

**MAINE DEPARTMENT OF TRANSPORTATION  
HIGHWAY/BRIDGE PROGRAM  
GEOTECHNICAL SECTION  
AUGUSTA, MAINE**

**GEOTECHNICAL DESIGN REPORT**

*For the Construction of:*

**LARGE CULVERT REPLACEMENT  
ROUTE 131  
SAINT GEORGE, MAINE**

*Prepared by:*  
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Knox County  
WIN 19267.00

Soils Report No. 2013-130

September 16, 2013

## GEOTECHNICAL DESIGN SUMMARY

The purpose of this report is to present subsurface information and make geotechnical recommendations for the replacement of a five-foot diameter corrugated metal pipe which carries an unnamed tributary under Route 131 at the intersection of Route 131 and School Street in Saint George. This is a tidal stream. Route 131 is a Priority 4 Highway Corridor. The proposed replacement structure will be seven-foot diameter concrete pipe culvert. No changes to the horizontal or vertical alignment of the roadway are proposed. The new structure will be 68-feet wide with eleven foot lanes and four foot shoulders. Side slopes at the culvert ends will be riprap covered, with a maximum slope of 1H:1V. Quarried stones at the existing culvert ends would work well for this treatment.

**Subsurface Investigation** – One boring and two probes were drilled for this project on January 23 and 24, 2013 by the MaineDOT drill crew. One boring was drilled using a solid stem auger with Standard Penetration Tests and split-spoon sampling. An additional two probes were drilled using solid stem augers to investigate depth to bedrock. Borings were drilled in the following locations:

<u>Boring</u>	<u>Station and Offset</u>
SB-STG-101	6+38.4, 21.1 Left
SB-STG-102	6+11.4, 19.9 Left
SB-STG-103	6+10.9, 13.0 Right

Boring logs are included in this report as Appendix A – Boring Logs.

**Subsurface Conditions** – Subsurface conditions found in the boring included a layer of fill soils overlying layers of native soils.

Fill – Fill soils consisted of brown, damp, gravelly fine to coarse sand with little silt. The Fill thickness was approximately 3-feet in boring SB-STG-101. No Standard Penetration Tests were done in the fill stratum.

Native Soils – Native sandy soils was encountered beneath the fill in boring SB-STG-101 below a depth of 3-feet. Native soils in this boring consist of brown, wet, loose fine to coarse sand with little gravel and little silt. The corrected SPT N-value in the fill was 3 blows per foot between the depths of 4.5-feet to 6.5 feet, which indicates that the fill is very loose. The Surficial Geology Map of the Tenants Harbor Quadrangle by Maine Geologic Survey shows Till soils in this area, with shallow bedrock on the eastern side of the inlet.

Bedrock – Shallow bedrock was encountered in all borings, and outcrops are visible in the streambed and on surrounding properties. Bedrock refusal was encountered at a depth of 6.6-feet below ground surface (bgs)

in SB-STG-101, at a depth of 11.5-feet bgs in SB-STG-102 and at a depth of 12.6-feet bgs in SB-STG-103. No geophysics was done at this site and trends in bedrock elevations are not known. A rock core taken at Station 6+38, 21 feet Left showed the bedrock to be white, salt and pepper grained Granite with RQD of 95%.

Groundwater – Groundwater was observed at a depth of 4.2 feet bgs in boring SB-STG-101. This was at approximate streambed elevation. Groundwater levels surrounding the stream may fluctuate seasonally depending on precipitation, although the stream is tidal.

**Scour and Riprap** – Plain riprap inlet and outlet aprons shall be constructed to minimize future scour at this structure. Riprap conforming to Standard Specifications 610 and 703 shall be placed at as flat a slope as is practicable at this site.

**Construction Considerations** – It is anticipated that bedrock may be encountered at or above culvert subgrade. Any bedrock knobs should be overexcavated to allow a bedding layer of granular material meeting the requirements of Standard Specification 703.19, Material for Underwater Backfill.

If large boulders are encountered within the construction limits for this project, the boulders must be removed and the excavation backfilled with granular borrow or soils from the surrounding excavation, similar to soils at the same depth within the excavation. Very large stones should not be used as part of the backfill for this construction. If pockets of silt exist within the native soils, the soils could become difficult to work with when wet. Surface water should be controlled to allow the Contractor to maintain the integrity of excavated slopes during construction.

## **Attachments**

### **Sheets**

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Sheet 1 - Location Map

Sheet 2 – GeoPlan and Cross Section

### **Appendices**

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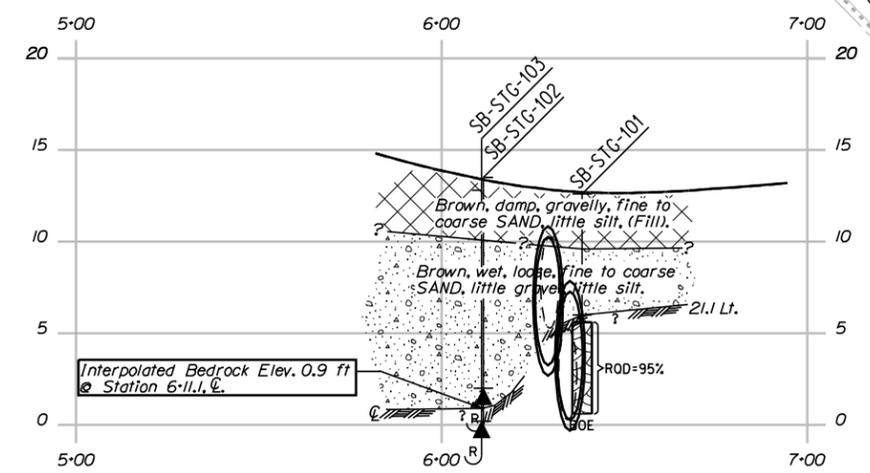
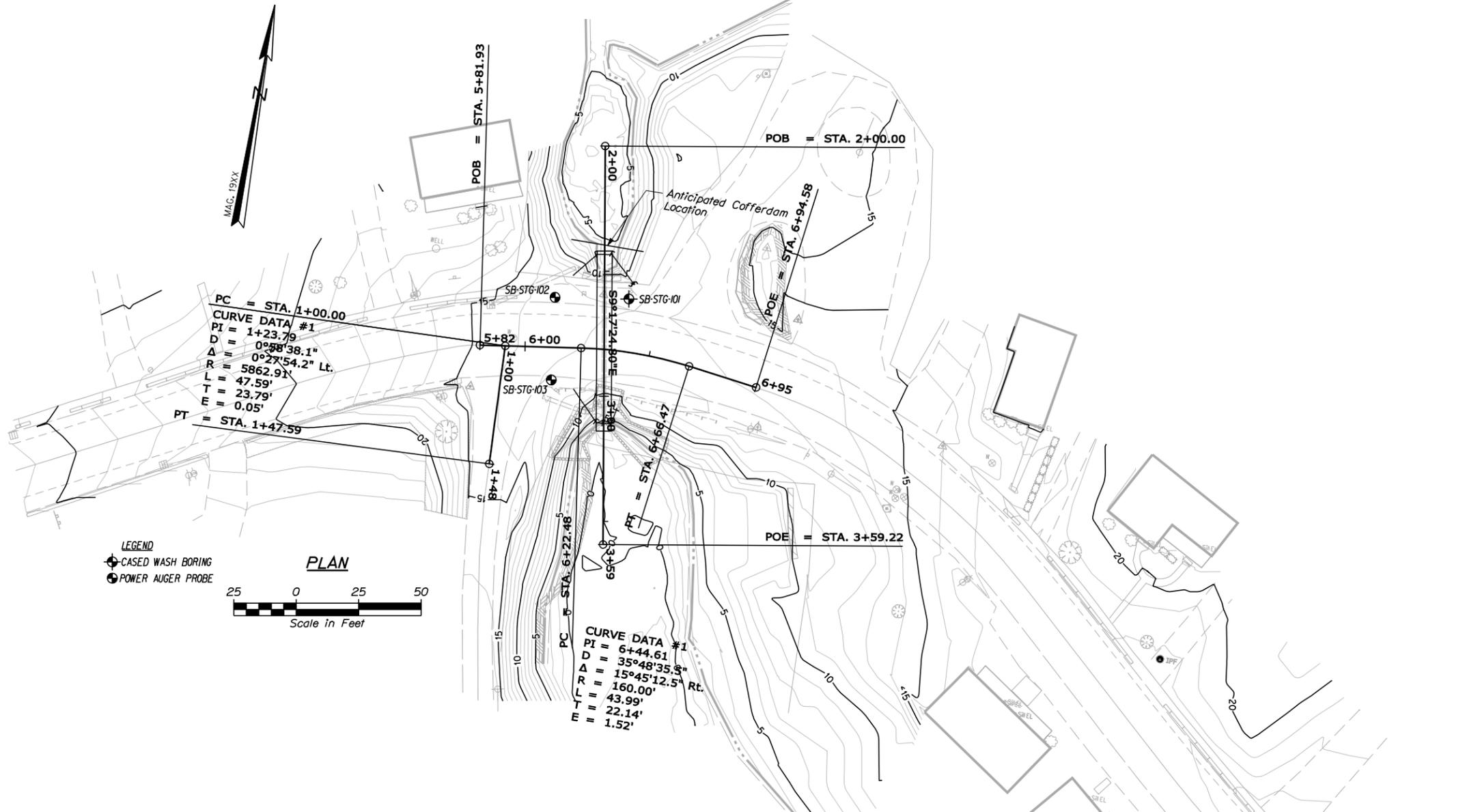
Appendix A - Boring Logs



**Location Map**  
Route 131 Strut Replacement  
St. George (Tenants Harbor)  
Knox County  
WIN 19267.00  
USGS 7.5' Series Topographic  
Tenants Harbor Quadrangle  
DeLORME Map 8 Grid B2

**Map Scale 1:24000**

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. Road names used on this map may not match official road names.



R1: Bedrock: White-salt and pepper, fine grained (1 to 3mm and coarser at bottom of the core 2 to 5 mm) GRANITE (Feldspar, Quartz and Biotite with accessory Garnet) with pink staining near a coarse grained layer in the middle of the core. The four breaks and sub-horizontal and irregular. There is also a sub-vertical open but not separated joint near the bottom of the core. One segment was 1' long, one about 5', one 13' and one 40' long.

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 transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

STATE OF MAINE		DEPARTMENT OF TRANSPORTATION	
019267.00		WIN 19267.00 HIGHWAY PLANS	
PROJ. MANAGER	BY	DATE	SIGNATURE
CHECKED-REVIEWED	T. WHITE	AUG. 2013	
DESIGNS-DETAILED	K. BRESKIN		P.E. NUMBER
DESIGNS-DETAILED			DATE
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			
ST. GEORGE		ROUTE 131 STRUT	
GEOPLANS & INTERPRETIVE		SUBSURFACE PROFILE	
SHEET NUMBER		2	
OF 3			

Route 131 Strut  
Unnamed Stream  
Saint George, Maine  
WIN 19267.00

## **Appendix A Boring Logs**

Driller: MaineDOT	Elevation (ft.): 12.6	Auger ID/OD: 5" Solid Stem
Operator: Enos/Giles	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: B. Wilder	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 1/23/2013-1/24/2013	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 6+38.4, 21.1 ft Lt.	Casing ID/OD: HW	Water Level*: 4.2 ft bgs.

**Hammer Efficiency Factor:** 0.756      **Hammer Type:** Automatic  Hydraulic  Rope & Cathead

Definitions:  
D = Split Spoon Sample      R = Rock Core Sample      S<sub>u</sub> = Insitu Field Vane Shear Strength (psf)      S<sub>u(lab)</sub> = Lab Vane Shear Strength (psf)  
MD = Unsuccessful Split Spoon Sample attempt      SSA = Solid Stem Auger      T<sub>v</sub> = Pocket Torvane Shear Strength (psf)      WC = water content, percent  
U = Thin Wall Tube Sample      HSA = Hollow Stem Auger      q<sub>p</sub> = Unconfined Compressive Strength (ksf)      LL = Liquid Limit  
MU = Unsuccessful Thin Wall Tube Sample attempt      RC = Roller Cone      N-uncorrected = Raw field SPT N-value      PL = Plastic Limit  
V = Insitu Vane Shear Test, PP = Pocket Penetrometer      WOH = weight of 140lb. hammer      Hammer Efficiency Factor = Annual Calibration Value      PI = Plasticity Index  
MV = Unsuccessful Insitu Vane Shear Test attempt      WOR/C = weight of rods or casing      N<sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency      G = Grain Size Analysis  
WO1P = Weight of one person      N<sub>60</sub> = (Hammer Efficiency Factor/60%)\*N-uncorrected      C = Consolidation Test

Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N <sub>60</sub>	Casing Blows					
0											Brown, damp, gravelly, fine to coarse SAND, little silt, (Fill).	
5	1D	24/10	4.50 - 6.50	WOH/WOH/2/15	2	3			9.60		Brown, wet, loose, fine to coarse SAND, little gravel, little silt.	
									6.00		Roller Coned ahead from 6.5-7.0 ft bgs.	
	R1	60/60	7.00 - 12.00	RQD = 95%					5.60		Top of Bedrock at Elev. 6.0 ft.	
10											R1: White - salt and pepper fine grained (1 to 3 mm and coarser at the bottom of the core, 2 to 5 mm) Granite (Feldspar, Quartz and Biotite with accessory Garnet) and pink staining near a coarse grained layer in the middle of the core. The four breaks are sub-horizontal and irregular. there is also a sub-vertical open but not separated joint near the bottom of the core. One segment was 1" long, one about 5", one was 13" and one was 40" long.	
									0.60		R1: Core Times (min:sec) 7.0-8.0 ft (3:25) 8.0-9.0 ft (2:40) 9.0-10.0 ft (2:30) 10.0-11.0 ft (2:30) 11.0-12.0 ft (2:15) 100% Recovery	
15											<b>Bottom of Exploration at 12.00 feet below ground surface.</b>	
20												
25												

**Remarks:**

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 13.5	<b>Auger ID/OD:</b> 5" Solid Stem
<b>Operator:</b> Enos/Giles	<b>Datum:</b> NAVD88	<b>Sampler:</b> N/A
<b>Logged By:</b> B. Wilder	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> N/A
<b>Date Start/Finish:</b> 1/23/2013-1/23/2013	<b>Drilling Method:</b> Power Auger Probe	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 6+11.4, 19.9 ft Lt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> None Observed

**Hammer Efficiency Factor:** \_\_\_\_\_ **Hammer Type:** Automatic  Hydraulic  Rope & Cathead

Definitions: R = Rock Core Sample      S<sub>u</sub> = Insitu Field Vane Shear Strength (psf)      S<sub>u(lab)</sub> = Lab Vane Shear Strength (psf)  
 D = Split Spoon Sample      SSA = Solid Stem Auger      T<sub>v</sub> = Pocket Torvane Shear Strength (psf)      WC = water content, percent  
 MD = Unsuccessful Split Spoon Sample attempt      HSA = Hollow Stem Auger      q<sub>p</sub> = Unconfined Compressive Strength (ksf)      LL = Liquid Limit  
 U = Thin Wall Tube Sample      RC = Roller Cone      N-uncorrected = Raw field SPT N-value      PL = Plastic Limit  
 MU = Unsuccessful Thin Wall Tube Sample attempt      WOH = weight of 140lb. hammer      Hammer Efficiency Factor = Annual Calibration Value      PI = Plasticity Index  
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer      WOR/C = weight of rods or casing      N<sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency      G = Grain Size Analysis  
 MV = Unsuccessful Insitu Vane Shear Test attempt      WO1P = Weight of one person      N<sub>60</sub> = (Hammer Efficiency Factor/60%)\*N-uncorrected      C = Consolidation Test

Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N <sub>60</sub>	Casing Blows					
0											Similar soils to SB-STG-101.	
5												
10												
11.50									2.00		Bottom of Exploration at 11.50 feet below ground surface. REFUSAL	
15												
20												
25												

**Remarks:**

Driller: MaineDOT	Elevation (ft.): 12.8	Auger ID/OD: 5" Solid Stem
Operator: Enos/Giles	Datum: NAVD88	Sampler: N/A
Logged By: B. Wilder	Rig Type: CME 45C	Hammer Wt./Fall: N/A
Date Start/Finish: 1/23/2013-1/23/2013	Drilling Method: Power Auger Probe	Core Barrel: N/A
Boring Location: 6+10.9, 13.0 ft Rt.	Casing ID/OD: N/A	Water Level*: None Observed

**Hammer Efficiency Factor:** \_\_\_\_\_ **Hammer Type:** Automatic  Hydraulic  Rope & Cathead

Definitions: R = Rock Core Sample      S<sub>u</sub> = Insitu Field Vane Shear Strength (psf)      S<sub>u(lab)</sub> = Lab Vane Shear Strength (psf)  
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Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N <sub>60</sub>	Casing Blows					
0											Similar soils to SB-STG-101.	
5												
10												
12.60									0.20		Bottom of Exploration at 12.60 feet below ground surface. REFUSAL	
15												
20												
25												

**Remarks:**