S.W.COLE
ENGINEERING, INC.

REPORT

22-1493 S

October 21, 2022

Explorations and Geotechnical Engineering Services

Proposed Highway Garage
Salisbury Highway (NH Route 4)
Andover, New Hampshire

Prepared For:
Dubois & King, Inc.
Attention: John Kenney, P.E.
36 Penn Plaza
Bangor, ME 04401

Prepared By:
S. W. Cole Engineering, Inc.
10 Centre Road
Somersworth, NH 03878-2926
T: 603.692.0088

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22-1493 S

October 21, 2022

Dubois & King, Inc.
Attention: John Kenney, P.E.
36 Penn Plaza
Bangor, ME 04401

Subject: Explorations and Geotechnical Engineering Services
Proposed Highway Garage
Salisbury Highway (NH Route 4)
Andover, New Hampshire

Dear John:

In accordance with our Proposal, dated September 13, 2022, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations, and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

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

1.2 Site and Proposed Construction

The site is located off the east side of Salisbury Highway (NH Route 4) in Andover, New Hampshire and is comprised of mature wooded area. The site is bordered to the north by existing gravel access drive and to the east by an existing gravel pit. Based on the plans provided, existing site grades generally slope downward northwest to southeast from about elevation 624 to 614 feet.

We understand proposed construction will consist of a new 50 by 75 foot highway garage building with paved access drive and parking areas to the north and west. We understand finish floor elevation is planned at about elevation 621.7 feet.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Four test borings (B-1 through B-4) were made at the site on October 12, 2022 by S. W. Cole Explorations, LLC. The exploration locations were selected and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using a mapping grade GPS receiver. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. Elevations noted on the logs were estimated based on topographic information shown on the "Exploration Location Plan."

2.2 Field Testing

The test borings were drilled using hollow stem auger drilling techniques. The soils were sampled at 2 to 5 foot intervals with a split-spoon sampler using the Standard Penetration Testing (SPT) procedures.

2.3 Laboratory Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. A total of two gradation and moisture content tests were performed on select soil samples. Results of gradations are included in Appendix D. Moisture content results are noted on the boring logs.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

Beneath a surficial 3 to 4 inches of topsoil, the test borings encountered native soil deposits consisting of loose to medium dense, light brown to gray sand with varying portions of silt and gravel to a depth of 27 feet, where the test borings were terminated. Surficial roots were encountered extending to a depth of 1 foot below the ground surface in test boring B-4. For more detailed subsurface information, refer to the attached logs.

3.2 Groundwater

Saturated soils were encountered below depths ranging from 15 to 18 feet below the ground surface at the time of exploration work. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

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

- Spread footing foundations and a slab-on-grade floors bearing on properly prepared subgrades appear suitable for the proposed building. Footings should bear on a 3 inch leveling coarse of compacted Crushed Stone overlying undisturbed native non-organic soils. Slab-on-grade floors should bear on at least 12 inches of properly compacted Structural Fill overlying properly prepared subgrades.

- All topsoil and soils containing organics must be completely removed from beneath proposed construction and replaced with compacted Granular Borrow. The extent of removal should extend laterally 1 foot for every 1 foot of excavation depth (1H:1V bearing splay).

- The design frost depth for the Andover, New Hampshire area is 5.0 feet. Footings that will be exposed to freezing temperatures (i.e. perimeter footings) should have at least 5.0 feet of soil cover to provide frost protection.

- Given the drainage characteristics of the native soils and depth to groundwater in explorations, we do not anticipate the need for incorporating perimeter foundation drainage at the site.

4.2 Site Preparation

The soils that will be exposed will be subject to erosion. Site preparation should begin with construction of an erosion control system to protect drainage ways and areas outside the construction limits. All topsoil and soils containing organic material must be completely

removed beneath areas of proposed construction and replaced with compacted Granular Borrow. The extent of removal should extend laterally 1 foot for every 1 foot of excavation depth (1H:1V bearing splay). As much vegetation as possible should remain undisturbed adjacent to the construction site to reduce the potential for erosion.

4.3 Excavation and Dewatering

Excavation work will generally encounter topsoil overlying native sands with surficial roots, overlying non-organic subgrade soils. The subgrade soils will be susceptible to disturbance, particularly when wet. Care must be exercised during construction to reduce disturbance of the bearing soils. Final cuts to subgrade should be done with a smooth-edged bucket. Should the subgrade become yielding or difficult to work, disturbed areas should be over-excavated and backfilled with compacted Granular Borrow.

The Contractor should anticipate the need for dewatering excavations, particularly during and following periods of precipitation. Ditching with gravity drainage, and sumping and pumping should be adequate.

Excavations must be properly shored and/or sloped in accordance with OSHA trenching regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways as needed. The contractor is responsible for selection, design, and implementation of the excavation and dewatering program.

4.4 Foundations

We recommend the proposed building be supported on spread footings cast on a 3 inch leveling coarse of Crushed Stone, placed on properly prepared subgrades soils. We recommend the following geotechnical parameters for foundation design:

GEOTECHNICAL FOUNDATION DESIGN PARAMETERS	
Design Frost Depth	5.0 feet
Net Allowable Foundation Bearing Pressure	2.0 ksf
Seismic Site Class (2015 IBC, N-value Method)	D
Total Unit Weight of Backfill – Structural Fill	125 pcf
Internal Friction Angle – Structural Fill	32°
Base Friction Factor – Concrete to Crushed Stone	0.45
At-Rest Lateral Earth Pressure Coefficient – Structural Fill	0.5
Estimated Post-Construction Settlement	1 inch or less
Estimated Post-Construction Differential Settlement	1/2-inch or less over 100 feet

Strip and column footings should be at least 24 inches in width, regardless of the bearing pressure.

4.5 Foundation Drainage

Given the drainage characteristics of the native soils and depth to groundwater observed in the explorations, we do not anticipate the need for incorporating perimeter foundation drainage at the site. It is important to reduce the potential for surface water infiltration into foundation backfills. This can be achieved by surfacing foundation backfill with a relatively impermeable layer such as asphalt pavement, walkways, entrance slabs, and/or clay/loam cap and sloping the grade away from the building. We recommend a periodic maintenance schedule be established to maintain the functionality of installed permeable layer(s).

4.6 Slab-On-Grade

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

If there are areas where moisture sensitive flooring will be installed, we recommend installation of a sub-slab vapor retarder to reduce the potential for floor covering damage from moisture. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient

durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping, and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

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

4.7 Entrance Slabs, Concrete Apron, and Sidewalks

Entrance slabs, concrete apron, and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that non-frost susceptible Structural Fill be provided to a depth of at least 5.0 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full footprint of the entrance slabs, thereafter, transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope.

4.8 Fill, Backfill and Compaction

We recommend the following fill and backfill materials: recycled products must also be tested in accordance with applicable environmental regulations and approved by a qualified environmental consultant.

Structural Fill: Backfill for foundations, slab base material, and material below exterior entrances slabs and sidewalks should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 6

In our opinion, 2016 NHDOT Standard Specification 209.2.1.2 Granular Backfill (gravel) meets the requirements of Structural Fill.

Granular Borrow: Fill to raise grades in building and paved areas should be sand or silty sand meeting the following gradation:

Granular Borrow	
Sieve Size	**Percent Finer by Weight**
6 inch	100
Portion Passing 3 inch Sieve	
No. 40	0 to 70
No. 200	0 to 20

Crushed Stone: Crushed stone used beneath foundations should be washed, hard, durable rock meeting the requirements of 2016 NHDOT Standard Specification 703-1 Standard Stone Size #57.

Re-Use: The non-organic on-site soils may be reused as Granular Borrow, provided the material is at a moisture content capable of meeting projection compaction specifications.

Placement and Compaction: Fill should be placed in horizontal lifts and be compacted. Lift thickness should range between 6 to 12 inches depending upon the size and type of equipment such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. We recommend that fill placed below building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557 (Modified Proctor). Foundation backfill should be compacted to at least 95 percent of ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

4.9 Weather Considerations

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

4.10 Design Review and Construction Testing

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

A construction materials testing and quality assurance program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces and pavement subgrades, as well as to provide testing and IBC Special Inspection services for soils, concrete, steel, spray-applied fireproofing, fire-stopping, structural masonry and asphalt construction materials.

5.0 CLOSURE

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

Sincerely,

S. W. Cole Engineering, Inc.

Tyler Demers

Digitally signed by Tyler Demers
DN: cn=Tyler Demers, o=S.W. Cole Engineering, Inc., ou, email=tyler.demers@swcole.com, c=US
Date: 2022.10.21 12:22:32 -04'00'

STATE OF NEW HAMPSHIRE
TYLER SCOTT DEMERS
No.16284
LICENSED PROFESSIONAL ENGINEER

Tyler S. Demers, P.E.
Project Geotechnical Engineer

TSD:rec

APPENDIX A

Limitations

This report has been prepared for the exclusive use of Dubois & King, Inc. for specific application to the proposed Highway Garage on Salisbury Highway (NH Route 4) in Andover, New Hampshire. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

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

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

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

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

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

APPENDIX B

Figures

LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"= 40' SCALE PLAN OF THE SITE ENTITLED "PROPOSED CONDITIONS PLAN," PREPARED BY DUBOIS & KING, INC., RECEIVED 09/12/2022.
2. THE BORINGS WERE LOCATED IN THE FIELD BY S. W. COLE ENGINEERING, INC. USING A RECREATIONAL GRADE GPS.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 40 80 Feet

S.W.COLE ENGINEERING, INC.

DUBOIS & KING, INC.

EXPLORATION LOCATION PLAN

PROPOSED HIGHWAY GARAGE
SALISBURY HIGHWAY (NH ROUTE 4)
ANDOVER, NEW HAMPSHIRE

Job No.:	22-1493	Scale:	1" = 40'
Date:	10/19/2022	Sheet:	1

APPENDIX C

Exploration Logs and Key

BORING LOG

S.W.COLE

CLIENT: Dubious & King, Inc.
PROJECT: Proposed Highway Garage
LOCATION: Salisbury Highway, Andover, New Hampshire

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO. 22-1493
DATE START: 10/12/2022
DATE FINISH: 10/12/2022

Drilling Information

LOCATION: See Exploration Location Plan | ELEVATION (FT): 620' +/- | TOTAL DEPTH (FT): 27.0 | LOGGED BY: Sean Hlywa
DRILLING CO.: S. W. Cole Explorations, LLC | DRILLER: Jeff Lee | DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | AUGER ID/OD: 2 1/4 in / 5 5/8 in | SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic | HAMMER WEIGHT (lbs): 140 | CASING ID/OD: N/A /N/A | CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: 0.82 | HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ▽ 18 ft Free water observed at 18 feet 10/12/2022
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/20	4-7-7-5			0.3 4" Topsoil / Medium dense, light brown SAND some gravel trace silt		
			2D		2-4	24/18	5-5-7-9			2.0 Medium dense, gray-light brown Silty fine SAND		
615	5		3D		5-7	24/23	6-6-7-8					
610	10		4D		10-12	24/23	6-7-6-8					
605	15		5D		15-17	24/23	6-7-8-9			15.0 Loose to medium dense, light brown fine to medium SAND some silt	▽	
600	20		6D		20-22	24/24	3-4-4-6					
595	25		7D		25-27	24/24	5-7-10-12					

Bottom of Exploration at 27.0 feet

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

BORING NO.: B-1

BORING / WELL 10-12-2022 22-1493.GPJ SWCE TEMPLATE.GDT 10/18/22

BORING LOG

S.W.COLE

CLIENT: Dubious & King, Inc.
PROJECT: Proposed Highway Garage
LOCATION: Salisbury Highway, Andover, New Hampshire

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO. 22-1493
DATE START: 10/12/2022
DATE FINISH: 10/12/2022

Drilling Information

LOCATION: See Exploration Location Plan | ELEVATION (FT): 618' +/- | TOTAL DEPTH (FT): 27.0 | LOGGED BY: Sean Hlywa
DRILLING CO.: S. W. Cole Explorations, LLC | DRILLER: Jeff Lee | DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | AUGER ID/OD: 2 1/4 in / 5 5/8 in | SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic | HAMMER WEIGHT (lbs): 140 | CASING ID/OD: N/A /N/A | CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: 0.82 | HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ▽ 15 ft Free water observed at 15 feet 10/12/2022
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/12	2-3-8-8			0.2 3" Topsoil		
			2D		2-4	24/10	6-6-6-6			Medium dense, light brown fine to medium SAND trace gravel trace silt		
615												
	5		3D		5-7	24/13	4-5-8-10					
610												
	10		4D		10-12	24/23	5-5-6-6					
605												
	15		5D		15-17	24/24	5-5-5-6	ID 22183s w =24.9 %		15.0 Loose, brown Silty fine SAND	▽	
600												
	20		6D		20-22	24/24	3-5-6-6			20.0 Loose to medium dense, light brown fine to medium SAND trace silt		
595												
	25		7D		25-27	24/24	3-4-5-7					

Bottom of Exploration at 27.0 feet

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

BORING NO.: B-2

BORING LOG

S.W.COLE

CLIENT: Dubious & King, Inc.
PROJECT: Proposed Highway Garage
LOCATION: Salisbury Highway, Andover, New Hampshire

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO. 22-1493
DATE START: 10/12/2022
DATE FINISH: 10/12/2022

Drilling Information

LOCATION: See Exploration Location Plan | ELEVATION (FT): 620' +/- | TOTAL DEPTH (FT): 27.0 | LOGGED BY: Sean Hlywa
DRILLING CO.: S. W. Cole Explorations, LLC | DRILLER: Jeff Lee | DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | AUGER ID/OD: 2 1/4 in / 5 5/8 in | SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic | HAMMER WEIGHT (lbs): 140 | CASING ID/OD: N/A /N/A | CORE BARREL: N/A
HAMMER EFFICIENCY FACTOR: 0.82 | HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ▽ 15.5 ft Free water observed at 15.5 feet 10/12/2022
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/12	2-3-4-4			Loose to medium dense, light brown SAND some gravel trace silt		
			2D		2-4	24/12	4-4-5-5					
615	5		3D		5-7	24/12	3-4-4-5	ID 22184s w =2.2 %				
610	10		4D		10-12	24/24	5-5-6-7					
605	15		5D		15-17	24/24	6-5-7-7			15.0 Medium dense, gray Silty fine SAND	▽	
600	20		6D		20-22	24/24	4-6-7-10			20.0 Medium dense, light brown fine to medium SAND some silt		
595	25		7D		25-27	24/24	4-7-9-12					

Bottom of Exploration at 27.0 feet

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

BORING LOG

S.W.COLE

CLIENT: Dubious & King, Inc.
PROJECT: Proposed Highway Garage
LOCATION: Salisbury Highway, Andover, New Hampshire

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO. 22-1493
DATE START: 10/12/2022
DATE FINISH: 10/12/2022

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 618' +/- | **TOTAL DEPTH (FT):** 27.0 | **LOGGED BY:** Sean Hlywa
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:** N/A
HAMMER EFFICIENCY FACTOR: 0.82 | **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 15 ft Free water observed at 15 feet 10/12/2022
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/24	2-2-3-3			Loose, light brown fine SAND with roots to 1 foot		
			2D		2-4	24/12	4-3-4-4					
615												
	5		3D		5-7	24/12	4-4-4-5					
610												
	10		4D		10-12	24/24	6-6-8-8			10.0 Medium dense, light brown Silty fine SAND		
605												
	15		5D		15-17	24/16	2-3-4-4			15.0 Loose, light brown fine SAND trace silt	▽	
600												
	20		6D		20-22	24/24	3-4-6-7			21.5 Medium dense, light brown SAND some gravel trace silt		
595												
	25		7D		25-27	24/24	4-6-7-8					

Bottom of Exploration at 27.0 feet

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

KEY TO NOTES & SYMBOLS
Test Boring and Test Pit Explorations

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

Key to Symbols Used:

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

Description of Proportions:

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

Description of Stratified Soils

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

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

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

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

APPENDIX D

Laboratory Test Results

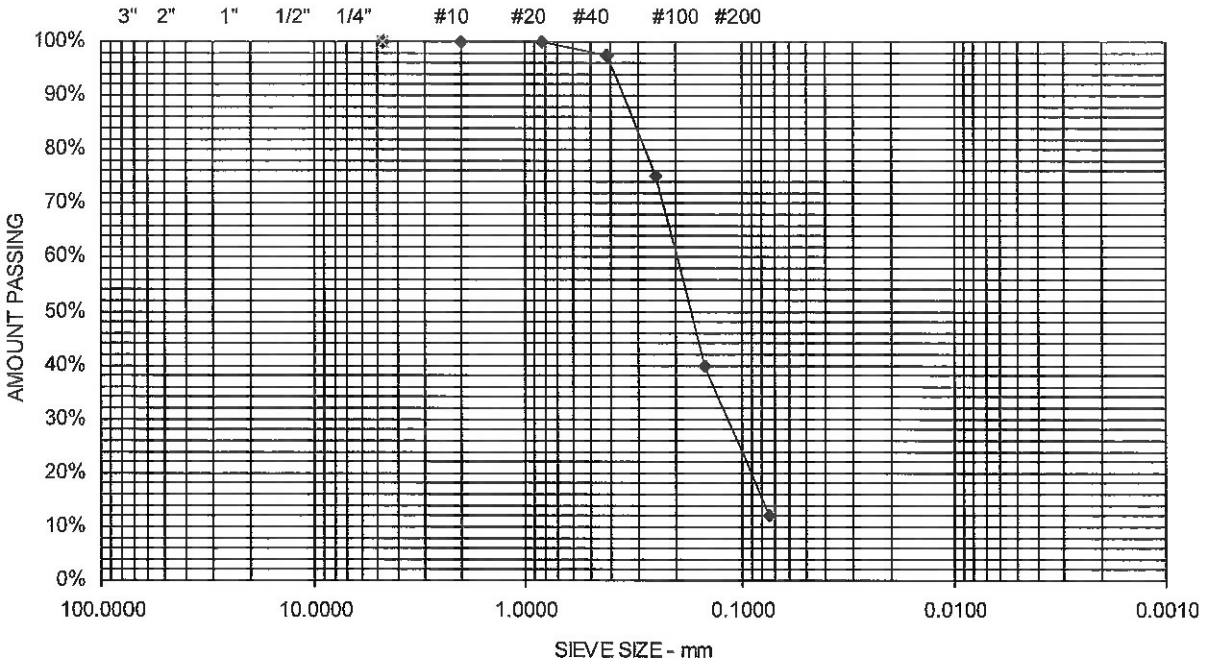
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	ANDOVER NH - PROPOSED HIGHWAY GARAGE - EXPLORATIONS AND GEOTECHNICAL ENGINEERING SERVICES	Project Number	22-1493
		Lab ID	22183S
Client	DUBOIS & KING INC.	Date Received	10/14/2022
Exploration	**B2, 5D, 15'-17'**	Date Completed	10/18/2022
Material Source		Tested By	BRADLEY GERSCHWILER

STANDARD DESIGNATION (mm/um)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	**No. 4**	**100**	0% Gravel
2.00 mm	**No. 10**	**100**	
850 um	**No. 20**	**100**	
425 um	**No. 40**	**98**	88% Sand
250 um	**No. 60**	**75**	
150 um	**No. 100**	**40**	
75 um	**No. 200**	**12.0**	12% Fines



Comments: Moisture Content = 24.9%

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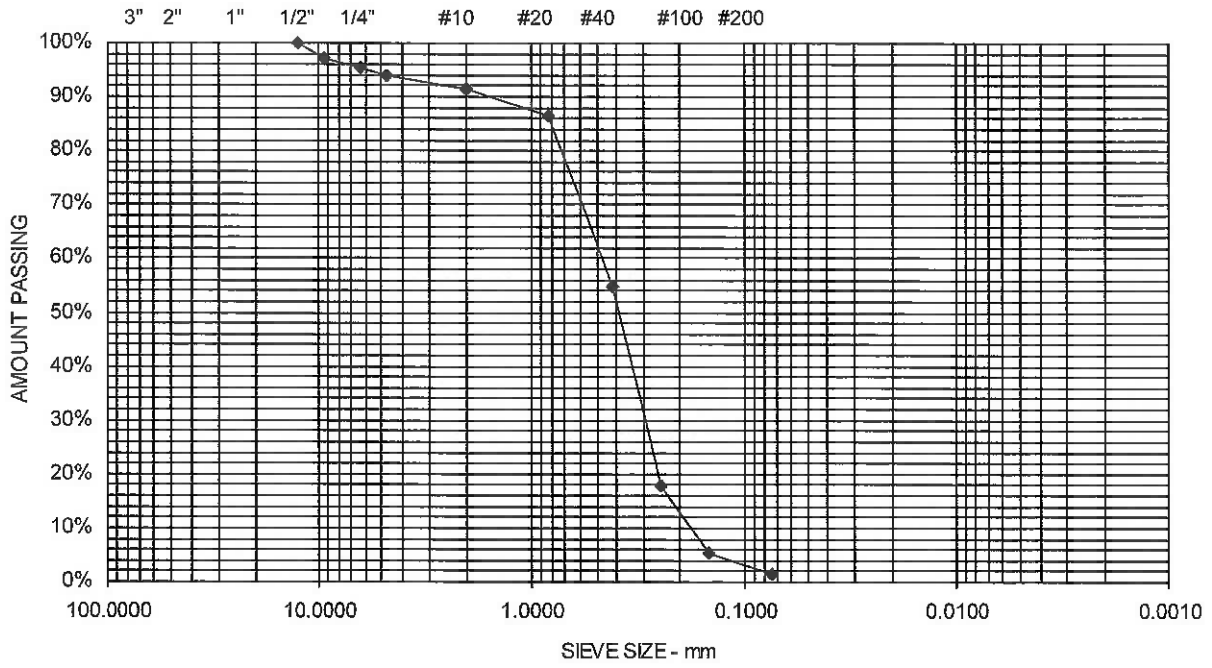
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	ANDOVER NH - PROPOSED HIGHWAY GARAGE - EXPLORATIONS AND GEOTECHNICAL ENGINEERING SERVICES	Project Number	22-1493
Client	DUBOIS & KING INC.	Lab ID	22184S
Exploration	**B3, 3D, 5'-7'**	Date Received	10/14/2022
Material Source		Date Completed	10/18/2022
		Tested By	BRADLEY GERSCHWILER

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
12.5 mm	**1/2"**	**100**	
9.5 mm	**3/8"**	**97**	
6.3 mm	**1/4"**	**95**	
4.75 mm	**No. 4**	**94**	6.1% Gravel
2.00 mm	**No. 10**	**91**	
850 um	**No. 20**	**87**	
425 um	**No. 40**	**55**	92.5% Sand
250 um	**No. 60**	**18**	
150 um	**No. 100**	**5**	
75 um	**No. 200**	**1.4**	1.4% Fines



Comments: Moisture Content = 2.2%

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