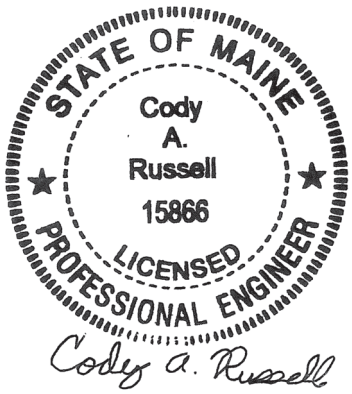
MAINE DEPARTMENT OF TRANSPORTATION
HIGHWAY PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN REPORT

For the Rehabilitation of:

LARGE CULVERT #770402
ROUTE 161
ST. JOHN PLANTATION, MAINE

Prepared by:
Cody Russell, P.E.
Geotechnical Engineer



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

Aroostook County
WIN 25409.00

Soils Report 2022-15
June 8, 2022

PROJECT DETAILS

The purpose of this Geotechnical Design Report is to present subsurface information and make geotechnical design and construction recommendations for the rehabilitation of an existing 96-inch span by 48-inch rise by 110-foot-long concrete box culvert (Large Culvert #770402) on Route 161 in St. John Plantation. The inlet end of the structure is failing, leading to water infiltration, soil migrations, and settlement of the roadway shoulder. The culvert is located approximately 0.84 of a mile east of Jalbert Road as shown on the attached Location Map. Route 161 is a Highway Corridor Priority 3 road.

The rehabilitation of the existing structure will consist of a 63-inch span by 43-inch rise by 130-foot-long pipe arch slipline and the installation of a 60-inch diameter, 120-foot-long overflow Option III Pipe culvert on a skew of approximately 11.7 degrees to the roadway centerline. The invert of the proposed overflow culvert is approximately 12 feet below the existing road grade at the roadway centerline. The roadway embankment slopes at the proposed overflow culvert inlet and outlet shall be no steeper than 2H:1V on the inlet end and no steeper than 1.5H:1V with 4 feet of heavy riprap armor to protect against erosion.

SUBSURFACE INVESTIGATION

One (1) boring (HB-STJ-101) and one (1) probe (HB-STJ-102) were drilled for this project on August 4, 2021 by the MaineDOT drill crew using a trailer mounted drill rig. Exploration locations are shown on the attached Boring Location Plan & Interpretive Subsurface Profile. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are shown on the attached boring logs.

Boring HB-STJ-101 was drilled using solid stem auger, cased wash boring, and open hole drilling techniques. Probe HB-STJ-102 was drilling using solid stem auger drilling techniques. Soil samples were obtained in boring HB-STJ-101 at 5-foot intervals using Standard Penetration Test (SPT) methods. No soils samples were obtained in probe HB-STJ-102. 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.

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 borings 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 four (4) standard grain size analyses with natural water content, one (1) 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 Curves.

SUBSURFACE CONDITIONS

Subsurface conditions encountered at the test boring generally consisted of fill sand underlain by glacial till consisting of silt. An interpretive subsurface profile depicting the generalized soil stratigraphy at the boring location is shown on the attached Boring Location Plan & Interpretive Subsurface Profile.

Boring HB-STJ-101 was drilled to a depth of approximately 32.0 feet below ground surface (bgs) and did not encounter a refusal surface. Probe HB-STJ-102 was drilled to a depth of approximately 30.5 feet bgs and did not encounter a refusal surface.

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

Approx. Depth BGS[1] (feet)	Soil Description	AASHTO[2] Classification	USCS[3]	WC%[4]
0.0 – 0.6	Pavement			
0.6 – 18.0	Fill: Brown, olive brown, and grey, damp to wet, fine to coarse SAND, little to some gravel, little to some silt.	A-1-b or A-2-4	SW-SM or SM	5.0 to 17.7
18.0 – 32.0	Glacial Till: Grey, wet, silt, some fine to coarse sand, some clay, little gravel.	A-4	CL	10.1

[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

Corrected N-values obtained in the fill ranged from 12 to 27 blows per foot (bpf) indicating that the fill is medium dense in consistency. Corrected N-values obtained in the glacial till ranged from 31 to 56 bpf indicating that the glacial till is hard in consistency.

Groundwater was recorded at a depth of approximately 19.0 feet bgs in boring HB-STJ-101. Groundwater was not recorded in probe HB-STJ-102. Groundwater levels can be expected to fluctuate subject to seasonal variations, local soil conditions, topography, precipitation, and construction activity.

GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

Option III Pipe Construction – The proposed overflow structure will be a 60-inch diameter, 120-foot-long overflow Option III Pipe culvert on a skew of approximately 11.7 degrees to the roadway centerline. The proposed overflow culvert shall be furnished and installed in accordance with MaineDOT Standard Specification 603.

The invert of the proposed overflow culvert pipe ranges from approximately 543.00 feet at the inlet end to approximately 540.00 feet at the outlet end with a 2.5% slope. 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 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.

The full nature of the culvert bearing surface will not become evident until the culvert excavation is made. Any cobbles or boulders in excess of 6 inches encountered at the bedding elevation shall be removed and replaced with compacted Granular Borrow Material for Underwater Backfill or Crushed Stone ¾-Inch. Any disturbed soils at the bedding elevation resulting from excavation activities should be removed by hand prior to placement of the bedding material. 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.

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 Option III Pipe 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 proposed Option III Pipe culvert shall be protected against scour with riprap conforming to MaineDOT Standard Specification Section 703.28 Heavy Riprap. Slopes shall be no steeper than 2H:1V on the inlet end and 1.5H:1V on the outlet end. Any slope steeper than 2H:1V shall be armored with 4 feet of riprap conforming to MaineDOT Standard Specification Section 703.28 Heavy Riprap. 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 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 Option III 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 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 for specific application to the proposed rehabilitation of Large Culvert #770402 under Route 161 in St. John Plantation, 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:

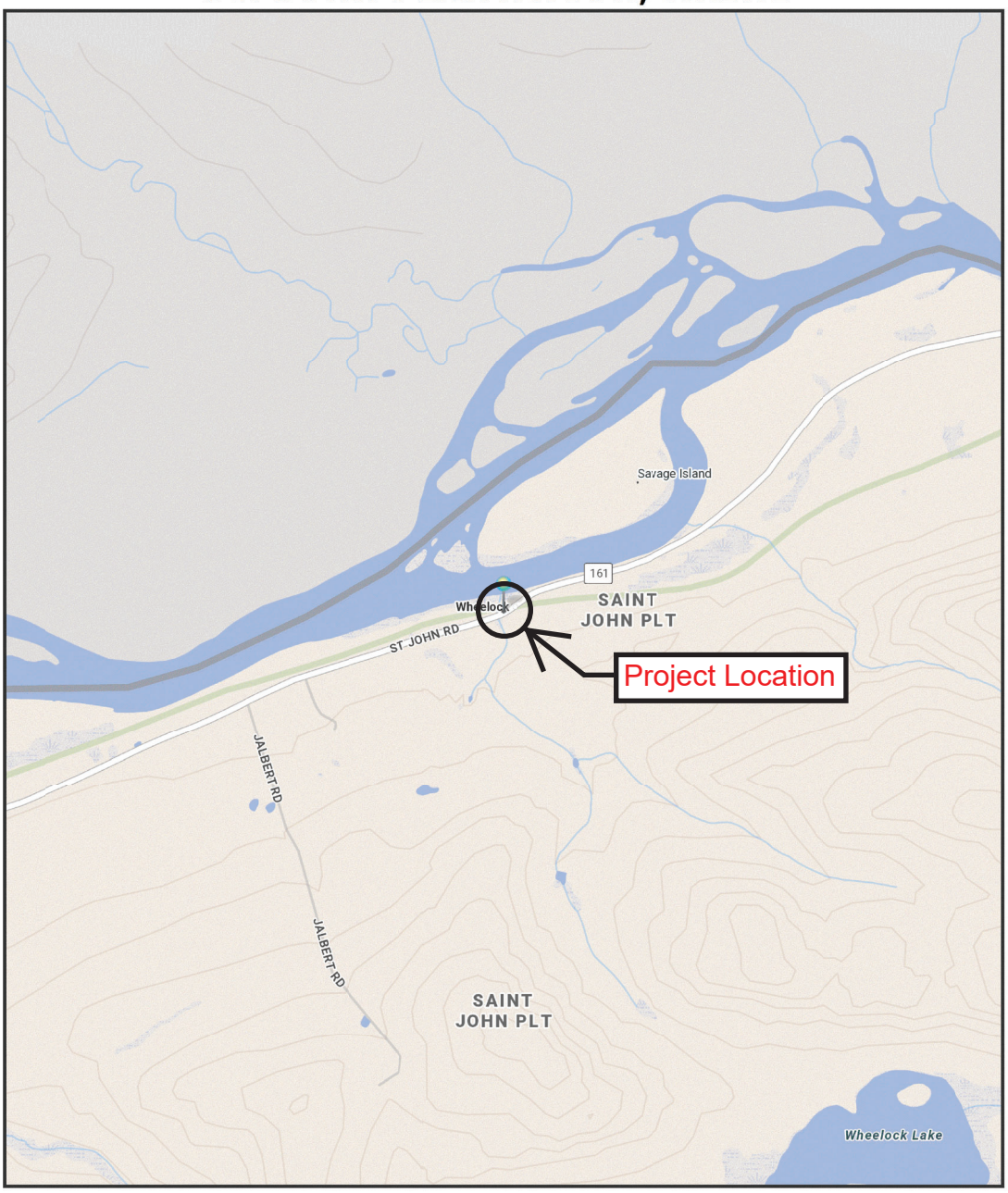
Location Map
Boring Location Plan & Interpretive Subsurface Profile
Key to Soil and Rock Descriptions and Terms
Boring Logs
Laboratory Testing Summary Sheet
Grain Size Distribution Curve Sheet

Date:5/26/2022

Division: GEOTECH

Username: Cody.A.Russell

ST. JOHN PLANTATION, MAINE



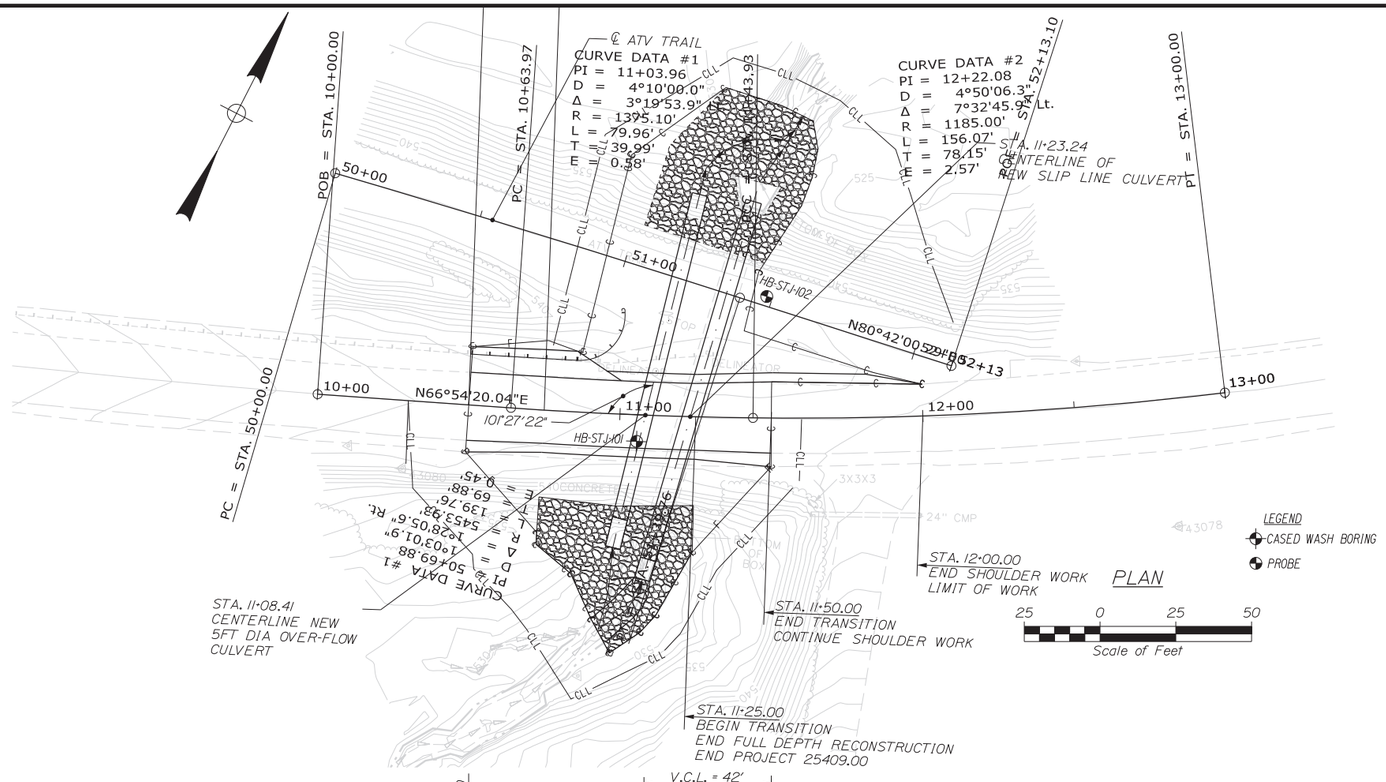
The Maine Department of Transportation provides this publication for information only. Reliance upon this information is at user risk. It is subject to revision and may be incomplete depending upon changing conditions. The Department assumes no liability if injuries or damages result from this information.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

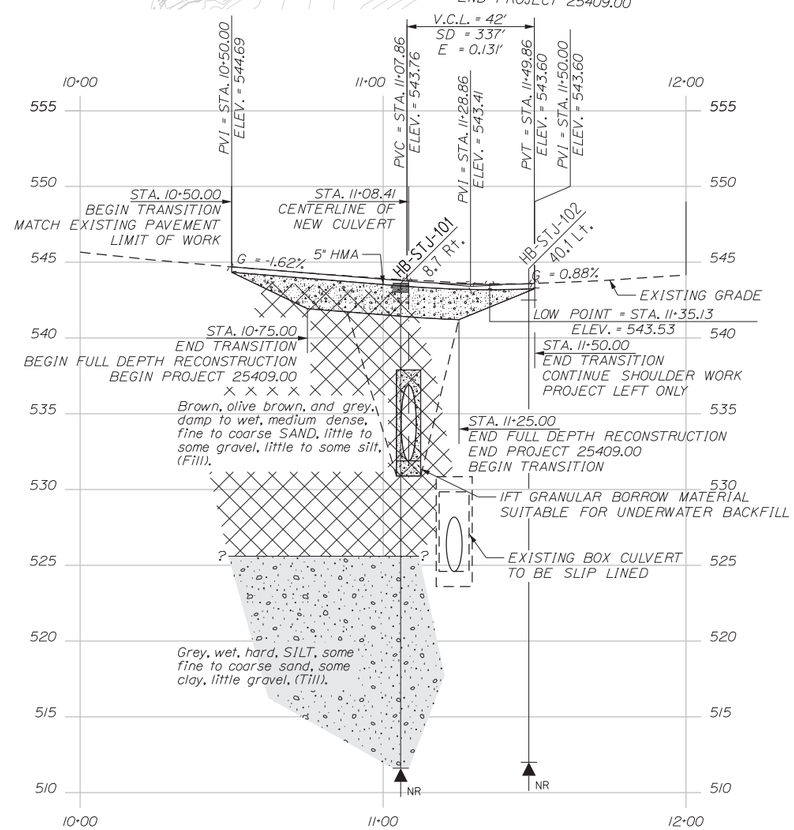
0.5 Miles

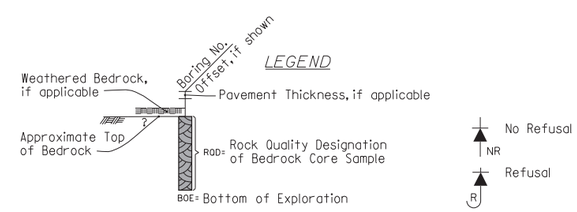
1 inch = 0.57 miles

Date: 5/19/2022
Time: 8:44:32 AM

SHEET NUMBER		
1	ST. JOHN PLANTATION ROUTE 161	STATE OF MAINE DEPARTMENT OF TRANSPORTATION
		25409.00
OF 2	LOCATION MAP	WIN 25409.00 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.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

25409.00

WIN 25409.00

HIGHWAY PLANS

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

SIGNATURE

P.E. NUMBER

DATE

ST. JOHN PLANTATION
ROUTE 161
BORING LOCATION PLAN & INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER
2
OF 2

Filename: ...\GEOTECH\MSTA\002_BLP&ISP1.dgn Division: GEOTECH Username: Cody.A.Russell Date:6/14/2022

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

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

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):

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

*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))

Sample Container Labeling Requirements:

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 161 Large Culvert Rehabilitation
Location: St. John Plantation, Maine

Boring No.: HB-STJ-101
WIN: 25409.00

Driller:	MaineDOT	**Elevation (ft.)**	543.6	**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:	8/4/2021; 08:00-12:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	11+05.8, 8.7 ft Rt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	19.0 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	543.0		7" HMA. 0.6	
	1D	24/18	1.00 - 3.00	8/11/7/9	18	27				Brown, damp, medium dense, fine to coarse SAND, some gravel, little silt, (Fill).	G#340997 A-1-b, SW-SM WC=5.0%
5	2D	24/16	5.00 - 7.00	4/4/4/4	8	12	4			Brown, damp, medium dense, fine to coarse SAND, some silt, little gravel, (Fill).	G#340998 A-1-b, SM WC=6.6%
							14				
							16				
							69				
							68				
10	3D	24/11	10.00 - 12.00	6/9/8/9	17	25	15			Olive brown, wet, medium dense, fine to coarse SAND, some gravel, little silt (Fill).	G#340999 A-1-b, SM WC=13.7%
							22				
							46				
							37				
							43				
15	4D	24/14	15.00 - 17.00	4/6/5/5	11	16	24			Grey, wet, medium dense, fine to coarse SAND, some gravel, some silt (Fill).	G#341000 A-2-4, SM WC=17.7%
							26				
							26				
							52	525.6		18.0	
							44				
20	5D	24/17	20.00 - 22.00	12/18/20/24	38	56	49			Grey, wet, hard, SILT, some fine to coarse sand, some clay, little gravel, (Till).	G#337004 A-4, CL WC=10.1%
							63				
							94				
							151				
25							OPEN				

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.

Boring No.: HB-STJ-101

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 161 Large Culvert Rehabilitation
Location: St. John Plantation, Maine

Boring No.: HB-STJ-101
WIN: 25409.00

Driller:	MaineDOT	**Elevation (ft.)**	543.6	**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:	8/4/2021; 08:00-12:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	11+05.8, 8.7 ft Rt.	**Casing ID/OD:**	NW-3"	**Water Level*:**	19.0 ft bgs.
Hammer Efficiency Factor:	0.89	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
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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)
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N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
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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	24/6	25.00 - 27.00	10/21/15/18	36	53	HOLE			Grey, wet, hard, SILT, some fine to coarse sand, some clay, little gravel, (Till).	
30	7D	24/17	30.00 - 32.00	8/11/10/20	21	31				Grey, wet, hard, SILT, some fine to coarse sand, some clay, little gravel, (Till).	
								511.6		32.0	
35										**Bottom of Exploration at 32.0 feet below ground surface.** NO REFUSAL	
40											
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.

Boring No.: HB-STJ-101

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 161 Large Culvert Rehabilitation
Location: St. John Plantation, Maine

Boring No.: HB-STJ-102
WIN: 25409.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	542.5	**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:	8/4/2021; 08:00-12:00	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	11+48.1, 40.1 ft Lt. (Main Line)	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample
S = Sample off Auger Flights
B = Bucket Sample off Auger Flights
MD = Unsuccessful Split Spoon Sample Attempt
U = Thin Wall Tube Sample
MV = Unsuccessful Field Vane Shear Test Attempt
V = Field Vane Shear Test, PP= Pocket Penetrometer
MU = Unsuccessful Thin Wall Tube Sample 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 1 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-value = Raw Field SPT N-value
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent ≅ = Similar or Equal too
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA			Probe, similar soils as HB-STJ-101.	
5										
10										
15										
20										
25										

Remarks:

(ATV Station/Offset) 51+47.9, 3.1 ft Lt

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.

Boring No.: HB-STJ-102

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Route 161 Large Culvert Rehabilitation
Location: St. John Plantation, Maine

Boring No.: HB-STJ-102
WIN: 25409.00

Drilling Contractor:	MaineDOT	**Elevation (ft.)**	542.5	**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:	8/4/2021; 08:00-12:00	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	11+48.1, 40.1 ft Lt. (Main Line)	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions: D = Spilt Spoon Sample; S = Sample off Auger Flights; B = Bucket Sample off Auger Flights; MD = Unsuccessful Split Spoon Sample Attempt; U = Thin Wall Tube Sample; MV = Unsuccessful Field Vane Shear Test Attempt; V = Field Vane Shear Test, PP= Pocket Penetrometer; MU = Unsuccessful Thin Wall Tube Sample 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 1 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-value = Raw Field SPT N-value; T_v = Pocket Torvane Shear Strength (psf); WC = Water Content, percent ≅ = Similar or Equal too; 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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25										
30							512.0		**Bottom of Exploration at 30.5 feet below ground surface.** NO REFUSAL (30.5)	
35										
40										
45										
50										

Remarks:

(ATV Station/Offset) 51+47.9, 3.1 ft Lt

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.

Boring No.: HB-STJ-102

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): St. John Plantation Work Number: 25409.00

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-STJ-101, 1D	11+05.8	8.7 Rt.	1.0-3.0	340997	1	5.0			SW-SM	A-1-b	0
HB-STJ-101, 2D	11+05.8	8.7 Rt.	5.0-7.0	340998	1	6.6			SM	A-1-b	II
HB-STJ-101, 3D	11+05.8	8.7 Rt.	10.0-12.0	340999	1	13.7			SM	A-1-b	0
HB-STJ-101, 4D	11+05.8	8.7 Rt.	15.0-17.0	341000	1	17.7			SM	A-2-4	II
HB-STJ-101, 5D	11+05.8	8.7 Rt.	20.0-22.0	337004	1	10.1			CL	A-4	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.

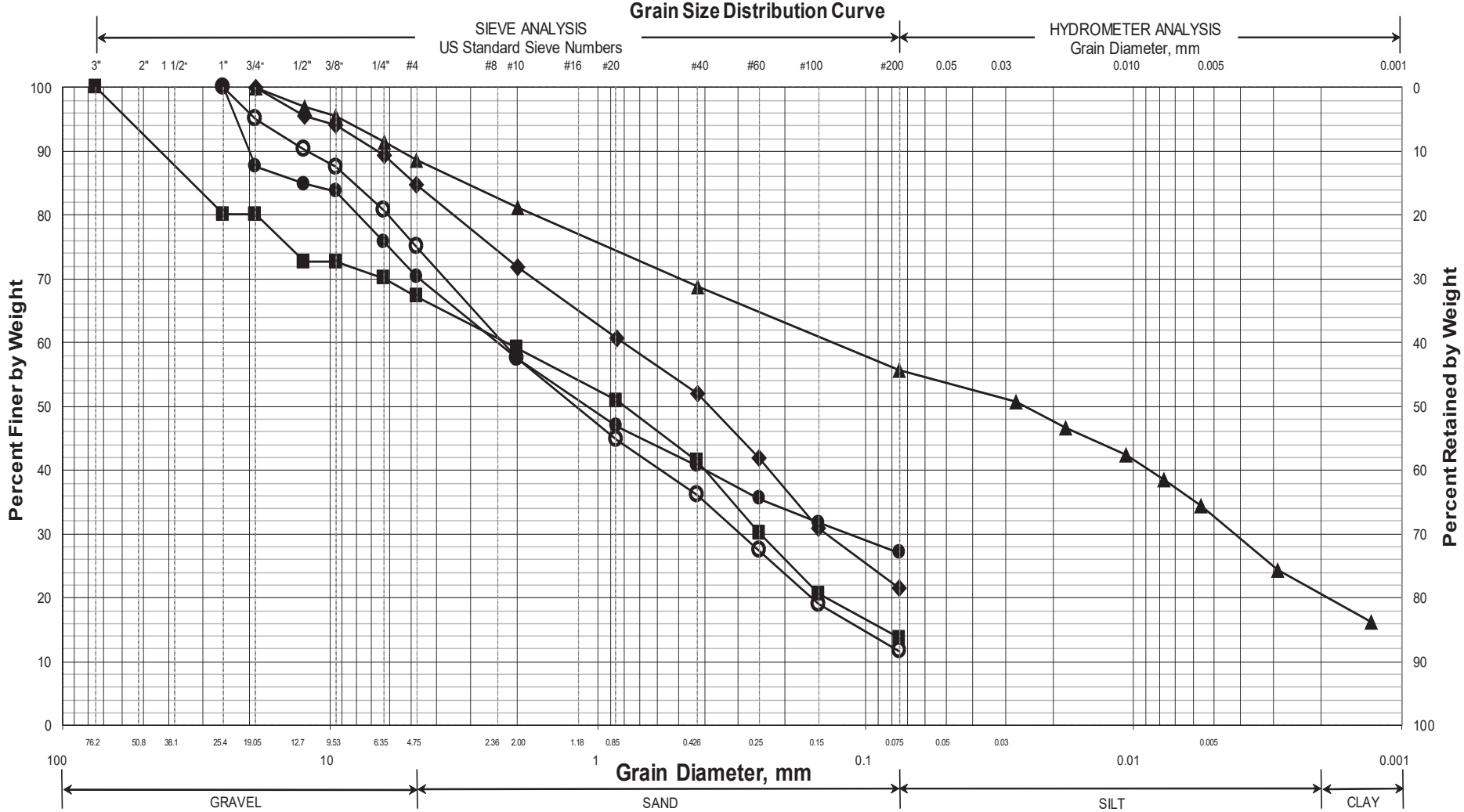
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

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-STJ-101/1D	11+05.8	8.7 RT	1.0-3.0	SAND, some gravel, little silt.	5.0			
◆	HB-STJ-101/2D	11+05.8	8.7 RT	5.0-7.0	SAND, some silt, little gravel.	6.6			
■	HB-STJ-101/3D	11+05.8	8.7 RT	10.0-12.0	SAND, some gravel, little silt.	13.7			
●	HB-STJ-101/4D	11+05.8	8.7 RT	15.0-17.0	SAND, some gravel, some silt.	17.7			
▲	HB-STJ-101/5D	11+05.8	8.7 RT	20.0-22.0	SILT, some sand, some clay, little gravel.	10.1			
×									

WIN
025409.00
Town
Saint John Plt
Reported by/Date
WHITE, TERRY A 5/19/2022

SHEET 1