Soils Report 78-17
Brooklin/Sedgwick - Hancock County
Benjamin River Bridge
No. 3216
March, 1978

Maine Department of Transportation

Materials and Research Division

Soils Section

SURFACE AND SUBSURFACE INVESTIGATION FOR THE PROPOSED RECONSTRUCTION OF THE BENJAMIN RIVER BRIDGE BETWEEN THE TOWNS OF BROOKLIN AND SEDGWICK

Hancock County | Bridge No. 3216 | Soils Report 78-17

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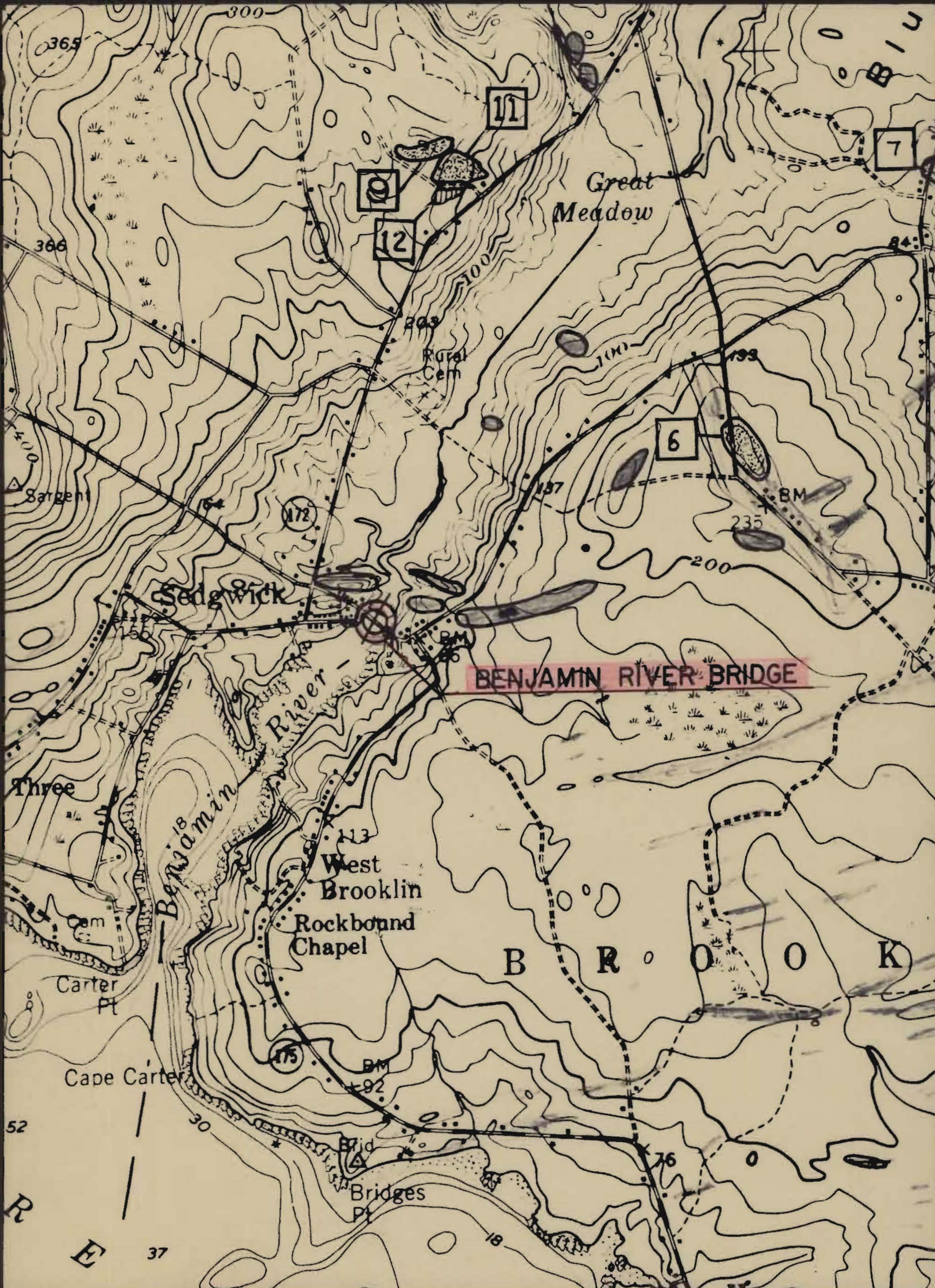

11
9
12
7
6
Great Meadow
Rural Cem
Sargent
Sedgwick
172
BM 86
BENJAMIN RIVER BRIDGE
Benjamin River
Three
113
West Brooklin
Rockbound Chapel
Cem
Carter Pt
Cape Carter
175
BM 92
Brid
Bridges Pt
B R O O K

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INTRODUCTION

A surface and subsurface soils investigation has been completed for the proposed causeway widening and reconstruction of the Benjamin River Bridge on Route 175. This bridge connects the two towns of Sedgwick and Brooklin in Hancock County.

Field investigations consisted of one washboring and four quarry bit probes done in February, 1978, by a washboring crew under the supervision of Mr. Arden Carlisle. The locations of these borings and their details are shown on Sheets 6 and 10 of the Illustrations. The plan and profile of the proposed bridge are shown on Sheet 10. Also, detailed investigation of the existing causeway and bridge foundations was performed by Geologist Mr. Albert Eggleston during low tide and his findings are illustrated on Sheets 3 - 9.

Samples were forwarded to the Central Laboratory in Bangor for identification and standard tests. The originals of these sheets will be forwarded to the Bridge Design Section for inclusion with the construction plans.

GENERAL CONDITIONS

The observations of Mr. Eggleston summarize the existing conditions well. They are summarized as follows:

Station 7+50 - 9+75±. Causeway and Bridge Abutment:

Causeway constructed on log crib work. Tidal flow through the crib between Stations 9+25 - 9+60±. (Sheets 5 and 7)

Evidence of 24" ± settlement at North Abutment (Station 9+75±) during construction or which required reconstruction at a later time. Note wedge - Sheet 3.

Abutment on spread footing constructed with granite slabs. (Sheets 3 and 4)

There is flow of tidal water through the stone causeway wall at all elevations.

Highest tide elevation reached during storms January and February, 1978, was elevation 10.5±.

North Abutment apparently stable for period of 50± years. No data on exact date of construction (known to be before 1926 bridge survey) found.

Some granite blocks are held together with iron staples (⌐¬) or 1¼" iron dowels. All blocks along guardrail are stapled.

Southerly - right - wall of causeway blocks are tipped and pushed out of alignment (2 - 5") by heavy seas during periods of abnormal tide in the vicinity of Station 9+0±.

Station 10+00 - 12+50±. Bridge Abutment and Causeway:

Causeway constructed on boulder fill. Tidal flow through stone on causeway at all elevations. No crib work visible but reported by local residents to be present.

Abutment constructed with large blocks (18") for footing and lower two courses of stone. (Sheets 8 and 9)

Southerly - right - wall of causeway shows evidence of storm damage 12+00 - 14+25±.

No evidence of iron pins to hold lower courses of stones.

General Notes:

Causeway constructed with 2 - 6 feet of gravel over 2 - 4 feet of stone fill. (Sheet 6)

Pavement, 6 to 13 inches thick.

High tide elevation was recorded as +5.6 feet and low tide at -1.5 feet during the survey period. However, with high running tide and a strong southerly wind, an inch or more of water covers the causeway and bridge. This elevation is approximately +9.0±.

Fill under the pavement from Station 9+70 to 12+00± is washing out from tide water flow and this loss of granular base material results in holes in the roadway. New and old patches are numerous in this section.

SUBSTRUCTURE DETAILS

Bridge:

Washboring AC-6-78 was made at Station 9+80, 12.5 feet right (elevation -3.4 feet). This was made as close to the existing footing as possible working from the roadway above. The underlying soil stratification is as follows:

Depth	Description
0' - 1'	Brown sand, gravel, and rocks
1' - 2'	Black sand, gravel, and rocks
2' - 4'	Brown sand, gravel, and rocks
4' - 8'	Gray sandy clayey silt
8' - 10'	Gray-brown clayey sandy silt with fine sand layers
10' - 28'	Brown, silty sandy gravel with scattered rocks
28'	Refusal

It is believed that this soil exhibits an adequate bearing capacity for the additional load which will be imposed by the concrete abutment wings and their footing foundations. These footings for the widened abutments can probably be constructed using the excavated cut granite blocks from the roadway shoulders above. Adequate levelling and preparation of the base for the blocks should be accomplished before placement.

Roadway:

To obtain some information about the existing road and its base material, four quarry bit probes were undertaken at selected stations. These are tabulated below:

Location	Elevation	Description	
9+00, 4.5 feet right	+9.0'	0-9"	Bituminous pavement
		9"-75"	Granular fill (becomes very coarse below)
		75"	Refusal
9+50, 6 feet right	+8.7'	0-13"	Bituminous pavement - seven different layers visible
		13"-22"	Sand base
		22"-48"	Granular fill (becomes coarse with depth)
		48"	Refusal on large stone
10+50, 6 feet right	+8.8'	0-7"	Bituminous pavement - four layers visible
		7"-24"	Sand base (becomes coarse with depth)
		24"-36"	Cobbles, pebbles
		36"	Refusal on coarse stone
11+00, 7.5 feet right	+9.0'	0-6"	Bituminous pavement
		6"-60"	Granular fill (becomes coarse with depth)
		60"	Refusal on coarse stone

It is believed from these borings that the finer granular base material is being washed away from underneath the road as a result of the continual flow of tidal water through the causeway. Initially, this free flow of water was unknown, and thus a filter system was proposed beneath the riprap along the roadway slopes to prevent the base material washout. However, from the results of the four borings made through the road, and on-site observations, this natural tidal flow was found all through the stones and log crib work in the causeway. It is believed that placing the filter behind the riprap as originally proposed would not completely stop the loss of material from the road base. It is recommended that this natural flow be left unimpeded, and a filter fabric be used at subgrade beneath the reconstructed road surface along the causeway. This would effectively stop the loss of fines in the roadway base without impeding the free flow of tidal water through the causeway.

After excavating to subgrade, all voids should be filled with rocks. If it is found that fine granular material is present at subgrade, this should be excavated and backfilled with coarse material (gravel, rocks, etc.) until a satisfactory surface for the fabric is obtained. No fine material susceptible to being washed away should be left below the fabric. Also, the new fill placed along each side outside of the existing granite block wall should consist entirely of stones (minimum size three inches). The excavated bituminous pavement from the roadway can be utilized in lieu of rock fill within the bottom couple feet of the fill. Thorough compaction of the entire subgrade before placing the non-woven fabric sheets is recommended. Recommended longitudinal overlapping of the fabric sheets should be a minimum of one foot. It is also recommended that the fabric be turned inward to prevent loss of fines from the shoulder edges. This design is illustrated on Sheet 2.

SUMMARY

The Benjamin River Bridge in Hancock County is to be widened and improved. Soils investigations consisted of one washboring in the riverbed and four quarry bit probes in the roadway, plus careful inspection of the existing facility through all tide levels. From the washboring it was found that there exists loose sand, gravel, and rocks in the upper four feet of soil. Below this is gray clayey sandy silt underlain by loose brown silty sand and gravel. Refusal occurred at a depth of 28 feet. This soil is believed to be capable of supporting the additional load imposed by the proposed construction.

It was found from the four quarry bit probes through the existing roadway and observation that the tidal water flow is the cause of the existing surface problems. The roadway consists of a bituminous pavement (varying thickness due to patching) on granular base. Some sand is still found immediately underlying

the pavement but in other sections this finer material has been washed away. In all four quarry probes, the granular fill became coarser with depth. Below this granular fill is a stone fill with very large stones and boulders through which water flows freely all along the causeway.

It is recommended that this flow be left unimpeded, which will require that new fill placed outside the limits of the existing causeway consist of stone, and that a non-woven filter fabric be utilized to prevent further loss of fine material from the roadway. After excavation to subgrade, voids should be filled and any remaining sandy granular material should be removed and replaced with stone to provide an even surface for the fabric sheets. Thorough compaction is necessary before fabric placement also. Each adjacent sheet of fabric should overlap by a minimum of one foot and enough should remain along the shoulder edges to turn upward to retain the base material. Embankment material on each side should consist of large stones, rocks, excess granite blocks, and possibly the excavated bituminous pavement. No granular fill is recommended due to the continual tidal flow conditions and occasional severe pounding during storm conditions.

Prepared by Peter Coughlan
Peter Coughlan
Assistant Engineer — Soils

Approved by Guy Baker
Guy Baker
Assistant Soils Engineer

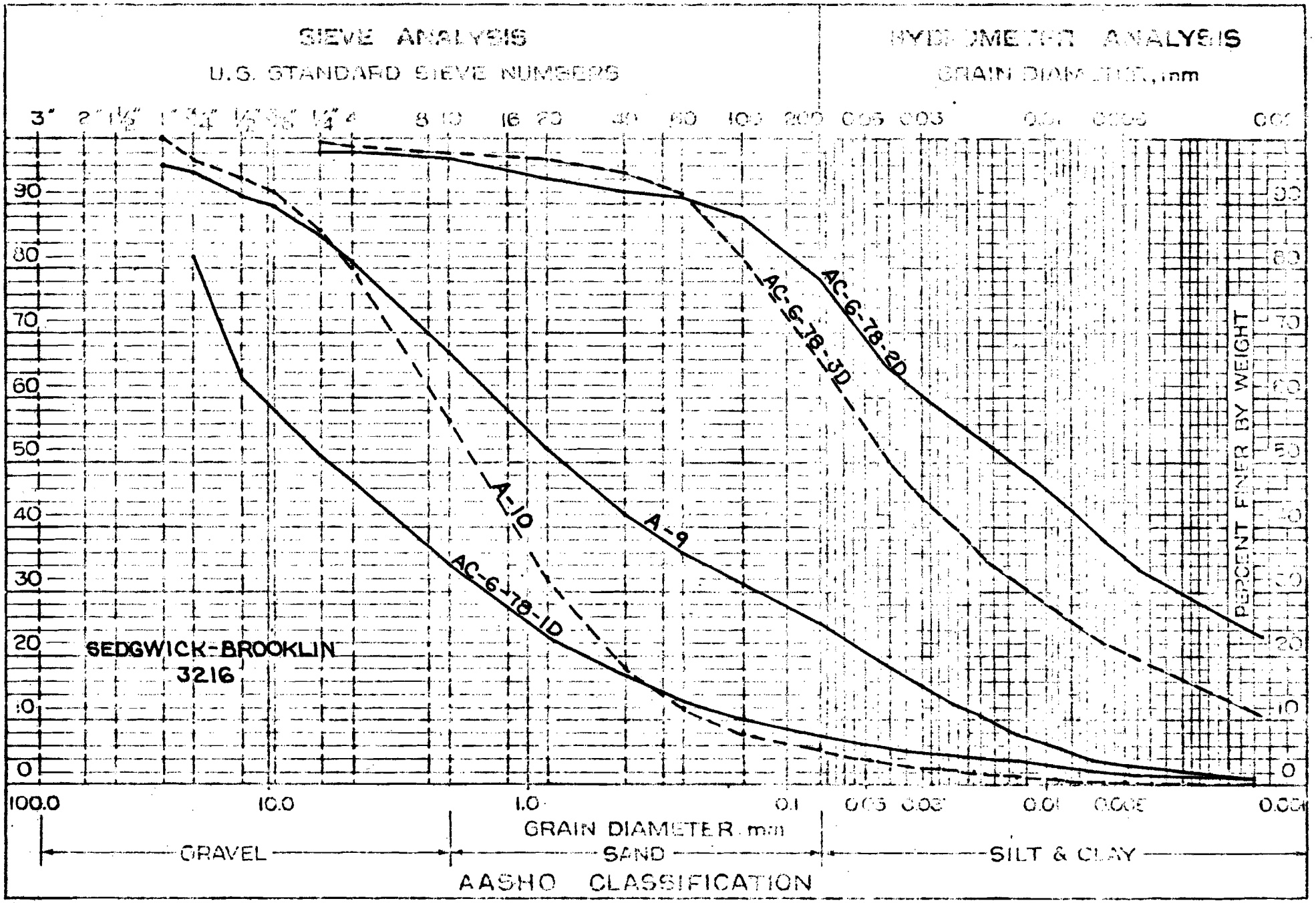
Melvin W. Morgan
Soils Engineer

TOWN BROOKLIN PROJ. NO. 3216

STATION	OFFSET	DEPTH	SAMPLE NO.	G.S. SHEET	W.C.	L.L.	P.I.	IGN.	CLASSIFICATION AASHO	CLASSIFICATION FROST
9+50	6' RT.	13"-22"	A-9		9.1				A-1-b	III
10+50	6' RT.	7"-24"	A-10		10.6				A-1-b	0
9+80	12.5' RT	2'-3'6"	AC-6-78 1-D		14.5					
9+80	12.5' RT	6'-7'6"	AC-6-78 2-D		17.5					
9+80	12.5' RT	8-9'6"	AC-6-78 3-D		17.6					

Classification of these soil samples in accordance with the AASHTO Classification System M-145-49. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the Division of Federal Aid & State Highways and Corps of Engineers Classification Systems.

SML-108 (3/66)

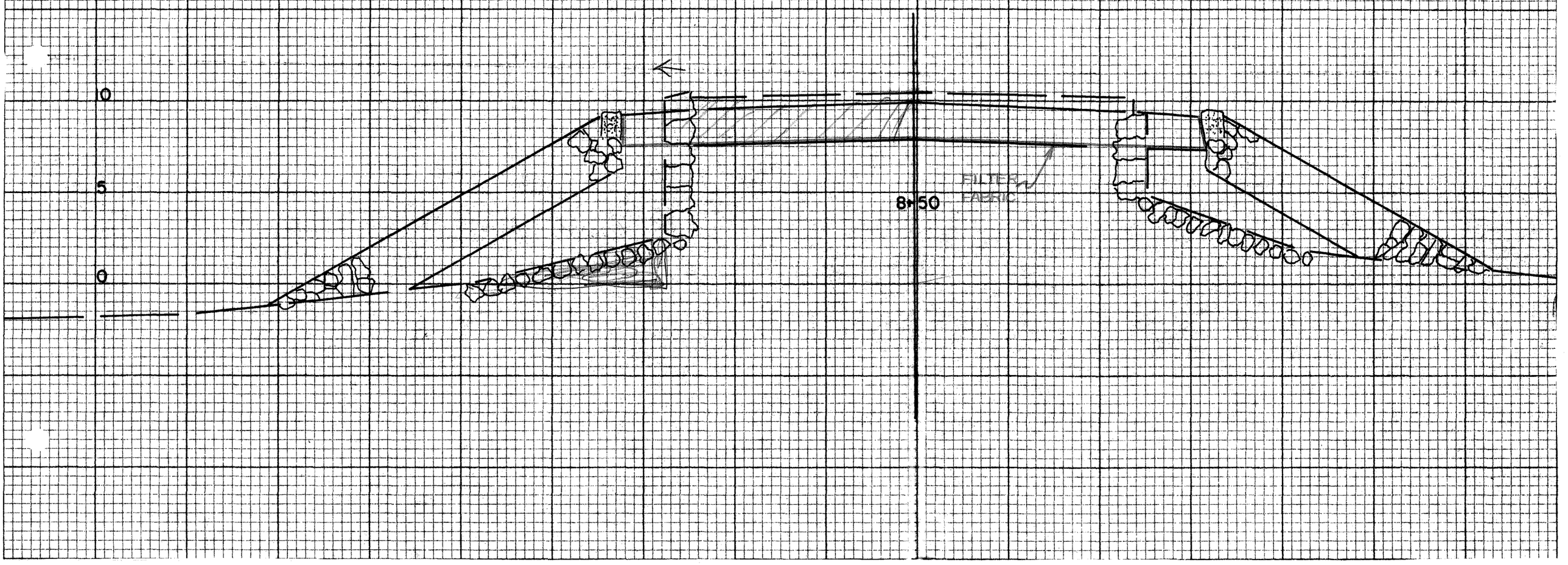


STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

GRAIN SIZE DISTRIBUTION CURVES

BUREAU OF HIGHWAYS
MATERIALS & RESEARCH DIVISION

SHEET NO. 1


10
5
0
8+50
FILTER FABRIC

Excavated to subgrade from Bucklin end to Abut.

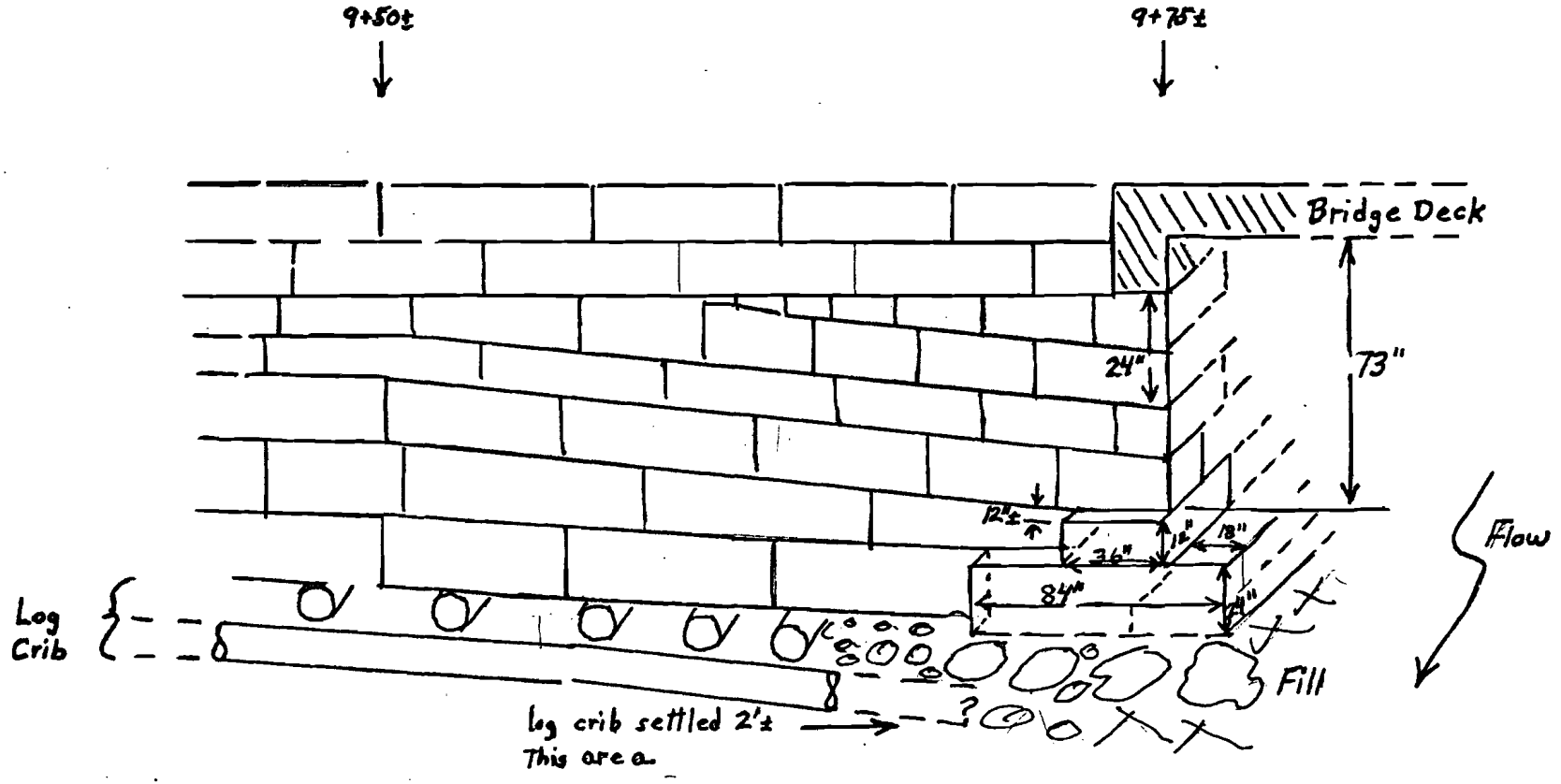
Excavated from Abut to Sedgwick wall kicked out in vicinity 8+50-8+75 during excavations. Wall tipped in at 9+50 I

On opposite side in vicinity 8+50 wall bowed out and crack opened in pavement 3-4' inside granite. bows in vicinity Sta 9+50 on right wall

Rebacked area with common borrow and constructed wooden barricade to keep traffic away from right edge.

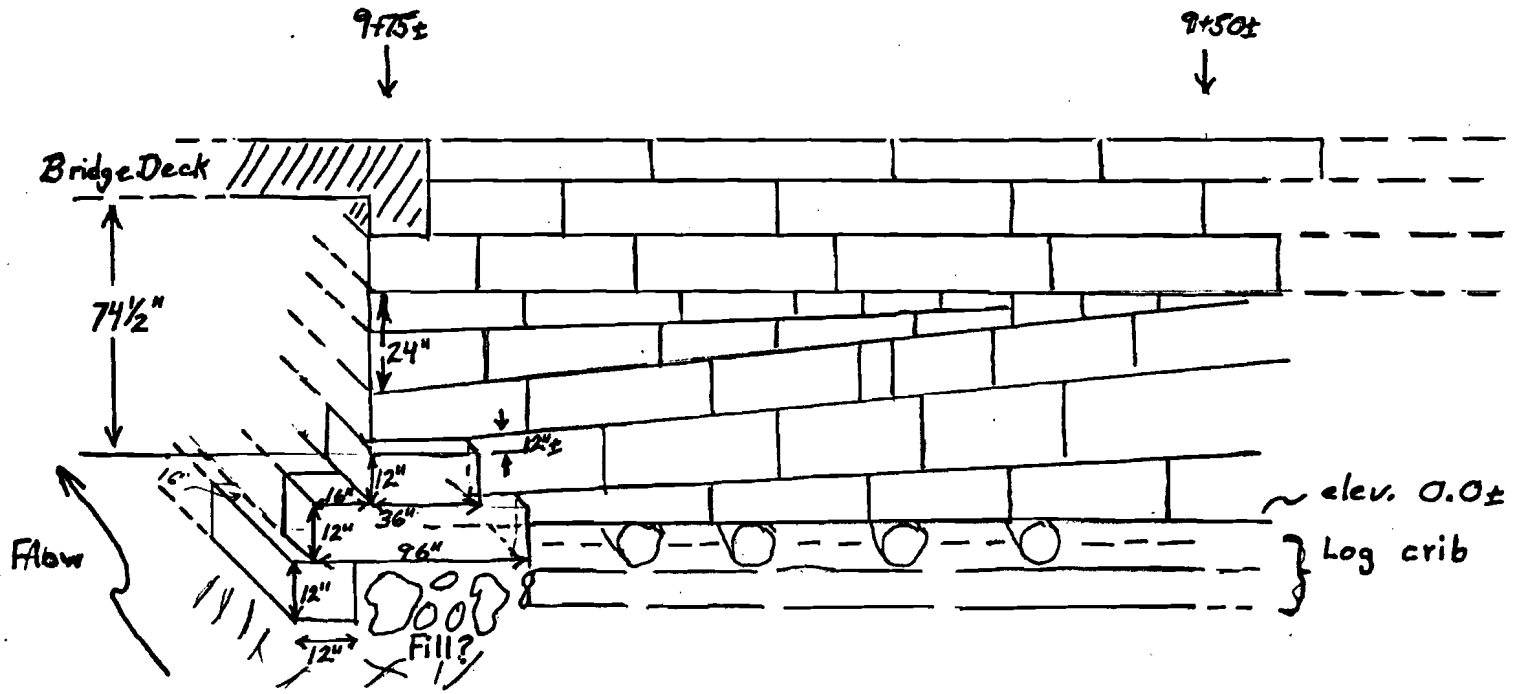
Wed Am Shot abutments found About 1 down ½" + 5/8" below dz

Pump seal Concrete



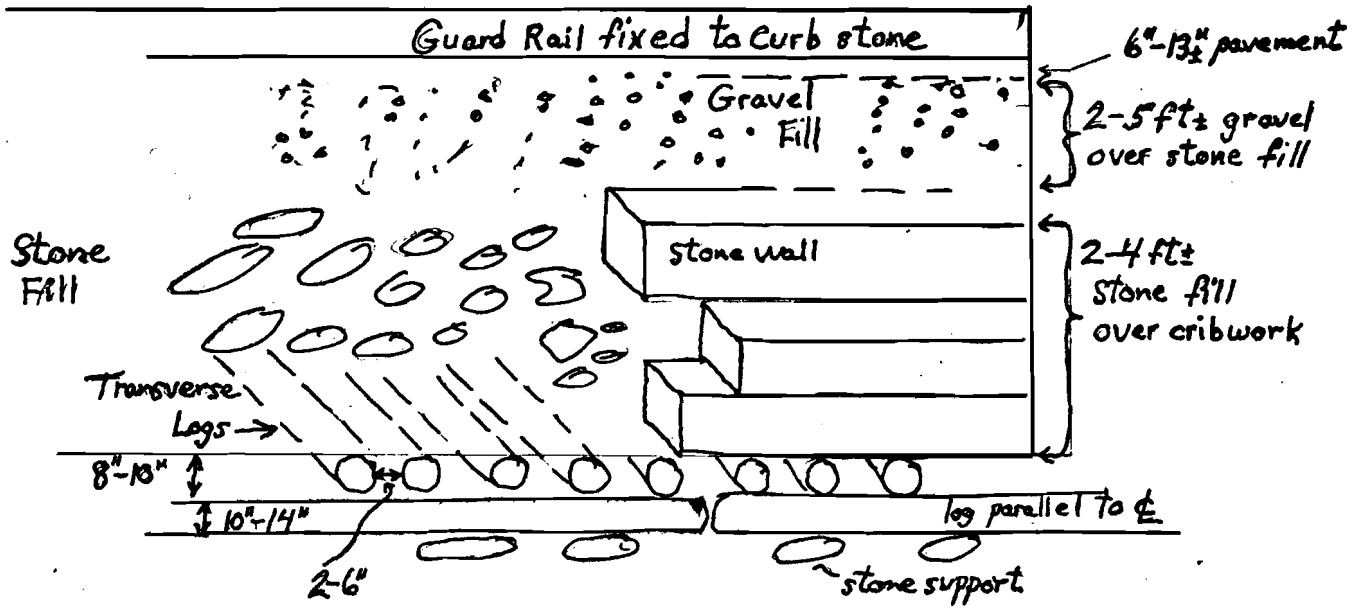
South side (right) of West Abutment
Abut #1

SHEET NO. 3



North side (Left) of West Abutment

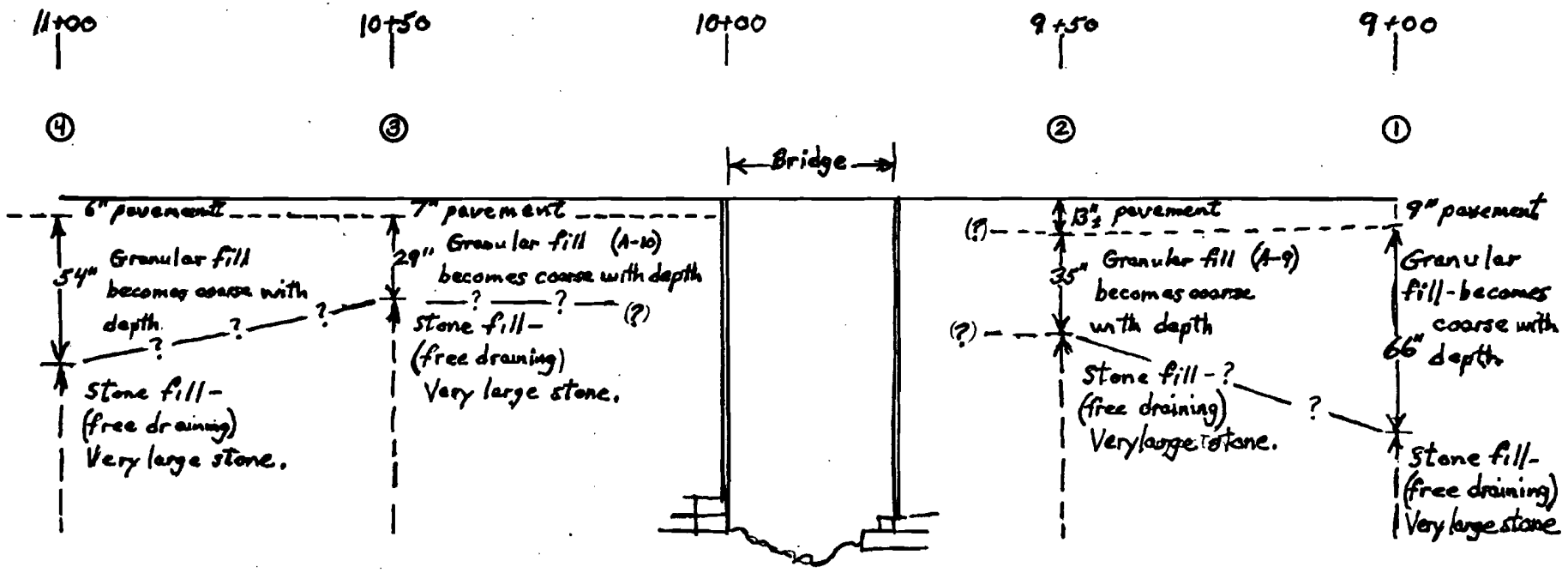
Abut #1



NOTE: No logs visible stations 10+00 - 12+00

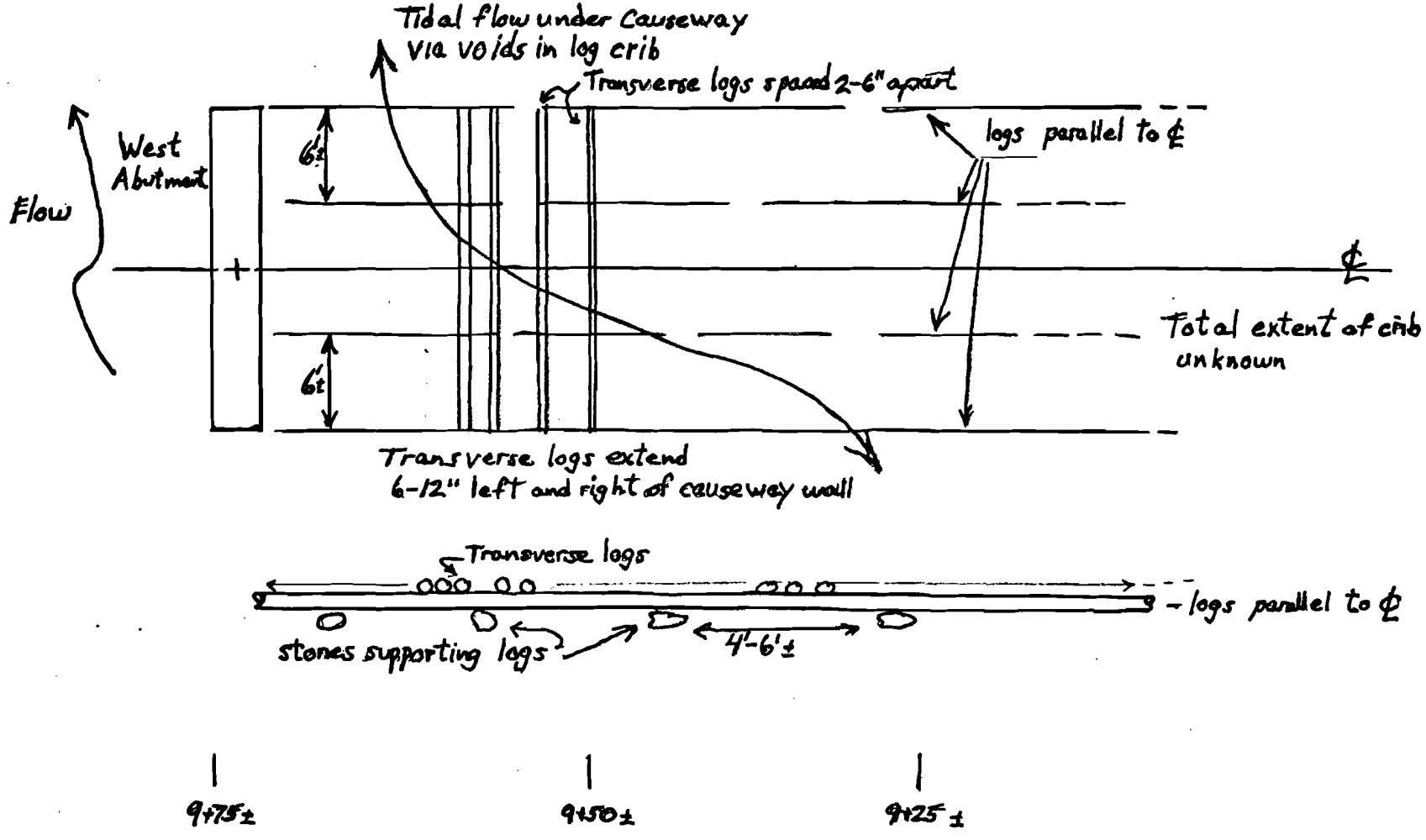
Typical Section Causeway

SHEET NO. 5



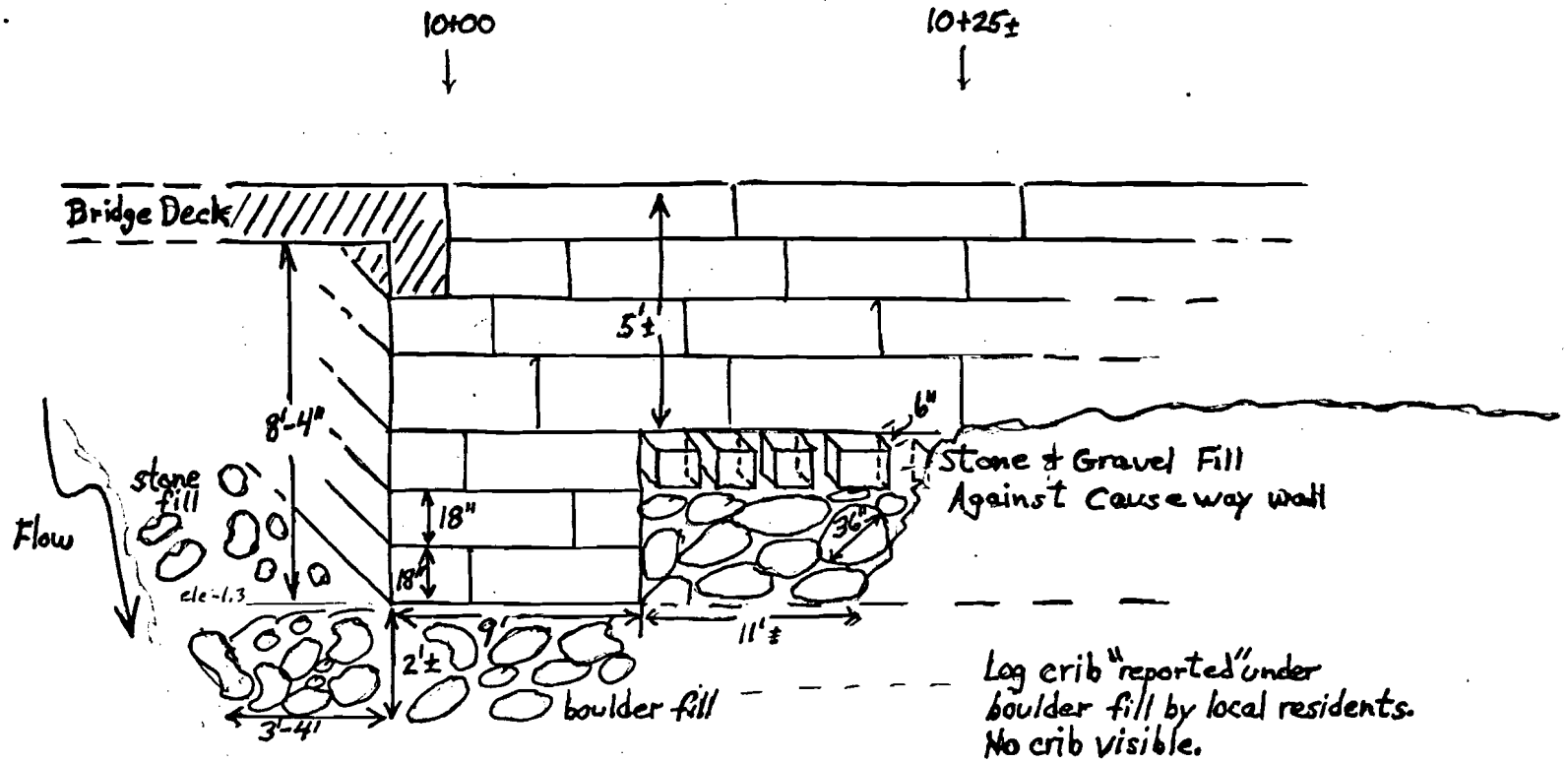
Causeway fill - Quarry Bit Explorations

SHEET NO. 6



Log Crib Causeway Foundation

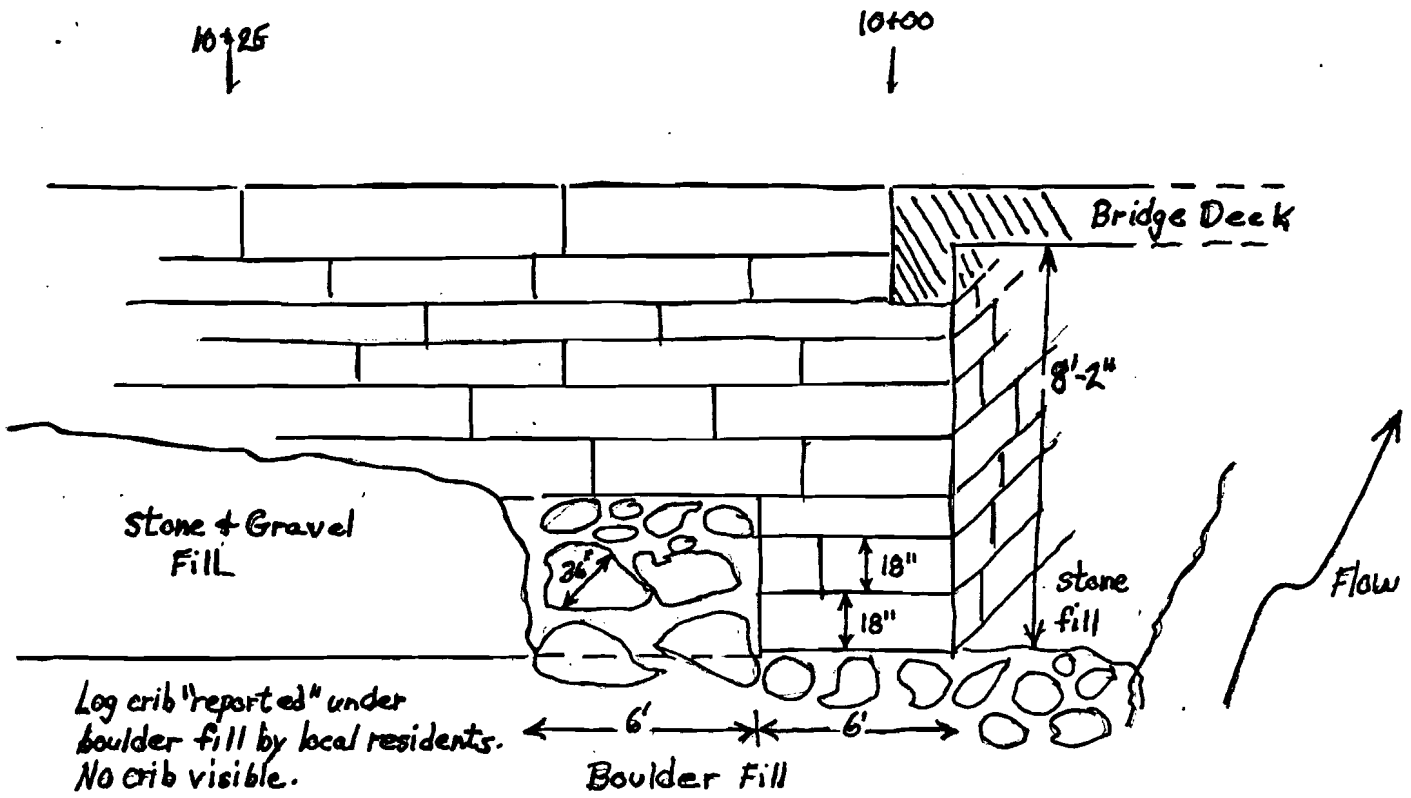
SHEET NO. 7



South side (right) of East Abutment

ABUT #2

SHEET NO. 8

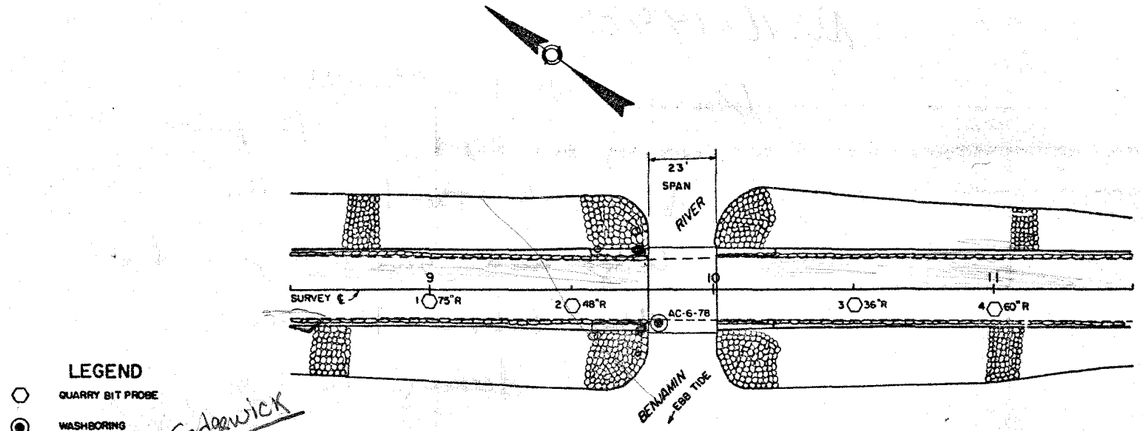


North Side (left) of East Abutment

Abut #2

SHEET NO. 9

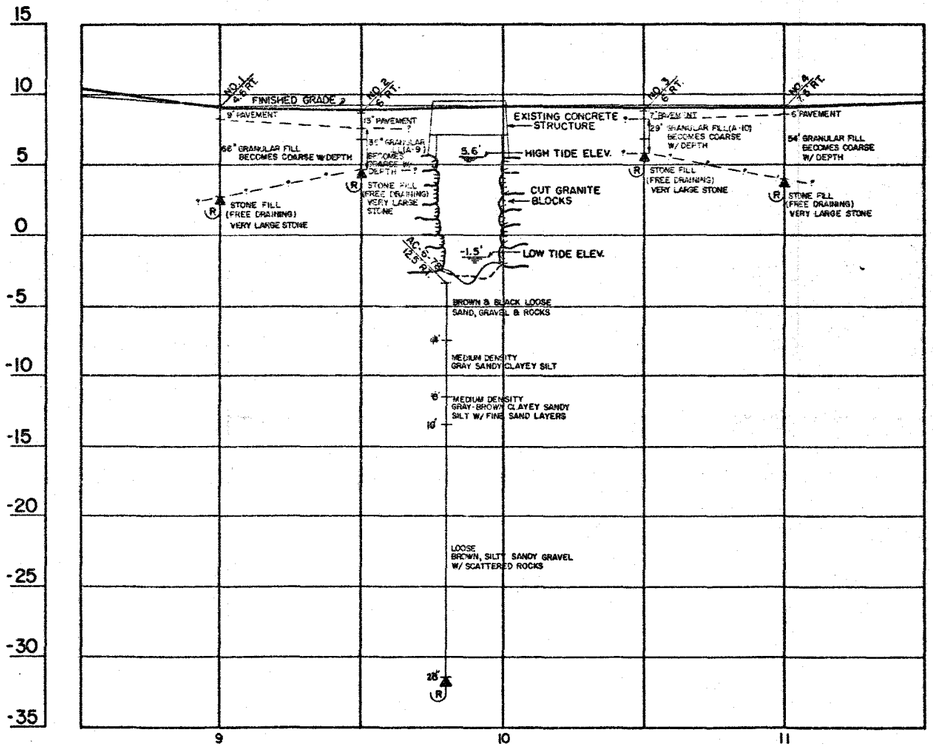
F.H.W.A. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		10	



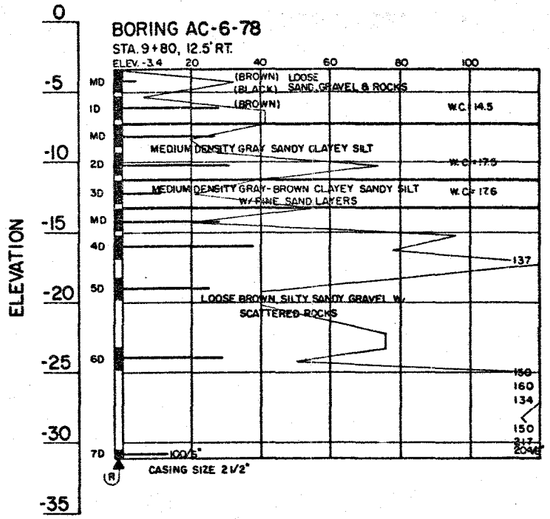
LEGEND

- ⬡ QUARRY BIT PROBE
- ◉ WASHBORING

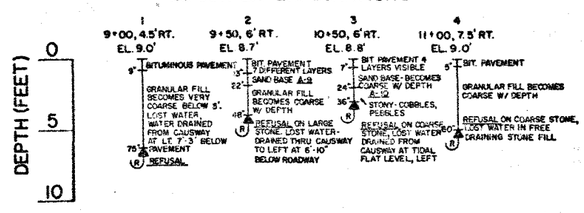
PLAN
SCALE
25' 10' 0 25' 50'



PROFILE
SCALE
HORIZ. 25' 10' 0 25' 50'
VERT. 5 0 5 10'



QUARRY BIT EXPLORATIONS



BORING NOTES

- All samples and vanes 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 sample
  - ID S & H Sampler # 1290's
  - MD 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
- (R) Refusal of drill rods or casing (may not be ledge)

PROJECT DESIGN ENGINEER
PLANS
DESIGN - DETAILED
CHECKED
REVISIONS
FIELD CHANGES

BY	DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BENJAMIN RIVER BRIDGE
OVER
BENJAMIN RIVER
BETWEEN THE TOWNS OF
SEDGWICK AND BROOKLIN
HANCOCK COUNTY
FOUNDATION SURVEY

SHEET OF AUGUSTA, MAINE

Nov 16 1978

Discussed with Tim Chandler using a layer of old pavement to chunk the top of the ledge and give a layer under the fabric that would not damage the fabric