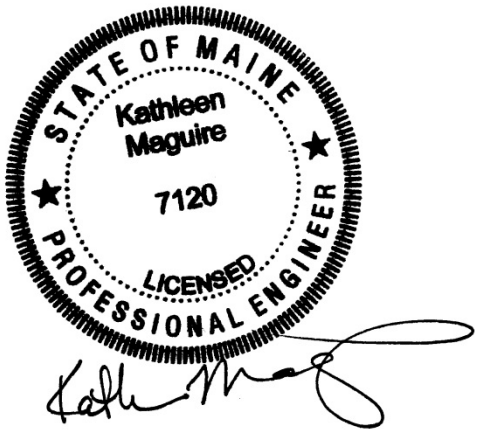
MAINE DEPARTMENT OF TRANSPORTATION
HIGHWAY PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN REPORT

For the Replacement of:

LARGE CULVERT #264890
ROUTE 46
BUCKSPORT, MAINE

Prepared by:
Cody Russell, E.I.
Assistant Geotechnical Engineer



Reviewed by:
Kathleen Maguire, P.E.
Senior Geotechnical Engineer.

Hancock County

Soils Report 2018-10

WIN 18812.00
March 2, 2018

PROJECT DETAILS

The purpose of this Geotechnical Design Report is to present subsurface information and make geotechnical design and construction recommendations for the replacement of an existing approximately 3-foot span by 5-foot rise by 35-foot long dry laid stone culvert (#264890) on Route 46 in Bucksport. The existing culvert has insufficient length and some washout has occurred in the shoulders and slopes. The culvert is located approximately 0.36 of a mile north of Heritage Park Road as shown in the attached Location Map. Route 46 is a Highway Corridor Priority 3 road.

The proposed replacement structure will be a 96-foot long, 108-inch diameter reinforced concrete pipe (RCP) culvert on a skew of approximately 16 degrees to the roadway centerline. The invert of the proposed culvert is approximately 13 feet below the existing road grade at the roadway centerline. The invert of the proposed culvert will be lined with approximately 2 feet (at the culvert centerline) of Special Fill with stream channel rock to facilitate fish passage. The roadway embankment slopes at the proposed culvert inlet and outlet shall be no steeper than 2H:1V to protect against erosion.

SUBSURFACE INVESTIGATION

One (1) boring (HB-BUCK-101) and one (1) probe (HB-BUCK-102) were drilled for this project on January 21, 2016 by Northern Test Boring (NTB) of Gorham, Maine using a track mounted drill rig. Exploration locations are shown on the attached Boring Location Plan & Interpretive Subsurface Profile sheet. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are shown on the attached boring logs.

The boring and probe were drilled using hollow stem auger and solid stem auger techniques, respectively. Soil samples were obtained in boring HB-BUCK-101 at 5-foot intervals using Standard Penetration Test (SPT) methods. The NTB drill rig is equipped with an automatic hammer to drive the split spoon. The NTB calibrated automatic hammer delivers approximately 65 percent more energy during driving than the standard rope and cathead system. All N-values discussed in this report are corrected values (N_{60}) computed by applying an average energy transfer factor of 0.990 to the raw field N-values. No soil samples were obtained in the probe.

The MaineDOT Geotechnical Team member selected the boring and probe locations, drilling methods, designated type and depth of sampling, reviewed field logs for accuracy and identified field and laboratory testing requirements. A NorthEast Transportation Training and Certification (NETTCP) certified Subsurface Investigator logged the subsurface conditions encountered. The boring and probe were located in the field by taping to surveyed site features after completion of the drilling program.

LABORATORY TESTING

A laboratory testing program was conducted to assist in soil classification, evaluation of engineering properties of the soils and geologic assessment of the project site. Laboratory testing consisted of two (2) standard grain size analyses with natural water content and two (2) grain size analyses with hydrometer and natural water content. The results of the laboratory testing program

are discussed in the following section and are shown on the attached boring logs, Laboratory Testing Summary Sheet, and Grain Size Distribution Curve sheet.

SUBSURFACE CONDITIONS

Subsurface conditions encountered at the test boring and probes generally consisted of fill overlying native silt overlying glacial till. An interpretive subsurface profile depicting the generalized soil stratigraphy at the boring location is shown on the attached Boring Location Plan & Interpretive Subsurface Profile sheet.

Boring HB-BUCK-101 was drilled to a depth of approximately 21.5 feet below ground surface (bgs) and did not encounter a refusal surface. Probe HB-BUCK-102 was drilled to a depth of approximately 25.0 feet bgs and did not encounter a refusal surface.

The table below summarizes the field and laboratory information obtained in boring HB-BUCK-101:

Approx. Depth BGS[1] (feet)	Soil Description	AASHTO[2] Classification	USCS[3]	WC%[4]
0 – 0.4	Pavement	--	--	--
0.4 – 12.5	Fill: Brown, damp, fine to coarse sand, little silt, little gravel. Brown, wet, silt, some sand, some gravel. Olive, wet, silt, some clay, trace sand, trace gravel, trace organics and wood.	 A-1-b A-4 A-4	 SM SM CL	 1.3 12.4 32.3
12.5 – 25.0	Glacial Till: Grey-brown and grey, wet, fine to coarse sand, some gravel, little silt, trace clay.	A-1-b	SC-SM	8.7

[1]BGS = below ground surface
[2]AASHTO = American Association of State Highway and Transportation Officials
[3]USCS = Unified Soil Classification System
[4]WC% = Water content in percent

Two (2) corrected N-value obtained in the silt fill ranged from 21 to 28 blows per foot (bpf) indicating that the silt fill was hard to very stiff in consistency. Two corrected N-values obtained in the glacial till ranged from 28 bpf to 31 bpf indicated that the glacial till is medium dense to dense in consistency.

Groundwater was not recorded in the boring or the probes. Groundwater levels can be expected to fluctuate subject to seasonal variations, local soil conditions, topography, precipitation, and construction activity.

GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

Reinforced Concrete Pipe Culvert Construction – The proposed replacement structure will be a 96-foot long, 108-inch diameter RCP culvert on a skew of approximately 16 degrees to the roadway centerline. The proposed RCP shall be furnished and installed in accordance with MaineDOT Standard Specification 603.

The invert of the proposed RCP culvert ranges from approximately 105.7 feet at the inlet end to approximately 104.25 feet at the outlet end with a 1.5% slope. The culvert will be lined with approximately 2 feet of Special Fill with stream channel rock to facilitate fish passage.

The full nature of the proposed culvert bearing surface will not become evident until the culvert excavation is made. Any cobbles or boulders encountered in excess of 6 inches shall be removed and replaced with compacted Granular Borrow Material for Underwater Backfill or Crushed Stone ¾-Inch. The prepared subgrade shall be proofrolled using a static roller to visually confirm the prepared subgrade is firm and stable. The exposed subgrade shall be free of ponded water so that bedding material placement and compaction can be completed in the dry.

The proposed structure shall be bedded on a 1-foot thick layer of Granular Borrow, Material for Underwater Backfill meeting the requirements of MaineDOT Standard Specification 703.19. The soil envelope and backfill shall consist of Standard Specification 703.19 - Granular Borrow with a maximum particle size of 4 inches. The granular borrow bedding and backfill material shall be placed in lifts of 6 to 8 inches loose measure and compacted to the manufacturer's specifications or, in the absence of manufacturer's specifications. The bedding and backfill soil shall be compacted to at least 92 percent of the AASHTO T-180 maximum dry density. All subgrade surfaces should be protected from construction traffic in order to limit disturbance.

Settlement – No settlement issues are anticipated at the site. No changes to the existing vertical or horizontal alignment are currently planned for this project. The proposed RCP culvert is larger than the existing culvert and will result in a net unloading of the site soils at the structure location. Any settlement due to elastic compression of the bedding material will be immediate and negligible.

Scour and Riprap – Both the inlet and outlet of the RCP culvert shall be protected against scour with riprap conforming to MaineDOT Standard Specification Section 703.26 Plain and Hand Laid Riprap. Slopes shall be no steeper than 2H:1V. No specific scour protection recommendations are needed other than armoring with riprap. The riprap on the slopes shall be underlain by a non-woven, Class 1 Erosion Control Geotextile meeting the requirements of MaineDOT Standard Specification 722.03 that is underlain by a 1-foot layer of protective aggregate cushion consisting of Granular Borrow Material for Underwater Backfill (703.19). The toe of the riprap sections shall be keyed into the existing soils 1 foot below the streambed elevation.

Construction Considerations – Construction activities will include construction of cofferdams and earth support systems to control stream flow during construction. Construction activities will also include common earth excavation. Construction of the proposed precast concrete box culvert will require deep soil excavation. Earth support systems shall be implemented if laying back slopes

is not feasible. It is likely that the use of complex (four-sided) braced excavations with dewatering will be necessary due to the depth of the excavation. If this is the case, adequate embedment into the glacial till will be necessary to allow for the excavation and maintenance of a stable excavation bottom. All earth support systems shall be designed by a Professional Engineer licensed in the State of Maine. Regardless of the method of excavation, all excavations and earth support systems shall meet all applicable OSHA regulations.

Any cobbles or boulders encountered in excess of 6 inches shall be removed and replaced with compacted Granular Borrow Material for Underwater Backfill (MaineDOT 703.19) or Crushed Stone ¾-Inch (MaineDOT 703.13). All subgrade surfaces shall be proofrolled using a static roller to provide a firm and stable surface and protected from any unnecessary construction equipment or traffic. If disturbance and rutting occur, the Contractor shall remove and replace disturbed areas with compacted Granular Borrow for Underwater Backfill (703.19) or Crushed Stone ¾-Inch (703.13).

The Contractor shall control groundwater and surface water infiltration using temporary ditches, sumps, granular drainage blankets, stone ditch protection or hand-laid riprap with geotextile underlayment to divert groundwater and surface water as needed to maintain a stable excavation and allow work in the dry.

Using the excavated native soils as backfill around the culvert shall not be permitted. The native soils may only be used as Common Borrow in accordance with MaineDOT Standard Specifications 203 and 703.

The Contractor will have to excavate the existing subbase and subgrade fill soils in the vicinity of the culvert. These materials should not be used to re-base the roadway. Excavated subbase sand and gravel may be used as fill below roadway subgrade level in fill areas provided all other requirements of MaineDOT Standard Specifications 203 and 703 are met.

CLOSURE

This report has been prepared for the use of the MaineDOT Highway Program and their project design consultant for specific application to the proposed replacement of a large culvert (#264890) under Route 46 in Bucksport, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

In the event that any changes in the nature, design, or location of the proposed project are planned, this report should be reviewed by a geotechnical engineer to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to reflect the changes in design. These analyses and recommendations are based in part upon a limited subsurface investigation at discrete exploratory location completed at the site. If variations from the conditions encountered during the investigation appear evident during construction, it may also become necessary to re-evaluate the recommendations made in this report.

It is recommended that a geotechnical engineer be provided the opportunity for a review of the design and specifications in order that the earthwork and foundation recommendations and construction considerations presented in this report are properly interpreted and implemented in

the design and specifications.

Attachments:

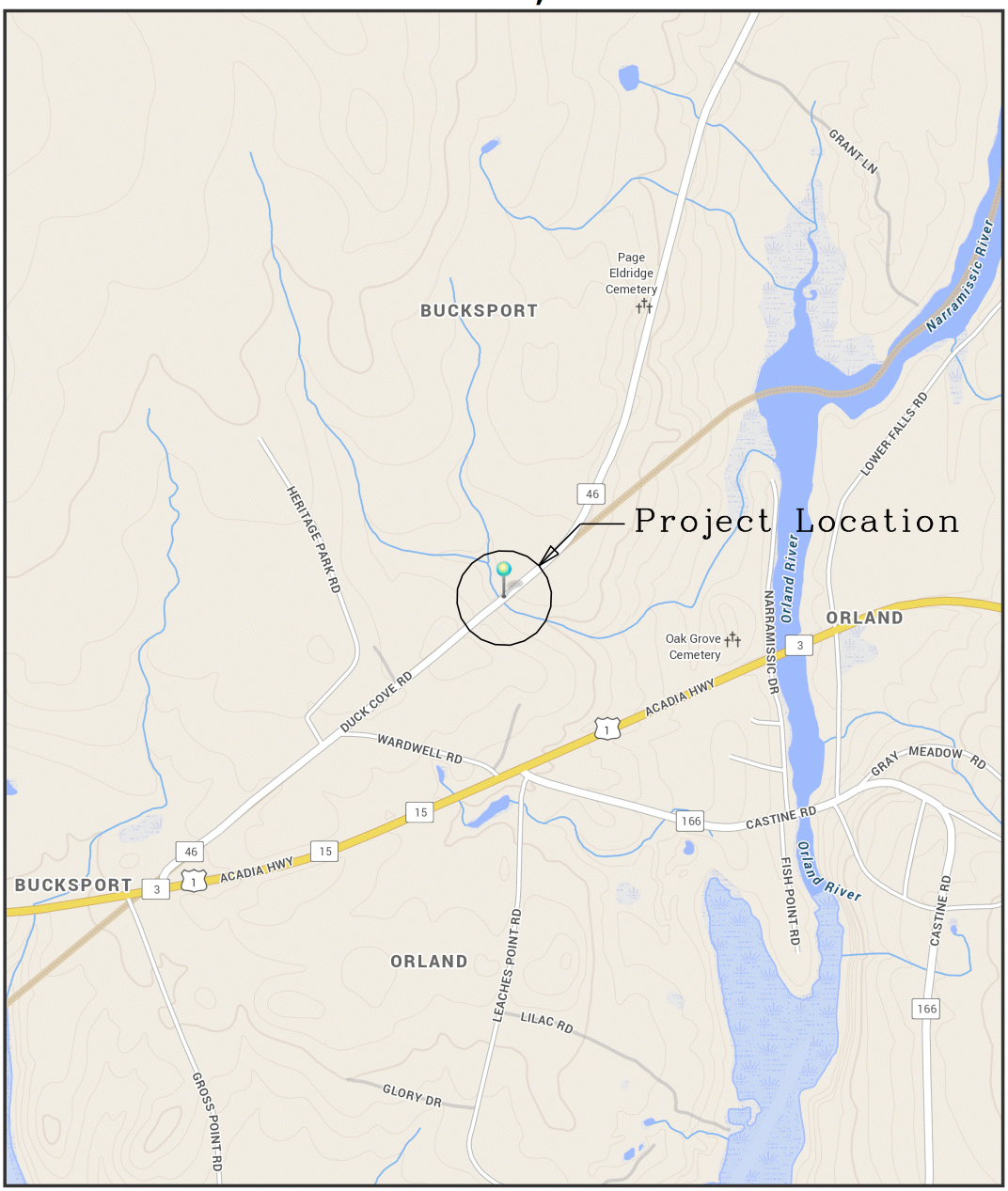
Location Map
Boring Location Plan & Interpretive Subsurface Profile Sheet
Key to Soil and Rock Descriptions and Terms
Boring Logs
Laboratory Testing Summary Sheet
Grain Size Distribution Curves

Date:2/21/2018

Division: GEOTECH

Username: Terry.White

BUCKSPORT, MAINE

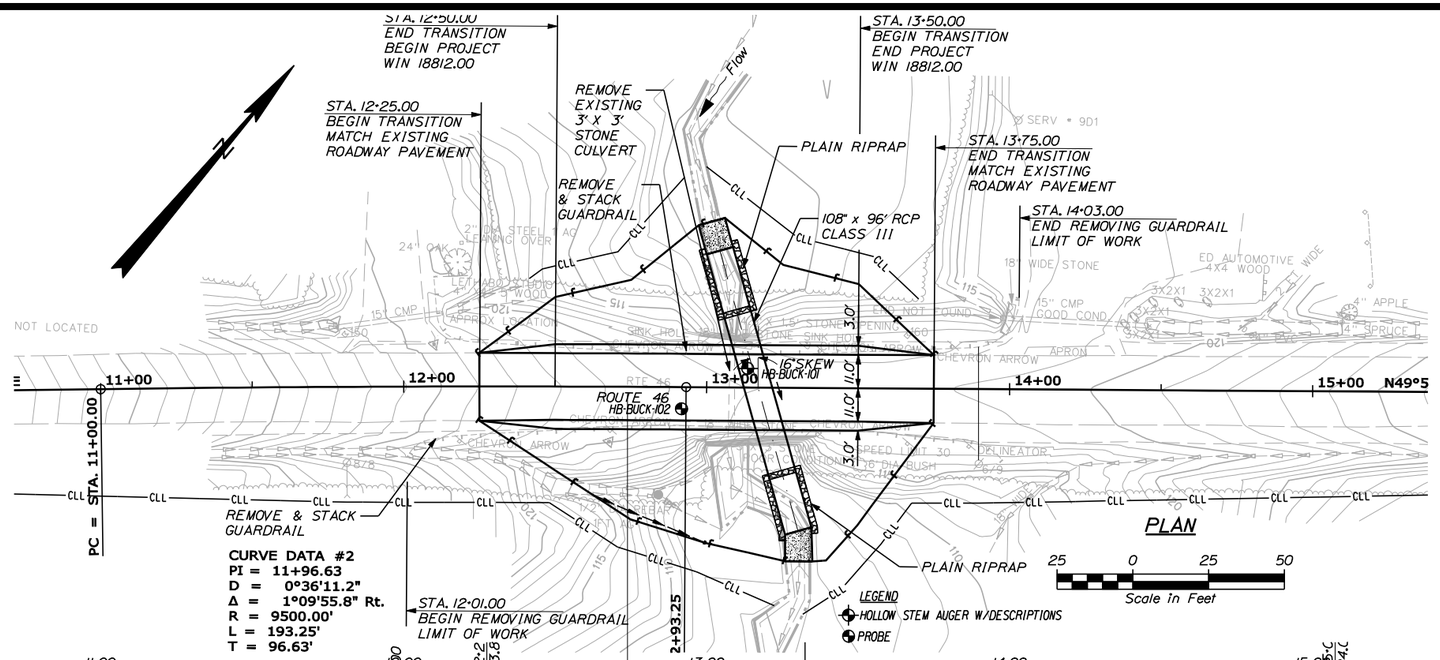


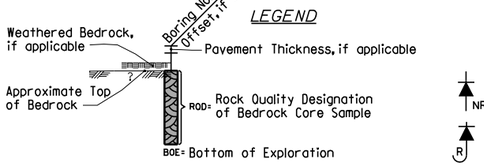
0.25 Miles

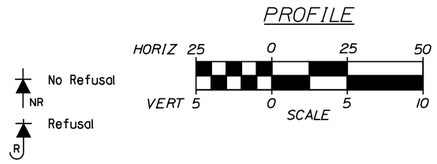
1 inch = 0.28 miles

Date: 2/21/2018
Time: 8:42:06 AM

SHEET NUMBER		STATE OF MAINE DEPARTMENT OF TRANSPORTATION
1	BUCKSPORT ROUTE 46 LARGE CULVERT	018812.00
OF 2	LOCATION MAP	WIN 018812.00 HIGHWAY PLANS







Note: This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil and bedrock transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 46 Large Culvert (#2648901 Replacement
Location: Buckspor+, Maine

Boring No.: HB-BUCK-101
WIN: 18812.00

Driller:	Northern Test Boring	Elevation (ft.):	118.5	Auger ID/OD:	2.75-6.25"
Operator:	Daggett, Mike/Adam	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	1/21/2016 08:30-11:00	Drilling Method:	Hollow Stem Auger	Core Barrel:	N/A
Boring Location:	13+13.6, 8.3 ft Lt.	Casing ID/OD:	N/A	Water Level*:	None Observed
Hammer Efficiency Factor:	0.9901	Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows/6 in. or Pressure (tsf) or RQD (%)	Uncorrected	N60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0							HSA	118.1		4.5" PAVEMENT.	
											0.4
	10	6/6	1.00 - 1.50	50						Brown, damp, very dense, fine to coarse SAND, little silt, little gravel. (Fill).	GM303560 A-1-b, SM WC=1.3%
	20	24/12	4.50 - 5.50	4/10/12/12	22	36				Brown, wet, hard, SILT, some sand, some gravel. (Fill).	GM303561 A-4, SM WC=12.4%
10	30	24/18	9.50 - 11.50	5/5/8/13	13	21				Olive, wet, very stiff, SILT, some clay, trace sand, trace gravel, trace organics and wood. (Fill).	GM303562 A-4, CL WC=32.3%
								106.0		Wood layer from 11.0-12.0 ft bgs.	
											12.5
15	40	24/4	14.50 - 16.50	6/8/9/60	17	28				Grey-brown, wet, medium dense, fine to coarse SAND, some gravel, little silt, trace clay. (Till).	
										Cobble from 16.5-17.1 ft bgs.	
20	50	24/12	19.50 - 21.50	6/8/11/40	19	31				Grey, wet, dense, fine to coarse SAND, some gravel, little silt, trace clay. (Till).	GM303563 A-1-b, SC-SM WC=8.7%
								97.0			21.5
25										Bottom of Exploration at 21.5 feet below ground surface. NO REFUSAL	

Remarks:
Hammer #283

Stratification lines represent approximate boundaries between soil typeset transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1
Boring No.: HB-BUCK-101

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 46 Large Culvert (#2648901 Replacement
Location: Buckspor+, Maine

Boring No.: HB-BUCK-102
WIN: 18812.00

Drilling Contractor:	Northern Test Boring	Elevation (ft.):	119.7	Auger ID/OD:	5" Dia.
Operator:	Daggett, Mike/Adam	Datum:	NAVD88	Sampler:	N/A
Logged By:	B. Wilder	Rig Type:	Diedrich D-50	Hammer Wt./Fall:	N/A
Date Start/Finish:	1/21/2016	Drilling Method:	Solid Stem Auger	Core Barrel:	N/A
Boring Location:	12+91.8, 7.3 ft Rt.	Casing ID/OD:	N/A	Water Level*:	None Observed

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows/6 in. or Pressure (tsf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0						SSA			Probe, no material descriptions given.	
5										
10										
15										
20							94.7			
25									Bottom of Exploration at 25.0 feet below ground surface. NO REFUSAL	25.0

Remarks:

Stratification lines represent approximate boundaries between soil typeset transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Page 1 of 1
Boring No.: HB-BUCK-102

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

018812.00

WIN
18812.00

HIGHWAY PLANS

PROJ. MANAGER	BY	DATE
DESIGN-DETAILED		
CHECKED-REVIEWED	C.RUSSELL	JAN 2016
DESIGN2-DETAILED2	C.RUSSELL	
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

BUCKSPORT
ROUTE 46 LARGE CULVERT

BORING LOCATION PLAN & INTERPRETIVE SUBSURFACE PROFILE WITH BORING LOGS

SHEET NUMBER
2
OF 2

Filename: ...\MSTA\001_BLP&ISP WBL1.dgn Division: GEOTECH Username: Terry.White Date:3/2/2018

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 4 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel sand mixtures, little or no fines.
		GRAVEL WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sand, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Desired Soil Observations (in this order, if applicable):

Color (Munsell color chart)
Moisture (dry, damp, moist, wet)
Density/Consistency (from above right hand side)
Texture (fine, medium, coarse, etc.)
Name (sand, silty sand, clay, etc., including portions - trace, little, etc.)
Gradation (well-graded, poorly-graded, uniform, etc.)
Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)
Structure (layering, fractures, cracks, etc.)
Bonding (well, moderately, loosely, etc.,)
Cementation (weak, moderate, or strong)
Geologic Origin (till, marine clay, alluvium, etc.)
Groundwater level

MODIFIED BURMISTER SYSTEM

Descriptive Term	Portion of Total (%)
trace	0 - 10
little	11 - 20
some	21 - 35
adjective (e.g. sandy, clayey)	36 - 50

TERMS DESCRIBING DENSITY/CONSISTENCY

Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) silty or clayey gravels; and (3) silty, clayey or gravelly sands. Density is rated according to standard penetration resistance (N-value).

Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy or silty clays; and (3) clayey silts. Consistency is rated according to undrained shear strength as indicated.

Consistency of Cohesive soils	SPT N-Value (blows per foot)	Approximate Undrained Shear Strength (psf)	Field Guidelines
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily penetrates
Soft	2 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

Rock Quality Designation (RQD):

RQD (%) = sum of the lengths of intact pieces of core* > 4 inches / length of core advance

*Minimum NQ rock core (1.88 in. OD of core)

Correlation of RQD to Rock Mass Quality

Rock Mass Quality	RQD (%)
Very Poor	≤25
Poor	26 - 50
Fair	51 - 75
Good	76 - 90
Excellent	91 - 100

Desired Rock Observations (in this order, if applicable):

Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Rock Type (granite, schist, sandstone, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
- -dip (horiz - 0-5 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.)
- -spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet)
- -tightness (tight, open, or healed)
- -infilling (grain size, color, etc.)

Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock mass quality (very poor, poor, etc.)
ref: ASTM D6032 and AASHTO Standard Specification for Highway Bridges, 17th Ed. Table 4.4.8.1.2A
Recovery (inch/inch and percentage)
Rock Core Rate (X.X ft - Y.Y ft (min:sec))

Maine Department of Transportation
Geotechnical Section
Key to Soil and Rock Descriptions and Terms
Field Identification Information

Sample Container Labeling Requirements:

WIN
Bridge Name / Town
Boring Number
Sample Number
Sample Depth
Blow Counts
Sample Recovery
Date
Personnel Initials

May 2016

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 46 Large Culvert (#264890) Replacement
Location: Bucksport, Maine

Boring No.: HB-BUCK-101
WIN: 18812.00

Driller:	Northern Test Boring	**Elevation (ft.)**	118.5	**Auger ID/OD:**	2.75-6.25"
Operator:	Daggett, Mike/Adam	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	1/21/2016; 08:30-11:00	**Drilling Method:**	Hollow Stem Auger	**Core Barrel:**	N/A
Boring Location:	13+13.6, 6.3 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.9901	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							HSA	118.1		4½" PAVEMENT. 0.4	
	1D	6/6	1.00 - 1.50	50						Brown, damp, very dense, fine to coarse SAND, little silt, little gravel, (Fill).	G#303560 A-1-b, SM WC=1.3%
	2D	24/12	4.50 - 6.50	4/10/12/12	22	36				Brown, wet, hard, SILT, some sand, some gravel, (Fill).	G#303561 A-4, SM WC=12.4%
5											
	3D	24/18	9.50 - 11.50	5/5/8/13	13	21				Olive, wet, very stiff, SILT, some clay, trace sand, trace gravel, trace organics and wood, (Fill).	G#303562 A-4, CL WC=32.3%
10										Wood layer from 11.0-12.0 ft bgs.	
								106.0		12.5	
	4D	24/4	14.50 - 16.50	6/8/9/60	17	28				Grey-brown, wet, medium dense, fine to coarse SAND, some gravel, little silt, trace clay, (Till).	
15										Cobble from 16.5-17.1 ft bgs.	
	5D	24/12	19.50 - 21.50	6/8/11/40	19	31				Grey, wet, dense, fine to coarse SAND, some gravel, little silt, trace clay, (Till).	G#303563 A-1-b, SC-SM WC=8.7%
20								97.0		21.5	
										Bottom of Exploration at 21.5 feet below ground surface. NO REFUSAL	
25											

Remarks:

Hammer #283

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 46 Large Culvert (#264890) Replacement
Location: Bucksport, Maine

Boring No.: HB-BUCK-102

WIN: 18812.00

Driller:	Northern Test Boring	**Elevation (ft.)**	119.7	**Auger ID/OD:**	5" Dia.
Operator:	Daggett, Mike/Adam	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	1/21/2016	**Drilling Method:**	Soild Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+91.8, 7.3 ft Rt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:		**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample Attempt
V = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA			Probe, no material descriptions given.	
5											
10											
15											
20											
25											

Remarks:

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Maine Department of Transportation

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Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25								94.7		25.0 **Bottom of Exploration at 25.0 feet below ground surface.** NO REFUSAL	
30											
35											
40											
45											
50											

Remarks:

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State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Bucksport Work Number: 18812.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
HB-BUCK-101, 1D	13+13.6	6.3 Lt.	1.0-1.5	303560	1	1.3			SM	A-1-b	II
HB-BUCK-101, 2D	13+13.6	6.3 Lt.	4.5-6.5	303561	1	12.4			SM	A-4	III
HB-BUCK-101, 3D	13+13.6	6.3 Lt.	9.5-11.5	303562	1	32.3			CL	A-4	IV
HB-BUCK-101, 5D	13+13.6	6.3 Lt.	19.5-21.5	303563	1	8.7			SC-SM	A-1-b	III

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

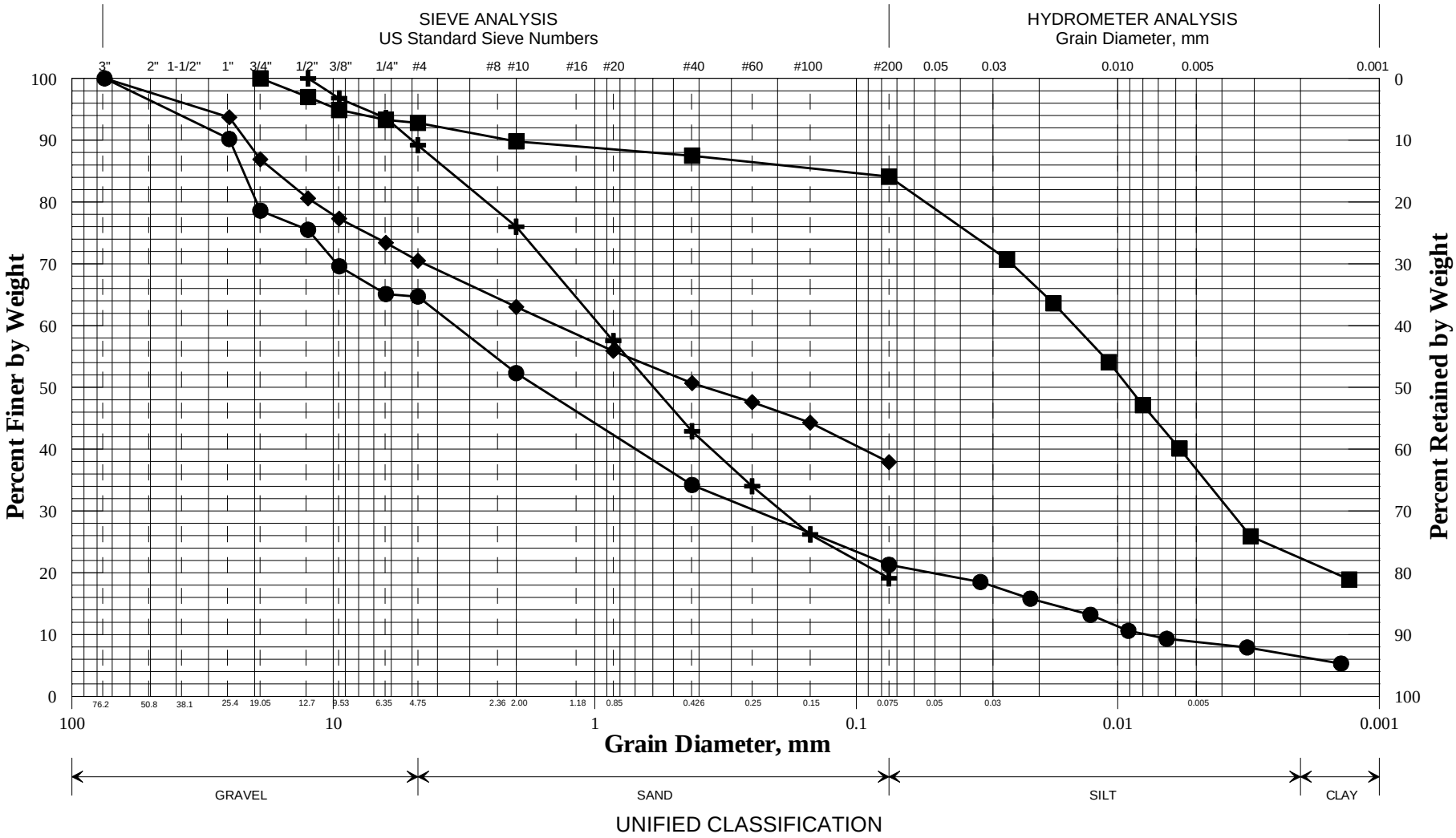
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98 NP = Non Plastic

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	HB-BUCK-101/1D	13+13.6	6.3 LT	1.0-1.5	SAND, little silt, little gravel.	1.3			
◆	HB-BUCK-101/2D	13+13.6	6.3 LT	4.5-6.5	SILT, some sand, some gravel.	12.4			
■	HB-BUCK-101/3D	13+13.6	6.3 LT	9.5-11.5	SILT, some clay, trace sand, trace gravel.	32.3			
●	HB-BUCK-101/5D	13+13.6	6.3 LT	19.5-21.5	SAND, some gravel, little silt, trace clay.	8.7			
▲									
✖									

WIN
018812.00
Town
Bucksport
Reported by/Date
WHITE, TERRY A 4/6/2016