5 were drilled to refusal, at depths ranging from 8.1 to 18 feet (bgs). Standard penetration tests (SPT) with split spoon samples

were obtained at 5-foot intervals. The location of the explorations is shown on the Test Boring Location Plan in Appendix A. Logs of the borings are included in Appendix B.

3.0 Laboratory Testing

One sample of the existing fill was tested for grain size analyses in accordance with ASTM D422 and moisture content in accordance with ASTM D2216. Results of the laboratory tests are in Appendix C. Summary of the gradation results are presented below:

LABORATORY SUMMARY TABLE					
Location	**USCS**	**%Gravel**	**%Sand**	**%Fines**	**MC**
B-3, 8 to 30 inches	SW-SM	26.8%	64.3%	8.8%	4.5%

Based on ASTM D422 test and Unified Soil Classification System particle distribution.

4.0 Subsurface Conditions

The subsurface conditions generally consist of ***topsoil*** or ***fill***, overlying ***glacial marine deposits***, overlying ***glacial till*** grading to ***bedrock***.

The ***topsoil***, where encountered, consists of dark brown silt with little fine sand and trace organics and is visually classified as ML in accordance with the Unified Soil Classification System (USCS). The topsoil is generally loose to soft and damp.

The ***fill***, encountered to a depth of 1 to 3 feet in borings B-3 through B-5, consists of brown sand with some gravel and little silt and is classified as SW-SM based on grain size analysis in accordance with the USCS. The fill is generally compact and humid.

The ***glacial marine deposit*** generally consists of two subunits of silty clay and is visually classified as CL in accordance with the USCS. The upper subunit is 4 to 8 feet thick and consists of stiff olive brown silty clay with SPT-N values ranging from 9 to 18 blows per foot (bpf) and averaging 15 bpf. The olive brown silty clay was generally damp and pocket penetrometer values obtained in the field indicate the compressive strength of the olive brown silty clay is approximately 9,000 psf.

A lower subunit consisting of soft gray silty clay was encountered in borings B-1, B-2, and B-4 at depths ranging from 8 to 11 feet. The gray silty clay ranges from 6 to 8 feet in thickness and has SPT-N values ranging from 3 bpf to weight of hammer, indicating soft to very soft conditions. The gray silty clay was generally wet and pocket penetrometer values obtained in the field indicate the compressive strength of the clay is approximately 1,000 to 2,000 psf.

A layer of olive brown, fine sandy silt was encountered in boring B-1 from a depth of approximately 0.5 to 3 feet. The sandy silt was generally firm and moist.

The ***glacial till*** was encountered 1 to 3 feet above the bedrock surface in borings B-3 through B-5. The glacial till generally consists of olive gray to brown silty sand with little gravel and trace clay and is visually classified as SM in accordance with the USCS. The till was generally compact and wet with SPT-N values ranging from 10 to 27 blows per foot (bpf) and averaging 17 bpf.

Bedrock was encountered at depths of 8.1 to 18 feet in borings B-3, B-4, and B-5. Bedrock mapping by the Maine Geological Survey indicates the bedrock is part of the Silurian - Ordovician Vassalboro formation consisting of massive, bluish-gray sandstone. Locally, it may be quartzite, where shaly layers have been altered to pyritiferous mica schists.

Groundwater was measured at depths of 12.6 to 11.3 feet (elevation 45 ft +/-) in borings B-3 and B-4, respectively. No groundwater was observed in borings B-1, B-2, and B-5. However, observed moisture content indicates groundwater was present near a depth of 8 feet (elevation 46 ft +/-) in borings B-1 and B-2 and at a depth of 5 feet (elevation 52 ft +/-) in boring B-5. Based on observed site conditions, we anticipate groundwater is typically present within lower portions of the glacial marine deposits, near the surface of the glacial till.

5.0 Foundation Design Recommendations

Based on the proposed finished floor elevation and the anticipated footing depths, the footings will be constructed on either imported granular fill or upper silty clay glacial marine subunit. We anticipate up to 4 feet of fill will be required to meet finished grades for the proposed building. With proper site preparation, the existing soil and imported granular fill will be suitable to support the proposed building addition using a conventional spread footing and slab on grade foundation.

A. Allowable Bearing Pressure

We recommend that the foundations be designed using a net allowable bearing pressure of 3,000 psf. Based on analyses conducted for the maximum fill location, the soft silty clay will not have a significant impact on settlement at the site, due to its presence in only a thin layer and its distance from the loading. For the proposed footing and fill loads, settlement associated with the above bearing pressure is calculated to be ½ inch or less. Differential settlement is estimated at less than a deflection of 1/300 (δ/L, deflection divided by span length).

The allowable bearing pressure and associated settlement is based on the following conditions:

- All existing pavement is removed in its entirety from within the building footprint. If desired, the existing concrete slab can be left in place as described below.

- After removal of the pavement and grubbing, we recommend the exposed soil be proofrolled. Proofrolling should consist of a minimum of three passes in a north-south direction and then three passes in an east-west direction using a large (10 ton operating weight) vibratory roller.

- Footing trenches excavated into the silty clay are excavated using a smoothed edge bucket to minimize disturbance of the native soil.

- The soil at the base of footing trenches loosened during excavation is proofrolled prior to placing footings.

It may be desirable to leave the existing concrete slab in place to reduce site demolition costs. We recommend that cuts in the existing slab, where required to build foundation walls, be completed by sowing to minimize disturbance to the smoothed surface integrity of the slab. The slab should be cut at least 4 feet from the inside face of the new wall to preclude the creation of a void beneath the slab, as excavation for the new footing extends below the existing slab. Fill required for the new slab can be placed directly over the existing slab.

B. Frost Protection

Based on the required frost protection depth, exterior footings should be constructed at a minimum depth of 4 feet below the exterior finished grade. This frost protection depth is based on a design air-freezing index of 1,250-degree days for the Portland area.

We recommend that the exterior of the foundation walls be backfilled with soil meeting the following gradation specifications passing the 3-inch sieve:

FOUNDATION BACKFILL	
Sieve Size	**Percent finer**
3 inch	100
¼ inch	60 to 100
No. 40	0 to 50
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type F

The maximum particle size should be limited to 6 inches. The Foundation Backfill should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557.

C. Building Slab

We recommend the building slab be constructed on Structural Fill (SF). The maximum particle size should be limited to 6 inches and meet the following gradation specifications passing the 3-inch sieve:

STRUCTURAL FILL (SF)	
Sieve Size	**Percent finer**
3 inch	100
1/4 inch	25 to 70
No. 40	0 to 30
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type D

Structural Fill should be placed in a maximum of 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557. Structural Fill should be placed down to the proofrolled subgrade soil within the building footprint.

For the conditions described above, the slab can be designed using a subgrade modulus of 200 pci.

D. Groundwater Control

Based on observed groundwater depths, we anticipate that groundwater will be below the bottom of the footings and perimeter underdrains are not strictly necessary.

It is generally good practice to install underdrains to account for unanticipated changes in regional hydrogeology and to control potential infiltration of surface or roof runoff water into the foundation backfill soils. We recommend exterior grades slope away from the building footprint to reduce runoff water from infiltrating the foundation backfill soils.

Perimeter underdrains, if used, 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. Where exposed at the ground surface, the ends of pipes should be screened or otherwise protected from entry and nesting of wildlife, which could cause clogging.

E. Seismic Design

Based on the depth to bedrock, the soil descriptions, and the blow counts obtained in the test borings, the soil at the site is classified as Seismic Site Class D (Stiff Soil Profile). Liquefaction potential for the soils encountered on site is considered low. The following seismic site coefficients are in accordance with the 2009 International Building Code (IBC):

SUBGRADE SITE SEISMIC DESIGN COEFFICIENTS – IBC 2009	
Seismic Coefficient	**Site Class D**
Short period spectral response (S_S)	0.321
1 second spectral response (S_1)	0.078
Site coefficient (F_a)	1.6
Site Coefficient (F_v)	2.4
Design short period spectral response (S_{DS})	0.330
Design 1 second spectral response (S_{D1})	0.124

6.0 Exterior Slab Recommendations

We understand exterior slabs will be constructed around the perimeter of the building addition to accommodate loading dock zones. We recommend that all exterior slabs subject to freezing conditions be constructed on a minimum of 24 inches of subbase soil (MDOT 703.06 Type D) beneath 6 inches of base soil (MDOT 703.06 Type A). All subbase and base soil should be placed in 9 to 12 inch lifts and be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557, Modified Proctor Density. Backfill beneath the subbase soil, if required, should consist of Granular Borrow.

The portion of Granular Borrow passing the 3-inch sieve shall meet the following gradation specifications:

GRANULAR BORROW	
Sieve Size	**Percent finer**
3 inch	100
No. 40	0 to 70
No. 200	0 to 10

Reference: MDOT Specification 703.19 Granular Borrow

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

We recommend that all existing granular subgrade be proof-rolled prior to placing subbase soil, or Granular Borrow. Proof rolling should consist of a minimum of three passes in a north-south direction and then three passes in an east-west direction using a large (10 ton operating weight) vibratory roller.

If excessive soil moisture is present, we recommend proof rolling be performed in the static mode to prevent disturbance of the native silty clay subgrade. Where the exposed silty clay is soft and wet, a layer of geotextile may be required to stabilize the subgrade sufficiently enough to allow for adequate compaction of the engineered fill.

Exterior slabs should not be structurally attached to the building foundations walls. All exterior slabs for the conditions described above can be designed using a subgrade modulus of 200 pci.

7.0 Pavement Section Design

The mean annual freezing index for the Portland area is approximately 900 degree F days. The mean annual frost penetration depth for this freezing index and the soil at the site is approximately 36 inches.

We recommend a minimum total pavement section thickness of 50% of the mean annual frost penetration or 18 inches for light duty pavement sections and 60% of the mean annual frost penetration depth or 22 inches for pavements subjected to moderate to heavy truckloads. We further recommend that the pavement section consist of the following materials:

MATERIAL	THICKNESS (in) Light Duty	THICKNESS (in) Heavy Duty	SPECIFICATION
Asphalt Surface Course	1	1-1/2	MDOT Superpave
Asphalt Binder Course	2	2-1/2	MDOT Superpave
Base Soil	3	3	MDOT 703.06 Type A
Subbase Soil	12	15	MDOT 703.06 Type D

We recommend the following gradation requirements be used for subbase and base gravel:

Sieve Designation	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	--
¼ Inch	30 – 55	25 – 70
No. 40	0 – 20	0 – 30
No. 200	0 – 5	0 - 7

The material specifications are referenced to the 1995 Maine Department of Transportation Standard Specifications for Highways and Bridges and Maine Department of Transportation Standard Specifications, Revision of 2002.

The maximum particle size should be limited to 2 inches for MDOT Type A base and 6 inches for MDOT Type D subbase. All base and subbase soil should be placed in 3 to 12 inch lifts and be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557, Modified Proctor Density. Additional fill below the base and subbase soils, if necessary, should consist of Granular Borrow in accordance with MDOT Specification 703.19 and Section 6.0 of this report.

Pavement underdrains are not necessary. Drainage ditches should be constructed to the greatest extent possible to control surface water runoff.

8.0 Earthwork Considerations

We recommend the existing pavement be removed and natural surfaces grubbed within the proposed building footprint. Exposed granular subgrade soil should be proofrolled. Proofrolling should consist of a minimum of three passes in a north-south direction and then three passes in an east-west direction using a large (10 ton operating weight) vibratory roller.

Fill required to level the site outside the building footprint should consist of Granular Borrow meeting MDOT Specification 703.19. This soil should be compacted to 95% of its maximum dry density where it is placed beneath pavement sections. In landscaped areas the compaction requirement can be reduced to 90%.

Based on grain size analysis performed on a sample obtained from 8 to 30 inches below grade in boring B-3, existing fill at the site meets gradation requirements for Granular Borrow. We recommend additional samples of the fill be collected and tested to confirm the soil meets specifications for reuse on site.

Based on observed groundwater seepage, 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.

General excavations within the silty clay soil may be susceptible to softening, especially when wet. If subgrade softening does occur, we recommend over excavation and replacement with 6 to 12 inches of ¾" crushed stone overlying geotextile fabric such as Mirafi 500X, Geotex 200ST, or equivalent. Crushed stone should be tamped to lock the stone structure together.

Excavations below 4 feet should be sloped no greater than 1H to 1V for the silty clay soil and no greater than 1.5H to 1V for granular soils. Excavations below groundwater should be limited to 1.5H to 1V. These slopes are based on the current OSHA Excavation Guidelines.

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 in consistence with this report.

9.0 Closure

Our evaluation is based on professional judgment and generally accepted principles of geotechnical engineering. No other warranty is expressed or implied. Analyses and evaluations are based on project construction information provided by others. Some changes in subsurface conditions from those presented in this report may occur and would not be evident until construction. Should subsurface conditions or project information differ materially from those described in this letter, Summit 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 yours,
Summit Geoengineering Services,

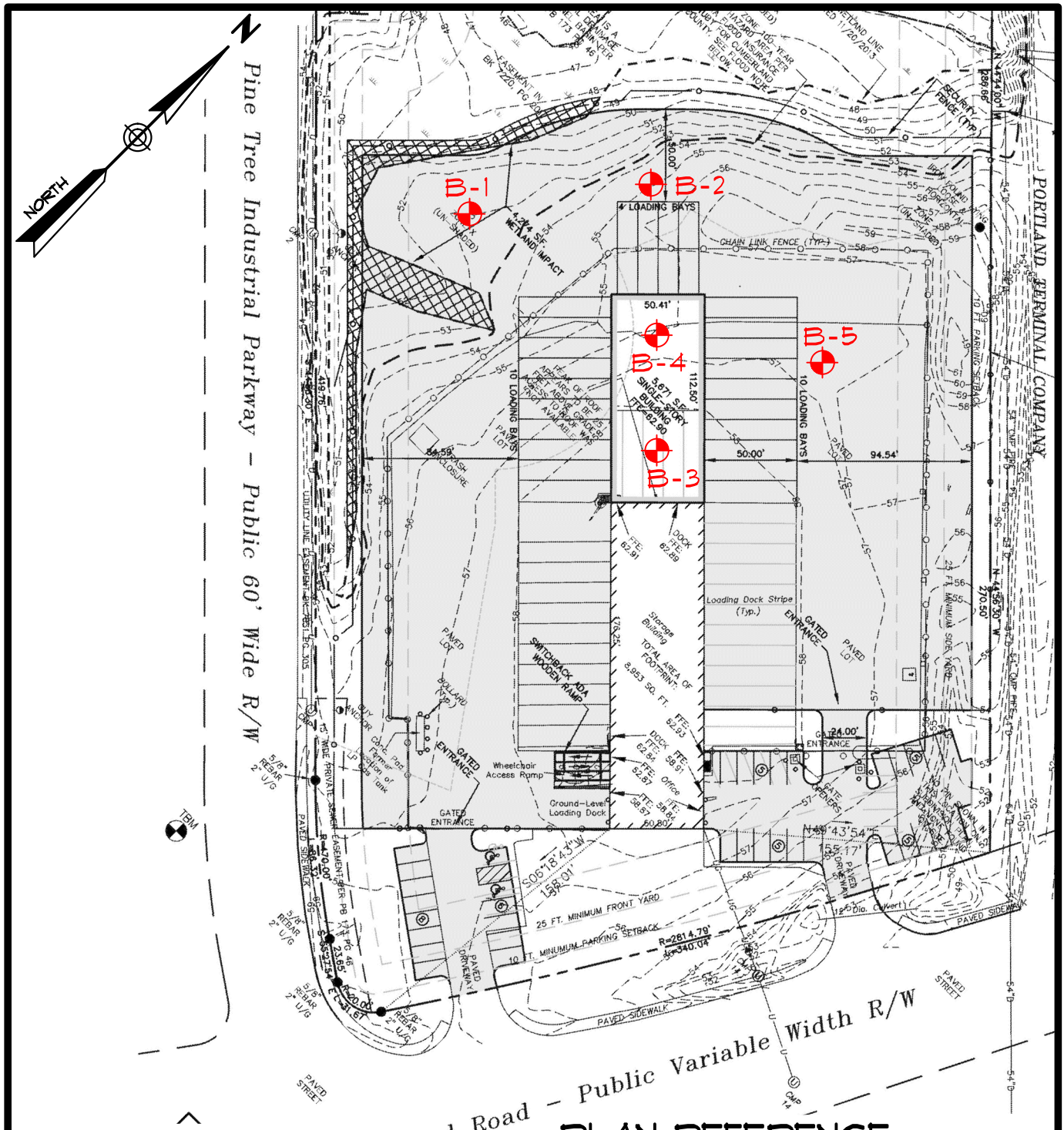
Erika Hawksley

Erika Hawksley, E.I
Geotechnical Engineer

William M. Peterlein

William M. Peterlein
Principal Geotechnical Engineer

APPENDIX A
TEST BORING LOCATION PLAN



LEGEND

B-1 SUMMIT TEST BORING (MARCH 12, 2014)

PLAN REFERENCE

"SITE LAYOUT PLAN, PROPOSED BUILDING EXPANSION", DATED JANUARY 21, 2014, PREPARED BY SITELINES, PA.

TEST BORING LOCATION PLAN
OLD DOMINION FREIGHTLINE EXPANSION

RAND ROAD - PORTLAND, MAINE

PREPARED FOR

SITELINES, PA

DATE: MAR 2014	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 14034	SCALE: 1" = 80'	FILE: 14034 BOR

145 LISBON ST. - SUITE 601
LEWISTON, ME 04240
Tel.: (207) 576-3313

2002 ATLANTIC HIGHWAY
CAMDEN, ME 04843
Tel.: (207) 706-7999

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APPENDIX B
BORING LOGS

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SOIL BORING LOG

Project:	Old Dominion Freight Line	Boring #:	B-1
Location:	185 Rand Road	Project #:	14034
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	53 ft +/-
Driller:	C. Coolidge, P.E.	Reference:	Site plan prepared by Sitelines, January 21, 2014
Summit Staff:	B. Peterlein, P.E.	Date started: 3/12/2014	Date Completed: 3/12/2014

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: 24" SS
Model: AMS Power Probe	Diameter: 2"OD/1.5"ID
Method: 2-1/2" H.S.A.	Hammer: 140 lb
Hammer Style: Auto	Method: ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/12/2014			None observed - borehole dry

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/12	0 to 2	1		Dark brown SILT, little fine Sand, tr. Organics, ML		TOPSOIL
1				3				
				4		Olive-brown fine Sandy SILT, moist, firm, ML		GLACIAL MARINE
2				5				
3								
4								
	S-2	24/16	4 to 6	3		Olive-brown Silty CLAY, trace fine Sand, blocky,	PP=4.5+ tsf	
5				6		mottled, damp, CL		
				8				
6				10				
7								
8								
9								
	S-3	24/24	9 to 11	WH		Olive-gray Silty CLAY, wet, very soft, CL	PP=0.3 to 0.5 tsf	
10				1				
				1				
11				1				
12								
13								
14								
	S-4	24/24	14 to 16	WH		Gray Silty CLAY, wet, very soft, CL		
15				WH				
				WH				
16				1				
						End of Boring at 16 ft		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

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%

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SOIL BORING LOG

Project:	Old Dominion Freight Line	Boring #:	B-2
Location:	185 Rand Road	Project #:	14034
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	55 ft +/-
Driller:	C. Coolidge, P.E.	Reference:	Site plan prepared by Sitelines, January 21, 2014
Summit Staff:	B. Peterlein, P.E.	Date started: 3/12/2014	Date Completed: 3/12/2014

DRILLING METHOD	SAMPLER
Vehicle: Tracked	Length: 24" SS
Model: AMS Power Probe	Diameter: 2"OD/1.5"ID
Method: 2-1/2" H.S.A.	Hammer: 140 lb
Hammer Style: Auto	Method: ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/12/2014			None observed - borehole dry

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/15	0 to 2	1		Olive-brown Silty CLAY, blocky, stiff, humid, CL		
1				2				
				2				GLACIAL MARINE
2				2				
3								
4								
	S-2	24/24	4 to 6	5		Same as above	PP=4.5+ tsf	
5				8				
				10				
6				12				
7								
8								
9								
	S-3	24/24	9 to 11	WH		Olive-gray Silty CLAY, wet, very soft, CL		
10				WH				
				WH				
11				1				
12								
13								
14								
	S-4	24/24	14 to 16	WH		Same as above		
15				WH				
				WH				
16				1				
						End of Boring at 16 ft		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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	

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LL = Liquid Limit, PI = Plastic Index

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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%

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GEOENGINEERING SERVICES

SOIL BORING LOG

Project:	Old Dominion Freight Line	Boring #:	B-3
Location:	185 Rand Road	Project #:	14034
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	58 ft +/-
Driller:	C. Coolidge, P.E.	Reference:	Site plan prepared by Sitelines, January 21, 2014
Summit Staff:	B. Peterlein, P.E.	Date started: 3/12/2014	Date Completed: 3/12/2014

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/12/2014	12.6 ft	45.4 ft +/-	In borehole at completion

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1						8" Concrete Slab		
						Brown SAND, some Gravel, little Silt, humid,	Gravel = 26.8%	
2						compact, SW-SM	Sand = 64.3%	FILL
							Fines = 8.8%	
3							MC = 4.5%	
4								
5	S-1	24/24	4.5 to 6.5	5		Olive-brown Silty CLAY, blocky, stiff, humid, CL		GLACIAL MARINE
				8				
6				9				
				10				
7								
8								
9								
10	S-2	24/24	9.5 to 11.5	3		Same as above	PP=0.8 to 1.0 tsf	
				5				
11				4				
				5				
12								
13								
14								
15	S-3	24/24	14.5 to 15.5	4		Gray Silty fine SAND, little Gravel, trace Clay, moist,		GLACIAL TILL
				6		compact, SM		
16				50 for 2"		End of Boring at 15.7 ft - Spoon and Auger Refusal		BEDROCK
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

Granular Soils		Cohesive Soils		% Composition
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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
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Bedrock Joints
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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%

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SOIL BORING LOG

Project:	Old Dominion Freight Line	Boring #:	B-4
Location:	185 Rand Road	Project #:	14034
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	56 ft +/-
Driller:	C. Coolidge, P.E.	Reference:	Site plan prepared by Sitelines, January 21, 2014
Summit Staff:	B. Peterlein, P.E.	Date started: 3/12/2014	Date Completed: 3/12/2014

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH			
Date	Depth	Elevation	Reference
3/12/2014	11.3 ft	44.7 ft +/-	In borehole at completion

Depth (ft.)	SAMPLE No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}		Geological/ Test Data	Geological Stratum
1						4" Pavement		FILL
2						Brown SAND, some Gravel, little Silt, humid, compact, SW-SM		
3								
4								GLACIAL MARINE
5	S-1	24/24	4.5 to 6.5	5		Olive-brown Silty CLAY, trace fine Sand, blocky,		
				8		mottled, very stiff, CL		
6				8				
				9				
7								
8								
9								
10	S-2	24/24	9.5 to 11.5	3		Gray Silty CLAY, wet, soft, CL		
				1				
11				2				
				1				
12								
13								
14								
15	s-3	24/24	14.5 to 16.5	12				GLACIAL TILL
				13		Olive-gray Silty SAND, little Gravel, trace Clay,		
16				14		wet, compact, SM		
				9				
17								
18								
19						End of Boring at 18 ft - Auger Refusal		BEDROCK
20								
21								
22								
23								
24								
25								
26								
27								

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

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:	Old Dominion Freight Line	Boring #:	B-5
Location:	185 Rand Road	Project #:	14034
City, State:	Portland, Maine	Sheet:	1 of 1
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	57 ft +/-
Driller:	C. Coolidge, P.E.	Reference:	Site plan prepared by Sitelines, January 21, 2014
Summit Staff:	B. Peterlein, P.E.	Date started: 3/12/2014	Date Completed: 3/12/2014

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	2-1/2" H.S.A.	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
3/12/2014			Borehole caved at 4.5 ft - dry

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	N_{60}	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
1						3-1/2" Pavement Brown SAND, some Gravel, little Silt, humid, SW-SM		FILL
2						Olive-brown Silty CLAY, blocky, stiff, humid, CL		GLACIAL MARINE
3								
4								
5	S-1	24/24	4.5 to 6.5	3		Olive-brown Silty SAND, little Gravel, trace clay, wet, compact, SM		GLACIAL TILL
				4				
6				11				
				17				
7								
8								
9						End of Boring at 8.1 ft - Auger Refusal		BEDROCK
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								

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

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%

APPENDIX C
LABORATORY RESULTS

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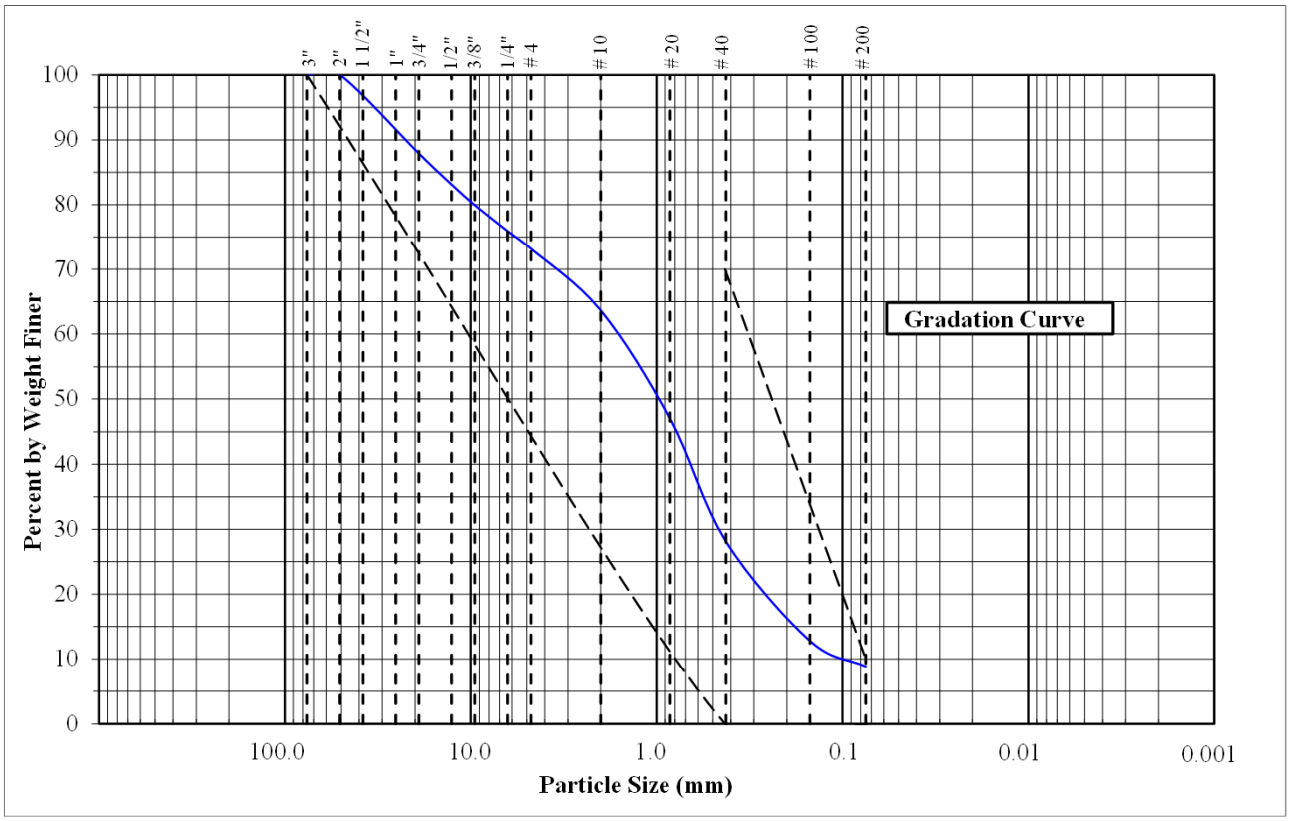
GEOENGINEERING SERVICES

GRAIN SIZE ANALYSIS - ASTM D422

PROJECT NAME:	Old Dominion Freight Line	PROJECT NUMBER:	14034
CLIENT:	Sitelines	SAMPLE NUMBER:	B-3, 8"-30"
SOURCE:	Existing Fill	DESCRIPTION:	SAND, some Gravel, little Silt, SW-SM
DATE:	3/21/2014	TECHNICIAN:	Erika Hawksley, E.I.

DATA

PARTICLE SIZE mm		% BY WT FINER	MDOT 703.19 GRANULAR BORROW
76.20	(3 in)	100.0	100
50.80	(2 in)	100.0	
38.10	(1-1/2 in)	88.4	
25.40	(1 in)	88.4	
19.05	(3/4 in)	87.9	
12.70	(1/2 in)	83.1	
9.53	(3/8 in)	79.9	
6.35	(1/4 in)	75.9	0 - 70
4.75	(No. 4)	73.2	
2.00	(No. 10)	63.7	
0.85	(No. 20)	47.0	
0.43	(No. 40)	28.1	
0.15	(No. 100)	12.8	
0.075	(No. 200)	8.8	0 - 10



REMARKS: Moisture Content = 4.5%

2002 Atlantic Highway (PO Box 838) Camden, Maine, (207) 318-7761
145 Lisbon Street (PO Box 7216) Lewiston, Maine (207) 576-3313