MAINE DEPARTMENT OF TRANSPORTATION
HIGHWAY PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN REPORT

For the Construction of

SEAL HARBOR BRIDGE
ROUTE 73
ST. GEORGE, MAINE

Prepared by:
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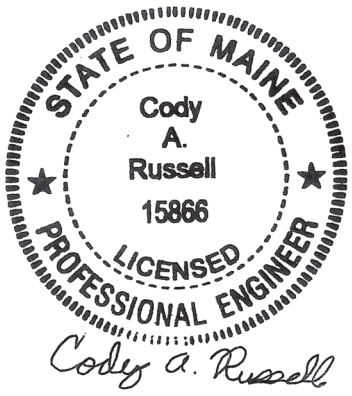
Geotechnical Engineer



Reviewed by:
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Knox County
WIN 25515.00

Soils Report 2022-36
Bridge No. 6679

December 21, 2022

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Appendices

1.0 INTRODUCTION

The purpose of this Geotechnical Design Report is to present subsurface information and make geotechnical recommendations for the replacement of an existing large culvert (#46906) on Route 73 in St. George, Maine. A subsurface investigation has been completed at the site to evaluate subsurface conditions and to develop geotechnical design and construction recommendations for the replacement structure. This report presents the subsurface information obtained during the subsurface investigation and soil laboratory testing programs and provides design and construction recommendations and geotechnical design parameters for the culvert replacement.

The existing structure consists of an approximately 30-inch span by 66-inch rise by 65-foot long granite box culvert with 60-inch diameter, 40-foot long corrugated metal pipe (CMP) extension on the outlet end. The CMP extension is unzipped and pitted, and the inlet end had been repeatedly blocked by debris. Route 73 is a Highway Corridor Priority 4 road.

The proposed replacement structure will be a 12-foot diameter, 140-foot long polymer-coated corrugated steel pipe culvert on a skew of approximately 32 degrees to the roadway centerline. The invert of the proposed culvert is approximately 20.9 feet below the existing road grade at the roadway centerline. The roadway embankment slopes at the proposed culvert inlet and outlet shall be no steeper than 2H:1V to protect against erosion.

2.0 GEOLOGIC SETTING

The existing culvert carries an unnamed stream under Route 73 in St. George and is located approximately 0.3 of a mile west of Clark Island Road as shown on Sheet 1 – Location Map.

According to the Maine Geological Survey (MGS) map titled Surficial Geology Thomaston Quadrangle, Maine, Open File 11-30 (2011) the surficial soils at the site consist of Presumpscot Formation and Artificial Fill. Presumpscot Formation consists of glaciomarine silt, clay, and sand. Artificial Fill consists of a mixture of soil, rock, and manmade materials used as fill for roads.

According to the map titled Bedrock Geologic Map of Maine (1985) published by the MGS, the bedrock in the vicinity of the site consists of intrusive Devonian granite with muscovite inclusions.

3.0 SUBSURFACE INVESTIGATION

Two (2) borings (HB-STG-101 and HB-STG-104) and two (2) probes (HB-STG-102 and HB-STG-103) were drilled near the proposed structure between May 12, 2021 and May 14, 2021 by the MaineDOT drill crew using a trailer mounted drill rig. Exploration locations are shown on Sheet 2 – Boring Location Plan. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented on the Boring Logs in Appendix A.

Borings HB-STG-101 and HB-STG-102 were drilled using solid stem auger, cased wash boring, and open hole drilling techniques. Soil samples were obtained at 5-foot intervals in HB-STG-101 to a depth of 37 feet below ground surface (bgs) and in HB-STG-104 for its full depth using

Standard Penetration Test (SPT) methods. The MaineDOT drill rig is equipped with an automatic hammer to drive the split spoon. The MaineDOT calibrated automatic hammer delivers approximately 48 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 0.89 to the raw field N-values. Nine (9) in-situ vane shear tests were conducted in the cohesive soils using a Geonor 55-mm by 110-mm rectangular vane. Probes HB-STG-102 and HB-STG-103 were drilled using solid stem auger techniques. No soil samples were obtained in the probes.

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 in the boring and probe. The boring and probe were located in the field by taping to surveyed site features after completion of the drilling program.

4.0 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 eight (8) standard grain size analysis with natural water content, four (4) standard grain size analyses with hydrometer and natural water content, and the (3) Atterberg Limits tests. The results of the laboratory testing program are discussed in the following section and are included in Appendix B – Laboratory Test Results. Laboratory test information is also shown on the Boring Logs in Appendix A.

5.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered in the test borings and probes generally consisted of fill consisting of sand underlain by native sand, gravel, and sandy silt underlain by Presumpscot Formation consisting of silt and clayey silt underlain by sand. An interpretive subsurface profile depicting the generalized soil stratigraphy at the boring location is shown on Sheet 3 Interpretive Subsurface Profile.

Borings HB-STG-101 and HB-STG-104 were drilled to depths of approximately 56.6 feet and 42.1 feet bgs, respectively, where they encountered a refusal surface. The exact nature of the refusal surface was not determined in the borings. Probes HB-STG-102 and HB-STG-103 were each drilled to a depth of approximately 30.0 feet bgs and did not encounter a refusal surface. The sections below summarize the field and laboratory information obtained in borings HB-STG-101 and HB-STG-104.

5.1 Pavement and Fill Materials

The borings encountered approximately 6 inches of pavement at the ground surface. The pavement was underlain by fills soils consisting of:

- Brown, damp, fine to coarse sand, some gravel, little to some silt, occasional cobbles.

The thickness of the fill ranged from approximately 13.5 feet to 14.0 feet. N_{60}-values obtained in the fill ranged from 10 bpf to 77 bpf indicating that the fill is loose to very dense in consistency. Occasional cobbles were encountered at the bottom of the fill in boring HB-STG-104.

Water contents from four (4) samples obtained within the fill ranged from approximately 6.5% to 15.9%. Grain size analyses conducted on four (4) samples of the fill resulted in the soil being classified as an A-1-b or A-2-4 under the AASHTO Soils Classification System and an SM under the Unified Soil Classification System.

5.2 Gravel and Sand

The fill soils were underlain by layers of native granular soils consisting of:

- Brown and grey, wet, fine to coarse sand, little to some gravel, little to some silt.
- Brown, wet, gravel, some fine to coarse sand, little silt.

The thickness of the gravel, and sand layers ranged from approximately 3.5 feet to 5.0 feet. N_{60}-values obtained in the gravel and sand ranged from 12 to 50 blows per foot (bpf) indicating that the soil is medium dense to dense in consistency.

Water contents from three (3) samples obtained within the gravel and sand ranged from approximately 11.2% to 12.6%. Grain size analyses conducted on three (3) samples of the native granular soils range resulted in the soil being classified as an A-1-a or A-1-b under the AASHTO Soils Classification System and an GP-GM, SM, or SW-SM under the Unified Soil Classification System.

5.3 Silt

The gravel and sand were underlain by or interbedded with silt consisting of:

- Olive grey, wet, silt, little fine to coarse sand, little clay, trace gravel.
- Grey, wet, fine to coarse sandy silt, trace gravel.

The thickness of the silt layers ranged from approximately 2.0 feet to 6.5 feet. One (1) N_{60}-value obtained in the silt was 7 blows per foot (bpf) indicating that the silt is medium stiff in consistency.

Water contents from two (2) samples obtained within the silt ranged from approximately 26.5% to 28.2%. Grain size analyses conducted on two (2) samples of the silt ranged resulted in the soil being classified as an A-4 under the AASHTO Soils Classification System and a CL or ML under the Unified Soil Classification System.

5.4 Presumpscot Formation

The sand, gravel and silt were underlain by Presumpscot Formation consisting of:

- Grey, wet, clayey silt, trace fine to coarse sand, trace gravel.

The thickness of the Presumpscot Formation ranged from approximately 16.8 feet to 26.5 feet. N_{60}-values obtained in the fill ranged from Weight of Hammer to 7 bpf, indicating that the Presumpscot Formation in very soft to medium stiff in consistency.

Water contents from three (3) samples obtained within the Presumpscot Formation ranged from approximately 34.0% to 34.3%. Grain size analyses conducted on three (3) samples of the Presumpscot Formation resulted in the soil being classified as an A-4 or A-6 under the AASHTO Soils Classification System and an ML under the Unified Soil Classification System.

Nine (9) vane shear tests conducted within the Presumpscot Formation showed measured undrained shear strength ranging from approximately 335 psf to 491 psf with remolded shear strengths ranging from approximately 89 psf to 179 psf. Based on the ratio of undrained to remolded shear strength from the vane shear test, the Presumpscot Formation was determined to have a sensitivity ranging from approximately 2.5 to 4.5 and is classified as moderately sensitive to sensitive.

The following table summarizes the results of Atterberg Limits tests done on three (3) samples of the clayey silt:

Boring No. and Sample No.	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
HB-STG-101 6D	34.3	31	21	10	1.33
HB-STG-104 6D	34.0	34	21	13	1.00
HB-STG-104 7D	34.1	32	21	11	1.19

Interpretation of these results indicate that the clayey silt has medium plasticity. The clayey silt in sample 6D from boring HB-STG-101 and sample 7D from boring HB-STG-104 are on the verge of being a viscous liquid if disturbed. Overburden pressure and interparticle cementation is providing stability to keep the soil in its current state, but the slightest disturbance causing remolding could convert the soil into a viscous fluid. The clayey silt in sample 6D, boring HB-STG-104 is normally consolidated, meaning it is currently experiencing its highest stress.

5.5 Sand

The Presumpscot Formation was underlain by sand consisting of:

- Grey, wet, fine to coarse sand, little gravel, little silt.
- Silty Sand.

The as drilled thickness of the sand layer ranged from approximately 0.8 feet to 4.6 feet bgs, but the full depth of the sand layer was not penetrated by the borings. One (1) N_{60}-value obtained in the sand was 17 bpf indicating that the sand is medium dense in consistency.

5.6 Groundwater

Groundwater was recorded at depths ranging from approximately 14.5 feet to 18.0 feet bgs in borings HB-STG-101 and HB-STG-104. Groundwater levels can be expected to fluctuate subject to seasonal variations, local soil conditions, topography, precipitation, and construction activity.

6.0 GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

The following sections discuss geotechnical recommendations for the design and construction of the proposed polymer-coated corrugated steel pipe culvert.

6.1 Polymer-Coated Corrugated Steel Pipe Culvert Design and Construction

The proposed replacement structure will consist of a 12-foot diameter, 140-foot long polymer-coated corrugated steel pipe culvert on a skew of approximately 32 degrees to the roadway centerline. The proposed structure inlet and outlet slopes shall be riprapped with slopes no steeper than 2H:1V to protect against erosion. The proposed polymer-coated corrugated steel pipe culvert shall be designed and constructed in accordance with MaineDOT Standard Specification 603. The invert of the proposed polymer-coated corrugated steel pipe culvert ranges from approximately 22.5 feet at the inlet end to approximately 22.0 feet at the outlet end with a slope of approximately 0.36%.

The proposed structure shall be bedded on a 2-foot thick, geotextile wrapped, geogrid reinforced, crushed stone mat (Culvert Bedding Stone; Pay Item 203.55). The geogrid reinforcement shall meet the requirements of Special Provision 620, attached. The Reinforcement Geotextile shall meet the requirements of MaineDOT Standard Specification 722.01. The soils at the bedding elevation shall be excavated using a smooth-edged backhoe bucket to limit disturbance. Any disturbed soils at the bedding elevation resulting from excavation activities shall be removed by hand prior to placement of the geotextile wrapped, geogrid reinforced, crushed stone mat. All subgrade surfaces should be protected from construction traffic in order to limit disturbance. Groundwater and surface water levels shall be depressed sufficiently to allow work in the dry.

The soil backfill shall consist of Granular Borrow (703.19) with a maximum particle size of 4 inches. The Granular Borrow backfill 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, to at least 92 percent of the AASHTO T-180 maximum dry density. In no case shall the backfill soil be compacted less than 92 percent of the AASHTO T-180 maximum dry density.

6.2 Settlement

No settlement issues are anticipated at the site. The proposed precast concrete box culvert will be constructed at a new location east (down station) of the existing culvert overlapping portions of the existing culvert location. The proposed polymer-coated corrugated steel pipe culvert is larger than the existing culvert and will result in a net unloading of the site soils at the proposed structure location. Placement of fill soils at the location of the existing structure is not anticipated to exceed the past loading condition of the site soils. Any settlement due to elastic compression of the bedding material will be immediate and negligible.

6.3 Scour and Riprap

Both the inlet and outlet of the polymer-coated corrugated steel pipe 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.

6.4 Seismic Design Considerations

In conformance with LRFD Article 3.10.1, seismic analysis is not required for buried structures, except where they cross active faults. There are no known active faults in Maine; therefore, seismic analysis is not required.

6.5 Construction Considerations

Construction activities may 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 polymer-coated corrugated steel pipe 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 native silts 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.

The soils at the bedding elevation shall be excavated using a smooth-edged backhoe bucket to limit disturbance. Any disturbed soils at the bedding elevation resulting from excavation activities shall be removed by hand prior to placement of the geotextile wrapped, geogrid reinforced, crushed stone mat. All subgrade surfaces should be protected from construction traffic in order to

limit disturbance. Groundwater and surface water levels shall be depressed sufficiently to allow work in the dry.

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.

7.0 CLOSURE

This report has been prepared for the use of the MaineDOT Highway Program for specific application to the proposed replacement of an existing large culvert (#46906) under Route 73 in St. George, 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.

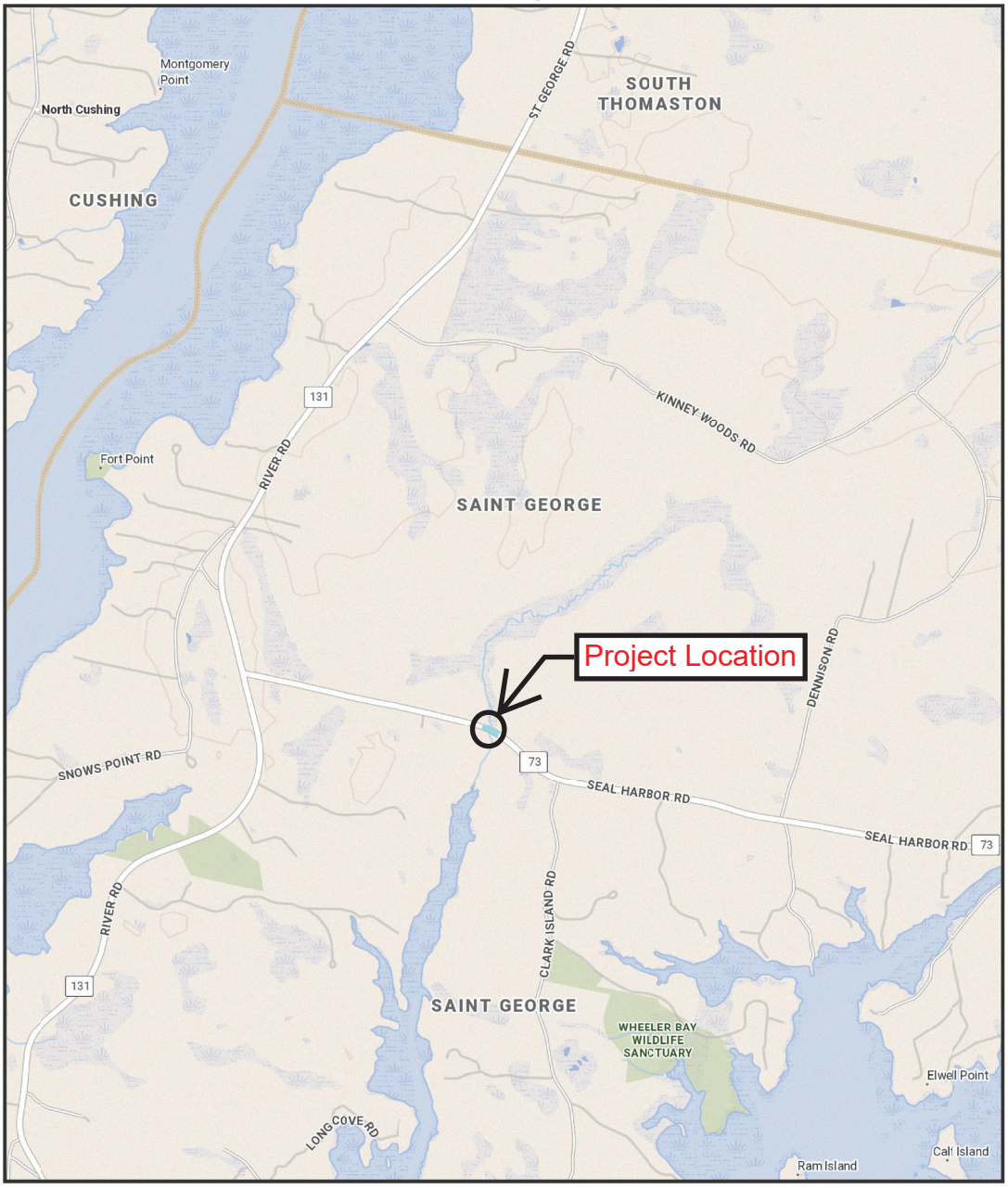
Sheets

Date:11/14/2022

Division: GEOTECH

Username: terry.white

ST. GEORGE, MAINE



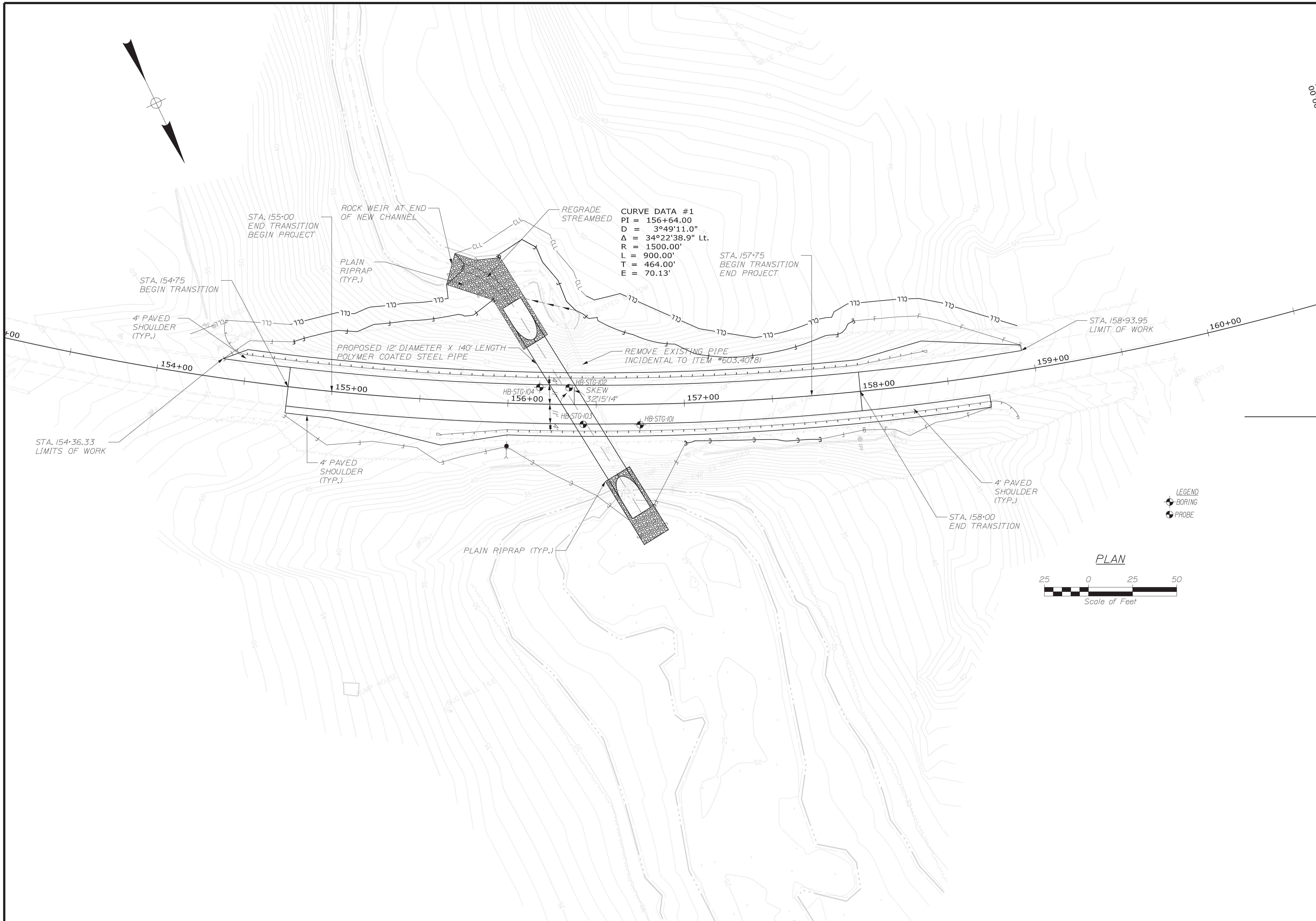
The Maine Department of Transportation provides this publication for information only. Reliance upon this information is at user risk. It is subject to revision and may be incomplete depending upon changing conditions. The Department assumes no liability if injuries or damages result from this information. This map is not intended to support emergency dispatch.

0.45 Miles

1 inch = 0.48 miles

Date: 11/14/2022
Time: 10:44:03 AM

SHEET NUMBER 1 OF 3	ST. GEORGE ROUTE 73 LOCATION MAP	STATE OF MAINE DEPARTMENT OF TRANSPORTATION 25515.00 WIN 25515.00 HIGHWAY PLANS



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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

25515.00

WIN 25515.00

HIGHWAY PLANS

BRIDGE NO. 6679

	BY	DATE
PROJ. MANAGER		
DESIGN-DETAILED	C.RUSSELL	DEC 2022
CHECKED-REVIEWED	T.WHITE	
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

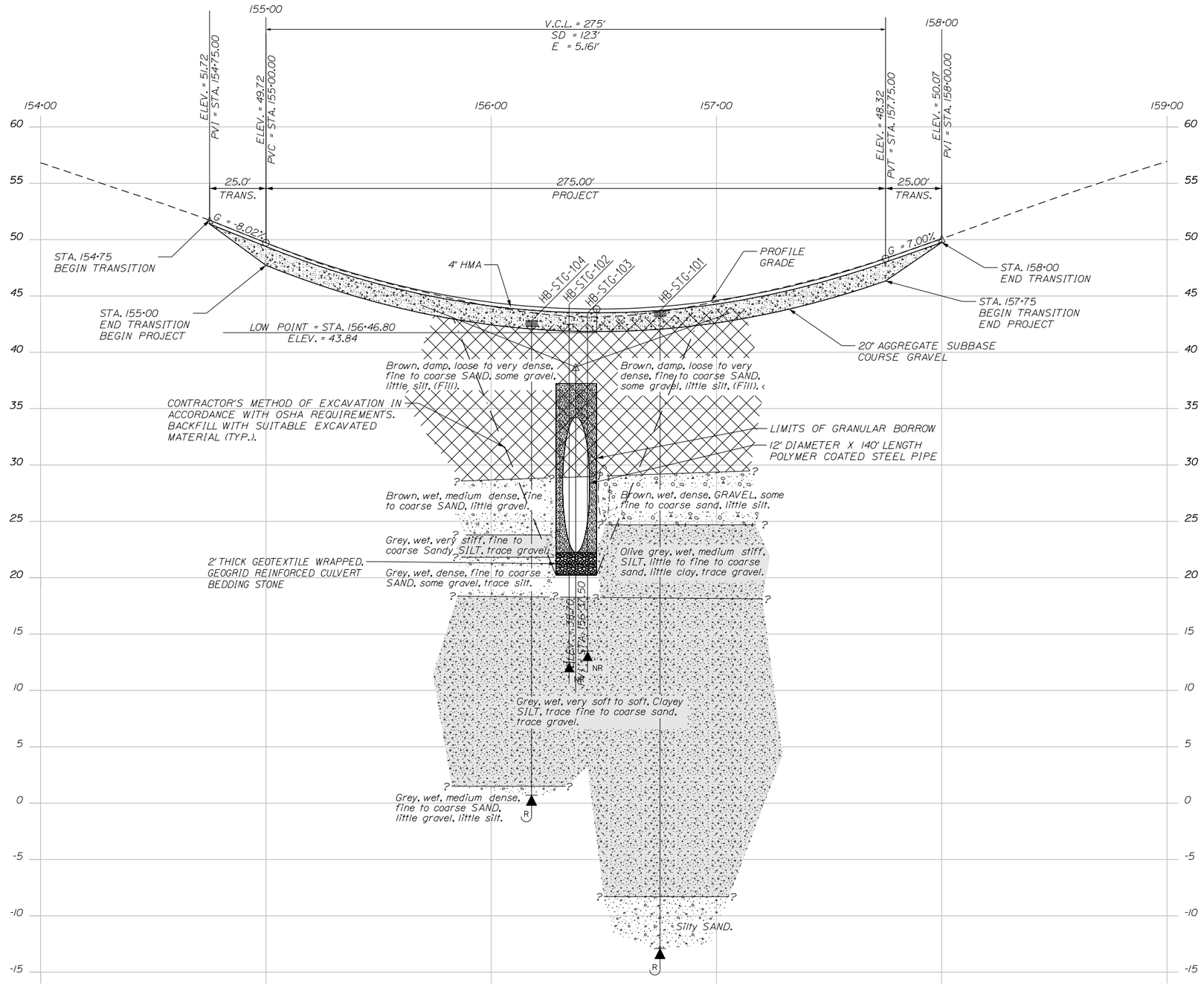
P.E. NUMBER

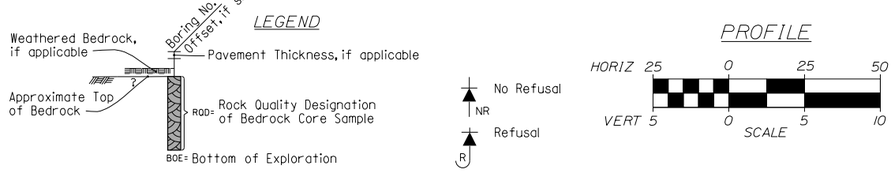
DATE

ST. GEORGE
ROUTE 73

BORING LOCATION PLAN

SHEET NUMBER
2
OF 3





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.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

25515.00

WIN
25515.00

HIGHWAY PLANS

	BY	DATE
PROJ. MANAGER	-------	-------
DESIGN-DETAILED	C.RUSSELL	DEC 2022
CHECKED-REVIEWED	-----	-----
DESIGN2-DETAILED2	-------	-------
DESIGN3-DETAILED3	-------	-------
REVISIONS 1	-------	-------
REVISIONS 2	-------	-------
REVISIONS 3	-------	-------
REVISIONS 4	-------	-------
FIELD CHANGES	-------	-------

SIGNATURE

P.E. NUMBER

DATE

ST. GEORGE
ROUTE 73

INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER

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Appendix A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 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):

$$\text{RQD (\%)} = \frac{\text{sum of the lengths of intact pieces of core* > 4 inches}}{\text{length of core advance}}$$

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

Rock Quality Based on RQD

Rock 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 quality (very poor, poor, etc.)
ref: ASTM D6032 and FHWA NHI-16-072 GEC 5 - Geotechnical Site Characterization, Table 4-12
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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73

Location: St. George, Maine

Boring No.: HB-STG-101

WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	43.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	5/12/2021; 09:00-13:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	156+74.9, 11.6 ft Rt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	18.0 ft bgs.
Hammer Efficiency Factor: 0.89		**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							SSA	43.2		6" HMA.	
										0.5	
	1D	24/13	1.00 - 3.00	5/3/4/11	7	10				Brown, damp, loose, fine to coarse SAND, some gravel, some silt, old pavement, (Fill).	G#340956 A-2-4, SM WC=12.0%
5	2D	24/17	5.00 - 7.00	8/7/6/6	13	19				Brown, damp, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	G#340957 A-1-b, SM WC=11.2%
10	3D	24/16	10.00 - 12.00	4/4/4/5	8	12	15			Brown, damp, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	
							12				
							41				
							22				
							30	29.2		14.5	
15	4D	24/11	15.00 - 17.00	6/7/27/18	34	50	15			Brown, wet, dense, GRAVEL, some fine to coarse sand, little silt.	G#340958 A-1-a, GP-GM WC=11.2%
							48				
							144				
							79				
							69	24.7		19.0	
20	5D	24/18	20.00 - 22.00	3/2/3/5	5	7	20			Olive grey, wet, medium stiff, SILT, little fine to coarse sand, little clay, trace gravel.	G#340959 A-4, ML WC=26.5%
							19				
							31				
							28				
25							20				

Remarks:

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

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-101
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	43.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	5/12/2021; 09:00-13:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	156+74.9, 11.6 ft Rt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	18.0 ft bgs.
Hammer Efficiency Factor: 0.89		**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 140 lb. 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.
25	6D	24/20	25.00 - 27.00	2/1/2/2	3	4	OPEN HOLE	18.2		25.5 6D (25.5-27.0 ft bgs.) Grey, wet, soft, Clayey SILT, trace fine to coarse sand, trace gravel.	G#340960 A-4, ML WC=34.3% LL=31 PL=21 PI=10
	V1		27.63 - 28.00	Su=446/134 psf						55x110 mm raw torque readings: V1: 10.0/3.0 ft-lbs	
	V2		28.63 - 29.00	Su=335/134 psf						V2: 7.5/3.0 ft-lbs.	
30	7D	24/24	30.00 - 32.00	WOR/WOR/WOH/ WOH	---					Grey, wet, very soft, Clayey SILT, trace fine to coarse sand, trace gravel.	
	V3		30.63 - 31.00	Su=402/134 psf						55x110 mm raw torque readings: V3: 9.0/3.0 ft-lbs	
	V4		31.63 - 32.00	Su=446/134 psf						V4: 10.0/3.0 ft-lbs	
35	8D	24/24	35.00 - 37.00	WOR/WOR/WOH/ WOH	---		RC/OH			Grey, wet, very soft, Clayey SILT, trace fine to coarse sand trace gravel. Roller Coned ahead from 35.0-56.6 ft bgs. Used 250 lbs down pressure on bit.	
	V5		35.63 - 36.00	Su=402/156 psf						55x110 mm raw torque readings: V5: 9.0/3.5 ft-lbs	
	V6		36.63 - 37.00	Su=402/89 psf						V6: 9.0/2.0 ft-lbs	
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-101
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	43.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	5/12/2021; 09:00-13:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	156+74.9, 11.6 ft Rt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	18.0 ft bgs.
Hammer Efficiency Factor: 0.89		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. 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.
50								-8.3		Firm fine Silty SAND.	
										Some sand at 54.0 ft bgs.	
55								-12.9		**Bottom of Exploration at 56.6 feet below ground surface.** Roller Cone REFUSAL	
60											
65											
70											
75											

52.0
56.6

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73

Location: St. George, Maine

Boring No.: HB-STG-102

WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	42.5	**Auger ID/OD:**	5" Dia.
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	5/13/2021-5/14/2021	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+65.3, 9.5 ft Rt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:		**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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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
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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.
0							SSA			Probe, similar soils as HB-STG-104.	
5											
10											
15											
20											
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-102
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	42.5	**Auger ID/OD:**	5" Dia.
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	5/13/2021-5/14/2021	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+65.3, 9.5 ft Rt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:		**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☐		

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WOH = Weight of 140 lb. Hammer
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S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
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N-uncorrected = Raw Field SPT N-value
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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											
30								12.5		30.0 **Bottom of Exploration at 30.0 feet below ground surface.** NO REFUSAL	
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73

Location: St. George, Maine

Boring No.: HB-STG-103

WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	43.5	**Auger ID/OD:**	5" Dia.
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	5/13/2021-5/14/2021	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+57.2, 11.2 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:		**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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WOH = Weight of 140lb. Hammer
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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
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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.
0							SSA			Probe, similar soils as HB-STG-101.	
5											
10											
15											
20											
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-103
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	43.5	**Auger ID/OD:**	5" Dia.
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	N/A
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	5/13/2021-5/14/2021	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	12+57.2, 11.2 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed
Hammer Efficiency Factor:		**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☐		

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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											
30								13.5		30.0 **Bottom of Exploration at 30.0 feet below ground surface.** NO REFUSAL	
35											
40											
45											
50											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-104
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	42.8	**Auger ID/OD:**	5" Solid Stem
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	5/13/2021; 08:00-11:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	156+17.9, 9.5 ft Lt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	14.5 ft bgs.
Hammer Efficiency Factor: 0.89		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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N-uncorrected = Raw Field SPT N-value
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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							SSA	42.3		6" HMA. 0.5	
	1D	24/15	1.00 - 3.00	7/5/4/4	9	13				Brown, damp, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	G#340961 A-1-b, SM WC=6.5%
5	2D	24/10	5.00 - 7.00	3/3/6/4	9	13				Brown, damp, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	G#340962 A-1-b, SM WC=15.9%
10	3D	24/13	10.00 - 12.00	18/46/6/6	52	77				Brown, damp, very dense, fine to coarse SAND, some gravel, little silt, occasional cobbles, (Fill).	
								28.8		14.0	
15	4D	24/16	15.00 - 17.00	3/4/4/4	8	12	28			Brown, wet, medium dense, fine to coarse SAND, little gravel, little silt.	G#340963 A-1-b, SM WC=12.1%
							28				
							13				
							19				
							29	23.8		19.0	
20	5D/A	24/16	20.00 - 22.00	4/6/14/10	20	30	20			5D (20.0-21.0 ft bgs.) Grey, wet, very stiff, fine to coarse Sandy SILT, trace gravel.	G#340964 A-4, CL WC=28.2%
							44	21.8		21.0 5D/A (21.0-22.0 ft bgs.) Grey, wet, dense, fine to coarse SAND, some gravel, trace silt.	G#340965 A-1-b, SW-SM WC=12.6%
							22				
							20				
25							18	18.3		24.5	

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Boring No.: HB-STG-104

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Large Culvert Route 73
Location: St. George, Maine

Boring No.: HB-STG-104
WIN: 25515.00

Driller:	MaineDOT	**Elevation (ft.)**	42.8	**Auger ID/OD:**	5" Solid Stem
Operator:	Daggett/Jay	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	5/13/2021; 08:00-11:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	156+17.9, 9.5 ft Lt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	14.5 ft bgs.
Hammer Efficiency Factor: 0.89		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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RC = Roller Cone
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WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
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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.
25	6D MV	24/24	25.00 - 27.00 25.63 - 25.83	1/WOH/WOH/1 Would Not Push	1	1	OPEN HOLE			Grey, wet, very soft, Clayey SILT, trace to coarse fine sand, trace gravel. Failed 55x110 mm vane attempt.	G#340966 A-6, ML WC=34.0% LL=34 PL=21 PI=13
30	7D V1 V2	24/24	30.00 - 32.00 30.63 - 31.00 31.63 - 32.00	WOR/WOR/WOH/ WOH Su=402/156 psf Su=446/179 psf	---					Grey, wet, very soft, Clayey SILT, trace fine to coarse sand, trace gravel. 55x110 mm vane raw torque readings: V1: 9.0/3.5 ft-lbs V2: 10.0/4.0 ft-lbs	G#340967 A-6, ML WC=34.1% LL=32 PL=21 PI=11
35											
40	8D V3 MV	24/6	40.00 - 42.00 40.63 - 41.00 41.00 - 41.17	WOR/3/14/40 Su=491/112 psf Would Not Push	17	25		1.5 0.7		8D (40.0-41.3 ft bgs.) Grey, wet, very soft, Clayey SILT, trace fine to coarse sand, trace gravel. 55x110 mm vane raw torque readings: V3: 11.0/2.5 ft-lbs Failed 55x110 mm vane attempt. 41.3 8D (41.3-42.1 ft bgs.) Grey, wet, medium dense, fine to coarse SAND, little gravel, little silt. 42.1 **Bottom of Exploration at 42.1 feet below ground surface.** Spoon REFUSAL, good bounce.	
45											
50											

Remarks:

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.

Appendix B

Laboratory Test Results

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): St. George Work Number: 25515.00

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-STG-101, 1D	156+74.9	11.6 Rt.	1.0-3.0	340956	1	12.0			SM	A-2-4	II
HB-STG-101, 2D	156+74.9	11.6 Rt.	5.0-7.0	340957	1	11.2			SM	A-1-b	II
HB-STG-101, 4D	156+74.9	11.6 Rt.	15.0-17.0	340958	1	11.2			GP-GM	A-1-a	0
HB-STG-101, 5D	156+74.9	11.6 Rt.	20.0-22.0	340959	1	26.5			ML	A-4	IV
HB-STG-101, 6D	156+74.9	11.6 Rt.	25.0-27.0	340960	1	34.3	31	10	ML	A-4	IV
HB-STG-104, 1D	156+17.9	9.5 Lt.	1.0-3.0	340961	2	6.5			SM	A-1-b	II
HB-STG-104, 2D	156+17.9	9.5 Lt.	5.0-7.0	340962	2	15.9			SM	A-1-b	II
HB-STG-104, 4D	156+17.9	9.5 Lt.	15.0-17.0	340963	2	12.1			SM	A-1-b	II
HB-STG-104, 5D	156+17.9	9.5 Lt.	20.0-21.0	340964	3	28.2			CL	A-4	IV
HB-STG-104, 5D/A	156+17.9	9.5 Lt.	21.0-22.0	340965	3	12.6			SW-SM	A-1-b	0
HB-STG-104, 6D	156+17.9	9.5 Lt.	25.0-27.0	340966	3	34.0	34	13	ML	A-6	III
HB-STG-104, 7D	156+17.9	9.5 Lt.	30.0-32.0	340967	3	34.1	32	11	ML	A-6	IV

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.

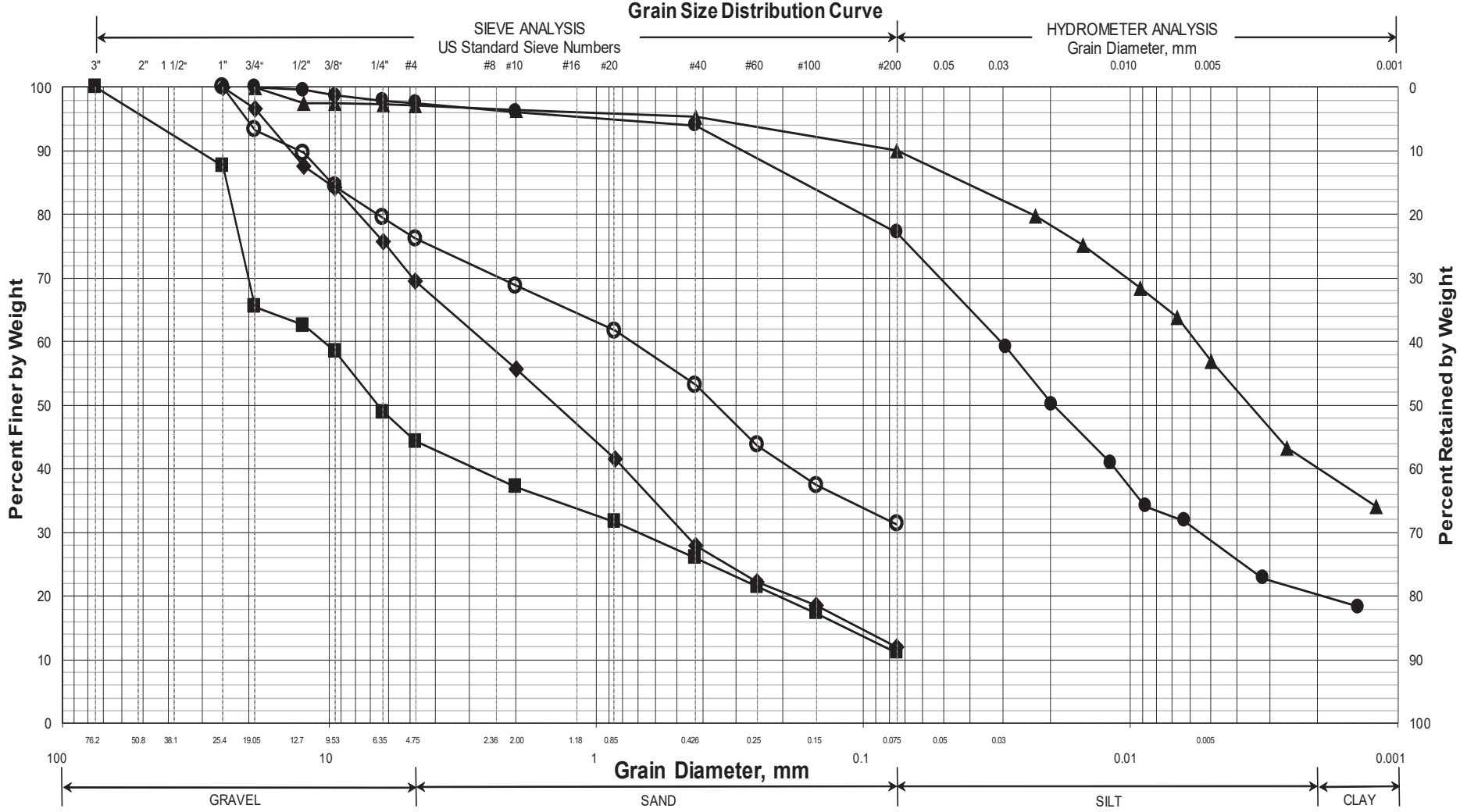
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

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

Maine Department of Transportation
Grain Size Distribution Curve



UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	WC, %	LL	PL	PI
○	HB-STG-101/1D	156+74.9	11.6 RT	1.0-3.0	SAND, some silt, some gravel.	12.0			
◆	HB-STG-101/2D	156+74.9	11.6 RT	5.0-7.0	SAND, some gravel, little silt.	11.2			
■	HB-STG-101/4D	156+74.9	11.6 RT	15.0-17.0	GRAVEL, some sand, little silt.	11.2			
●	HB-STG-101/5D	156+74.9	11.6 RT	20.0-22.0	SILT, little sand, little clay, trace gravel.	26.5			
▲	HB-STG-101/6D	156+74.9	11.6 RT	25.0-27.0	Clayey SILT, trace sand, trace gravel.	34.3	31	21	10
×									

WIN
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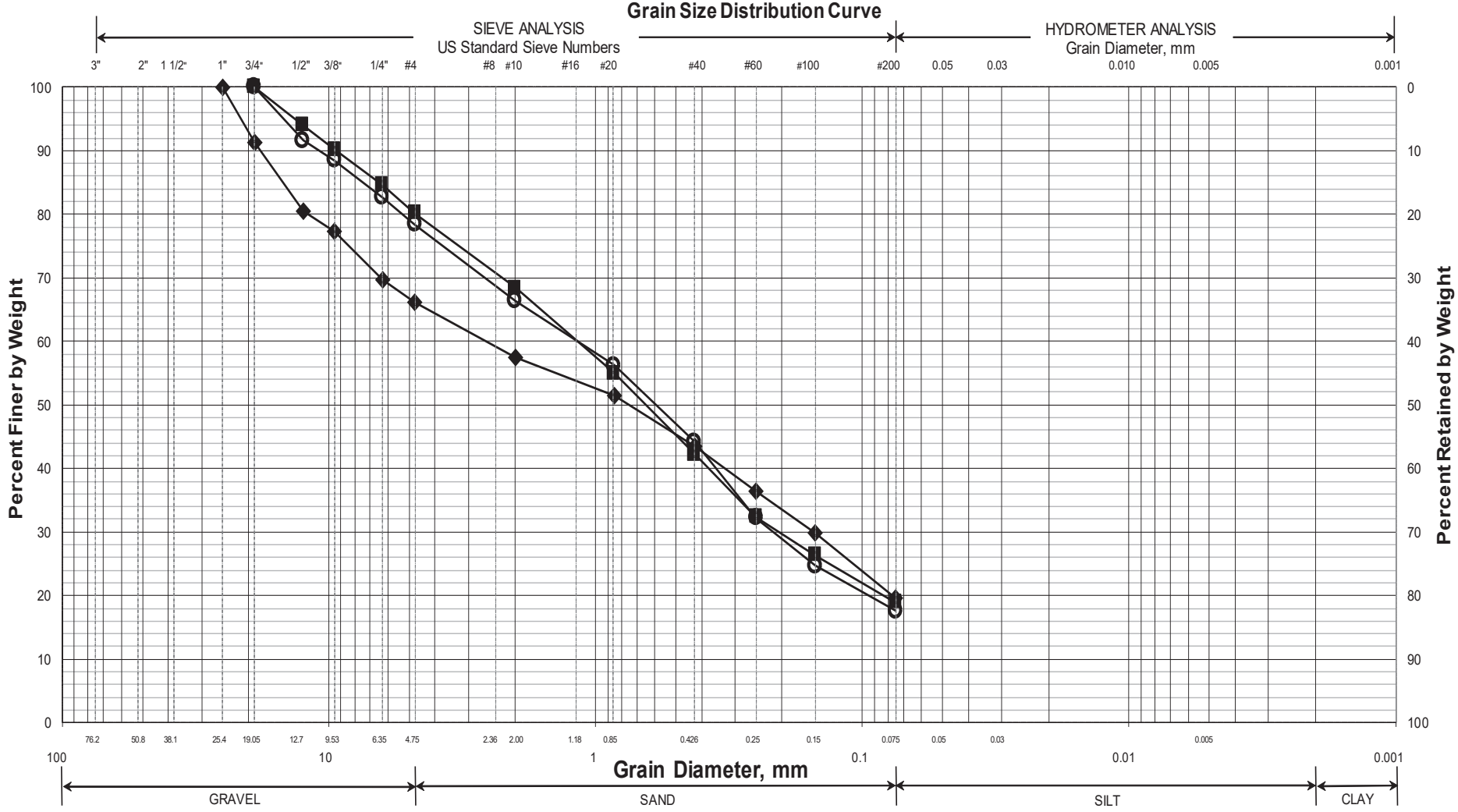
Town
Saint George
Reported by/Date
WHITE, TERRY A 11/14/2022

Maine Department of Transportation
Grain Size Distribution Curve



UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	WC, %	LL	PL	PI
○	HB-STG-104/1D	156+17.9	9.5 LT	1.0-3.0	SAND, some gravel, little silt.	6.5			
◆	HB-STG-104/2D	156+17.9	9.5 LT	5.0-7.0	SAND, some gravel, little silt.	15.9			
■	HB-STG-104/4D	156+17.9	9.5 LT	15.0-17.0	SAND, little gravel, little silt.	12.1			
●									
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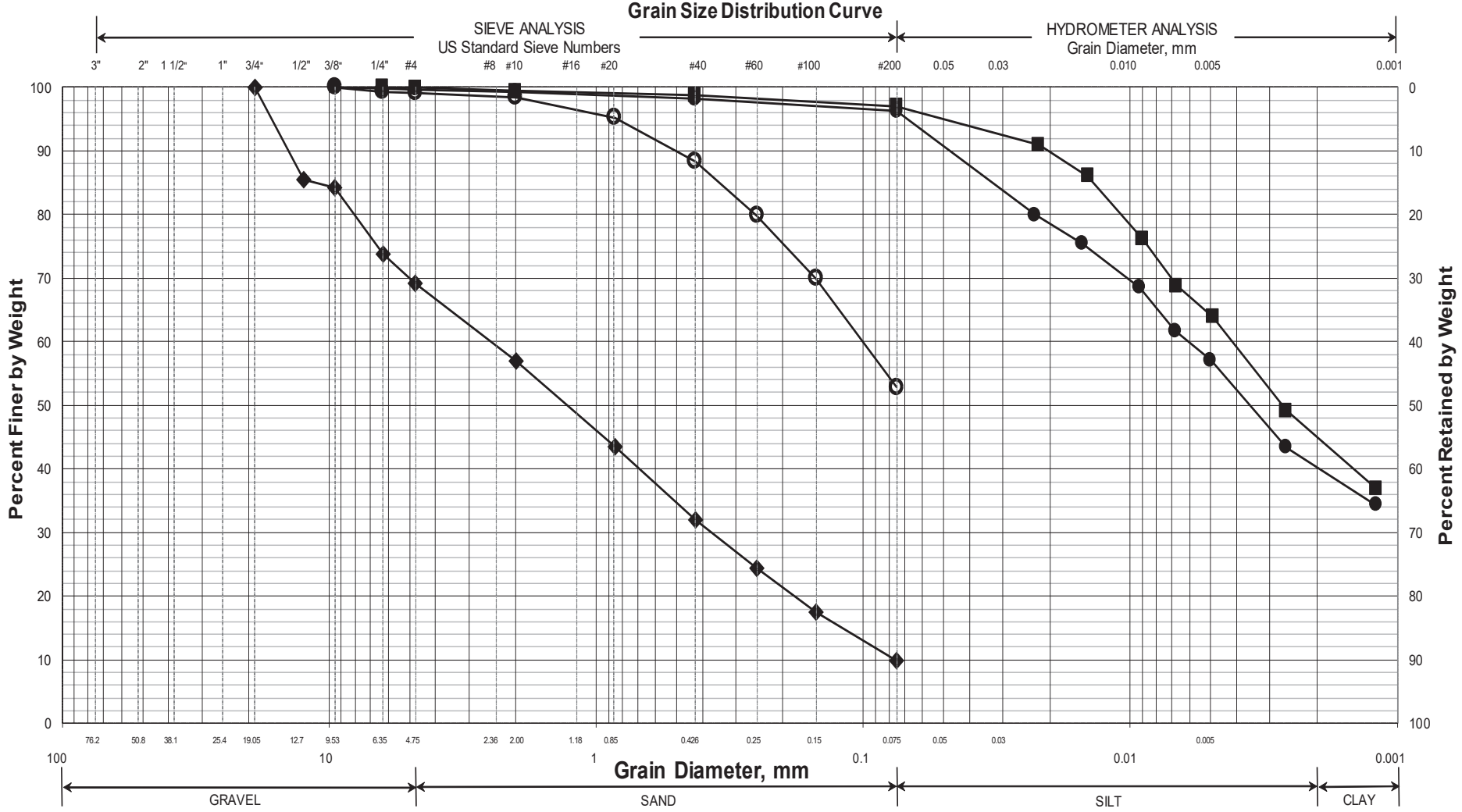
Town
Saint George
Reported by/Date
WHITE, TERRY A 11/14/2022

SHEET 2

Maine Department of Transportation
Grain Size Distribution Curve



UNIFIED CLASSIFICATION

	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	WC, %	LL	PL	PI
○	HB-STG-104/5D	156+17.9	9.5 LT	20.0-21.0	Sandy SILT, trace gravel.	28.2			
◆	HB-STG-104/5DA	156+17.9	9.5 LT	21.0-22.0	SAND, some gravel, trace silt.	12.6			
■	HB-STG-104/6D	156+17.9	9.5 LT	25.0-27.0	Clayey SILT, trace sand, trace gravel.	34.0	34	21	13
●	HB-STG-104/7D	156+17.9	9.5 LT	30.0-32.0	Clayey SILT, trace sand, trace gravel.	34.1	32	21	11
▲									
×									

WIN
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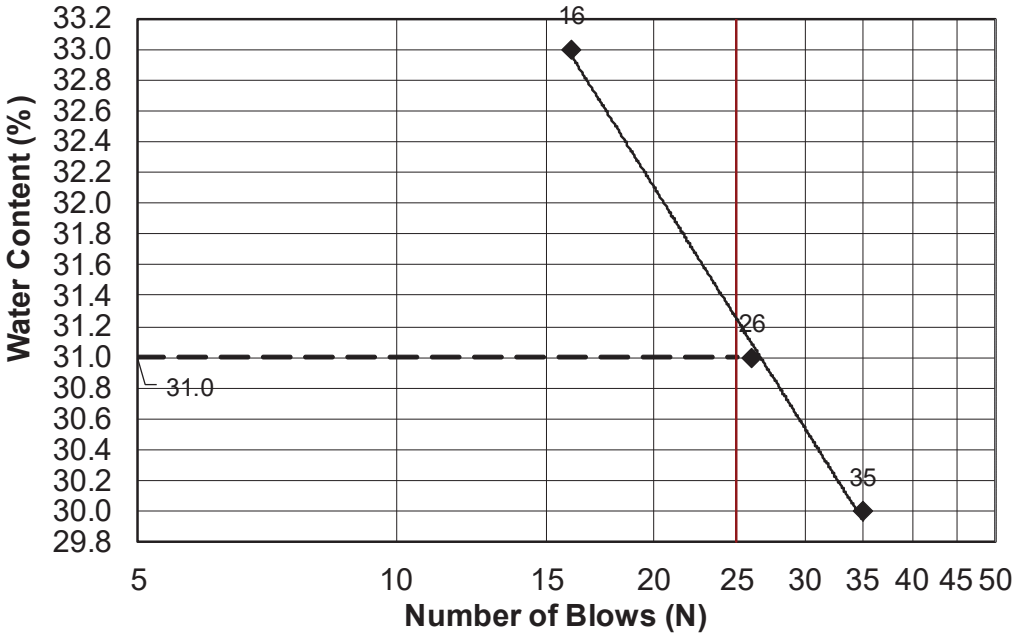
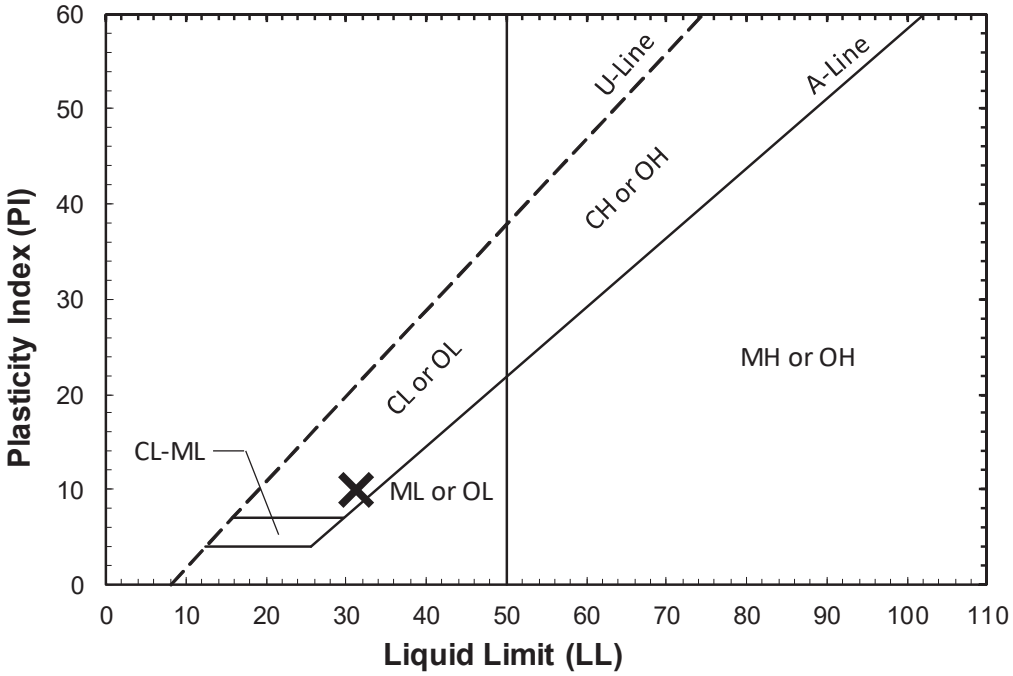
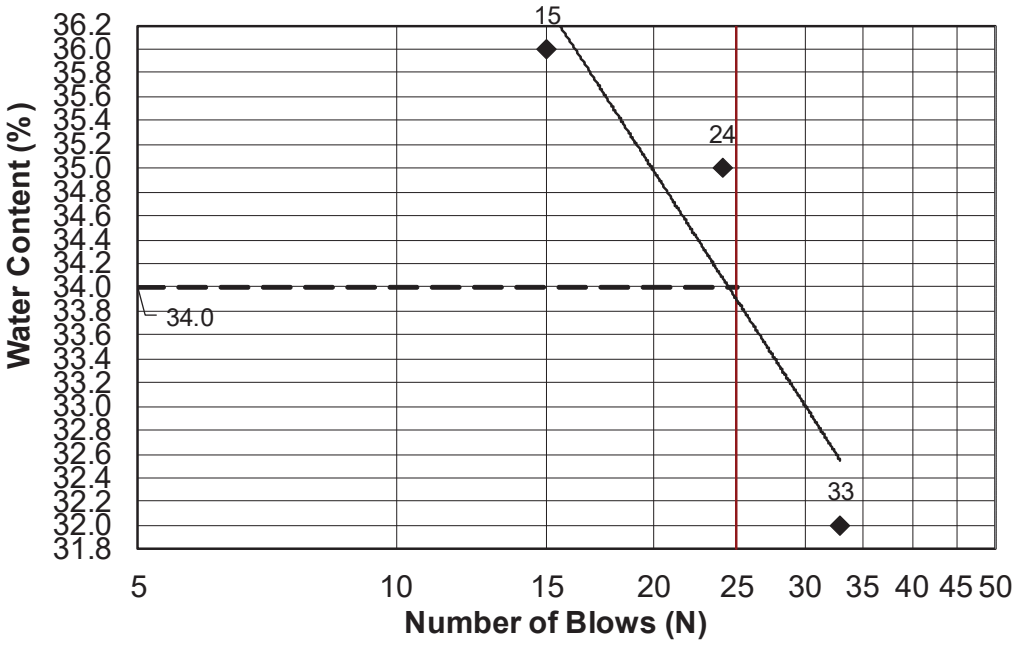
Town
Saint George
Reported by/Date
WHITE, TERRY A 11/14/2022

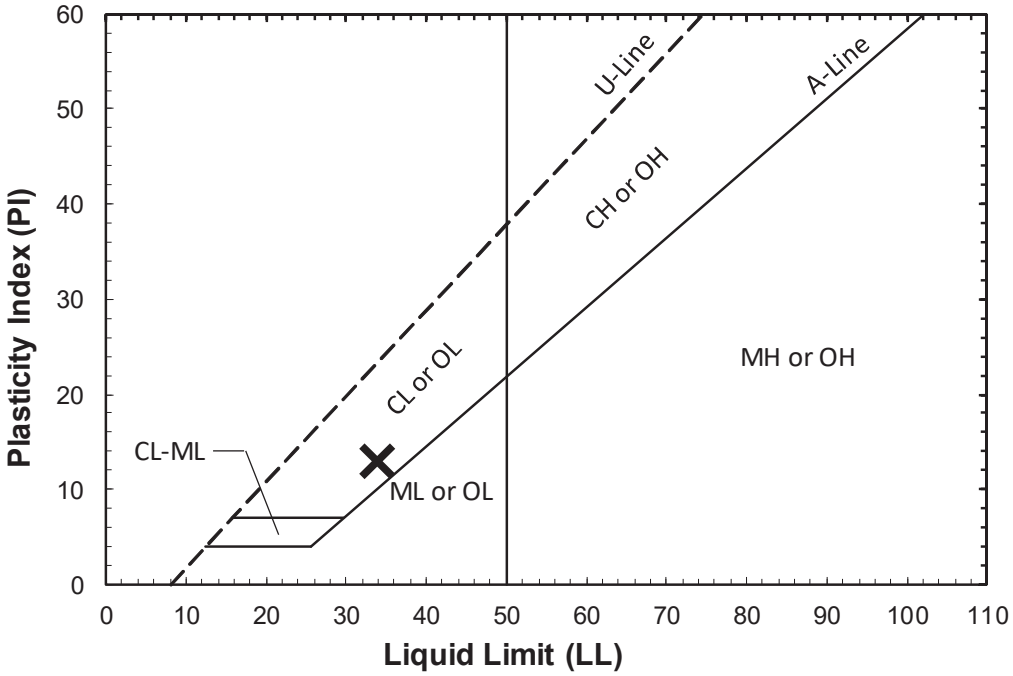
TOWN	Saint George	Reference No.	340960
WIN	025515.00	Water Content, %	34.3
Sampled	5/12/2021	Liquid Limit @ 25 blows (T 89), %	31
Boring No./Sample No.	HB-STG-101/6D	Plastic Limit (T 90), %	21
Station	156+74.9	Plasticity Index (T 90), %	10
Depth	25.0-27.0	Tested By	BBURR



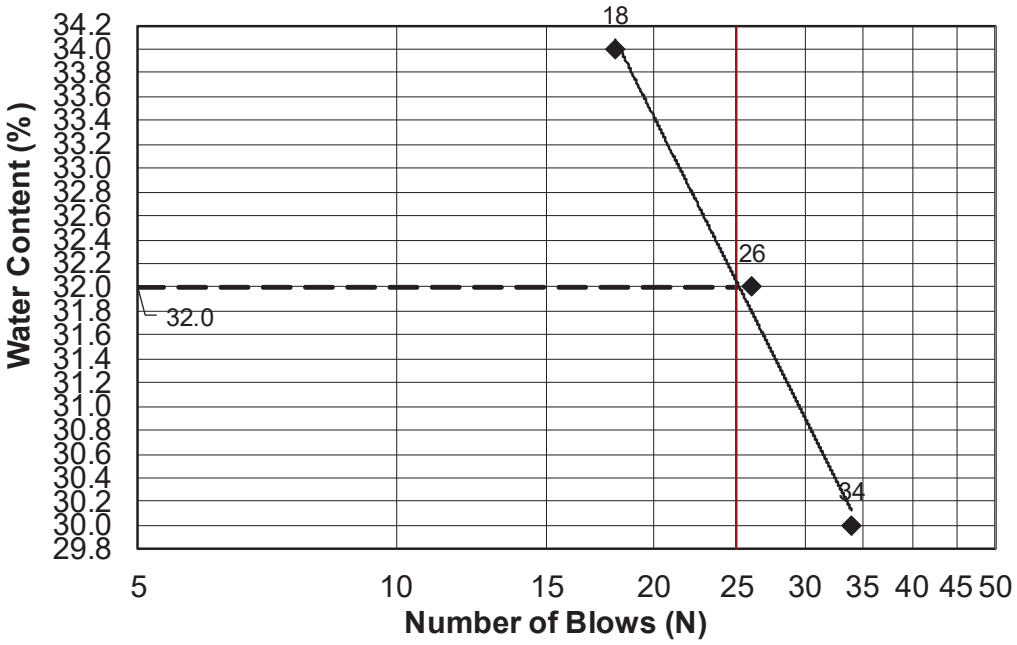


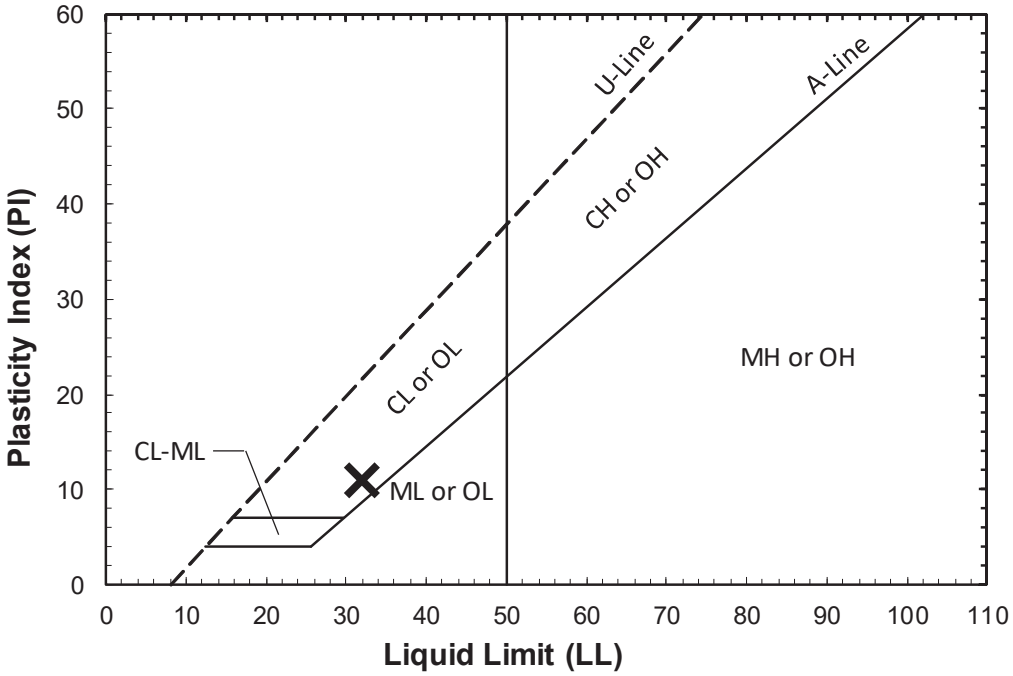
TOWN	Saint George	Reference No.	340966
WIN	025515.00	Water Content, %	34
Sampled	5/13/2021	Liquid Limit @ 25 blows (T 89), %	34
Boring No./Sample No.	HB-STG-104/6D	Plastic Limit (T 90), %	21
Station	156+17.9	Plasticity Index (T 90), %	13
Depth	25.0-27.0	Tested By	BBURR





TOWN	Saint George	Reference No.	340967
WIN	025515.00	Water Content, %	34.1
Sampled	5/13/2021	Liquid Limit @ 25 blows (T 89), %	32
Boring No./Sample No.	HB-STG-104/7D	Plastic Limit (T 90), %	21
Station	156+17.9	Plasticity Index (T 90), %	11
Depth	30.0-32.0	Tested By	BBURR





Appendix C

Special Provision 620 – Geotextiles (Reinforcement Geogrid)

SPECIAL PROVISION
SECTION 620 – GEOTEXTILES
(Reinforcement Geogrid)

Amend Standard Specification 620 – GEOTEXTILES to include the following:

620.01 Description This work shall consist of furnishing and installing Reinforcement Geogrid within the Culvert Bedding Stone in accordance with these specifications and in reasonably close conformity with the lines, grades, and dimensions shown on the plans or as directed by the Resident.

620.02 Material Reinforcement Geogrid shall consist of a regular network of integrally connected, polymeric tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate or other material. The Reinforcement Geogrid structure shall be dimensionally stable to retain its geometry under construction stresses and shall have high resistance to damage during construction, ultraviolet degradation, and all forms of chemical and biological degradation encountered in the soil being reinforced.

The Reinforcement Geogrid shall meet or exceed the Minimum Average Roll Values (MARV) of the properties in Table 1. Acceptable manufacturers for Reinforcement Geogrids must be approved by the Resident.

Table 1 - Physical Property Requirements
(Biaxial Reinforcement Geogrid)

Reinforcement Geogrid Mechanical Property	Test Method	Minimum Average Roll Value (MARV)[1]
Tensile strength at 5% Strain MD or XD	ASTM D 6637	1,200 lb/ft
Rib Junction Strength	GRI-GG2	1,000 lb/ft in both directions
Aperture Openings		Between 0.75 and 3 inches
Percent Open Area		50 to 80%

[1] Values are minimum average roll values determined in accordance with ASTM D 4759

A biaxial Reinforcement Geogrid shall be used in this application.

620.03 Placement Reinforcement Geogrid shall be installed, in accordance with the manufacturer's recommendations, unless otherwise modified by this Special Provision. The Reinforcement Geogrid shall be placed within the layers of Crushed Stone Bedding at the proper elevation and alignment as shown on the Plans or as directed by the Resident.

1. The Reinforcement Geogrid shall be placed in continuous longitudinal strips. Splicing along the length will not be allowed. Reinforcement Geogrid shall be oriented such that the roll length runs either parallel or perpendicular to the construction centerline. The Contractor shall verify correct orientation of the Reinforcement Geogrid.

2. Reinforcement Geogrid may be temporarily secured in-place with staples, pins, sand bags or backfill as required by fill properties, fill placement procedures, or weather conditions, or as directed by the Resident.

3. Coverage of less than 100 percent shall not be allowed.

4. The Reinforcement Geogrid shall be lightly anchored and pulled taut to reduce any slack as directed by the Resident.

5. Fill shall not be dumped directly onto the Reinforcement Geogrid. It shall be dumped at the edge of the Reinforcement Geogrid or on a previous course of fill with a minimum compacted depth of 8 inches.

6. The Reinforcement Geogrid shall be covered with fill materials within 7 days of placement to protect against unnecessary exposure.

7. Fill may then be pushed onto the Reinforcement Geogrid using a track mounted bulldozer. At no time shall construction equipment be allowed directly onto the Reinforcement Geogrid. Track mounted equipment shall be allowed on previous courses of fill with a minimum compacted depth of 8 inches. Smooth drum roller compaction equipment shall be allowed on previous courses of fill with a minimum compacted depth of 8 inches and spread fill with a minimum depth of 12 inches, loose measure. At no time shall rubber tired or sheeps-foot rollers be allowed onto the reinforced fill. Turning of vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the Reinforcement Geogrid. Sudden breaking and sharp turning shall be avoided. Equipment speeds over 10 MPH shall not be allowed.

8. Placement, spreading, and compaction of soil on top of the Reinforcement Geogrid shall advance from one end of the Reinforcement Geogrid and move towards the other. Care shall be taken to minimize the development of wrinkles and to ensure that the Reinforcement Geogrid doesn't move from its position during fill placement. A spotter shall observe all fill placement operations to ensure the Reinforcement Geogrid does not slip, achieves the minimum coverage specified on the Plans, and is not damaged by the work.

9. Fill shall be compacted as specified in (1) the Standard Specifications or (2) to at least 90 percent of the maximum dry density determined in accordance with AASHTO T-180, whichever is greater. Density testing shall be made at a minimum frequency of one (1) test per lift or as otherwise specified in the Standard Specifications. Care shall be taken not to drive test apparatus through the Reinforcement Geogrid tensile elements.

10. All rutting formed during construction shall be filled with new Culvert Bedding Stone. In no case shall rutting be filled by blading down

620.04 Overlap Adjacent rolls of Reinforcement Geogrid shall be overlapped a minimum of 1 foot.

620.05 Seams Seams along adjacent lengths of Reinforcement Geogrid shall be tied together with hog rings or cable ties every 3 to 6 feet.

620.06 Certification Prior to construction the Contractor shall submit to the Resident the Manufacturer’s certification that the Reinforcement Geogrid supplied has been evaluated in full compliance with this Specification and is fit for long-term, critical soil reinforcement applications.

The Contractor's submittal package shall include, but not be limited to, actual tests for tension/creep, durability/aging, construction damage, and quality control tensile testing.

620.08 Shipment, Storage, Protection, and Repair of Fabric The Contractor shall check the Reinforcement Geogrid upon delivery to ensure that the proper material has been received. Each Reinforcement Geogrid roll shall be shipped in a protective bag and clearly marked with roll number, lot number, geogrid style and principle strength direction. During all periods of shipment and storage, the Reinforcement Geogrid shall be protected from temperatures greater than 140°F and all deleterious materials that might otherwise become affixed to the Reinforcement Geogrid and effect its performance. The manufacturer's recommendations shall be followed with regard to protection from direct sunlight. The Reinforcement Geogrid shall be stored off the ground in a clean, dry environment out of the pathway of construction equipment.

Any Reinforcement Geogrid damage shall be repaired or replaced in accordance with the manufacturer's recommendations. The Contractor shall replace any Reinforcement Geogrid damaged during installation at no additional cost to the Department.

620.09 Method of Measurement Reinforcement Geogrid will be measured by the number of Square Yards of surface area installed. Overlaps for connections, splices, patches, and repairs of damaged Reinforcement Geogrid, etc. are incidental to this Pay Item.

620.10 Basis of Payment Reinforcement Geogrid placement will be paid for per Square Yard in-place which shall be full compensation for all off-loading, inspection, storage, labor, materials, equipment, tools and any incidentals to complete the installation.

Payment will be made under:

Pay Item	Pay Unit
620.65 Reinforcement Geogrid	Square Yard