



Maine Department
of Transportation

Scour Critical Bridge
Plan of Action (POA) Report

Full POA
 Abbreviated POA

Town: Burnham

Bridge Number: 6209

Bridge Name: Eel Weir

Feature Carried: Eel Weir (mount) R

Waterway Crossed: Sebasticook River

Final Recommended Action:

Increased Inspection Frequency: Yes No _____

Flood Monitoring:

Flood Warning Issued by National Weather Service
 USGS Gage Station Station#: _____

Frequency of Flood Monitoring: 12 hrs

Closure Trigger:

Water Surface Elevation Reaches Low Chord
 Water Reaches Closure Elevation:
169.5 ft (10-yr), Placard

SEE SECTION 8 FOR OTHER CLOSURE CONSIDERATIONS

Interim Reopening Trigger:

SEE FIELD VERIFICATION CARD

SEE SECTION 9 FOR OTHER REOPENING CONSIDERATIONS

Hydraulic/Structural Countermeasures: Yes No

The Following Materials Are Being Submitted With This Report:

- POA Report
- Attachment A: Hydraulic and Hydrologic Summary Page
- Attachment B: Photos
- Attachment C: Map Showing Detour Route(s)
- Attachment D: Bridge Elevation Summary Showing Existing Streambed and Foundation Depth(s)
- Attachment E: Boring Logs and/or Other Subsurface Information
- Attachment F: Supporting Documentation, Calculations, Estimates, and Conceptual Designs for Scour Countermeasures
- Attachment G: Plan View Showing Location of Scour Holes, Debris, etc,
- Attachment H: Post Flood Inspection Documentation
- Attachment I: Field Verification Card
- Attachment J: MaineDOT Underwater Inspection Reports
- Attachment K: T.Y. LIN 1995 Bridge Scour Evaluation Report
- Attachment L: 2008 USGS Report
- Attachment M: Scour / H&H Backup Calculations



SCOUR CRITICAL BRIDGE - PLAN OF ACTION

Burnham 6209

1. GENERAL INFORMATION

Structure: Eel Weir	City, County: Burnham, Waldo	Bridge Number: 6209
Feature On: Eel Weir (mount) R	Waterway Crossed: Sebastcook River	Owner: State Highway Agency
Year Built: 1973	Year Reconstruction: NA	

Structure Size and Description:

Three-span continuous steel multi-beams, built in 1973. The Left and Right abutments are concrete, the Left is on friction piles (40 ft long) and Right is on a spread footing (3 ft thick), both abutments are set back from the channel. The Left embankment blocks a significant amount of main channel flow. The two piers are concrete and founded on distribution blocks (4 ft thick) on concrete seal footings (6.5 ft thick) encircled by permanent steel sheeting. The plans indicate that original embedment at the Left and Right abutments, Pier 1 and 2 are approx. 5.0 ft, 6.5 ft, 5.5 ft and 5.5 ft, respectively. During the 2009 site visit it was noted that the riprap protection has slumped at the abutments and has been partially grouted was in good condition and plain riprap was present at the piers. The 1995 Bridge Scour Evaluation indicates no footing exposure at the Right Abutment or piers. The 1995 report indicates that the protection around the Left Abutment had slumped into the stream and exposed the footing. The 2004 Underwater Inspection noted up to 2.5 and 1.7 ft of foundation seal exposure at Piers 1 and 2, respectively. That report also noted only finding riprap on the right side of Pier 2. The distribution block at both piers was evident via dropline soundings during the 2009 site visit and visible from the deck, but the water depth prevented wading to the pier. The Left abutment pile cap was exposed with only 0.5 ft of remaining embedment. The Right abutment footing was not exposed with a remaining embedment of 5.7 feet. Remaining embedment observed as 5.3 feet and 5.2 ft and Piers 1 and 2, respectively. Primary bed material is estimated as sand, secondary bed material is gravel, and armoring potential is high.

Foundation Details: (Looking Downstream L to R) KNOWN <input checked="" type="checkbox"/> UNKNOWN <input type="checkbox"/>	Left Abutment (Looking Downstream)	Embedment (ft): 0.5	Exposure (ft): 2.5
	Right Abutment (Looking Downstream)	Embedment (ft): 4.8	Exposure (ft): 0
	Pier 1	Embedment (ft): 5.3	Exposure (ft): 5.2
	Pier 2	Embedment (ft): 5.2	Exposure (ft): 5.3
	Pier 3	Embedment (ft): N/A	Exposure (ft): N/A
	Pier 4	Embedment (ft): N/A	Exposure (ft): N/A

Reference Datum: NGVD 1929

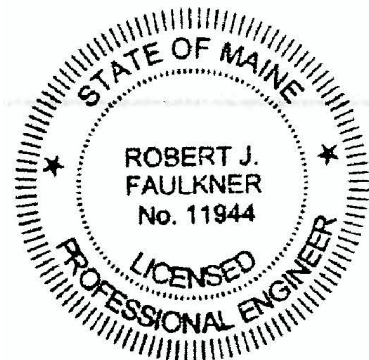
Scour Critical Footing Elevation(s) (ft):	Left Abutment 171.1 (Looking Downstream)	Pier 1: 152.1 Pier 2: 152.1 Pier 3: N/A Pier 4: N/A
	Right Abutment 169.1 (Looking Downstream)	

2. RESPONSIBLE FOR POA

Author(s) of POA (name, title, agency/organization, telephone, email):

Robert Faulkner P.E., CHA Principal Eng. VI, (603) 357-2445, chakeene@chacompanies.com

Signature: **Date:** 8/30/2011



Concurrences on POA (name, title, agency/organization, telephone, email):

Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580 **Date:** _____

POA Updated by: Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580

Date of Update: _____ **Items Updated:** _____

Reason for Update: Inspection Cycle Monitoring Event Post Flood Inspection

POA Updated Every _____ **months by (name, title, agency, organization):** Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580
Next Update: _____ **months**

3. SCOUR VULNERABILITY

Current Item 113 Code: 3 2 1 Other: _____

Source of Scour Critical Code: Observation Assessment Calculation Other: _____

Scour Evaluation Summary: Primary bed material is estimated as sand, secondary bed material is gravel, and armoring potential is high. CHA scour calculations indicate that both piers will be completely undermined during the 100-year flood event. Scour depths range from 17.4 ft to 17.0 ft. The Item 113 rating should remain a 3. CHA recommends that countermeasures be placed at both abutments and Piers 1 and 2. Due to the shallow remaining embedment at the Left abutment, excavation should be limited and partially grouted riprap should be placed. Deep, fast water indicates use of A-Jacks around both piers. The bridge should be monitored during and after significant flood events until the countermeasures are installed. CHA recommends that placards be installed at the upstream ends of Piers 1 and 2 at elevation 169.5 (10-yr event). The Item 113 rating may be reevaluated after the countermeasures are in place.

Scour History: The bridge was built in 1973. According to Town of Burnham FIS (6-1991), the flood of record on the Sebasticook River occurred in 1987, with a recurrence interval near 100 years. Floods also occurred in 1973 and 1984.

According to the Maine State Planning Office Report, flooding has occurred in the Lower Kennebec (Kennebec) Watershed in 1923, March 1936, March 1953, December 1969, April 1987, December 2003 and March 2005.

4. NBI CODING INFORMATION

Date		<u>Current</u> 4/14/2010	<u>Previous</u> 5/30/2008
Item 113	Scour Critical	3	3
Item 60	Substructure	5	5
Item 61	Channel & Channel Protection	5	4
Item 71	Waterway Adequacy	9	8

5. RECOMMENDED ACTION(S)

	<u>Recommended</u>	<u>Implemented</u>	<u>Date</u>
a. Increased Inspection Frequency:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
b. Fixed Monitoring Device(s):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
c. Flood Monitoring Program:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
d. Hydraulic/Structural Countermeasures:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____

6. MONITORING PROGRAM RECOMMENDATION

6a. Regular Inspection Cycle

Biennial
 Annual
 Riverbed Profile Readings - Upstream Face
 Riverbed Profile Readings - Downstream Face
 Surveyed Cross-Section

Items to Watch: Changes to embedment at abutments and piers. Remaining embedment observed as 0.5 feet (piles), 5.3 feet, 5.2 ft and 5.7 ft in April 2009 at the Left and Right abutments and Piers 1 and 2, respectively. The Left abutment footing was exposed 2.5 ft; Right abutment footing was not exposed. Pier 1 and 2 footings and concrete seal foundations were exposed. Riprap protection was slumped at the abutments and missing at the piers. Perform a drop-line survey to establish the riverbed profile at the upstream and downstream fascia and along each substructure. Provide photo documentation of countermeasures at abutments and piers.

Underwater Inspection Required

4 Year Cycle
 2 Year Cycle
 1 Year Cycle

Items to Watch: Changes to embedment at piers. Pier 1 and 2 concrete seal foundations were exposed 1.3 ft and 1.2 ft, respectively. Riprap protection only existing on the right side of Pier 2. Provide photo documentation of countermeasures at abutments and piers.

6b. Fixed Monitoring Device(s) **Not Applicable**

Type of Instrument:

Installation Location(s):

Routine Sample Interval 30 minute 1 hr 6 hrs 12 hrs Other

Frequency of Data Download and Review: Daily Weekly Monthly Other:

Action(s) Required if Scour Critical Elevation Detected: *(See Section 7 and Section 8)*

Criteria of Termination For Fixed Monitoring:

Event Sample Interval: Continual 10 min 30 min 1 hour Other

Frequency of Data Download and Review: Daily Weekly Monthly Other:

Action(s) Required if Scour Critical Elevation Detected: *(See Section 7 and Section 8)*

Criteria of Termination For Event Monitoring

6c. Flood Monitoring Program

During Inspection Event, Look For:

Type: Visual Inspection

Water surface at or above placard elevation.

Instrument *(check all that apply)*

Portable Geophysical Sonar Other

Flood Monitoring event defined by:

(check all that apply)

Notified By Public

Flood Warning Issued by NWS

DOT Situation Report

USGS Gage Station Station#:

Stage (Water Surf. Elev.)

Discharge

NOAA Gage Station #

Stage (WSE)

Frequency of Flood Monitoring: Continual 3 hrs 12 hrs Daily

Criteria to End Flood Monitoring Revisit Bridge Recommended Post Flood Inspection
 Close Bridge (See Section 8) Conditions Stable / Water Receding

Action(s) Required if Scour Critical Elevation Detected: *(See Section 7 and Section 8)*

Assess changes in channel/riverbed profiles, possible undermining evidence, and overall stability. Consider closing bridge.

6d. Post-Flood Inspection Tasks Required

- Visual Inspection
- Riverbed Profile Readings - Upstream and Downstream face
- Profile at Substructure
- Undermining
- Underwater Inspection
- Probing

Items to Watch: Changes to embedment at abutments and piers. Remaining embedment observed as 0.5 feet (piles), 5.3 feet, 5.2 ft and 5.7 ft in April 2009 at the Left and Right abutments and Piers 1 and 2, respectively. The Right abutment footing was not exposed. Pier 1 and 2 footings and concrete seal foundations were exposed. Riprap protection was slumped at the abutments and missing at the piers. Perform a drop-line survey to establish the riverbed profile at the upstream and downstream fascia and along each substructure. Provide photo documentation of countermeasures at abutments and piers.

Date of Event: _____ Date of Post Flood Inspection: _____

Agency and Department Responsible for Monitoring:

Maine DOT

Contact Person (name, title, agency/organization, telephone, e-mail):

- Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580
- Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580

7. DETOUR ROUTE

Detour Route Description:

Troy Rd to Rte 11. This detour crosses Burnham 5257 which is also a scour critical bridge, consider bridge closure or longer detour.

Bridges on Detour Route: To be provided by Maine DOT

Bridge Number	Feature On	Feature Under	Item 113	Load Posting (tons) / Date	Vertical Clearance (feet)	Width Restrictions (feet)

Traffic Control Equipment and Storage location(s):

Additional Considerations or Critical Issues:

News Release, Other Public Notice Information to be provided and limitations:

Public Information Officer, Office of Communications - (207) 624-3030

8. BRIDGE CLOSURE PLAN

Criteria For Consideration of Bridge Closure:

Check all that apply

- | | |
|--|---|
| <input type="checkbox"/> Water Surface Elevation Reaches Low Chord | <input type="checkbox"/> Overtopping Road or Structure |
| <input checked="" type="checkbox"/> Water Reaches Critical Elevation:
169.5 ft (10-yr), Placard | <input checked="" type="checkbox"/> Scour Measurement Results / Monitoring Device (See Section 6) |
| <input type="checkbox"/> USGS Gage Station # | <input type="checkbox"/> Stage (WSE) |
| | <input type="checkbox"/> Discharge |
| <input type="checkbox"/> NOAA Gage Station # | <input type="checkbox"/> Stage (WSE) |
| <input checked="" type="checkbox"/> Other: <input checked="" type="checkbox"/> Loss of Road Embankment <input checked="" type="checkbox"/> Ice Jam <input checked="" type="checkbox"/> Debris Accumulation <input checked="" type="checkbox"/> Movement of RipRap / Other Armor Protection | |

Agency and Department Responsible for Closure:

- DOT Municipality: Other

Contact Person(s) (name, title, telephone, email):

Maine DOT Radio Operations, (207) 624-3339

9. BRIDGE REOPENING PLAN

9a. Criteria for Consideration to Complete Interim Bridge Reopening:

- | | |
|--|--|
| <input checked="" type="checkbox"/> Water Surface Levels Dropping | <input checked="" type="checkbox"/> No Approach Settlement |
| <input checked="" type="checkbox"/> Critical Elevation Marker Is Visible | <input checked="" type="checkbox"/> No Embankment Erosion Endangering Abutment |
| <input checked="" type="checkbox"/> Reasons for Closure Have Abated | <input checked="" type="checkbox"/> Abutments and Piers are Plumb and Stable |
| <input checked="" type="checkbox"/> Straight and Consistant Bridgerails | <input checked="" type="checkbox"/> Assess Riverbed Elevation at Piers (drop line reading) |

Agency and Person Responsible for Interim Re-Opening Bridge After Inspection:

9b. Criteria for Completing Bridge Reopening Process:

- | | |
|--|--|
| <input checked="" type="checkbox"/> Post Flood Inspection Completed | <input checked="" type="checkbox"/> Verify Riverbed Elevation (drop line readings) |
| <input checked="" type="checkbox"/> Diving Inspection Completed within 7 calendar days | <input checked="" type="checkbox"/> Streambed Elevation Drops Less than 4.2 Feet |

Agency and Person Responsible for Re-Opening Bridge After Inspection:

- Region Bridge Manager
- Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580
- Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580

10. COUNTERMEASURE RECOMMENDATIONS

Conceptual Structural / Hydraulic Countermeasures:

	<u>Priority</u>	<u>Estimated Cost</u>
(1) <u>A-Jacks around both piers</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	\$ <u>240,000</u>
(2) <u>Partially grouted riprap - both abutments</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	\$ <u>220,000</u>
(3)	<input type="checkbox"/> Yes <input type="checkbox"/> No	\$

Basis for the Selection of the Preferred Scour Countermeasure: Lack of remaining embedment at abutments - use PGR; deep fast water at piers - use A-Jacks

Recommended Countermeasures to be Performed by:

- Maintenance
 Bridge Program
 Highway Program
 Other

Recommended Completion Date: _____

Contact Person: *(include name, title, telephone, e-mail)*

- Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580
- Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580



MaineDOT Scour Investigation East PIN:15631.10

Hydraulic and Hydrologic Summary Page (POA Attachment A)

Bridge ID: Burnham 6209

Name: Eel Weir

Date: 7/7/2009

GENERAL INFORMATION

Town: Burnham	Owner: State Highway Agency	
Feature Carried: Eel Weir (mount) R	Feature Crossed: Sebasticook River	
Functional Class: 09 - Rural Local	Major Basin (HU8): Lower Kennebec	
Detour Length: 2 (miles)	Bridge Plan File Loc: NO DATA	
Year Built: 1973	Capacity (Actual Metric Tons, Signed) : 58.1 ,	
Year of Reconstruction: NA	ADT: 377	Year of ADT: 2007
Overall Fed Sufficiency Rating: 99		

Current: (scale of 1-9) (worst - best)	Substructure Item 60: 5	Channel Stability Item 61: 5	Hydraulic Adequacy Item 71: 9	Scour Risk Item 113: 3
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HYDRAULIC INFORMATION

FEMA Study: <input checked="" type="checkbox"/> 6/3/1991
USGS Report: <input type="checkbox"/>
Tidal Influence: <input type="checkbox"/>
Watershed Area (sq. mi): 567.3
100-Yr Overtopping Relief: Left Approach

T.Y. Lin Information (Bridge Scour Report) : <input checked="" type="checkbox"/> <small>Nov 1995</small>
100-Yr Water Velocity (feet per sec): 6.9
Angle Of Attack (Flood Flow) : 10

Other Hydrologic & Hydraulic Data:
Town of Burnham FIS (6-1991) provides velocity, flows and water surface elevations at bridge. FEMA WSPRO back-up model provides velocity for bridge opening. Maine DOT also provides flows (Q10=10290 cfs, Q50=13595 cfs, Q100=15036 cfs, Q500=18342 cfs). Burnham Dam is 2.5 miles DS of the bridge, and impounds Sebasticook River.

Table:	Flow (cfs)	Elevation (ft)	Flow Impacting Bridge	Flow Overtopping Bridge
Low Chord		178.3		
Roadway		182		
10 year	10500	169.5	No	No
50 year	14000	171.4	No	No
100 year	15500	172	No	No
500 year	19000	173.5	No	No

BRIDGE INFORMATION

Bridge Width (in feet): 31.00
Plans Available: <input checked="" type="checkbox"/>
Worst Abutment (Looking Downstream L to R) : Left
Abutment Foundation: Friction Piles

Bridge Length (in feet): 250.00
Number of Spans: 3
Borings Available: <input checked="" type="checkbox"/>
Worst Pier (Looking Downstream L to R) : 1
Pier Foundation: Spread Footing

Flood / Scour History Comments: The bridge was built in 1973. According to Town of Burnham FIS (6-1991), the flood of record on the Sebasticook River occurred in 1987, with a recurrence interval near 100 years. Floods also occurred in 1973 and 1984.

According to the Maine State Planning Office Report, flooding has occurred in the Lower Kennebec (Kennebec) Watershed in 1923, March 1936, March 1953, December 1969, April 1987, December 2003 and March 2005.

RECOMMENDATIONS

Field Investigation Rec: <input checked="" type="checkbox"/>	Agree w/ Item 113 Rating: <input checked="" type="checkbox"/>	Scour POA Recommended: <input checked="" type="checkbox"/>	
Comp: <input checked="" type="checkbox"/>	CHA Rec Item 113 Rating: 3	CHA Recommended POA Choice: Partially Grouted Riprap / A-Ja	

Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:43 PM
Source: CHAScourInsp
Description: Upstream elevation



Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:46 PM
Source: CHAScourInsp
Description: Downstream elevation



Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:42 PM
Source: CHA
Description: Right Abutment



Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:45 PM
Source: CHAScourInsp
Description: Left abutment

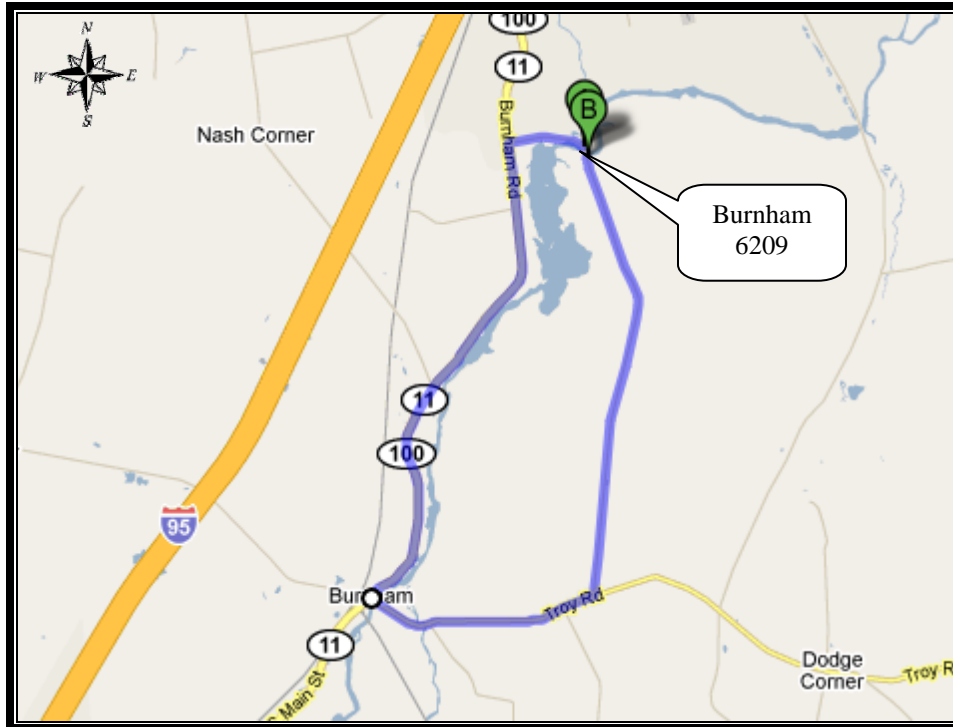


Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:40 PM
Source: CHA
Description: Pier 2 Right



Bridge: Burnham 6209
Date Taken: 4/22/2009 7:34:48 PM
Source: CHAScourInsp
Description: Debris in channel (downstream of bridge)





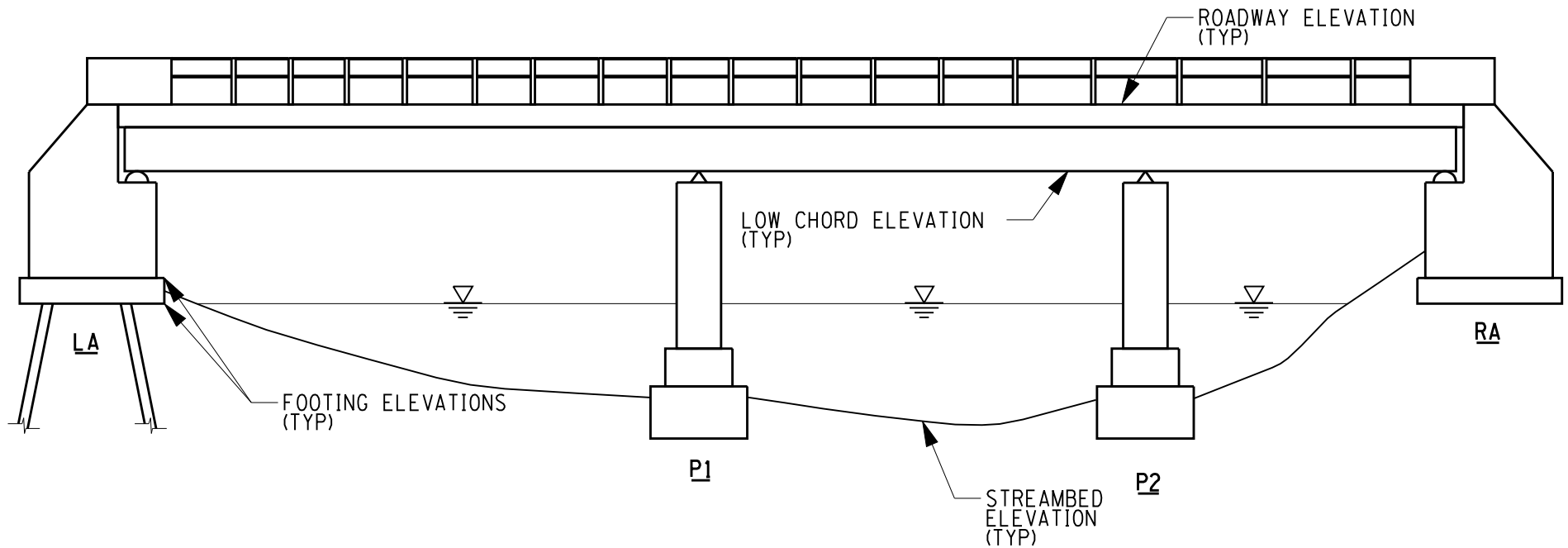
DETOUR MAP

GOING NORTHWEST ON EELWEIR RD.

	Eelweir Rd	
	1. Head northwest on Eelweir Rd toward Burnham Rd	go 0.6 mi total 0.6 mi
	2. Turn left at Burnham Rd/ME-100 S/ME-11 S Continue to follow ME-100 S/ME-11 S	go 4.4 mi total 5.0 mi
	3. Turn left at Troy Rd	go 2.0 mi total 7.0 mi
	4. Turn left at Mt Rd	go 3.8 mi total 10.8 mi
	Mt Rd	

IF GOING SOUTHEAST ON EEL WEIR RD, REVERSE DIRECTIONS.

		<p>Burnham 6209</p> <p>Attachment C: Detour Route</p>
	<p>11 King Court Keene, NH 03431-4648 Main: (603)-357-2445</p>	<p>Maine Scour Investigation</p>



**UPSTREAM ELEVATION
N.T.S.**

SUBSTR. UNIT	ROADWAY ELEVATION (FT)	LOW CHORD ELEVATION (FT)	FOOTING ELEVATION (FT)		STREAMBED ELEVATION (FT)			CHA 100-YEAR SCOUR ELEVATION (FT)
			TOP	BOTTOM	ORIGINAL DESIGN PLANS (1969)	TY LIN (1995)	CHA FIELD (2009)	
LEFT ABUT.	182.8	179.1	174.1	171.1 (PILE CAP)	176.6	172.9 (DS)	172.3 (DS)	N/A
PIER 1	182.5	178.8	161.6 (FTG)	157.6 (FTG), 151.1 (SEAL)	156.6	158.3 (DS)	156.4 (US)	139.2
PIER 2	182.2	178.5	161.6 (FTG)	157.6 (FTG), 151.1 (SEAL)	156.6	156.1 (DS)	156.3 (US)	139.0
RIGHT ABUT.	182.0	178.3	171.1	168.1	174.8	175.7 (DS)	172.9 (US)	N/A

- UNLESS OTHERWISE SPECIFIED, ALL ELEVATIONS ARE REFERENCED TO NGVD 1929.
- THE SUBSTRUCTURE LABELING CONVENTION ESTABLISHED BY CHA DEFINES LEFT AND RIGHT LOOKING DOWNSTREAM.
- STREAMBED ELEVATIONS GIVEN ARE APPROXIMATE AT EACH SUBSTRUCTURE UNIT AND ALONG THE FASCIA INDICATED. FOR DETAILED SUBSTRUCTURE RIVERBED PROFILE MEASUREMENTS SEE ATTACHMENT H. ATTACHMENT G PROVIDES THE LOCATION OF SCOUR RELATED FEATURES AND OTHER MINOR STREAMBED VARIATIONS.
- PIER 1 & 2 SPREAD FOOTINGS ARE ON CONCRETE FOUNDATION SEALS THAT EXTEND TO ELEVATION 151.1 FEET.
- THE SCOUR DEPTHS ARE CONSERVATIVE AS THEY DO NOT TAKE INTO ACCOUNT THE CONCRETE FOUNDATION SEALS AT PIERS 1 & 2.
- LEFT ABUTMENT IS FOUNDED ON FRICTION PILES (40 FEET LONG).



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Main: (603) 357-2445 • www.chacompanies.com

MAINE BRIDGE SCOUR
INVESTIGATION

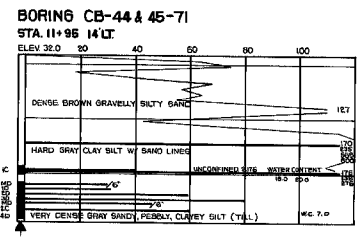
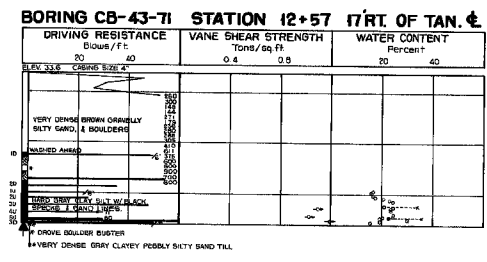
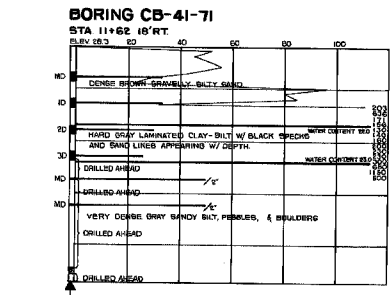
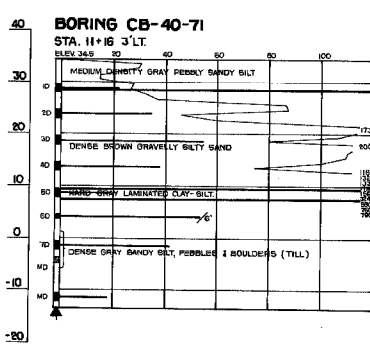
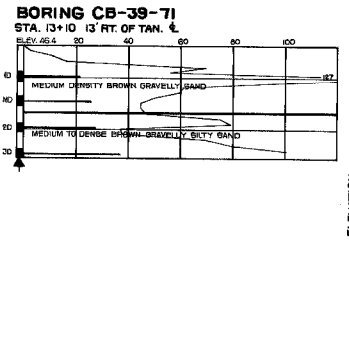
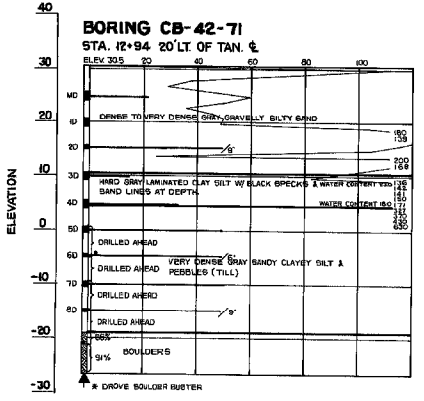
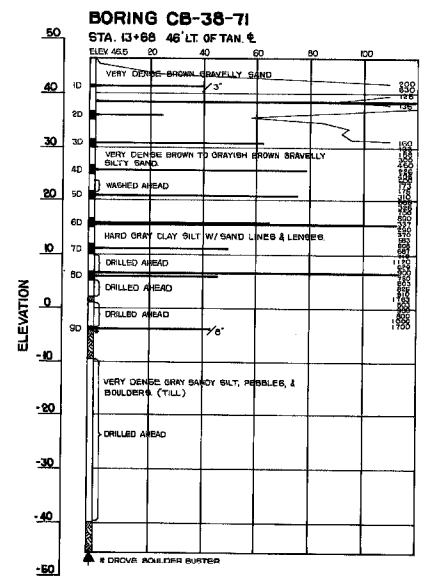
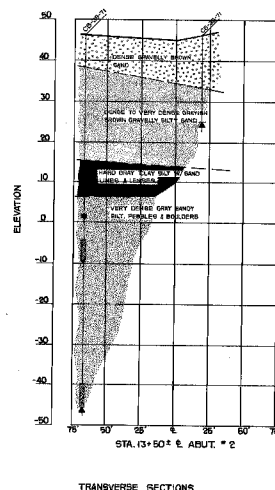
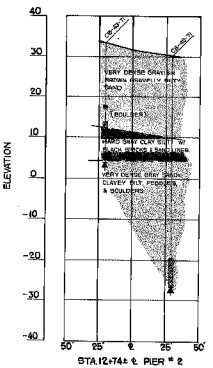
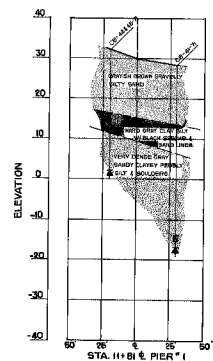
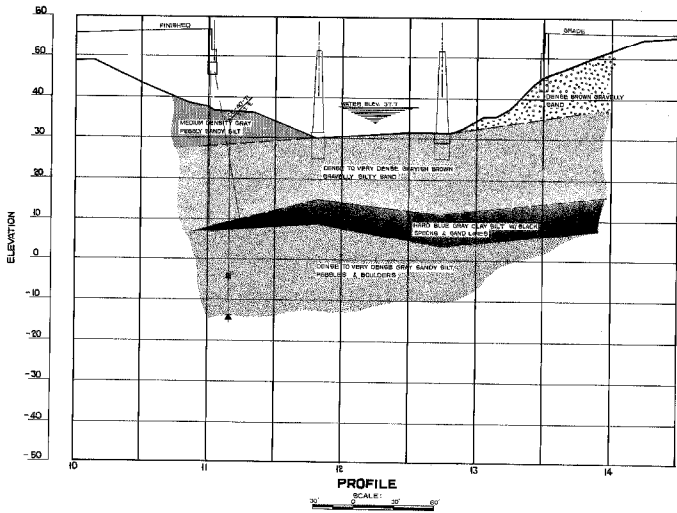
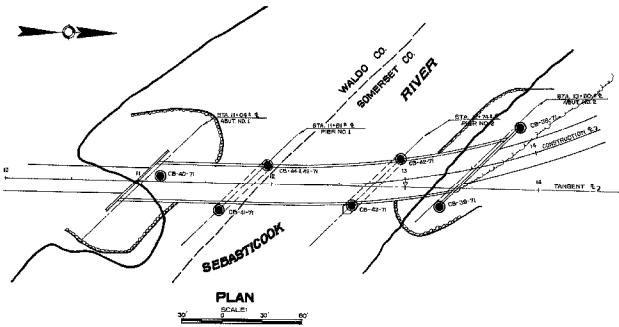
BURNHAM 6209

BRIDGE ELEVATION SUMMARY

ATTACHMENT

D

DATE: 4/10



BORING NOTES

- All samples and vane are made ahead of casing
- Water elevation
- Number of blows required to drive extra heavy casing one foot with 400 ft lbs. of energy per blow
- Location of sample or sample attempt
- Number and type of dry samples
- S&W sampler = 1630%
- 2" O.D. 16 ga. seamless tubing
- 3/4" O.D. 16 ga. seamless tubing
- Unsuccessful sample attempt and type of sampler
- Number of blows required to drive spoon or tubing one foot with 350 ft. lbs. of energy per blow

▲ Bottom of boring (may not be bottom of real strata)

◆ 1/4" Locations cored by diamond bit and percent recovery of rock

WATER CONTENT NOTES

- Natural water content, given as per cent of dry weight
- X Plastic and liquid limits

SHEAR NOTES

- Shear strengths in excess of capacity of equipment
- One half unconfined compressive strengths

FILE NAME = K:\9571\CADD\M5N\Br-dge P04 F:\es\Burnham 6209\19971-cpb-geo-b.p.01.dgn DATE = 11/27/2010 USER = JCS

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Main: (603) 357-2445 • www.chacompanies.com

**MAINE BRIDGE SCOUR
INVESTIGATION**

BURNHAM 6209

BORING DETAILS

ATTACHMENT

E

DATE: 11/09

**Attachment F:
Supporting Documentation, Calculations,
Estimates, and Conceptual Designs for Scour
Countermeasures**



11 King Court
Keene, NH 03431-4648
Main: (603)-357-2445

**Burnham 6209
Attachment F: Scour Countermeasures**

Maine Scour Investigation

ESTIMATED COST OF PROPOSED COUNTERMEASURES:

PIERS ONLY - HIGH PRIORITY

Bridge No.	6209
Town	Burnham
Dist. Between Abutment Faces	250
Bridge Width	31
Remaining embedment	0.5
Predicted scour depth, ys, ft	17
Design flow depth, ft	16

SSU's Protected	Both piers	
Spans Protected	N/A	
Approved Countermeasure Type	A-Jacks at piers	
Low Flow Water Depth	8.5	
Pier Width (ft)	4.75	A-Jacks width = 2.0 times pier width
Pier Length (ft)	48	A-Jacks Length is along its center
A-Jacks area based on	2.0	times pier width is 1454 sq ft
alternatively, A-Jacks area based on ys =	17.0	width (3 sides) => 2291 sq ft
use A-Jacks based on 2 x pier width area (intermediate area)		

SSU	CM TYPE	Item	Length (ft)	Width (ft)	Depth (ft)	No. Items	Quantity	Unit	Unit Price	Subtotal	
Access to piers from one side and barges for work at piers											
Both Abutments	Partially Grouted Riprap	Water Diversion System				2	2	LS	\$7,000	\$14,000	
		Excavation and site prep (along abuts)	0	0	-	2	0	SY	\$0	\$0	
		Provide and place filter	0	0	-	2	0	SY	\$0	\$0	
		Provide and place riprap	0	0	3	2	0	CY	\$0	\$0	
		Partial grouting	0	0	-	2	0	SY	\$0	\$0	
Both Piers	A-Jacks	Site Prep	153	10		2	323	SY	\$20	\$6,460	
		A-Jacks (tied together)	153	10		2	1861	EA	\$45	\$83,745	
		Underwater placement support (Divers)				2	2	LS	\$15,000	\$30,000	
		Proposed work at Abutments: - water diversion - excavate and level area - place filter - place riprap - partial grout Use width = 2 x design water depth	Proposed work at Piers: - water diversion not required - excavate and level area - place A-Jacks - use divers to tie together						Mobilization		\$20,000
									Subtotal		\$184,205
									25% Contingency		\$46,051
									Total Estimated Cost		\$230,256
									Conceptual Budget		\$240,000

Assumptions:

Environmental impact associated with the proposed work is judged to be: *potentially significant*
 Given the estimated quantities for this item, the unit price is judged to be *equal to* average unit prices.

Notes:

The cost of mitigating or eliminating potential environmental impacts is not included in this estimate.
 The cost of environmental permit preparation is also not included herein.

ESTIMATED COST OF PROPOSED COUNTERMEASURES:

ABUTMENTS ONLY - LOWER PRIORITY

Bridge No.	6209
Town	Burnham
Dist. Between Abutment Faces	250
Bridge Width	31
Remaining embedment	0.5
Predicted scour depth, ys, ft	17
Design flow depth, ft	16

SSU's Protected	Both abutments	
Spans Protected	N/A	
Approved Countermeasure Type	Partially grouted riprap	
Low Flow Water Depth	8.5	
Pier Width (ft)	4.75	A-Jacks width = 2.0 times pier width
Pier Length (ft)	48	A-Jacks Length is along its center
A-Jacks area based on	2.0	times pier width is 1454 sq ft
alternatively, A-Jacks area based on ys =	17.0	width (3 sides) => 2291 sq ft
use A-Jacks based on 2 x pier width area (intermediate area)		

SSU	CM TYPE	Item	Length (ft)	Width (ft)	Depth (ft)	No. Items	Quantity	Unit	Unit Price	Subtotal	
Access to abutments from both sides											
Both Abutments	Partially Grouted Riprap	Water Diversion System				1	1	LS	\$20,000	\$20,000	
		Excavation and site prep (along abuts)	95	32	-	2	676	SY	\$20	\$13,511	
		Provide and place filter	95	32	-	2	676	SY	\$50	\$33,778	
		Provide and place riprap	95	32	3	2	676	CY	\$75	\$50,667	
		Partial grouting	95	32	-	2	676	SY	\$50	\$33,778	
Both Piers	A-Jacks	Site Prep	0	0		2	0	SY	\$0	\$0	
		A-Jacks (tied together)	0	0		2	0	EA	\$0	\$0	
		Underwater placement support (Divers)				2	2	LS	\$0	\$0	
		Proposed work at Abutments: - water diversion - excavate and level area - place filter - place riprap - partial grout Use width = 2 x design water depth	Proposed work at Piers: - water diversion not required - excavate and level area - place A-Jacks - use divers to tie together						Mobilization		\$10,000
								Subtotal		\$175,733	
						25%		Contingency		\$43,933	
								Total Estimated Cost		\$219,667	
								Conceptual Budget		\$220,000	

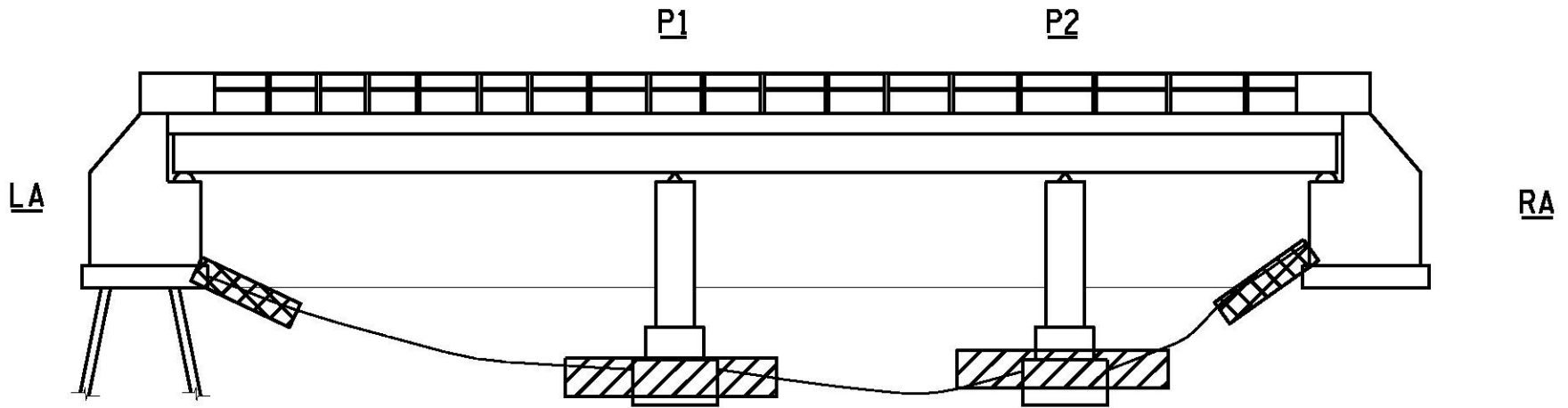
Assumptions:

Environmental impact associated with the proposed work is judged to be:
Given the estimated quantities for this item, the unit price is judged to be

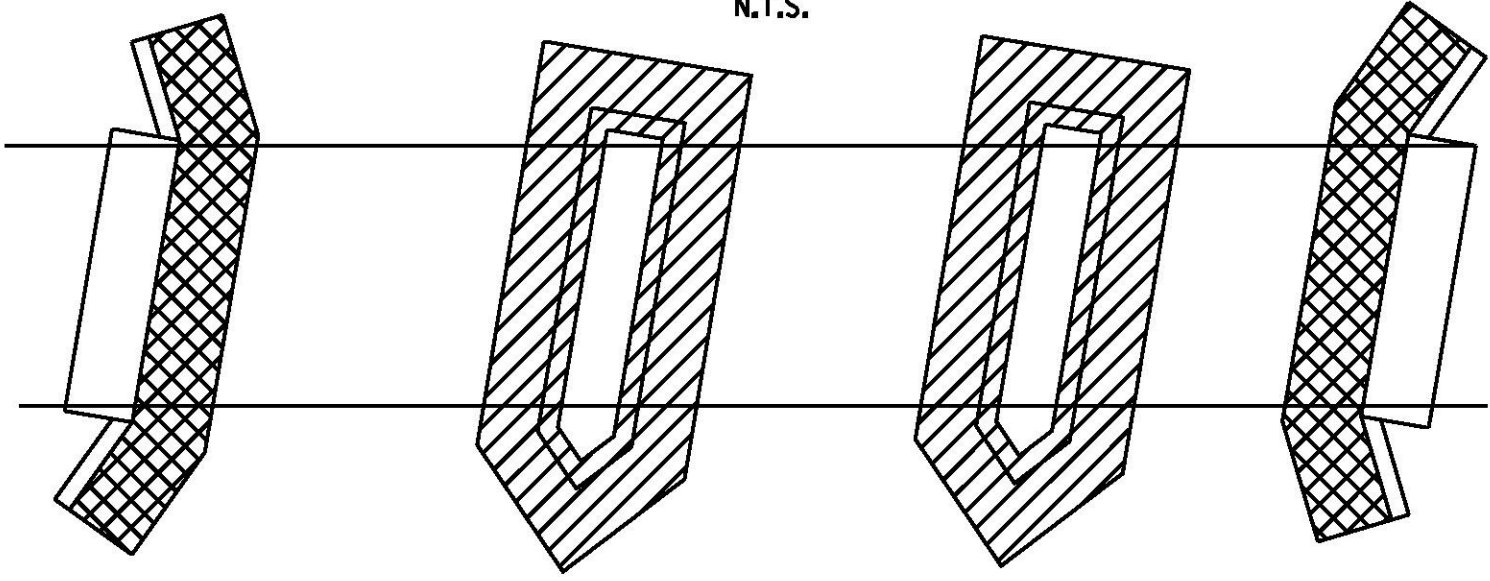
potentially significant
equal to average unit prices.

Notes:

The cost of mitigating or eliminating potential environmental impacts is not included in this estimate.
The cost of environmental permit preparation is also not included herein.





UPSTREAM ELEVATION
N.T.S.




PLAN VIEW
N.T.S.

LEGEND

-  INSTALL A-JACKS
-  INSTALL PARTIALLY GROUTED RIPRAP

FILE NAME: \\s1p071\cadd\main\bridge\pda_files\burnham\2009\110717_appb.mxd
 DATE PLOTTED: 4/10/09 10:52:29 AM
 USER: jms

 <small>Doing Copyright © 2006</small> 11 King Court • Keens, NH 03431-4848 Mail: (603) 867-2445 • www.chacompanies.com	MAINE BRIDGE SCOUR INVESTIGATION	ATTACHMENT F
	BURNHAM 6209	DATE: 4/10
	CONCEPTUAL COUNTERMEASURE SUMMARY	

RIP-RAP Sizing at Bridge Abutments

Project Number: 19571

Project Name: Burnham 6209 - Eel Weir Road over Sebasticook River in the Town of Burnham, ME
100-year flood event data

D_{50} Equation Used for Froude Number $\leq 0.80 = y((k/(S_s-1)(V^2)/gy))$

D_{50} Equation Used for Froude Number $> 0.80 = y((k/(S_s-1)(V^2)/gy)^{0.14})$

Where:
 V = Characteristic average velocity in the contracted section or velocity at toe of abutment from model output m/s (ft/s)
 S_s = Specific Gravity of Riprap
 y = Depth of flow adjacent to the abutment
 g = Gravitational acceleration m/s² (ft/s²)

User Input:

Enter M for Metric units. Enter E for English units:

S (Spill-through abutment) or V (Vertical wall abutment) : (for k value)

V =

S_s =

y =

Constants / Calculated:

g =

k =

Froude Number = $(V/gy)^{1/2}$ =

Result:

D_{50} =

Stone Fill Specification =

D_{Max} =

Min. Thickness (1.5 x D_{50}) =

Extent into floodplain (from toe of slope) =

*Town of Burnham FIS (6-91) back-up model provides average channel velocity.

Equations obtained from "Bridge Scour and Stream Instability Counter Measures". US FHWA. March 2001. Equations 8.2 and 8.3

Designed by:
 Checked by:

RIP-RAP Sizing at Piers 1 and 2

Project Number: 19571

Project Name: Burnham 6209 - Eel Weir Road over Sebasticook River in the Town of Burnham, ME
100-year flood event data

$$D_{50} = \frac{0.692 (KV)^2}{(S_s - 1) 2g}$$

Where:
 D_{50} = Median stone diameter, m (ft)
K = Coefficient for pier shape
(1.5 for round-nosed pier, 1.7 for rectangular pier)
 V^* = Velocity on pier, m/s (ft/s)
 S_s = Specific gravity of riprap (normally 2.65)

Constants: $g =$

User input: Units =

$K =$

$V =$

$S_s =$

Pier Width =

Result: $D_{50} =$

Stone Fill Specification =**

$D_{Max} =$

Min. Thickness (3 x D_{50}) =

Min. Width[†] (2 x Pier Width) =

*Town of Burnham FIS (6-91) back-up model provides velocity at the piers.

**Due to the uncertainty associated with the design parameters, the smallest stone fill gradation specified for installation at a pier will be MaineDOT Plain Riprap.

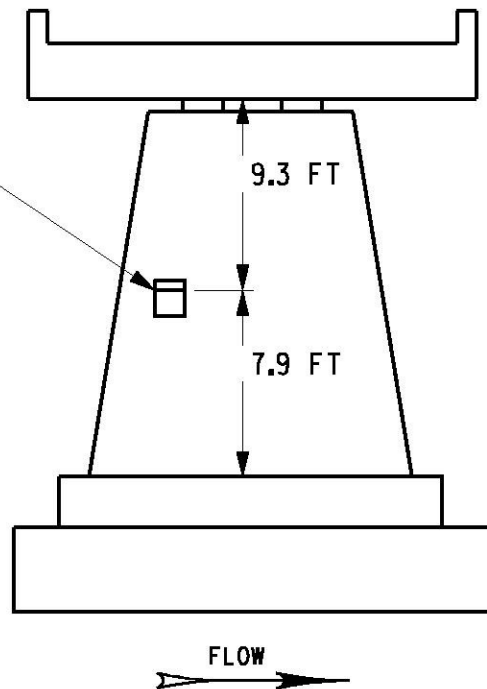
[†]Minimum width extending from both sides of the pier

Equations obtained from "Bridge Scour and Stream Instability Counter Measures". US FHWA. March 2001. Equation 8.1.

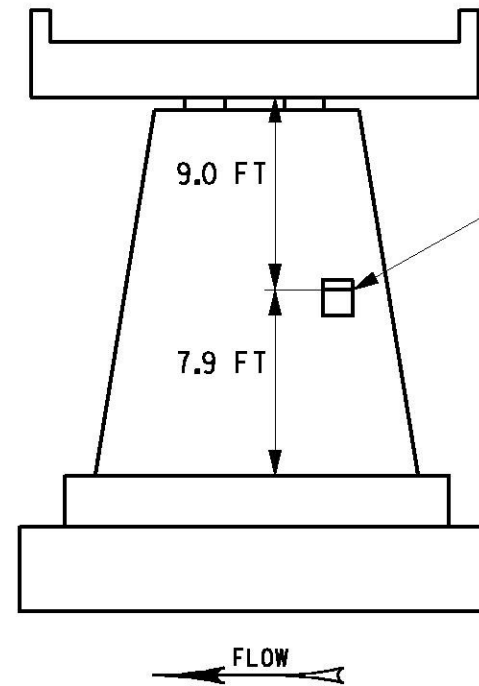
Designed by:
Checked by:

FILE NAME: \\s1\p1\cadd\maine\bridge\2011\burnham\2011\10171_app.plt.dgn
DATE PLOTTED: 4/10/10
USER: jcs

10-YEAR FLOOD
ELEVATION 169.5
(SEE NOTE 1)



PIER 1 ELEVATION
N.T.S.




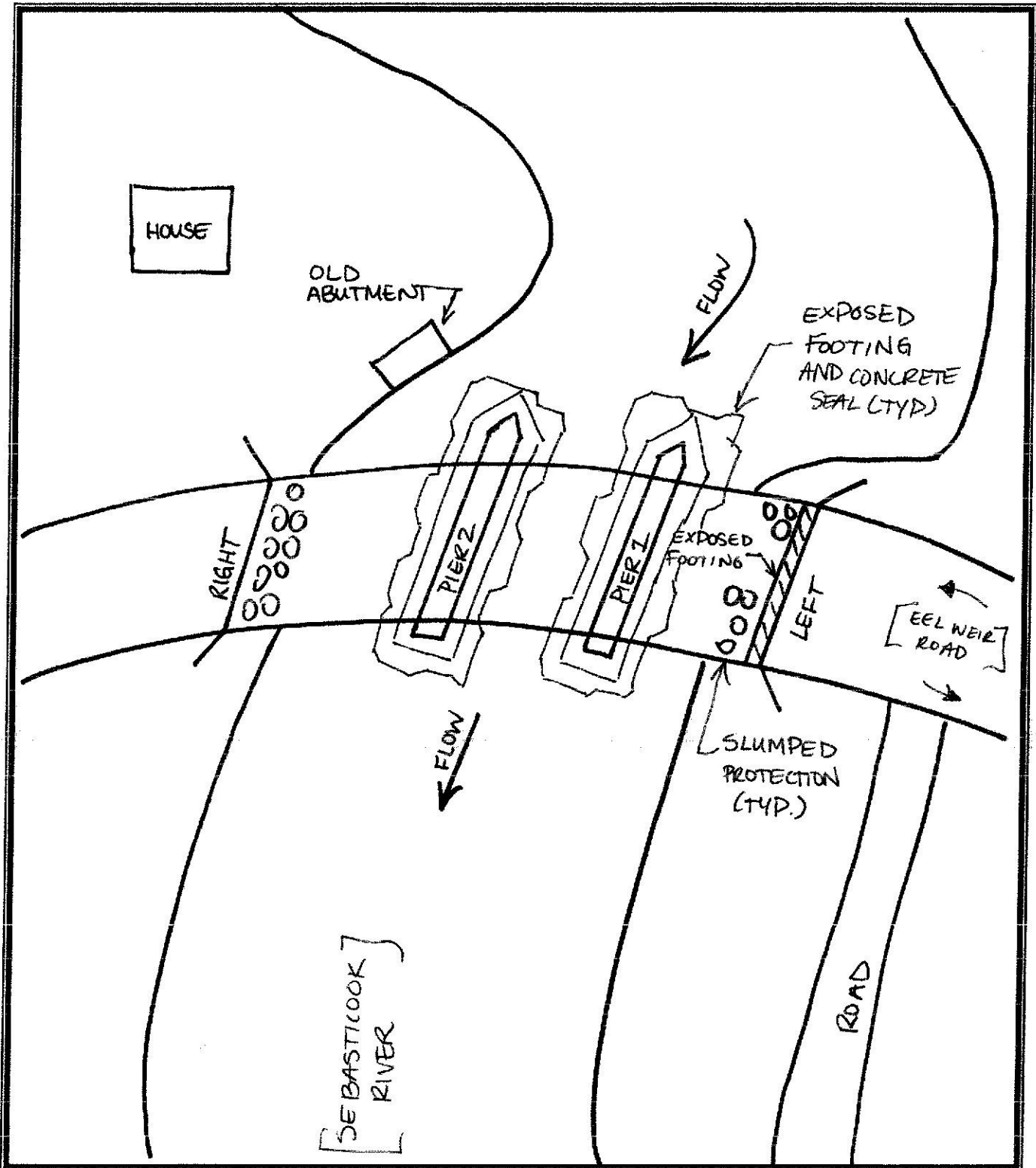
10-YEAR FLOOD
ELEVATION 169.5
(SEE NOTE 1)

PIER 2 ELEVATION
N.T.S.

NOTES:

1. ELEVATION 169.5 CORRESPONDS TO A 10 YEAR FLOOD EVENT.
2. PLACARD LOCATIONS ARE AT THE UPSTREAM END OF BOTH PIERS.
3. PLACARD LOCATION MEASURED TO LOW CHORD AND TOP OF FOOTING.
4. ALL WORK IS TO BE PERFORMED IN DRY CONDITIONS.
5. SKETCH IS CONCEPTUAL ONLY, NOT FOR CONSTRUCTION, AND NOT TO SCALE.

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	BURNHAM 6209	F
	PLACARD INSTALLATION LOCATION	DATE: 4/10



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BURNHAM 6209
Attachment G: Plan view showing
location of scour holes, debris, etc.

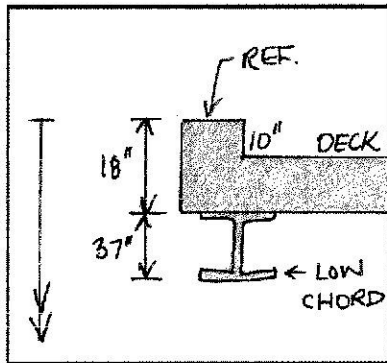
Maine Scour Investigation

MAINE DOT CHANNEL PROFILE

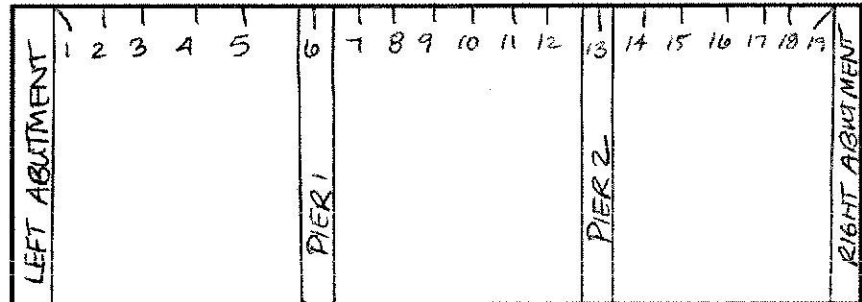
Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP



Datum Reference



**Actual skew, if present, not shown*

Fascia Location	Location/Description	Date: 4/22/09		Date:		Date:	
		Upstream Readings (ft)	Downstream Readings (ft)	Upstream Readings (ft)	Downstream Readings (ft)	Upstream Readings (ft)	Downstream Readings (ft)
Sta. 1	LEFT ABUTMENT	9.4	11.4				
Sta. 2	POST 3	13.5	14.2				
Sta. 3	POST 5	18.6	21.2				
Sta. 3	WATER SURFACE	-	18.5				
Sta. 4	POST 7	24.2	26.0				
Sta. 5	POST 9	28.0	27.0				
Sta. 6	NOSE OF PIER 1	27.0	25.1				
Sta. 7	POST 13	27.2	25.0				
Sta. 8	POST 15	28.0	24.8				
Sta. 9	POST 17	27.2	25.3				
Sta. 10	POST 19	28.2	26.8				
Sta. 11	POST 21	28.5	27.0				
Sta. 12	POST 23	26.4	27.0				
Sta. 13	NOSE OF PIER 2	26.8	25.5				
Sta. 14	POST 27	27.0	25.8				
Sta. 15	POST 29	27.1	22.4				
Sta. 16	POST 31	22.0	21.7				
Sta. 17	POST 33	18.9	13.7				
Sta. 18	POST 35	13.5	11.0				
Sta. 19	RIGHT ABUTMENT	10.0	8.4				

Notes: Stations are numbered from left to right looking downstream.

**All units are in English and in decimal form*

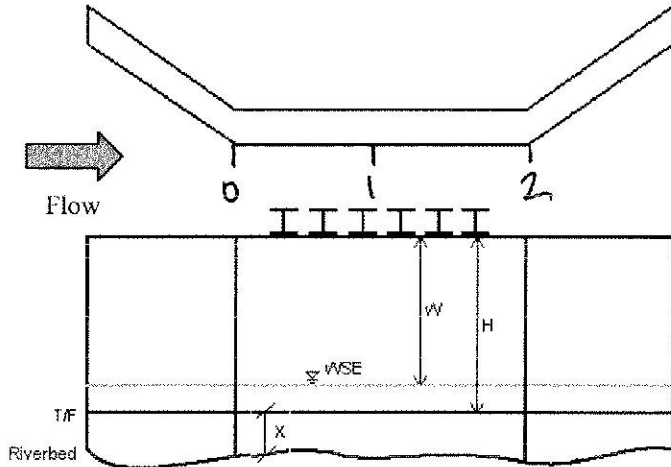
MAINE DOT ABUTMENT RIVERBED PROFILE FORM

Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP

Abutment: Left



W = Distance from Low Chord to Water Surface = DRY ft

H = Distance from Low Chord to top of footing = 4.6+/- ft

Location	Location Description	DATE: 4/22/09	DATE:	DATE:
		X (ft)	X (ft)	X (ft)
0	UPSTREAM CORNER	0		
1	MID-STEM	1.25		
2	DOWNSTREAM CORNER	2.5		
3				
4				
5				
6				
7				
8				
9				
10				

Notes: Cobble slope protection in front of the abutment has slid, but has been partially grouted.

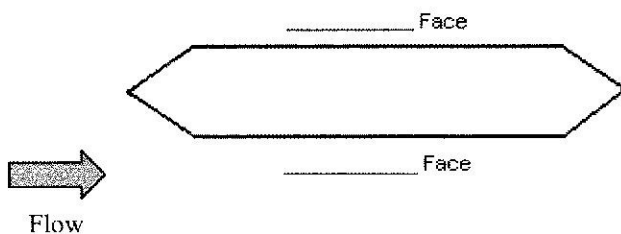
**All units are in English and in decimal form*

MAINE DOT PIER PROFILE FORM

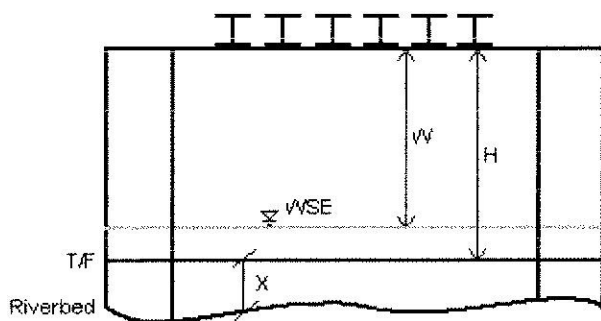
Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP



Pier: 1



W = Distance from Low Chord to Water Surface = 13.9± ft

H = Distance from Low Chord to top of footing = 17.2 ft

Location	Location/Description	Date:		Date:		Date:	
		Left Face (ft)	Right Face (ft)	Left Face (ft)	Right Face (ft)	Left Face (ft)	Right Face (ft)
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							

Notes: No measurements were taken during 2009 site visit as the water was too deep to wade in. Refer to the underwater inspection report.

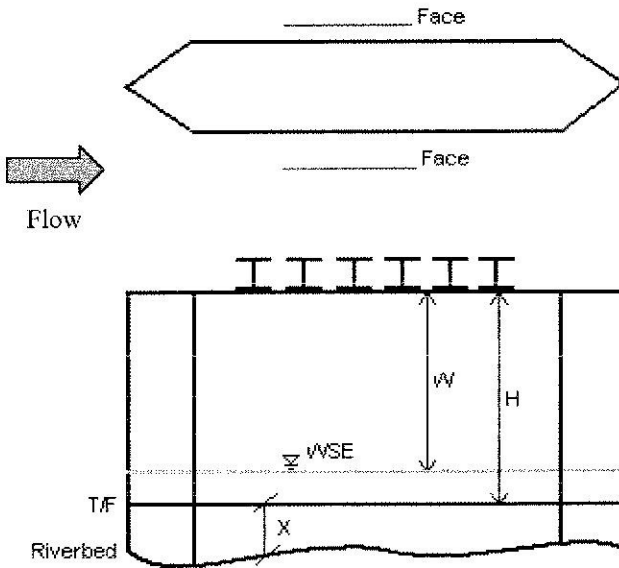
*All units are in English and in decimal form

MAINE DOT PIER PROFILE FORM

Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP



Pier: 2

W = Distance from Low Chord to Water Surface = 13.9± ft

H = Distance from Low Chord to top of footing = 16.9 ft

Location	Location/Description	Date:		Date:		Date:	
		Left Face (ft)	Right Face (ft)	Left Face (ft)	Right Face (ft)	Left Face (ft)	Right Face (ft)
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							

Notes: No measurements were taken during 2009 site visit as the water was too deep to wade in. Refer to the underwater inspection report.

*All units are in English and in decimal form

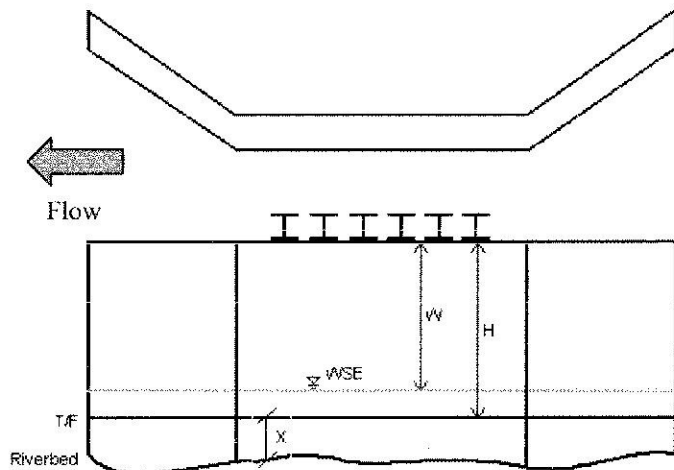
MAINE DOT ABUTMENT RIVERBED PROFILE FORM

Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP

Abutment: Right



W = Distance from Low Chord to Water Surface = DRY ft

H = Distance from Low Chord to top of footing = 7.2 ft

Location	Location Description	DATE:	DATE:	DATE:
		X (ft)	X (ft)	X (ft)
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes: Footing not exposed at the Right Abutment during the 2009 site visit.

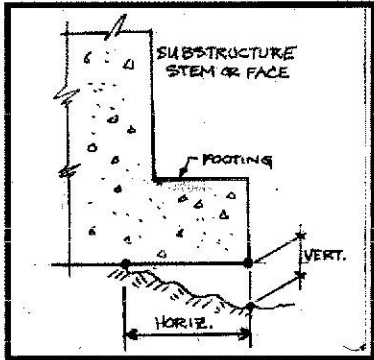
**All units are in English and in decimal form*

MAINE DOT UNDERMINING FORM

Bridge Information

Town/Bridge No. BURNHAM 6209
 Feature Carried EEL WEIR ROAD
 Feature Crossed SEBASTICOOK RIVER
 Owner MDOT

Date of Inspection 4/22/09
 Inspector PCP



Location 0 _____

SSU: _____

FACE: _____

Start of Measurement: _____

Interval of Measurement: _____ FT

Location	Date:		Date:		Date:		Date:	
	Vertical (ft)	Horizontal (ft)	Vertical (ft)	Horizontal (ft)	Vertical (ft)	Horizontal (ft)	Vertical (ft)	Horizontal (ft)
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Notes: No undermining found in 2009 site visit at either abutment.

*All units are in English and in decimal form

FIELD VERIFICATION CARD (POA Attachment I)

GENERAL INFORMATION

Structure: Eel Weir **Bridge Number:** 6209
Owner: State Highway Agency **Feature On:** Eel Weir (mount) R
City, County: Burnham - Waldo **Waterway Crossed:** Sebasticook River
Contact Person: - Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580
- Assistant Bridge Maintenance Engineer, Maine DOT Bridge Maintenance Division - (207) 624-3580

BRIDGE INFORMATION

Detour (miles): 2 **Last ADT: Total:** 50 **Year:** 2008
USGS Gage Station: 1049000 **USGS Station Prox To Bridge:** 3.1 miles DS of bridge
Superstructure Type: Stringer/Multi-Beam or Girder **Number of Spans:** 3
Superstructure Material: Steel **Diving Insp Reports:** **Dates:** 9/10/2004

Foundation Details: <input type="checkbox"/> UNKNOWN (Looking Downstream L to R) <input checked="" type="checkbox"/> KNOWN	Worst Abutment: Left	Embedment (feet): 0.5	Exposure: Footing Exposed
	Worst Pier: 1	Embedment (feet): 4	Exposure: Footing Exposed

Scour Critical Feature: Abutment and Pier Footings

Placard Location: Placard located at the upstream ends of both piers.

Items to Watch: Changes to embedment at abutments and piers. Remaining embedment observed as 0.5 feet (piles), 5.3 feet, 5.2 ft and 5.7 ft in April 2009 at the Left and Right abutments and Piers 1 and 2, respectively. The Right abutment footing was not exposed. Pier 1 and 2 footings and concrete seal foundations were exposed. Riprap protection was slumped at the abutments and missing at the piers. Perform a drop-line survey to establish the riverbed profile at the upstream and downstream fascia and along each substructure. Provide photo documentation of countermeasures at abutments and piers.

CRITERIA FOR CONSIDERATION OF BRIDGE CLOSURE

- | | |
|--|---|
| <input type="checkbox"/> Water Surface Elevation Reaches Low Chord | <input checked="" type="checkbox"/> Loss of Road Embankment |
| <input checked="" type="checkbox"/> Water Reaches Closure Elevation
169.5 ft (10-yr), Placard | <input checked="" type="checkbox"/> Scour Measurement Results / Monitoring Device (See Section 6) |
| <input type="checkbox"/> Overtopping Road or Structure | <input checked="" type="checkbox"/> Observed Structure Movement / Settlement |
| <input checked="" type="checkbox"/> Debris Accumulation | <input checked="" type="checkbox"/> Movement of RipRap / Other Armor Protection |
| <input type="checkbox"/> USGS Gage Station # <input type="checkbox"/> Stage (WSE) | <input checked="" type="checkbox"/> Ice Jam <input type="checkbox"/> Discharge |
| <input type="checkbox"/> NOAA Gage Station # <input type="checkbox"/> Stage (WSE) | |

ACTION TAKEN Post-Flood Inspection Recommendations Revisit Bridge Close Bridge

POST-FIELD VERIFICATION Completed Proper Notification **Date/Time Notified:** **Agency:**

CRITERIA FOR CONSIDERATION TO COMPLETE INTERIM BRIDGE REOPENING:

- | | |
|--|---|
| <input checked="" type="checkbox"/> Water Surface Levels Dropping | <input checked="" type="checkbox"/> No Approach Settlement |
| <input checked="" type="checkbox"/> Critical Elevation Marker Is Visible | <input checked="" type="checkbox"/> No Embankments Erosion Endangering Abutment |
| <input checked="" type="checkbox"/> Reasons for Closure Have Abated | <input checked="" type="checkbox"/> Abutments and Piers are Plumb and Stable |
| <input checked="" type="checkbox"/> Straight and Consistent Bridgerails | <input checked="" type="checkbox"/> Assess Riverbed Elevation at Piers (drop line readings) |

Agency and Person Responsible for Interim Re-Opening Bridge After Inspection:

Interim Reopening Approved By: **Interim Reopening Date:** **Time:**

INTERIM REOPENING COMMENTS

REFERENCE PHOTOS (Left to Right Convention Looking Downstream)

Upstream Low Water



Upstream Elevation of Bridge at Low Water



Scour Critical Feature at Low Water



**Attachment J: MaineDOT Underwater Inspection
Reports**



11 King Court
Keene, NH 03431-4648
Main: (603)-357-2445

**Burnham 6209
Attachment J: MaineDOT Underwater
Inspection Reports**

Maine Scour Investigation

UNDERWATER DIVE INSPECTION FIELD REPORT

Revised January 8, 2003

BridgeNo: 6209	DiveID: 534	Division: Fairfield	SPNMATERL SPNTYPE	
Town1: Burnham	Yr. Built: 1973			
Town2: Pittsfield	No. Spans: 3	Found. 1: Piles	Shaft Type 1: Stub concrete	
Bridge Name: EEL WEIR	Str. Length: 250	Found. 2: Gravel base	Shaft Type 2: Full ht reinf co	
Location: 0.6 MI E OF RTE 11 & 100		Found. 3: Not applicable	Shaft Type 3: Not applicable	
Feature On Struc: EEL WEIR (MOUNT) ROAD		Custodian: MDOT		
Feature Under Struc: SEBASTICOOK RIVER		Cocustodn: Not applicable		
		Topside Equip/Add: 		

Tidal: (Y/N) No	Tide Information:
Dive Entry Loc: Good entry point downstream on side dirt road.	Photos: None
Comments/ Haz.: Extremely low water table - fast water	Some tree debris on U.S. nose.
STREAMBED/Comp Material: Fist to headsie stones with some boulders. Plans show hard sand.	

CHANNEL DESCRIPTION / CONDITION:

Scour has exposed the seal up to 5' on the upstream end and tapered up as you progress downstream.
 Scour has exposed the seals up to 3'

STRUCTURE DESCRIPTION / CONDITION:

2 concrete piers on footings with ^{sheet pile seals} cofferdams. Various amounts of ^{seal} cofferdam exposed. Some surface scaling at joint between cofferdam seal and footing. Minor. Otherwise footing and cofferdam is in good condition. Original plans show a 6.5 foot thick seal with 1 foot originally exposed. This leaves 1.5 feet to the bottom of the seal at the 5 foot exposure. The plans did not show the depth of the cofferdam sheet piles.

Did not find 5' of seal footing exposed as 1999 inspect. report mentions.
 Plans call for 2' thick riprap layer around entire piers, leaving 1' of seal exposed.
 Riprap only found on shore side of northerly pier (Pier #2 on as-built)

INSPECTION TEAM:

Edwards	MD	Wentworth	TL		
Arseault	D	Wentworth	D		
Barden	SD	Petley	D		
Petley	T	Edwards	SD		
		Madore	T		

TL = Team Leader, D = Diver, SD = Safety Diver, T = Tender

DIVE CONDITIONS:

12:10	Time: Entry:	12:00 PM
1:15	Time: Exit:	12:35 PM
60	Water Temp:	70
1'	Visibility:(ft.):	2'
10	Max Depth:(ft.):	7
None	Current:	None
cloudy	Weather:	Sunny

Strong

INSPCTION: **09102004** Date: 09011999

Signature: *Carl Edwards*

5 Channel Condition.: (scouring)
 7 Substruc/Culvert. Cond: (exposed seals)

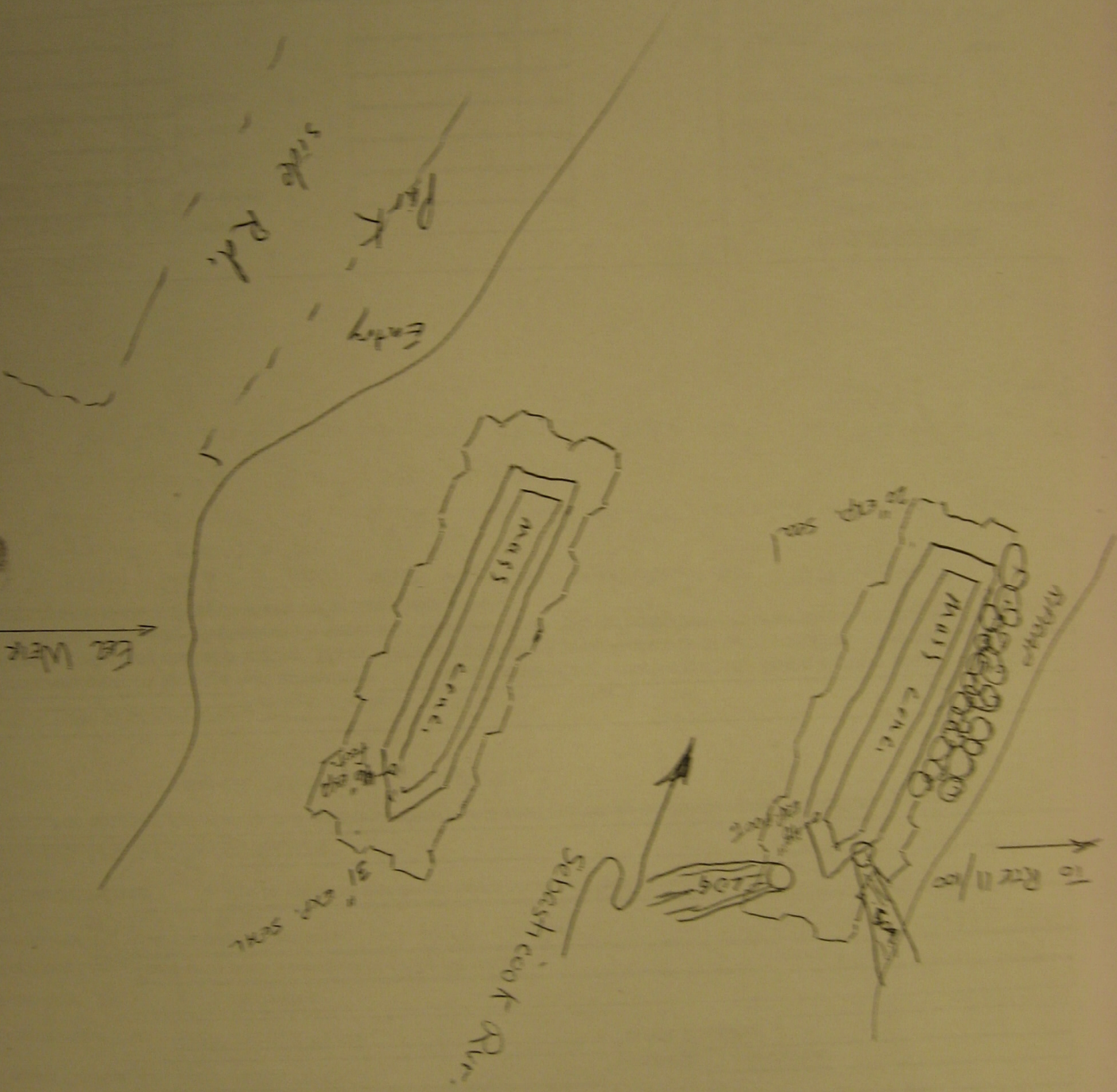
460	Inspec. Cycle:	Y60
4000	Equip/Add Insp2:	
40448	Rec. Rep.1	40448
	Rec. Rep.2	

6209

BURNHAM

EEL WEIK

09-10-04



**Attachment K: T.Y. Lin 1995 Bridge Scour
Evaluation Report**

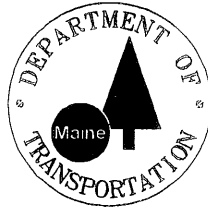


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Keene, NH 03431-4648
Main: (603)-357-2445

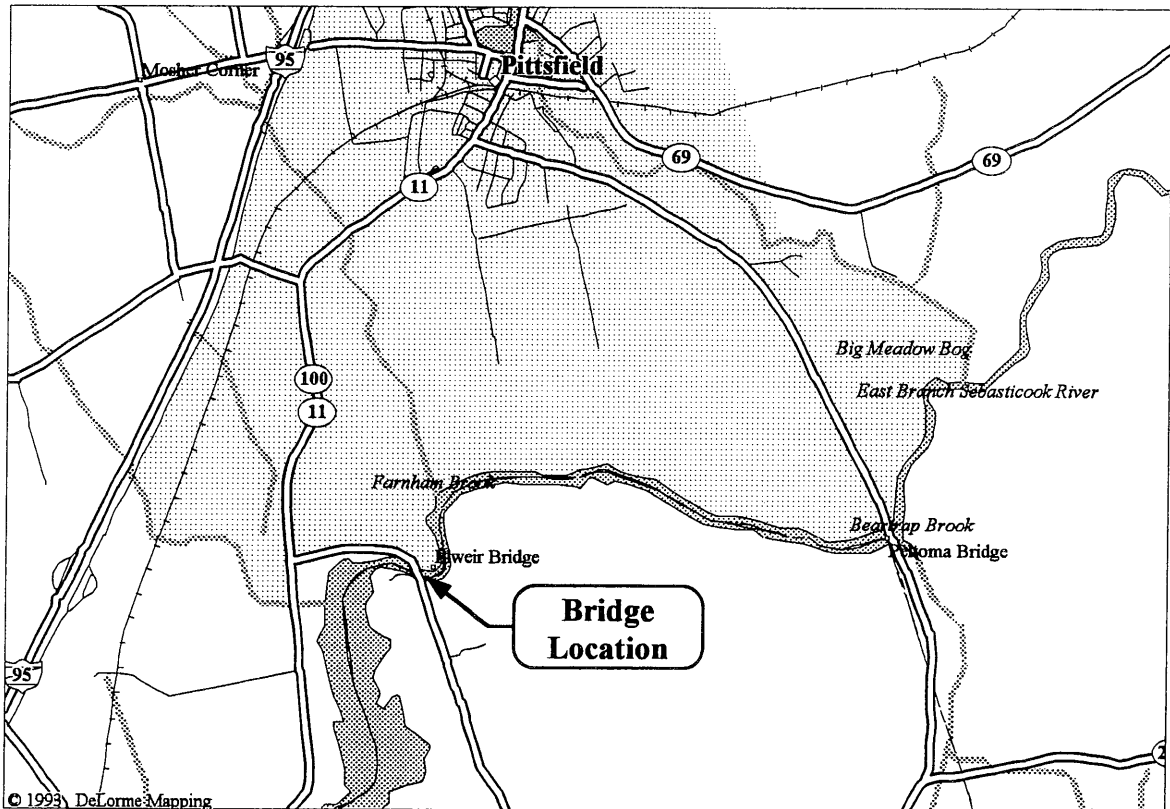
**Burnham 6209
Attachment K: T.Y. Lin 1995 Bridge
Scour Evaluation Report**

Maine Scour Investigation

BRIDGE SCOUR EVALUATION REPORT



Name: **Eel Weir Bridge**
County: **Waldo**
Town: **Burnham**
Route: **Mount Road**
Stream: **Sebasticook River**
Bridge #: **6209**
Date: **December 1995**



Prepared by: **Whitman & Howard**
500 Southborough Drive
South Portland, Maine 04106

In association with: **T.Y. Lin International**
5 Fundy Road
Falmouth, Maine 04105

TY·LIN INTERNATIONAL

BRIDGE SCOUR EVALUATION SUMMARY

Bridge Name: Eel Weir

Town: Burnham

Bridge Number: 6209

Route/Name: Mount Road

Stream: Sebasticook River

River Basin: Kennebec

Review Date: 12-Oct-95

Note : See Office/Field Review Report for Additional Data.

SUMMARY AND CONCLUSIONS

The bridge is a three-span steel beam structure constructed in 1973. High water elevation in 1936 reached about 0.6 feet below present low chord. Potential for overtopping or pressure flow is low. FEMA indicates a 100 year flood water surface elevation of approximately 6 feet below low chord. The bridge may have experienced a 100 year flow or greater in 1987 (refer to USGS report 92-141); MDOT inspections do not report any damage from this event.

The stream reach has low channel migration potential, with incised channel and well-vegetated banks. The bed material reported in the 1994 underwater inspection was cobbles and boulders. The natural bed material, described by boring reports, is silt, gravel, and sand, and is erodible. Thalweg elevations measured by soundings are 4.7 feet above the bottom of concrete seal.

The channel is moderately constricted through the bridge opening. The left road embankment, which is protected by large boulder riprap, protrudes into the channel and is attacked by flow. Slope protection around the left abutment has slumped into the stream. Contraction scour potential is moderate.

The bridge is supported by stub abutments; the right abutment is on a spread footing and the left abutment is on piles. Abutment slopes consist of large 2-foot diameter riprap; protection around the left abutment has slumped into the stream and exposed the footing. This was also noted by MDOT inspection (12/1/92): "abutment riprap has rolled downhill (bottom of footing visible among rocks; has void 6" high at downstr. corner)". The right abutment is attacked by flow at 10 degrees.

The bridge is also supported by two piers, both on spread footings over concrete seals. The footings are protected by sheet piling and plain riprap 10 feet wide from the faces of the concrete seals (per plans). Both piers are attacked by flow at 10 degrees. Condition of the pier riprap may be questionable. The 1989 MDOT underwater inspection indicates "no constant depth on the stone blanket. Many void areas. Top of stone blanket varied from 1' to 4' from top of the seal. The 1994 underwater inspections notes "various amounts of cofferdam exposed". Soundings indicate possible scour at the downstream end of the right pier.

An Item 113 rating of 3A is recommended based on possible insufficient pier protection, moderate contraction potential, erodible streambed material, and slumping of the riprap slope around the left abutment. It is recommended that the next underwater inspection include measurement of pier footing exposure, riprap condition and extent of riprap. The Item 113 rating should be re-evaluated if the riprap is found to be in good condition.

RECOMMENDATIONS

Countermeasures: Supplemental Monitoring - Measure footing exposure, check condition and extent of riprap at next underwater inspection.

Recommended Repair Code: Element: Work: Priority: Effort:

Level Two Analysis: Not Required -

RECOMMENDED SCOUR VULNERABILITY RATING (PER FHWA)

Scour Vulnerability: Contraction - Pier

Recommended NBI Rating Item 61: 7 Item 71: 8 Item 113: 3A

BRIDGE SCOUR EVALUATION SUMMARY

BRIDGE DESCRIPTION

Bridge Description: Multi Span	Number of Spans: 3	Bridge Datum: Assumed
Date Built: 1973	Date of Widening/Major Repairs: None	
Low Chord Elev (ft): 50.6	Bridge Deck Elev (ft): 56.8	Thalweg Elev (ft): 29.6
Overtopping Elev (ft): 56.8	Overtopping Location: At Bridge	

ABUTMENTS

	Left Abutment	Right Abutment
Type:	Stub Abut. on Slope	Stub Abut. on Slope
Support:	Expansion	Expansion
Foundation Type:	Spread Footings, Piles	Spread Footings
Footing Exposed:	No	No
Top of Footing Elev (ft):	48.0	45.0
Footing Height (ft):	3.0	3.0
Exposure (ft):	0	0
Piles Exposed:	No	NA
Pile Tip Elev (ft):	5.0	NA
Rock Elev (ft):	Unknown	Unknown
Riprap (Type/Size):	2' diameter	2' diameter
Riprap Condition:	Good	Good
Other Protection:	None	None
Condition:	NA	NA
Scour		
Tilt/Settlement:	No	No
Max Depth Undermining (ft):	0	0
Scour Holes:	No	No
Location:	NA	NA

PIERS

Pier Number: 1	Type: Solid Shaft	Support: Expansion	Angle of Flow Attack: 10
Foundation Type:	Spread Footings	Scour	
Footing Exposed:	No	Tilt/Settlement:	No
Top of Footing Elev (ft):	31.5	Max Depth Undermining (ft):	0
Footing Height (ft):	6.5	Scour Holes:	No
Exposure (ft):	0	Location:	NA
Piles Exposed:	NA		
Pile Tip Elev (ft):	NA		
Rock Elev (ft):	NA		
Riprap (Type/Size):	Plain riprap		
Riprap Condition:	Unknown		
Other Protection:	Cofferdam		
Condition:	Good		

BRIDGE SCOUR EVALUATION SUMMARY

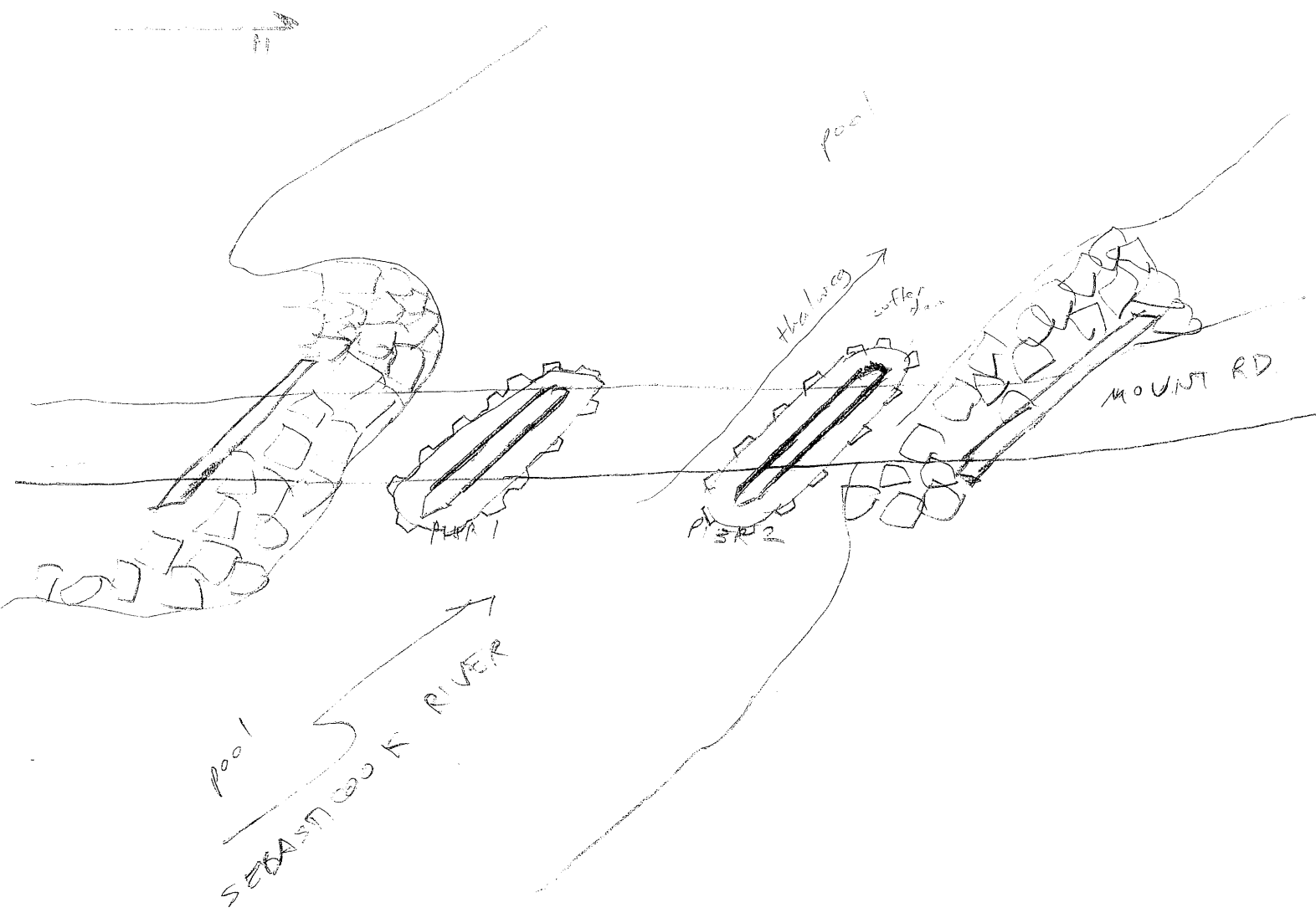
Pier Number: 2 Type: Solid Shaft Support: Expansion Angle of Flow Attack: 10

Foundation Type:	Spread Footings	Scour	
Footings Exposed:	No	Tilt/Settlement:	No
Top of Footing Elev (ft):	31.5	Max Depth Undermining (ft):	0
Footing Height (ft):	6.5	Scour Holes:	No
Exposure (ft):	0	Location:	NA
Piles Exposed:	NA		
Pile Tip Elev (ft):	NA		
Rock Elev (ft):	NA		
Riprap (Type/Size):	Plain riprap		
Riprap Condition:	Unknown		
Other Protection:	Cofferdam		
Condition:	Good		

Bridge Name: <u>EEL HED</u>	Town: <u>BURNHAM</u>	Bridge #: <u>6809</u>
Route No./Name: <u>MOUNT RD.</u>	Stream: <u>SEASTOCK RIVER</u>	Review Date: <u>10/12/25</u>

Sketch (Plan view)

Bridge plans supplemented by field sketch.



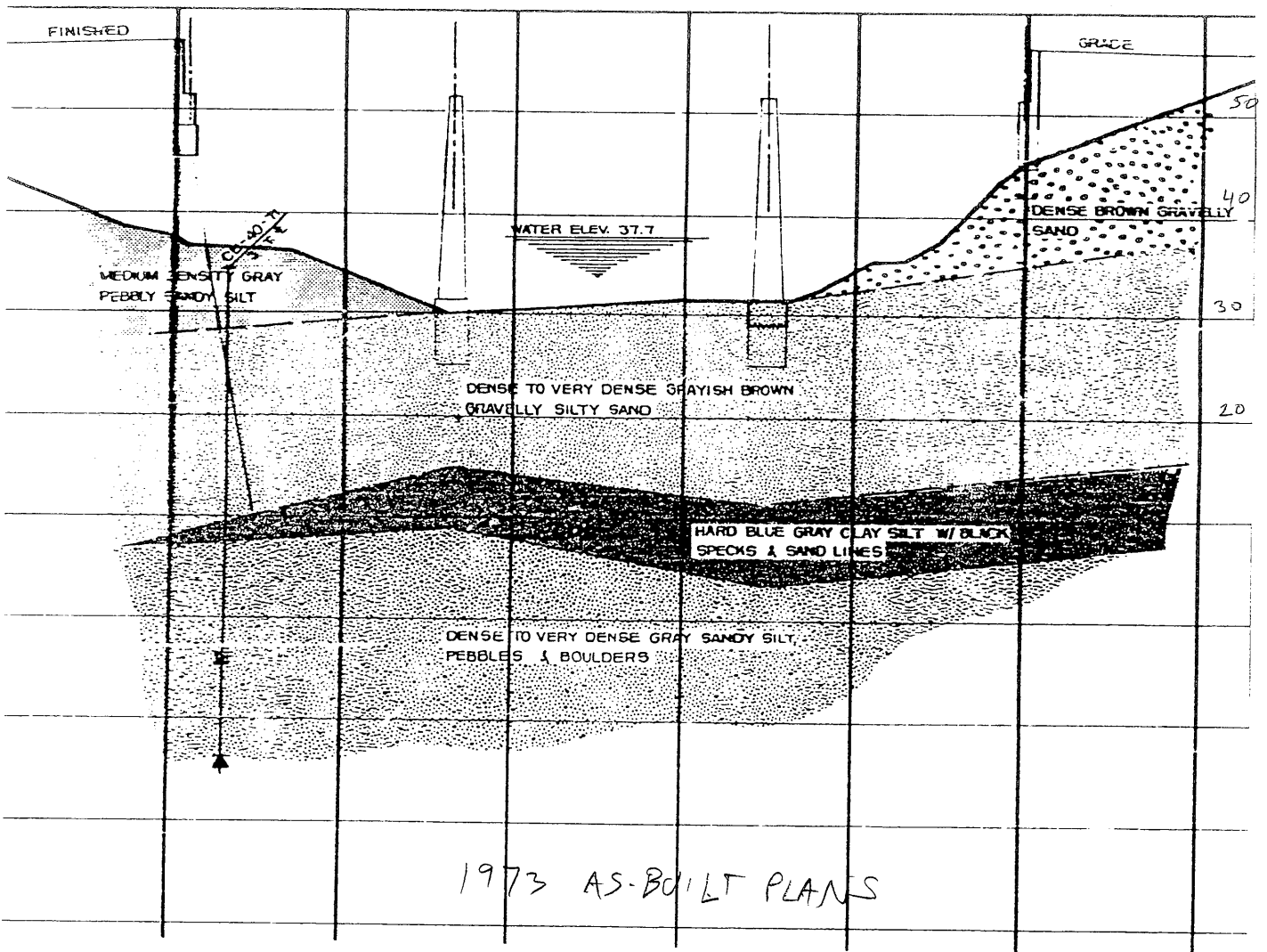
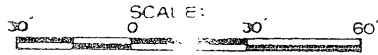
OFFICE/FIELD REVIEW REPORT

Bridge Name: <i>EEL WER</i>	Town: <i>BUFFINGTON</i>	Bridge #: <i>6209</i>
Route No./Name: <i>WOLFE RD</i>	Stream: <i>SEARS CREEK RIVER</i>	Review Date: <i>10/12/95</i>

Sketch (Profile)

Bridge plans supplemented by field sketch.

PLAN

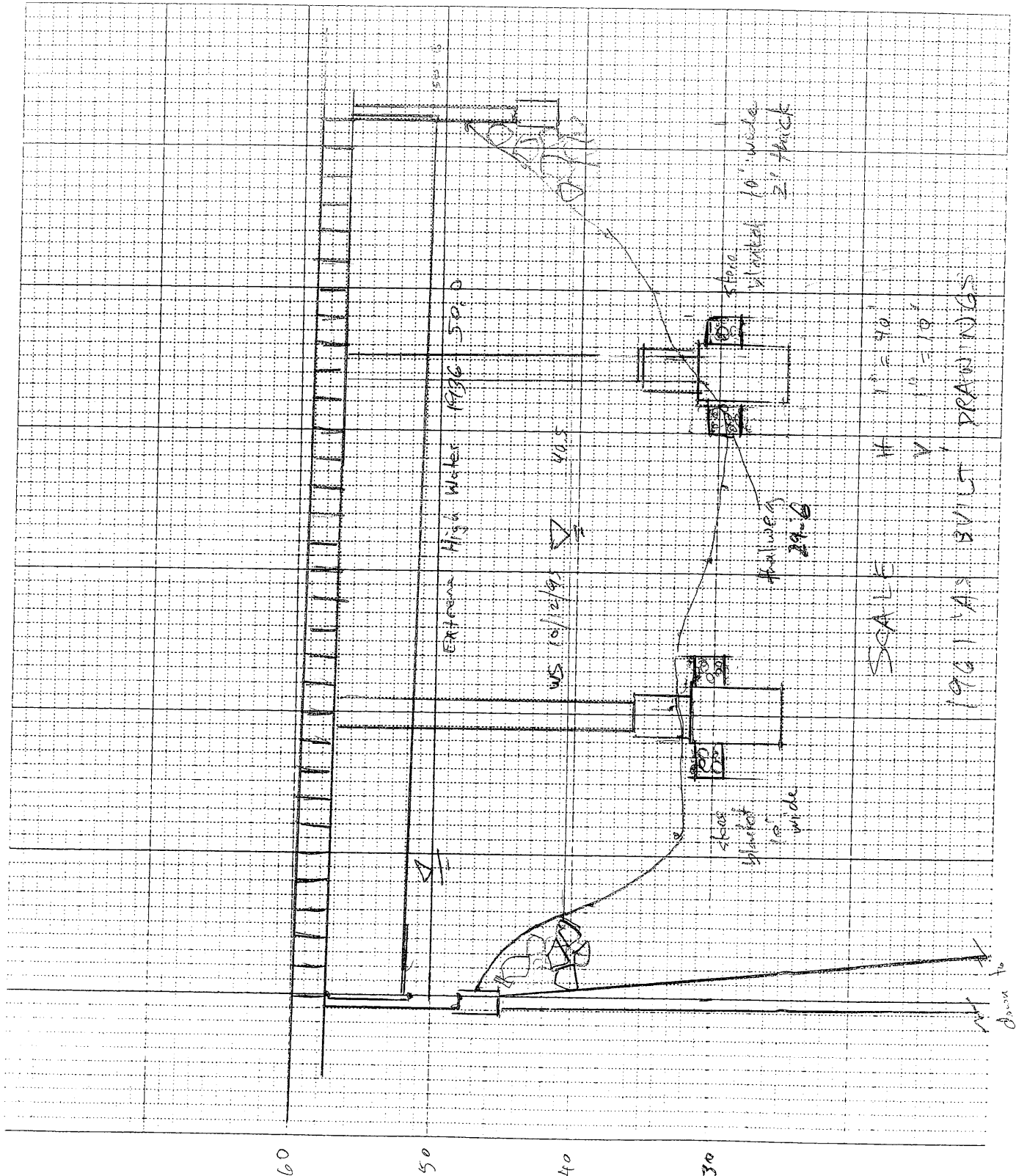


OFFICE/FIELD REVIEW REPORT

Bridge Name: <u>EE - WEF</u>	Town: <u>GRAND</u>	Bridge #: <u>2222</u>
Route No./Name: <u>MOHAWK RD</u>	Stream: <u>DECATUR CO. RIVER</u>	Review Date: <u>10/1/01</u>

Stream Cross Section at Bridge (Facing Downstream)

Upstream Side: _____ Downstream Side: X



OFFICE/FIELD REVIEW REPORT

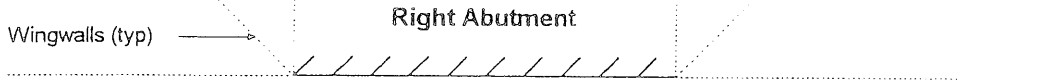
Bridge Name: <u>EELWEE 2</u>	Town: <u>GARRISON</u>	Bridge #: <u>2207</u>
Route No./Name: <u>DOWN RD.</u>	Stream: <u>SEASIDE CREEK PIER</u>	Review Date: <u>10/2/05</u>

Soundings/Problings

E - Footing Exposure U - Depth of Undermining
 P - Depth of Rod Probe W - Water Depth

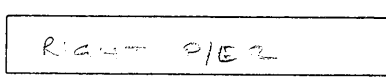
the top is high to see in inspection

<u>30'</u>	<u>20'</u>	<u>10'</u>	<u>0'</u>		<u>0'</u>	<u>10'</u>	<u>20'</u>	<u>30'</u>
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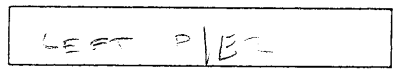


stair abutment slope
 E=3' E=3' E=3'

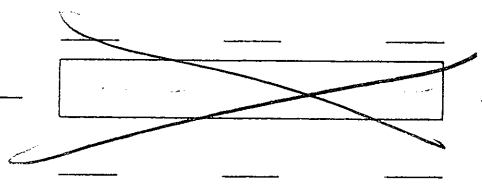
Flow



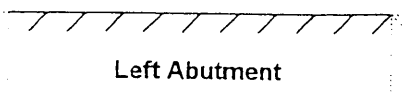
← **FLOW**



← **FLOW**



stair abutment slope



Attachment M: Scour/H&H Backup Calculations



11 King Court
Keene, NH 03431-4648
Main: (603)-357-2445

**Burnham 6209
Attachment M: Scour/H&H Backup
Calculations**

Maine Scour Investigation

Computed by: SVE
Checked by: RKW

Burnham 6209 – Eel Weir Road over Sebasticook River in the Town of Burnham, ME

Contraction Scour 100-yr (Approach XS 29)

	Left	Channel	Right
Input Data			
Average Depth (ft):		5.38	2.52
Approach Velocity (ft/s):		0.88	0.26
Br Average Depth (ft):		9.78	
BR Opening Flow (cfs):		15400.00	
BR Top WD (ft):		227.13	
Grain Size D50 (mm):	0.5	0.5	0.5
Approach Flow (cfs):		13008.38	2191.62
Approach Top WD (ft):		2750.85	3391.48
K1 Coefficient:		0.640	0.590
Results			
Scour Depth Ys (ft):		17.36	
Critical Velocity (ft/s):		1.75	
Equation:		Clear	

Computed by: SVE
Checked by: RKW

Pier Scour 100-yr

Pier: #1 (CL = 295)

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	6.01
Grain Size D50 (mm):	0.50000
Depth Upstream (ft):	9.28
Velocity Upstream (ft/s):	5.19
K1 Nose Shape:	1.00
Pier Angle:	10
Pier Length (ft):	26.00
K2 Angle Coef:	1.85
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	6.00000
K4 Armouring Coef:	1.00

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	16.97
Froude #:	0.30
Equation:	CSU equation

Computed by: SVE
Checked by: RKW

Pier: #2 (CL = 390)

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	5.62
Grain Size D50 (mm):	0.50000
Depth Upstream (ft):	9.28
Velocity Upstream (ft/s):	5.19
K1 Nose Shape:	1.00
Pier Angle:	10
Pier Length (ft):	26.00
K2 Angle Coef:	1.85
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	6.00000
K4 Armouring Coef:	1.00

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	16.25
Froude #:	0.30
Equation:	CSU equation

Computed by: SVE
Checked by: RKW

Pier Scour 100-yr with Armoring Layer

Pier: #1 (CL = 295)

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	6.01
Grain Size D50 (mm):	100.00000
Depth Upstream (ft):	9.28
Velocity Upstream (ft/s):	5.19
K1 Nose Shape:	1.00
Pier Angle:	10
Pier Length (ft):	26.00
K2 Angle Coef:	1.85
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	180.00000
K4 Armoring Coef:	0.40

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	6.79
Froude #:	0.30
Equation:	CSU equation

Computed by: SVE
Checked by: RKW

Pier: #2 (CL = 390)

Input Data

Pier Shape:	Sharp nose
Pier Width (ft):	5.62
Grain Size D50 (mm):	100.00000
Depth Upstream (ft):	9.28
Velocity Upstream (ft/s):	5.19
K1 Nose Shape:	1.00
Pier Angle:	10
Pier Length (ft):	26.00
K2 Angle Coef:	1.85
K3 Bed Cond Coef:	1.10
Grain Size D90 (mm):	180.00000
K4 Armouring Coef:	0.40

Set K1 value to 1.0 because angle > 5 degrees

Results

Scour Depth Ys (ft):	6.50
Froude #:	0.30
Equation:	CSU equation

Notes:

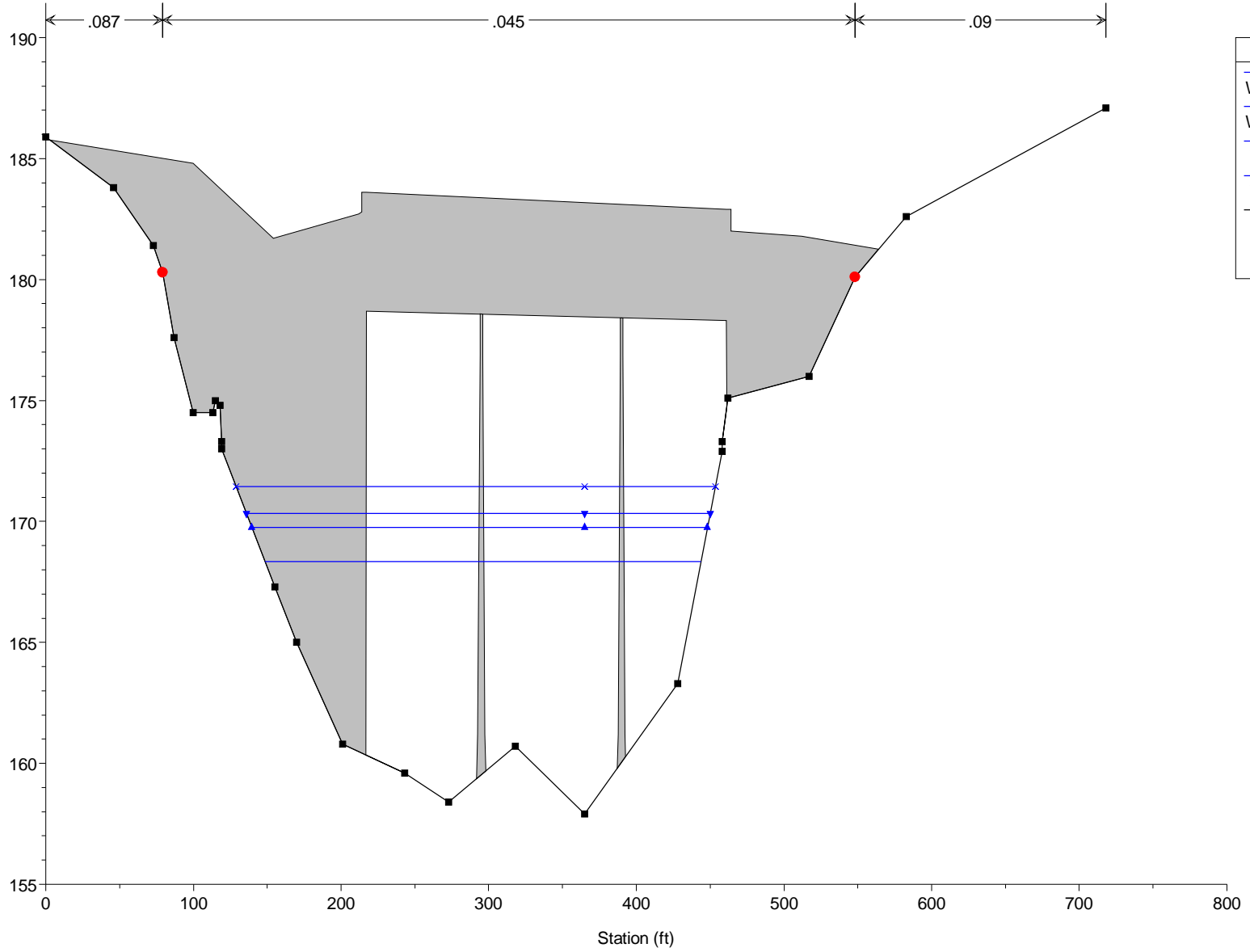
Pier length based on model, which defaults to bridge width.

Soil grain size (D50 & D90) is based on field observations.

HEC-RAS Plan: B_S River: BURNHAM- MAINE F Reach: PROFILES STARTED

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
PROFILES STARTED	31	10-yr	10502.00	157.40	172.30		172.49	0.000686	3.52	3093.94	507.39	0.22
PROFILES STARTED	31	50-yr	13666.00	157.40	173.19		173.45	0.000815	4.11	3581.83	583.88	0.24
PROFILES STARTED	31	100-yr	15100.00	157.40	173.60		173.89	0.000852	4.33	3932.47	1035.74	0.25
PROFILES STARTED	31	500-yr	17967.00	157.40	174.44		174.76	0.000871	4.63	4989.64	1484.62	0.25
PROFILES STARTED	30	10-yr	10572.00	159.70	171.10		171.11	0.000144	0.73	17390.72	6331.65	0.07
PROFILES STARTED	30	50-yr	13756.00	159.70	172.32		172.33	0.000096	0.64	25183.56	6389.23	0.05
PROFILES STARTED	30	100-yr	15200.00	159.70	172.85		172.85	0.000084	0.62	28542.58	6413.90	0.05
PROFILES STARTED	30	500-yr	18086.00	159.70	173.86		173.87	0.000066	0.59	35072.55	6461.57	0.04
PROFILES STARTED	29	10-yr	10572.00	145.80	170.55		170.57	0.000102	1.08	11711.32	5930.74	0.10
PROFILES STARTED	29	50-yr	13756.00	145.80	171.92		171.93	0.000085	0.92	19887.95	6079.97	0.07
PROFILES STARTED	29	100-yr	15200.00	145.80	172.48		172.50	0.000078	0.88	23364.64	6142.32	0.07
PROFILES STARTED	29	500-yr	18086.00	145.80	173.57		173.57	0.000066	0.81	30065.04	6260.74	0.06
PROFILES STARTED	28	10-yr	10711.00	157.90	168.81	163.90	169.15	0.001295	4.63	2315.71	299.77	0.29
PROFILES STARTED	28	50-yr	13937.00	157.90	170.29	164.67	170.69	0.001285	5.03	2769.72	313.71	0.30
PROFILES STARTED	28	100-yr	15400.00	157.90	170.92	165.01	171.34	0.001279	5.19	2967.11	319.59	0.30
PROFILES STARTED	28	500-yr	18324.00	157.90	172.09	165.63	172.55	0.001267	5.47	3348.31	330.64	0.30
PROFILES STARTED	27		Bridge									
PROFILES STARTED	26	10-yr	10711.00	150.80	168.58		168.67	0.000196	2.33	4603.67	402.66	0.12
PROFILES STARTED	26	50-yr	13937.00	150.80	170.04		170.15	0.000242	2.67	5222.37	436.64	0.14
PROFILES STARTED	26	100-yr	15400.00	150.80	170.65		170.77	0.000256	2.80	5491.64	443.65	0.14
PROFILES STARTED	26	500-yr	18324.00	150.80	171.80		171.94	0.000278	3.05	6008.52	455.74	0.15
PROFILES STARTED	25	10-yr	10711.00	151.00	168.47		168.49	0.000039	0.91	11851.05	1351.71	0.05
PROFILES STARTED	25	50-yr	13937.00	151.00	169.92		169.94	0.000042	1.02	13880.32	1457.92	0.06
PROFILES STARTED	25	100-yr	15400.00	151.00	170.53		170.55	0.000044	1.06	14791.50	1520.15	0.06
PROFILES STARTED	25	500-yr	18324.00	151.00	171.69		171.71	0.000046	1.14	16613.74	1640.99	0.06
PROFILES STARTED	24	10-yr	10780.00	148.00	167.69		167.85	0.000428	3.24	3330.88	319.80	0.18
PROFILES STARTED	24	50-yr	14028.00	148.00	169.00		169.22	0.000548	3.72	3772.68	354.26	0.20
PROFILES STARTED	24	100-yr	15500.00	148.00	169.56		169.80	0.000598	3.90	3976.18	371.47	0.21
PROFILES STARTED	24	500-yr	18443.00	148.00	170.64		170.91	0.000657	4.20	4391.68	401.41	0.22
PROFILES STARTED	23	10-yr	10780.00	139.40	167.62		167.64	0.000014	1.11	9784.32	573.20	0.05
PROFILES STARTED	23	50-yr	14028.00	139.40	168.90		168.93	0.000019	1.35	10595.16	712.36	0.05
PROFILES STARTED	23	100-yr	15500.00	139.40	169.45		169.48	0.000021	1.45	11004.22	784.98	0.06

Burnham_Sebasticook Plan: Burnham_Sebasticook 4/6/2010
 Bridge at SR18B (Bridge #6209)



Legend

- WS 500-yr (x)
- WS 100-yr (inverted triangle)
- WS 50-yr (triangle)
- WS 10-yr (horizontal line)
- Ground (square)
- Bank Sta (red circle)

Plan: B_S BURNHAM- MAINE F PROFILES STARTED RS: 27 Profile: 100-yr

E.G. US. (ft)	171.34	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	170.92	E.G. Elev (ft)	171.09	170.91
Q Total (cfs)	15400.00	W.S. Elev (ft)	170.34	170.67
Q Bridge (cfs)	15400.00	Crit W.S. (ft)	165.47	158.59
Q Weir (cfs)		Max Chl Dpth (ft)	12.44	19.87
Weir Sta Lft (ft)		Vel Total (ft/s)	6.93	3.96
Weir Sta Rgt (ft)		Flow Area (sq ft)	2221.61	3889.24
Weir Submerg		Froude # Chl	0.35	0.16
Weir Max Depth (ft)		Specif Force (cu ft)	14915.59	35367.93
Min El Weir Flow (ft)	181.26	Hydr Depth (ft)	9.78	16.31
Min El Prs (ft)	179.00	W.P. Total (ft)	275.94	318.68
Delta EG (ft)	0.57	Conv. Total (cfs)	294683.9	680750.4
Delta WS (ft)	0.27	Top Width (ft)	227.13	238.47
BR Open Area (sq ft)	4155.82	Frctn Loss (ft)	0.03	0.10
BR Open Vel (ft/s)	6.93	C & E Loss (ft)	0.15	0.04
Coef of Q		Shear Total (lb/sq ft)	1.37	0.39
Br Sel Method	Energy only	Power Total (lb/ft s)	9.52	1.54