

Maine Department of Transportation
Highway Program

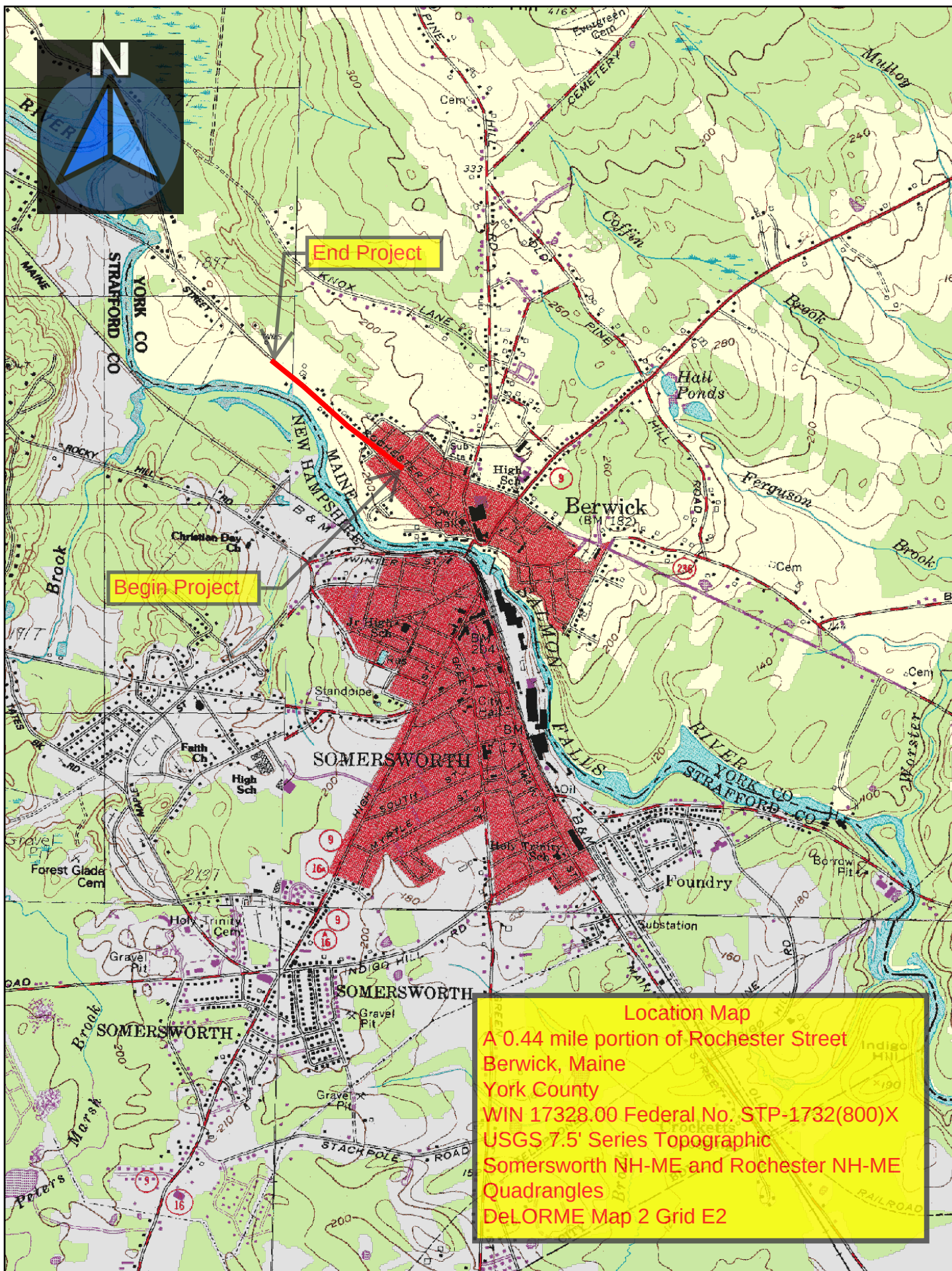
GEOTECHNICAL SERIES 100 REPORT
Highway Reconstruction
Rochester Street (INV RD 31B0577)
Berwick, Maine

Prepared by:
Karen Gross
Geotechnical Design Engineer

York County

Soils Report No. 2013-131

WIN 17328.00
STP-1732(800)X
October 08, 2013



Map Scale 1:24000

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Brad Foley, Program Manager
Scott Bickford & Heath Cowan, Assistant Program Managers
Phone: 624-3480 Fax: 624-3481

Memorandum

To: Ernie Martin
From: Karen Gross
Date: 10/08/2013
Subject: Final Geotechnical Report
Berwick, Rochester Street
WIN 17328.00
Report No. 2013-131

The geotechnical investigations for the Berwick-Rochester Street project have been completed. The following is a summary of those investigations and an assessment of existing conditions in relation to the options for the new pavement structure. Any other probable geotechnical issues will also be discussed. The information reviewed for this assessment includes a field reconnaissance and subsurface investigations. No as-built plans were located for this project.

Project Overview

The project begins at Sweetser Street and extends 0.42 miles northwesterly to just past Hall Brothers Roofing. For the purpose of this report, the endpoint is the entrance to the Berwick Water Department. The proposed scope of work is reconstruction which includes new subsurface drainage and a new sidewalk on the northeastern side of the project.

This roadway is classified as a major collector (Federal Functional Classification) and as an inventory road (#31B0577) by MaineDOT classifications.

This section of Rochester Street lies within 500 feet of the Salmon Falls River. The topography is relatively flat and the roadway lies a few feet above the river elevation. Flooding of the roadway occurs occasionally at a large culvert between Hall Brothers Roofing and the Berwick Water Department.

Existing Pavement Condition

The existing pavement consists of two 11-ft travel lanes and variable width gravel shoulders. Current pavement management data (2011) indicates that the International Roughness Index (IRI) is 172 to 207 inches/mile, the Pavement Condition Rating (PCR) is between 2.89 and 3.12, and the right rut is 0.3" in depth.

The IRI is a measure of ride quality and the lower the number, the better the feel of the ride. A new pavement typically has IRI values of 40 to 50 inches/mile. The current values indicate that the road has a comfortable ride at 45 mph, but there will be noticeable swaying and movements felt that are induced by the existing distresses.

The PCR is a numerical measure of all the distresses (cracking and rutting) including extent and severity. The PCR scale ranges from 0 (poor) to 5 (excellent). PCR values of 3 or less indicate that the roadway is in fair condition and rehabilitation is warranted. The distresses on this project are considered moderate in severity for most of the project. These distresses include transverse cracking, block cracking, longitudinal cracking in the wheel paths, alligator cracking, and right wheel path rutting. The longitudinal cracks, alligator cracking, and rutting are of most concern because they indicate structural deficiencies. Transverse and block cracks form due to temperature differences and are considered functional cracks (produce ride quality issues). I have attached ARAN images of the various distresses existing on this project.

The method that the rut depths are measured and recorded are not always valid for roads with gravel shoulders and where there is evidence of rutting due to lack of travel lane edge confinement. The reported value of 0.3" is less than what I physically measured on the southwest side of the roadway. I measured 0.5" to 1.25". These were just spot checks and stations were not recorded (none available at the time). I would expect these rut depths or even greater depths with gravel shoulders and poor drainage conditions.

Existing Surface Course

The existing roadway surface is Hot Mix Asphalt (HMA) and is 22' in total width. Borings indicate that the HMA ranges from 4" to 6" in thickness. There is a coarser mix in the bottom layer and finer mixes as you move towards the surface.

Existing Base/Subbase

Borings were drilled at eleven locations to a depth of 10 feet below the ground surface or refusal, whichever came first. Boring locations were selected based on avoiding underground utilities (sewer and water) that exist on most of the project.

The existing base/subbase aggregate ranges from 8.2" to 30" in thickness. Lab testing indicates that the existing aggregate does not meet MaineDOT gradation specifications for base (#304.09) or subbase (#304.10) aggregate at all locations. The following table shows the existing gradation in respect to the specification.

Sieve Size	% Passing Base Specification # 304.09	% Passing Subbase Specification # 304.10	Station 104+59 (S1)	Station 108+87 (S4)	Station 112+30 (S6)	Station 119+47 (S9)	Station 121+11 (S11)	Station 124+72.5 (S13)
1/2"	35 - 75	xxxx	86	100	88	81	97	94
1/4"	25 - 60	25 - 70	74	95	72	74	72	77
# 40	0 - 20	0 - 30	39	67	29	45	27	29
# 200	0 - 5	0 - 7	12	22	9	15	11	6

It should be noted that we collect very small sample sizes as part of the subsurface investigations. Because of this small sample size, the results can be skewed toward the finer particle sizes since larger stones are not included. Plus, samples were collected off of auger flights, so larger particles may not be collected on the flights. Test pits allow the collection of bag samples which will contain a wide range of samples and give a better picture of the existing base/subbase aggregate.

Based on the lab test results, the existing material will be moderately frost susceptible and have poor drainage properties.

Subgrade

The subgrade consists predominately of sand with varying amounts of silt and gravel. There is not much difference between the subgrade soils and the base/subbase aggregate to a depth of approximately 10 feet below the HMA surface. Based on this, I suspect the road was never constructed to any standard and the existing granular material was simply graded and paved over. There is a possibility that thick fills were placed, but looking at the surrounding topography, this is not highly probable.

The Maine Geologic Survey surficial geology map for this area indicates the natural soils are Till (Sweetser Street to just past Morse Street) and Marine Regressive Sand deposits (Morse Street to end of project). The lab testing information shows that the natural soils are very similar, therefore I am assuming that the natural soils are marine Regressive Sand deposits. These deposits are typically 3' to 15' in thickness and overly marine clay-silt.

Based on the existing subgrade soils, the appropriate Subgrade Resilient Modulus value to use for the pavement design is 4000 psi.

Bedrock

Refusal was encountered a depth of 6.3 feet at Station 104+59 which is between Sweetser and Merrick Street. It was not confirmed if the refusal was due to shallow bedrock, a boulder, or other types of obstructions. Geology and Soil Conservation maps do not indicate a restrictive layer, so I am assuming this is a boulder.

Shoulders

The existing shoulders are granular and variable in width. There is a sidewalk which is paved with HMA at roadway elevation from Sweetser Street to just beyond Morse Street. No subsurface investigations were done in the existing shoulders because of the existence of underground utilities. Based on the roadway boring information and the lab test results, I am assuming the underlying granular material is the same as under the travel lanes.

Groundwater

Shallow water and wet soils were encountered from the intersection with Bridge Street to the end of the project. Groundwater tends to flow towards and discharge into rivers, lakes, and wetlands because these water bodies often occur in low points of the watershed. The following table shows the where and at what depth shallow water and wet soils were encountered.

Design Station	Offset (ft)	Depth to Wet Soils (ft)	Depth to Water (ft)
108+87	1.6 R	3	
108+87	8.4 L	3.0	
112+30	0.8 R	6.5	7.5
114+87	1.8 L		3.2
115+12	1.0 L		3.6
119+47	8.2 L	8.6	9.5
121+12	8.1 L	6.2	
121+11	4.0 R	6.0	
123+09	7.6 L		6.0

There are two issues associated with shallow groundwater. First, there is the lost of strength of the underlying soils when they are wet. The second is that there is an available water source to produce frost heaving. The anticipated depth of frost is approximately 5 feet for this area. Water located within 10 feet below a snow free pavement will potentially create frost heaving issues based on the existing soil types. Weak pavement structure foundations and frost heaving both result in a shortened performance period for the pavement structure. Drainage improvements should be incorporated into the design that will provide rapid removal of water from beneath the pavement, lower the groundwater table, and reduce the effects of frost. This can be accomplished by daylighting the subbase gravel to ditches or providing underdrains where ditching is not possible.

Culvert at Sta. 119+40

A boring was drilled adjacent to the 48" corrugated metal pipe that exists between Hall Brothers Roofing and the Berwick Water Department. As mentioned previously, this is the culvert where flooding of the roadway occurs with larger storm events. Information was collected at this location in anticipation that the existing culvert will be replaced.

The boring information indicates that a 5 ½' marine clay-silt layer sandwiched between silty sand layers. The upper sand layer is 13 feet thick. The boring was terminated at 20 feet, so the thickness of the underlying sand layer is unknown. Water was encountered at 9.5 feet below the roadway surface and is approximately the same as the river surface elevation. Actual pipe invert elevations are unknown at this time, so the soil that the pipe is founded is assumed to be sand.



Highway Program

New Pavement Structure Options

Because of the length of this project, recycling the existing HMA would not be considered cost effective. Full depth reconstruction is recommended since the existing underlying granular material has a high fines content and does not meet MaineDOT gradation specifications. Since the sample size used for testing was so small, test pits where larger sample sizes can be collected and tested are recommended if leaving the existing granular material needs to be considered.

Regardless if the base/subbase will be new material or if it is determined that the existing material can be left in place, the following designs meet a 12-year performance period.

Option 1	
HMA	4
subbase	26
total	30

Option 2	
HMA	5
subbase	22
total	27

Option 3	
HMA	6
subbase	18
total	24

There are advantages and disadvantages to each option, primarily cost related, but all are considered acceptable designs for this roadway classification. If the existing subbase is left in place and does not meet specification, adjustments to these designs will be necessary.

Summary

The existing pavement is in fair condition but is exhibiting signs of distress that is associated with unpaved shoulders and poor drainage conditions.

The existing pavement structure consists of 4" to 6" of HMA over variable depth granular material. This granular material, or subbase, does not meet MaineDOT's specification # 304.10 - Aggregate Subbase Course Gravel. It substantially exceeds the requirements for the % passing the #200 sieve which affects the permeability and frost susceptibility.

The subgrade consists predominately of sand with variable amounts of silt and gravel. Lab testing indicates that there is very little difference between the subbase and subgrade material, therefore I conclude that the HMA was paved directly on the natural soils.

Because of the proximity of the roadway to the Salmon Falls River and the local topography, a high groundwater table can be expected from the intersection with Bridge Street to the end of the project. Wet soils and water were encountered in most of the borings at shallow depths. Provisions for positive drainage for the pavement structure that will remove water and lower the groundwater table are recommended along the entire project length. This will increase the strength of the underlying soils as well as reduce the potential for frost action.

Because of the project length (0.42 miles), recycling the existing HMA will not be cost effective. Full reconstruction is recommended based on the lab test results which indicate that the subbase does not meet the specifications for gradation. If leaving the existing subbase in place needs to be considered for budgetary reasons, test pits and bag samples should be collected and tested in order to get a better representation of the existing material and what risk will be associated with doing so.

Pavement structures that will meet a 12-year design life include: 1) 4" of HMA over 26" of subbase, 2) 5" of HMA over 22" of subbase, and 3) 6" of HMA over 18" of subbase. These layer thicknesses are based on materials that meet MaineDOT specifications.

No recommendations are provided at this time for the culvert at Station 119+40. Proposed design of this culvert is unknown.

All supporting documentation is attached for your reference. Please let me know if I can provide you with any additional information or clarify anything in this report.

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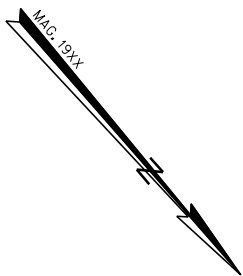
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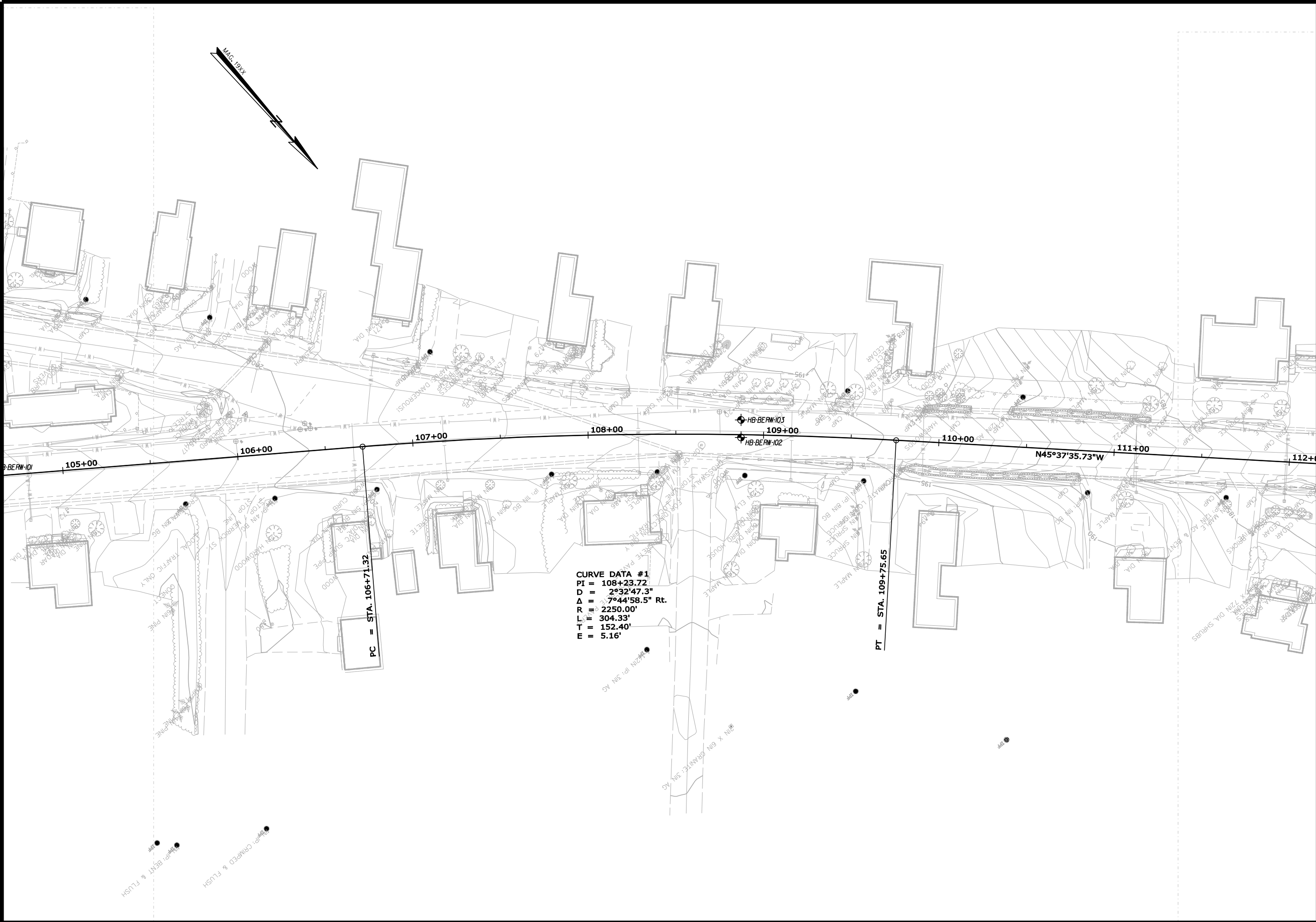




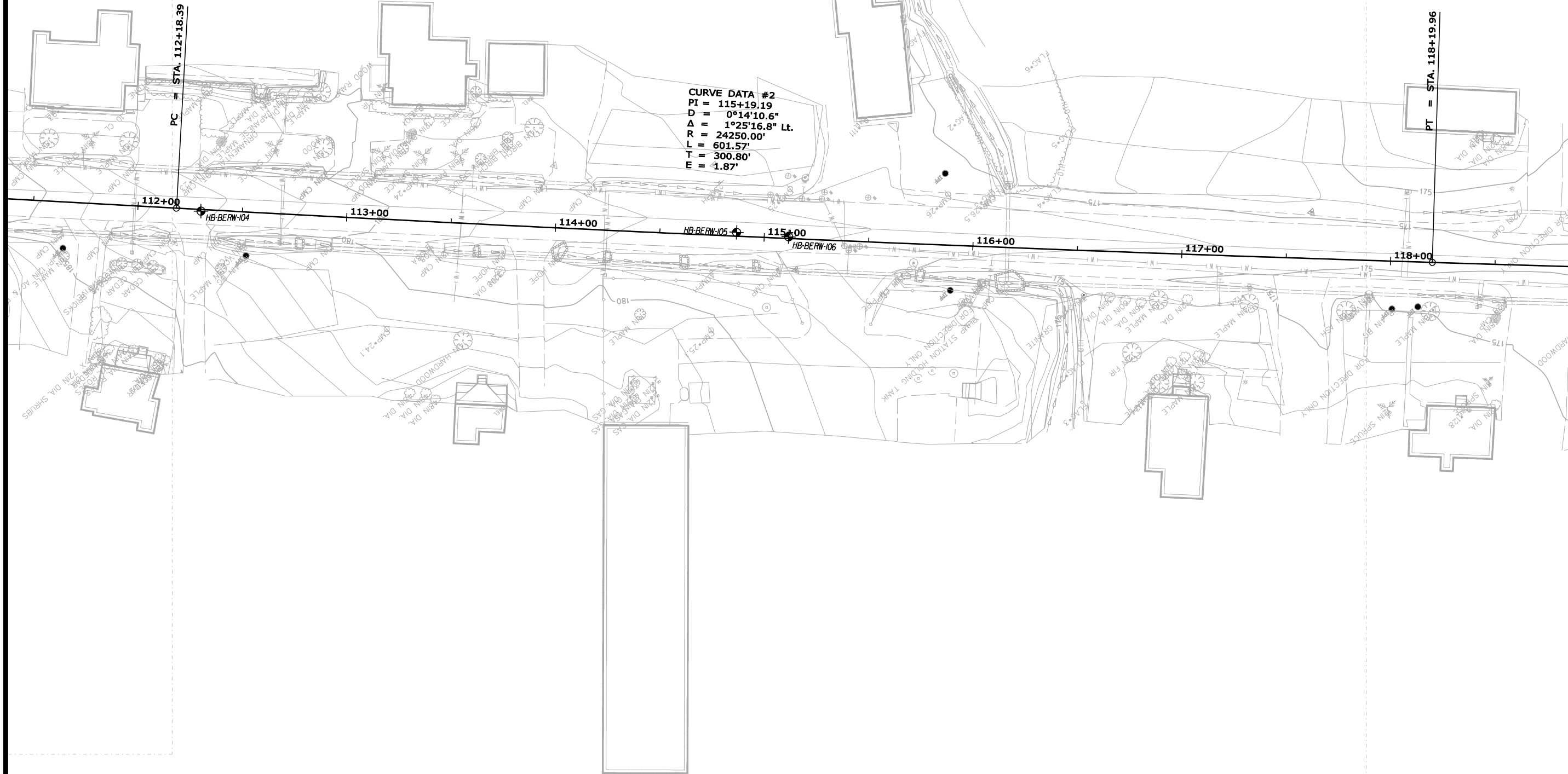




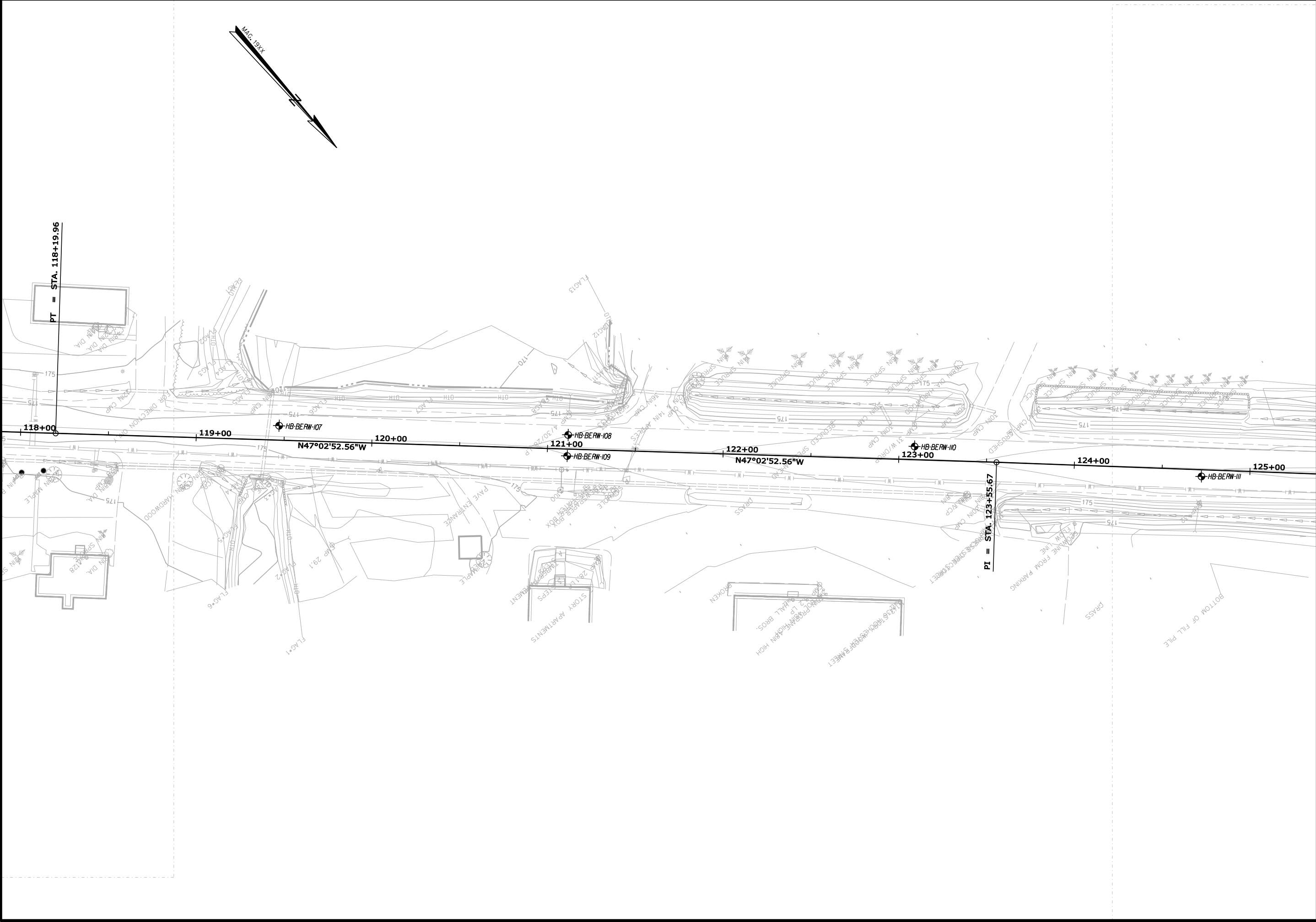
SHEET NUMBER 1 OF 5 BERWICK ROCHESTER STREET GEOPLANS		PROJ. MANAGER DESIGN-DETAILED DESIGN2-DETAILED2 DESIGN3-DETAILED3 REVISIONS 1 REVISIONS 2 REVISIONS 3 REVISIONS 4 FIELD CHANGES				BY T. WHITE		DATE APR 2012		SIGNATURE P.E. NUMBER DATE		STATE OF MAINE DEPARTMENT OF TRANSPORTATION STP-1732(800)X WIN 17328.00 HIGHWAY PLANS	
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STATE OF MAINE		DEPARTMENT OF TRANSPORTATION	
STP-1732(800)X		WIN 17328.00	
HIGHWAY PLANS			
PROJECT NAME		PROJECT NUMBER	
BERWICK ROCHESTER STREET		1732	
SHEET NUMBER		DATE	
2		APR 2012	
OF 5		SIGNATURE	
		P.E. NUMBER	
		DATE	
		BY	
		DATE	
		DESIGN-DETAILED	
		CHECKED-REVIEWED	
		DESIGN2-DETAILED	
		DESIGN3-DETAILED	
		REVISIONS 1	
		REVISIONS 2	
		REVISIONS 3	
		REVISIONS 4	
		FIELD CHANGES	



SHEET NUMBER		BERWICK ROCHESTER STREET		PROJ. MANAGER		BY	DATE	STATE OF MAINE	
3	OF 5	GEOPLANS		DESIGN DETAIL				SIGNATURE	
				CHECKED-REVIEWED					
				DESIGN-2 DETAIL-2	K. GROSS	T. WHITE	APR 2012		
				DESIGN-3 DETAIL-3					
				REVISIONS 1					
				REVISIONS 2				P.E. NUMBER	
				REVISIONS 3					
				REVISIONS 4					
				FIELD CHANGES					
								DATE	
								WIN 17328.00	
								HIGHWAY PLANS	



STATE OF MAINE

DEPARTMENT OF TRANSPORTATION

STP-1732(800)X

WIN
17328.00

HIGHWAY PLANS

PROJ. MANAGER

DESIGN-DETAILED

CHECKED-REVIEWED

DESIGN2-DETAILED2

DESIGN3-DETAILED3

REVISIONS 1

REVISIONS 2

REVISIONS 3

REVISIONS 4

FIELD CHANGES

BY

T. WHITE

DATE

APR 2012

SIGNATURE

P.E. NUMBER

DATE

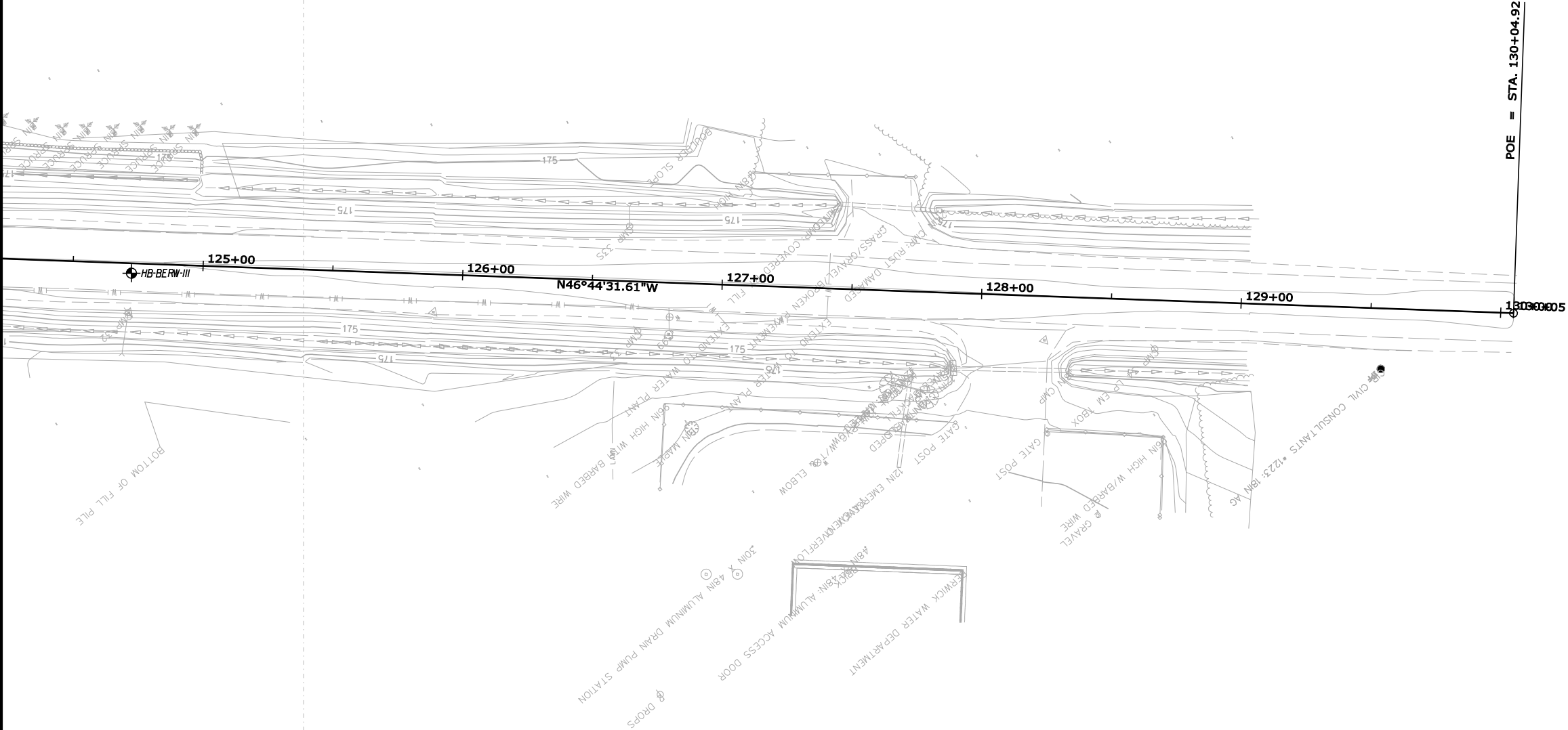
BERWICK
ROCHESTER STREET

GEOPLANS

SHEET NUMBER

4

OF 5



PROJ. MANAGER	BY	DATE	SIGNATURE	P.E. NUMBER	DATE
DESIGN DETAILED					
CHECKED-REVIEWED			T. WHITE		APR 2012
DESIGN2-DETAILED2			K. GROSS		
DESIGN3-DETAILED3					
REVISIONS 1					
REVISIONS 2					
REVISIONS 3					
REVISIONS 4					
FIELD CHANGES					

BORING SUMMARY**Berwick, Rochester Street WIN 17328.00**

Boring No.	Design Station	Offset (ft)	Exploration Depth (ft)	Refusal Depth (ft)	Depth to wet soils (ft)	Depth to water (ft)	Pavement Thickness			Subbase % passing #200	Subgrade Type	Subgrade % passing #200 sieve
							HMA (in)	Subbase (in)	Total (in)			
HB-BERW-101	104+59	5.2 L	6.3	6.3			5	8.2	13.2	12	SAND (SP-SM)	11
HB-BERW-102	108+87	1.6 R	10		3		5.5	30.5	36	22	SAND (SM)	27
HB-BERW-103	108+87	8.4 L	10.0		3.0		5.5	30.5	36.0	22.0	SAND	27
HB-BERW-104	112+30	0.8 R	10.0		6.5	7.5	4.0	11.6	15.6	9.0	SAND (SP-SM)	11
HB-BERW-105	114+87	1.8 L	10.0			3.2	4.0	12.8	16.8	9.0	SAND (SP-SM)	11
HB-BERW-106	115+12	1.0 L	10.0			3.6	4.5	14.7	19.2	9.0	SAND (SP-SM)	11
HB-BERW-107	119+47	8.2 L	20.0		8.6	9.5	5.0	31	36.0	15.0	SAND (SM)	15
HB-BERW-108	121+12	8.1 L	10		6.2		5.0	31	36.0	15.0	SAND (SW-SM)	15
HB-BERW-109	121+11	4.0 R	10.0		6.0		5.0	31	36.0	11.0	SAND (SW-SM)	11
HB-BERW-110	123+09	7.6 L	10.0			6.0	6.0	30	36.0	11.0	SAND (SP-SM)	11
HB-BERW-111	124+73	3.8 R	8.0				6.0	30	36.0	6.0	SAND (SP-SM)	6

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Rochester Street Location: Berwick, Maine		Boring No.: HB-BERW-101 PIN: 17328.00				
Driller: MaineDOT		Elevation (ft.)		Auger ID/OD: 5" Dia.						
Operator: Giguere/Guiles/Daggett		Datum: NAVD88		Sampler: Off Flights						
Logged By: B. Wilder		Rig Type: CME 45C		Hammer Wt./Fall: N/A						
Date Start/Finish: 3/26/2012-3/26/2012		Drilling Method: Solid Stem Auger		Core Barrel: N/A						
Boring Location: 104+59, 5.2 ft Lt.		Casing ID/OD: N/A		Water Level*: None Observed						
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test						
Sample Information										
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	PC-1		0.00 - 0.42			SSA	-0.42		5" PAVEMENT, core taked.	G#264076
	S1		0.42 - 1.10				-1.10		Brown, damp, fine to coarse SAND, some gravel, little silt.	A-1-b, SW-SM
	S2		1.10 - 4.20						Light brown, damp, fine to medium SAND, little silt, trace gravel.	WC=3.5%
										G#264077
										A-2-4, SP-SM
5	S3		4.20 - 6.30				-4.20		Brown, moist, fine to coarse SAND, some gravel, trace silt.	WC=6.8%
							-6.30		Bottom of Exploration at 6.30 feet below ground surface. REFUSAL	
10										
15										
20										
25										
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.										
Page 1 of 1										
Boring No.: HB-BERW-101										

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-102 PIN: 17328.00																																																																																																																																																																																																								
Driller: MaineDOT				Elevation (ft.)				Auger ID/OD: 5" Dia.																																																																																																																																																																																																								
Operator: Giguere/Guiles/Daggett				Datum: NAVD88				Sampler: Off Flights																																																																																																																																																																																																								
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Boring Location: 108+87, 1.6 ft Rt.				Casing ID/OD: N/A				Water Level*: None Observed																																																																																																																																																																																																								
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Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS						Project: Rochester Street Location: Berwick, Maine			Boring No.: HB-BERW-103 PIN: 17328.00								
Driller: MaineDOT						Elevation (ft.)			Auger ID/OD: 5" Dia.								
Operator: Giguere/Guiles/Daggett						Datum: NAVD88			Sampler: Off Flights								
Logged By: B. Wilder						Rig Type: CME 45C			Hammer Wt./Fall: N/A								
Date Start/Finish: 3/26/2012-3/26/2012						Drilling Method: Solid Stem Auger			Core Barrel: N/A								
Boring Location: 108+87, 8.4 ft Lt.						Casing ID/OD: N/A			Water Level*: None Observed								
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger						Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) S_{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing						Definitions: 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 No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log									
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							-3.00		Grey-brown, wet, fine to medium SAND, some silt, trace gravel. ≈S5								
5																	
10							-10.00		Bottom of Exploration at 10.00 feet below ground surface. NO REFUSAL								
15																	
20																	
25																	
Remarks:																	
HB-BERW-103 has similar depths and soils as HB-BERW-103.																	
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.																	
Page 1 of 1																	
Boring No.: HB-BERW-103																	

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-104 PIN: 17328.00																																																																																																																																																																																																												
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	S8		6.30 - 10.00				-6.30		Rust, saturated, fine to coarse SAND, little silt, little gravel.																																																																																																																													
10							-10.00		Bottom of Exploration at 10.00 feet below ground surface. NO REFUSAL																																																																																																																													
15																																																																																																																																						
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* 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-BERW-105																																																																																																																												

Maine Department of Transportation <u>Soil/Rock Exploration Log</u> <u>US CUSTOMARY UNITS</u>				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-106 PIN: 17328.00							
Driller: MaineDOT				Elevation (ft.)				Auger ID/OD: 5" Dia.							
Operator: Giguere/Guiles/Daggett				Datum: NAVD88				Sampler: Off Flights							
Logged By: B. Wilder				Rig Type: CME 45C				Hammer Wt./Fall: N/A							
Date Start/Finish: 3/26/2012-3/26/2012				Drilling Method: Solid Stem Auger				Core Barrel: N/A							
Boring Location: 115+12, 1.0 ft Lt.				Casing ID/OD: N/A				Water Level*: 3.6 ft bgs.							
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger				Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing				Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test							
Sample Information										Visual Description and Remarks				Laboratory Testing Results/ AASHTO and Unified Class	
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							
0						SSA	-0.38		4½" PAVEMENT.				-0.38		
							-1.60		Brown, damp, fine to coarse SAND, some gravel, trace silt. ≈S6				-1.60		
									Light brown, moist, fine to medium SAND, little silt, trace gravel ≈S7				-1.60		
5							-5.50		Rust, saturated, fine to coarse SAND, little silt, little gravel. ≈S8				-5.50		
10							-10.00		Bottom of Exploration at 10.00 feet below ground surface. NO REFUSAL				-10.00		
15															
20															
25															
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.															
Page 1 of 1															
Boring No.: HB-BERW-106															

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS						Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-107 PIN: 17328.00																	
Driller: MaineDOT						Elevation (ft.)				Auger ID/OD: 5" Dia.																	
Operator: Giguere/Guiles/Daggett						Datum: NAVD88				Sampler: Off Flights																	
Logged By: B. Wilder						Rig Type: CME 45C				Hammer Wt./Fall: N/A																	
Date Start/Finish: 3/26/2012-3/26/2012						Drilling Method: Solid Stem Auger				Core Barrel: N/A																	
Boring Location: 119+47, 8.2 ft Lt.						Casing ID/OD: N/A				Water Level*: 9.5 ft bgs.																	
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger						Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing						Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test															
Sample Information																											
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		S9		0.42 - 8.60			SSA	-0.42		5" PAVEMENT. Brown, moist, fine to coarse SAND, some gravel, little silt.										G#264082 A-1-b, SM WC=7.35							
5																											
		S10		8.60 - 13.00				-8.60		Grey, saturated, silty SAND, trace gravel.										G#264083 A-4, SM WC=18.3%							
10																											
								-13.00		Grey, wet, clayey-SILT.																	
15																											
								-18.50		Grey, wet, fine to coarse SAND, some gravel, some silt.																	
20								-20.00		Bottom of Exploration at 20.00 feet below ground surface. NO REFUSAL																	
25																											
Remarks:																											
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.														Page 1 of 1													
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Maine Department of Transportation <u>Soil/Rock Exploration Log</u> <u>US CUSTOMARY UNITS</u>				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-108 PIN: 17328.00							
Driller: MaineDOT				Elevation (ft.)				Auger ID/OD: 5" Dia.							
Operator: Giguere/Guiles/Daggett				Datum: NAVD88				Sampler: Off Flights							
Logged By: B. Wilder				Rig Type: CME 45C				Hammer Wt./Fall: N/A							
Date Start/Finish: 3/26/2012-3/26/2012				Drilling Method: Solid Stem Auger				Core Barrel: N/A							
Boring Location: 121+11.5, 8.1 ft Lt.				Casing ID/OD: N/A				Water Level*: None Observed							
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger				Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing				Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test							
Sample Information										Visual Description and Remarks				Laboratory Testing Results/ AASHTO and Unified Class	
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							
0						SSA	-0.42		5" PAVEMENT.	-0.42					
									Brown, damp, fine to coarse SAND, some gravel, little silt. ≈S11						
5							-6.20		Grey, wet, silty, fine to medium SAND, some clay. ≈S12	-6.20					
10							-10.00		Bottom of Exploration at 10.00 feet below ground surface. NO REFUSAL	-10.00					
15															
20															
25															
Remarks:															
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.										Page 1 of 1					
* 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-BERW-108					

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-109 PIN: 17328.00																																																																																																			
Driller: MaineDOT				Elevation (ft.)				Auger ID/OD: 5" Dia.																																																																																																			
Operator: Giguere/Guiles/Daggett				Datum: NAVD88				Sampler: Off Flights																																																																																																			
Logged By: B. Wilder				Rig Type: CME 45C				Hammer Wt./Fall: N/A																																																																																																			
Date Start/Finish: 3/26/2012-3/26/2012				Drilling Method: Solid Stem Auger				Core Barrel: N/A																																																																																																			
Boring Location: 121+11, 4.0 ft Rt.				Casing ID/OD: N/A				Water Level*: None Observed																																																																																																			
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger				Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing				Definitions: 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								Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.																																																																																																	
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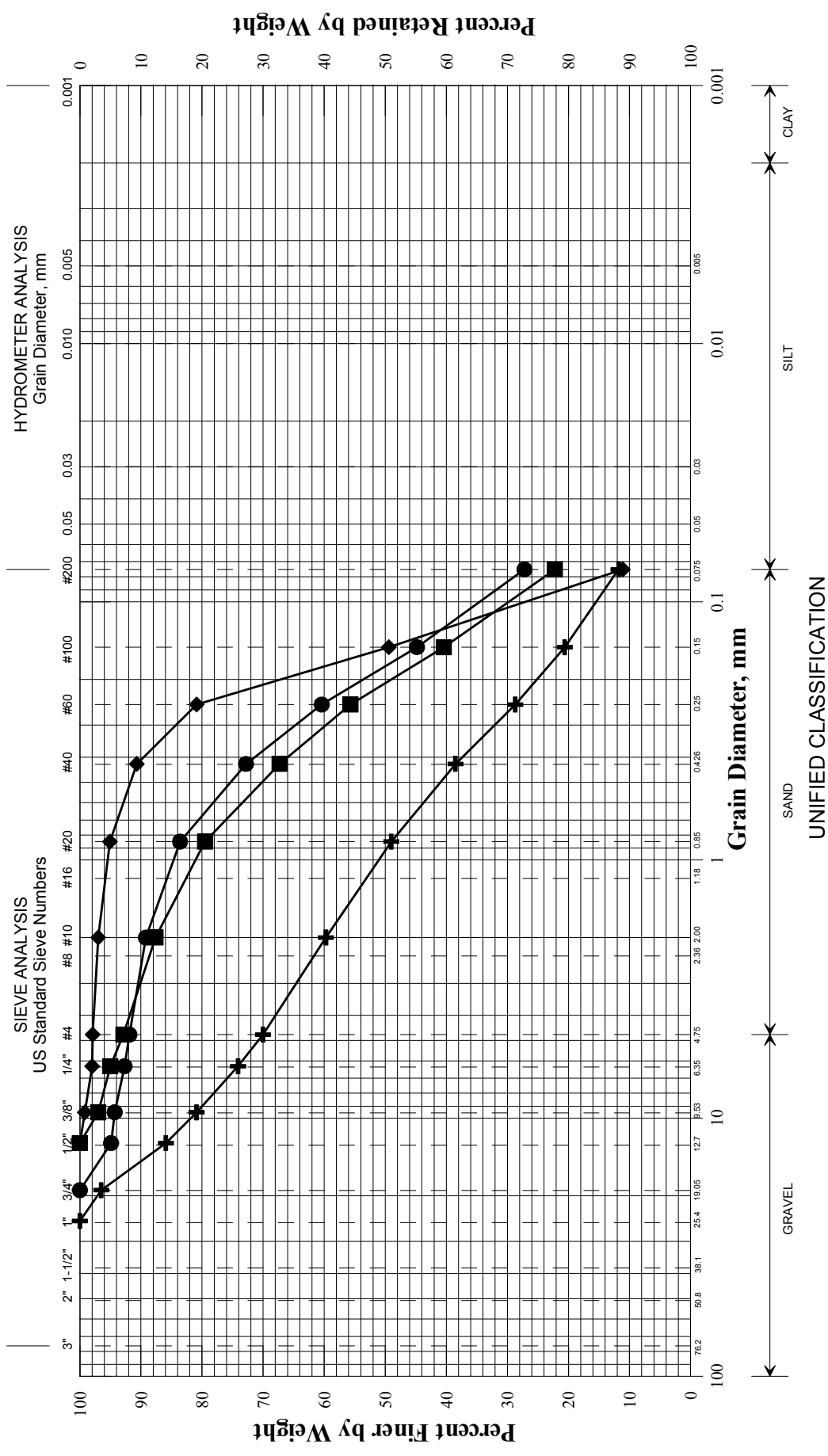
Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Rochester Street Location: Berwick, Maine				Boring No.: HB-BERW-110 PIN: 17328.00																																																																																												
Driller: MaineDOT				Elevation (ft.)				Auger ID/OD: 5" Dia.																																																																																												
Operator: Giguere/Guiles/Daggett				Datum: NAVD88				Sampler: Off Flights																																																																																												
Logged By: B. Wilder				Rig Type: CME 45C				Hammer Wt./Fall: N/A																																																																																												
Date Start/Finish: 3/26/2012-3/26/2012				Drilling Method: Solid Stem Auger				Core Barrel: N/A																																																																																												
Boring Location: 123+09, 7.6 ft Lt.				Casing ID/OD: N/A				Water Level*: 6.0 ft bgs.																																																																																												
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger				Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing				Definitions: 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							Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.																																																																																											
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Maine Department of Transportation						Project: Rochester Street				Boring No.: HB-BERW-111																							
Soil/Rock Exploration Log US CUSTOMARY UNITS						Location: Berwick, Maine				PIN: 17328.00																							
Driller: MaineDOT						Elevation (ft.)				Auger ID/OD: 5" Dia.																							
Operator: Giguere/Guiles/Daggett						Datum: NAVD88				Sampler: Off Flights																							
Logged By: B. Wilder						Rig Type: CME 45C				Hammer Wt./Fall: N/A																							
Date Start/Finish: 3/26/2012-3/26/2012						Drilling Method: Solid Stem Auger				Core Barrel: N/A																							
Boring Location: 124+72.5, 3.8 ft Rt.						Casing ID/OD: N/A				Water Level*: None Observed																							
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger						Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing						Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test																					
Sample Information																																	
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		S13				0.50 - 8.00						SSA		-0.50				6" PAVEMENT. Brown, moist, fine to coarse SAND, some gravel, trace silt, occasional cobbles.														G#264086 A-1-b, SW-SM WC=4.2%	
5														-8.00				Bottom of Exploration at 8.00 feet below ground surface. NO REFUSAL															
10																																	
15																																	
20																																	
25																																	
Remarks:																																	
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Boring No.: HB-BERW-111																																	

Work Number: 17328.00

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

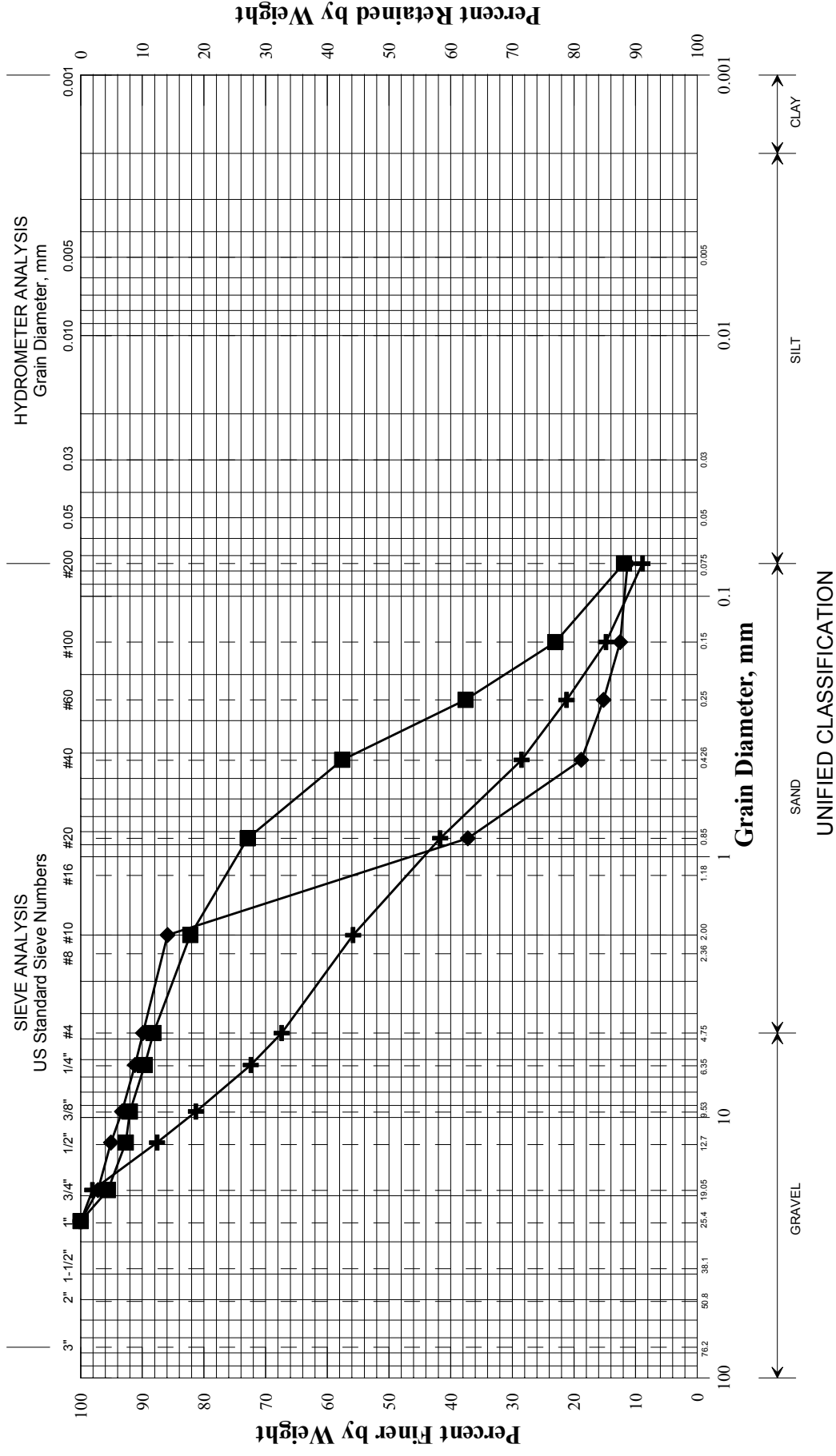
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
HB-BERW-101/S1	104+59	5.2 LT	0.42-1.1	SAND, some gravel, little silt.	3.5			
HB-BERW-101/S2	104+59	5.2 LT	1.1-4.2	SAND, little silt, trace gravel.	6.8			
HB-BERW-102/S4	108+87	1.6 RT	0.46-3.0	SAND, some silt, trace gravel.	7.5			
HB-BERW-102/S5	108+87	1.6 RT	3.0-10.0	SAND, some silt, trace gravel.	11.4			

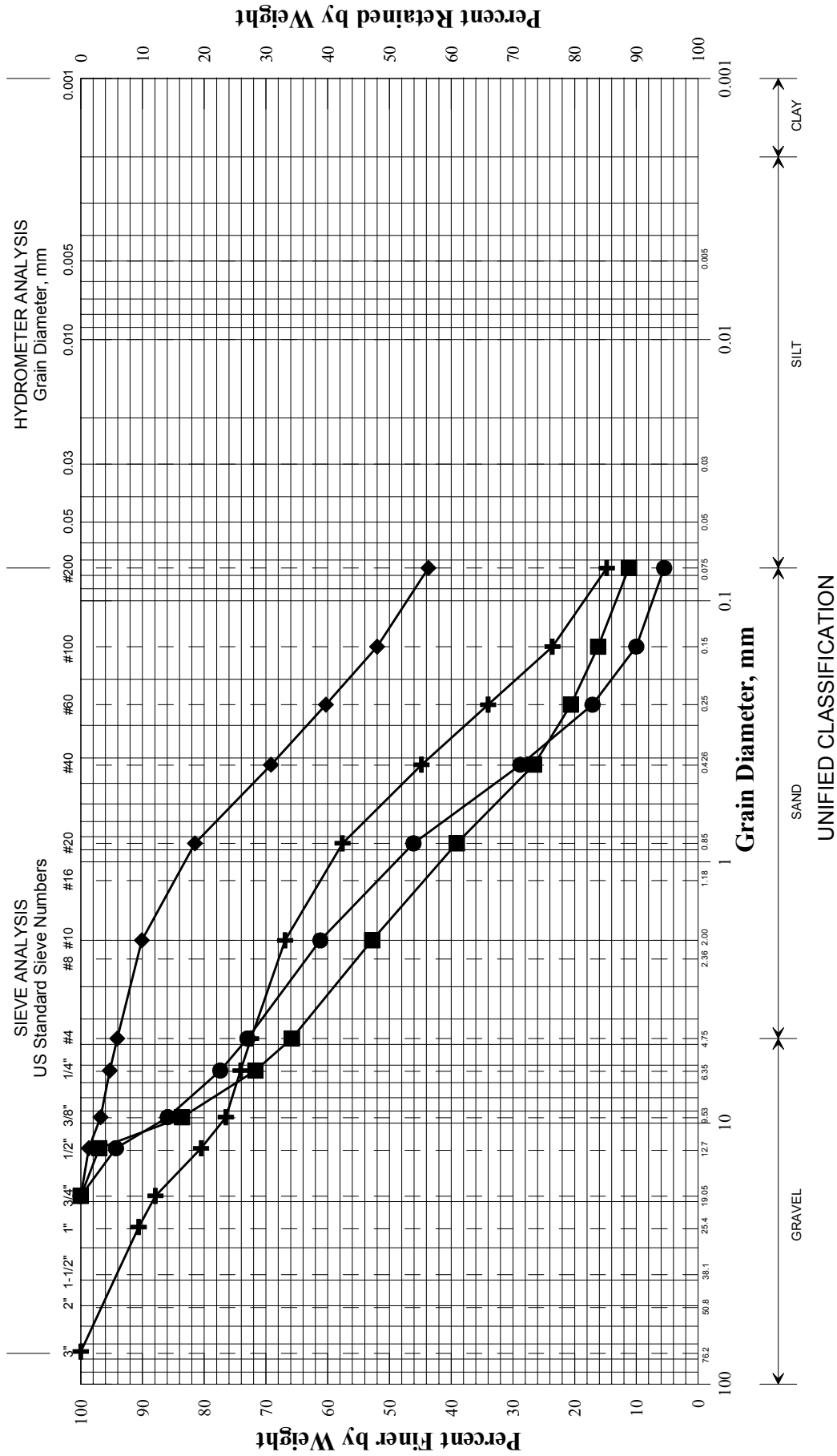
WIN	017328.00	Town	Reported by/Date
	Berwick		WHITE, TERRY A 4/17/2012

State of Maine Department of Transportation

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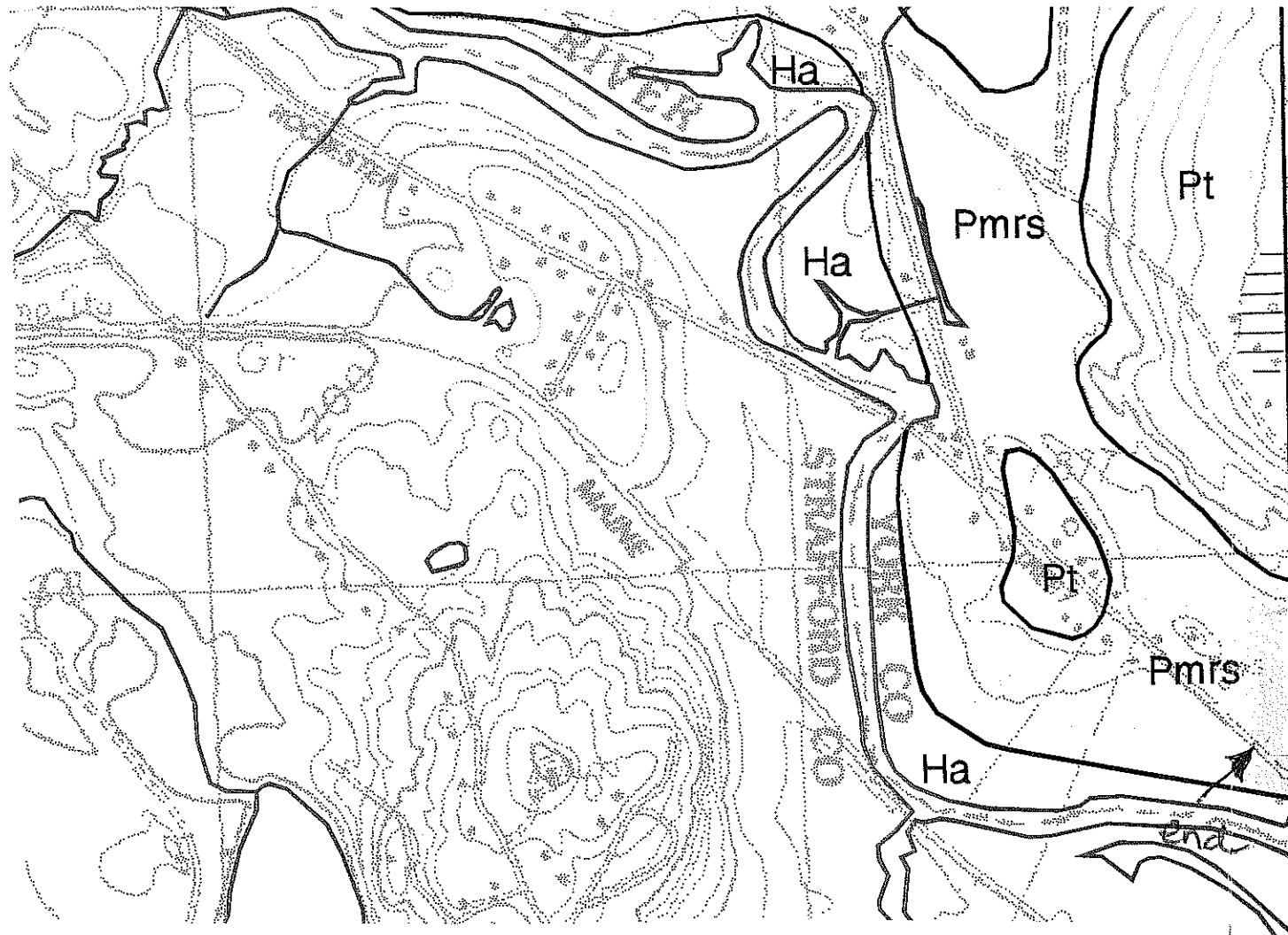
WIN
017328.00
Town
Berwick
Reported by/Date
WHITE, TERRY A 4/17/2012

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



WIN	017328.00
Town	Berwick
Reported by/Date	WHITE, TERRY A 4/17/2012

Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
HB-BERW-107/S9	119+47	8.2 LT	0.42-8.6	SAND, some gravel, little silt.	7.3			
HB-BERW-107/S10	119+47	8.2 LT	8.6-13.0	Silty SAND, trace gravel.	18.3			
HB-BERW-109/S11	121+11	4.0 RT	0.42-6.0	SAND, some gravel, little silt.	3.6			
HB-BERW-111/S13	124+72.5	3.8 RT	0.5-8.0	SAND, some gravel, trace silt.	4.2			



Somersworth Quadrangle, Maine

Surficial geologic mapping by
Geoffrey W. Smith

Digital cartography by:
Robert A. Johnston

Cartographic design and editing by:
Robert D. Tucker

State Geologist

Funding for the preparation of this map was provided by the Maine Geological Survey.



Maine Geological Survey
Address: 22 State House Station, Augusta, Maine 04333
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Home page: <http://www.maine.gov/doc/mgsc/home.htm>

Open-File No. 99-99
1999

For additional information,
see Open-File Report 99-130.

Rochester Quadrangle, Maine

Surficial geologic mapping by
Geoffrey W. Smith

Digital cartography by:
Robert A. Johnston

Cartographic design and editing by:
Robert D. Tucker

State Geologist

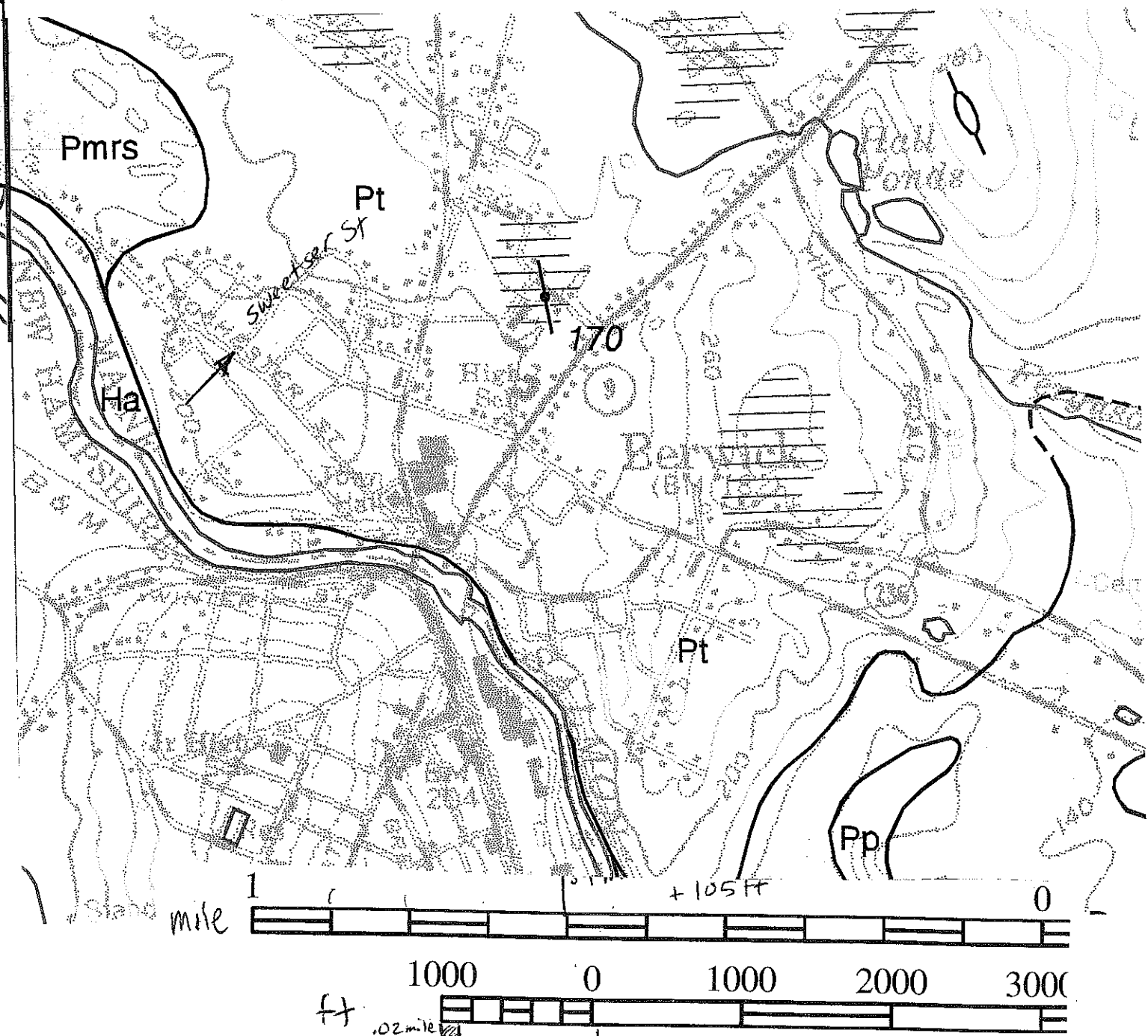
Funding for the preparation of this map was provided by the Maine Geological Survey.



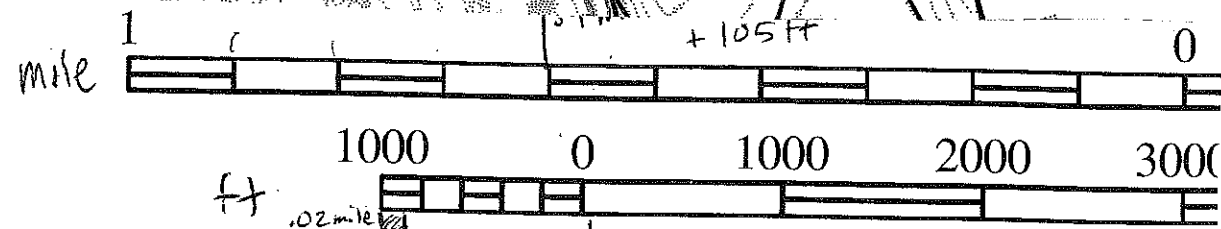
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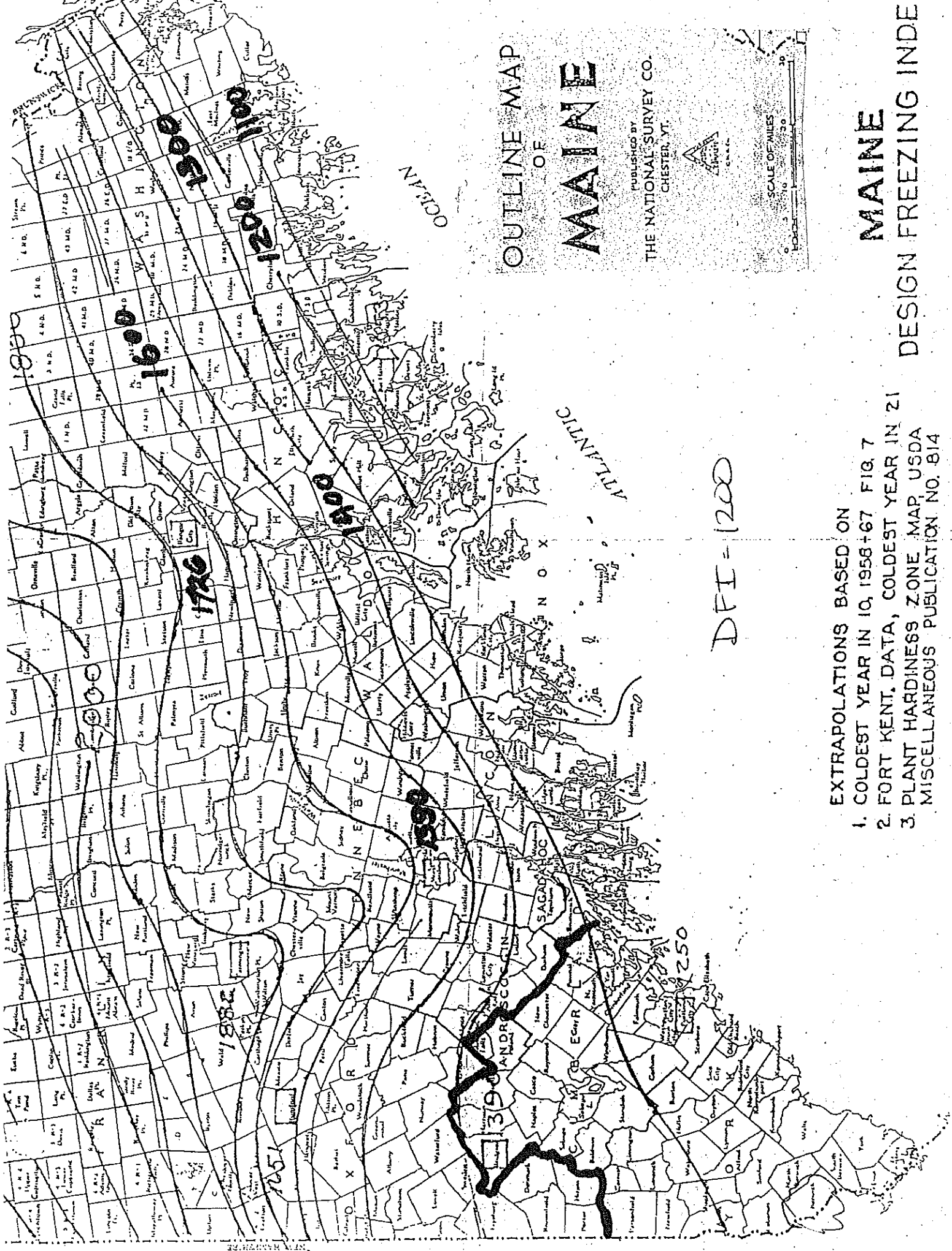
Open-File No. 99-98
1999

For additional information,
see Open-File Report 99-129.



- | | |
|--|---|
| <p>Ha Stream alluvium - Gray to brown fine sand and silt with some gravel. Comprises flood plains along present streams and rivers. Extent of alluvium approximates areas of potential flooding.</p> <p>Hws Wetland, swamp* - Muck, peat, silt, and sand. Poorly drained areas, often with standing water.</p> <p>Hwfm Wetland, freshwater marsh - Poorly drained freshwater grassland.</p> <p>Hwhp Wetland, heath* - Peat and fine-grained inorganic sediment. Distinguished from other wetlands by the absence of trees and the presence of shrubs.</p> <p>Pmrs Marine regressive sand deposits - Massive to stratified and cross-stratified, well sorted brown to gray-brown sand. May have gradational basal contact with unit Pp. Thickness between 1 and 5 m. Deposited during regressive phase of marine submergence.</p> <p>Pp Presumpscot Formation - Massive to laminated gray and blue-gray (weathering to brown) silt and silty clay. Locally may contain boulders, sand, and gravel. Occurs as blanket deposit over bedrock and older glacial sediments. Variable thickness from less than 1 m to more than 50 m. Deposited during period of late-glacial marine submergence.</p> <p>Pmd Marine delta - Coarse sand and gravel grading to sand and silt. Flat to gently sloping constructional surface formed by glacial streams discharging into late-glacial sea. Floods of ice-contact deltas (Pmd) mark ice frontal positions. Sediments in distal portions of deltas commonly grade into glacial-marine sediments (Pp, Pmrs). Variable thickness from more than 10 m at delta head to less than 1 m at delta toe.</p> <p>Ppi Ice-contact deposits (undifferentiated) - Coarse gravel and sand deposited in contact with melting glacial ice. Average thickness probably between 10 and 15 m. Locally kettled.</p> <p>Pgo Esker - Coarse gravel and sand comprising distinct linear ridges, deposited in glacial ice tunnels. May be more than 10 m thick.</p> <p>Pm Outwash - Sand and gravel deposited by glacial meltwater in the Little River valley.</p> <p>Pem End moraine - Coarse gravel and sand. Locally includes till and silt. Generally occurs in areas of glacial-marine sediments (Pp, Pmrs) and is complexly interstratified with them. Formed at or near the ice front during retreat of marine-based glacier. Sediments commonly display significant deformation. Typically 5 to 10 m thick.</p> <p>Pemc End moraine complex - Coarse gravel, sand, fill, and silt, commonly over shallow bedrock. Mapped in areas of closely spaced small (DeGeer) end moraines. Formed at or near ice front during retreat of marine-based glacier. Sediments commonly display significant deformation. Generally less than 5 m in thickness.</p> | <p>Pt Till - Gray to gray-brown poorly sorted mixture of silt, sand, pebbles, cobbles, and boulders. Forms a blanket deposit over bedrock and is inferred to underlie younger sediments where not exposed at surface. Thin over topographic highs; thickens in topographic lows. May occur in and over end moraines (Pem, Pemc). Averages 3 to 5 m in thickness.</p> <p>Bedrock - Bedrock of Paleozoic age. The ruled pattern indicates area where outcrops are common and surficial sediments are generally less than 3 m thick.</p> <p>Artificial fill - Mainly composed of coarse gravel and sand, or various man-made materials.</p> <p>Contact - Boundary between map units. Dashed where boundary is uncertain or inferred.</p> <p>Moraine ridge - Ridge of till and/or water-laid sediments deposited in the marginal zone of the glacier. Lines indicate ridge crest.</p> <p>Scarp - Symbol indicates scarps formed by stream erosion, or by marine erosion during period of higher sea level. Ticks are on downslope side of scarp line.</p> <p>Esker ridge - Shows trend of sand and gravel ridge deposited in meltwater tunnel beneath the ice sheet (Pgo). Chevrons indicate the direction of inferred meltwater flow.</p> <p>Glacial striation locality - Dot indicates point of observation. Arrow shows direction of ice flow if known. Number is azimuth in degrees of ice flow direction.</p> <p>Glacially streamlined hill - Indicates a hill that has been elongated parallel to the direction of ice flow. The hill may be bedrock-cored.</p> <p>Area of many large boulders</p> <p>Kettlehole - Depression resulting from melting of a block of glacial ice.</p> <p>Delta foresets - Range of dip directions of foreset beds in glacial marine delta.</p> <p>Grooved till surface - Narrow ridges and grooves in till sculpted by flow of glacial ice.</p> <p>Meltwater channel - Channel cut by glacial meltwater stream.</p> |
|--|---|
- *NOTE: Wetland symbols followed by "*" indicate areas where peat deposits probably do not constitute a significant commercial resource, either because they are thin (< 1.5 m), or they have an ash content greater than 25 percent. Symbols followed by "p" indicate peat deposits that are thicker (generally > 1.5 m), with ash content less than 25 percent, and thus may be suitable for commercial applications.





OUTLINE MAP OF MAINE

PUBLISHED BY
THE NATIONAL SURVEY CO.
CHESTER, VT.



SCALE OF MILES
0 10 20 30

MAINE DESIGN FREEZING INDE

DPI = 1200

- EXTRAPOLATIONS BASED ON
1. COLDEST YEAR IN 10, 1958-67 FIG. 7
 2. FORT KENT, DATA, COLDEST YEAR IN 21
 3. PLANT HARDINESS ZONE MAP, USDA MISCELLANEOUS PUBLICATION NO. 814

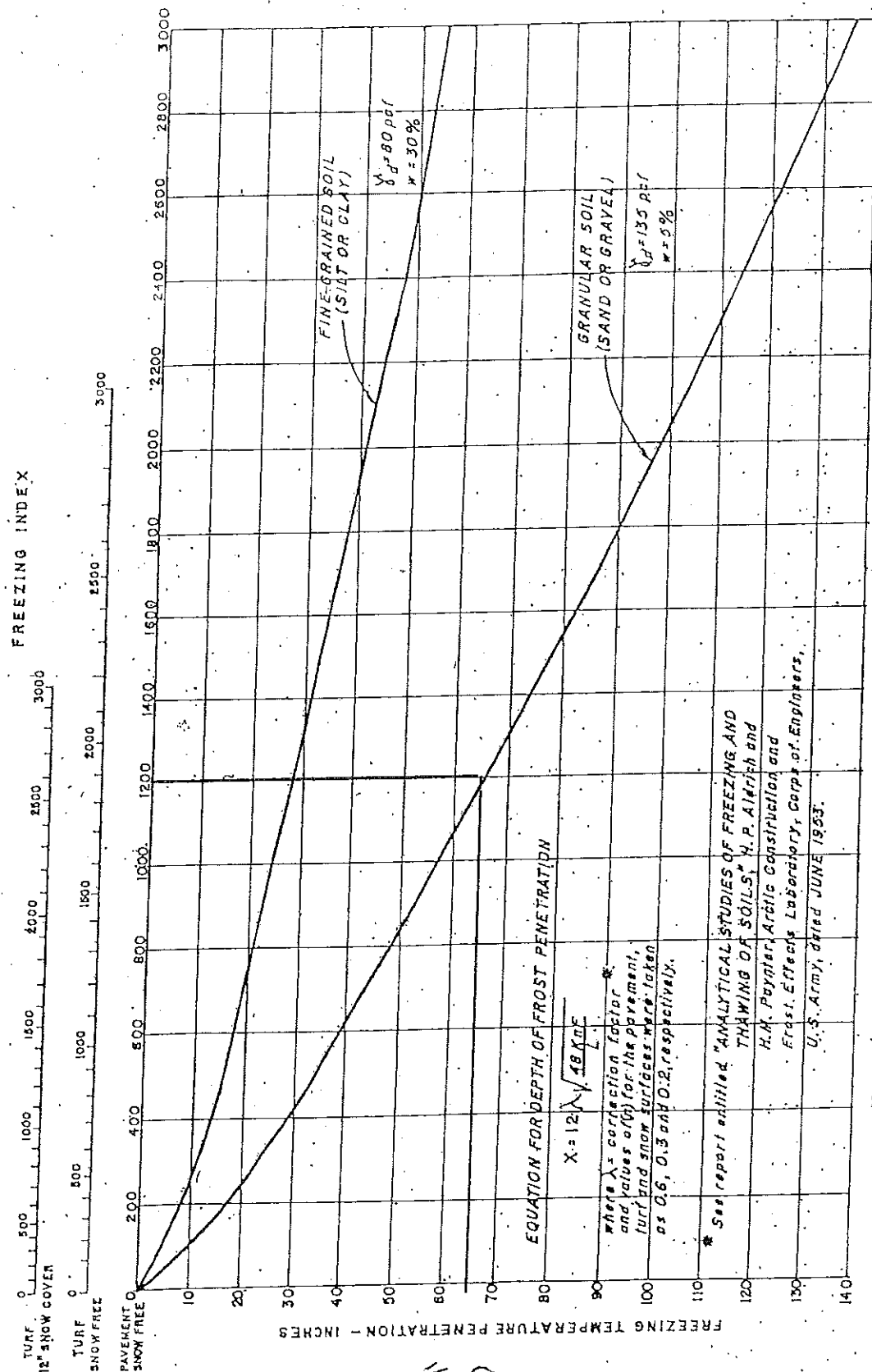


Figure 13-3 RELATIONSHIP BETWEEN FREEZING INDEX AND
FREEZING TEMPERATURE PENETRATION FOR VARIOUS SURFACE
CONDITIONS FOR GRANULAR AND FINE-GRAINED SOILS.



MaineDOT

Route Log Mile ~ E x p a n d e d ~ Detail Report

Tide Load date: 04/23/2012
Tide year: 2011

[Back](#)

Filter Results

Pavement Data					
Surface	IRI	PCR	Inv Year	Rut Left	Rut Right

Node ID	Node Description	MP	Fed. Func. Class
Berwick -- Primary Route: 31B0577; Begin MP: .29, End MP: 10.29			
52120	Int of ANNIE ST, ROCHESTER ST	0.29	Major/urb collector
52121	Int of ROCHESTER ST, SWEETSER ST	0.34	Major/urb collector
52136	Int of MERRICK ST, ROCHESTER ST	0.40	Major/urb collector
52123	Int of BRIDGE ST, ROCHESTER ST	0.42	Major/urb collector
52125	Int of MORSE ST, ROCHESTER ST	0.45	Major/urb collector
52097	Non-Int ROCHESTER ST	0.57	Major/urb collector
		0.66	Major/urb collector
		1.14	Major/urb collector
52100	Int of HUBBARD RD, ROCHESTER ST	1.16	Major/urb collector
52101	End of ROCHESTER ST	1.28	END BREAK

Flexible	207	3.12	2011	.1	.3
Flexible	207	3.12	2011	.1	.3
Flexible	207	3.12	2011	.1	.3
Flexible	207	3.12	2011	.1	.3
Flexible	207	3.12	2011	.1	.3
Flexible	172	2.89	2011	.1	.3
Flexible	172	2.89	2011	.1	.3
Flexible	231	1.97	2011	.1	.5
Flexible	231	1.97	2011	.1	.5

STATE OF MAINE

INTERDEPARTMENTAL MEMORANDUM

FILE: York Cty.

COPY:

Date of Request: 06/13/2011

Return: 06/29/11

Latest Date Needed By: ASAP

To: Ed Hanscom

Dept.: MDOT, Bureau of Planning

From: Mike Barden

Dept.: Highway Design

Subject: Request for Traffic Information

Project Manager: Ernie Martin

TOWN(S): Berwick

P.I.N. 017328.00

Consultant Proj ☐

COUNTY: York

ROUTE: Rochester Street

LOCATION/ DESCRIPTION: Reconstruction: beginning at Sweetser St., extending NW app. 0.42 miles to the Rochester Loop, by Hall Bros. Roofing. Includes new subsurface drainage & granite curb on NE side.

	Roadway Changes or Relocation (Attach Sketch)	Turning Movement needed (Provide Locations under Comments)	Other Please Describe Under Comments
Please Check Box if Applicable:	☐	☐	☐

Prep By: JG

Sec. 1

Sec. 2

Sec. 3

Sec. 4

Sec. 5

Description of Sections

Rochester Street
NW/O Morse
Street, Berwick

1 Latest AADT (Year)	<u>7300 (2010)</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
2 Current <u>2013</u> AADT	<u>7300</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
3 Future <u>2025</u> AADT	<u>8180</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
4 Future <u>2033</u> AADT	<u>8760</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
5 DHV - % of AADT	<u>10%</u>	<u> </u> %	<u> </u> %	<u> </u> %	<u> </u> %
6 Design Hourly Volume	<u>876</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
7 % Heavy Trucks (AADT)	<u>5%</u>	<u> </u> %	<u> </u> %	<u> </u> %	<u> </u> %
8 % Heavy Trucks (DHV)	<u>3%</u>	<u> </u> %	<u> </u> %	<u> </u> %	<u> </u> %
9 Direct Dist. (DHV)	<u>63%</u>	<u> </u> %	<u> </u> %	<u> </u> %	<u> </u> %
10 18-KIP Equivalent P 2.0	<u>199</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
11 18-KIP Equivalent P 2.5	<u>190</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Notes or Remarks: 18-Kip ESALS is based on 20 year life or highest Future year

PLEASE PROVIDE: (1) PIN NUMBER, (2) THE CURRENT & FUTURE YEARS FOR WHICH YOU WANT AADT CALCULATED, AND SEND TO MIKE MORGAN. (A LOCATION MAP IS NO LONGER NEEDED.)

TRAFFIC REQUESTS WILL BE FILLED ON A FIRST COME / SERVE BASIS. PLEASE SEND WHEN PROJECT KICKS OFF!!!

Need Only Data Items Numbered

Comments:

$$(190)(12)(365) = 832,200$$

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
State of Maine

Flexible Structural Design Module

Berwick, Rochester Street
WIN 17328.00

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	832,200
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	90 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	4,000 psi
Stage Construction	1
Calculated Design Structural Number	4.09 in

Specified Layer Design

<u>Layer</u>	<u>Material Description</u>	Struct Coef. <u>(Ai)</u>	Drain Coef. <u>(Mi)</u>	Thickness <u>(Di)(in)</u>	Width <u>(ft)</u>	Calculated <u>SN (in)</u>
1	HMA	0.44	1	4	-	1.76
2	Subbase	0.09	1	26	-	2.34
Total	-	-	-	30.00	-	4.10

1993 AASHTO Pavement Design

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1	HMA	0.44	1	4	-	1.76
2	HMA	0.34	1	1	-	0.34
3	Subbase	0.09	1	22	-	1.98
Total	-	-	-	27.00	-	4.08

1993 AASHTO Pavement Design

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Specified Layer Design

<u>Layer</u>	<u>Material Description</u>	Struct Coef. <u>(Ai)</u>	Drain Coef. <u>(Mi)</u>	Thickness <u>(Di)(in)</u>	Width <u>(ft)</u>	Calculated <u>SN (in)</u>
1	HMA	0.44	1	4	-	1.76
2	HMA	0.34	1	2	-	0.68
3	Subbase	0.09	1	18	-	1.62
Total	-	-	-	24.00	-	4.06