

MAINE DEPARTMENT OF TRANSPORTATION  
HIGHWAY PROGRAM  
GEOTECHNICAL GROUP  
AUGUSTA, MAINE

**SUBSURFACE INVESTIGATION FOR  
REHABILITATION OF ROUTE 1A,  
MAIN STREET, HAMPDEN, MAINE**

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Penobscot County  
PIN 14796.00

Soils Report No. 2012-07

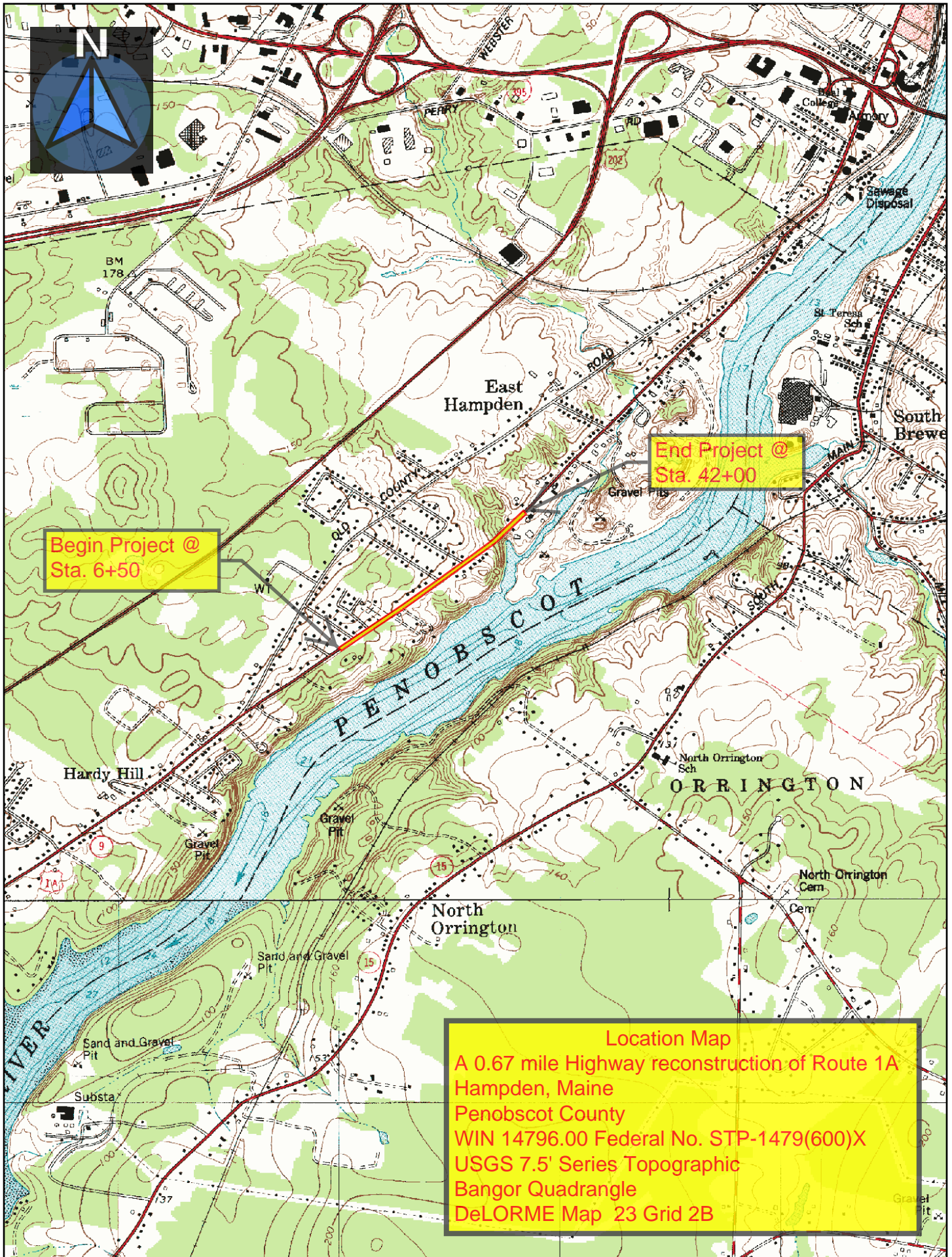
Federal AC-STP-1479(600)X  
March 31, 2012

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## **1.0 Introduction**

### **1.1 Project Overview**

Maine DOT proposes to rehabilitate and widen a portion of Route 1A in the Town of Hampden. The project starts 250 feet south of Mount View Drive and extends 0.67 miles northerly, ending 200 feet north of Stearns Mill Road. This highway was originally built as State Highway "L" in 1928. The project scope includes removal of the existing concrete pavement and full construction with a closed drainage system. A deep culvert in the northerly portion of the project will also be replaced.

This report describes existing conditions for this project.

### **1.2 Summary of Recommendations**

Concrete was encountered under the HMA pavement in most borings. Existing PCC pavement should be removed for this construction.

A reinforced soil slope will be required from approximately Station 35+00 to Station 37+00. This will have a finished slope of 1.5h:1v and have riprap surface treatment.

A deep cut will be needed for replacement of a culvert at Station 35+53. Poor soils in this area may require the use of a braced excavation to support the cut for this construction. This would allow a single lane of traffic on Route 1A at all times, and will minimize the length of water and sewer pipes to be supported during construction. Open cut excavation would require support of an existing gravity sewer line and a detour of traffic onto local roads. Wet soils were encountered at a depth of 14 feet in a boring at Station 37+23. If wet soils are encountered in sideslopes during construction, seepage forces may require the use of flatter slopes than OSHA minimum standards allow for construction of the new culvert if an open cut is used.

## **2.0 Site and Subsurface Conditions**

### **2.1 General Site Conditions**

This portion of Route 1A serves an area of gently rolling land with primarily residential development. There are a few small businesses at the north end of the project. The project begins 150 feet south of Mountainview Drive and extends north for a distance of 0.67 miles, 0.25 miles north of the intersection of Wheeldon Heights. This highway was originally built in 1928 as State Highway L; it was built with reinforced concrete pavement in ten foot lanes and three foot wide gravel shoulders. It has been widened over the years, but it was never built with appropriate aggregate materials to the full width section. Appendix A includes the as-builts and plans for this project.

### **2.2 Mapped Data**

The Maine Geologic Survey (MGS) Surficial Geology map for the Hampden Quadrangle shows two soil types along this job. From the beginning of the project to approximately Station 76+00 the map shows thin drift glacial Till over shallow bedrock. The soils for the northern area of the project are shown as Presumpscot Formation (marine silt and clay.) The MGS Surficial Materials map indicates bedrock outcrops north of the road in the southern portion of the project.

Natural Resources Conservation Services (NRCS) maps include information on soils for the five feet below the surface; deeper soils are not discussed. No soils under this highway are listed as having a depth to bedrock of less than 6 feet, although nearby soils are shown with bedrock as shallow as 2 inches. NRCS mapping for this area shows Suffield soils from the beginning of the project to approximately Station 7+50 of the project and Bangor and Dixmont soils in the northern portion. These soils are poorly graded silty sands, silts and clay-silts.

The National Wetland Inventory (NWI) map of the area does not show areas of wetlands within the project limits. Portions of the NRCS and MGS maps of the area are included in Appendix B.

### **2.3 Subsurface Investigation**

The preliminary subsurface investigation for this project was conducted in June and July of 2008. Eight borings were done and seven cores were taken. All borings were extended to a depth of seven feet except borings for the culvert at Station 36+33 which were extended to thirty feet. No FWD analysis was done due to the presence of concrete pavement.

### **2.4 Native Soils**

According to geologic mapping by MGS and NRCS, native soils in this area are predominantly sand, silty sand, and clay-silt. Our borings confirm this. The soils near the surface are generally medium dense. Table 1 shows the soils and water conditions at pavement section subgrade encountered in borings for this project:

A deep boring was done to investigate soils surrounding the deep culvert to be replaced as part of this project. HB-HAMP-201 at Station 37+23.5, 8 ft Left, encountered medium dense to loose sands to a depth of 18 feet, and soft silty Clay or Clay-Silt to a depth of 31 feet below ground surface. The soils were loose and wet with a water content of 21.5% at a depth of 9 feet in July 2008. This is approximately 95% saturation, although this is above the top of the existing culvert.

**Table 1 – Native Soils at Subgrade**

Boring	Station	soils at Subgrade	depth to groundwater	Water Content
HB-HAMP-101	13+01.5	SAND, some silt, trace gravel	5.0' bgs	20%
HB-HAMP-102	15+56.5	SAND, trace silt, trace gravel	2.7' bgs	20.4%
HB-HAMP-103	20+96.5	SAND, trace silt	-	
HB-HAMP-104	26+46.5	Sandy GRAVEL, little silt	-	16.4%
HB-HAMP-105	31+96.5	SILT with clay, trace sand	-	23.7%
HB-HAMP-106	36+46.5	Sandy GRAVEL, trace silt.	-	
HB-HAMP-107	40+41.5	SILT, trace sand, trace gravel	-	27.30%
HB-HAMP-201	37+23.5	SAND, some silt, some gravel	-	5.40%

Boring logs are included in Appendix C. Appendix D includes Lab Testing data.

**2.5 Subsurface Bedrock**

No bedrock was encountered in our borings and no bedrock outcrops are shown on the plans, however shallow bedrock is indicated on the surficial geology map and outcrops are indicated in the area of this project. Twenty-one probes to a depth of 10 feet were done in or near catchbasin locations along the roadway, and no refusals were encountered. A summary sheet showing probe locations is included in Appendix C.

**2.6 Existing Pavement**

The existing pavement is in poor condition. The pavement in the original construction was reinforced Portland Cement Concrete in 10' x 40' sections, doweled together at the centerline. Concrete was 7" thick at the centerline and 9" thick at the edges. The as-built plans show both variable gravel and 8" gravel base. The existing HMA is generally 6" to 8" thick over the PCC. Our borings show a maximum gravel thickness of 1.2 ft, and three borings encountered no discernable gravel. The concrete in three borings was badly deteriorated or only short sections were recovered. Solid, full length cores were obtained in three borings. It is likely that the concrete at the edges of the original concrete sections is in worse condition than the middle of the original panels. The precise location of the original concrete is not known; the centerline may have shifted over time, or utility repairs may have necessitated removal of sections of concrete. Typical sections from the original plans are included in Appendix A. Table 2 shows the thickness of HMA and PCC pavement in borings for this project.

**Table 2 – Pavement and Concrete Thickness**

Boring	Station	Offset	HMA	PCC
HB-HAMP-101	13+01.5	5.5 RT	10"	6"
HB-HAMP-102	15+56.5	6.5 LT	7"	6"
HB-HAMP-103	20+96.5	4.5 RT	5"	3"
HB-HAMP-104	26+46.5	8.0 LT	6.5"	11.4"
HB-HAMP-105	31+96.5	4.5 RT	10.2"	8"
HB-HAMP-106	36+46.5	8.0 LT	10.5"	
HB-HAMP-107	40+41.5	7.0 LT	8"	9"
HB-HAMP-201	37+23.5	8.0 LT	9.6"	

Boring logs HB-HAMP-101 through -105 listed 6" of HMA and 12" of PCC, however this is thicker than indicated on the original plans. Pavement thickness shown in this table

was measured on pavement cores. All thicknesses given are approximate. Pavement core photographs are included as Appendix E.

### 2.7 Groundwater

Shallow groundwater was found in borings at the beginning of the project. Groundwater was encountered at a depth of 5 feet below the ground surface at Station 13+01.5 and at a depth of 2.7 feet below grade at Station 15+56.5. This is an area of Till that apparently overlies a unit of Presumpscot Formation clay-silt, producing a perched groundwater table. Shallow water was also found in a boring at Station 37+23, 70 feet north of the deep culvert to be replaced.

## **3.0 Design Recommendations**

The new horizontal and vertical alignment for this project will be very similar to the existing alignment. Significant cuts and fills are not proposed, but replacement of the culvert at Station 36+50 will require reconstruction of the embankment in this area.

### 3.1 Soil Fill Slopes

Fill slopes will be required on the Left side of the highway for construction of a sidewalk but in general these will be less than 2 feet high. A ditch on the Left side will also be filled, and proper construction practices must be followed to ensure the stability of these cut and fill areas.

Replacement of an existing deep culvert at Station 36+50 will require reshaping of slopes on the Left and reconstruction of steep, unstable slopes on the Right. The slope work will extend from Station 35+00 Left to 37+50 Left. Soils encountered in borings included loose to medium-dense brown sand with some silt to a depth of 18 feet, with olive-brown wet soft clayey silt below this depth. The exploration was extended to elevation 7 feet which is below the outlet invert of the existing pipe. Wet soils were encountered at elevation 29.2 feet, well above the existing culvert.

On the Left the embankment reaches a maximum height of 26 feet, with a maximum slope of 1.75h:1v between Station 35+50 and Station 36+53. Riprap is not needed for global stability of this slope, but care must be exercised during construction to ensure that the slope surface is stable and does not erode or slough until vegetation is well established. Benching will be required for construction of the finished slope, and geotextile layers may be added as compaction aids if the Resident feels it is needed. If an open cut excavation is done, compaction should be required across the full width of the embankment on the left to ensure that the finished slope is stable, and surface treatment other than loam and seed may be needed. If a braced excavation is used, benching and compaction of the slope will be needed.

A reinforced soil slope will be required on the Right between approximately Station 35+98 and Station 37+00. The existing slope on this side of the highway has been oversteepened by erosion at the toe of slope, and it is not stable in the existing condition. The existing slope is 34 feet high with an overall slope on the order of 1:1. It is not feasible to flatten the toe of slope by extending it into the river. Construction of a 1.5h:1v reinforced soil slope will provide global stability and riprap will protect the slope surface in this area. Geosynthetic reinforcements a minimum of 9 feet long will be placed every three feet, starting at elevation 15 and ending at elevation 36. All lifts should be even and well compacted. Intermediate layers of geosynthetic for compaction

aid may be required; this decision should be made during construction by the Resident, and will depend on the apparent stability of the slope surface prior to riprap placement. Compaction will be required for the full width of the reinforced area.

Great strength is not required for a 1.5h:1v reinforced soil slope, and a biaxial geosynthetic meeting the minimum requirements of MDOT Standard Specification 722.01, Stabilization/Reinforcement geotextile will be adequate for this application. This is a tangent section of highway, and geotextile may be installed either parallel or perpendicular to the centerline if a biaxial geosynthetic is used.

Soil within the reinforced zone must meet the requirements of MaineDOT Standard Specification 703.19 with the restrictions prescribed in Special Provision 620.

A geotextile may be needed to separate clay silt soils within the excavation from the reinforced fill. This need will be determined during construction.

### 3.2 Soil Cut Slopes

As no major alignments changes will be required, only limited cut slopes will be required. These will be needed for ditches or swales, or to construct a sidewalk on the Left side of the highway. No stability problems are anticipated in these cuts.

### 3.3 Pavement Design

The existing Portland Cement Concrete Pavement will be removed and a new pavement section will be construction across the full width of roadway and shoulder. A Resilient Modulus of 3600 psi should be used for design of the new pavement section.

### 3.4 Groundwater

Groundwater was encountered at shallow depths at the beginning of the project. At Station 13+01.5, groundwater was found at a depth of 5 feet below ground surface. At Station 15+56.5 groundwater was encountered at a depth of 2.7 feet. Wet soils at a depth of 14 feet at Station 37+23.5 may be an indication of groundwater, but it is higher than the stream elevation. Groundwater may discharge from the slopes above the road and seep through the embankment into the river, causing an elevated groundwater table in this area. Groundwater discharge could lead to slope instability in an excavations.

### 3.5 Frost Action

The Design Freezing Index for Hampden is 1200. The freezing index can be used to calculate the depth of frost under the pavement section. Frost depth below a roadway depends on the Freezing index, grain size distribution of the subgrade soils, and the thickness of the pavement section. The design depth of frost in Hampden for a 30 inch total pavement section is as follows:

Granular subgrade	65 inches
Silt or Clay-Silt subgrade	44 inches

Any lenses of water trapped above these depths will freeze and potentially distort the pavement section. A gradual 20:1 transition zone should be constructed between granular and fine subgrade areas to minimize damage that differential frost heaves would cause to the HMA in these areas.

### 3.6 Culvert Replacement

A four foot diameter culvert at Station 36+43 will be replaced as part of this project. The existing pipe is in poor condition and it is undersized. A 72" RCP culvert will be installed at Station 36+53 to replace it. The outlet invert of the existing pipe is approximately 31 feet below the roadway surface. Native soils from approximately elevation 20 feet to river level are wet, soft silty clay with a trace of sand and gravel. A monitoring well was not installed to determine the elevation of groundwater, but wet soils were encountered at elevation 29.2 feet, and wet soils can be anticipated in this area. Groundwater elevation may be estimated to be at or near the inlet invert, or at the elevation of any standing water at the inlet.

If an open cut excavation is done, care must be taken to ensure that the material used as fill will be stable at the design slopes, and that the finished slope surface has gained adequate vegetation or other stabilization to protect it. Geosynthetic may be added at the direction of the Resident to aid compaction at the face of slope.

A braced excavation may be used for pipe installation, as support of existing water and gravity sewer lines could be problematic with an open cut excavation, and a detour would require the use of local roads.

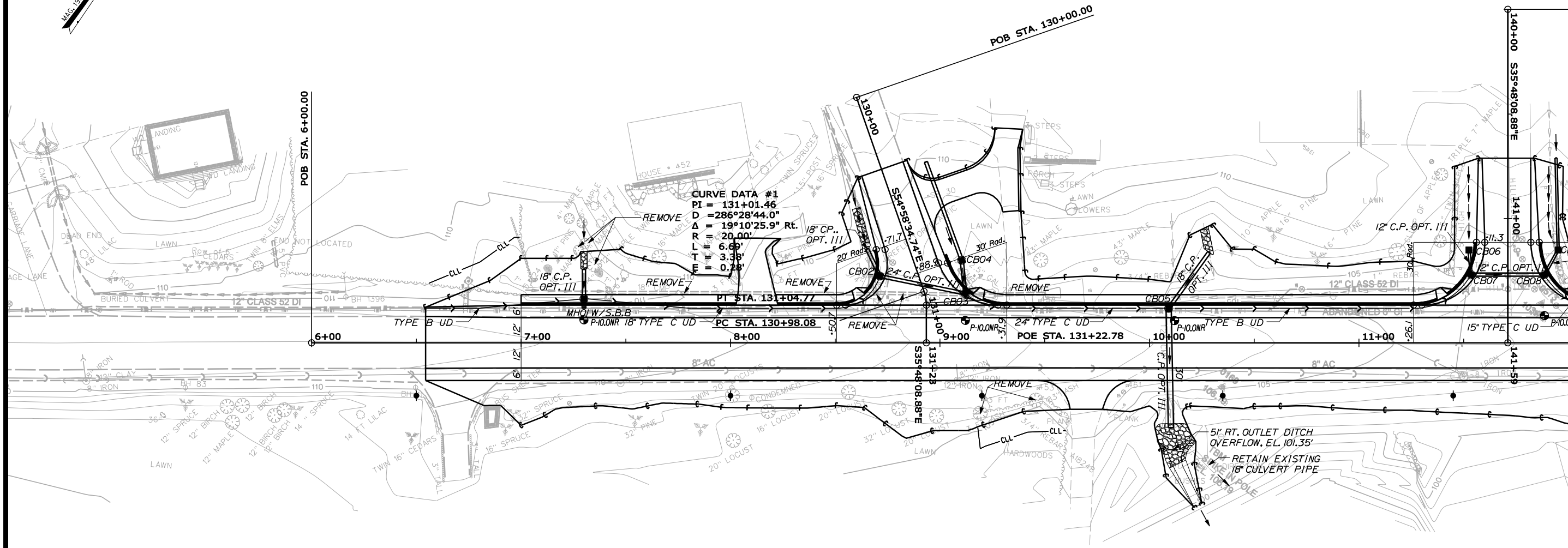
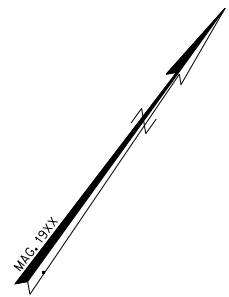
The following soil properties should be used in design of any slope or shoring system in this area:

Depth (feet)	Soil Unit	Total Unit Weight (pcf)	$\phi$ (degrees)	Undrained Shear Strength (psf)
0 - 9	Sand	115	34	N/A
9 - 18	Sand	125	32	N/A
18 - 26	Clay-Silt	115	17	1000
26 - 31	Clay-Silt	115	17	500

Any shoring system required for work at this depth must be stamped by a PE registered in the State of Maine and meet all requirements of Standard Specification 510.10. The Contractor is responsible for choosing an applicable Factor of Safety for any slope or shoring system. The factor of safety and maximum applied loads and resistances used for the design shall be clearly stated on the submitted calculations. The Contractor's design shall also consider the means and methods and construction sequencing proposed by the Contractor.

**Appendix A  
Geoplans  
As-Built Section**

Filename: ... \GEOTECH\MSTA\001\_Ceoplom1.dgn Division: GEOTECH Username: kity.breskin Date: 3/21/2012



**CURVE DATA #1**  
 PI = 131+01.46  
 D = 286°28'44.0"  
 Δ = 19°10'25.9" Rt.  
 R = 20.00'  
 L = 6.65'  
 T = 3.33'  
 E = 0.23'

**LEGEND**  
 HB-HAMP-201 CASED WASHBORING  
 HB- SOLID STEM AUGER W/DESCRIPTIONS  
 PC- PAVEMENT CORE  
 P- POWER AUGER PROBE

**KEY**  
 R = Refusal of augers (actual nature of refusal surface unknown)  
 NR = No Refusal surface encountered  
 W = Weathered Rock, top of

STATE OF MAINE  
 DEPARTMENT OF TRANSPORTATION  
 STP-1479(600)X  
 WIN 014796.00  
 HIGHWAY PLANS

DATE	BY	REVISION
JUN 2011	T. WHITE	DESIGN DETAILED
		CHECKED-REVIEWED
		DESIGN DETAILED
		DESIGN DETAILED
		REVISION 1
		REVISION 2
		REVISION 3
		REVISION 4
		FIELD CHANGES

HAMPDEN  
 ROUTE 1A  
 GEOPLANS

SHEET NUMBER  
**1**  
 OF 6

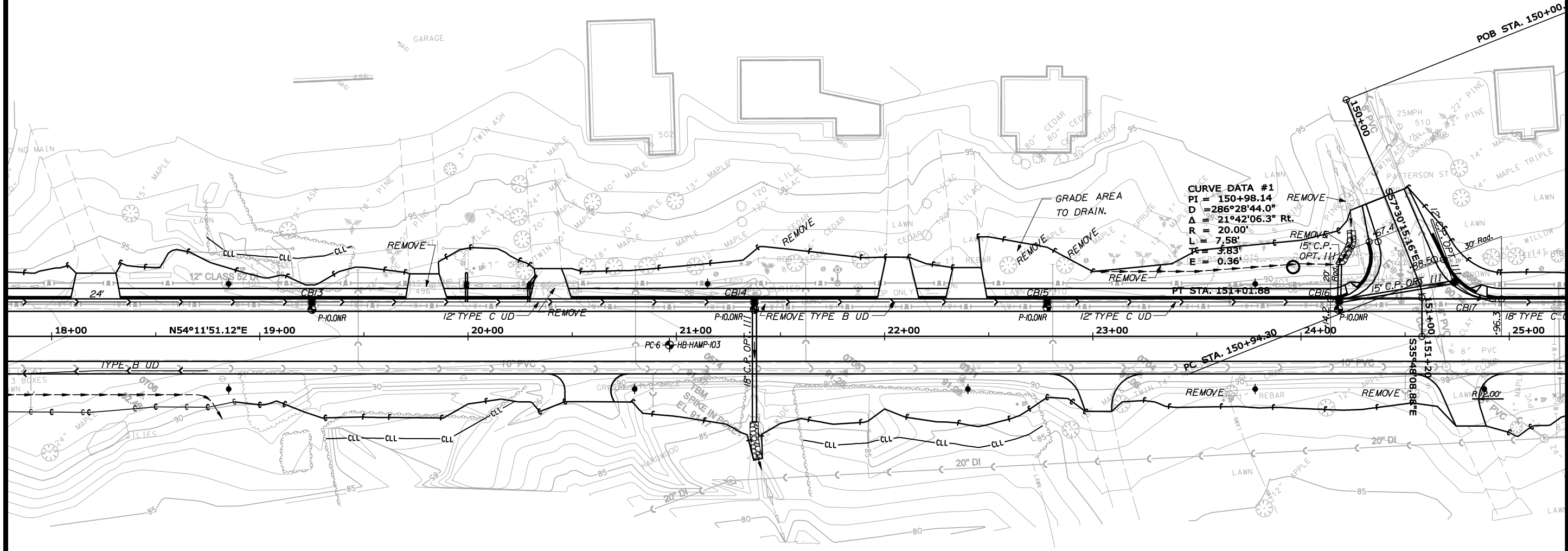
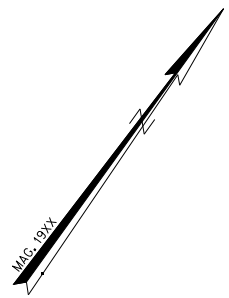


Date: 3/21/2012

Username: kity.breskin

Division: GEOTECH

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**CURVE DATA #1**

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Δ	= 21°42'06.3" Rt.
R	= 20.00'
L	= 7.58'
E	= 3.83'
E	= 0.36'

STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION  
STP-1479(600)X  
WIN 014796.00  
HIGHWAY PLANS

DATE	BY	SIGNATURE	P.E. NUMBER	DATE
JUN 2011	T. WHITE	[Signature]		
	K. BRESKIN	[Signature]		

HAMPDEN  
ROUTE 1A  
GEOPLANS

SHEET NUMBER  
**3**  
OF 6

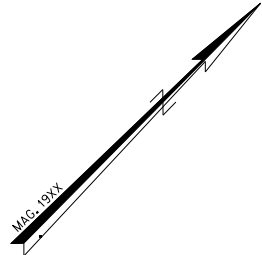
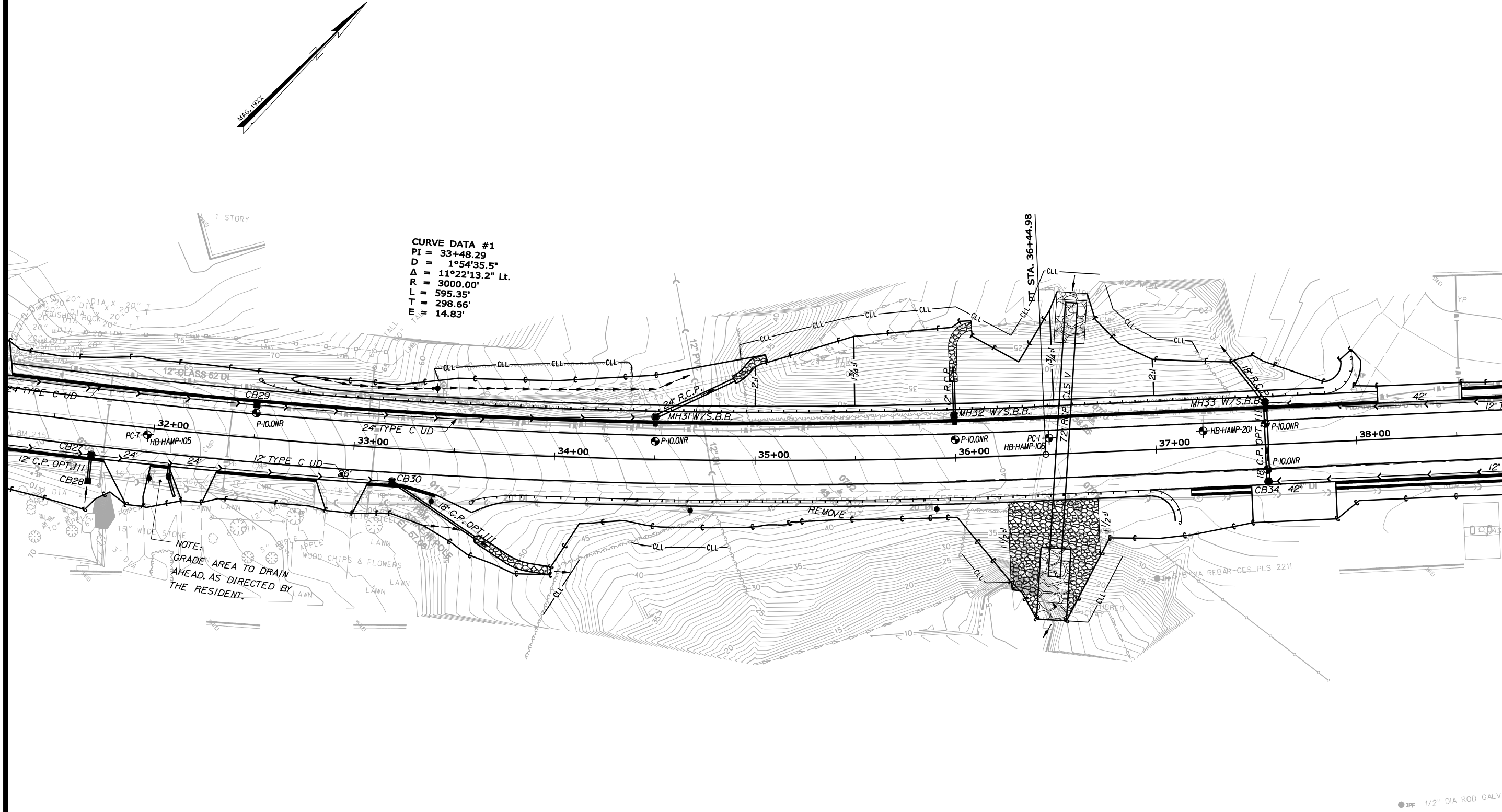


Date: 3/21/2012

Username: kity.breskin

Division: GEOTECH

Filename: ... \geotech\msta\005\_Geoplan5.dgn



**CURVE DATA #1**  
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 D = 1°54'35.5"  
 Δ = 11°22'13.2" Lt.  
 R = 3000.00'  
 L = 595.35'  
 T = 298.66'  
 E = 14.83'

NOTE:  
 GRADE AREA TO DRAIN  
 AHEAD, AS DIRECTED BY  
 THE RESIDENT.

● 1/2" DIA ROD GALV

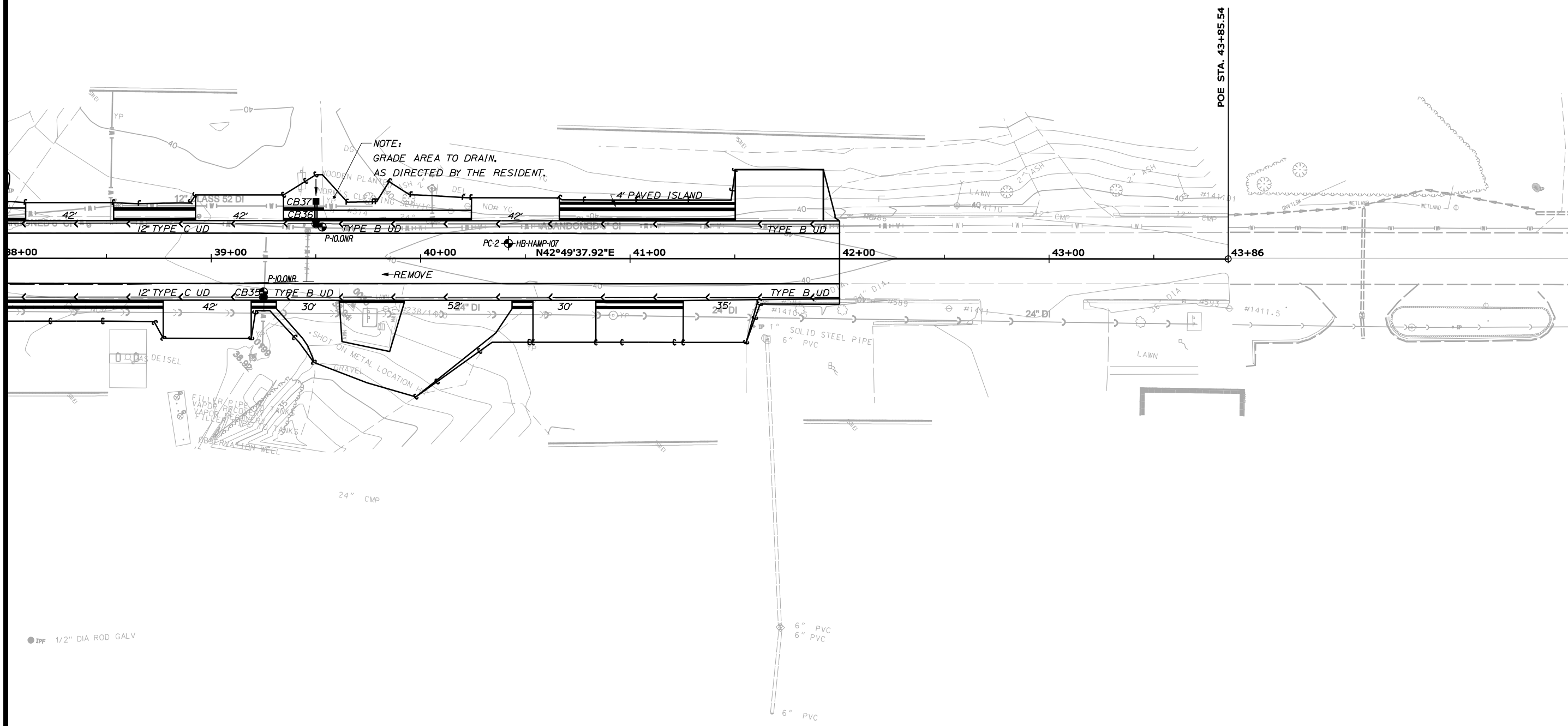
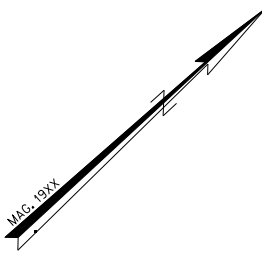
STATE OF MAINE		DEPARTMENT OF TRANSPORTATION	
STP-1479(600)X		WIN 014796.00 HIGHWAY PLANS	
PROJ. MANAGER	ERNEST MARTIN	BY	T. WHITE
DESIGN-DETAILED	K. BRESKIN	DATE	JUN 2011
CHECKED-REVIEWED		SIGNATURE	
DESIGNS-DETAILED		P.E. NUMBER	
REVISIONS 1		DATE	
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			
HAMPDEN ROUTE 1A		GEOPLANS	
SHEET NUMBER		5	
		OF 6	

Date: 3/21/2012

Username: kity.breskin

Division: GEOTECH

Filename: ... \geotech\msta\006\_Geoplans.dgn



STATE OF MAINE  
 DEPARTMENT OF TRANSPORTATION  
 STP-1479(600)X

WIN  
 014796.00  
 HIGHWAY PLANS

PROJ. MANAGER	BY	DATE
ERNEST MARTIN	T. WHITE	JUN 2011
DESIGN-DETAILED	K. BRESKIN	
CHECKED-REVIEWED		
DESIGN-DETAILED		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

HAMPDEN  
 ROUTE 1A  
 GEOPLANS

SHEET NUMBER  
**6**  
 OF 6



**Appendix B**  
**Resource Maps**  
Surficial Geology  
NRCS Soils Map



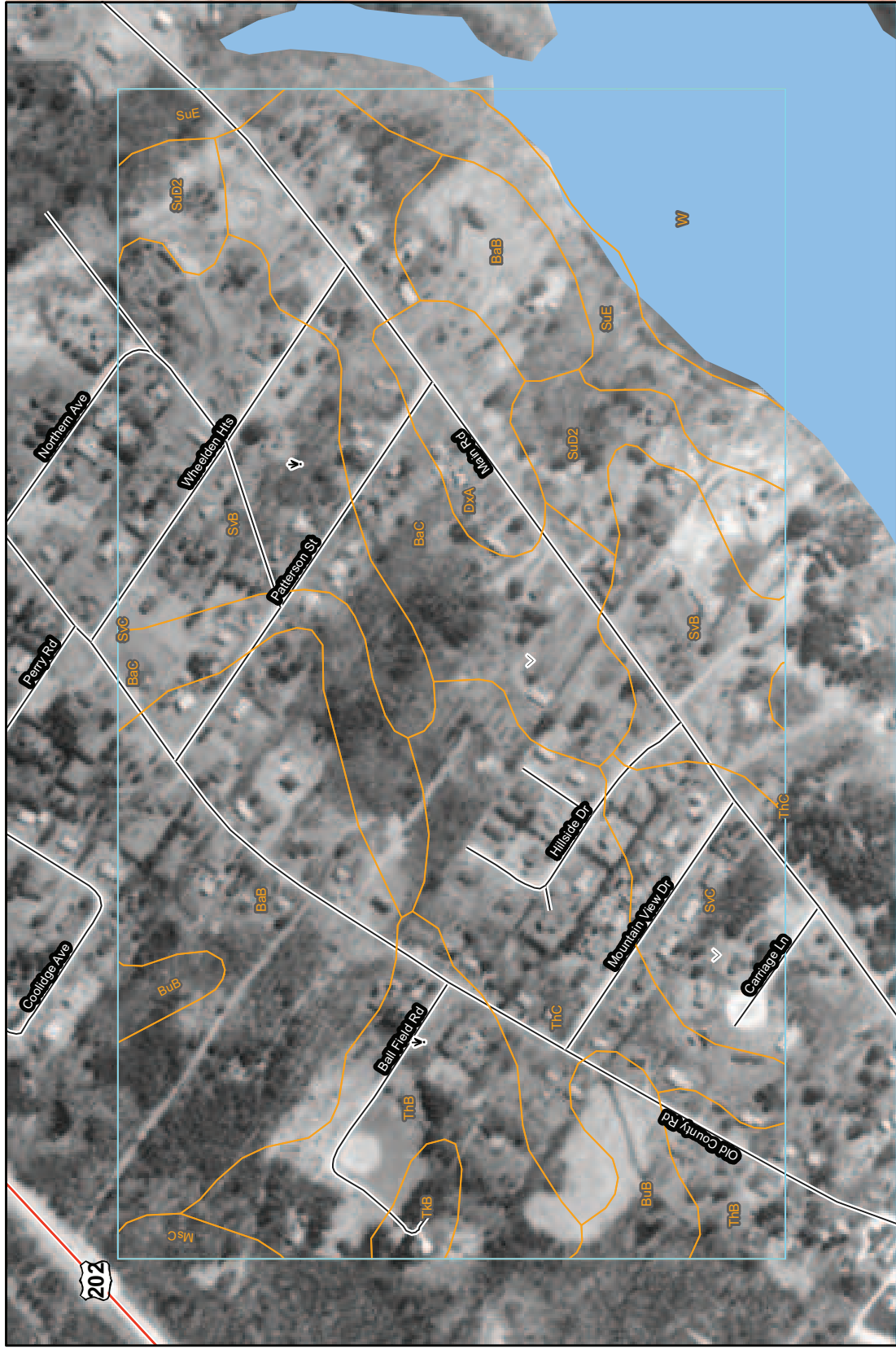
Soil Map—Penobscot County, Maine; and Penobscot County, Maine, Southern Part  
(Hamden, Route 1A)

68° 48' 56"

68° 47' 59"

44° 46' 3"

44° 46' 3"



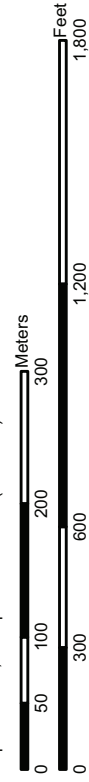
44° 45' 36"

44° 45' 36"








































68° 48' 56"

68° 47' 59"

Map Scale: 1:5,890 if printed on A size (8.5" x 11") sheet.



## MAP LEGEND

 Area of Interest (AOI)	 Very Stony Spot
 Soils	 Wet Spot
 Area of Interest (AOI)	 Other
 Soil Map Units	<b>Special Line Features</b>
<b>Special Point Features</b>	 Gully
 Blowout	 Short Steep Slope
 Borrow Pit	 Other
 Clay Spot	<b>Political Features</b>
 Closed Depression	 Cities
 Gravel Pit	<b>Water Features</b>
 Gravelly Spot	 Oceans
 Landfill	 Streams and Canals
 Lava Flow	<b>Transportation</b>
 Marsh or swamp	 Rails
 Mine or Quarry	 Interstate Highways
 Miscellaneous Water	 US Routes
 Perennial Water	 Major Roads
 Rock Outcrop	 Local Roads
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	
 Spoil Area	
 Stony Spot	

## MAP INFORMATION

Map Scale: 1:5,900 if printed on A size (8.5" x 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000. Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine  
 Survey Area Data: Version 8, Jan 5, 2009

Soil Survey Area: Penobscot County, Maine, Southern Part  
 Survey Area Data: Not available

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 4/27/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Penobscot County, Maine (ME614)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BaB	Bangor silt loam, 2 to 8 percent slopes	30.0	18.2%
BaC	Bangor silt loam, 8 to 15 percent slopes	25.3	15.4%
BuB	Buxton silt loam, 2 to 8 percent slopes	4.9	2.9%
DxA	Dixmont silt loam, 0 to 2 percent slopes	5.3	3.2%
MsC	Monarda and Burnham extremely stony silt loams, 0 to 15 percent slopes	1.1	0.7%
SuD2	Suffield silt loam, 15 to 25 percent slopes, eroded	7.8	4.8%
SuE	Suffield silt loam, 25 to 45 percent slopes	8.5	5.1%
SvB	Suffield very fine sandy loam, 2 to 8 percent slopes	26.9	16.3%
SvC	Suffield very fine sandy loam, 8 to 15 percent slopes	8.7	5.3%
ThB	Thorndike shaly silt loam, 2 to 8 percent slopes	15.9	9.6%
ThC	Thorndike shaly silt loam, 8 to 15 percent slopes	17.2	10.4%
TkB	Thorndike very rocky silt loam, 2 to 8 percent slopes	1.6	0.9%
W	Water bodies	12.0	7.2%
<b>Subtotals for Soil Survey Area</b>		<b>165.1</b>	<b>100.0%</b>
<b>Totals for Area of Interest</b>		<b>165.1</b>	<b>100.0%</b>

Penobscot County, Maine, Southern Part (ME612)			
No soil data available for this soil survey area.			
<b>Totals for Area of Interest</b>		<b>165.1</b>	<b>100.0%</b>

**Appendix C**  
**Field Exploration Data**  
Soils Descriptions  
Boring Logs  
Probe Summary Sheet

UNIFIED SOIL CLASSIFICATION SYSTEM				TERMS DESCRIBING DENSITY/CONSISTENCY																																								
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	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	<p><b>Coarse-grained soils</b> (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. Consistency is rated according to standard penetration resistance.</p> <p style="text-align: center;">Modified Burmister System</p> <table border="0"> <tr> <td style="text-align: center;"><u>Descriptive Term</u></td> <td style="text-align: center;"><u>Portion of Total</u></td> </tr> <tr> <td>trace</td> <td>0% - 10%</td> </tr> <tr> <td>little</td> <td>11% - 20%</td> </tr> <tr> <td>some</td> <td>21% - 35%</td> </tr> <tr> <td>adjective (e.g. sandy, clayey)</td> <td>36% - 50%</td> </tr> </table> <table border="0"> <tr> <td style="text-align: center;"><u>Density of Cohesionless Soils</u></td> <td style="text-align: center;"><u>Standard Penetration Resistance</u> <u>N-Value (blows per foot)</u></td> </tr> <tr> <td>Very loose</td> <td>0 - 4</td> </tr> <tr> <td>Loose</td> <td>5 - 10</td> </tr> <tr> <td>Medium Dense</td> <td>11 - 30</td> </tr> <tr> <td>Dense</td> <td>31 - 50</td> </tr> <tr> <td>Very Dense</td> <td>&gt; 50</td> </tr> </table>	<u>Descriptive Term</u>	<u>Portion of Total</u>	trace	0% - 10%	little	11% - 20%	some	21% - 35%	adjective (e.g. sandy, clayey)	36% - 50%	<u>Density of Cohesionless Soils</u>	<u>Standard Penetration Resistance</u> <u>N-Value (blows per foot)</u>	Very loose	0 - 4	Loose	5 - 10	Medium Dense	11 - 30	Dense	31 - 50	Very Dense	> 50																	
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Medium Dense	11 - 30																																											
Dense	31 - 50																																											
Very Dense	> 50																																											
(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	SW	Well-graded sands, gravelly sands, little or no fines																																									
	(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.	<p><b>Fine-grained soils</b> (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 shear strength as indicated.</p> <table border="0"> <tr> <td style="text-align: center;"><u>Consistency of Cohesive soils</u></td> <td style="text-align: center;"><u>SPT N-Value</u> <u>blows per foot</u></td> <td style="text-align: center;"><u>Approximate Undrained Shear Strength (psf)</u></td> <td style="text-align: center;"><u>Field Guidelines</u></td> </tr> <tr> <td>Very Soft</td> <td>WOH, WOR, WOP, &lt;2</td> <td>0 - 250</td> <td>Fist easily Penetrates</td> </tr> <tr> <td>Soft</td> <td>2 - 4</td> <td>250 - 500</td> <td>Thumb easily penetrates</td> </tr> <tr> <td>Medium Stiff</td> <td>5 - 8</td> <td>500 - 1000</td> <td>Thumb penetrates with moderate effort</td> </tr> <tr> <td>Stiff</td> <td>9 - 15</td> <td>1000 - 2000</td> <td>Indented by thumb with great effort</td> </tr> <tr> <td>Very Stiff</td> <td>16 - 30</td> <td>2000 - 4000</td> <td>Indented by thumb nail</td> </tr> <tr> <td>Hard</td> <td>&gt;30</td> <td>over 4000</td> <td>Indented by thumbnail with difficulty</td> </tr> </table> <p><b>Rock Quality Designation (RQD):</b></p> <p>RQD = <math>\frac{\text{sum of the lengths of intact pieces of core}^*}{\text{length of core advance}}</math></p> <p style="text-align: center;">*Minimum NQ rock core (1.88 in. OD of core)</p> <p style="text-align: center;">Correlation of RQD to Rock Mass Quality</p> <table border="0"> <tr> <td style="text-align: center;"><u>Rock Mass Quality</u></td> <td style="text-align: center;"><u>RQD</u></td> </tr> <tr> <td>Very Poor</td> <td>&lt;25%</td> </tr> <tr> <td>Poor</td> <td>26% - 50%</td> </tr> <tr> <td>Fair</td> <td>51% - 75%</td> </tr> <tr> <td>Good</td> <td>76% - 90%</td> </tr> <tr> <td>Excellent</td> <td>91% - 100%</td> </tr> </table> <p><b>Desired Rock Observations: (in this order)</b></p> <p>Color (Munsell color chart)</p> <p>Texture (aphanitic, fine-grained, etc.)</p> <p>Lithology (igneous, sedimentary, metamorphic, etc.)</p> <p>Hardness (very hard, hard, mod. hard, etc.)</p> <p>Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)</p> <p>Geologic discontinuities/jointing:</p> <ul style="list-style-type: none"> <li>-dip (horiz - 0-5, low angle - 5-35, mod. dipping - 35-55, steep - 55-85, vertical - 85-90)</li> <li>-spacing (very close - &lt;5 cm, close - 5-30 cm, mod. close 30-100 cm, wide - 1-3 m, very wide &gt;3 m)</li> <li>-tightness (tight, open or healed)</li> <li>-infilling (grain size, color, etc.)</li> </ul> <p>Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)</p> <p>RQD and correlation to rock mass quality (very poor, poor, etc.)</p> <p>ref: AASHTO Standard Specification for Highway Bridges 17th Ed. Table 4.4.8.1.2A</p> <p>Recovery</p>	<u>Consistency of Cohesive soils</u>	<u>SPT N-Value</u> <u>blows per foot</u>	<u>Approximate Undrained Shear Strength (psf)</u>	<u>Field Guidelines</u>	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 thumb nail	Hard	>30	over 4000	Indented by thumbnail with difficulty	<u>Rock Mass Quality</u>	<u>RQD</u>	Very Poor	<25%	Poor	26% - 50%	Fair	51% - 75%	Good	76% - 90%	Excellent	91% - 100%
		<u>Consistency of Cohesive soils</u>	<u>SPT N-Value</u> <u>blows per foot</u>		<u>Approximate Undrained Shear Strength (psf)</u>	<u>Field Guidelines</u>																																						
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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.																																										
<p><b>Desired Soil Observations: (in this order)</b></p> <p>Color (Munsell color chart)</p> <p>Moisture (dry, damp, moist, wet, saturated)</p> <p>Density/Consistency (from above right hand side)</p> <p>Name (sand, silty sand, clay, etc., including portions - trace, little, etc.)</p> <p>Gradation (well-graded, poorly-graded, uniform, etc.)</p> <p>Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)</p> <p>Structure (layering, fractures, cracks, etc.)</p> <p>Bonding (well, moderately, loosely, etc., if applicable)</p> <p>Cementation (weak, moderate, or strong, if applicable, ASTM D 2488)</p> <p>Geologic Origin (till, marine clay, alluvium, etc.)</p> <p>Unified Soil Classification Designation</p> <p>Groundwater level</p>				<p><b>Sample Container Labeling Requirements:</b></p> <table border="0"> <tr> <td>PIN</td> <td>Blow Counts</td> </tr> <tr> <td>Bridge Name / Town</td> <td>Sample Recovery</td> </tr> <tr> <td>Boring Number</td> <td>Date</td> </tr> <tr> <td>Sample Number</td> <td>Personnel Initials</td> </tr> <tr> <td>Sample Depth</td> <td></td> </tr> </table>		PIN	Blow Counts	Bridge Name / Town	Sample Recovery	Boring Number	Date	Sample Number	Personnel Initials	Sample Depth																														
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<p><b>Maine Department of Transportation</b></p> <p><b>Geotechnical Section</b></p> <p><b>Key to Soil and Rock Descriptions and Terms</b></p> <p>Field Identification Information</p>																																												

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 101.8	<b>Auger ID/OD:</b> 5" Dia
<b>Operator:</b> E. Giguere/C. Giles	<b>Datum:</b> NAVD 88	<b>Sampler:</b> 24" Standard Split Spoon
<b>Logged By:</b> C. Beebe	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> 140#/30"
<b>Date Start/Finish:</b> 6/13/08-6/13/08	<b>Drilling Method:</b> Solid Stem Auger	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 13+01.5, 5.5 Rt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> 5.0' bgs.
<b>Hammer Efficiency Factor:</b> 0.77	<b>Hammer Type:</b> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>	

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample attempt V = Insitu Vane Shear Test MV = Unsuccessful Insitu 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 = weight of rods WO1P = Weight of one person	S <sub>u</sub> = Insitu Field Vane Shear Strength (psf) T <sub>v</sub> = Pocket Torvane Shear Strength (psf) q <sub>u</sub> = Unconfined Compressive Strength (ksf) N-uncorrected = Raw field SPT N-value Hammer Efficiency Factor = Annual Calibration Value N <sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected
		S <sub>u(lab)</sub> = Lab Vane 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								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									101.30		PAVEMENT. (PC-5)		
									100.30		CONCRETE.		
5	1D	24/24	5.00 - 7.00	3/7/6/4	13	17			94.80		Brown, moist, medium dense, fine SAND, some silt, trace gravel. Clay in tip of spoon.	G#210663 A-2-4, SM WC=20.0%	
											<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL		

**Remarks:**

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 97.6	<b>Auger ID/OD:</b> 5" Dia
<b>Operator:</b> E. Giguere/C. Giles	<b>Datum:</b> NAVD 88	<b>Sampler:</b> 24" Standard Split Spoon
<b>Logged By:</b> C. Beebe	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> 140#/30"
<b>Date Start/Finish:</b> 6/13/08-6/13/08	<b>Drilling Method:</b> Solid Stem Auger	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 15+56.5, 6.5 Lt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> 2.7' bgs.
<b>Hammer Efficiency Factor:</b> 0.77	<b>Hammer Type:</b> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>	

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample attempt V = Insitu Vane Shear Test MV = Unsuccessful Insitu 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 = weight of rods WO1P = Weight of one person	S <sub>u</sub> = Insitu Field Vane Shear Strength (psf) T <sub>v</sub> = Pocket Torvane Shear Strength (psf) q <sub>u</sub> = Unconfined Compressive Strength (ksf) N-uncorrected = Raw field SPT N-value Hammer Efficiency Factor = Annual Calibration Value N <sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected	S <sub>u(lab)</sub> = Lab Vane Shear Strength (psf) WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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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									97.10		PAVEMENT. (PC-4)	
	1D/AB	24/15	1.50 - 3.50	5/5/5/5	10	13			96.10		CONCRETE.	
									95.35		(1D/A) 1.75-2.25' bgs. Brown, moist, fine to medium subangular GRAVEL, little well graded sand trace silt, some cohesiveness, (Fill).	
											(1D/B) 2.25-2.75' bgs. Brown, damp, medium dense, fine to medium SAND, trace silt, trace gravel.	
5	2D	24/24	5.00 - 7.00	3/6/6/6	12	15			92.60		Yellow brown, wet, medium dense, fine SAND, little silt, uniform. Water pooled in container.	
									90.60		<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL	
10												
15												
20												
25												

**Remarks:**

Driller: MaineDOT	Elevation (ft.): 91.9	Auger ID/OD: 5" Dia
Operator: E. Giguere/C. Giles	Datum: NAVD 88	Sampler: 24" Standard Split Spoon
Logged By: C. Beebe	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 6/13/08-6/13/08	Drilling Method: Solid Stem Auger	Core Barrel: N/A
Boring Location: 20+96.5, 4.5 Rt.	Casing ID/OD: N/A	Water Level*: None Observed

Hammer Efficiency Factor: 0.77      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 = Insitu Vane Shear Test MV = Unsuccessful Insitu 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 = weight of rods WO1P = Weight of one person	S <sub>u</sub> = Insitu Field Vane Shear Strength (psf) T <sub>v</sub> = Pocket Torvane Shear Strength (psf) q <sub>u</sub> = Unconfined Compressive Strength (ksf) N-uncorrected = Raw field SPT N-value Hammer Efficiency Factor = Annual Calibration Value N <sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected
		S <sub>u(lab)</sub> = Lab Vane 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								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									91.40		PAVEMENT. (PC-6)	G#210664 A-3, SP-SM WC=20.4%
									90.40		CONCRETE.	
5	1D	24/24	5.00 - 7.00	2/5/8/8	13	17			84.90		Orange-brown, moist, medium dense, fine SAND, trace silt.	
											<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL	
10												
15												
20												
25												

**Remarks:**

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 88.3	<b>Auger ID/OD:</b> 5" Dia
<b>Operator:</b> E. Giguere/C. Giles	<b>Datum:</b> NAVD 88	<b>Sampler:</b> 24" Standard Split Spoon
<b>Logged By:</b> C. Beebe	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> 140#/30"
<b>Date Start/Finish:</b> 6/13/08-6/13/08	<b>Drilling Method:</b> Solid Stem Auger	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 26+46.5, 8.0 Lt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> None Observed
<b>Hammer Efficiency Factor:</b> 0.77		<b>Hammer Type:</b> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>

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>u</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                      WOR = weight of rods                              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									87.80	PAVEMENT. (PC-3)		
	1D	24/17	1.50 - 3.50	9/21/22/12	43	55			86.80	CONCRETE.		
										Brown, dry, dense, well graded Sandy GRAVEL, little silt. (Fill).	G#210665 A-1-a, GW-GM WC=0.0%	
5	2D	24/22	5.00 - 7.00	2/3/4/3	7	9			82.60	Brown with red brown streaking, moist medium dense, SAND, some silt, trace gravel.	G#210666 A-2-4, SM WC=16.4%	
									81.30	<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL		
10												
15												
20												
25												

**Remarks:**

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 66.7	<b>Auger ID/OD:</b> 5" Dia
<b>Operator:</b> E. Giguere/C. Giles	<b>Datum:</b> NAVD 88	<b>Sampler:</b> 24" Standard Split Spoon
<b>Logged By:</b> C. Beebe	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> 140#/30"
<b>Date Start/Finish:</b> 6/13/08-6/13/08	<b>Drilling Method:</b> Solid Stem Auger	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 31+96.5, 4.5 Rt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> None Observed
<b>Hammer Efficiency Factor:</b> 0.77	<b>Hammer Type:</b> Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>	

Definitions: R = Rock Core Sample      S<sub>u</sub> = Insitu Field Vane Shear Strength (psf)      S<sub>u</sub>(lab) = 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>u</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                      WOR = weight of rods                              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									66.20	SSA	PAVEMENT. (PC-7)	
									65.20		CONCRETE.	
5	1D	24/24	5.00 - 7.00	3/3/4/4	7	9			59.70		Grey with red brown streaking, moist, medium stiff, plastic SILT with clay, trace sand.	G#210667 A-4, CL-ML WC=23.7%
											<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL	
10												
15												
20												
25												

**Remarks:**

Driller: MaineDOT	Elevation (ft.): 39.5	Auger ID/OD: 5" Dia
Operator: E. Giguere/C. Giles	Datum: NAVD 88	Sampler: 24" Standard Split Spoon
Logged By: C. Beebe	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 6/12/08-6/12/08	Drilling Method: Solid Stem Auger	Core Barrel: N/A
Boring Location: 36+46.5, 8.0 Lt.	Casing ID/OD: N/A	Water Level*: None Observed
Hammer Efficiency Factor: 0.77	Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>	

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>u</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      WOR = weight of rods      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									38.63	SSA	PAVEMENT. (PC-1)	
	1D S1	24/17	1.00 - 3.00	8/10/12/12	22	28					Brown, dey, medium dense, sandy subangular medium to fine GRAVEL, well graded sand, trace silt, (Fill). Dark brown, moist, organic rich sandy SILT, wood fragments, fine to medium sand.  Cobbles at 3.7' bgs, intermitate to 10.0' bgs.	
5												
	S2		8.00 - 10.00						31.50		Grey brown, silty SAND, little rounded fine gravel, trace organics, (Presumscott).	8.00
10												
	S3		10.00 - 15.00								Green-grey, sandy SILT, trace rounded fine gravel, modeling on colors, (Presumscott Formation).	
15												
	S4		15.00 - 20.00						27.50		Brown, moist, clayey SILT, trace fine sand, cohesion, plasticity, (Desecated Presumscott). Frequent cobbles from 15.0-20.0' bgs.	12.00
20												
25												
	S5		25.00 - 30.00						22.50		Similar to S4, but greyer brown color, (Desecated Presumscott).	17.00

**Remarks:**

Driller: MaineDOT	Elevation (ft.): 39.5	Auger ID/OD: 5" Dia
Operator: E. Giguere/C. Giles	Datum: NAVD 88	Sampler: 24" Standard Split Spoon
Logged By: C. Beebe	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 6/12/08-6/12/08	Drilling Method: Solid Stem Auger	Core Barrel: N/A
Boring Location: 36+46.5, 8.0 Lt.	Casing ID/OD: N/A	Water Level*: None Observed

**Hammer Efficiency Factor:** 0.77      **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)  
 U = Thin Wall Tube Sample      RC = Roller Cone      N-uncorrected = Raw field SPT N-value  
 MU = Unsuccessful Thin Wall Tube Sample attempt      WOH = weight of 140lb. hammer      Hammer Efficiency Factor = Annual Calibration Value  
 V = Insitu Vane Shear Test      WOR = weight of rods      N<sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency  
 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				
30									9.50		30.00	
												<b>Bottom of Exploration at 30.00 feet below ground surface.</b> NO REFUSAL
35												
40												
45												
50												

**Remarks:**

\* 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.

<b>Driller:</b> MaineDOT	<b>Elevation (ft.):</b> 39.9	<b>Auger ID/OD:</b> 5" Dia
<b>Operator:</b> E. Giguere/C. Giles	<b>Datum:</b> NAVD 88	<b>Sampler:</b> 24" Standard Split Spoon
<b>Logged By:</b> C. Beebe	<b>Rig Type:</b> CME 45C	<b>Hammer Wt./Fall:</b> 140#/30"
<b>Date Start/Finish:</b> 6/12/08-6/12/08	<b>Drilling Method:</b> Solid Stem Auger	<b>Core Barrel:</b> N/A
<b>Boring Location:</b> 40+41.5, 7.0 Lt.	<b>Casing ID/OD:</b> N/A	<b>Water Level*:</b> None Observed

**Hammer Efficiency Factor:** 0.77      **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 = Insitu Vane Shear Test MV = Unsuccessful Insitu 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 = weight of rods WO1P = Weight of one person	S <sub>u</sub> = Insitu Field Vane Shear Strength (psf) T <sub>v</sub> = Pocket Torvane Shear Strength (psf) q <sub>u</sub> = Unconfined Compressive Strength (ksf) N-uncorrected = Raw field SPT N-value Hammer Efficiency Factor = Annual Calibration Value N <sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency N <sub>60</sub> = (Hammer Efficiency Factor/60%)*N-uncorrected	S <sub>u(lab)</sub> = Lab Vane Shear Strength (psf) WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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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									SSA	38.70	PAVEMENT and CONCRETE. (PC-2)	
5	1D	24/17	5.00 - 7.00	2/4/6/6	10	13				32.90	Grey and brown streaked, moist, stiff, SILT, trace fine sand, trace gravel, some plasticity and cohesion, (Desecated Presumscott).	G#210668 A-4, ML WC=27.3%
											<b>Bottom of Exploration at 7.00 feet below ground surface.</b> NO REFUSAL	

**Remarks:**  
[STRONG GAS ODOR in hole]

Driller: MaineDOT	Elevation (ft.): 38.2	Auger ID/OD: 5" Dia
Operator: E. Giguere/C. Giles	Datum: NAVD 88	Sampler: 24" Standard Split Spoon
Logged By: B. Wilder	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/29/08-7/29/08	Drilling Method: Cased Wash Boring	Core Barrel: N/A
Boring Location: 37+23.5, 8.0 Lt.	Casing ID/OD: NW	Water Level*: None Observed
Hammer Efficiency Factor: 0.77	Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>	

Definitions:  
D = Split Spoon Sample  
MD = Unsuccessful Split Spoon Sample attempt  
U = Thin Wall Tube Sample  
MU = Unsuccessful Thin Wall Tube Sample attempt  
V = Insitu Vane Shear Test  
MV = Unsuccessful Insitu 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 = weight of rods  
WO1P = Weight of one person

S<sub>u</sub> = Insitu Field Vane Shear Strength (psf)  
T<sub>v</sub> = Pocket Torvane Shear Strength (psf)  
q<sub>u</sub> = Unconfined Compressive Strength (ksf)  
N-uncorrected = Raw field SPT N-value  
Hammer Efficiency Factor = Annual Calibration Value  
N<sub>60</sub> = SPT N-uncorrected corrected for hammer efficiency  
N<sub>60</sub> = (Hammer Efficiency Factor/60%)\*N-uncorrected

S<sub>u(lab)</sub> = Lab Vane 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								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	S1		0.80 - 2.50						37.40	PAVEMENT.		
									35.70	Brown, damp, gravelly fine to coarse SAND, little silt, (Fill).		
5	1D	24/6	5.00 - 7.00	6/9/7/6	16	21	20			Brown, moist, medium dense, Sand, some gravel, some silt. (Fill).	G#208692 A-1-b, SM WC=5.4%	
							22					
							37					
							29					
10	2D	24/12	9.00 - 11.00	6/3/5/9	8	10	11		29.20	Brown, wet, loose, fine to coarse SAND, some gravel, little silt.	G#208693 A-1-b, SM WC=21.5%	
							24					
							21					
							27			Dark brown muck and wood in wash water from 12.5-13.5' bgs.		
							27					
15	3D	24/4	14.00 - 16.00	4/5/9/6	14	18	30		24.20	Grey-brown, wet, medium dense, silty fine to medium SAND, some gravel, some wood fragments.		
							37					
							46					
							57					
							67		20.20			
20	4D	24/16	19.00 - 21.00	4/3/4/3	7	9	42			Olive-brown, wet, soft, clayey SILT, trace fine sand, wood fragments.		
							43					
							54					
							62					
							74					
25	5D	24/18	24.00 - 26.00	2/3/3/4	6	8	55			Silty CLAY, trace sand, trace gravel.	G#208694 A-6, CL WC=26.6%	
							66					

**Remarks:**

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

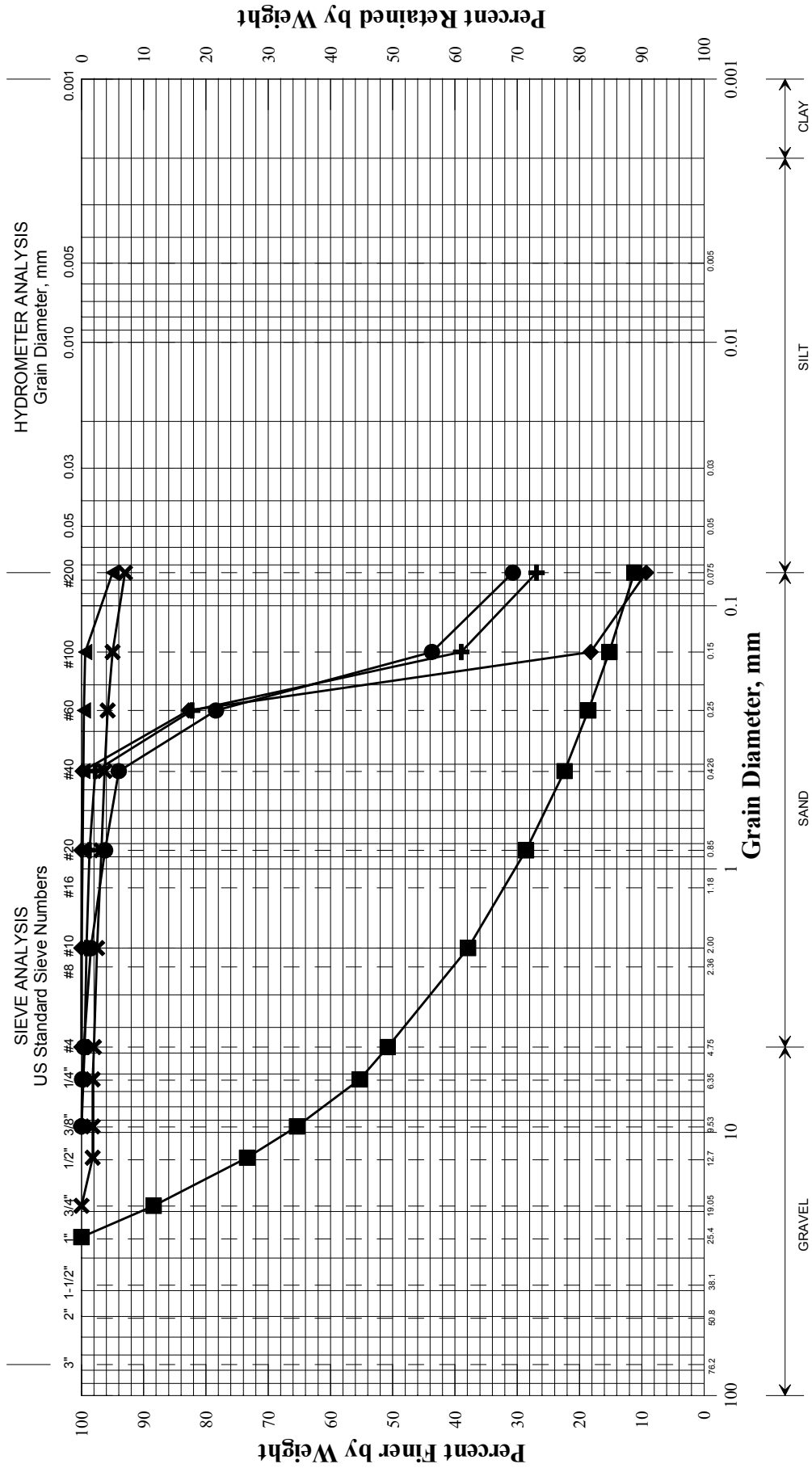




**Appendix D**  
**Lab Test Data**  
Lab Testing Summary Sheet  
Grain Size Curves



*State of Maine Department of Transportation*  
GRAIN SIZE DISTRIBUTION CURVE

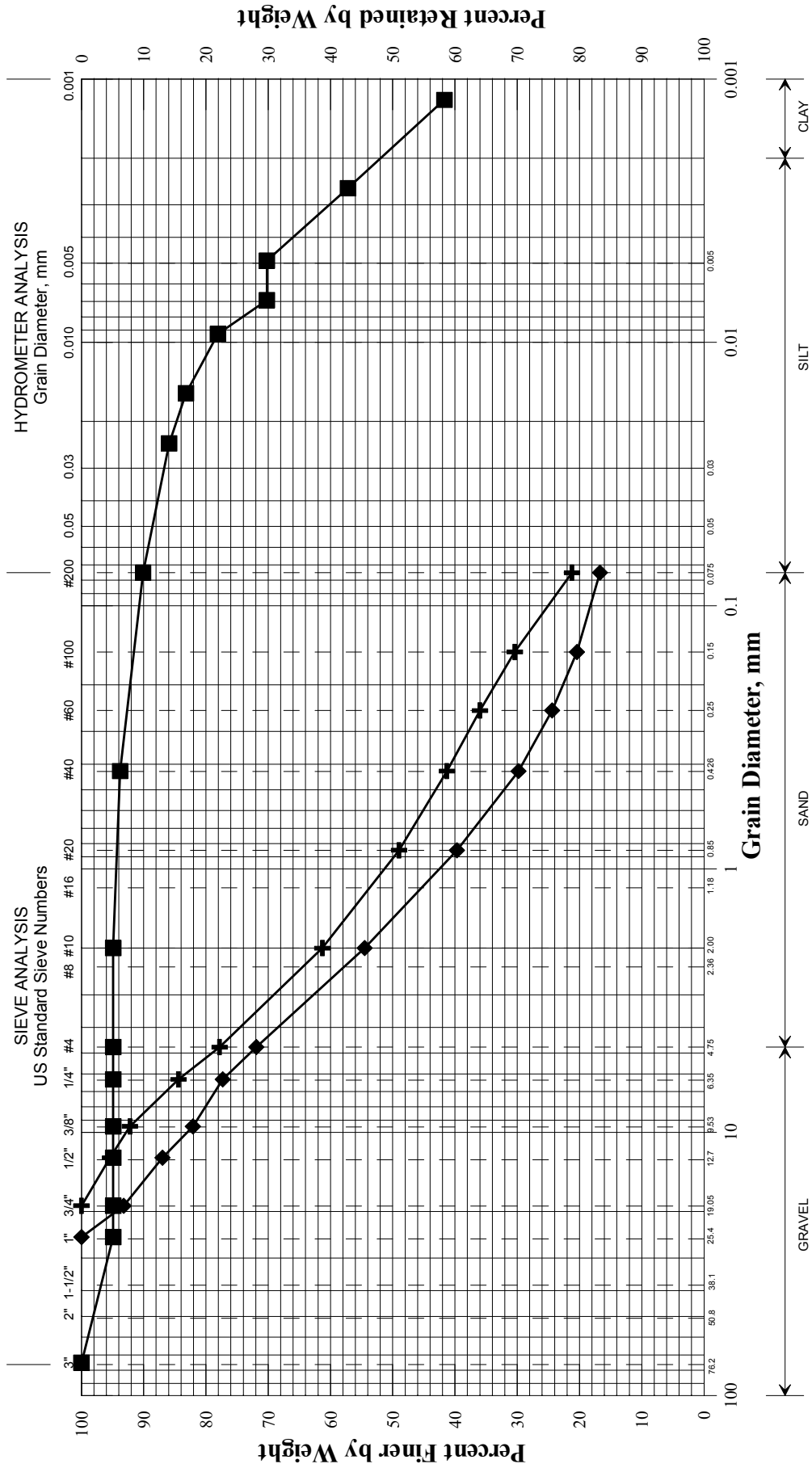


UNIFIED CLASSIFICATION

Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+ HB-HAMP-101/1D	13+01.5	5.5 RT	5.0-7.0	SAND, some silt, trace gravel.	20.0			
◆ HB-HAMP-103/1D	20+96.5	4.5 RT	5.0-7.0	SAND, trace silt.	20.4			
■ HB-HAMP-104/1D	26+46.5	8.0 LT	1.5-3.5	Sandy GRAVEL, little silt.	0.0			
● HB-HAMP-104/2D	26+46.5	8.0 LT	5.0-7.0	SAND, some silt, trace gravel.	16.4			
▲ HB-HAMP-105/1D	31+96.5	4.5 RT	5.0-7.0	SILT with clay, trace sand.	23.7			
× HB-HAMP-107/1D	40+41.5	7.0 LT	5.0-7.0	SILT, trace sand, trace gravel.	27.3			

PIN	014796.00
Town	Hampden
Reported by/Date	WHITE, TERRY A 7/25/2008

*State of Maine Department of Transportation*  
GRAIN SIZE DISTRIBUTION CURVE



UNIFIED CLASSIFICATION

+	Station	37+23.5
◆	Offset, ft	8.0 LT
■	Depth, ft	5.0-7.0
●	Description	SAND, some gravel, some silt.
▲	W, %	5.4
×	PL	
	LL	
	PI	

Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
HB-HAMP-201/1D	37+23.5	8.0 LT	5.0-7.0	SAND, some gravel, some silt.	5.4			
HB-HAMP-201/2D	37+23.5	8.0 LT	9.0-11.0	SAND, some gravel, little silt.	21.5			
HB-HAMP-201/5D	37+23.5	8.0 LT	24.0-26.0	Silty CLAY, trace sand, trace gravel.	26.6			

PIN	014796.00
Town	Hampden
Reported by/Date	WHITE, TERRY A 9/15/2008

**Appendix E**  
Pavement Core Photographs





143-HAMP-102

15+56.5  
G.5 LT

APR 12 2011



20+96.5  
4.5 RT

HB-HAMP-103

APR 12 2011



113- WAMP-104  
26+46.5  
8.0 LT

APR 12 2011



HB-14 AMP-105  
31+96.5  
4.5 RT

APR 12 2011



HB 107 40+41.5  
7.0 LT

APR 12 2011