

REPORT

March 04, 2016

15-1302 S

Geotechnical Engineering Services

Proposed Penobscot River Trail Extension
Brewer, Maine

PREPARED FOR:

Kleinfelder, Inc.

Attention: Elizabeth Bissonnette

151 Capitol Street, Suite 2

Augusta, ME 04330

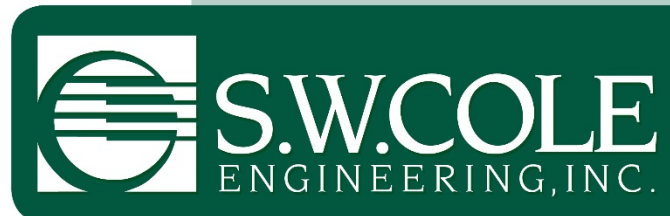
PREPARED BY:

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Bangor, ME 04401

Tel: (207) 848-5714



- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

www.swcole.com

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15-1302 S

March 04, 2016

Kleinfelder, Inc.
Attention: Elizabeth Bissonnette
151 Capitol Street, Suite 2
Augusta, ME 04330

Subject: Explorations and Geotechnical Engineering Services
Proposed Penobscot River Trail Extension
Brewer, Maine

Dear Liz:

In accordance with our Proposal, dated November 24, 2015, 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 Attachment 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 earthwork and a retaining wall associated with the proposed construction. Our scope of services included completion of four test boring explorations, geotechnical analysis of the subsurface findings, and preparation of this report.

1.2 Site and Proposed Construction

The site is located along the Penobscot River, between Wilson and State Street, in Brewer, Maine. We understand development plans call for construction of a trail along the river including a retaining wall, up to 15 feet tall, at the existing Veterans Park. We understand the trail will be constructed with bituminous pavement overlying a gravel section. A switchback retaining wall is proposed for compliance with American Disability Act (ADA) requirements. An existing stormwater outfall pipe at the Veterans Park will

need to be rerouted in favor of the proposed retaining wall. Details regarding proposed site grading and the retaining wall system are not available at this time.

Existing site features are shown on the "Exploration Location Plan," attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Exploration

2.1.1 Current Explorations

Four test borings (B-101 through B-104) were made at the site on January 22, 2016. The test borings were made by S. W. Cole Explorations, LLC of Augusta, Maine working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE). The boring locations were selected by Kleinfelder, Inc. and established in the field by S.W.COLE. The test boring locations were subsequently located by S.W.COLE using a mapping grade GPS unit. Ground surface elevations noted on the test boring logs were interpolated from existing ground contours as shown on Sheet 1.

The approximate exploration locations are shown on Sheet 1. Logs of the explorations are attached as Sheets 2 through 5. A key to the notes and symbols used on the logs is attached as Sheet 6.

2.1.2 Prior Explorations

S.W.COLE completed a geotechnical investigation for a Riverbank Stabilization Project from 2002 to 2003. The approximate location of explorations within the proposed trail alignment are shown on Sheet 1.

2.2 Testing

The test borings were drilled using hollow stem augers. The soils were sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) techniques. Pocket Penetrometer Tests (PPT) were performed on split spoon samples where stiffer clayey soils were encountered. SPT blow counts and PPT results are shown on the logs.

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. The results of one grain size analysis is presented on Sheet 7.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site is located along the Penobscot River, between Wilson and State Street, in Brewer, Maine. The site conditions are variable due to the length of the proposed trail. Generally, surficial topsoil exists adjacent to the rip-rap covered slopes along the river extents. The Veterans Park consists of landscaped area with surficial topsoil, walkways and retaining walls.

3.2 Subsurface Conditions

3.2.1 Current Test Borings

Underlying a surficial layer of topsoil, the test borings encountered a soils profile generally consisting of fill soils overlying native glaciomarine soils or sand and gravel with depth. A refusal surface was encountered at test boring B-102. The principal strata encountered are summarized below.

Fill Soils: The fill soils at the proposed retaining wall location (test borings B-101 and B-102) generally consisted of loose to medium dense, sand and silt with varying portions of gravel and brick debris. The test borings encountered fill soils extending to depths of 15.5 and 18.0 feet below the existing ground surface. The fill soils along the proposed trail alignment (test borings B-103 and B-104) generally consisted of loose, gravelly sand and silt with brick and ash debris. The test borings encountered fill soils extending to depths of 3.0 and 7.0 feet below the existing ground surface

Glaciomarine Soils: Underlying the fill soil, test borings B-102 and B-103 encountered glaciomarine soils generally consisting of stiff consistency, brown and gray clayey silt. The glaciomarine soils were encountered to depths ranging from 6.5 to 18.6 feet below the existing ground surface.

Sand and Gravel: Underlying the fill soils, test borings B-101 and B-104 encountered medium dense to dense sand with some silt and varying portions of gravel.

Glacial Till: Underlying the glaciomarine soils, test boring B-103 encountered glacial till consisting of medium dense gravelly sandy silt.

Refusal Surface: A refusal surface was encountered at test boring B-102 at a depth of 18.6 feet below the existing ground surface.

Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

3.2.2 Prior Explorations

S.W.COLE completed a geotechnical investigation for a Riverbank Stabilization Project from 2002 to 2003. Test boring logs from explorations within the proposed trail alignment are attached as Appendix A.

3.3 Groundwater Conditions

Free water was observed in test boring B-101 at a depth of 14.4 feet below the ground surface. Long term groundwater information is not available. It should be anticipated groundwater levels will fluctuate seasonally, in response to precipitation and snowmelt, and with the water level of the adjacent Penobscot River.

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 are:

- Retaining wall design should consider a flexible wall system, such as Redi-rock, and should bear on native soils.
- Where fill soils remain below the proposed trail, the subgrade should be proof-rolled and include a woven geotextile stabilization fabric underlying a gravel and pavement section.

- Imported Crushed Stone and Structural Fill will be needed for construction. The native soils are unsuitable for reuse as backfill for retaining wall foundations.

4.2 Site and Subgrade Preparation

We recommend site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

Uncontrolled fill soils were encountered at the proposed retaining wall location and generally consisted of loose to medium dense, sand and silt with varying portions of gravel and brick debris. The uncontrolled fill soils must be completely removed from beneath the retaining wall. The extent of removal should extend 1 foot laterally outward from edge of perimeter footings for every 1-foot of excavation depth (1H:1V bearing splay). The overexcavated area should be backfilled with compacted Structural Fill or Crushed Stone.

Where uncontrolled fill soils remain below the proposed trail, we recommend the subgrade be proof-rolled prior to the placement of subbase gravel. Proof-rolling should be performed by making 3 to 5 passes with a smooth drum vibratory roller weighing at least 10 kips. Areas that become soft or continue to yield after proof-rolling should be removed and replaced with compacted subbase gravel.

We recommend that excavations for foundations be completed with a smooth-edged bucket to help lessen disturbance of native soils and foundation bearing surfaces. S.W.COLE should observe proof-rolling operations and exposed subgrades prior to placement of Structural Fill or Crushed Stone.

4.3 Excavation and Dewatering

Excavation work will generally encounter uncontrolled fills, silty sand, silt, and clay soils. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier Summer and Fall seasons. Rubber tired construction equipment should not operate directly on the native silt and clays.

Final cuts to subgrade should be performed with a smooth-edged bucket to help minimize soil disturbance.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. Controlling the water levels to at least 1 foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored 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. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor.

4.4 Retaining Wall

We understand a switchback retaining wall is proposed and will retain up to 15 feet of soil. Retaining wall design should consider a flexible wall system, such as Redi-rock, and should bear on native soils. If used, we recommend that the blocks be founded on at least 12 inches of compacted Crushed Stone wrapped with a geotextile filter fabric (Mirafi 160N or equivalent) overlying undisturbed native soils. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

- Design Frost Depth = 5.0 feet
- Allowable Soil Bearing Pressure = 3 ksf (native soil)
- Seismic Site Soil Class = D (IBC 2012)
- Base Friction Factor = 0.40 (compacted Crushed Stone)
- Lateral Earth Pressure = 65 pcf (equivalent fluid pressure)
- Unit Weight of Backfill = 130 pcf (compacted Structural Fill)
- At-Rest Lateral Earth Pressure Coefficient = 0.5 (compacted Structural Fill)
- Active Lateral Earth Pressure Coefficient = 0.3 (compacted Structural Fill)
- Internal Friction Angle of Backfill = 30° (compacted Structural Fill)
- Internal Friction Angle of Backfill = 28° (existing soil)

The wall must account for construction surcharge loads and future live load conditions. Wall backfill should generally consist of free draining non-frost susceptible Structural Fill.

If a Redi-rock wall system is used, the infill spaces between the blocks should be filled with Crushed Stone. In addition, we recommend that the toe be provided with a minimum of 12-inch embedment. An underdrain should be considered at the base of the retaining wall system.

The design freezing index for the Brewer, Maine area is approximately 1,700 Fahrenheit degree-days, which corresponds to a frost penetration on the order of 5.0 feet. Considering this, the wall should be backfilled with at least 5.0 feet (horizontal measure behind face of wall) of Structural Fill.

4.5 Paved Trail

We understand that the walking trails will be constructed with base and subbase materials and pavement. We recommend the following pavement section for your consideration. The materials are based on Maine Department of Transportation specifications.

BITUMINOUS PAVEMENT SECTION	
Pavement Section Layer	Standard Duty
Maine DOT 9.5 mm Superpave (50 Gyration Design)	2½ inches
Maine DOT Crushed Aggregate Base 703.06 Type A	6 inches
Maine DOT Aggregate Subbase 703.06 Type D	12 inches
Geotextile Subgrade Reinforcement Fabric, such as Mirafi 600X (or equivalent)	

Given the potential of uncontrolled fill soils as subgrade, we recommend placement of a geotextile stabilization fabric such as Mirafi 600X (or equivalent) between subgrade soils and subbase gravel. Where fill soils are encountered, we recommend the subgrade be proof-rolled prior to the placement of the stabilization fabric. Proof-rolling should be performed by making 3 to 5 passes with a smooth drum vibratory roller weighing at least 10 kips. Areas that become soft or continue to yield after proof-rolling should be removed and replaced with compacted subbase gravel.

We recommend that the base and subbase gravels extend 12 inches laterally beyond the pavement edges. The base and subbase materials should be compacted to at least 95 percent of their maximum dry densities as determined by ASTM D-1557 (Modified Proctor).

Bituminous pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. Consideration should be given to the development of both surface and subgrade drainage.

Frost penetration can be on the order of 5 feet or more in this area of the state. In the absence of full depth excavation of frost susceptible soils or use of insulation, frost will penetrate into the subgrade and some frost heaving and pavement distress must be anticipated.

4.6 Backfill and Compaction

The native soils and silty fill soils are unsuitable for reuse as backfill for the retaining wall or pavement section gravels, but may be suitable for reuse in landscape areas. For retaining wall areas, we recommend the following fill and backfill materials:

Structural Fill: Fill to repair of soft areas and backfill for the retaining wall 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
#40	0 to 30
#200	0 to 5

Crushed Stone: Crushed Stone, used beneath the retaining wall and for underdrain aggregate, should meet the gradation requirements of MaineDOT 703.22 Type C.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by 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.

4.7 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades and foundations 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.

4.8 Design Review and Construction Testing

S.W.COLE should be retained to observe the subgrade and to provide soils engineering and testing services during the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and design recommendations and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to start of construction.

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.

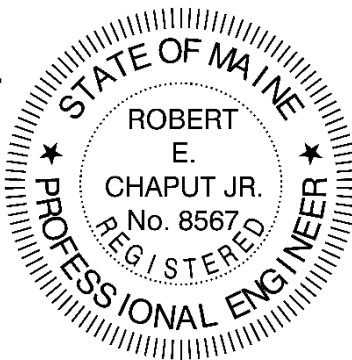
Sincerely,

S. W. Cole Engineering, Inc.

Nathan D. Strout, P.E.
Geotechnical Engineer



Robert E. Chaput, Jr., P.E.
Senior Geotechnical Engineer



NDS:rec

Attachment A Limitations

This report has been prepared for the exclusive use of Kleinfelder, Inc. for specific application to the proposed Penobscot River Trail Extension project in Brewer, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

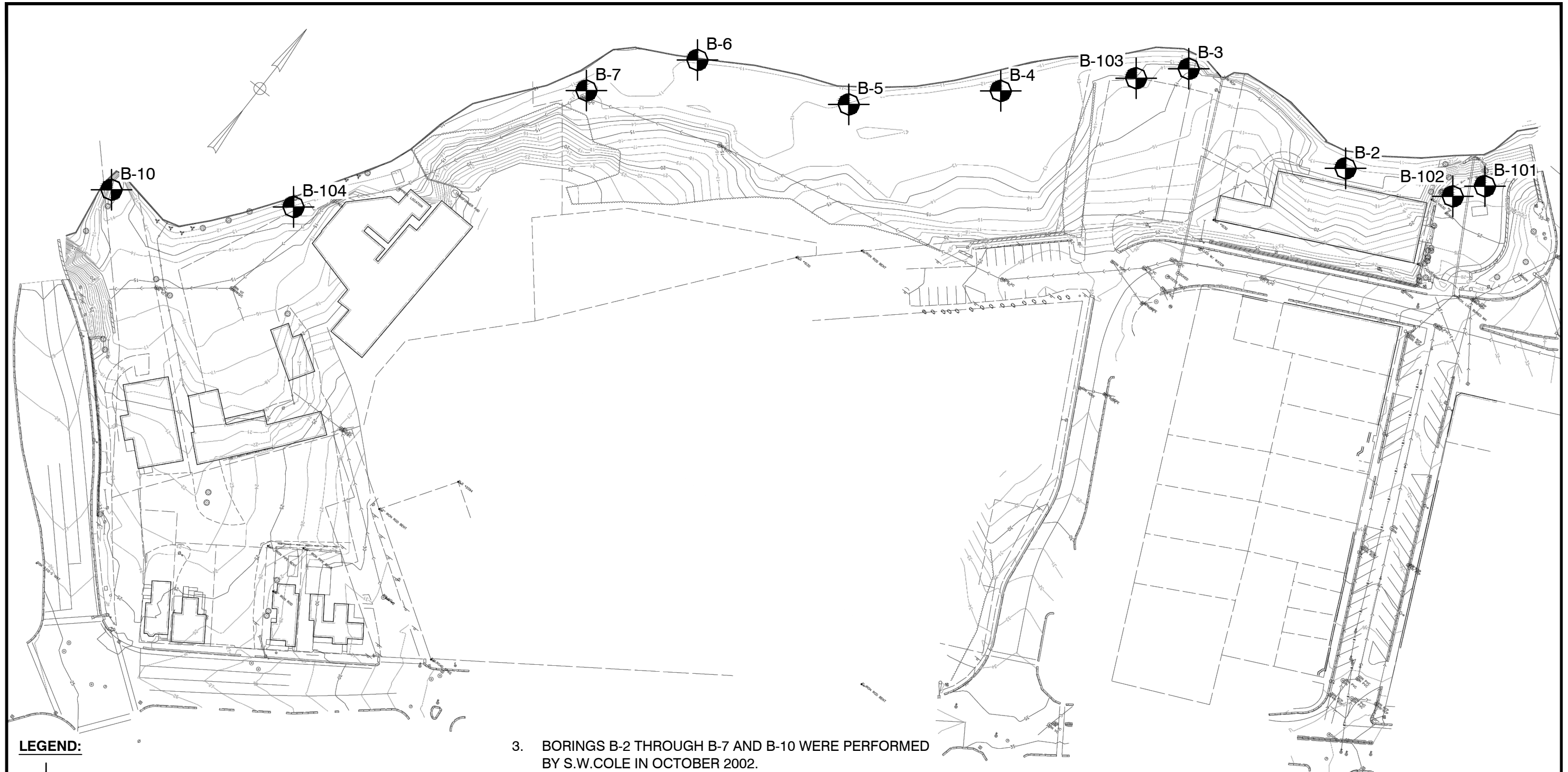
The soil and bedrock profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

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.



LEGEND:

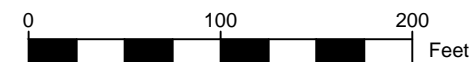


APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=60' SCALE PLAN OF THE SITE PROVIDED BY KLEINFELDER, INC. AS A PORTABLE DOCUMENT FORMAT (PDF) FILE.
2. BORINGS B-101 THROUGH B-104 WERE LOCATED IN THE FIELD BY GPS SURVEY BY S. W. COLE ENGINEERING, INC. (S.W.COLE) USING A MAPPING GRADE TRIMBLE GPS RECEIVER AND OVERLAID ON THIS PLAN BASED ON RELATIVE LOCATION TO EXISTING SITE FEATURES.

3. BORINGS B-2 THROUGH B-7 AND B-10 WERE PERFORMED BY S.W.COLE IN OCTOBER 2002.
4. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S.W.COLE GEOTECHNICAL REPORT.
5. 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.



KLEINFELDER, INC.

EXPLORATION LOCATION PLAN
 PROPOSED PENOBSCOT RIVER TRAIL EXTENSION
 BREWER, MAINE

Job No.: 15-1302
 Date: 02/25/2016

Scale: 1" = 100'
 Sheet: 1



BORING LOG

BORING NO.: **B-101**
 SHEET: **1 OF 1**
 PROJECT NO.: **15-1302 S**
 DATE START: **1/27/2016**
 DATE FINISH: **1/27/2016**
 ELEVATION: **23' +/-**
 SWC REP.: **N. STROUT**

PROJECT / CLIENT: **PROPOSED PENOBSCOT RIVER TRAIL EXTENSION / KLEINFELDER, INC**
 LOCATION: **BREWER, MAINE**
 DRILLING CO.: **S.W. COLE EXPLORATIONS, LLC** DRILLER: **KEVIN HANSCOM**

CASING: TYPE **HSA** SIZE I.D. **2 1/4"** HAMMER WT. **140 LBS** HAMMER FALL **30"**
 SAMPLER: **SS** **1 3/8"** **140 LBS** **30"**
 CORE BARREL:

WATER LEVEL INFORMATION
 FREE WATER OBSERVED AT **14.4'**

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.5'	TOPSOIL
	1D	24"	10"	2.0'	3	8	8	9	4.5'	BROWN GRAVELLY SILTY SAND (FILL) ~MEDIUM DENSE~
	2D	24"	16"	4.0'	13	9	18	20		
	3D	24"	15"	6.5'	11	12	13	10	9.5'	BROWN GRAVELLY SAND, SOME SILT WITH BRICK DEBRIS (FILL) ~MEDIUM DENSE~
	4D	24"	16"	11.5'	2	3	5	7	18.0'	BROWN GRAVELLY SANDY SILT WITH BRICK DEBRIS (FILL) ~LOOSE~
	5D	24"	10"	16.5'	3	3	4	4		
	6D	24"	20"	22.0'	9	16	20	21	22.0'	BROWN MEDIUM SAND, SOME GRAVEL, TRACE SILT ~DENSE~
										BOTTOM OF EXPLORATION AT 22.0'

SAMPLES: D = SPLIT SPOON
 C = 2" SHELBY TUBE
 S = 3" SHELBY TUBE
 U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
 DRILLER - VISUALLY
 SOIL TECH. - VISUALLY
 LABORATORY TEST

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

2

BORING NO.: **B-101**



BORING LOG

BORING NO.: **B-102**
 SHEET: 1 OF 1
 PROJECT NO.: 15-1302 S
 DATE START: 1/27/2016
 DATE FINISH: 1/27/2016
 ELEVATION: 24' +/-
 SWC REP.: N. STROUT
 WATER LEVEL INFORMATION
 NO FREE WATER OBSERVED

PROJECT / CLIENT: PROPOSED PENOBSCOT RIVER TRAIL EXTENSION / KLEINFELDER, INC
 LOCATION: BREWER, MAINE
 DRILLING CO.: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

CASING: TYPE HSA SIZE I.D. 2 1/4" HAMMER WT. HAMMER FALL
 SAMPLER: SS 1 3/8" 140 LBS 30"
 CORE BARREL:

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.5'	TOPSOIL
	1D	24"	14"	2.0'	8	14	10	6		BROWN GRAVELLY SILTY SAND (FILL) -LOOSE TO MEDIUM DENSE-
									9.5'	
	2D	24"	8"	6.5'	9	9	6	3		BROWN SILTY SAND, SOME GRAVEL WITH GLASS DEBRIS (FILL) -LOOSE-
									14.5'	
	3D	24"	6"	11.5'	6	6	5	4		BROWN & GRAY CLAYEY SILT WITH GLASS DEBRIS (FILL) -MED. CONSISTENCY- BROWN AND GRAY CLAYEY SILT qp = 4 KSF -STIFF CONSISTENCY-
									15.5'	
	4D	24"	20"	16.5'	3	3	4	5		AUGER REFUSAL AT 18.6'
									18.6'	

SAMPLES:
 D = SPLIT SPOON
 C = 2" SHELBY TUBE
 S = 3" SHELBY TUBE
 U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
 DRILLER - VISUALLY
 SOIL TECH. - VISUALLY
 LABORATORY TEST

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



BORING LOG

BORING NO.: **B-104**
 SHEET: 1 OF 1
 PROJECT NO.: 15-1302 S
 DATE START: 1/27/2016
 DATE FINISH: 1/27/2016
 ELEVATION: 12' +/-
 SWC REP.: N. STROUT

PROJECT / CLIENT: PROPOSED PENOBSCOT RIVER TRAIL EXTENSION / KLEINFELDER, INC
 LOCATION: BREWER, MAINE
 DRILLING CO.: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

CASING: TYPE HSA SIZE I.D. 2 1/4" HAMMER WT. HAMMER FALL
 SAMPLER: SS 1 3/8" 140 LBS 30"
 CORE BARREL:

WATER LEVEL INFORMATION
 NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.5'	TOPSOIL
	1D	24"	14"	2.0'	5	7	7	5	1.5'	BROWN GRAVELLY SAND, SOME SILT (FILL) ~MEDIUM DENSE~
	2D	24"	10"	4.0'	3	3	3	4		DARK BROWN GRAVELLY SAND AND SILT WITH BRICK AND ASH DEBRIS (FILL) ~LOOSE~
	3D	24"	8"	6.0'	10	5	4	4	7.0'	
	4D	24"	14"	8.0'	4	4	6	5	8.0'	BROWN MEDIUM SAND, SOME SILT ~MEDIUM DENSE~
										BOTTOM OF EXPLORATION AT 8.0'

SAMPLES:
 D = SPLIT SPOON
 C = 2" SHELBY TUBE
 S = 3" SHELBY TUBE
 U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
 DRILLER - VISUALLY
 SOIL TECH. - VISUALLY
 LABORATORY TEST

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

KEY TO THE NOTES & SYMBOLS

Test Boring and Test Pit Explorations

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

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q _u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S _v	-	field vane shear strength, kips/sq. ft.
L _v	-	lab vane shear strength, kips/sq. ft.
q _p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W _L	-	liquid limit - Atterberg test
W _P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ _T	-	total soil weight
γ _B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
“Y”	12 to 35%
And	35+%
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.

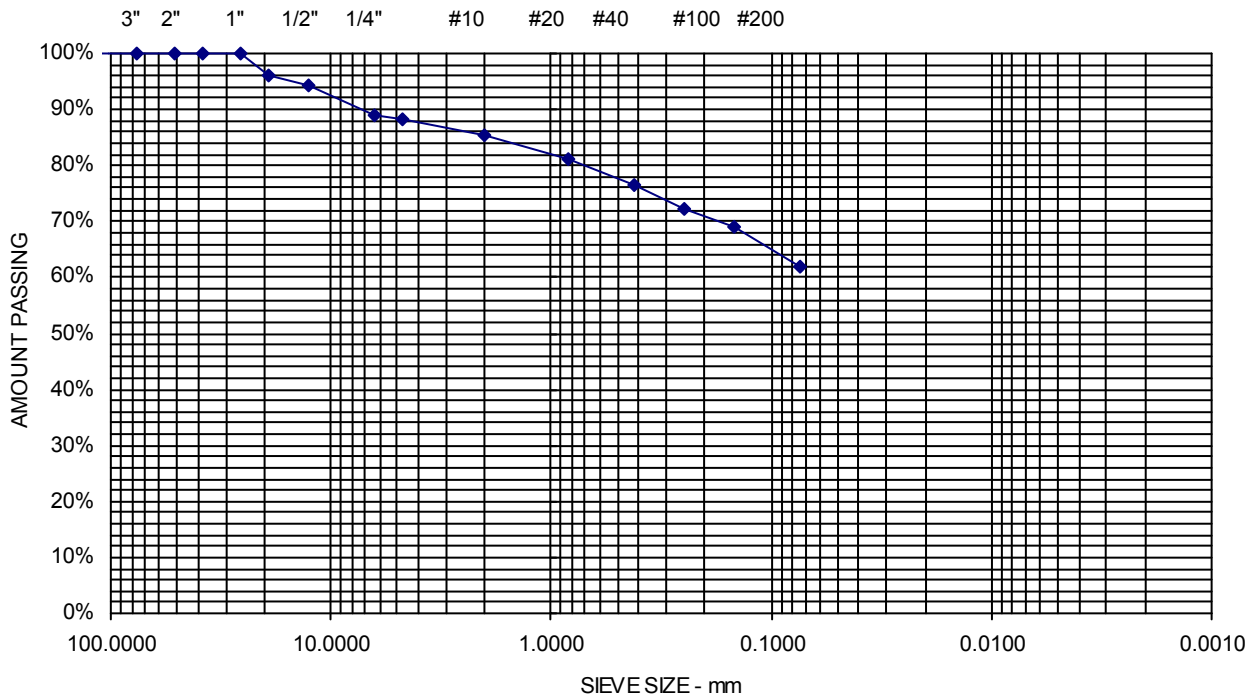
REFUSAL: Test Pit Explorations - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

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.

Project Name BREWER ME - RIVER TRAIL EXTENSION PROJECT -
GEOTECHNICAL ENGINEERING SERVICES
Client KLEINFELDER, INC.
Exploration **4D**
Material Source **B-101, 9.5 - 11.5'**

Project Number 15-1302
Lab ID 19186B
Date Received 1/30/2016
Date Completed 2/2/2016
Tested By JASON ORCUTT

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
150	6"	100	
125	5"	100	
100	4"	100	
75	3"	100	
50	2"	100	
38.1	1-1/2"	100	
25.0	1"	100	
19.0	3/4"	96	
12.5	1/2"	94	
6.3	1/4"	89	
4.75	No. 4	88	11.6% Gravel
2.00	No. 10	85	
850	No. 20	81	
425	No. 40	77	26.7% Sand
250	No. 60	72	
150	No. 100	69	
75	No. 200	61.8	61.8% Fines



APPENDIX A



BORING LOG

BORING NO.: B-2
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/16/2002
 DATE FINISH: 10/16/2002
 ELEVATION: 19.5 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER AT 13.0 AFTER AUGER REMOVAL
CAVED @ 14.0'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									0.5'	BROWN SANDY SILT WITH SOME ORGANICS (TOPSOIL)
	1D	24"		4.0'	4	3	4	2	10.2'	BROWN SILTY FINE TO MEDIUM SAND WITH TRACE OF GRAVEL (FILL) ~ LOOSE ~
	2D	24"		7.0'	4	4	3	3		
	3D	18"		11.5'	35	43	38			
									13.5'	BROWN GRAVELLY SAND AND SILT (TILL) ~ VERY DENSE ~
	4D	18"		16.5'	34	28	39		16.5'	BROWN SILTY SANDY GRAVEL WITH COBBLES (TILL) ~ VERY DENSE ~
										BOTTOM OF EXPLORATION 16.5'

SAMPLES: _____ SOIL CLASSIFIED BY: _____
 D=SPLIT SPOON DRILLER - VISUALLY
 C=3" SHELBY TUBE SOIL TECH. - VISUALLY
 U=3.5" SHELBY TUBE LABORATORY TEST

REMARKS: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.
 BORING NO.: **B-2**



BORING LOG

BORING NO.: B-3
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/16/2002
 DATE FINISH: 10/16/2002
 ELEVATION: 20 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER AT 16.0 AFTER AUGER REMOVAL
CAVED @ 17.0'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
										BROWN GRAVELLY SILTY SAND WITH TRACE OF PAVEMENT AND BRICK (FILL)
	1D	24"		4.0'	6	6	8	6	4.0'	~ MEDIUM DENSE ~
										BROWN SILTY GRAVELLY SAND (FILL)
	2D	24"		7.0'	10	23	13	42	6.8'	~ DENSE ~
										BROWN AND GRAY GRAVELLY SANDY SILT WITH SOME CLAY, WOOD, ORGANICS AND BRICK (FILL)
										~ LOOSE ~
	3D	24"		12.0'	6	2	2	14	14.0'	
										BROWN GRAVELLY SANDY SILT WITH COBBLES (FILL?)
	4D	24"		17.0'	3	7	10	9	18.0'	~ MEDIUM DENSE ~
										BROWN-GRAY SILTY MEDIUM TO COARSE SAND WITH SOME GRAVEL
	5D	24"		22.0'	4	18	19	22	22.0'	~ DENSE ~
										BOTTOM OF EXPLORATION 22.0'

SAMPLES: _____ SOIL CLASSIFIED BY: _____
 D=SPLIT SPOON DRILLER - VISUALLY
 C=3" SHELBY TUBE SOIL TECH. - VISUALLY
 U=3.5" SHELBY TUBE LABORATORY TEST

REMARKS: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.
 BORING NO.: **B-3**



BORING LOG

BORING NO.: B-4
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/14/2002
 DATE FINISH: 10/14/2002
 ELEVATION: 19 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER AT 12.8'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									1.0'	BROWN SANDY SILT WITH SOME ORGANICS, COARSE SAND AND GRAVEL (FILL)
	1D	24"		4.0'	4	11	5	6	8.0'	BROWN GRAVELLY SANDY SILT WITH TRACE OF PAVEMENT (FILL) ~ MEDIUM DENSE ~
	2D	24"		7.0'	5	6	5	4		
									13.5'	BROWN SILTY CLAY WITH SOME GRAVEL, BRICKS, CONCRETE, TRACE OF ORGANICS (FILL) ~ SOFT TO MEDIUM CONSISTENCY ~
	3D	24"		12.0'	1	3	1	5		
									16.4'	BROWN SILTY SANDY GRAVEL WITH COBBLES (TILL) ~ DENSE ~ REFUSAL @ 16.4'
	4D	17"		16.4'	13	33	100/5"			

SAMPLES: D=SPLIT SPOON
 C=3" SHELBY TUBE
 U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

<input checked="" type="checkbox"/>	DRILLER - VISUALLY
<input checked="" type="checkbox"/>	SOIL TECH. - VISUALLY
<input type="checkbox"/>	LABORATORY TEST

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

(6)

BORING NO.: **B-4**



BORING LOG

BORING NO.: B-5
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/14/2002
 DATE FINISH: 10/14/2002
 ELEVATION: 19 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER AT 11.5' AFTER AUGER REMOVAL
CAVED AT 14.1'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
	1D	24"		4.0'	5	2	2	6	8.0'	BROWN GRAVELLY SILTY SAND WITH SOME PAVEMENT, WOOD, ORGANICS, ASH AND BRICK (FILL) ~ LOOSE TO MEDIUM DENSE ~
	2D	24"		7.0'	4	7	14	3		
	3D	24"		12.0'	11	12	13	21	14.0'	BROWN-GRAY GRAVELLY SANDY SILT WITH TRACE OF ORGANICS, BRICKS AND COBBLES (FILL) ~MEDIUM DENSE ~
	4D	24"		17.0'	5	20	16	10	18.5'	DARK BROWN-BLACK GRAVELLY SANDY SILT WITH ORGANICS, ASH, BRICKS AND COBBLES (FILL) ~MEDIUM DENSE ~
	5D	24"		22.0'	19	27	21	21	22.0'	GRAY SILTY FINE SAND ~ DENSE ~
										BOTTOM OF EXPLORATION 22.0'

SAMPLES: D=SPLIT SPOON
 C=3" SHELBY TUBE
 U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
 DRILLER - VISUALLY
 SOIL TECH. - VISUALLY
 LABORATORY TEST

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

(7)

BORING NO.: **B-5**



BORING LOG

BORING NO.: B-6
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/14/2002
 DATE FINISH: 10/14/2002
 ELEVATION: 16 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER AT 7.9' AFTER AUGER REMOVAL
CAVED AT 10.5'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
										BROWN SAND AND SILT WITH SOME WOOD, BRICKS, ORGANICS AND COBBLES (FILL) ~ LOOSE TO MEDIUM DENSE ~
	1D	24"		7.0'	5	6	5	10	9.0'	
	2D	24"		12.0'	1	6	1	2	13.5'	BROWN GRAVELLY SILTY SAND WITH TRACE OF ORGANICS, BRICKS AND COBBLES (FILL) ~ LOOSE ~
									15.5'	BROWN SILTY SAND WITH WOOD (FILL) ~ LOOSE ~
	3D	24"		17.0'	5	33	38	53	17.0'	GRAY SILTY SANDY GRAVEL (TILL) ~ VERY DENSE ~
										BOTTOM OF EXPLORATION 17.0'

SAMPLES: D=SPLIT SPOON
 C=3" SHELBY TUBE
 U=3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

<input checked="" type="checkbox"/>	DRILLER - VISUALLY
<input checked="" type="checkbox"/>	SOIL TECH. - VISUALLY
<input type="checkbox"/>	LABORATORY TEST

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

BORING NO.: **B-6**



BORING LOG

BORING NO.: B-7
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/21/2002
 DATE FINISH: 10/21/2002
 ELEVATION: 19 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

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

WATER LEVEL INFORMATION
WATER IN AUGERS AT 14.3'
CAVED AND NO WATER OBSERVED AT 11.8'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
										BROWN SILTY SAND WITH GRAVEL, TRACE OF ORGANICS AND WOOD (FILL) ~ LOOSE TO MEDIUM DENSE ~
	1D	24"		4.0'	4	4	6	5	4.0'	
										BROWN GRAVELLY SILTY SAND WITH TRACE OF ORGANICS, WOOD AND BRICKS (FILL) ~ LOOSE TO MEDIUM DENSE ~
	2D	24"		7.0'	3	5	7	3	7.0'	
										BROWN SANDY SILT WITH WOOD AND ORGANICS (FILL) ~ LOOSE ~
	3D	24"		12.0'	5	2	1	1		
									15.5'	
	4D	24"		17.0'	2	13	16	11		BROWN SILTY SANDY GRAVEL WITH COBBLES (TILL) ~ DENSE ~
	D	10"		17.8'	50/10"				17.8'	
										REFUSAL @ 17.8'

SAMPLES: _____ SOIL CLASSIFIED BY: _____
 D=SPLIT SPOON DRILLER - VISUALLY
 C=3" SHELBY TUBE SOIL TECH. - VISUALLY
 U=3.5" SHELBY TUBE LABORATORY TEST

REMARKS: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.
 BORING NO.: **B-7**



BORING LOG

BORING NO.: B-10
 SHEET: 1 OF 1
 PROJECT NO.: 02-0549 S
 DATE START: 10/22/2002
 DATE FINISH: 10/22/2002
 ELEVATION: 20 +/-
PROJECT DATUM

PROJECT / CLIENT: PROPOSED WATERFRONT IMPROVEMENTS / WOODARD & CURRAN CONSULTING ENGINEERS
 LOCATION: BREWER, MAINE
 DRILLING FIRM: MAINE TEST BORINGS, INC. DRILLER: JERRY RUDNICKI

CASING: TYPE HSA SIZE I.D. 2 1/2"
 SAMPLER: SS 1 3/8" 140 LB 30"
 CORE BARREL: _____

WATER LEVEL INFORMATION
WATER IN AUGERS AT 15.2'
CAVED AND NO WATER OBSERVED AT 11.0'

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
	1D	24"		4.0'	2	2	1	4	13.6'	DARK BROWN SILTY GRAVELLY SAND WITH SOME COBBLES, ORGANICS, TRACE OF WOOD AND BRICKS (FILL) ~ LOOSE TO MEDIUM DENSE ~
	2D	24"		7.0'	5	5	4	14		
	3D	24"		12.0'	18	7	13	6		
	4D	24"		17.0'	WOR	WOH	WOH	WOH	20.5'	DARK BROWN SILT, SAWDUST AND WOOD (FILL) ~ LOOSE ~
									21.0'	BROWN FINE TO MEDIUM SAND ~ LOOSE ~
	5D	24"		22.0'	1	4	45	101	22.0'	BROWN GRAVELLY SAND WITH SOME SILT (TILL) ~ VERY DENSE ~
										BOTTOM OF EXPLORATION 22.0'

SAMPLES: _____ SOIL CLASSIFIED BY: _____
 D=SPLIT SPOON DRILLER - VISUALLY
 C=3" SHELBY TUBE SOIL TECH. - VISUALLY
 U=3.5" SHELBY TUBE LABORATORY TEST

REMARKS: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.
 BORING NO.: **B-10**