AD-A191 507 BAY SPRINGS LOCK AND DAM FOUNDATION COMPLETION REPORT TENNESSEE-TOMBIGBEE..(U) CORPS OF ENGINEERS NASHVILLE TN NASHVILLE DISTRICT P ROSS ET AL. AUG 87 1/5

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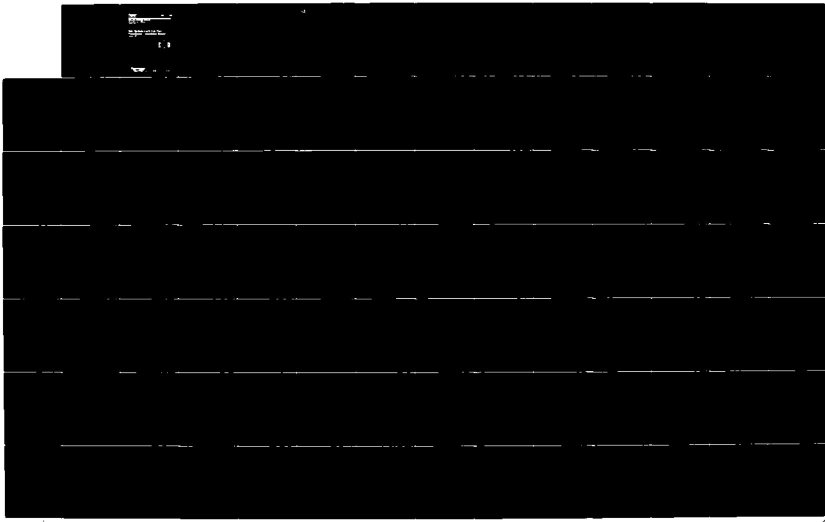

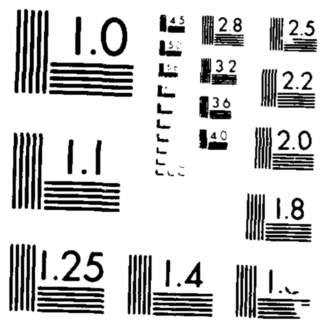

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US Army Corps
of Engineers
Nashville District

Tennessee-Tombigbee Waterway
Mississippi and Alabama
Divide Section

Bay Springs Lock and Dam Foundation Completion Report

August 1987

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REPORT DOCUMENTATION PAGE

Form Approved OMB No 0704-0188

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Bay Springs Lock and Dam Foundation Completion Report (Unclassified)

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Paul Ross, David Sanders, Tommy Haskins

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N/A

17. N/A COSATI CODES

FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Bay Springs Lock and Dam construction, geology, excavation blasting, grouting, rock bolts, wall anchors (tendons), instrumentation, construction photos, as built drawings.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)
The Bay Springs Lock and Dam Project is located in northeast Mississippi on Mackeys Creek, a southerly flowing stream that drains the southwest quarter of Tishomingo County and empties into the Tombigbee River. This project, which is included in the Divide Section of the Tennessee-Tombigbee Waterway, forms the connecting link between the Divide Cut to the north, and Canal Section of the Waterway to the south. The project consists of an earth and rockfill dam, a navigation lock, and a downstream approach channel. The dam itself, measures 2750 feet along its crest (elevation 449) and has a maximum height above the streambed of 129 feet. A 7,645 acre (surface water) reservoir has been created by the structure. Downstream of the dam, the excavated channel, which is the upstream limit of the Lock E pool (elevation 330), has a constant depth of 13 feet and a width of 300 feet.

The Bay Springs lock chamber has nominal dimensions of 110 feet by 600 feet thereby meeting the size standard for a navigation lock. Unique to the structure are relatively thin concrete lock walls or "hang on walls" which are anchored to rock by tendons.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION N/A
22a. NAME OF RESPONSIBLE INDIVIDUAL Tommy A. Haskins	22b. TELEPHONE (Include Area Code) (615) 736-5691 22c. OFFICE SYMBOL CEORN-ED-G

CEORD-ED-G (CEORN-ED-G/11 Sep 87) (1110) 1st End Mr. Canning/lw/FTS 684-3028
SUBJECT: Bay Springs Lock and Dam Foundation Completion Report

DA, Ohio River Division, Corps of Engineers, P.O. Box 1159, Cincinnati, Ohio 45021-1159 1 October 1987

FOR: CDR, Nashville District, ATTN: CEORN-ED-G

This office has reviewed the subject report and has no comments. The report is well organized and very informative.

FOR THE COMMANDER:

Encl wd

RICHARD C. ARMSTRONG, P.E.
Chief, Engineering Division

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT. CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

IN REPLY REFER TO

CEORN-ED-G

11 SEP 1987

MEMORANDUM FOR: CDR, Ohio River Division, ATTN: CEORD-ED-G

SUBJECT: Bay Springs Lock and Dam Foundation Completion Report

In accordance with ER 1110-1-1801 one copy of subject report is submitted for your review and files.

FOR THE COMMANDER:

Encl

E. C. MOORE
Chief, Engineering Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NASHVILLE DISTRICT

TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
DIVIDE CUT SECTION

BAY SPRINGS LOCK AND DAM
FOUNDATION COMPLETION REPORT

AUGUST 1987

FOUNDATION REPORT
BAY SPRINGS LOCK AND DAM

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1. INTRODUCTION

1.01 Location and General Description of Project.--The Bay Springs Lock and Dam Project is located in northeast Mississippi on Mackeys Creek, a southerly flowing stream that drains the southwest quarter of Tishomingo County and empties into the Tombigbee River. This project, which is included in the Divide Section of the Tennessee-Tombigbee Waterway, forms the connecting link between the Divide Cut to the north, and the Canal Section of the Waterway to the south. The project consists of an earth and rockfill dam, a navigation lock, and a downstream approach channel. The following are pertinent data for the project:

LOCK

Nominal size of chamber, feet	110 by 600
Distance center to center of gate pintles, feet	670
Lift, feet	
Normal	
Summer	84
Winter	78

DAM

Type	Rockfill
Height above streambed, feet	129$\pm$
Slope:	
Upstream	1V on 2.5H
Downstream	1V on 2.0H
Top of Dam Elevation (MSL)	449.0
Length at Crest, feet	2750
Reservoir Pool Elevation (MSL):	
Winter	408
Summner	414

DOWNSTREAM CHANNEL

Bottom Width, feet	300
Bottom Elevation (MSL)	317.0
Pool Elevation (MSL) (no seasonal adjustment)	330.0
Slopes	
Rock	4V on 1H
Overburden	1V on 3H

1.02 Construction Authority.--Construction of the Bay Springs Lock and Dam Project was authorized by the Rivers and Harbors Act of 1946 (Public Law 525, 79th Congress, Second Session), in accordance with recommendations contained in House Document 486, 79th Congress, Second Session.

1.03 Purpose of Report.--The purpose of this report is to present a record of foundation conditions encountered during construction, along with the procedures used in preparing these foundations. It is also intended to serve as an "As-Built" record.

1.04 Contractors.--There were eight successful bidders for the Bay Springs Lock & Dam Project. On 12 April 1979, the contract was awarded to Al Johnson Construction Company of Minneapolis, Minnesota for a bid price of $76,209,130.00. Martin K. Eby Construction Co., Inc., Morrison-Knudsen Co., Inc., and Brown & Root, Inc.-A Joint Venture submitted the high bid of $96,909,879.00 which was approximately 6 million dollars above the government estimate of $90,728,366.00. The first day of the contract was 15 May 1979, with a scheduled time for completion of 1,496 calendar days. The contract was essentially complete on 26 August 1983. Modifications to the contract increased the ultimate cost of the project to $85,790,026.77.

Al Johnson Construction Company of Minneapolis, Minnesota, was awarded the construction contract on 12 April 1979 for a bid price of $76,209,130.00. The first day of the contract was 15 May 1979, with a scheduled time for completion of 1,496 calendar days. The contract was essentially complete on 26 August 1983, with only claims yet to be resolved.

The following subcontractors were employed by Al Johnson Construction Company during the course of the contract:

Company	Area of Responsibility
W. G. Jaques Company 2183 N.W. 86th Street Des Moines, Iowa 50322	Drilling and grouting
Alpha Building Company, Inc. P.O. Box 1826 Columbus, Mississippi 39701	Resident engineer's office
Western Pacific Drilling Company P.O. Box 3320 Portland, Oregon 97208	Wall anchors
Busch and Latta Painting Corporation 1360 North Rice Road St. Louis, Missouri 63132	Painting
Martyn Brothers, Inc. P.O. Box 18074 Dallas, Texas 75218	Mechanical
J.C. Cheek, Sod and Erosion Contractor, Inc. P.O. Box 159 Kosciusko, Mississippi 39090	Landscaping, revegetation
Haw Knob, Inc. P.O. Drawer 1000 Robbinsville, North Carolina 28771	Clearing

Burcham & Sons Electrical Contractors, Inc. P.O. Box 479 Booneville, Mississippi 38829	Electrical
Field Instrumentation Services Company, Inc. 1265 Roblee Road Mill Brae, California 94030	Inclinometer Installation

1.05 Contract Supervision.--Contract supervision and inspection was provided by Construction Division, U.S.A.E.D. Nashville. The Resident Engineer was Clyde R. Orr, Civil Engineer, Construction Division.

1.06 Army Corps of Engineers Personnel.--The following list includes all employees who participated in the construction of the Bay Springs Lock and Dam construction.

PERSONNEL	CLASSIFICATION/TITLE	AREAS OF RESPONSIBILITY
1. Clyde R. Orr	Civil Engineer/Resident Engineer	Supervisory; all aspects of foundation work
2. Jack Roland	Mechancial Engineer/none	Responsible for mechanical and electrical work
3. Hoyet Holder	Civil Engineer/Assistant Resident Engineer	Office engineering, contract administration, limited foundation inspection, involved with all aspects of project
4. Francis Haynes	Civil Engineering Technician/None	Office engineering, inspection on embankment
5. Paul Ross	Geologist/Project Geologist	All aspects of foundation treatment including inspection of rock for soundness, geologic mapping, installation of rock bolts, pore pressure cell installation, piezometer installation, grouting, blasting, core logging, tendon installation, installation of uplift cells.
6. Kristin Westbrook	Geologist/None	Grouting, blasting, drilling inspection, core logging.
7. Dan Riggs	Supervisory Construction Inspector/None	Rock bolts, shotcrete, concrete placement, foundation cleanup, excavation.

PERSONNEL	CLASSIFICATION/TITLE	RELEVANT AREAS OF WORK
8. Whitey Weimer	Construction Representative/None	Shotcrete application, foundation concrete
9. George Marsh	Construction Inspector/ None	Survey
10. Odie Curtis	Materials Engineering Technician	Inspection on embankment, Chief of laboratory
11. M. F. McFerrin	Materials Engineering Technician	Laboratory
12. LaVerna McBride	Clerk	
13. Lt. David Horner	Military Representative	Inspection of resident office
14. Robert Lindsey	Laborer	
15. Carley Lewis	Construction Inspector	
16. John Dickens	Construction Inspector	Concrete
17. Josie Buckner	Civil Engineer	Concrete of diversion culvert
18. Terry Penny	Civil Engineering Technician Survey/Office Engineering	Survey final sections layout for foundation mapping, assisted with plane table/alidade
19. Gregg Doyle	Construction Inspector	Inspector on embankment
20. CPT Brian Olinger	Military Representative/ Office Engineer	
21. Connie Ozment	Summer Aid Secretary	
22. Tommy Clayton	Materials Technician	Batch Plant
23. Willie McDonald	Civil Engineer Technician	Survey
24. Jim Young	Construction Inspector	Blasting
25. Randy Whitson	Summer Aid Laborer	
26. Gary Bowers	Summer Aid Laborer	
27. Bobby Grinder	Supervisory Construction Inspector	Limited embankment inspection

PERSONNEL	CLASSIFICATION/TITLE	AREAS OF RESPONSIBILITY
28. Tony Crow	Civil Engineering Technician	Laboratory
29. Terry Hamm	Engineering Aide, 4 years in summer	Rock bolts, floor anchors
30. Wanda Crow	Clerk Typist	
31. Carroll Overstreet	Civil Engineer Technician	Office engineering
32. John McGuire	Construction Inspector	Contract administration
33. Jeff Walden	Construction Inspector	Shotcrete
34. Charles Yeager	Construction Inspector	Shotcrete, concrete laboratory
35. Bill Massie	Materials Technician	Laboratory
36. John Kirchner	Construction Inspector	Concrete
37. Dave Sanders	Geologist	All aspects of foundation treatment (same duties as Paul Ross)
38. Carl Anderson	Civil Engineer/Chief of Office Engineering	Office Engineering, contract administration
39. Clyde Lann	Construction Inspector	Rock bolts out of lock
40. Bob Green	Construction Inspector	Embankment
41. Jackie Logsdon	Construction Inspector	Rock tendon installation
42. Don Stephens	Construction Inspector	Rock tendon installation
43. Cecil McBride	Construction Inspector	Restressing of anchors
44. Debbie Phillips	Civil Engineer Technician	Survey
45. Jackie Woodruff	Construction Inspector	Survey
46. Greg Enlow	Construction Inspector	Concrete, restressing of tendons
47. Wanda Mercer	Civil Engineering Technician	Office
48. Charles Malin	Construction Inspector	Embankment

PERSONNEL	CLASSIFICATION/TITLE	AREAS OF RESPONSIBILITY
49. James Taylor	Laborer	
50. David Benjamin	Laborer	
51. Bonnie Fancher	Summer Aide	
52. Mike Robinson	Summer Aide	
53. Mark Maroon	Summer Aide	
54. Nancy Grisham	Summer Aide	

1.07 Unit Price Schedule.--The bid schedule and actual contract performance is compared on Table 1, which is located on pages 7 through 14.

TABLE 1

BAY SPRINGS LOCK AND DAM

BID SCHEDULE - ACTUAL PERFORMANCE COMPARISON

			BID SCHEDULE			ACTUAL PERFORMANCE	
ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID UNIT PRICE	AMOUNT	QUANTITY	AMOUNT
SP.1	Worker-Trainee	MHR	100000	$3.00	$30,000.00	100000.00	$300,000.00
1B.1	Mobilization & Prepara. Work	LS	1	$6,000,000.00	$6,000,000.00	1.00	$6,000,000.00
2A.1	Clearing - Lock and Dam	LS	1	$1,000,000.00	$1,000,000.00	1.00	$1,000,000.00
2B.1	Diversion & Care of Water	LS	1	$700,000.00	$700,000.00	1.00	$700,000.00
2C.1	Common Excavation - Lock & Dam	CY	781000	$2.50	$1,952,500.00	812118.00	$2,030,295.00
2C.2	Impervious Borrow Excavation	CY	260000	$1.50	$390,000.00	445603.00	$668,404.50
2C.3	Rock Excav-Drilling & Blast.	CY	166000	$3.50	$5,810,000.00	1701409.00	$5,954,931.50
2C.4	Rock Excavation-Ripping	CY	115000	$3.00	$345,000.00	132250.00	$396,750.00
2C.5	Presplitting	SF	411000	$0.70	$287,700.00	421595.00	$295,116.50
2C.6	Sawing	SF	74000	$1.25	$92,500.00	91845.00	$114,806.25
2C.7	Foundation Cleanup, Intermed.	SY	9000	$4.00	$36,000.00	10698.00	$42,792.00
2C.8	Final Fdn Cl. Up Prep-Conc. Str.	SY	45000	$7.00	$315,000.00	55116.00	$385,812.00
2C.9	Final Fdn Clup & Prep-Imp Cutf	SY	6600	$12.00	$79,200.00	9229.00	$110,748.00
2C.10	Dental Excavation	CY	100	$100.00	$10,000.00	271.00	$27,100.00
2C.11	Dental Grout	CF	100	$20.00	$2,000.00	777.00	$15,540.00
2C.12	Dental Concrete	CY	100	$150.00	$15,000.00	115.00	$17,250.00
2D.1	Compacted Impervious Fill	CY	233000	$0.50	$116,500.00	216300.00	$108,150.00
2D.2	Rockfill, Select & Random	CY	1240000	$1.50	$1,860,000.00	1368271.00	$2,052,406.50
2D.3	Compacted Backfill	CY	24000	$4.00	$96,000.00	40710.00	$162,840.00
2D.4	Filter Material No. 1	CY	124000	$1.30	$161,200.00	127095.00	$165,223.50
2D.5	Filter Material No. 2	CY	119000	$8.00	$952,000.00	122594.00	$980,752.00
2D.6	Addl Rolling for Comp of Rockf	HR	100	$40.00	$4,000.00	7.00	$280.00
2D.7	Addl Rll for Comp of Imp Fill	HR	100	$40.00	$4,000.00	50.00	$2,000.00
2D.8	Rockfill Field Density Tests	EA	60	$500.00	$30,000.00	48.00	$24,000.00
2D.9	Gradation Tests	EA	60	$1,000.00	$60,000.00	48.00	$48,000.00
2E.1	Saddle Dike Construction	LS	1	$100,000.00	$100,000.00	1.00	$100,000.00
2F.1	Rock Bolts - 1-¼ Inch Dia.	LF	33200	$10.00	$332,000.00	29915.00	$299,150.00
2F.3	Rock Bolts - One Inch Diam.	LF	68800	$9.00	$619,200.00	67313.00	$605,817.00
2F.7	Chain Link Fabric	SF	4300	$1.00	$4,300.00	4173.00	$4,173.00
2F.8	Expn.BoltsSupp.Chain-Link Fenc	EA	450	$20.00	$9,000.00	116.00	$2,320.00
2F.9	Testing Rock Bolts	EA	15	$300.00	$4,500.00	13.00	$3,900.00

TABLE 1

BAY SPRINGS LOCK AND DAM

BID SCHEDULE - ACTUAL PERFORMANCE COMPARISON

			BID SCHEDULE			ACTUAL PERFORMANCE	
ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID UNIT PRICE	AMOUNT	QUANTITY	AMOUNT
2F.10	Rock Bolt Load Cells	EA	12	$2,000.00	$24,000.00	12.00	$24,000.00
2F.11	Shale Prot. Temp Type	SY	12000	$2.00	$24,000.00	17897.00	$35,794.00
2F.12	6-In.Shale Protection,Shotcrete	SY	10500	$35.00	$367,500.00	15636.00	$547,260.00
2F.13	Shotcrete Test Samples	EA	300	$70.00	$21,000.00	258.00	$18,060.00
2G.1a	Mobilization & Demobilization	LS	1	$20,000.00	$20,000.00	1.00	$20,000.00
2G.1b	Drill Grt Holes in Rock-Vert.	LF	400	5.50	2,200.00	0.00	0.00
2G.1c	Drill Grt Holes in Rock-Angle	LF	9360	$5.00	$46,800.00	14858.00	$74,290.00
2G.1d	Portland Cement in Grout	CF	3500	$4.00	$14,000.00	2545.00	$10,180.00
2G.1e	Bentonite in Grout	LB	16400	$0.20	$3,280.00	8060.00	$1,612.00
2G.1f	Placing Grout	CF	3740	$5.00	$18,700.00	2636.00	$13,180.00
2G.1g	Connections to Grout Holes	EA	460	$8.00	$3,680.00	903.00	$7,224.00
2G.1h	Washing & Pressure Testing	HR	20	$100.00	$2,000.00	57.52	$5,752.00
2G.1i	Drill Drain Holes-2 7/8" Dia.	LF	12300	$4.00	$49,200.00	11063.00	$44,252.00
2G.1j	Drill Drain Holes 2 Inch Dia.	LF	6400	$4.00	$25,600.00	6560.00	$26,240.00
2G.1k	Drive Sample, Boring & Sampling	LF	1000	$20.00	$20,000.00	0.00	$0.00
2G.1l	Drill Thru Ovbon & 4" Boring V	LF	120	$18.00	$2,160.00	70.50	$1,269.00
2G.1m	Drill Thru Ovbon-NQ Borings	LF	50	$20.00	$1,000.00	0.00	$0.00
2G.1n	Drill Explor Core Holes-4"VTL	LF	2360	$25.00	$59,000.00	2109.00	$52,725.00
2G.1o	Drill Expl Core Holes, NQ Size	LF	340	$25.00	$8,500.00	206.90	$5,172.50
2G.1p	Drill Explor holes-1 ½" Perc	LF	1400	$4.00	$5,600.00	949.00	$3,796.00
2G.1q	Pressure Test Explor Holes Hyd	HR	10	$100.00	$1,000.00	6.80	$680.00
2G.1r	Steel Pipe Grout Holes	LF	800	$6.00	$4,800.00	224.30	$1,345.80
2G.1s	Slotted PVC Pipe F/Drain Holes	LF	6400	$4.00	$25,600.00	6560.00	$26,240.00
2H.1	Clearing & Grub-Rt Bnk Scc Rd	LS	1	$5,000.00	$5,000.00	1.00	$5,000.00
2H.2	Common Excavation-Roadway	CY	10200	$1.00	$10,200.00	10200.00	$10,200.00
2H.3	Bedding Layer Stone	TON	2360	$3.00	$7,080.00	6386.00	$19,158.00
2H.4	Dense Graded Agg. Base Course	TON	14860	$10.00	$148,600.00	15544.00	$155,440.00
2H.5	Prime Coat	GAL	8000	$1.00	$8,000.00	9751.00	$9,751.00
2H.6	Tack Coat	GAL	600	$1.00	$600.00	623.00	$623.00
2H.7	Dbl Bit. Surface Treatemnt-Alt	SY	25260	$6.00	$151,560.00	22868.00	$137,208.00
2H.8	Hot Bit. Pavemt Binder Course	TON	960	$50.00	$48,000.00	939.00	$46,950.00

TABLE 1

BAY SPRINGS LOCK AND DAM

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ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID SCHEDULE BID UNIT PRICE	AMOUNT	ACTUAL PERFORMANCE QUANTITY	AMOUNT
2H.9	Hot Bit. Pavemt Surface Course	TON	700	$50.00	$35,000.00	795.00	$39,750.00
2H.10	Concrete Sidewalks	SY	220	$25.00	$5,500.00	230.00	$5,750.00
2H.11	Concrete Curbs	LF	900	$30.00	$27,000.00	893.00	$26,790.00
2H.12	Pavement Stripping	LS	1	$1,500.00	$1,500.00	1.00	$1,500.00
2H.13	Barricade	LS	1	$1,500.00	$1,500.00	1.00	$1,500.00
2H.14	Concrete Bumpers	EA	12	$50.00	$600.00	12.00	$600.00
2H.15	Rock Flumes	SY	20	$50.00	$1,000.00	0.00	$0.00
2H.16	Overlook Road	LS	1	$25,000.00	$25,000.00	1.00	$25,000.00
2I.1	Permanent Seeding	MSF	2000	$20.00	$40,000.00	4400.00	$88,000.00
2I.2	Lime	TON	220	$23.00	$5,060.00	390.00	$8,970.00
2I.3	Vegetative Mulch	MSF	205	$9.00	$1,845.00	3800.00	$34,200.00
2I.4	Solid Sod	SY	26000	$2.00	$52,00.00	39186.00	$78,372.00
2I.5	Asphalt Emulsion	GAL	20500	$0.60	$12,300.00	0.00	$0.00
2I.6	Non-Vegetative Mulch	SY	30000	$0.85	$25,500.00	22301.00	$18,955.85
2I.7	Irrigation	MGAL	1500	$4.00	$6,000.00	142.00	$568.00
2I.8	Mowing	MSF	500	$1.00	$500.00	0.00	$0.00
2I.9	Reliming	TON	30	$20.00	$600.00	0.00	$0.00
2I.10	Refertilization	TON	30	$250.00	$7,500.00	0.13	$31.25
2K.1	Instrumentation	LS	1	$600,000.00	$600,000.00	0.97	$582,675.00
2L.1	Steel H. Piles	LF	1630	$20.00	$32,600.00	0.00	$0.00
2M.1	Prestressed Wall Anchors	LS	1	$880,000.00	$880,000.00	1.00	$880,000.00
2M.2	Cement in Grout-Tst of Anch Hl	CF	6140	$6.00	$36,840.00	2832.00	$16,992.00
2M.3	Re-Drilling of Anchor Holes	LF	8660	$10.00	$86,600.00	6903.00	$69,030.00
2M.4	Water Tests	EA	118	$200.00	$23,600.00	90.00	$18,000.00
2M.5	Anchor Installation	LS	1	$100,000.00	$100,000.00	1.00	$100,000.00
2M.6	Addl Stresing of Prestd Wall Anc	EA	200	$200.00	$40,000.00	137.00	$27,400.00
2N.1	30-Foot Anchor Bolts	EA	50	$225.00	$11,250.00	50.00	$11,250.00
2N.2	33 Foot Anchor Bolts	EA	50	$250.00	$12,500.00	50.00	$12,500.00
2N.3	Testing Anchor Bolts	EA	5	$3,500.00	$17,500.00	5.00	$17,500.00
2N.4	D/S Rt Guide Wall Drain Pipes	EA	40	$180.00	$7,200.00	40.00	$7,200.00

TABLE 1
BAY SPRINGS LOCK AND DAM
BID SCHEDULE - ACTUAL PERFORMANCE COMPARISON

			BID SCHEDULE			ACTUAL PERFORMANCE	
ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID UNIT PRICE	AMOUNT	QUANTITY	AMOUNT
3A.1	Conc. in Lock Walls & Sills	CY	365000	$45.00	$16,425,000.00	370914.00	$16,691,130.00
3A.2	Conc. in Anchored Wall Stems	CY	11100	$70.00	$777,000.00	11078.00	$775,460.00
3A.3	Conc. in Guide Walls	CY	49500	$45.00	$2,227,500.00	49630.00	$2,233.350.00
3A.4	Conc. in Lock Floor System	CY	26200	$72.00	$1,886,400.00	24650.00	$1,774,800.00
3A.5	Concrete, Structural	CY	3900	$120.00	$468,000.00	3942.00	$473,040.00
3A.6	Conc. in Sitffleg Drk Foundat.	CY	900	$50.00	$45,000.00	916.00	$45,800.00
3A.7	Concrete in Trust Blocks	LS	1	$75,000.00	$75,000.00	1.00	$75,000.00
3A.8	Conc. in Blockouts	LS	1	$160,000.00	$160,000.00	0.90	$143,537.00
3A.9	Conc. Ton Diversion Culvert	CY	3700	$100.00	$370,000.00	4918.00	$491,800.00
3A.10	Concrete in Protective Slab	CY	4300	$40.00	$172,000.00	5805.00	$232,200.00
3A.11	Conc. in Exterior Stairs	LS	1	$35,000.00	$35,000.00	1.00	$35,000.00
3A.12	Concrete in Plug Pours	CY	9100	$30.00	$273,000.00	8786.00	$263,580.00
3A.13	Portland Cement	CWT	1331000	$3.25	$4,325,750.00	1281337.00	$4,164,345.25
3A.14	Pozzolan	CF	171500	$2.50	$428,750.00	211436.00	$528,590.00
3A.15	Steel Reimfmt. Mod 18, 25, 32	LBS	11300000	$0.38	$4,294,000.00	12771535.00	$4,853,183.30
3A.16	Precast Conc. Closure Panels	LS	1	$35,000.00	$35,000.00	1.00	$35,000.00
3A.17	Waterstop	LF	11300	$6.30	$71,190.00	13478.00	$84,911.40
5C.1	Upper Miter Gate, 2 Leaves	LS	1	$1,300,000.00	$1,300,000.00	1.00	$1,300,000.00
5C.2	Lower Miter Gate, 2 Leaves	LS	1	$4,500,000.00	$4,500,000.00	1.00	$4,500,000.00
5D.1	Culvert Valves	LS	1	$1,350,000.00	$1,350,000.00	1.00	$1,350,000.00
5E.1	Cul. Blkhds & Pickup Assembly	LS	1	$200,000.00	$200,000.00	1.00	$200,000.00
5E.2	Cul. Blkhd Recess Sealing DPM	LS	1	$40,000.00	$40,000.00	1.00	$40,000.00
5E.3	Cul. Blkhd Recess Embedded Matl	LS	1	$630,000.00	$630,000.00	0.85	$534,200.00
5E.4	Cul.&Bulk.Fill,Drainage,Piping	LS	1	$100,000.00	$100,000.00	1.13	$113.026.00
5F.1	Floor Drains	LS	1	$135,000.00	$135,000.00	1.00	$135,000.00
5G.1	Lock Floor Anchorage System	LS	1	$210,000.00	$210,000.00	1.00	$210,000.00
2G.2	Load Test Lock Floor Anchorage	EA	135	$75.00	$10,125.00	135.00	$10,125.00
5H.1	Floating Mooring Bitts	LS	1	$465,000.00	$465,000.00	1.00	$465,000.00
5H.2	Lock Maint. Stoplg Embd Metals	LS	1	$64,000.00	$64,000.00	1.00	$64,000.00
5H.3	Emergency Closure Embd Metals	LS	1	$535,000.00	$535,000.00	1.00	$535,000.00

TABLE 1

BAY SPRINGS LOCK AND DAM

BID SCHEDULE - ACTUAL PERFORMANCE COMPARISON

				BID SCHEDULE		ACTUAL PERFORMANCE	
ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID UNIT PRICE	AMOUNT	QUANTITY	AMOUNT
5H.4	Gratings, Covers and Frames	LS	1	$320,000.00	$320,000.00	0.94	$301,077.00
5H.5	Wall Arm.Corn.Arm.Port.Angle	LS	1	$460,000.00	$460,000.00	1.00	$460,000.00
5H.6	Handrailing	LS	1	$290,000.00	$290,000.00	1.00	$290,000.00
5H.7	Tile Gages	LS	1	$28,000.00	$28,000.00	1.00	$28,000.00
5H.8	Miscellaneous Metals	LS	1	$970,000.00	$970,000.00	1.00	$969,371.00
5H.9	Warning Signs & Navigat. Aids	LS	1	$25,000.00	$25,000.00	1.00	$25,000.00
5H.10	Low Flow Supply Intake Trashks	LS	1	$32,000.00	$32,000.00	1.00	$32,000.00
5I.1	Install Govt Furn. Stoplogs	LS	1	$115,000.00	$115,000.00	1.00	$115,000.00
9A.1	Painting	LS	1	$345,000.00	$345,000.00	0.92	$317,776.00
13A.1	Control Station	LS	1	$500,000.00	$500,000.00	1.00	$500,000.00
13A.2	Control Booths	LS	1	$50,000.00	$50,000.00	1.00	$50,000.00
13A.3	Stiffleg Derrick Hoist House	LS	1	$75,000.00	$75,000.00	1.00	$75,000.00
13B.1	Water Quality Building	LS	1	$20,000.00	$20,000.00	1.00	$18,395.00
13C.1	Resident Engineer's Office	LS	1	$300,000.00	$300,000.00	1.00	$300,000.00
13C.2	Dense Graded Aggreg Base Crse	TON	500	$10.00	$5,000.00	930.00	$9,300.00
13C.3	Prime Coat	GAL	740	$1.00	$740.00	740.00	$740.00
13C.4	Dbl Bit. Surface Treatment	SY	2260	$6.00	$13,560.00	2724.00	$16,344.00
13C.5	Sidewalks	SY	80	$45.00	$3,600.00	82.00	$3,690.00
13C.6	Concrete Bumpers	EA	37	$80.00	$2,960.00	32.00	$2,560.00
13C.7	Flagpole	LS	1	$2,600.00	$2,600.00	1.00	$2,600.00
13C.8	One-Inch Water line	LF	20	$14.00	$280.00	50.00	$700.00
13C.9	Two-Inch Water Line	LF	600	$16.00	$9,600.00	145.00	$2,320.00
13C.10	One Inch Valve and Box	EA	1	$100.00	$100.00	1.00	$100.00
13C.11	Two Inch Valve and Box	EA	1	$250.00	$250.00	1.00	$250.00
13C.12	Water Hydrant	EA	1	$400.00	$400.00	1.00	$400.00
13C.13	Sewerage System	LS	1	$16,000.00	$16,000.00	1.00	$16,000.00
13C.14	Well	LF	25	$50.00	$1,250.00	58.00	$2,900.00
13C.15	Set Up for Pumping Test	EA	1	$300.00	$300.00	0.00	$0.00
13C.16	Pumping Test	HR	8	$30.00	$240.00	3.00	$90.00
13C.17	Well Screen	LF	14	$50.00	$700.00	20.00	$1,000.00

TABLE 1
BAY SPRINGS LOCK AND DAM
BID SCHEDULE - ACTUAL PERFORMANCE COMPARISON

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	BID SCHEDULE BID UNIT PRICE	AMOUNT	ACTUAL PERFORMANCE QUANTITY	AMOUNT
13C.17	Well Screen	LF	14	$50.00	$700.00	20.00	$1,000.00
13C.18	Well Casing	LF	10	$20.00	$200.00	40.00	$800.00
13C.19	Sampling Well	EA	1	$500.00	$500.00	1.00	$500.00
13C.20	Water Supply & Treatment Systm	LS	1	$18,000.00	$18,000.00	1.00	$18,000.00
14A.1	Stiffleg Derrick	LS	1	$950,000.00	$950,000.00	1.00	$950,000.00
14B.1	Emergency Stoplog Hoist Mchy	LS	1	$820,000.00	$820,000.00	1.00	$820,000.00
14C.1	20-Ton Mobile Crane	LS	1	$80,000.00	$80,000.00	1.00	$80,000.00
15A.1	Miter Gate Machinery	LS	1	$1,300,000.00	$1,300,000.00	1.00	$1,300,000.00
15A.2	Culvert Valve Opr Machinery	LS	1	$550,000.00	$550,000.00	1.00	$550,000.00
15B.1	Hydraulic System	LS	1	$500,000.00	$500,000.00	1.00	$500,000.00
15B.2	Diesel Fuel System	LS	1	$26,000.00	$26,000.00	1.00	$26,000.00
15C.1	Comprsd. Air & Raw Water System	LS	1	$290,000.00	$290,000.00	1.00	$290,000.00
15D.1	Lock Unwatering System	LS	1	$300,000.00	$300,000.00	1.00	$300,000.00
15H.1	4" Water Line	LF	4380	$10.00	$43,800.00	4211.00	$42,110.00
15H.2	4" Ductile Iron Ball Jt. Pipe	LF	1880	$30.00	$56,400.00	1907.00	$57,210.00
15H.3	4"C.I. OR D.I. Water Pipe	LF	840	$12.00	$10,080.00	830.00	$9,960.00
15H.4	4" Gate Valve with Box	EA	4	$300.00	$1,200.00	4.00	$1,200.00
15J.1	4"C.I. OR D.I. Sewer Pipe	LF	180	$15.00	$2,700.00	200.00	$3,000.00
15J.2	4"C.I. OR D.I. Sewer Pipe W/Mech	LF	100	$22.00	$2,200.00	109.00	$2,398.00
15J.3	Septic Tank, Distrbn, Box, Etc.	LS	1	$10,000.00	$10,000.00	1.00	$10,000.00
16A.1	Electrical Work	LS	1	$730,000.00	$730,000.00	1.00	$730,000.00
16A.2	Solid State Control Consoles	LS	1	$50,000.00	$50,000.00	1.00	$50,000.00
16B.1	Diesel-Elec. Generator Set	LS	1	$30,000.00	$30,000.00	1.00	$30,000.00
16C.1	Cathodic Protection System	LS	1	$50,000.00	$50,000.00	1.00	$200,000.00
16D.1	Comm.T.V.,&Data Acq. Systems	LS	1	$200,000.00	$200,000.00	1.00	$200,000.00
16H.1	Radio System	LS	1	$80,000.00	$80,000.00	1.00	$80,000.00

1.08 Modifications to Contract Relative to Foundation.--During the contract twenty-eight modifications were issued which pertained to foundation related items including (1) lock and dam foundation treatment, (2) instrumentation, (3) additional quarries, and (4) water supply from a drilled well. These modifications were issued pursuant to General Provision 3, changes, and had the effect of increasing the contract cost by $2,770,914.00. Case numbers, narratives of the description of work *, and unit price schedules have been taken from the contract modifications and included in this report in the following paragraphs.

Modification No. P00003

Case #103, Additional Piezometers, BSPZ-15R, BSPZ-24R

A. Two additional piezometers are to be added, one each at Stations 10+00S - 1+00D and 14+00S - 1+00D. The revisions to contract drawings and specifications are incorporated into the contract by reference.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2G.1 (L)	Drilling Through Overburden and 4-Inch Boring - Vertical	120	LF	$18.00	$ 2,160.00
2G.2 (N)	Drilling Exploratory Core Holes, 4-Inch Vertical	2,360	LF	25.00	59,000.00

Piezometers were added to monitor pressures downstream of the grout curtai and near the embankment toe to monitor higher than anticipated pressures.

There was no change in contract performance time by reason of this modification.

Modification No. P00005

Case #118 - Additional Inclinometers

A. Install six additional inclinometers, one at each of the following stations: 1+78D - 23+02S, 3+98D - 23+02S, 6+00D - 23+02S, 1+89D - 20+22S, 4+18D - 20+22S, and 7+03D - 20+22S. Work consists of drilling a 6-inch diameter hole to a depth of approximately 90-feet below the top of rock for each inclinometer. The inclinometer casings are installed with centering guides at 20-foot intervals, then grouted in place to top of rock. Temporary protective covers are to be installed at top of rock. Inclinometer casings are to be later extended to the top of associated fills where permanent protective covers are to be installed.

B. For and in consideration of the change described above, a new item is hereby added to the Unit Price Schedule as shown in (1) below:

*Sketches referenced by modifications are on file at the Bay Springs Resource Managers Office, Route 1, Dennis, Mississippi 38838.

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.3	Additional Inclinometers		LS		$ 24,999.00

Additional inclinometers were installed to observe movements of the rockmass ude to blasting.

There was no change in contract performance time by reason of this modification.

Modification No. P00007

Case #102 - Water Supply

A. Furnish all equipment, labor and materials to accomplish the following described work:

Drill a 6-inch well approximately 175-feet deep at the location indicated on attached Sketch No. 79-213-1, which is hereby incorporated in the contract by reference. The well shall be cased down to the top of rock and sealed by grouting or other approved methods. Set up for and perform pumping test on completed well, monitor and record drawdown levels and pumping rate.

B. Revise the water supply and treatment system as follows:

Locate well house in Resident Engineer's compound. Provide well house with removable roof with attachments to secure roof to building and to facilitate removal with a crane. System to be designed by contractor and approved by Contracting Officer. Add approximately 80-feet of 3-inch P.V.C. drain pipe from the well house. Install additional discharge pipe and power cable to pump, exact length to be determined from results of pumping test. Delete approximately 455-feet or four No. 6 direct burial cable.

Provide temporary pump, storage tank, electrical controls and hookup to available single phase commercial power necessary to furnish the Resident Engineer's facilities with an adequate water supply. All temporary equipment to remain the property of the contractor. NOTE: Permanent pump and motor to be as specified in Paragraph 15E-10, and installed once commercial three phase power is available.

C. Revise the quantity of 2-inch water line from approximately 600 L.F. to approximately 145 L.F.

The location originally planned for the water supply well was nonproductive. It was necessary to drill a deeper well and for practical reasons the well was moved closer to the Resident Engineer's Office. The contract cost was reduced by $2,370.00.

There was no change in contract performance time by reason of this modification.

Modification No. P00008

Case #120 - Inclinometer and Observation Holes

A. Install an inclinometer at Station 19+02S - 0+04.7D. Drill four observation holes one at each of the following stations: 19+02S - 0+16.7D, 19+02S - 0+25.6D, 19+02S - 0+07.8U, and 19+02S - 0+19.3U. The hole for the inclinometer shall be a minimum of 5 inches in diameter and reach a depth of 60 feet below the top of rock. Observation holes shall be a minimum of 5 inches in diameter and reach a depth of 20 feet below the top of rock. Holes shall be washed clean with water. Steps shall be taken to prevent the wash water from contacting the clay core. Inclinometer casing is to be installed with centering guides at 20 feet intervals, then grouted in place to top of rock. Additional foundation clean-up will be required for the area disturbed by drilling (approximately 41 feet x 76 feet). Prior to placement of fill between dam and lock, observation holes and inclinometer shall be filled with grout.

B. For and in consideration of the change described above, a new item is hereby added to the existing contract Unit Price Schedule as shown below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.4	Inclinometer and Observation Holes	XX	LS	XX	$3,402.00

Extensive blasting in the area of the tie-in between the lock and dam necessitated the monitoring of the movement of rock in that area. The need for this instrument was not recognized when the contract was awarded.

There was no change in contract performance time by reason of this modification.

Modification No. P00013

Case #108 - Stop Grouting

A. The grouting method used under this contract is to be performed in accordance with the enclosed changes in the contract specifications. Changes include the deletion of pages 2G-3, 2G-5, 2G-6, and 2G-8. The following pages are added: 2G-3, 2G-5, 2G-5A, 2G-6, 2G-7A, and 2G-8. This change provides for a stop grouting procedure whereby the hole is drilled to full depth, or to lesser specified depths, and a packer or expansion plug is used to separate the hole into segments for grouting purposes.

B. For and in consideration of the change described above, the following new item is hereby added to the Unit Price Schedule as shown below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2G.1t.	Packer Settings	1,150	EA	$11.78	$13,547.00

Specified stage grouting procedures had resulted in lifting insitu rock. Stop grouting was specified by this modification to grout the foundation without subjecting the upper levels of the rock to high pressures.

There was no change in contract performance time by reason of this modification.

Modification No. P00014

Case #123, Test Anchor Bolts

A. Install five test anchor bolts for downstream right guide wall and remove two load cells previously installed on production anchor bolts. The 100 anchor bolts shown on Drawing TTBS-10/20 shall be production bolts only. The five test anchor bolts shall be installed at other locations determined by the Contracting Officer. Installation of the five test anchor bolts shall be as follows:

1-7/8-inch diameter holes are drilled to a depth of 28 feet-7 inches. The back portion of the hole is filled with six cartridges of Dupont Fasloc. The 30-foot, 1 1/4-inch diameter bolt is inserted into the hole with the back 7-8 feet of the bolt enclosed in the Fasloc resin. After an initial set time, the anchor bolt testing will proceed in accordance with Specifications Section 2N-11.

B. For and in consideration of the change described above, a new item is hereby added to the Unit Price Schedule as shown in (1) below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2N5(New)	Test Anchor Bolts		LS		$1,640.00

Test anchor bolts were needed to insure proper installation of production anchor bolts. The five test anchor bolts were inadvertently omitted from the contract specifications.

There was no change in contract performance time by reason of this modification.

Modification No. P00022

Case #135 - Diversion Culvert Forming

Erect a vertical form at intersection of 4V on 1H slope and top of rock excavation. This vertical form shall be high enough to intersect the 1V on 2H sloping roof of the Diversion Culvert. In the area of the impervious core and filter materials, the form shall be placed on a 1V on 1H slope.

For and in consideration of the above change, a new bid item is hereby added to the existing Unit Price Schedule as shown below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.18 (New)	Diversion Culvert	XX	LS	XX	$11,390.00

Amendment 0004 to the contract drawings raised the inlet and outlet elevations of the diversion culvert. This in turn raised the roof elevation causing the slope line of the roof to intersect top of rock instead of intersecting the 4V to 1H rock slope. This was overlooked when the invert elevation was raised.

The additional forming was determined necessary to eliminate placing of extra concrete and to eliminate concrete that would feather down to a point under the dam embankment.

Contract performance time extensions are included under modification P.00039.

Modification No. P00023

Case #138 - Foundation Concrete

A. Place approximately 15 cubic yards of concrete in foundation of impervious core trench at Station 18+90S, Embankment. Place approximately 44 cubic yards of concrete in foundation of EL1, Lock Structure. Placement shall be coordinated and as directed in the field.

B. For and in consideration of the change described above, the following item is hereby added to the existing contract Unit Price Schedule:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.13	Foundation Concrete	60	CY	$67.00	$4,020.00

Localized gouged conditions in the foundation were observed after being exposed by excavation operations. These two locations were rather large and deemed to be out of the normal slope of dental concrete. The embankment location required some form work also. The foundation concrete was determined necessary to provide a more uniform foundation upon which to initiate construction.

There was no change in contract performance time by reason of this modification.

Modification No. P00027

Case #132, Revised Floor Culvert Angle, Plumbing and Monolith Joint Requirements

1. Lengthen the floor culvert protection angle as shown on revised Drawing 10/202.

2. Change the 8-inch diameter pipe at the centerline of the filling and emptying system to a 12-inch diameter pipe.

3. Add waterstops around the floor culvert monolith joints at Stations 1+91D, 2+46D, 2+92.25D, 5+28D, 5+74D, and 6+29.79D as shown on revised Drawing 10/52.3.

For and in consideration of the change described above, Item No. 3A.17 of the existing contract Unit Price Schedule which now reads as shown in (1) is hereby changed to read as shown in (2) below and a new bid item is added to the contract Unit Price Schedule as shown in (3) below:

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.17	Waterstops	11,300	LF	$6.30	$71,190.00

(2)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.17	Waterstops	11,910	LF	$6.30	$75,033.00

(3)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.21 (New)	Revised Floor Culvert Angle, Plumbing and Monolith Joint Requirements	XX	LS	XX	$ 5,300.00

The changes were made for the following reasons:

a. Extend the culvert protection angle the full faceof the monolith joint. The culvert is deeper at this point.

b. The diameter of the pipe was increased from 8 inches to 12 inches in order to avoid the possibility of this pipe becoming clogged with sediment and debris.

c. Waterstop was added to the monolith joints of the floor culvert to prevent water from getting through these joints.

The details of these items were inadvertently overlooked at the time the contract drawings were prepared.

There was no change in contract performance time by reason of this modification.

Modification No. P00031

Case #137 - Remove and Replace Shotcrete, Station 1+34D

A. Remove and replace the shotcrete at Station 1+34D from Elevation 311.5 to 300.0. Remobilize equipment to drill 2-inch diameter drain holes for slotted PVC pipe and install 1-inch diameter rock bolts in the vertical shale faces in the lock excavation. All work is to be performed in accordance with applicable contract drawings and specifications.

B. For and in consideration of the above described work, a new bid item is hereby added to the Unit Price Schedule as follows:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2F.14	Remove and Replace Shotcrete at Station 1+34D	XX	LS	XX	$9,655.00

This change was necessary in order to provide protection against weathering for the sensitive shale formation at Lock Station 1+34D where the permanent shale protection (shotcrete) had pulled away from the shale surface. Two-inch drains and one-inch rock bolts were not initially installed in this face. The effect of the lock floor drains which allowed surface water to penetrate the protective slab at Elevation 311.5 and build up hydrostatic pressure behind the shotcrete was not recognized when the shotcrete was initially applied.

There was no change in contract performance time by reason of this modification.

Modification No. P00032

Case #109, Revisions to Reinforcement, Anchors, and Wall Armor

1. Add reinforcement to the hoist machinery room walls and change the number of bars in the retaining walls at the dam.

2. Add one wall anchor in Monolith L19 and delete one wall anchor from Monoliths L23, L25, and R24 and change identification numbers and locations of several others.

3. Relocate extensometer in Monolith L19.

4. Revise location and quantity of wall armor in several monoliths.

5. Delete three wall anchor load cells and change identification numbers of several others.

6. Change dimension of wall anchor recess frame to agree with other views.

Also included in proposed change are revised Contract Drawings TTBS 10/1.3, TTBS 10/4.3, TTBS 10/12.2, TTBS 10/13.2, TTBS 10/15.3, TTBS 10/16.3, TTBS 10/51.3, TTBS 10/114.3, TTBS 10/121.3, and TTBS 43/3.2.

For and in full consideration of the above described work, the contract price is decreased by the total estimated amount of $17,197.20. Payment, therefore, will be provided by revising the existing contract Unit Price Schedule shown in (A) below to read as shown in (B) and by adding one new payment item as shown in (C) below:

(A)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2M.2	Cement	6,140	CF	6.00	$38,840.00
2M.3	Redrilling	8,660	LF	10.00	86,600.00
2M.4	Water Tests	118	EACH	200.00	23,600.00
3A.1	Concrete	365,000	CY	45.00	16,425,000.00
3A.15	Steel Reinforcement	11,264,912	LB	0.38	4,280,666.56

(B)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2M.2	Cement	6,040	CF	6.00	$36,240.00
2M.3	Redrilling	8,580	LF	10.00	85,800.00
2M.4	Water Tests	116	EACH	200.00	23,200.00
3A.1	Concrete	365,004	CY	45.00	16,425,180.00
3A.15	Steel Reinforcement	11,262,672	LB	0.38	4,279,815.36

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2M.7 (New)	Miscellaneous Wall Anchor Revisions	Lump Sum	XX	XX	$-14,726.00

The added wall anchors were needed to insure stability of Monolith L19. The deleted wall anchors were not required for stability. The extensometer in L19 was moved to avoid conflict with the new wall anchor. The changed locations of other wall anchors were made to better distribute the anchor forces. The added wall armor made the armor consistent with other monoliths and to reflect moving the extensometer. Three load cells were deleted because they were in excess of the number required. The wall anchor frames were changed to be consistent with other dimensional views. The added reinforcement to the hoist machinery room wall and the number of bars in the retaining wall at the dam were needed to insure safety in the wall. These changes were inadvertently omitted at the time the plans and specifications were prepared.

There was no change in contract performance time by reason of this modification.

Modification No. P00035

Case #106 - Revised Quarry Slopes

A. The Contractor shall furnish all plant, labor and material and perform all work necessary to complete the following listed work:

(1) Mobilize the necessary drilling and excavation equipment to perform the necessary drilling and blasting in order to obtain a smooth face as indicated on contract drawings TTBS 9/6.3 and TTBS 9/10.3. It shall be necessary to presplit the old quarry face on a 4V on 1H slope beginning at the 1V on 2H slope that has been previously excavated for the impervious core, and proceed north and south to tie into the existing 4V on 1H slopes for the diversion culvert. Excavate and haul away the blasted rock.

(2) In order to determine what preparation will be required at the toe of the existing 1V on 2H slope where fractured rock has resulted in a vertical face, exploratory core borings shall be drilled vertically through the existing 1V on 2H slope where required. Once the samples have been evaluated, instructions will be given on how to prepare the vertical face at the toe of the 1V on 2H slope.

(3) Remobilize the necessary drilling and excavation equipment to change the presently excavated 1V on 2H slope to a 1V on 1H slope. Top of the new slope will start at approximately 3 to 5 feet west of the existing top of the 1V on 2H slope and intersect Elevation 338.5± at the bottom. The slope shall transition at each end to blend into the existing 4V on 1H slopes.

(4) Construct a concrete wall at the toe of the 1V on 1H slope in the old quarry area in accordance with Sketch No. BS-035-01 which is hereby incorporated into the Contract by reference.

(5) All work shall be performed in accordance with the applicable portions of the contract specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $144,275.00. The existing Unit Price Schedule Items shown in (1) below is revised to read as shown in (2) below, and one new payment item as shown in (3) below is added to the Unit Price Schedule.

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.3	Rock Excavation-Drilling and Blasting	1,660,000	CY	$3.50	$5,810,000.00
2C.5	Presplitting	411,000	SF	0.70	287,700.00
2D.1	Compacted Impervious Fill	233,000	CY	0.50	116,500.00
2D.2	Rockfill, Select and Random	1,240,000	CY	1.50	1,860,000.00
2D.4	Filter Material No. 1	124,000	CY	1.30	161,200.00
2D.5	Filter Material No. 2	119,000	CY	8.00	952,000.00
			TOTAL(1) =		$9,187,400.00

(2)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.3	Rock Excavation-Drilling and Blasting	1,672,000	CY	$3.50	$5,852,000.00
2C.5	Presplitting	432,000	SF	0.70	302,400.00
2D.1	Compacted Impervious Fill	235,000	CY	0.50	117,550.00
2D.2	Rockfill, Select and Random	1,248,700	CY	1.50	1,873,050.00
2D.4	Filter Material No. 1	124,600	CY	1.30	161,980.00
2D.5	Filter Material No. 2	119,600	CY	8.00	956,800.00
			TOTAL(1) =		$9,263,780.00

(3)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.15 (New)	Revised Quarry Slopes	XX	LS	XX	$ 76,895.00

Subsequent to award of the Contract, it was found that the existing face of the old rock quarry upstream and downstream of the limits of the impervious core and the filters, was so irregular that dental excavation and concrete could not produce an acceptably smooth face as indicated on Drawing TTBS-9/10.3. Therefore, it was determined necessary and in the best interest of the Government to remove the existing jagged face by drilling and blasting a 4V on 1H slope, tieing it in upstream and downstream to the existing rock excavation for the inlet and outlet channels of the concrete diversion channel.

Drawing TTBS/9/10.3 required the area of the old rock quarry within the contact limits of the impervious core and filters, to be drilled and blasted to a 1V on 2H slope. When that drilling and blasting was accomplished, it was determined that an acceptable face had not been achieved because of the fractured condition of the rock caused by the previous quarrying operations. Particularly at the toe of the 1V on 2H slope as the rock had broken out vertically. It was determined to perform exploratory drilling to evaluate the condition of the fractured work. Following the exploratory work, it was judged necessary to step back three to five feet from the top edge of the IV on 2H slope and drill and blast a new lV on lV slope within the contact limits of the impervious core and filters, transitioning the face into the previously excavated 4V on 1H slope.

After development of the 1V on 1H slope it was determined that the quality of the zone of less acceptable rock near the toe of the face was such that it was in the best interest of the Government to protect it with a concrete wall which was placed against the rock face.

The need for the changes set forth by this modification was deemed necessary due to unforeseen conditions encountered during construction of the project.

By this modification the contract performance time was extended by 6 calendar days.

Modification No. P00037

Case #151, Additional Transducer Boxes

A. Provide three pressure transducer boxes in accordance with Sketch 1 dated 16 September 1981 and install at approximate locations indicated on attached Sketch 2 dated 16 September 1981. Drill holes of sufficient size to accommodate 2-inch diameter PVC conduit down thru existing concrete to culvert ceiling, route 2-inch diameter PVC conduit with pull wire from culvert ceiling through drilled hole to gallery, and grout drilled portion. For each box, excavate a dovetail recess to install box. Install and backfill box as indicated on attached Sketch 1 dated 16 September 1981.

B. For and in consideration of the change described above, a new item is hereby added to the Unit Price Schedule as follows:

This change is necessary to provide additional instrumentation of the collection of hydraulic design data for the Waterway Experimental Station. The need for this additional instrumentation was not included in Waterway Experimental Station's original request for instrumentation made prior to the award of the contract.

There was no change in contract performance time as a result of this modification.

(3)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
16D.2	Additional Transducer Boxes	XX	LS	XX	$13,247.00

Modification No. P00039

Case #117, Additional Slopes and Concrete Wall

A. The Contractor shall furnish all plant, labor and material and perform all work necessary to complete the following listed work:

(1) Construct a concrete wall paralleling the 1V on 1H slope adjacent to the diversion culvert in the creek bed. The concrete wall is to be placed at Station 17+10 and from Elevation 324 to Elevation 340. The wall is to extend from the upstream to the downstream limits of the internal filter zones.

(2) Presplit 4V on 1H slopes upstream of the internal zones of the dam for both right and left banks. The upper limit is to be the upstream filter zone of the permanent diversion dam.

(3) Presplit 4V on 1H slopes downstream of the internal zones of the dam for both right and left banks. The left bank downstream limit is to be the select rockfill. Right bank downstream limit is to be Station 1+50D.

(4) Construct a concrete slab between the right bank 1V on 1H slope and the diversion culvert. The concrete slab shall extend from the upper to the lower limits of the filter zones.

(5) All work shall be in accordance with Drawing No. RE-79-0132-117-1 which is hereby incorporated into the Contract by reference, and with the applicable portions of the contract specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $256,345.00. Accordingly, the following two new items are hereby added to the contract Unit Price Schedule.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.19 (New)	Additional Slopes and Concrete Wall	XX	LS	XX	$243,415.00
SP.2 (New)	Extended Fixed Job Overhead	10	Days	$1,293	12,930.00

Subsequent to the award of the Contract and excavation of the dam cutoff trench, it was determined by field investigation that the existing quality of the jagged rock faces of the old Mackey's Creek channel was marginal. It was believed that when the face was cleaned and bared back to firm and sound rock that surface would be extremely irregular and generally unsuitable for the tie-in of the impervious core and filter zones of the dam embankment.

Therefore, it was determined necessary and in the best interest of the Government to remove the marginal rock face by blasting a new presplit face.

Since the potential need for extensive dental excavation and dental concrete was so great, it was further determined to construct a concrete wall along the right bank's face with a concrete slab between the right bank 1V on 1H slope and the diversion culvert so as to provide a sound foundation against which to compact the impervious core and filter zones of the dam embankment.

The need for the changes set forth by this modification was determined necessary due to unforeseen conditions encountered during construction of the project.

Contract performance time was extended 10 calendar days by reason of this modification.

Modification No. P00040

Case #160, Rock Development

A. The Contractor shall furnish all plant, labor and material and perform all work necessary to complete the following listed work:

(1) Clear, grub and dispose of all trees in the proposed quarry area.

(2) Install a lighting system within the area of the Rock Borrow quarry so that future quarrying operations may be operated on a multiple shift operation. Operation of the lighting system shall be included in the Contractor's field overhead.

(3) Strip all overburden down to the top of rock in the proposed Rock Borrow quarry area. The cost of stripping, top-loading and hauling to disposal of all unsuitable overburden remaining after final cross sections for impervious borrow have been taken, is included in this change order. Suitable impervious material that has been scraper loaded and utilized in the dam impervious fill shall be paid for at the contract unit price for Bid Item 2C.2 - Impervious Borrow Excavation.

(4) Construct a haul road from the proposed Rock Borrow quarry area utilizing old MS Hwy 4 as much as possible, and up around the dam's right abutment to the Grizzly. The haul road, not counting old Hwy 4, will be approximately 1800 feet long (400 ft + 400 ft + 1000 ft), 25 feet wide, 2 feet thick and constructed of random rock. The haul road shall be plated with approximately 6 inches of Filter No. 1 from the Grizzly stockpile. Maintenance of the haul road shall be paid under change order Case No. 152, Rock Borrow.

(5) Construct a ramp from old MS Hwy 4 down into Gin Branch, utilizing material from the exploratory work in change order Case No. 158, Rock Borrow Exploration. Drill and Blast the irregular faces from the exposed rock on both sides of Gin Branch, necessary for starting production blasting. After blasting the irregular faces, push the shot rock down into Gin Branch to construct a base from which to start loading rock from the Rock Borrow quarry.

(6) All culvert pipe required (approximately 240 linear feet of 36-inch BCCMP) to be installed in the rock quarry development and construction of the haul road shall be furnished by the Government. The 36-inch BCCMP

culvert is presently located between DA 503 and DA 802 on Divide Cut Section 2. The Contractor shall be responsible for loading, transporting, unloading, and installing all required 36-inch BCCMP.

(7) Construct a ramp of random rock to connect the rock borrow quarry haul road to the North Side of the existing Grizzly unloading ramp to provide ready access to the Grizzly. The added ramp upon completion of the rock borrow operation shall be leveled out in conjunction with present site grading plans.

(8) All work shall be in accordance with applicable portions of the contract plans and specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $49,870.00. Accordingly, the following new item is hereby added to the contract Unit Price Schedule:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.16 (New)	Rock Quarry Development	XX	LS	XX	$49,870.00

Because of a shortage in select rock, this modification was issued to provide additional rock. The nature of the shortage is described in Section VIII, Additional Quarry.

Modification No. P00041 - Part I

Case #152, Rock Borrow

A. Due to an anticipated shortage of suitable H_a rock in the remaining rock excavation necessary to complete the select rockfill sections of the embankment, it is necessary to modify the contract to provide for furnishing suitable rock from alternate sources. The rock directly upstream from the embankment along the west bank of Mackey's Creek is a source for making up the estimated shortage of approximately 400,000 cubic yards. The following restrictions shall be placed on the use of this area:

(1) The quarry operations initially shall be a minimum of 400 feet from the upstream toe of the existing embankment.

(2) The quarry operations shall be conducted to preclude blocking of Mackey's Creek and the diversion culvert.

(3) Provision shall be made to comply with the turbidity requirements of the contract.

Should the Contractor elect to use the downstream source, there is an estimated 100,000 cubic yards of suitable material available in the downstream channel excavation, between Stations 21+20S and 35+00S, and contractor designated as

Area No. 5. Restrictions on the downstream channel excavation which will be below grades are as follows:

(1) The contractor shall step in ten feet from the designed sidewalls.

(2) The new sidewalls must be presplit.

(3) If unsafe conditions or conditions which threaten the designed sidewalls are encountered, sufficient rock bolts to stabilize the area shall be installed at the direction of the Contracting Officer.

(4) All flyrock and/or projections above designed grade will be removed.

B. For and in consideration of the change described herein, one new payment item is added to the contract Unit Price Schedule as follows:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.17	Rock Borrow Quarry	400,000	CY	4.25	$1,700,000.00

Measurement will be by the cubic yard from cross-sections taken before and after excavation, with quantities computed using the average end-area method. Payment will be at the stated unit price and shall include all plant, labor, equipment, materials, and incidentals necessary to excavate the rock from the quarry areas designated in this modification, and the rock hauled to the grizzly. Oversize rock that obviously cannot pass through the grizzly can remain in the quarry areas. In order to subtract the oversize rock quantity from the excavation pay quantity, the volume of oversize rock will be determined and a factor of 25 percent will be used to reduce the volume of oversize rock back to bank cubic yards.

C. This Part 1 will provide $1,700,000.00 for making partial payments as the work progresses. It is expressly understood that this amount is tentative and is based on an estimated 400,000 cubic yards of material. When a reasonable estimate of the quantity of suitable material required to make up the shortage of Select Rockfill and No. 1 Filter material is determined, the final adjustment in the contract price and the contract performance time, if any, will be made in Part 2 of this modification.

Modification No. P00041 - Part II

Case #152, Rock Borrow - Quarry

A. This Part II establishes the final equitable adjustment for the additional work set forth in Part I of this modification.

B. For and in consideration of said change order, the contract price is increased a total of $1,259,000.00. Therefore, the tentative amount of $1,700,000.00 previously estimated under Part I for progress payments, shall be revised to that shown in (2).

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.17	Rock Borrow Quarry	400,000	CY	$4.25	$1,700,000.00

(2)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.17	Rock Borrow Quarry		LS		$1,259,000.00

Because of a shortage in select rock, a modification was issued to provide additional rock. The circumstances germane to the shortage is described in Section VIII.

No change in contract performance time resulted from this modification.

Modification No. P00042

Case #139, Revisions at Dam Cut-off Trench at Left Lock Wall Tie-In

A. The Contractor shall furnish all plant, labor and materials and perform all work necessary to complete the following listed work:

(1) Presplit a 1V on 1H slope to extend the full width of the internal zones from approximately Elevation 362.00 to Elevation 380.00. The total area of presplitting is approximately 2000 sq ft.

(2) Excavate approximately 520 CY of rock.

(3) Perform foundation cleanup in preparation for concrete on the exposed presplit slope. The total area of foundation cleanup is approximately 2000 sq. ft.

(4) Place a concrete wall against the exposed presplit slope in accordance with Sketch Numbers SK-G/6 and SK-G/6 which are hereby incorporated into the contract by reference. The top elevation of the wall is to be approximately Elevation 380.00 and waterstops are to be provided at all construction joints. The total quantities involved are as follows: Concrete - 188 CY, Cement - 771, CWT, Pozzolan - 127 CF, and Waterstop - 24 LF.

(5) All work shall be in accordance with applicable portions of the contract plans and specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $41,072.00. Accordingly, the following new item is hereby added to Contract Unit Price Schedule.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.22 (New)	Revisions at Dam Cut-off Trench at Left Lock Wall Tie-in	XXX	LS	XXX	$41,072.00

This change was necessary to provide a suitable foundation for the impervious core at the left wall tie-in where a two-foot thick clay seam was exposed during excavation. The foundation conditions and extent of treatment needed were not known prior to award of the contract.

There was no change in contract performance time by reason of this modification.

Modification No. P00043

Case #141, Extension of Inclinometer #16

A. The contractor shall furnish all plant, labor and materials and perform all work necessary to complete the following listed work:

(1) Extend existing inclinometer #16 from top of rock through the impervious core to top of embankment. This work should be accomplished in accordance with the applicable provisions of the contract specifications section 2K-9, including monthly readings of the inclinometer.

(2) The compaction for a minimum radius of 3-feet around the inclinometer shall be accomplished by power tampers in accordance with section 2D-8.2 of the specifications.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $27,600.00. Accordingly, the following new item is hereby added to the contract Unit Price Schedule:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.5	Extension of Inclinometer #16	XXX	LS	XXX	$27,600.00

The extension of inclinometer #16 is necessary to obtain a complete history of the settlements and deflections of the embankment as fill placement is completed. The addition of this inclinometer to a depth of 60 feet below top of rock was made by Modification P00008, Inclinomter and Observation Holes, to monitor the rock movements below the area of the embankment foundation during blasting operations for the lock. At that time it was scheduled to be filled with grout prior to placement of embankment. It was subsequently determined that this inclinometer could also provide valuable data on the embankment, which necessitated this modification.

There was no change in contract performance time by reason of this modification.

Modification No. P00059

Case #166, Foundation Repair L28, L29 and L30

A. The work covered hereby is defined as that below and adjacent to the first increment.

The Government shall reimburse the contractor for all work, labor, materials, and plant furnished or incidental to removal and replacement of damaged foundation material behind the L28, L29, L30 template with the exception of the initial increment of material removed. The first increment is that which was removed by shot number 193 and is defined by the following corner stations (beginning at the external corner of L30 and rotating clockwise):

22+76S, 7+21D
22+76S, 6+53D
22+86S, 6+53D
22+92S, 6+73D
23+31S, 6+94D
23+29S, 7+21D

The first increment has an average top elevation of 359 and an average bottom elevation of 350. Materials include lengthened anchor tendons. (Sketch No. 0132-166/1 is available but not included herein.) Refer to Drawing Nos. BSFR 35 and 36.

B. For and in consideration of the changed work addressed by this modification, the total estimated contract price is increased by an estimated amount of $264,000.00. The existing Unit Price Schedule will be revised to include (1) below.

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
3A.27	Foundation Repair L28, L29 and L30	XXX	LS	XXX	$264,000.00

The foundation rock for anchored wall monoliths L28, L29 and L30 was damaged by initial blasting in the lock chamber area. During removal of the damaged rock it became impossible to separate blast damage from inherent rock defects beyond the first increment of rock removal. It was necessary to remove and replace the underlying rock even though direct blast damage could not be identified.

This modification became necessary as lock rock excavation progressed. The effects of the combination of geologic conditions, blast patterns and powder factors was not totally predictable. The damage to the foundation was not anticipated.

Initial blasting of rock in the lock chamber area resulted in broken foundation rock. Following the first shot on 16 January 1980, subsequent shots were fired which resulted in similar damage to the foundation rock. The Resident Engineer directed the contractor to remove and replace the damaged material at his expense. There was a 5 day increase in contract performance time.

Modification No. P00051

Case #162, Drain Pipe Extension and Anchor Bar Modification

A. The contractor shall furnish all plant, labor and materials and perform all work necessary to complete the following listed work:

(1) Extend existing drain pipes in lower guide wall approximately one foot beyond concrete face.

(2) Modify upper miter gate tie back anchors to provide sufficient concrete cover while minimizing the reduction in anchor length.

All work shall be in accordance with applicable portions of the contract plans and specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the above described work, the total estimated contract price is increased by the estimated amount of $1,389.00. Accordingly, the following new item is added to the contract Unit Price Schedule.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2N.6 (New)	Drain Pipe Extension	XX	LS	XX	$1,389.00

It was necessary to extend the existing drain pipes in the lower guide wall beyond the concrete face to eliminate staining and pitting of the concrete caused by highly acidic water flow. This isolated acidic water source was unknown at the time the contract was awarded.

It was necessary to modify the upper miter gates tie back anchors to provide sufficient concrete cover while minimizing the reduction in anchor length. As designed, the tie back anchors would protrude into the gallery stairwell. This was an inadvertent design error in the original contract drawings.

There was no change in contract performance time.

Modification No. P00055

Case #167, Downstream Anchor Bolt Modification

A. Remove that portion of all rock bolt assemblies protruding beyond the rock face in the downstream navigation channel area between Elevation 321.00 and Elevation 335.00.

B. For and in consideration of the change described above a new item is hereby added to the Unit Price Schedule as follows:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2F.15	Downstream Anchor Bolt Modification	100	EACH	$38.00	$3,800.00

Total estimated increase in contract price will be $3,800.00

C. There will be no change in contract performance time by reason of this modification.

D. This modification constitutes compensation in full on behalf of the contractor and his subcontractors and suppliers for all costs and markup directly or indirectly attributable to the changes ordered herein, for all delays related thereto, and for performance of changes within the time stated.

The anchor bolts presented a hazard as they projected into the channel. Cutting the bolts off flush with the rock wall was not considered during the design phase of the project.

Modification No. P00061

Case #159, Extensometer and Load Cell Revisions

A. The contractor shall furnish all plant, labor, and material and perform all work necessary to complete the following listed work:

(1) Install hydraulic anchors at the bottom anchor location for the six extensometers shown on the contract drawings. The anchors shall be installed in accordance with the manufacturer's recommendation.

(2) Install 10 additional load cells on the wall anchor tendons at locations to be designated by the Contracting Officer's Authorized Representative. The load cells shall be installed in accordance with the applicable contract provisions of Section 2M, Prestressed Rock Anchors, and Section 2K, Monumentation and Instrumentation.

B. For and in consideration of the above described work, two new bid items are hereby added to the Unit Price Schedule as shown below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2M.8	Extensometer and Load Cell Revisions	XX	LS	XX	$41,994.00
2M.9	Technical Services	10	DAY	$568.00	5,680.00

This change was necessary to provide a more positive anchorage for the bottom reference anchor of the extensometers, and to provide additional data on the loading of the lock wall anchors with the additional load cells. Information on the hydraulic anchors for the extensometers was not available prior to add additional load cells; however, the location and number of additional load cells needed could not be determined prior to award of the contract.

There was no change in contract performance time by reason of this modification.

Modification No. P00070

Case #134, Revised Concrete Elevation Monoliths L14, L15, L16, R11, R12, R13, R14, R15, and R16

A. The contractor shall furnish all plant, labor, and material and perform all necessary work to lower the landside top of concrete elevations in monoliths L14, L15, L16, R11, R12, R13, R14, R15, and R16 to conform with the existing top of sound rock. The work shall be as shown on Drawings TTBS-10/8.5, 10/21.3, 10/22.4, 10/37.5, 10/107.3 and 10/110.3, and shall be in accordance with applicable contract specifications and as directed in the field by the Authorized Representative of the Contracting Officer.

B. For and in consideration of the changed work required by this modification the contract price will be decreased $51,982.29. Accordingly, the existing unit price items shown in (1) below, will be changed to read as shown in (2) and two new items are added to the Unit Price Schedule as shown in (3):

(1)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.2	Impervious Borrow Excavation	260,000	CY	$ 1.50	$ 390,000.00
2C.8	Final Foundation Cleanup and Preparation - Concrete Structures	45,000	SY	7.00	315,000.00
2C.9	Final Foundation Cleanup and Preparation - Impervious Cutoff	6,600	SY	12.00	79,200.00
2D.1	Compacted Impervious Fill	235,100	CY	0.50	117,550.00
2D.2	Rockfill, Select and Random	1,248,700	CY	1.50	1,873,050.00
2D.4	Filter Material No. 1	124,600	CY	1.30	161,980.00
2D.5	Filter Material No. 2	119,600	CY	8.00	956,800.00
3A.1	Concrete in Lock Walls and Sills	365,516	CY	45.00	16,448,220.00
3A.3	Concrete in Guide Walls	49,500	CY	45.00	2,227,520.00
3A.13	Portland Cement	1,332,220	CWT	3.25	4,329,715.00
3A.14	Pozzolan	171,950	CF	2.50	429,875.00
3A.15	Steel Reinforcement	11,215,672	LBS	0.38	4,261,955.36
			TOTAL (1) =		$31,590,845.36

(2)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.2	Impervious Borrow Excavation	261,030	CY	$ 1.50	$ 391,545.00
2C.8	Final Foundation Cleanup and Preparation - Concrete Structures	44,632	SY	7.00	312,424.00
2C.9	Final Foundation Cleanup and Preparation - Impervious Cutoff	6,681	SY	12.00	80,172.00
2D.1	Compacted Impervious Fill	235,927	CY	0.50	117,963.00
2D.2	Rockfill, Select and Random	1,249,334	CY	1.50	1,874,001.00
2D.4	Filter Material No. 1	124,882	CY	1.30	162,346.00
2D.5	Filter Material No. 2	119,916	CY	8.00	959,328.00
3A.1	Concrete in Lock Walls and Sills	363,534	CY	45.00	16,359,030.00
3A.3	Concrete in Guide Walls	49,424	CY	45.00	2,224,080.00
3A.13	Portland Cement	1,327,279	CWT	3.25	4,313,656.75
3A.14	Pozzolan	171,453	CF	2.50	428,632.50
3A.15	Steel Reinforcement	11,217,944	LBS	0.38	4,262,818.72
			TOTAL (2) =		$31,485,998.07

(3)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.22 (New)	Additional Fill Cost	XX	LS	XX	$ 6,996.00
3A.28 (New)	Additional Concrete Forming and Surface Treatment	XX	LS	XX	45,869.00
			TOTAL (3) =		$52,865.00

The contract requires the landside base of Monoliths L14 thru L16 and R11 thru R16 to be placed against solid rock on a 4V:1H slope up to a specific elevation that had been determined by preliminary subsurface investigation to be the approximate top of sound rock. At this elevation the landside of the monoliths is a flat horizontal shelf of variable width before rising on a 12V:2H slope to finish elevation.

When the excavation was performed in the area of these monoliths it was revealed the top of solid rock was lower than anticipated. Subsequently, this lowers the elevation of the horizontal shelf and reduces the amount of concrete. However, there will be additional forming for the wall concrete, and additional backfill material.

The sound rock levels were lower than anticipated when the landside concrete elevations were originally set for these monoliths.

There was no change in contract performance time by reason of this modification.

Modification No. P00072

Case #176, Delete Inclinometer Drilling

A. The contractor shall furnish all plant, labor, and material and perform all work necessary to complete the following listed work:

(1) Delete the drilling and installation for inclinometers IN-1, IN-3, IN-4, IN-7, IN-8, and IN-9. The contractor is to provide the inclinometer casing materials with hardware, the cement for grouting the casing, and the technical services of the manufacturer per Paragraph 2K9.3 of the contract specifications.

(2) The contractor shall provide and install concrete protective boxes with covers, for the for 49 Government installed piezometers. The protective boxes shall be similar to the inclinometer protective boxes required in the contract and shall be installed flush with the final paving elevation.

B. For and in consideration of the changed work required herein, Item No. 2K.1 of the existing Unit Price Schedule which now reads as shown in (A) below is hereby changed to read as shown in (B) below and two new bid items are added to the Unit Price Schedule as shown in (C) below:

(A)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.1	Instrumentation	XX	LS	XX	$600,000.00

(B)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.1	Instrumentation	XX	LS	XX	$582,675.00

(C)

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.6	Piezometer Protective Boxes	XX	LS	XX	$13,674.00
2K.7	Technical Services	10	DAYS	$519.00	$ 5,190.00
			TOTAL (3) =		$18,864.00

The Government drill crew was to be drilling and installing 49 piezometers atop the dam during the time frame in which the contractor would be drilling and installing the 6 inclinometers. To avoid possible conflicts and undue delays and as a trade-off for the piezometer protective boxes which were inadvertently omitted from the contract, it was deemed advantageous for the Government crews to install the six inclinometers. The contractor would remain responsible for the materials nad procurement of the services of the factory representative to assist in the initial installations.

There was no change in contract performance time by reason of this moditication.

Modification No. P00088

Case #194, Lower Crossover Trench Shoring and Emergency Repairs

A. Provide all plant, labor, and materials necessary to remove a rock fallout from the permanent slope at Station 7+20D and 22+58S. The fallout is to be replaced with concrete anchored with 1-inch diameter rock bolts. To prevent further movement along this joint, install shoring in the lower crossover trench at approximately Station 22+25S to 22+45S. The shoring is to be constructed of structural steel and will remain in place.

B. For and in consideration of the changed work required herein, the estimated contract price is increased $8,858.00. Accordingly, the following new bid item is hereby added to the contract Unit Price Schedule.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2F.16 (New)	Lower Crossover Trench Shoring and Emergency Repairs	XXX	LS	XXX	$8,858.00

A potential safety hazard due to unstable rock existed at the crossover gallery excavation near monolith L31. The Resident Contracting Officer directed the Contractor to make the necessary repairs. It was determined that these repairs were the responsibility of the Government.

There was no change in contract performance time by reason of this modification.

Modification No. P00102

Case #204, Inclinometer Repairs

A. The contractor shall furnish all plant, labor, and material and perform all work necessary to accomplish the following repairs to Inclinometer Nos. IN-7 and IN-9:

(1) On Inclinometer No. IN-7, chip the grout incasement inside the protective box, remove the protective box and excavate approximately 2 feet, cut off the plastic inclinometer casing and replace. Backfill the excavation. The work shall be accomplished in such a manner to minimize damage to the existing double bituminous surface treatment.

(2) On Inclinometer No. IN-9, excavate approximately 8 feet. After Government drillers realign metal casing, backfill excavated area.

B. For and in consideration of the additional work described above, the contract price is increased by the lump sum amount of $2,620.00. Payment will be made by adding one new item to the existing Unit Price Schedule as follows:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2K.9 (New)	Inclinometer Repairs	XX	LS	XX	$2,620.00

After the Government drillers had completed installing the inclinometers, it was determined that Inclinometers Nos. IN-7 and IN-9 were not functioning properly. Since the Government did not have the equipment or facilities to correct the problems it was necessary to have the Contractor repair two inclinometers.

There was no change in contract performance time as a result of this modification.

Modification No. P00103

Case #216, Dam Piezometer Revisions, Seepage Weirs, and Riprap Repair

A. The contractor shall provide all plant, labor, and materials necessary to accomplish the following listed work:

(1) Construct two weirs to monitor seepage at the toe of the west embankment. The weirs are to be constructed in accordance with drawing No. TTBS-4/3 which is hereby incorporated into the contract by reference.

(2) Provide all materials necessary to extend the riser pipes on the dam piezometers approximately 3 inches. In addition drain holes are to be drilled in the bottom of the piezometer boxes to remove standing water.

(3) Provide all materials and equipment necessary to place riprap stone protection at the outlet of seepage weir No. 2 and to repair the riprap slope protection between Mooring cells "E" and "F" in the downstream channel.

(4) Install 16 quick-release disconnect couplings on the uplift cell riser pipes in the upper miter sill crossover gallery. The quick-release valves are to be in accordance with existing contract drawing TTBS-43/8A.

(5) Install a check valve in the 1-inch diameter diesel fuel supply line, between the diesel fuel transfer pump and the storage tank. In addition fabricate and install a brace at the elbow in the discharge line of the raw water utility pump.

B. For and in consideration of the above described work, the estimated contract amount is increased $16,729.00. Accordingly, the following new bid items are added to the contract Unit Price Schedule:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2D.13	Riprap Repair	XXX	LS	XXX	$9,878.00
2K.10	Piezometer Revisions and Seepage Weirs	XXX	LS	XXX	$6,851.00

This change was necessary to correct deficiencies and to monitor seepage discovered during the Interim Periodic Inspection of the Bay Springs Lock and Dam. These deficiencies were unknown at the time the Plans and Specifications were prepared.

There was no change in contract performance time as a result of this modification.

Modification No. P00111

Case #224, Clay Seam Claim

A. This modification represents a final and complete settlement for all costs claimed by the Contractor for additional work and inefficient excavation and grizzly operations caused by the shortage of recoverable select rockfill material from the lower approach channel.

In recognition of the above change in the contract price, the Contractor agrees to withdraw the differing site condition claim of record identified as the "Clay Seam Claim."

B. For and in consideration of the additional work and inefficiencies involved with excavating, and hauling rock from the stockpile and Excavation Areas 4 and 5, and processing rock through the grizzly, the contract price is increased by the lump sum amount of $495,000.00. For payment one new item is added to the Unit Price Schedule as follows:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
2C.26	Clay Seam Claim Settlement	XXX	LS	XX	$495,000.00

The clay seam claim is described in Section VIII, Additional Quarry.

There was no change in contract performance time by reason of this modification.

1.09 Preparers of Foundation Report.--Bay Springs Foundation Report was prepared by Geologists Paul Ross and David Sanders, and was revised by Tommy Haskins. Mr. Ross, serving in the capacity of Project Geologist, was on the project site from the commencement of the contract until 27 May 1982.

David Sanders was assigned to the Bay Springs Project Office on 18 May 1980. He served as Project Geologist from 27 May 1982 until 12 December 1983.

Mr. Haskins, a geologist, revised the report between September 1985 and June 1986. Data for the revisions were taken from the job records and interviews with Corps personnel who participated in the design and construction of the project.

II. FOUNDATION EXPLORATIONS

2.01 Investigations Prior to Construction.--Prior to construction, extensive subsurface investigations had been conducted for the lock and dam studies. In addition to data searches with various state and federal agencies, exploratory drilling was conducted by the Mobile District and the Nashville District. Investigations consisted of augering, drive, and Denison sampling of the overburden; NX and NQ size and 6-inch diameter coring in rock, both vertical and angle; vertical 4-inch and 5-3/8-inch diameter coring in rock. Pressure testing and geophysical logging were performed in a number of core holes. Groundwater studies were based on water level readings obtained during and after drilling and on water level readings obtained from piezometers. To supplement the drilling program, exploratory excavations were made along the left bank of Mackeys Creek and along the proposed axis of the future dam and a remote sensing study, as referenced in DM N-12, was made of the entire project area. The laboratory testing program included testing of soils from the project area, and extensive testing of bedrock samples from the lock and damsite. See contract documents for preconstruction investigation data.

The lock test excavation was completed in 1978, see Bay Springs Lock and Dam Lock Test Excavation Completion Report, dated March 1979.

2.02 Investigations During Construction.--Thirty-nine 4-inch core borings were drilled in the lock foundation shale to allow for final evaluation of foundation conditions. Holes were drilled with a B-53 Mobile rig and a Chicago Pneumatic skid rig. Diamond bits, which had been effective in the sandstone, were not effective in the shale (members H_c, H_d, H_e) as the cuttings interacted with the drill fluid resulting in a "gum" which buffered the cutting edge of the bit from the undisturbed shale and reduced production. A 4- by 6-inch stratapex carbide bit was used to drill the majority of the holes. When drilling was performed with a carbide bit, core recovery was 94.3 percent with drill rates of 10 feet in 20 to 30 minutes.

Three core holes were added in the lower miter sill area. BSCL-31A was for additional coverage of the lower miter sill. Core from BSCR-30 indicated a zone of fractured shale in the Monolith R30 foundation, though it could not be determined if the fractured zone resulted from drill action or was natural. BSCR-30A was added and the core from this hole did not contain the fractured zone. During the placement of the "A" lift in Monolith R31, water began to flow from a concrete form anchor hole drilled into the shale. The placement was completed using a drain to control the water. BSCR-31A was drilled from the top of the "A" lift concrete to check this area for zones of water flow. Core and pressure tests on this hole did not indicate adverse conditions in the foundation and the hole and drain were backfilled with grout.

Twelve of the 39 holes had artesian flow originating from the G_a limestone with pressures of 1 to 2-1/2 psi measured at the top of the holes. All holes were tremie backfilled with a 0.75 grout mix.

Four 4-inch core borings were drilled on the centerline of the downstream approach channel to provide additional information on the quantity of select rockfill material available in this area, as a shortage of select rock was experienced.

These cores confirmed the presence of numerous weathered shale (clay) beds, as indicated on the contract drawings. Sources for select rock are discussed in Section VIII.

Five 4-inch core holes were drilled near the centerline of the dam in the bottom of Mackeys Creek. No major discontinuities were evident from study of the core recovered; however, subsequent foundation cleanup revealed a vertical fracture nearby. None of the drill holes had penetrated this fracture.

Five NQ core holes were drilled to determine the extent of blast damage in the area behind Monolith L27. See Drawings BSFR-35 and 36, and discussion of L27-L30 corner blast damage.

Thirty-seven 2-inch exploratory percussion holes were drilled in the lock structure areas as required by the specifications. Those in the shale foundation proved to be of little value and some were deleted.

Core log sheets are kept on file at the Bay Springs Resource Management Office. A tabulation (Table Number 2) of all construction phase exploratory borings is given on pages 42-50. See Drawing BSFR-8 for plan of exploration during construction. See Drawings BSFR-9 thru BSFR-21 for logs of borings made during construction.

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:
4-INCH CORE HOLES*

PRESSURE TEST (P-T)

HOLE NO.	LOCATION	TR ELEVATION	DRILL DEPTH (FT)	STAGE DEPTH (FT)	TAKE $FT.^3$ IN 5 Min.	GAGE PRESSURE (PSI)	REASON FOR DRILLING	ARTESIAN FLOW	ARTESIAN HEAD (PSI) OR FLOW(GPM) (IF MEASURED)	DATE DRILLING COMPLETED
BSCL-16	22+87S, 0+23D	312.0	60.8	0-60.8 20-60.8	0 0.3	5 15	Per Specs	NO		11/12/80
BSCL-17	22+40S, 0+55D	293.6	43.0	0-43.0 20-43.0	1.0 1.2	5 12	Per Specs	NO		12/04/80
BSCL-18	23+13.5S, 1+11D	293.9	45.7	0-45.7 20-45.7	1.0 1.2	5 12	Per Specs	YES	5 GPM	12/05/80
BSCL-19	22+45.5S, 1+53.5D	297.5	47.5	0-47.5 20-47.5	5.0 1.5	5 12	Per Specs	NO		12/08/80
BSCL-20	22+20S, 1+96D	297.5	46.8	0-46.8 20-46.8	1.4 0.8	5 12	Per Specs	NO		12/08/80
BSCL-21	22+45.5S, 2+44D	298.0	47.2	0-47.2 20-47.2	0.9 2.4	5 12	Per Specs	YES	0.5 GPM	12/10/80
BSCL-22	22+20S, 2+97D	298.6	48.3	0-48.3 20-48.3	3.0 3.0	5 12	Per Specs	NO		12/10/80
BSCL-23	22+49S, 3+38D	292.2	42.2	0-42.2 20-42.2	0 1.4	5 12	Per Specs	YES		12/19/80
BSCL-25	22+48.5S, 4+41D	292.9	43.0	0-43.0 20-43.0	0 0	2 12	Per Specs	NO		12/17/80

*Holes are vertical unless otherwise delineated.

TABLE 2
CONSTRUCTION PHASE EXPLORATORY BORINGS:
4-INCH CORE HOLES (Cont)

PRESSURE TEST (P-T)

HOLE NO.	LOCATION	TR ELEVATION	DRILL DEPTH (FT)	STAGE DEPTH (FT)	TAKE FT.[3] IN 5 Min.	GAGE PRESSURE (PSI)	REASON FOR DRILLING	ARTESIAN FLOW	ARTESIAN HEAD (PSI) OR FLOW(GPM) (IF MEASURED)	DATE DRILLING COMPLETED
BSCL-26	22+20S, 4+90D	297.6	47.9	0-47.9 20-47.9	1.9 0.2	2 12	Per Specs	NO		12/12/80
BSCL-27	22+49S, 5+33D	297.2	47.0	0-47.0 20-47.0	0 0.5	2 12	Per Specs	NO		12/12/80
BSCL-28	22+20S, 5+79D	296.8	46.4	0-46.4 20-46.4	1.1 0	2 12	Per Specs	NO		12/15/80
BSCL-29	22+53S, 6+34D	296.7	46.6	0-46.6 20-46.6	0.4 0.5	2 12	Per Specs	NO		12/13/80
BSCL-30	22+20S, 6+90D	294.3	45.1	0-45.1 20-45.1	0 0	2 12	Per Specs	NO		01/07/81
BSCL-31A	21+90.8S, 7+61.7D	294.1	41.6	0-41.6 20-41.6	0.3 0	2 12	Per Specs	NO		01/08/81
BSCL-31	23+03.5S, 7+52D	294.5	43.7	0-43.7 10-43.7	0 0.7	2 12	Per Specs	NO		01/23/81
BSCL-32	22+50S, 7+86D	296.4	47.1	0-47.1 10-47.1	2.2 3.4	2 12	Per Specs	NO		01/13/81
BSCL-34	22+26S, 8+81D	294.7	42.6	10-42.6	0.9	5	Per Specs	NO		01/12/81
BSCR-16	21+10S, 0+45D	310.3	58.1	0-58.1 10-58.1	1.2 0	5 15	Per Specs	NO		11/18/80
BSCR-18	20+7[illegible]S, 1+0[illegible]	295.0	45.1	0-45.1 10-45.1	2.5 2.0	5 10	Per Specs	YES	2 PSI	11/25/80

TABLE

CONSTRUCTION PHASE EXPLORATORY BORINGS:
4-INCH CORE HOLES (Cont)

HOLE NO.	LOCATION	TR ELEVATION	DRILL DEPTH (FT)	PRESSURE TEST STAGE DEPTH (FT)	PRESSURE TEST TAKE FT.^{3} IN 5 Min.	PRESSURE TEST GAGE PRESSURE (PSI)	REASON FOR DRILLING	ARTESIAN FLOW	ARTESIAN HEAD (PSI) OR FLOW (GPM) (IF MEASURED)	DATE DRILLING COMPLETED
BSCR-20	21+10.5S, 2+41D	293.5	41.7		NO P-T		Per Specs	NO		11/24/80
BSCR-22	21+10.5S, 3+12D	293.5	45.1	5-45.1	[illegible]	[illegible]	Per Specs	YES	2½ PSI 3-4 GPM	11/21/80
BSCR-23	20+315S, 3+76D	[illegible]	42.1	20-42.1	1.6	10	Per Specs	YES	2 PSI 10 GPM	11/06/80
BSCR-24	21+10.5S, 4+31D	292.7	43.5		NO P-T		Per Specs	YES	2 PSI	10/17/80
BSCR-25	20+81.5S, 4+79.5D	295.2	46.2		NO P-T		Per Specs	YES	2½ PSI	10/22/80
BSCR-26	21+10.5S, 5+23D	295.5	47.1		NO P-T		Per Specs	NO		10/23/80
BSCR-27	20+81.5S, 5+69D	294.7	47.6	0-5	0	5	Per Specs	YES	1 PSI	10/28/80
BSCR-28	21+10.5S, 6+24D	293.9	44.6	5-44.6 20-44.6	8.2 1.4	1 12	Per Specs	YES		11/04/80
BSCR-29	20+77S, 6+80D	294.2	45.5		NO P-T		Per Specs	YES	1 GPM	11/05/80
BSCR-30	21+10.5S, 7+20D	293.8	44.6	0-44.6 20-44.6	0 0	4 12	Per Specs	NO		11/07/80
BSCR-30A	20+84S, 6+94D	292.7	23.2	0-23.2	0	5	Add'l Invest of Mon. R30	NO		11/30/80

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:
4-INCH CORE HOLES (Cont)

HOLE NO.	LOCATION	TR ELEVATION	DRILL DEPTH (FT)	PRESSURE TEST: STAGE DEPTH (FT)	PRESSURE TEST: TAKE FT.3 IN 5 Min.	PRESSURE TEST: GAGE PRESSURE (PSI)	REASON FOR DRILLING	ARTESIAN FLOW	ARTESIAN HEAD (PSI) OR FLOW(GPM) (IF MEASURED)	DATE DRILLING COMPLETED
BSCR-31	20+18.5S 7+76D	292.8	45.7		NO P-T		Per Specs	NO		11/24/80
BSCR-31A	20+56S, 7+73D	285.8, Top of Concrete	15.4	15-28 17-28 *Top of pipe was 296.0' at time of pressure test.	0.7 0	6 6	Add'l Invest of Lower Miter Sill	YES		12/18/80
BSCR-32	21+10S, 8+26D	292.2	41.5		NO P-T		Per Specs	NO		11/21/80
BSCR-33	20+73S, 8+71D	293.0	40.1	0-40.1 20-40.1	3.2 0	5 10	Per Specs	NO		11/19/80
BSCR-34	21+04.5S, 9+15D	295.2	47.4	0-47.4 20-47.4	6.2 0.2	5 15	Per Specs	NO		11/11/80
BSCR-37	21+10S, 10+20D	314.6	66.1	0-66.1 10-66.1	0 0	5 12	Per Specs	NO		12/02/80
BSCR-41	21+06.5S, 11+80D	313.7	65.4	0-65.4 20-65.4	7.2 0.2	5 12	Per Specs	NO		12/03/80
BSCR-44	21+08S, 12+72D	313.0	65.0	0-65 20-65	0 0	2 12	Per Specs	NO		01/21/81
BSC -1	22+41S, 21+00D	362.0	55.9		NO P-T		Estimation of Rock Quantities			02/26/80

TABLE 2
CONSTRUCTION PHASE EXPLORATORY BORINGS:
4-INCH CORE HOLES (Cont)

HOLE NO.	LOCATION	TR ELEVATION	DRILL DEPTH (FT)	PRESSURE TEST: STAGE DEPTH (FT)	PRESSURE TEST: TAKE FT.^{3} IN 5 Min.	PRESSURE TEST: GAGE PRESSURE (PSI)	REASON FOR DRILLING	ARTESIAN FLOW	ARTESIAN HEAD (PSI) OR FLOW(GPM) (IF MEASURED)	DATE DRILLING COMPLETED
BSC-2	22+41S, 25+00D	255.4	48.8		NO P-T		Est of Rock Quantities			02/22/80
BSC-3	22+41S, 29+00D	344.9	46.5		NO P-T		Est of Rock Quantities			02/19/80
BSC-4	22+41S, 34+00D	331.4	36.6		NO P-T		Est of Rock Quantities			02/18/80
BSC-5	17+68.3S, 0+08.3D	323.4 (Hole Angled 30°, N50°W)	27.0		NO P-T		Assurance of Foundation Adequacy			02/28/80
BSC-6	17+68.3S, 0+33U	323.9	24.6		NO P-T		Assurance of Foundation Adequacy			02/29/80
BSC-7	17+64.5S, 0+10D	323.0	9.0		NO P-T		Assurance of Foundation Adequacy in Mackeys Creek			03/03/80
BSC-8	17+71.5S, 0+08D	323.0	23.7		NO P-T		Assurance of Foundation Adequacy in Mackeys Creek			03/03/80
BSC-9	17+27S, 0+19D	324.0	24.4		NO P-T		Assurance of Foundation Adequacy in Mackeys Creek			03/04/80

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:
NQ CORE HOLES (Cont)

HOLE NO.	LOCATION	TR ELEVATION	HOLE BEARING & ANGLE	DRILL DEPTH (FT)	REASON FOR DRILLING	DATE DRILLING COMPLETED
BSC-10	23+20.5S, 5+84.6D	361.8	N 125°E, 45° from vertical	40.9	Investigation of Joints in L29, L30	05/19/82
BSC-11	23+26.8S, 5+92D	361.8	N 130°E, 20° from vertical	32.0	Investigation of Joints in L29, L30	05/23/80
BSC-12	23+46S, 5+40.5D	362.2	N 125°E, 45° from vertical	34.9	Investigation of Joints in L29, L30	05/23/80
BSC-13	23+58.5S, 5+.08D	362.2	N 125°E, 20° from vertical	30.9	Investigation of Joints in L29, L30	05/27/80
BSC-14	15+70S, 0+05.3D	366.5	N 130°E, 45° from vertical	30.7	Investigation of Joints in L29, L30	05/27/80
C-1	15+70S, 0+05.3D	353.8	Vertical	11.8	Assurance of Foundation Adequacy	08/14/79
C-2	15+76S, 0+30D	351.7	West, 20° from vertical	10.0	Assurance of Foundation Adequacy	08/15/80
R-19	20+65.3S, 1+71D	334.12	West, 8° below the horizontal	157.8	Determination of Anchor Settings for Extensometer	04/08/81
R-23	20+64.8S, 3+57D	334.07	West, 8° below the horizontal	108.2	Determination of Anchor Settings for Extensometer	04/17/81
R-29	20+62.5S, 6+65D	333.71	West, 8° below the horizontal	104.5	Determination of Anchor Settings for Extensometer	04/14/81
L-19	*, 1+72.5D	362.21	East, 8° below the horizontal	153.3	Determination of Anchor Settings for Extensometer	11/02/81

*Information not available

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:
NQ CORE HOLES (Cont)

HOLE NO.	LOCATION	TR ELEVATION	HOLE BEARING & ANGLE	DRILL DEPTH (FT)	REASON FOR DRILLING	DATE DRILLING COMPLETED
L-23	23+63.81S, 3+57D	334.27	East, 8° below the horizontal	108.8	Determination of Anchor Settings for Extensometer	05/21/81
L-29	23+68.29S, 6+65D	333.64	East, 8° below the horizontal	104.3	Determination of Anchor Settings for Extensometer	05/26/81

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:

2-Inch Percussion Holes (Cont)

HOLE NO.	LOCATION	ELEVATION TR	DRILL DEPTH (FT)	REASON FOR DRILLING
BSPR16A	21+00S, 0+24.5D	307.16	10.0	Per Specifications
BSPR16B	20+70S, 0+34.5D	307.8	10.0	Per Specifications
BSPR23A	20+86S, 3+42D	292.5	10.0	Per Specifications
BSPR23B	20+96S, 3+56D	292.5	10.0	Per Specifications
BSPR24A	21+5.5S, 3+91D	291.0	10.0	Per Specifications
BSPR24B	20+96S, 4+08.5D	291.0	10.0	Per Specifications
BSPR25A	20+86.5S, 4+46D	292.5	12.0	Per Specifications
BSPR25B	20+96S, 4+60.25D	292.5	12.0	Per Specifications
BSPR26A	21+05.5S, 4+94.5D	292.5	12.0	Per Specifications
BSPR26B	20+96S, 5+06.25D	292.5	12.0	Per Specifications
BSPR27A	20+86.5S, 5+38D	293.0	10.0	Per Specifications
BSPR27B	20+96S, 5+51D	293.0	10.0	Per Specifications
BSPR28A	21+05.5S, 5+84D	293.0	10.0	Per Specifications
BSPR28B	20+96S, 6+01.5D	293.0	10.0	Per Specifications
BSPR29A	20+82S, 6+39D	292.5	10.0	Per Specifications
BSPR29B	20+93.6S, 6+57D	292.5	10.0	Per Specifications
BSPR1	20+95S, 6+00U	366.6	20.0	Per Specifications
BSPR2	21+14S, 5+69U	365.3	20.0	Per Specifications
BSPR3	20+94S, 5+29U	365.1	20.0	Per Specifications
BSPR4	21+04S, 4+96U	363.9	30.0	Per Specifications
BSPR5	20+92.7S, 4+49U	363.5	20.0	Per Specifications

TABLE 2

CONSTRUCTION PHASE EXPLORATORY BORINGS:
2-Inch Percussion Holes (Cont)

HOLE NO.	LOCATION	ELEVATION TR	DRILL DEPTH (FT)	REASON FOR DRILLING
BSPR6	21+11S, 4+15U	362.1	20.0	Per Specifications
BSPR7	21+13.7S, 3+89U	353.2	20.0	Per Specifications
BSPR9	20+75S, 2+69U	343.7	20.0	Per Specifications
BSPR11	20+62S, 1+79U	342.5	19.0	Per Specifications
BSPR12	21+09S, 1+45U	341.8	20.0	Per Specifications
BSPR13	20+55S, 0+89U	340.9	20.0	Per Specifications
BSPR14	21+09S, 0+44U	339.9	20.0	Per Specifications
BSPR15	20+42.3S, 0+09.5U	340.3	20.0	Per Specifications
BSPR31A	20+39S, 7+44D	280.1	10.0	Per Specifications
BSPR31B	20+54.5S, 7+42.5D	280.1	10.0	Per Specifications
BSPL10	22+61S, 2+60U	344.0	20.0	Per Specifications
BSPL11	22+25S, 1+98U	344.0	20.0	Per Specifications
BSPL12	22+70S, 1+69U	341.0	20.0	Per Specifications
BSPL13	22+18S, 1+24U	341.0	18.0	Per Specifications
BSPL14	22+75S, 0+79U	341.0	20.0	Per Specifications
BSPL15	22+21S, 0+34U	341.0	20.0	Per Specifications

III. GEOLOGY

3.01 General Geologic and Physiographic Features.--The project is located in the extreme eastern part of the Mississippi Embayment, a synclinal structure which is part of the Gulf Coastal Plain. This embayment has been divided into a number of physiographic districts. The damsite is located in the Fall Line Hills District which occupies the periphery of the embayment from Alabama to southern Tennessee. In this district, Mississippian, Cretaceous, and Quaternary sediments are exposed. Most of the Mississippian rocks are overlain by Cretaceous and Quaternary clays, silts, sands and gravels. These Mississippian rocks crop out only along the valleys and, like the Cretaceous and Quaternary sediments, have a southwestwardly regional dip toward the axis of the syncline.

3.02 Site Geology - General.--The valley floor at the damsite is approximately 2,000 feet wide at Elevation 385. East of the valley center, Mackeys Creek has carved a pronounced channel which, at its base, occupies approximately 35 feet of the floodplain width. Vertical sandstone cliffs, rising 50 feet above stream level, are common in the area upstream from the dam axis.

3.03 Overburden.--Overburden in general is approximately 15 feet thick, except in the abutment areas of the dam where it averages 40 feet in thickness. The overburden consists of clay, silts, sands, and gravels of Cretaceous age and alluvial sands and gravels of Quaternary age. In ascending order, the unconsolidated sediments consist of varicolored sands, gravels, and clays of the Gordo Formation. Overlying these sediments are interlaminated micaceous clays and glauconitic sands and occasional thin beds of gravel of the McShan Formation. The remainder of the Cretaceous section is comprised of glauconitic and slightly micaceous sands and dark gray silty clays also of the McShan Formation. The valley section along the axis of the dam is overlain by alluvial deposits of mostly sands, clays, and some gravel. These deposits were mostly derived from the Eutaw and McShan Formations, but also partly from the Gordo and underlying Mississippian formations. A complete regional description of overburden materials is contained in the Generalized Geologic Column, Exhibit 1, pages 55-57.

3.04 Bedrock Stratigraphy.--The bedrock, which consists of sandstone and shale of the Hartselle Formation of Mississippian age, immediately underlies the alluvial and Cretaceous materials in the area and forms the foundation for the lock and dam. The uppermost sandstone unit in the immediate area of the lock and dam, the H_a member, is massive bedded to occasionally cross-bedded, moderately hard, fine grained, and light brown with occasional soft light grav clay beds in the upper portion of the lock and dam area. From the lock to the southern terminus of the project, the bedrock dipped downstream progressively increas[illegible] from about 4 degrees (in the lock area) to about 15 degrees (in the lower approach channel at the southern terminus). In the lower approach channel, sandstone containing numerous weathered shale beds overlay the massive sandstone which occupy the uppermost horizon for rock in the lock area. Although lithologically dissimilar, both the interbedded sandstone/shale and massive sandstone were considered the same member, H_a. The contact between the H_a and the underlying H_b member is difficult to determine because of their similar appearance. The H_b sandstone, which averages 5 to 6 feet in thickness, is medium bedded to occasionally crossbedded, carbonaceous, moderately hard, fine grained, light gray with paper thin black carbonaceous partings and occasional light gray clayey shale bands. Underlying the H_b are the interbedded sandstones and shales of the H_c and H_d members, averaging 17 to 18 feet in combined thickness. The contact between these transitional members is difficult to determine with a gradational increase in shale with depth. The sandstones are thin bedded, argillaceous, moderately hard, fine grained, green-gray with occasional crossbedding. The cemented shales are soft to moderately hard and dark gray. The basal member of the Hartselle Formation, H_e, is a low strength, massive bedded, silty, and occasionally sandy shale. The shale is soft to moderately hard, dark gray, and contains occasional siltstone bands and nodules. This shale is air-sensitive and deteriorates rapidly upon exposure. Underlying the Hartselle Formation are the limestones and shales of the Golconda Formation. A complete regional description of the bedrock is contained in the Generalized Geologic Column, Exhibit 1, pages 55-57.

3.05 Bedrock Structure.--Foundation explorations made prior to and during construction indicate two major joint systems striking N35°E and N40°W. The dominant dip on the joints varies between 80 degrees from horizontal and vertical. Joint spacings generally varied from 1 to 20 feet, averaging approximately 5 feet, although major joint blocks average 40 feet in width. The joints are often open near the surface and usually have been filled with clay or sand. These joints are typically weathered and iron stained.

During construction, a fault was found which crosses the lock structure from Monolith R10 through L14, continuing across the dam centerline at approximately Station 23+25S. The strike and dip are slightly irregular, but generally, it trends N45°W with a vertical dip. There is an approximate 2-foot displacement with the upstream wall having dropped in relation to the downstream wall and with some associated minor branch faulting and drag folding of adjacent beds. The fault line was tight except near the surface where, due to weathering, it had opened approximately 0.2 foot and subsequently filled with sandy clay and iron cemented sand. Where exposed on horizontal surfaces, the fault closely resembled a typical joint. The presence of this fault was brought to the attention of the district geologists who determined that it was not consequential and should receive the same treatment as a joint.

Rippled beds are common throughout the sandstone and sandstone-shale interbeds. Occasional clay filled vugs are found in the H_a sandstone.

The left wall of the downstream approach channel, location 20+91S, 24+00D to 35+00D, has been subjected to a past episode of compression as evidenced by folding, occasional vertical bedding, and several shear planes. The only evidence of deformation on the right wall is a shear plane and associated dragging of the beds, found at location 23+91S, 33+00D.

3.06 <u>Weathering</u>.--The sandstones are relatively resistant to weathering and the depth and severity is slight. Most of the weathering occurred along joint planes and bedding planes. In areas along the valley walls, where the sandy shales and shaly sandstones were exposed, the weathering was more severe. As a result, these underlying beds had receded, and weathering along the overlying sandstone joints and bedding planes had resulted in large blocks of this sandstone creeping or falling into the valley.

3.07 <u>Groundwater</u>.--As determined prior to construction, the groundwater table was above the level of Mackeys Creek and followed the surface contours at a depth of approximately 15 to 20 feet.

Examination of the lower end of the downstream guide wall in late winter of 1982 revealed that groundwater seeping out of several drain holes, which extended through the concrete wall, was chemically eroding the grout on the wall face. The District Office when notified of the condition requested that the PVC pipes be extended to keep the water off the concrete. Water samples were taken at different locations within the lock structure and downstream approach channel and sent to the District for analysis. See test results, Exhibit 2, page 58. Results of the analysis indicated that the acid water condition was localized, probably resulting from a build-up of sulfur compounds along joints which were intersected by the drain holes. It was concluded that impoundment would alleviate the problem by diluting the acidic water.

3.08 <u>Engineering Characteristics of Overburden Materials</u>.--There are four types of overburden materials present at the damsite.

(1) The floodplain alluvium is a heterogeneous mixture of fine sand (SP), clayey sand (SC), sandy clay (CL) and sandy, silty gravel (GM). When necessary, the alluvial material was removed to provide a suitable foundation for the rockfill section of the dam.

(2) The GDM and Bay Springs L&D specifications show the Eutaw to overlie the McShan in the immediate area of the damsite. However, later field mapping has shown that the dam abuts the McShan and Gordo Formations but not the Eutaw Formation as shown in the previous documents. The Eutaw formation lies immediately up section from the project proper. The mislabeling of the formation illustrates the difficulty in discerning between the Eutaw and McShan Formations. The field maping which resulted in the formation reclassification occurred after an extensive amount of Eutaw and McShan had been excavated and mapped in the Divide Cut Section.

The McShan Formation consists of a number of lithologies including the following:

(a) Tightly bedded clay bands and thin beds separated by bands of sand or silt.

(b) Sands (SP, SP-SM, SM, SC) with interbeds of silt and clay bands.

(c) Sands (SP, SP-SM, SM, SC).

(d) Interlaminated sand, silt, and clay.

(e) Zones of silt (ML and MH).

Characteristically, McShan lithologies are discontinuous over a relatively short lateral distance (as little as a few hundred feet). Densities for the unit generally exceed 100 pounds per cubic feet.

(3) The Gordo Formation (Tuscaloosa group) is irregularly bedded sandy-clayey gravel (GC) and clay (CH).

(4) Capping the Mississippian and Cretaceous formations in the region is a residual sandy clay (CL) (clay content decreases with depth) or clayey sand (SC) which has developed as an insitu weathering produce of the formations. This residual material, which varies from 1 to 5-feet thick, was excavated from the hilltops and hillsides within the reservoir just north of the axis of the dam and used as impervious fill material for the dam.

Bay Springs Lock and Dam Design Memorandum No. N-12, Appendix VI and VII has a complete evaluation of the overburden materials.

3.09 Engineering Characteristics of the Bedrock.--Rock mass strengths were developed from the results of laboratory tests of bedrock core samples. (See Appendix IV, DM No. N12, dated February 1977). The average laboratory values obtained from these tests are as follows:

TABLE 3
LABORATORY RESULTS OF ROCK MASS TESTING

Member	Unconfined Compression (TSF)	Specific Gravity	Dry Unit Weight (PCF)	Water Content (%)
H_a	656.4	2.59	129.1	9.1
H_b	557.8	-	132.0	7.9
H_c	8.5	-	135.4	3.9
H_d	19.2	-	141.4	7.4
H_e	49.0	2.75	133.6	10.1

The results of index testing of the shales from the H_c, H_d, and H_e members included Atterberg limits as follows:

Member	LL*	PI**
H_c	33 to 53	14 to 29
H_d	31 to 45	3 to 24
H_e	35 to 53	17 to 28

*Liquid Limit
**Plasticity Index

EXHIBIT 1

GENERALIZED GEOLOGIC COLUMN

ERA	PERIOD (Rock) (Time)	SERIES (Rock) EPOCH (Time)	FORMATION	AVERAGE THICKNESS	ELEVATION RANGE	FORMATION AND MEMBER SYMBOL	GENERAL DESCRIPTION
CENOZOIC	QUATERNARY	HOLOCENE	ALLUVIUM			Q_{al}	Sands, clays, silts, and gravel, varicolored brown and gray, irregularly bedded; sands—fine to medium grained, medium to very loose, occasionally clayey; clays—soft to very stiff, occasionally sandy; gravels—fine to coarse.
		PLEISTOCENE	TERRACE DEPOSITS			Q_t	Sands with occasional gravel lenses and clay lenses, fine to medium grained, brown to yellowish-brown to reddish-brown, occasionally gravelly.
MESOZOIC	CRETACEOUS	UPPER (LATE)	EUTAW-LOWER PART (Coffee Member)	0–90'	465–326	K_e	Sand with zones of dark gray clay lenses and/or laminae, fine grained, brown to yellowish-brown to reddish-brown with grays and greens in subsurface, dense, micaceous, glauconitic, gravely near base, generally bedded and cross-bedded, disseminated carbonaceous material, irregular layers of ferruginous sandstone are common in lower part of zone of weathering. Unit lies up section from project proper.
			McSHAN			K_m	Interbedded and interlaminated sand and clay; even bedded to rippled; zones of cross-bedded sand; zones of carbonaceous material; an occasional, probably discontinuous, fine to coarse, gravel bed, sand—fine grained, white to gray to reddish-brown to brown to purple to varicolored green and gray in the subsurface. Occasionally very silty, dense, micaceous to very micaceous, finely glauconitic; clay—soft to stiff, light gray to gray to reddish-brown.
			GORDO (TUSCALOOSA GROUP)			K_t	Gravels, clays, and sands; irregularly bedded, occasional carbanaceous material; gravel—fine to coarse, sandy and/or clayey; clays—soft to predominantly hard, mottled light gray and reddish-brown, zones of imbedded gravel; sand—fine to coarse, brown to yellowish-brown to light gray.

EXHIBIT 1

GENERALIZED GEOLOGIC COLUMN--(Cont)

ERA	PERIOD (Rock) (Time)	SERIES (Rock) EPOCH (Time)	FORMATION	AVERAGE THICKNESS	ELEVATION RANGE	FORMATION AND MEMBER SYMBOL	GENERAL DESCRIPTION
PALEOZOIC	MISSISSIPPIAN	CHESTER	HARTSELLE	64'+	383-308	H_a	Sandstone—massive bedded*, slightly argillaceous, moderately hard, fine grained, light brown; stained brown to dark brown with iron, well sorted, well cemented with silica.
				11'±	363-301	H_b	Sandstone—massive bedded, carbonaceous, moderately hard, fine grained, light gray with numerous paper thin black carbonaceous partings and occasional light gray clayey shale bands.
				5'±	339-297	H_c	Sandstone and shale—interbedded-thin, bedded; sandstone (60%) argillaceous, moderately hard, fine grained, green-gray, occasional cross-bedding, moderately well sorted, and cemented shale (40%) moderately hard to soft, fossiliferous, dark gray.
				8'±	334-289	H_d	Sandstone and shale—as above (H_c), but 60% shale, 40% sandstone.
				46'±	325-256	H_e	Shale-massive bedded, silty, occasionally sandy, moderately hard to soft, fossiliferous, dark gray with occasional light brown or gray moderately hard siltstone bands and nodules.
			GOLCONDA	6'±	280-251	G_a	Limestone—massive bedded, very argillaceous, slightly carbonaceous, silty, moderately hard, very fine, crystalline to dense, very fossiliferous, gray mottled and speckled with white calcite, fossil casts and black carbonaceous fossil casts.
				37'±	268-214	G_b	Shale—massive bedded, silty, moderately hard to soft, fossiliferous, dark gray with occasional brown-gray silty bands.

*Sandstone is massive bedded in the immediate area of the lock; however, the H_a is interbedded with shale in the downstream approach area.

EXHIBIT 1

GENERALIZED GEOLOGIC COLUMN—(Cont)

ERA	PERIOD (Rock) (Time)	SERIES (Rock) EPOCH (Time)	FORMATION	AVERAGE THICKNESS	ELEVATION RANGE	FORMATION AND MEMBER SYMBOL	GENERAL DESCRIPTION
Paleozoic	Mississippian	Chester	GOLCONDA (Cont'd)	11'±	232-210	G_c	Limestone or shale: shale—calcareous, silty, hard, gray; limestone—very argillaceous, hard, dense, dark gray, variably fossiliferous.
				3'±	220-201	G_d	Shale—silty, hard, gray to light gray.
				17'±	212-177	G_e	Shale—gray to dark gray; variably interlaminated with light gray siltstone; occasional light brown siltstone nodules and bands.
			CYPRESS	22'+	177-150	C_a	Shale—hard, gray, interlaminated with light gray siltstone; occasional light brown siltstone nodules and bands.

EXHIBIT 2

SAMPLE ANALYSIS RESULTS

DATE COLLECTED: 4 March 1982
DATE COMPLETED: 10 March 1982

STATION	CONDUCTIVITY UMHOES/CM	pH STD UNITS	ACIDITY MG/L AS CaCO3	SULFATE MG/L	IRON MG/L
R-43 DRAIN	3500	2.6	1985	2600	820
9+50 D* LEFT WALL DRAIN	75	6.1	0	L5	L1***
L-23 EXT	290	7.2	0	80	L1
UC-LMS-1 **	700	7.8	0	L5	1.2
SETTLING POND BETWEEN M. CREEK AND CANAL 13+50 D SE +365	170	9.1	0	L5	0.3
M. CREEK U/S OF DIVERSION CULVERT	110	6.7	0	L5	0.3
SETTLING POND BATCH PLANT DISCHARGE 13+50 1600 D LEFT SIDE OF CHANNEL	180	9.8	0	28	L1
SEEPAGE Ss-Sh AT + EL 360 OPPOSITE R-8 ON LEFT WALL APPROX. 3+20	90	7.0	0	10	L1
R-35 D/S DRAIN HOLE 9+56 D EL 332.6	120	6.5	0	21	0.4
SURFACE STREAM FLOWING BY R.E. OFFICE ORIGINATING FROM HILLSIDE LEFT ABUTMENT AREA	150	6.1	6	L5	0.2
R.E. OFFICE WELL WATER	160	5.9	2	L5	0.1

*Iron had settled on container, reported concentration is low.
**This sample contained detergent.
Algae growing on concrete was identified as genus zygnema (green algae).
***L1 means monolith L1.

IV. EXCAVATION AND TREATMENT FOR DIVERSION CULVERT

4.01 Excavation.--The rock cut for the diversion culvert ranged from approximately 40 feet on either end to 13 feet across the old test quarry floor. Side slopes were 4V on 1H and the bottom width was 15 feet. The floor of the culvert excavation was near the H_b/H_c contact and tended to follow the slight (±4°) downstream dip of the rock, resulting in some excavation below planned grade. A minimum 6-inch thick protective "mud slab" was placed immediately after final foundation cleanup to prevent deterioration of the shale. Some over excavation occurred along the sides where blasting caused back breakage to joint planes. This required removal of loose blocks during cleanup and the use of additional concrete. See diversion culvert foundation map, drawings BSFR-23 and 24.

4.02 Treatment.--Water continuously entered the culvert excavation along bedding planes and vertical joints that terminated at the H_b/H_c contact. Water flows were small, ranging from only seepage to approximately 1 gallon per minute. Before concrete placement, water flows were either pumped down with "dewatering wells" or diverted through drains. The wells consisted of 5-inch diameter drill holes located at some point behind the rock slope and drilled to a point which intersected the water flow, plus 3 to 4 feet. A pump was then installed to draw down the water flow. Drain installations provided a more successful method of water control. Holes were chipped out and perforated pipes set into the point of flow, extending upward above the concrete litt. The holes were then filled with gravel and covered with a sheet of plastic. During concrete placement a "bazooka" type vacuum was attached to the pipe to dry up the foundation. Occasionally, after placing concrete for one monolith, a water flow would appear in an adjacent monolith, requiring additional drain installations. After completion of the diversion culvert, these drain pipes were grouted. See Diversion Culvert Drain Grouting, Table 4, pages 59-60.

The grouting program, in conjunction with the completion of the diversion culvert, had a confining effect on groundwater, with a resulting rise in groundwater elevation in the quarry floor area to the west (elevation top of culvert ±342, elevation quarry floor ±336). Shortly after completion of the culvert, water began flowing from joints 71, 72, and 74 (See drawings BSFR-23 and 24). Additional grout holes were required to dry up the foundation before fill placement could begin. See extra grout hole tabulations for Holes 1E-23E and 1AE-4AE in table 7E on pages 126 and foundation drawing No. BSFR-26.

TABLE 4
GROUTING - DIVERSION CULVERT DRAINS

HOLE	LOCATION	MONOLITH	GROUT TAKE (CF SOLIDS)	DATE GROUTED	REMARKS
A	16+53S, 0+21D	DC-18	1.0	2/8/80	Communicated w/Hole B
B	16+51S, 0+29D	DC-18	0.0	2/11/80	
C	16+59S, 0+14U	DC-16	1.0	2/8/80	Surface leak in creek area
	16+59S, 0+14U	DC-16	0.3	2/11/80	
D	16+60S, 0+19U	DC-16	2.5	2/8/80	Surface leak in creek area
E	16+47S, 0+22D	DC-16	1.1	2/8/80	Surface leak in quarry floor, JT 74
F	16+10S, 1+66D	DC-26	0.0	2/11/80	
G	16+00S, 2+17D	DC-28	0.0	2/11/80	
H	15+98S, 2+25D	DC-29	0.5	2/11/80	Communicated w/Hole I
I	15+94S, 2+43D	DC-30	*	2/11/80	Grouted w/Hole H
J	16+09S, 2+46D	DC-30	5.4	2/11/80	

*Information not available

V. EXCAVATION AND TREATMENT FOR EMBANKMENT

5.01 Overburden.--Approximately 2 feet of topsoil was stripped from the embankment area before placement of filter or rockfill material. On the downstream side of the dam (from Stations 8+50S to 13+50S, and 0+50D to 2+15D) it was necessary to remove up to 6 feet of wet alluvium and replace it with random fill. Excavation was accomplished with endloaders, clam bucket, and dragline.

5.02 Excavation.--The core trench was excavated to top of rock along the centerline of the dam. Overburden slopes were 1V on 1.75H. Minimum bottom width was 20 feet. Excavation of the core trench was divided into two phases:

Overburden excavation on the right side of the lock structure started just west of the old test quarry (approximately Station 14+00S) on 11 July 1979, and progressed toward the right abutment. Material suitable for impervious fill was stockpiled, the rest was hauled to designated disposal areas. Sandbags were placed along the base of overburden slopes to help keep the rock surface clean while the grouting contractor performed his work. Due to the sandy composition of the alluvial material, the slopes were severely eroded and during periods of heavy rain the sandbags were overtopped, requiring additional cleanup. Impervious fill placement started at the right abutment (Station 4+70S) on 17 October 1979.

Between Mackeys Creek and the lock structure, the overburden was completely removed from the embankment area.

The core trench excavation left of the lock structure started on 5 October 1981. Material suitable for use as impervious fill was stockpiled for later use in the dam. Impervious fill placement began early spring of 1982. Slope erosion was not a problem after the commencement of fill placement.

Rock excavation for the embankment and core trench consisted of presplitting all slopes to 4V on 1H in the rockfill sections and 1V on 1H in the core and filter sections. Due to thin bedding and/or jointing in the sandstone, some of these presplit shots produced irregular slope surfaces. Within the core and filter areas, these irregular slopes were formed and covered with concrete fillets to permit better compaction of fill material against them.

In the core trench, one section of thin bedded sandstone (Station 15+35S to 13+80S) that was thought to have been lifted by stage grouting pressures, was removed by presplitting and ripping. See Grouting Discussion, paragraph 5.04 and Impervious Core Foundation, drawing BSFR-26.

5.03 Treatment.--Foundation preparation in the cutoff trench was accomplished by hand labor using picks, shovels, etc. All loose rock was removed. The entire rock surface and joints and fractures were cleaned by the use of compressed air - water blasters. Open joints were cleaned to a depth of at least three times their width and filled with dental grout or concrete. Overhangs were removed by chipping and all vertical faces were sloped to approximately 1V on 1H using dental grout or concrete. See Impervious Core Foundation drawings BSFR-25 thru BSFR-29. Actual and bid dental quantities are shown in Table 5 below.

TABLE 5
DENTAL QUANTITIES

	ACTUAL (FT^3)	ORIGINAL ESTIMATE (FT^3)
Dental Excavation	271	100
Dental Grout	777	100
Dental Concrete	115	100

5.04 Curtain Grouting.--The grout curtain was installed parallel to the axis of the dam, fanning outward at generally a 20° angle (from vertical) from the diversion culvert area toward the respective abutments of the dam. It consists of a single full length grout line with supplemental short lines grouted in limited areas. One line, on centerline of the dam, extends the full length of the dam from Station 4+70S to 26+50S. A second line was installed 10 feet upstream of the centerline across the Mackeys Creek and diversion culvert area, from Station 13+55S to 19+05S. A third grout line was installed 10 feet downstream of the centerline across the Mackeys Creek and diversion culvert areas, from Station 16+35S to 19+05S. The grout holes were drilled at the locations, directions, and depths shown on drawings BSFP-30 thru BSFP-32. Typically, holes were on a 20° angle to a depth of 2 feet below the H_b/H_c geologic contract, or 40 feet, whichever was deeper. The grout curtain was divided into sections of varying lengths to facilitate the contractors operations. Primary holes, on 20-foot spacing, were drilled, water tested, and grouted. Secondary, split-spaced holes, were then drilled regardless of grout takes of the primary holes. Grouting summaries are located in Table 7, pages 82-126.

Foundation grouting was accomplished through a total of 347 drill holes w/14,190 linear feet of rock drilled. There was no grouting through the overburden materials. As evidenced by the low grout takes shown in Table 7, grout summary, the Bay Springs foundation was tight. A total of 1,394 cubic feet of solid materials was used in grouting. The average grout take for all holes was 4.0 cubic feet of solids per hole with averages of 3.31 cubic feet for the primary holes, 4.97 cubic feet for the secondary holes, 1.68 cubic feet for the tertiary holes, 1.05 cubic feet for the quaternary holes, and 3.8 cubic feet for the supplemental holes. Because 13 primary (6 holes) and secondary (7 holes) holes on the 0+00 U/D grout line experienced comparatively high grout takes due to surface leaks or hydraulic jacking (of the rock just beneath the surface), the grout take average has been skewed high and is not reflective of the true average grout take. For example, excluding these 13 holes', grout take for all holes was 1.82 cubic feet with averages of 1.58 cubic feet for the primary holes and 1.20 cubic feet for the secondary holes. The average grout takes per hole for the tertiary holes, the quaternary holes, and the supplemental holes remained the same. With the exception of the 13 grout takes which are not representative, the average grout take per linear foot of hole for all holes was 0.05 cubic feet per linear foot w/an average of 0.03 cubic feet per linear foot for the primary holes, 0.03 cubic feet per linear foot of the secondary holes, 0.04 cubic feet per linear foot of the tertiary holes, 0.03 cubic feet per linear foot of quaternary holes, and 0.24 cubic feet per linear foot of supplemental holes.

During early stages of the grouting program when it became apparent that some changes were necessary, District Office Construction and Engineering Geologists were consulted. Variations in grouting procedures were suggested and used in an attempt to determine a more suitable method. The following paragraphs describe the problems and the corrective actions taken in the grouting program.

Initially all water testing and pressure grouting was done from top of the hole, downstage, without use of a packer. Holes were drilled to a selected stage depth, or until drill water was lost, then pressure tested and grouted. Grout within the hole was washed out before taking a hard set (2-4 hours after placement). Then, after a minimum 24-hour waiting period, drilling resumed and the procedure was repeated for each succeeding stage until bottom of the hole was reached. Work on the grout curtain began at centerline, Station 14+30S, on 2 August 1979. In this area, the upper 6.5 feet of rock was thin bedded sandstone interbedded with weathered shale. This weathered shale appeared to be a highly plastic clay (CH), but laboratory tests show it to be a clayey silt (ML). The upper stages of grout holes were grouted using low pressure, approximately 5 psi. Subsequent stages were water tested and grouted with pressures increasing with depth. It was found that even after first stage grouting had been completed, the upper thin bedded rock would not stand the higher pressures required for the deeper grout stages. At higher pressures (in the 15 to 20 psi range) water or grout penetrated these beds along bedding planes resulting in uplift and possibly fracturing.

The contract was modified to provide for stop grouting to allow grouting deeper portions of the foundation at the higher pressures desired, without subjecting the upper portion to these relatively high pressures. Hole sizes were enlarged from Ex (1 1/4-inch) to Ax (2-inch) size to permit the use of inflatable down hole packers. Another pay item, "Packer Settings," was added to the contract. Grout holes were drilled full depth unless drill water was lost, in which case drilling was stopped to allow for immediate grouting of the area of lost circulation. Holes drilled to full depth were water tested and grouted in successive zones from the bottom up, using correspondingly lower pressures toward top of the hole.

Water test and grout pressures were adjusted to require 1 psi (gauge and static) per foot of packer depth. Holes were considered to have reached refusal when there was no take whatever at three-fourths of the maximum pressure for a given packer setting.

Primary holes 38 through 49 and secondary holes 40A through 49A were stage grouted, all others were stop grouted. It should be noted that most of the grout takes for holes 38 through 49 and 40A through 49A were from surface leaks. This fact is not apparent from the study of grout line drawing BSFR-30.

In the area of the cutoff where it was felt that hydraulic jacking had fractured the foundation, from Station 13+80S to 15+33S, the rock was removed by presplitting and ripping. Presplit holes were drilled on 18-inch centers and loaded with three strands of 60-grain detonating cord only. The thickness of beds removed was approximately 6.5 feet (Elevation 367.5 to 361.0). See impervious core foundation drawing BSFR-26.

In addition to the described grout curtain, other grout holes were added as needed to dry up water seepage within the impervious core zone and to provide additional coverage in the grout curtain. Most of these additional holes were in the old test quarry floor area. See diversion culvert-water problems discussion and tabulation of supplemental grout holes, Table No. 7D, pages 122-125.

Foundation cleanup revealed several holes, drilled prior to construction, which had been left open. All such holes were washed clean and gravity grouted as provided for in the specifications. See open hole grouting, Table No. 7E, page 126.

A Mobile B-53 drill rig was used for most grout hole drilling. On slopes and other areas inaccessible to this truck mounted drill, a Chicago Pneumatic 65 drill was used. Drill bits used included two and three cone roller bits, carbide insert drag bits and diamond plug bits. Drilling with drag bits yielded the greatest productivity in shales and diamond plug bits yielded the greatest productivity in sandstone.

A grout plant was equipped with a moyno type positive displacement pump, a mixing and pumping tub with a mechanical agitator in each to ensure a thorough and uniformly mixed grout. Grout was passed through a sieve before being introduced into the pumping tub. The capacity of this grout plant was not documented.

Grout used was a mixture of Type II Portland cement, GB 100 sodium type bentonite manufactured by Federal Bentonite, and water. Mixes ranged from 5.0 to 1.0 (ratio of water to cement measured by volume). Bentonite was added to equal 5 percent of weight of cement.

Grout takes for each hole are shown on drawings BSFR-30 thru BSFR-32. See Table No. 6 for water pressure test data, pages 66-81. See Table No. 7 for dates of pressure grouting, pages 82-126.

5.05 <u>Drainage Provisions</u>.--During final cleanup of Mackeys Creek bed, a water flow, estimated to be 2 gallons per minute, was issuing from a vertical fracture in the H_C sandstone-shale member. This fracture was within the area of the impervious core and downstream of the previously installed grout curtain.

Two angle holes, drilled through the rock adjacent to the seep area, were pressure grouted in an attempt to seal off the water flow. However, these holes experienced no grout take. Apparently, the source for the water was not intercepted by these holes, as the attempt to eliminate the water flow was unsuccessful.

An alternative plan to control the water seep and to facilitate construction was implemented as follows: A Gradall was used to cut a trench approximately 2 feet deep along the joint and extending upstream to a grout hole at 17+40S, 0+00U/D which had continued to seep water after several attempts of backfilling. The trench extended downstream to the coarse-fine filter contact. A 4-inch perforated drain pipe was laid in the bottom of the trench, covered with 6 to 8 inches of coarse filter material, 1 1/2 to 2 feet of concrete was then placed in the trench covering the drain. A standpipe was installed on either end of the drain pipe and the water flow was kept pumped down until the concrete had set.

One lift of impervious material was placed. The drain was gravity backfilled by pumping 1.0 grout mix into the U/S standpipe until grout returned out the D/S standpipe. Seventy-two bags were used during grouting - some of this leaking out below the concrete at the D/S filter area. After setting overnight, there was still a water flow (estimated to be 1 gallon per minute) from below the concrete in the D/S coarse filter area. When the clay core material was cut back to the template line, the clay-to-concrete and clay-to-rock contact was examined. These areas were dry and a good seal had been obtained. In the clay core zone the water flow was contained beneath the concrete slab and was being diverted into the downstream filters. See foundation map of this area which is located on drawing number BSFR-27.

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT 3)	GAGE PRESSURE (PSI)
1	4+70S	47	0	5
1A	4+80S	47	0.8	5
2	4+90S	47	0	5
2A	5+00S	47	0	5
3	5+10S	47	0	5
3A	5+20S	47	0	5
4	5+30S	47	0	5
4A	5+40S	47	2.8	5
5	5+50S	47	0	5
5A	5+60S	47	3.2	5
6	5+70S	47	0	5
6A	5+80S	47	0	5
7	5+90S	47	0	5
7A	6+00S	47	3.3	5
8	6+10S	47	0	5
8A	6+20S	47	0	5
9	6+30S	47	0	5
9A	6+40S	47	0	5
10	6+50S	47	0	5
10A	6+60S	47	0.5	5
11	6+70S	47	0	5
11A	6+80S	47	0	5
12	6+90S	47	0	5
12A	7+00S	47	0	5
13	7+10S	50	0.3	5
13A	7+20S	47	0	5
14	7+30S	50	0	5
14A	7+40S	47	0	5
15	7+50S	0-50	9.6	5
		6-50	4.0	5
		20-50	4.0	5
15A	7+60S	47	0	5
16	7+70S	50	0	5
16A	7+80S	0-50	0	5
		15-50	0	10
		27-50	0	15
17	7+90S	0-50	0	5
		15-50	0	10
		27-50	0	15
17A	8+00S	0-50	0	5
		15-50	0	10
		27-50	0	15

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT 3)	GAGE PRESSURE (PSI)
18	8+10S	0-50	0	5
		15-50	0	10
		27-50	0	15
18A	8+20S	0-50	0	5
		15-50	0	10
		27-50	0	15
19	8+30S	0-50	0	5
		15-50	0	10
		30-50	0	15
19A	8+40S	0-50	0	5
		15-50	0	10
		27-50	0	15
20	8+50S	0-50	0	5
		15-50	0	10
		30-50	0	15
20A	8+60S	0-51	0	5
		15-51	0	10
		27-51	0	15
21	8+70S	0-50	0.5	5
		15-50	0	10
		30-50	0	15
21A	8+80S	0-51	0	5
		15-51	0	10
		27-51	0	15
22	8+90S	0-50	0	5
		15-50	0	10
		30-50	0	15
22A	9+00S	0-51	0	5
		15-51	0	10
		27-51	0	15
23	9+10S	0-50	0.8	5
		15-50	0	10
		30-51	0	15
23A	9+20S	0-51	1.4	5
		15-51	1.3	10
		27-51	0	15
24	9+30S	0-51	0	5
		15-51	0	10
		30-51	0	15
24A	9+40S	0-50	0	5
		15-50	0	10
		27-50	0	15

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT 3)	GAGE PRESSURE (PSI)
25	9+50S	0-51	0	5
		15-51	0	10
		30-51	0	15
25A	9+60S	0-51	0.1	5
		15-51	0	10
		27-51	0	15
26	9+70S	0-50.5	0	5
		15-50.5	0	10
		30-50.5	0	15
26A	9+80S	0-51	0.1	5
		15-51	0	10
		27-50	0	15
27	9+90S	0-51	0	5
		15-51	0	10
		30-51	0	15
27A	10+00S	0-51	0.1	5
		15-51	0	10
		30-51	0	15
28	10+10S	0-51	0	5
		15-51	0	10
		30-51	0	15
28A	10+20S	0-51	0	5
		15-51	0	10
		27-51	0	15
29	10+30S	0-51	0	5
		15-51	0	10
		30-51	0	15
29A	10+40S	0-51	0	5
		15-51	0	10
		27-51	0	15
30	10+50S	0-51	0	5
		15-51	0	10
		30-51	0	15
30A	10+60S	0-51	0	5
		15-51	0	10
		27-51	0	15
31	10+70S	0-51	0	5
		15-51	0	10
		30-51	0	15
31A	10+80S	0-51	0	5
		15-51	0	10
		27-51	0	15

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
32	10+90S	0-10	0	5
		0-15	0	10
		0-51	0	10
32A	11+00S	0-51	0	5
		15-51	0	10
		27-51	0	15
33	11+10S	0-10	0	5
		0-51	0	5
		15-51	0	10
		30-51	0	10
33A	11+20S	0-51	0	5
		15-51	0	10
		27-51	0	15
34	11+30S	0-10	0	8
		0-50	0	5
		15-50	0	10
		30-50	0	10
34A	11+40S	0-15	0	5
		15-50	0	10
		27-50	0	15
35	11+50S	0-10	0	5
		0-52	0	5
		15-52	0	10
		30-52	0	10
35A	11+60S	0-52	0	5
		15-52	0	10
		30-52	0	15
36	11+70S	0-10	0	5
		0-52	0	5
		15-52	0	10
		30-52	0	10
36A	11+80S	0-51	0	5
		15-51	0	10
		27-51	0	15
37	11+90S	0-10	0	5
		0-52	0	5
		15-52	0	10
		30-52	0	10

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT ^{3})	GAGE PRESSURE (PSI)
37A	12+00S	0-51	0	5
		15-51	0	10
		27-51	0	15
38	12+10S	0-10	0	5
		0-52	1.1	8
38A	12+20S	0-52	0	5
		15-52	0	10
		27-52	0	15
39	12+30S	0-10	0	5
		0-51	0.2	6
39A	12+40S	0-51	0	5
		15-51	0	10
		27-51	0	15
40	12+50S	0-10	0	5
		0-30	0.6	5
		0-30	0.9	10
		0-30	2.9	17
		0-50	6.0	25
40A	12+60S	0-10	0	8
		4.5-50	4.1	20
41	12+70S	0-10	0	5
		0-30	0.5	5
		0-50	4.5	25
41A	12+80S	0-10	3.2	8
		4.5-50	0.9	28
42	12+90S	0-10	0	5
		0-30	2.4	5
		0-51	0	25
42A	13+00S	0-10	1.4	8
		0-50	0	8
43	13+10S	0-10	0.15	5
		0-30	0	5
		0-30	0	5
		0-30	0	10
		0-30	2.8	17
		0-51	6.0	25
43A	13+20S	0-10	3.8	8
		0-50	0	8
44	13+30S	0-10	0.1	5
		0-30	0	5
		0-30	0.3	10
		0-51	6.4	25

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
44A	13+40S	0-10	0	8
		0-50	6.4	28
45	13+50S	0-10	0	5
		0-30	0	5
		0-30	0	10
		0-30	0	17
		0-50	0	25
45A	13+60S	0-10	1.2	8
		0-50	8.0	28
46	13+70S	0-10	0	5
		0-30	0	5
		0-30	0	10
		0-30	0	17
		0-50	0	25
46A	13+80S	0-10	5.0	8
		0-50	7.5	28
47	13+90S	0-37	1.5	5
		0-50	4.1	25
47A	14+00S	0-10	4.7	8
		0-50	no record	
48	14+10S	0-37	0	5
		0-37	2.6	20
		0-50	3.5	25
48A	14+20S	0-10	0	8
		0-50	7.9	28
49	14+30S	0-37	1.0	5
		0-50	2.6	25
49A	14+40S	0-10	0	8
		0-50	3.0	20
		0-50	6.0	25
50	14+50S	0-37	0.1	5
		0-50	0.3	8
50A	14+60S	0-43	3.0	5
		15-43	0	8
51	14+70S	0-43	0.6	5
51A	14+80S	0-43	0	5
52	14+90S	0-43	0.5	5
52A	15+00S	0-43	0.4	5
53	15+10S	0-43	3.3	5
		17-43	0	5
		27-43	0	5

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT ^{3})	GAGE PRESSURE (PSI)
53A	15+20S	0-43	3.2	5
54	15+30S	0-43	3.9	5
		27-43	0	5
54A	15+40S	0-43	2.9	5
55	15+50S	0-43	1.2	5
55A	15+60S	0-43	3.4	5
56	15+70S	0-43	7.6	2
		[illegible]-43	0	5
56A	15+80S	0-43	[illegible].9	5
57	15+90S	[illegible]	0	5
57A	16+00S	0-43	1.7	5
[illegible]	16+10S	0-43	2.2	5
		[illegible]-43	0	5
		[illegible]		15
[illegible]	16+20S	[illegible]	[illegible]	5
[illegible]	16+30S	[illegible]	[illegible]	5
[illegible]	16+40S	[illegible]	0	5
[illegible]	16+[illegible]	0-43	3.0	5
		10-43	.6	5
60A	16+60S	0-43	0	5
61	16+70S	6-43	2.4	5
		17-43	0	5
61A	16+80S	0-43	7.6	5
		16-43	1.3	10
62	16+90S	9-38	2.2	5
		30-38	0	5
62A	17+00S	0-43	1.3	2
		5-43	1.5	5
		10-43	1.4	10
63	17+10S	0-43	4.3	5
		5-43	0	5
63A	17+20S	0-43	1.4	5
		2.5-43	2.4	5
		10-43	0	5
64	17+30S	0-43	3.1	5
		10-43	2.1	5
64A	17+40S	0-43	0.8	3
		5-43	0	5
65	17+50S	0-43	1.6	5
		10-43	2.2	5
		20-43	2.8	5

TABLE 6

PRESSURE TEST DATA:

0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
65A	17+60S	0-43	0.1	
66	17+70S	0-43	6.0	0
		10-43	0	5
66A	17+80S	0-43	3.7	5
		2.5-43	0	5
67	17+90S	0-43	0.5	5
67A	18+00S	0-43	0	5
68	18+10S	0-43	6.9	0
		10-43	0	5
68A	18+20S	0-43	1.6	5
		2.5-43	0.1	5
69	18+30S	0-43	0.1	5
69A	18+40S	0-43	0	5
70	18+50S	0-43	0.8	5
70A	18+60S	0-43	2.2	5
		7-43	1.7	5
71	18+70S	0-43	8.0	0
		5-43	3.0	5
71A	18+80S	3-43	0	5
72	18+90S	0-48	0.1	5
		13-48	0.1	7
72A	19+00S	0-48	0.4	5
		15-48	0	10
		30-48	0	15
73	19+10S	0-44	1.3	5
		15-44	1.2	10
		30-44	0	15
73A	19+20S	0-48	0.2	5
		15-48	0	10
		30-48	0	15
74	19+30S	0-48	0.1	5
		15-48	0	10
		30-48	0	15
74A	19+40S	0-48	0	5
		15-48	1.5	10
		30-48	1.9	15
75	19+50S	0-48	0.2	5
		15-48	0	10
		30-48	0	15
75A	19+60S	0-48	0.2	5
[illegible]	19+70S	0-48	7.6	5
			0	7

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
76A	19+80S	0-48	0	5
77	19+90S	0-48	0.6	5
77A	20+00S	0-48	0	5
78	20+10S	0-48	0.9	5
78A	20+20S	0-48	1.1	5
		15-48	0	10
79	20+30S	0-48	0.9	5
79B	20+40S	0-30	0.4	5
79A	20+42S	0-40	5.8	5
		15-40	0	10
79C	20+48S	0-30	0	5
80	20+52S	0-40	0	5
80A	20+62S	0-18	4.0	5
		3-18	0	5
81	20+73S	0-40	0	5
81A	20+83S	0-40	0	5
82	20+92S	0-40	0	5
82A	21+02S	0-40	0	5
83	21+11S	0-40	0	5
83A	21+20S	0-45	2.2	5
		2-45	1.1	5
		5-45	0	5
84	21+30S	0-45	4.6	5
		15-45	1.3	8
		30-45	0.4	15
84A	21+40S	0-45	0.2	5
85	21+50S	0-45	4.0	5
85A	21+60S	0-45	0.4	5
86	21+70S	0-45	4.0	5
		15-45	0	8
86A	21+80S	0-45	6.0	5
		15-45	0	8
87	21+90S	0-45	2.2	5
		15-45	0	8
87A	22+00S	0-45	2.3	5
		15-45	0.16	10
		30-45	0	15
88	22+10S	0-45	0.9	5
88A	22+20S	0-40	0.1	5
89	22+31.5S	0-40	2.0	5
		15-40	0	10

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT ^{3})	GAGE PRESSURE (PSI)
89A	22+41S	0-26	0.1	5
90	22+52.5S	0-40	0.3	5
90A	22+61.5S	7-40	0	5
91	22+72S	0-40	0	5
91A	22+81.5S	0-40	0	5
92	22+89.5S	0-40	1.6	5
		15-40	0	10
92B	22+98S	0-20	8.8	5
92A	23+00S	0-30	8.6	5
		0-45	3.9	5
92C	23+06S	0-40	6.5	5
93	23+10S	0-25	8.2	5
		15-25	10.0	10
		20-25	8.6	10
		25-48	3.8	10
		0-48	4.9	5
93E	23+15S	0-40	4.0	5
93A	23+20S	0-45	7.6	5
		15-45	7.3	10
		30-45	5.1	15
94	23+30S	0-10	8.4	5
		3-21	8.3	5
		2-33	7.7	5
		5-48	3.3	5
94A	23+40S	0-43	3.3	5
		17-43	6.5	10
		30-43	2.7	15
95	23+54.5S	0-48	4.9	5
		15-48	2.8	10
		30-48	0	15
95A	23+60S	2-40	1.0	5
		12-40	0	7
96	23+70S	2-47	2.9	5
		30-47	4.1	17
96A	23+80S	2-60	0.7	5
		30-60	0.4	17
97	23+90S	2-60	2.4	5
		30-60	1.4	17
97A	24+00S	2-60	0.2	5
		30-60	0.5	17

TABLE 6

PRESSURE TEST DATA:

0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT 3)	GAGE PRESSURE (PSI)
98	24+10S	30-60	0	5
		30-60	0.1	17
98A	24+20S	2-60	1.2	5
		30-60	1.7	17
99	24+30S	2-60	0.6	5
		30-60	0.3	17
99A	24+40S	2-60	0	5
		30-60	0	17
100	24+50S	2-61	0.4	5
		30-61	0.4	17
100A	24+60S	2-54.5	0.1	5
		30-54.5	0.1	17
101	24+70S	2-61	0.4	5
		28-61	0.3	15
101A	24+80S	2-60	2.9	5
		30-60	5.2	17
102	24+90S	2-64	0.5	5
		30-64	0.2	17
102A	25+00S	2-60	0.4	5
		15-60	0.7	8
103	25+10S	7-62	0.3	5
		30-62	0.3	17
103A	25+20S	2-60	0.5	5
		30-60	0.8	17
104	25+30S	2-60	0.25	4
		28-60	0	15
104A	25+40S	2-60	0.3	5
		30-60	0.1	17
105	25+50S	1.5-61	4.3	5
		30-61	2.0	17
105A	25+60S	2-60	0.3	5
		30-60	0.3	17
106	25+70S	2-60	0.7	5
		28-60	0.4	15
106A	25+80S	2-60	0.5	5
		30-60	0.6	17
107	25+90S	1.5-64	0.7	5
		30-60	0.4	17
107A	26+00S	2-60	0.2	5
		30-60	0.3	17

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
108	26+10S	2-65	3.9	5
		30-65	4.3	17
108A	26+20S	2-60	0.05	5
		30-60	0.1	17
109	26+30S	2-65	5.0	5
		45-65	8.5	7
109B	26+30S	2-60	0.7	5
	0+01U	30-60	1.1	17
109A	26+40S	2-60.5	0.6	5
		30-60.5	0.5	17
110	26+50S	2-65	2.0	5
		30-65	1.1	17

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT ^{3})	GAGE PRESSURE (PSI)
1-0	13+55S	0-45	2.2	5
1-1	13+65S	0-45	2.4	5
1-1A	13+85S	0-43	0	5
1-2	13+95S	0-43	0.4	5
1-2A	14+05S	0-43	0	5
1-3	14+15S	0-43	0.7	5
1-3A	14+25S	0-43	0	5
1-4	14+35S	0-43	0.3	5
1-4A	14+45S	0-43	0	5
1-5	14+55S	0-43	1.1	5
1-5A	14+65S	0-43	0	5
1-6	14+75S	0-43	0	5
1-6A	14+85S	0-43	2.8	5
1-7	14+95S	0-43	1.9	5
1-7A	15+05S	0-43	0.5	5
1-8	15+15S	0-43	1.5	5
1-8A	15+25S	0-43	3.4	5
1-9	15+35S	0-43	5.0	5
1-9A	15+45S	0-43	2.5	5
1-10	15+55S	0-43	0.2	5
1-10A	15+65S	0-42	0	5
1-11	15+75S	0-43	4.4	5
1-11A	15+85S	0-42	1.4	5
1-12	15+95S	0-42	4.5	5
1-12A	16+05S	0-42	0	5
1-13	16+15S	0-42	0	5
1-13A	16+25S	0-42	0	5
1-14	16+35S	0-42	3.5	5
		2-42	0	5
1-14A	16+45S	0-43	0	5
1-15	16+55S	0-43	4.4	5
1-15A	16+65S	0-43	0.9	5
1-16	16+85S	0-43	0	5
1-17	17+05S	0-43	0	3
		2-43	0	5
		0-43	0.3	10
1-18	17+25S	0-43	0	5
		10-43	0	10
1-18A	17+35S	0-43	4.9	3
		2-43	0	5
		5-43	0	5

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
1-19	17+45S	9-43	0.4	5
1-19A	17+55S	0-43	0	5
1-20	17+65S	0-43	0.6	5
		2-43	0.5	5
		5-43	0	5
1-21	17+85S	10-43	0	10
		5-43	0	5
		2-43	0.5	5
		0-43	1.0	5

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT^3)	GAGE PRESSURE (PSI)
1-19	17+45S	9-43	0.4	5
1-19A	17+55S	0-43	0	5
1-20	17+65S	0-43	0.6	5
		2-43	0.5	5
		5-43	0	5
1-21	17+85S	10-43	0	10
		5-43	0	5
		2-43	0.5	5
		0-43	1.0	5
1-22	18+05S	0-43	6.0	0
		2-43	0	5
		10-43	0	10
1-23	18+25S	0-43	6.0	0
		2-43	0	5
		10-43	0	10
1-23A	18+35S	0-43	0.9	5
1-24	18+45S	0-43	0	5
1-24A	18+55S	2-43	0.1	5
1-25	18+65S	0-43	0.6	5
1-25A	18+75S	0-43	0	5
1-26	18+85S	0-43	0	5
1-26A	18+95S	0-43	0.1	5
		15-43	0.1	10
		30-43	1	15
1-27	19+05S	3-42	1.1	5
		15-42	0	10
		30-42	0	15

TABLE 6
PRESSURE TEST DATA:
0+00UD GROUT LINE (Cont)

HOLE NO.	LOCATION	STAGE DEPTH (FT)	TAKE IN 5 MIN. (FT ^{3})	GAGE PRESSURE (PSI)
2-1	16+35S	0-42	4.1	5
2-1A	16+45S	0-43	0	5
2-2	16+55S	0-43	0.9	5
2-2A	16+65S	0-43	0.3	5
2-3	16+85S	0-43	0.1	5
2-4	17+05S	0-43	0	5
2-5	18+25S	0-43	0	5
2-5A	18+35S	0-43	0	5
2-6	18+45S	0-43	0.2	5
2-6A	18+55S	0-43	8.0	0
		5-43	0	5
2-7	18+65S	0-43	0	5
2-7A	18+75S	0-43	8.0	0
		5-43	0	5
2-8	18+85S	0-43	0	5
2-8A	18+95S	0-48	0.4	5
		15-48	0	10
		30-48	0	15
2-9	19+05S	0-48	0.5	5
		15-48	0	10
		30-48	0.3	15

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = [illegible] STOP = *
1	4+70S	362.8	318.6	10/08/79	10/08/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
1A	4+80S	363.0	318.8	10/09/79	10/09/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
2	4+90S	363.1	318.9	10/08/79	10/08/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
2A	5+00S	363.2	319.0	10/09/79	10/09/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
3	5+10S	363.4	319.1	10/08/79	10/08/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
3A	5+20S	363.3	319.1	10/09/79	10/09/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
4	5+30S	365.2	321.0	10/08/79	10/08/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
4A	5+40S	365.1	320.9	10/09/79	10/09/79	N 86°W	20	0–47	0.15		*
								15–47	0		
								27–47	0	0.15	
5	5+50S	365.1	320.9	10/02/79	10/04/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
5A	5+60S	365.1	320.9	10/09/79	10/09/79	N 86°W	20	0–47	0.15		*
								15–47	0		
								27–47	0	0.15	
6	5+70S	365.2	321.0	10/02/79	10/04/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
6A	5+80S	365.3	321.1	10/08/79	10/09/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
7	5+90S	365.5	321.3	10/02/79	10/04/79	N 86°W	20	0–47	0		*
								15–47	0		
								27–47	0	0	
7A	6+00S	365.0	320.8	10/08/79	10/09/79	N 86°W	20	0–47	0.15		*
								15–47	0		
								27–47	0	0.15	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
8	6+10S	364.5	320.3	10/02/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
8A	6+20S	364.0	319.8	10/08/79	10/09/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
9	6+30S	364.0	319.8	10/01/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
9A	6+40S	364.2	320.0	10/08/79	10/09/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
10	6+40S	364.5	320.3	10/01/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
10A	6+60S	364.5	320.3	10/08/79	10/09/79	N 86°W	20	0-47	0.45		*
								15-47	0		
								27-47	0	0.45	
11	6+70S	364.7	320.5	10/01/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
11A	6+80S	364.8	320.6	10/05/79	10/09/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
12	6+90S	364.9	320.[illegible]	10/01/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
12A	7+00S	365.0	320.8	10/05/79	10/09/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
13	7+10S	365.1	318.1	09/28/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
13A	7+20S	365.3	321.1	10/05/79	10/08/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
14	7+30S	365.4	318.4	09/28/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
14A	7+40S	365.5	321.3	10/05/79	10/08/79	N 86°W	20	0-47	0		*

TABLE 7A

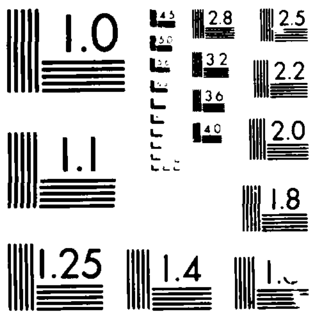
GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
[illegible]	[illegible]	365.6	318.6	09/12/79	10/04/79	N 86°W	20	0-47	0.5+		*
								15-47	2.1		
								27-47	1.4	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	10/05/79	10/08/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	09/11/79 09/12/79	10/04/79	N 86°W	20	0-47	0		*
								15-47	0		
								27-47	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	09/20/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	09/11/79	N 86°W	20	0-50	0		*
								15-50	0.9		
								30-50	0	0.9	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	

* [illegible] Grout Hole 15

AD-A191 507 BAY SPRINGS LOCK AND DAM FOUNDATION COMPLETION REPORT 2/5
TENNESSEE-TOMBIGBEE..(U) CORPS OF ENGINEERS NASHVILLE
TN NASHVILLE DISTRICT P ROSS ET AL. AUG 87

UNCLASSIFIED F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = [illegible] STOP = *
18	8+10S	366.1	319.1	09/07/79	09/11/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	
18A	8+20S	366.5	319.5	09/20/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
19	8+30S	366.9	319.9	09/07/79	09/11/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	
19A	8+40S	366.9	319.9	09/19/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
20	8+50S	367.3	320.3	09/07/79	09/11/79	N 86°W	20	0-50	0.15+		*
								15-50	0		
								30-50	0	0.15	
20A	8+60S	367.0	319.0	09/19/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
21	8+70S	367.4	320.4	09/07/79	09/11/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	

+ Slight Grout Leak at Top of Hole

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
21A	8+80S	366.2	318.2	09/19/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
22	8+90S	366.0	319.0	09/06/79	09/11/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	
22A	9+00S	366.5	318.3	09/19/79	09/26/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
23	9+10S	366.5	319.5	09/06/79	09/11/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	
23A	9+20S	367.0	320.0	09/12/79	09/26/79	N 86°W	20	0-51	+		*
								15-51	0		
								25-51	0	0	
24	9+30S	367.5	319.5	09/06/79	09/11/79	N 86°W	20	0-50	0 .7		*
								15-50	0		
								30-50	0	0.7	

+ Numerous Small Surface Leaks - Otherwise No Grout Take

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
24A	9+40S	368.5	321.5	09/12/79	09/26/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
25	9+50S	368.3	320.3	08/28/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-51	0	0	
25A	9+60S	368.3	320.3	09/06/79	09/06/79	N 86°W	20	4-51	0		*
								15-51	0		
								27-51	0	0	
26	9+70S	367.3	319.8	08/28/79	08/29/79	N 86°W	20	0-50	0		*
								15-50	0		
								30-50	0	0	
26A	9+80S	367.2	319.2	09/05/79	09/06/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
27	9+90S	367.8	319.8	08/28/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-50	0	0	
27A	10+00S	368.2	320.2	09/05/79	09/07/79	N 86°W	20	0-51	3.0 +		*
								15-51	0		
								27-51	0	3.0	

+ Surface Leak Through Joints in Rock

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
28	10+10S	368.2	319.7	08/24/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-51	0	0	
28A	10+20S	369.1	320.2	09/05/79	09/07/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
29	10+30S	368.0	320.0	08/24/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-51	0	0	
29A	10+40S	367.8	319.8	09/05/79	09/07/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
30	10+50S	368.0	320.0	08/24/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-51	0	0	
30A	10+60S	369.4	321.4	09/05/79	09/07/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
31	10+70S	368.3	320.3	08/24/79	08/29/79	N 86°W	20	0-51	0		*
								15-51	0		
								30-51	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
31A	10+80S	368.4	320.4	09/04/79	09/07/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
32	10+90S	368.4	320.8	08/14/79	08/20/79	N 86°W	20	1-10	0		@
				08/23/79	08/29/79			0-51	0		
				08/24/79				15-51	0		
								30-51	0	0	
32A	11+00S	368.8	320.8	09/04/79	09/07/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
33	11+10S	368.1	320.6	08/14/79	08/20/79	N 86°W	20	1-10	0		@
				08/23/79	08/29/79			0-50	0		
								15-50	0		
								30-50	0	0	
33A	11+20S	368.4	320.9	09/04/79	09/07/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
34	11+30S	368.1	321.1	08/14/79	08/20/79	N 86°W	20	1-10	0.15		@
				08/23/79	08/29/79			0-50	0		
								15-50	0		
								30-50	0	0.15	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	LOCATION	T.R. & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
34A	11+40S	368.4	320.9	09/04/79	09/07/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
35	11+50S	368.9	320.0	08/13/79	08/20/79	N 86°W	20	1-10	0		@/*
				08/23/79	08/29/79			0-52	0		
								15-52	0		
								30-52	0	0	
35A	11+60S	368.9	320.0	08/30/79	09/04/79	N 86°W	20	0-52	0		*
								15-52	0		
								27-52	0	0	
36	11+70S	369.1	320.2	08/13/79	08/28/79	N 86°W	20	1-10	0		@/*
				08/23/79	08/29/79			0-52	0		
								15-52	0		
								30-52	0	0	
36A	11+80S	369.1	321.6	08/30/79	09/04/79	N 86°W	20	0-50	0		*
								15-50	0		
								27-50	0	0	
37	11+90S	369.2	320.3	08/13/79	08/20/79	N 86°W	20	1-10	0		@/*
				08/23/79	08/29/79			0-52	0		
								15-52	0		
								30-52	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
37A	12+00S	369.3	321.4	08/30/79	09/04/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
38	12+10S	369.4	320.5	08/13/79	08/20/79	N 86°W	20	1-10	0		@ *
				08/22/79	08/29/79			0-52	0	0	
38A	12+20S	369.5	320.6	08/30/79	09/04/79	N 86°W	20	0-52	0		*
								15-52	0		
								27-52	0	0	
39	12+30S	369.5	321.6	08/13/79	08/20/79	N 86°W	20	0-51	0		@/*
				08/21/79	08/29/79			1-10	0	0	
39A	12+40S	369.5	321.6	08/30/79	09/04/79	N 86°W	20	0-51	0		*
								15-51	0		
								27-51	0	0	
40	12+50S	369.5	322.5	08/02/79	08/02/79	N 86°W	20	0-50	65.5+		@
				08/03/79	08/07/79			0-30	2.4++		
				08/09/79	08/10/79			0-10	0	67.9	

+Grout leaked at clay seams near surface
++Minor grout leak at surface

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
40A	12+60S	368.0	321.0	08/15/79	08/20/79	N 86°W	20	1-10	0.6		@
				08/21/79	08/27/79			1-50	0	0.6	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
41	12+70S	368.7	321.2	08/02/79	08/02/79	N 86°W	20	0-10	0		@
				08/03/79	08/07/79			0-30	0.5		
				08/09/79	08/10/79			0-50	2.1	2.6	
41A	12+80S	368.5	321.5	08/20/79	08/21/79	N 86°W	20	0-10	2.4		@
				08/27/79	08/21/79			0-50	0	2.4	
42	12+90S	368.8	320.8	08/02/79	08/02/79	N 86°W	20	0-10	0		@
				08/06/79	08/07/79			0-30	1.1		
				08/08/79	08/10/79			0-51	0	1.1	
42A	13+00S	367.7	320.7	08/15/79	08/20/79	N 86°W	20	1-10	1.4		@
				08/22/79	08/27/79			1-50	0.15	1.55	
43	13+10S	368.8	320.7	08/01/79	08/02/79	N 86°W	20	0-10	0		@
				08/06/79	08/07/79			+0-30	4.3		
				08/08/79	08/10/79			+0-51	1.4	5.7	
+ Grout Leak at Clay Seam Near Hole 42 and in Grout Line											
43A	13+20S	368.8	321.8	08/15/79	08/20/79	N 86°W	20	1-10	2.4		@
				08/22/79	08/27/79			1-50	0.3	2.7	
44	13+30S	369.0	321.0	08/01/79	08/02/79	N 86°W	20	0-10	0		@
				08/06/79	08/07/79			0-30	4.3		
				08/08/79	08/10/79			0-51	4.9	9.2	
44A	13+40S	368.4	321.4	08/15/79	08/20/79	N 86°W	20	0-10	0		@
				08/22/79	08/27/79			1-50	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
45	13+50S	368.0	320.8	08/01/79 08/06/79 08/08/79	08/02/79 08/10/79	N 86°W	20	0-10 1-50	0 0	0	@
45A	13+60S	367.9	320.9	08/17/79 08/21/79	08/20/79 08/27/79	N 86°W	20	1-10 1-50	7.6+ 0.3	7.9	@
+ Hydraulic Jacking Occurred Near Top of Rock											
46	13+70S	368.2	321.1	08/01/79 08/06/79 08/08/79	08/02/79 08/10/79	N 86°W	20	0-10 0-50	0 0	0	@
46A	13+80S	368.2	321.1	08/17/79 08/21/79	08/20/79 08/27/79	N 86°W	20	1-10 1-50	0.3 37.6+	37.9	@
+ Hydraulic Jacking Occurred Near Top of Rock; Jacked Rock Removed - See Drawing BSFR-30											
47	13+90S	368.2	320.9	07/31/79 08/08/79	08/02/79 08/10/79	N 86°W	20	0-37 0-50	+		@
+ Grout Holes 47, 48, 49, 50 Have a Composite Take of 169.8 Ft^3, Hydraulic Jacking Occurred Near Top of Rock. Jacked Rock Removed Per Drawing BSFR-30											
47A	14+00S	368.2	321.2	08/17/79 08/21/79	08/20/79 08/27/79	N 86°W	20	1-10 1-50	1.1 86.0+	87.1	@
+ Hydraulic Jacking Occurred Near Top of Rock; See Drawing BSFR-30											

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
48	14+10S	368.0	320.7	07/31/79 08/07/79	08/02/79 08/10/79	N 86°W	20	0-37 0-50	+	+	@
+ See Note for Grout Hole No. 47											
48A	14+20S	368.0	321.0	08/17/79 08/21/79	08/20/79 08/27/79	N 86°W	20	1-10 1-50	0 +167.6	167.6	@
+ Hydraulic Jacking Occurred Near Top of Rock; See Drawing BSFR-30.											
49	14+30S	368.0	320.7	07/30/79 08/07/79	08/02/79 08/10/79	N 86°W	20	0-37 0-53	+	+	@
49A	14+40S	368.2	321.2	08/1/79 08/21/79	08/20/79 08/23/79 08/24/79	N 86°W	20	1-10 1-50	0 +219.3	219.3	@
50	14+50S	365.1	321.1	07/31/79 08/07/79	08/10/79	N 86°W	20	0-50	+	+	@
+ See Note for Hole No. 47											
50A	14+60S	362.3	321.9	10/22/79	10/23/79	N 86°W	20	0-43 15-43 27-43	0.75 0 0	0.75	@

TABLE 7A
GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
51	14+70S	362.3	319.3	10/18/79	10/19/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
51A	14+80S	362.4	322.0	10/22/79	10/23/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
52	14+90S	362.8	322.4	10/17/79	10/19/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
52A	15+00S	362.8	322.4	10/22/79	10/23/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
53	15+10S	363.1	322.8	10/17/79	10/19/79	N 86°W	20	0–43	1.5		*
								15–43	0		
								27–43	0	1.5	
53A	15+20S	363.2	320.2	10/22/79	10/23/79	N 86°W	20	0–43	1.0		*
				10/23/79				15–43	0		
								27–43	0	1.0	
54	15+30S	363.5	323.1	10/18/79	10/19/79	N 86°W	20	0–43	1.7		*
								15–43	0		
								27–43	0	1.7	

TABLE 7A
GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
54A	15+40S	356.7	316.3	10/22/79	10/23/79	N 86°W	20	0–43	0.15		*
								15–43	0		
								27–43	0	0.15	
55	15+50S	346.0	305.6	10/18/79	10/19/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
55A	15+60S	336.4	296.0	10/31/79	11/1/79	N 86°W	20	0–43	8.6		*
								15–43	0		
								27–43	0	8.6	
56	15+70S	336.4	296.0	10/29/79	10/30/79	N 86°W	20	0–43	16.9		*
								15–43	0		
								27–43	0	16.9	
56A	15+80S	336.4	296.0	10/31/79	11/1/79	N 86°W	20	0–43	1.1		*
								15–43	0		
								27–43	0	1.1	
57	15+90S	336.4	296.0	10/29/79	10/30/79	N 86°W	20	0–43	0		*
								15–43	0		
								27–43	0	0	
57A	16+00S	336.4	296.0	10/31/79	11/1/79	N 86°W	20	0–43	5.45		*
								15–43	0		
								27–43	0	5.45	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
58	16+10S	336.5	296.1	10/29/79	10/30/79	N 86°W	20	0-43	1.5		*
								15-43	0		
								27-43	0	1.5	
58A	16+20S	336.6	296.0	11/01/79	11/01/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
59	16+30S	336.4	296.0	10/16/79 10/17/79	10/30/79	N 86°W	20	3-43	1.6		*
								15-43	0		
								27-43	0	1.6	
59A	16+40S	336.5	306.5	11/01/79	11/01/79	N 86°W	20	0-30	0		*
								15-30	0		
								27-30	0	0	
60	16+50S	327.9	287.5	10/15/79	10/30/79	N 86°W	20	2-43	0		*
								15-43	0		
								27-43	0	0	
60A	16+66S	336.7+	293.7	05/21/80	05/21/80		VERT	0-43	0	0	*
+ Surface Elevation Taken From Hole No. 61											
61	16+75S	336.7	296.3	10/16/79	10/30/79	N 86°W	20	2-43	2.5		*
								15-43	0		
								27-43	0	2.5	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
61A	16+80S	336.7+	296.3	05/12/80	05/14/80	N 86°W	20	0–43	67.7	67.7	*
+ Elevation Taken From Hole No. 61A											
62	16+89S	336.7	301.0	04/29/80 04/30/80	05/05/80 05/14/80	N 86°W	20	0–38	9.8	9.8	*
62A	17+00S	328±	285±	05/13/80	05/14/80	N 86°W	20	0–43 5–43	0 0	0	*
63	17+10S	324.6	284.2	04/30/80	05/05/80	N 86°W	20	0–43	0.3	0.3	*
63A	17+20S	322.0	281.7	05/06/80	05/07/80	N 86°W	20	0–43 3–43	2.1 1.1	3.2	*
64	17+30S	321.4	279.1	04/03/80	05/05/80	N 86°W	10	0–43	0.2	0.2	*
64A	17+40S	321.0	236.4	05/06/80	05/07/80	N 86°W	5	2–43	0	0	*
65	17+50S	321.0	278.0	05/01/80	05/02/80		VERT	0–43 10–43 20–43	0.2 3.2 1.6	5.0	*

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
65A	17+60S	321.2	278.9	05/06/80	05/07/80	S 86°E	5	0-43	0	0	*
66	17+70S	321.1	278.8	05/01/80	05/02/80	S 86°E	10	0-43	34.4	34.4	*
66A	17+80S	323.0	281.5	05/06/80	05/07/80	S 86°E	15	0-43	3.2	3.2	*
67	17+90S	322.8	282.4	05/01/80	05/02/80	S 86°E	20	0-43	0.1	0.1	*
67A	18+00S	322.8	282.4	05/07/80	05/07/80	S 86°E	15	0-43	0	0	*
68	18+10S	323.7	283.3	05/01/80	05/02/80 05/05/80	S 86°E	20	0-43 10-43	22.6+ 0	22.6	*
68A	18+20S	323.7	283.3	05/07/80	05/07/80	S 86°E	20	0-43	0	0	*
69	18+30S	328.1	287.8	05/20/80	05/20/80 05/28/80	S 86°E	20	0-43	0	0	*

+ Leaking Out Toe of Nearby One on One Slope on East Bank

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
69A	18+40S	338.0	297.7	05/21/80	05/23/80 05/28/80	S 86°E	20	0–43	0	0	*
70	18+50S	347.5	307.2	05/15/80 05/19/80	05/20/80	S 86°E	20	0–43	0.5	0.5	*
70A	18+60S	351.2	310.9	05/27/80	05/28/80	S 86°E	20	0–43 7–43	0 7.5+	 7.5	*
71	18+70S	352.4	312.1	05/22/80	05/26/80	S 86°E	20	0–43 5–43	0 0	 0	*
71A	18+80S	352.4	312.1	05/27/80	05/28/80	S 86°E	20	3–43	0	0	*
72	18+90S	361.0	315.9	05/29/80 05/30/80	05/31/80	S 86°E	20	0–48 13–48	0 0	 0	*
72A	19+00S	361.3	316.2	06/02/80	06/03/80	S 86°E	20	0–48 15–48 30–48	0 0 0	 0	*
73	19+10S	361.0	315.9	05/03/80	05/31/80	S 86°E	20	0–44 15–44 30–44	0 0 0.7	 0.7	*
73A	19+20S	361±	316±	06/02/80	06/03/80	S 86°E	20	0–48 15–48 30–48	0 0 0	 0	*

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
74	19+30S	360.9	315.8	05/28/80	05/31/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	
74A	19+40S	360.9	316.8	06/02/80	06/03/80	S 86°E	20	3-47	0		*
				06/03/80				15-47	0		
								30-47	1.6	1.6	
75	19+50S	360.8	315.7	05/28/80	05/31/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	
75A	19+60S	360.1	315.0	10/08/80	10/09/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	
76	19+70S	360.9	315.8	10/03/80	10/07/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	
76A	19+80S	360.7	315.6	10/03/80	10/09/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	
77	19+90S	360.9	315.8	10/03/80	10/06/80	S 86°E	20	0-48	0		*
								15-48	0		
								30-48	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
77A	20+00S	360.2	315.1	10/08/80	10/09/80	S 86°E	20	0–48	0		*
								15–48	0		
								30–48	0	0	
78	20+10S	360.2	315.1	10/06/80	10/07/80	S 86°E	20	0–48	0.3		*
								15–48	0		
								30–48	0	0.3	
78A	20+20S	360.2	315.1	10/08/80	10/09/80	S 86°E	20	0–48	1.1		*
								15–48	0		
								30–48	0	1.1	
79	20+30S	360.2	313.2	10/06/80	10/07/80	S 86°E	12	0–48	0		*
								15–48	0		
								30–48	0	0	
79B	20+40S	341.0	312.0	10/15/80	10/16/80	N 86°W	15	0–30	0.2		*
								15–30	0	0.2	
79A	20+42S	340.5	302.9	10/13/80	10/14/80	S 86°E	20	0–40	3.2		*
								15–40	0		
								30–40	0	3.2	
79C	20+48S	340.5	312.3	10/15/80	10/16/80	N 86°W	15	0–30	0		*
								15–30	0	0	
80	20+52S	340.6	303.0	10/11/80	10/11/80	S 86°E	20	0–40	0	0	*

TABLE 7A
GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
80A	20+62S	340.6	322.7	10/13/80	10/14/80	S 86°E	20	0-18	2.1		*
				10/14/80				15-18	0	2.1	
81	20+73S	340.3	302.7	10/10/80	10/11/80	S 86°E	20	1-40	0		*
				10/11/80				15-40	0		
								30-40	0	0	
81A	20+83S	339.7	302.4	10/13/80	10/14/80	S 86°E	20	0-40	0		*
								15-40	0		
								30-40	0	0	
82	20+92S	339.4	301.8	10/09/80	10/11/80	S 86°E	20	1-40	0		*
				10/10/80				15-40	0		
								30-40	0	0	
82A	21+02S	338.9	301.3	10/13/80	10/14/80	S 86°E	20	0-40	0		*
								15-40	0		
								30-40	0	0	
83	21+11S	341.3	303.7	10/10/80	10/11/80	S 86°E	20	0-40	0		*
								15-40	0		
								30-40	0	0	
83A	21+20S	347.1	304.8	10/21/80	10/23/80	S 86°E	20	0-45	1.6		*
								15-45	0		
								30-45	0	1.6	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
84	21+30S	347.1	304.9	10/16/80	10/20/80	S 86°E	20	0-45	2.1		*
								15-45	1.1		
								30-45	0.6	3.8	
84A	21+40S	347.3	305.0	10/22/80	10/22/80	S 86°E	20	0-45	0		*
								15-45	0		
								30-45	0	0	
85	21+50S	347±	305±	10/15/80	10/20/80	S 86°E	20	0-45	3.2		*
								15-45	0		
								30-45	0	3.2	
85A	21+60S	347.5	305.2	10/21/80	10/23/80	S 86°E	20	0-45	0		*
								15-45	0		
								30-45	0	0	
86	21+70S	348±	306±	10/15/80	10/20/80	S 86°E	20	0-45	0		*
								15-45	0		
								30-45	0	0	
86A	21+80S	348.1	305.8	10/21/80	10/22/80	S 86°E	20	0-45	1.4		*
								15-45	0		
								30-45	0	1.4	
87	21+90S	348±	306±	10/15/80	10/20/80	S 86°E	20	0-45	0		*
								15-45	0		
								30-45	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
87A	22+00S	346.8	304.5	10/21/80	10/22/80	S 86°E	20	0–45	0.5		*
								15–45	0.5		
								30–45	0	1.0	
88	22+10S	346+	304+	10/16/80	10/20/80	S 86°E	20	0–45	2.7		*
								15–45	0		
								30–45	0	2.7	
88A	22+20S	339.8	302.2	10/31/80	11/4/80	S 86°E	20	2–40	0		*
								15–40	0		
								30–40	0	0	
89	22+31.5S	340.1	302.5	10/27/80 10/28/80	10/30/80	S 86°E	20	0–40	0		*
								15–40	1.1		
								30–40	0	1.1	
89A	22+41S	340.3	315.9	10/31/80 11/01/80	11/04/80	S 86°E	20	2–26	0		
								10–26	0	0	*
90	22+52.5S	340.5	302.9	10/29/80	10/30/80	S 86°E	20	0–40	0		*
								15–40	0		
								30–40	0	0	
90A	22+61.5S	340.2	302.6	11/03/80	11/04/80	S 86°E	20	2–40	0		*
								15–40	0		
								30–40	0	0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
91	22+72S	341.2	303.6	10/28/80 10/29/80	10/30/80	S 86°E	20	0–40 15–40 30–40	0 0 0	0	*
91A	22+81.5S	340.1	303.5	11/03/80	11/04/80	S 86°E	20	2–40 15–40 30–40	0 0 0	0	*
92	22+89S	340.1	302.5	10/30/80	10/30/80	S 86°E	20	0–40 15–40 30–40	0 0 0	0	*
92B	22+98S	362.6	343.3	01/03/81	01/30/81	N 86°W	15	0–20	3.2+		*
+ Near One on Four Slope Face, Numerous Leaks on Slope Face											
92A	23+00S	364.7	322.7	01/28/81 01/29/81	01/29/81	S 86°E	20	0–45 0–30	1.1+ 1.1	2.2	*
+ Near One on Four Slope Face, Numerous Leaks on Slope Face											
92C	23+00S (0+01U)	364.1	325.5	01/30/81 01/31/81	01/31/81	N 86°W	15	0–40	2.1	2.1	*
93	23+10S (0+01U)	364.2	319.1	01/13/81 01/19/81	01/16/81 01/20/81	S 86°E	20	0–25 25–48	10.2 1.6	11.8+	*

+ Some Grout Exited on Rock Surface

TABLE 7A

GROUTING SUMMARY: 0+90 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
93B	23+15S (0+01U)	364.1	325.5	01/30/81	01/31/81	N 86°W	15	0-40	3.2+	3.2	*
+ Grout Leak on Rock Face L17 U/S, 0+14D											
93A	23+20S	364.1	321.9	01/24/81	01/28/81 01/29/81	S 86°E	20	0-45 15-45 30-45	2.1+ 1.1 2.9	6.1	*
+ Grout Coming From Numerous Surface Leaks											
94	23+30S	364.2	319.1	01/14/81 01/19/81 01/21/81 01/22/81	01/16/81 01/20/81 01/22/81 01/23/81	S 86°E	20	0-10 10-21 21-33 33-48	1.3 3.2 9.7 3.7	17.9	@
94A	23+40S	363.7	323.3	01/24/81	01/28/81	S 86°E	20	0-43 15-43 30-43	3.2+ 1.1 0	4.3	*
+ Numerous Surface Leaks											
95	23+54S	365.0	319.9	01/14/81	01/16/81	S 86°E	20	0-48	1.7	1.7	*
95A	23+60S	365±	327.4	11/18/81 11/19/81	11/20/81	S 86°E	20	2-40 12-40	0 0	0	*

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
96	23+70S	374.0	329.8	11/16/81	11/17/81	S 86°E	20	2-47	2.4		*
								30-47	3.2	5.6	
96A	23+80S	380.0	323.6	11/18/81	11/20/81	S 86°E	20	2-60	0.15		*
								30-60	0.3	0.45	
97	23+90S	380.2	323.8	11/14/81	11/17/81	S 86°E	20	2-60	0.5		*
								30-60	0.2	0.7	
97A	24+00S	379.9	323.5	11/18/81	11/19/81	S 86°E	20	2-60	0.2		*
								30-60	0	0.2	
98	24+10S	379.8	323.4	10/23/81	11/17/81	S 86°E	20	2-60	0.2		*
								30-60	0	0.2	
98A	24+20S	379.8	323.4	11/06/81	11/19/81	S 86°E	20	2-60	0		*
								30-60	0.3	0.3	
99	24+30S	379.9	323.5	11/02/81	11/17/81	S 86°E	20	2-60	0.25		*
								30-60	0	0.25	
99A	24+40S	380.2	323.8	11/06/81	11/19±/81	S 86°E	20	2-60	0		*
								30-60	0	0	
100	24+50S	381.6	324.3	11/02/81	11/04/81	S 86°E	20	2-60	0.15		*
								30-60	0.15	0.3	
100A	24+60S	381.8	330.6	11/07/81	11/10/81	S 86°E	20	2-60	0.15		*
								30-60	0.6	0.75	

TABLE 7A
GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = O STOP = *
101	24+70S	381.3	324.0	11/03/81	11/05/81	S 86°E	20	2-61	0.05		*
								30-61	0.45	0.5	
101A	24+80S	381.4	325.0	11/07/81	11/11/81	S 86°E	20	2-60	0.15		*
								30-60	1.5	1.65	
102	24+90S	381.5	321.4	10/26/81	11/05/81	S 86°E	20	2-64	0.15		*
								30-64	0.45	0.6	
102A	25+00S	381.8	325.4	11/07/81	11/10/81	S 86°E	20	2-60	0.15		*
								30-60	0.45	0.6	
103	25+10S	382.8	324.5	10/26/81	11/05/81	S 86°E	20	2-62	0.3		*
								30-62	0.3	0.6	
103A	25+20S	382.7	326.3	11/09/81	11/11/81	S 86°E	20	2-60	0.15		*
								30-60	1.0	1.15	
104	25+30S	382.8	326.4	10/26/81	11/05/81	S 86°E	20	2-60	0.1		*
								30-60	0.3	0.4	
104A	25+40S	382.6	326.2	11/09/81	11/11/81	S 86°E	20	2-60	0.15		*
								30-60	0.75	0.9	
105	25+50S	382.5	325.2	10/27/81	11/05/81	S 86°E	20	2-61	0.1		*
								30-61	0.9	1.0	
105A	25+60S	382.4	326.0	11/09/81	11/11/81	S 86°E	20	2-60	0.4		*
								30-60	0.6	1.0	

TABLE 7A

GROUTING SUMMARY: 0+00 U/D GROUT LINE (Cont

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
106	25+70S	382.3	325.9	10/28/81	11/05/81	S 86°E	20	2–60 30–60	0.05 0.45	0.5	*
106A	25+80S	381.9	325.5	11/09/81	11/11/81	S 86°E	20	2–60 30–60	0.3 0.45	0.75	*
107	25+90S	381.6	321.5	10/28/81	11/05/81	S 86°E	20	2–64 30–64	0.1 0.3	0.4	*
107A	26+00S	381.5	325.1	11/09/81	11/11/81	S 86°E	20	2–60 30–60	0.4 1.0	1.4	*
108	26+10S	381.4	320.3	10/28/81	11/05/81	S 86°E	20	2–65 30–65	0.1 0.9	1.0	*
108A	26+20S	381.4	325.0	11/09/81	11/11/81	S 86°E	20	2–60 30–60	0.2 0.1	0.3	*
109	26+30S	381.5	320.4	10/28/81 10/29/81	11/05/81	S 86°E	20	2–65 45–65	0.6 26.0	26.6	*
109B	26+30S (0+01U/D)	381.5	325.1	11/13/81	11/17/81	S 86°E	20	2–60 30–60	0.05 0.1	0.15	*
109A	26+40S	382.4	325.6	11/10/81	11/11/81	S 86°E	20	2–60.5 30–60.5	0.4 0.5	0.9	*
110	26+50S	383.1	322.0	10/29/81	11/05/81	S 86°E	20	2–65 30–65	0.1 0.2	0.3	*

TABLE 7B

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = [illegible] STOP = *
1-0	13+55S	368.0	325.7	10/25/79	10/26/79	N 86°W	20	0-45	2.9+		*
								15-45	0		
								27-45	0	2.9	
+ Numerous Surface Leaks, No Grout Take Below a Depth of 2.5 feet.											
1-1	13+65S	368-0	325.7	10/25/79	10/26/79	N 86°W	20	0-45	3.5+		
								15-45	0		*
								27-45	0	3.5	
+ Numerous Surface Leaks, No Grout Take Below a Depth of 2.5 feet.											
1-1A	13+85S	361.5	321.1	10/23/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-2	13+95S	361.5	321.1	10/18/79	10/19/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-2A	14+05S	361.5	321.1	10/23/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-3	14+15S	361.5	321.1	10/18/79	10/19/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	

TABLE 7B

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
1-3A	14+25S	361.5	321.1	10/23/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-4	14+35S	361.5	321.1	10/18/79	10/19/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-4A	14+45S	362.0	321.6	10/22/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-5	14+55S	362.0	321.6	10/18/79	10/19/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-5A	14+65S	362.2	321.8	10/22/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-6	14+75S	362.3	321.9	10/24/79	10/24/79	N 86°W	20	0-43	0.1		*
								15-43	0		
								27-43	0	0.1	
1-6A	14+85S	362.5	322.1	10/25/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0.2		
								27-43	0	0.2	

TABLE 7B

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
1-7	14+95S	362.5	322.1	10/24/79	10/24/79	N 86°W	20	0-43	1.6		*
								15-43	0.6		
								27-43	0	2.2	
1-7A	15+05S	363.2	323.1	10/25/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-8	15+15S	363.2	323.1	10/24/79	10/24/79	N 86°W	20	0-43	3.8		*
								15-43	0		
								27-43	0	3.8	
1-8A	15+25S	363.0	323.1	10/25/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0.9		
								27-43	0	0.9	
1-9	15+35S	362.0	321.6	10/24/79	10/24/79	N 86°W	20	0-43	3.5+		*
								15-43	0		
								27-43	0	3.5	

+ Leaked Through Rock at Surface

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
1-9A	15+45S	351.5	311.1	10/25/79	10/26/79	N 86°W	20	0-43	0		*
								15-43	0		
								27-43	0	0	
1-10	15+55S	340.0	299.6	10/29/79	11/01/79	N 86°W	20	0-43	7.0+		*
				10/31/79	11/05/79			2-43	6.2+		
								15-43	0		
								27-43	0	13.2+	

+ Grout Leaked From Fractures in Rock onto Rock Surface

TABLE 7B

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
1-10A	15+65S	336.9	296.5	11/06/79	11/07/79	N 86°W	20	2-42	0		*
								15-42	0		
								27-42	0	0	
1-11	15+75S	337.0	296.6	11/02/79	11/05/79	N 86°W	20	2-43	2.1+		*
								15-43	0		
								27-43	0	2.1+	

+ Grout Leaked From Fractures in Rock onto Rock Surface

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
1-11A	15+85S	336.5	297.0	11/06/79	11/07/79	N 86°W	20	0-42	0		*
								15-42	0.1		
								27-42	0	0.1	
1-12	15+95S	336.9	297.4	11/02/79	11/05/79	N 86°W	20	0-42	0.5		*
								15-42	0		
								27-42	0	0.5	
1-12A	16+05S	336.8	297.3	11/06/79	11/07/79	N 86°W	20	0-42	0		*
								15-42	0		
								27-42	0	0	
1-13	16+15S	336.8	297.3	11/02/79	11/05/79	N 86°W	20	0-42	0		*
								15-42	0		
								27-42	0	0	
1-13A	16+25S	336.7	297.2	11/06/79	11/07/79	N 86°W	20	0-42	0.3		*
								15-42	0		
								27-42	0	0.3	

TABLE 78

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING STAGE = S STOP = *
1-14	16+35S	336.8	297.3	11/05/79	11/05/79	N 86°W	20	0–42 15–42 27–42	0 0 0	0	*
1-14A	16+45S	328.0	287.6	11/06/79	11/07/79	N 86°W	20	0–43 15–43 27–43	0 0 0	0	*
1-15	16+55S (0+09U)	328.0	287.6	11/02/79	11/05/79	N 86°W	20	0–43 4–43 15–43 27–43	0.3 0 0 0	0.3	*
1-15A	16+65S	337±	294±	05/15/80	05/17/80		VERT	0–43	0	0	*
1-16	16+85S	337±	294±	05/15/80	05/17/80		VERT	0–43	0	0	*
1-17	17+05S	325±	282±	05/16/80	05/17/80	N 86°W	20	0–43	0	0	*
1-18	17+25S	323±	280±	05/15/80	05/19/80	N 86°W	20	0–43	0	0	*
1-18A	17+35S	322±	281±	05/20/80	05/20/80	N 86°W	15	0–43 2–43	0.2+ 0	0.2	*
1-19	17+45S	321.0	278.4	05/13/80	05/19/80	N 86°W	10	0–43	8.1+	8.1	*

+ Grout Leaked Through Fractures in Rock Near Top of Hole and Poor Seal With Grout Pipe

TABLE 7B

GROUTING SUMMARY: 0+10 [illegible] GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = G STOP = *
1-19A	17+45S	321±	279±	05/20/80	05/20/80	N 86°W	5	5-43	0	0	*
1-20	17+65S	321±	278±	05/13/80	05/19/80		VERT	0-43	0	0	*
1-21	17+85S	323±	280±	05/08/80	05/19/80	S 86°E	10	0-43	0	0	*
1-22	18+05S	323.0	282.6	05/09/80	05/19/80	S 86°E	20	2-43	1.6	1.6	*
1-23	18+25S	324+	284±	05/08/80	05/19/80	S 86°E	20	0-43	0	0	*
1-23A	18+35S	331.8	291.4	05/23/80	05/24/80	S 86°E	20	0-43	1.1	1.1	*
1-24	18+45S	341.5	301.1	05/22/80	05/23/80	S 86°E	20	0-43	0	0	*
1-24A	18+55S	349.8	309.4	06/06/80	06/07/80	S 86°E	20	2-43	0	0	*
1-25	18+55S	351.2	310.8	06/05/80	06/05/80	S 86°E	20	0-43	0.4	0.4	*
1-25A	18+75S	351.3	310.9	06/06/80	06/07/80	S 86°E	20	0-43	0	0	*

TABLE 7B

GROUTING SUMMARY: 0+10 U GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = ã STOP = *
1-26	18+35S	351.3	310.9	06/04/80 06/05/80	06/05/80	S 86°E	20	0-43	0.2	0.2	*
1-26A	18+95S	361.3	313.3	06/06/80	06/07/80	S 86°E	20	3-48	0	0	*
1-27	19+05S	361.2	321.7	06/04/80	06/05/80	S 86°E	20	0-42	1.1	1.1	*

TABLE 7C

GROUTING SUMMARY: [illegible] GROUT LINE (Cont)

HOLE NO.	STATION	FR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = @ STOP = *
2-1	16+35S	336.4	296.9	11/07/79	[illegible]	N 86°W	20	0-42	0.4		*
								6-42	0		
								15-42	0		
								27-42	0	0.4	
2-1A	16+45S	328.0	288.5	11/05/79	11/07/79	N 86°W	20	0-42	0		*
								15-42	0		
								27-42	0	0	
2-2	16+55S	328.0	287.6	11/06/79	11/07/79	N 86°W	20	0-43	0.1		*
								15-43	0		
								27-43	0	0.1	
2-2A	16+65S	337±	294±	05/19/80	05/20/80		VERT	0-43	0	0	*
2-3	16+85S	337±	294±	05/19/80	05/20/80		VERT	0-43	0	0	*
2-4	17+05S	325±	284.6±	05/20/80	05/20/80	N 86°W	20	0-43	0	0	*
2-5	18+25S	324±	283.6±	05/23/80	05/24/80	S 86°E	20	0-43	0	0	*
2-5A	18+35S	334.9	294.5	05/26/80	05/26/80	S 86°E	20	0-43	0	0	*
2-6	18+45S	344.5	304.1	05/24/80	05/24/80	S 86°E	20	0-43	0	0	*

TABLE 7C

GROUTING SUMMARY: [illegible] D GROUT LINE (Cont)

HOLE NO.	STATION	TR & SURF ELEV	B.O.H. ELEV	DATE(S) DRILLED	DATE(S) GROUTED	ORIENTATION OF HOLE	ANGLE OF HOLE (DEGREES FROM VERT)	STAGE DEPTH (FT)	GROUT TAKE (FT^3) SOLIDS FOR EACH STAGE	COMPOSITE GROUT TAKE (FT^3) OF SOLIDS	TYPE GROUTING: STAGE = [illegible] STOP = *
2-6A	18+55S	[illegible]	310.7	06/10/80	06/11/80	S 86°E	20	0-43	5.4	5.4	*
2-7	18+65S	352.4	312.0	06/09/80	06/09/80	S 86°E	20	0-43	0	0	[illegible]
2-7A	18+75S	352.4	312.0	06/10/80	06/11/80	S 86°E	20	0-43	4.3	4.3	*
2-8	18+85S	358.8	316.5	06/0[illegible]/80	06/09/80	S 86°E	20	0-45	0	0	*
2-8A	18+85S	360.8	315.7	06/10/80	06/11/80	S 86°E	20	0-48	0	0	*
2-9	19+05S	361±	315.9±	06/09/80	06/09/80	S 86°E	20	0-48	0	0	*

TABLE 7D

GROUTING SUMMARY: SUPPLEMENTAL GROUT HOLES (Cont)

HOLE NO.	LOCATION	ELEVATION	HOLE ORIENTATION, AND ANGLE FROM VERTICAL	PRESSURE TEST STAGE DEPTH (FT)	WATER TAKE (FT^3 IN 5 MIN.)	GAGE PRESSURE (PSI)	GROUT STAGE DEPTH (FT)	GROUT TAKE (FT^3 OF SOLIDS)	GAGE PRESSURE (PSI)
1E	16+03S,	337.[illegible]	N 115°E, 25°	0-15		0	0-15	4.1	[illegible]
	0+25U			4-15	5.7	5	4-15	0	[illegible]
				10-15	[illegible]	5			
2E	16+00S,	337.4	N 30°W, 30°	0-15		0	0-15	2.2	[illegible]
	0+20U			4-15	0.8	5	4-15	0.3	5
				10-15	0	5			
3E	15+96S,	337.4	N 50°W, 30°	0-15		0	0-15	1.9	5
	0+15U			4-15	0	5	4-15	0	5
				10-15	0	5			
4E	16+08S,	337.4	N 75°W, 35°	0-15		0	0-15	3.8	5
	0+30U			4-15	1.0	5			
5E	16+04S,	337.4	N 150°W, 35°	0-15		0	0-15	4.8	5
	0+37U			4-15	4.1	5	4-15	0.3	5
				10-15	0	5			
6E	15+97S,	337.4	N 150°W, 25°	0-15		0	0-15	3.8	5
	0+43U			4-15	0.4	5	4-15	0.2	5
				10-15	0	5			
7E	15+70S,	337.0	N 132°W, 30°	0-10	0.98	5	0-15	2.0	5
	0+30U								
8E	15+74S,	337.4	N 135°W, 30°	0-10	3.3	5	0-10	3.6	5
	0+ 26U								
1AE	16+02S,	337.4	N 90°W, 35°	0-10	2.7	5	0-10	2.7	5
	0+22U			4-10	0	5			
2AE	15+94S,	337.4	N 120°E, 35°	0-10	2.2	5	0-10	0	5
	0+18U			4-10	0.2	5			
3AE	15+95S,	337.4	N 50°W, 30°	0-10	4.0	5	0-10	0	5
	0+12U			4-10	0	5			
4AE	16+10S,	337.4	N 130°E, 35°	0-10	2.0	5	0-10	0	5
	0+27D			4-10	0	5			
11E	16+22S,	337.0	N 135°W, 45°	NO P-T			0-15	34.9	2
	0+25D								
12E	16+14S,	337.0	N 45°W, 42°	NO P-T			0-15	41.4	5
	0+00								
13E	15+98S,	337.0	N 90°W, 44°	NO P-T			0-15	2.7	5
	0+[illegible]								
14E	15+32S,	[illegible]	[illegible]	NO P-T			0-15	[illegible]	[illegible]

TABLE 7D
GROUTING SUMMARY: SUPPLEMENTAL GROUT HOLES (Cont)

HOLE NO.	LOCATION	ELEVATION	HOLE ORIENTATION, AND ANGLE FROM VERTICAL	PRESSURE TEST STAGE DEPTH (FT)	WATER TAKE (FT³ IN 5 MIN.)	GAGE PRESSURE (PSI)	GROUT STAGE DEPTH (FT)	GROUT TAKE (FT³ OF SOLIDS)	GAGE PRESSURE (PSI)
15E	15+64S, 0+37U	337.0	N 90°W, 45°	NO P-T			0-15	2.1	8
16E	16+18S, 0+09D	337.0	N 80°E, 45°	0-15 5-15 10-15	1.1 1.2 1.2	2 [illegible] 5	0-15	0	5
17E	16+22S, 0+26D	337.0	N 80E, 45°	0-15 5-15 10-15	2.4 0 0	2 5 5	0-15	8.6	[illegible]
18E	15+24S, 0+34U	364.0	N 95°E, 30°	0-24	3.5	5	0-24	2.4	5
19E	15+24S, 0+40U	363.5	N 90°E, 30°	0-24	1.6	5	0-24	2.5	5
20E	15+24S, 0+37U	363.5	N 90°E, 30°	0-24	1.3	5	0-24	0.6	5
21E	15+27S, 0+39U	364.1	N 90°E, 30°	NO P-T			0-50	18.3	8
22E	15+27S, 0+16U	363.2	N 90°E, 35°	NO P-T			0-10	5.4	10
23E	15+27S, 0+06U	364.0	N 90°E, 35°	NO P-T			0-50	6.4	10
24E	20+69S, 0+05U	340.0	N 90°E, 20°	0-15	6.0	4	0-15	2.1	3
25E	20+80S, 0+06D	340.0	N 90°E, 20°	0-15	9.4		0-15	1.7	4
26E	20+89.5S, 0+06D	340.0	N 90°E, 20°	0-15	4.9	4	0-15	1.3	4
27E	22+51S, 0+02D	340.0	N 90°W, 20°	0-15	7.2	4	0-15	6.4	5
28E	22+57.5S, 0+02D	340.0	N 90°E, 20°	0-15	4.3	5	0-15	4.3	3
29E	22+76S, 0+03D	340.0	N 90°E, 15°	0-20	4.9	4	0-20	3.5	4
30E	22+82.5S, 0+03D	340.0	N 90°E, 20°	0-20	4.3	5	COMMUNICATED WITH #29E		

TABLE 7D

GROUTING SUMMARY: SUPPLEMENTAL GROUT HOLES (Cont)

HOLE NO.	LOCATION	ELEVATION	HOLE ORIENTATION, AND ANGLE FROM VERTICAL	PRESSURE TEST STAGE DEPTH (FT)	WATER TAKE (FT^3 IN 5 MIN.)	GAGE PRESSURE (PSI)	GROUT STAGE DEPTH (FT)	GROUT TAKE (FT^3 OF SOLIDS)	GAGE PRESSURE (PSI)
31E	17+56S, 0+23D	320.0	Due South, 45°	NO P-T			5-10	0	8
32E	17+47S, 0+21D	320.0	Due South, 45°	NO P-T			4-10	0	10
33E	22+95S, 0+05U	364.0	VERT	NO P-T			5-26 1-26	1.6 8.1	5 4
34E	22+95S, 0+06D	364.0	VERT	1-23	7.4	5	1-23	7.0	4
35E	22+95S, 0+00U/D	364.0	VERT	2-24	1.6	5	2-23	0.7	5
36E	20+21S, 0+12D	361.5	VERT	NO P-T			2-25	0	5
37E	20+33S, 0+00U/D	361.5	VERT	NO P-T			2-25	0.7	5
38E	20+06S, 0+19D	361±	N 45°E, 30°	NO P-T			0-11	0	5
39E	20+85S, 0+18D	361±	N 45°E, 30°	NO P-T			0-11	0.25	5
40E	20+03S, 0+05D	361±	N 45°E, 30°	NO P-T			0-11	0	5
41E	19+91S, 0+04D	361±	N 45°E, 30°	NO P-T			0-11	0.5	5
42E	19+93S, 0+17U	361±	N 40°E, 30°	NO P-T			0-11	1.0	5
43E	19+97S, 0+21U	361±	N 40°W, 30°	NO P-T			0-11	6.0 (surface leaks)	5
44E	20+03S, 0+25U	361±	N 40°W, 30°	NO P-T			0-11	0	5
1S	15+56S, 0+20U	340.2	N 90°W, 40°	0-12	5.0	4	0-12	2.0	5
2S	15+56S, 0+29.5U	339.8	N 90°W, 40°	NO P-T			0-10	2.0	5

TABLE 7D

GROUTING SUMMARY: SUPPLEMENTAL GROUT HOLES (Cont)

HOLE NO.	LOCATION	ELEVATION	HOLE ORIENTATION, AND ANGLE FROM VERTICAL	PRESSURE TEST STAGE DEPTH (FT)	WATER TAKE (FT^3 IN 5 MIN.)	GAGE PRESSURE (PSI)	GROUT STAGE DEPTH (FT)	GROUT TAKE (FT^3 OF SOLIDS)	GAGE PRESSURE (PSI)
3S	15+57S, 0+29.5U	338.8	N 90°W, 40°	NO P-T			0-10	0.3	5
4S	15+57S, 0+20U	339.0	N 90°W, 40°	0-10	1.4	5	0-10	1.0	5
5S	15+57S, 0+38U	338.7	N 90°W, 40°	0-10	0.9	5	GROUTED WITH 6S		
6S	15+57S, 0+38.5U	338.0	N 90°W, 40°	0-10	2.2	5	0-10	5.0	0
7S	15+58S, 0+38.5U	341.0	N 90°W, 45°	0-10	1.5	5	0-20	1.4	3
8S	15+58S, 0+45U	342.0	N 90°W, 45°	NO P-T			0-20	0	5
9S	15+57S, 0+43U	342.5	N 90°W, 45°	NO P-T			0-20	7.0	5
10S	15+58S, 0+24U	340.0	N 90°W, 35°	NO P-T			0-15	0.1	8
11S	15+58S, 0+08U	339.5	N 90°W, 45°	NO P-T			0-10	0	8
12S	15+58S, 0+36D	338.0	N 90°W, 45°	NO P-T			0-15	0	8

TABLE 7E

GROUTING SUMMARY: OPEN HOLE GROUTING*

LOCATIONS U/D	LOCATIONS S	HOLE SIZE (Inches)	SURFACE ELEVATION	DEPTH (FT)	GROUTED	AREA
0+00	[illegible].45	**	365.6	47.0	10/03/79	Core Trench
***0+00	17+02.8	3	325.4	9.0	05/01/80	Core Trench
1+99U	17+47	5-1/2	324.2	33.0	04/15/80	Diversion Dam
5+76U	21+10S	5-1/2	366.5	53.0	05/11/81	R-2
5+40U	21+10S	5-1/2	365.0	26.0	05/11/81	R-3
4+17U	21+10S	5-1/2	365.0	6.0	05/11/81	R-6
0+00	22+40S	5-1/2	341.0	1.7	11/04/80	L-15
0+1[illegible]U	22+20	3	341.5	20.0	11/04/80	L-15
4+01D	20+99	5-1/2	290.5	8.0	12/17/80	R-24
8+00D	20+95	5-1/2	292.5	12.0	12/01/80	R-32
6+30D	22+00	5-1/2	300.0	5.0	01/09/81	29 L-PS
5+55.5	22+41.5	5-1/2	292.5	5.5	01/21/81	L-27
9+31.5D	21+04	5-1/2	312.0	17.0	04/24/81	R-35
9+71.5D	21+04	5-1/2	312.0	22.0	04/24/81	R-36
10+18D	21+03	5-1/2	312.0	20.0	04/24/81	R-37
11+01D	21+04	8	312.0	6.0	04/24/81	R-39
6+00D	22+00	5-1/2	300.0	18.0	01/09/81	28 L-PS
0+00	19+95S	5-1/2	361.0	90.0	05/18/82	Core Trench

* Holes left open from pre-bid era investigations.
** Information not available. All other holes were Gravity Grouted.
*** This hole was pressure grouted at 5 psi

VI. EXCAVATION AND TREATMENT FOR LOCK CHAMBER AND DOWNSTREAM APPROACH CHANNEL TO 20+20D

6.01 Overburden.--Overburden excavation started at the Mississippi Highway 4 relocation section (20+20D) on 27 June 1979 and progressed upstream across the lock area. The excavated material was disposed of in designated spoil areas. Overburden slopes were 1V on 3H with a 10-foot berm at top of rock.

6.02 Excavation to Elevation 330.--Rock excavation started with removal and disposal of "cap rock." This was a thin-bedded sandstone with numerous shale bands overlying the lowest clay shale bed in the H_a member. This unit ranged in thickness of 18 feet in the upper approach area to 4 feet in the lock chamber to 8 feet south of the lock area. All sandstone and sandstoneshale interbeds were excavated to Elevation 330-326 by blasting. Slopes were presplit with holes on 30-inch centers in the sandstone and on 24-inch centers in the sandstone-shale interbeds. Slopes running parallel to the lock centerline were 4V on 1H while slopes running normal to the lock centerline were vertical. Normal production blasting began with shot 20 on 17 August 1979. See drawings BSFR-33 and 34 for excavation plan.

The contract did not specify a blasting procedure to accomplish rock excavation but rather required certain results including excavation which preserved the rock outside the lines of excavation in sound condition and produced rock of suitable size (after processing) to be used as rip rap and filters for the dam. The contractor was furnished information that showed these desired results were achieved in the Bay Springs Test Excavation using a 6-foot by 8-foot rectangular pattern with holes drilled to a maximum depth of 12 feet and a powder factor of 0.5 lb/c.y. using a semi-gelatin dynamite. The contractor utilized a blasting program with hole depths which varied from 6 to 28 feet (average $\pm$20 feet) and powder factors that varied from 0.90 to 1.46 lb/c.y. In the lock area the contractor attempted but five shots utilizing blasting techniques equivalent to those proven in the test excavation blasting program.

The contractor began his blasting program downstream of Station 15+25D excluding the interval for the Mississippi Highway 4 bridge between Stations 17+20D to 20+20D. The contractor opted to use a two-stage operation (i.e., presplit and production shots fired separately), which was permitted by the specifications for this particular segment of the excavation. When the excavation progressed upstream of Station 15+25D, the contractor began blasting, as required using a single stage, two-step operation with millisecond delays in the blast pattern. However, an exception to this procedure was shot 122 where the presplit and first row production holes were set off simultaneiously. After shots 122 and 126 resulted in blast damage behind presplit lines of L28, L29, and L30 monoliths, the blasting program was stopped to allow for a re-evaluation of procedures. Determining the exact effect of blast damage in the rock was complicated by the jointed nature of the rock and because the blast had extended around the corner of L30 monolith. This occurred in spite of a directive by the Corps not to shoot around the corner. There was an apparent miscommunication or lack of communication between contractor personnel which resulted in non-compliance with the directive. Nevertheless, the blast damage did result in a change of procedures which are discussed later in this section. Pertinent to the damage and the subsequent changes are the depth of hole and the powder factor for each shot (122, 126) that resulted in blast damage. The depth of hole and powder factor for shot 122 was 22 feet and 0.84 respectively. Similar information for shot 126 was 23 feet and 0.94. These hole depths and powder factors exceeded those which had yielded acceptable results in the Bay Springs Test Excavation. It should be reiterated, however, that hole depths and powder factors used during the test excavation were not incorporated into the specifications as requirements but rather as information "to illustrate that stone of the proper size and gradation can be obtained without damaging the foundation." (Quote from specification paragraph 2C-13.4.)

The blast damage resulted in the eventual removal of additional rock in the area behind these monoliths and replacement with 4398 cubic yards of concrete. Disturbed and jointed rock was removed with "small" shots designed to minimize the amount of over excavation and further damage. These shots, which had presplit holes on 12-inch centers and production holes on a random pattern, were usually loaded with detonator cord only in an attempt to minimize damage. However, each ensuing shot revealed blast damage fractures as well as open joints. Eventually, six "small" production shots were required before geologists were satisfied with the foundation. A sound foundation was essential for the installation and performance of the wall anchors used in the tie-back wall design.

As a result of the damage, and to prevent further damage in the lock area, the following changes were made in the blasting procedures:

(1) All presplit and production shots were fired separately with the presplit shots being fired first to provide a plane of weakness which would limit the breakage of the production shots. In theory, this minimizes the transfer of shock waves from the production shots beyond the presplit plane, thereby reducing shattering and overbreak.

(2) Hole depths were decreased from ± 20 feet to ± 10 feet to decrease the amount of energy expended at one time.

(3) The use of poured ANFO explosive agent which had been producing unsatisfactory breakage in this rock was discontinued.

(4) The use of Ammonia Gelatin Dynamites which, due to their high density and velocity, allowed wider holes spacing and a decrease in powder factors was increased.

(5) Powder factors were reduced 26 percent from an average of 0.92 lb./c.y. to an average of 0.68 lb/c.y. However, this information may be misleading as the powder factors for individual shots before and after the blast damage (from shoots 122 and 126) varied considerably ranging from approximately 0.3 lb./c.y. and exceeding 1.6 lb./c.y.

These changes having been made, rock excavation in the lock area was completed with little damage to the final rock faces. One exception was at the L19 corner where shot number 185 caused movement in a block along a joint plane and bedding plane. This block was later removed by shot number 253 and replaced with approximately 178 cubic yards of concrete.

Implementing the changes in the blasting procedure had the effect of increasing the percentage of oversize rock. This statement is based on observations made by the Corps resident staff and the contractor's production data which indicated an increase of loads hauled from the oversize stockpile. Oversize rock required stockpiling and secondary breakage. The use of Ammonia Gelatin Dynamites provided the best compromise, providing maximum breakage while maintaining a sound final rock face.

In general, the contractor had the best results with explosives of relatively high densities and detonation velocities. The Ammonia Gelatin Dynamites such as Atlas Power Primer or Hercules Unigel produced the best, most uniform, breakage with a lower overall powder factor and with less damage to the final rock face. To the contractor these advantages did not outweigh the approximately 20-percent higher cost of these products, except in the lock area where after shot number 126, most shots were loaded with Power Primer.

Water gels, DuPont Tovex and Atlas Apex, were used in the majority of shots on this project. Their detonation velocity and density are slightly lower, but they have greater water resistance, increased safety, and are more economical than the Ammonia Gel Dynamites mentioned. Slower detonating explosives caused some problems which increased as the complexity of the blast patterns increased. Some loaded holes failed to detonate when the blasts from adjacent holes offset the rock, snapping the cap cord prior to detonation. It appeared that the millisecond delay sequencing occurred too rapidly for the slower detonating blasting mediums (such as water gels, DuPont Tovex, and Atlas Apex) to react. Blasting performed with explosives having faster detonating velocities did not experience this problem.

Despite DuPont's claim that Tovex is cap sensitive, many unexploded cartridges were found in early shots. Misfires continued to occur even when detaprimers were used. Eventually, the contractor elected to prime every hole with Atlas Power primer.

Presplit blasting was done primarily with DuPont Tovex T-1 because of its water resistance. The few notable exceptions being the shots in critical areas such as near the dam centerline and at corners, some of which were loaded with a combination of detonating cord and T-1, or with detonating cord only. Either 400 grain cord or multiple strands of 60 grain cord were used with hole spacing of 12 to 15 inches. These detcord shots produced very good results with good breakage between holes and no damage to the final face. Atlas Kleen Kut F was used in a few presplit shots and proved unsatisfactory due to its low water resistance. See drawings BSFR-50 and 51 for blast patterns, see table numbers 9, 10, 11, and 12 for blasting data, pages 137-168.

6.03 Excavation Below Elevation 330.--Below Elevation 330 to 326, all material was excavated by sawing, ripping, and removed by endloaders, with top loaded trucks. This includes some of the lower H_c and all of the H_d and H_e members. Blasting the shale proved to be unnecessary as the contractor successfully ripped the material below Elevation 330. Most of the slopes were cut with a Joy coal saw Model No. 10RU. Although the Model NO. 15RU was specified by the contract, the contractor was allowed to use a 10RU because of the difficulty in locating the Model 15RU. Later the contractor was able to locate a 15RU. Both the original unit and the 15RU were rented. Finally, with difficulty, the contractor located a Joy 10RU coal saw, which he purchased. Purchasing the saw was more economical than renting. Each of the three saws, all of which were used, had chronic maintenance problems which resulted in down-time for the saw and delays in excavation.

There were other problems with the saws as well. In the wet, muddy conditions of the lock excavation, the electrically powered saw was a constant electrical shock hazard. Personal injury was not experienced, but "shorts" in the saw system "knocked out" electrical service to the site. The muck that developed on the highly plastic shale caused tracking difficulties for the saw and complicated the task of keeping within the required tolerances for the cut face. The contractor experienced considerable difficulty in sawing the 4V on 1H slope face as the saw continually veered off course. At the contractor's request, the Corps allowed the contractor to cut vertical faces with stairstep like benches in lieu of cutting the specified 4V on 1H slope face. The hard phosphate nodules, which occurred in bands, provided minor problems with productivity and staying on course. Despite the problems, the coal saw performed its intended function well, producing undamaged final vertical shale faces within the required tolerances. Excavation of the shale within these sawed faces was completed by ripping and end loading to within 2 feet of the founding elevation. Then, excavation to final grade was accomplished by a Gradall and a backhoe. Not all the final shale faces were sawed as specified. In limited areas, the shale was scraped to grade by a 880 Gradall which was equipped with a 3-foot wide toothed bucket (based on conversations w/members of the resident staff). Generally, this was done in scattered, small areas, which were not documented, with one exception. In this area the contractor excavated about 2 feet below the saw line from Station 1+48D to 7+00D. This particular area was dressed with the 880 Gradall to grade and sealed. This deviation from the specification resulted from a failure in the quality control/assurance system. Also, it was necessary to scrape inside corners where the saw could not reach.

The shale foundation was subject to rapid deterioration unless it was kept moist. With the exception of the areas described above, all shale surfaces were excavated and treated in the following sequence:

(1) Saw final face in ± 5 feet increments. (The specifications permit cutting a continuous vertical slope from one to seven feet or greater in depth without causing damage to the remaining rock.)

(2) Excavate material to expose face.

(3) Apply Sika-Seal protective spray within one hour of exposing face.

(4) Install rock bolts within 48 hours of exposing face. There were a few bolts installed after the 48 hour limit.

(5) Hang wire fabric.

(6) Apply 6 inches of shotcrete within 15 days. In some instances shutdowns because of weather delayed the application of the shotcrete. Also, high humidity and rain caused some shotcrete to slough off rock face. Some delay resulted from equipment non-availability. For example, delays were experienced when the shotcrete pump became non-functional.

(7) Repeat steps 1 through 6 until reaching final grade.

(8) Place a minimum 6-inch thick protective "mud slab" on the floor of excavation immediately after cleanup.

See drawing BSFR-48 for plan of protective slab placement. See drawings BSFR37-42, BSFR52-53 for geologic sections. Water in the lock excavation was controlled by the use of sumps and pumps.

Founding elevations were essentially as indicated as the contract plans except for limited areas that required dental type over-excavation. This dental excavation was required to remove undesirable material along shear planes, intersecting shear planes, closely spaced shear planes, and certain joints. Several shear planes were encountered in the shale lock foundation, ranging in thickness from 0.01 foot to 0.2 foot. All were filled with brecciated shale and gray clayey gouge material. The average dip of the shear planes was 45 degrees. V-shaped trenches were chipped out or cut by a Gradall along the shear planes prior to concrete placement. Dental excavation was also required between closely spaced or intersecting shear planes to remove all loose and fractured material. This occurred most notably in the highly fractured right emptying lateral foundation where dental excavation to a depth of as much as 5 feet was required. Here, the floor of the excavation tended to follow the slight downstream dip (4 degrees) of the shale. The actual or "As Built" excavation limits for the Bay Springs L&D are shown on drawings BSFR 43-46 and BSFR 54-55. Proposed monolith and floor slab founding elevations are located on contract drawings TTBS-10/2.1 and TTBS-10/3.1.

6.04 Slope Failure.--Due to adverse strike and dip of the shear planes, three slope failures occurred in the shale foundation. Behind Monolith R22, a shale block slipped along intersecting shear planes, before rock bolts could be installed (surpassing the specified, 48 hour time limit for rock bolt installation). See Appendix A, photo 11. This void was filled with concrete which was then bolted in place. In the downstream wall of the right emptying lateral, a similar slope failure occurred above a previously installed row of rock bolts. See photo 15. It was noted at the time that even though only a small portion of this slope had failed, geologic conditions were favorable for additional slope failure. The contractor was asked to make an attempt to dislodge remaining shale along the shear planes, which he did, using a dozer. This action was unsuccessful and no additional shale was removed. The face was re-shotcreted and remained in good condition until concrete was placed against it. It should be noted that the upper half of the slope had been dressed by a gradall while the lower half had been sawed. See drawing BSFR-47. The third failure occurred at the Monolith L30 corner area. A shear plane, striking transversely to the corner and dipping SW toward the crossover gallery trench, allowed a shale block to slip out of the excavated corner. See Appendix A, photo 5. This void was replaced with concrete and bolted in place. Displacement of bedding indicated that a movement of 1/2-inch had occurred along a portion of this shear plane near the L30 corner in the lower crossover gallery trench. To preclude failure in that area, eight rock bolts and steel I-beam shoring were installed in the crossover gallery trench to add reinforcement and concrete placements in the trench were accelerated as much as possible. The rock bolts were installed on two levels in the area of instability. One level containing four rock bolts approximately 1 1/2 feet below the top of the lock chamber floor (slab LS 2U). The lower level was approximately 4 feet below the top of the floor slab. The bolts, which were installed in the same manner as those required by the specifications, were placed on a staggered 1 1/2-foot horizontal by 2 1/2-foot vertical pattern. As shown in photograph 14, interlocking sheet pile type shoring was installed against the unstable wall in attempt to thwart any additional movement by the rock (shale) along the joint/fracture plane. The shoring extending between Stations 22+25S and 22+45S was positioned against the bottom 2/3 of the lower miter sill crossover trench. Four heavy duty steel H-beams extended from the back of the sheet pile interlock wall across the trench bracing the sheet pile wall against the shale. There was no additional rock movement in this area.

6.05 Disposal of Excavated Material.--Most of the sandstone of the H_a and H_b members was processed through a "grizzly" and used as select rockfill, filter no. 1 material, and random rockfill in the embankment. Most oversized material was transported from the immediate "grizzly" area and placed into windrows 2-3 feet tall and 150-200 feet long adjacent to the "grizzly" by Caterpillar end loaders (Models 988 and 992-with 7 1/2 and 12 yard buckets, respectively). The windrows were arranged to permit passage of a crane which reduced the oversize rock to a smaller size with a headache ball. Subsequently, the rock was reprocessed through the grizzly with oversize rock being placed back into the windrows for further reduction in size. The interbedded shale-sandstone material and shale material were placed in either the random fill or disposed of in designated spoil areas. Early in the contract the contractor was given permission to process the H_b sandstone along with the H_a sandstone. This changed the contract specification which required the use of the processed H_a member material exclusively in the select fill and the no. 2 filter. A portion of the oversized sandstone and other materials were used to fill Mackey's Creek channel below the dam.

6.06 Treatment - Rock Bolting.--Rock slopes in the lock chamber excavation were reinforced by rock bolts, installed as shown on foundation maps. Rock bolts were Dywidag thread-bars, 1 1/4-inch diameter in sandstone and 1-inch diameter in the shale and sandstone-shale interbeds. With a few exceptions rock bolts were installed within 48 hours of exposure of the excavated face. Bolts in the sandstone were installed on a staggered 10-x10-foot pattern. However, there was no pattern bolting where excavation did not extend into the sandstone-shale member. Bolts in the sandstone-shale interbeds and shale were installed on a staggered 6-x6-foot pattern. One row of 1 1/4-inch diameter bolts was installed 10 feet down from the top of rock in the upper approach (Monoliths R-1 through R-15 and L-10 through L-15). Below this row, bolts were installed on a random pattern based on rock conditions. Below 11+50D on the left wall and below Station 13+25D on the right wall, bolts were installed on a random pattern based on rock conditions. Bolts were installed on a 5 degree angle down from the horizontal and normal to the slope. For added toe support, floor bolts were installed on 6-foot centers, 3 feet off the toe of the slope, and angled 25 degrees down from the horizontal. Virtually all 1 1/4-inch diameter bolts were tensioned to 150,000 pounds and all 1-inch bolts were tensioned to 60,000 pounds. Stressing jacks were center hole hydraulic jacks with pneumatic or electric pumps and were furnished by Dyckerhoff and Widmann, Inc. Jacks were calibrated against a load cell at least every seven working days to assure accurate tensioning.

In the upper miter sill area (right side) two rock bolts installed on the lock floor about 3 feet from the wall received a minimal stress. Upon stressing these angled bolts, the shale moved toward the lock wall. Investigation revealed that the cut made by the coal saw used to cut the shale face had penetrated the shale floor by 2 feet. Therefore, stressing the rock bolt closed the gap (cut) made by the coal saw. Rather than disturbing the shale any further, these bolts were left in a near unstressed condition. The contractor, who was not paid for these installations, was not required by the resident staff to install supplemental rock bolts in this area.

Drilling of holes for rock bolts was accomplished by a Gardner-Denver percussion drill with a modified 32-foot boom. 1-5/8-inch and 1-7/8-inch carbide tipped X-bits were used.

The DuPont Fasloc resin grout anchorage system was used. Resin cartridges of two different set times were used in each hole. Fast set cartridges were inserted first to provide the bond zone at the back of the hole, then slow set cartridges were added to completely fill the stressing zone. On the average, each resin cartridge encapsulated 12 inches of bolt (one cartridge was used per foot of hole depth). Hole diameters were measured periodically. Elongation measurements were made on all bolts after stressing. (Hole diameter measurements were not preserved.)

As specified in Section 2F, pull out tests were conducted early in the bolting program to determine the length and strength of the anchorage system. See pull out test data, Table Number 8, page 136. Where failure did occur, it occurred at the resin grout/rock interface. Generally, a 6-foot bond zone was used in the sandstone and an 8-foot bond zone was used in the shale and sandstone-shale interbeds.

For long-term monitoring of the anchorage system, 12 test bolts were equipped with load cells and read on a weekly basis. Load cell plots, are on file at the Bay Springs Resource Manager's Office. The rock bolts performed as designed holding the sandstone in place.

A polyester resin (Celtite-21) grout pad was placed behind all rock bolt bearing plates to provide uniform load distribution. Bearing plates were 8 inches by 8 inches by 1 inch in the sandstone, and 14 inches by 14 inches by 1 inch in the shale and sandstone-shale interbeds. Problems were experienced generally in the early portion of the bolting program with the installation of the Celtite grout pad. Certain bearing plates were installed that did not have either uniform support from the Celtite grout pad or proper plate alignment. The contractor was able to improve the results by applying the Celtite grout to the back of the plate instead of the rock face in conjunction with the installation of the bearing plate. The contractor also made improvements in the installation by gaining familiarity with the resin set times at various temperatures.

A problem encountered during rock bolt installation was related to temperature extremes and their effect on resin set times. For example, set time for the fast set cartridges was 5 minutes at 45 degrees F, 2 minutes at 55 degrees F, and only 1 minute at 85 degrees F. This wide variation of set times, dependent upon temperature, applied to all three different resins used on each bolt installation. The procedure of mixing the Celtite grout pad and inserting the bolt into the hole, thereby mixing the Fasloc resins, had to be precisely coordinated based on daily temperatures. Fasloc resin was stored in a temperature controlled room to minimize the affects of the temperature extremes. In hot weather, bolts were covered to protect them from direct sunlight or cooled with water before installation. In cold weather, bearing plates were heated to speed the set of the grout pad.

Beveled washers were used between the jack and bearing plate to permit proper jack alignment, even on slightly misaligned bearing plates.

Prior to blasting, rock bolts were installed in general accordance with specification requirements as delineated on contract drawing no. TTBS-3/10A. A total of 87 rock bolts were installed to increase the stability of the corners. In some instances angle rock bolts were either substituted for vertical rock bolts or added to the rock bolt scheme as shown on table 13 and drawings BSFR-71 and 72. Angle rock bolts were added to tie rock blocks together which were separated by joint planes. Adding angle rock bolts in lieu of or in addition to vertical rock bolts was adopted after most of the corners had received the vertical rock bolt treatment which was specified. Some or possibly all of the corners would have been stabilized in part, by angle rock bolts (instead of vertical rock bolts exclusively) had the angle rock bolts been considered earlier. Therefore, the fact that some corners received angle rock bolts (while others did not) does not necessarily reflect different or less stable rock conditions.

6.97 <u>Treatment-Lock Floor Anchor Bolts</u>.--Lock floor anchor bolts were installed at locations shown on drawings BSFR 43-46. As specified, the contractor used number 11, grade 72 rebar rods for floor anchor bolts. While awaiting approval of his submittal for anchor bolt assembly and placement procedures, the contractor installed 386 lock floor anchors in protective slab areas EL 1, EL 2, FS 18, FS 19, FS 20, and FS 21. The anchors, however, were not approved because the contractor's threading of the rebar had reduced the diameter (and strength) of the end of the rod and because the Cadweld "B" series sleeve used to hold the anchor plate had been installed incorrectly (inverted). Tension tests on the inverted sleeve yielded results of only 72 to 90 kips which were well below the required 117 kips. The contractor corrected the problems by cutting the bars off 1-inch below the Cadweld "B" series sleeve (or threaded portion if sleeve was not installed) and attaching a 1-1/4-inch Dywidag bar onto the 1-3/8-inch rebar with a Cadweld "T" series sleeve. A Dywidag 1-1/4-inch hex nut was used to secure the 8-inch by 8-inch by 1-inch anchor plate on the rock anchor immediately above the Cadweld sleeve. As required by the specifications, 10 percent of the anchors were subjected to a tension of 67 kips. The contractor used a center hole hydraulic jack to achieve this tension. After the installation of the rod and after the grout had set, the center hole jack was placed over the rebar rod onto the floor slab. The anchor plate and Dywidag hex nut were then mounted in place on the bar above the jack. Simultaneous jacking against the floor slab and the bottom of the anchor plate generated the required tension on the rock anchor. No failures occurred. After the completion of the installation, the 2-foot stickup of the anchor bolt (rebar rod) assembly was incorporated into the 3-foot thick concrete, "A" lift, of the floor slab as shown on contract drawing TTBS-10/141.1.

6.08 Treatment - Drain Holes.--As specified by paragraphs 2G-7 and 2G-8 of the contract, drain holes were installed in the lock floor. Three-inch diameter drain holes were installed on 10-foot centers 1-foot above the top of shotcrete (H_b/H_c contact). These holes were 25 feet deep and drilled on a 5 degree angle up from the horizontal and normal to the slope. The contractor elected to extend the holes with PVC pipe to prevent sloughing of the shotcrete. From Station 9+21D to 13+25D (downstream right guidewall), the 3-inch drain holes were installed at Elevation 345 and extended through the guidewall concrete for permanent relief of water pressures. Two-inch diameter drain holes were installed on a staggered 10-by 10-foot pattern below the H_b/H_c contact. These holes were drilled through the shotcrete to a depth of 10 feet, on a 5 degree angle down from the horizontal and normal to the slope. Slotted 1-1/2-inch PVC pipe filled with 3/4-inch to No. 4 rounded, siliceous gravel was inserted into each hole after completion of drilling. There were no serious problems with installing the PVC pipe, however, some minor problems with binding were overcome by tapping the end of the pipe. Permanent drains were installed in the lock floor as shown on drawing BSFR-49. These holes do not extend into the shale foundation but are set in the top of rows of porous concrete placed on top of the shale foundation. See drain detail on drawing BSFR-49.

Drains were sometimes required along shear planes before the placement of the protective "mud slab" over the shale foundation. These were used to control water seepage and were backfilled with grout after the protective slabs were placed. A drain installed in the protective slab, FS-25-R-PS, was not grouted due to the concern of grouting up the overlying porous concrete for the floor drainage system.

6.09 Water Problems.--Water problems in the lock excavation, other than rainfall and surface runoff, occurred in four areas.

Water seepage occurred at the H_b/H_c geologic contact, where surface water followed vertical joints downward until it reached the impermeable H_c sandstone-shale interbeds. Though drains were installed along this contact, water still trickled down the face. This caused the shotcrete to slough off after being applied to the wall. Where sloughing occurred, another application of shotcrete was required. This problem was greatly reduced by extending pipes from the drain holes thus keeping most of the water off the face.

Excavation for the lower miter sill crossover gallery exposed a bedding plane in the H_e shale at Elevation 286.5. There was a steady water flow from this bedding plane on the upstream foundation faces of Monoliths LS1-C and

LS2-C the downstream faces were dry. A drain was installed to control water during concrete placement and was later gravity grouted full. The relatively high pressures of 10 to 15 psi registered in uplift cells LMS-1, LMS-4, and LMS-7 during the raising of the lock wall may be related.

Artesian water flow was encountered in several exploratory holes in the shale foundation, see Exploratory Hole Tabulation, Table Number 2, pages 42-50. Rates of flow ranged from an estimated 1/4 gpm to 10 gpm. The largest flow was from BSCR23. Water pressures measured by gage or by standpipe ranged from 1 psi to 2-1/2 psi. These water flows originated from the G_a limestone member approximately 20 feet below founding elevation. All holes were tremie grouted with a 0.75 grout mix; pressure grouting was not necessary.

Many of the lock floor anchor bolt holes had artesian water flow and some were interconnected. See drawing BSFR-43 through BSFR-46. This occurred primarily in the area of Monoliths 23, 24, and 25, where the excavation was near its lowest elevation. The drillers reported hard drilling at 20 to 25 feet. This correlated with the G_a limestone logged in exploratory core holes. Since the water flow originated at an approximate 20-foot depth, the weight of the anchor bolt grout was usually sufficient to overcome the artesian pressure. However, as the bolt installations neared completion at the upstream end of Monolith 23, the pressures became high enough to wash grout from the holes. Two 5-inch diameter holes were drilled nearby with the intention of installing a pump to draw down water flow. The pump was never needed because the open 5-inch holes provided sufficient relief to allow the anchor bolt holes to be grouted full. The relief holes were tremie backfilled with grout after bolt installations were completed. Many of the holes load tested in Monolith 23, 24, and 25 were ones that had artesian water flow before grouting, as these were considered most likely to fail. Consideration was given to installing permanent drains into the G_a limestone from the existing lock foundation drains. This was discussed with District Office geologists who advised against it.

TABLE 8
ROCK BOLT
PULL-OUT TEST DATA

TEST BOLT NO.	LOCATION	ELEVATION	GEOLOGIC MEMBER	BOND LENGTH (FT)	MAXIMUM STRENGTH (PSI)	FAILURE
1	17+50D, Left Side	336.0	H_a	2	152,200	Yes
2	17+81D, Left Side	336.0	H_a	3	164,200	No
3	6+43D, Right Side	327.0	H_c	2	32,379	Yes
4	6+38D, Right Side	327.0	H_c	3	51,222	Yes
5	4+76D, Right Side	319.5	H_d	3	14,147	Yes
6	4+58D, Right Side	319.5	H_d	5	27,034	Yes
[illegible]	4+52D, Right Side	319.5	H_d	7	43,803	Yes
8	3+39.5D, Right Side	319.0	H_d	8	47,664	Yes
9	1+90.5D, Right Side	320.0	H_d	8	66,974	Yes
10	1+96.5D, Right Side	320.0	H_d	10	66,974	No
11	7+02.5D, Right Side	305.5	H_e	8	78,971	Yes
12	2+34D, Left Side	304.0	H_e	8	71,547	Yes
13	8+29D, Left Side	312.0	H_e	8	84,149	No

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
11	19+35-19+75D	7x8	-	360	15	3667	0.80	T7,AN	08-07-79	X
16	19+75-20+50D	6x7	-	360	14	4307	1.41	T7,AN	08-09-79	X
17	19+75-20+50D SW	5x5	-	365	6	782	1.18	T7	08-10-79	X
20 (18)	D/S Quarry	-	30	358-361	20	-	-	T1	08-17-79	
22	56	4x4,5x6	-	356	3-16	2515	0.79	T7,T1,AN	08-20-79	
25	20+30 South Wall	3x3	36	360	13-16	-	-	T7,T1	08-24-79	X
27	56	6x6	-	358-363	22	10240	1.04	T7,T8	08-30-79	
28	56	6x6	-	358-363	-	5641	1.34	T7,T8	09-04-79	
29	56	6x6	-	355-359	19	9071	1.36	T7	09-07-79	
30	11+00-12+00D	6x7	-	356	5	1700	1.27	T7,AN	09-08-79	X
31	17+20-20+20D East	-	30	358-361	14-18	-	-	T1	09-10-79	X
32	12+00-12+50D	6x8	-	357	6	1564	0.86	T7,AN	09-10-79	X
33	12+40-13+00D	6x8	-	357	6	3120	0.73	T7,AN	09-11-79	X
34	56	6x6	-	360	19	12240	1.04	T7	09-12-79	
35	56	6x6	-	353-357	17	10403	1.01	T7	09-15-79	
36	56	6x6	36	351	12	4560	1.09	T7,T1	09-18-79	
37	15+25-16+00D	-	30	358	28	-	-	T1	09-22-79	X
38	9+50-10+00D East	10x10	-	356	3	-	-	T7,AN	09-19-79	X
39	9+50-7+50 East	10x10	-	356	3	1864	0.43	T7,T2,AN	09-20-79	X
40	18+00-19+50 West	-	30	342	25	-	-	T1	09-20-79	X
41	56	6x8	30	364	6-28	1826	1.17	T7,AN,T1	09-21-79	
42	56	6x8	30	364	6-25	3280	0.59	T7,AN,T1	09-24-79	
43	56	-	30	344	18-27	-	-	T1	09-25-79	
44	50 & 56	-	30	353	25	-	-	T1	09-25-79	
45		10x10	-	364	3	2486	0.23	T7,AN	09-25-79	
46	17+20-18+50D	-	30	341	24	-	-	T1	09-26-79	X
47	14+20-15+00D	6x8	-	362	5	1506	0.63	T7,AN	09-26-79	
48	56	-	30	341	15-24	-	-	T1	09-27-79	
49	12+50-13+30D	6x8	-	355	5	1508	0.76	T7,AN	09-27-79	X
21	17+30-20+30D	-	30	336	16-20	-	0.10	T1	08-17-79	X

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord

E - East
C - Center
W - West

* Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. USER-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
51	56	6x6	36	337	20	6966	1.39	T7,T1	09-29-79	
52	56	5x6	-	361	8	1881	1.62	T7,AN	10-01-79	
54	56	6x6	-	339	22	7000	1.27	T7	10-02-79	
55	56	6x6	-	340	24	7236	1.38	T7	10-03-79	
56(1)	56	6x6	-	340	25	12632	1.39	T7,AN	10-06-79	
(2)										
57	56	6x6	-	340	26	8688	1.07	T7,AN	10-09-79	
58	56	6x8	30	337	6-24	555	0.90	T7,T1	10-10-79	
60	56	6x6	-	340	25	11940	1.08	T7,AN	10-12-79	
61	50	-	30	355	4-18	-	-	T1	10-12-79	
63	11+50D	6x8	-	355	6	2187	0.54	T7,AN	10-15-79	X
65	56	6x6	-	341	24	9268	1.54	T7,AN	10-17-79	
68	56	6x6,6x8	36	358	20	6111	1.20	T7,AN,T1	10-17-79	
69	56	6x6	-	340	24	9268	1.54	T7,AN	10-22-79	
70	56	6x6,8x8	-	358	20	10824	1.21	T7,AN,UN	10-24-79	
71	56	6x6,8x8	-	358	15-18	8236	1.19	T7,UN	10-26-79	
72	0+14.5D-0.39.5U	10x10	-	367	6-10	2856	0.57	T7	10-30-79	X
73	50	-	30	353	18	-	-	T1	10-31-79	
74	0+39U-0+60D W									
	0+40U-1+25U E	10x10	-	364	3-11	3462	0.57	T1	11-02-79	X
75	56	6x6,9x9	-	357	17	11555	0.97	T7,UN	11-06-79	
79	0+39U-0+50D W	10x10	-	364	3	2666	0.30	T7	11-07-79	X
80	50		30	352-356	17-18	-	-	T1	11-08-79	
81		10x10	-	-	13	4853	0.89	T7,AN	11-08-79	X
82	1+20U-2+10U C	10x10	-	-	12	5260	0.78	T7,AN	11-12-79	X
83	2+64U-3+37U C	10x10	-	-	6-12	3463	0.77	T7.AN	11-13-79	X
84	50	10x10	-	-	3	777	0.30	T7	11-14-79	
85	9+50-13+50D	10x10	-	-	3	2652	0.39	T7	11-14-79	X
86	1+90-5+50D E	10x10	-	-	3	2619	0.38	T7	11-15-79	X
87	50	-	15-30	360	20	-	-	T1,DC	11-16-79	
89	56	5x5,8x8	-	357	3-18	3204	1.43	T7,AN	11-20-79	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord

E - East

C - Center

W - West

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
90(A)		-	30	381	20-24	-	-	T1	11-27-79	
90	50	-	30	360	20	-	-	T1	11-23-79	
91		10x10	-	364	3	1289	0.36	T7	11-27-79	
92	0+14D-1+04U E	10x10	-	382	5-15	5280	0.74	T7,AN	11-28-79	X
93	0+54U-3+00U W	10x10	-	372	3	2220	0.33	T7	11-29-79	X
94	1+74U-2+00U E	-	30	381	3-36	-	-	T1,DC	11-30-79	X
95	1+40U-1+80U E	8x8	-	380	15	3911	0.67	T7,UN,AN	12-03-79	X
96	13+00-14+00 E	8x8	-	358-352	3	2508	0.29	T7	12-05-79	X
97	13+00-13+40 E	8x8	-	354	3	2390	0.35	T7	12-06-79	X
98	50	-	15-30	364	23	-	-	T1,DC	12-07-79	
99	50	-	15-30	367	23	-	-	T1,DC	12-10-79	
100	56	6x6,8x8	-	351	11-17	9478	1.11	T7,UN,AN	12-11-79	
101	50	-	15-30	380-367	3-36	-	-	T1,DC	12-12-79	
102	50	6x7	-	351-355	11-16	10410	0.89	T7,UN	12-15-79	
103	50	-	15-30	368	27	-	-	T1,DC	12-17-79	
104	50	6x7	-	352-356	12-17	7440	0.99	T7,UN	12-18-79	
106	16+00 haul road	-	30	335	20	-	-	T1	12-20-79	X
107	50	7x8	-	350	10-12	15447	0.87	T7	12-21-79	
108	50	7x8	-	353	14-16	8754	0.78	T7	12-22-79	
109	50	6x7	-	360	18-22	6962	1.39	T7,UN,AN	12-31-79	
110	50	6x8	-	356	15-18	7324	1.46	T7,AN	01-03-80	
111	50	-	15-30	362	24	-	-	T1,DC	01-03-80	
112	50	6x8	-	356-358	18-20	7786	1.23	T7,AN	01-04-80	
113	56	-	30	338	20-22	-	-	T1	01-07-80	
114	2+09U-3+00U E	10x10	-	375-382	8-14	3666	0.61	T7	01-05-80	X
115	56	6x8	-	338-340	22-23	11777	1.28	T7	01-09-80	
117	56	-	30	339	22-25	-	-	T1	01-10-80	
118	50	SAME AS 119	-	358-360	20-22	9777	0.94	T7,AN	01-10-80	
119	50	7x10	30	360	25	7638	0.86	T7	01-14-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord   E - East

*Stations given where shot does not appear on drawings

TABLE 9
BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
120	14+25-16+00	-	30	336	19	-	-	T1	01-15-80	X
121	56	5x5	-	336	19	823	1.70	T7	01-15-80	
122	50	7x10	30	360	22	7473	0.84	T7,AN	01-16-80	
123	56	6x9	-	338	20	13379	0.81	T7	01-18-80	
124	56	6x9	-	340	24	6111	0.81	T7	01-18-80	
125	56	8x10	-	336	21	4416	0.91	T7	01-23-80	
126	50	9x10	30	361	23	12140	0.94	T7,AN,T1	01-24-80	
127	51 & 56	9x10	-	339	24	9263	0.92	T7	01-28-80	
128	50	-	15-30	360	10	-	-	T1,DC	02-04-80	
129	0+60-1+60 E	10x10	-	366	3	3474	0.35	T7	02-05-80	X
131	50	-	15-30	362	25	-	-	T1,DC	02-06-80	
1C	50	9x10	-	361	24	6295	-	T7		
2C	50	9x10	-	361	24	4511	0.58	T7	04-18-80	
133	11+38-12+30 E	-	30	340	27	-	-	T1	04-28-80	X
133A	51	9x10	30	340	27	10222	0.96	T7,T1	03-11-80	
134	50	-	15-36	362	24	-	-	T1,DC	04-23-80	
136	51	8x9		341	15	6172	0.94	T7	04-21-80	
3	50	-	30	361	25	-	-	KK	03-26-80	
4	50	6x8	-	361	10	3888	0.57	T7	03-27-80	
6	50	-	30	362	24-26	-	-	KK,DC	04-06-80	
7	50	6x8	-	361	11	3880	0.78	AP,PP	04-30-80	
8	50	6x8	-	362	11	4203	1.02	T7,PP	05-23-80	
9	50	6x8	-	351	11	4134	0.61	T7	06-03-80	
10	51	-	-	341	27	-	-	KK	03-26-80	
11A	51	6x8	-	342	8-14	4346	0.74	T7,PP	04-14-80	
137	50	-	-	380	30	-	-	KK	04-15-80	
138	3+320-4+110 E	5x10	-		3-8	1461	0.31	AP-PP	04-17-80	X
139	51	-	30	342	27	-	-	T1,DC		

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, AP-Apex 240, KK-Kleen Kut

E - East
C - Center

*Stations given when shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
140	disapproved									
141	disapproved									
142	51	8x9	-	342	14	3813	1.00	T7,AN	04-24-80	
143	50	-	30	363	25	-	-	KK	05-01-80	
144	51	8x9	-	341	14-15	3385	0.97	T7	04-30-80	
145	51	8x9	-	342	14-15	3120	1.18	T7,AN	05-02-80	
146	51	8x9	-	341	11-15	4679	1.00	T7,AN	05-05-80	
147	51	9x9	-	342	15	8956	0.77	T7,AN	05-08-80	
148	51	-	15-30	341-343	27-29	-	-	KK,T1	05-09-80	
149	Not shot									
150	51	9x9	-	341	14-15	8190	0.73	T7	05-21-80	
151	50	6x8	-	361	11	1452	0.62	T7	05-14-80	
152	51	9x9	-	341-342	15	4167	0.90	T7	05-17-80	
153	50	-	15-30	363	27	-	-	KK,T1	05-20-80	
154	0+14.5D-1+74U E	-	15-30		25	-	-	KK,T1	05-27-80	X
155	51	-	15-30	342	14-15	-	-	T1	08-15-80	
156	Not shot									
157	50	9x9	-	352	13	5325	0.68	T7	06-04-80	
158	51	9x9	-	341	12-15	3889	0.67	T7,PP	06-02-80	
159	50	-	15-30	365-368	16-24	-	-	T1,DC	06-07-80	
160	50	5x5	-	365-368	3-20	1991	2.01	T7	05-29-80	
161	50	6x8	-	350	10	1452	0.68	PP	06-02-80	
162A	50	-	15-30	362	26	-	-	T1	06-13-80	
162B	50	-	15-30	362	26	-	-	T1	06-17-80	
162C	50	-	15-30	362	26	-	-	T1	06-17-80	
162D	50	-	15-30	362	26	-	-	T1	06-18-80	
162E	50	-	15-30	362	24	-	-	T1,DC	06-25-80	
163	51	9x10	-	327	11-14	4542	0.85	T7,PP	06-06-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

E - East
C - Center
W - West

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
164	3+68-5+02	-	30	362	23	-	-	T1	06-06-80	X
165	50	8x8	-	362	23	3575	1.01	T7,PP	06-06-80	
166	50	7x8	-	351	14	6232	0.77	PP	06-11-80	
167A	51	-	15-30	340	23-26	-	-	T1	06-26-80	
167B	51	-	15-30	340	26	-	-	T1,DC	06-12-80	
168	51	9x9	-	338-341	11-15	8636	0.74	T7	06-09-80	
169	Not shot									
170	50	9x9	-	364	3-16	1239	1.03	T7,PP	06-10-80	
171	50	6x9	-	365-368	3-20	933	1.05	T7,PP		
172	51	10x10	-	326-328	12-14	6644	0.66	T7	06-13-80	
173	2+85-4+04D W	-	15-30	362	25-26	-	-	KK,T1,DC	06-09-80	X
174	50	9x9	-	362	25	3130	0.75	T7	06-09-80	
175	50	9x10	-	365	17-18	6233	0.78	T7,PP	06-11-80	
176	50	9x10	-	364	17	7367	0.77	T7,PP	06-12-80	
177	50	10x10	-	363	17	7556	0.67	T7,PP	06-14-80	
178	50	7x8	-	361	11	3178	0.70	PP	06-16-80	
179	51	10x10	-	340	14-14	2333	0.45	T7	06-16-80	
180	50	7x9	-	362	11	2999	0.61	PP	06-18-80	
181	50	8x9,10x10	-	362	11-18	5428	0.79	T7,PP	06-18-80	
182										
183	50	7x9	-	362	11-13	3740	0.70	PP	06-20-80	
184	50	7x9	-	362	11-13	2884	0.67	PP,T1	06-24-80	
185A	50	7x9	-	362	13	2642	0.75	PP	06-23-80	
185B	50	7x9	-	362	13	3208	0.58	PP	06-26-80	
186	50	7x9	-	362	11	2314	0.56	PP	06-20-80	
187	50	7x9	-	362	11	3936	0.66	PP	06-23-80	
188	50	7x9	-	362	11	2926	0.62	PP	06-24-80	
189	50	7x9	-	351	11-12	2945	0.74	PP	06-20-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

E - East
C - Center
W - West

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
190	51	10x10	-	340	10-15	2817	0.56	T7	06-25-80	
191	51	10x10	-	341	14	2248	0.54	AP,T7	06-28-80	
192	6+56-6+36 W	-	15	361	9-10	-	-	DC	07-28-80	X
193	50	Irregular	-	361	6-8	890	0.24	PP,T1	07-29-80	
194	50	7x9	-	351	12	3496	0.65	PP	06-28-80	
195	51	10x10	-	329	13-15	4900	0.70	T7	07-01-80	
196	50	7x9	-	361	11	2869	0.52	PP	06-27-80	
197	50	7x9	-	361	11	1603	0.58	PP	06-25-80	
198	50	10x10	-	361	14	3027	0.49	T7,PP	06-28-80	
199	50	10x10	-	361.5	14.5	1716	0.71	T7,PP	06-30-80	
200	50	10x10	-	363	15-17	3484	0.43	T7,PP	07-02-80	
201	50	7x9	-	363	13	1227	0.57	PP	06-27-80	
202	50	10x10	-	365	18	2840	0.63	T7,PP	06-28-80	
203	50	10x10	-	364	18	2047	0.69	T7,PP	06-30-80	
204	50	10x10	-	363	16	3738	0.47	T7,PP	07-01-80	
205A	51	10x10	-	329	15	2000	0.75	T7	07-07-80	
205B	51	10x10	-	329	15	3289	0.77	T7	07-10-80	
206	Not Shot									
207	50	10x10	-	365	18	1418	0.54	T7,PP	07-07-80	
208	50	-	24	349	35	-	-	T1	07-09-80	
209	50	10x10	-	364.5	18	1895	0.52	T7,PP	07-10-80	
210	50	7x9	-	351	12	2558	0.60	PP,T1	07-02-80	
211	50	7x9	-	351	12	4961	0.81	PP	07-03-80	
212	51	-	15-24	338	24-26	-	-	T1,DC	07-10-80	
213	51	-	15-24	338	24-26	-	-	T1	07-10-80	
214	51	-	15-24	338	24-26	-	-	T1	07-11-80	
215	50	8x0	-	352	12	1982	0.68	PP	07-08-80	
216	50	7x9	-	352	12	2962	0.69	PP	07-08-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

E - East
C - Center
W - West

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
217	50	10x10	-	364	16	3474	0.63	T7,PP	07-07-80	
218	50	10x10	-	366	18	3060	0.53	T7,PP	07-12-80	
219	50	10x10	-	364	17	3578	0.47	T7,PP	07-10-80	
220	50	7x9	-	352	11	5732	0.82	PP	07-09-80	
221	51	10x10	-	338	11	2132	0.71	T7,PP	07-14-80	
222	51	-	24	338-340	25-26	-	-	T1	07-14-80	
223	51	-	24	338	25	-	-	T1	07-15-80	
224	50	7x9	-	352	12	2978	0.74	PP	07-11-80	
225	50	7x9	-	352	12	2978	0.78	PP	07-12-80	
226	50	7x9	0	352	12	2613	0.69	PP	07-14-80	
227	50	7x9	-	352	12	2613	0.68	PP	07-15-80	
228	50	7x9	-	352	12	640	0.54	PP	07-17-80	
229	50	7x9	-	352	12	640	0.54	PP	07-17-80	
230	51	-	24	338-341	24-26	-	-	T1	07-15-80	
231	51	-		338-341	24-26	-	-	-	07-17-80	
232	50	-	15-30	348-349	8	-	-	T1	07-18-80	
233	50	7x9	-	349	9	-	-	PP	07-24-80	
234	50	-	15-24	347	9	-	-	T1	07-25-80	
235	50	7x9	-	348-349	8	3039	0.64	PP	07-29-80	
236	51	10x10	-	338	12	3553	0.59	T7,PP	07-16-80	
237	51	10x10	-	338	11	3300	0.53	T7,PP	07-16-80	
238	51	10x10	-	340	11	3069	0.52	T7,PP	07-17-80	
239	51	10x10	-	340	11	4107	0.59	T7,PP	07-18-80	
240	51	10x10	-	340	6-11	2766	0.52	T7,PP	07-19-80	
241	51	-	15-24	340	26	-	-	T1,DC	07-19-80	
242	51	-	15-24	341	27	-	-	T1	07-24-80	
243	51	-	15-30	340-341	26-27	-	-	T1	07-25-80	
244	51		15-24	341	27	-	-	T1	08-07-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

*Stations given where shot does not appear on drawings

TABLE 9
BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
245	51	10x10	-	341	11	6089	0.59	T7,PP,T1	07-30-80	
246	51	-	24	340	27	-	-	T1	07-24-80	
247	51	-	24	340	27	-	-	T1,DC	07-28-80	
248	51	-	15-24	340	27	-	-	T1,DC	08-11-80	
249	51	-	15-24	340	27	-	-	T1,DC	07-29-80	
250	51	-	15-24	340	27	-	-	T1	07-31-80	
251	51	-	15-24	340	27	-	-	T1	07-31-80	
252	51	-	24	340	27	-	-	T1	08-04-80	
253	50	Irregular	-	365	10	178	0.24	PP,T1	08-11-80	
254	51	10x10	-	340	11	3015	0.69	T7,PP	07-28-80	
255	51	10x10	-	340	11	5956	0.61	T7,PP	08-01-80	
256	51	7x9	-	340	11	4767	0.70	PP	07-30-80	
257	51	8x9	-	340	11	2770	0.46	PP,T1	08-01-80	
258	51	8x9	-	340	11	2770	0.48	PP,T1	08-01-80	
259	51	8x9	-	340	11	2730	0.59	PP	08-04-80	
260	51	8x9	-	340	11	2730	0.68	PP	08-04-80	
261	51	9x9	-	340	11	3173	0.47	PP	08-08-80	
262	51	8x9	-	340	11	3173	0.59	PP	08-06-80	
263	50	-	12	360-350	20-10	-	-	DC	08-06-80	
263A	50	Irregular	-	360-350	8	666	0.33	PP,T1	08-08-80	
264	50	-	24	348-350	4-7	-	-	T1	08-07-80	
265	50	-	24	348	4.5	-	-	T1	08-20-80	
266	50	5x5	-	351	7	830	0.37	T7,PP	09-26-80	
267	50	6x8	-	350	6	1011	0.77	PP	10-01-80	
268	50	-	24	369	6-8	-	-	KK	08-19-80	
269	51	8x9	-	340-341	11	3178	0.59	PP	08-12-80	
270	51	-	15-24	340	27	-	-	T1,DC	08-13-80	
271	51	9x9	-	340	14	3074	0.67	PP	08-15-80	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
272	51	9x9		340	15	4808	0.55	PP	08-24-80	
273	50	9x9		369	16	844	0.52	PP		
274	50	5x5		368	3-5	1367	0.76	PP	08-18-80	
274A	50	-		361	9	-	-	DC	08-19-80	
275	51	10x10		329	5	3344	0.32	T7	08-21-80	
275A	50	Irregular		361	8				08-20-80	
276	51	12x12		330	5	2960	0.30	T7	08-22-80	
277	50	-	12	360	8-9	-	-	DC	08-29-80	
278	50	Irregular		360	7	272	0.27		08-29-80	
279	51	9x9		338	24	6578	0.44	T7,PP	09-26-80	
280	51	Irregular		340	4	84	-		09-26-80	
281	50	7x7	30	368	16	2963	0.63	T7		
30PS	50	-		368	17	-	-	T1	09-15-82	
NC1	50	6x6		362	9	276	0.67	T7,PP	09-16-82	
NC2	50	3x4		365	15	270	0.54	T1	09-17-82	
NC3	50	6x6		366	16	576	0.87	T7,PP	09-18-82	
NC4	50	6x6		368	17	576	0.87	T7,PP	09-20-82	
NC5	50	6x6		368	17	576	0.71	T7,PP	09-21-82	
NC6	50	5x6		368	17	340	0.74	T7,PP	09-22-82	
NC7	50	5x6		368	17	340	0.74	T7,PP	09-22-82	
29PS	56	-	30	360	20	-	-	T1	09-29-82	
31PS	56	-	30	334	19	-	-	T1	10-04-82	
32PS	56	-	30	336	20	-	-	T1	10-06-82	
DSR1	56	6x6		356	8	888	0.70	T8,PP	09-29-82	
DSR2	56	6x6		356	8	533	0.90	T8,PP	09-29-82	
DSR3	56	6x6		357	8	622	0.70	T8,PP	09-30-82	
DSR4	56	6x6		346	10	1111	0.93	T8,PP	09-30-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

*Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
DSR5	56	6x6		345	10.5	1089	1.14	T8,PP	10-01-82	
DSR6	56	6x6		334	19	1133	1.23	T8,PP	10-05-82	
DSR7	56	6x6		334	19	833	0.97	T8,PP	10-04-82	
DSR8	56	6x6		333	18	680	1.13	T8,PP	10-06-82	
DSR9	56	6x6		333	18	768	1.06	T8,PP	10-06-82	
DSR10	56	6x6		337	22	840	1.07	T8,PP	10-11-82	
DSR11	56	6x6		337	22	840	1.07	T8,PP	10-11-82	
DSR12	56	6x6		337	22	340	1.08	T8,PP	10-11-82	
DSR13	56	6x6		337	22	784	0.99	T8,PP	10-13-82	
DSR14	56	6x6		335	20	253	0.98	T8,PP	10-13-82	
DSR15	56	6x6		337	22	840	0.99	T8,PP	10-13-82	
DSR16	56	6x6		338	23	254	0.98	T8,PP	10-14-82	
DSR17	56	6x6		339	24	736	0.98	T8,PP	10-14-82	
DSR18	56	6x6		340	25	706	1.05	T8,PP	10-15-82	
DSR19	56	6x6		340	25	833	0.90	T8,PP	10-15-82	
DSR20	56	6x6		334-329	18-12	1444	0.93	T8,PP	10-16-82	
DSCR21	56	6x6		339-337	22-26	2444	0.73	T8,PP	10-19-82	
DSCR22	56	6x6		337	10	1111	0.90	T8,PP	10-18-82	
DSCR23	56	6x6		338-344	28-23	2222	0.96	T8,PP	10-20-82	
DSCR24	56	6x6		346-343	30-26	3000	1.01	T8,PP	10-22-82	
DSCR25	56	6x6		360-356	3-8	510	0.72	T8,PP	10-23-82	
DSCR26	56	6x6		360	8	776	0.65	T8,PP	10-23-82	
DSCR27	56	6x6		360	8	1777	0.67	T8,PP	10-26-87	
DSCR28	56	5x5		347	31	2666	1.34	T8,PP	10-28-82	
DSCR29	56	5x5		350	10	1212	1.33	T8,PP	10-29-82	
DSCR30	56	5x5		350	10	1666	1.10	T8,PP	11-01-82	
DSCR31	56	5x5		345	10	1850	1.19	T8,PP	11-04-82	
DSCR32	56	5x5		335	20	1573	1.25	T8,PP	11-03-82	
DSCR33	56	5x5		335	20	981	1.51	T1,T8,PP	11-05-82	
DSCR34	56	5x5		335	20	851	1.69	T1,T8,PP	11-06-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

* Stations given where shot does not appear on drawings

TABLE 9

BLASTING DATA - LOCK AND CANAL AREA (Cont)

SHOT NO.	*LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	SHEAR OR POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
DSCR35	56	5x5		335	20	1314	1.79	T1,T8,PP	11-09-82	
DSCR36	56	5x5		335	20	1296	1.88	T8,PP	11-10-82	
DSCR37	56	5x5		335	20	800	1.44	T8,PP	11-10-82	
DSCR38	56	5x5		335	20	1574	1.81	T8,PP	11-12-82	
35PS			30	360	25			T1	11-15-82	X
DSCR39	56	6x6		350	10	1617	0.95	T8,PP	11-16-82	
36PS	56		30	335	18			T1	11-18-82	
34PS	56	-	30	360	23-25	-	0.11	T1	11-15-82	
33PS	56	-	30	362	25	-	0.11	T1	10-19-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord
PP-Power Primer, KK-Kleen Kut

*Stations given where shot does not appear on drawings

VII. EXCAVATION AND TREATMENT FOR THE DOWNSTREAM APPROACH CHANNEL, 20+20D to 35+00D

7.01 Overburden.--Overburden excavation started at Station 20+20D and progressed south to Station 35+00D. The excavation was made with scrapers and endloaders, with the material being disposed of in designated spoil areas. Overburden slopes were 1V on 3H.

7.02 Excavation.--Rock excavation in the downstream channel started in early August 1981 with presplit shots. Slopes were presplit with holes on 30-inch centers using DuPont's Tovex T-1. Rock slopes were 4V on 1H. Presplit shots were fired separately from production shots. The majority of production shots were made with Tovex 700, Tovex 800 and power primers, with shots delayed such that the blast was directed toward an open face. Powder factors were in the same range as those in the lock chamber. The maximum and minimum powder factors were 1.06 and 0.21, respectively. Due to the downstream dip and thickness of the bedrock, three lifts were required to reach grade from 20+20D to 24+00D, two lifts from 24+00D to 31+00D, and one lift from 31+00D to 35+00D.

The H_a member in this area contained numerous shale beds interbedded with sandstone. Because of the interbedded nature of this material, the contractor shot the sandstone and shale together rendering a portion of it unsuitable for use in the select fill and no. 2 filter. Zones of sandstone were selectively loaded in some instances to obtain the maximum amount of suitable embankment material from this area. See table numbers 10, 11, and 12 for blast data, pages 150-168. See drawings BSFR-56 and 57 for blast patterns. See drawings BSFR-58 through BSFR-61 for geologic sections.

7.03 Treatment.--A limited amount of foundation treatment was required for this area. Rock bolts were installed on a random pattern based on rock conditions encountered. The rock bolt installation method was the same as the lock chamber. After all rock bolts had been installed, the contractor was directed by modification P.00055 to cut off all rockbolts flush with the rock face between Elevation 335 and 321 in the downstream approach channel (9+50D to 35+00D). This was to prevent possible damage to river traffic which might brush along the walls.

Three-inch drain holes were drilled 25 feet deep, on 20-foot centers at Elevation 332 in the portion of the channel that reached grade above the H_b/H_c contract.

TABLE 10

BLASTING DATA - CANAL AREA 5, PRESPLIT

SHOT NO.	LOCATION OR DWG NO. BSFR-	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FT)	SHEAR FACTOR	TYPE POWDER	DATE SHOT
1PS	56	30	351-356	17-19	0.10	T1	08-12-81
2PS	56	30	349.5	19	0.10	T1	08-13-81
3PS	56	30	347.5-349.5	17-22	0.10	T1	08-14-81
4PS	56	30	344.9-347.4	22-23	0.10	T1	08-14-81
5PS	56	30	344.9	25	0.10	T1	08-19-81
6PS	56	30	340.0	23-24	0.10	T1	08-19-81
7PS	56	30	357	22-23	0.11	T1	
8PS	56	30	357-360	23-30	0.11	T1	08-21-81
9PS	56	30	339	22.8	0.10	T1	07-20-81
10PS	56	30	360-365	30-31	0.10	T1	09-14-81
11PS	56	30	350	28-29	0.09	T1	08-28-81
12PS(1)	56	30	351	29-30	0.09	T1	08-28-81
12PS(2)	56	30	351	29-33	0.08	T1	07-27-81
13PS	56	30	351	32.5	0.08	T1	07-27-81
14PS	56	30	349-350	33	0.09	T1	08-25-81

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord

TABLE 10

BLASTING DATA - CANAL AREA 5, PRESPLIT (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FT)	SHEAR FACTOR	TYPE POWDER	DATE SHOT
15PS	56	30	347	30	0.10	T1	09-11-81
16PS(1)	56	30	345	28	0.09	T1	09-30-81
16PS(2)	56	30	342	22-27	0.10	T1	10-01-81
17PS	56	30	363	19	0.11	T1	11-17-81
18PS	56	30	365	20	0.10	T1	11-17-81
19PS	56	30	365	19	0.11	T1	11-18-81
20PS(PT 1)	56	30	326-337	11-21	0.19	T1	12-10-81
20PS(PT 2)	56	30	327	12	0.13	T1	01-19-82
21PS	56	30	357	16	0.10	T1	11-20-82
22PS	56	30	338	23	0.09	T1	01-06-82
23PS(PT 1)	56	30	344	24-28	0.10	T1,DC	01-27-82
23PS(PT 2)	56	30	343	25-28	0.09	T1	02-02-82
24PS	56	30	340-332	19	0.11	T1	03-05-82
25PS	56	30	327	12	0.09	T1	03-10-82
26PS(PT 1)	56	30	330-325	10-16	0.10	T1	03-11-82
26PS(PT 2)	56	30	-	2-9	0.35	T1	05-06-82

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord

TABLE 10

BLASTING DATA - CANAL AREA 5, PRESPLIT (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PRESPLIT SPACING (INCHES)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FT)	SHEAR FACTOR	TYPE POWDER	DATE SHOT
27PS(1)	56	30	329-317	14.3	0.14	T1	03-22-82
27PS(2)	56	30	333-329	12	0.13	T1	03-23-82
28PS(1)	56	30	344-332	29-20	0.11	T1	04-15-82
28PS(2)	56	30	349-336	34-24	0.11	T1	04-20-82

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T1-Tovex T-1, T8-Tovex 800, T2-Tovex 200, AN-ANFO, DC-Detonating Cord

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS ( )
1pd	56	9x9	340	30-35	5445	0.93	T7,PP	09-01-81	
2pd	56	10x12	347	10-12	2130	0.54	T7,PP	09-08-81	
3pd	56	10x12	351	12-14	2889	0.46	T7,PP	09-11-81	
4pd	56	10x12	355	13	3467	0.43	T7,PP	09-16-81	
5pd	56	10x12	355	13	3466	0.49	T7,PP	09-24-81	
6pd	56	11x12	350	12	3300	0.44	T7,PP	09-26-81	
7pd	56	11x12	353	13	3432	0.42	T7,PP	09-29-81	
8pd	56	11x12	354	13	3432	0.42	T7,PP	10-02-81	
9pd	56	11x12	355	13	2860	0.42	T7,PP	10-19-81	
10pd	56	11x12	350	13	3548	0.41	T7,PP	10-15-81	
11pd	56	11x12	353	13	3813	0.41	T7,PP	10-16-81	
12pd	56	11x12	357	13	2288	0.42	T7,PP	10-20-81	
13pd	56	11x12	355-357	13-15	3962	0.38	T7,PP	10-20-81	
14pd	56	11x12	357-359	13-15	3300	0.36	T7,PP	10-22-81	
15pd	56	11x12	350	10.5	3080	0.30	T7,PP	10-22-81	
16pd	56	10x12	345-350	10-12	2957	0.26	T7,PP	10-23-81	
17pd	56	11x12	357	11	1936	0.29	T7,PP	10-23-81	
18pd	56	11x12	350-352	10	2933	0.29	T7,PP	10-24-81	
19pd	56	11x12	354	10	2200	0.29	T7,PP	10-24-81	
20pd	56	11x12	350	10	3933	0.19	T7,PP	10-27-81	
21pd	56	11x12	350	10	2966	0.21	T7,PP	10-27-81	
22pd	56	11x12	353	13	5980	0.25	T7,PP	10-28-81	
23pd	56	11x12	354-357	10-13	5160	0.26	T7,PP	10-28-81	
24pd	56	10x10	340	10	7037	0.56	T7,PP	10-29-81	
25pd	56	10x10	343	10	4444	0.63	T7,PP	10-30-81	
26pd	56	10x10	343	10	3333	0.63	T7,PP	10-31-81	
27pd	56	10x10	347	10	3333	0.63	T7,PP	11-02-81	
28pd	56	11x12	345	32	5866	0.46	T7,PP	11-03-81	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11
BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (
29pd	56	10x10	337-342	10	2222	0.62	T7,PP	11-03-81	
30pd	56	10x10	343	10	3148	0.57	T7,PP	11-04-81	
31pd	56	10x10	348	7	1137	0.43	T7,PP	11-05-81	
32pd	56	10x10	343	10	2222	0.55	T7,PP	11-05-81	
33pd	56	10x10	345	10	1666	0.44	T7,PP	11-06-81	
34pd	56	10x10	345	10	1296	0.50	T7,PP	11-07-81	
35pd	56	11x12	340-345	25-30	4888	0.47	T7,PP	11-11-81	
36pd	56	10x10	342	10	2488	0.49	T7,PP	11-10-81	
37pd	56	11x12	345	32-34	6081	0.44	T7,PP	11-11-81	
38pd	56	10x10	345	10	3377	0.43	T7,PP	11-11-81	
39pd	56	10x10	342	10	2000	0.48	T7,PP	11-16-81	
40pd	56	11x12	347-349	34	7040	0.50	T7,PP	11-13-81	
41pd	56	10x10	343-347	10	2963	0.40	T7,PP	11-17-81	
42pd	56	11x12	340	10	2300	0.30	T7,PP	11-20-81	
43pd	56	10x10	354	10	2962	0.48	T7,PP	11-20-81	
44pd	56	10x10	360	10	2904	0.51	T7,PP	11-24-81	
45pd	56	11x12	347	33	6600	0.48	T7,PP	11-24-81	
46pd	56	10x10	358	10	2592	0.56	T7,PP	11-25-81	
47pd	56	10x10	359	10	1481	0.51	T7,PP	12-02-81	
48pd	56	10x10	359	10	1481	0.51	T7,PP	12-02-81	
49pd	56	10x10	358	8	889	0.65	T7,PP	12-03-81	
50pd	56	10x10	358	8	593	0.41	T7,PP	12-03-81	
51pd	56	10x10	358	8	889	0.28	T7,PP	12-04-81	
52pd	56	11x12	344-339	25-30	5989	0.51	T7,PP	12-04-81	
53pd	56	11x12	339-344	25-30	5989	0.48	T8,PP	12-07-81	
54pd	56	10x10	357	10	3704	0.51	T8,PP	12-08-81	
55pd	56	*	337	10	*	*	*	*	
56pd	56	10x10	358	10	185	0.50	T8,PP	12-08-81	
57pd	56	8x8	357	8	1706	0.45	T8,PP	12-09-81	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240
* INFORMATION NOT AVAILABLE

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (?)
58pd	56	8x8	359	8	1706	0.42	T8PP	12-10-81	
59pd	56	8x8	359	8	682	0.57	T8PP	12-10-81	
60pd	56	8x8	359	8	682	0.57	T8PP	12-11-81	
61pd	56	8x8	359	8	853	0.30	T8PP	12-11-81	
62pd	56	11x12	340	25-33	10388	0.55	T8PP	12-15-81	
63pd	56	10x10	357	10	4296	0.50	T8PP	12-12-81	
64pd	56	10x10	359	10	2981	0.56	T8PP	12-16-81	
65pd	56	10x11	359	10	1405	0.52	AP,PP	12-16-81	
66pd	56	11x12	338-345	25-33	10388	0.56	AP,T8,PP	12-22-81	
67pd	56	8x8	360	8	1706	0.47	AP,PP	12-30-81	
68pd	56	11x12	337-345	25-32	9166	0.56	AP,PP	12-28-81	
69pd	56	10x10	334	10	3703	0.49	AP,PP	01-05-82	
70pd	56	8x8	360	8	1194	0.47	AP,PP	01-08-82	
71pd	56	10x10	334	10	5555	0.60	T8,AP,PP	01-20-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
72pd	56	8x8	365	8	592	0.48	AP,PP	01-25-82	
73pd	56	8x8	365	8	592	0.48	AP,PP	01-25-82	
74pd	56	8x8	365	8	592	0.48	AP,PP	01-26-82	
75pd	56	8x8	365	8	767	0.47	AP,PP	01-26-82	
76pd	56	8x8	365	8	512	0.37	AP,PP	02-01-82	
77pd	56	8x8	365	8	512	0.37	AP,PP	02-01-82	
78pd	56	11x12	335-340	22-27	8066	0.61	AP,PP	02-19-82	
79pd	56	10x10	326-331	12-17	7777	0.60	AP,PP	02-04-82	
80pd	56	10x10	324-327	10-13	4259	0.51	AP,PP	02-08-82	
81pd	56	10x10	343-335	10	4814	0.51	AP,PP	02-11-82	
82pd	56	10x10	336-330	10	4481	0.47	AP,PP	02-20-82	
83pd	56	11x12	342-331	16-27	11806	0.45	AP,PP	02-23-82	
84pd	56	11x12	338-328	14-26	12160	0.51	T8,PP	03-03-82	
85pd	57	8x8	343	12	376	0.43	T8,PP	03-09-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X
86pd	57	8x8	343	8	376	0.40	PP	03-09-82	
87pd	57	8x8	342	12	376	0.60	PP	03-10-82	
88pd	57	8x8	341	12	376	0.60	PP	03-10-82	
89pd	57	8x8	340	12	376	0.56	PP	03-11-82	
90pd	57	8x8	340	12	376	0.56	PP	03-11-82	
91pd	57	8x8	340	12	376	0.56	PP	03-12-82	
92pd	57	8x8	340	12	376	0.56	PP	03-12-82	
93pd	57	8x8	339	12	376	0.56	PP	03-16-82	
94pd	57	8x8	340	12	376	0.56	PP	03-16-82	
95pd	57	8x8	340	12	376	0.56	PP	03-18-82	
96pd	57	8x8	338	12	1109	0.71	PP	03-19-82	
97pd	35+01-34+65D 20+91-22+15S	12x12	327	12	1920	0.23	PP	03-17-82	X
98pd	57	8x8	338	12	1109	0.71	PP	03-19-82	
99pd	57	8x8	339	12	1109	0.67	PP	03-22-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X
100pd	56	10x10	340	12	1333	0.59	T8,PP	03-22-82	
101pd	57	10x10	340	12	1333	0.65	AP,PP	03-23-82	
102pd	57	10x10	340	12	1333	0.65	AP,PP	03-23-82	
103pd	57	10x10	339	12	3555	0.66	AP,PP	03-24-82	
104pd	57							03-25-82	
105pd	57	10x10	336	12	5333	0.62	T8,PP	03-26-82	
106pd	32+8U-34+64D 20+91-21+41S	12x12	324	6-10	1444	0.21	T8,PP	03-30-82	X
107pd	57	8x8	343	12	341	0.43	T8,PP	04-06-82	
108pd	57	8x8	343	12	341	0.43	PP	04-06-82	
109pd	57	8x8	346	12	341	0.57	PP	04-07-82	
110pd	57	8x8	344	12	341	0.57	PP	04-07-82	
111pd	57	8x8	342	12	341	0.57	PP	04-09-82	
112pd	57	8x8	341	12	341	0.57	PP	04-09-82	
113pd	57	8x8	340	12	341	0.57	PP	04-09-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11
BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X
114pd	57	8x8	341	12	341	0.57	PP	04-09-82	
115pd	56	8x8	341	12	341	0.57	PP	04-09-82	
116pd	57	8x8	340	12	341	0.57	PP	04-12-82	
117pd	57	8x8	340	12	341	0.57	PP	04-12-82	
118pd	57	8x8	340	12	1024	0.65	PP	04-13-82	
119pd	57	8x8	339	12	1024	0.65	PP	04-13-82	
120pd	57	8x8	340	12	1066	0.63	PP	04-14-82	
121pd	57	8x8	339	12	1422	0.64	PP	04-14-82	
122pd	57	10x10	338	12	1333	0.61	PP	04-15-82	
123pd	56	10x10	337	12	1333	0.62	PP	04-15-82	
124pd	--	Irregular	319	3	high bottom shot		T8	04-14-82	X
125pd	57	10x10	335	12	3111	0.62	T8,PP	04-21-82	
126pd	57	10x10	333	12	3111	0.62	T8,PP	04-21-82	
127pd	56	10x10	331-333	12	6222	0.61	T8,PP	04-22-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X
128pd	57	8x8	349	12	391	0.46	T8,PP	04-21-82	X
129pd	57	8x8	349	12	391	0.40	T8,PP	04-21-82	
130pd	57	8x8	347	12	394	0.54	PP	04-22-82	
131pd	57	8x8	345	12	391	0.54	PP	04-22-82	
132pd	57	8x8	350	12	390	0.58	PP	04-23-82	
133pd	57	8x8	350	12	390	0.58	PP	04-23-82	
134pd	57	8x8	348	12	390	0.58	PP	04-24-82	
135pd	57	8x8	348	12	390	0.58	PP	04-26-82	
136pd	57	8x8	347	12	390	0.58	PP	04-26-82	
137pd	57	8x8	346	12	390	0.58	PP	04-22-82	
138pd	57	8x8	345	12	390	0.58	PP	04-27-82	
139pd	57	10x10	332	12	6222	0.62	T8,PP	04-23-82	
140pd	57	10x10	336	12	3422	0.57	T8,PP	04-24-82	
141pd	57	10x10	322-329	7-12	5185	0.63	T8,PP	04-24-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (*Cont*)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
142pd	57	8x8	345	12	1109	0.65	PP	04-28-82	
143pd	57	8x8	343	12	1203	0.61	PP	04-28-82	
144pd	57	8x8	342	12	1130	0.66	PP	04-30-82	
145pd	57	10x10	325-330	9-12	5444	0.62	T8,PP	04-27-82	
146pd	57	5x5 to 10x10	319-324	5-9	3370	0.94	T8,PP	04-28-82	
147pd	57	8x8	340	12	1592	0.59	PP	04-30-82	
148pd	57	10x10	338	12	1466	0.62	T8,PP	04-30-82	
149pd	57	10x10	338	12	1466	0.62	T8,PP	05-01-82	
150pd	57	10x10	336	12	3555	0.53	T8,PP	05-01-82	
151pd	57	5x5 to 10x10	319-323	4-9	*	*	T8,PP	05-03-82	
152pd	57	5x5 to 10x10	319-323	4-9	*	*	T8,PP	05-03-82	
153pd	56	5x5 to 8x8	318-326	4-8	4888	0.99	T8,PP	05-05-82	
154pd	56	5x5 to 8x8	318-326	4-8	3895	0.79	T8,PP	05-11-82	
155pd	57	6x8	334	20	462	0.62	PP	05-11-82	

*Information unavailable

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11
BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
156pd	57	6x8	334	20	362	0.69	PP	05-12-82	X
157pd	57	6x8	335	20	427	0.62	PP	05-12-82	
158pd	57	6x8	334	20	426	0.62	PP	05-13-82	
160pd	57	8x8	334	19	512	0.58	PP	05-14-82	
161pd	57	8x8	332	18	512	0.58	PP	05-14-82	
162pd	57	8x8	331	17	512	0.56	PP	05-14-82	
163pd	57	8x8	331	17	512	0.58	PP	05-17-82	
164pd	57	10x10	330	16	592	0.51	T8,PP	05-18-82	
165pd	57	10x10	318-328	3-12	4444	0.97	T8,PP	05-17-82	
166pd	22+50-23+50D	10x10	325	2	1333	0.45	T8	05-11-82	X
167pd	22+50-23+50D	10x10	323	2	1185	0.48	T8	05-12-82	
	near centerline								
168pd	23+50-24+50D	10x10	323	2	800	0.32	T8	05-12-82	X
	E canal centerline								
169pd	57	5x5	323	3-5	1076	0.71	T8	05-18-82	
170pd	57	10x10	322-326	8-10	1962	0.46	T8,PP	05-19-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
171pd	23+50-24+50 E	10x10	330	2	777	0.42	T8	05-13-82	
172pd	57	10x10	330	16	592	0.60	T8,PP	05-18-82	
173pd	57	10x10	330	16	592	0.60	T8,PP	05-19-82	
174pd	57	10x10	330	16	592	0.55	T8,PP	05-19-82	
175pd	57	10x10	330	16	592	0.60	T8,PP	05-19-82	
176pd	57	10x10	326	10-12	1564	0.47	T8,PP	05-20-82	
177pd	57	10x10	329	15	555	0.64	T8,PP	05-20-82	
178pd	57	10x10	328	14	518	0.62	T8,PP	05-21-82	
179pd	57	10x10	328	14	518	0.62	T8,PP	05-21-82	
180pd	57	10x10	327	12-13	1777	0.62	T8,PP	05-21-82	
181pd	57	6x8	331	17	362	0.67	PP	05-21-82	
182pd	57	6x8	331	17	362	0.74	PP	05-24-82	
183pd	57	6x8	331	17	362	0.47	PP	05-24-82	
184pd	57	6x8	330	16	341	0.64	PP	05-26-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
185pd	57	6x8	330	16	341	0.64	PP	05-26-82	
186pd	57	6x8	330	15.5	341	0.64	PP	05-26-82	
187pd	57	8x8	330	16	440	0.68	PP	05-26-82	
188pd	57	8x8	329	15.5	440	0.60	PP	05-27-82	
189pd	57	8x8	329	15	440	0.60	PP	05-27-82	
190pd	57	8x8	329	15	440	0.60	PP	05-27-82	
191pd	57	10x10	329	15	555	0.52	T8,PP	05-27-82	
192pd	57	10x10	329	15	555	0.58	T8,PP	05-28-82	
193pd	57	10x10	328	14	518	0.56	T8,PP	05-28-82	
194pd	57	10x10	327-328	13-14	1000	0.53	T8,PP	05-28-82	
195pd	57	10x10	326-327	12-13	1333	0.57	T8,PP	05-31-82	
196pd	57	10x10	324-325	10-11	1222	0.54	T8,PP	06-01-82	
197pd	57	10x10	321	7-10	2203	0.56	T8,PP	06-02-82	
198pd	57	6x8	330-331	16-17	245	0.88	PP	06-01-82	

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
199pd	57	6x8	330	16-17	293	0.74	PP	06-01-82	
200pd	57	6x8	330	16-17	293	0.74	PP	06-02-82	
201pd	57	6x8	330	16-17	293	0.74	PP	06-02-82	
202pd	57	8x8	329	15	568	0.70	PP	06-03-82	
203pd	57	6x6	320	5	1111	1.06	T8,PP	06-04-82	
H1	*	5x5	*	3-7	694	0.72	T8	06-04-82	
204pd	57	8x8	330	15	568	0.70	PP	06-07-82	
H2	*	5x5	323	8	518	0.90	T8	06-07-82	
205pd	57	10x10	327	13	866	0.58	T8,PP	06-07-82	
206pd	57	10x10	326	12-13	925	0.60	T8,PP	06-08-82	
207pd	57	10x10	325	12	1120	0.62	T8	06-08-82	
H3	*	5x5	*	5	666	0.85	T8	06-08-82	
H4	*	5x5	*	6-8	324	1.03	T8	06-09-82	
208pd	57	10x10	325	11	1466	0.62	T8,PP	06-09-82	

*Information unavailable

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 11

BLASTING DATA - CANAL AREA 5, PRODUCTION (Cont)

SHOT NO.	LOCATION OR DWG NO. BSFR-	PATTERN (FEET)	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME (CY)	POWDER FACTOR	TYPE POWDER	DATE SHOT	NOT SHOWN ON DWGS (X)
209pd	57	5x5	329	5	1400	0.66	T8	06-08-82	
210pd	57	10x10	321-324	7-10	1777	0.67	T8	06-10-82	
211pd	57	5x5	320	5-8	2268	0.94	T8	06-14-82	
212pd	57	10x10	320-321	12	2032	0.66	T8	06-14-82	
213pd	57	6x8	330-331	16-17	293	0.34	PP	06-12-82	
214pd	57	6x8	330-331	16-17	293	0.75	PP	06-12-82	
215pd	57	6x8	330-331	16-17	293	0.38	PP	06-12-82	
216pd	57	8x8	329	15	364	0.68	PP	06-14-82	
217pd	57	8x8	329	14	364	0.68	PP	06-14-82	
218pd	57	10x10	327	12	610	0.58	T8,PP	06-15-82	
219pd	57	10x10	327	12	1369	0.48	T8,PP	06-15-82	
220pd	57	10x10	326	12	1662	0.57	T8,PP	06-15-82	
221pd		5x6	321	3-4	High Bottom	+	T8	09-03-82	X
222pd		5x5	321	3-4	High Bottom	+	T8	09-07-82	X
223pd		5x5	321	3-4	High Bottom	+	T8	09-08-82	X

+ Extra shots to correct for high bottom. No volume calculated, no powder factor.

SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

VIII. ADDITIONAL QUARRY

Because of an oversite in the preparation of the bid quantities for the select rock available in the downstream approach area of the dam, the Corps issued a change order for an additional quarry. The underrun in the select rock quantities occurred when the decision was made during the design phase of the project by the Corps to require contractors to use the sandstone in the downstream approach area instead of a separate quarry. It was argued that perspective contractors, given the option, would waste the sandstone interbedded with shale in the downstream approach area and use the massive rock from other sites on the project. This action would have had the overall effect of increasing the cost of the contract. Therefore, the contract required the bidders to use the downstream approach rock. However, when the bid quantities were computed, the Government estimators mistakingly considered the downstream rock to be a massive sandstone. This error caused a shortage in the select rock required for filters and riprap for the dam. Due to this shortage, the Corps issued modifications 40 and 41 to provide for suitable rock by developing an additional quarry located approximately 700 feet north of the axis of the dam.

Quarry excavation progressed in a northwesterly direction paralleling Gin Branch, a tributary of Mackeys Creek which had dissected the bedrock. Quarry development consisted of one lift in the H_a member having an average thickness of 20 feet. Presplitting was neither required nor used. Tovex 800 and power primers were used in all but one shot with powder factors in the range of 1.0. The maximum powder factor was 1.12 while the minimum was 0.74. The average powder factor was 0.93. Approximately 300,000 cubic yards of sandstone were excavated from this quarry, see Table 12 for blast data page 168. Descriptions of changes for modifications 40 and 41 are located on pages 26-28.

TABLE 12
BLASTING DATA - ADDITIONAL QUARRY

SHOT NO.	PATTERN FEET	APPROXIMATE SURFACE ELEVATION (MSL)	DEPTH (FEET)	VOLUME CY	POWDER FACTOR	TYPE POWDER	DATE SHOT
2Q	7x10	360	16	*	*	T8,PP,	05-24-82
3Q	7x10	360-364	16	6222	1.07	T8	06-17-82
4Q	7x10	360-364	16	6222	0.98	T8,PP	06-18-82
5Q	7x10	365	16	3608	0.96	T8,PP	06-19-82
6Q	7x10	360-364	16	8881	1.03	T8,PP	06-21-82
7Q	7x10	366	18	4990	0.95	T8,PP	06-22-82
8Q	7x10	370	18-19	6092	1.02	T8,PP	06-23-82
9Q	8x10 7x10	370	19-22	8960	0.96	T8,PP	06-25-82
10Q	8x10	373	22-25	9671	0.94	T8,PP	06-28-82
11Q	8x10	373	25-27	8000	0.94	T8,PP	06-30-82
12Q	8x10	375	27	6080	0.95	T8,PP	07-01-82
13Q	8x10	377	*	13511	0.92	T8,PP	07-07-82
14Q	8x10	379	33-35	14411	0.99	T8,PP	06-12-82
15Q	8x10	362	4-15	*	*	T8,PP	06-13-82
16Q	8x10	362-368	15-18	15644	0.89	T8,PP	07-19-82
17Q	8x10	379-381	35	10888	1.03	T8,PP	07-14-82
18Q	9x10	379-381	35	9800	0.81	T8,PP	07-16-82
19Q	8x10	362-368	15-18	10998	0.93	T8,PP	07-21-82
20Q	8x10	362-368	18	10426	1.00	T8,PP	07-23-82
21Q	8x10	382	30	19247	0.96	T8,PP	07-27-82
22Q	8x10	362-368	18	12640	0.93	T8,PP	07-31-82
23Q	8x10	364-368	18	7786	0.89	T8,PP	08-03-82
24Q	8x10	368	18	5786	0.80	T8,PP	07-04-82
25Q	8x10	370	18	12692	0.74	T8,PP	07-07-82
26Q	8x10	371-377	18	11232	*	T8,PP	08-10-82
27Q	8x10	369-374	18	10893	0.99	T8,PP	08-13-82
28Q	8x10	371	18	10124	0.98	T8,PP	08-16-82
29Q	8x10	372	16	7964	1.01	T8,PP	08-18-82
30Q	8x10	372	16	8343	1.01	T8,PP	08-19-82
31Q	8x10	372-376	16	9955	0.99	T8,PP	08-21-82
32Q	8x10	364	6-20	4528	0.88	T8,PP	08-25-82
33Q	8x10	383	27	14080	1.01	T1,T8,PP	08-27-82
34Q	8x10	369	20-25	9665	0.87	T8,PP	08-31-82
35Q	8x10	384	25	9333	0.99	T8,PP	09-02-82
36Q	8x10	384	25	9842	0.89	T8,PP	09-10-82
37Q	8x10	370-373	16	5802	1.12	T7,T8,PP	09-14-82
38Q	7x10	372-374	15	10278	1.12	T8,PP	09-24-82

*Information unavailable
SYMBOLS FOR POWDER TYPE: T7-Tovex 700, T8-Tovex 800, PP-Power Primer, AP-Apex 240

TABLE 13
CORNER ROCK BOLT DATA

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
3+57U 20+58S (corner)	05-30-80	*	26.9	27.8	Yes	35°, N 44°W	Locations Scaled off Dwgs.
3+31U 20+48S (corner)	05-30-80	*	26.9	27.8	Yes	30°, N 52°W	Locations Scaled off Dwgs.
3+31U 20+83S (corner)	05-30-80	*	29.2	30.0	Yes	30°, N 53°W	Locations Scaled off Dwgs.
3+64U 20+48S (corner)	05-30-80	*	26.6	27.8	No	Vertical	Locations Scaled off Dwgs.
3+64U 20+83S (corner)	05-30-80	*	26.9	27.8	No	Vertical	Locations Scaled off Dwgs.
3+64U 20+83S (corner)	05-30-80	*	29.1	30.0	Yes	30°, N 15°W	Locations Scaled off Dwgs.
3+64U 20+83S (corner)	05-30-80	*	29.1	30.0	Yes	30°, N 28°W	Locations Scaled off Dwgs.
2+64U 20+63S (corner)	05-30-80	*	26.9	27.8	No	Vertical	Locations Scaled off Dwgs.

*Information Not Available

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
2+64U 20+63S (corner)	05-30-80	*	29.1	30.0	Yes	30°, S 62°W	Locations Scaled off Dwgs.
2+64U 20+63S (corner)	05-30-80	*	29.1	30.0	Yes	30°, N 84°W	Locations Scaled off Dwgs.
3+31U 20+63S (corner)	05-29-80	*	29.2	30.0	No	30°, N 38°W	Locations Scaled off Dwgs.
3+31U 20+63S (corner)	05-29-80	*	29.2	30.0	Yes	38°, N 44°W	Locations Scaled off Dwgs.
3+31U 20+63S (corner)	05-29-80	*	26.8	27.8	Yes	30°, N 50°W	Locations Scaled off Dwgs.
1+52D ±22+85S	04-03-80	±365.0	29.1	30	Yes	Vertical	L-19 Corner Location Scaled off Dwg.
1+54D ±22+85S	04-03-80	365.0	29.1	30	Yes	20°, ±East	L-19 Corner Location Scaled off Dwg.
1+60D ±22+85S	04-03-80	365.0	26.9	27.8	Yes	20°, ±East	Location Scaled off Dwg.

*Information Not Available

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
1+60D ±22+85S	04-03-80	365.0	26.9	27.8	Yes	20°, ±East	Location Scaled off Dwg.
0+84U 20+47.7S (corner)	12-05-79	341.0	29.5	30	Yes	Vertical	Location Surveyed
0+84U 20+47.7S (corner)	12-05-79	341.0	24.1	25	Yes	Vertical	Location Surveyed
0+84U 20+47.7S (corner)	12-05-79	341.0	24.2	25	Yes	Vertical	Location Surveyed
2+02U 20+65S (corner)	12-05-79	*	24.5	25	Yes	Vertical	Location Scaled off Dwg.
2+02U 20+64S (corner)	12-05-79	*	29.5	30	Yes	Vertical	Location Scaled off Dwg.
1+48D 23+15S (corner)	06-27-80	*	29.1	30	Yes	20°, ±West	Location Scaled off Dwg.
1+48D 23+30S (corner)	06-27-80	*	24.1	25	Yes	20°, ±West	Location Scaled off Dwg.

*Information Not Available

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
1+48D 23+45S (corner)	06-27-80	*	24.1	25	Yes	20°, ±West	Location Scaled off Dwg.
1+83D 23+40S (corner)	06-27-80	*	29.1	30	No	Vertical	Location Scaled off Dwg.
0+84U 22+80.2S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed
0+84U 22+80.2S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed
0+84U 22+80.2S (corner)	12-07-79	*	30	30	Yes	Vertical	Location Surveyed
0+39.5U 22+86.7S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed
0+39.5U 22+86.7S (corner)	12-07-79	*	30	30	Yes	Vertical	Location Surveyed
0+39.5U 22+86.7S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed

*Information Not Available

TABLE 13

CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL) ORIENTATION	REMARKS
0+13.5D 22+89.7S (corner)	12-07-79	*	30	30	Yes	Vertical	Location Surveyed
0+13.5D 22+89.5S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed
0+13.5D 22+89.7S (corner)	12-07-79	*	25	25	Yes	Vertical	Location Surveyed
12+80D 21+00S (corner)	01-17-80	341.2	26.9	27.8	Yes	Vertical	Location Scaled off Dwg.
12+80D 21+00S (corner)	01-17-80	341.2	26.9	27.8	Yes	Vertical	Location Scaled off Dwg.
12+80D 21+00S (corner)	01-17-80	341.2	26.9	27.8	Yes	Vertical	Location Scaled off Dwg.
8+06D 23+32S (corner)	01-09-80	±360	24.5	25	Yes	Vertical	Location Scaled off Dwg.
8+06D 23+32S (corner)	01-09-80	±360	29.5	30	Yes	Vertical	Location Scaled off Dwg.

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL) ORIENTATION	REMARKS
8+06D 23+32S (corner)	01-09-80	±360	24.5	25	Yes	Vertical	Location Scaled off Dwg.
7+20D 22+75S (corner)	01-09-80	±360	24.5	25	Yes	Vertical	Location Scaled off Dwg.
7+20D 22+75S (corner)	01-09-80	±360	29.5	30	Yes	Vertical	Location Scaled off Dwg.
7+20D 22+75S (corner)	01-09-80	±360	24.5	25	Yes	Vertical	Location Scaled off Dwg.
0+15U 20+21S (corner)	12-04-79	*	24	25	Yes	Vertical	Location Scaled off Dwg.
0+15U 20+21S (corner)	12-04-79	*	24	25	Yes	Vertical	Location Scaled off Dwg.
0+15U 20+21S (corner)	12-04-79	*	29	30	Yes	Vertical	Location Scaled off Dwg.
0+39U (corner)	12-04-79	*	24.1	25	Yes	Vertical	Location Scaled off Dwg.

*Information Not Available

TABLE 13

CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
0+39U (corner)	12-04-79	*	24	25	Yes	Vertical	Location Scaled off Dwg.
0+39U (corner)	12-04-79	*	29.1	30	Yes	Vertical	Location Scaled off Dwg.
9+33.5D 20+80.3S (bolt)	10-26-79	362.9	24.2	25	Yes	Vertical	
9+26.5D 20+80.3S (bolt)	10-26-79	362.9	29.2	30	Yes	Vertical	
9+26.5D 20+73.3S (bolt)	10-26-79	362.9	24.2	25	Yes	Vertical	
8+53.7D 20+45.3S (bolt)	10-26-79	361.5	24.2	25	Yes	Vertical	
8+53.7D 20+38.3S (bolt)	10-26-79	361.5	29.2	30	Yes	Vertical	
8+60.7D 20+45.3S (bolt)	10-29-79	361.5	29.2	30	Yes	Vertical	

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
0+50D 20+19S (corner)	02-06-80	366.2	26	27.8	No	Vertical	Locations Scaled off Dwgs.
0+50D 20+19S (corner)	02-06-80	366.2	26	27.8	No	Vertical	Locations Scaled off Dwgs.
0+50D 20+19S (corner)	02-06-80	366.2	26	27.8	Yes	70°, West	Locations Scaled off Dwgs.
0+14.5U 20+31S (corner)	02-06-80	366.7	26	27.8	Yes	70°, West	Locations Scaled off Dwgs.
2+08U 20+63S (corner)	02-06-80	373.5	26	27.8	Yes	70°, West	Locations Scaled off Dwgs.
0+50D 23+12S (corner)	02-07-80	379.0	26	27.9	No	Vertical	Location Scaled off Dwgs.
0+50D 23+12S (corner)	02-07-80	379.0	26	27.9	No	Vertical	Location Scaled off Dwgs.
0+50D 23+12S (corner)	02-07-80	379.0	26	27.9	No	Vertical	Location Scaled off Dwgs.

TABLE 13
CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
2+53U 22+82S (corner)	02-07-80	376.5	26	27.9	No	Vertical	Location Scaled off Dwgs.
2+53U 22+82S (corner)	02-07-80	376.5	26	27.9	No	Vertical	Location Scaled off Dwgs.
2+53U 22+82S (corner)	02-07-80	376.5	26	27.9	No	Vertical	Location Scaled off Dwgs.
7+20D 20+52S (corner)	02-05-80	364.4	26	27.9	Yes	70°, West	Location Scaled off Dwg.
7+20D 20+52S (corner)	02-05-80	364.4	26	27.9	Yes	70°, West	Location Scaled off Dwg.
7+20D 20+52S (corner)	02-05-80	364.4	26	27.9	Yes	70°, West	Location Scaled off Dwg.
7+20D 20+52S (corner)	02-05-80	364.4	26	27.9	Yes	70°, West	Location Scaled off Dwg.
1+48D 20+63S (corner)	02-05-80	373.5	26	27.9	Yes	90°, West	Location Scaled off Dwg.

TABLE 13

CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
1+48D 20+63S (corner)	02-05-80	373.5	26	27.9	Yes	90°, West	Location Scaled off Dwg.
1+48D 20+63S (corner)	02-06-80	373.5	26	27.9	No	90°, West	Location Scaled off Dwg.
2+04U 20+64S (corner)	12-06-79	±362	24.1	25	Yes	Vertical	Location Scaled from Dwg.
1+74U 23+68S (corner)	12-06-79	±362	24.1	25	Yes	Vertical	Location Scaled from Dwg.
1+74U 23+68S (corner)	12-06-79	±362	24.1	25	Yes	Vertical	Location Scaled from Dwg.
1+74U 23+68S (corner)	12-06-79	±362	29.1	30	Yes	Vertical	Location Scaled from Dwg.
1+74U 20+51S (corner)	12-06-79	±374	24.1	25	Yes	Vertical	Location Scaled from Dwg.
1+74U 20+51S (corner)	12-06-79	±374	29.1	30	Yes	Vertical	Location Scaled from Dwg.

TABLE 13

CORNER ROCK BOLT DATA (Cont)

LOCATION	DATE INSTALLED	SURFACE ELEVATION (FT) (MSL)	HOLE DEPTH (FT)	BOLT LENGTH (FT)	STRESSED	HOLE ANGLE (FROM VERTICAL), ORIENTATION	REMARKS
1+74[illegible] 20+51S (corner)	12-06-79	±374	24.1	25	Yes	Vertical	Location Scaled from Dwg.

IX. WALL ANCHORS

9.01 Introduction.--In the Bay Springs Lock and Dam, tendons were required in 24 of the lock chamber monoliths. Monoliths R19-R30 and L19-L30 comprise the anchored walls within the lock chamber. The anchored walls were designed primarily to reduce foundation pressures at the base of each monolith, and to reduce the quantity of rock excavation and the quantity of concrete. Each anchored monolith was designed to be independent of adjacent monoliths. Monoliths R19 through R30 and L25 through L30 required four tendons per monolith while monoliths L19 through L24 required from six to nine tendons per monolith. The specifications called for 118 tendons for both anchored walls which are depicted on drawing BSFR-62. Modification number P00032 added one wall anchor in Monolith L19 while deleting one wall anchor each from monoliths L23, L25, and R24. Therefore, 116 tendons were actually installed (drawings BSFR-64-67).

The wall anchors were fabricated to the dimensions shown on drawing BSFR-63 and installed on an 8 degree downward slope, normal to the centerline of the lock chamber, at designated locations. Anchor locations are defined on the drawing by working points "A" and "B". Working point "A", w.p.a., is the location of the tendon at the lock face and working point "B", w.p.b., is an approximate location on the rock face which varied with the configuration of the rock face.

Tendon holes were drilled and tendons installed and tested by a specialty contractor approved by the Contracting Officer. The specialist was required to have installed anchors of the same general length and capacity for at least 5 years and be fully experienced in all aspects of anchor design and installation. Western-Pacific Drilling Company, a subsidiary of Riedel International, was approved as the specialty contractor. Prescon Corporation, a subsidiary of Freyssinet International, was the materials supplier. Load cells were supplied by Terrametrics Corporation. Quality control of the grout and concrete was the responsibility of the prime contractor, Al Johnson Construction Company.

The specifications required that a tendon installation test be performed by the specialty contractor for the purpose of testing his equipment and installation procedures. The test anchor was installed in the downstream approach channel at Station 8+42D, Elevation 345, on the east wall. A 6-foot concrete cube with a formed recess was placed at the rock face to simulate the lock wall face. The overall tendon length was 80 feet, with a length in rock of 59 feet, a length in concrete of 6 feet, a bond length of 30 feet, and a stressing length of 45 feet. Drilling, water tightness testing, fabrication, placing, grouting, stressing, monitoring, and performance testing were conducted in the same manner as described hereafter, except that the tendon and tubing were inserted in the hole in one operation and grouted. The tendon was equipped with a load cell and monitored on a weekly basis for the remainder of the test period. Test tendon performance is on file at the Bay Springs Resource Managers Office. This procedure deviated from the specifications in that Brazilian steel was used for the test anchor in lieu of the specified American steel which was unavailable on the market place at the time. The Brazilian steel was a higher strength than the American steel, thereby negating some of the purposes of the test. The American steel was the type steel used, as specified, for the anchorage system on the project.

Subsequent to the installation of the test tendon and based on recommendations by the specialty contractor, two changes were made concerning the installation procedures. The specifications called for the tubing to be inserted into the drill hole and the tendon inserted into the tubing. Then the portion of tendon in rock, both inside and outside the corrugated tubing, was to be grouted full. Upon completion of stressing, the portion of tendon inside the 6-inch pipe was to be grouted full. The specialty contractor was concerned that, due to the flexible nature of the tubing, excessive tearing would result if the tendon was inserted before the tubing was grouted in place. He requested that the tubing be grouted in place, then the tendon inserted and grouted inside the tubing. He also requested to grout the full length of tendon in one operation. Due to the location of the grout vent tube, grouting after completion of stressing would create a situation where grout would pour out the vent onto the shim stack and load cell and require an additional cleanup operation. After discussion with the District Office, it was decided to allow the contractor to grout the tubing in place before the tendon was inserted and to grout the full length of tendon in one operation.

The first hole was drilled on 05 April 1981 and the last tendon was grouted in place on 23 January 1982. Stressing operations started on 03 March 1982 and completed on 18 August 1982 with an approximate 10-week delay due to evaluating and correcting a design deficiency in the anchor wedge blocks. During stressing the thread length through the 4-inch wedge block proved to be inadequate as the block threads failed. To correct the problem, the contractor increased the wedge block thickness to 6 inches. This provided a sufficient surface contact between the threads of the anchor and the wedge block assembly.

As specified in the original contract, 60 anchors were to be equipped with load cells to monitor anchor performance.

Three anchors and respective load cells, which were to be installed in monoliths L23, L25 and R24, were deleted from the contract by modification no. P00032. Modification no. P00061 called for ten additional load cells on wall anchor tendons at locations designated by the Contracting Officer's Authorized Representative. Therefore, the final quantity of load cells installed was 67.

4.02 Drilling.--Drilling of the holes was accomplished by a top hydraulic drive, rotary drill with a down hole pneumatic driven hammer. The rig was built at the job site by Western Pacific, using a drill carriage manufactured in 1955 by Riech Brothers. Drill tools included an 8-inch carbide button plug set in front of the hammer, followed by an 18-foot 7-1/4-inch diameter fluted stabilizer bar, followed by 10-foot lengths of 5-inch diameter hollow drill rods. Drilling with this equipment was good with an average drilling rate of [illegible] feet per hour. The drill bits averaged 1000 to 1200 feet per bit. See Appendix A, photo number 53 for a picture of drill rig.

The general drilling plan was to drill the odd number monoliths on the right wall, the odd number monoliths on the left wall, the even number monoliths on the right wall, and the even number monoliths on the left wall, respectively. This was to facilitate the prime contractor's mass concrete placements. Once the lock wall concrete approached working point "B", w.p.b., and the last placed concrete lift had set for the specified time, the drill rig was set on top of the concrete and the hole drilled. To maintain alignment on the drill setup, two tack blocks, approximately 20 and 30 feet from w.p.a., were set in the concrete. The drill carriage was then centered over the tack blocks by use of plumb bobs attached to "eyes" set at the theoretical center of the drill carriage. Knowing the distance from w.p.a., the distance between tack blocks and the center of the drill stem could be computed for the desired drill angle.

The first six holes were drilled on the specified 8 degree angle. Hole alignment surveys were then run and the results showed that five of the six holes were out or close to being out of alignment requirements. Since these were the shortest holes to be drilled, the contractor expressed concern that meeting the alignment specification would not be possible for the longer holes if he were held to the 8 degree setup angle. After discussion with the District Office, it was decided to allow the contractor to deviate up to 1.5 degrees on setup from the theoretical 8 degree line. Thereafter, holes 70 feet or less were drilled on 7.5 degree angles and the long holes drilled on a 7 degree and a 6.5 degree angle.

The contractor elected to overdrill the holes 2 to 4 feet to ensure the required hole depth. Immediately after drilling with the drill tools and hammer at the bottom of the hole and rotating, air and water were pumped through the drill stem to wash out the hole. When clean water returned from the hole, the flushing was stopped and the tools removed.

9.13 Water Test.--The specifications required each hole to be pressure tested to determine if consolidation grouting would be required. The specifications called for the groundwater pressure at the top of the hole be determined and this pressure plus 5 p.s.i. be used for the water tests. Each test was run for 10 minutes and the leakage measured by a meter accurate to 0.1 gallon. Each hole had to satisfy leakage requirements for the bond zone portion [illegible] hole and the stressing zone portion of the hole. Maximum allowable leakage for the bond zone was 0.3 gallon per foot of length and [illegible] gallon per [illegible] of length in the stressing zone. The leakage for the stressing [illegible] determined by taking the difference between the leakage [illegible] and the leakage for the entire length of the hole.

The contractor performed these tests by [illegible] pneumatic packer in the top of the [illegible] adding water at a pressure [illegible] [illegible] zero groundwater pressure [illegible] water testing.

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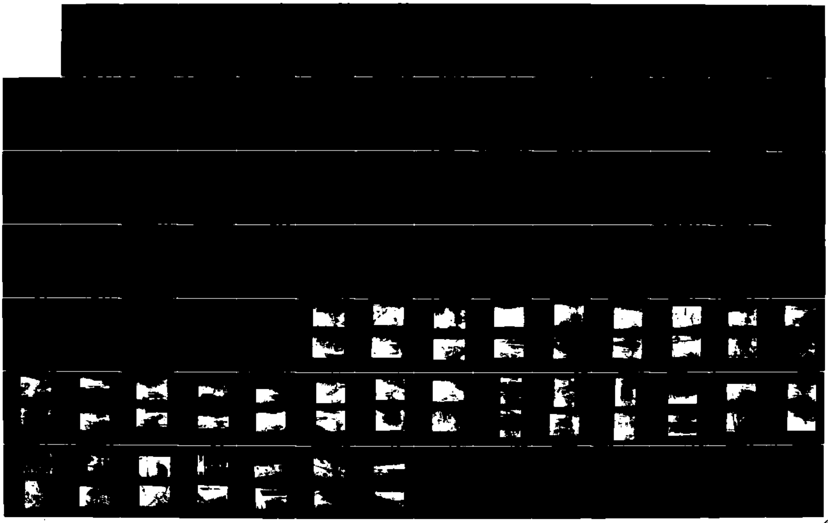
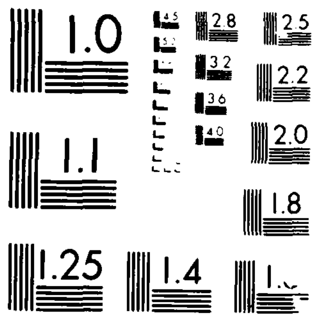
UNCLASSIFIED F/G 13/2 NL





MICROCOPY RESOLUTION TEST CHART

The holes were first tested at the top of the hole. If the leakage during this test exceeded the allowable leakage for both the bond and stressing zones, the hole failed and the bond zone test was not performed. If the leakage was below the maximum leakage required for the bond zone, the hole passed from the top of the hole. If the leakage exceeded the allowable leakage for the bond zone and was below the allowable leakage for both the bond and stressing zones, the packer was inserted to the top of the bond zone and the bond zone water tested.

In some instances, the contractor or the contracting officer elected to pressure grout holes which passed the water test at the top of hole or indicated the need for a bond zone test. This was due to various causes: caving of the hole during removal of drill tools, water leakage from nearby joints and 25-foot drain holes drilled at the H_b/H_c contact, leakage for the full length test was very close to exceeding the allowable leakage for both the bond and stressing zones.

Of the 116 drill holes water tested, 87 holes failed the initial water test. Sixty-eight of the 87 holes failed the test from the top of the hole and a bond zone test was not required.

On completion of pressure grouting, the holes were redrilled and additional pressure tests performed. The procedures and water leakage criteria were the same as used during the initial water tests. This procedure of water testing and grouting was continued until each hole met the leakage requirements for both zones. This is discussed in paragraph 9.05, Pressure Grouting.

9.04 Hole Alignment.--After the initial water test and prior to pressure grouting, each hole was checked for alignment. The specifications required that the bottom of the hole be within 1 foot of its location as shown on the drawings and a variation in alignment of no more than 3 inches in 10 feet. This requirement was later modified such that bottom of hole locations for the long holes, 100 feet and longer, be within 2 feet of the theoretical 8 degree line. (Refer to paragraph 9.02 for additional information.)

Although the accuracy of the instrument was suspect from the beginning, the contractor nevertheless, proposed using a Terrametrics bore hole deflectometer as the method for checking hold alignment. This method was tried on several holes but lack of repeatability of readings and instrument accuracy, 1 foot in 100 feet, forced the contractor to abandon this method. It was later determined that the repeatability problem was due to the deflectometer probe being out of calibration. The contractor proposed using standard surveying methods for checking alignment. The procedure was to set a transit approximately 10 feet from the rock face and on the theoretical 8 degree line. A "rabbit" with an attached penlight was pushed down the hole and readings made at 10-foot intervals. The vertical and horizontal components were measured by sighting on the light attached to the rabbit and reading the angles on the transit head for the respective components. The angles were then converted to inches of displacement from the theoretical 8 degree hole. See Appendix A, photo number 46. Alignment checks on holes 100 feet and longer required a different method because the curvature of the hole prevented sighting on the rabbit for the full length. The survey method was used to check alignment down to 100 feet. The alignment for the last 20 to 30 feet was checked using the deflectometer, which had been recalibrated. Because a baseline is required to reference the deflectometer readings against, it was necessary to project a baseline to the bottom of hole. This was accomplished by taking the average deflection of the last two intervals made with the survey method and projecting this average deflection to the bottom of the hole in 10-foot intervals.

The alignment surveys indicated that five of the 116 drill holes were out on the bottom of hole requirements. These holes were: L19A2-low 2.51 feet, L28A1-low 1.25 feet, R19B1-high 3.27 feet, R21B2-low 1.25 feet, and R29B2-lo 1.05 feet. The specifications called for a variation in alignment of no more than 3 inches per 10 feet. These alignments were analyzed with regard to the slope of the holes and locations of the bottom of the holes to adjacent bottom of hole positions. It was determined that the alignments presented no problems and to accept the holes as drilled.

9.05 Pressure Grouting.--Pressure grouting was required on each hole that did not meet the water leakage requirements for both the bond and stressing zones. The grouting was accomplished with a hydraulically driven, double vat grout plant with a progressing cavity pump. The grout plant was manufactured by Chem-Grout. Both vats were equipped with mechanical agitators to ensure a uniform and thoroughly mixed grout. The grout was passed through a wire mesh sieve before being introduced into the pump. Each hole was grouted full at a pressure of 15 psi using a sliding head balloon packer and grout mixes determined by the contracting officer representative. Grout was continuously supplied to the hole until the representative determined that the hole had been grouted sufficiently tight. The pressure was locked into the hole until the grout set sufficiently (3-4 hours) to allow removal of the packer. After the grout had set at least 18 hours but not longer than 36 hours, the hole was redrilled. Due to equipment breakdowns, some holes were redrilled after the 36 hours.

Eighty-seven required pressure grouting, and five of these 87 required a second pressure grouting. The general grouting scheme was to start with a 4 to 1 mix ratio and gradually thicken the mix till the grout take indicated the hole was sufficiently tight. The majority of the grout pumped was at 3 to 1 and 2 to 1 ratios. The rock did not readily accept a 1 to 1 mix. The approximate average take was 70 cubic feet of grout, 25 bags of cement, for holes 70 feet and less and 120 cubic feet of grout, 40 bags of cement, for holes 100 feet and longer.

Some problems were encountered during the grouting which required special attention. Premature plugging was a constant problem with holes that had moderate to low grout takes. The cement would settle out of the grout in the top 10 feet of the hole because of the near horizontal drill angle, the large diameter of the hole, and the low grout take. When this occurred the packer was removed. The grout in the top 10 feet of the hole was flushed with water through an open end rod. The packer was reinserted and grouting resumed. There were extensive interconnections of the drill holes to joints, bedding planes, and drain holes that were drilled at the H_b/H_c contact. Though the grout leaks were not large enough to require intermittent grouting, the grout mix was thickened at a rate faster than normal to help seal the leaks. The contractor attempted to caulk all grout leaks though some leaks were inaccessible and some leaks, once caulked, would reappear at a different point on the joint or bedding plane.

9.06 Tubing Installation.--Seven-inch O.D., six-inch I.D. corrugated polyethylene tubing was inserted in each drill hole and grouted in place. Specifications required that the tubing conform to AASHTO M252 and ASTMF 405 and be non-perforated, unspliced and not more than 6 months old at time of insertion. The tubing was of sufficient length to extend to the bottom of the drill hole even if the hole was overdrilled.

The required length of tubing was cut from the roll, laid on top of the concrete lift, and a metal end cap inserted in one end of the tubing. The open end of the tubing was elevated 7 to 8 feet and the tubing filled with water to check for leaks. All leaks found were repaired with waterproof tape and the end cap-tubing connection was required to be watertight. A 1/2-inch I.D. plastic grout tube was taped to the outside of the corrugated tubing and the tubing and grout line were manually inserted to the bottom of the hole. Because the tubing tended to compress as it was being pushed into the hole, it became necessary to insert a pipe inside the tubing down to the end cap and push the tubing to the bottom of the hole to ensure insertion the full hole depth. The tubing was again filled with water and checked for leakage. If leakage was noted, the tubing was pulled, leaks repaired, tubing reinserted in the hole, and checked for leakage a second time. When the tubing was deemed watertight, the tubing was grouted in place. Most tubings were grouted in placed within 24 hours of their installation. No record, however, was kept of those grouted after the 24-hour period.

The grout mix, designed by the contractor, was a mixture of Type I Portland cement, water, and a nonshrink admixture conforming to CRD-C566. Water content was 5.5 gallons (0.74 cubic foot) per 94-pound sack of cement with 0.75 pound of Intraplast N added per sack of cement to reduce shrinkage within the grout. The percentage of expansion was determined in accordance with CRD-C81 and the grout consistency tested in accordance with CRD-C79.

The grouting equipment was the same as used for the pressure grouting. The grout was injected into the hole starting at the low end and the grout line pulled in increments of 5 feet for each cubic foot of grout pumped into the hole. This was to ensure that the grout line was buried in the grout at all times to prevent entrapment of water and air. After the grouting operation was completed and the grout had set at least 2 hours, the top 10 feet of grout was flushed from the hole and replaced with fresh grout.

The specifications stated that the grouting pressure measured at the top of the hole shall not exceed 10 psi. Since a pressure in excess of 10 psi was required to overcome the head, it was assumed that the 10 psi referred to in the specifications was the exit pressure of the grout, though there was no way to measure this exit pressure. A grouting pressure of 40 to 80 psi was required to maintain grout flow. This pressure was measured at the top of the hole as the grout was introduced into the grout line and was certainly much greater than the exit pressure. The grouting pressures were most dependent on the temperature of the grout. During hot weather, the temperature of the grout was between 90° and 100°F, was visibly thicker and required a pumping pressure of 70 to 80 psi. In cooler weather the grout could be pumped with 40 to 50 psi pressure.

The average rate of pumping was 0.5 cubic feet per minute. The volume of grout used to grout in the tubing was recorded and compared to the theoretical volume. If a large difference was noted, the cause was determined and corrective action taken.

As required by the specifications, each batch of grout was tested. The test consisted of making eight 2-inch square cubes and performing compressive strength tests in accordance with ASTM-C109. The grout was required to reach a minimum compressive strength of 3500 psi. See table number 14, pages 196-207 for grout cube breaks.

Several problems were encountered during the grouting of the tubings. The pipe used to insert the tubing to the bottom of the hole was inadvertently left inside a tubing and during grouting, the pipe began to back out the hole. The only explanation was that the tubing was being compressed as the grout was pumped into the hole. Thereafter, the pipe was required to hold the tubing on the bottom of the hole during grouting. Approximately 20 tubings had been grouted in place before this was discovered and subsequent measurements indicated that six of the tubings were now short of design depth by 1 to 5 feet.

As mentioned earlier, actual grout take was compared to the theoretical take for each tube grouting. Five tubings were required to be drilled out due to large differences in the takes. Actual takes were from 1.5 to 3.0 cubic feet less than theoretical takes for these five holes. Measurements of the grout lines after completion of grouting indicated the grout lines had pulled loose from the tubings during insertion and the tubings were not grouted the full length. The tubings were backfilled with grout, redrilled and a new tubing installed at the contractor's expense. One tubing was replaced due to a low break on the 3-day test cube. Based on the 3-day break, it was decided the grout would not reach 3500 psi, as required in specifications, and the contractor elected to replace the tubing.

9.07 Six-Inch Pipe and Trumplate Assembly.--A 2-inch by 18-inch by 18-inch bearing plate made from A36 steel with a 8-7/8-inch diameter center cut hole was placed normal to the 6-inch pipe. The bearing plate was welded to a transition cone which in turn was welded to 6-inch schedule 40 metal pipe extending through the lockwall to the rock face. The center of the bearing plate was set at w.p.a. A grout vent system was provided for by routing a 1/2-inch metal tube from the transition cone to the top outside edge of the bearing plate. See drawing number BSFR-63. Line and grade on the pipe-trumplate assembly was maintained by standard survey methods. The 6-inch pipe consisted of two coupled 20-foot sections and a short pipe cut the required length and keyed 1 foot into the drill hole. A watertight connection was made between the 6-inch pipe and the corrugated tubing. For added support, the space between the rock and the pipe tubing connection was grouted full with Celtite 21. A 2-foot long half section was then cut from the short pipe to allow access to the tendon during installation.

9.08 Tendons and Installation Procedures.--The tendons consisted of thirty 1/2-inch diameter, seven wire strands with an ultimate tensile strength of 41.3 kips per strand. Each strand was greased and sheathed along its stressing length with an unsheathed 30-foot bond length. The lower end of each sheath was taped to prevent the entry of grout. The sheathing was 1/2-inch diameter, smooth polyethylene tubing with a required wall thickness of 60 mils. The grout line, which was located in the middle of the tendon, was 3/4-inch diameter, smooth polyethylene tubing. The prestressing steel used in the tendons was manufactured by C.F. and I. Corporation, Pueblo, Colorado, and Armco Corporation, Kansas City, Missouri. The anchors were shop-fabricated by Prescon Corporation, San Antonio, Texas, wound on a coiling device, and shipped to the job site where they were stored in a wooden building. Inspection of the first tendon brought out for installation revealed that the plastic sheathing had 30 mil wall thickness. The contractor was notified that only sheathing with 60 mil wall thickness would be accepted and shortly thereafter, the unacceptable tendons on the job site were returned to the supplier for sheathing replacement.

When the tendons with the approved sheathing arrived on the site and the first of these tendons was brought out for installation it became apparent that a considerable amount of work would be required before the tendons would be acceptable for installation. During the coiling of the tendons at the factory, the sheathing was forced down and encroached 3 to 4 feet in the bond zone. This required that each sheath be pulled back to its proper location, the lower end of the sheath taped again, and the grease cleaned from the four-foot length of bond zone on which the sheathing had encroached. Banding of the tendon bundle was required at specific points along the bond length and, though not required, the bundle was banded at several points along the stressing length to hold the bundle together for the coiling operation. The banding was accomplished with a pneumatic bander and the bands were drawn so tight that the grout line, located in the middle of the bundle, was mashed flat and required replacing. The bands also tore into the sheathing which required repairing with waterproof tape. Two spacer blocks were required at specific locations within the bond length. Often the spacer blocks had to be moved to be at the specified location.

Beyond the work caused by the fabrication problems, each tendon required some field preparation before installation. This preparation included pressure testing of the grout line. The grout line was replaced if any leakage was observed. A guide cone, with a metal grout tube extension attached to the grout line and through the cone, was banded to the lower end of the tendon to prevent tearing of the corrugated tubing during the insertion of the tendon.

The tendon was banded with metal bands at specified points along the bond length and tape banded every 3 feet along the stressing length. Sufficient sheathing was cut from the upper end of the tendon to allow the setting of a tapered hole anchor block which was used to lift the tendon. A 1/8-inch "aircraft" cable was attached to the anchor block and run the full length of the tendon with an extra 45 feet of cable coiled and taped to the guide cone. The cable was then banded to the tendon every 25 feet for the full length of the tendon. If loose rust, dirt, or grease were found on any portion of the tendon, it was brushed with a wire brush, wiped with a cloth, and cleaned with pressurized water prior to insertion in the hole. Each tendon was measured for the required length and marked by Government personnel.

Most tendons were inserted without difficulty and required approximately 2 hours to install. Men were required at three positions during the installation: the crane operator, workers guiding the tendon into the 6-inch pipe, and workers operating a winch at the rock face. The ease with which the tendon was inserted was greatly dependent upon the coordination between the three positions. A gantry crane, which ran behind and parallel to the lock wall, was used to lift the tendon and funnel assembly. See photo number 54, Appendix A. The funnel was fabricated at the job site by Western-Pacific and used to keep the tendon aligned on the hole and in a vertical position, thus using the weight of the tendon to push itself into and down the hole.

A typical installation was to pick up the funnel with the jib line and the tendon with the main line of the gantry crane. The funnel was set and attached to the trumplate and held with the jib line. The tendon was lowered through the funnel until the end of the tendon was at the trumplate. The 1/8-inch aircraft cable was then uncoiled from the end of the tendon and fed down the 6-inch pipe to the window cut from the 6-inch short pipe at the rock face. The cable was run through a pulley which was attached to a grouted rebar pin in the rock face, and back to a winch which was bolted on the 6-inch short pipe just back of the window. See Appendix A, photo number 56. The end of the tendon was then fed into the trumplate and lowered into the hole. The metal bands used to attach the aircraft cable to tendons were cut and removed as the tendon was lowered into the hole. If the tendon would not go down the hole to the required depth, it was pulled to the required depth with the aircraft cable winch. The tendon was inspected through the window in the 6-inch short pipe as it was lowered into the hole. If any tears in the sheathing or damaged banding were observed, the installation was stopped and repairs made. It should be noted that only the top half of the tendon could be viewed and the extent of damage, if any, to the bottom half of the tendon could not be determined. When the installation was complete, the half-section cut from the 6-inch short pipe was replaced and a watertight seal made.

Each tendon was grouted into position within 24 hours of its installation except for two tendons which required special grouting procedures. Problems with installation and grouting techniques for these two tendons are discussed in subparagraph 11 of paragraph 9.08. The grout mix, grouting equipment, methods and frequency of testing the grout were the same as used for the grouting of the tubings. Prior to grouting, the exposed tendon strands were inserted through a wooden grout plate and the plate clamped to the bearing plate. This was to ensure that the entire tendon would be encased with grout. A waterline was then connected to the grout line and water pumped into the hole until flow from the vent tube was noted. This was to check the grout line and vent tube, and the watertightness of the 6-inch pipe-tubing connection and the window replacement on the 6-inch short pipe.

The grout was injected into the hole starting at the low end and grouted continuously until grout flowed from the vent tube for at least 1 minute. A grouting pressure of 20 to 60 psi was required to maintain a steady flow of grout with an average pumping rate of 0.5 cubic foot per minute. The pressure was measured at the top of the hole as the grout was introduced into the grout line. The difference in grouting pressures between the tubing and tendon grouting can be attributed to the difference in grout line diameters.

Theoretical takes were calculated for each tendon and compared to actual takes. In nearly every grouting operation, actual takes exceeded theoretical takes by 0.1 to 1.5 cubic feet through most were in the range of 0.5 cubic foot. The large differences in take may be attributed to measurement errors, grout entering the sheathing, leakage from the window in the short pipes, or failure to make the final measurement when grout was first emitted from the vent tube.

During the grouting, it was noticed that approximately one-half of the sheathed strands in the tendon were dripping water and, on a number of tendons, strands dripped grout. Twenty-six of the first 65 tendons grouted had strands which dripped grout. The number of strands varied from one to ten, with most having four to five dripping grout. Tearing of the sheathing during the installation was the most probable cause and was likely that these strands were located on the bottom of the tendon bundle where the chance of tearing was much greater. Another possible cause of tearing was that due to the bottleneck shape of the tendon bundle at the lower end of sheathings, the taped ends of the sheathings were being torn loose as they slid over the tubing corrugations. To correct the problem, the contractor was directed to slit the lower end of the sheathings approximately 2 inches, inject silicon caulking into the void between the sheathing and the strand, and double wrap the lower end of the sheath. For added protection the tendon bundle was double wrapped with tape at the bottleneck. Thereafter, 20 of the last 51 tendons grouted had one to two strands which made grout and very few strands dripped water.

At the request of Engineering Division, the contractor was directed to devise a system whereby individual strands could be stressed to determine the effect, if any, the grout would have on the elongation of the strands. Two tendons were designated for testing and two strands which dripped grout and one strand which did not drip grout in each tendon were stressed. Results of the stressing indicated the grout had a minimal effect on the elongation in the upper end of the load range but had a more pronounced effect in the low end of the load range. It was concluded that the grease used on the stressing length portion of the strands had prevented bonding of the grout and the grout would have little effect on the stressing of the tendon. To preclude the possibility of overstressing a grouted strand, the load applied to the tendons was reduced from 80 to 75 percent of ultimate strength and adequate time was given for the tendon to adjust at each load increment.

As mentioned previously, two tendons required special grouting procedures. Tendons L19B1 and R27A2 required two stages of grouting. During the initial grouting, a small volume of grout had been pumped into the hole when the grout line plugged. Attempts to clear the line were unsuccessful. It was decided to let the grout harden, and then insert a 1/2-inch copper line down the hole between the tendon and tubing. The top of the grout was calculated based on the volume of grout which had been pumped into the hole and in both cases, the copper line was inserted to the calculated position and would go no farther. Grouting of the tendon was completed by pumping grout down the copper line until the hole was full, then pulling the copper line. Grouting of tendon L19B1 was completed 6 days after its installation and R27A2 completed within 48 hours of installation.

See table number 15, pages 208-211, and table number 16, pages 212-215, for wall anchor installation data.

9.09 Recess and Plug Pours.--After all tendons were installed and grouted in place, concrete was placed in the plug sections and anchor recesses. See drawing number BSFR-63 for location and dimensions of the plug section and anchor recess. Type E concrete was placed in the plug section and required to reach minimum compressive strength of 3,000 psi. The anchor recess concrete was designed by the contractor and required to reach a minimum compressive strength of 5,000 psi at 7 days.

Prior to placing the recess concrete, a 1-foot length of 18-inch diameter, spiral number 4 rebar with a 2-inch pitch was placed back of the 2-inch bearing plate and around the transition cone.

9.10 Load Cells.--A total of 67 load cells were installed on designated tendons to monitor and evaluate the performance of the tendons. The load cells were Model No. PC-500 Load Cells manufactured by Terrametrics, Inc. now a division of Slope Indicator Company, Seattle, Washington. The load cells have an outside dimension of 11 3/4 inches, and an inside diameter of 10 1/2 inches. The design of the anchorage assembly and shim stack was coordinated with the load cell dimensions so that the load cells can be removed and replaced without detensioning the tendons. Each load was furnished with sufficient signal cable to allow for termination and readout in the Lock Wall Gallery at approximately Elevation 415.0. The signed cable was routed through one-inch diameter PVC conduit from the wall anchor recess to the Lock Wall Gallery.

Calibration of the load cells at the factory was performed using variable shim stacks similar to the conditions under which the load cells would be used. This calibration indicated the need for machined shims on each side of the load cell and behind the anchor wedge block in order to obtain accurate and repeatable readings. Factory calibration sheets were furnished for each load cell. After several load cells were installed, a load difference of 5 to 20 percent was observed between the load cells and the calibrated jack pressure gauge. A recalibration in the field was required to provide accurate and repeatable readings due to the shim stack seating losses and minor warpage of the shims. All load cells were field calibrated by the Manufacturer's Factory Representative during the stressing operation. The Manufacturer's Representative provided a certificate of installation for each load cell installed. A new calibration will be required each time the load cell or shim stack is moved. Field calibration procedures are outlined in Appendix B.

The initial 57 load cells were installed between May and August 1982. The tendons were restressed and ten additional load cells installed in January, February, and March 1983. Until the restressing operation, all load cells appeared to be performing satisfactorily. After the restressing operations, five load cells could not be read and during the following months several load cells had erratic readings. After the reservoir was flooded in November 1983, several load cells failed to function properly. In January 1984, an inspection of the malfunctioning load cells revealed that their failure was caused by water shorting out the strain gauge connections inside the load cells. Several problems that could have contributed to the failure were discovered. These problems were; heat damage to the signal cable; physical damage to the load cells and signal cable; and failure of the coal tar epoxy coating to adhere to the load cells. A total of seventeen load cells were identified as being shorted out by water inside the load cells. These were removed and repaired by the load cell manufacturer and reinstalled in April 1984.

Shortly after the seventeen load cells were reinstalled, the lock chamber was filled to the upper pool level and maintenance at that level for several weeks. Under the prolonged flooding condition, additional load cells failed to function properly. In June 1984, 28 additional load cells were removed and repaired by the Manufacturer. Again, the failure was a result of water shorting out the internal strain gauge connections in the load cells. As with the first seventeen removed, the same three problems were discovered; heat damage to signal cable; physical damage to load cells and signal cable; and failure of the coal tar epoxy coating to adhere to the load cells. The load cells consist of a high strength steel ring 2 5/8-inches high with an inside diameter of 10 1/2-inches and an outside diameter of 11 3/4-inches. On the back side of the metal ring, a groove approximately 1/4-inch deep times 1 1/2-inches wide is machined for placement of the strain gauges around the outside perimeter of the ring. After attachment of the strain gauges the groove is covered with a raised-surface sheet metal band 16 to 18 gauge. The sheet metal band is attached to the main load cell body (high strength metal ring) using lazer welding to prevent heat damage to the sensitive strain gauges. There are two openings in the sheet metal cover. One is a 1/2-inch diameter hole for the signal cable hub and the other is a 1/4-inch diameter hole for filling the void space with insulating material. The signal cable consists of a four conductor shielded telephone cable, sutiable for direct burial. It has four insulated 24-gauge solid copper conductors surrounded by an insulating jacket. This jacket is surrounded by a cooper shield and a final outer insulation jacket surrounds the entire cable.

The hub which is attached to the load cell with a 1/2-inch threaded nipple is approximately one-inch-square by two-inches-long and is threaded on one side for the 1/2 diameter nipple. On the opposite side, it is threaded for a 1/2 diameter access plug and a 1/4-inch diameter for filling plug. At one end the hub is threaded for a 1/2 diameter water proof connector where the signal cable enters the hub. The four conductors of the signal cable are attached to the strain gauge wire inside the hub and the copper shield is attached to the hub to ground the shield. After the wiring connections have been made, the void area behind the raised surface sheet metal band and inside the hub are filled with an insulating material Scotch Cast 2104 by 3M. Finally the outer surfaces of the load cell, except for the machined bearing surfaces are coated with a coal tar epoxy paint.

The heat damage appears to be the result of the Contractor heating the tendon grease above the recommended temperature. The tendon grease, Viconorust 2090P-4 CASING FILLER, manufactured by Viscosity Oil Company, Chicago, Illinois has a melting point of approximately 140 degrees F and the manufacturer recommends that the grease be heated to about 180 degrees F prior to pumping. The electircal insulation on the signal cable should have withstood temperatures in this range without damage, however, there were signs of heat damage (insulation melted) on about one third of the load cells removed. Temperatures in excess of 250 degrees F range would have been required to melt the insulation.

The physical damage to the load cells and signal cables appears to be the result of poor design of the signal cable and negligence on the part of the specialty subcontractor during the restressing of the tendons. The damage observed was as follows:

(1) Physical damage to the signal cable was restricted primarily to the first 4 feet of cable from the load cells and probably occurred during the stressing operation. The damage to the signal cable was in the form of tears to the outer insulation jacket and breaks in the cooper shield. Except for those cables damaged by heat, the individual wire insulation and the surrounding insulation jacket were in tact and not damaged.

(2) Physical damage to the load cells was restricted raised-surface sheet metal band. Flat areas were observed on the raised-surfaced sheet metal band. This was apparently caused by the Contractor's workmen jacking the grease cap into position when the holes failed to line up. In order for the 13 inch by 13 inch grease cap to fit properly over the tendon, the load cell, with an outside diameter of 11 3/4-inches must be centered almost perfectly on the 18 inch by 18 inch bearing plate. The only other damage observed as on the L-29A1 load cell where the raised-surface sheet metal band was torn in two places. It appeared this damage was a result of the load cell being struck by the jack chair while positioning the jack on the tendon.

The load cells were removed by the specialty contractor and shipped to the Manufacturer's Shop in Golden, Colorado for repairs. The load cell repair consisted of removing the old signal cable, drying out the load cells in an oven at 220 degrees F, replacing the signal cable, renforcing and protecting the signal cable to load cell connection and applying a new coal tar epoxy. The signal cable to load connection was reinforced and protected by adding a kellums grip to the water proof connector and installing a 3/8-inch heavy duty rubber hose over the first 6 feet of signal cable. The void between the signal cable and the inside of the hose was filled with an insulating material, Scotch Cast 2104 by 3M. The existing coal tar epoxy paint manufactured by Pittsburg Paints was not compatible with the tendon grease and was removed and replaced with Poly-EP two component epoxy paint by DEGRACO.

An analysis of the damages to the load cell and the mode of load cell failure, indicates that the damage to the signal cable was the most probable cause of the load cell failure. The areas mashed flat on the raised-surface sheet metal cover although not desirable, did not allow for the entry of water into the load cell. The intent of the epoxy coating was to provide corrosion protection, although it could have sealed faulty welds, had they existed. Since the load cells were totally encapsulated in the tendon grease, the only possible way water could enter the load cell was through the signal cable. Once the outer insulation jacket was broken, the copper shield provided a direct path into the hub, where the other conductors were attached to the strain gauge wires.

The telephone cable with the copper foil shield is not flexible and the outer insulation is intended to merely hold the copper shield in place, not to take physical abuse. Consequently, the problem with the signal cable could have been prevented by specifying a cable with a braided shield and tougher outer jacket, ensuring the connection inside the hub were waterproof and exercising more care in the handling of the load cells during installation and restressing operations.

9.11 Anchorages and Shim Stack.--Anchorage components consisted of anchor blocks, wedges, and split ring shim stacks. Each component was required to develop the minimum ultimate strength of the prestressing steel. The split ring shims were made from 633 grade steel with an O.D. of 11.75 inches and I.D. of 8 inches. Shims were of various thicknesses such that the load could be adjusted in increments of 3/16-inch or more.

Three piece wedges were used to attach the anchor block to the end of the tendon.

The first set of anchor blocks were fabricated from 1042 grade steel with an O.D. of 10.25 inches, 4 inches in thickness, and a threaded 4-inch diameter center cut hole. The anchor blocks were designed to allow stressing and lift-off checking of the tendons without gripping individual strands and to allow adjustment of the load without unseating the wedges.

During the stressing of the tenth tendon, R25B2, the anchor block failed at approximately 900 kips. The mode of failure was a shearing of the threads in the center cut 4-inch diameter hole. Subsequent investigations revealed that several factors had led to the failure. The anchor block had deformed in the direction of the applied load thus creating a convex surface on the tapered hole side of the anchor block. As the convexity of the block increased with increasing load, the area of thread contact between the pull rod and anchor block was being reduced. The pull rod had been turned into the hole approximately 3-1/2 inches, not the full 4 inches. The tendon had ot been grouted in the center of the 2-inch bearing plate hole. The stressing jack had to be forced up and over to engage the jack alignment pins in the 2-inch bearing plate. This created an eccentric loading condition on the pull rod and anchor block as the load was applied.

Measurements made on the nine previously stressed anchor blocks revealed they had also deformed, exhibiting a convex surface across the tapered hole side of the block. The anchor blocks did not meet the contract requirement of developing the ultimate strength of the prestressing steel as evidenced by the deformation. The contractor elected to have another set of anchor blocks manufactured from 4340 grade steel, 6 inches in thickness, with all other dimensions the same as for the 4-inch blocks. These blocks were used for stressing all tendons and performed satisfactorily.

9.12 Stressing.--Prior to the stressing, anchor blocks were mounted on the tendon ends. A 2-inch shim was placed between the bearing plate and anchor block for all tendons with calculated elongations less than 7-7/8 inches. The 2-inch shim was needed because the load cell installation required at least 7-7/8 inches from bearing plate to anchor block. A single strand chuck was then attached to a strand and stressed to 1 kip. Four to six strands were stressed in this manner to draw the anchorage assembly flush against the bearing plate. See photo number 47, Appendix A.

After the plug-pour concrete had reached a minimum compressive strength of 3,500 psi and the recess pour concrete had reached a minimum compressive strength of 5,000 psi, the anchors were stressed with a hydraulic jack with a capacity of 5,000 tons and equipped with a calibrated pressure gage. Anchors were equipped with load cells, if applicable, and loaded to 10 percent of ultimate strength, which was the starting point for measurements of elongations. Measurements were made on the jack ram with dial calipers accurate to one-thousandth of an inch. The anchors were stressed in increments of 100 kips to 75 percent of the ultimate strength, the load held there for 10 minutes, then locked off at 70 percent of ultimate strength with the split ring shim stack in place. See photo number 48, Appendix A. The stressing of the anchors was conducted so that accurate elongation measurements could be made, recorded, and compared to the calculated elongations. If elongations measured during the stressing differed more than 10 percent from the calculated elongations, stressing was stopped and the cause determined. All anchor elongations were within 10 percent of the calculated, though some anchors required 5 to 10 minutes for strand adjustment in the lower load increments. This resulted from the grout intruding into the sheathing as discussed in paragraph 9.08. Immediately following lock-off, the anchor was lifted off and this initial lift-off load recorded. Stressing data for individual tendons as well as the comparison with theoretical elongation calculations are on file at the Bay Springs Resource Managers Office.

9.13 Performance Test.--After a minimum of 7 days, but no more than 14 days subsequent to initial stressing, each anchor was reloaded and a second lift-off load recorded. If the load lost between the time of the initial lift-off and this second lift-off was less than 10 percent of the initial lift-off, the anchor was accepted. The anchor was then restressed, if necessary, and locked off at 70 percent of ultimate strength. If the load loss was greater than 10 percent, the anchor was restressed to 70 percent of ultimate strength, locked off, lifted off and this third lift-off load recorded. After an additional three days, the anchor was lifted off a fourth time. If the load loss was greater than 10 percent of the third lift off, the anchor was rejected. If the load loss was less than 10 percent, the anchor was restressed, locked off at 70 percent of ultimate strength and the anchor accepted. One hundred and fifteen anchors passed the first performance test and only one anchor, R22B2, required a second performance test.

After all stressing operations were complete, a steel tube or cap was placed over each tendon anchorage assembly and bolted to the 2-inch bearing plate. Each tube was then pumped full of grease for corrosion protection.

Early in the stressing program, the breaking of strands and the breaking of wires within a strand occurred on several anchors. All breakage occurred on the inside row of strands. The cause is thought to be that the cone of grout surrounded by the inside row of strands was put in compression as the tendon elongated, thus putting a bending moment on the inside row of strands. Corrective action was to drill six 1/2-inch diameter holes approximately 6 inches into the grout cone to allow the cone to collapse as the anchor was stressed. The following anchors had one strand break, the steel area of the anchor and load was reduced accordingly: R20A2, L19B1, L20C3, L24A2, L24C3. The following anchors had from one to three wires break within a strand, loads were not reduced for these anchors but care should be exercised during subsequent restressing: L19A3, L20C1, L23B1, L23B3. One anchor, L23A1, was drilled into during the drilling for pore pressure cell installations. After discussion with the drill operator, it was decided that the damage was minimal, but the load was reduced to 60 percent of ultimate strength for this anchor.

The nine tendons stressed with the 4-inch anchor blocks will not easily accommodate a load cell. These tendons are: R29B1, R29B2, R28B1, R28B2, R27B1, R27B2, R26B1, R26B2, R25B1. The 6-inch anchor blocks were mounted such that the wedges would bite the strands in front of the bite marks which were created when the anchor was stressed with the 4-inch block. This resulted in the distance between the 2-inch bearing plate and the anchor block being insufficient to accommodate a load cell, which may tend to give a slightly inaccurate reading. Load cells originally designated for these particular tendons were shifted to other tendons in the same monolith.

Anchor stressing data and load cell plots are on file at the Bay Springs Resource Managers Office.

9.14 Anticipated Problems.--The major concern is the seepage of water through the 6-inch pipe. The most probable point of entry is at the face of the rock where the pipe changes from plastic to metal. At the last lift off the water that was seeping from the 6-inch pipe had not created a serious corrosion problem, only slight rusting, some of which could have occurred after the grease caps had been removed. Those tendons with the seepage should be checked periodically to insure that the problem does not worsen.

Those load cells not repaired (a total of twenty-two) could present a problem in the future and will require repair or replacement.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING*

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
**	06-13-81	2843	4806	3525	5438	X	
R-25 B1	06-16-81	2213	3588	3344	3625	X	
R-23 B2	06-16-81	2200	4375	3363	4128	X	
R-21 B1	06-18-81	2094	3331	4050	3938	X	
R-21 B2	06-18-81	2819	3800	3550	3625	X	
R-27 B1	06-18-81	2444	3700	3469	3844	X	
R-27 B2	06-20-81	2675	2675	3769	3344	X	
R-23 B1	06-20-81	2625	2263	3725	3781	X	
R-29 B1	06-24-81	2681	3881	4163	3688	X	
R-29 B2	06-24-81	2469	3188	4450	4125	X	
R-29 B1&B2	06-24-81	2213	3000	2975	4125	X	
R-29 B1&B2	06-25-81	2063	3656	3313	3813	X	
R-27 A1	07-01-81	2513	2850	3400	4563	X	
R-27 A2	07-01-81	4363	4163	4000	4125	X	
R-25 A1	07-02-81	1856	2344	3688	3625	X	
R-25 A2	07-02-81	2006	2406	3563	3600	X	
R-23 A1	07-03-81	2100	2938	3875	3950	X	
R-21 A1	07-03-81	2600	3937	3563	4938	X	
R-21 A2	07-03-81	3031	4063	4188	4563	X	
R-21 A2	07-03-81	3563	4438	4938	5000	X	
R-21 A1&A2, R-23 A2	07-06-81 **	2531	3031	3625	3813	X	
L-21 B1	07-07-81	2625	2700	3313	3875	X	
L-21 B2	07-07-81	2375	2312	4375	5250	X	
L-21 B3	07-07-81	2813	3313	2875	3825	X	
L-27 B1	07-08-81	2938	3375	3813	4625	X	
L-27 B1&B2	07-08-81	2750	3313	2938	4438	X	
L-27 B2	07-08-81	3063	3438	4656	5000	X	
L-25 B1	07-09-81	2563	*	3688	3800	X	
L-25 B2	07-09-81	2623	*	3063	4000	X	
L-23 B1	07-09-81	3156	*	4625	5125	X	
L-23 B2	07-09-81	2469	*	4250	5125	X	

*Breaks were arbitrarily not performed when prior break(s) were high.

**Information unavailable.

TABLE 14
GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.		DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-23	B2&B3	07-09-81	2125	*	2875	4375	X	
L-23	B3	07-09-81	2438	*	5250	5625	X	
R-22	B1	07-10-81	2100	*	3750	4875	X	
R-22	B2&B1	07-10-81	2438	*	3750	5188	X	
R-22	B2	07-10-81	2531	*	3875	3750	X	
R-22	B1&B2	07-11-81	2188	*	3625	4363	X	
R-23	B2	07-14-81	*	3781	4875	6313		X
R-23	B2	07-14-81	*	3313	4875	4625		X
R-27	B1	07-15-81	*	3250	5125	5350	X	
R-27	B1	07-15-81	*	3938	4875	5000	X	
L-29	B1	07-15-81	*	3938	4656	5188	X	
L-29	B1&B2	07-15-81	*	2750	3875	4813	X	
L-29	B2	07-15-81	*	3125	4250	5313	X	
R-23	B1	07-16-81	2969	4394	4688	5600		X
R-23	B1	07-16-81	3625	4875	5063	5250		X
R-29	A1	07-20-81	2188	4813	3513	5438	X	
R-30	B2&A1	07-23-81	*	4313	4625	4650	X	
R-27	B1,	07-23-81	*	4438	4875	4988	X	
R-29	A2	**	*					
**		07-23-81	*	5313	5375	5688	X	
R-30	B1	07-24-81	*	4688	5000	5463	X	
R-30	B1	07-24-81	*	4625	4250	4500	X	
R-21	B1	07-24-81	*	4938	4875	5306		X
R-21	B1	07-24-81	*	3875	4000	5088		X
R-21	B2	07-25-81	*	4188	5250	6063		X
R-21	B2	07-27-81	*	3688	5375	*		X
R-21	B2	07-27-81	*	4625	5125	*		X
R-19	B1	07-28-81	4000	*	3750	5031	X	
R-19	B1	07-28-81	3000	*	4125	4531	X	
R-19	B2	07-28-81	3125	*	4125	4844	X	
L-19	C2	07-30-81	3688	*	3688	*	X	
L-19	C2	07-30-81	3688	*	4375	*	X	

*Breaks were arbitrarily not performed when prior break(s) were high.
**Information unavailable.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-19 C1	07-30-81	3313	*	3750	*	X	
L-19 C1	07-30-81	3000	*	3875	*	X	
L-19 C3	07-30-81	4781	*	4188	*	X	
L-19 C3	07-30-81	4150	*	4156	*	X	
L-23 A1	07-31-81	2500	*	3125	4313	X	
L-23 A2	07-31-81	2719	*	4188	*	X	
L-23 A3	07-31-81	2313	*	3625	*	X	
L-22 B1	07-31-81	3125	*	3625	*	X	
L-22 B2	07-31-81	3750	*	3813	*	X	
L-22 B3	07-31-81	2812	*	3500	*	X	
L-19 B1&B2&B3	08-01-81	3375	*	3625	*	X	
L-27 A1	08-01-81	2625	*	3250	4438	X	
L-27 A2	08-01-81	2563	*	3000	3500	X	
L-25 A2	08-01-81	2375	*	3250	3781	X	
L-25 A1	08-01-81	3438	*	3063	3888	X	
L-24 C3	08-03-81	3438	*	3563	*	X	
L-24 C1	08-03-81	2688	*	3375	3563	X	
L-27 A1&A2	08-04-81	3438	*	3688	*	X	
L-25 A1&A2	08-04-81	3250	*	3000	3813	X	
L-24 C1&C3	08-04-81	2500	*	2938	4813	X	
L-29 A1	08-07-81	*	3125	4781	*	X	
L-29 A2	08-07-81	*	3438	4531	*	X	
R-25 B2	08-08-81	*	4688	5838	*		X
R-25 B2	08-08-81	*	4000	4638	*		X
R-27 B1	08-11-81	*	4000	4019	*		X
R-27 B1	08-11-81	*	2938	3500	*		X
	08-12-81	*	2000	2938	3875	X	
	08-12-81	*	2688	3000	3594	X	
L-26 B1	08-13-81	2750	*	4950	*	X	
L-26 B2	08-13-81	3438	*	5438	*	X	
L-21 A1	08-13-81	3125	*	3531	*	X	
L-21 A2	08-13-81	2438	*	4594	*	X	

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-21 A3	08-13-81	2313	*	3625	*	X	
R-27 B2	08-13-81	2625	*	3406	3438		X
R-27 B2	08-13-81	2375	*	3563	*		X
L-30 B1	08-14-81	2875	*	3594	*	X	
L-30 B1	08-14-81	2875	*	5688	*	X	
L-30 B2	08-14-81	2375	*	3281	3838	X	
L-30 B2	08-14-81	2750	*	5000	*	X	
L-20 C2	08-18-81	*	4281	*	*	X	
L-20 C3	08-18-81	*	3756	*	*	X	
L-20 C1	08-18-81	*	3450	4063	*	X	
L-20 C1	08-18-81	*	3094	4000	*	X	
L-25 B2	08-20-81	*	2781	4250	*		X
L-25 B2	08-20-81	*	3531	3725	*		X
L-25 B1	08-21-81	2500	3125	4156	*		X
L-25 B1	08-21-81	2156	3000	3719	*		X
R-24 B1	08-22-81	2075	3063	4531	*	X	
R-24 B2	08-22-81	2219	3906	*	*	X	
R-26 B2	08-22-81	1688	2438	3031	2969	X	
R-26 B1	08-22-81	DRILLED OUT		*	*		
R-28 B2	08-24-81	*	2969	3875	*	X	
R-28 B1	08-24-81	*	2875	4325	*	X	
R-22 A1	08-24-81	*	1813	2556	3719	X	
L-27 A1	08-26-81	*	3375	3650	*		X
L-27 A1	08-26-81	2406	3806	*	*		X
L-27 A2	08-26-81	3250	4819	*	*		X
L-27 A2	08-26-81	1656	2813	2130	3824		X
L-29 A1,A2,A3	08-27-81	3344	4038	*	*	X	
L-20 C1,C2,C3	08-27-81	2063	3844	*	*	X	
L-29 A2	08-27-81	2406	3200	3750	*	X	
R-19 A2	08-28-81	1950	2669	4563	*	X	
R-19 A1	08-28-81	2313	3881	*	*	X	
R-19 A1	08-28-81	1006	2475	2156	3656	X	

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-29 A1	08-29-81	1613	4250	*	*		X
L-29 A1	08-29-81	*	*	3000	4300		X
L-29 A2	08-29-81	*	*	5000	*		X
L-29 A2	08-29-81	*	*	3750	*		X
R-22 A2	08-31-81	*	*	4438	*	X	
L-21 A1&A2	08-31-81	*	*	4325	*	X	
L-19 B2	08-31-81	*	*	3750	*	X	
L-19 B2	08-31-81	*	*	3563	*	X	
L-19 B3	09-01-81	*	*	4563	*	X	
L-19 B3	09-01-81	*	*	4756	*	X	
L-21 A3	09-02-81	2375	3750	*	*		X
L-21 A3	09-02-81	*	2944	4275	*		X
L-19 B1	09-03-81	*	3063	3563	*	X	
L-19 B1	09-03-81	*	2813	3563	*	X	
R-26 B1	09-03-81	*	2750	3238	3563	X	
L-21 A2	09-03-81	*	2919	3500	*		X
L-21 A1	09-03-81	*	3656	*	*		X
L-21 A2	09-03-81	*	3681	*	*		X
L-21 A1	09-03-81	*	*	*	*		
R-30 A1	09-08-81	2300	3313	3500	*	X	
R-30 A1	09-08-81	3775	*	*	*	X	
L-19 B1	09-08-81	2544	3594	*	*	X	
R-30 A2	09-08-81	3025	3663	*	*	X	
R-30 A1,B1,B2	09-09-81	1500	1788	3063	3625	X	
R-20 B1	09-09-81	2725	4363	*	*	X	
R-20 B2	09-09-81	2125	2738	3731	*	X	
R-30 A1,B1,B2	09-09-81	1000	1938	2313	3588	X	
L-22 B2	09-09-81	2563	3938	*	*		X
L-22 B2	09-09-81	2500	3025	2313	3656		X
L-22 B1	09-10-81	2875	*	3063	4938		X
L-22 B1	09-10-81	2500	3894	*	*		X
L-22 B3	09-10-81	1938	2438	3750	*		X

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.		DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-22	B3	09-10-81	2188	4138	*	*		X
R-22	B1	09-12-81	3625	*	*	*		X
R-26	B2	09-12-81	3100	3375	4688	*		X
R-26	B2	09-12-81	2469	3750	*	*		
R-22	B2	09-12-81	3294	2500	3875	*		X
R-22	B2	09-12-81	3656	*	*	*		X
R-19	A2	09-14-81	3538	*	*	*	X	
R-19	A2	09-14-81	3094	3894	*	*	X	
L-24	B3	09-15-81	2656	3438	4025	*	X	
R-26	B1	09-15-81	3113	3750	4625	*		X
R-26	B1	09-15-81	2206	2430	3025	4088		X
R-24	B1	09-15-81	1625	2375	3250	3500		X
R-24	B1	09-15-81	2063	2775	3688	*		X
R-24	B2	09-15-81	2450	2688	3625	*		X
R-24	B2	09-15-81	2275	2750	3375	4469		X
L-19	B2	09-16-81	2550	3400	4438	*		X
L-19	B2	09-16-81	2575	3588	4313	*		X
L-19	B2	09-16-81	3075	4119	5894	*		X
L-28	B2	09-17-81	2631	3775	*	*	X	
L-28	B1	09-17-81	1975	2625	3656	*	X	
L-28	B2	09-17-81	2606	3769	*	*	X	
L-19	B2	09-18-81	1606	2800	3038	3798		X
L-19	B2	09-18-81	1350	1775	2413	3594		X
L-19	B2	09-18-81	1438	2400	2938	3781		X
L-26	A2	09-18-81	1250	2500	2950	3625	X	
L-26	A1	09-18-81	1813	2813	3906	*	X	
L-24	B2	09-21-81	2313	3431	4438	*	X	
L-24	B1	09-21-81	2075	3200	4125	*	X	
L-24	B1&B2	09-22-81	2500	4100	*	*	X	
L-26	A1&A2	09-22-81	1875	3719	*	*	X	
L-28	B1&B2	09-22-81	2025	3594	*	*	X	
R-30	A2	09-23-81	3256	3838	*	*		X

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
R-30 A2	09-23-81	3063	3625	*	*		X
R-30 A2	09-23-81	3038	3619	*	*		X
L-20 B3	09-24-81	2313	2938	3000	3750	X	
L-20 B2	09-24-81	2625	3188	5000	*	X	
L-20 B1	09-24-81	2719	3388	4625	*	X	
R-30 A1	09-24-81	2294	2750	3625	*		X
R-30 A1	09-24-81	1656	3563	*	*		X
R-30 A1	09-24-81	2875	3719	*	*		X
L-19 B1	09-24-81	2063	3000	4438	*		X
L-19 B1	09-24-81	2625	2906	4219	*		X
L-19 B1	09-24-81	3156	4094	*	*		X
R-22 A2	09-25-81	2388	3798	*	*		X
R-22 A1	09-25-81	2350	3844	*	*		X
R-22 A1	09-25-81	2469	3775	*	*		X
R-22 A2	09-25-81	2156	3406	5081	*		X
R-28 B2	09-25-81	1375	1968	3938	*		X
R-28 B2	09-25-81	2025	2938	3781	*		X
R-28 B1	09-25-81	1575	2688	3719	*		X
R-28 B1	09-25-81	1625	2625	4156	*		X
R-24 A2	09-26-81	2681	3594	*	*	X	
L-19 A1	09-26-81	2500	3738	*	*	X	
L-19 A1	09-26-81	2625	4281	*	*	X	
L-19 A2	09-28-81	2563	4250	*	*	X	
L-19 A3	09-28-81	1938	3563	*	*	X	
L-19 A2	09-28-81	1500	2438	3531	*	X	
L-19 A3	09-28-81	1250	2750	3625	*	X	
L-20 C1&C2	09-29-81	1569	2875	4525	*		X
L-20 C2	09-29-81	1588	2875	4163	*		X
L-20 C3	09-29-81	1688	3125	4563	*		X
L-20 C3	09-29-81	1598	2625	4756	*		X
L-20 C1	09-29-81	1625	2438	3438	4063		X
L-22 A1	09-30-81	1600	2781	4063	*	X	

*Breaks were abitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.		DATE MADE	STRENGTH (PSI)				CASING	TENDON
			3 DAY	7 DAY	14 DAY	28 DAY		
L-30	A1	09-30-81	2231	4063	*	*	X	
L-30	A1	09-30-81	1531	2688	3444	3875	X	
L-30	A2	09-30-81	1313	2625	2938	3750	X	
L-30	A2	09-30-81	1313	2406	4138	*	X	
L-26	A1	09-30-81	1531	3575	*	*		X
L-26	A1	09-30-81	1750	3588	*	*		X
L-26	A2	09-30-81	1625	3625	*	*		X
R-24	A1	10-01-81	2000	3056	3844	*	X	
R-26	A2	10-01-81	2344	2625	3675	*	X	
R-26	A1	10-02-81	2169	3656	*	*	X	
R-28	A2	10-02-81	2750	4313	*	*	X	
R-28	A2	10-02-81	1844	4438	*	*	X	
R-19	A1	10-02-81	2219	3663	3625	*		X
R-19	A1	10-02-81	2344	4406	*	*		X
R-19	A1	10-02-81	2156	3556	*	*		X
R-28	A1&A2	10-02-81	1375	2500	4031	*	X	
R-26	A1&A2	**	**	**	**	**		
R-19	A2	10-03-81	2625	3844	*	*		X
R-19	A2	10-03-81	2375	3531	*	*		X
R-19	A2	10-03-81	2250	3563	*	*		X
L-22	A1	10-03-81	2188	3219	4094	*	X	
L-19	A1	10-03-81	2325	3219	4563	*	X	
L-19	A1	10-03-81	2750	3594	*	*	X	
L-19	A1,A2,A3	10-05-81	2094	3219	4294	*	X	
L-30	A1	10-07-81	1844	3438	4138	*		X
R-20	A1	10-07-81	1813	3281	4000	*	X	
L-30	A1	10-07-81	1719	3313	4406	*		X
L-30	A2	10-07-81	2188	3825	*	*		X
L-30	A2	10-07-81	1438	2486	4094	*		X
L-28	A1	10-08-81	2219	3156	3719	*	X	
R-20	A1	10-08-81	2063	2625	3706	*	X	
L-24	A1	10-10-81	2375	2750	3575	*	X	

*Breaks were abitrarily not performed when prior break(s) were high.

**Information unavailable.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.		DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-24	A2	10-10-81	2656	3219	4125	*	X	
L-24	A3	10-10-81	2625	3531	*	*	X	
L-24	A1,A2,A3	10-12-81	2563	3250	3781	*	X	
L-22	A2	10-13-81	*	3094	3094	3758	X	
L-26		10-13-81	*	3000	3813	*	X	
R-26	A2	10-13-81	*	3650	*	*		X
R-26	A2	10-13-81	*	3375	4500	*		X
L-22	A3	10-13-81	*	2094	2438	3629	X	
R-26	A1	10-13-81	*	3188	3188	4650		X
R-26	A1	10-13-81	*	1656	2250	3625		X
R-26	A1	10-13-81	*	2250	2375	3875		X
R-26	A1	10-13-81	*	2250	2500	3594		X
R-20	A2	10-14-81	*	2938	4381	*	X	
L-24	B3	10-14-81	*	3306	4363	*		X
L-24	B3	10-14-81	*	3000	4656	*		X
L-24	B2	10-14-81	*	3513	4569	*		X
L-24	B2	10-14-81	*	2906	3594	*		X
L-24	B1	10-14-81	*	2000	3969	*		X
R-28	A2	10-15-81	1933	2438	3938	*		X
R-28	A1	10-15-81	2338	2581	4031	*		X
R-24	A2	10-15-81	2094	2600	3969	*		X
R-24	A1	10-15-81	2244	2575	4225	*		X
R-24	A2	10-15-81	1906	2281	2563	3538		X
R-28	A2	10-15-81	1350	2331	2250	2750		X
L-20	B1	10-16-81	1744	2656	3625	*		X
L-20	B2	10-16-81	2075	2688	3588	*		X
L-20	B2	10-16-81	1875	2719	4038	*		X
L-20	B3	10-16-81	1875	2469	4156	*		X
L-20	B3	10-16-81	1813	2719	3719	*		X
L-28	A2	10-17-81	1979	3188	4069	*		X
L-28	A2	10-17-81	2063	3313	3894	*		X
L-28	A2	10-17-81	1938	2313	3563	*		X

*Breaks were abitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-28 A1	10-17-81	2181	2750	3781	*		X
L-22 A2	10-21-81	3000	4156	*	*		X
L-22 A2	10-21-81	3156	4238	*	*		X
L-22 A3	10-21-81	2656	3938	*	*		X
L-22 A1	10-21-81	3094	4125	*	*		X
L-22 A1	10-21-81	2125	3375	3525	*		X
R-20 A1	10-22-81	2000	2719	3656	*		X
R-20 A1	10-22-81	2031	2615	3813	*		X
R-20 A2	10-22-81	1875	2656	3588	*		X
L-24 A1	10-24-81	2031	3125	3656	*		X
L-24 A1	10-24-81	2594	3188	3250	3619		X
L-24 A2	10-24-81	2313	3450	3531	*		X
L-24 A3	10-24-81	2563	3313	3388	3781		X
L-20 A2	10-26-81	1438	3219	4938	*	X	
L-20 A3	10-26-81	1313	2313	3750	*	X	
L-20 A1	10-26-81	1219	2688	3688	*	X	
L-20 A1,A2,A3	10-28-81	2156	2563	3344	4063	X	
L-19 A2	10-29-81	2444	3313	4344	*		X
L-19 A2	10-29-81	2263	3213	4469	*		X
L-19 A2	10-29-81	2175	2838	3813	*		X
L-19 A3	10-30-81	1844	3188	4188	*		X
L-19 A3	10-30-81	1975	3313	4350	*		X
L-19 A1	10-30-81	2031	2750	4438	*		X
L-19 A1	10-30-81	1688	2719	3906	*		X
R-29 B2	11-05-81	1844	2875	3000	3625		X
R-29 B2	11-05-81	1719	2781	3000	3550		X
R-29 B1	11-05-81	2094	3231	3250	4313		X
R-27 A2	11-17-81	1781	1781	3588	*		X
R-27 A2	11-13-81	2031	3563	*	*		X
R-27 A1	11-18-81	1781	3188	3625	*		X
R-27 A1	11-18-81	1781	2813	3813	*		X
R-29 A2	11-18-81	1281	2438	2813	3250		X

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.	DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
R-29 A2	11-18-81	1219	1906	2281	3125		X
R-29 A1	11-19-81	1781	3344	3594	*		X
R-29 A1	11-19-81	1656	3125	3563	*		X
L-20 A2	11-20-81	1875	3275	3563	*		X
L-20 A3	11-20-81	1781	3219	3625	*		X
L-20 A3	11-20-81	1094	2875	3625	*		X
R-20 A1	11-20-81	1250	2250	3719	*		X
R-20 A1	11-20-81	2190	2531	3688	*		X
R-21 A1	12-02-81	2938	3231	3656	*		X
R-21 A1	12-02-81	2625	3188	3525	*		X
R-21 A2	12-02-81	2313	3213	3344	4313		X
R-21 A2	12-02-81	2000	2875	3031	4188		X
R-19 B2	12-03-81	2594	3125	3231	3531		X
R-19 B2	12-03-81	2063	2813	3750	*		X
R-19 B2	12-03-81	2625	3313	4188	*		X
R-27 A2	12-04-81	3031	3344	3688	*		X
R-27 A2	12-04-81	3469	3688	*	*		X
R-27 A2	12-04-81	3000	3125	4250	*		X
R-23 A2	12-08-81	2263	3781	*	*		X
R-23 A2	12-08-81	2094	3688	*	*		X
R-23 A1	12-08-81	2190	3188	3781	*		X
R-23 A1	12-08-81	2313	4031	*	*		X
R-30 B2	12-09-81	2032	2625	3500	*		X
R-30 B2	12-09-81	1875	2313	3313	3500		X
R-30 B1	12-11-81	2688	3981	*	*		X
R-30 B1	12-11-81	3188	4425	*	*		X
R-25 A2	12-15-81	2813	3688	*	*		X
R-25 A2	12-15-81	3656	*	*	*		X
R-25 A1	12-05-81	3169	4038	*	*		X
L-29 B1	12-16-81	2281	3594	*	*		X
L-29 B2	12-16-81	2606	4350	*	*		X
L-29 B2	12-16-81	2281	3388	3625	*		X
L-19 C2	12-21-81	2094	3094	4031	*		X

*Breaks were arbitrarily not performed when prior break(s) were high.

TABLE 14

GROUT CUBE BREAKS FOR WALL ANCHORS AND CASING* (Cont)

TENDON NO.		DATE MADE	STRENGTH (PSI) 3 DAY	7 DAY	14 DAY	28 DAY	CASING	TENDON
L-19	C2	12-21-81	2190	3188	3781	*		X
L-19	C3	12-21-81	3188	3800	*	*		X
L-19	C1	12-23-81	3106	3169	3563	*		X
L-19	C1	12-23-81	3094	3313	3750	*		X
L-21	B3	12-24-81	3219	3313	3594	*		X
L-21	B2	12-24-82	2856	3188	3688	*		X
L-23	A1	01-05-82	*	4063	*	*		X
L-23	A2	01-05-82	*	4000	*	*		X
L-23	A3	01-05-82	*	3656	*	*		X
L-23	A3	01-05-82	*	3719	*	*		X
L-21	B1	01-06-82	*	3188	3969	*		X
L-21	B1	01-06-82	*	3906	*	*		X
L-23	B1	01-07-82	*	3500	*	*		X
L-23	B2	01-07-82	*	3750	*	*		X
L-23	B3	01-07-82	*	3531	*	*		X
L-23	B3	01-07-82	*	3594	*	*		X
L-24	C3	01-08-82	*	3969	*	*		X
L-24	C1	01-08-82	*	3688	*	*		X
L-24	C1	01-08-82	*	4188	*	*		X
L-26	B1&B2	01-18-82	2781	2875	3594	*		X
L-25	A1	01-19-82	3250	3313	3594	*		X
L-25	A2	01-19-82	3094	3406	3833	*		X
L-25	A2	01-19-82	3125	3844	*	*		X
L-27	B2	01-21-82	2688	3406	3613	*		X
L-27	B1	01-21-82	2813	3281	3588	*		X
L-27	B1	01-21-82	3000	3594	*	*		X
L-26	B1	01-21-82	2338	3063	3538	*		X
L-26	B2	01-21-82	2125	2938	3513	*		X
L-26	B2	01-21-82	1938	2688	3281	3750		X
L-28	B1	01-22-82	2138	3094	3313	4125		X
L-28	B1	01-22-82	2063	3063	3406	4250		X
L-28	B2	01-23-82	1688	2813	3563	*		X
L-28	B2	01-23-82	2125	2875	3513	*		X
L-30	B[illegible]	01-23-8[illegible]	[illegible]	2938	3538	*		X
[illegible]-30	[illegible]	[illegible]-82	[illegible]	3313	3834	*		X

TABLE 15

TENDON GROUTING AND INSTALLATION DATA

TENDON DESIGNATION	DATE GROUTED	GROUT TAKE (C.F. SOLIDS)	DATE REDRILLED	DATE TUBING INSTALLED	LENGTH OF TUBING (FT)	DATE TENDON INSTALLED	DATE TENDON GROUTED
R28B2	08-19-81	12	08-20-81	08-24-81	62.5	09-24-81	09-25-81
R28A1	09-25-81	19	09-26-81	10-01-81	68	10-14-81	10-15-81
R28A2	09-25-81	28	09-26-81	10-01-81	68	10-14-81	10-15-81
R29B1	+	+	+	06-09-81	62	11-04-81	11-05-81
R29B2	05-21-81	20	05-23-81	06-19-81	62	11-04-81	11-05-81
R29A1	07-16-81	24	07-17-81	07-18-81	67	11-18-81	11-19-81
R29A2	07-16-81	35	07-17-81	07-18-81	67	11-17-81	11-18-81
R30B1	06-26-81	20	06-27-81	07-24-81	123	12-10-81	12-11-81
R30B2	06-26-81	55	06-28-81	07-28-81	124	12-08-81	12-09-81
R30A1	08-31-81	44	09-01-81	09-08-81	125	09-23-81	09-24-81
R30A2	08-31-81	39	09-01-81	09-08-81	128	09-22-81	09-23-81
L19C1	06-05-81	24	06-12-81	07-29-81	124	12-22-81	12-23-81
L19C2	06-06-81 07-06-81	6/40	06-13-81 07-07-71	07-29-81	123	12-17-81	12-18-81
L19C3	06-05-81	79	06-13-81	07-29-81	123	12-17-81	12-18-81
L19B1	08-11-81	17	08-13-81	09-03-81	127	09-18-81	09-24-81
L19B2	08-12-81	34	08-13-81	09-01-81	131.5	09-16-81	09-17-81
L19B3	08-12-81	52	08-13-81	09-02-81	133.5	09-15-81	09-16-81
L19A1	+	+	+	10-03-81	126	10-30-81	10-30-81
L19A2	+	+	+	09-28-81	131	10-28-81	10-29-81
L19A3 *	+	+	+	09-28-81	130	10-29-81	10-30-81
L20C1 *	+	+	+	08-18-81	65	09-28-81	09-29-81
L20C2	+	+	+	08-18-81	65	09-28-81	09-29-81
L20C3 *	+	+	+	08-18-81	65	09-28-81	09-29-81
L20B1	+	+	+	09-24-81	74	09-15-81	09-16-81
L20B2	09-18-81	26	09-19-81	09-24-81	74	09-15-81	09-16-81
L20B3	+	+	+	09-24-81	74	09-15-81	09-16-81
L20A1	10-21-81	49	10-23-81	10-27-81	70	10-20-81	10-20-81
L20A2 *	10-22-81	24	10-23-81	10-27-81	70	10-19-81	10-20-81
L20A3	10-22-81	22	10-23-81	10-27-81	70	10-19-81	10-20-81
L21B1	+	+	+	06-24-81	62	01-05-82	01-06-82
L21B2	06-06-81	[illegible]	06-14-81	06-24-81	62	12-23-81	12-24-81

*Refer to paragraph [illegible]

+[illegible]

TABLE 15

TENDON GROUTING AND INSTALLATION DATA (Cont)

TENDON DESIGNATION	DATE GROUTED	GROUT TAKE (C.F. SOLIDS)	DATE REDRILLED	DATE TUBING INSTALLED	LENGTH OF TUBING (FT)	DATE TENDON INSTALLED	DATE TENDON GROUTED
L21B3	06-06-81	13	06-14-81	06-24-81	62	12-23-81	12-24-81
L21A1	08-05-81	17	08-06-81	08-13-81	68	09-02-81	09-03-81
L21A2	08-05-81	20	08-06-81	08-13-81	68	09-02-81	09-03-81
L21A3	08-05-81	22	08-06-81	08-13-81	68	09-01-81	09-02-81
L22B1	+	+	+	07-31-81	64	09-10-81	09-11-81
L22B2	+	+	+	07-31-81	64	09-10-81	09-11-81
R19B1	06-19-81	34	06-20-81	07-28-81	124	12-04-81	12-04-81
R19B2	06-01-81	66	06-12-81	07-25-81	124	12-02-81	12-03-81
R19A1	+	+	+	08-29-81	126	09-30-81	10-01-81
R19A2	+	+	+	09-14-81	128	10-01-81	10-02-81
R20B1	+	+	+	09-09-81	65	10-12-81	10-13-81
R20B2	+	+	+	09-09-81	64	10-12-81	10-13-81
R20A1	10-01-81	40	10-01-81	10-11-81	68	10-21-81	10-22-81
R20A2	10-01-81	24/	10-05-81	10-14-81	68	10-21-81	10-22-81
	10-08-81	21	10-10-81				
R21B1	06-01-81	11	06-04-81	06-17-81	62	07-23-81	07-24-81
R21B2	05-29-81	22	06-04-81	06-17-81	62	07-24-81	07-25-81
R21A1	06-30-81	47	07-01-81	07-03-81	67	12-01-81	12-02-81
R21A2	06-30-81	33	07-02-81	07-03-81	67	12-01-81	12-02-81
R22B1	+	+	+	07-09-81	62	09-11-81	09-12-81
R22B2	+	+	+	07-09-81	62	09-11-81	09-12-81
R22A1	+	+	+	08-24-81	68	09-24-81	09-25-81
R22A2	08-25-81	21	08-28-81	09-01-81	68	09-24-81	09-25-81
R23B1	05-27-81	26	06-01-81	06-14-81	62	07-15-81	07-16-81
R23B2	05-26-81	46	05-27-81	06-14-81	62	07-11-81	07-14-81
R23A1	06-30-81	24/	07-01-81	07-06-81	67	12-07-81	12-08-81
	07-02-81	14	07-03-81				
R23A2	06-29-81	21	06-30-81	07-03-81	67	12-08-81	12-08-81
R24B1	+	+	+	08-22-81	62.5	09-14-81	09-15-81
R24B2	+	+	+	08-22-81	62.5	09-14-81	09-15-81
R24A1	09-28-81	33	09-29-81	10-01-81	68	10-14-81	10-15-81
R24A2 *	09-22-81	29	09-23-81	09-26-81	68	10-14-81	10-15-81

*Refer to paragraph 4.13 [illegible] attempt [illegible] prestressing.

+[illegible]

TABLE 15

TENDON GROUTING AND INSTALLATION DATA (Cont)

TENDON DESIGNATION	DATE GROUTED	GROUT TAKE (C.F. SOLIDS)	DATE REDRILLED	DATE TUBING INSTALLED	LENGTH OF TUBING (FT)	DATE TENDON INSTALLED	DATE TENDON GROUTED
R25B1	05-26-81	48	05-30-81	06-14-81	62	08-05-81	08-06-81
R25B2	CONNECTED TO R25B1		05-30-81	06-12-81	62	08-07-81	08-08-81
R25A1	06-29-81	24	06-30-81	07-01-81	67	12-14-81	12-15-81
R25A2	06-29-81	21	06-30-81	07-01-81	67	12-14-81	12-15-81
R26B1	+	+	+	08-22-81	64	09-14-81	09-15-81
R26B2	+	+	+	09-03-81	63	09-12-81	09-13-81
R26A1	09-28-81	24	09-29-81	10-01-81	69	10-12-81	10-13-81
R26A2	09-28-81	26	09-29-81	10-01-81	69	10-12-81	10-13-81
R27B1	05-22-81	32	05-27-81	07-09-81	62	08-11-81	08-12-81
R27B2	05-22-81	50	05-26-81	06-18-81	62	08-12-81	08-13-81
R27A1	06-25-81	21	06-26-81	06-30-81	67	11-16-81	11-18-81
R27A2	06-24-81	20	06-25-81	06-30-81	67	11-16-81	11-18-81
R28B1	08-19-81	47	08-20-81	08-24-81	63	09-24-81	09-25-81
L22B3	+	+	+	07-31-81	65	09-10-81	09-11-81
L22A1	+	+	+	09-30-81	70	10-20-81	10-21-81
L22A2	10-05-81	23/	10-06-81	10-13-81	69	10-20-81	10-21-81
	10-09-81	20	10-10-81				
L22A3	10-05-81	35/	10-07-81	10-13-81	69	10-20-81	10-21-81
	10-09-81	21	10-10-81				
L23B1 *	06-15-81	6	06-15-81	06-24-81	62	01-06-82	01-07-82
L23B2	06-14-81	24	06-16-81	06-24-81	62	01-06-82	01-07-82
L23B3 *	06-14-81	20	06-16-81	07-08-81	62	01-07-82	01-08-82
L23A1 *	07-21-81	26	07-23-81	07-25-81	68	01-05-82	01-06-82
L23A2	07-21-81	20	07-22-81	07-25-81	68	01-04-82	01-05-82
L23A3	07-21-81	18	07-22-81	07-25-81	66	01-04-82	01-05-82
L24C1	+	+	+	07-31-81	64	01-08-82	01-09-82
L24C3 *	+	+	+	07-31-81	64	01-07-82	01-08-82
L24B1	09-16-81	19	09-18-81	09-21-81	74	10-13-81	10-14-81
L24B2	09-16-81	18	09-18-81	09-21-81	74	10-13-81	10-14-81
L24B3	+	+	+	09-15-81	72	10-13-81	10-14-81
L24A1	10-06-81	23	10-07-81	10-10-81	69	10-23-81	10-24-81
L24A2	10-06-81	27	10-07-81	10-10-81	69	10-23-81	10-24-81

* Refer to paragraph 9.13 before attempting restressing.

\+ Information not available.

TABLE 15

TENDON GROUTING AND INSTALLATION DATA (Cont)

TENDON DESIGNATION	DATE GROUTED	GROUT TAKE (C.F. SOLIDS)	DATE REDRILLED	DATE TUBING INSTALLED	LENGTH OF TUBING (FT)	DATE TENDON INSTALLED	DATE TENDON GROUTED
L24A3	10-06-81	35	10-07-81	10-10-81	68	10-23-81	10-24-81
L25B1 *	06-14-81	28	06-15-81	07-08-81	62	08-20-81	08-21-81
L25B2	06-13-81	28	06-14-81	07-08-81	62	08-19-81	08-20-81
L25A1	07-22-81	29	07-23-81	07-30-81	70	01-18-82	01-19-82
L25A2	07-22-81	22	07-23-81	07-30-81	70	01-18-82	01-19-82
L26B1 *	08-01-81	18	08-05-81	08-13-81	62	01-20-82	01-21-82
L26B2 *	08-04-81	27	08-05-81	08-13-81	62	01-20-82	01-21-82
L26A1	09-14-81	44	09-15-81	09-18-81	66	09-29-81	09-30-81
L26A2	09-14-81	21	09-15-81	09-18-81	66	09-29-81	09-30-81
L27B1 *	06-07-81	29	06-14-81	07-08-81	62	01-20-82	01-21-82
L27B2 *	+	+	+	07-08-81	62	01-19-82	01-20-81
L27A1	07-23-81	21	07-24-81	07-30-81	68	08-25-81	08-26-81
L27A2	07-23-81	28	07-24-81	07-30-81	67	08-25-81	08-26-81
L28B1 *	09-10-81	19	09-11-81	09-17-81	65	01-21-82	01-22-82
L28B2 *	09-10-81	32	09-12-81	09-17-81	104	01-22-82	01-23-82
L28A1	+	+	+	10-08-81	68	10-16-81	10-17-81
L28A2	10-09-81	57	10-10-81	10-13-81	109	10-16-81	10-17-81
L29B1	07-08-81	42	07-09-81	07-14-81	100	12-15-81	12-16-81
L29B2	07-08-81	33	07-10-81	07-14-81	100	12-16-81	12-16-81
L29A1	07-29-81	34	07-30-81	08-06-81	105	08-28-81	08-29-81
L29A2	07-29-81	35	07-31-81	08-06-81	105	08-29-81	08-29-81
L30B1	08-03-81	33	08-04-81	08-14-81	124	01-23-82	01-23-82
L30B2	08-03-81	39	08-05-81	08-14-81	124	12-23-81	12-24-81
L30A1	09-23-81	34	09-24-81	09-30-81	128	10-06-81	10-07-81
L30A2	09-23-81	54	09-24-81	09-30-81	128	10-06-81	10-07-81

* Refer to paragraph 9.13 before attempting restressing.
+ Information unavailable.

TABLE 16

TENDON DRILLING, STRESSING AND WATER TEST DATA

DESIGNATION	LOCATION	W.P.A. ELEV.	DRILL ANGLE (DEGREES)	DRILL DEPTH (FT)	DATE HOLE DRILLED	ALLOWABLE LEAKAGE (G.P.M.) BOND	ALLOWABLE LEAKAGE (G.P.M.) STRESSING	INITIAL WATER TEST (G.P.M.) BOND	INITIAL WATER TEST (G.P.M.) FULL LENGTH	ADDITIONAL WATER TEST (G.P.M.) BOND	ADDITIONAL WATER TEST (G.P.M.) FULL LENGTH
L22B3	3+25.5D	350.0	7.5	65	07-29-81	1.05	1.8	-	0.27		
L22A1	2+99D	360.0	7.5	70	09-22-81	1.05	2.1	0.65	2.13		
L22A2	3+12.5D	360.0	7.5	69	09-21-81	1.02	2.1	1.74	2.08	1.2	1.46/.82
L22A3	3+25.5D	360.0	7.5	69	09-21-81	1.02	2.1	-	3.56	1.96	2.38/.95
L23B1	3+42D	350.0	7.5	62	06-06-81	0.96	1.8	-	5.4	-	0.62
L23B2	3+57D	350.0	7.5	62	06-06-81	0.96	1.8	-	4.1	-	0.34
L23B3	3+72D	350.0	7.5	62	06-05-81	0.96	1.8	-	4.4	-	0.58
L23A1	3+42D	360.0	7.5	68	07-18-81	0.99	2.1	-	7.04	1.09	1.96
L23A2	3+57D	360.0	7.5	68	07-18-81	0.99	2.1	-	5.1	1.06	1.38
L23A3	3+72D	360.0	7.5	68	07-20-81	0.99	2.1	-	3.84	1.04	1.42
L24C1	3+88D	346.5	7.5	64	07-28-81	1.02	1.8	-	0.39		
L24C3	4+28D	346.5	7.5	64	07-29-81	1.02	1.8	-	0.29		
L24B1	3+88D	354.5	7.5	74	09-10-81	1.02	2.4	1.24	2.3	-	0.79
L24B2	4+08D	354.5	7.5	74	09-10-81	1.02	2.4	0.38	2.57	-	0.73
L24B3	4+28D	362.5	7.5	74	09-10-81	1.02	2.4	1.0	1.9		
L24A1	3+88D	362.5	7.5	69	09-30-81	1.02	2.1	1.72	2.14	-	0.96
L24A2	4+08D	362.5	7.5	69	09-30-81	1.02	2.1	1.41	1.72	-	0.70
L24A3	4+28D	362.5	7.5	69	09-30-81	1.02	2.1	-	7.1	-	0.93
L25B1	4+47D	353.0	7.5	62	06-04-81	0.96	1.8	-	8.02	0.52	1.27
L25B2	4+73D	353.0	7.5	62	06-03-81	0.96	1.8	-	12.3	0.56	1.19
L25A1	4+47D	361.0	7.5	70	07-20-81	1.05	2.1	-	9.3	0.89	1.24
L25A2	4+73D	361.0	7.5	70	07-21-81	1.05	2.1	-	4.1	-	0.80
L26B1	4+93D	352.0	7.5	62	08-01-81	0.96	1.8	2.18	2.28	-	0.88
L26B2	5+21.5D	352.0	7.5	62	07-31-81	0.96	1.8	-	9.54	-	0.81
L26A1	4+93D	360.0	7.5	66	09-09-81	0.93	2.1	-	11.38	1.0	1.3
L26A2	5+21.5D	360.0	7.5	66	09-09-81	0.93	2.1	-	2.9	-	1.0
L27B1	5+39D	350.0	7.5	62	06-02-81	0.96	1.8	-	5.3	-	0.63
L27B2	5+68D	350.0	7.5	62	06-03-81	0.96	1.8	-	0.83		
L27A1	5+39D	358.0	7.5	68	07-21-81	0.99	2.1	-	3.49	0.96	1.45
L27A2	5+68D	358.0	7.5	68	07-22-81	0.99	2.1	-	8.2	-	1.15
L28B1	5+80.5D	350.0	7.5	65	09-03-81	1.05	1.8	1.6	1.93	-	0.78

TABLE 16

TENDON DRILLING, STRESSING AND WATER TEST DATA

DESIGNATION	LOCATION	W.P.A.	DRILL ANGLE (DEGREES)	DRILL DEPTH (FT)	DATE HOLE DRILLED	ALLOWABLE LEAKAGE (G.P.M.)		INITIAL WATER TEST (G.P.M.)		ADDITIONAL WATER TEST (G.P.M.)	
						BOND	STRESSING	BOND	FULL LENGTH	BOND	FULL LENGTH
L28B2	6+19.5D	350.45	8	104	09-04-81	1.02	4.2	2.63	3.84	-	0.28
L28A1	5+80.5D	358.0	7.5	68	10-05-81	0.99	2.1	1.04	1.83		
L28A2	6+19.5D	358.45	8	110	10-06-81	1.05	4.5	-	11.5	-	0.92
L29B1	6+52.5D	350.0	8	100	06-18-81	1.05	3.9	-	9.9	-	0.41
L28B2	6+71D	350.0	8	100	06-17-81	1.05	3.9	-	5.78	0.45	1.39
L29A1	6+52.5D	358.0	8	105	07-24-81	1.05	4.2	-	3.9	-	0.51
L29A2	6+71D	358.0	8	105	07-24-81	1.05	4.2	-	4.8	-	0.41
R19B1	1+62D	351.0	6.5	124	05-08-81	1.02	5.4	3.1	3.56	-	0.99
R19B2	1+80D	351.0	6.5	124	05-09-81	1.02	5.4	-	14.0	-	0.21
R19A1	1+62D	361.0	6.5	128	08-21-81	0.99	5.7	0.78	1.96		
R19A2	1+80D	361.0	6.5	128	08-22-81	0.99	5.7	0.69	1.98		
R20B1	1+97.5D	351.0	7.5	65	09-02-81	1.05	1.8	-	0.59		
R20B2	2+36.5D	351.0	7.5	64	09-02-81	1.02	1.8	-	0.93		
R20A1	1+97.5D	361.0	7.5	68	09-29-81	1.02	2.1	-	4.0	1.1	1.24
R20A2	2+36.5D	361.0	7.5	68	09-28-81	1.02	2.1	1.42	2.1	1.33	1.92/.44
R21B1	2+51D	351.0	7.5	62	05-13-81	0.96	1.8	-	11.1	-	0.66
R21B2	2+81D	351.0	7.5	62	05-13-81	0.96	1.8	0.06	2.2	-	0.18
R21A1	2+51D	361.0	7.5	67	06-29-81	0.96	2.1	-	14.0	-	0.99
R21A2	2+81D	361.0	7.5	67	06-29-81	0.96	2.1	-	14.0	0.77	1.34
R22B1	3+02D	352.0	7.5	63	07-03-81	0.99	1.8	-	0.92		
R22B2	3+23D	352.0	7.5	63	07-02-81	0.99	1.8	-	0.65		
R22A1	3+02D	360.0	7.5	68	08-20-81	0.99	2.1	0.78	1.11		
R22A2	3+23D	360.0	7.5	68	08-19-81	0.99	2.1	1.3	1.83	0.89	1.19
R23B1	3+45D	352.0	7.5	62	05-14-81	0.96	1.8	-	2.24	-	0.78
R23B2	3+69D	352.0	7.5	62	05-14-81	0.96	1.8	-	11.65	-	0.57
R23A1	3+45D	360.0	7.5	67	06-27-81	0.96	2.1	-	2.78	1.14/.61	1.78/1.14
R23A2	3+69D	360.0	7.5	67	06-27-81	0.96	2.1	-	3.12	0.99	1.65
R24B1	3+87D	353.0	7.5	63	08-19-81	0.99	1.8	0.54	1.58		
R24B2	4+28D	353.0	7.5	63	08-19-81	0.99	1.8	0.62	1.51		
R24A1	3+87D	361.0	7.5	68	09-11-81	0.99	2.1	-	5.85	1.05	1.7
R24A2	4+28D	361.0	7.5	68	09-12-81	0.99	2.1	-	4.53	-	0.71

TABLE 16

TENDON DRILLING, STRESSING AND WATER TEST DATA

DESIGNATION	LOCATION	W.P.A. ELEV.	DRILL ANGLE (DEGREES)	DRILL DEPTH (FT)	DATE HOLE DRILLED	ALLOWABLE LEAKAGE (G.P.M.)		INITIAL WATER TEST (G.P.M.)		ADDITIONAL WATER TEST (G.P.M.)	
						BOND	STRESSING	BOND	FULL LENGTH	BOND	FULL LENGTH
R25B1	4+47D	352.0	8	62	05-15-81	0.96	1.8	0.03	2.53	-	0.57
R25B2	4+73D	352.0	8	62	05-15-81	0.96	1.8	-	11.8	-	0.85
R25A1	4+47D	360.0	7.5	67	06-25-81	0.96	2.1	-	1.7	0.82	1.5
R25A2	4+73D	360.0	7.5	67	06-25-81	0.96	2.1	-	2.6	0.75	1.43
R26B1	4+93D	352.0	7.5	64	08-18-81	1.02	1.8	-	0.89		
R26B2	5+21.5D	352.0	7.5	64	08-18-81	1.02	1.8	0.5	1.21		
R26A1	4+93D	360.0	7.5	70	09-21-81	1.05	2.1	-	4.3	1.09	1.42
R26A2	5+21.5D	360.0	7.5	70	09-23-81	1.05	2.1	-	3.4	1.04	1.5
R27B1	5+39D	350.0	8	62	05-16-81	0.96	1.8	3.3	-	-	0.53
R27B2	5+63D	350.0	8	62	05-16-81	0.96	1.8	4.86	-	-	0.51
R27A1	5+39D	358.0	7.5	67	06-10-81	0.96	2.1	-	1.91	1.0	1.72
R27A2	5+63D	358.0	7.5	67	06-16-81	0.96	2.1	1.11	2.3	0.87	1.9
R28B1	5+80.5D	346.0	7.5	63	08-17-81	0.99	1.8	-	11.27	-	0.05
R28B2	6+19.5D	346.0	7.5	63	08-17-81	0.99	1.8	-	2.7	-	.34
R28A1	5+80.5D	356.0	7.5	68	09-15-81	0.99	2.1	-	2.92	.84	1.12
R28A2	6+19.5D	356.0	7.5	68	09-15-81	0.99	2.1	-	6.25	.88	1.29
R29B1	6+50.96D	345.0	8	62	05-05-81	0.96	1.8	0.77	.95		
R29B2	6+71D	345.0	8	62	05-07-81	0.96	1.8	1.2	2.05	-	.2
R29A1	6+50.96D	355.0	7.5	67	07-06-81	0.96	2.1	-	6.4	1.08	1.32
R29A2	6+71D	355.0	7.5	67	07-07-81	0.96	2.1	-	12.66	-	.92
R30B1	6+94D	345.0	7	123	06-24-81	0.99	5.4			.5	1.3
R30B2	7+12D	345.0	7	124	06-23-81	1.02	5.4	-	12.0	.08	1.67
R30A1	6+94D	355.0	6.5	128	08-28-81	0.99	5.7	-	7.4	.84	1.38
R30A2	7+12D	355.0	6.5	128	08-27-81	0.99	5.7	-	6.5	1.17	1.81
L19C1	1+62D	345.0	7	124	05-19-81	1.02	5.4	-	4.1	.02	1.99
L19C2	1+72.5D	345.0	7	124	05-20-81	1.02	5.4	-	11.4		6.86/.25
L19C3	1+83D	345.0	7	124	05-19-81	1.02	5.4	-	12.0	.55	2.77
L19B1	1+62D	353.0	6.5	134	08-10-81	1.02	6.0	-	2.07	-	1.1
L19B2	1+72.5D	353.0	6.5	133	08-07-81	0.99	6.0	-	7.88	-	.5
L19B3	1+83D	353.0	6.5	134	08-08-81	1.02	6.0	-	12.0	-	.98
L19A1	1+62D	361.0	8	128	09-17-81	0.99	5.7	0.9	1.6		

TABLE 16

TENDON DRILLING, STRESSING AND WATER TEST DATA

DESIGNATION	LOCATION	W.P.A. ELEV.	DRILL ANGLE (DEGREES)	DRILL DEPTH (FT)	DATE HOLE DRILLED	ALLOWABLE LEAKAGE (G.P.M.) BOND	ALLOWABLE LEAKAGE (G.P.M.) STRESSING	INITIAL WATER TEST (G.P.M.) BOND	INITIAL WATER TEST (G.P.M.) FULL LENGTH	ADDITIONAL WATER TEST (G.P.M.) BOND	ADDITIONAL WATER TEST (G.P.M.) FULL LENGTH
L19A2	1+72.5D	361.0	8	131	09-18-81	1.08	5.7	1.05	1.58		
L19A3	1+83D	361.0	8	130	09-19-81	1.05	5.7	0.62	1.5		
L20C1	1+97.5D	346.0	7.5	65	08-14-81	1.05	1.8	-	.91		
L20C2	2+33D	345.0	7.5	65	08-15-81	1.05	1.8	-	.04		
L20C3	2+40D	345.0	7.5	65	08-15-81	1.05	1.8	-	.02		
L20B1	1+97.5D	354.0	7.5	74	09-19-81	1.02	2.4	-	.54		
L20B2	2+33D	353.0	7.5	74	09-17-81	1.02	2.4	0.12	2.97	-	.24
L20B3	2+40D	353.0	7.5	74	09-17-81	1.02	2.4	-	.50		
L20A1	1+97.5D	362.0	7.5	70	10-20-81	1.05	2.1	-	14.0		
L20A2	2+33D	361.0	7.5	70	10-19-81	1.05	2.1	-	3.82	-	.45
L20A3	2+40D	361.0	7.5	70	10-19-81	1.05	2.1	-	3.63	-	.67
L21B1	2+51D	351.0	7.5	62	05-21-81	0.99	1.8	-	.62	-	.63
L21B2	2+73D	351.0	7.5	62	05-21-81	0.99	1.8	-	7.3		
L21B3	2+84D	351.0	7.5	62	05-20-81	0.99	1.8	-	3.4	-	.17
L21A1	2+51D	361.0	7.5	68	08-03-81	0.99	2.1	1.43	1.75	-	.58
L21A2	2+73D	361.0	7.5	68	08-04-81	0.99	2.1	-	3.85	-	.76
L21A3	2+84D	361.0	7.5	68	08-01-81	0.99	2.1	-	7.06	-	.77
L22B1	2+99D	350.0	7.5	64	07-27-81	1.02	1.8	-	.44	-	.59
L22B2	3+12.8D	350.0	7.5	64	07-27-81	1.02	1.8	-	.71		
L30B1	6+94D	350.0	8	124	07-30-81	1.02	5.4	1.8	2.1		0.41
L30B2	7+12D	350.0	8	124	07-30-81	1.02	5.4	-	6.97	-	0.72
L30A1	6+94D	358.0	8	128	09-15-81	0.99	5.7	-	10.0	-	0.77
L30A2	7+12D	358.0	8	128	09-14-81	0.99	5.7	-	11.0	-	0.92

X. INSTRUMENTATION

10.01 General.--Bay Springs Lock and Dam has been instrumented with a variety of earth movement and pressure measuring devices. Except as noted, each instrument type was installed by contractor's personnel and, for certain types, a representative of the manufacturer of the instrument was present to supervise the installation. Each instrument was certified to be fully operational after installation. When applicable, instrument and data collection devices were calibrated at the factory and then in the field before installation. The factory representative trained contractor personnel in the proper techniques of maintenance and data collection pertaining to his company's instrument.

10.02 Inclinometers.--Ten inclinometers were installed during the construction period and monitored on a monthly basis during construction of the embankment and lock structures. Six inclinometers located around the perimeter of the lock chamber were read by Government personnel. Four inclinometers located in the embankment were read by contractor's personnel. Six inclinometers were to be installed in the embankment by Government drill crews upon completion of the embankment. However, only five of these six were installed. IN-3 was deleted by Nashville Geotechnical Branch because of its proximity to IN-4. The holes for the Government-installed instruments were drilled using a churn drill in the embankment and a 1500 failing rig with a PQ diameter core barrel in rock. Some problems were experienced by the Government drill crew during the installation of the inclinometers. IN-7 casing was unexplanably crimped 3-4 feet below the embankment surface. The grout backfill had to be broken out by jackhammers and the upper section of inclinometer replaced. On the installation of IN-9, the 69-foot metal casing broke near the top while the casing was being pulled by a Walker-Neer W5-31 churn rig. The area around the break was excavated, the casing was welded together, and the casing was pulled. No damage to the inclinometer was apparent. In fact, each of the inclinometers is functional. However, it should be noted that IN-16 casing is bent and, at times, causes the probe to hang in the casing.

The following performance evaluating was taken from "Instrumentation Data For First Periodic Inspection, Bay Springs Lock and Dam--Tennessee-Tombigbee Waterway (August 1984)":

After reviewing the plots of the six inclinometers on either side of the lock excavation, it can be stated that during excavation the movements in the left side inclinometers (IN-10, IN-11, IN-12) were toward the right side (excavation for lock) and downstream. Those instruments on the right side of the lock excavation (IN-13, IN-14, IN-15) indicated movements toward the left side (lock excavation) and upstream. It is believed that the blasting caused the rock mass to move along separated bedding planes toward the excavation in blocks bounded by joints. This agrees with the joint set in the area of about N37°E. This is the same type of movement measured during the test excavation construction before the lock contract was awarded. It can also be stated that the stressing of the tendons caused no detectable compressing of the rock mass.

The shear resistance along the bedding planes is apparently greater than the stressing loads placed on the wall tendons. Inclinometer 16 indicated a small displacement along bedding planes at Elevation 330 and 350. This is not thought to be excessive. After completion of the embankments along with extension of the inclinometer casing, new spiral twist surveys were run along with new initial base line surveys. Spiral twist surveys were not conducted on inclinometers IN-5, 11, 12, 15, and 16. The initial spiral twist surveys can be used in the rock portion of these instruments. The movement in rock indicated since the last initial or base set of readings was obtained is so small as to be beyond the accuracy capability of the instrument.

See Table No. 17, page 225, for inclinometer installation data and drawing BSFR-68 for installation details. The Corps installations deviated from that shown in the drawing. Instead of grout, the Corps backfilled along the instrument with pea gravel in rock while the remainder of the hole was backfilled as originally specified. Also, fixed couplings were used in lieu of the telescoping couplings shown on the drawing. It was felt that the telescoping couplings provided no extra benefit over the more easily installed fixed couplings.

10.03 Extensometers.--Six extensometers were installed in the lock chamber in 1982 after stressing of the wall anchors. Extensometers were installed on an 8 degree angle down from the horizontal and normal to the centerline of the lock. Anchor settings were selected by the contracting officer and the factory representative based on core recovered from the extensometer holes. One each was installed in lock monoliths L19, L23, L29, R19, R23, and R29. Each of the specified eight anchors was set just below joints which would appear to have the most potential for movement, i.e., below joints which were open, sheared, stained or combinations of the three. Readout for the extensometers is made in the lock gallery. See Table No. 15, pages 208-211, for installation data and drawing BSFR-68 for installation details.

The following performance evaluation was taken from a report entitled "Instrumentation Data For First Periodic Inspection, Bay Springs Lock and Dam--Tennessee Tombigbee Waterway (August 1984)":

Evaluation of Extensometers.

Extensometer L-19 - This extensometer was installed after the initial stressing and first lift-off tests were performed on the tendons in monolith L-19. Anchor No. 6 indicates a 0.065-inch expansion between the readings of 15 and 22 October 1982. After this indicated initial movement, none other is noted. None of the other anchors indicate any movement since installation even though a third lift-off tests was performed on the wall tendons during the period 25 January through 4 March 1983. Readings for anchor No. 6 for 19 April 1983 show a total expansion of 0.075 inch with little or no change to October 1984. Readings for anchor Nos. 1, 2, 3, and 4 showed an increase in tension on 10 July 1984 and 15 August 1984.

Extensometer L-23 - This extensometer was installed after initial stressing and the first lift-off tests of the tendons in monolith L-23. Essentially, no movement has been indicated since the instrument has been installed. On 10 March 1983, the head assembly was readjusted. This caused an apparent tension between anchor No. 1 and anchor No. 8 of 0.10 inch. It is believed that this indicated change was due to the readjustment of the head since no changes have been noted after that date. Readings for anchors Nos. 2 and 4 show compression and for anchors Nos. 3 and 5 show slight tension when the chamber was filled to elevation 415.3 on 1 May 1984 and to elevation 417.6 on 8 May 1984. When the water level in the chamber was lowered, the readings were the same as before. Readings for these same four anchors showed an increase in tension on 10 July 1984 and 15 August 1984.

Extensometer L-29 - This extensometer was installed before any of the tendons in monolith L-29 were stressed. After the initial stressing of the tendons in monolith L-29 on 13, 14, 15 and 16 July 1982, each of the extensometer anchors indicated about 0.10 inch of extension or tension. The first lift-off test was performed between 27 July and 13 August 1982. Extensometer L-29 was again read on 1 September 1982, and all anchors indicated essentially the same reading as the initial one. Readings indicate compression for anchor No. 1 and tension for anchor Nos. 2 through 7 when the chamber was filled on 1 and 8 May 1984. Readings showed an increase in tension on 10 July 1984 and 15 August 1984.

Extensometer R-19 - This extensometer was installed 24 July 1982 after the initial stressing and first lift-off of the tendons in monolith R-19. The second lift-off was performed on 26 July 1982, 2 days after extensometer R-19 installation. The second reading on extensometer R-19 indicates compression of the rock mass between the bottom anchor (No. 8) and anchors 2 through 6. The compression ranges from 0.20 inch in the first anchor to 0.04 inches in anchor No. 6. Anchor No. 7 indicates 0.013 inch of extension or tension movement. After the second extension reading, essentially no movement is indicated for the next 4 months. The electronic head was readjusted on 5 November 1982 and 14 March 1983. The final tendon stressing was accomplished on 19 and 21 January 1983. No movement is indicated in any of the anchors of the extensometer. Readings for anchor Nos. 3, 5, 6, and 7 show tension with high water levels in the lock chamber on 1 and 8 May 1984. Readings show an increase in tension on 10 July 1984 and 15 August 1984.

Extensometer R-23 - This extensometer was installed after initial stressing and the first three lift-off tests had been performed on the tendons of monolith R-23. The final lift-off tests were performed on the tendons from 1 January through 3 March 1983. No movements were indicated for any of the anchors of the extensometer since installation. There were no readings taken from 10 February 1983 until 19 September 1983 because the conduit was not pulled through. There were difficulties with the readout box between 17 April 1984 and 5 July 1984. Since that time, there has been a recording of slight compression for all anchors except No. 5 which does not appear to be operating correctly. Slight compression was recorded with high water levels in the chamber on 1 and 8 May 1984.

Extensometer R-29 - Extensometer R-29 was installed after the initial stressing and first lift-off tests of the tendons in monolith R-29. The first reading after installation indicates the rock mass is expanding with all anchors of the instrument indicating tension. The movements indicated range from 0.274 inch for the head down to 0.03 inches for anchor No. 3 which is set at 72 feet. It is not apparent as to why the rock mass is in a state of expansion since the tendon loads should place it in compression. The second reading indicates the rock mass is compressing between these two readings. The readings for all the anchors for the next two months (September and October) indicate an expansion of the rock mass. After October 1982, the readings indicate that the rock mass is essentially stable with the extensometer being in tension. Readings for anchor Nos. 2 and 7 have been irregular and that for No. 3 has shown slight tension.

Conclusion - The reason for the behavior of the extensometers is unclear. When the loads are placed on the tendons, one would expect the rock mass to become into a state of compression. In most cases, the tendons were stressed before the extensometers were installed. Notwithstanding, the final stressing was well after the instruments were installed and still the movements indicated that the rock mass was in a state of expansion. Based on readings obtained from all the extensometers, the rock mass is essentially stable with minor movement recorded during periods when the lock chamber has been filled (Elevation 415.3 on May 1984 and 417.6 on 8 May 1984). The apparent movement as indicated by the readings of the instruments on 10 July 1984 and 15 August 1984 is believed to be a result of a malfunction of the readout device.

10.04 Uplift and Pore Pressure Cells.--Eighty-two uplift cells and 36 pore pressure cells were installed in the lock chamber. Pore pressure cells were installed on the shale slopes and uplift cells were installed in the shale foundation. These instruments were made at the job site and installed by the mechanical subcontractor, Martyn Brothers. As of 12 December 1982, the only cells which have been monitored are the lower miter sill uplift cells which have been monitored on a bi-weekly basis by Government personnel. Readout of these cells is in the lower miter sill cross-over gallery. The upper miter sill uplift cells readout is located in the upper miter sill cross-over gallery..

The following, which describes the performance of the uplift and pore pressure cells has been taken from a report entitled "Instrumentation Data for the First Periodic Inspection, Bay Springs Lock and Dam--Tennessee Tombigbee Waterway (August 1984)":

Monolith R-19. All of the uplift cells except UC-R19-9 are functioning together and probably fluctuate with the water level in the lock chamber. When the lock is filled during the first 10 days of May 1984, the uplift cells definitely reflect the water level in the lock chamber. The pore pressure cells show a constant band of heads which range from El. 350 to El. 360. Nothing seems to affect these cells. They are probably affected by the groundwater in the rock formations beside the lock walls.

Monolith R-20. All of the uplift cells are acting the same way as the ones in Monolith R-19. They are probably reflecting varying lock chamber water levels. The pore pressure cells in R-23 are affected slightly by the lock chamber water level, but are probably affected to a larger degree by groundwater in the rock formations.

Monolith R-29. The uplift cells appear slow to be affected by the lock chamber water level and load cells UC-R29-1, UC-R29-2, and UC-R29-4 appear to be permanently inoperative. The pore pressure cells are greatly affected by the lock chamber water level. This suggests a poor concrete seal around the base of this monolith.

Monolith L-19. The uplift cells in L-19 can be classed generally as a failure. Some of the cells should be fitted with pressure gages at the top so some useful data can be obtained from this monolith. The pore pressure cells are not apparently affected by any outside water and probably show the effect of groundwater in the rock formations beside the lock walls.

Monolith L-20. The uplift cells, with the exception of UC-L23-8, generally reflect the water level in the lock chamber. Cell UC-L23-8 is probably inoperative due to a bad installation. The pore pressure cells probably show the groundwater effect in the rock formations beside the lock walls.

Upper Miter Sill. The uplift cells showed a dramatic increase in pressure as the upper pool was allowed to fill. This pressure increase was lost between February and March of 1983. This loss of head could have been caused by the opening of a clear passageway completely under the upper miter sill to the lock chamber. The uplift cells responded to the filling and emptying of the lock chamber thereafter.

Lower Miter Sill. Many of the uplift cells under this sill show evidence of poor installation due to leakage fittings and defective gauges. Those cells that appear to work are sensitive to lock chamber water level.

One could conclude from the uplift cell data that lock wall monoliths should be designed for the highest water level on either side of the monoliths over 100% of the base area.

Readout for all other cells is made in the lock gallery. See Table No. 20, pages 227-228, for installation data and drawing BSFR-68 for installation details. Acid water is and will be a problem in the uplift cells installed in the lower crossover. The water has disintegrated parts of the quick release couplings. Non-reactive parts should be used in couplings.

10.05 Piezometers.--Four piezometers were installed by the contractor in the embankment during construction. Weekly readings were made by contractor's personnel on these four and four other piezometers installed during the Bay Springs test excavation. The Government installed fifty-one piezometers in the embankment upon completion of the embankment. See Table No. 21, pages 229-231, for installation data and drawing BSFR-68 for installation details. No problems were experienced during piezometer installation.

The following piezometer evaluation, included in a report entitled "First Periodic Inspection Bay Springs Lock and Dam--Tennessee Tombigbee Waterway (August 1984)" explains piezometer performance and hydrologic conclusions:

EVALUATION OF EMBANKMENT PIEZOMETERS AT BAY SPRINGS THROUGH JUNE 1984

There are 59 piezometers installed at the Bay Springs Project. Of these, 32 are installed in the impervious core of the embankment, 5 in the overburden of the right and left abutments, 2 in the downstream filter blanket, and the remaining 20 in the rock foundation under the dam or behind the lock walls.

Abutment Piezometers - Three piezometers (BSPZ 1, 2 and 4) are located on the right abutment while two (BSPZ 45 and 46) are on the left side. The mid-tip of BSPZ 2 and 4 are at top of rock (Elevation 361-362) and have a water elevation of 370 to 375, respectively. BSPZ-1, with its mid-tip at 389, has a water elevation of about 399. The left abutment piezometers have their mid-tips at top of rock (elevation 380) and have water elevations at 397 to 399. All the piezometers have relatively flat plots and also show a direct but small response to headwater levels.

Drainage Blanket Piezometers - Two piezometers (BSPZ 15 and 24) were installed in the drainage blanket about 100 feet downstream of the centerline of the dam. BSPZ 24 is still dry while BSPZ 15 shows a water elevation close to its mid-tip elevation (383). This indicates that the drainage blanket is functioning normally or that the seepage through the dam is probably exiting through the foundation rock before it gets to the downstream toe.

Embankment Piezometers - In general, the embankment piezometers are located in groups, spaced approximately 200 feet apart along the top of the dam. The number of piezometers in each group vary, but each group usually has one piezometer with its mid-tip set at top of rock and one or more with its mid-tip set in the impervious core, usually at elevations of 375 and 395. Two groups located at Station 12+00S and 17+70S have piezometer mid-tips set at top of rock 14 feet upstream and downstream of the centerline in addition to the instruments on the centerline. At Station 19+00S, two piezometers were installed in the core at the contact of the first embankment and tie-in placements.

The piezometers in the embankment were evaluated by comparing current piezometric levels to those predicted from a theoretical flow net. Below is a summary of these piezometers.

1. Station 6+00S - BPSZ 5 and 6. Both piezometers correspond well within a flow net with water elevations of 407 and 396, respectively.

2. Station 8+00S - BSPZ 7, 8, and 9. All three piezometers have water elevations higher than would be expected (399, 395, and 400, respectively). The piezometric plot for BSPZ 9 has continued to rise since January 1984 and has only recently leveled off. The mid-tip location of 9 is at top of rock, so the increase in its water level could be due to high reservoir pressures existing in the rock.

3. Station 10+00S - BSPZ 10 and 11. Both piezometers have water elevations that correspond well with a flow net (405 and 394, respectively).

4. Station 12+00S - BSPZ 16, 17, 18, and 18A. All the piezometers except BSPZ 16 have water levels that compare well with a flow net (406, 400, and 395, respectively). BSPZ 16 has a water elevation of 408 which is about 8 feet higher than would be expected.

5. Station 14+00S - BSPZ 19 and 20. These correspond well with the theoretical flow net with water elevations of 407, 395, respectively.

6. Station 16+00S - BSPZ 25, 26, and 27. Piezometer BSPZ 26 (mid-tip 370) is still showing a water elevation (410) higher than what is expected from a flow net (396). BSPZ 25 and 27 have water elevations (408 and 393, respectively) more in line with the theoretical flow net. Poor compaction or a very permeable material at this elevation (370) is the probable reason for BSPZ 26 having high water level.

7. Station 18+00S - BSPZ 28, 29, 29A, 29B, and 30. All of the piezometers correspond well with a theoretical flow net with the exception of BSPZ 29. This piezometer has a mid-tip elevation of 370 and shows a water level of 404 which is about 10 feet higher than what a flow net would predict. This piezometer has its mid-tip at the same elevation as BSPZ 26 indicating that there may be a widespread zone of material that has a different permeability than the rest of the core.

8. Station 19+00S - BSPZ 48 and 49. Piezometer BSPZ 49 has a water level equal to headwater while BSPZ 48 is at about 378. Since BSPZ 49 is located 15 feet upstream of the centerline, its water level is not unusual, while BSPZ 48 shows the expected drop across the core.

9. Station 20+30S - BSPZ 35, 36, and 37. Piezometers BSPZ 36 and 37 have water levels higher than expected (both at elevation 404). These piezometers are close to the lock wall and poor compaction here could be the reason for these higher water levels.

10. Station 23+00S - BSPZ 38, 39, and 40. All three piezometers show water levels (406, 399, and 390, respectively) which corresponds to a theoretical flow net.

11. Station 25+00S - BSPZ 41. This piezometer has a water elevation of 408 which is considered normal.

Summary - In general, the embankment, abutment, and drainage blanket piezometers show water elevations that correspond well with what would be predicted from a theoretical flow net. For those piezometers that have high water elevations, it is felt that they are located in areas where the horizontal permeability is greater than what was expected. This could result from poor compaction or from use of a more permeable borrow material. At this time, these piezometers do not indicate that a serious problem exists. All piezometers except the two located in the drainage blanket follow headwater levels.

Rock Piezometers - Twenty-one (21) piezometers were installed in rock and were located to monitor conditions during the lock test excavation as well as following impoundment. Four of these piezometers were installed on either side of the lock walls during the lock test excavation (BSP 10, 11, 12, and 13). The remaining 17 were installed during the lock and dam construction. Four were installed upstream of the grout curtain (BSPZ 12, 21, 33, and 42), four downstream of the grout curtain (BSPZ 13, 22, 32, and 43), four with mid-tips below the bottom of the grout curtain (BSPZ 14, 23, 34, and 44), and one with mid-tip located in a joint (BSPZ 3), two with the mid-tips in weathered clay (BSPZ 20A and BSPZ 47) and two with the mid-tips immediately below top of rock (BSPZ 15R and BSPZ 24R). The four piezometers installed during the test excavation were reactive, showing drops during excavation for the lock. From that time until the time of the impoundment, water levels in three of the piezometers were stable except for periods of heavy rain at which time the water level rose. The fourth piezometer, BSP 12, was plugged in March 1983 when the tip of a water level indicator broke off in the hole.

Water levels in the contractor installed BSPZ 15R and BSPZ 24R show a slight rise with headwater.

The location of the grout curtain to the bedrock piezometers has little or no effect. All piezometers showed a rise with headwater, but such a rise is not unusual and does not indicate detrimental seepage or leakage.

10.06 Rebound and Settlement Monuments.--Seven rebound and settlement monuments were installed during the Bay Springs test excavation. These monuments were monitored by contractor's personnel during the excavation of the lock chamber to check for rebound and settlement in the rock beneath the excavation. Weekly readings were taken during the excavation period. See Table No. 22, page 231, for installation data. Data from this instrumentation was erratic and of limited use. The most accurate form of measurement, the direct method is described in paragraph 10.07.

10.07 Reference Monuments and Surface Movement Monuments.--The contractor installed 6 reference monuments and 34 surface movement monuments.

a. Review of Horizontal Lock Movements are as follows:

(1) Land Lock Wall (Line L-11A--L-34). The first survey in September 1983 shows very small movements. The largest movement is about 0.01 foot (1/8 inch) at L27A and is toward the lock chamber. The next surveys in December 1983 and in July 1984 are parallel to one another from the upper end (L-11A) to (L-19A) and show small movements of about 0.01 foot (1/8 inch).

From (L-19A) to (L-31) the walls move in opposite directions for much of the distance. Below (L-31) the walls again start to move in a parallel manner. The largest movements of any of the three surveys (Sep 83, Dec 83, and Jul 84) are about 0.01 foot (1/8 inch) and are not considered significant.

(2) River Lock Wall (Line R-1--R-34). The September 1983 survey shows little or no deviation from the upstream end at R-1 to R-21. From R-21 to the end of the line at R-44, this first survey shows erratic but normal deviations of no more than 0.01 foot (1/8 inch). The December 1983 and July 1984 surveys show small erratic movements with no apparent pattern developing. However, a critical movement of 0.04 foot (1/2 inch) is recorded on both surveys at CS-11, R-32, and R-33. This is a real cause for concern and should be monitored closely.

b. Review of Vertical Lock Movements are as follows:

(1) Land Lock Wall. The only pattern that is consistent in all three surveys is a settlement at L-17 which has a maximum value of 0.015 foot (3/16 inch) in the July 1984 survey. The December 1983 and July 1984 surveys show an increase in elevation of about 0.01 foot (1/8 inch) from L-27 to the end of the wall. None of the vertical movements in this wall are excessive or abnormal.

(2) River Lock Wall. All three surveys show generally an increase above the original datum. The maximum amount is about 0.015 foot (3/16 inch) at monument R-37. This is not considered excessive or abnormal.

The following is an excerpt from a report entitled "Instrumentation Data for the First Periodic Inspection, Bay Springs Lock and Dam--Tennessee Tombigbee Waterway (August 1984)":

Monumentation

Location - Twenty-two monuments have been installed, at approximately 100-foot spacings along the crest of the dam. Twelve additional monuments are located on the downstream berm, access road, and the downstream slope (two on the left embankment and 10 on the right embankment).

Crest Monuments - The overall displacement of these monuments has been downstream and on the order of 0.10 foot. The monuments located near the abutments show no movement; however, the remaining monuments show a uniform displacement indicating that the dam, as a whole, has moved slightly downstream after the reservoir was filled. The trend is a continual, but small downstream movement. The overall settlement has been very small, less than 0.02 foot.

Downstream Monuments - These monuments show displacements similar to those displayed by the crest movements. SM-30 and SM-31 show a slight upstream movement, while the rest show movements in the downstream direction. SM-32 shows the greatest displacement, about 0.10 foot downstream and toward the - right abutment. None of these movements are considered excessive. The monuments located on the right embankment berm show a slight upward movement (0.01 foot - while the others show settlement, with SM-29 having the largest (about 0.02 foot). This monument is the only one showing a continuous settlement from - subsequent surveys.

None of the above movements are considered excessive or indicate that the structural integrity of the embankment is in danger. See contract drawings TTBS-43/6.4 and TTBS-43/7.3 for locations of this instrumentation.

10.08 Data Interpretation.--Data collected from these instruments during the construction period was sent to the Chief of Geotechnical Branch, Nashville District, for analysis and interpretation.

10.09 Load Cells.--Load cells and associated problems are discussed in paragraph 9.10 on page 190.

TABLE 17
INCLINOMETER INSTALLATION DATA

INCLINOMETER NO.	LOCATION D/U	LOCATION S	APPROXIMATE TIP ELEVATION	TOP OF ROCK ELEVATION	INSTALLED BY
IN-10	6+00D	23+02	272.4	361.1	C
IN-11	3+98D	23+02	276.4	365.1	C
IN-12	1+78D	23+02	275.1	364.2	C
IN-13	1+89D	20+22	274.0	362.6	C
IN-14	4+18D	20+22	274.6	363.2	C
IN-15	7+03D	20+22	270.2	359.2	C
IN-16	0+04D	19+02	301.5	361.4	C
IN-2	0+90D	11+00	350.0	370.0	C
IN-5	1+00D	17+50	305.0	319.8	C
IN-6	1+80D	17+50	305.0	320.3	C
IN-1	0+05U	11+00	350.0	*	G
IN-3	NOT INSTALLED				
IN-4	0+05D	17+50	305.0	*	G
IN-7	0+05U	20+00	335.0	*	G
IN-8	0+05U	23+30	335.0	*	G
IN-9	0+05U	26+00	340.0	*	G

C - Installed by contractor

G - Installed by Corps of Engineers

* - Information unavailable

TABLE 18
EXTENSOMETER INSTALLATION DATA

EXTENSOMETER NO.	STATION	ANCHOR NO. AND DISTANCE FROM EXTENSOMETER HEAD (FT) 1	2	3	4	5	6	7	8
L-19	1+72.5D	57	100	135	145	150	165	175	200
R-19	1+72.5D	46	90	130	140	145	160	170	200
L-23	3+57D	45	55	70	80	85	160	110	150
R-23	3+57D	45	56	70	80	85	160	110	150
L-29	6+65D	50	75	108	118	125	135	145	150
R-29	6+65D	50	60	72	82	87	102	112	150

TABLE 19

PORE PRESSURE CELL INSTALLATION DATA

CELL DESIGNATION	STATION D	MIDPOINT ELEVATION
PC-R19-1	1+54	330.2
PC-R19-2	1+69.5	330.0
PC-R19-3	1+85	329.9
PC-R19-4	1+54	301.0
PC-R19-5	1+69.5	301.0
PC-R19-6	1+85	301.0
PC-R23-1	3+39	330.6
PC-R23-2	3+57	330.7
PC-R23-3	3+75	330.4
PC-R23-4	3+39	299.0
PC-R23-5	3+57	299.0
PC-R23-6	3+79	299.0
PC-R29-1	6+35	326.8
PC-R29-2	6+57	327.2
PC-R29-3	6+79	325.6
PC-R29-4	6+35	301.0
PC-R29-5	6+57	301.0
PC-R29-6	6+79	301.0
PC-L19-1	1+54	329.2
PC-L19-2	1+69.5	328.6
PC-L19-3	1+85	328.8
PC-L19-4	1+54	301.0
PC-L19-5	1+69.5	301.0
PC-L19-6	1+85	301.0
PC-L23-1	3+39	329.9
PC-L23-2	3+57	329.2
PC-L23-3	3+75	329.9
PC-L23-4	3+39	299.0
PC-L23-5	3+57	299.0
PC-L23-6	3+75	299.0
PC-L29-1	6+35	326.6
PC-L29-2	6+57	325.9
PC-L29-3	6+79	325.7
PC-L29-4	6+35	301.0
PC-L29-5	6+57	301.0
PC-L29-6	6+79	301.0

TABLE 20

UPLIFT CELL INSTALLATION DATA

CELL DESIGNATION	LOCATION D	LOCATION S	MIDPOINT ELEVATION
UC-L19-1	1+54	22+47.25	292.7
UC-L19-2	1+69.5	22+47.5	292.7
UC-L19-3	1+85	22+47.5	292.5
UC-L19-4	1+54	22+34.13	292.6
UC-L19-5	1+69.5	22+34.13	292.6
UC-L19-6	1+85	22+34.13	292.6
UC-L19-7	1+54	22+21	292.5
UC-L19-8	1+69.5	22+21	292.6
UC-L19-9	1+85	22+21	292.4
UC-L23-1	3+39	22+47.25	290.8
UC-L23-2	3+57	22+47.25	290.9
UC-L23-3	3+75	22+47.25	290.7
UC-L23-4	3+39	22+34.13	290.9
UC-L23-5	3+57	22+34.13	290.9
UC-L23-6	3+75	22+34.13	290.7
UC-L23-7	3+39	22+21	290.8
UC-L23-8	3+57	22+21	290.6
UC-L23-9	3+75	22+21	290.9
UC-L29-1	6+35	22+51.58	292.5
UC-L29-2	6+57	22+51.58	292.5
UC-L29-3	6+79	22+51.58	292.4
UC-L29-4	6+35	22+36.29	292.4
UC-L29-5	6+57	22+36.29	292.6
UC-L29-6	6+79	22+36.29	292.5
UC-L29-7	6+35	22+21	292.5
UC-L29-8	6+57	22+21	292.6
UC-L29-9	6+79	22+21	292.7
UC-R19-1	1+85	20+82.75	292.4
UC-R19-2	1+69.5	20+82.75	292.5
UC-R19-3	1+54	20+82.75	292.8
UC-R19-4	1+85	20+95.87	292.3
UC-R19-5	1+69.5	20+95.87	292.5
UC-R19-6	1+54	20+95.87	292.7
UC-R19-7	1+85	21+09	292.5
UC-R19-8	1+69.5	21+09	292.7
UC-R19-9	1+54	21+09	292.7
UC-R23-1	3+75	20+82.75	290.5
UC-R23-2	3+57	20+82.75	290.5
UC-R23-3	3+39	20+82.75	290.1
UC-R23-4	3+75	20+95.87	290.7
UC-R23-5	3+57	20+95.87	289.7
UC-R23-6	3+39	20+95.87	290.7
UC-R23-7	3+75	21+09	290.7
UC-R23-8	3+57	21+09	290.7
UC-R23-9	3+39	21+09	290.9

TABLE 20
UPLIFT CELL INSTALLATION DATA (Cont)

CELL DESIGNATION	LOCATION D	S	MIDPOINT ELEVATION
UC-R29-1	6+78.9	20+75.9	292.6
UC-R29-2	6+57	20+76.9	292.8
UC-R29-3	6+35.2	20+77.3	292.6
UC-R29-4	6+78.9	20+91.3	292.6
UC-R29-5	6+57	20+92.5	292.6
UC-R29-6	6+35.2	20+92.3	292.7
UC-R29-7	6+78.9	21+06.5	292.4
UC-R29-8	6+57	21+07.5	292.6
UC-R29-9	6+35.2	21+07.7	292.7
UC-LMS-1	7+09	21+26	292.66
UC-LMS-2	7+34	21+26	280.18
UC-LMS-3	7+59	21+26	292.72
UC-LMS-4	7+09	21+52	292.64
UC-LMS-5	7+34	21+52	280.19
UC-LMS-6	7+59	21+52	292.76
UC-LMS-7	7+09	21+78	292.95
UC-LMS-8	7+34	21+78	280.12
UC-LMS-9	7+59	21+78	292.80
UC-LMS-10	7+09	22+04	292.72
UC-LMS-11	7+34	22+04	280.05
UC-LMS-12	7+59	22+04	292.85
UC-UMS-1	0+23	21+20	307.4
UC-UMS-2	0+41	21+20	307.7
UC-UMS-3	0+59	21+20	307.7
UC-UMS-4	0+77	21+20	307.3
UC-UMS-5	0+23	21+50	307.8
UC-UMS-6	0+41	21+50	307.8
UC-UMS-7	0+59	21+50	307.9
UC-UMS-8	0+77	21+50	307.6
UC-UMS-9	0+23	21+80	307.6
UC-UMS-10	0+41	21+80	307.7
UC-UMS-11	0+59	21+80	307.7
UC-UMS-12	0+77	21+80	307.3
UC-UMS-13	0+23	22+10	307.5
UC-UMS-14	0+41	22+10	307.7
UC-UMS-15	0+59	22+10	307.3
UC-UMS-16	0+77	22+10	307.4

TABLE 21
PIEZOMETER DATA

PIEZOMETER	TYPICAL SECTION	LOCATIONS STA. (AXIS)	LOCATIONS STA. (U-D)	APPROX. TIP ELEVATION	LOCATION OF TIP		TYPE	INSTALLED DURING CONST (1)	INSTALLED AFTER CONST (2)
BSPZ -1	In Rt. Abutment	1+00S	0+00D	388.0	Original Ground Above Ground		Norton		X
2	In Rt. Abutment	1+05S	0+00D	360.0	Top of Rock in Gordo		"		X
3	In Rt. Abutment	1+10S	0+00D	325.0	In Rock @ 325.0 or in Open Joint				X
4	1	4+00S	0+00	365.0	Top of Rock in Gordo				X
5	2	6+00S	0+00	390.0	In Core				X
6	2	6+05S	0+00	370.0	Top of Rock in Core				X
7	2	8+00S	0+00	395.0	In Core				X
8	2	8+05S	0+00	380.0	In Overburden				X
9	2	8+00S	0+00	370.0	Top of Rock in Core				X
10	2	10+00S	0+00	390.0	In Core				X
11	2	10+05S	0+00	372.0	Top of Rock in Core				X
12	2	10+00S	0+10U	345.0	In Rock, U/S of Grout Curtain				X
13	2	10+00S	0+10D	345.0	In Rock, D/S of Grout Curtain	Close to a Joint			X
14	2	10+05S	0+10D	310.0	In Rock, Below Bottom Grout Line	if Possible			X
15	2	10+00S	1+00D	383.0	In D/S Filter Blanket			X	
16	2	12+00S	0+00	395.0	In Core				X
17	2	12+05S	0+14U	370.0	In Core				X
18	2	12+05S	0+00	370.0	In Core				X
19	2	14+00S	0+00	390.0	In Core				X
20	2	14+05S	0+00	370.0	In Core				X
21	2	14+00S	0+10U	345.0	In Rock, U/S of Grout Line				X
22	2	14+00S	0+10D	345.0	In Rock, D/S of Grout Line				X
BSPZ-23	2	14+05S	0+10D	310.0	In Rock, Below Grout Line			X	
BSP -10*	-	23+35S	3+63D	292.4	In Rock				
BSP -11*	-	24+60S	3+65D	292.5	In Rock				
BSP -12*	-	19+92S	3+65D	290.2	In Rock				
BSP -13*	-	18+64S	3+65D	291.6	In Rock		Norton		

*Installed by Government during construction.

TABLE 21

PIEZOMETER DATA (Cont)

PIEZOMETER	TYPICAL SECTION	LOCATIONS STA. (AXIS)	STA. (U-D)	APPROX. TIP ELEVATION	LOCATION OF TIP	TYPE	INSTALLED DURING CONST (1)	AFTER CONST (2)
BSPZ-24	2	14+00S	1+00D	383.0	In D/S Filter Blanket	Norton	X	
25	3	16+00S	0+00	395.0	In Core	"		X
26	3	16+05S	0+00	370.0	In Core			X
27	3	16+10S	0+00	341.0	In Core Just Above Top of Rock			X
28	3	17+60S	0+00	395.0	In Core			X
29	3	17+65S	0+00	370.0	In Core			X
30	3	17+70S	0+00	345.0	In Core			X
31	3	17+75S	0+00	315.0	In Core Just Above Top of Rock			X
32	3	17+60S	0+10D	290.0	In Rock D/S Grout Line			X
33	3	17+60S	0+10U	290.0	In Rock U/S Grout Line			X
34	3	17+65S	0+10D	260.0	In Rock Below Grout Line			X
35	3	20+25S	0+00	395.0	In Core			X
36	3	20+30S	0+00	375.0	In Core			X
37	3	20+35S	0+00	355.0	In Core at Top of Rock or Top of Concrete			X
38	3	23+00S	0+00	395.0	In Core			X
39	3	23+05S	0+00	375.0	In Core			X
40	3	23+10S	0+00	355.0	In Core at Top of Rock or Top of Concrete			X
41	2	25+10S	0+00	390.0	In Core Near Top of Rock			X
42	2	25+10S	0+10U	355.0	In Rock U/S Grout Line in Weath. Clay			X
43	2	25+10S	0+10D	355.0	In Rock D/S Grout Line in Weath. Clay			X
44	2	25+15S	0+10D	310.0	In Rock Below Grout Curtain			X
45	1	27+00S	0+00	385.0	Top of Rock in Gordo			X
46	In Lt. Abutment	30+00S	0+00	385.0	Top of Rock			X
47	In Lt. Abutment	30+00S	0+00D	385.0	In Rock in Weathered Clay			X
18A	2	12+05S	0+14D	370.0	In Core at Top of Rock			X
20A	2	14+05S	0+00	362.0	In Weathered Clay of Rock			X
29A	3	17+65S	0+14U	315.0	In Core Just Above Top of Rock			X
29B	3	17+65S	0+14D	315.0	In Core Just Above Top of Rock			X
15R	2	10+00S	1+00D	360.0	In Rock Approx. 10' Below TR		X	
24R	2	14+00S	1+00D	360.0	In Rock Approx. 10' Below TR		X	
48	-	19+00S	0+15D	370.0	In Core At the Contact of the First			X
BSPZ-49	-	19+00S	0+15U	370.0	In Core Embankment Placements and the Tie-In Placements	Norton		X

TABLE 22

REBOUND - SETTLEMENT MONUMENTS

MONUMENT NO.	LOCATION D	LOCATION S	BOTTOM ELEVATION
Datum 1	2+43	21+65	140.5
BS R/S 1	1+90	21+65	285.5
BS R/S 2	2+35	22+40	285.5
BS R/S 3	2+69	21+65	285.5
BS R/S 4	2+35	20+95	285.5
BS R/S 5	2+00	20+90	285.5
BS R/S 6	2+00	22+40	285.5

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
L-19A1	862.1	7/2/84	Seepage from 6-inch pipe.
L-19A2	903.9	2/2/83	
L-19A3*	839.5	7/2/84	Two wires broke, reduce load to .70x29x41.3K = 838.4K.
L-19B1*	821.7	3/4/83	Six-inch pipe seeping water, two strands broke, reduce load to .70x28x41.3K = 809.5K*
L-19B2	857.0	1/26/83	
L-19B3	852.4	4/4/84	
L-19C1	852.4	4/9/84	Slight seepage from 6-inch pipe and slight rusting of anchor block at the wedges.
L-19C2	851.1	1/25/83	Seepage from 6-inch pipe. (Rate three drops per second)
L-19C3	862.1	4/6/84	
L-20A1	848.1	2/7/83	
L-20A2	854.0	2/4/83	
L-20A3	878.2	7/2/84	
L-20B1	839.5	4/4/84	Seepage from 6-inch pipe.
L-20B2	848.2	1/26/83	
L-20B3	833.5	1/26/83	
L-20C1*	852.4	7/20/84	One wire broke, reduce load to .70x29x41.3K = 838.4K

*When restressing or checking load on tendon, reduce lift off load to that shown under remarks.

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
L-20C2	862.8	1/25/83	
L-20C3*	820.1	4/6/84	One strand broke, reduce load to .70x29x41.3K = 838.4K. Seepage from 6-inch pipe. Signs of rust on strands, wedges and anchor block.
L-21A1	813.7	6/29/84	
L-21A2	859.9	2/3/83	
L-21A3	858.9	6/29/84	
L-21B1	858.8	4/5/84	Seepage from 6-inch pipe. Signs of rust on wedges, strands and anchor block.
L-22A1	854.0	1/27/83	
L-22A2	845.2	1/28/83	
L-22A3	854.0	1/28/83	
L-22B1	851.1	2/24/83	
L-22B2	833.0	7/20/84	
L-22B3	884.7	3/15/83	
L-23A1*	774.9	7/3/84	Tendon drilled into while installing conduit for culvert pressure transducers. One strand broke, sheathing damaged on two other strands, reduce load to .70x27x41.3K = 780.6K
L-23A2	833.5	1/28/83	
L-23A3	851.1	1/28/83	
L-23B1*	881.5	8/3/84	One wire broke, reduce load to .70x29x41.3K = 838.4K

*When restressing or checking load on tendon, reduce lift off load to that shown under remarks.

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
L-23B2	813.7	3/14/83	
L-23B3*	855.6	4/5/84	Two wires broke, reduce load to .70x29x41.3K = 838.4K. Seepage from 6-inch pipe.
L-24A1	858.9	6/29/84	
L-24A2*	827.6	2/11/83	One strand broken, reduce load to .70x29x41.3K = 838.4K
L-24A3	856.9	2/11/83	
L-24B1	880.4	3/1/83	
L-24B2	845.2	1/26/83	
L-24B3	839.3	1/27/83	
L-24C1	842.7	4/6/84	Seepage from 6-inch pipe. Signs of rust on wedges and anchor block.
L-24C3*	800.7	4/6/84	One strand broken. Reduce load to .70x29x41.3K - 838.4K. Seepage from 6-inch pipe. Signs of rust on wedges and anchor block.
L-25A1	856.9	2/3/83	
L-25A2	851.1	2/3/83	
L-25B1	858.8	4/4/84	
L-25B2	845.9	7/5/84	
L-26A1	859.9	2/2/83	
L-26A2	874.6	2/2/83	
L-26B1	855.6	7/12/84	

*When restressing or checking load on tendon, reduce lift off load to that shown under remarks.

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
L-26B2	852.4	4/5/84	Seepage from 6-inch pipe.
L-27A1	859.9	2/16/83	
L-27A2	857.0	2/16/83	
L-27B1	833.3	2/18/83	
L-27B2	857.0	2/18/83	
L-28A1	903.9	3/3/83	
L-28A2	850.4	2/16/83	
L-28B1	878.2	8/3/84	
L-28B2	880.4	2/17/83	
L-29A1	852.4	7/3/84	
L-29A2	862.8	2/17/83	
L-29B1	845.2	2/17/83	
L-29B2	845.9	7/13/84	
L-30A1	855.6	7/5/84	
L-30A2	887.6	3/7/83	
L-30B1	856.9	2/8/83	
L-30B2	862.1	8/6/84	
R-19A1	865.3	7/24/84	Seepage from 6-inch pipe.
R-19A2	825.6	1/19/83	
R-19B1	878.2	4/5/84	Seepage from 6-inch pipe.
R-19B2	837.4	2/23/83	
R-20A1	868.6	8/2/84	

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
R-20A2*	828.6	1/18/83	One strand broke, reduce load to .70x29x41.3K = 838.4K.
R-20B1	861.0	2/23/83	
R-20B2	843.3	2/23/83	
R-21A1	855.1	1/20/83	
R-21A2	825.6	1/20/83	
R-21B1	849.2	1/6/83	
R-21B2	878.7	1/7/83	
R-22A1	837.4	1/20/83	
R-22A2	849.2	1/24/83	
R-22B1	840.4	1/7/83	
R-23A1	885.7	4/17/84	
R-23A2	899.3	1/2/83	
R-23B1	855.1	1/10/83	Bearing plate at 15.5 degrees angle, hit during concrete placement, added wedge to surface to bring to 8 degree angle.
R-23B2	839.5	7/16/84	Tendon was detensioned on 1/31/83 and elongations rechecked against theoretical elongations. Checked okay.
R-24A1	843.3	1/14/83	
R-24A2	866.9	1/14/83	
R-24B1	872.8	1/13/83	
R-24B2	878.2	7/30/84	

*When restressing or checking load on tendon, reduce lift off load to that shown under remarks.

TABLE 23
TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
R-25A1	813.7	8/2/84	
R-25A2	843.3	1/17/83	
R-25B1	884.6	1/11/83	
R-25B2	839.5	7/16/84	4-inch tendon wedge block failed at 70% of ultimate load on tendon.
R-26A1	865.3	7/31/84	
R-26A2	845.9	7/24/84	
R-26B1	855.1	1/12/83	
R-26B2	875.8	1/12/83	
R-27A1	896.4	2/15/83	
R-27A2	865.3	7/31/84	
R-27B1	887.6	3/1/83	
R-27B2	884.6	3/1/83	
R-28A1	839.5	7/31/84	
R-28A2	855.6	7/23/84	1-inch shims substituted for 2-inch shims in order to get load cell on because strands were cut for 4-inch block.
R-28B1	866.9	3/2/83	
R-28B2	890.5	3/2/83	
R-29A1	884.6	2/14/83	
R-29A2	868.5	4/17/83	Slight seepage from 6-inch pipe. Some rust on shims, not on strands yet.
R-29B1	884.6	3/2/83	

TABLE 23

TENDON LIFT OFF LOADS AND SPECIAL CONSIDERATIONS (Cont)

TENDON NO.	LAST LIFT OFF (KIPS)	DATE	REMARKS
R-29B2	881.7	3/3/83	
R-30A1	899.4	2/15/83	
R-30A2	861.0	2/15/83	
R-30B1	872.8	2/7/83	
R-30B2	891.1	4/9/84	

XI. POSSIBLE FUTURE PROBLEMS

11.01 Embankment.--At the present time, no future problems are anticipated for the embankment. The numerous joints that trend across the embankment foundation are clay filled and were not susceptible to washing and pressure grouting. However, the possibility exists that the head pressure exerted by the reservoir could wash out some of the clay filling in the joints and create an avenue for water flow under the embankment. A scheduled program of piezometer monitoring should provide accurate information on the effects of the reservoir on the embankment foundation. Mackeys Creek bottom, in the area where a drain was installed in a shear plane to control water flow, should be watched closely.

The fault which crosses the embankment just east of Monolith L-15 is inactive, clay filled and should not present any problems.

11.02 Lock Structure.--No problems are anticipated for the lock structure, though due to the anchored wall design and the low-strength, air sensitive shale on which the lock is founded, the potential for problems is much greater than would be for a gravity lock structure. Though a stringent program of shale protection was initiated upon exposure of the shale, certainly some moisture was lost, leaving the shale in some condition less than its natural state. This could result in settlement or lateral movement of the walls beyond the predicted amount. Sufficient movement of either type could result in failure of the wall anchors.

Another area for potential problems revolves around the lock structure type. The relatively thin "concrete hang on walls" and associated tendon reinforcement used in the design of the Bay Springs Lock chamber are unique. (Generally, lock walls are comprised of thick sections of concrete, which are collectively referred to as a gravity structure.) Since the design stages of the project, the Geotechnical Branch has recognized the potential for rock/lock movement associated with the opening and closing of joints in the rock corresponding to the unloading and loading of the lock wall (and tendons) as the lock chamber is emptied and filled. The long term effects of the loading and unloading of the wall and wall anchors are not known. It should also be recognized that the potential for tendon failure exists in any stressed tendon system. To check this tendon system and lock wall stability, all instrumentation should be well maintained and carefully monitored. To observe the effects of the loading and unloading of the lock wall with the filling and emptying of the lock chamber, it is recommended that lock instrumentation readings be taken at both full and empty lock pool. Any movement should be reported immediately to Mobile District's Design Branch and Geotechnical Branch for evaluation.

The left side of the lower miter sill should be closely monitored for movement. As discussed in paragraph 6.06, movement was experienced in the lower miter sill cross-over trench along a shear plane in the shale during the excavation. Movement could possibly occur again.

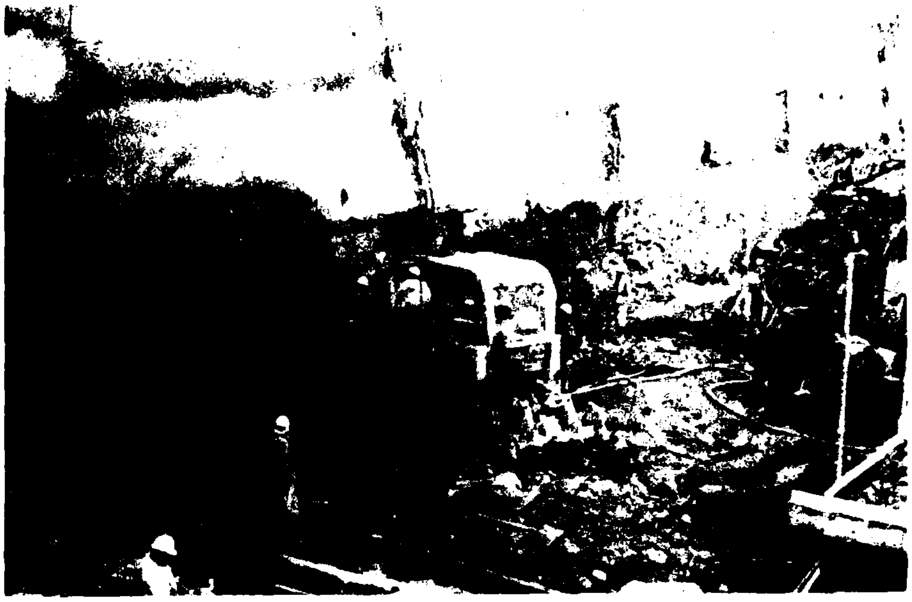
Acidity of the groundwater behind the lock walls should be checked periodically as an acid water condition was known to occur behind a section of the downstream guide wall. An acid water condition behind the anchor walls could create a chemical reaction at the grout-rock contact of the wall anchors, resulting in failure of the bond zone. Water from piezometers and pore pressure cells will give an indication as to the acidity of the groundwater. Dilution of the acid water by the lock water will probably eliminate any possible deleterious effect on the grout or concrete.

11.03 Downstream Approach Channel.--Some minor problems are anticipated for the downstream approach channel. Erosion of the shale beds exposed on the rock walls will probably undercut the overlying sandstone layers and could result in blocks of sandstone falling out and into the channel.

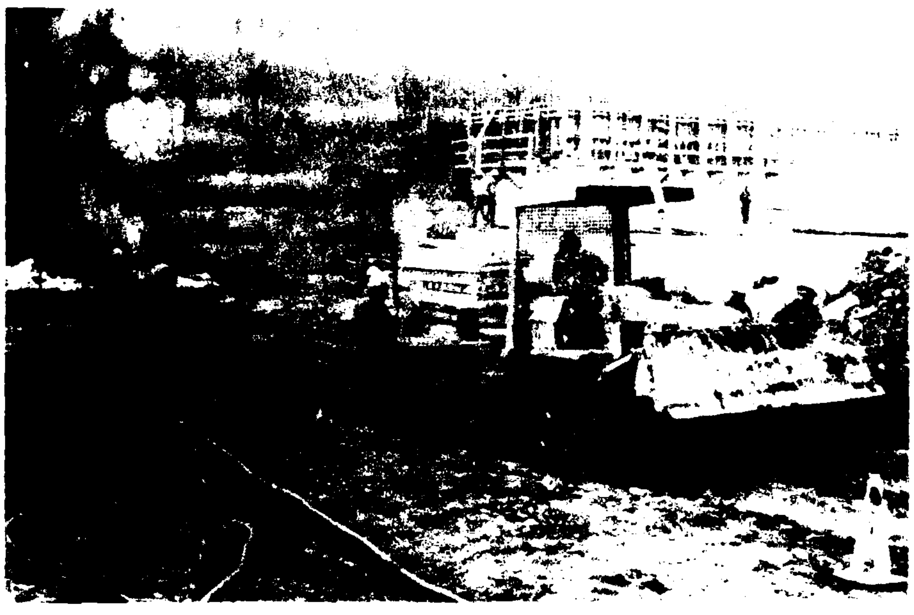
Erosion of the shale floor downstream of the lock chamber may occur. Stability of the emptying laterals and right guide wall could be effected should erosion become severe. Riprapping the shale portion of the floor would alleviate the problem.

APPENDIX A

CONSTRUCTION PHOTOS



1. Shotcreting over pore pressure cells in L-19.



2. Sawing shale for lower crossover trench at 7+39D. Monolith R-29 in background.

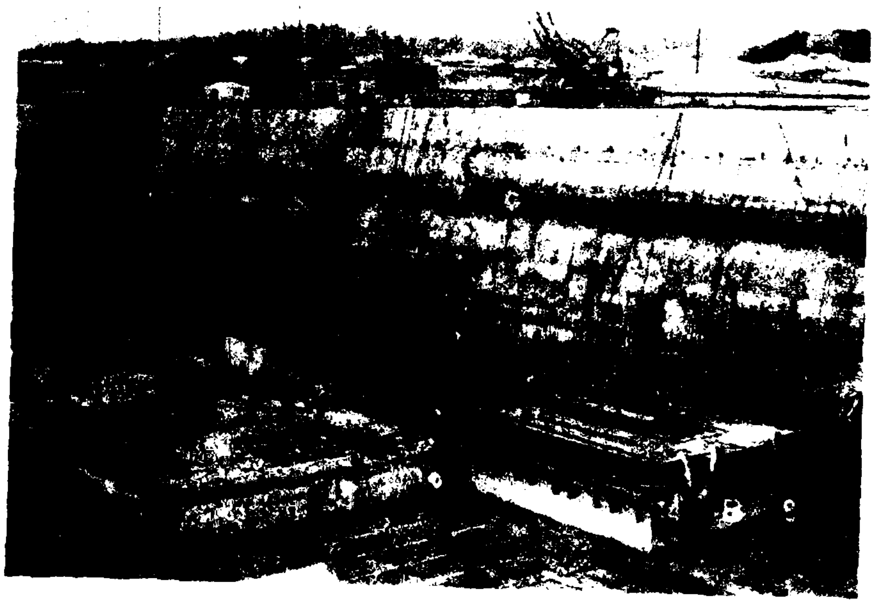
3. View looking downstream along east wall at excavation. Note pvc pipes extending from 25' drain holes drilled at Hb/Hc contact.

4. Looking down from top of east wall at foundation prior to placement of FS 24 LPS protective slab. Note excavation along shear plane trending northwest.

5. Sl pe failure at L-30 corner.

6. Drains installed in shear plane to control water in FS 25 RPS.

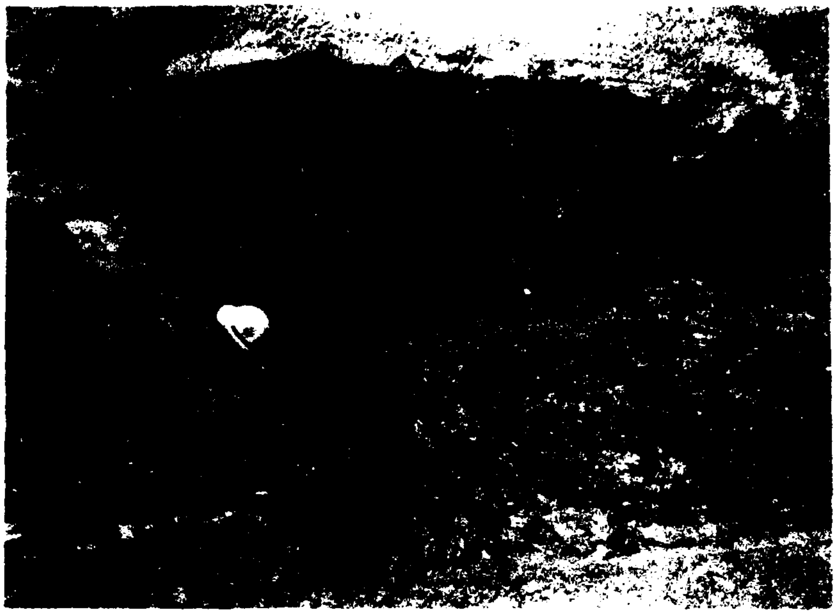
7. View looking downstream along west wall at excavation.



8. View looking southwest from top of east wall. Monolith R25, 27, 29 being raised.

9. Looking at west face of R-10 foundation. Fault line crosses west side of upper guide wall at this point. Notice offset of two bedding planes.

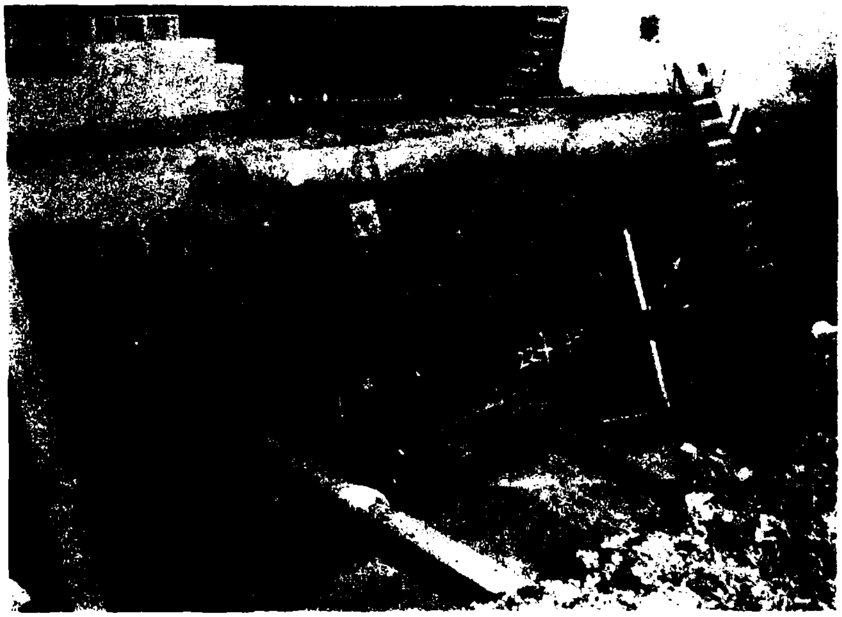
10. Looking at east face of L-14 foundation. Fault line crosses east side of upper guide wall at this point.



11. Slope failure on west wall at Station 3+00D. Toe elevation is 294.

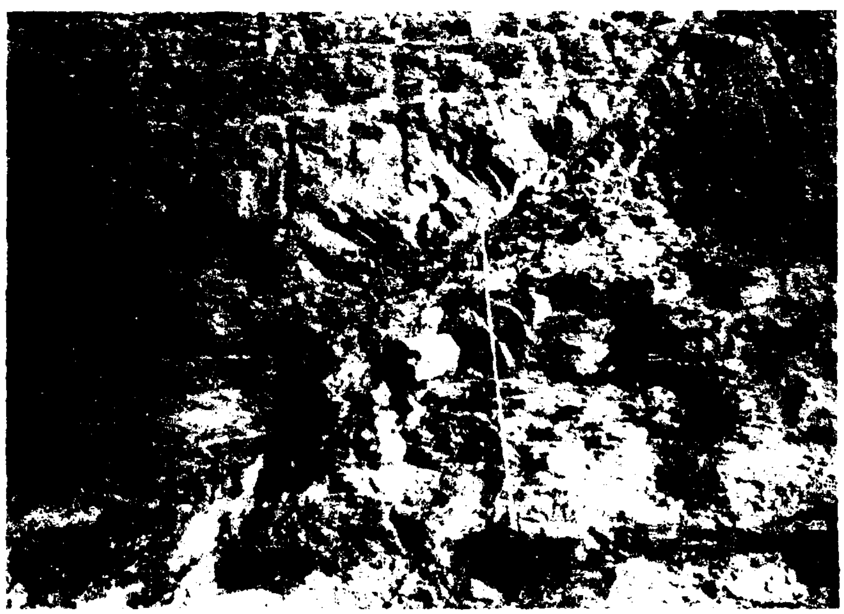
12. Looking at L-28, 29, 30 corner concrete replacement.

13. Looking southeast at shear planes in emptying lateral foundation.



14. Looking northeast at additional shoring in lower miter sill crossover trench. Note concrete replacement of L-30 slope failure (Photo #5).

15. Slope failure of downstream face, 9+00D, emptying lateral foundation.



16. Fault at one on one slope, in impervious core zone, 23+56S, 0+12D.

17. Looking west from Station 9+50S at impervious core foundation.

18. Impervious core foundation, looking northeast from 13+50S. Notice additional excavation required because of "lifting" of foundation during pressure grouting operations.

19. View of right abutment of embankment. Sand bagging at top of CH layer, elevation 404.0, to divert water flow from overlying sand layer.

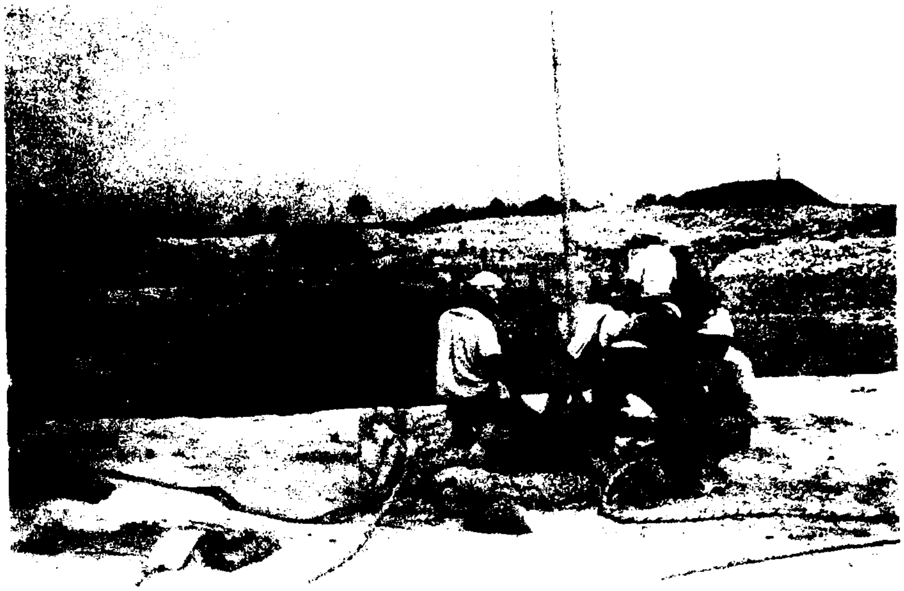
20. Looking west from top of diversion culvert at old quarry floor in impervious [illegible] foundation. Toe of concrete fillet is 15+59S, elevation 336.4.

21. Looking northwest from top of diversion culvert at placement of impervious fill on old quarry floor.

22. Looking southwest from [illegible] diversion dam at impervious fill placement. [illegible] version culvert in left side of photo

23. Looking downstream at excavation for diversion culvert.

24. Looking west from top of slope, 18+54S, along C/L of embankment at Mackey's Creek bottom. Notice foundation drain being installed along shear plane which flowed water.



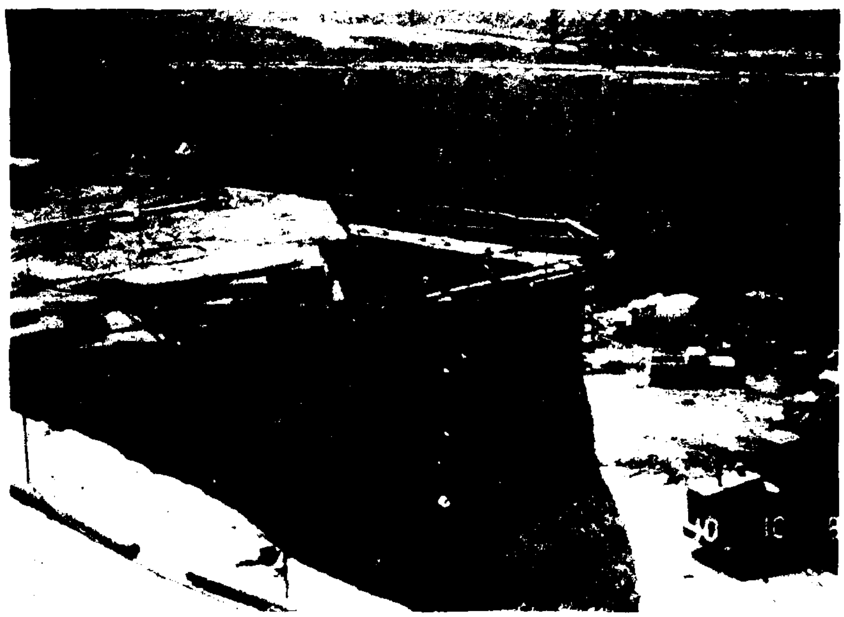
25. View looking west along C/L of embankment. Inclinometer 16 (19+02S, 0+02D) being installed.

26. Overburden being removed from Mackey's Creek bottom. View looking upstream.

27. Mackey's Creek floor cleanup. Looking downstream from 18+40S, 2+50U.

28.A. Looking upstream at 1 on 1 slope, toe at 18+23S, east side of Mackey's Creek. Notice diversion dam in background.

28.B. Rock bolting at L-30 corner, elevation 296. Notice shear planes in shale face.



29. Looking southwest at L-19 corner concrete replacement.

30. R-19 foundation prior to protective slab placement.

31. Making final saw cut in shale along face at 7+21D, west side.

32. Looking west at LS-2 foundation. (Lower crossover trench)

33. Installing test anchor bolt in Ha member for downstream guide wall anchorage.

34. Looking southwest from 19+50S at impervious core foundation.

35. Looking south from 19+80S at impervious core foundation. Notice joint number six trending south.

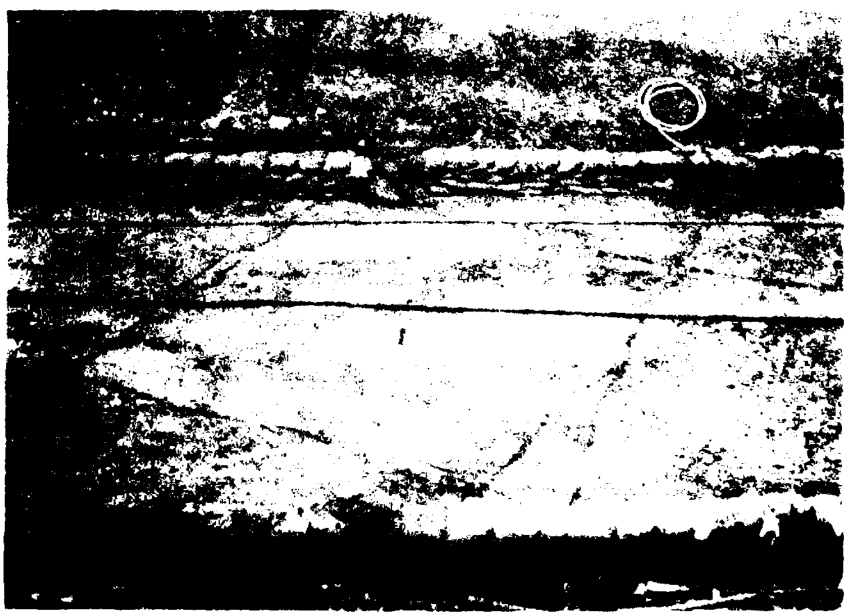
36. Looking northwest from inside corner of R-16. Notice joint No. 10 which required pressure grouting.

37. Looking east at 1 on 1 slope, 23+56S, offset of silty shale beds by fault on right side of slope.

38. Looking west from top of slope at east side of impervious core foundation. Toe of slope is 26+50S.

39. Looking northwest from 23+30S, 0+05U, at fault line in impervious core foundation.

40. Looking northwest from top of 1 on 1 slope, 23+77S, 0+00D at fault line in impervious core foundation.Monolith L-15 in background.



41. Looking upstream, across impervious core foundation, Station 25+30S to 25+50S.

42. East abutment of embankment.

43. Looking upstream during [illegible] of emb't lateral foundation. Taken from top of [illegible]. Note the two intersecting shear planes.

44. Looking southeast at I-30 foundation cleanup. Note two parallel shear planes.

4[illegible] shear plane in FS [illegible] FS foundation.

46. Checking wall anchor hole alignments using survey methods.

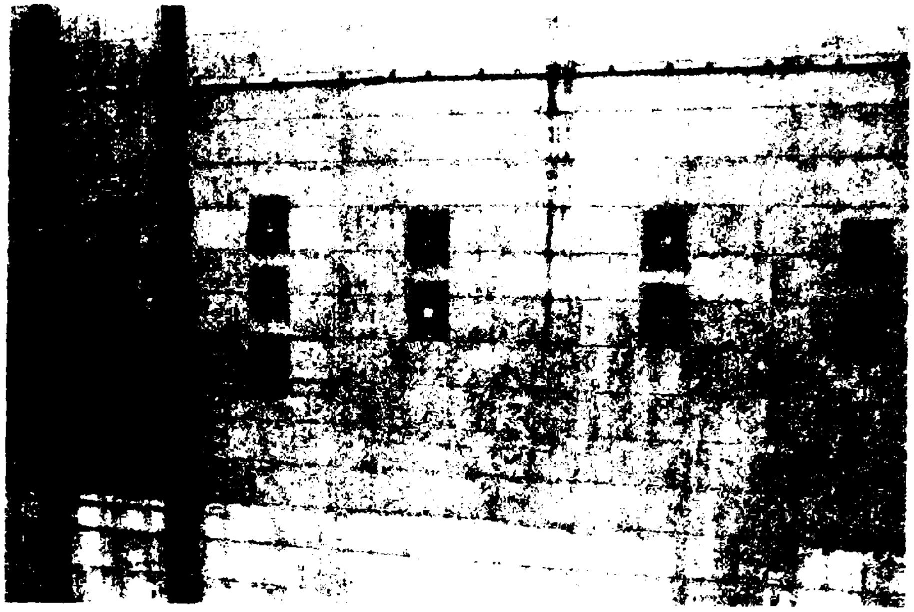
[illegible] strands.

4[illegible] Mea[illegible]
[illegible]perat[illegible]

49. Close up [illegible] wall [illegible] after
stressing.

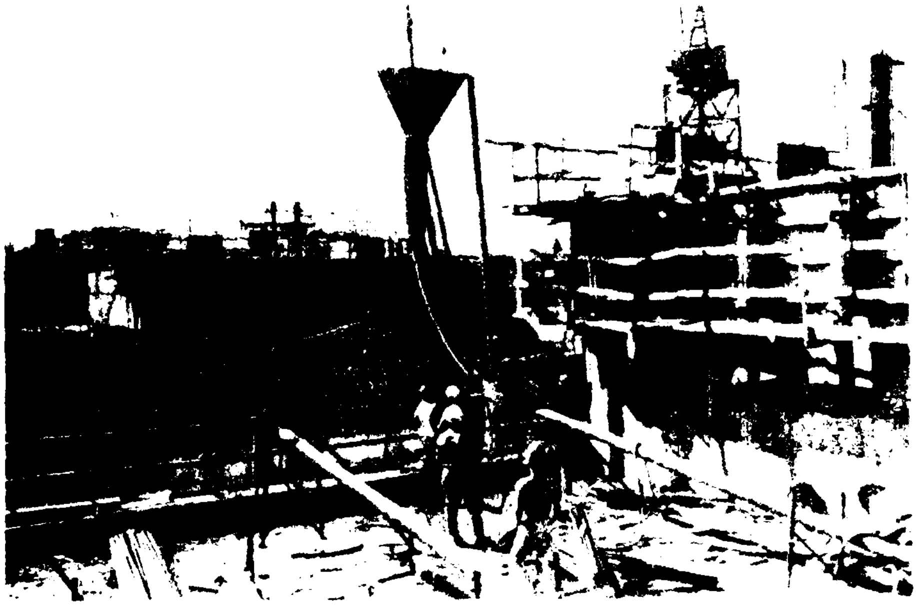
50. Close up of wall anchor head after completion of corrosion protection. Wall anchor head cover is filled with grease.

51. Split ring shims used to lock off load. Shim stack inserted between 2" bearing plate and threaded hole anchor block.



52. Section of anchored wall showing wall anchor recesses and heads.

53. Drill rig used for drilling wall anchor holes.



54. Inserting wall anchor into 6" pipe. Pipe is set from lock face to rock face.

55. Close up of wall anchor showing portions of bond and stressing lengths.

56. Winch used for pulling wall anc[illegible]

57. Looking at shear plane on right wall of downstream approach channel, Station 33+00D.

[illegible] upstream [illegible]
[illegible] approach [illegible]
[illegible]

59. Impervious core foundation, looking east from 24+00S.

APPENDIX B

[illegible] FIELD CALIBRATION PROCEDURES

[illegible]

[illegible] ad [illegible] at lift off, [illegible] the load cell. [illegible] strain gauge readout box. This [illegible] reading without any [illegible]

[illegible] with [illegible] inch machined shims bearing on both sides. [illegible] remainder of the shim stack should be arranged so that [illegible] degrees [illegible] the adjacent shim. A one inch machined [illegible] the wedge block.

[illegible] the shims is accomplished by [illegible] the jack from [illegible] load cell readings at zero jack pressure are [illegible] minus ten digits (strain gauge indicator digits). [illegible] cannot be achieved, the shim stack should be checked [illegible] machined shims are correctly installed, that the [illegible] and that the two segments of the split shims [illegible]. The load cell and bearing shims must be centered on [illegible] wedge [illegible] order to achieve accurate load cell readings.

[illegible] repeatable readings are achieved at zero pressure [illegible] stopping at every [illegible] psi incre[illegible] readings. The difference between [illegible] not vary more than 50 digits (strain gauge indi[illegible] can be plotted in graphic form [illegible] psi is plotted versus load cell reading at the [illegible] cannot be achieved, the shims stack should be [illegible] step [illegible] above. Note: The [illegible] psi increments on the [illegible] gauge must be very precise.

[illegible] the shims are seated and repeatable readings have been [illegible] perform [illegible] off, and record the jack pressure gauge reading. [illegible] can be determined by applying a pry bar to the shim stack and [illegible] the jack pressure the instant the shim stack moves. Another method [illegible] observe the load cell readings for the previously recorded no load [illegible] and record the jack pressure the instant the readout box null meter [illegible] stops moving. Note: The 500 ton hydraulic jack should be calibrated annually and preferable within six months of time of use. The Waterways Experimental Station in Vicksburg, Mississippi has the capability to perform this calibration.

6. Calculate Load Cell Calibration Factor - The load cell calibration factor is calculated by dividing the tendon load determined at lift off by the change in load cell readings from no load to full load. This factor can be multiplied times subsequent load cell readings to determine tendon load.

LOAD CELL

FIELD CALIBRATION WORK SHEET

TENDON NO. L-19-B3 DATE 4-4-84

LOAD CELL NO. 8A READOUT S/N 036954

A. LOAD CELL NO LOAD 3828

B. LOAD CELL FULL LOAD 8616

C. CHANGE IN LOAD CELL: (B-A) 8616 - 3828 = 4788

D. HYD JACK CAL FACTOR .1291526 DATE CALIBRATED 3-8-83

E. JACK PRESSURE READING AT LIFT OFF 6,600

F. TENDON LOAD: (D X E) .1291576 X 6,600 = 852,407

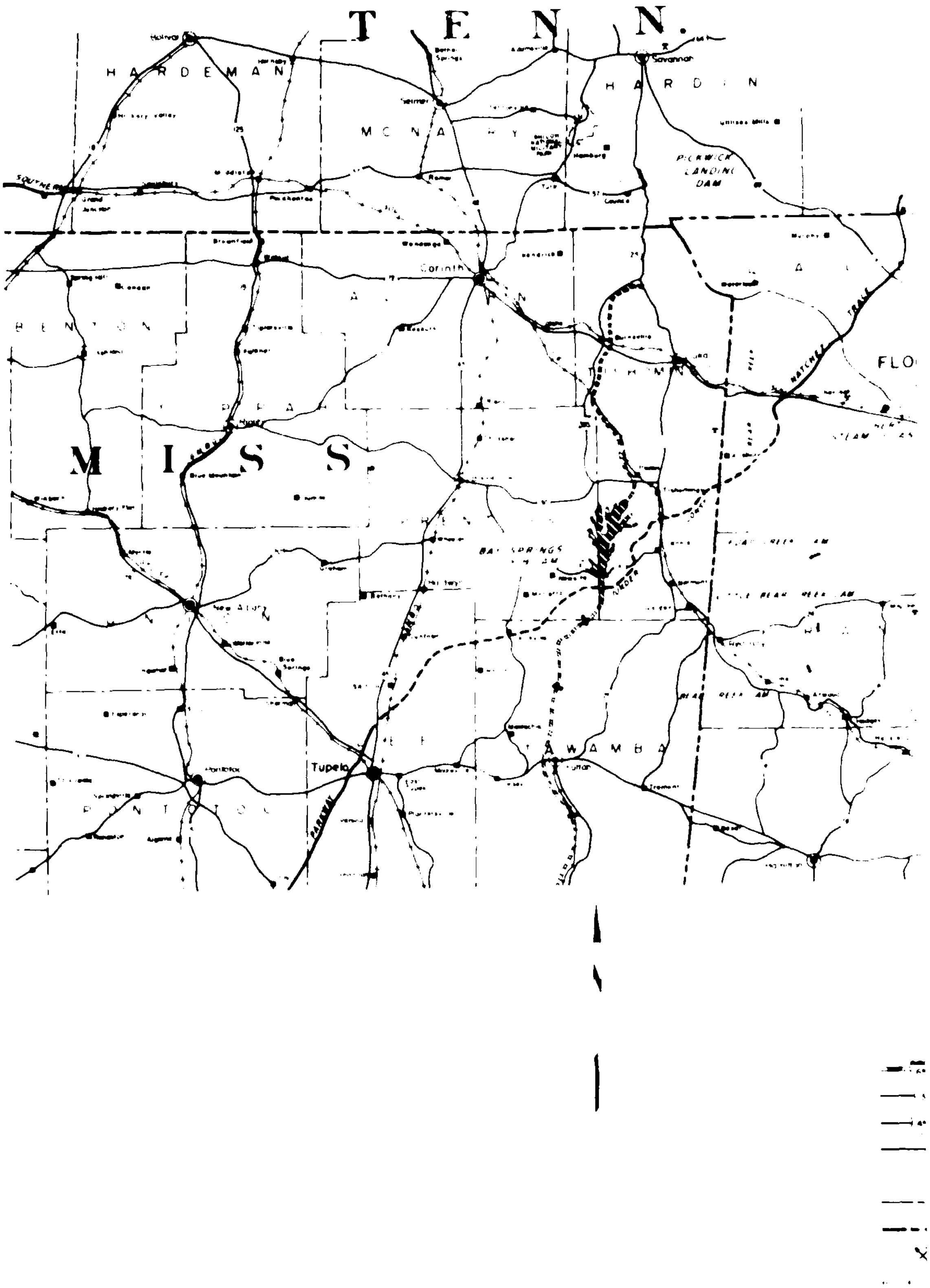
G. LOAD CELL CAL FACTOR: (F/C) 852,407/4788 = 178.0

	SEATING OF SHIMS		CHECK FOR LINEARITY			
CYCLE NO.	LOAD CELL READING	DIFFERENCE IN READING	LOAD ON LOAD CELL	PRESSURE	LOAD CELL READING	DIFFERENCE IN READING
1	8634		852,407	0	8616	
		32				763
2	8602		723,254	1,000	7853	
		3				731
3	8605		594,102	2,000	7122	
						703
4			464,949	3,000	6419	
						842
5			335,796	4,000	5577	
6			LIFT OFF	6,600	3828	
7						
8						
9						
10						

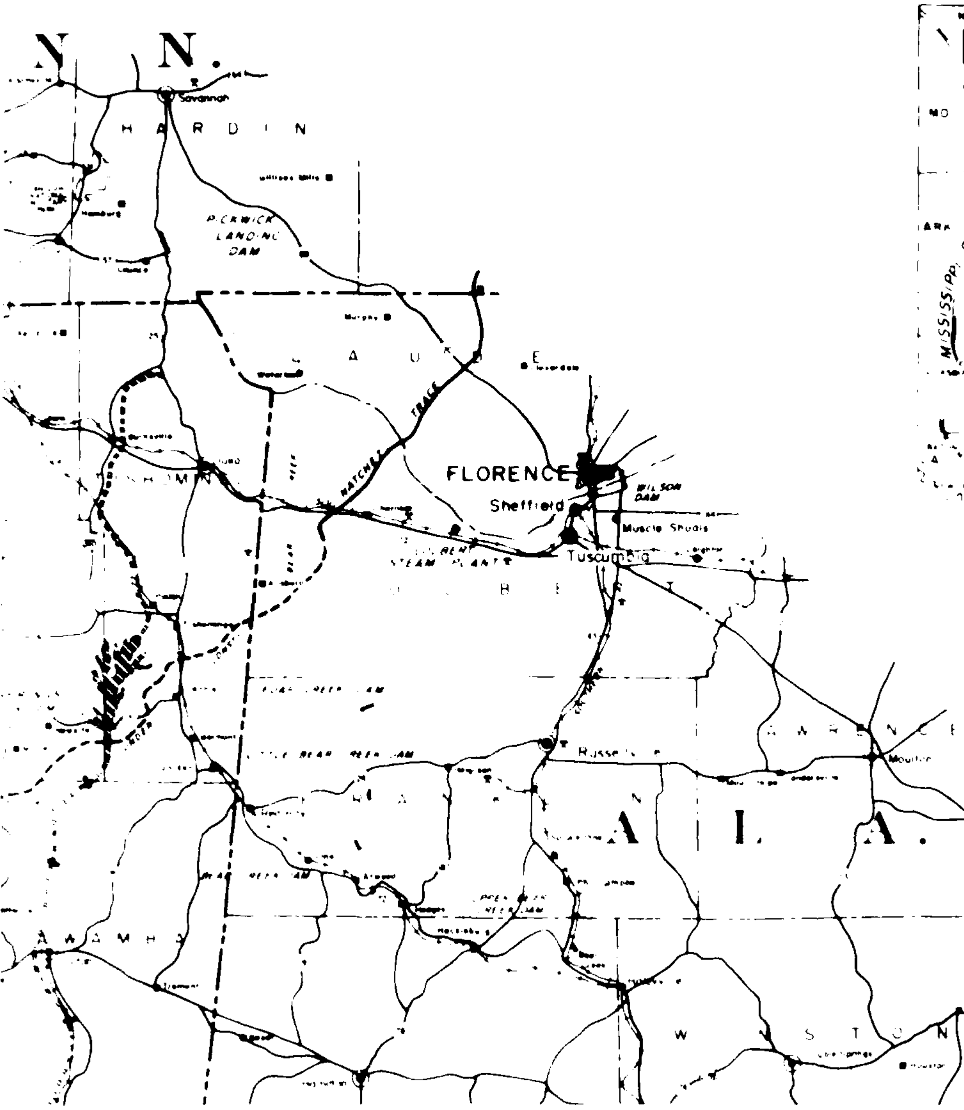
NOTES:

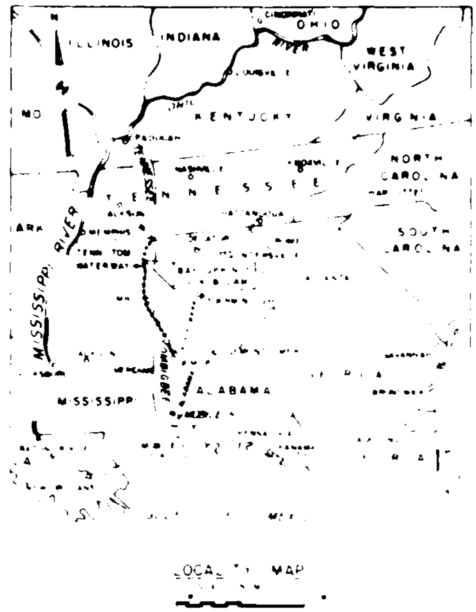
1. Load on load cells=(lift off pressure-pressure reading) x Hyd Jack Cal Factor.

2. Hydraulic jack must be accurately stopped at the 1,000 psi increments.



TENN.
HARDEMAN
HARDIN
Savannah
Selmer
PICKWICK LANDING DAM
Corinth
MISS.
Tupelo
New Albany





LEGEND

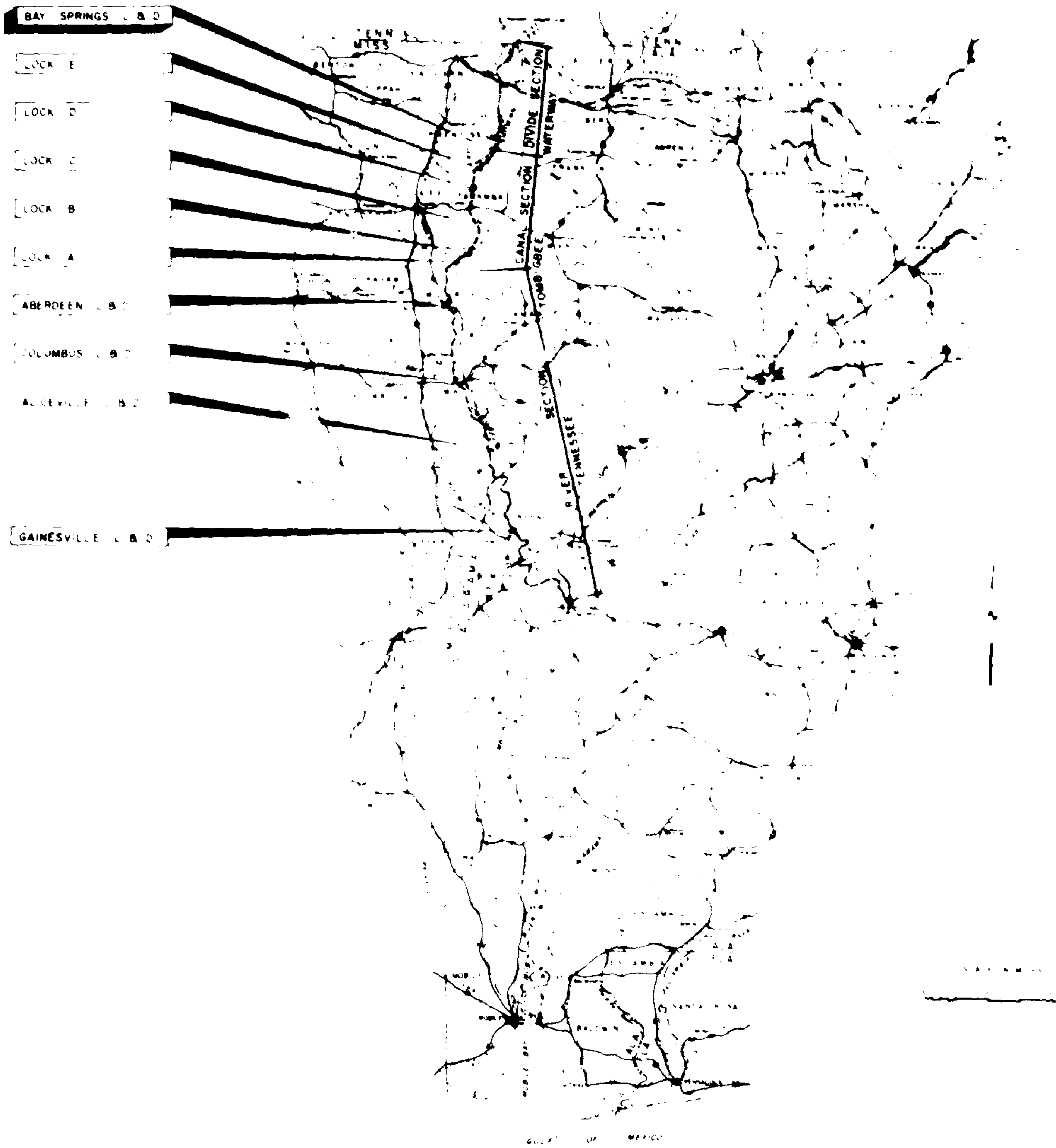
- INTERSTATE HWY
- PRIMARY STATE HWY
- U.S. HWY
- PAVED ROAD
- RESERVOIR
- COUNTY LINE
- STATE LINE
- QUARRY
- RAILROAD

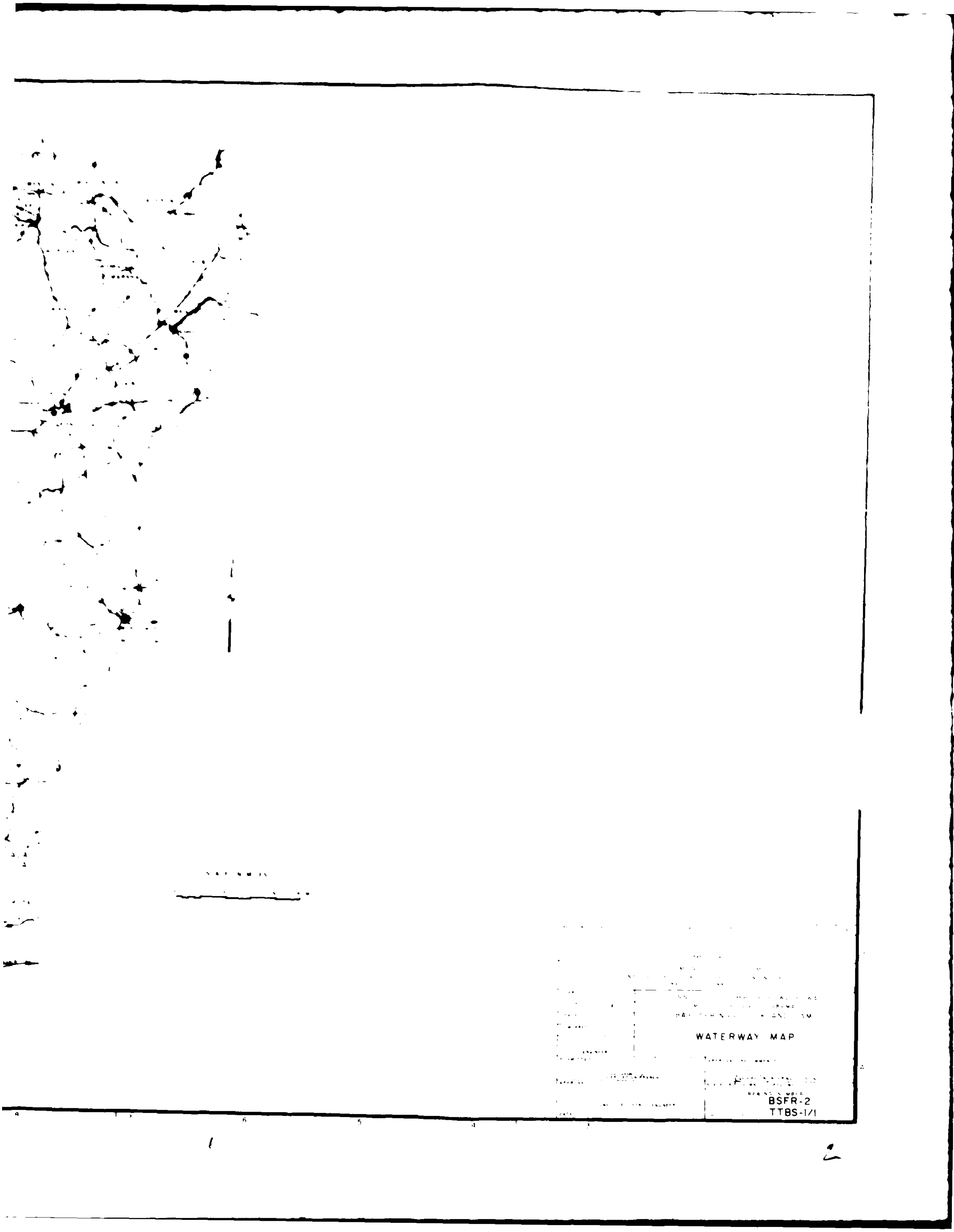
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

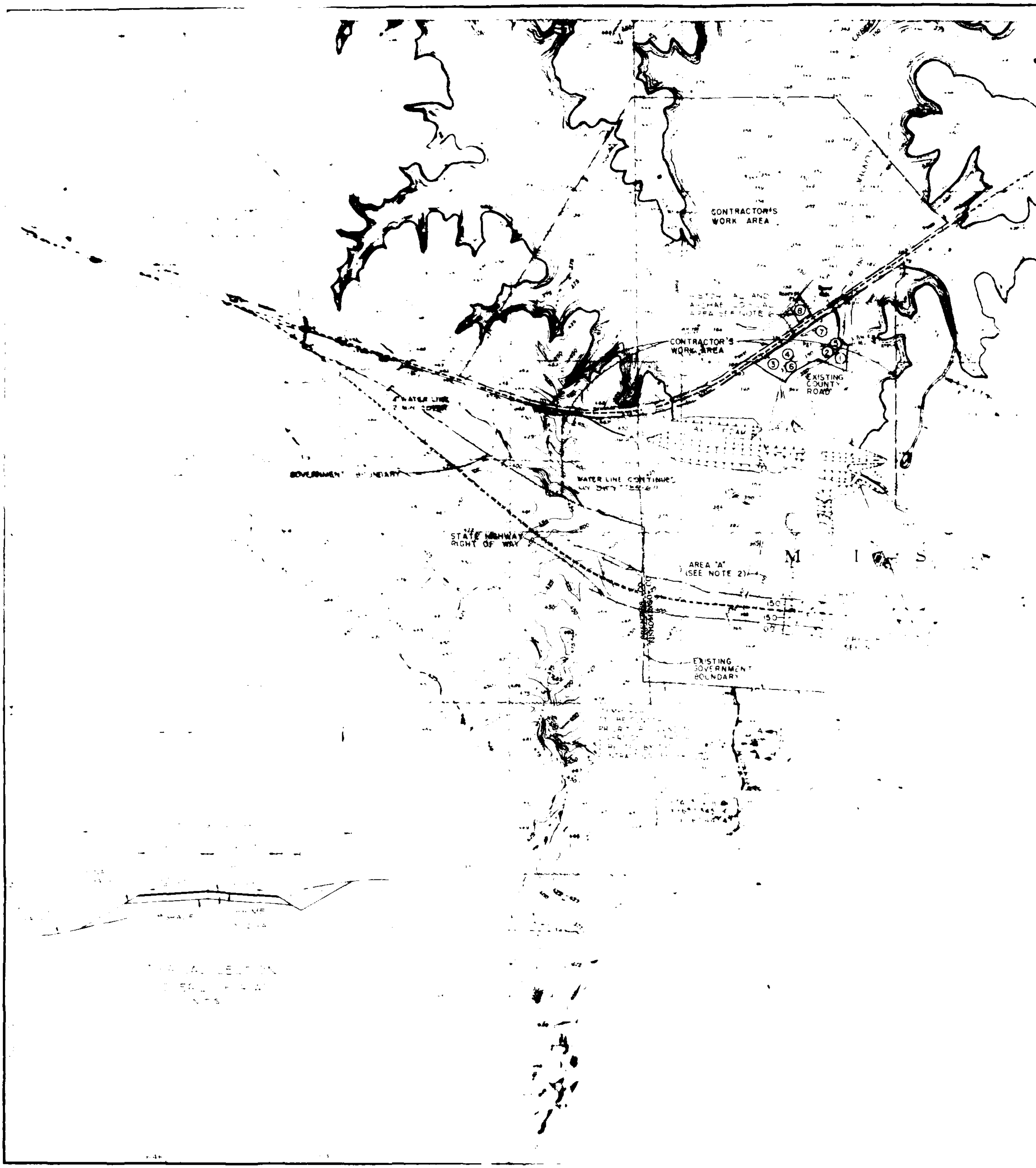
TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

LOCATION MAP

BSFR-1
TTBS-1/2


BAY SPRINGS L & D
LOCK E
LOCK D
LOCK C
LOCK B
LOCK A
ABERDEEN L & D
COLUMBUS L & D
GAINESVILLE L & D
DIVIDE SECTION
CANAL SECTION
RIVER SECTION
TENNESSEE TOMBIGBEE WATERWAY
GULF OF MEXICO

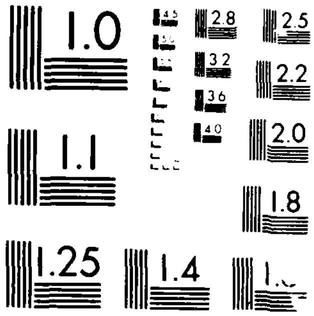

WATERWAY MAP
BSFR-2
TTBS-1/1



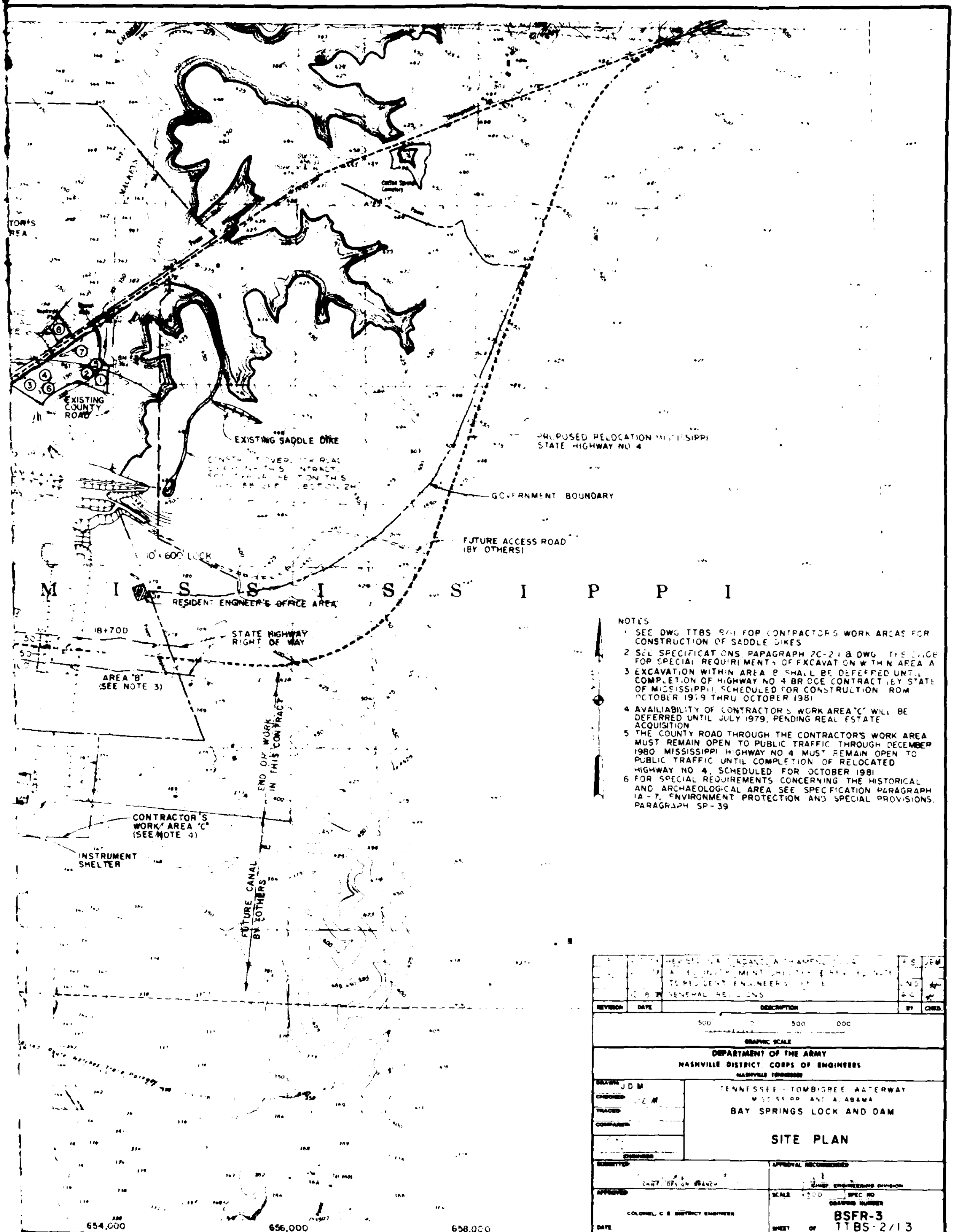
CONTRACTOR'S
WORK AREA
CONTRACTOR'S
WORK AREA
EXISTING
COUNTY
ROAD
GOVERNMENT BOUNDARY
WATER LINE CONTINUES
STATE HIGHWAY
RIGHT OF WAY
AREA "A"
(SEE NOTE 2)
EXISTING
GOVERNMENT
BOUNDARY

AD-A191 507 BAY SPRINGS LOCK AND DAM FOUNDATION COMPLETION REPORT TENNESSEE-TOMBIGBEE..(U) CORPS OF ENGINEERS NASHUILLE TN NASHUILLE DISTRICT P ROSS ET AL. AUG 87 4/5

UNCLASSIFIED F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART



NOTES

1 SEE DWG TTBS 9/1 FOR CONTRACTOR'S WORK AREAS FOR CONSTRUCTION OF SADDLE DIKES
2 SEE SPECIFICATIONS, PARAGRAPH 2C-2 I & DWG TTBS 2/6 FOR SPECIAL REQUIREMENTS OF EXCAVATION WITHIN AREA A
3 EXCAVATION WITHIN AREA B SHALL BE DEFERRED UNTIL COMPLETION OF HIGHWAY NO 4 BRIDGE CONTRACT (BY STATE OF MISSISSIPPI), SCHEDULED FOR CONSTRUCTION FROM OCTOBER 1979 THRU OCTOBER 1981
4 AVAILABILITY OF CONTRACTOR'S WORK AREA "C" WILL BE DEFERRED UNTIL JULY 1979, PENDING REAL ESTATE ACQUISITION
5 THE COUNTY ROAD THROUGH THE CONTRACTOR'S WORK AREA MUST REMAIN OPEN TO PUBLIC TRAFFIC THROUGH DECEMBER 1980 MISSISSIPPI HIGHWAY NO 4 MUST REMAIN OPEN TO PUBLIC TRAFFIC UNTIL COMPLETION OF RELOCATED HIGHWAY NO 4, SCHEDULED FOR OCTOBER 1981
6 FOR SPECIAL REQUIREMENTS CONCERNING THE HISTORICAL AND ARCHAEOLOGICAL AREA SEE SPECIFICATION PARAGRAPH IA-7, ENVIRONMENT PROTECTION AND SPECIAL PROVISIONS, PARAGRAPH SP-39

REVISION	DATE	DESCRIPTION	BY	CHKD.
		REVISED ... CLEARANCE ...	F S	JEM
		... MENT SHELTER & ... NOTE		
		TO RESIDENT ENGINEERS OFFICE	UND	
		GENERAL REVISIONS	EC	

500 0 500 1000

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN J D M
CHECKED JEM
TRACED
COMPARED
ENGINEER

TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

SITE PLAN

SUBMITTED
CHIEF, DESIGN BRANCH

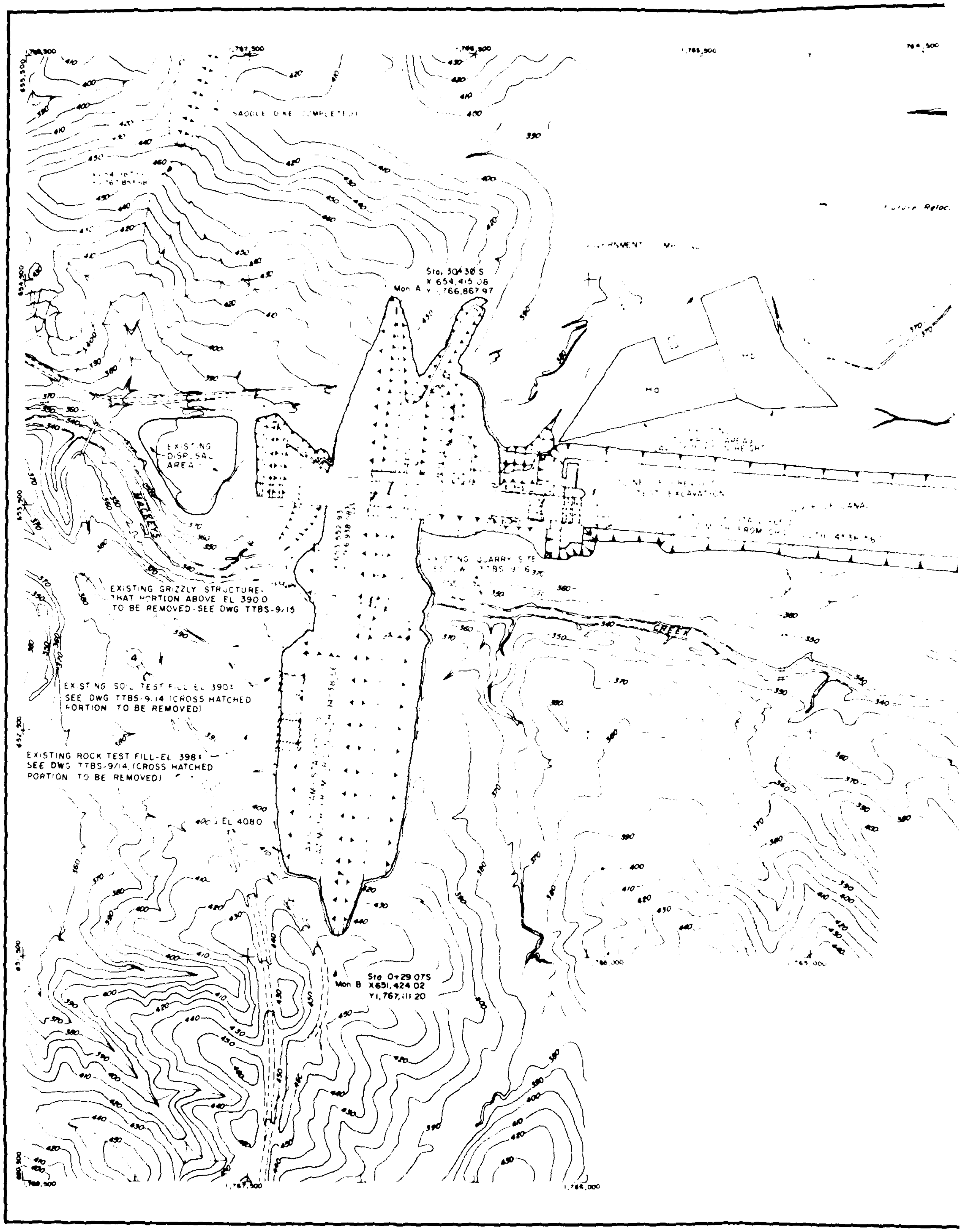
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

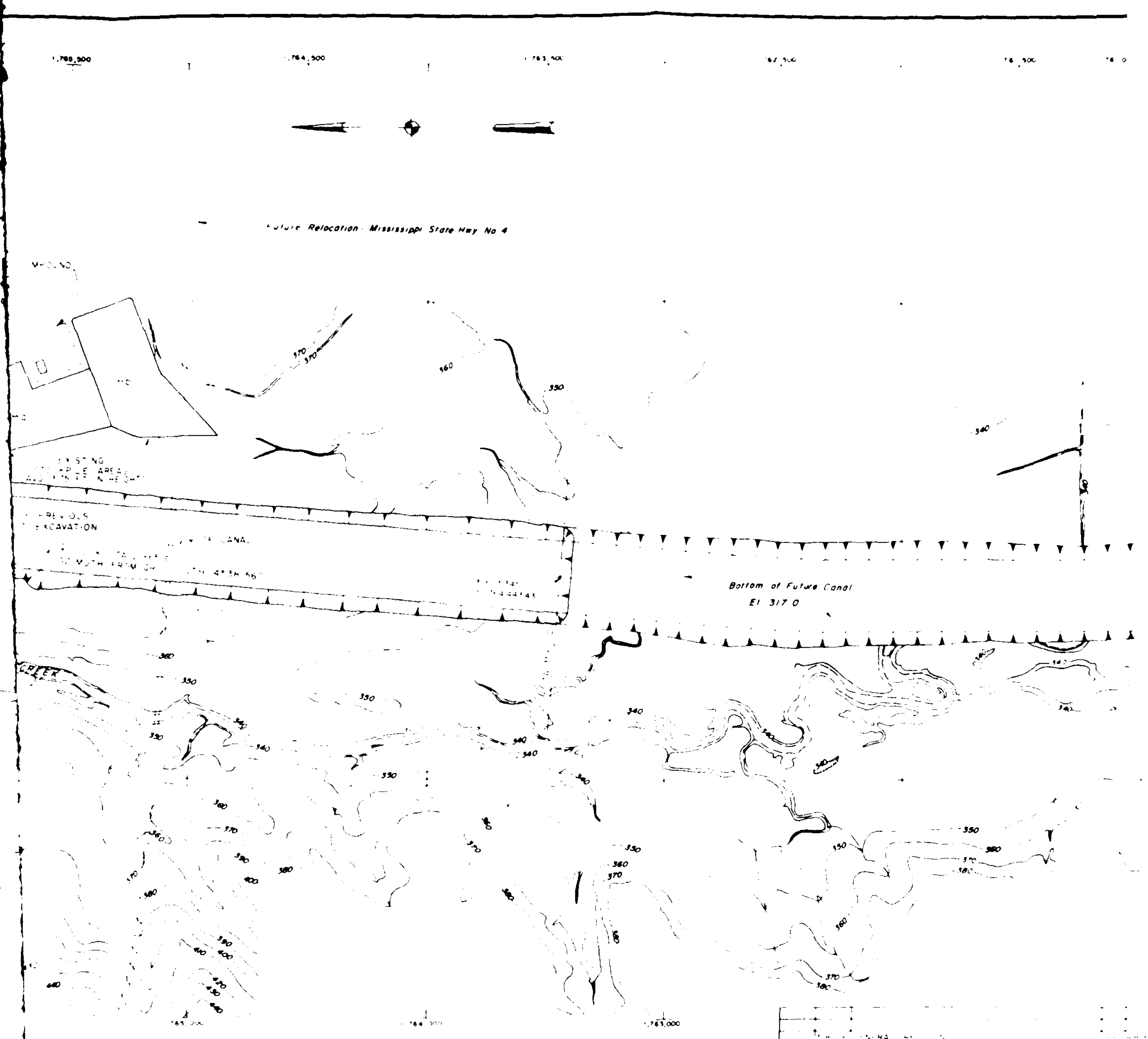
APPROVED
COLONEL, C E DISTRICT ENGINEER

DATE

SCALE 1:500 SPEC NO
DRAWING NUMBER
BSFR-3
SHEET OF TTBS-2/13

2


SADDLE DIKE COMPLETED
Sta 30+30 S
X 654,415.08
Mon A
Y 1,766,867.97
EXISTING DISPOSAL AREA
EXISTING GRIZZLY STRUCTURE - THAT PORTION ABOVE EL 390.0 TO BE REMOVED - SEE DWG TTBS-9/15
EXISTING SOIL TEST FILL-EL 390±
SEE DWG TTBS-9/14 (CROSS HATCHED PORTION TO BE REMOVED)
EXISTING ROCK TEST FILL-EL 398±
SEE DWG TTBS-9/14 (CROSS HATCHED PORTION TO BE REMOVED)
EL 408.0
Sta 0+29.07S
Mon B
X651,424.02
Y1,767,111.20
CREEK
TEST EXCAVATION



GENERAL NOTES

1. FOR EMBANKMENT PLAN AND SECTIONS, SEE DWG'S TTBS-9/2 THRU 9/5
2. FOR DIVERSION PLAN, SECTIONS AND DETAILS, SEE DWG'S TTBS-9/9 & 9/...
3. FOR EXCAVATION PLAN SEE DWG TTBS-9/6
4. FOR FLOOD CONTROL SADDLE DIKES PLAN AND SECTIONS SEE DWG'S TTBS-9/... THRU 9/...
5. FOR INSTRUMENTATION PLAN AND SECTIONS, SEE DWG'S TTBS-9/... THRU 47-9
6. FOR LOCATION OF DISPOSAL AREA SEE DWG TTBS-9/8
7. FOR LOCATION MAP OF ROCK AND EARTH BORROW AREAS SEE DWG TTBS-7/...
8. FOR DOWNSTREAM CHANNEL EXCAVATION SECTIONS, SEE DWG TTBS-9/7
9. SHADED AREAS SHOWN REQUIRE SODDING OF CUT SLOPES FOR DOWNSTREAM CHANNEL, ONLY THOSE CUT SLOPES ABOVE TOP OF ROCK REQUIRE SODDING

REVISION	DATE	DESCRIPTION	BY	CHKD
		GENERAL REVISION		
	28 78	GENERAL REVISION		

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

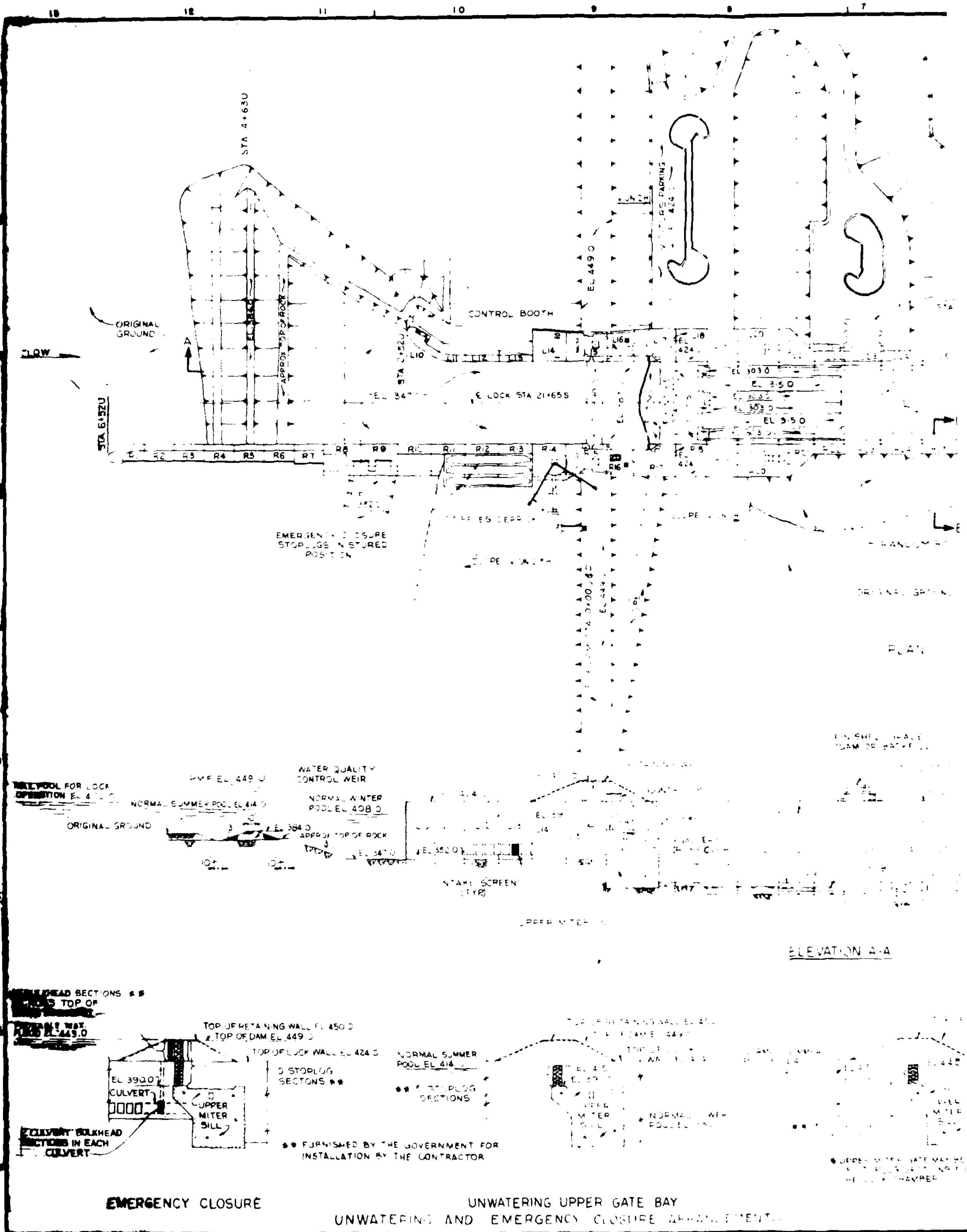
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

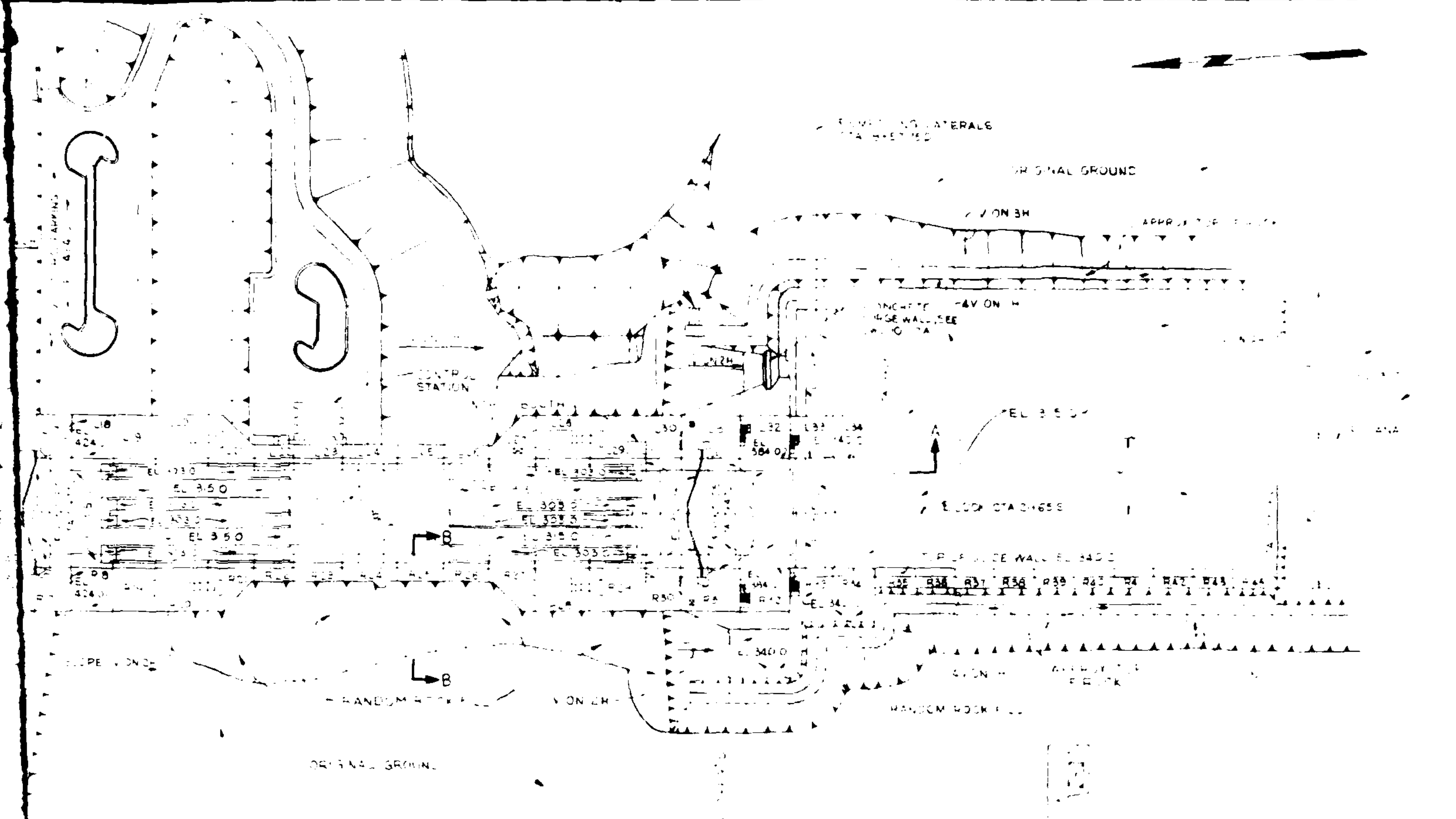
BAY SPRINGS LOCK AND DAM
DAM

GENERAL PLAN

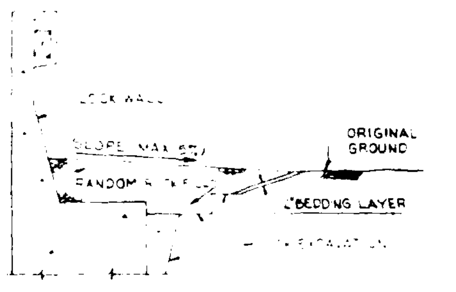
SUBMITTED
APPROVAL RECOMMENDED
ENGINEERING DIVISION
APPROVED
SCALE 1" = 200' SPEC NO
COLONEL C E DISTRICT ENGINEER
DATE
SHEET OF
DRAWING NUMBER
BSFR-4
TTBS-9/12

1


STA 4+63U
CONTROL BOOTH
ORIGINAL GROUND
FLOW
STA 6+52U
E LOCK STA 21+65S
EMERGENCY CLOSURE STOPLOGS IN STORED POSITION
EL 449.0
EL 350
EL 303.0
PLAN
PMF EL 449.0
WATER QUALITY CONTROL WEIR
NORMAL SUMMER POOL EL 414.0
NORMAL WINTER POOL EL 408.0
ORIGINAL GROUND
EL 384.0
APPROX TOP OF ROCK
INTAKE SCREEN (TYP)
ELEVATION A-A
TOP OF RETAINING WALL EL 450.0
TOP OF DAM EL 449.0
TOP OF LOCK WALL EL 424.0
NORMAL SUMMER POOL EL 414
STOPLOG SECTIONS **
EL 390.0
CULVERT
UPPER MITER SILL
** FURNISHED BY THE GOVERNMENT FOR INSTALLATION BY THE CONTRACTOR
EMERGENCY CLOSURE
UNWATERING UPPER GATE BAY
UNWATERING AND EMERGENCY CLOSURE ARRANGEMENTS

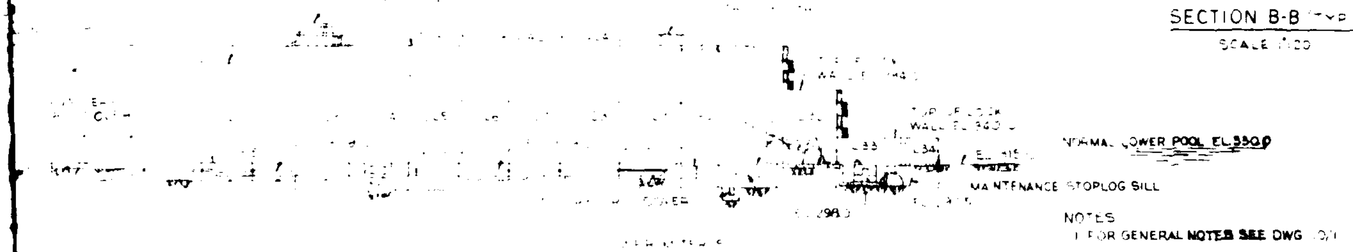


PLAN



SECTION B-B (TYPICAL)

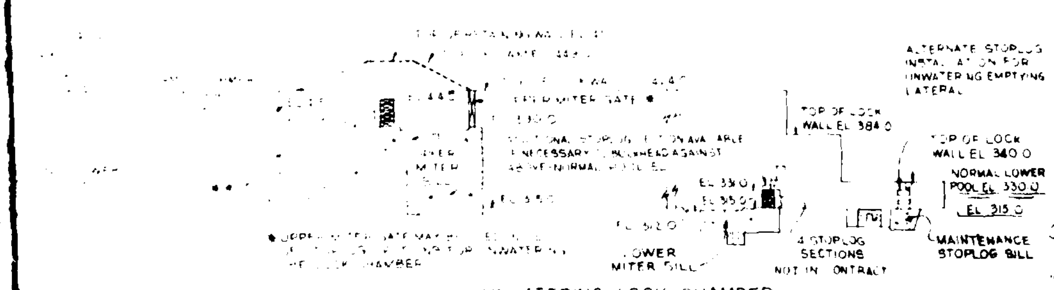
SCALE 1:20



ELEVATION A-A

NOTES

1. FOR GENERAL NOTES SEE DWG



UNWATERING LOCK CHAMBER

3	9-10-82	ADDED CONCRETE SURGE WALL BEHIND MONO L 32	B.L.E.	
2	2-15-79	ADDED RANDOM ROCK FILL ADJACENT TO RIGHT WALL	P.S.	
1	12-18-78	GENERAL REVISIONS		
REVISION	DATE	ZONE AND DESCRIPTION	BY	

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS

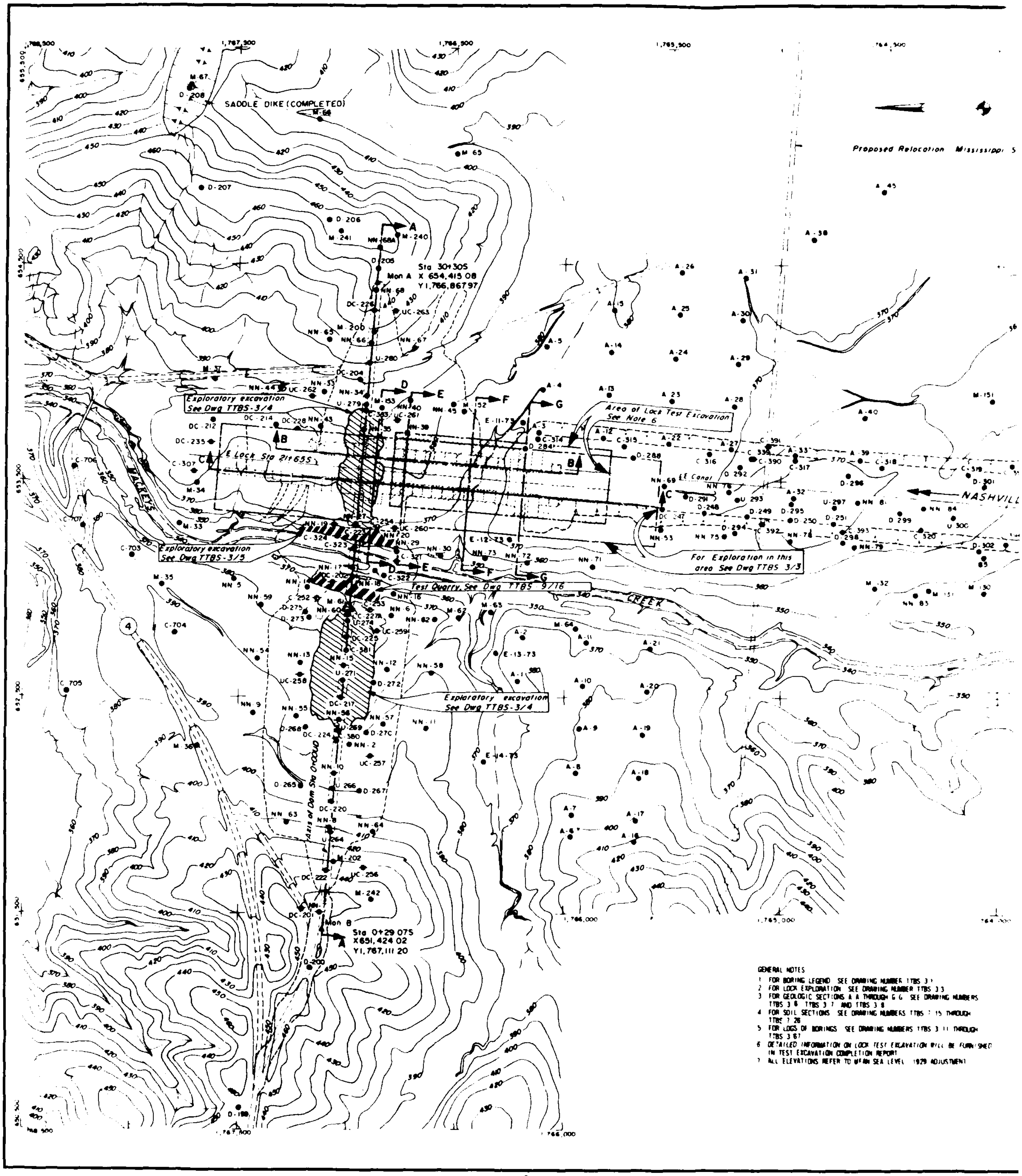
DRAWN: P S
CHECKED: J E M

TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

GENERAL PLAN

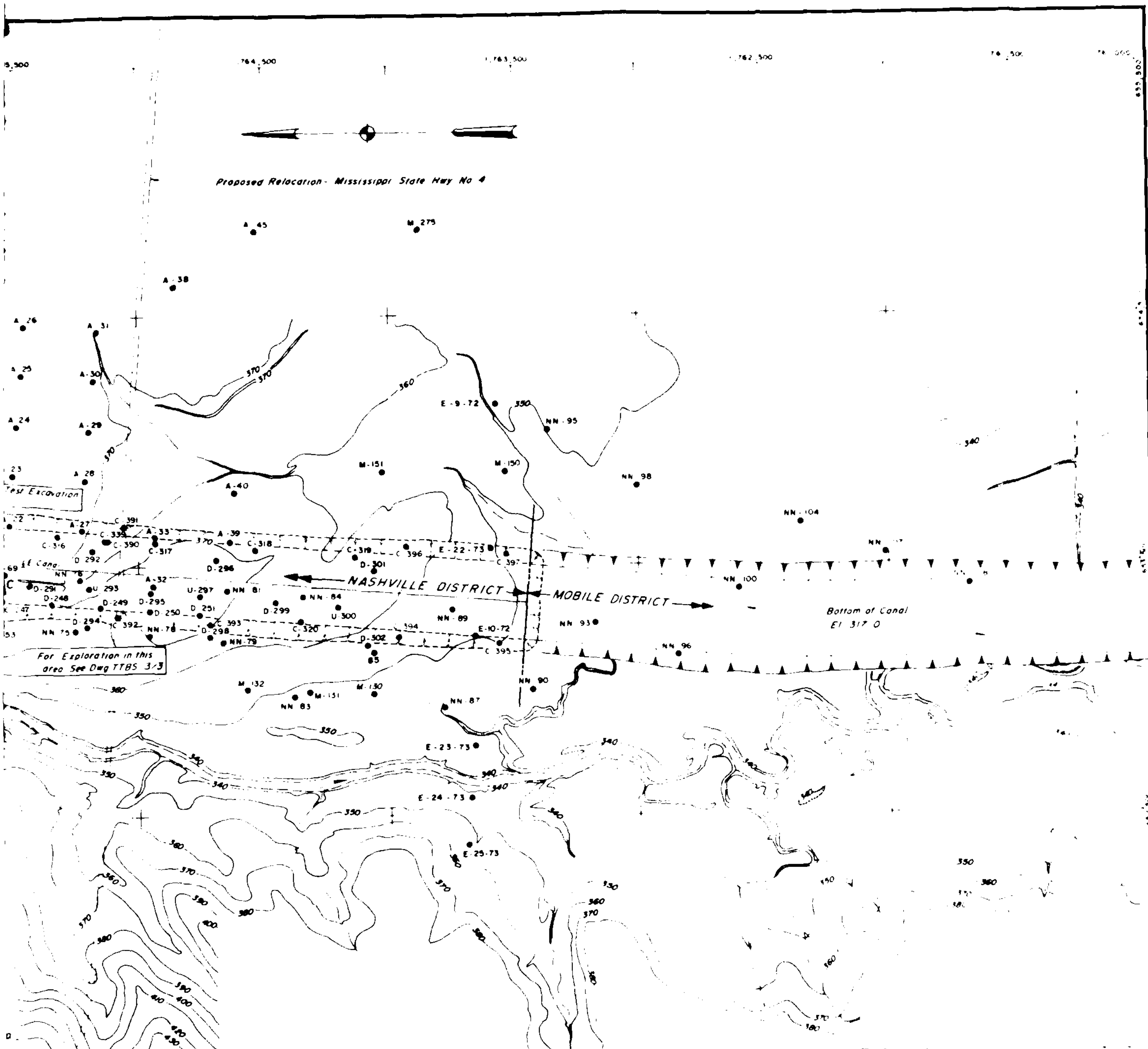
BSFR-5
TTBS-2/3.3

52



GENERAL NOTES

1. FOR BORING LEGEND SEE DRAWING NUMBER TTBS 3 1
2. FOR LOCK EXPLORATION SEE DRAWING NUMBER TTBS 3 3
3. FOR GEOLOGIC SECTIONS A A THROUGH G G SEE DRAWING NUMBERS TTBS 3 6 TTBS 3 7 AND TTBS 3 8
4. FOR SOIL SECTIONS SEE DRAWING NUMBERS TTBS 7 15 THROUGH TTBS 7 28
5. FOR LOGS OF BORINGS SEE DRAWING NUMBERS TTBS 3 11 THROUGH TTBS 3 67
6. DETAILED INFORMATION ON LOCK TEST EXCAVATION WILL BE FURNISHED IN TEST EXCAVATION COMPLETION REPORT
7. ALL ELEVATIONS REFER TO MEAN SEA LEVEL 1929 ADJUSTMENT



GENERAL NOTES

1. FOR BORING LEGEND SEE DRAWING NUMBER TTBS 3 1
2. FOR LOCK EXPLORATION SEE DRAWING NUMBER TTBS 3 3
3. FOR GEOLOGIC SECTIONS A A THROUGH G G SEE DRAWING NUMBERS TTBS 3 6 TTBS 3 7 AND TTBS 3 8
4. FOR SOIL SECTIONS SEE DRAWING NUMBERS TTBS 7 15 THROUGH TTBS 7 28
5. FOR LOGS OF BORINGS SEE DRAWING NUMBERS TTBS 3 11 THROUGH TTBS 3 87
6. DETAILED INFORMATION ON LOCK TEST EXCAVATION WILL BE FURNISHED IN TEST EXCAVATION COMPLETION REPORT
7. ALL ELEVATIONS REFER TO MEAN SEA LEVEL 1929 ADJUSTMENT

REVISION	DATE	DESCRIPTION	BY	CHKD
2	3-2-79	Corrected location of hole C-394 and reference notes directly on plan, to reflect correct dwg numbers		
1	12 29 78	Revised notes and changed drawing no.		

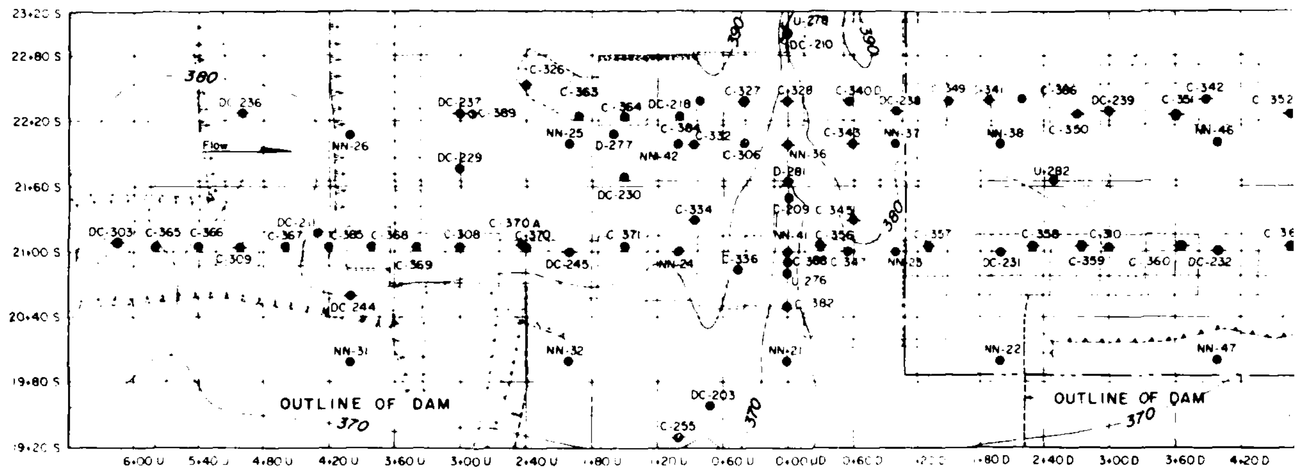
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

PLAN OF FOUNDATION EXPLORATION

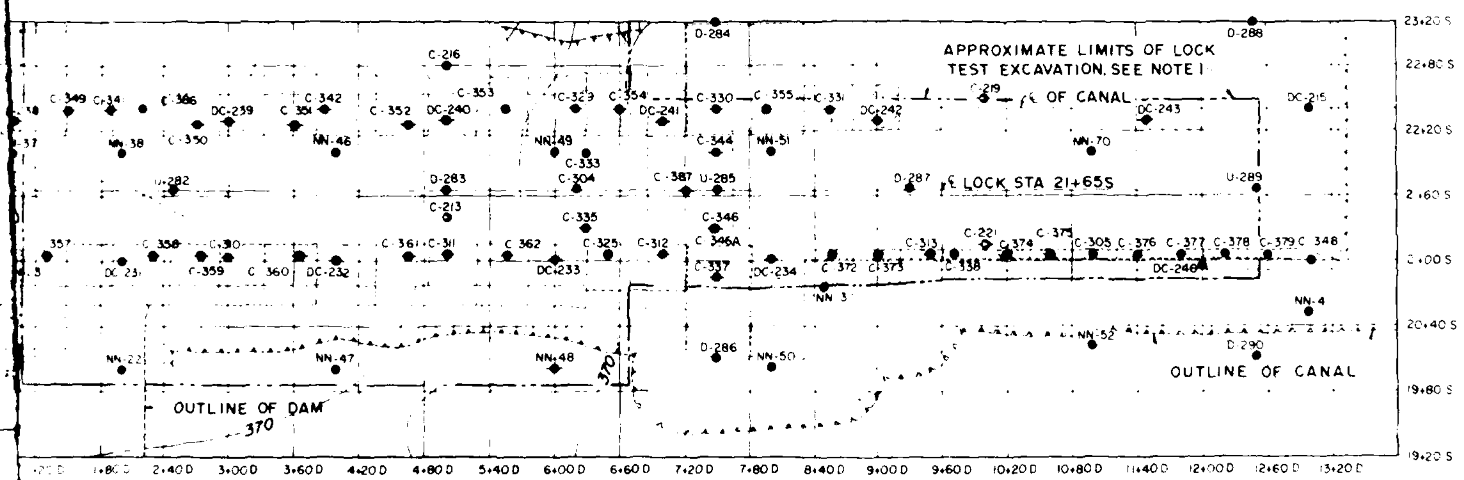
DRAWN
CHECKED GRH
TRACED
COMPARED
GEOLOGIST
SUBMITTED
Chief Geotechnical Branch
APPROVAL RECOMMENDED
CHIEF ENGINEERING DIVISION
APPROVED
COLONEL C E DISTRICT ENGINEER
DATE
SCALE 1" = 200' SPEC NO
DRAWING NUMBER
BSFR-6
SHEET OF TTBS-3/2 2



PLAN

SCALE 1" = 60'

* For Exploration outside this area, see Drawing No TTBS-3/2



PLAN

SCALE 1" = 60'

NOTES

1. DETAILED INFORMATION ON LOCK TEST EXCAVATION WILL BE FURNISHED IN TEST EXCAVATION COMPLETION REPORT
2. FOR GENERAL NOTES SEE DRAWING NUMBER TTBS 3/2

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD
2	3-28-79	REVISED IN ACCORDANCE WITH AMENDMENT 0002	EPD	FWS
1	12-29-78	Revised notes and changed drawing no	THL	FBS

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN CAG
CHECKED GRH
TRACED
COMPARED
GEOLOGIST

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
PLAN OF FOUNDATION EXPLORATION
(LOCK AREA)

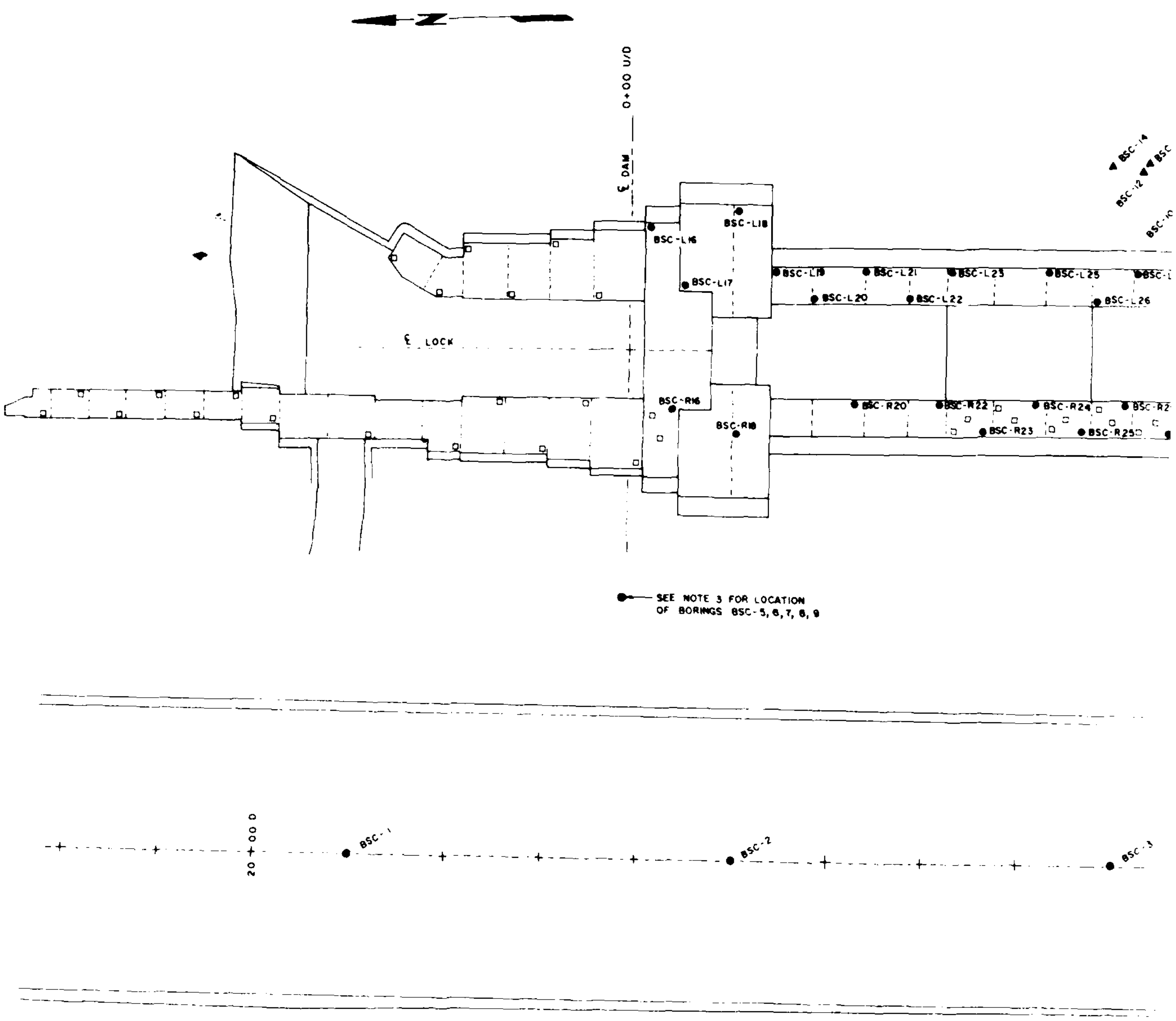
SUBMITTED
CHIEF, ARCHITECTURAL BRANCH

APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

APPROVED
COLONEL, C E DISTRICT ENGINEER

DATE

SCALE
SPEC NO
DRAWING NUMBER
BSFR-7
TTBS-3/32
SHEET OF

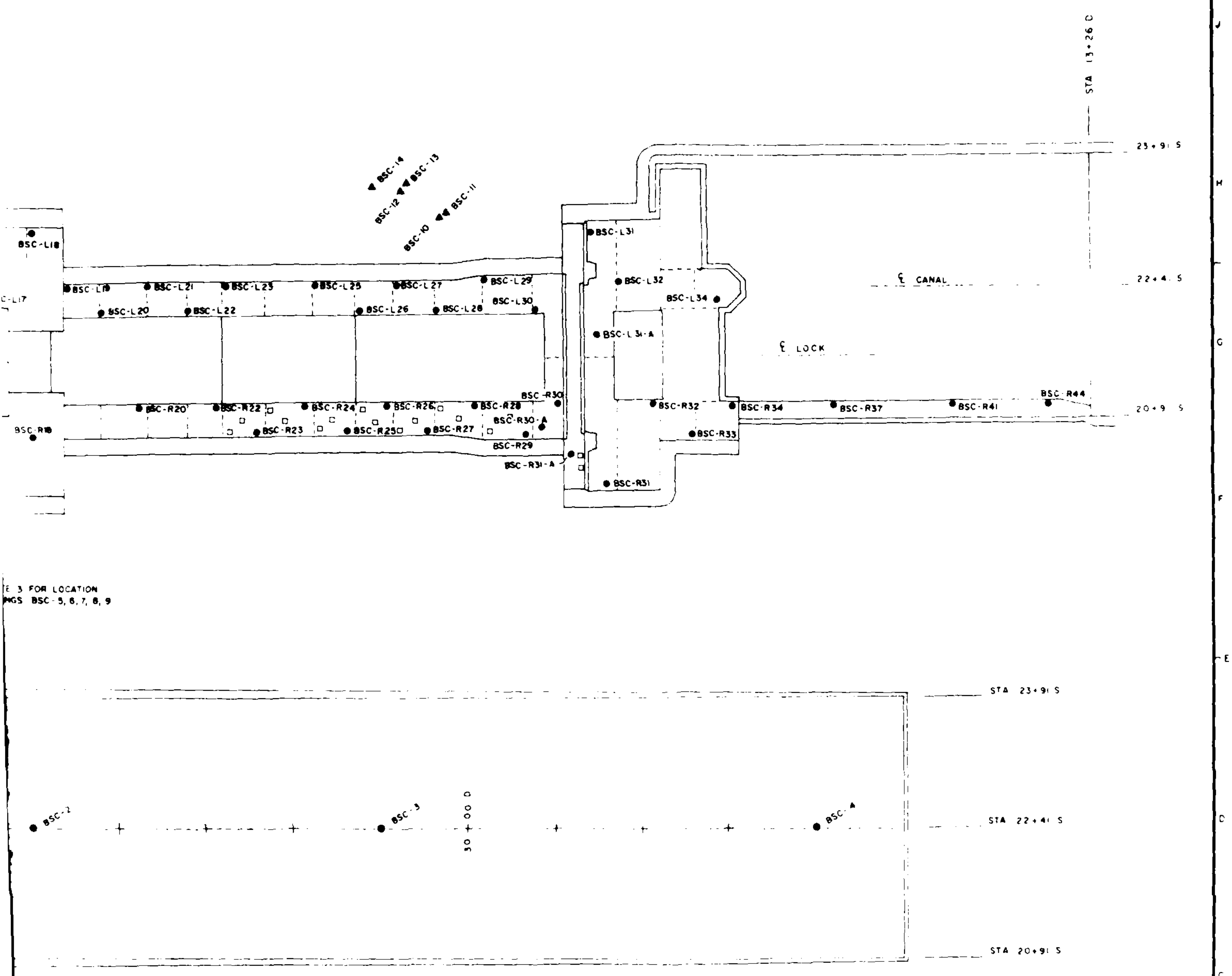


NOTES

1. FOR LOGS OF BORINGS REFER TO DRAWINGS BSFR-9 THRU 22.
2. FOR BORING LEGEND SEE CONTRACT DRAWING TTBS-3/1
3. LOCATIONS OF BORINGS BSC-5, 6, 7, 8, 9

BORING	LOCATION
BSC-5	17+68S, 0+08D
6	17+63S, 0+33U
7	17+64S, 0+10D
8	17+71S, 0+08D
9	17+27S, 0+19D

4. BORINGS BSC-L15, L24, L33, R17, R19, R35, R36, R38, R39, R40, R42, AND R43 WERE DELETED AS ADJACENT BORINGS INDICATED ADEQUATE FOUNDATION CONDITIONS



...E 3 FOR LOCATION
...NGS BSC-5, 6, 7, 8, 9

...GS BSFR-9 THRU 22
...WING TT89-3/1

...S R38, R39, R40, R42,
...RINGS INDICATED

LEGEND

- ● 4" CORE HOLE
- ▲ NQ CORE HOLE
- ◻ 2" PERCUSSION HOLE

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

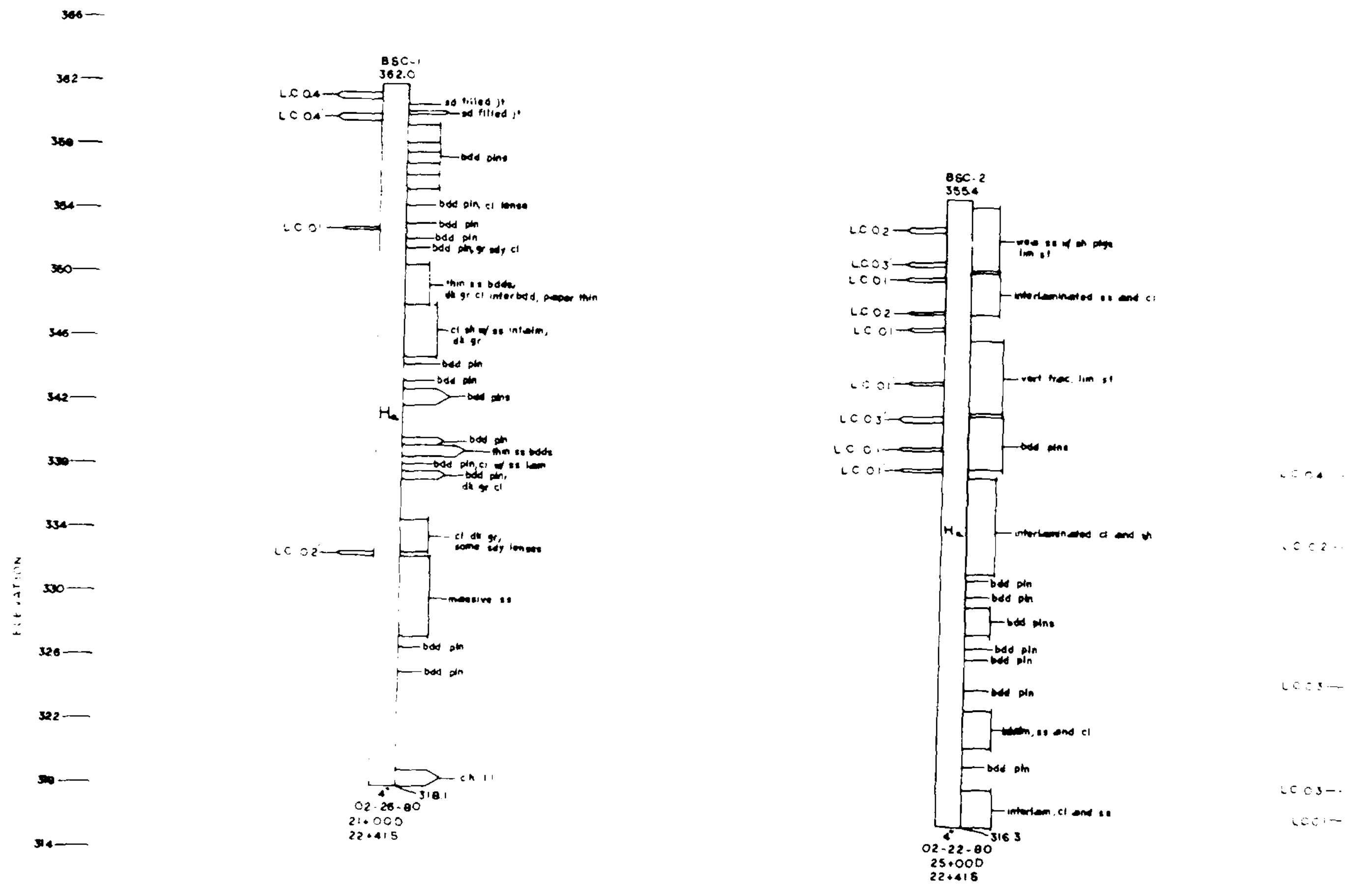
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN: FAR
CHECKED
TRACED
COMPARED

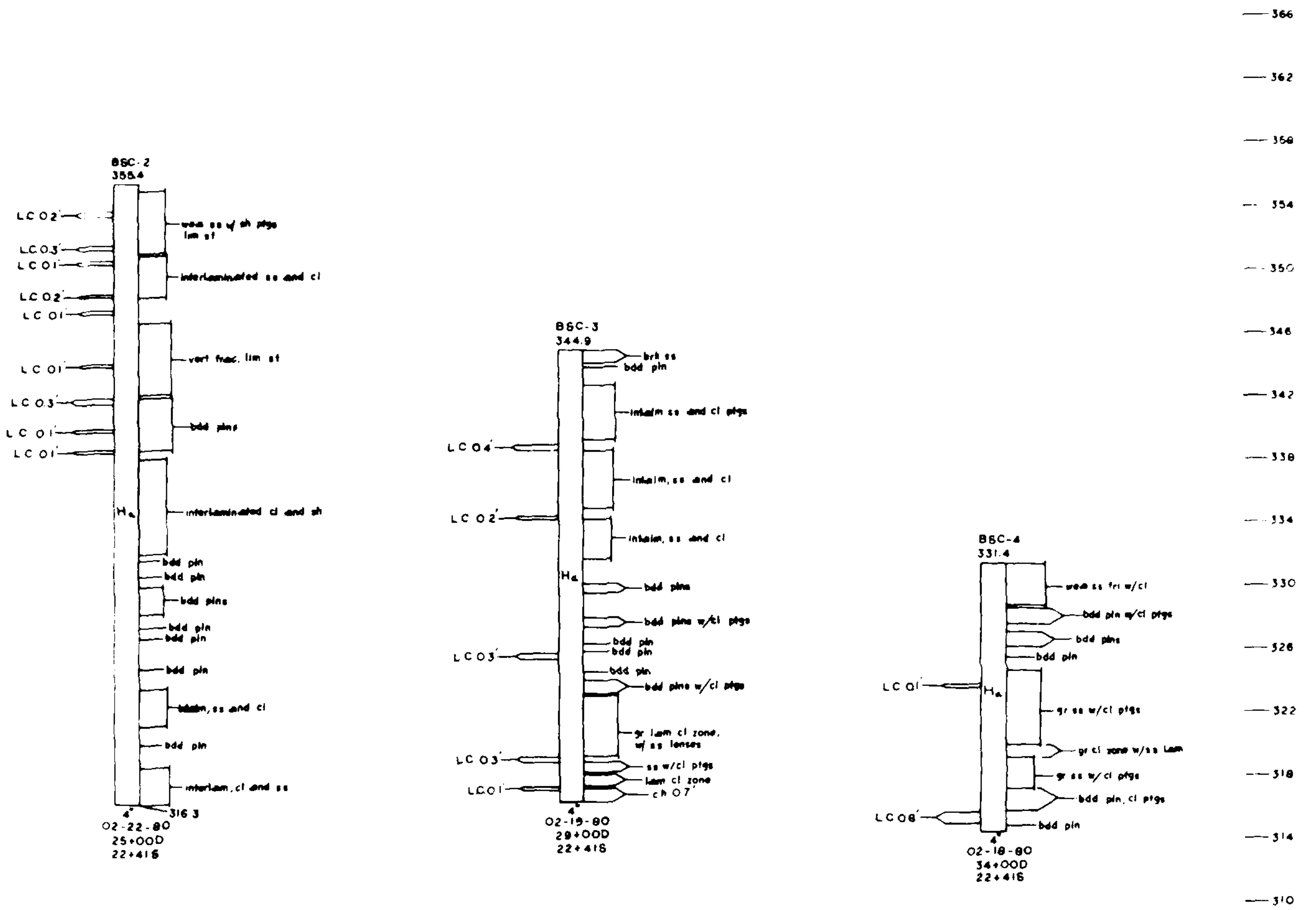
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
FOUNDATION EXPLORATION
DURING CONSTRUCTION
PLAN

SUBMITTED
APPROVAL RECOMMENDED
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
DRAWING NUMBER
BSFR-8
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



NOTES

1. BSC BSCA AND BSC, BOR...
CONTRACT EXCEPT AS SHOWN...
2. FOR ABBREV AT ON EXPLANA...
AND EXHIBIT ONE GENERAL...
3. FOR LOCATION OF BORINGS ...
4. LOGS OF BORINGS ARE ON ...
REPRESENTATIVE LOGS OF ...
5. ELEVATIONS REFER TO MEAN...



NOTES

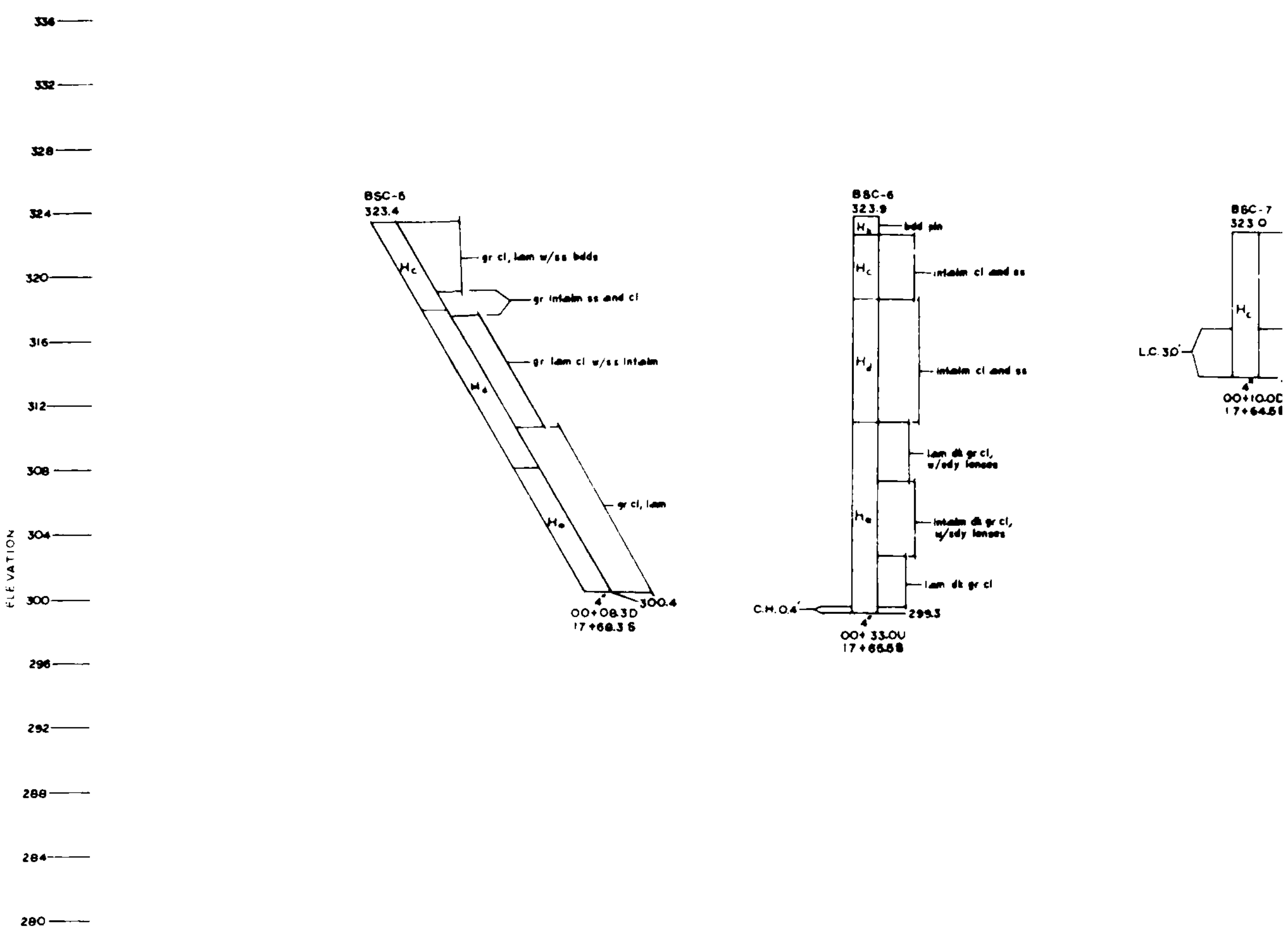
1. BSC, BSCR, AND BSCL BORINGS WERE INSTALLED DURING CONSTRUCTION AS REQUIRED BY THE CONTRACT EXCEPT AS SHOWN ON NOTE 4 ON BSFR 8
2. FOR ABBREVIATION EXPLANATION REFER TO CONTRACT DRAWING TTBS 3.1, BORING LEGEND AND EXHIBIT ONE, GENERALIZED GEOLOGIC COLUMN OF THE BAY SPRINGS FOUNDATION REPORT
3. FOR LOCATION OF BORINGS REFER TO DRAWINGS BSFR 6, 7, & 8
4. LOGS OF BORINGS ARE ON FILE AT THE BAY SPRINGS RESERVOIR MANAGER'S OFFICE. REPRESENTATIVE LOGS OF BORINGS ARE INCLUDED IN APPENDIX D
5. ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	DESCRIPTION

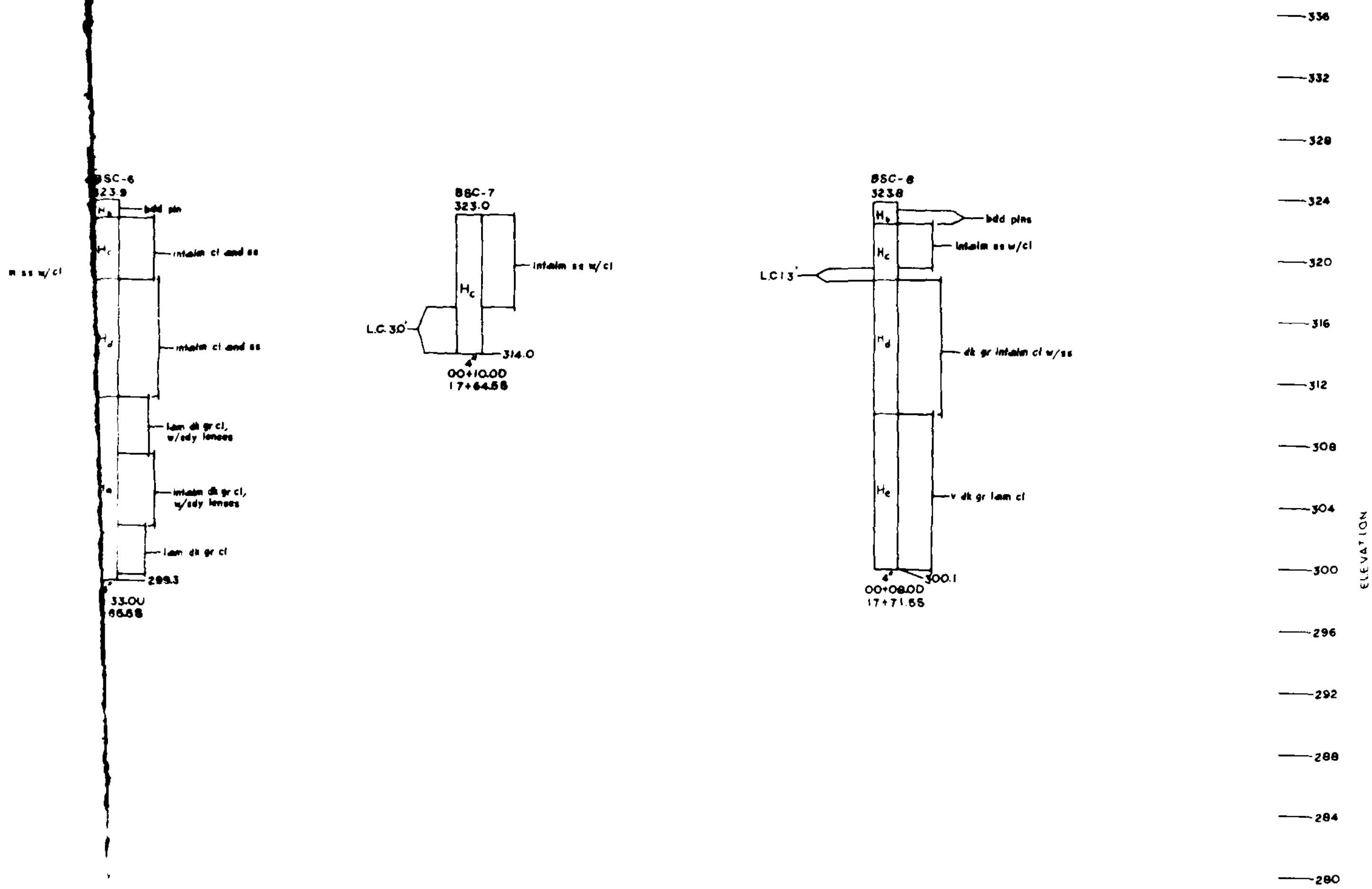
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN	TENNESSEE TOMBIGBEE WATERWAY
CHECKED	MISSISSIPPI AND ALABAMA
TRACED	BAY SPRINGS LOCK AND DAM
SUBMITTED	APPROVAL RECOMMENDED
APPROVED	SCALE: 1"=4' VERT. / DRAWING NUMBER: BSFR 9
DATE	SHEET OF

RECORD DRAWING AS CONSTRUCTED



336
332
328
324
320
316
312
308
304
300
296
292
288
284
280
ELEVATION
BSC-5
323.4
H_c
gr cl, lam w/ss bdds
gr intlam ss and cl
gr lam cl w/ss intlam
H_d
gr cl, lam
H_e
4"
300.4
00+08.3D
17+68.3 S
BSC-6
323.9
H_b
bdd pln
H_c
intlam cl and ss
H_d
intlam cl and ss
lam dk gr cl, w/sdy lenses
H_e
intlam dk gr cl, w/sdy lenses
lam dk gr cl
C.H. 0.4'
299.3
4"
00+ 33.0U
17+66.5 B
BSC-7
323.0
H_c
L.C. 3.0'
4"
00+10.0D
17+64.5



NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

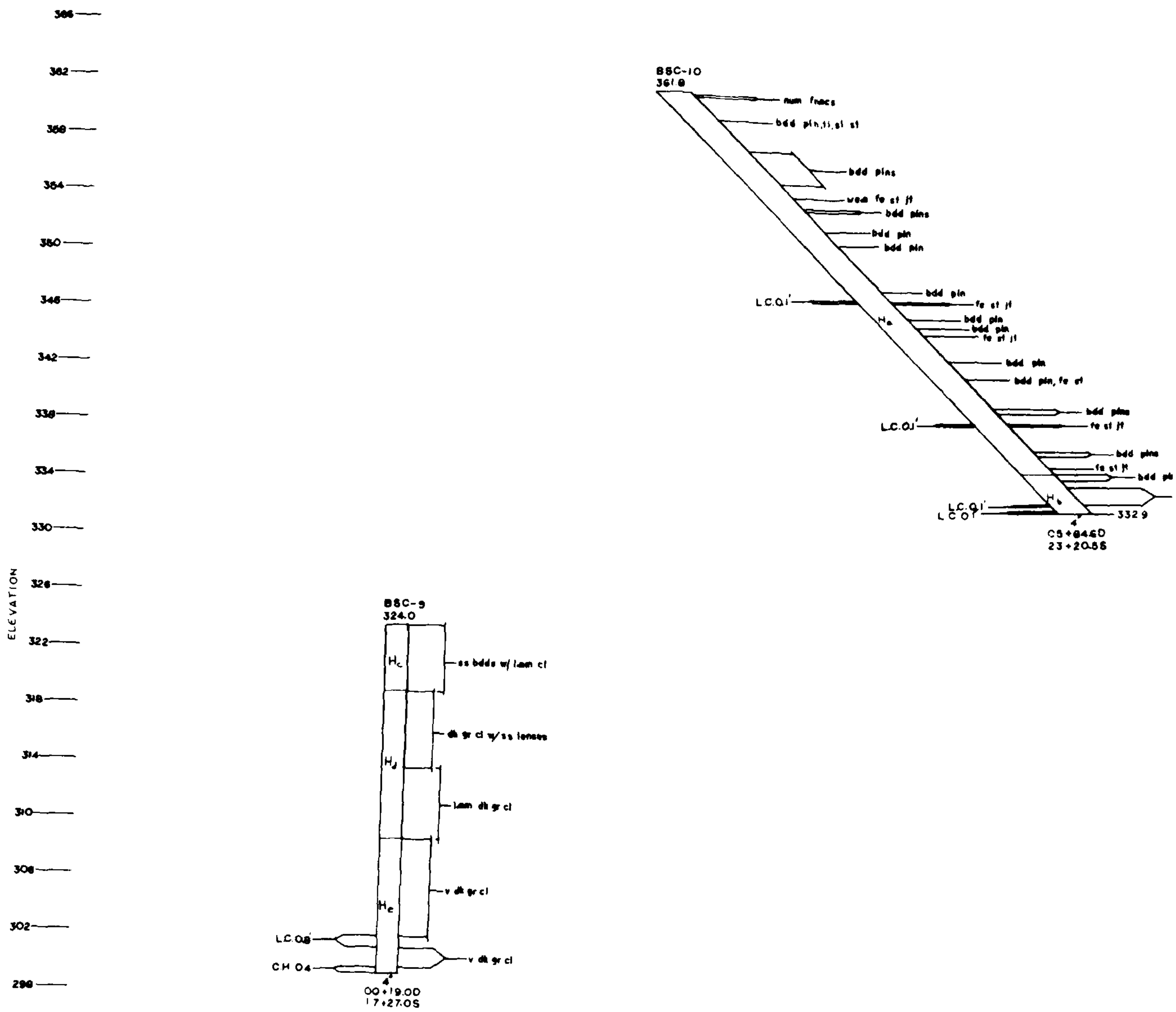
GRAPHIC SCALE

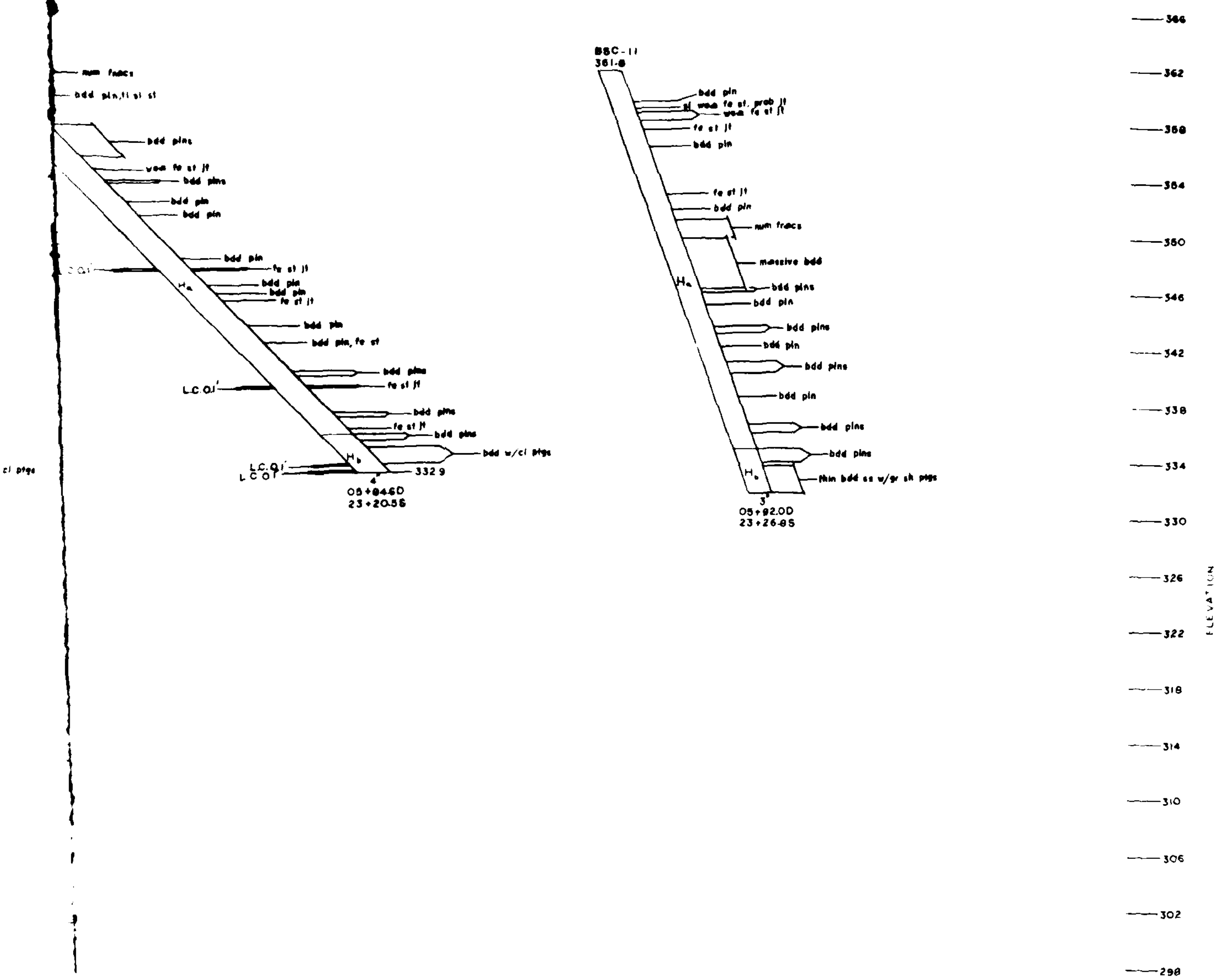
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1":4' VERT
SPEC NO
DRAWING NUMBER
BSFR-10
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED


ELEVATION
386
382
378
374
370
366
362
358
354
350
346
342
338
334
330
326
322
318
314
310
306
302
298
BSC-10
361.8
num fracs
bdd pln
fe st jt
LC 0.1'
bdd plns
332.9
C5+84.60
23+20.85
BSC-9
324.0
Hc
Hd
He
ss bdds w/ lam cl
dk gr cl w/ ss lenses
lam dk gr cl
v dk gr cl
LC 0.8'
CH 0.4
00+19.00
17+27.0S



NOTE
FOR NOTES, SEE DRAWING BSFR-9

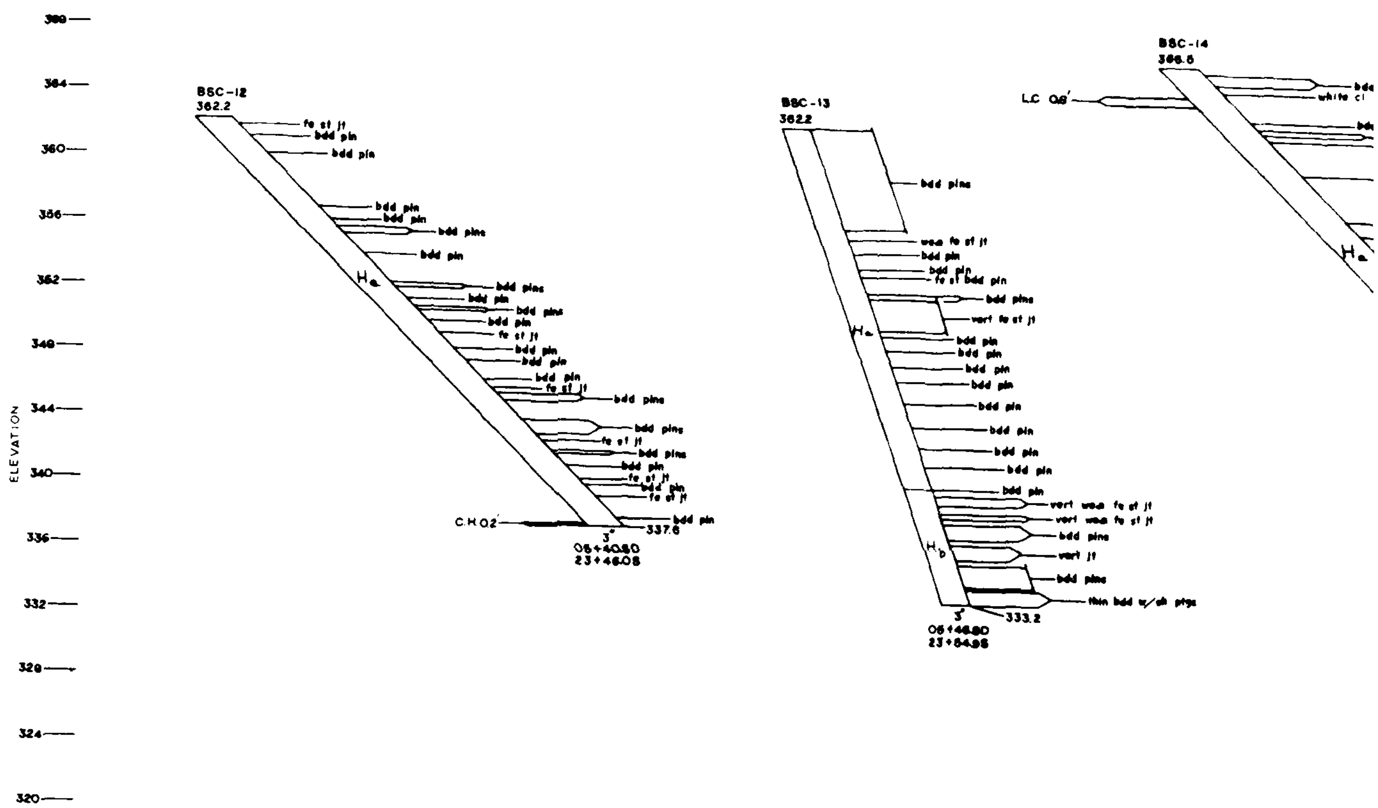
REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

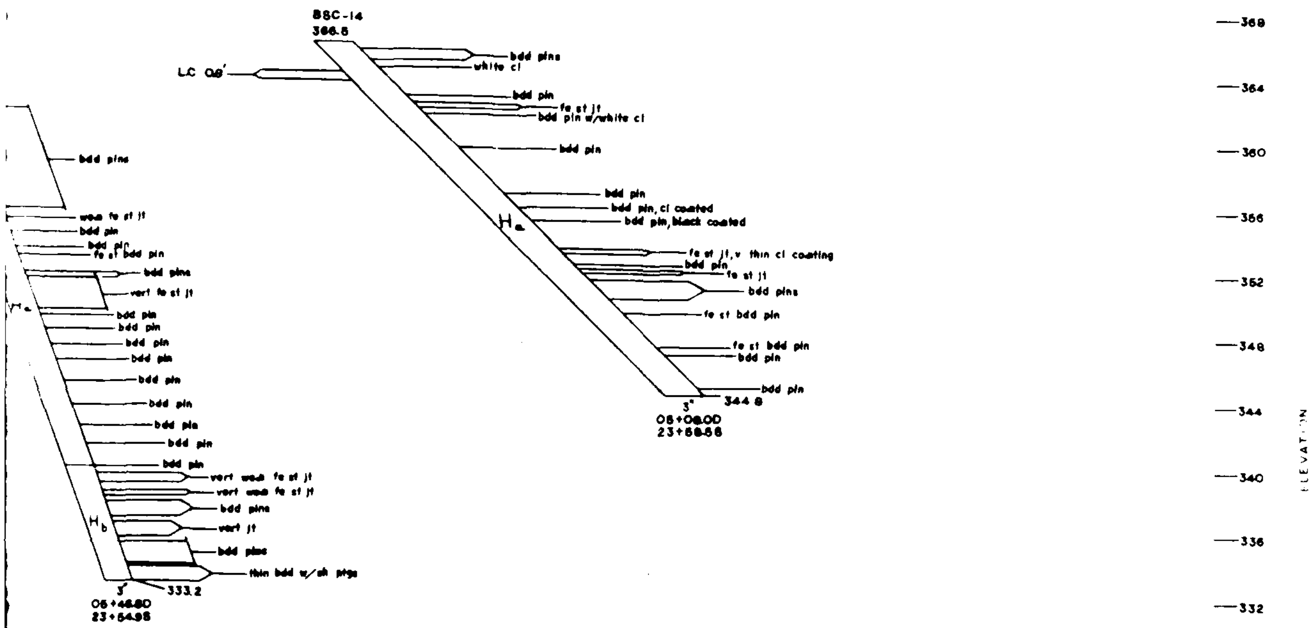
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOGS OF BORINGS

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
SCALE 1"=4' VERT. SPEC NO.
DRAWING NUMBER
BSFR-11
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



ELEVATION
368
364
360
356
352
348
344
340
336
332
328
324
320
BSC-12
362.2
fe st jt
bdd pln
bdd pln
bdd pln
bdd pln
bdd plns
bdd pln
Ha
bdd plns
bdd pln
bdd plns
bdd pln
fe st jt
bdd pln
bdd pln
bdd pln
fe st jt
bdd plns
bdd plns
fe st jt
bdd plns
bdd pln
fe st jt
bdd pln
fe st jt
bdd pln
C.H. 0.2'
337.6
3"
05+40.80
23+46.08
BSC-13
362.2
bdd plns
Ha
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
bdd pln
vert fe st jt
bdd plns
vert jt
bdd plns
thin bdd w/ sh ptgs
Hb
3"
333.2
05+46.80
23+54.95
BSC-14
366.6
L.C. 0.8'
white cl
Ha



NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION | DATE | ZONE AND DESCRIPTION | BY | CHKD

GRAPHIC SCALE

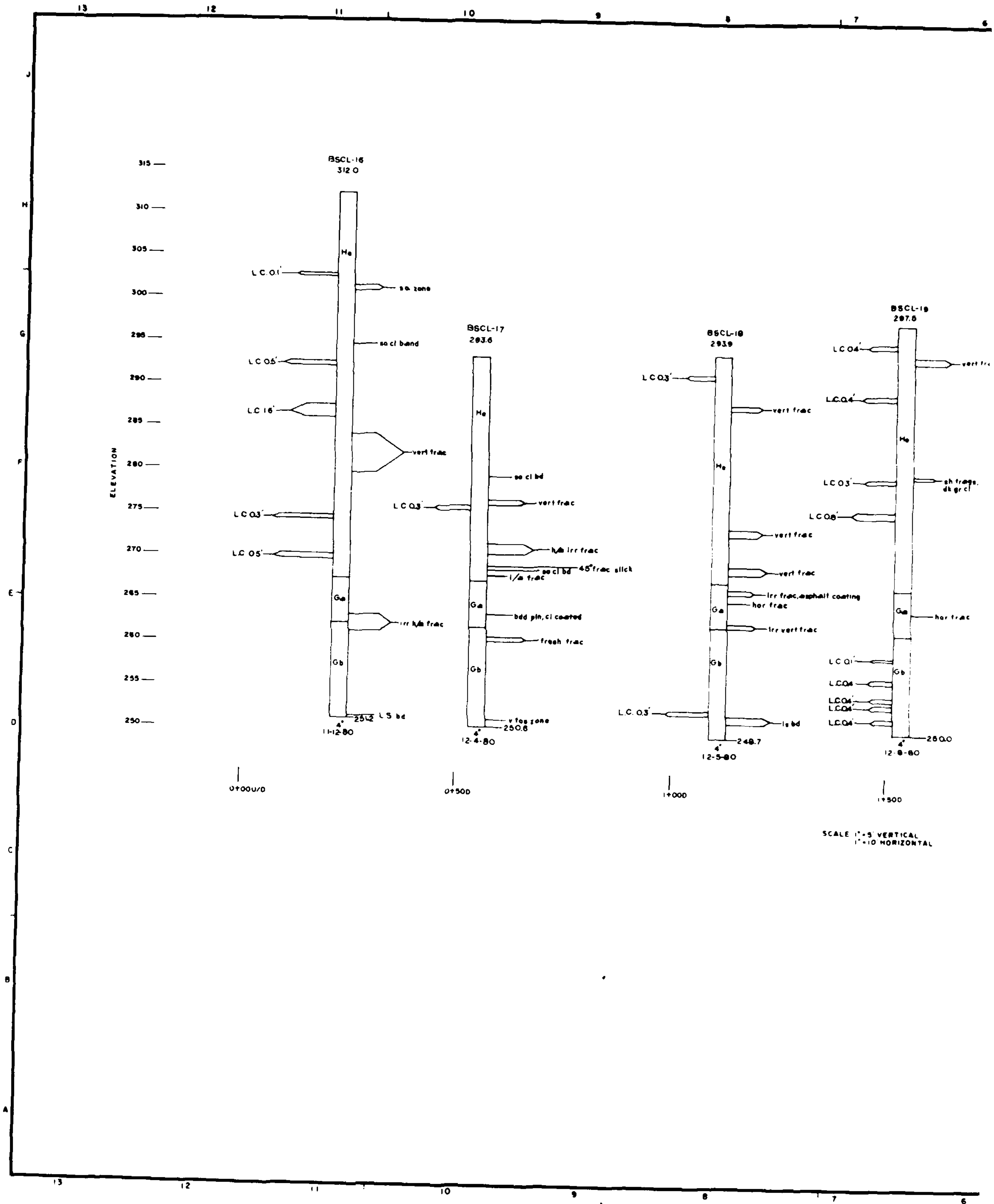
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN C. Logsdon
CHECKED
TRACED
COMPARED

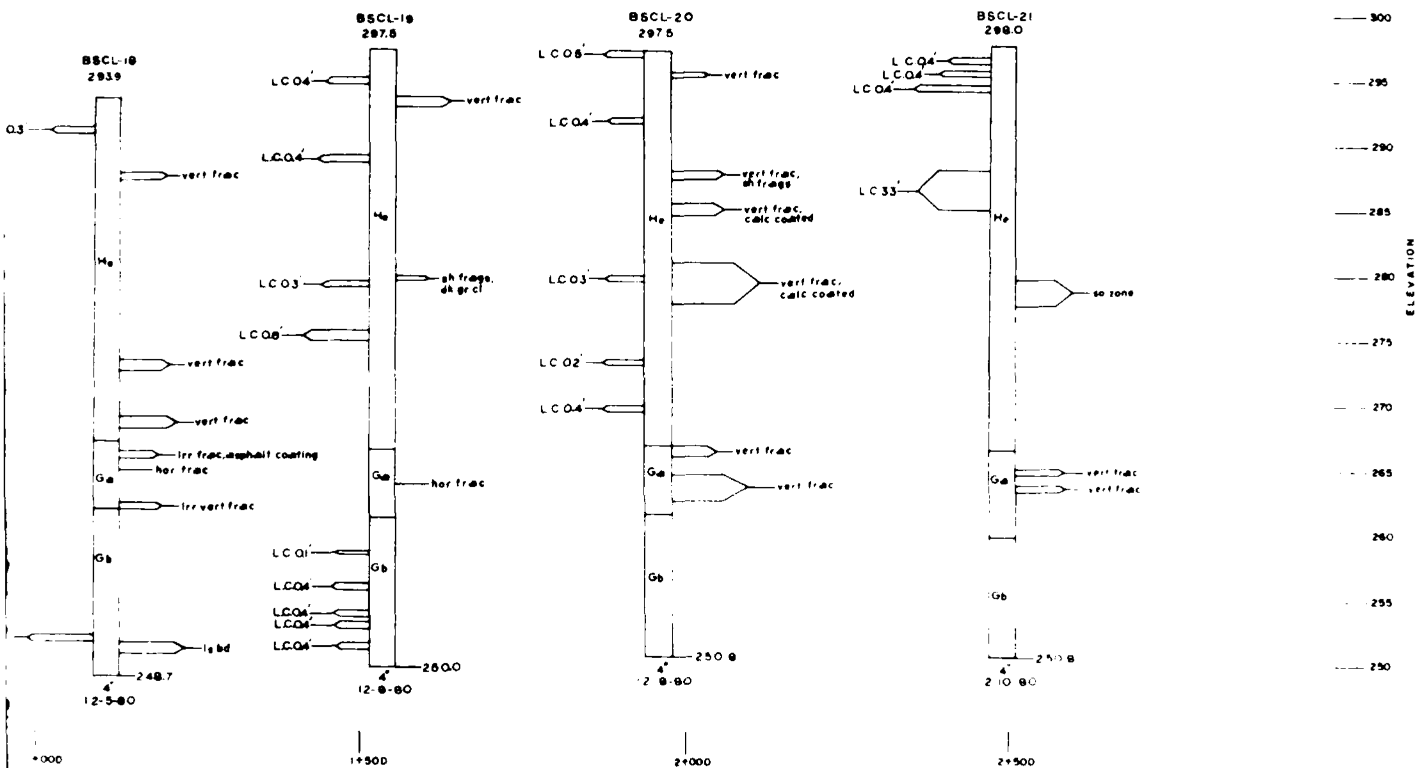
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 4' VERT
SPEC NO
DRAWING NUMBER
BSFR-12
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

7



BSCL-16
312.0
BSCL-17
293.6
BSCL-18
293.9
BSCL-19
297.5
ELEVATION
315
310
305
300
295
290
285
280
275
270
265
260
255
250
He
Ga
Gb
L.C. 0.1'
sa. zone
sa cl band
L.C. 0.5'
L.C. 1.6'
vert frac
L.C. 0.3'
L.C. 0.5'
irr h/a frac
2512
L.S. bd
11-12-80
sa cl bd
vert frac
L.C. 0.3
h/a irr frac
sa cl bd
45° frac slick
1/a frac
bdd pln, cl coated
fresh frac
v fos zone
250.8
12-4-80
L.C. 0.3'
vert frac
irr frac, asphalt coating
hor frac
irr vert frac
L.C. 0.3'
ls bd
248.7
12-5-80
L.C. 0.4'
L.C. 0.3'
sh frags, dk gr cl
L.C. 0.8'
hor frac
L.C. 0.1'
L.C. 0.4'
280.0
12-8-80
0+000/0
0+500
1+000
1+500
SCALE 1" = 5' VERTICAL
1" = 10' HORIZONTAL



SCALE 1" = 5' VERTICAL
1" = 10' HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR-9

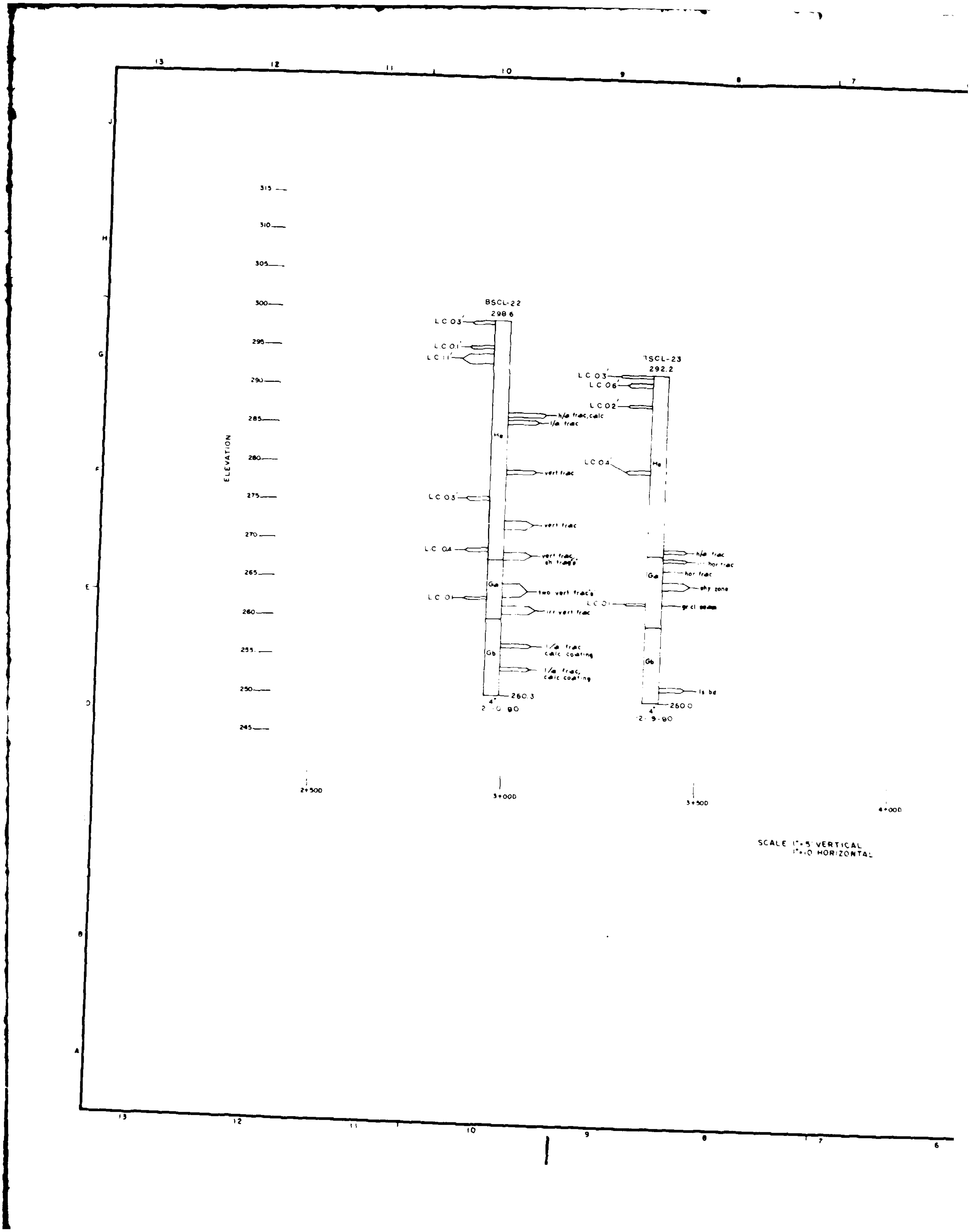
REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

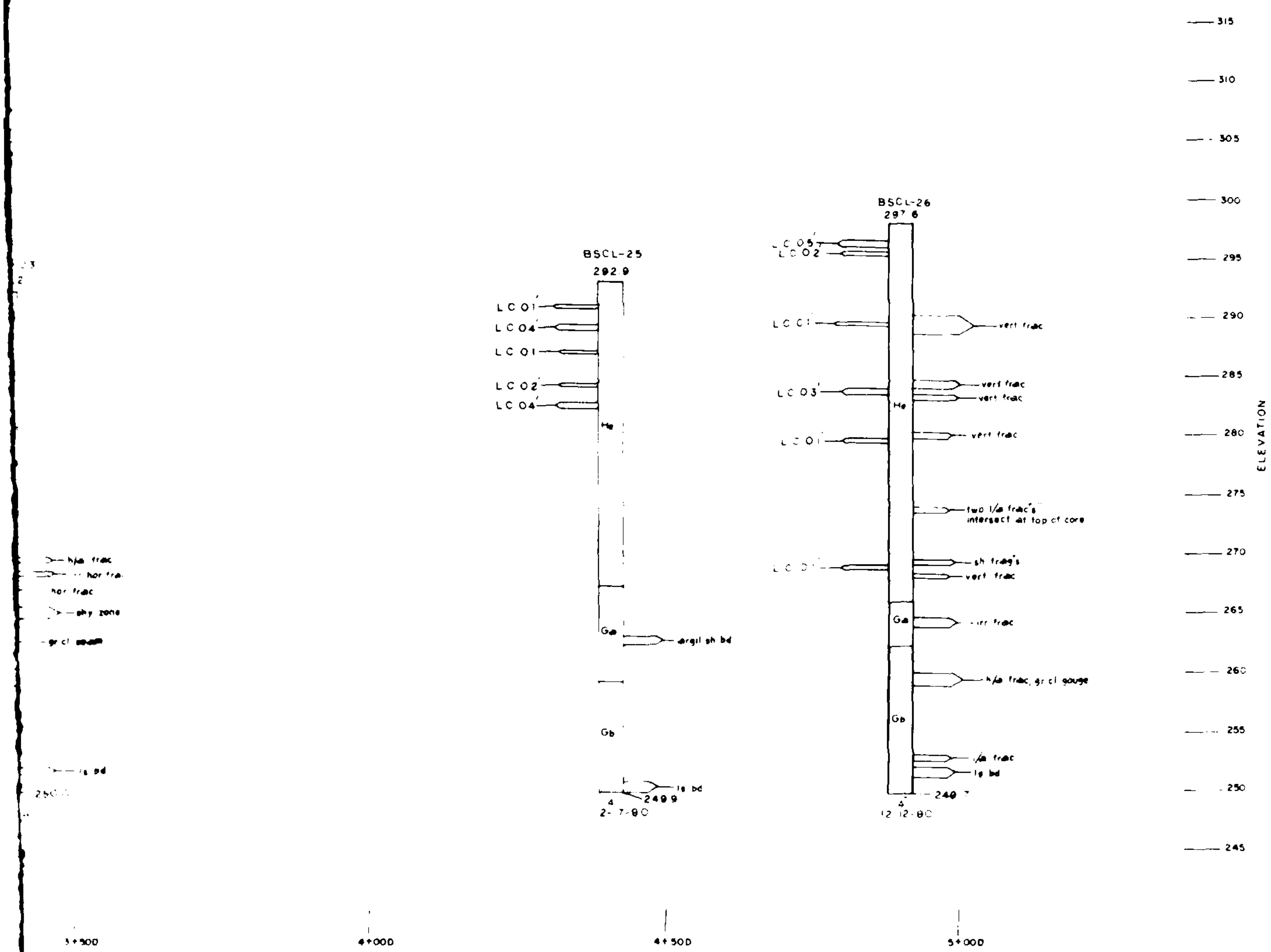
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

DRAWN
CHECKED
TRACED
COMPARED
SUBMITTED
APPROVED
COLONEL, C. E. DISTRICT ENGINEER
DATE
SCALE
DRAWING NUMBER
BSFR-13
SHEET



ELEVATION
315
310
305
300
295
290
285
280
275
270
265
260
255
250
245
BSCL-22
298.6
LC 03'
LC 0.1'
LC 1.1'
h/a frac, calc
l/a frac
Ha
vert frac
LC 03'
vert frac
LC 04
vert frac, sh frag's
Ga
two vert frac's
LC 01
irr vert frac
Gb
l/a frac calc coating
l/a frac, calc coating
4"
260.3
BSCL-23
292.2
LC 03'
LC 06'
LC 02'
LC 04'
Ha
h/a frac
hor frac
hor frac
Ga
shy zone
LC 01
gr cl seam
Gb
ls bd
4"
260.0
2+500
3+000
3+500
4+000
SCALE 1"=5' VERTICAL
1"=10 HORIZONTAL



SCALE 1"=5' VERTICAL
1"=10' HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

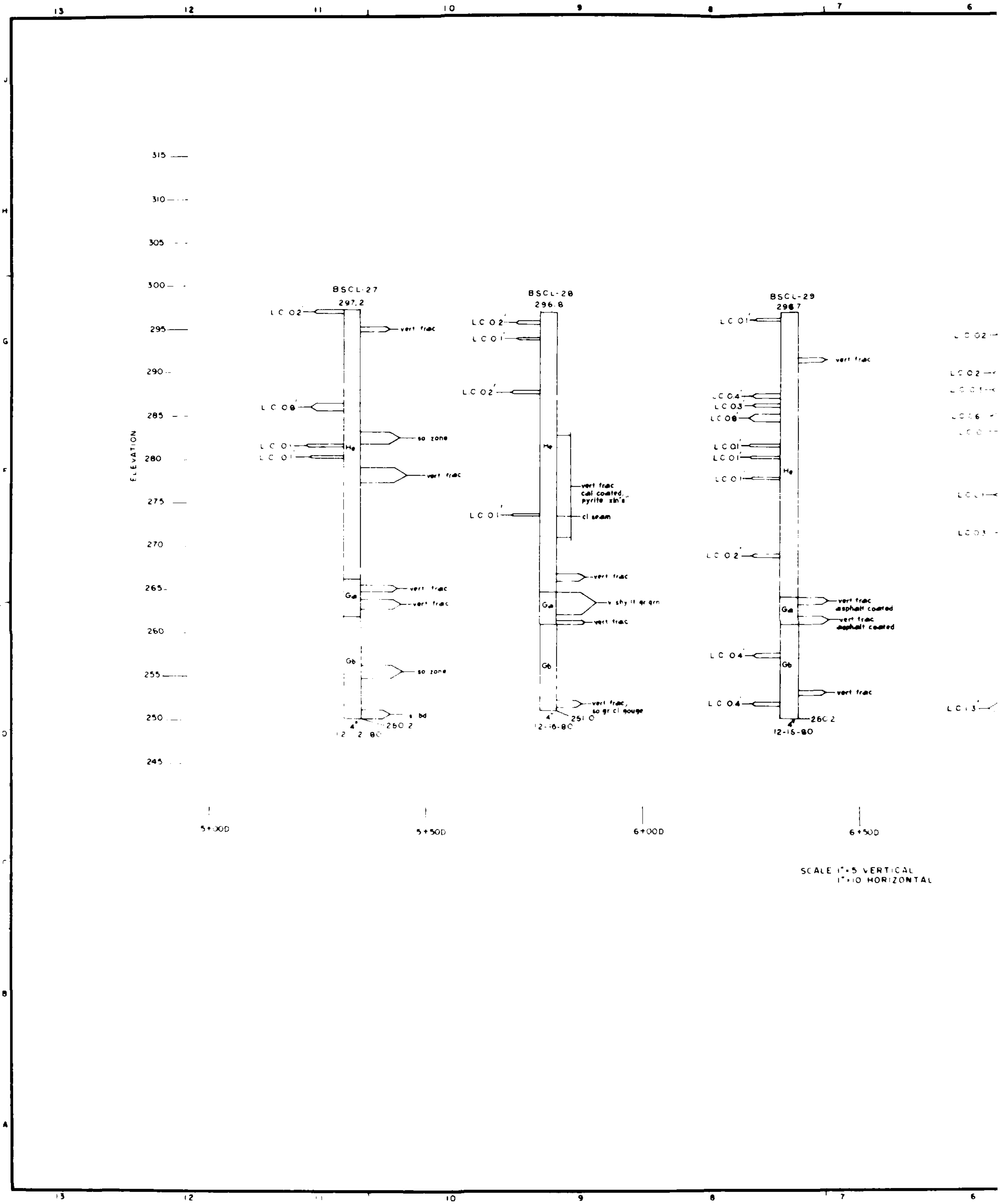
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

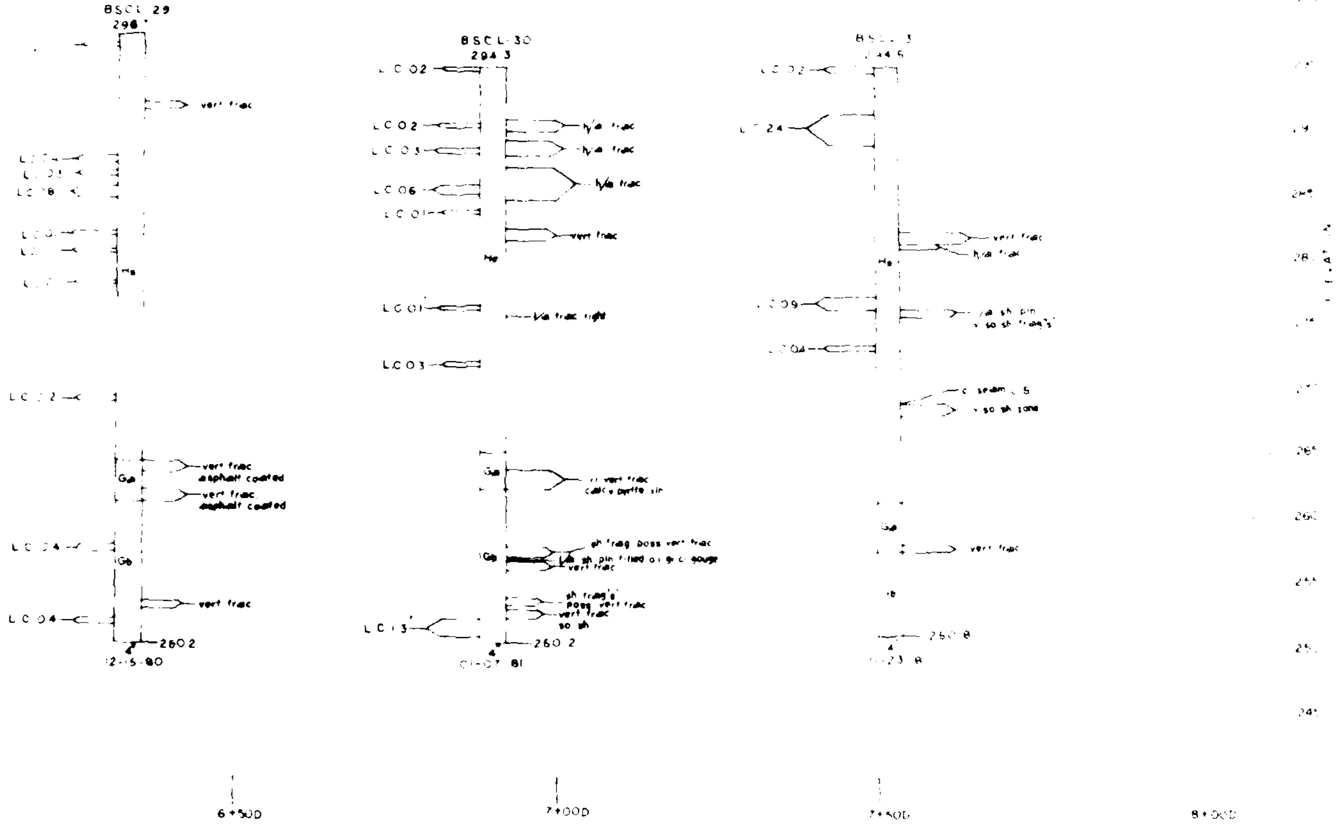
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC NO
DRAWING NUMBER
BSFR-14
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED


BSCL-27
297.2
BSCL-28
296.8
BSCL-29
296.7
ELEVATION
vert frac
so zone
cl seam
5+00D
5+50D
6+00D
6+50D
SCALE 1"=5 VERTICAL
1"=10 HORIZONTAL



SCALE 1"=5 VERTICAL
1"=10 HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION | DATE | DESCRIPTION | BY

GRAPHIC SCALE

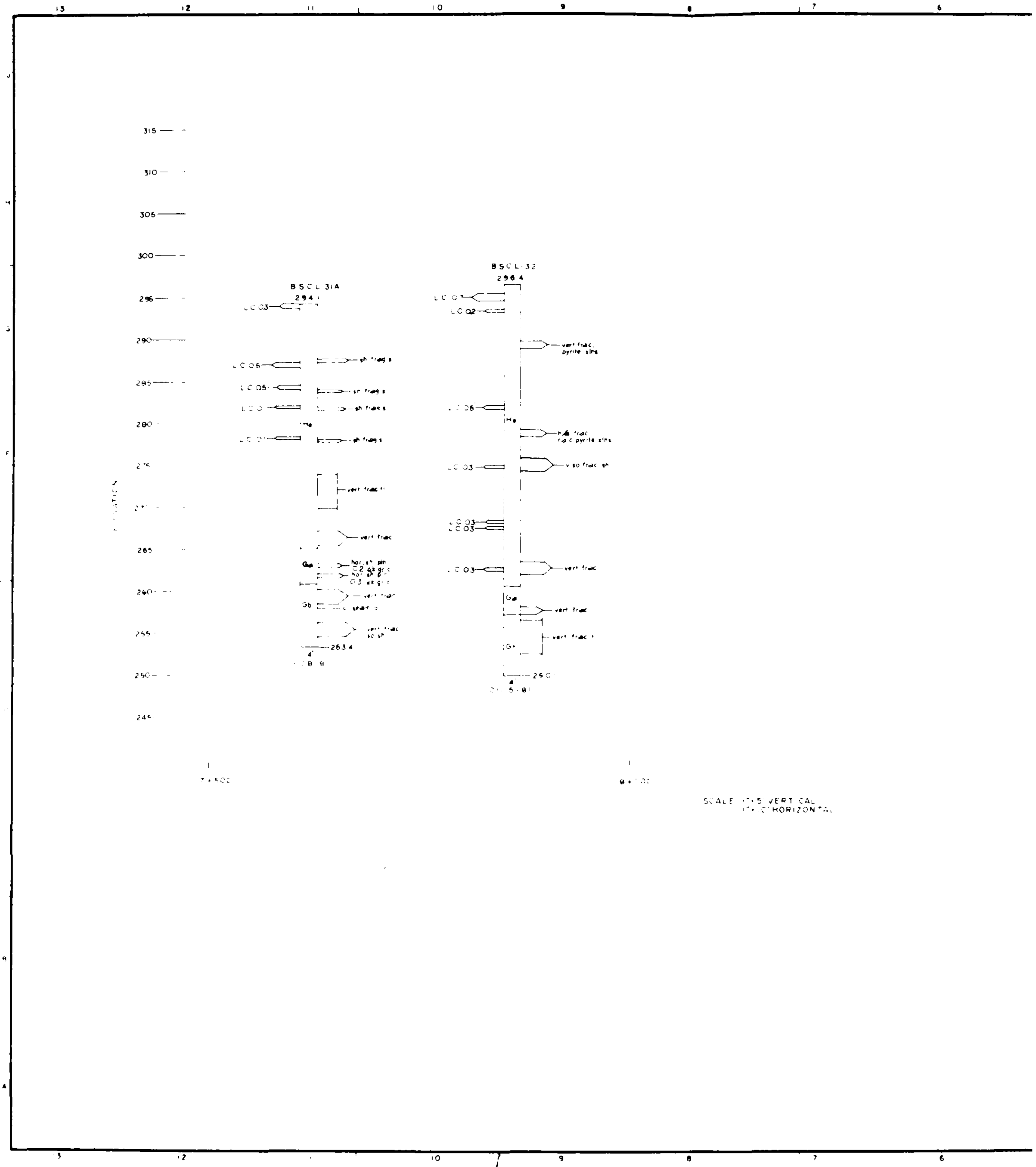
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

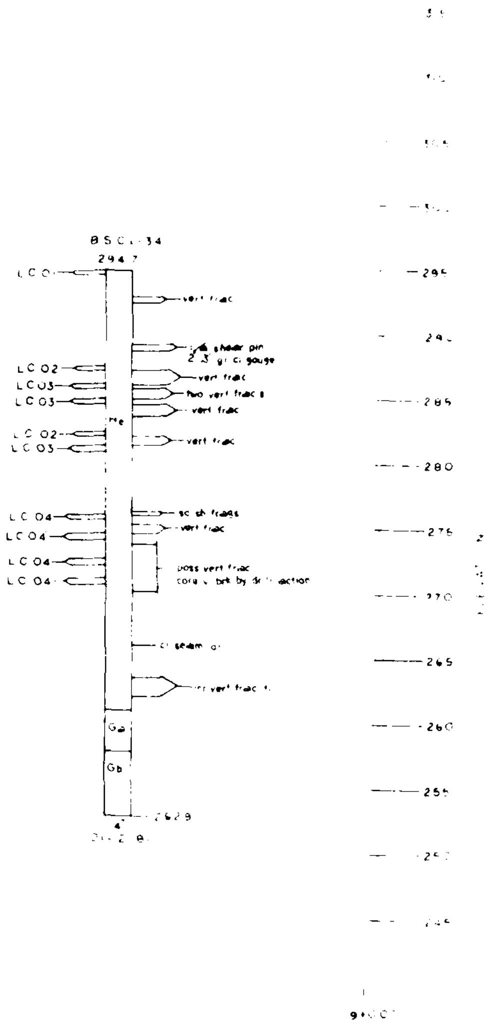
DRAWN
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
SCALE
SPEC NO
DRAWING NUMBER
BSFR-15
DATE
SHEET
RECORD DRAWING AS CONSTRUCTED DATED


BSCL 31A
BSCL 32
296.4
315
310
305
300
296
290
285
280
265
260
255
250
vert frac
vert frac
pyrite xlns
LC O2
LC O3
LC O6
LC O5
263.4
SCALE
VERTICAL
HORIZONTAL



NOTE:
FOR NOTES SEE DRAWING BSFR-9

REVISION	DATE	DESCRIPTION	BY	CHKD

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
SUBMITTED
APPROVED
DATE

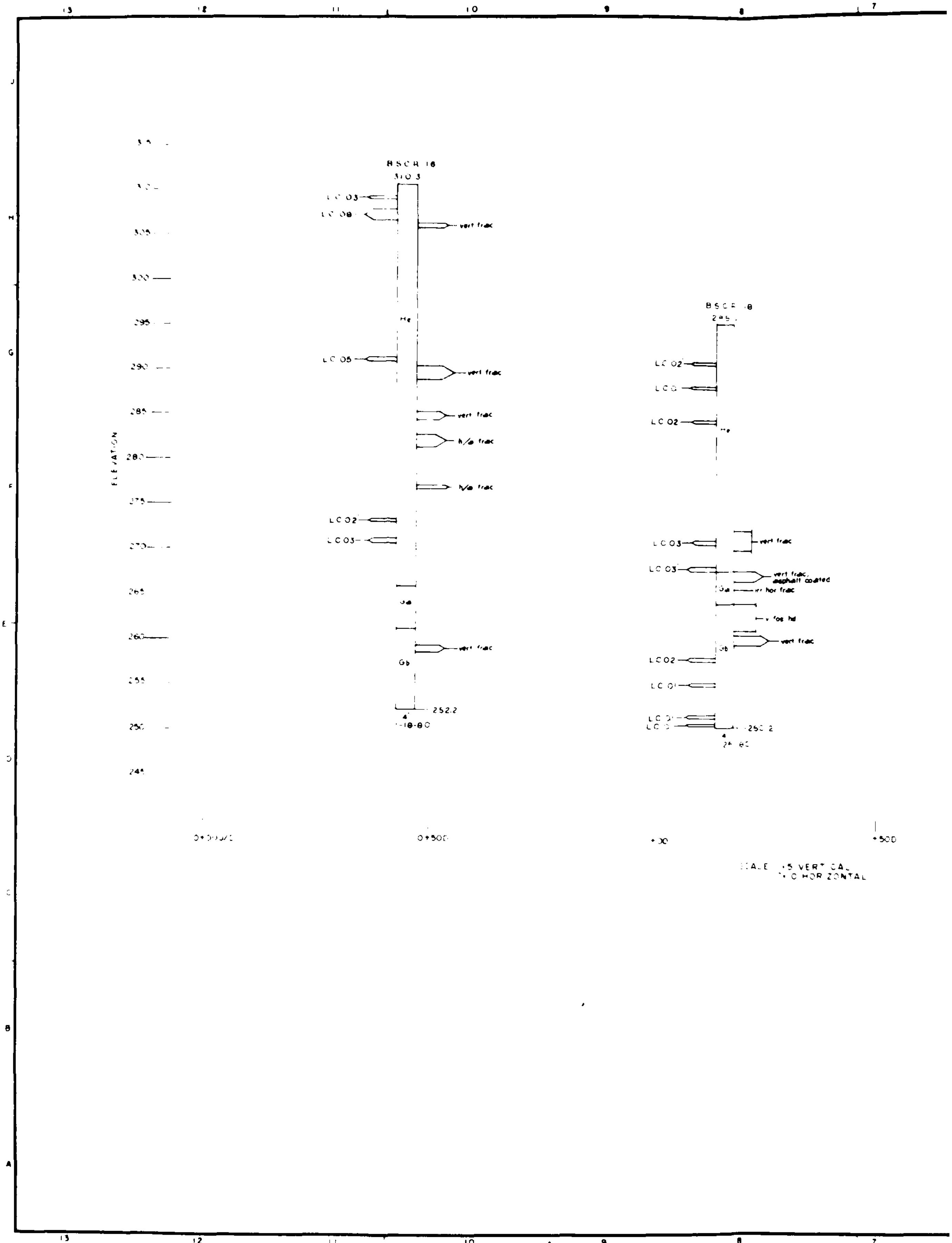
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

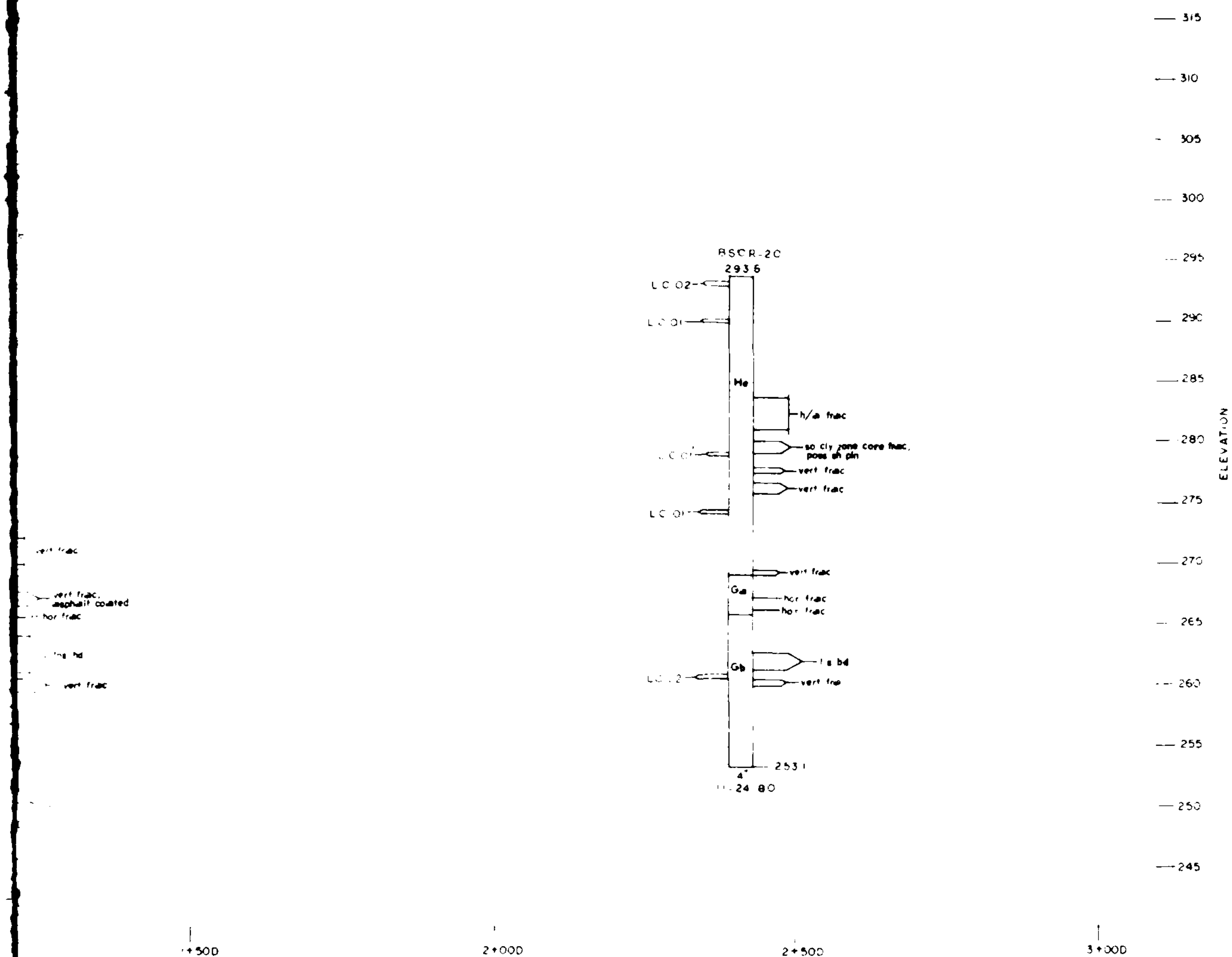
LOGS OF BORINGS

SCALE 1" = 5'

DRAWING NUMBER
BSFR-16

SHEET OF


BSCR 18
310.3
LC 03
LC 08
vert frac
LC 05
vert frac
vert frac
h/a frac
h/a frac
LC 02
LC 03
Ga
Gb
vert frac
252.2
4
ELEVATION
305
300
295
290
285
280
275
260
BSCR 18
LC 02
LC 02
LC 03
vert frac
LC 03
vert frac, asphalt coated
hor frac
vert frac
LC 02
0+500
+500



5 VERTICAL
10 HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

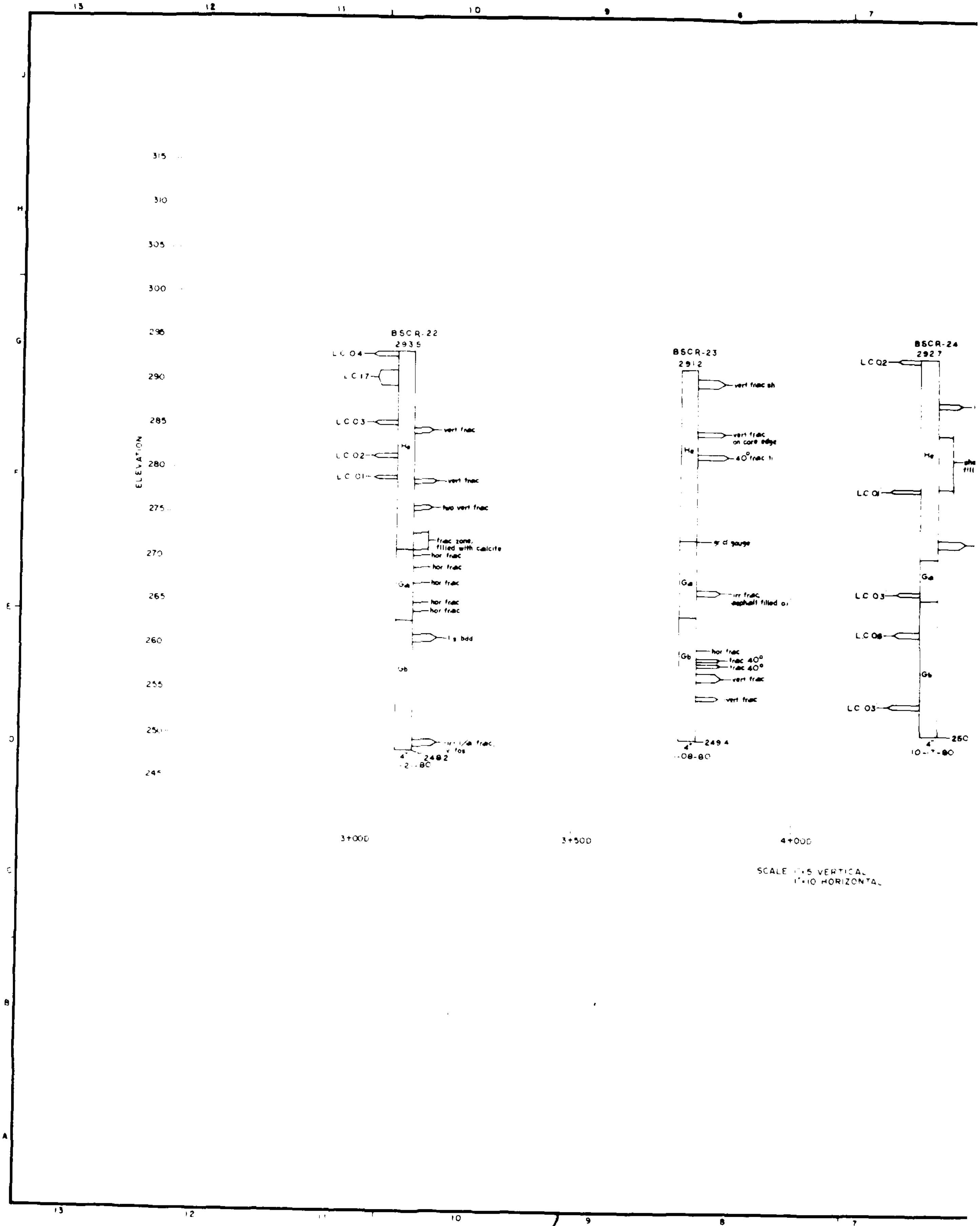
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

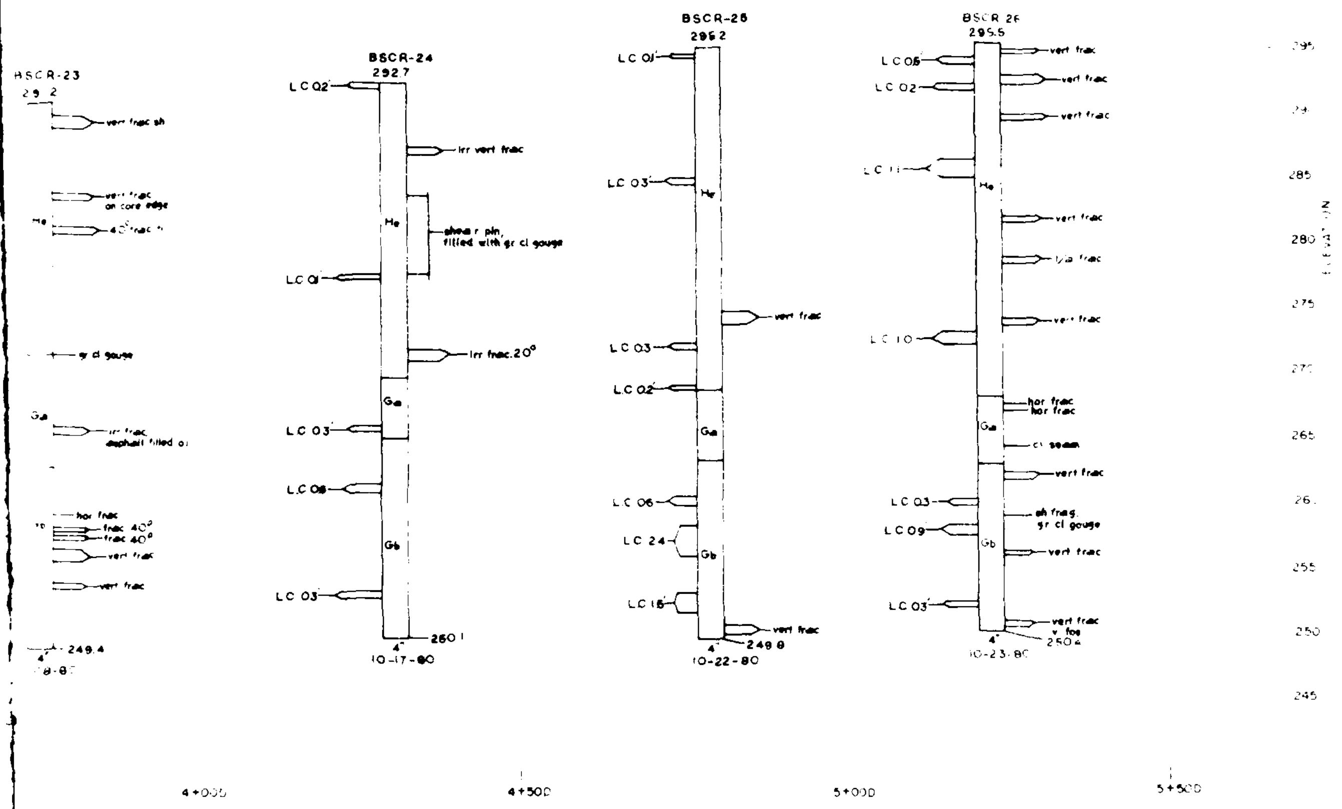
LOGS OF BORINGS

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF ENGINEERING DIVISION
APPROVED
COLONEL C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC NO
DRAWING NUMBER
BSFR-17
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

2



ELEVATION
315
310
305
300
295
290
285
280
275
270
265
260
255
250
245
BSCR-22
293.5
LC 04
LC 17
LC 03
LC 02
LC 01
vert frac
vert frac
two vert frac
frac zone, filled with calcite
hor frac
hor frac
hor frac
hor frac
hor frac
Ga
Gb
248.2
BSCR-23
291.2
vert frac
on core edge
40° frac
gr cl gouge
Ga
irr frac
asphalt filled
hor frac
frac 40°
frac 40°
vert frac
vert frac
Gb
249.4
BSCR-24
292.7
LC 02
LC 01
Ga
LC 03
LC 08
Gb
LC 03
250
10-17-80
3+000
3+500
4+000
SCALE 1"=5 VERTICAL
1"=10 HORIZONTAL



SCALE 1"=5' VERTICAL
1"=10' HORIZONTAL

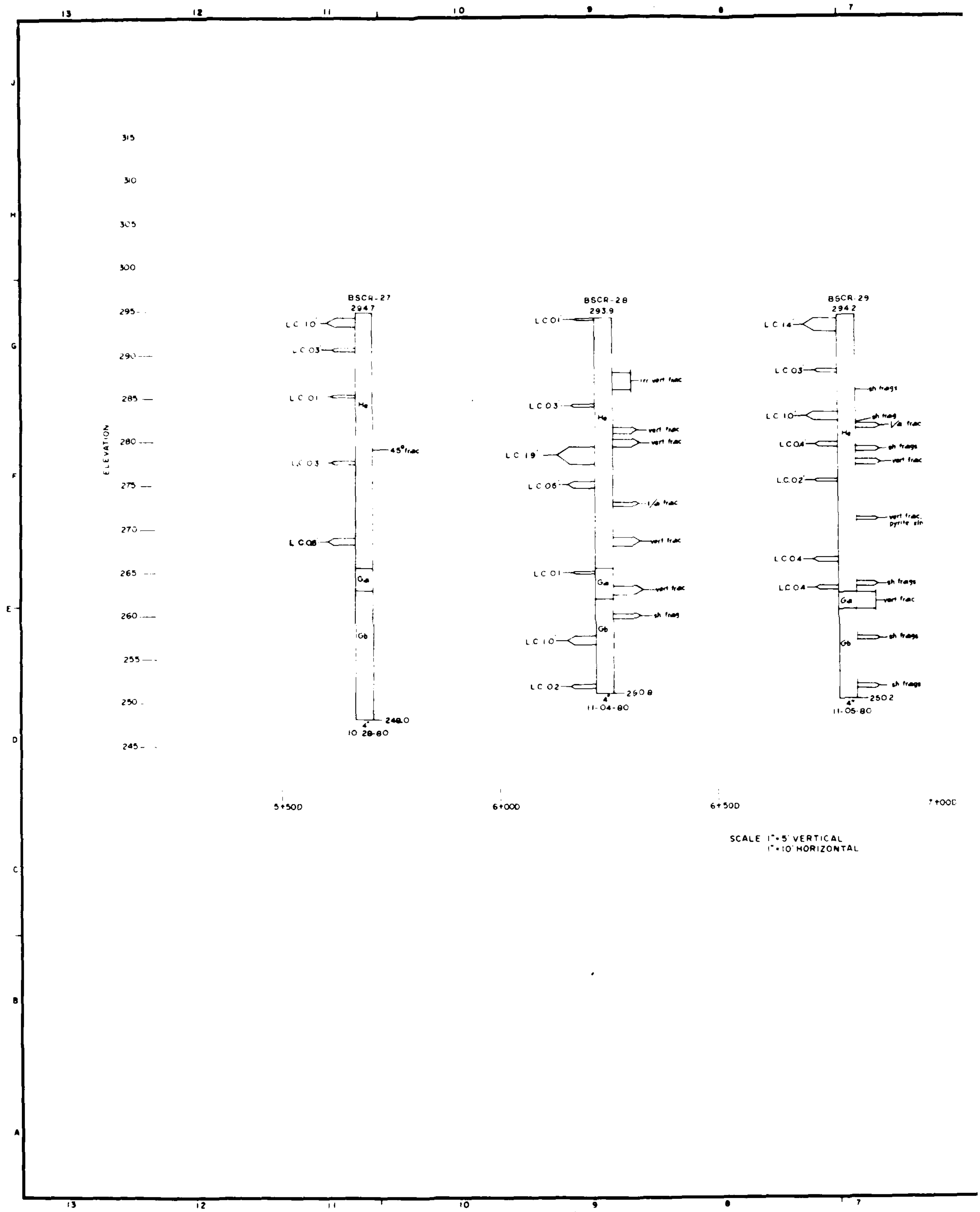
NOTE:
FOR NOTES SEE DRAWING BSFR-19

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

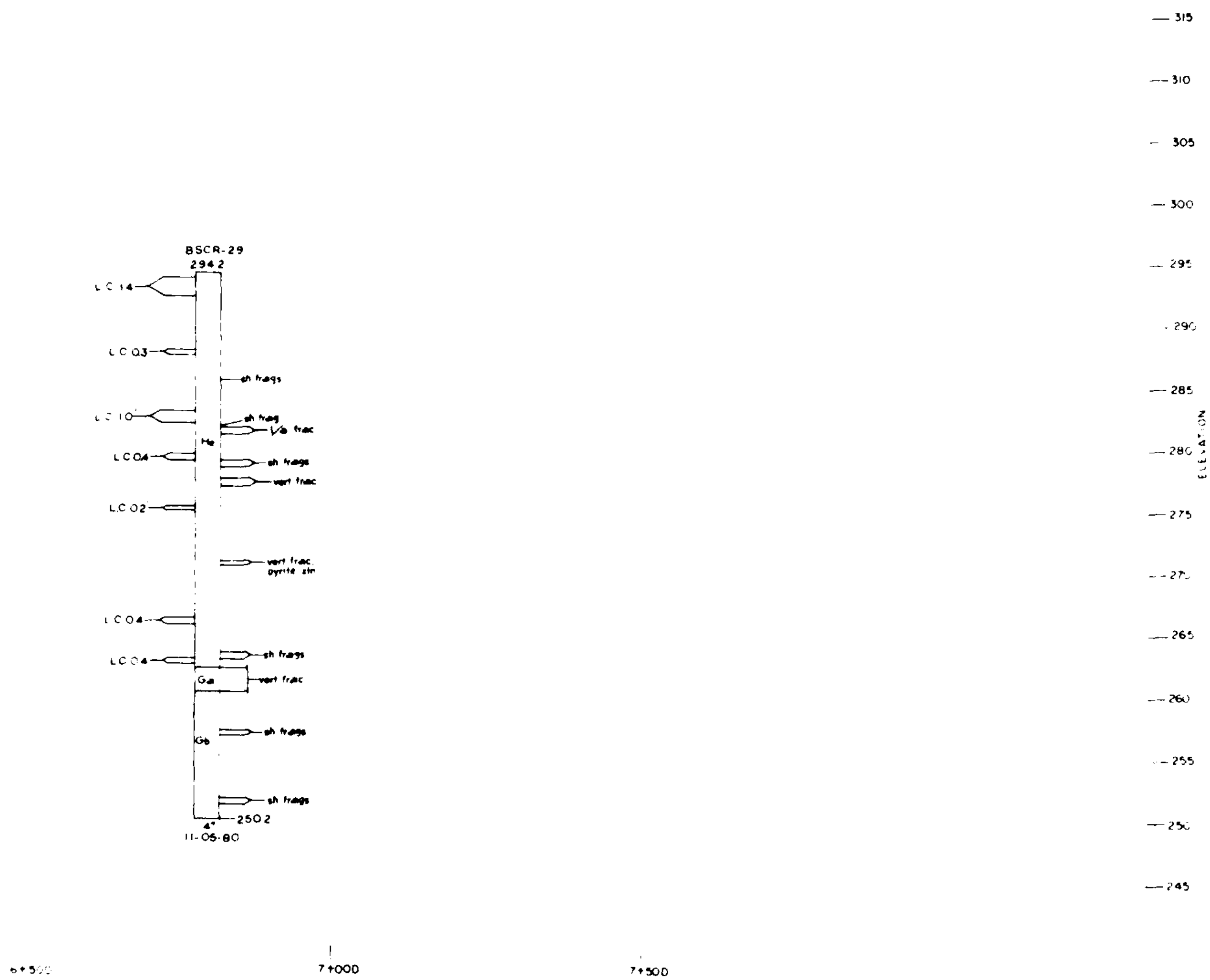
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

DRAWING NUMBER
BSFR-18



ELEVATION
315
310
305
300
295
290
285
280
275
270
265
260
255
250
245
BSCR-27
294.7
LC 1.0'
LC 0.3'
LC 0.1'
He
45° frac
LC 0.3'
LC 0.8'
Ga
Gb
4"
248.0
10-28-80
BSCR-28
293.9
LC 0.1'
irr vert frac
LC 0.3'
He
vert frac
vert frac
LC 1.9'
LC 0.6'
1/a frac
vert frac
LC 0.1'
Ga
vert frac
sh frag
Gb
LC 1.0'
LC 0.2'
4"
250.8
11-04-80
BSCR-29
294.2
LC 1.4'
LC 0.3'
sh frags
LC 1.0'
sh frag
V/a frac
He
LC 0.4'
sh frags
vert frac
LC 0.2'
vert frac, pyrite stn
LC 0.4
LC 0.4
sh frags
Ga
vert frac
sh frags
Gb
sh frags
4"
250.2
11-05-80
5+500
6+000
6+500
7+000
SCALE 1" = 5' VERTICAL
1" = 10' HORIZONTAL



SCALE 1"=5 VERTICAL
1"=10 HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR-9

SYMBOL	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

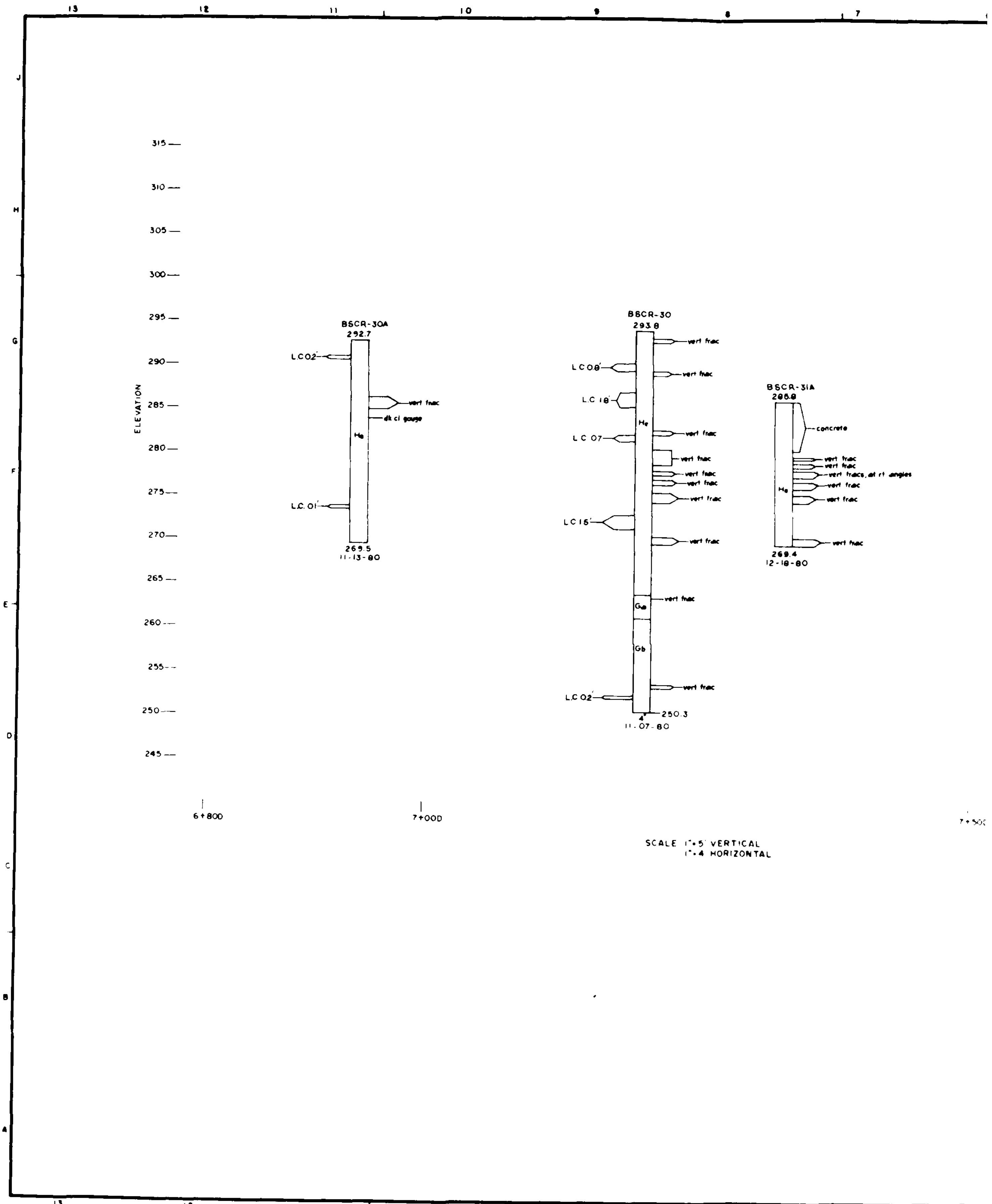
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

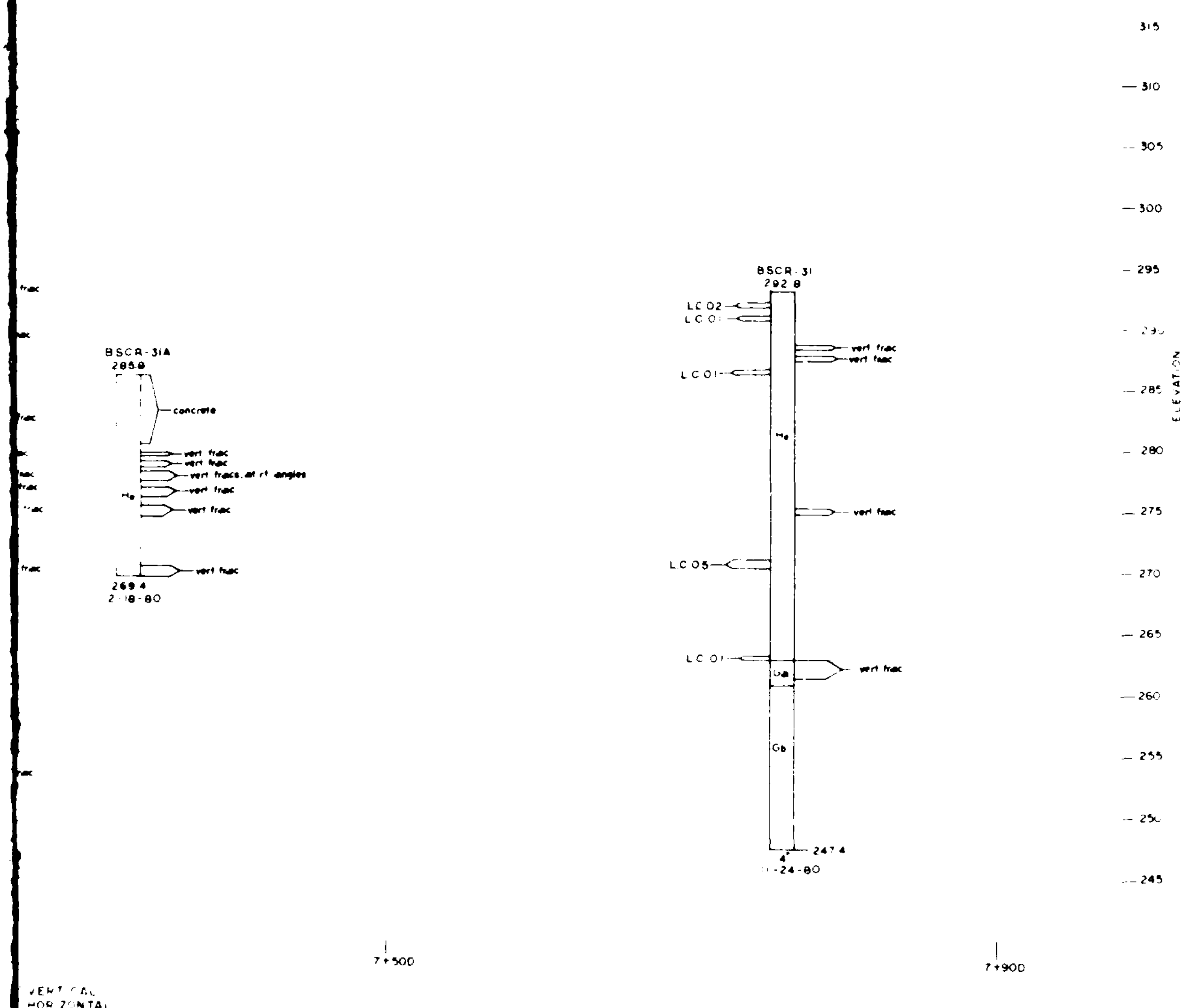
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC NO
DRAWING NUMBER
BSFR-19
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



ELEVATION
315
310
305
300
295
290
285
280
275
270
265
260
255
250
245
BSCR-30A
292.7
LC 02'
vert frac
dk cl gouge
He
LC 01'
269.5
11-13-80
BSCR-30
293.8
LC 08'
LC 18'
LC 07
LC 15'
LC 02'
vert frac
He
Ga
Gb
250.3
11-07-80
BSCR-31A
288.9
concrete
vert fracs, at rt angles
269.4
12-18-80
6+800
7+000
7+500
SCALE 1"=5' VERTICAL
1"=4' HORIZONTAL



NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

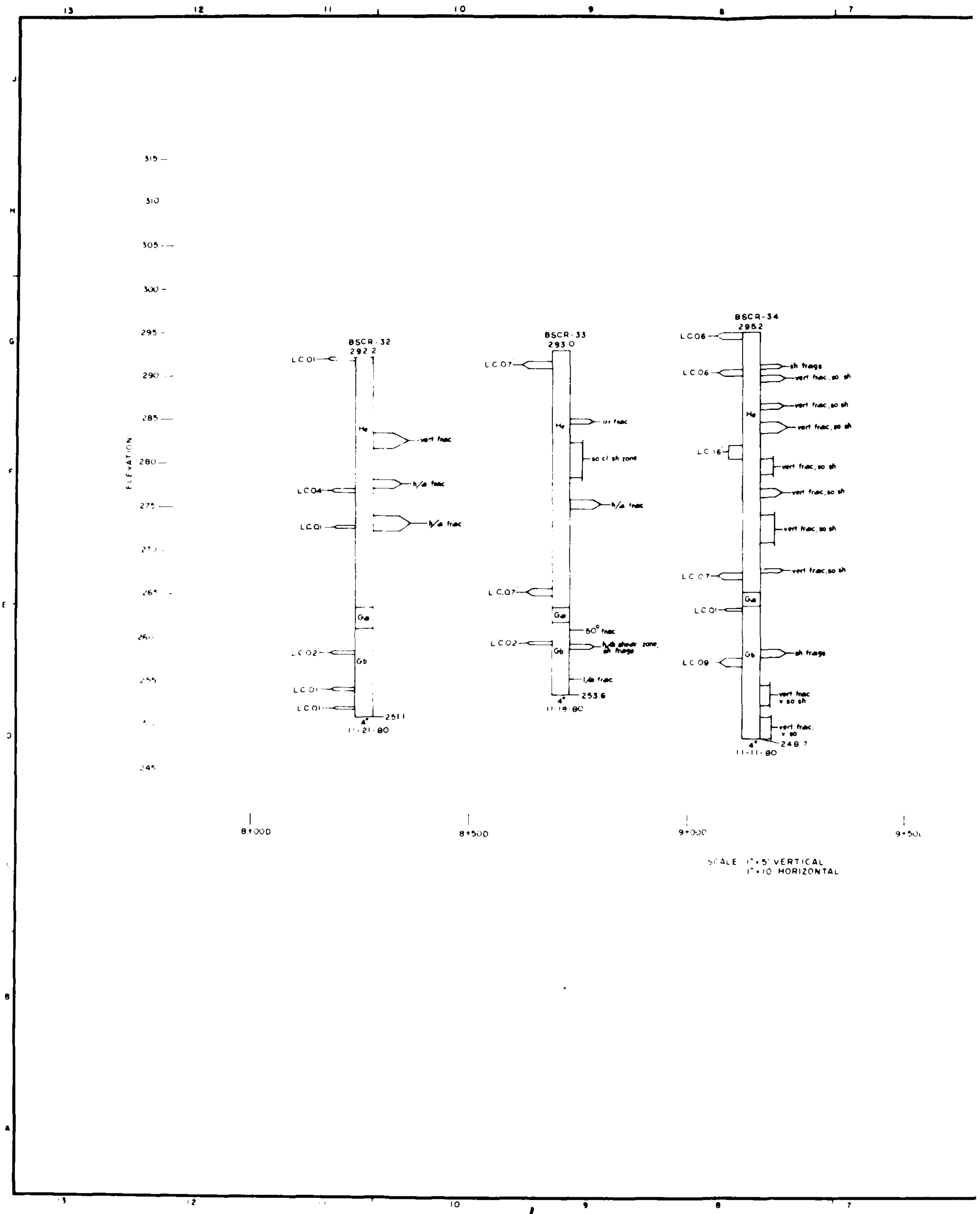
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

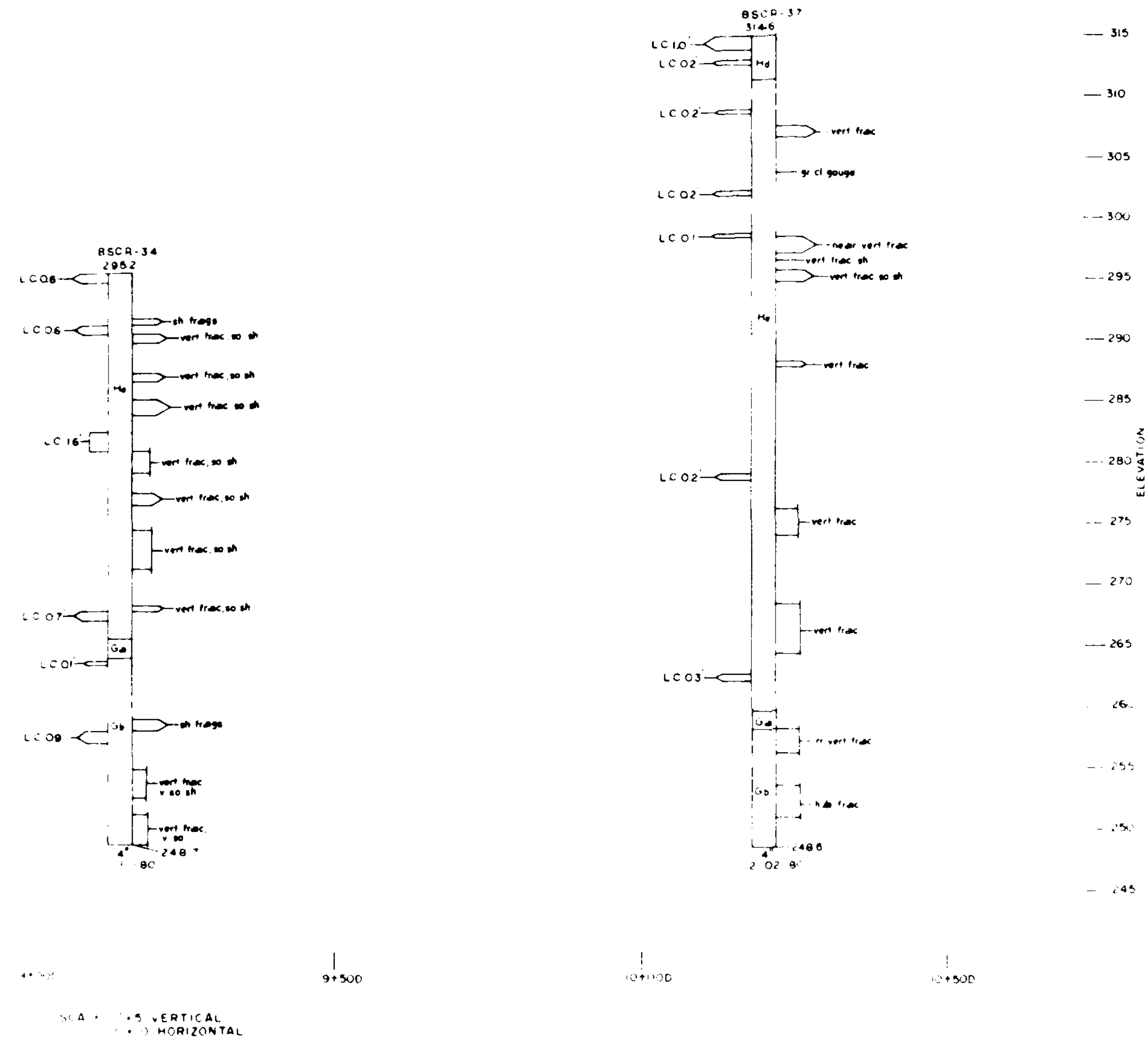
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
APPROVED
COLONEL, C. E. DISTRICT ENGINEER
SCALE
SPEC. NO.
DRAWING NUMBER
BSFR-20
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATE



BSCR-32
292.2
BSCR-33
293.0
BSCR-34
296.2
ELEVATION
8+000
8+500
9+000
9+50
SCALE 1"=5' VERTICAL
1"=10 HORIZONTAL



NOTE
FOR NOTES, SEE DRAWING BSFR-9

REVISION | DATE | ZONE AND DESCRIPTION | BY | CHKD

GRAPHIC SCALE

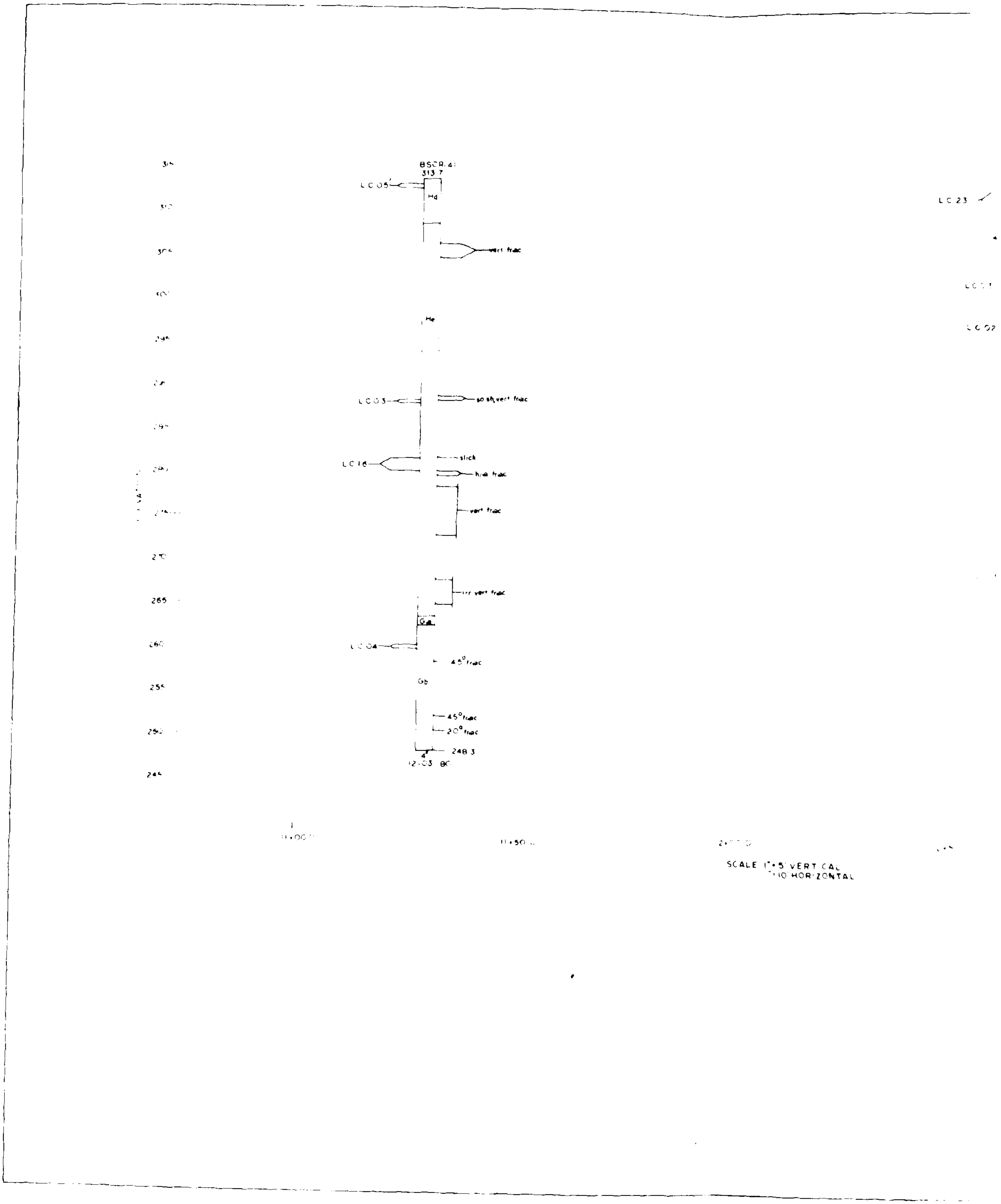
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

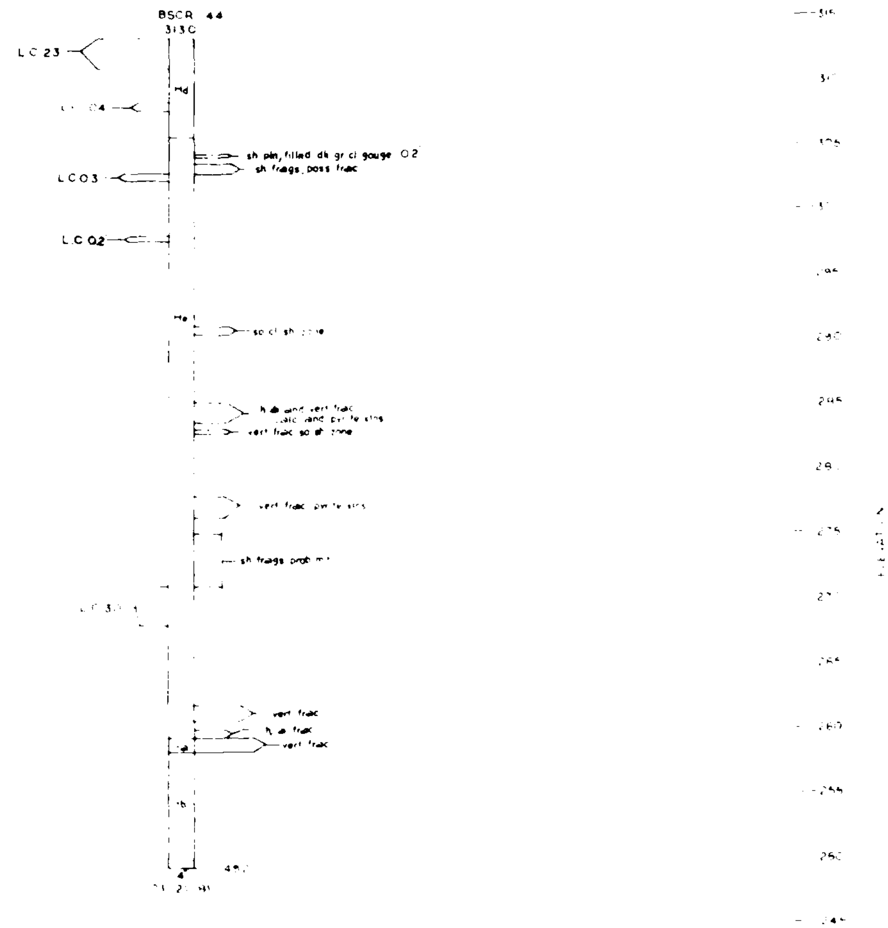
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LOGS OF BORINGS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
SCALE
SPEC NO
DRAWING NUMBER
BSFR-21
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



BSCR-41
313.7
LC05
Hd
vert frac
He
LC03
so sh vert frac
LC16
slick
h/e frac
vert frac
irr vert frac
Ga
LC04
45° frac
Gb
45° frac
20° frac
248.3
12-03-80
265
LC23
SCALE 1"=5' VERTICAL
1"=10' HORIZONTAL



2+50

3+00

SCALE 1"=5' VERTICAL
HORIZONTAL

NOTE
FOR NOTES, SEE DRAWING BSFR 9

REVISION | DATE | DESCRIPTION | BY

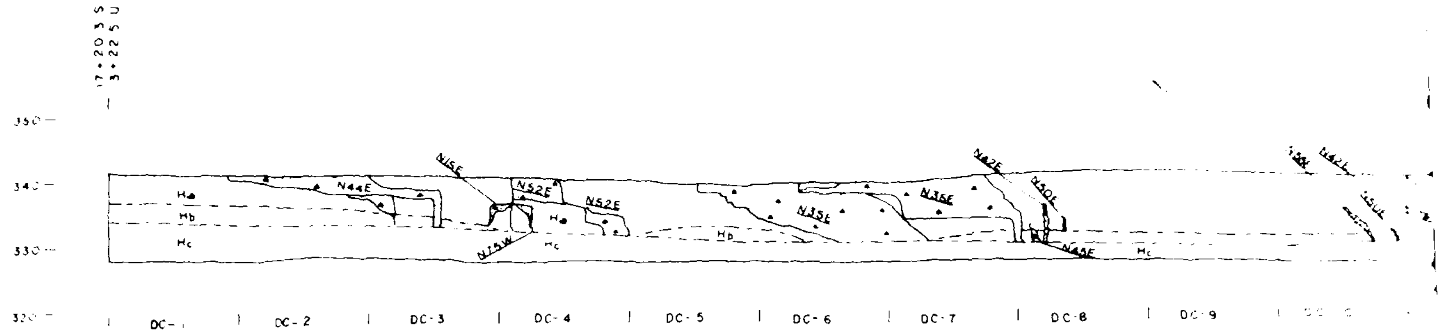
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

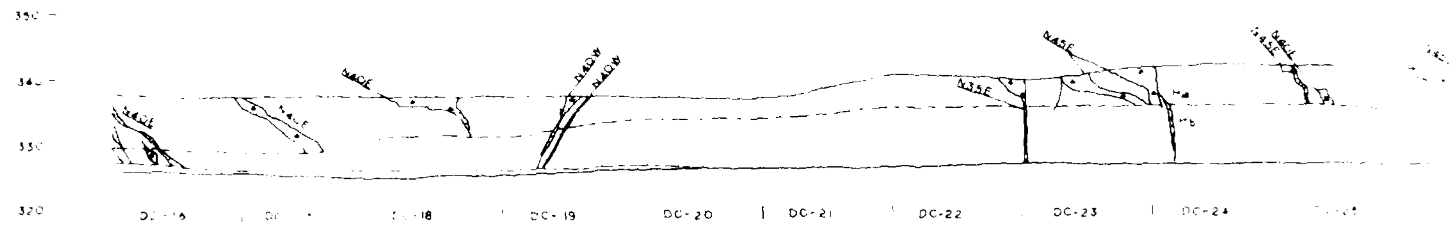
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

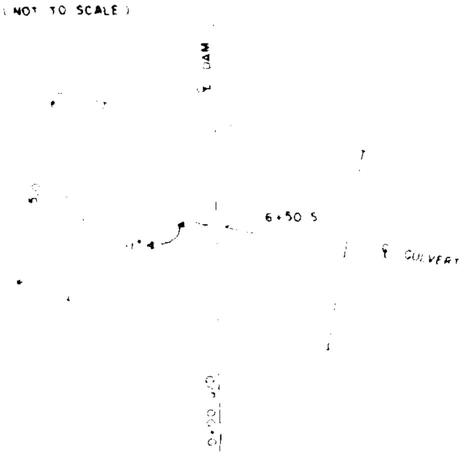
LOGS OF BORINGS

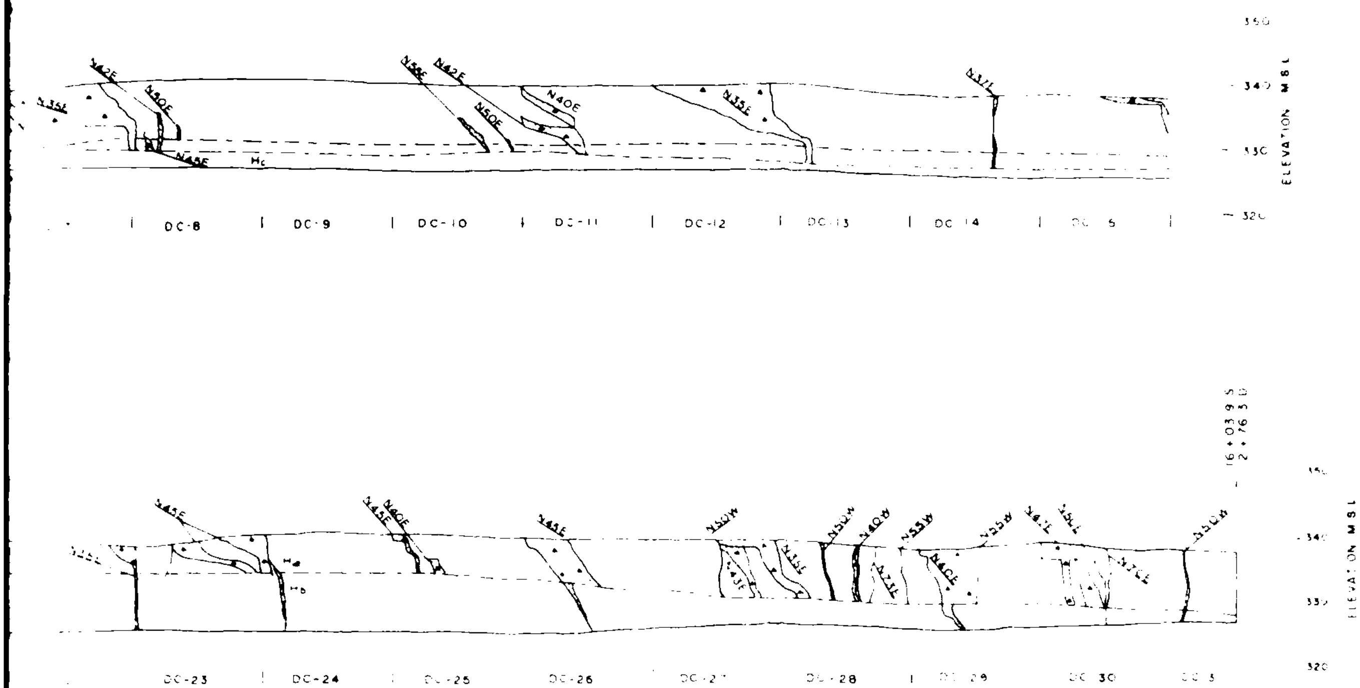
SUBMITTED
APPROVAL RECOMMENDED
ENGINEERING DIVISION
APPROVED
COLONEL, DISTRICT ENGINEER
SCALE
DRAWING NUMBER
DATE
SHEET





DC-17 PLAN VIEW
(NOT TO SCALE)





NOTES:
1. CULVERT END STATIONS ARE FOR BOTTOM OF 4 V on 1 H SLOPE
2. FOR LOCATION PLAN SEE DRAWING TTBS 9/6
3. ELEVATIONS SHOWN REFER TO MEAN SEA LEVEL

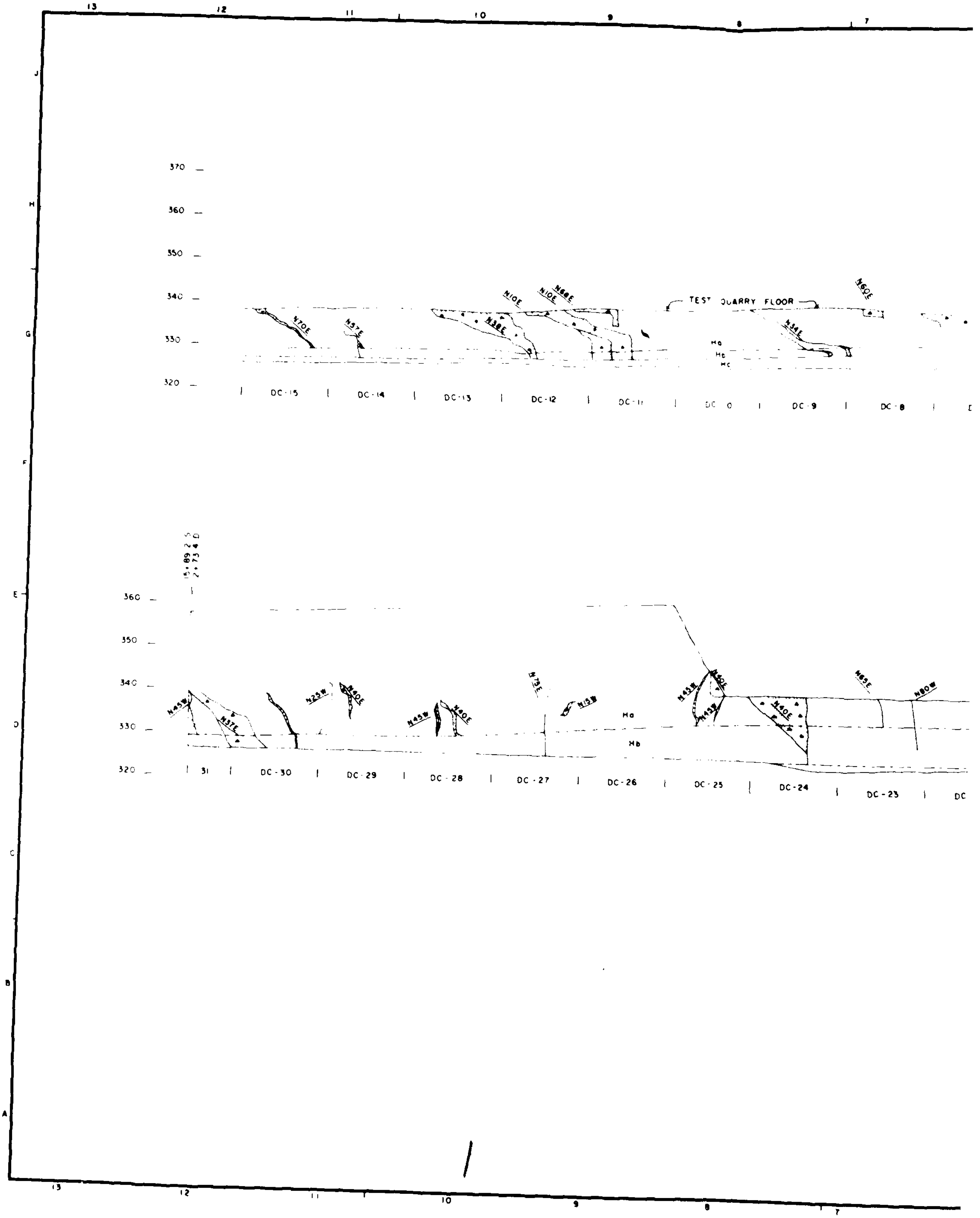
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
DIVERSION CULVERT FOUNDATION
LEFT WALL

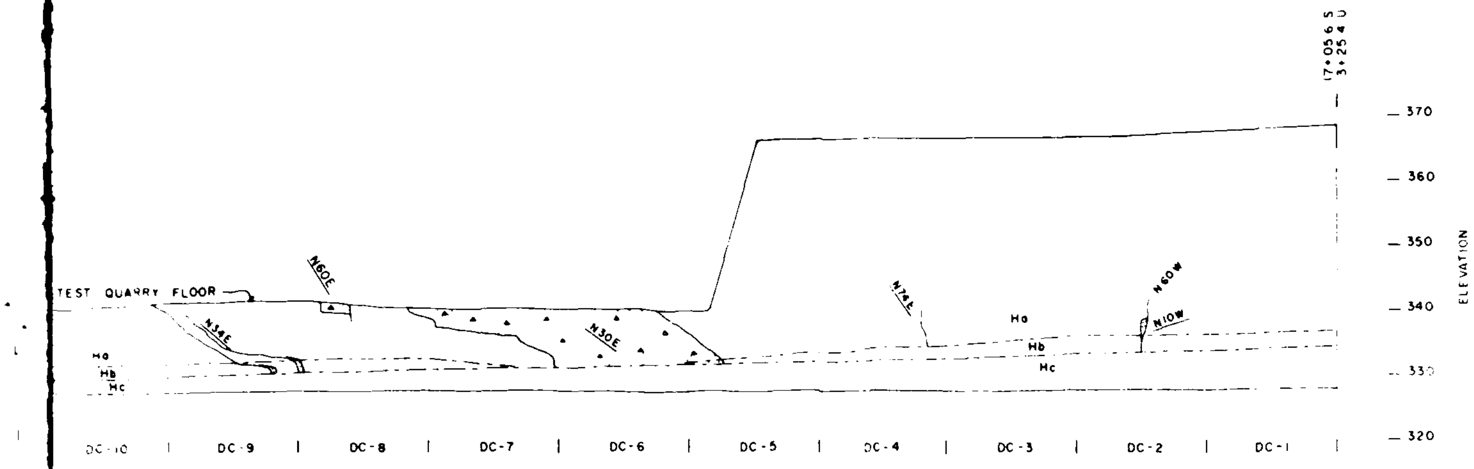
SCALE 1" = 10'
DRAWING NUMBER
BSFR-23

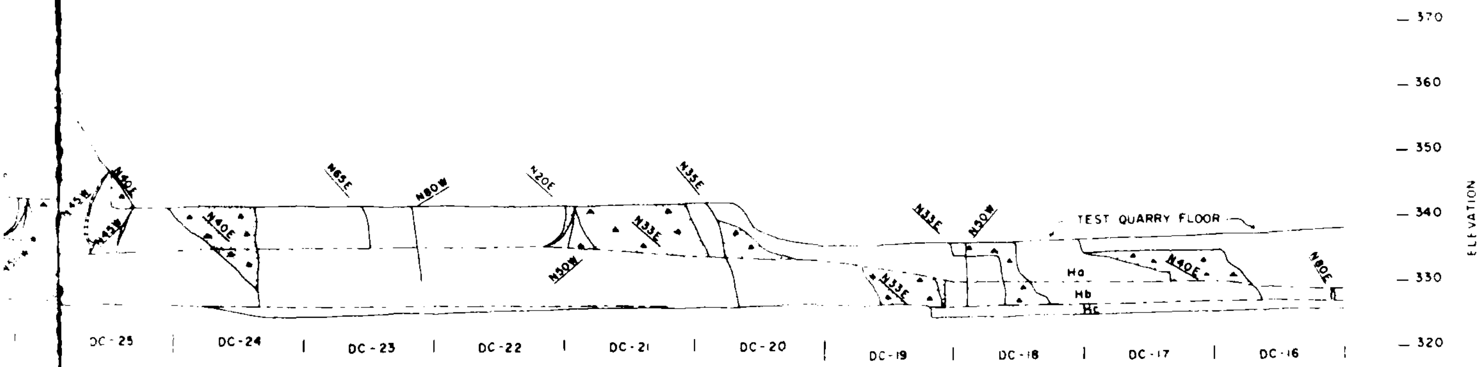
RECORD DRAWING AS CONSTRUCTED DATED

2



370
360
350
340
330
320
TEST QUARRY FLOOR
N70E
N37E
N38E
N10E
N68E
N34E
N60E
Ha
Hb
Hc
DC-15
DC-14
DC-13
DC-12
DC-11
DC-9
DC-8
15+89.25
2+73.40
N45W
N37E
N25W
N40E
N73E
N15W
N50E
N65E
N80W
DC-30
DC-29
DC-28
DC-27
DC-26
DC-25
DC-24
DC-23





NOTES
1 CULVERT END STATIONS ARE FOR BOTTOM OF 4 V on 1 H SLOPE
2 FOR NOTES, SEE DRAWING BSFR-23

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

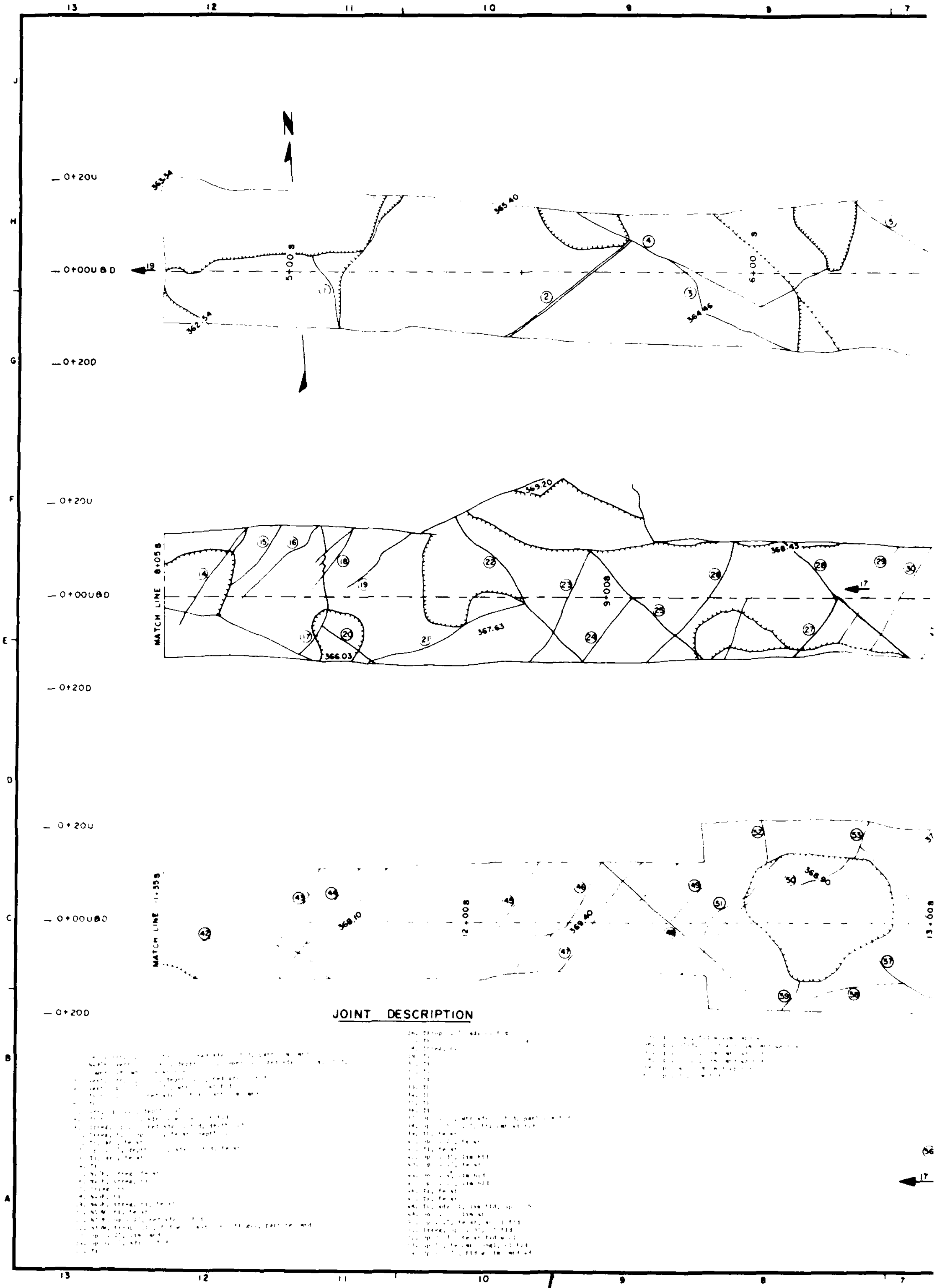
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

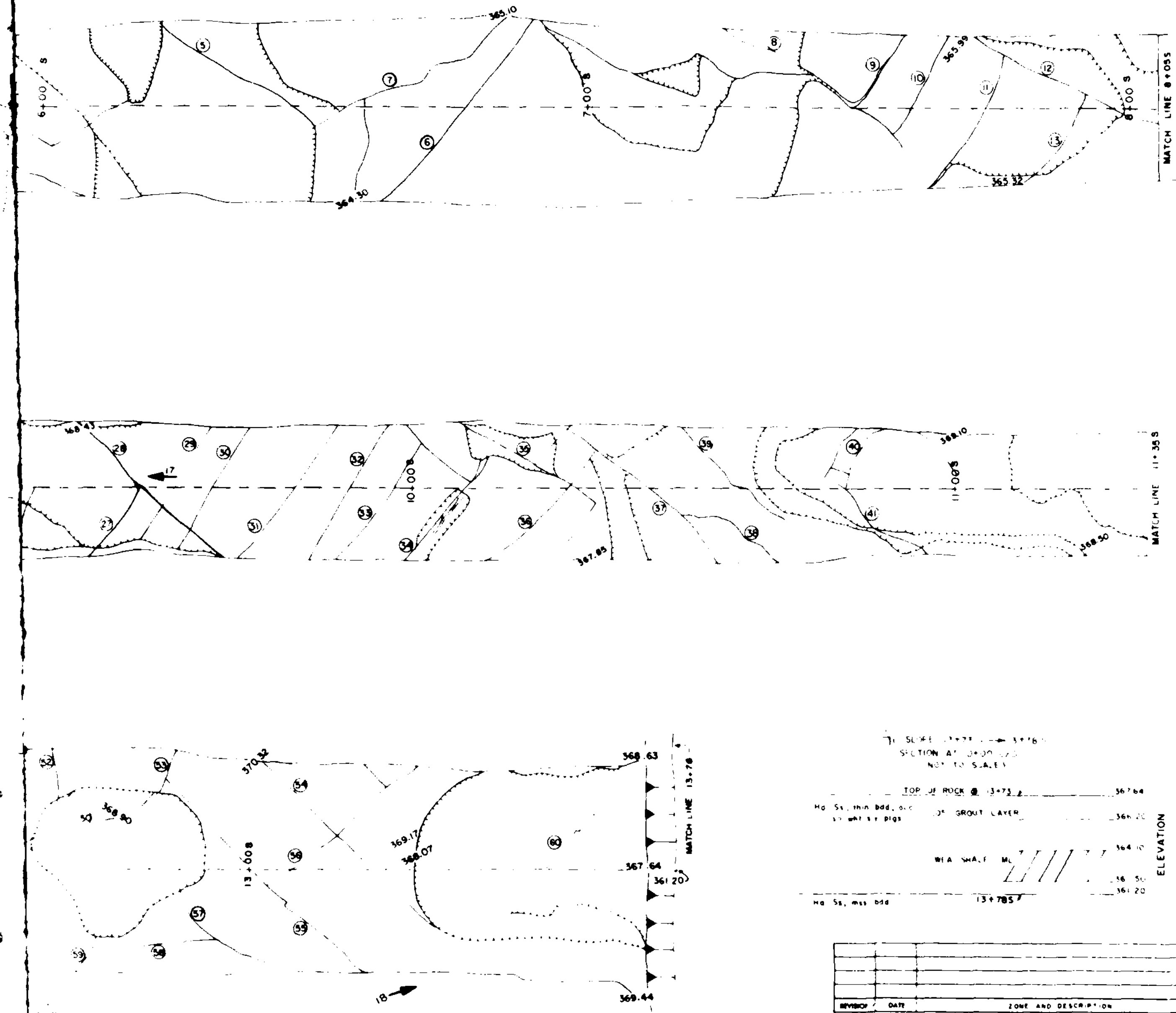
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
DIVERSION CULVERT FOUNDATION
RIGHT WALL

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-24
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



13 12 11 10 9 8 7
J H G F E D C B A
N
0+20U
0+00UBD
0+20D
5+00B
6+00
363.34
365.40
362.34
364.46
MATCH LINE 8+05B
9+00B
369.20
368.45
367.63
366.03
MATCH LINE 11+35B
12+00B
13+00B
368.10
369.40
368.90
JOINT DESCRIPTION



NOTES
1 PHOTOGRAPHS ARE LOCATED IN APPENDIX E
2 ELEVATIONS SHOWN REFER TO MEAN SEA LEVEL

LEGEND

(54) JOINT NO

←17 PHOTO NO AND ORIENTATION

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

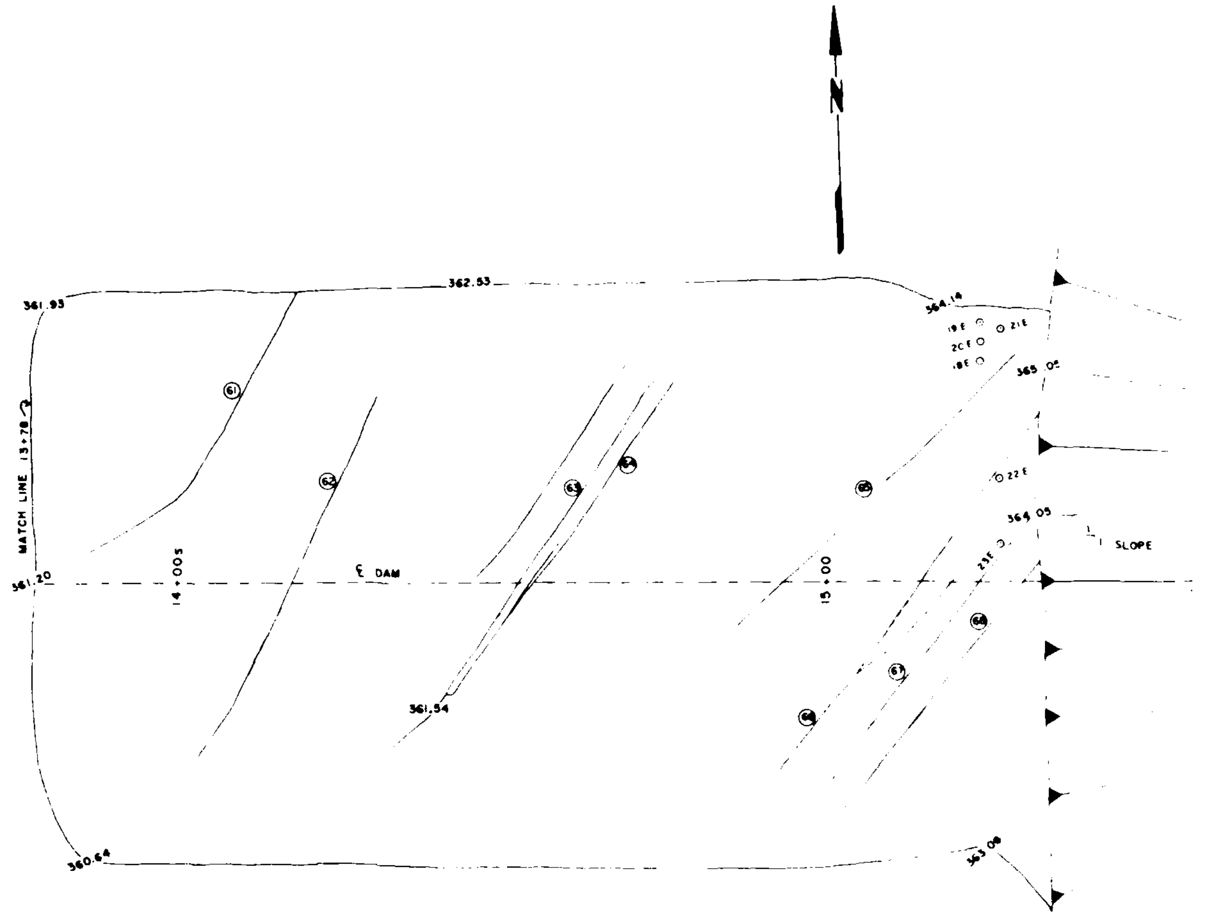
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

IMPERVIOUS CORE FOUNDATION
STA 4+70 to 13+78

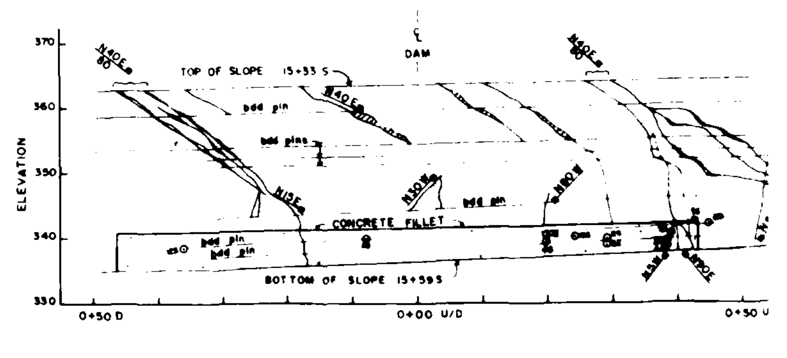
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-25
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

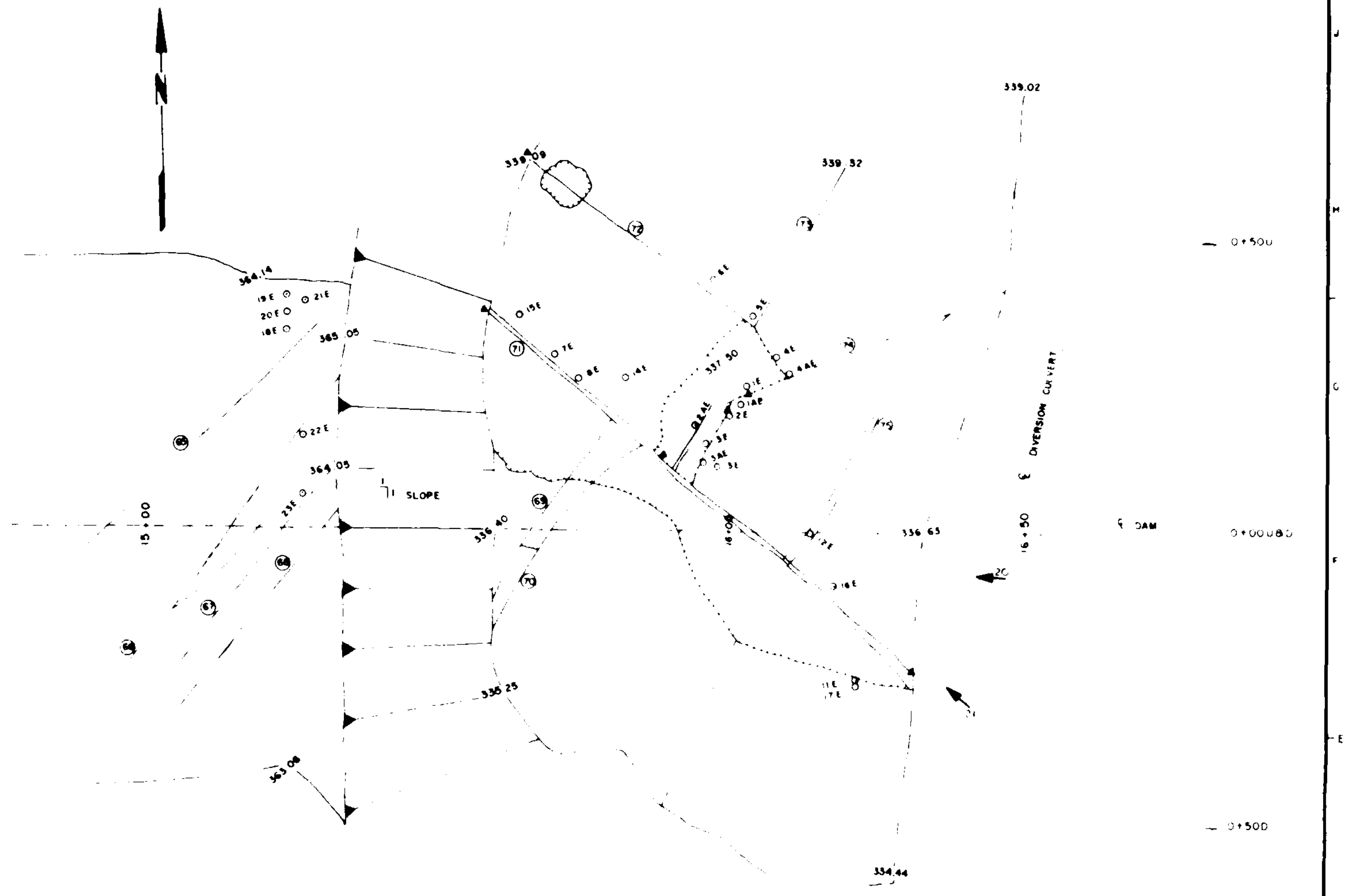


JOINT DESCRIPTION

61 Ti fe st
62 Ti
63 Op 0 05 fe hlo
64 Op 0 05 fe hlo
65 Ti fe st
66 Ti fe st
67 Ti fe st
68 Ti fe st
69 Irr op 0 02 part so cl flo
70 Irr op 0 02 fe st part so cl flo
71 Ti - op 0 55 red sdy cl flo
72 Op 0 03 cl flo
73 Op 0 02 cl flo
74 Op 0 05 so cl flo water flow
75 Op 0 02 cl flo

1:1 SLOPE
15+33 - 15+59 S

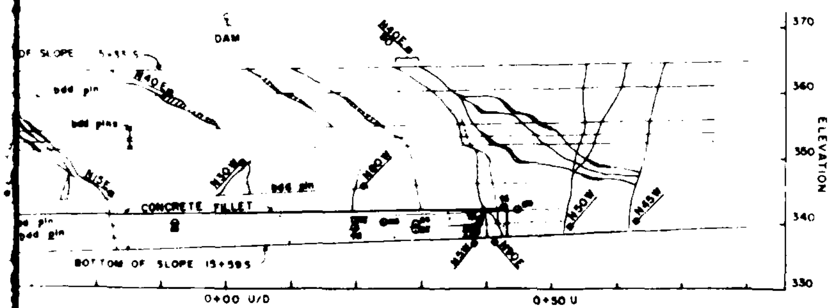




LEGEND

- (71) JOINT NO.
- ○ ADDED GROUT HOLES
- ▲ POINTS OF WATER FLOW
- PHOTO NO. AND ORIENTATION

SLOPE
15+33 – 15+59 S



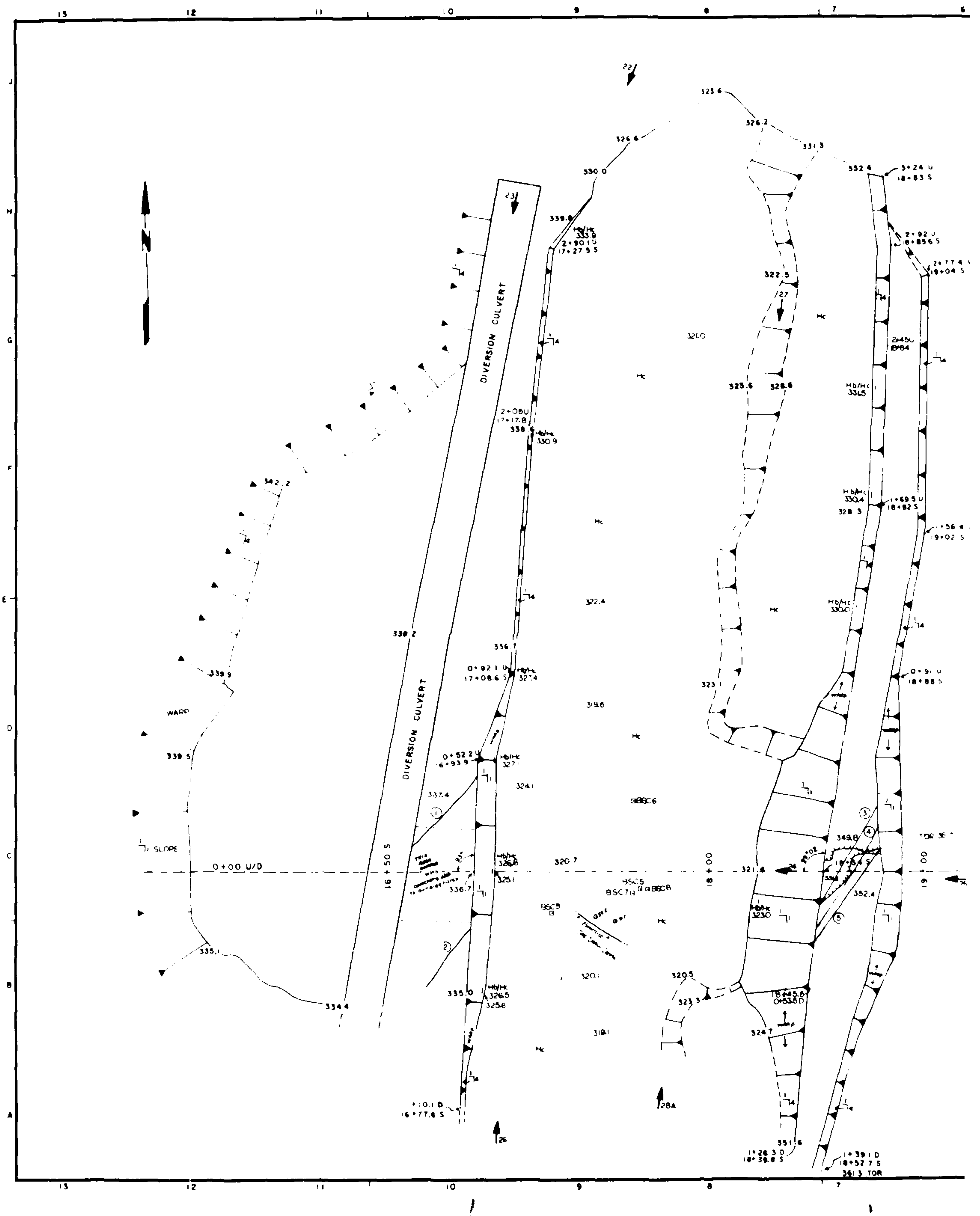
NOTE
FOR NOTES, SEE DRAWING BSFR-25

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

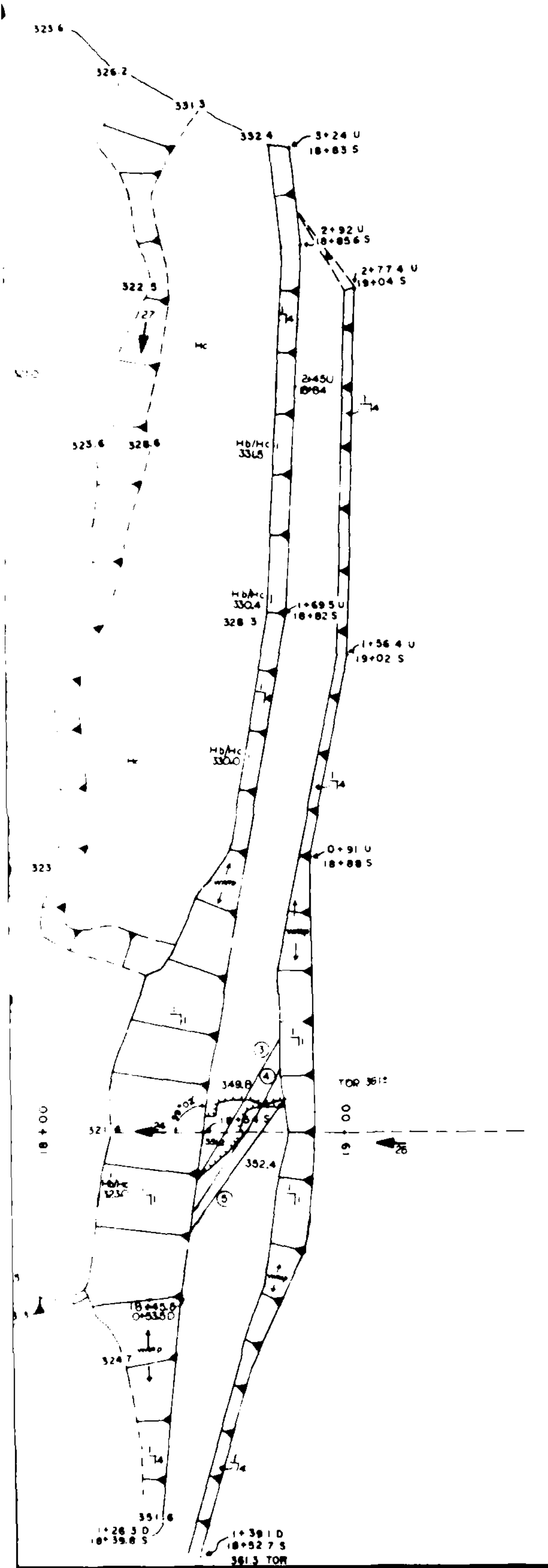
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
IMPERVIOUS CORE FOUNDATION
STA 13+78 to 16+50

SCALE 1" = 10'

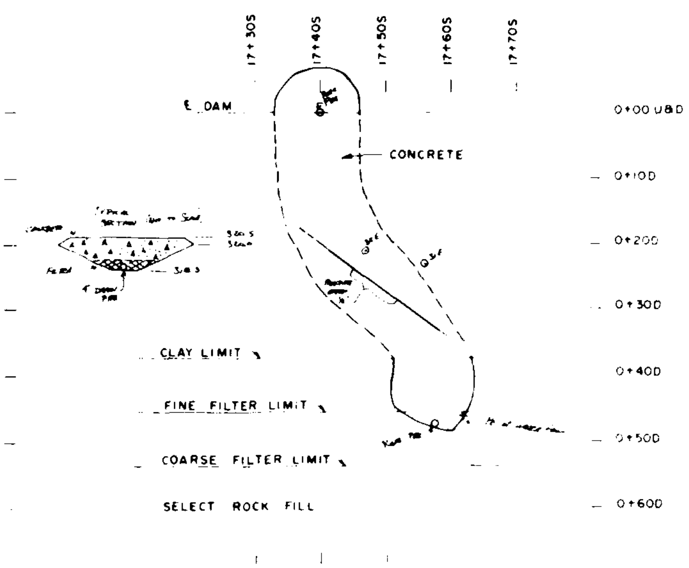
BSFR-26



DIVERSION CULVERT
DIVERSION CULVERT
WARP
SLOPE
0+00 U/D
16+50.5
18+00
19+00
TOR
Hb/Hc
Hc



DRAIN DETAIL - PLAN AND SECTION



JOINT DESCRIPTION

1 T, lt fe st
2 T, lt fe st
3 T, fe st
4 T to sl op, m fld
5 T to sl op, m fld

NOTES

1 PHOTOGRAPHS ARE LOCATED IN APPENDIX E
2 FOR ABBREVATIONS SEE CONTRACT DRAWING TTBS 3/1, BORING LEGEND
3 FOR LOGS OF BORINGS, SEE DRAWINGS BSFR-10 AND BSFR-11
4 ALL ELEVATIONS REFER TO MEAN SEA LEVEL

LEGEND

○ ADDED GROUT HOLES
⊡ 4 CORE HOLES
↑2 PHOTO NO AND ORIENTATION
(3) JOINT NO

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN HAL
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
EMBANKMENT FOUNDATION - MACKEYS CREEK CROSSING
STA 15+59 to 18+90

SUBMITTED

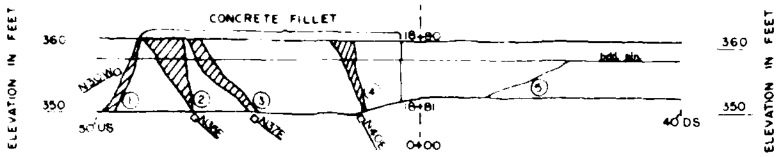
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE

SCALE 1" = 20'
SPEC NO
DRAWING NUMBER
BSFR-27
SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED

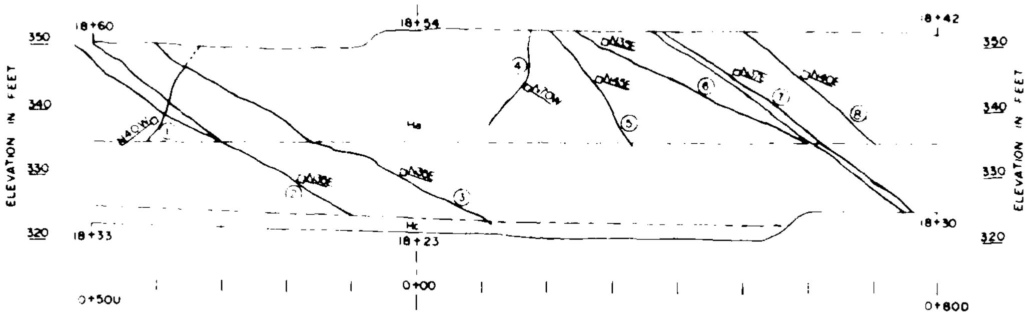
℄ SLOPE
18+90 - 18+81



JOINT DESCRIPTION

1 Qu 2 0 no fnd cr fld part fill nio
2 Qu 0 25 fill nid e pockets ut t or sd
3 Qu 0 04 fill nio
4 Qu 0 2 no fnd cr fld
5 T.

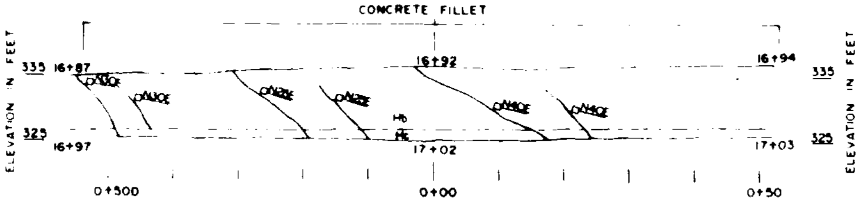
℄ SLOPE
18+54 - 18+23



JOINT DESCRIPTION

1 Ti
2 Ti fe st
3 Ti fe st
4 Ti fe st
5 Ti fe st
6 Ti fe st
7 Ti to st op fill fld
8 Ti to st op fe st

℄ SLOPE
16+92 - 17+02

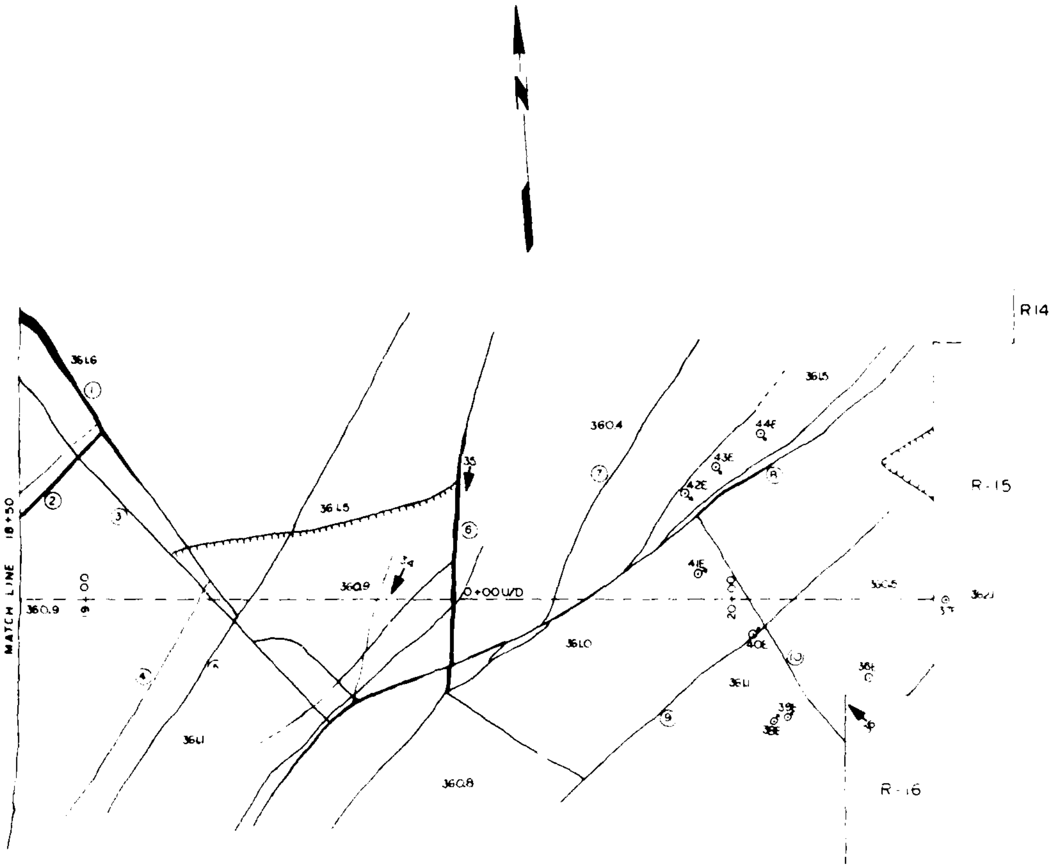


JOINT DESCRIPTION

ALL JTS TI, LT FE ST

NOTES

1 FOR LOCATION OF SLOPE SEE DRAWING BSFR 2?
2 PHOTOGRAPHS ARE LOCATI
3 FOR ABBREVIATIONS SEI
4 ALL ELEVATIONS REFER



JOINT DESCRIPTION

1. Op 1.8' to [illegible] and [illegible] part [illegible] cleaned to depth of 8' and backfilled with concrete
2. Op 4' [illegible] cleaned to depth of 1' and backfilled with concrete
3. Op 0.01' [illegible] some ss frags [illegible]
4. T[illegible] fe st
5. T[illegible] fe st
6. [illegible] op 0.2' [illegible] and ss frags [illegible]
7. [illegible]
8. [illegible] op .05' to 2' [illegible] and ss frags [illegible] pressure grouted [illegible] due to water take during cleanup
9. [illegible] fe st
10. Op 0.1' [illegible] coating heavy fe st pressure grouted [illegible] due to water take during cleanup

LEGEND

(7) JOINT NO

○ ADDED GROUT HOLES

↑ PHOTO NO. AND ORIENTATION

NOTES

1. FOR LOCATION OF SLOPE FACE 18 + 545 [illegible] 18 + 735 AND 18 + 925 [illegible] + 025 SEE DRAWING BSFR 27
2. PHOTOGRAPHS ARE LOCATED IN APPENDIX E
3. FOR ABBREVIATIONS SEE BORING LEGEND ON CONTRACT DRAWING [illegible]
4. ALL ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	DESCRIPTION	BY	CHKD

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

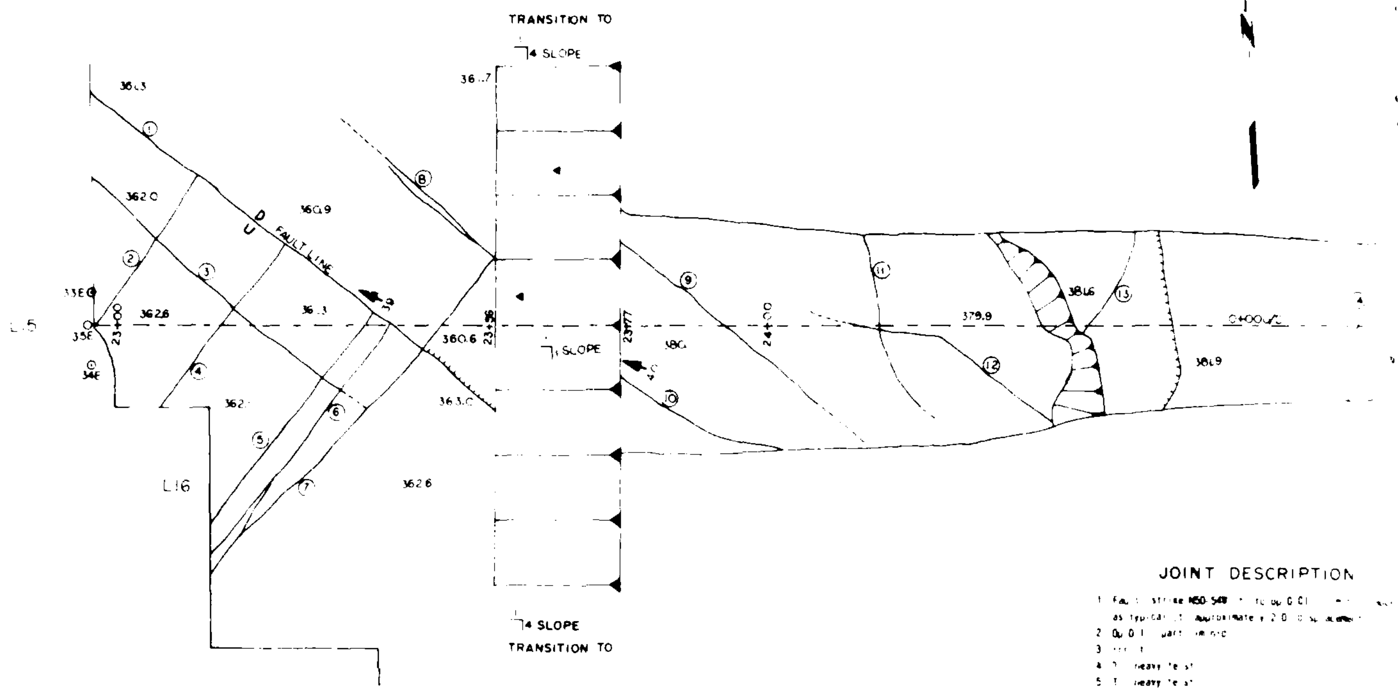
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

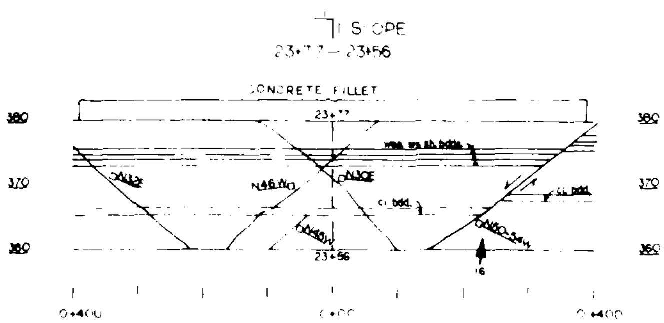
IMPERVIOUS CORE FOUNDATION
STA 18+90 TO 20+31

SCALE 1" = 10'

BSFR-28

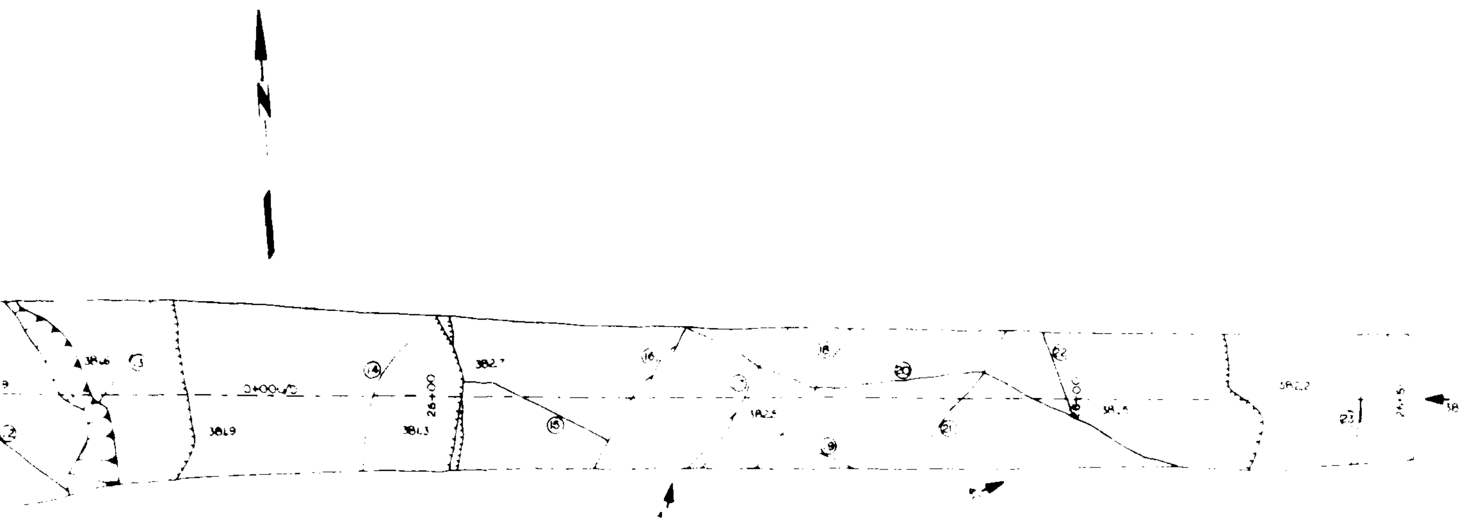
RECORD DRAWING AS CONSTRUCTED DATED





JOINT DESCRIPTION

1 Fault [illegible] strike N50-54W [illegible] to op 0.01 [illegible] as typical [illegible] approximately 2.0 [illegible]
2 Op 0.1 [illegible] part [illegible]
3 [illegible]
4 T [illegible] heavy [illegible]
5 T [illegible] heavy [illegible]
6 T [illegible] heavy [illegible]
7 T [illegible] heavy [illegible]
8 [illegible]
9 Op 0.05 [illegible] with some [illegible]
10 Continuation of [illegible] 8 op 0.05 [illegible]
11 [illegible]
12 Op 0.1 [illegible]
13 [illegible]
14 [illegible]
15 T
16 T [illegible] heavy [illegible]
17 [illegible] part op 0.02 [illegible] with heavy [illegible]
18 [illegible]
19 [illegible]
20 [illegible] op 0.03 [illegible] 0.05 [illegible] heavy [illegible] part [illegible]
21 [illegible]
22 T [illegible]
23 [illegible] to op 0.05 [illegible]



JOINT DESCRIPTION

1 Fault strike N50-54W [illegible] to op 0.01 [illegible] appears [illegible] approximately 2.0 [illegible] displacement
2 Op 0.1 [illegible]
3 [illegible]
4 [illegible] heavy fe st
5 [illegible] heavy fe st
6 [illegible] heavy fe st
7 [illegible] heavy fe st
8 [illegible]
9 Op [illegible] 0.05 [illegible] with some gy
10 Continuation of [illegible] 8 op 0.05 [illegible]
11 [illegible]
12 Op 0 [illegible]
13 [illegible]
14 [illegible]
15 [illegible]
16 [illegible] heavy fe st
17 [illegible] op 0.02 [illegible] sdy [illegible] and [illegible] ends [illegible] with heavy fe st
18 [illegible] fe st
19 [illegible]
20 [illegible] op 0.03 [illegible] 0.05 [illegible] sdy [illegible] heavy fe st [illegible]
21 [illegible] fe st
22 [illegible] e st
23 [illegible] to op 0.05 [illegible]

LEGEND

5 JOINT NO

ADDED GROUT HOLES

▲ POINTS OF WATER FLOW

PHOTO NO AND ORIENTATION

REVISION	DATE	DESCRIPTION	BY	APP

NOTE
FOR NOTES, SEE DRAWING BSFR-28

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

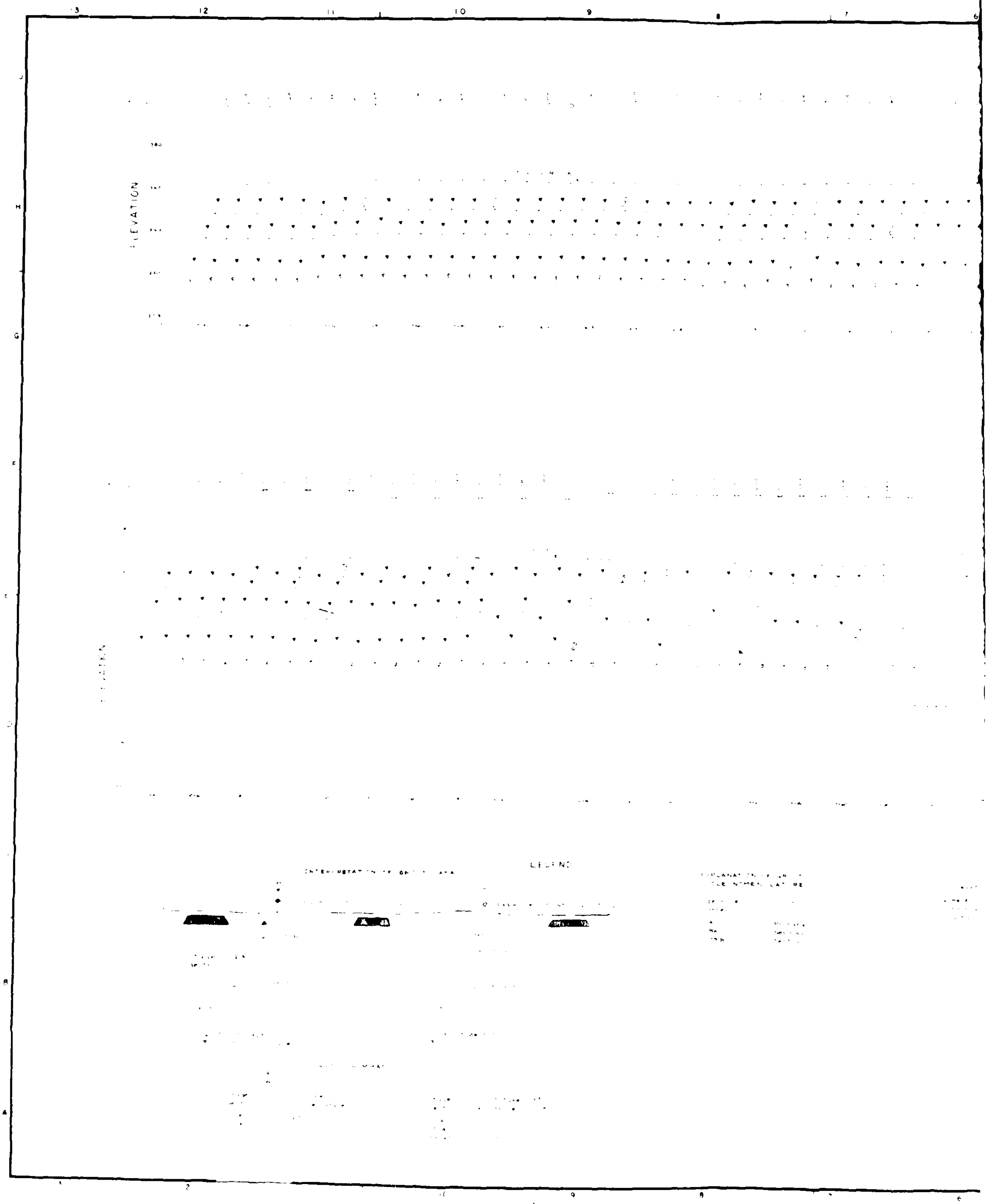
TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

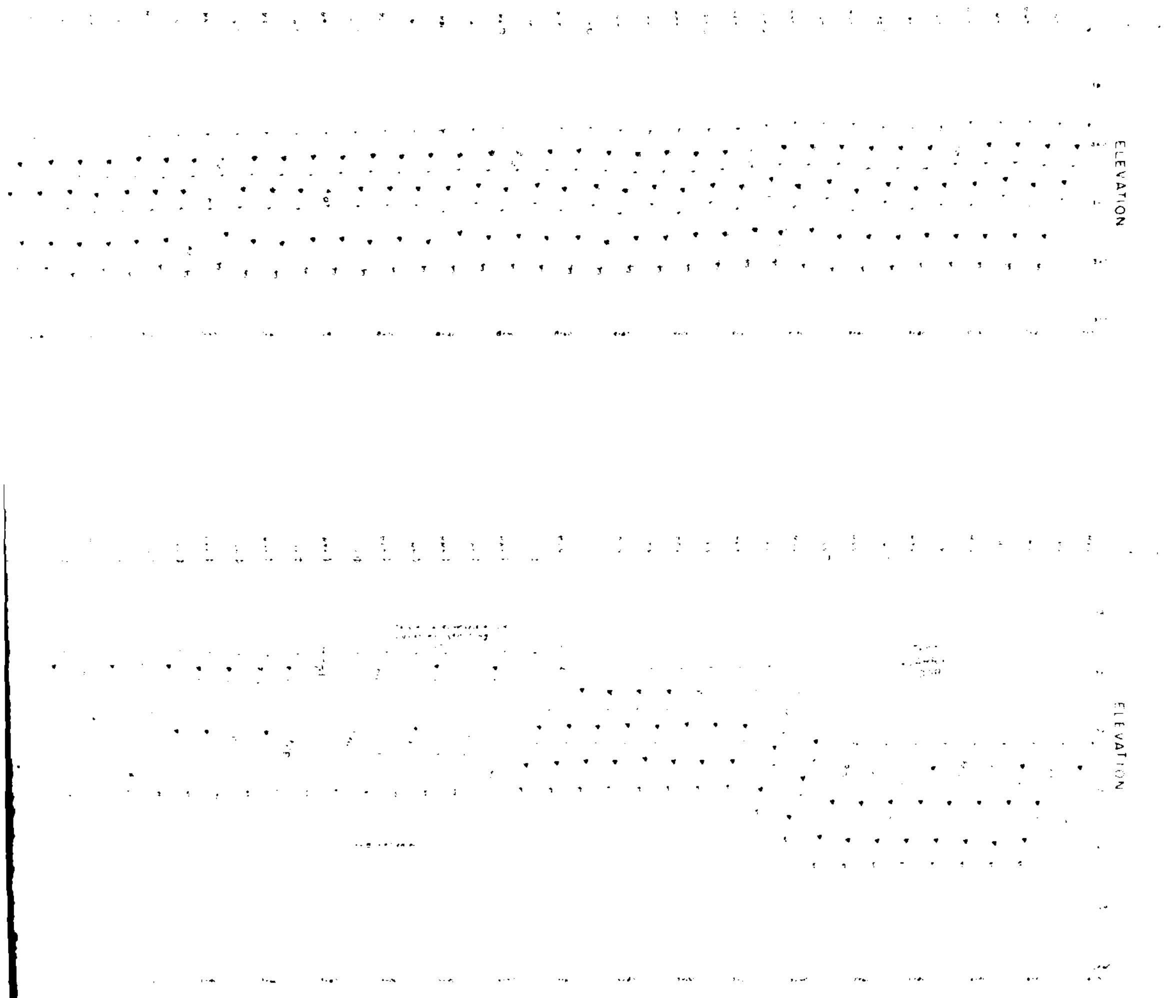
IMPERVIOUS CORE FOUNDATION
STA 22+96 TO 26+50

DRAWN | CHECKED | TRACED | COMPARED | SUBMITTED | APPROVED | DATE

COLONEL, C.E. DISTRICT ENGINEER

DRAWING NUMBER
BSFR-29


ELEVATION
LEGEND



NOTES:

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

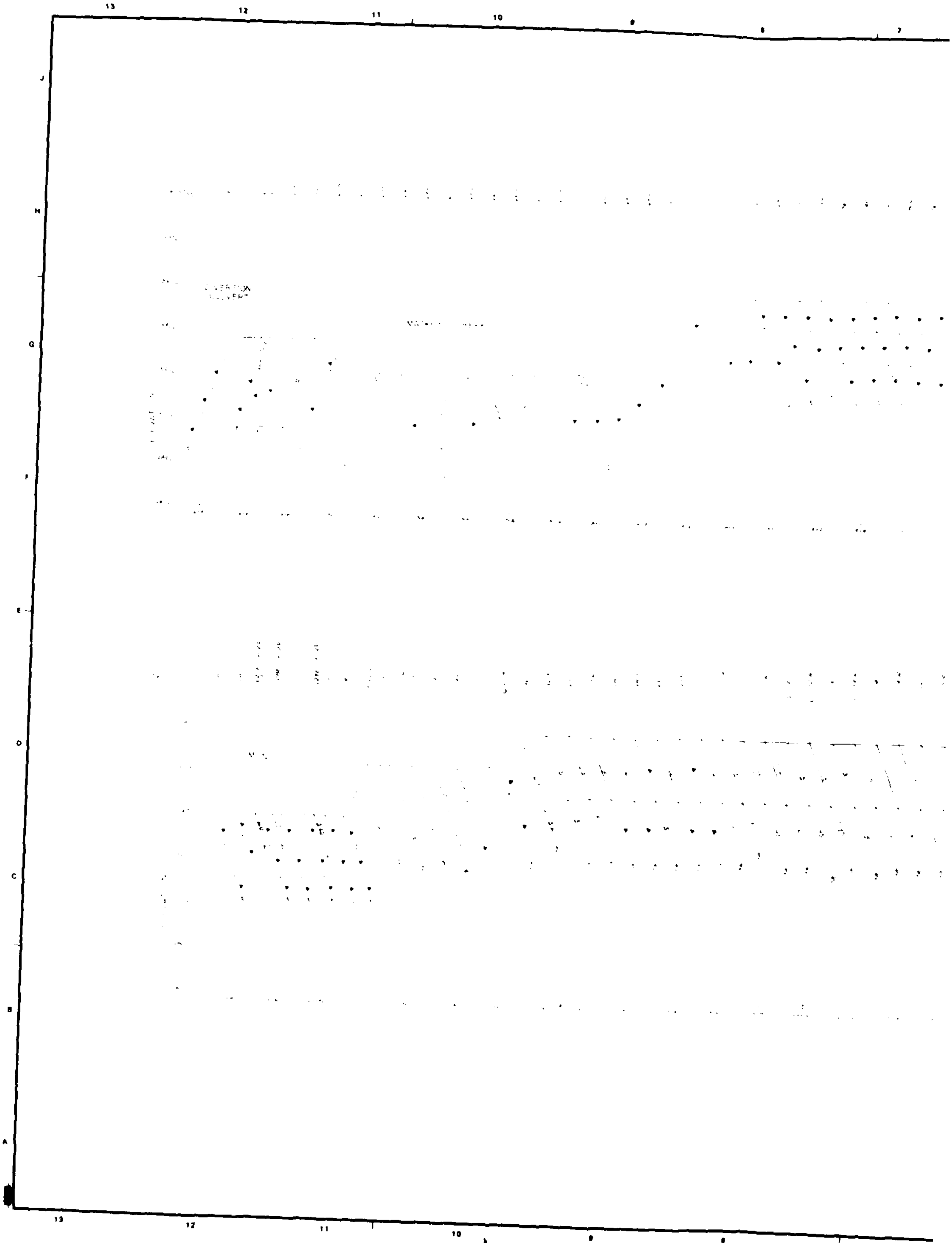
GRAPHIC SCALE

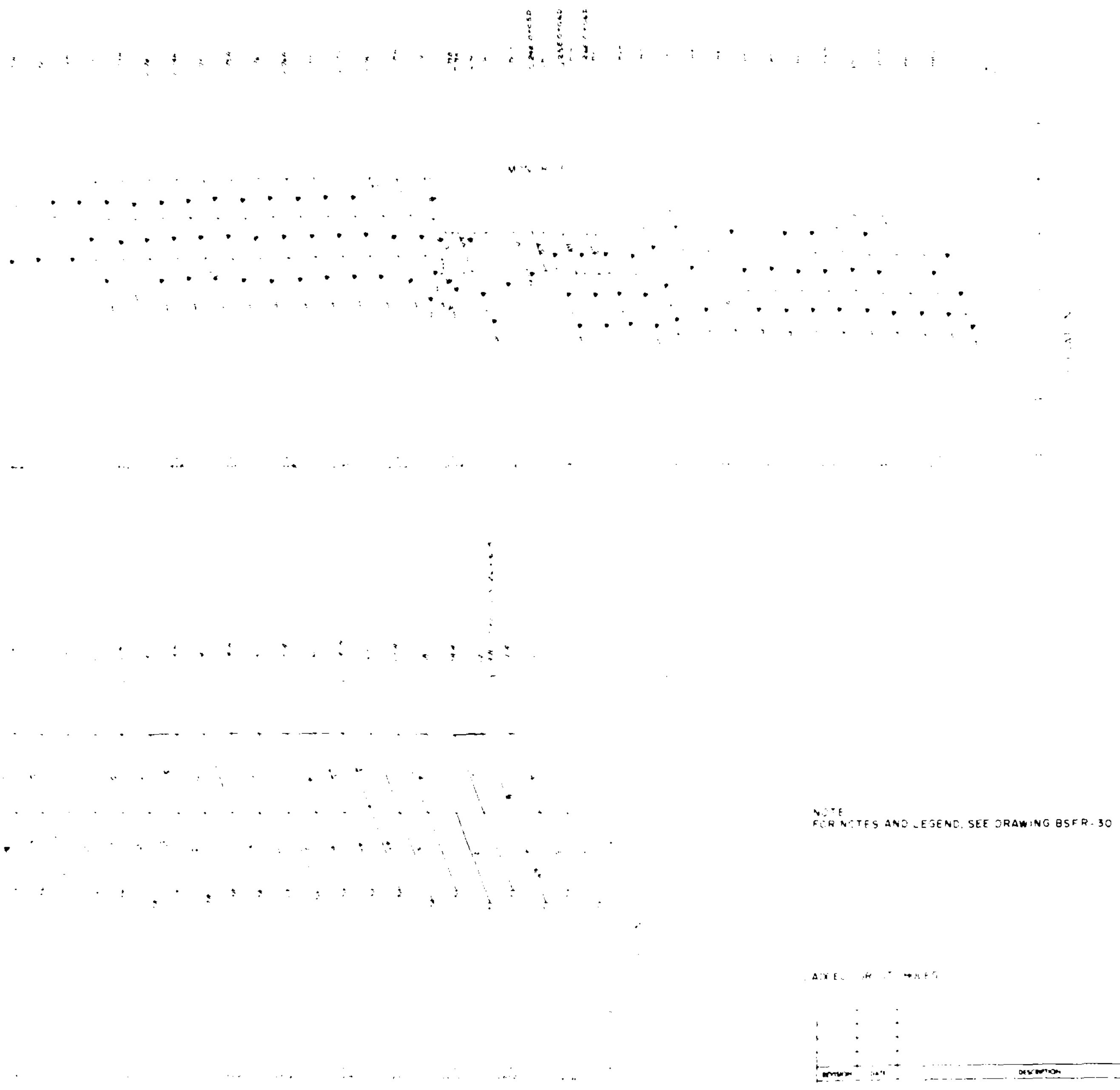
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
GROUT LINE - 0+00U/D
STA 4+70 to STA 16+40

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
SCALE 1" = 20 SPEC NO
DRAWING NUMBER
BSFR-30
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED





NOTE
FOR NOTES AND LEGEND, SEE DRAWING BSFR-30

REVISION	DATE	DESCRIPTION	BY	CHKD

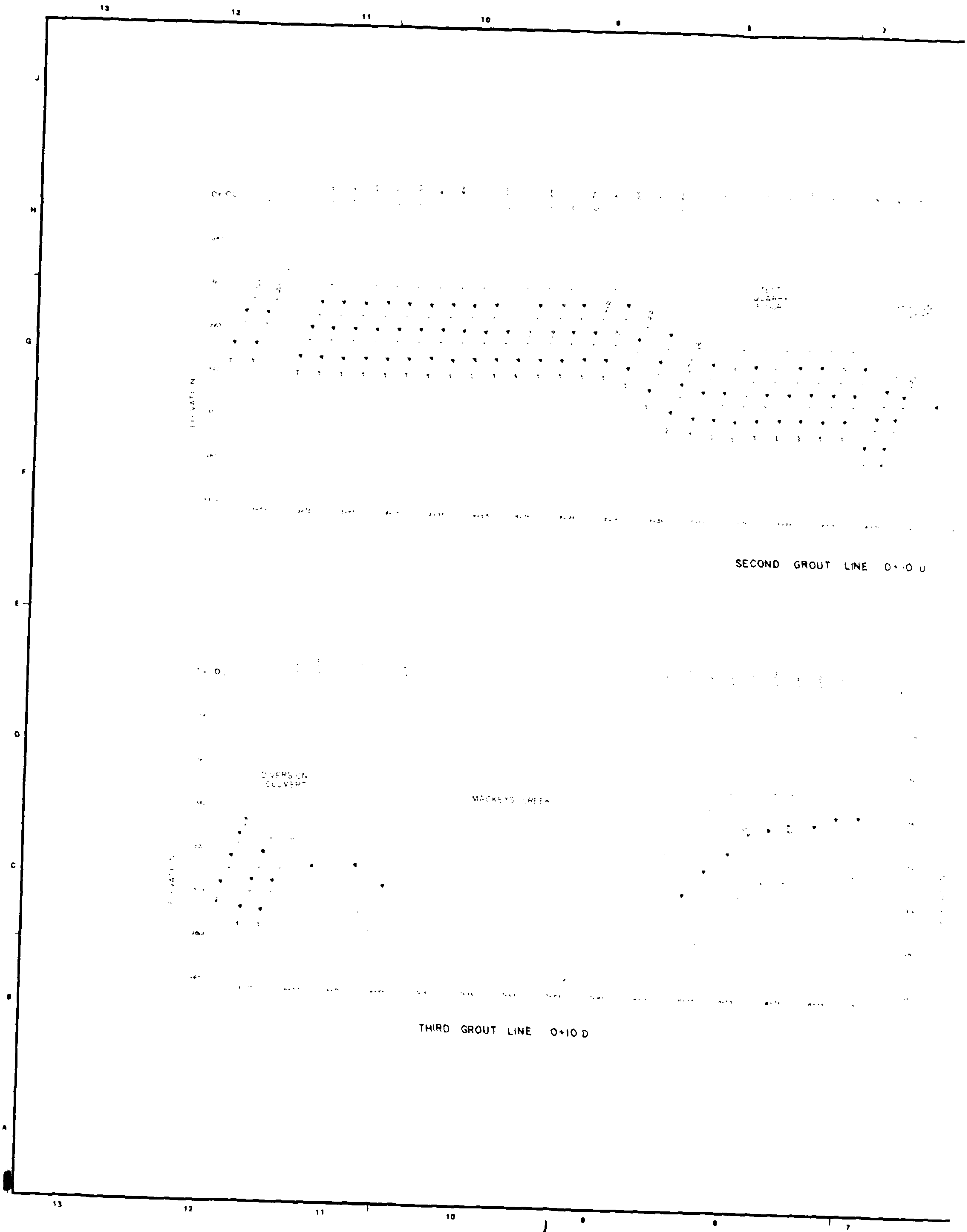
GRAPHIC SCALE

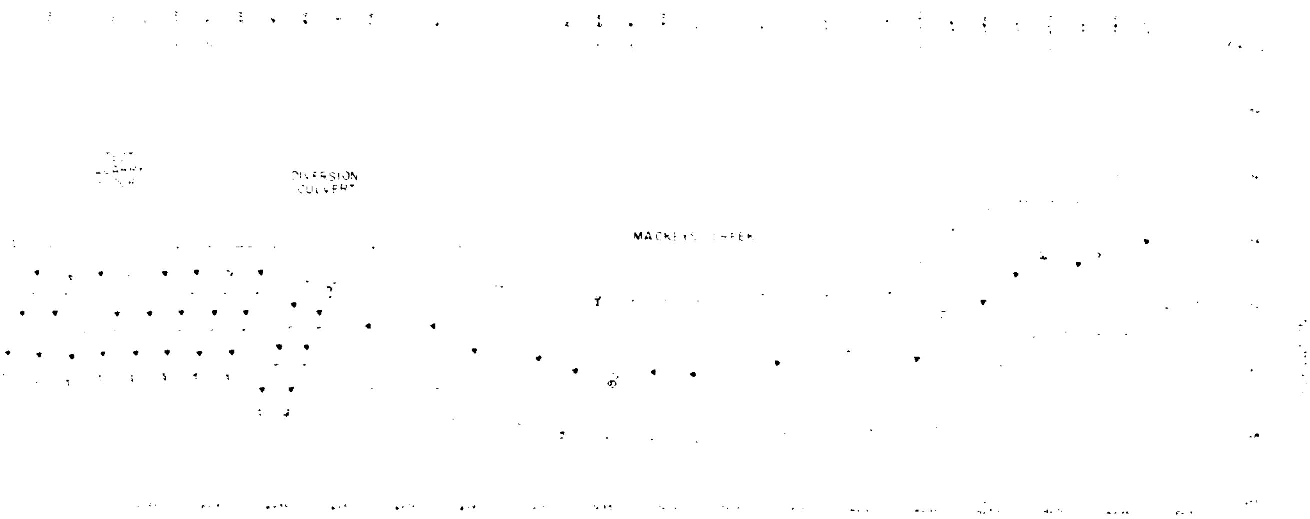
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

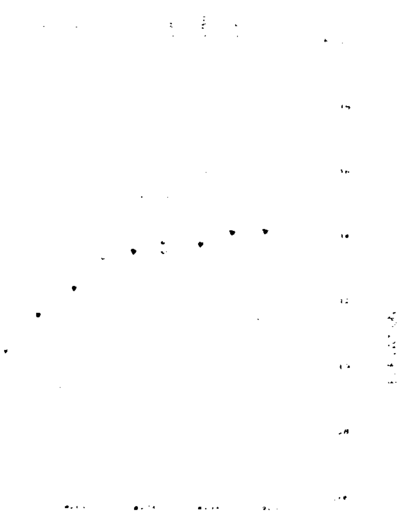
GROUT LINE - 0+00 U/D
STA 16+40 to STA 26+50

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF ENGINEERING DIVISION
APPROVED
COLONEL DISTRICT ENGINEER
DATE
SCALE 1" = 20'
SPEC NO
DRAWING NUMBER
BSFR-31
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED


SECOND GROUT LINE 0+10 U
DIVERSION CULVERT
MACKEYS CREEK
THIRD GROUT LINE 0+10 D



SECOND GROUT LINE 0+10 U



NOTE
FOR NOTES AND LEGEND, SEE DRAWING BSFR 30

REVISION	DATE	DESCRIPTION	BY	CHKD

GRAPHIC SCALE

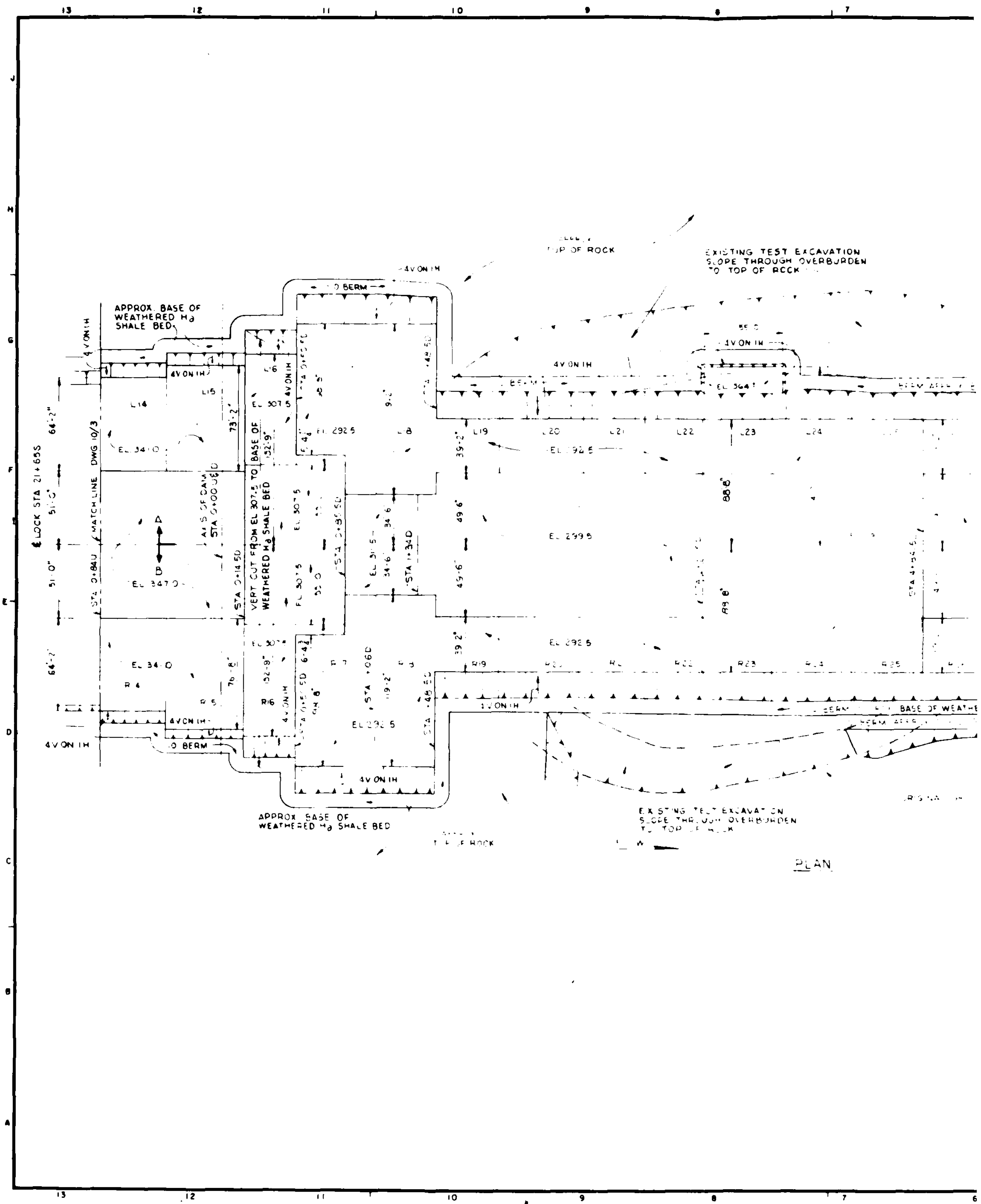
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN DLS
CHECKED
TRACED
COMPARED
ENGINEER

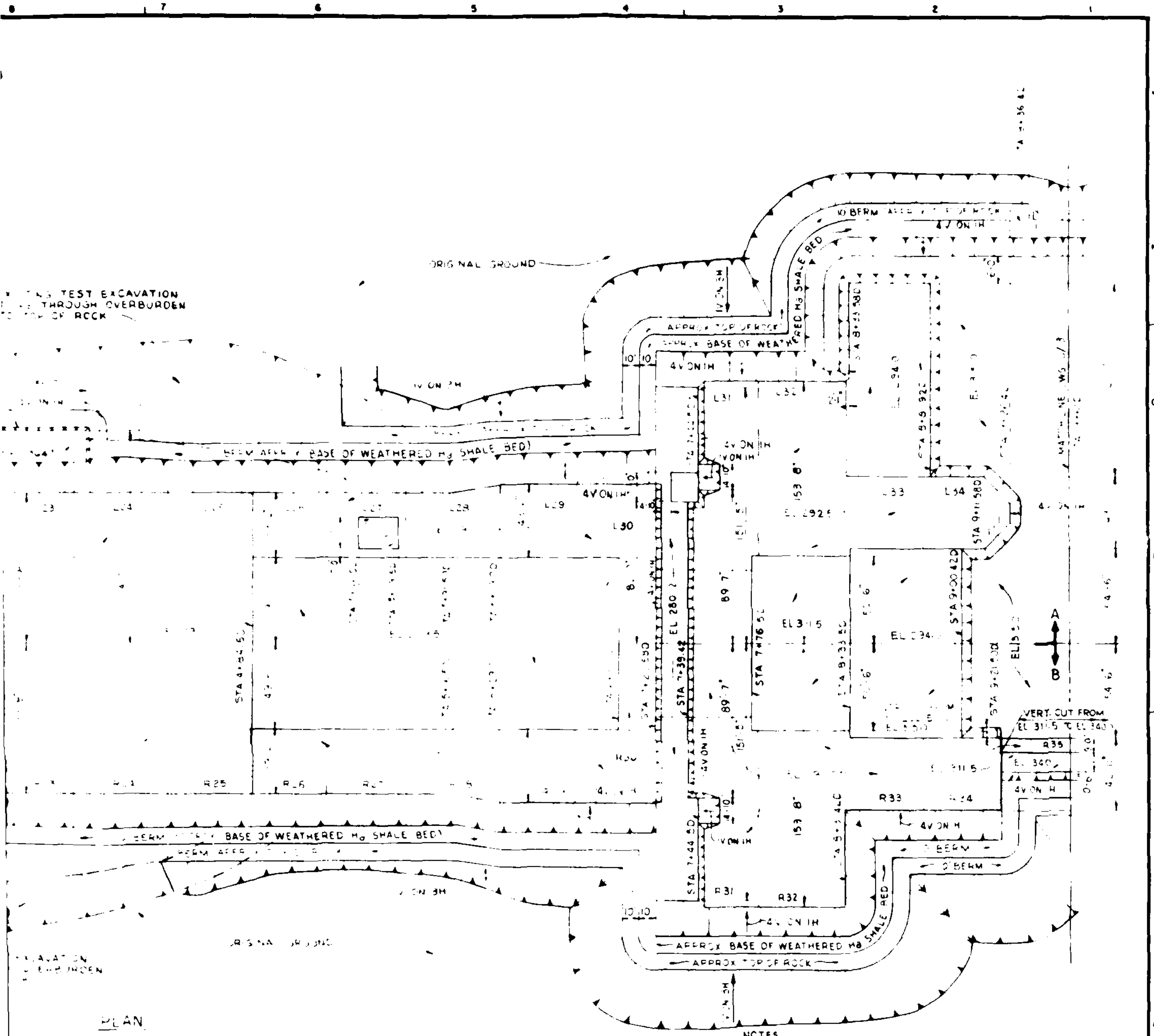
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

SECOND AND THIRD GROUT LINES
0+10U - 13+55 to 19+05
0+10D - 16+35 to 19+05

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C. E. DISTRICT ENGINEER
DATE
SCALE 1" = 20'
SPEC. NO.
DRAWING NUMBER
BSFR-32
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED


APPROX. BASE OF WEATHERED Ha SHALE BED
EXISTING TEST EXCAVATION SLOPE THROUGH OVERBURDEN TO TOP OF ROCK
TOP OF ROCK
4V ON 1H
10 BERM
EL 307.5
EL 292.5
EL 299.5
EL 341.0
EL 347.0
VERT CUT FROM EL 307.5 TO BASE OF WEATHERED Ha SHALE BED
MATCH LINE DWG 10/3
℄ LOCK STA 21+65S
AXIS OF DAM STA 0+00 U&D
STA 0+84U
STA 0+14.5D
STA 0+85.5D
STA 1+34D
STA 1+06D
STA 4+54.5D
L14
L15
L16
L18
L19
L20
L21
L22
L23
L24
R14
R15
R16
R17
R18
R19
R23
BASE OF WEATHERED

PLAN



NOTES
FOR GENERAL NOTES SEE DWG 10

Revision	Date	Zone and Description	By	Chkd
2	2 15 78	MINOR DIMENSION & ELEVATION CHANGES AND ADDED EXISTING TEST EXCAVATION SLOPES		EM
1	12 8 78	GENERAL REVISIONS		EM

30' 0 30' 60'
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN PS
CHECKED EM
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
EXCAVATION
PLAN - SHEET 1

SUBMITTED
CHIEF, DESIGN BRANCH

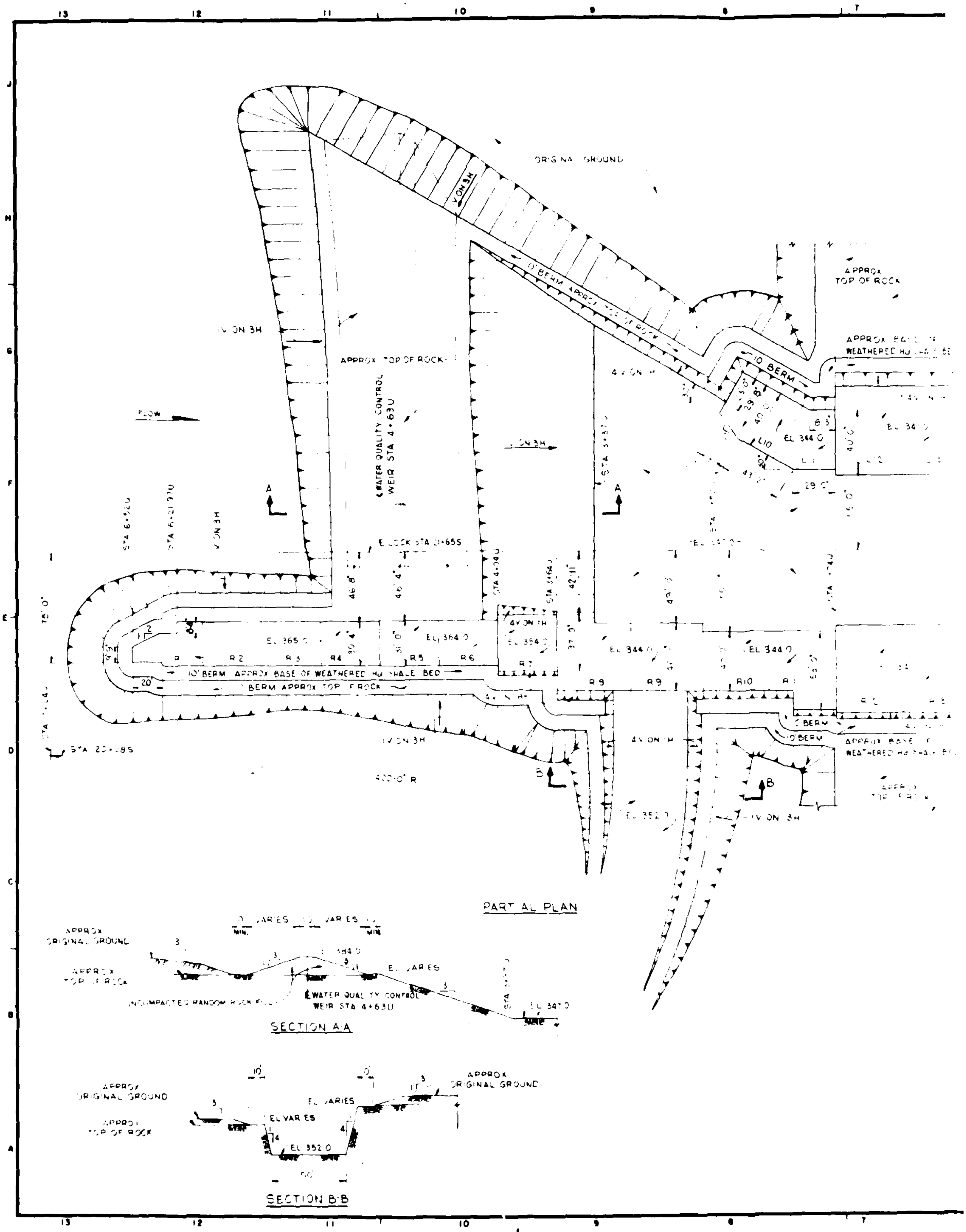
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

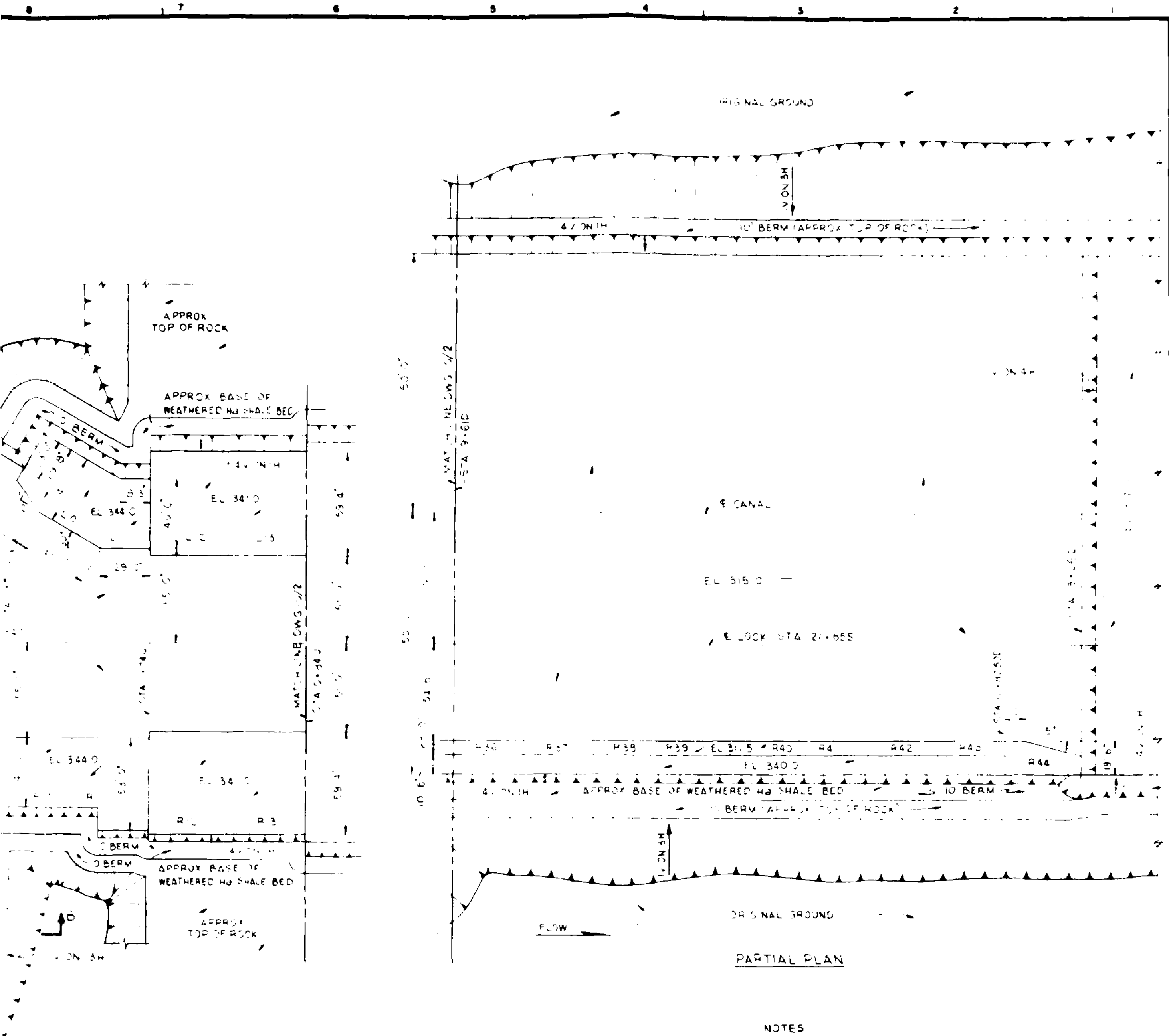
APPROVED
COLONEL, C.E. DISTRICT ENGINEER

DATE

SCALE 1" = 50'
SPEC. NO.
DRAWING NUMBER
BSFR-33
TTBS-10/2.2
SHEET

2


ORIGINAL GROUND
APPROX TOP OF ROCK
10' BERM APPROX TOP OF ROCK
10' BERM
APPROX BASE OF WEATHERED HU SHALE BED
FLOW
WATER QUALITY CONTROL WEIR STA 4+63U
1V ON 3H
EL 365.0
EL 364.0
EL 354.0
EL 344.0
EL 352.0
10' BERM APPROX BASE OF WEATHERED HU SHALE BED
STA 20+08S
400'-0" R
PARTIAL PLAN
APPROX ORIGINAL GROUND
APPROX TOP OF ROCK
UNCOMPACTED RANDOM ROCK FILL
WATER QUALITY CONTROL WEIR STA 4+63U
EL VARIES
EL 347.0
SECTION A-A
APPROX ORIGINAL GROUND
APPROX TOP OF ROCK
EL VARIES
EL 352.0
SECTION B-B



PARTIAL PLAN

NOTES

1 FOR GENERAL NOTES, SEE DWG 10/1

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD
3	4 6 79	REV SEC IN ACCORDANCE WITH AMEND 0004	PS	JEM
2	2 15 79	MINOR REVISIONS TO DIMENSIONS AND NOTES	DON	JEM
	12 18 78	GENERAL REVISIONS		EM

30' 0 30' 60

GRAPHIC SCALE

DEPARTMENT OF THE ARMY

NASHVILLE DISTRICT CORPS OF ENGINEERS

NASHVILLE, TENNESSEE

DRAWN B P

CHECKED JEM

TRACED PS

COMPARED

TENNESSEE TOMBIGBEE WATERWAY

MISSISSIPPI AND ALABAMA

BAY SPRINGS LOCK AND DAM

LOCK

EXCAVATION

PLAN - SHEET 2

SUBMITTED

CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED

CHIEF, ENGINEERING DIVISION

APPROVED

COLONEL, C E DISTRICT ENGINEER

DATE

SCALE 1" = 30'

SPEC NO

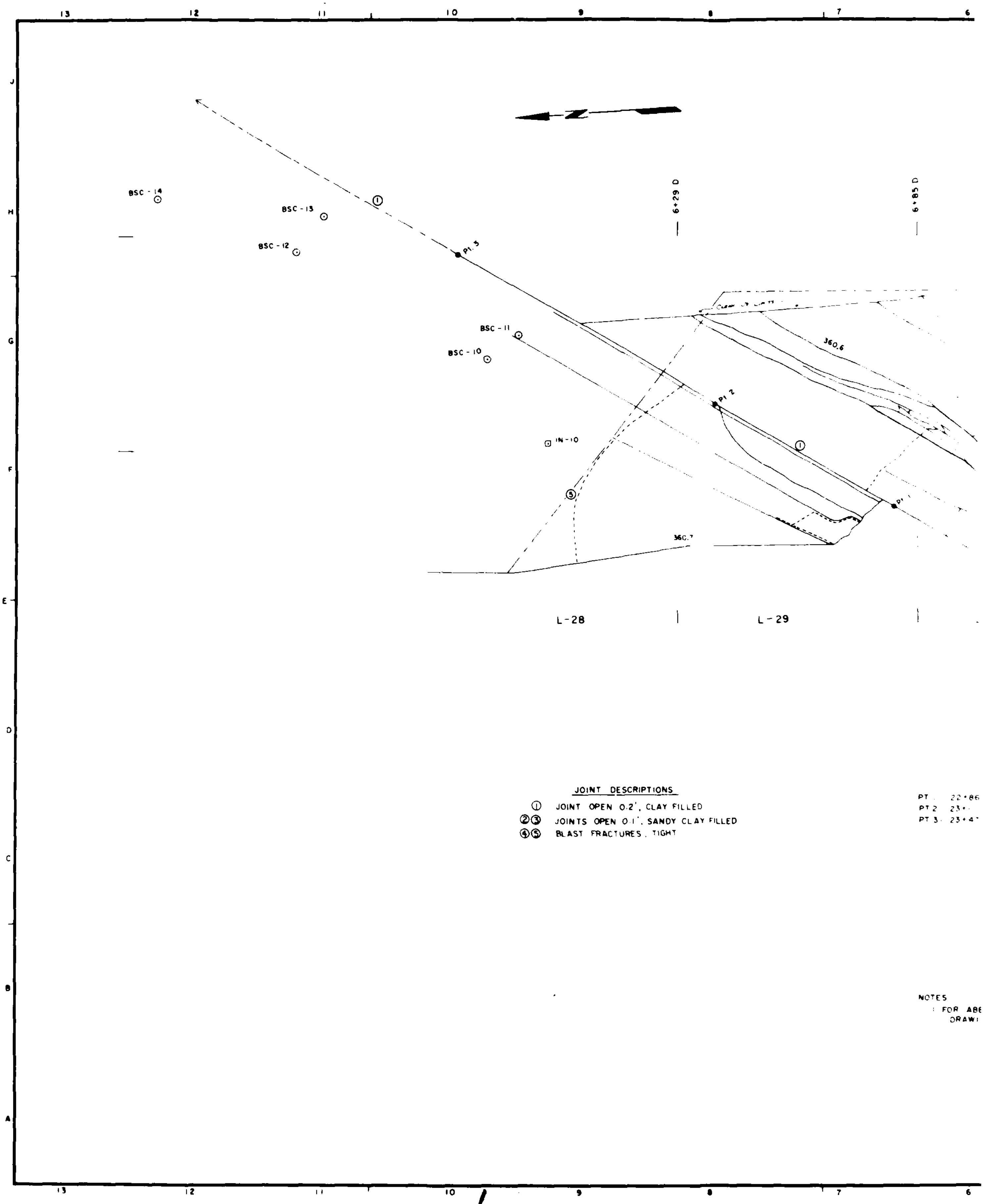
DRAWING NUMBER

BSFR-34

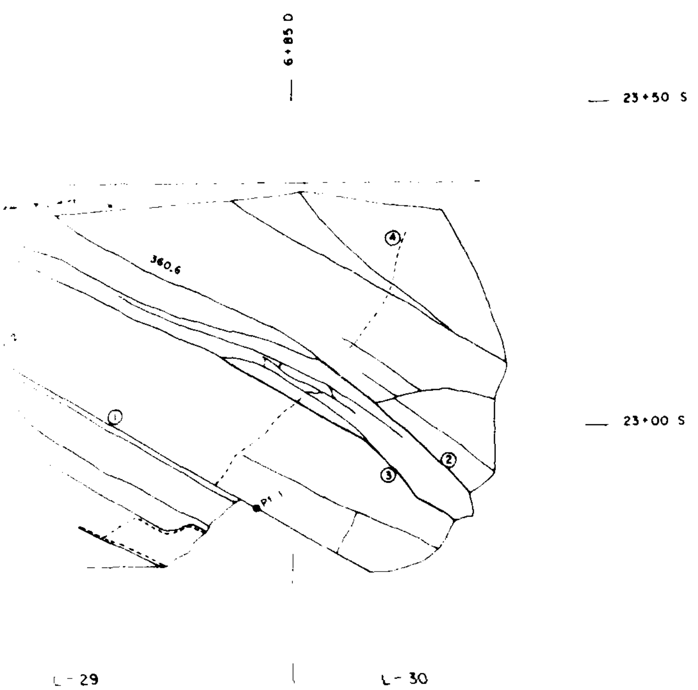
SHEET OF TTBS-10/3.3

RECORD DRAWING AS CONSTRUCTED DATED

2



BSC - 14
BSC - 13
BSC - 12
BSC - 11
BSC - 10
IN - 10
PT. 3
PT. 2
PT. 1
6+29 D
6+85 D
360.6
360.7
L - 28
L - 29
JOINT DESCRIPTIONS
① JOINT OPEN 0.2', CLAY FILLED
②③ JOINTS OPEN 0.1', SANDY CLAY FILLED
④⑤ BLAST FRACTURES, TIGHT
PT. 22+86
PT 2 23+
PT 3 23+4
NOTES
FOR ABE
DRAWI



LEGEND

③ JOINT OR FRACTURE DESIGNATION
— NATURAL JOINT
--- BLAST FRACTURE
⊙ NQ CORE HOLE
□ INCLINOMETER
● SURVEY POINT
LIMITS OF ROCK EXCAVATION

PT 1 22+86.66S, 6+79D
PT 2 23+11.35S, 6+37.7D
PT 3 23+47.78S, 5+77.95D

NOTES
1 FOR ABBREVIATIONS, SEE CONTRACT DRAWING NO TTBS-3/1

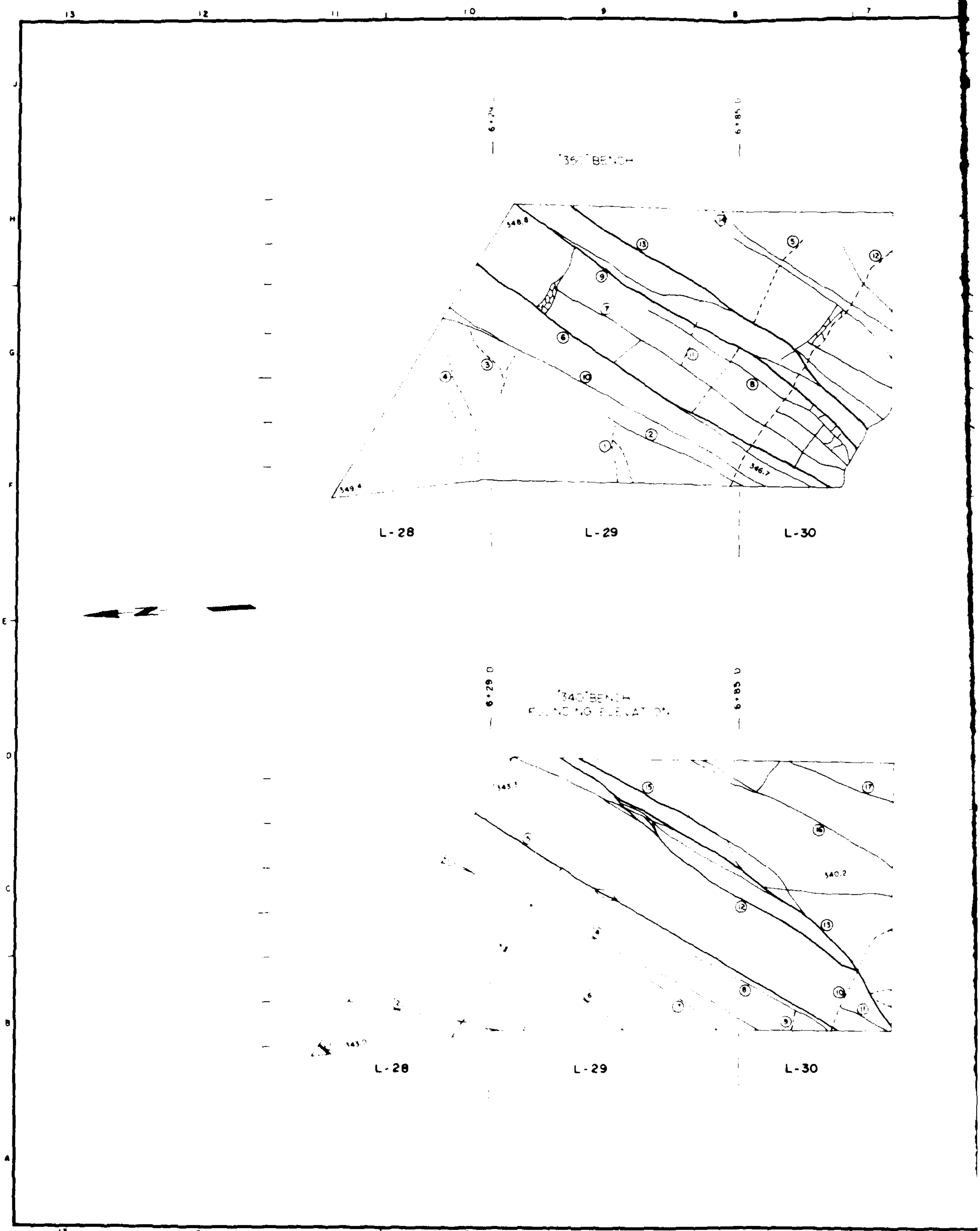
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
L-28, 29, 30 CORNER - AFTER SHOT 122

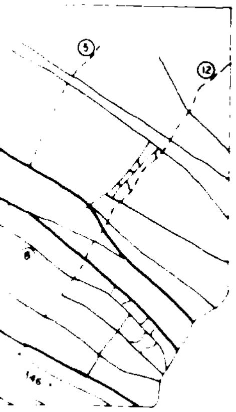
SCALE 1" = 10'

BSFR-35

2


6+29 D
6+85 D
L-28
L-29
L-30
340' BENCH
L-28
L-29
L-30

8 7 6 5 4 3 2 1



23+40

22+80

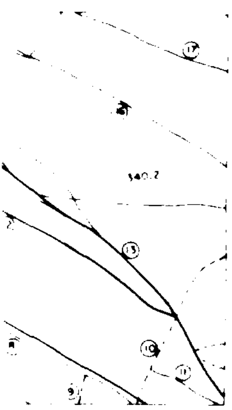
L-30

JOINT DESCRIPTION

1 Blast frac op 1 16
2 Jt t
3 Blast frac ti to op 1 1 4
4 Blast frac op 1 16 to 3 4
5 Blast frac
6 Jt op 1 to 4 or sly cl fld
7 Jt t
8 Jt t fe st
9 Jt op 1 4 to 1 or sly cl fld
10 Jt op 1 2 sdy cl fld
11 Blast frac op 1 16
12 Blast frac
13 Jt op 1 to 4 sd and c fld
14 Jt t

LEGEND

③ JOINT OR FRACTURE DESIGNATION
——— NATURAL JOINT
- - - - - - BLAST FRACTURE



23+30

22+70

L-30

JOINT DESCRIPTION

1 Jt op 0 01 or cl fld
2 Jt fe st sl movement
3 ?
4 Jt op 0 05 cl fld sl compression
5 Jt op 1 2 to 1 1 2 or cl and ss frag fld
6 Jt t heavy fe st
7 Jt t heavy fe st
8 Jt op 0 1 and c fld
9 Blast frac
10 Blast frac op 1 2
11 Jt fe st sl movement
12 Jt op 1 2 sd and ss frag fld
13 Jt heavy fe st
15 Jt op 0 01 sd and c fld
16 Jt op 0 03 fe st c fld
17 Jt op 0 1 fe st c fld

NOTES

1 Refer to Drawing BSFR-35 for notes

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
L-28, 29, 30 -
ADDITIONAL ROCK REMOVAL

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
SCALE 1" = 10' SPEC NO
DRAWING NUMBER
BSFR-36
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

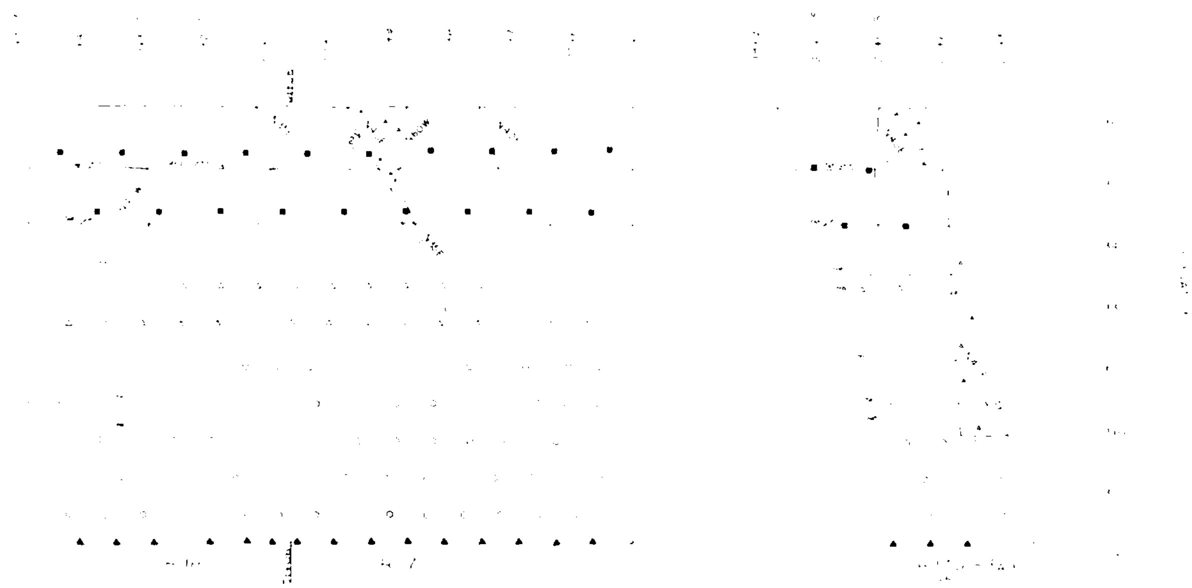
8 7 6 5 4 3 2 1

JOINT DESCRIPTION

OP 0.0 ... OR BR SL CL COATING HEAVY FE ST
2 OP 0.5 ... OR BR SL CL FLO FE ST
3 OP 1 ... PROB BLAST DAMAGE FE ST

**SAND LENSE IN B 16 CORNER WAS WASHED CLEAN AND
REPLACED WITH CONCRETE

**JOINTS NOT NUMBERED ARE TIGHT JOINTS IN THE
H4 AND H6 MEMBERS ARE TYPICALLY IRON STAINED



LEGEND

■ [illegible]" ROCK BOLTS, 25-30'
△ 1" ROCK BOLTS, 23'-28'
○ 1" ROCK BOLTS, 20'-25'
▲ 1" FLOOR ROCK BOLTS, 23'-28'
③ JOINT NO.

NOTES

1. FOR ABBREVIATIONS, SEE DRAWING TTBS-3/1
2. ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN PWC
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

RIGHT LOCK WALL

R-18—R-16 GEOLOGIC SECTIONS

SUBMITTED

APPROVAL RECOMMENDED

CHIEF, ENGINEERING DIVISION

APPROVED

COLONEL, CE DISTRICT ENGINEER

DATE

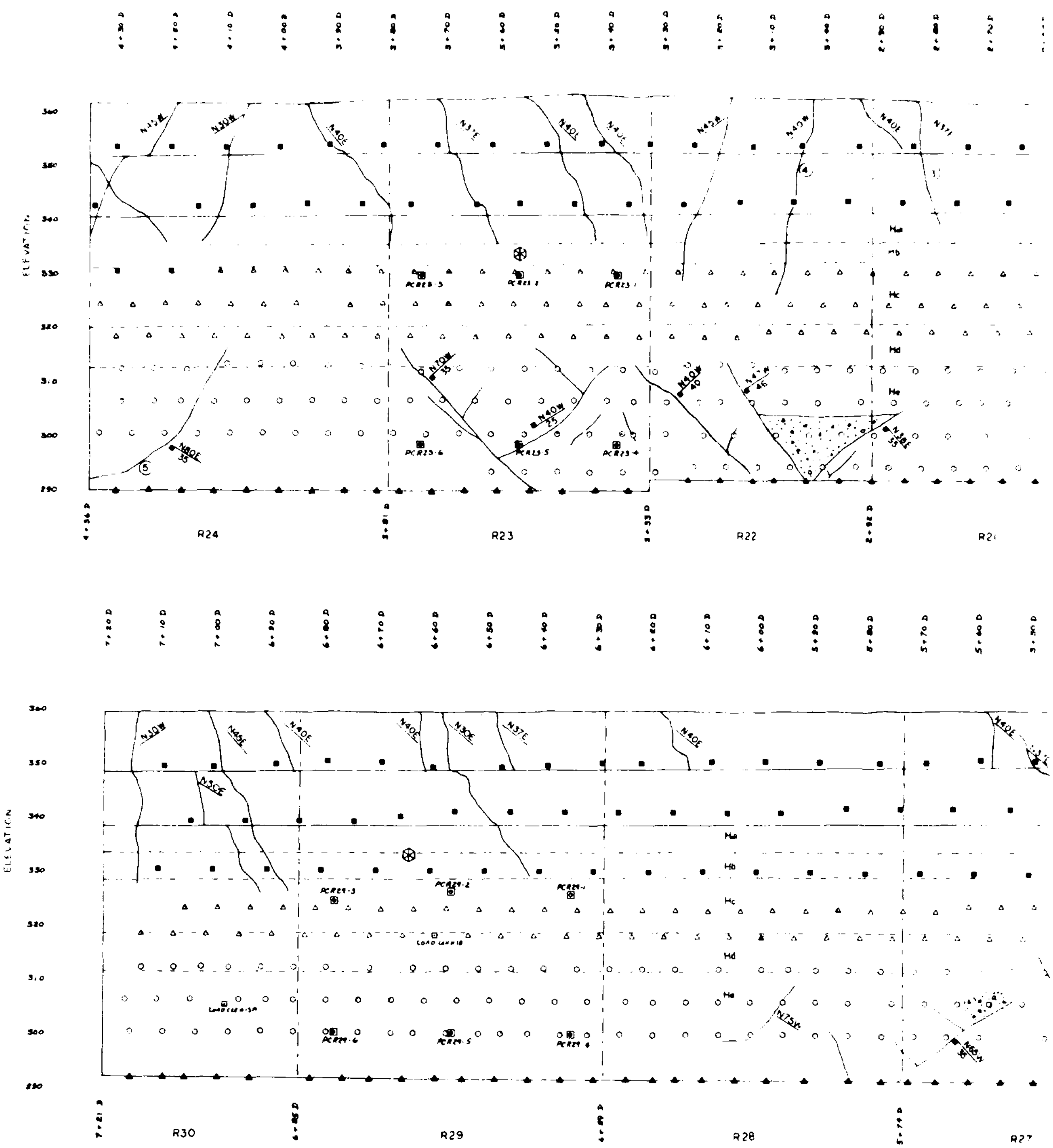
SCALE 1" = 10' SPEC. NO.

DRAWING NUMBER

BSFR-37

SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED

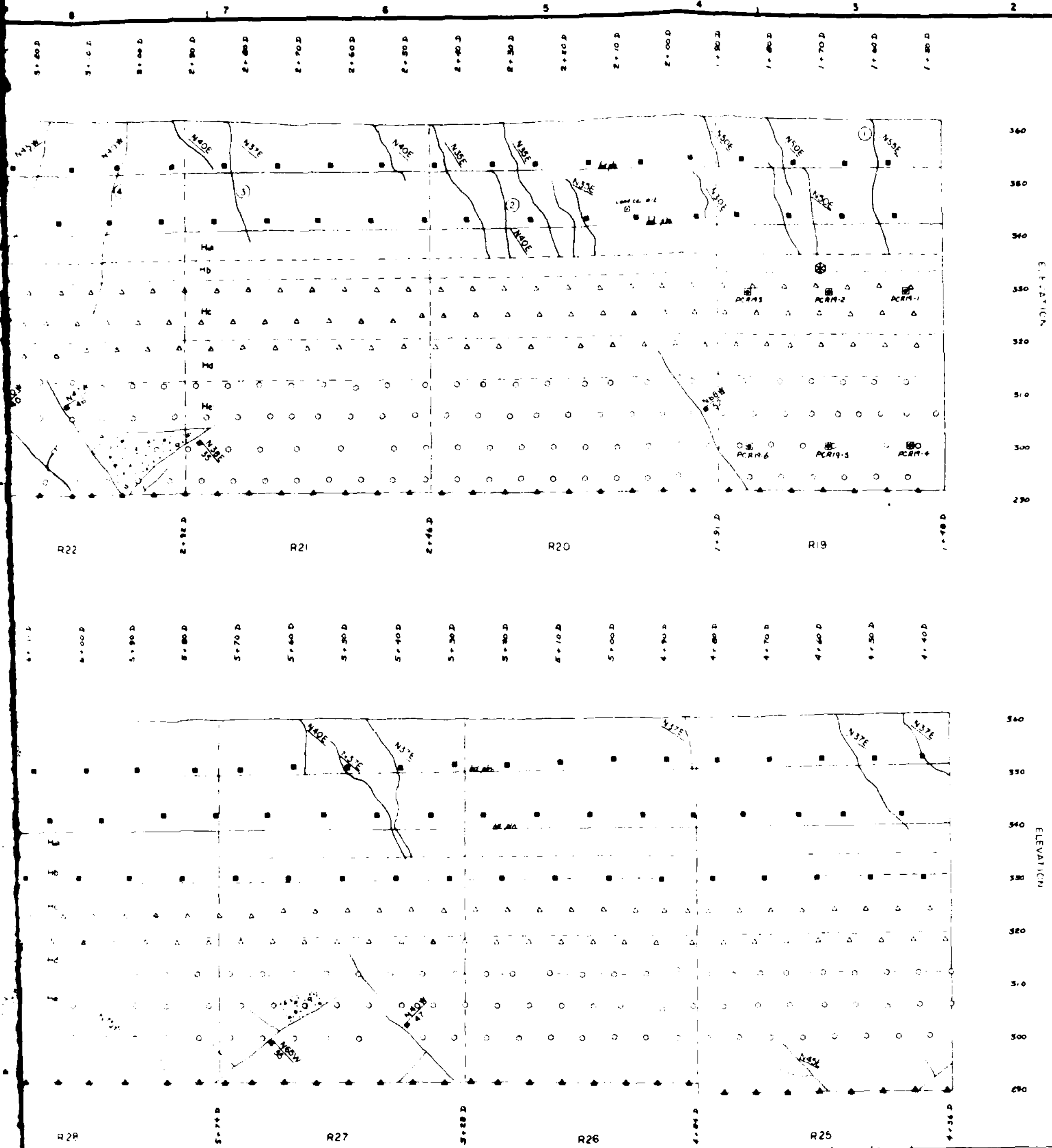


JOINT DESCRIPTION

1. Op 0.01', sly red cl fld, fe st
2. Op 0.03', heavy fe st
3. Op 0.07', sly red cl fld, heavy fe st
4. Op 0.05', cl fld, fe st
5. Irreg, op 0.01', so gr cl gouge fld

**Joints not numbered are tight. Joints in the Ha and Hb members are typically iron stained.

NOTE
FOR NOTES, SEE DRAWING BSFR-37



LEGEND

- ■ 1¼" ROCK BOLTS 25-30'
- △ 1" ROCK BOLTS 23'-28'
- ○ 1" ROCK BOLTS 20'-25'
- ▲ 1" FLOOR ROCK BOLTS 23'-28'
- (3) JOINT NO.
- ROCK BOLT LOAD CELL
- PORE PRESSURE CELL
- EXTENSOMETER
- REMOVED AND REPLACED WITH CONCRETE

...ES SEE DRAWING BSFR-37

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

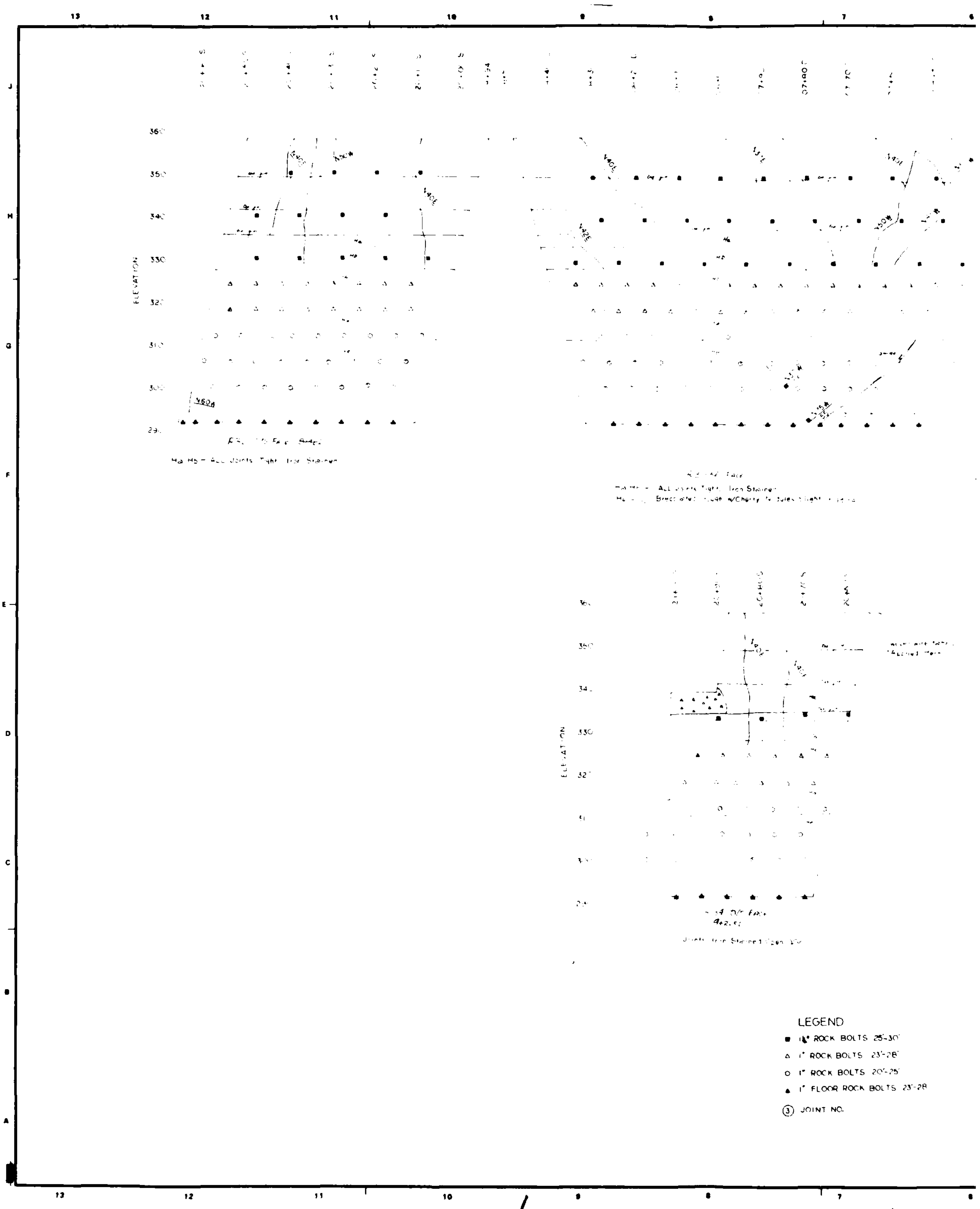
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE TENNESSEE

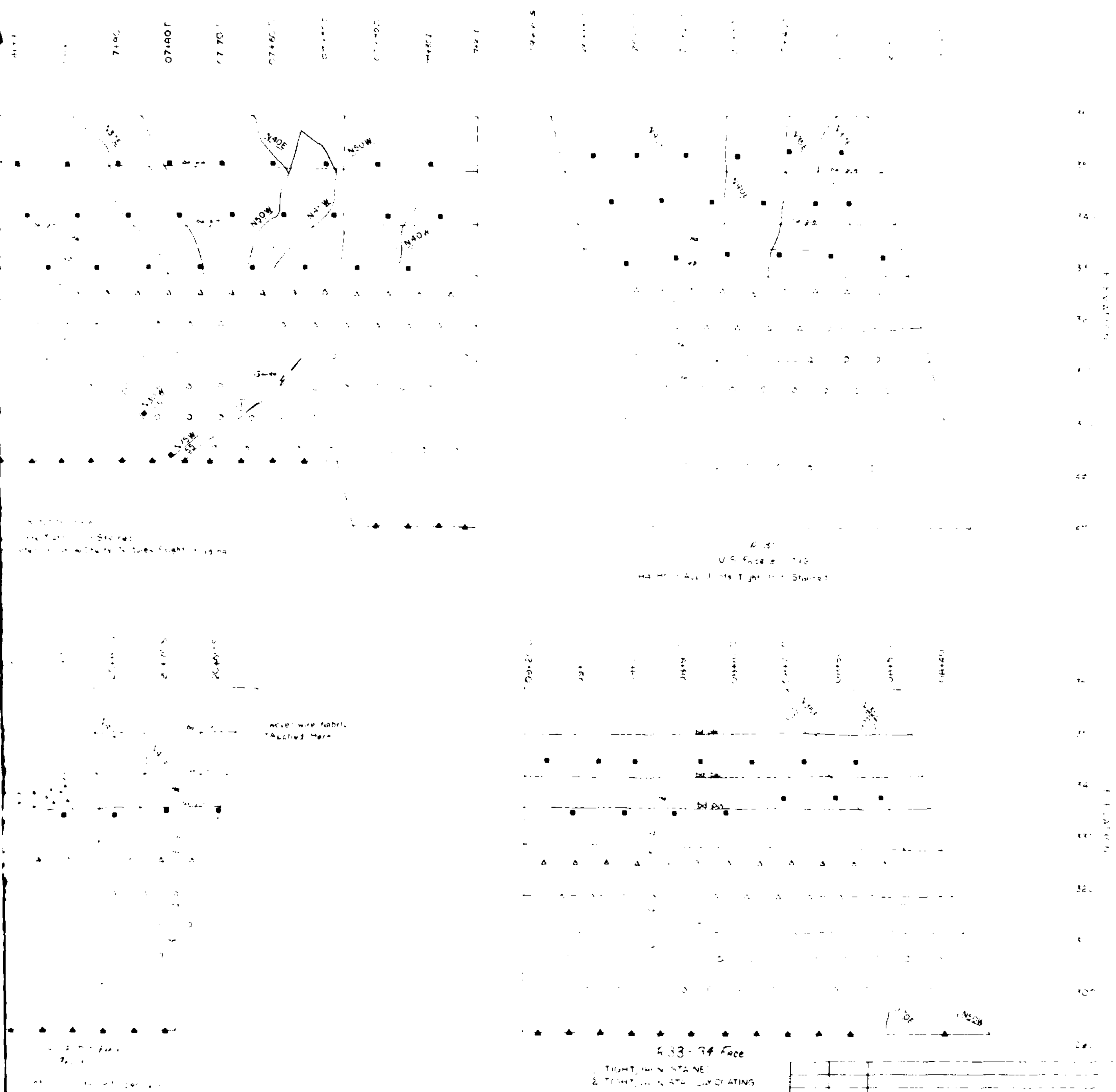
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
RIGHT LOCK WALL
R-19—R30 GEOLOGIC SECTIONS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-38
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



ELEVATION
LEGEND
ROCK BOLTS 25'-30'
1" ROCK BOLTS 23'-28'
1" ROCK BOLTS 20'-25'
1" FLOOR ROCK BOLTS 23'-28'
3 JOINT NO.



LEGEND

- ■ 1¼" ROCK BOLTS 25'-30'
- ∧ 1" ROCK BOLTS 23'-28'
- ○ 1" ROCK BOLTS 20'-25'
- ▲ 1" FLOOR ROCK BOLTS 23'-28'
- (3) JOINT NO.

NOTE
FOR NOTES, SEE DRAWING BSFR-37

REVISION	DATE	DESCRIPTION	BY	CHKD

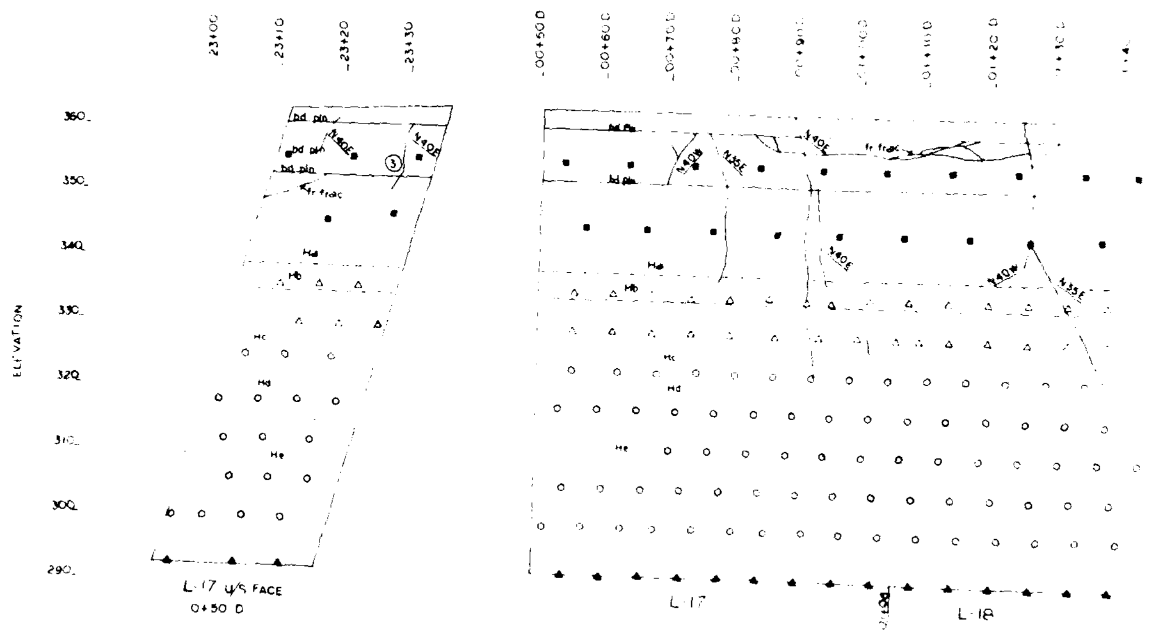
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN PAR
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
RIGHT LOCK WALL
R-31 – R-30 GEOLOGIC SECTIONS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-39
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

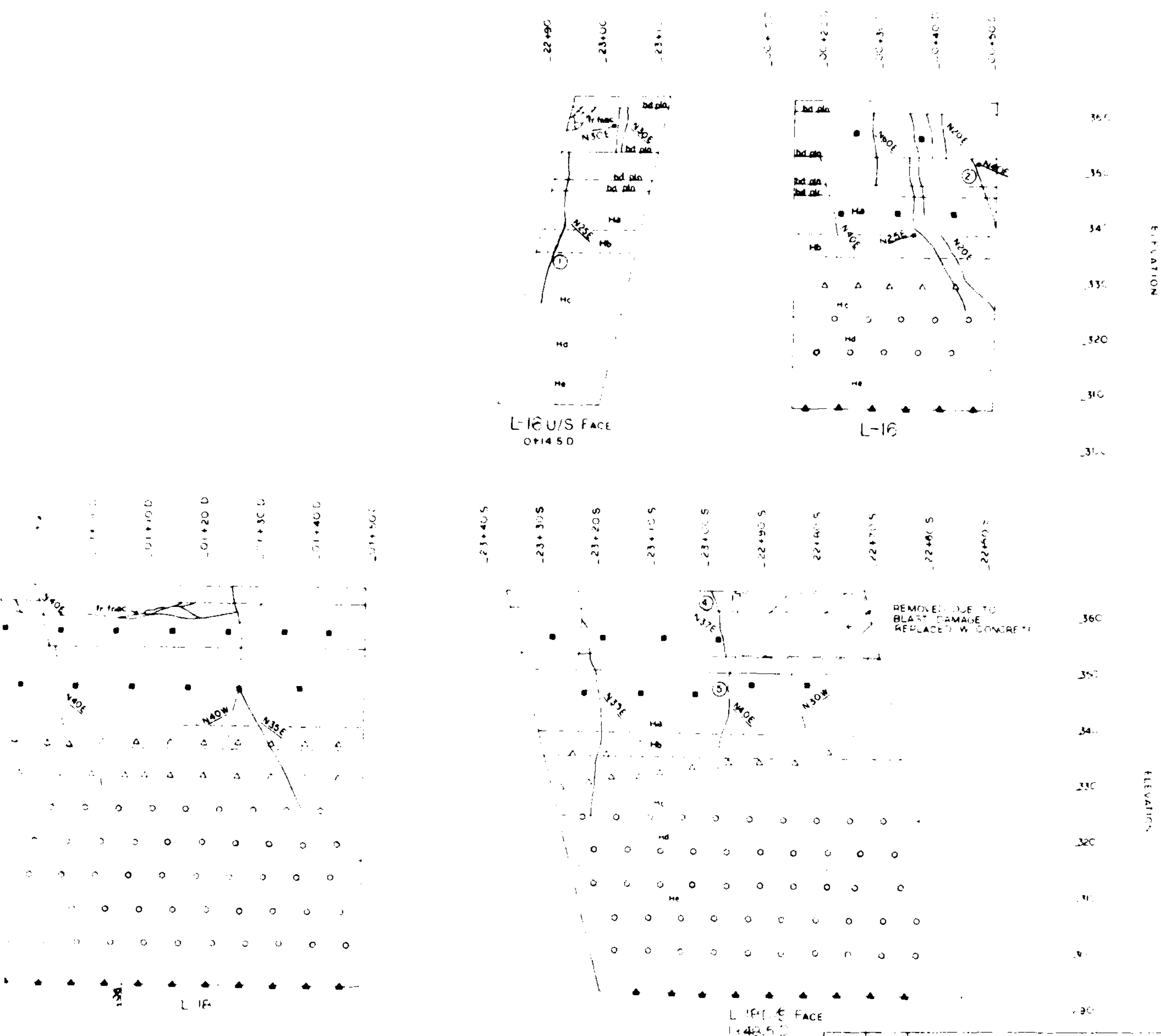


JOINT DESCRIPTION

1. Op 0.1', lt brown sly cl fld, fe st
2. Op 0.1', lt brown sly cl fld, fe st
3. Op 0.01', lt brown cl coating, fe st
4. Op 0.1', sly cl fld, fe st
5. Op 0.25', sly cl fld, fe st.(rock shifted along this jt pln and bd pln at elev 353)

**Joints not numbered are tight. Joints in the Ha and Hb are typically iron stained.

NOTES



NOTES

LEGEND

- 1¼" ROCK BOLTS 25'-30'
- 1" ROCK BOLTS 23'-28'
- 1" ROCK BOLTS 20'-25'
- 1" FLOOR ROCK BOLTS 23'-28'
- (3) JOINT NO.

NOTE
FOR NOTES, SEE DRAWING BSFR-37

REVISION	DATE	DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

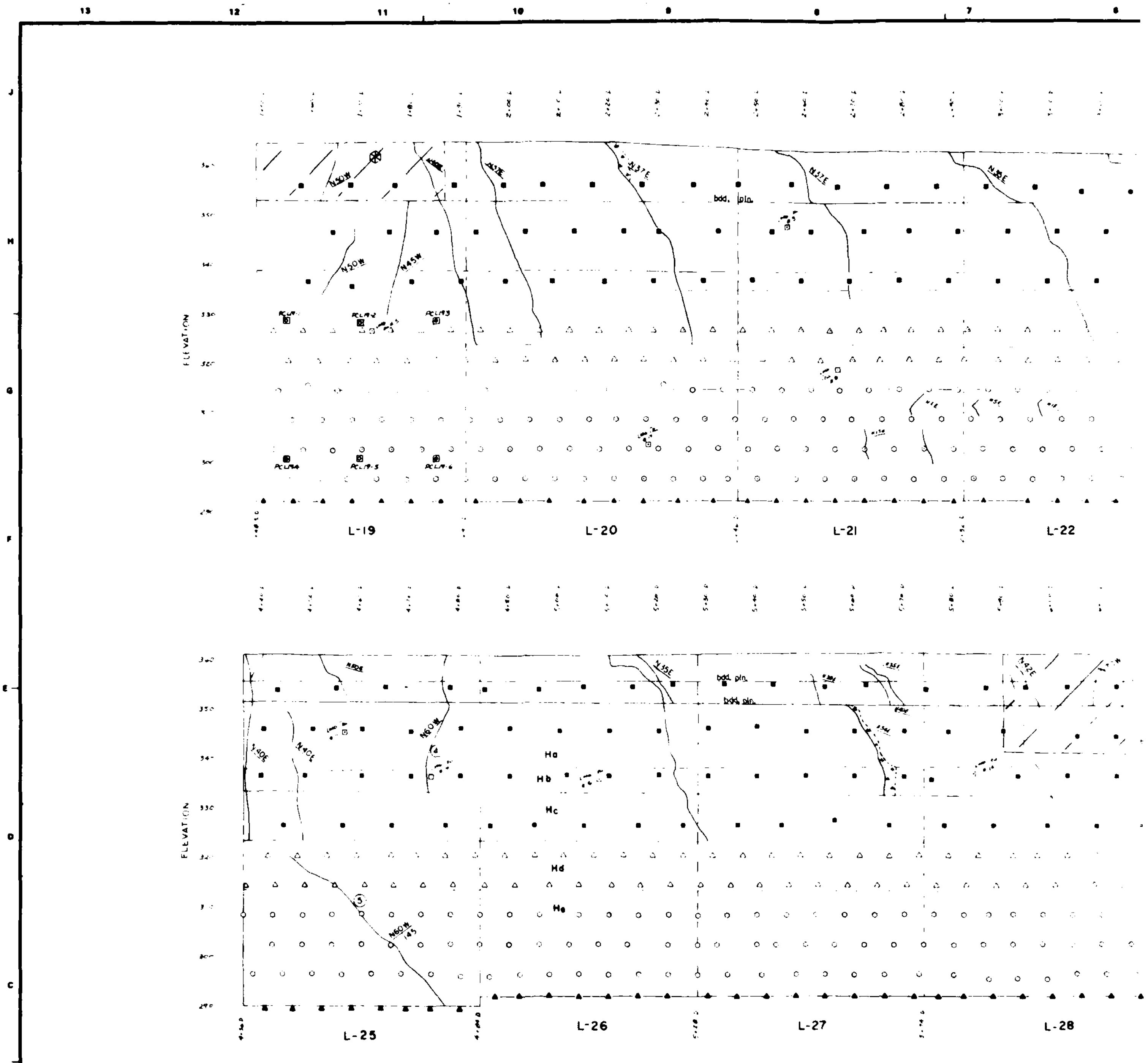
DRAWN PRT
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

LEFT LOCK WALL

L-18 — L-16, GEOLOGIC SECTIONS

SUBMITTED
APPROVAL RECOMMENDED
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR - 40
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

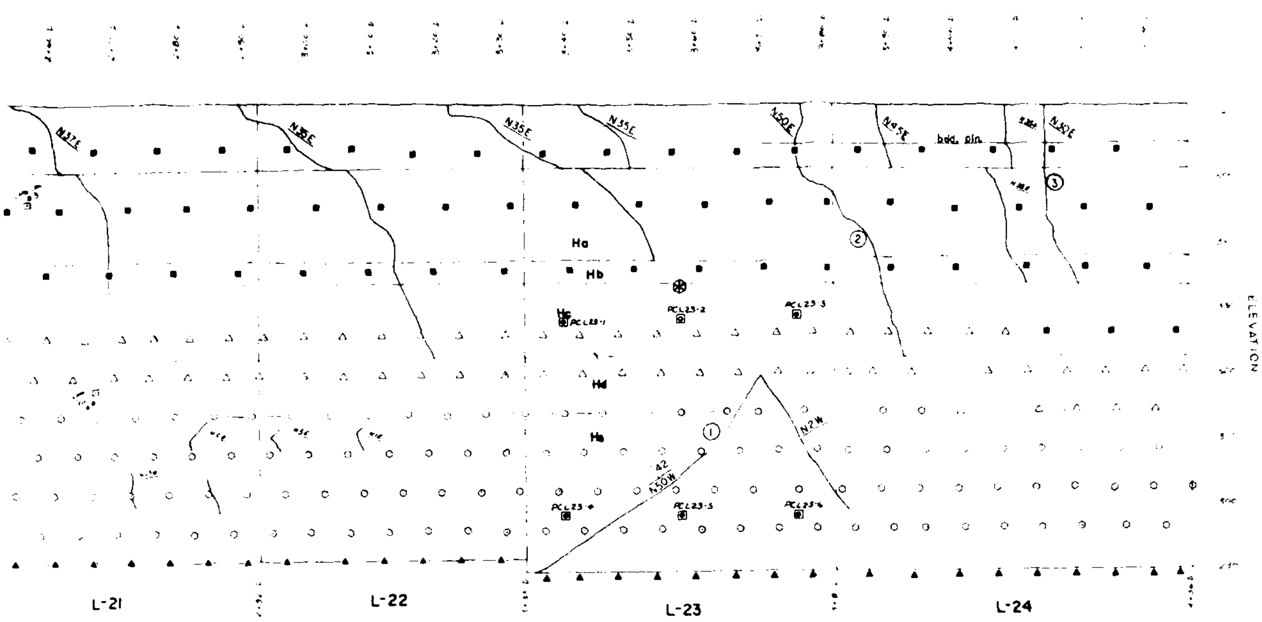


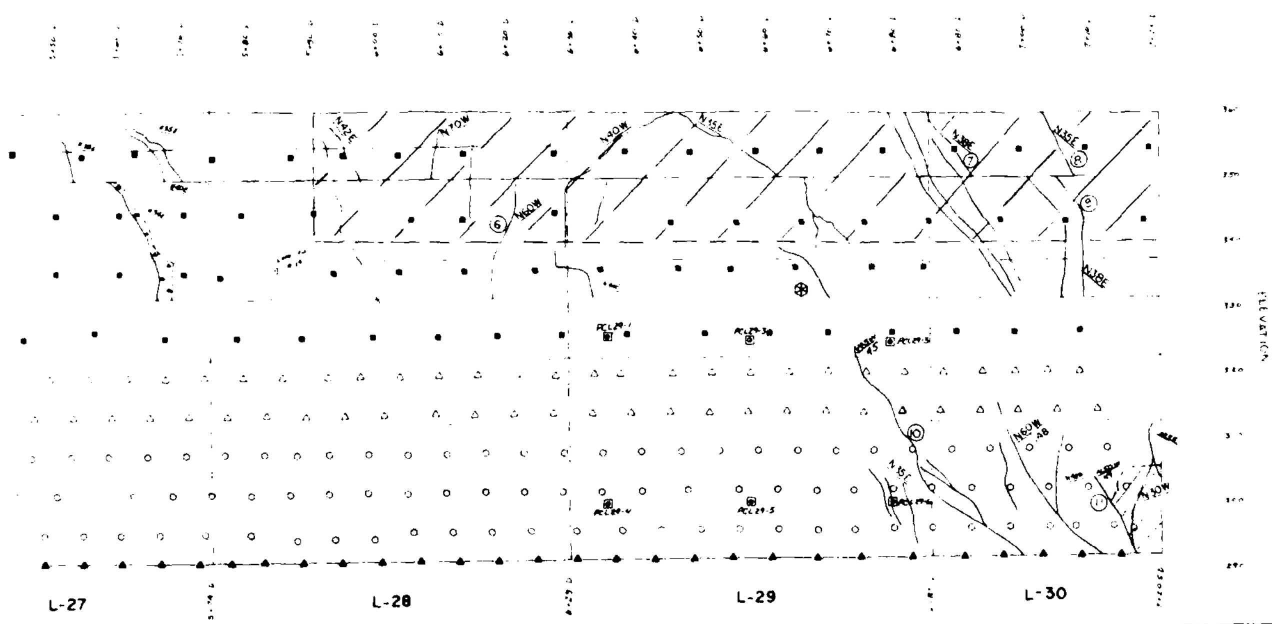
JOINT DESCRIPTION

1. Op .05' hd gr cl gouge fld, heavy fe st
2. Op .02', hd sly red cl fld, fe st
3. Op .02', sly red cl fld, fe st
4. Op .05', sly red cl fld, fe st
5. Op 0.1', so gr cl gouge fld
6. Ti to part op, .05' heavy fe st
7. Op .15' - 1.0', hd sly red cl s.s. frags fld
8. Op 0.1', sly red cl fld, fe st
9. Op .15' - 1.0', hd sly cl s.s. frags. flds
10. Op 0.05' to 0.1', so gr cl gouge fld
11. Op 0.05', so gr cl gouge fld

**Joints not numbered are tight. Joints in the Ha and Hb members are typically iron stained

NOTE
FOR NOTES, SEE DRAWING BSFR-41





LEGEND

- 1¼" ROCK BOLTS 25'-30
- 1" ROCK BOLTS 23'-28'
- 1" ROCK BOLTS 20'-25'
- 1" FLOOR ROCK BOLTS 23'-28'
- JOINT NO
- ROCK BOLT LOAD CELL
- PORE PRESSURE CEL
- EXTENSOMETER
- REMOVED AND REPLACED WITH CONCRETE

NOTE
FOR NOTES, SEE DRAWING BSFR-41

REVISION	DATE	DESCRIPTION	BY	CHKD

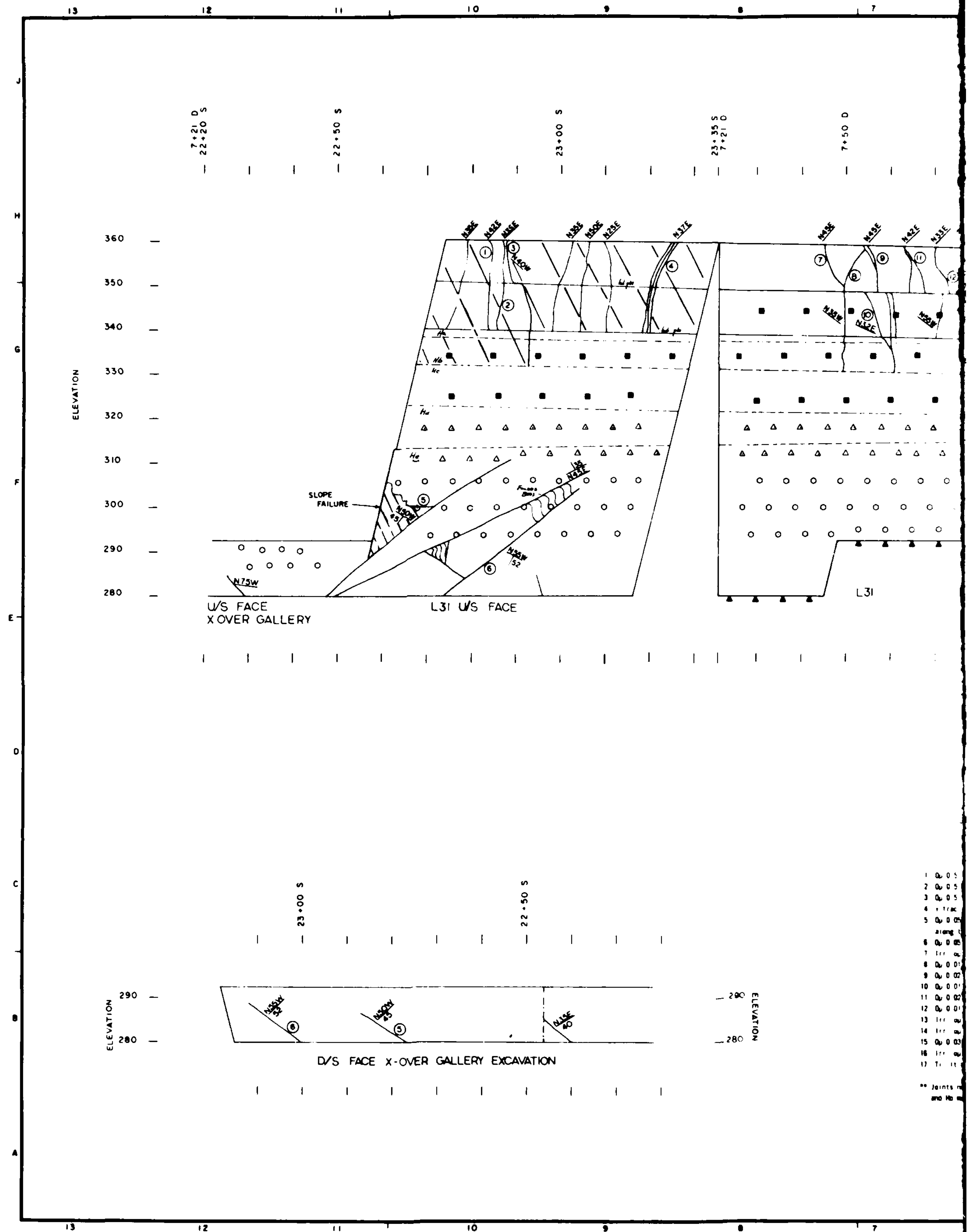
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

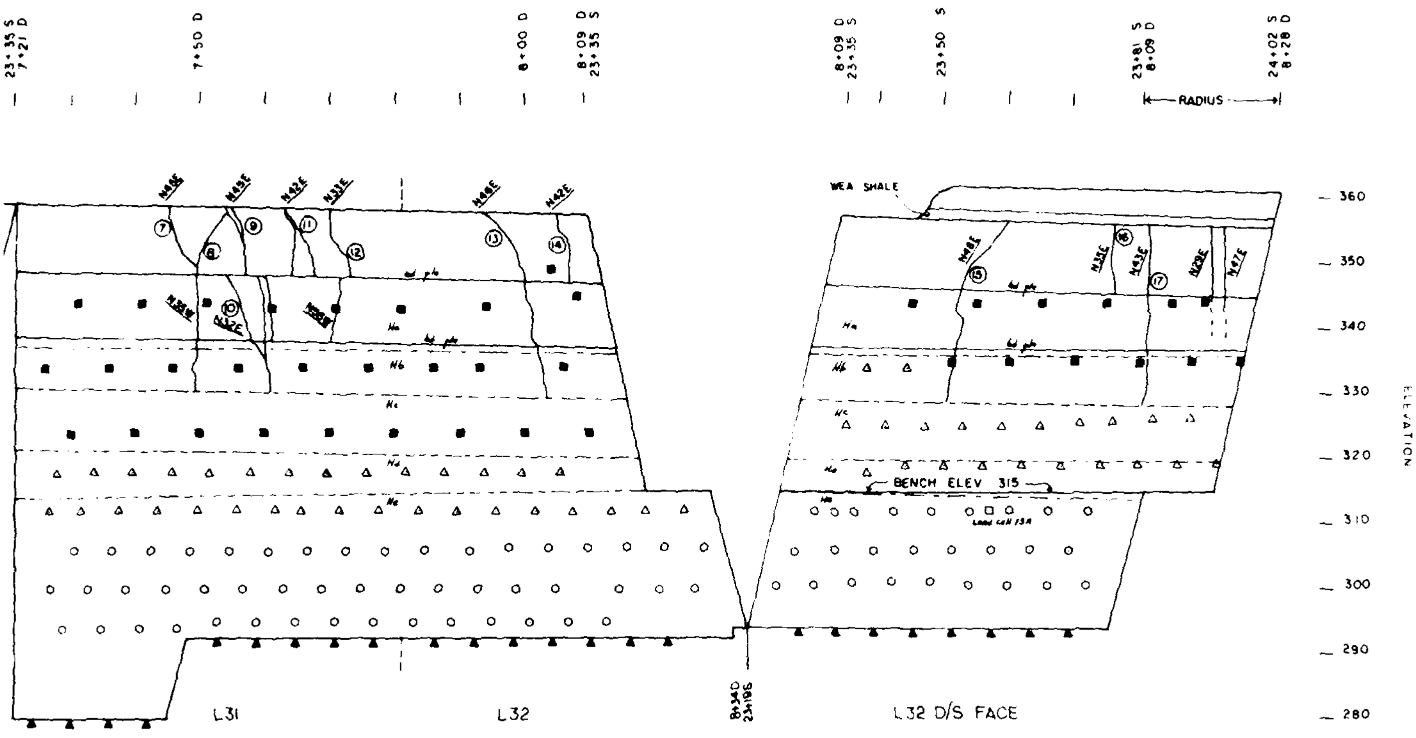
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LEFT LOCK WALL
L-19 — L-30, GEOLOGIC SECTION

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-41
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



7+21 D
22+20 S
22+50 S
23+00 S
23+35 S
7+21 D
7+50 D
ELEVATION
360
350
340
330
320
310
300
290
280
SLOPE
FAILURE
N75W
U/S FACE
X OVER GALLERY
L31 U/S FACE
L31
23+00 S
22+50 S
N55W
52
N50W
45
N35E
80
D/S FACE X-OVER GALLERY EXCAVATION



LEGEND

■	1-1/4" ROCK BOLTS 25'-30'
△	1" ROCK BOLTS 23'-28'
○	1" ROCK BOLTS 20'-25'
▲	1" FLOOR ROCK BOLTS 23'-28'
(3)	JOINT NO
⊡	ROCK BOLT LOAD CELL
(hatched)	REMOVED AND REPLACED WITH CONCRETE

JOINT DESCRIPTION

1 Op 0.5 - 1.0 lt gr sd and ss frags fld heavy fe st
2 Op 0.5 - 1.0 gr sd and ss frags fld fe st
3 Op 0.5 - 1.0 gr sd and ss frags fld fe st
4 v trgc jts heavy fe st w/lt br si cl fld
5 Op 0.05 to gr cl gouge fld slope failure occured along this jt pln
6 Op 0.05 to 0.1 to gr cl gouge fld
7 Irr op to 0.01 heavy fe st
8 Op 0.01 red si cl fld fe st
9 Op 0.02 fe st
10 Op 0.01 fe st
11 Op 0.02 red si cl fld fe st
12 Op 0.01 fe st
13 Irr op 0.01 fe st
14 Irr op 0.01 fe st
15 Op 0.03 heavy fe st
16 Irr op 0.01 fe st
17 Tr lt br cl coating heavy fe st

** Joints not numbered are tight. Joints in the Ha and Hb members are typically iron stained

NOTE
FOR NOTES, SEE DRAWING BSFR-37

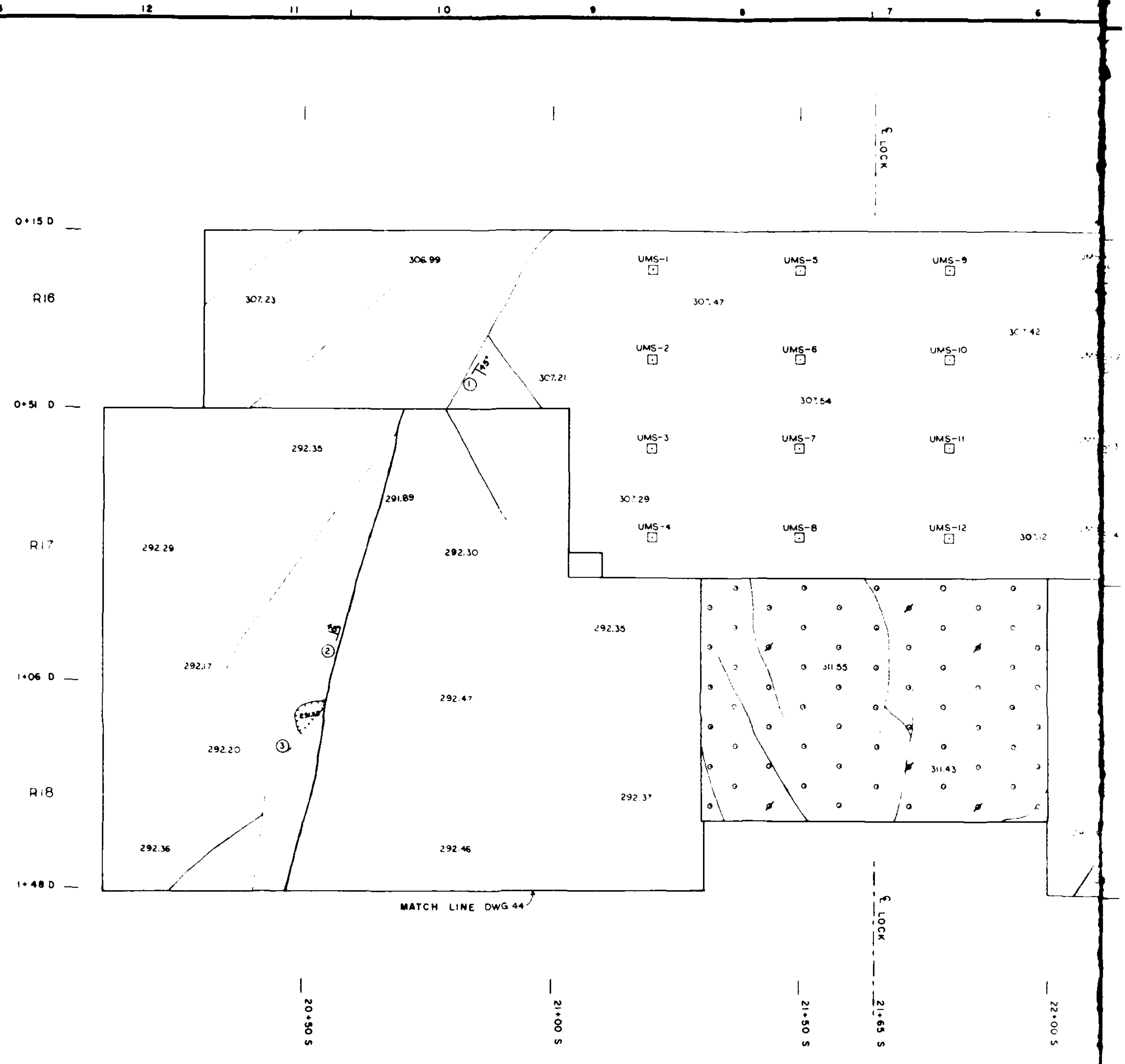
REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LEFT LOCK WALL
L-31 — L-32, GEOLOGIC SECTIONS

DRAWN: SRD
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-42
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



JOINT DESCRIPTION

1. Ti. occ. so gr cl fld
2. Op 0.05' to 0.1', so gr cl and sh frags fld
3. Op 0.1', so lam sh fld.
4. Op 0.05' to Ti, so gr cl gouge fld.

**Lock chamber founded in the member. Fractures not numbered are tight.

LEGEND

(7) JOINT NO.

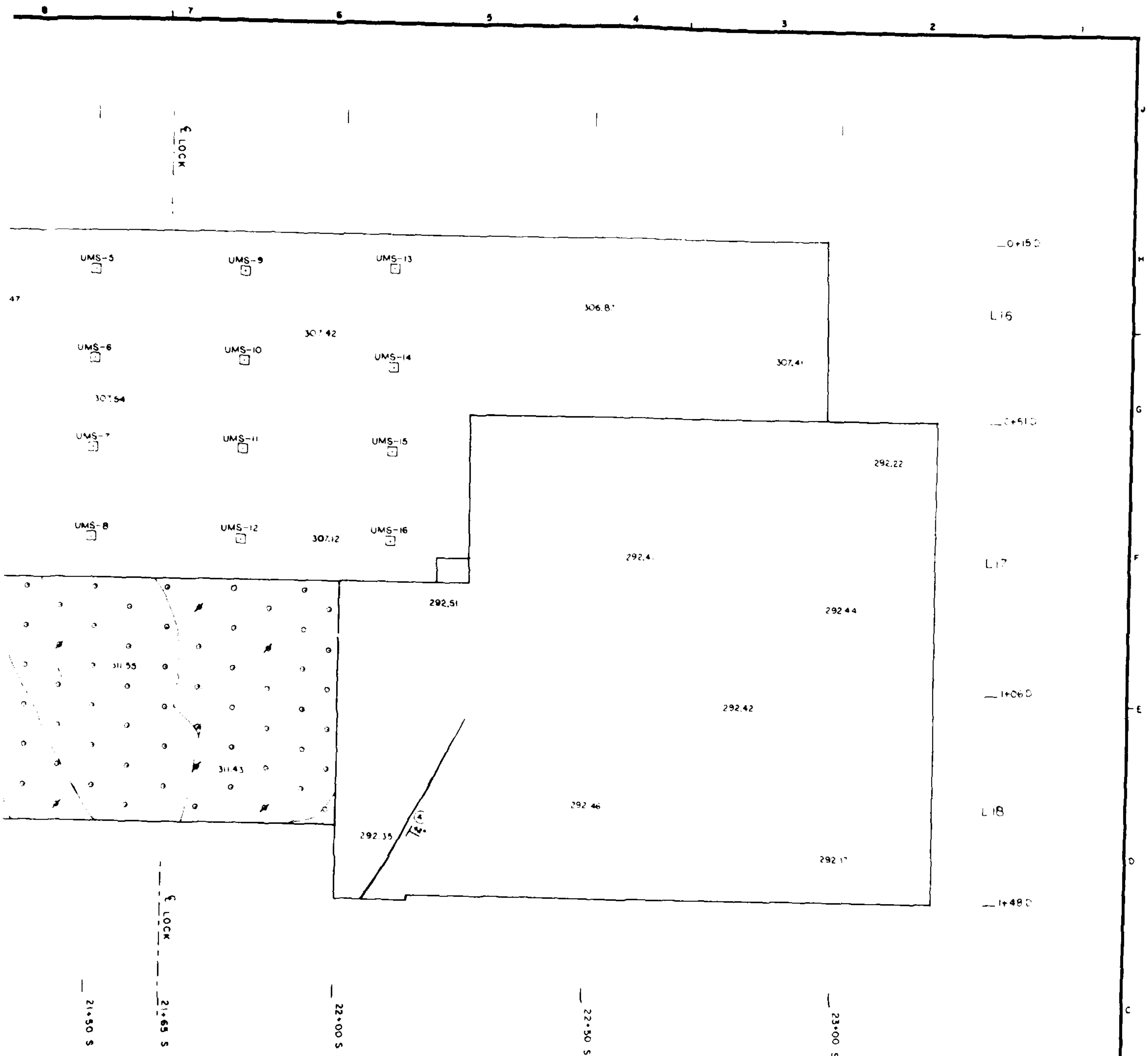
UPLIFT PRESSURE CELL

292.23 FOUNDING ELEVATION

1¼" ANCHOR BOLTS 30'

LOAD TESTED ANCHOR BOLTS

ANCHOR BOLT HOLES FLOWED WATER



LEGEND

- JOINT NO
- UPLIFT PRESSURE CELL
- 292.23 FOUNDING ELEVATION
- 1¼" ANCHOR BOLTS 30'
- LOAD TESTED ANCHOR BOLTS
- ANCHOR BOLT HOLES FLOWED WATER

NOTES

1. FOR ABBREVIATIONS, SEE CONTRACT DRAWING TTBS-3/1
2. ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

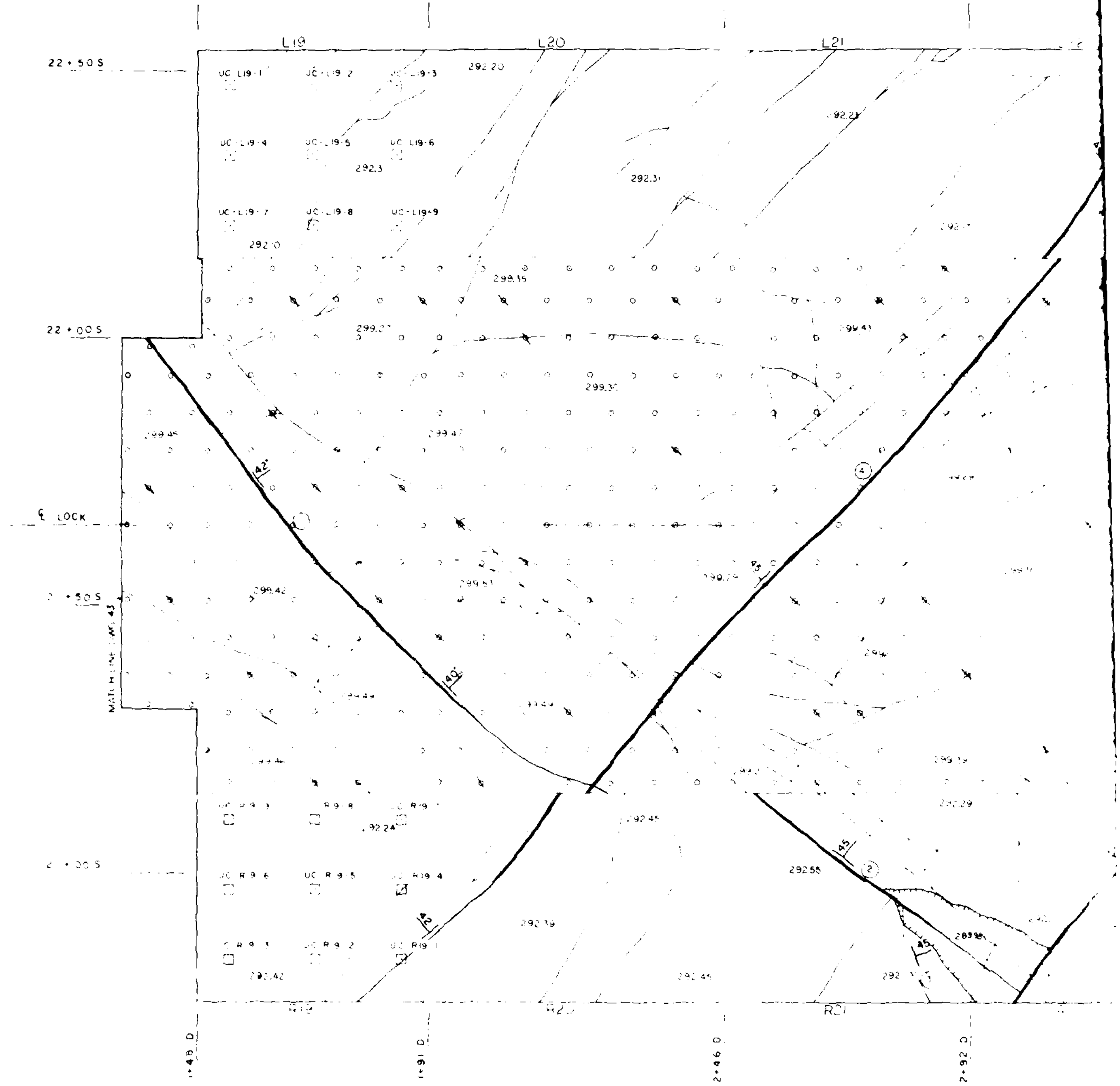
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN PAR, DRS
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LOCK CHAMBER FOUNDATION
0+150 to 1+48D, 20+10S to 23+20S

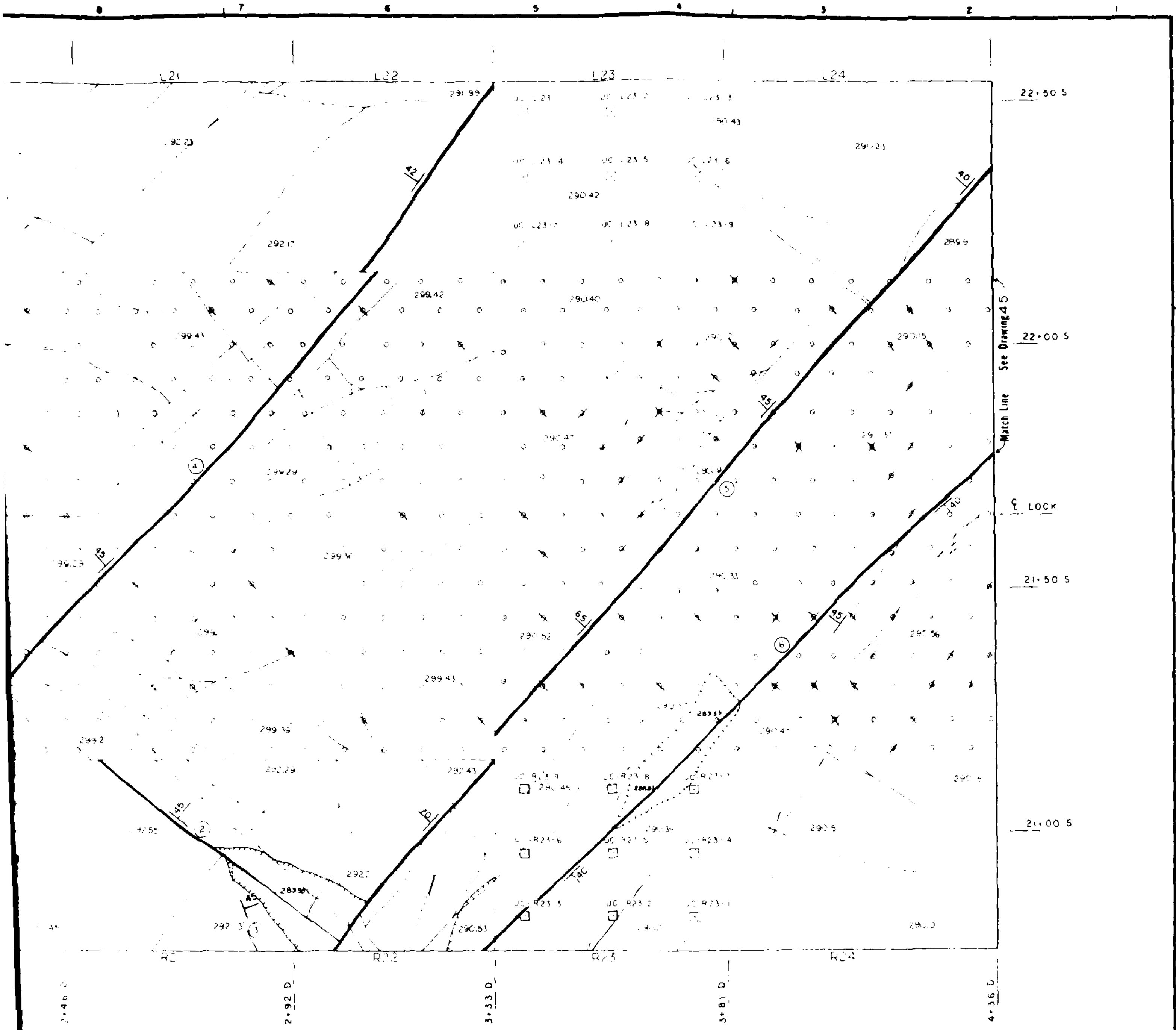
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C. E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-43
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



JUINT DESCR'PTION

1 ... gr cl gouge and ... frags fld
2 ... gr cl gouge and ... frags fld
3 ... gr cl gouge and sh frags fld
4 ... gr cl gouge and sh frags fld
5 ... gr cl gouge and sh frags fld.
6 ... gr cl gouge and sh frags fld

**Lock chamber founded in ... Fractures not numbered are tight



DESCRIPTION

LEGEND

(7) JOINT NO.
UPLIFT PRESSURE CELL
292.23 FOUNDING ELEVATION
1¼" ANCHOR BOLTS 30'
LOAD TESTED ANCHOR BOLTS
ANCHOR BOLT HOLES FLOWED WATER

NOTE:
FOR NOTES, SEE DRAWING BSFR-43

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

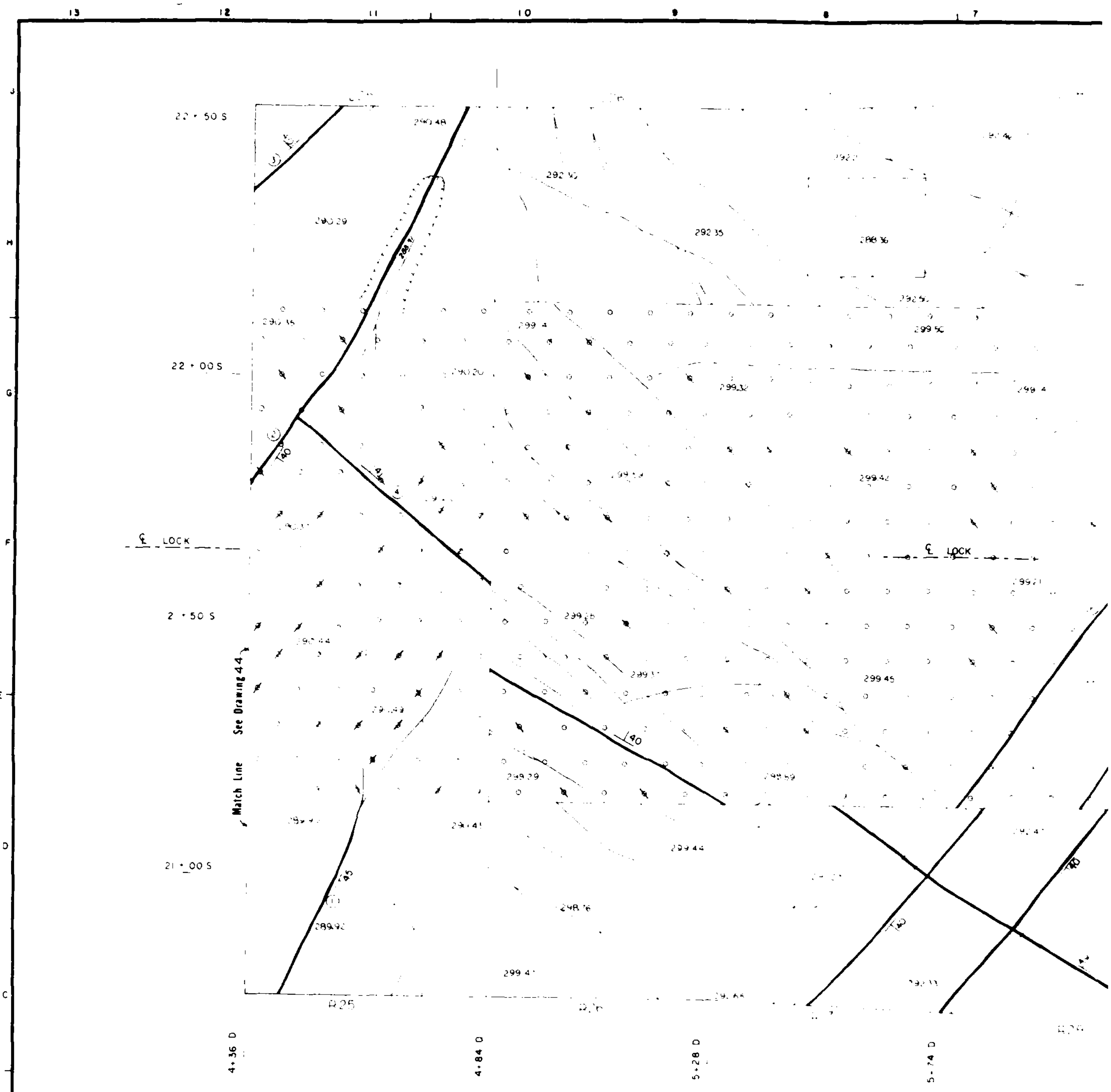
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN PAR, DKS
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LOCK CHAMBER FOUNDATION
1+48D to 4+36D, 20+76S to 22+54S

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC. NO.
DRAWING NUMBER
BSFR-44
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



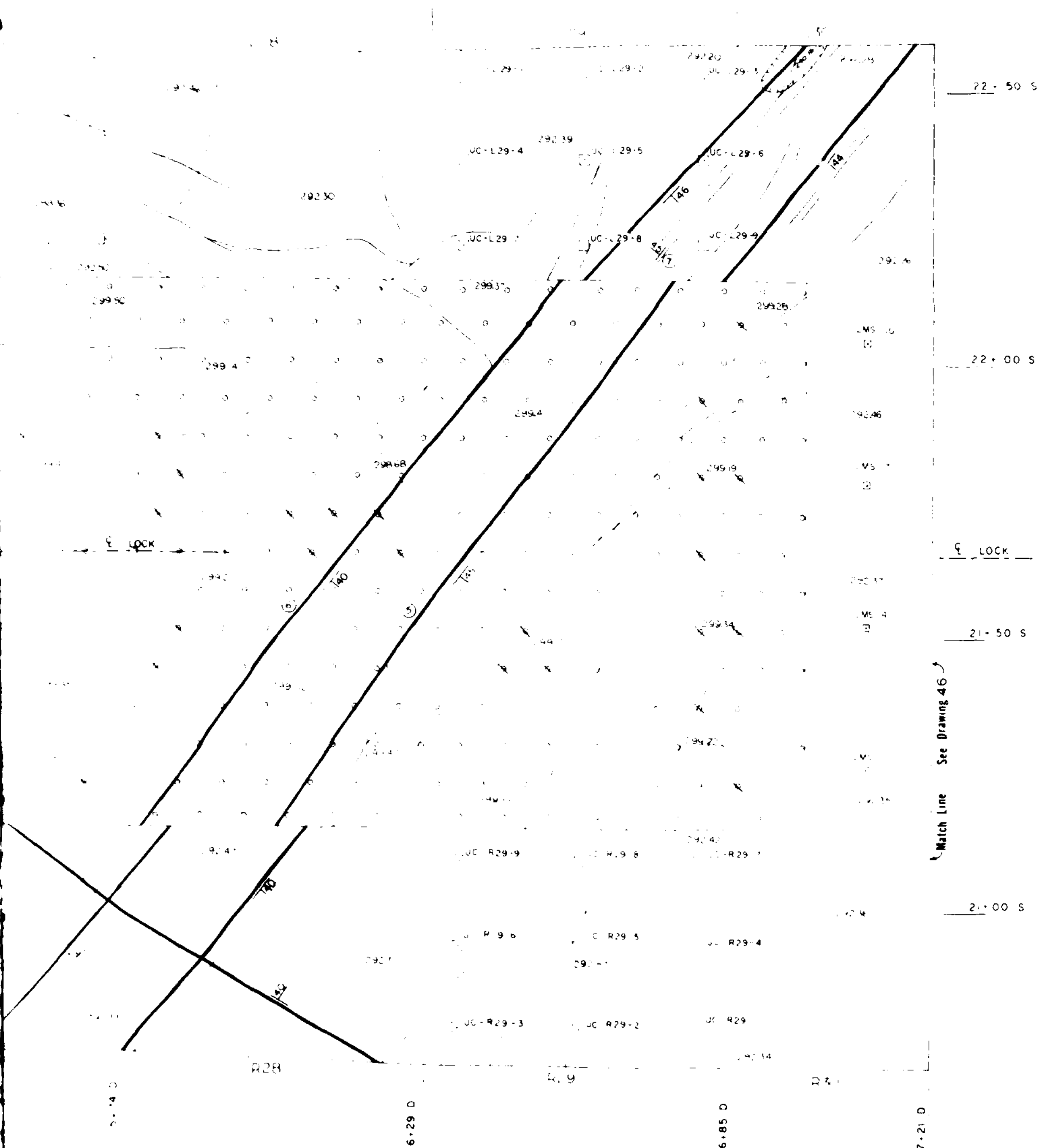
JOINT DESCRIPTION

1. Op 0.05' to Tl, so gr cl gouge fld.
2. Op 0.01', so gr cl gouge fld.
3. Op 0.01', so gr cl gouge fld.
4. Op 0.1' to 0.2', so gr cl gouge fld.
5. Op 0.05' to 0.1', so gr cl gouge fld.
6. Op 0.05', so gr cl gouge fld.
7. Op 0.01' to 0.05', so gr cl gouge fld.

**Lock chamber founded in Ke member. Fractures not numbered are tight.

LEGEND

- JOINT NO.
- UPLIFT PRESSURE CELL
- 292.23 FOUNDING ELEVATION
- ANCHOR BOLTS 30'
- LOAD TESTED ANCHOR BOLTS
- ANCHOR BOLT HOLES FLOWED WATER



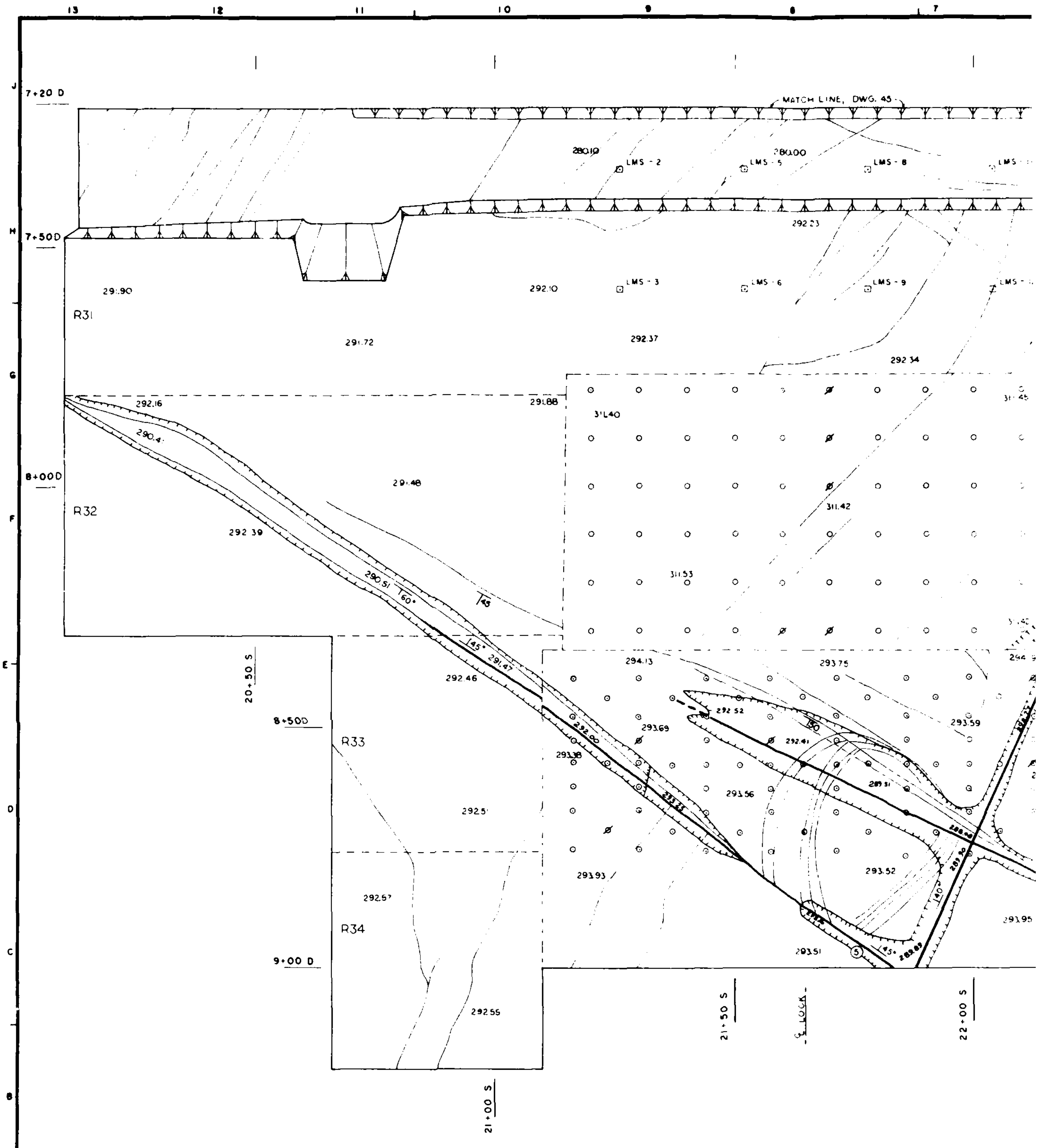
NOTE
FOR NOTES, SEE DRAWING BSFR-43

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN PAF, DLS	TENNESSEE TOMBIGBEE WATERWAY
CHECKED	MISSISSIPPI AND ALABAMA
TRACED	BAY SPRINGS LOCK AND DAM
COMPARED	LOCK
ENGINEER	LOCK CHAMBER FOUNDATION 4+36D to 7+21D, 20+71S to 22+59S
SUBMITTED	APPROVAL RECOMMENDED — CHIEF, ENGINEERING DIVISION
APPROVED — COLONEL, C E DISTRICT ENGINEER	SCALE 1" = 10' / SPEC NO
DATE	DRAWING NUMBER BSFR-45 / SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED



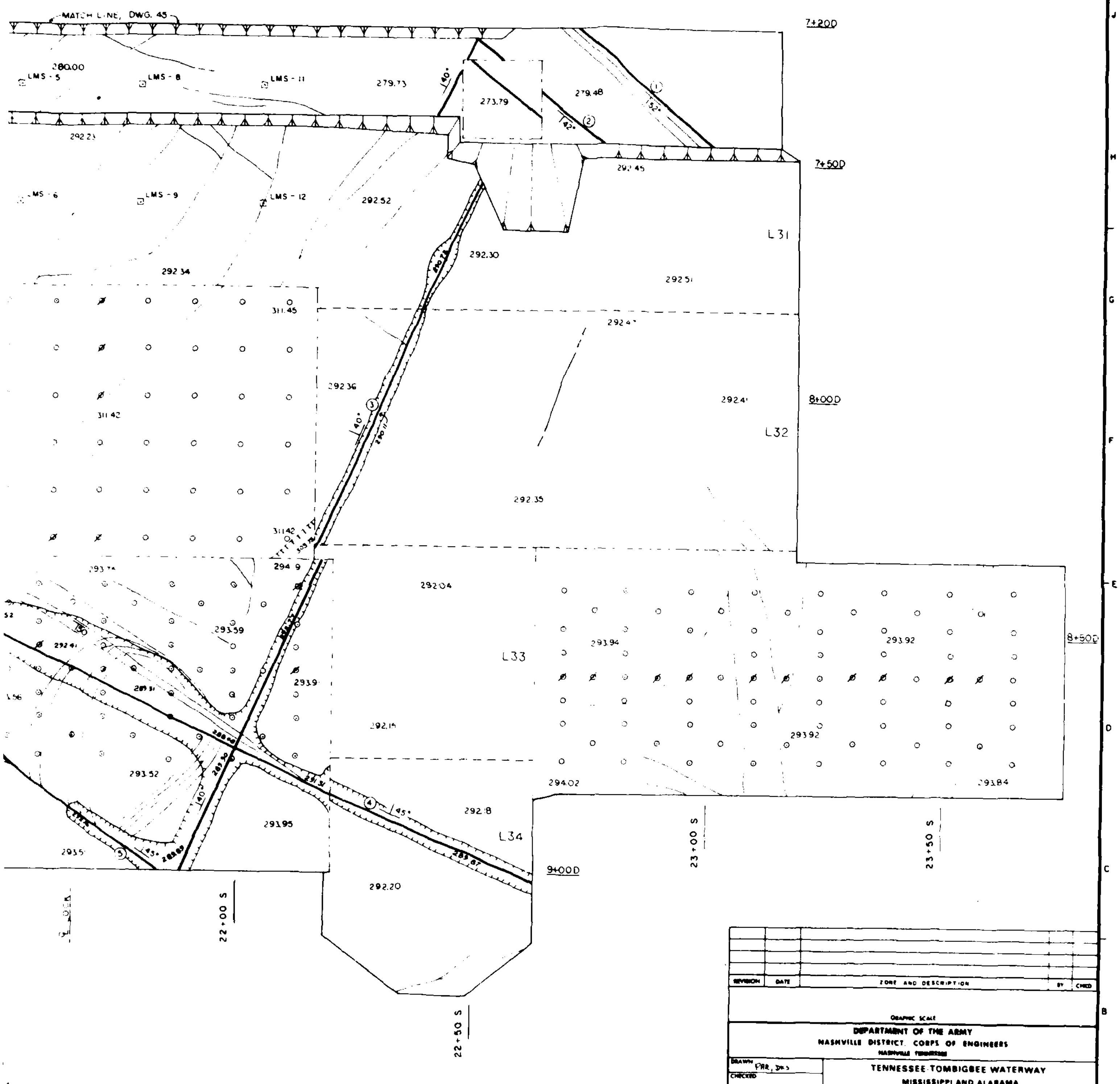
JOINT DESCRIPTION

1. Op 0.03' to 0.1', so dk gr cl gouge fld.
2. Op 0.1', so dk gr cl gouge fld.
3. Op 0.3', so dk gr cl gouge fld.
4. Op 0.05' to 0.1', so dk gr cl gouge fld.
5. Op 0.05', gr sh frags. and so dk gr cl gouge fld.

**Lock chamber founded in Ho member. Fractures not numbered are tight.

LEGEND

(7) JOINT NO.
⊡ UPLIFT PRESSURE CELL
292.23 FOUNDING ELEVATION
○ 1¼" ANCHOR BOLTS 30'
Ø LOAD TESTED ANCHOR BO



LEGEND

⑦ JOINT NO.
⊡ UPLIFT PRESSURE CELL
292.23 FOUNDING ELEVATION
○ 1¼" ANCHOR BOLTS 30'
ø LOAD TESTED ANCHOR BOLTS

NOTE
FOR NOTES, SEE DRAWING BSFR 43

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

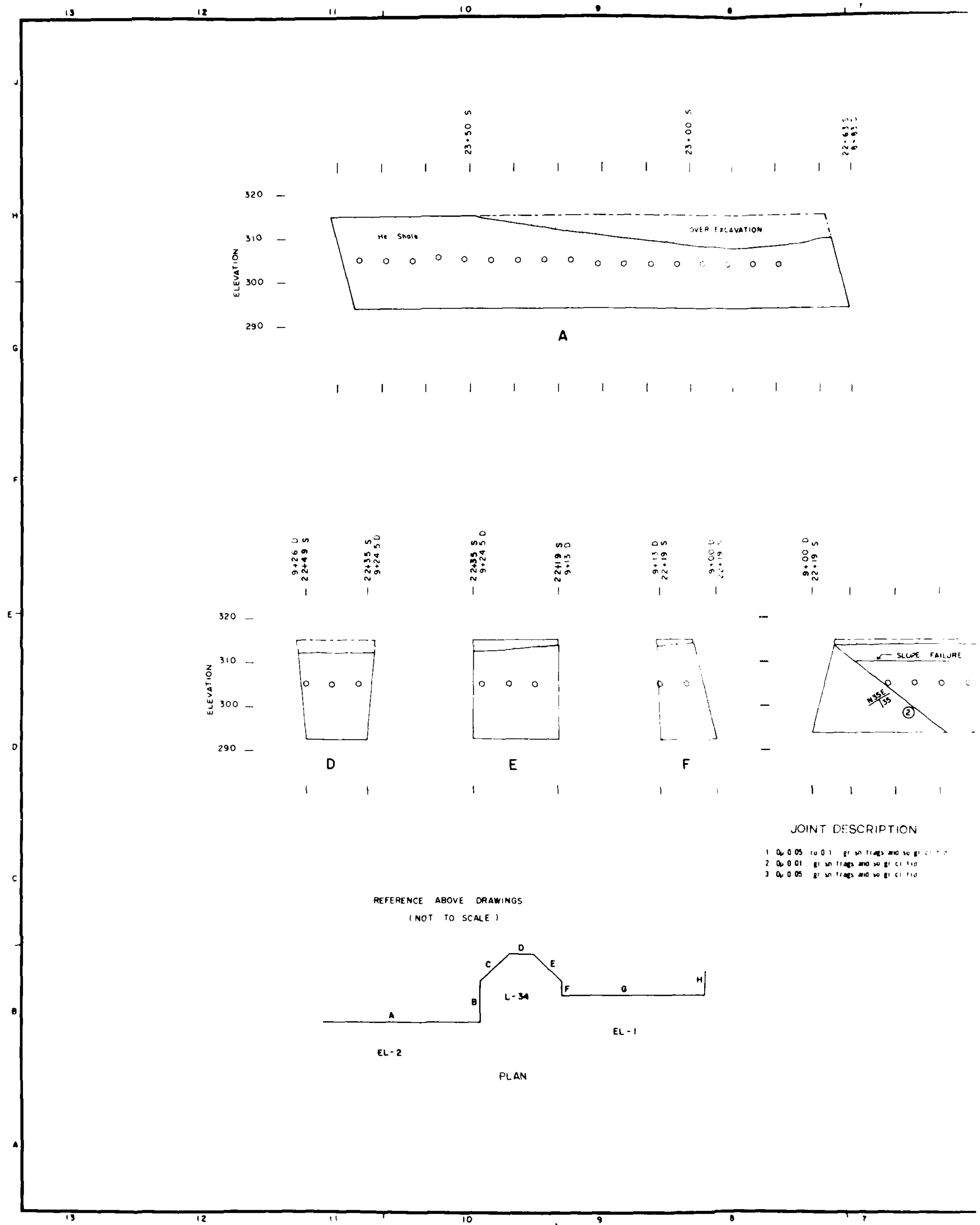
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE TENNESSEE

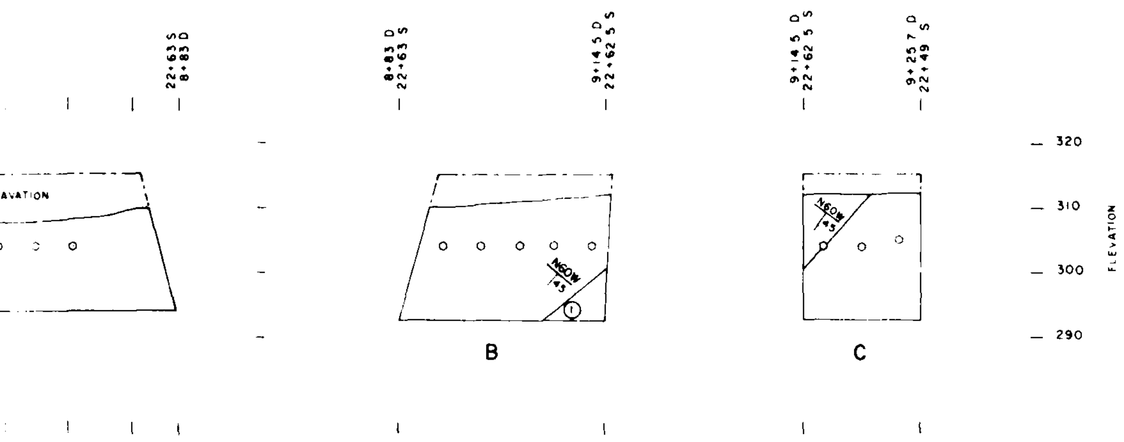
DRAWN PRR, DRS
CHECKED
TRACED
COMPARED

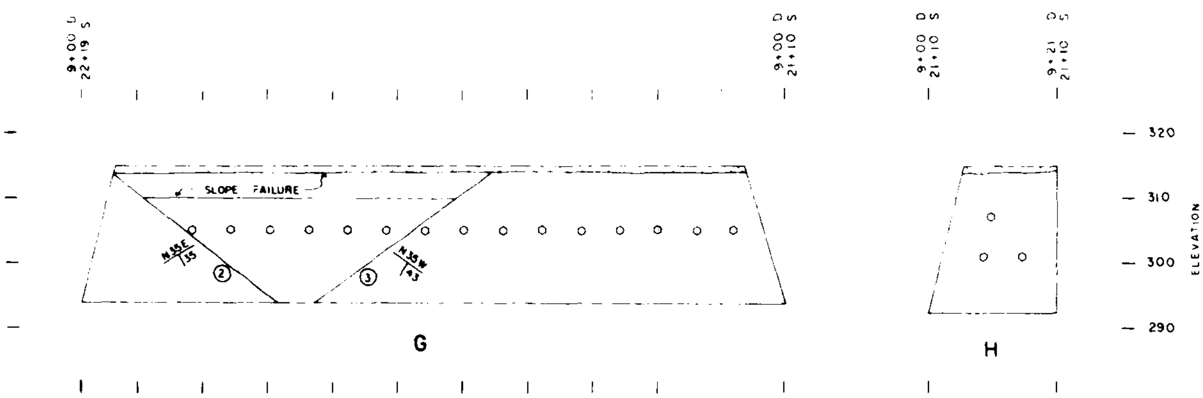
TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LOCK CHAMBER FOUNDATION,
7+21D to 9+21D, 20+10S to 23+76S

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-46
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



23+50 S
23+00 S
320
310
300
290
ELEVATION
He Shale
OVER EXCAVATION
A
9+26 D
22+49 S
22+35 S
9+24 5 D
22+35 S
9+24 5 D
22+19 S
9+13 D
9+13 D
22+19 S
9+00 D
22+19 S
SLOPE FAILURE
N35E
35
D
E
F
JOINT DESCRIPTION
1 Op 0 05 to 0 1 gr sh frags and so gr
2 Op 0 01 gr sh frags and so gr cl fld
3 Op 0 05 gr sh frags and so gr cl fld
REFERENCE ABOVE DRAWINGS
(NOT TO SCALE)
A
B
C
D
E
F
G
H
L-34
EL-2
EL-1
PLAN





JOINT DESCRIPTION

1 Op 0.05 to 0.1 gr sh frags and so gr cl fld
2 Op 0.01 gr sh frags and so gr cl fld
3 Op 0.05 gr sh frags and so gr cl fld

LEGEND

o ROCK BOLT, 20'-25' OVER-EXCAVATION

(2) JOINT NO.

NOTES
1 STATIONS ARE FOR BOTTOM OF 4V ON 1H SLOPES
2 FOR ABBREVIATIONS SEE CONTRACT DRAWING TTBS-3.1
3 ALL ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

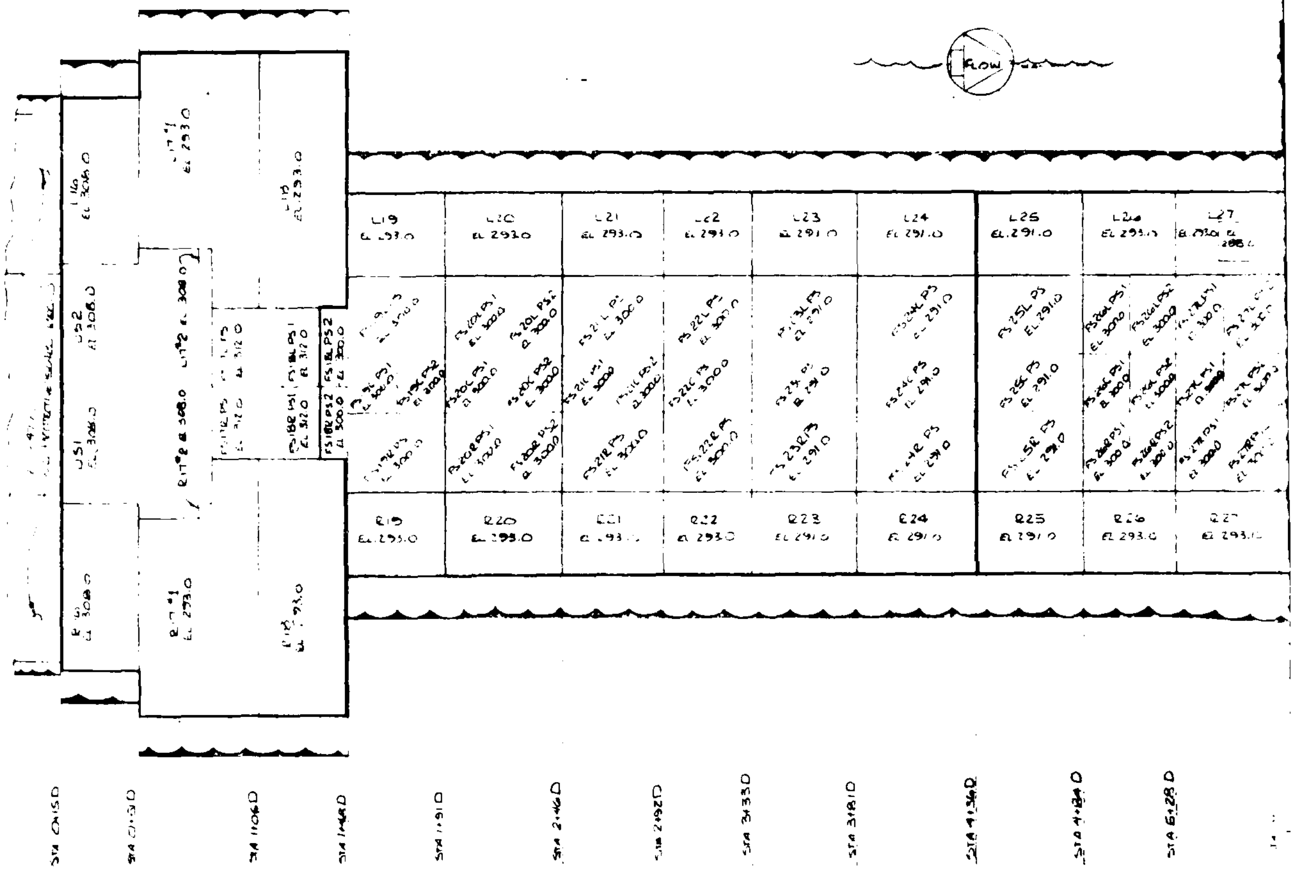
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN PKR
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTIONS
21+10S to 23+85S, 8+83D to 9+21D

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, CE, DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-47
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

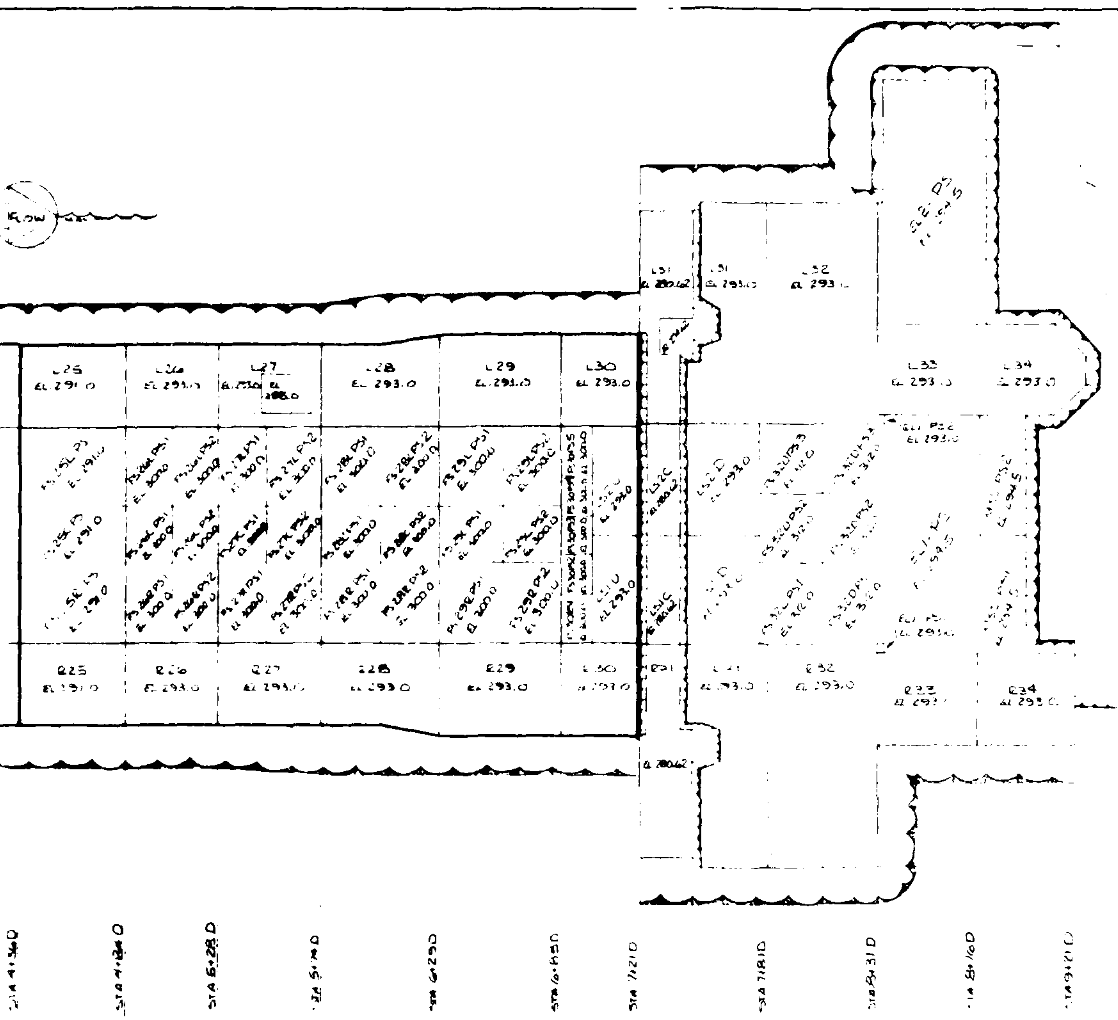


PLAN ~ PROTECTIVE SLABS

1" = 30'

NOTES

1. ALL ELEVATIONS ARE TOP OF PROTECTIVE SLAB
2. SLOPED SURFACES TO RECEIVE 6" SHOTCRETE
3. REFER TO DRAWING BSPR-73 FOR DATE OF SLAB INSTALLATIONS.



...TECTIVE SLABS

...30'

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
PROTECTIVE SLABS
PLAN

SUBMITTED

APPROVAL RECOMMENDED

CHIEF, ENGINEERING DIVISION

APPROVED

COLONEL, C. E. DISTRICT ENGINEER

DATE

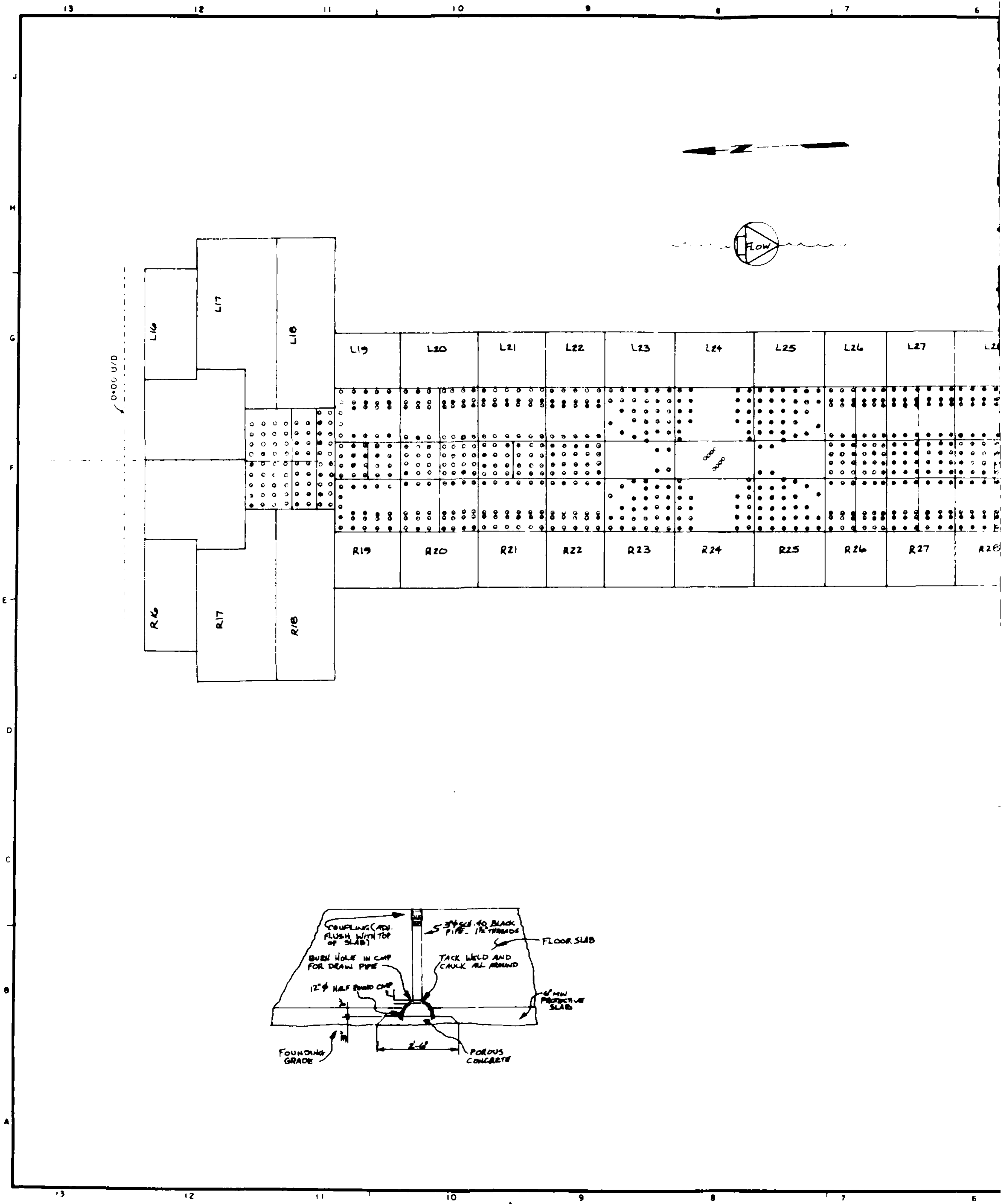
SCALE 1" = 30'

SPEC NO

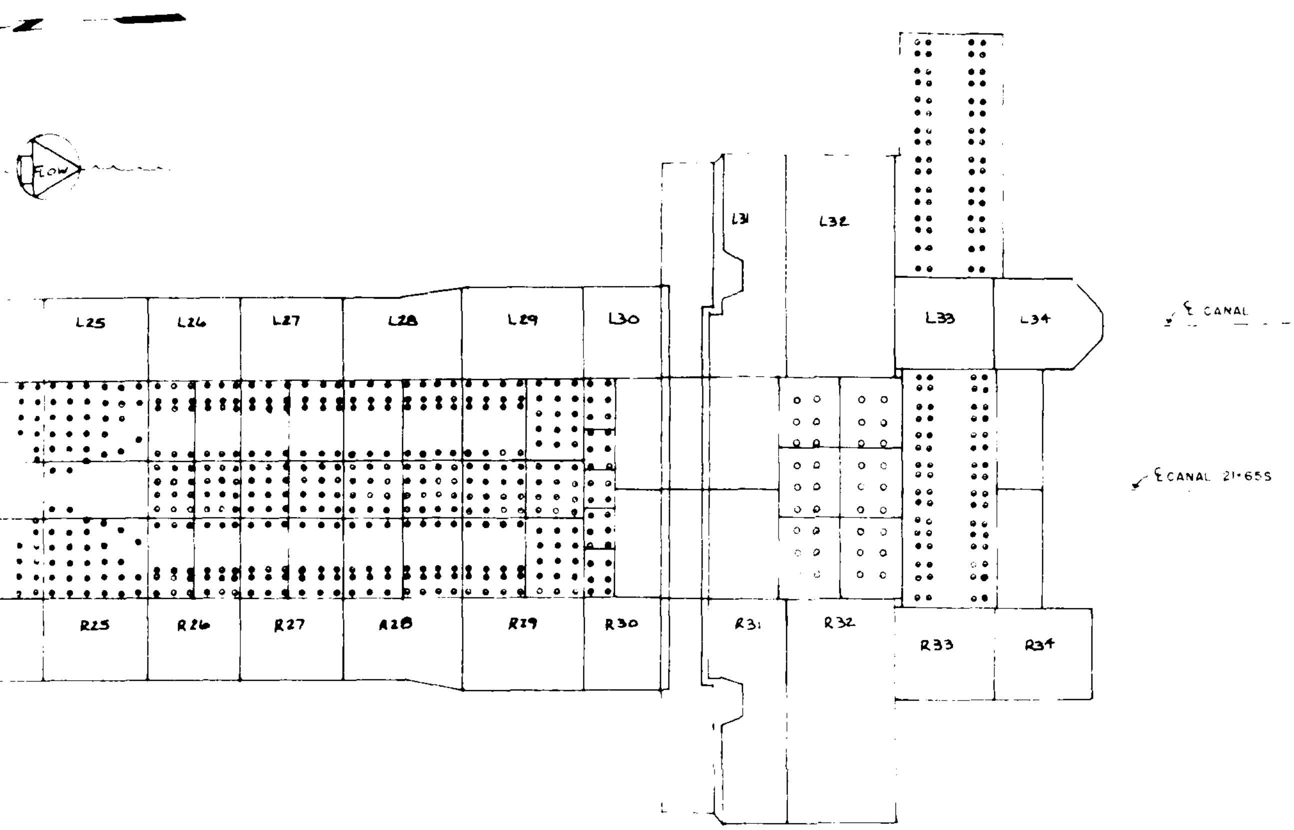
DRAWING NUMBER
BSFR-48

SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED



FLOW
0+00 U/D
L16
L17
L18
L19
L20
L21
L22
L23
L24
L25
L26
L27
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
COUPLING (ADJ. FLUSH WITH TOP OF SLAB)
FLOOR SLAB
BURN HOLE IN CAP FOR DRAW PIPE
TACK WELD AND CAULK ALL AROUND
12"φ HALF ROUND CAP
6" MIN PROTECTIVE SLAB
FOUNDING GRADE
POROUS CONCRETE



REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

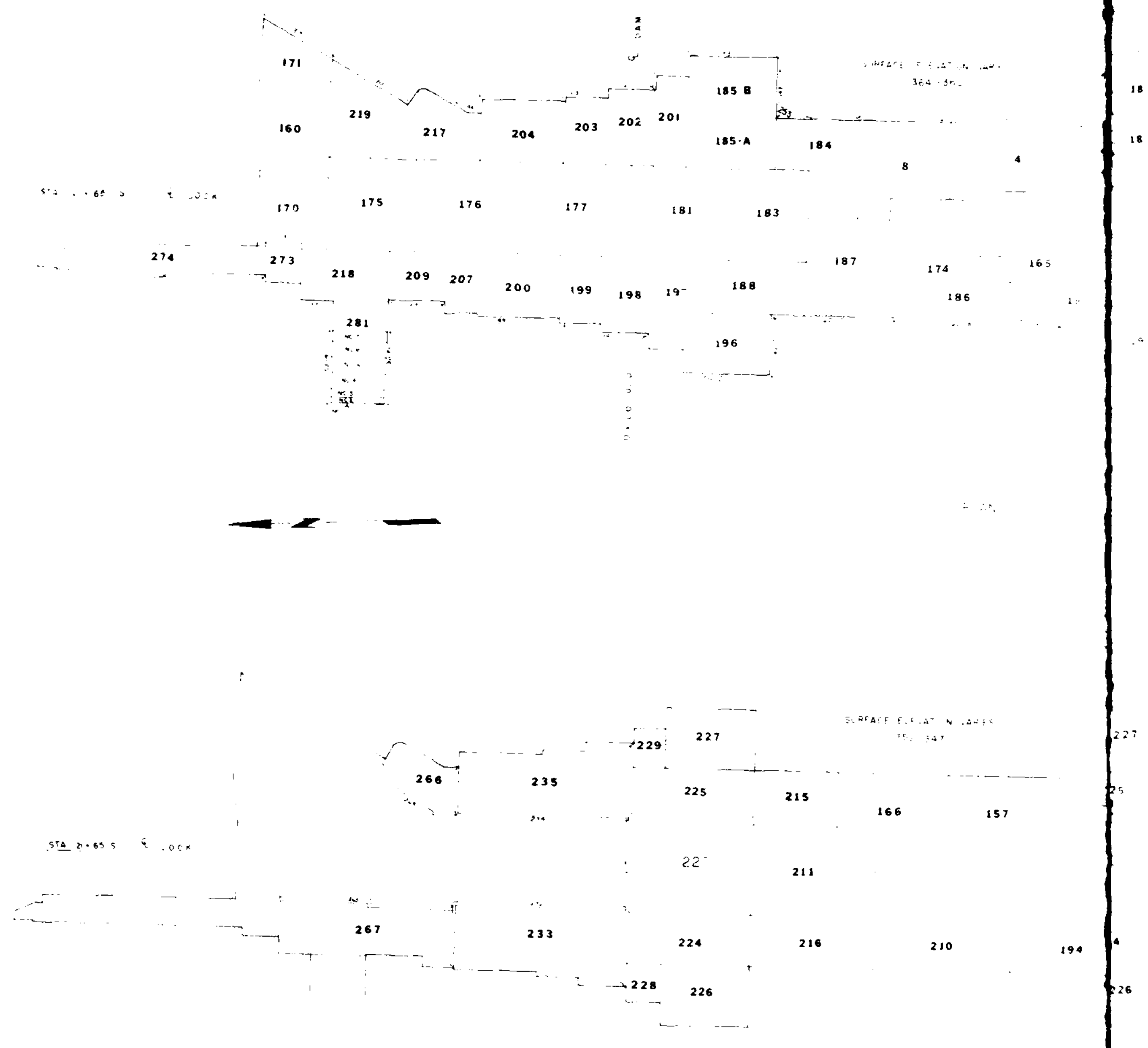
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

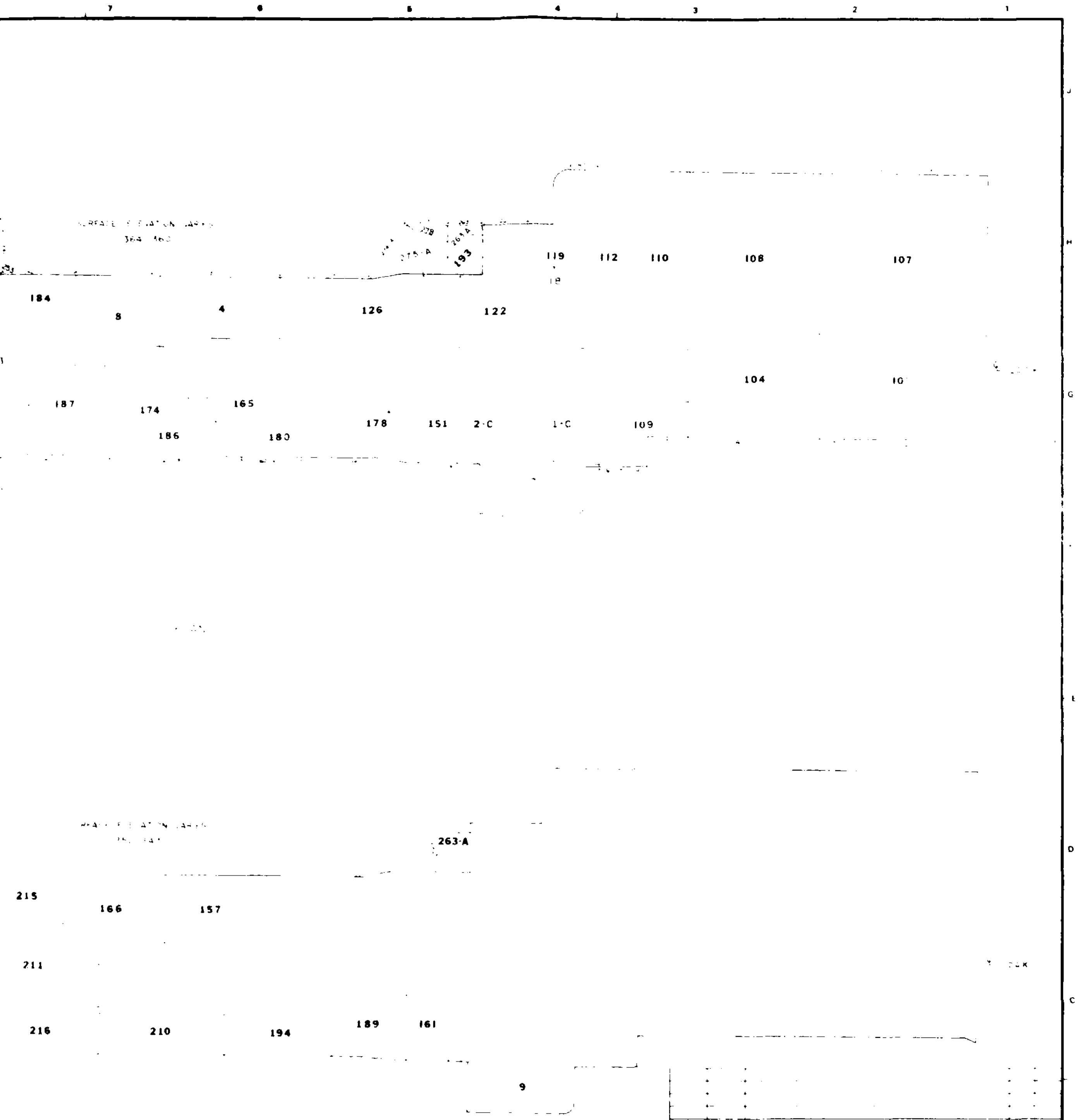
DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LOCK FLOOR DRAINS
PLAN

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, DISTRICT ENGINEER
DATE
SCALE 1" = 30'
SPEC NO
DRAWING NUMBER
BSFR-49
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



NOTES
1 BLOCKED OFF AREAS CONTAINING NUMBERS REPRES
2 NUMBERS SHOWN GENERALLY DELINEATE THE BLAS
3 THE NUMBERING SYSTEM IS NEITHER COMPLETEL
4 NUMBERS SHOWN ALONG PERIPHERY ARE PRESPL
HOWEVER, MOST PRESPLIT SHOT NUMBERS HAVE
5 PRODUCTION SHOT NOMENCLATURE IS SHOWN BY
6 ELEVATIONS SHOWN REFER TO MEAN SEA LEVE



NOTES
1. BLOCKED OFF AREAS CONTAINING NUMBERS REPRESENT PRODUCTION SHOTS
2. NUMBERS SHOWN GENERALLY DELINEATE THE BLAST SEQUENCE AND APPROXIMATE AREA OF BLAST
3. THE NUMBERING SYSTEM IS NEITHER COMPLETELY SYSTEMATIC NOR CHRONOLOGICALLY SEQUENTIAL
4. NUMBERS SHOWN ALONG PERIPHERY ARE PRESPLIT SHOTS. SOME ARE DESIGNATED PS (PRESPLIT), HOWEVER, MOST PRESPLIT SHOT NUMBERS HAVE NO "PS" MODIFIERS
5. PRODUCTION SHOT NOMENCLATURE IS SHOWN BY THE FOLLOWING EXAMPLES 127, NC 7, 10P4, AND DSR 36
6. ELEVATIONS SHOWN REFER TO MEAN SEA LEVEL

REVISION | DATE | DESCRIPTION | BY | CHKD

GRAPHIC SCALE

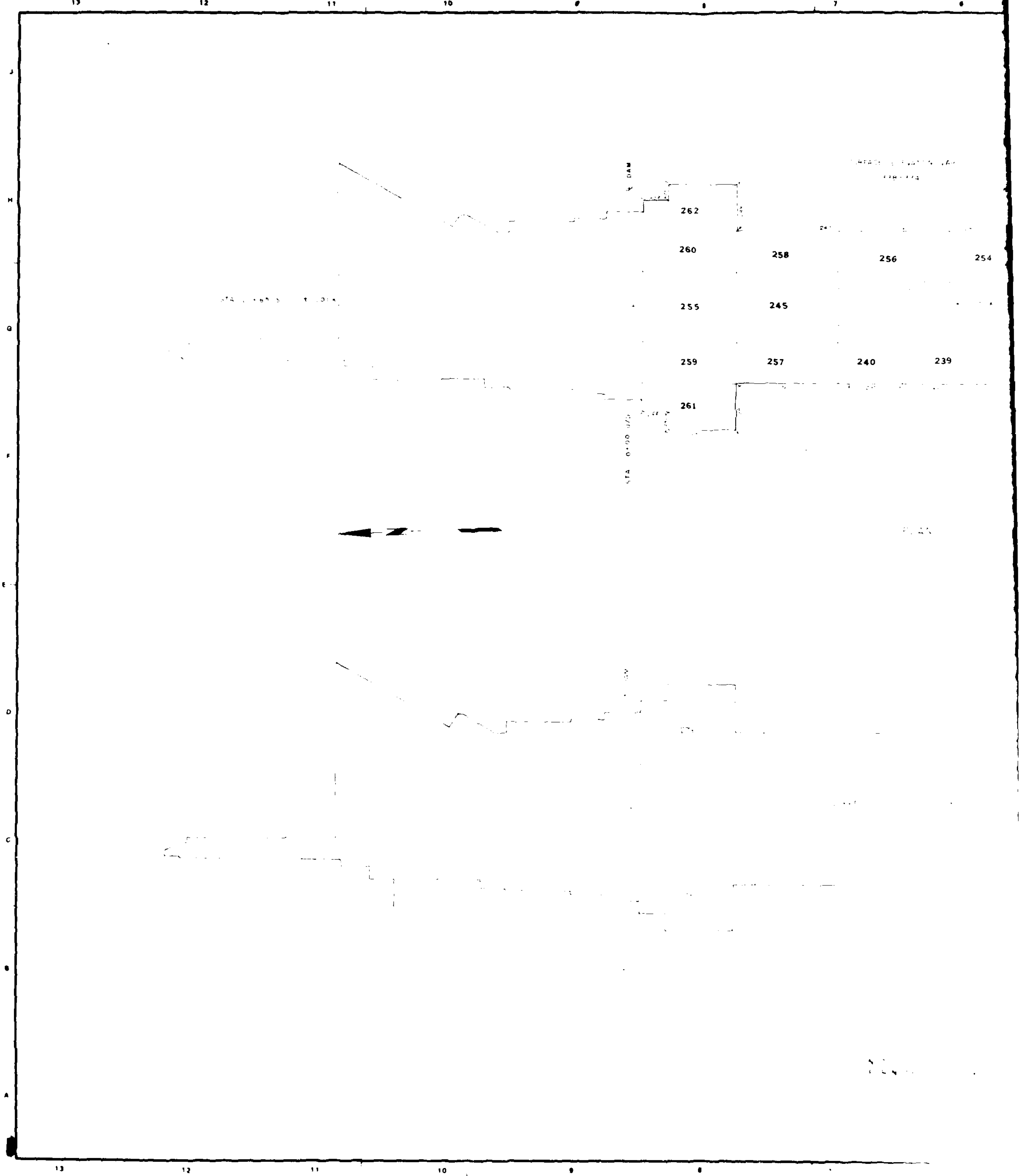
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

BLAST PATTERN - LOCK AREA
SURFACE ELEVATIONS 360-364, 347-350

ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
SCALE 1" = 60' SPEC NO
DRAWING NUMBER
BSFR-50
COLONEL, C. E. DISTRICT ENGINEER
DATE
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

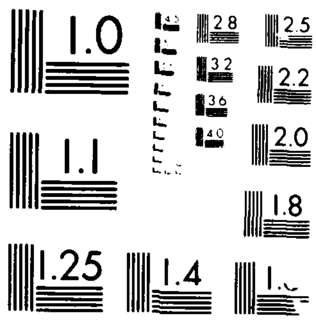


DAM
262
260
258
256
254
255
245
259
257
240
239
261

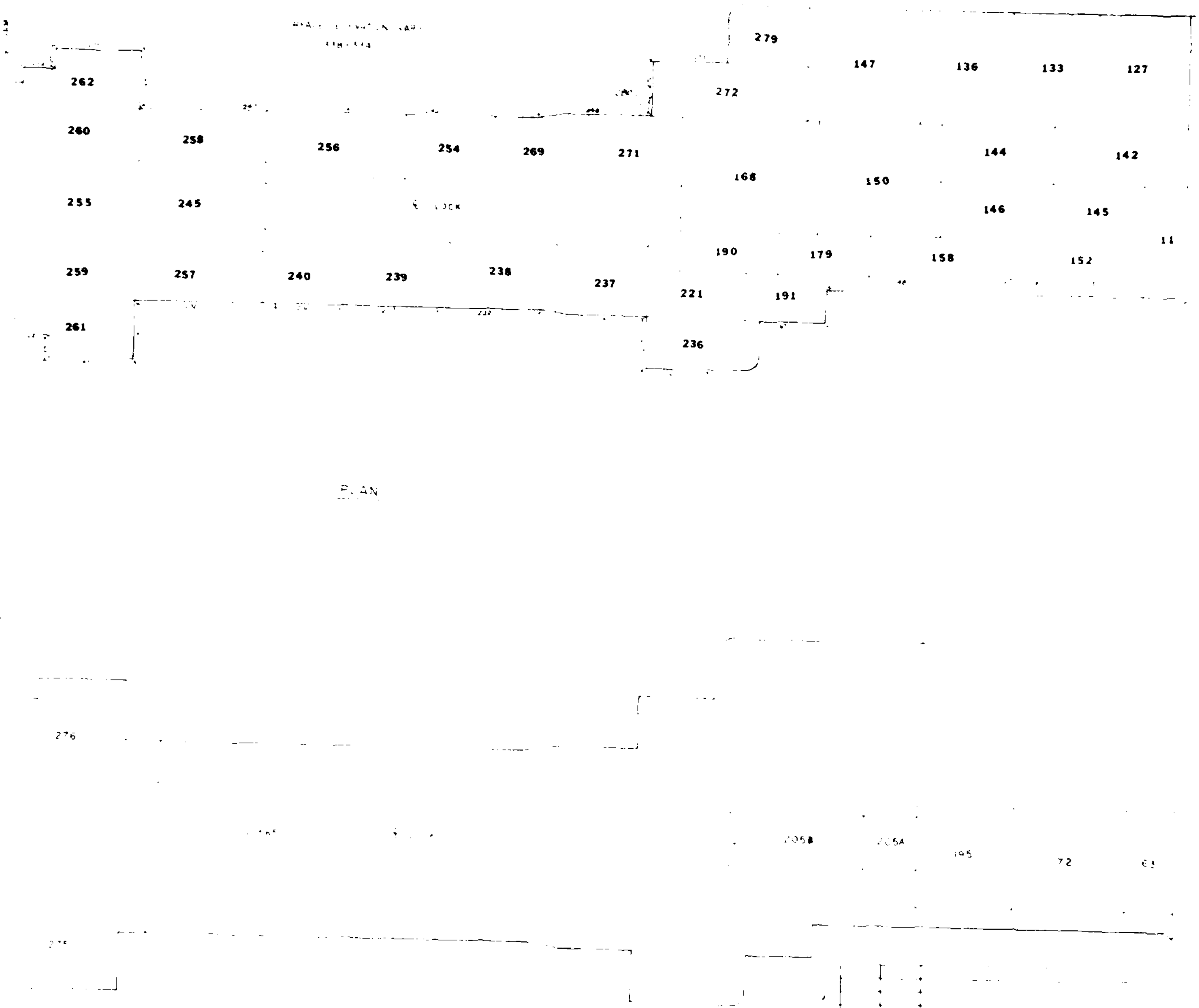
AD-A191 507 BAY SPRINGS LOCK AND DAM FOUNDATION COMPLETION REPORT 5/5
TENNESSEE-TOMBIGBEE..(U) CORPS OF ENGINEERS NASHVILLE
TN NASHVILLE DISTRICT P ROSS ET AL. AUG 87

UNCLASSIFIED F/G 13/2 NL

END
DATE
FILMED
5 8-



MICROCOPY RESOLUTION TEST CHART



NOTE
FOR NOTES SEE DRAWING BSFR 50

REVISION	DATE	DESCRIPTION	BY	CHKD

GRAPHIC SCALE

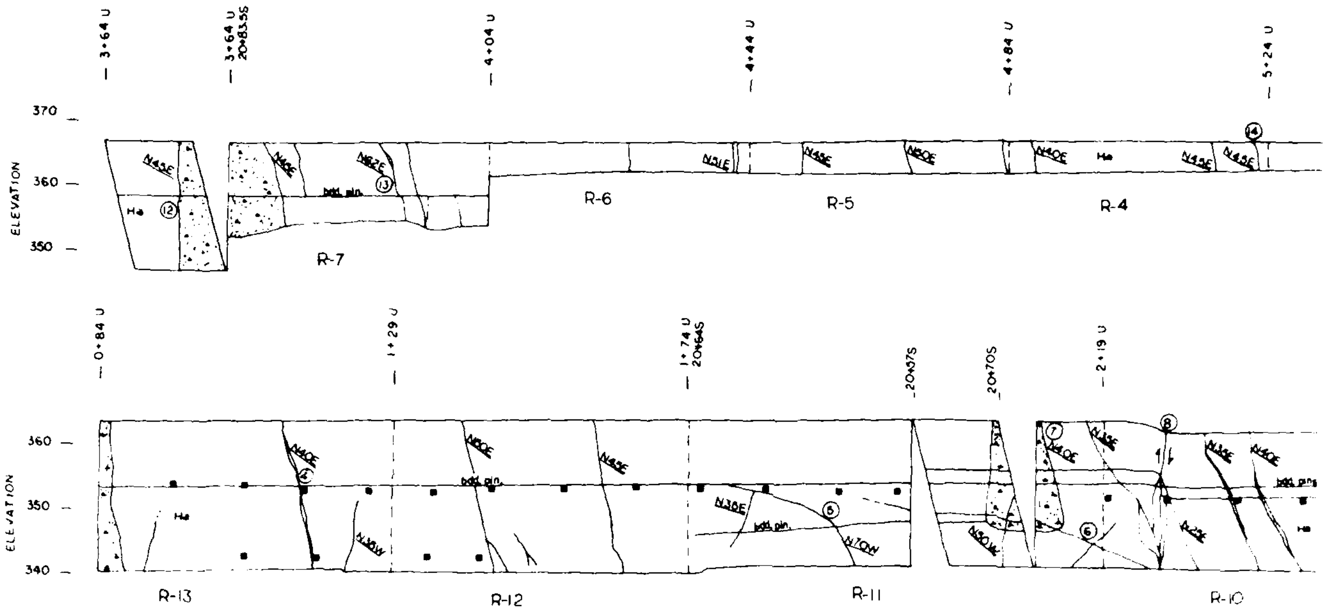
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

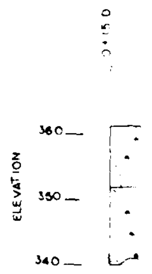
DRAWN
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

BLAST PATTERN - LOCK AREA
SURFACE ELEVATION 338-334

ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC NO
DRAWING NUMBER
BSFR - 51
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATE





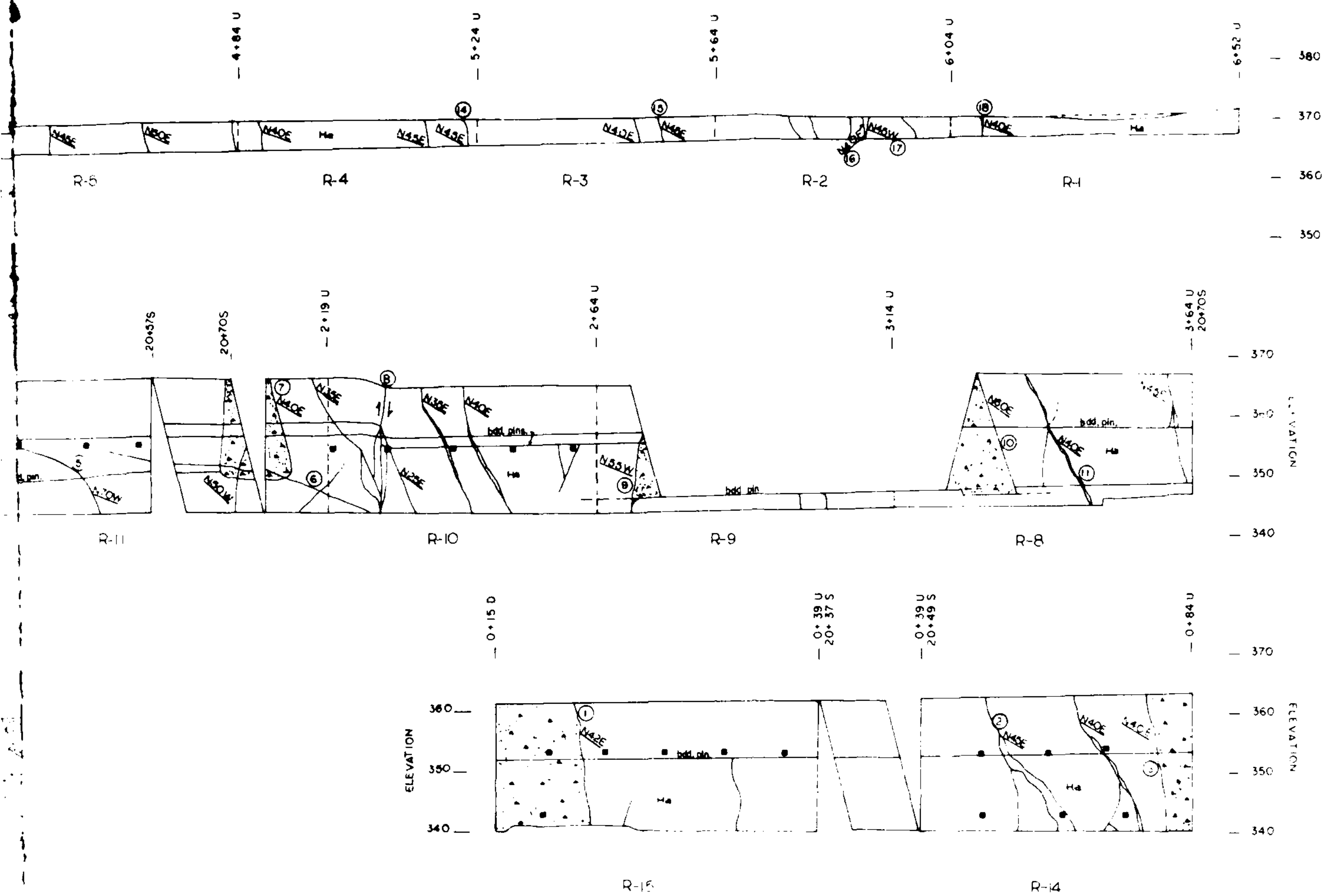
JOINT DESCRIPTION

1 Corner broke back and along jt pln heavy fe st
2 Irr op 0 05 part tim fld
3 Corner broke back and along jt pln heavy fe st
4 Op 0 04 fe cmtd sd and lim fld
5 Irr Dip 56° NB ti prob associated w fault
6 U/a frac associated w fault tj
7 Corner broke back and along jt pl heavy fe st
8 Fault N45B op 0 01 lt gr si cl fld heavy fe st
9 Corner broke back and along jt pln heavy fe st
10 Corner broke back and along jt pln heavy fe st
11 Op 0 5 fe cmtd sd and ss frags fld heavy fe st
12 Corner broke back and along jt pln heavy fe st
13 Op 0 05 fe cmtd sd and c fld heavy fe st
14 Op 0 05 br si cl and cmtd ss frags fld
15 Op 0 05 si cl fld heavy fe st
16 Op 0 2 by blast si cl fld fe st
17 Op 0 01 si cl fld fe st
18 Op 0 05 dk gr si cl and ss frags fld heavy fe st

** Joints not numbered are tight. Joints in the Ha and Hb members are typically iron stained.

LEGEND
■ 1&T ROCK B
② JOINT NO

NOTES
1 FOR ABBR
2 ALL ELEV



LEGEND

■ 1¼" ROCK BOLTS 25'–30'

② JOINT NO

S STATION AT BOTTOM OF ¼ SLOPE

NOTES

1. FOR ABBREVIATIONS SEE CONTRACT DRAWING TTBS 3.1
2. ALL ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

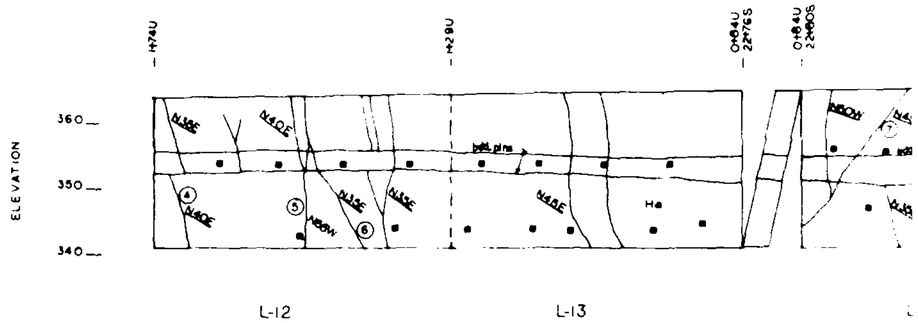
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN PAF
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTIONS – RIGHT WALL
R-1 thru R-15, 0+15D to 6+52U

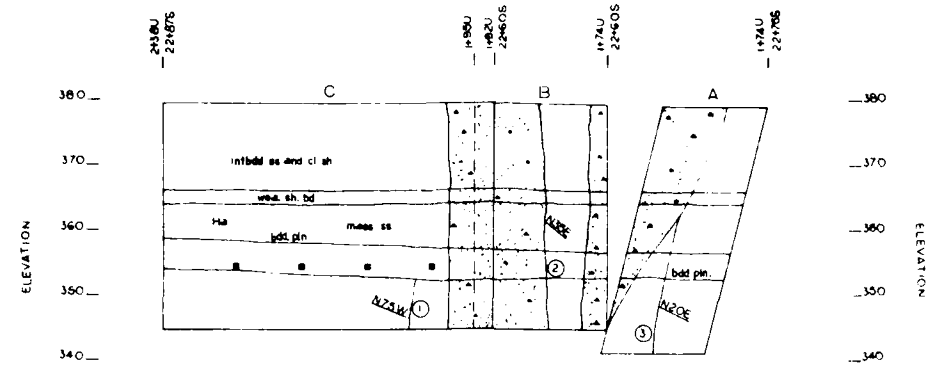
SUBMITTED
APPROVAL RECOMMENDED
CHIEF ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-52
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



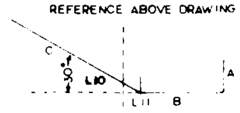
JOINT DESCRIPTION

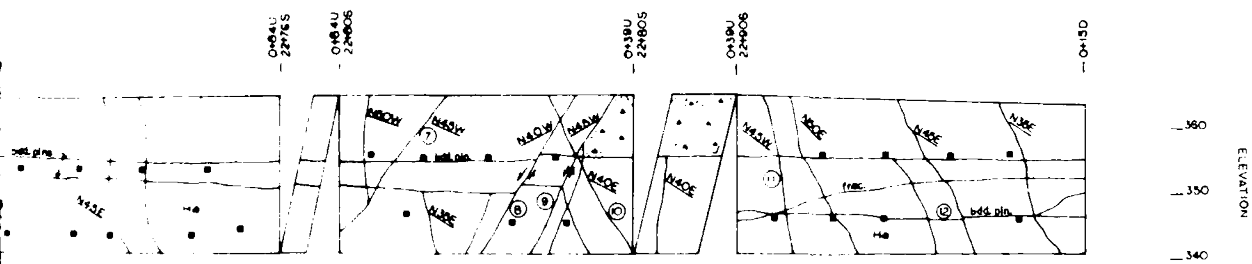
1 Op 0.02 sl red cl fld fe st
2 Corner broke back and along jt pln heavy fe st
3 Op 0.05 sl cl and ss frags fld heavy fe st corner broke back and along jt pln
4 Op 0.02 sl or cl fld fe st
5 Op 0.05 sl or cl fld fe st
6 Op 0.02 sl or cl fld fe st
7 Op 0.05 sl or cl fld fe st
8 & 9 Fault line approx 1.0 displacement along jt 8 and 1.5 to 2.0 displacement along jt 9. Jt 9 op 0.1 fld w br sl cl and ss frags. Heavy fe st
10 Tt approx 1.0 of displacement fe st
11 Op 0.02 sim fld
12 Irr bdd pln displaced along jt approx 0.9

** All joints not numbered are tt. Joints in Ha and Hb are typically iron stained



REFERENCE ABOVE DRAWING





L-14

L-15

LEGEND

- 1½" ROCK BOLTS 25'-30'
- (2) JOINT NO.

S STATIONS AT BOTTOM OF ¼ SLOPE

NOTES

1 Refer to Drawing BSFR-52 for notes.

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

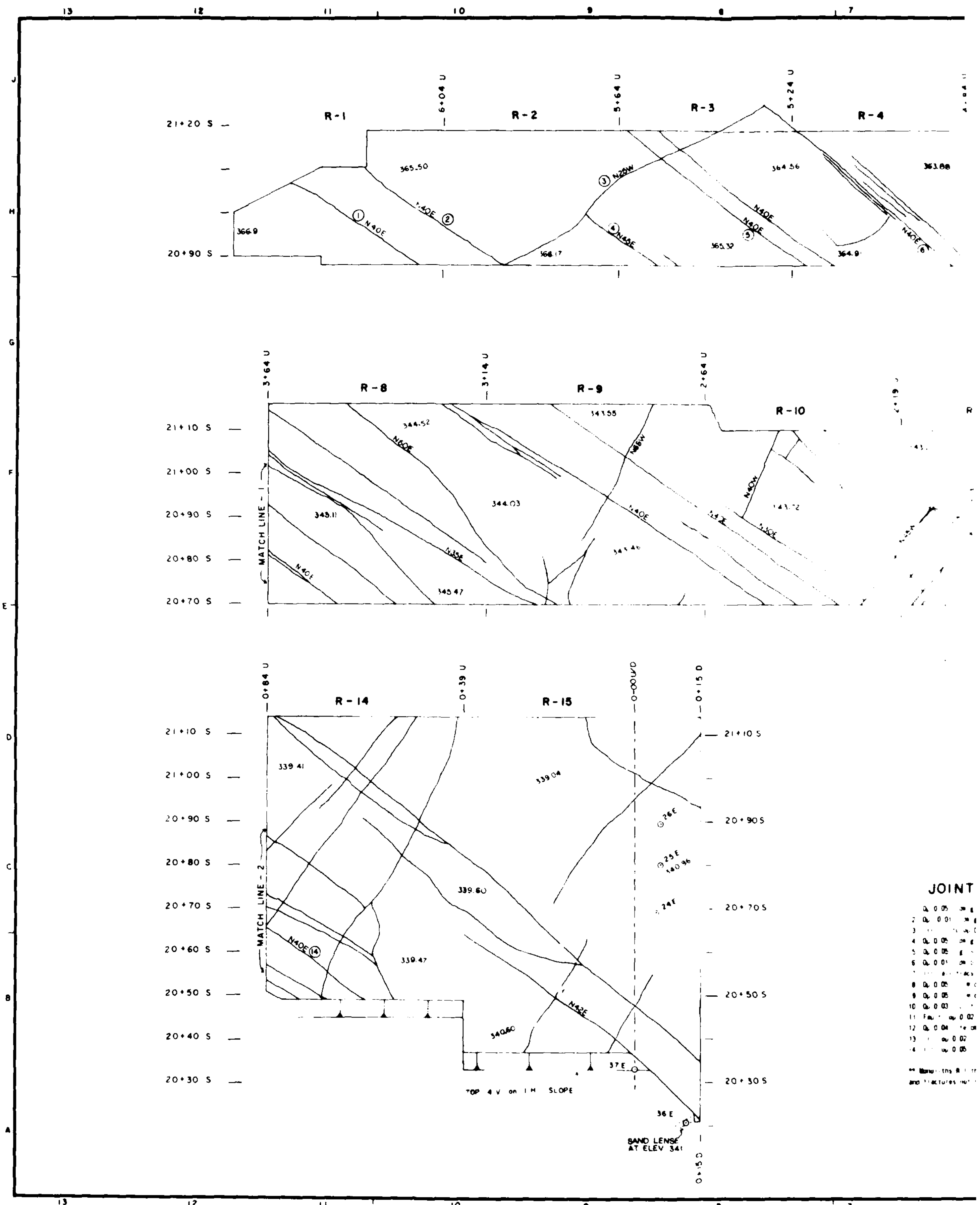
GRAPHIC SCALE

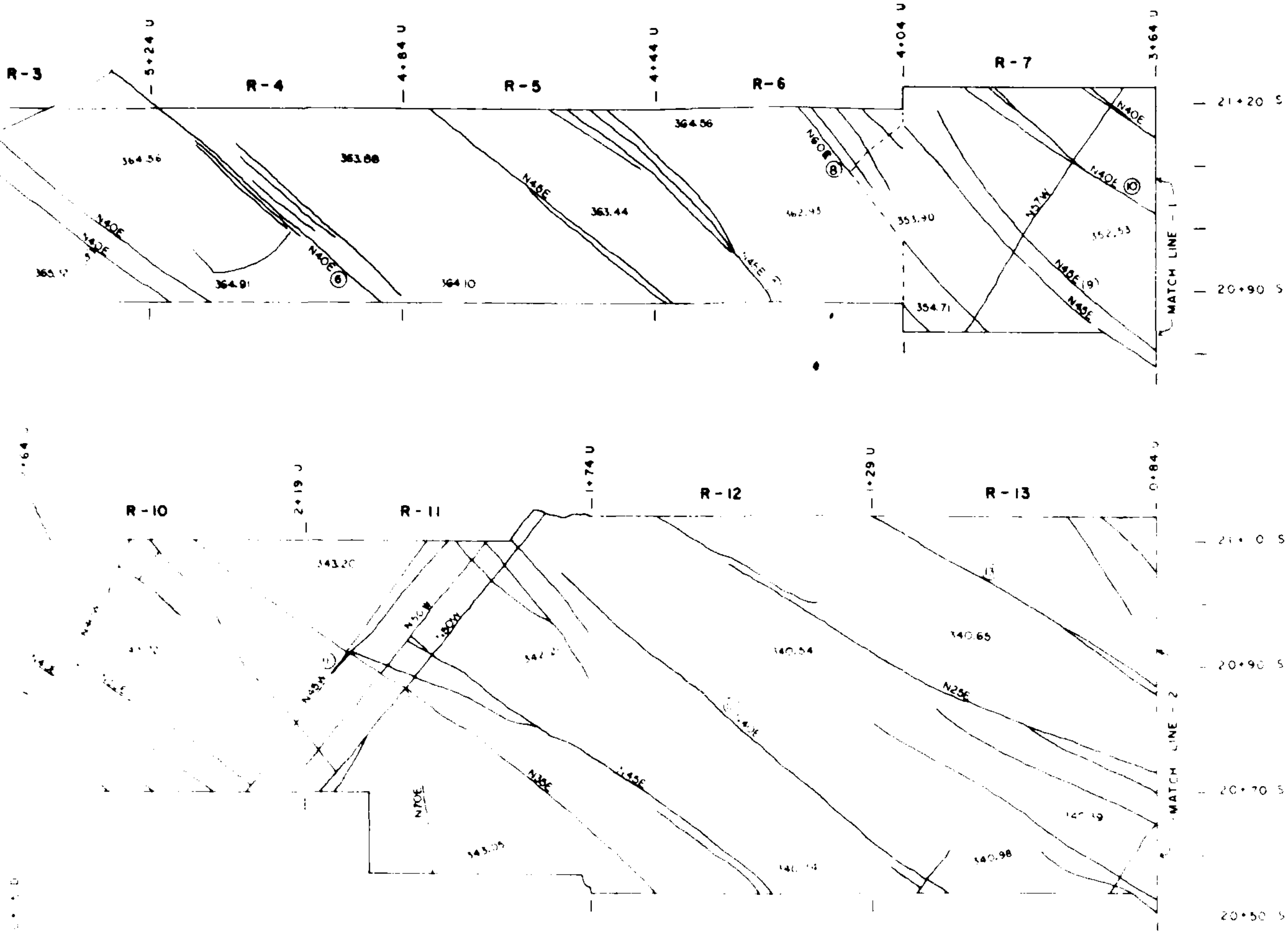
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTIONS – LEFT WALL
L-10 thru L-15, 0+15D to 2+38U

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-53
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED


R-1
R-2
R-3
R-4
6+04 U
5+64 U
5+24 U
21+20 S
20+90 S
365.50
366.9
368.17
365.32
364.56
363.88
364.9
③ N20W
① N40E
N40E ②
④ N45E
N40E
N40E ⑤
N40E ⑥
R-8
R-9
R-10
3+64 U
3+14 U
2+64 U
21+10 S
21+00 S
20+90 S
20+80 S
20+70 S
MATCH LINE - 1
344.52
343.55
344.03
345.11
345.47
N60E
N65W
N40W
N40E
N35E
N40E
R-14
R-15
0+64 U
0+39 U
0+00 U/D
0+15 D
21+10 S
21+00 S
20+90 S
20+80 S
20+70 S
20+60 S
20+50 S
20+40 S
20+30 S
MATCH LINE - 2
339.41
339.04
339.60
339.47
340.60
340.96
N40E ⑭
N42E
26E
25E
24E
37E
36E
TOP 4 V on 1 H SLOPE
SAND LENSE AT ELEV 341
0+15 D
JOINT
13
12
11
10
9
8
7
J
H
G
F
E
D
C
B
A



LEGEND

(5) JOINT NO.

ADDED GROUT HOLES

344.67 FOUNDING ELEVATION

JOINT DESCRIPTION

1 Op 0.05 dk gr sly cl and ss frags fld fe st
2 Op 0.01 dk gr sly cl fld fe st
3 Irr to op 0.01 sly cl fld
4 Op 0.05 dk gr sly cl fld heavy fe st
5 Op 0.05 gr sly cl and ss frags fld heavy fe st
6 Op 0.01 dk br sly cl fld
7 Irr all fracs are ti... heavy fe st
8 Op 0.05 lim cmt sd fld
9 Op 0.05 lim cmt sd and cl fld
10 Op 0.03 cl fld heavy fe st
11 Fault op 0.02 lt gr sly cl fld heavy fe st
12 Op 0.04 fe cmt sd nld
13 Irr op 0.02 - 0.04 lim and sdy cl fld
14 Irr op 0.05 part lim fld

** Monoliths R-1 thru R-15 founded in ... joints and fractures not numbered are tight

NOTES

1. FOR ABBREVIATIONS SEE CONTRACT DRAW NO. TTBS-371

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN R.R.
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
FOUNDATION PLANS
R-1 thru R-15

SUBMITTED

APPROVAL RECOMMENDED

CHIEF ENGINEERING DIVISION

APPROVED

COLONEL C.E. DISTRICT ENGINEER

DATE

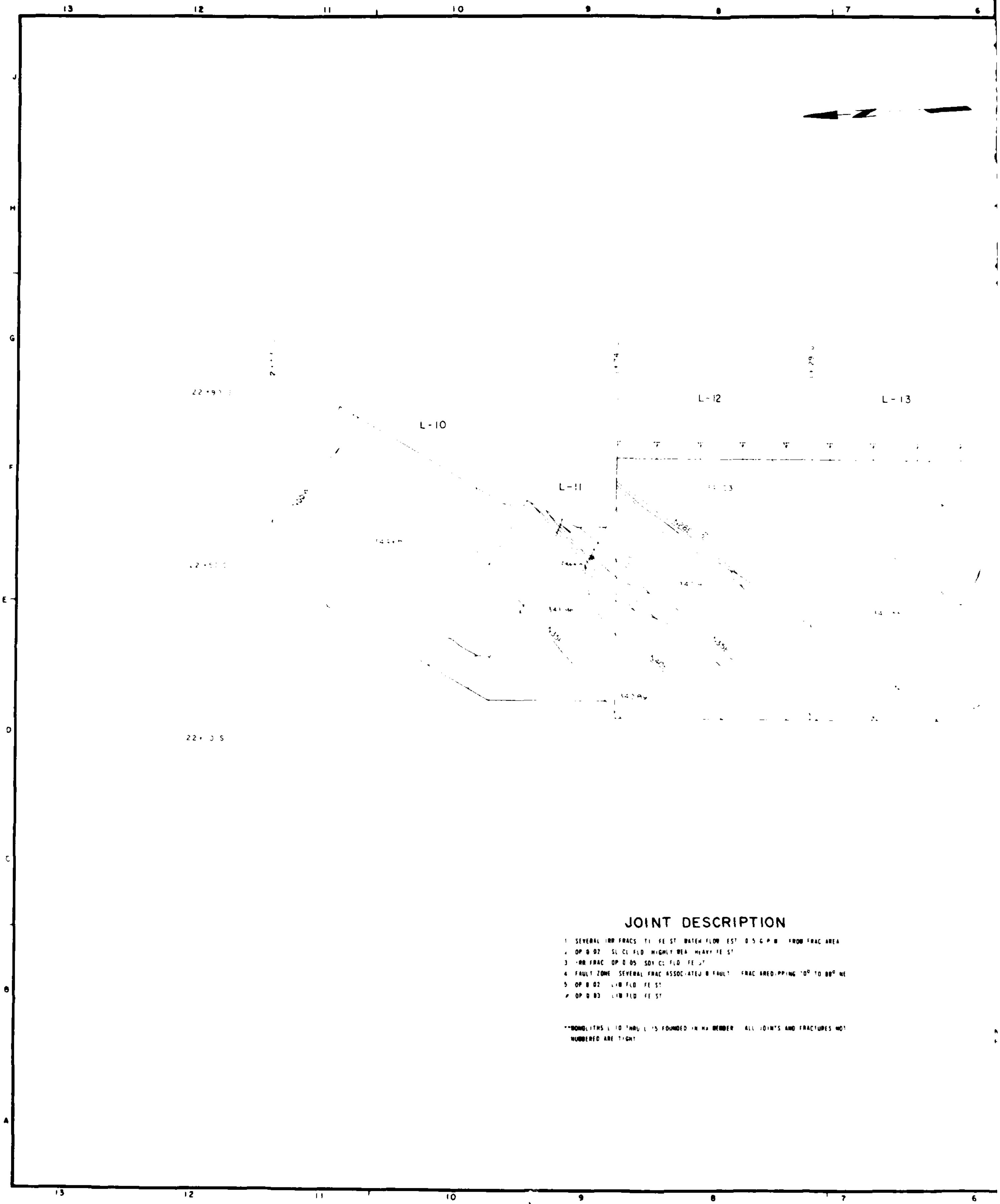
SCALE 1" = 10' SPEC NO

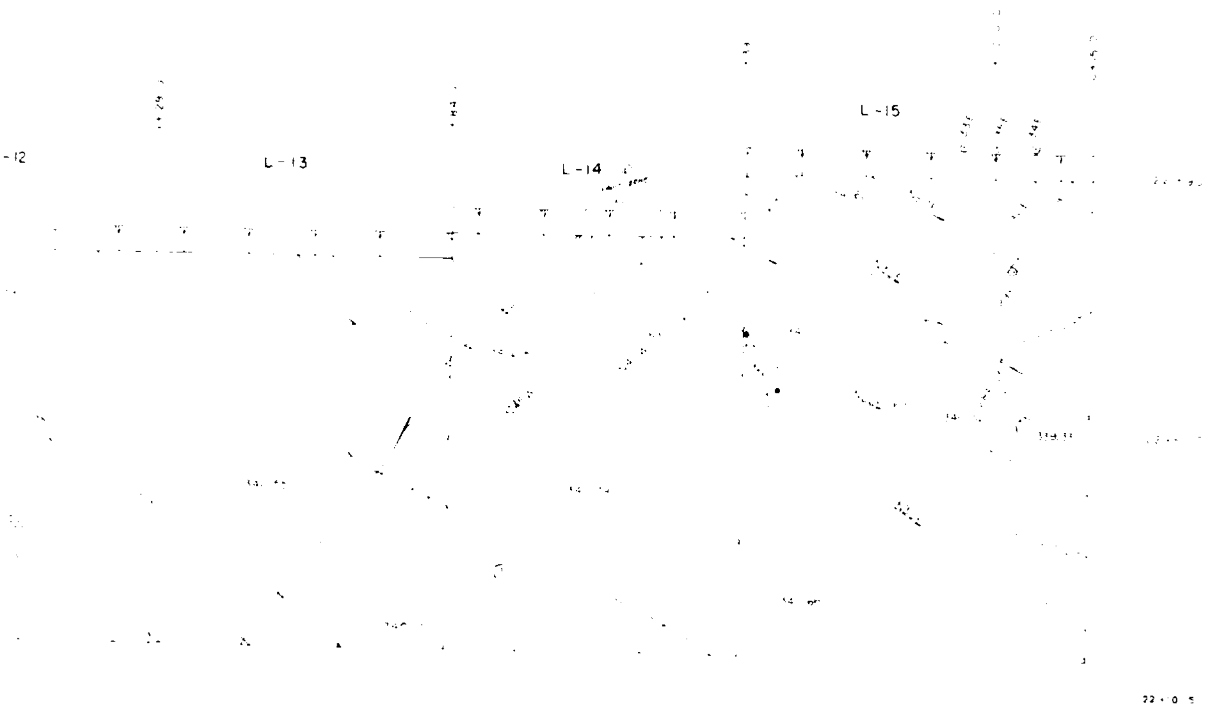
DRAWING NUMBER

BSFR-54

SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED


13
12
11
10
9
8
7
6
J
H
G
F
E
D
C
B
A
L-10
L-11
L-12
L-13
22+90
22+50
22+10 S
JOINT DESCRIPTION
1 SEVERAL IRR FRACS TI FE ST WATER FLOW EST 0.5 G.P.M. FROM FRAC AREA
2 OP 0.02 SL CL FLD HIGHLY WEA HEAVY FE ST
3 IRR FRAC OP 0.05 SDY CL FLD FE ST
4 FAULT ZONE SEVERAL FRAC ASSOCIATED W FAULT FRAC ARE DIPPING 10° TO 80° NE
5 OP 0.02 CLD FLD FE ST
6 OP 0.03 CLD FLD FE ST
**MONOLITHS L-10 THRU L-15 FOUNDED IN Ha MEMBER. ALL JOINTS AND FRACTURES NOT NUMBERED ARE TIGHT



CRIPTION

LEGEND

(2) JOINT NO.

⊙ ADDED GROUT HOLES

342.00 FOUNDING ELEVATION

NOTE

FOR NOTES, SEE DRAWING BSFR-54

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

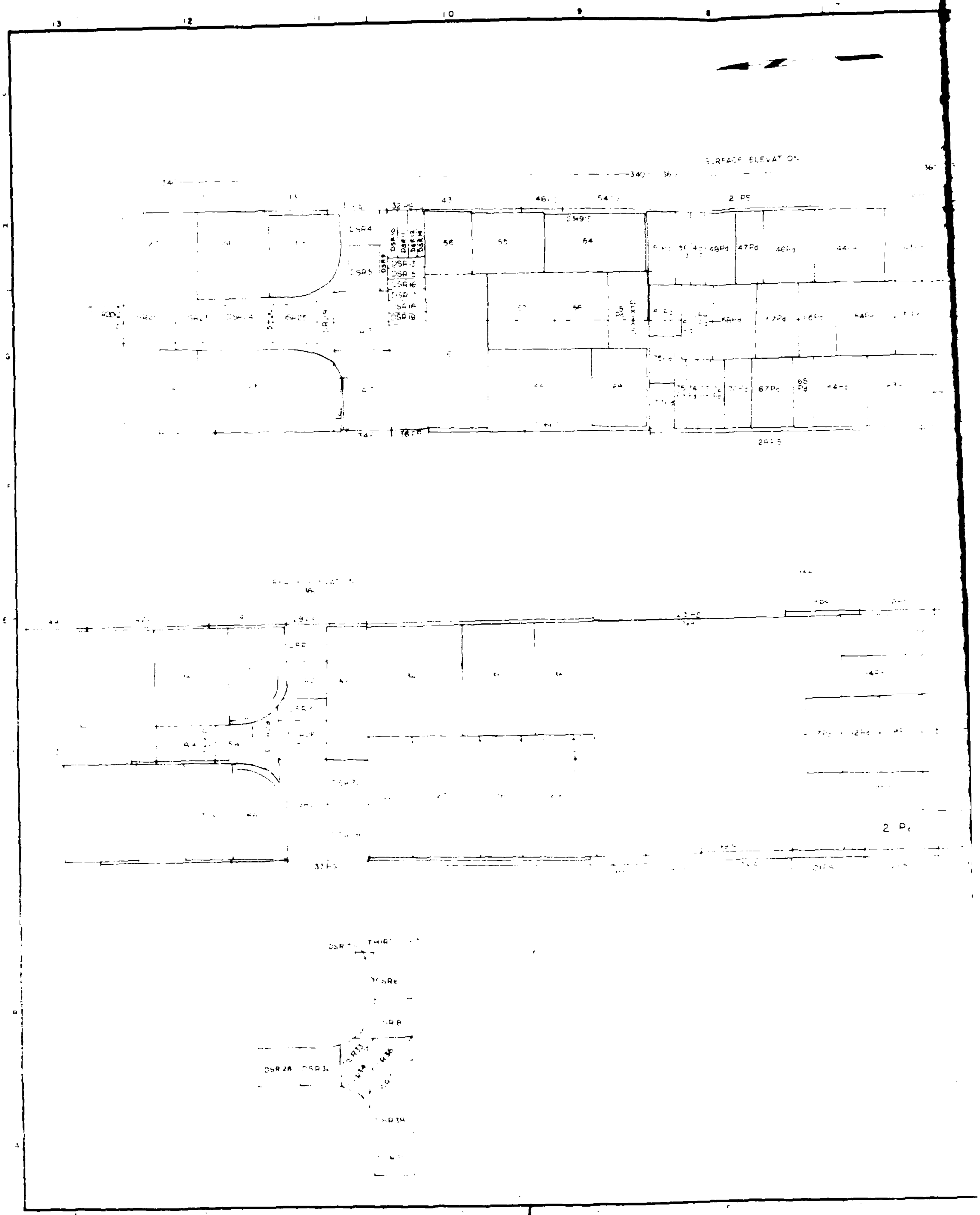
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

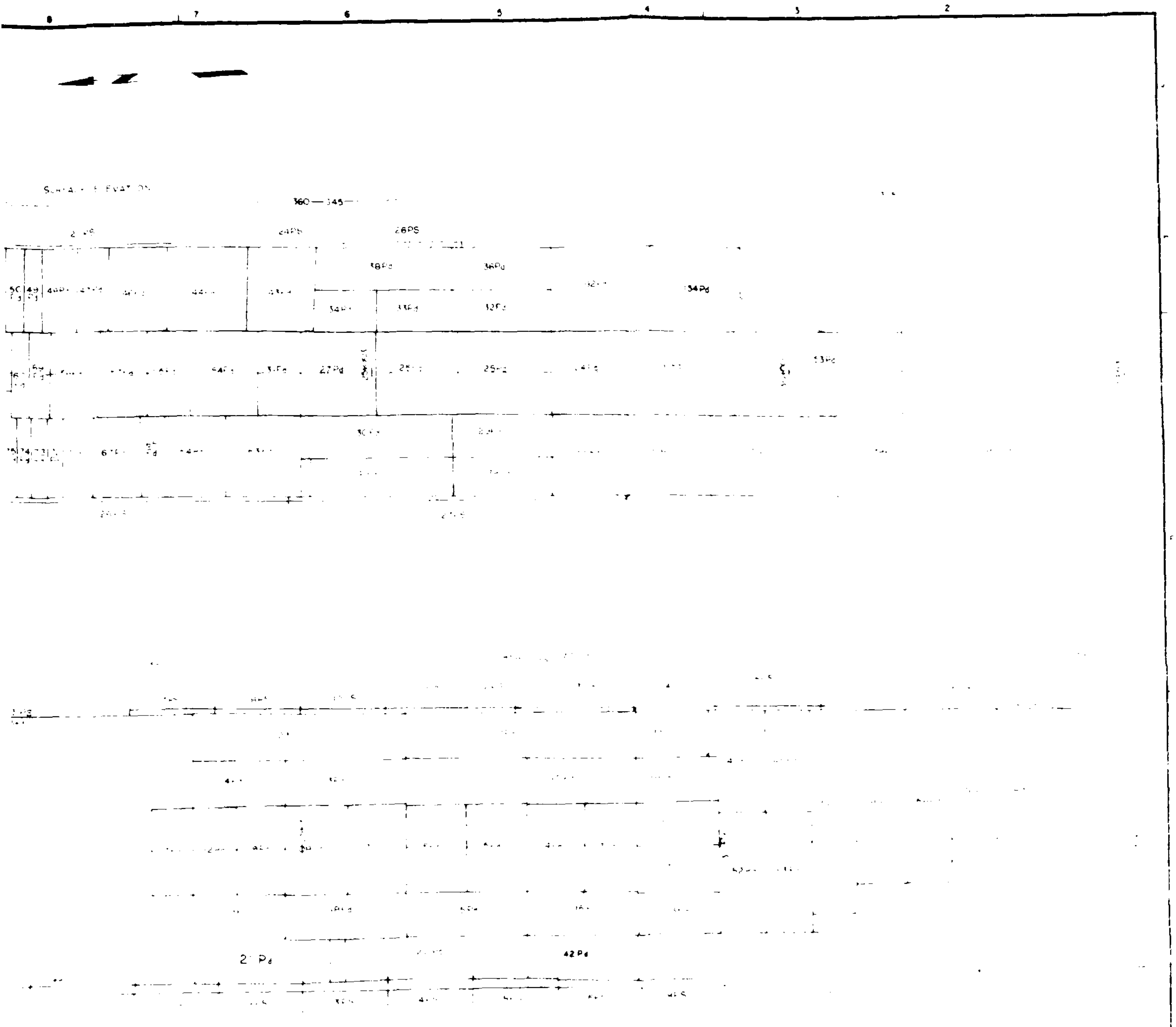
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
FOUNDATION PLANS
L-10 thru L-15

DRAWN
CHECKED
TRACED
COMPARED
SUBMITTED
APPROVAL RECOMMENDED
APPROVED
DATE

SCALE 1" = 10'
SPEC NO.
DRAWING NUMBER
BSFR-55
SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED


13
12
10
9
8
DSR4
DSR5
DSR13
DSR16
DSR18
58
55
64
67Pd
47Pd
48Pd
2 Pd
DSR 28
DSR3

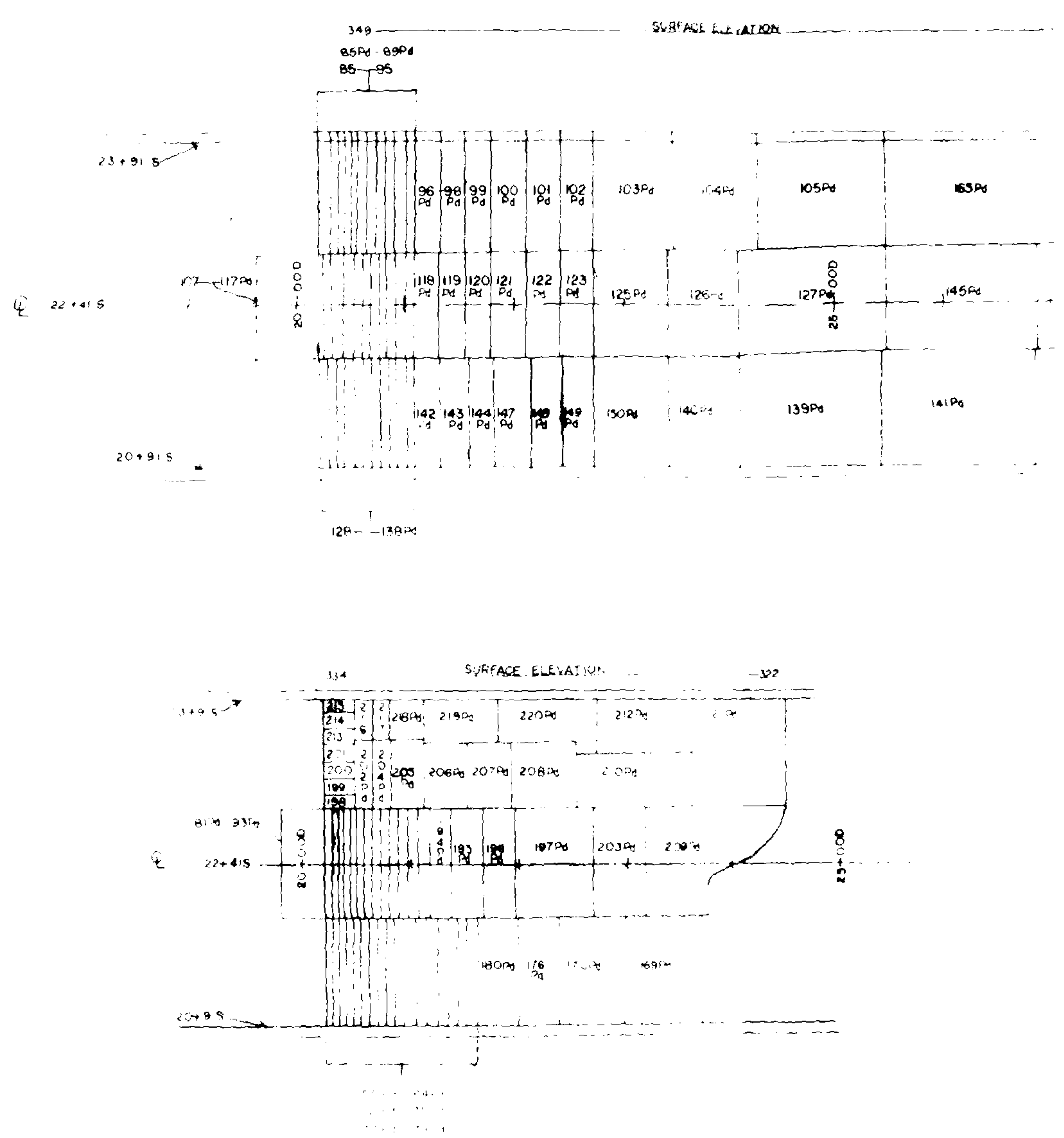


DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS

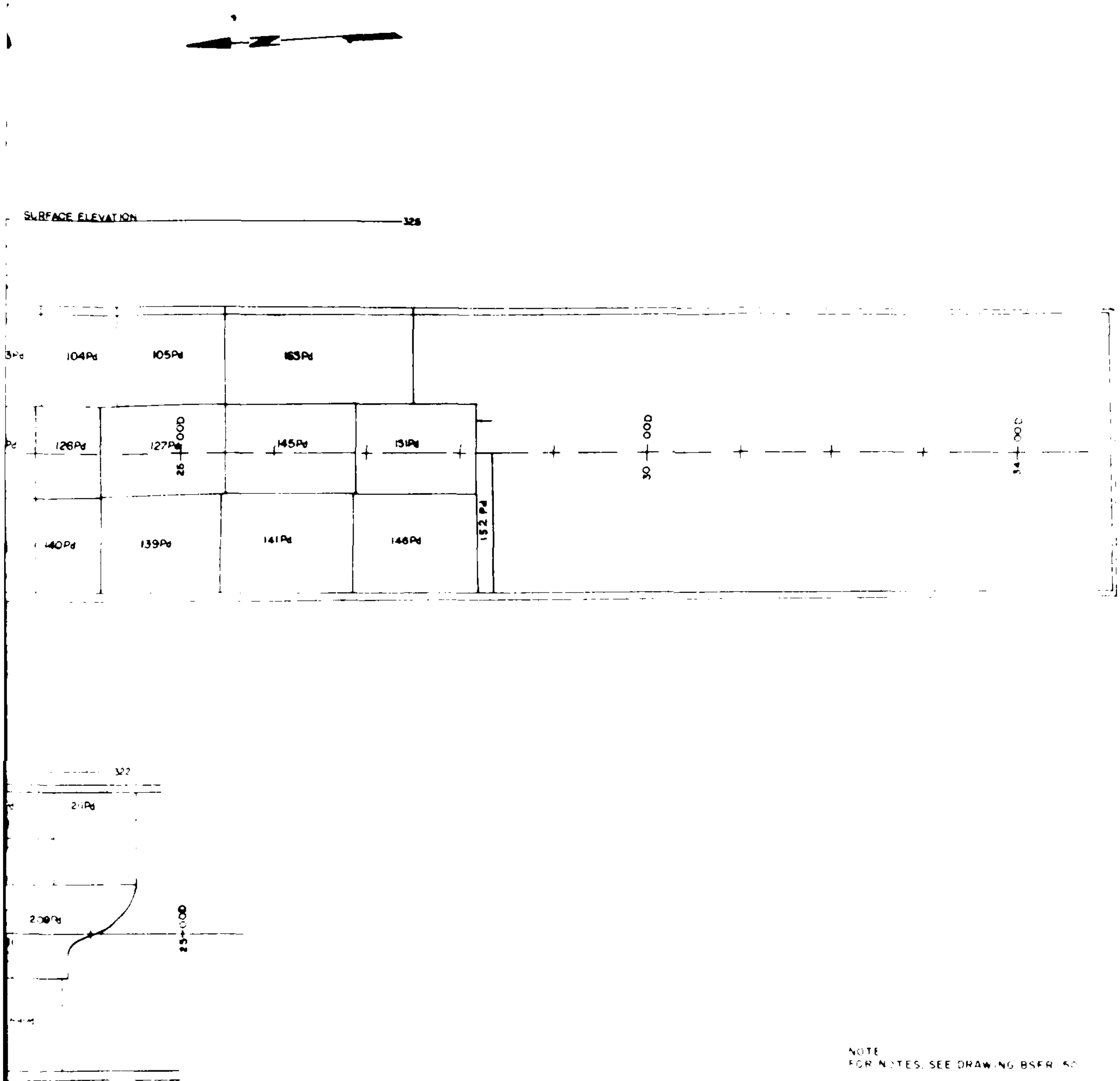
TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

BLASTING PATTERN
CANAL AREA

BSFR-56


SURFACE ELEVATION
85Pd - 89Pd
85 - 95
23+91 S
22+41 S
20+91 S
20+000
25+000
96 Pd
98 Pd
99 Pd
100 Pd
101 Pd
102 Pd
103Pd
104Pd
105Pd
163Pd
118 Pd
119 Pd
120 Pd
121 Pd
122 Pd
123 Pd
125Pd
126Pd
127Pd
145Pd
142
143 Pd
144 Pd
147 Pd
148 Pd
149 Pd
150Pd
140Pd
139Pd
141Pd
128 - 138Pd
SURFACE ELEVATION
334
322
219Pd
220Pd
212Pd
205 Pd
206Pd
207Pd
208Pd
197Pd
203Pd
180Pd
176 Pd
169Pd
22+41S
20+000
25+000

PLAN



PLAN

NOTE
FOR NOTES, SEE DRAWING BSFR 56

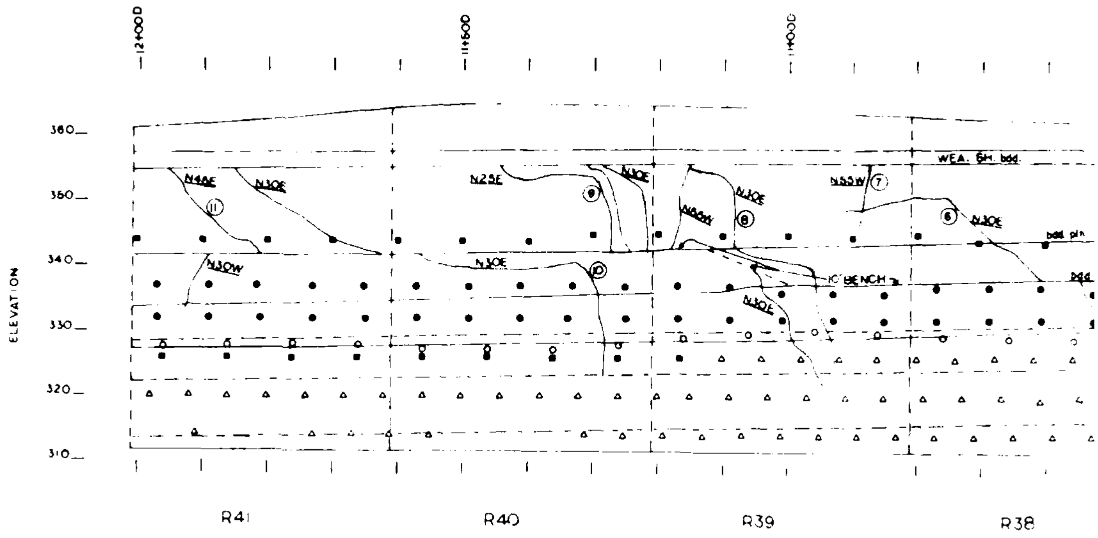
REVISION | DATE | BY | CHKD

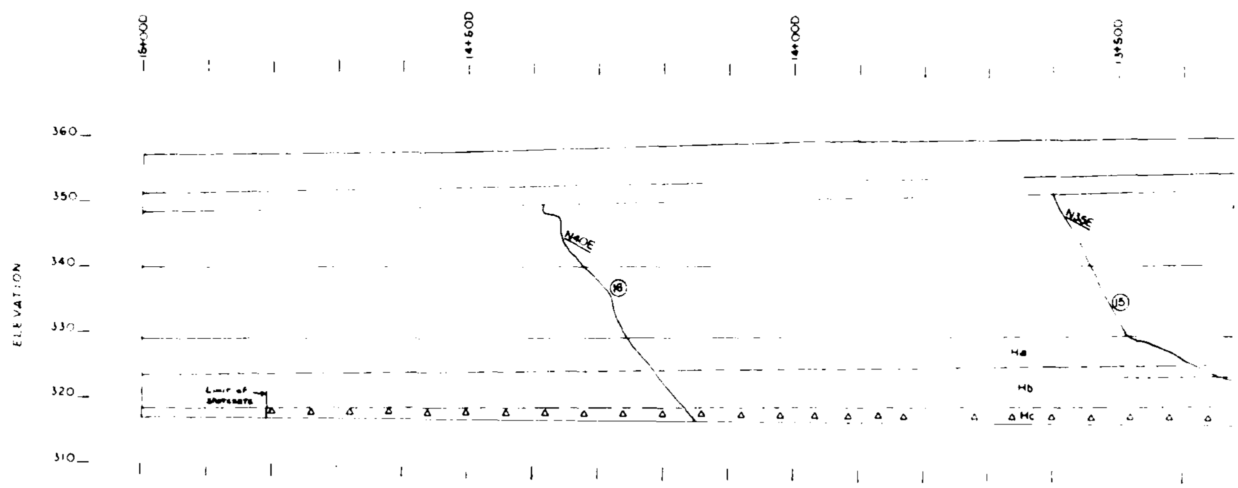
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

BLASTING PATTERN
CANAL AREA

DRAWN:
CHECKED:
TRACED:
COMPARED:
ENGINEER
SUBMITTED:
APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVED:
COLONEL, C. E. DISTRICT ENGINEER
DATE:
SCALE: 1" = 40'
SPEC. NO.
DRAWING NUMBER
BSFR-57
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

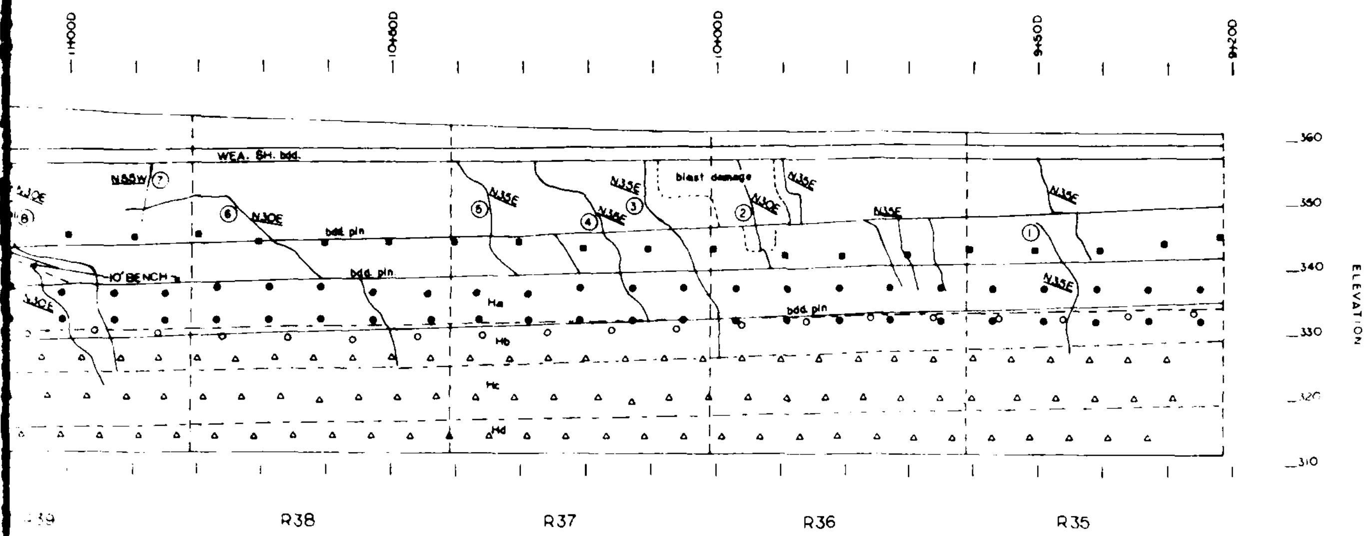


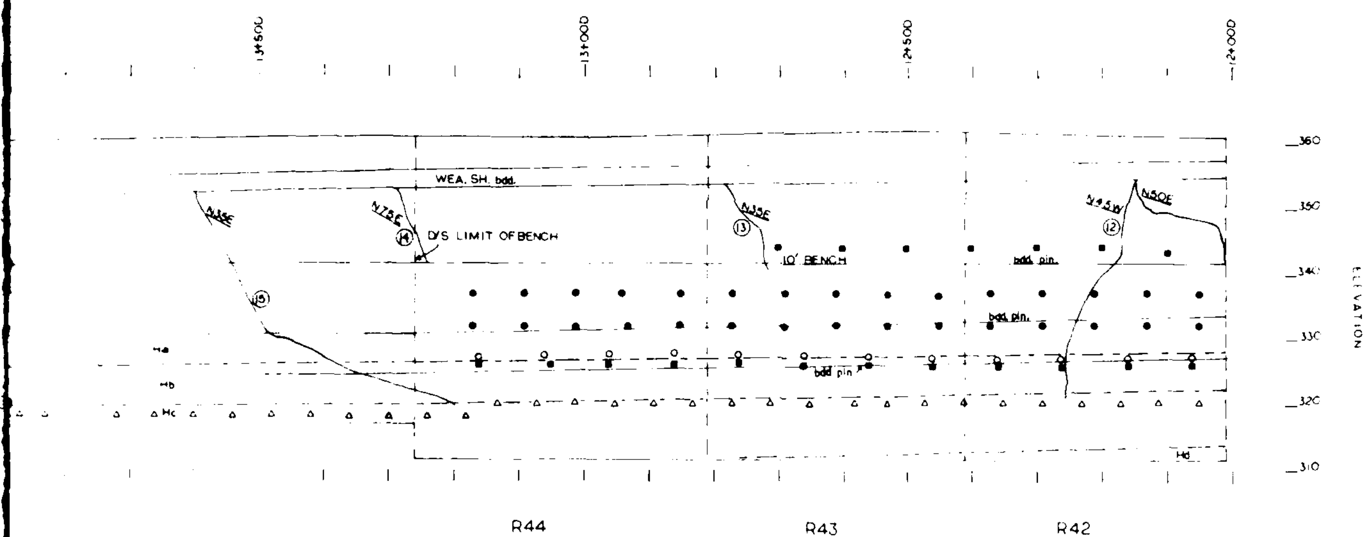


JOINT DESCRIPTION

1 Op 0 01 heavy fe st
2 Op 0 2 prob result of blast fe st
3 Irr op 0 01 fe st
4 Op 0 01 cl fld fe st
5 Op 0 01 fe st
6 Irr op 0 01 fe st
7 Op 0 02 fe st
8 Irr op 0 02 cl fld fe st
9 Op 0 01 fe st
10 Irr op 0 01 fe st
11 Op 0 01 fe st
12 Op 0 02 fe st
13 Op 0 02 fe st
14 Irr op 0 01 fe st
15 Op 0 01 pyrite fld
16 Op 0 01 part pyrite fld

All joints not numbered are tight. Joints in the Ha and Hb are typically iron stained





LEGEND

- ■ 1¼" ROCK BOLTS 25'-30'
- ● 1¼" ANCHOR BOLTS 25'-30'
- △ 1" ROCK BOLTS 23'-28'
- ○ 3" DRAIN HOLES 25'
- (7) JOINT NO

NOTES

1 FOR ABBREVIATIONS SEE DRAWING TTBS 3 1
2 ALL ELEVATIONS REFER TO MEAN SEA LEVEL

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN pRS
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTION - RIGHT WALL
STA. 9+21D to 15+00D

SUBMITTED

APPROVAL RECOMMENDED

CHIEF, ENGINEERING DIVISION

APPROVED

COLONEL, C. E. DISTRICT ENGINEER

DATE

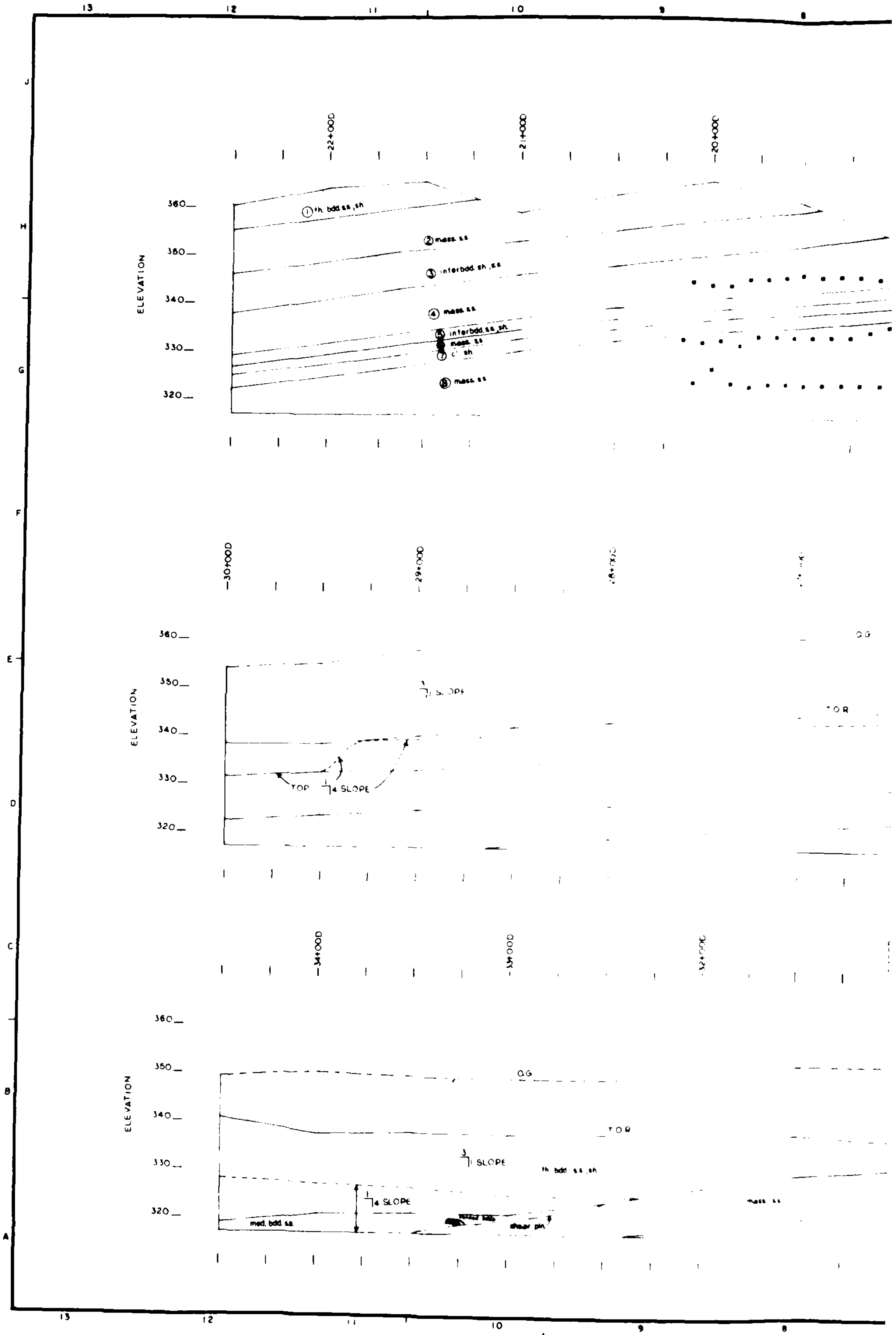
SCALE 1" = 10'

SPEC NO

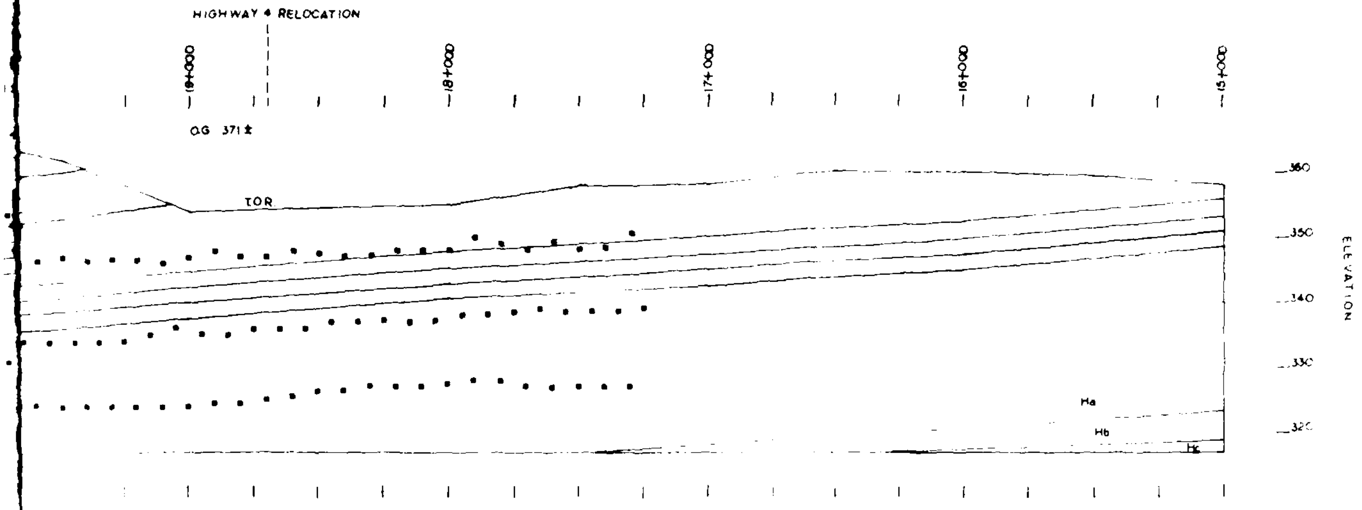
DRAWING NUMBER

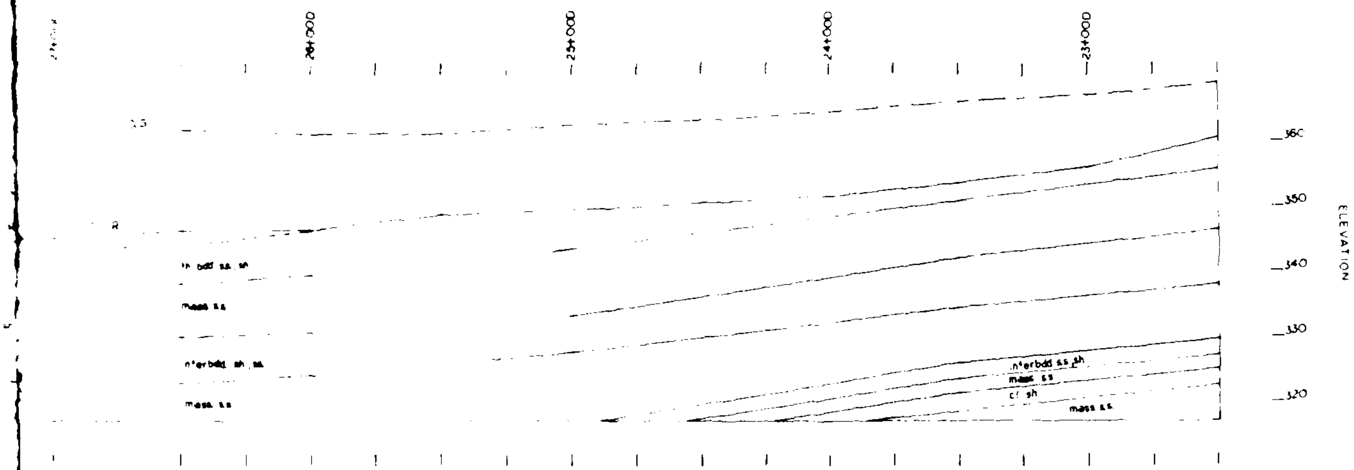
BSFR-58

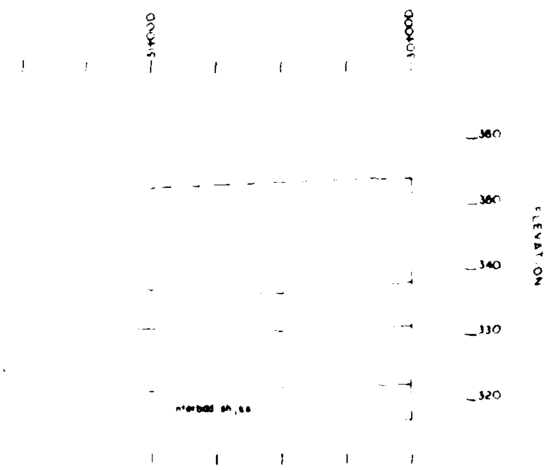
SHEET OF



ELEVATION
360
350
340
330
320
-22+00D
-21+000
-20+000
th. bdd. ss, sh
mass. ss
interbdd. sh, ss
mass. ss
interbdd. ss, sh
mass. ss
mass. ss
-30+00D
-29+000
SLOPE
TOP
4 SLOPE
O.G
T.O.R
-34+00D
-33+00D
O.G
T.O.R
SLOPE
th. bdd. ss, sh
4 SLOPE
mass. ss
med. bdd. ss
shear pin







DESCRIPTION

1. In bdd lt gr ss intbdd w dk gr cl sh 50% ss 50% cl sh. ss layers highly wea
2. Mss to med bdd lt gr ss si jt
3. Intbdd dk gr cl sh and lt gr ss 75% cl sh 25% ss
4. Mss bdd lt gr ss si
5. Intbdd lt gr ss and dk gr cl sh 70% ss 30% cl sh
6. Mss lt gr ss
7. Dk gr cl sh
8. Mss bdd ss lt gr to lt b s jt

SCALE 1"=10' VERT 1"=25' HORZ

● 1¼" ROCK BOLTS 25'-3'

NOTE
FOR NOTES SEE DRAWING BSFR 58

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN DKS
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTIONS - D/S CHANNEL
STA. 15+00D to 34+50D, RIGHT WALL

SUBMITTED

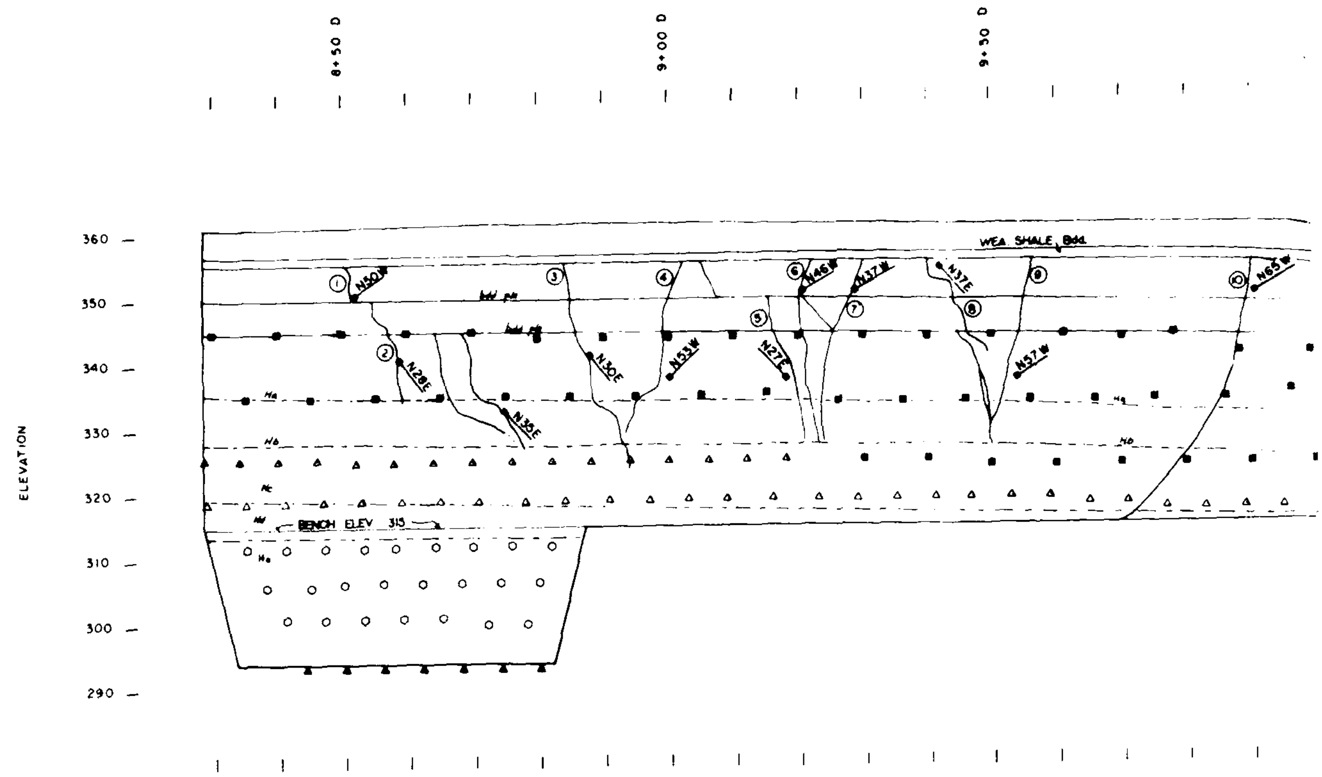
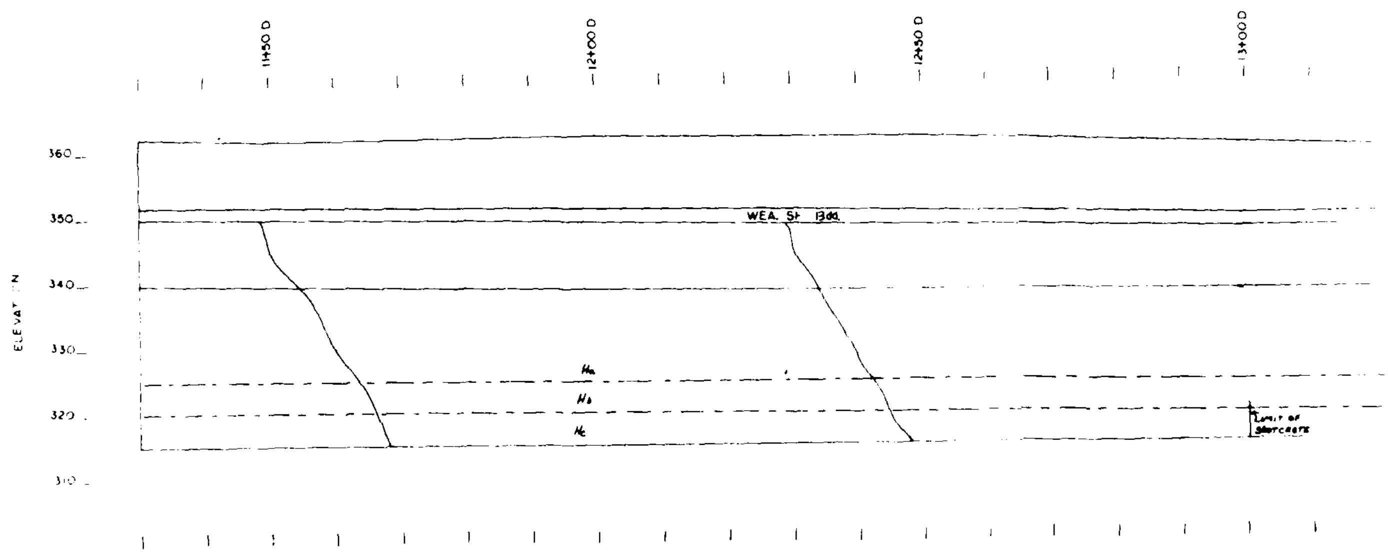
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

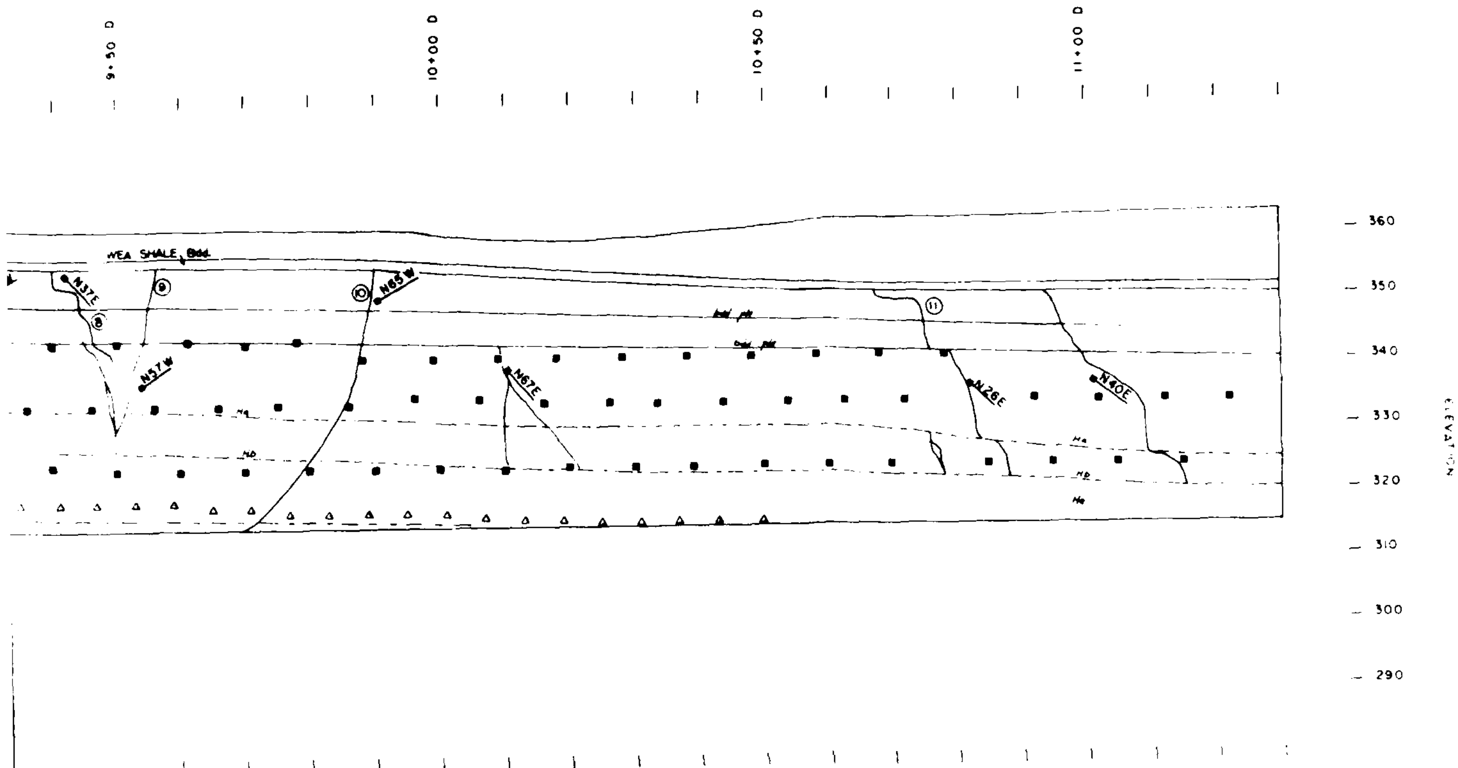
APPROVED
COLONEL, C.E. DISTRICT ENGINEER

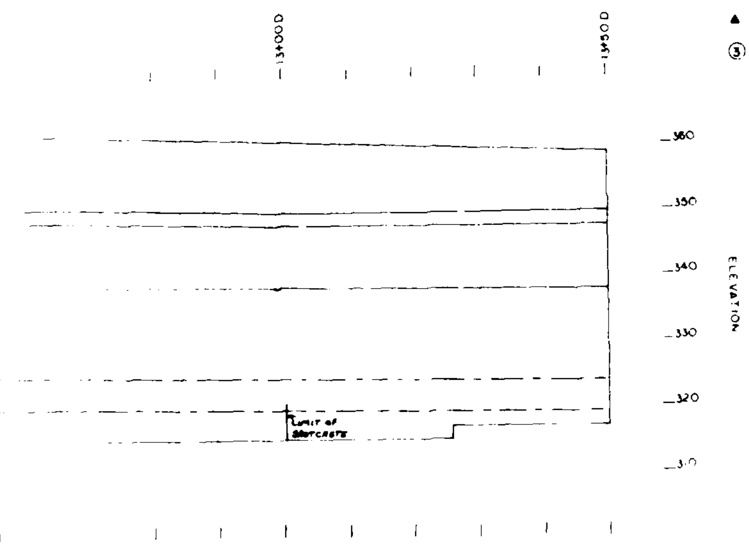
DATE

SCALE
SPEC NO
DRAWING NUMBER
BSFR-59
SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED


8+50 D
9+00 D
9+50 D
WEA SHALE Bdd
N50W
N29E
N35E
N30E
N53W
N27E
N46W
N37W
N37E
N57W
N65W
BENCH ELEV 315
ELEVATION
360
350
340
330
320
310
300
290

11+50 D
12+00 D
12+50 D
13+00 D
WEA. Sh Bdd
Ha
Hb
Hc
LIMIT OF SHOTCRETE
360
350
340
330
320
310





LEGEND

- ■ 1-1/4" ROCK BOLTS 25'-30'
- △ 1" ROCK BOLTS 23'-28'
- ○ 1" ROCK BOLTS 20'-25'
- ▲ 1" FLOOR ROCK BOLTS 23'-28'
- ③ JOINT NUMBER

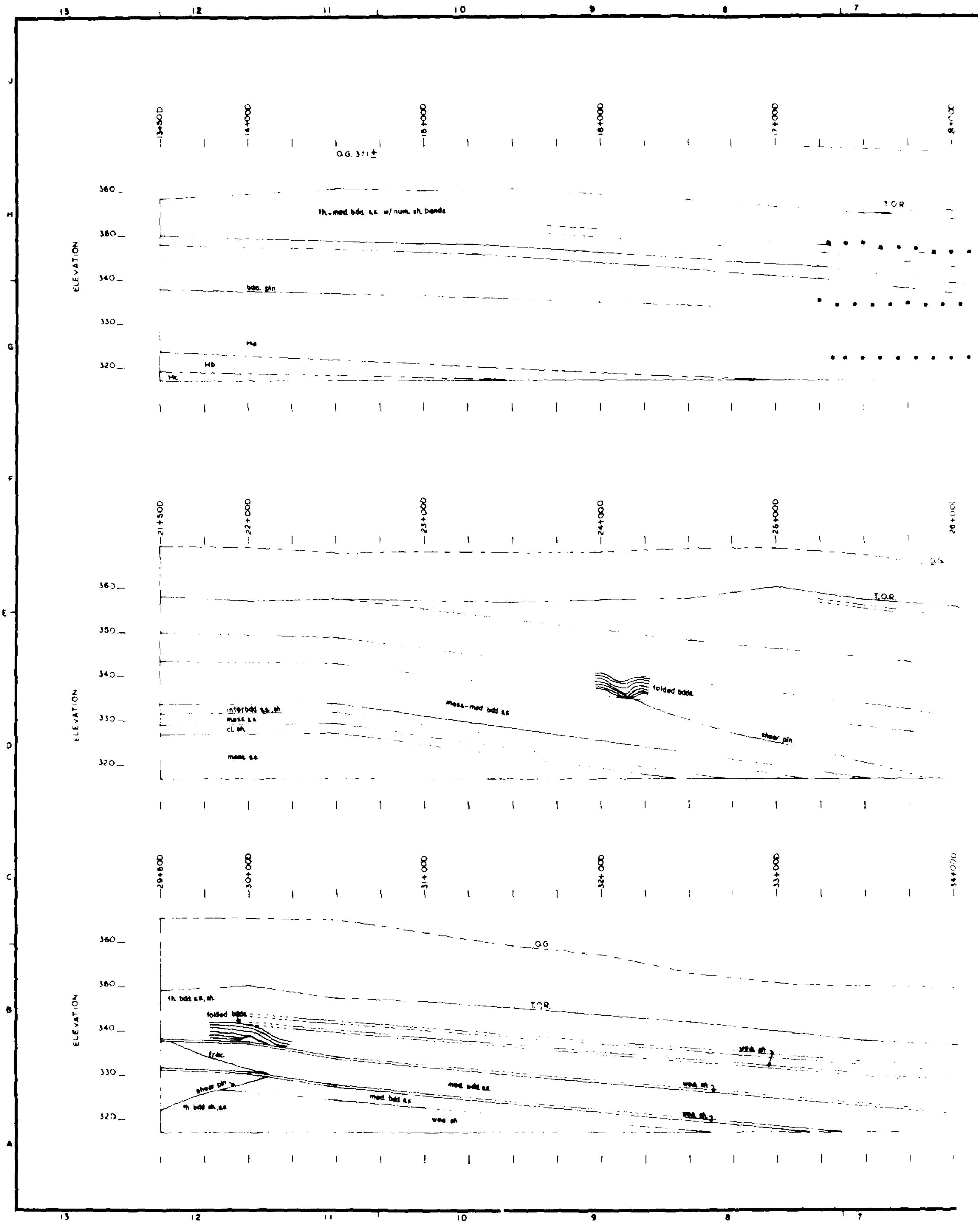
JOINT DESCRIPTION

1. Op 0.02 fe st
2. Op 0.03 fe st
3. Op 0.03 fe st
4. Op 0.02 FE ST
5. Op 0.02 fe st
6. Op 0.03 [illegible] fe st
7. Op 0.03 fe st
8. Op 0.03 fe st
9. Op 0.01 fe st
10. Op 0.05 to 0.15 [illegible] Ha and Hb [illegible] Hc
11. Op 0.01 fe st

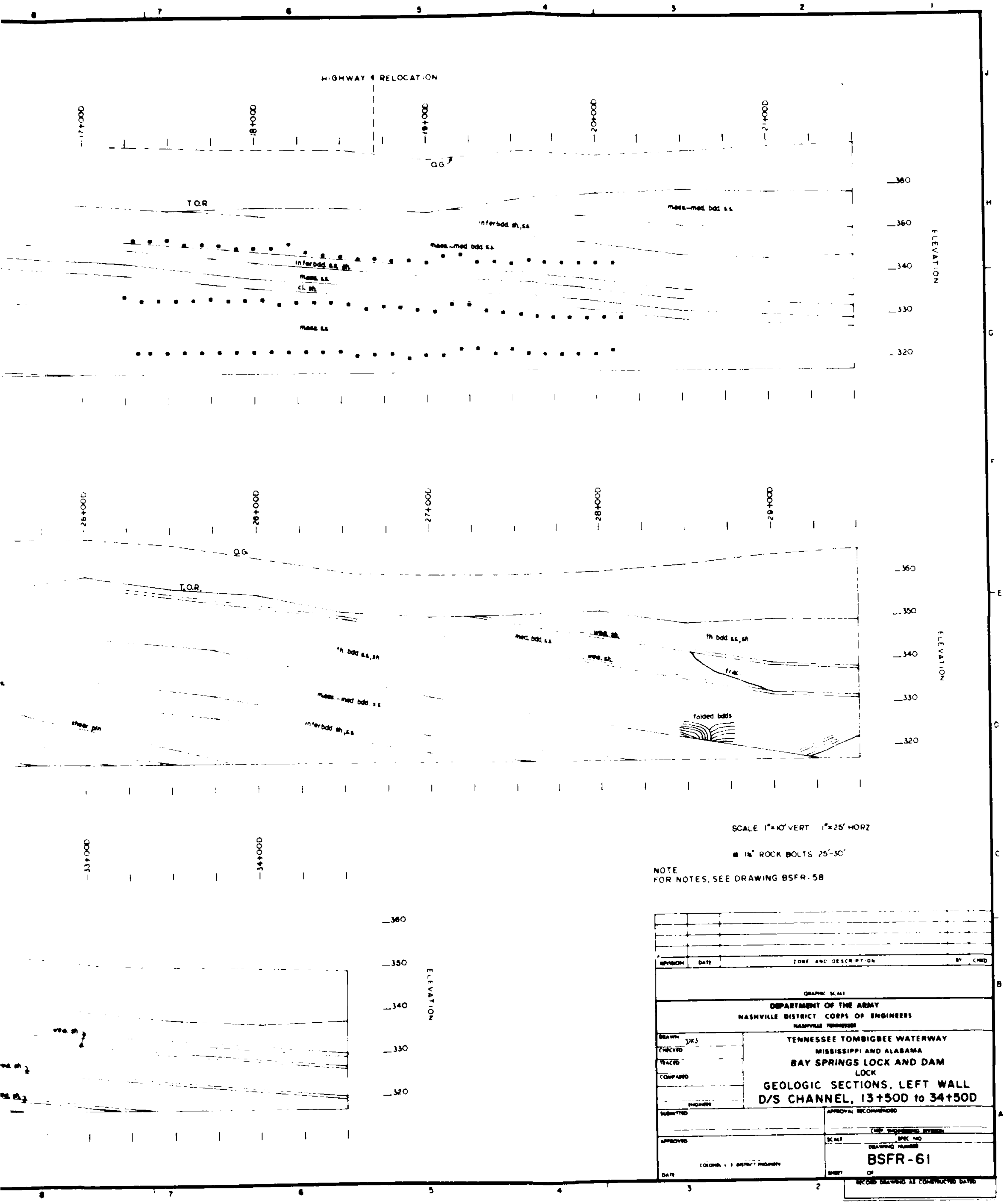
** Joints not numbered are tight. Joints in the Ha and Hb are typically iron stained

NOTE
FOR NOTES, SEE DRAWING BSFR-58

REVISION / DATE / ZONE AND DESCRIPTION / BY / CHKD	
GRAPHIC SCALE	
DEPARTMENT OF THE ARMY NASHVILLE DISTRICT CORPS OF ENGINEERS NASHVILLE TENNESSEE	
DRAWN HR, SKS CHECKED TRACED COMPARED ENGINEER	TENNESSEE TOMBIGBEE WATERWAY MISSISSIPPI AND ALABAMA BAY SPRINGS LOCK AND DAM LOCK GEOLOGIC SECTION STA. 8+30D to 13+50D, LEFT WALL
SUBMITTED	APPROVAL RECOMMENDED
APPROVED COLONEL C E DISTRICT ENGINEER DATE	SCALE 1" = 10' SPEC. NO. DRAWING NUMBER BSFR-60 SHEET OF
	RECORD DRAWING AS CONSTRUCTED DATED



13
12
11
10
9
8
7
O.G. 371±
th.-med. bdd. s.s. w/ num. sh. bands
T.O.R.
bdd. pln.
Ha
Hb
Hc
ELEVATION
360
350
340
330
320
21+500
22+000
23+000
24+000
25+000
T.O.R.
folded bdds.
interbdd s.s., sh.
mass s.s.
cl. sh.
mass s.s.
mass-med bdd s.s.
shear pln.
29+500
30+000
31+000
32+000
33+000
34+000
O.G.
T.O.R.
th. bdd s.s., sh.
folded bdds.
frac.
shear pln.
th. bdd sh., s.s.
med. bdd s.s.
wea. sh.
A
B
C
D
E
F
G
H
J



REVISION | DATE | ZONE AND DESCRIPTION | BY | CHKD

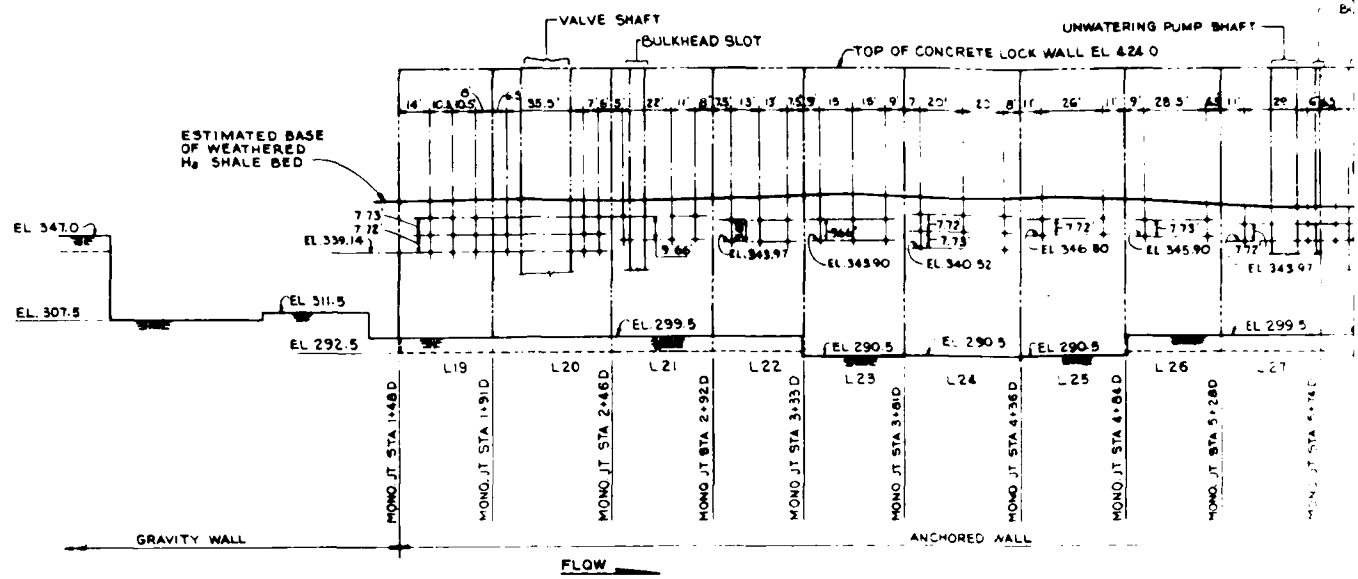
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

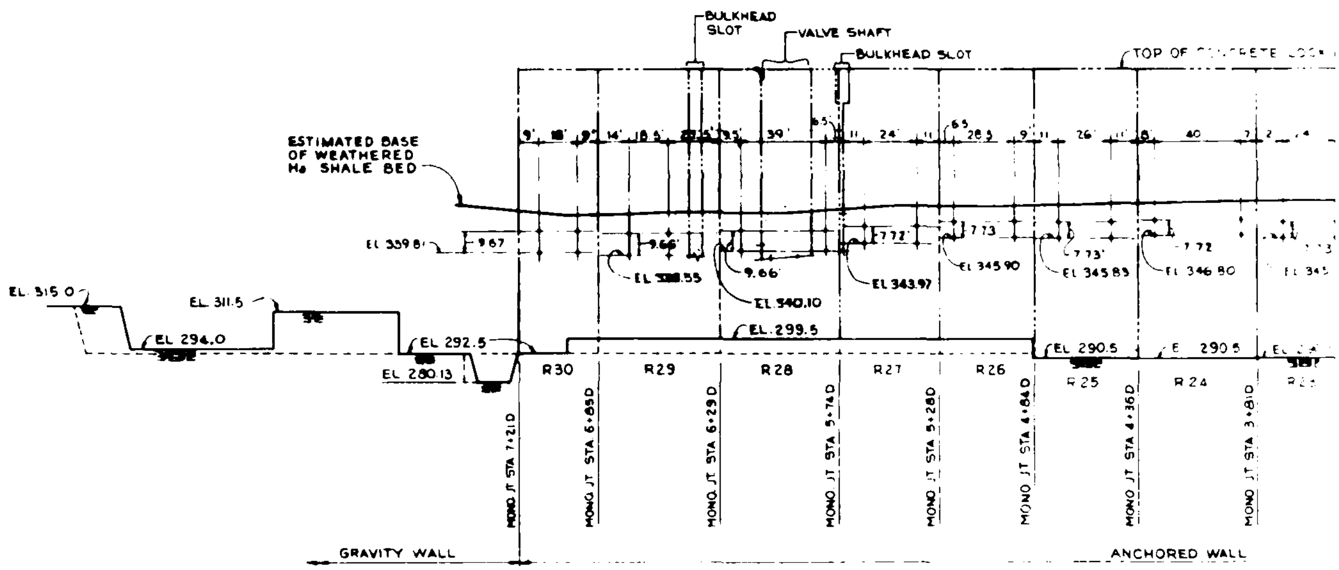
DRAWN DKS
CHECKED
TRACED
COMPARED

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
GEOLOGIC SECTIONS, LEFT WALL
D/S CHANNEL, 13+50D to 34+50D

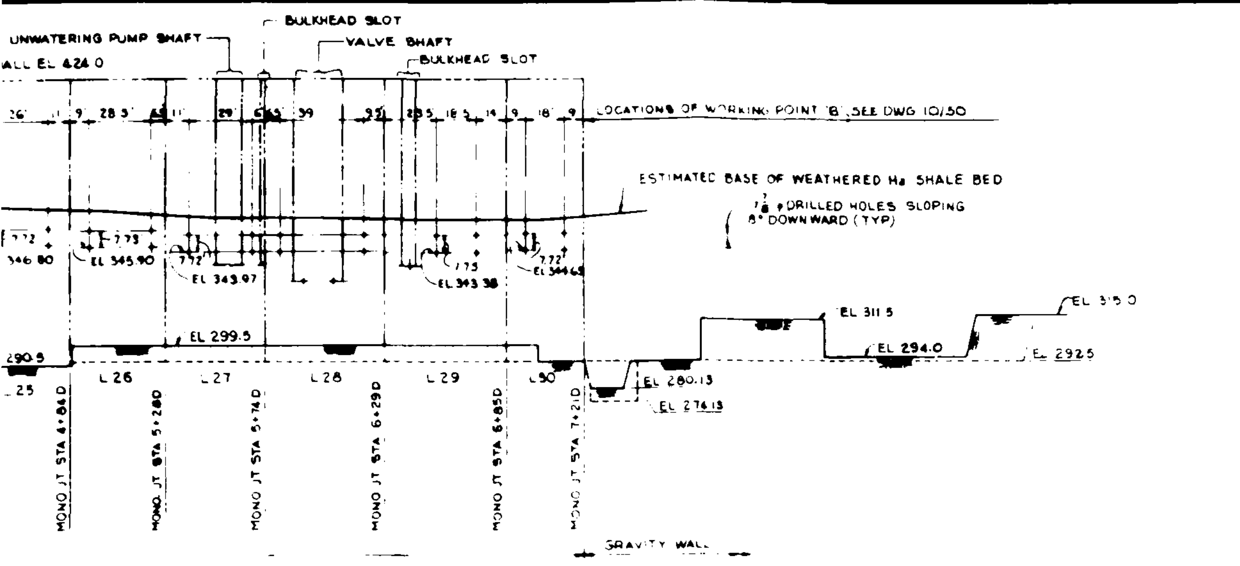
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC. NO.
DRAWING NUMBER
BSFR-61
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



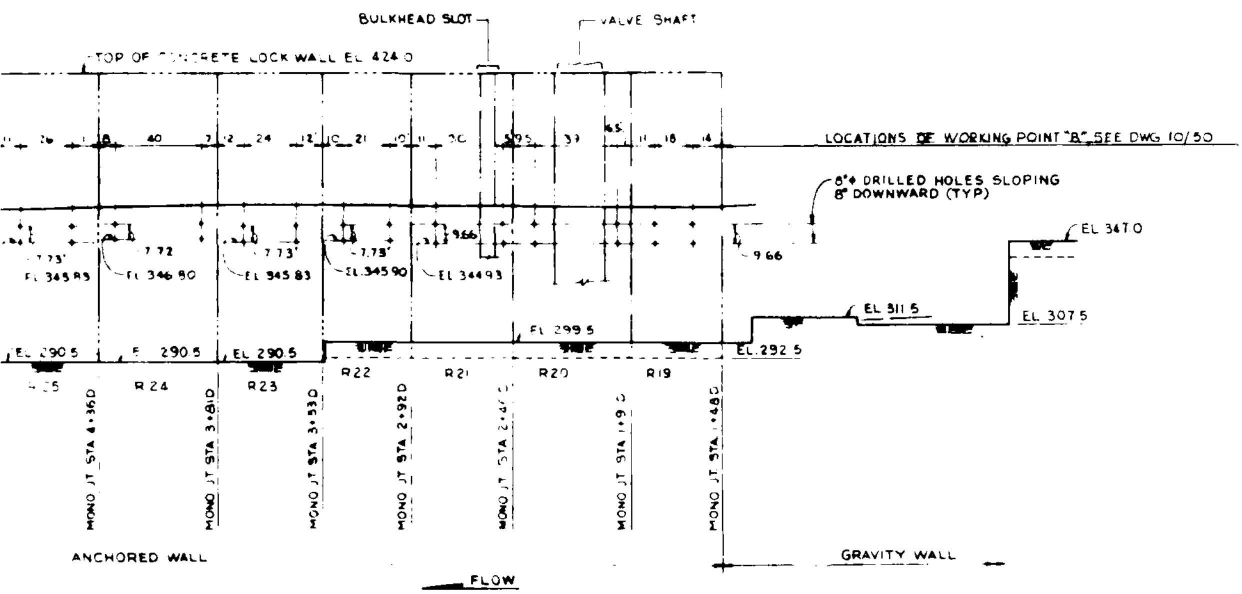
ELEVATION A-A



ELEVATION B-B



A



ELEVATION B-B

NOTES

1. FOR GENERAL NOTES, SEE DWG. 10/1
2. FOR LOCATION OF ELEVATION A-A & B-B SEE DWG. 10/2
3. FOR WALL ANCHOR DETAILS, SEE DWG. 10/50

NOTE A

1. IN MONOLITH L19 ADDED ONE WALL ANCHOR
2. IN MONOLITH L23 DELETED ONE WALL ANCHOR AND CHANGED US/DS LOCATION OF ONE WALL ANCHOR
3. IN MONOLITH L29 DELETED ONE WALL ANCHOR AND CHANGED US/DS LOCATION OF REMAINING WALL ANCHORS
4. IN MONOLITH R24 DELETED ONE WALL ANCHOR
5. IN MONOLITH R25 CHANGED US/DS LOCATION OF TWO WALL ANCHORS

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD
4	2-14-80	REMOVED U.S. BULKHEAD RECESS AT FILLING VALVES	DJ	
3	11-9-79	SEE NOTE A	MJB	JEM
2	5-28-79	REVISED IN ACCODANCE WITH AMEND. 0002	PS	JEM
1	12-18-78	GENERAL REVISIONS	WDG	WRG

30' 0 30' 60'
GRAPHIC SCALE

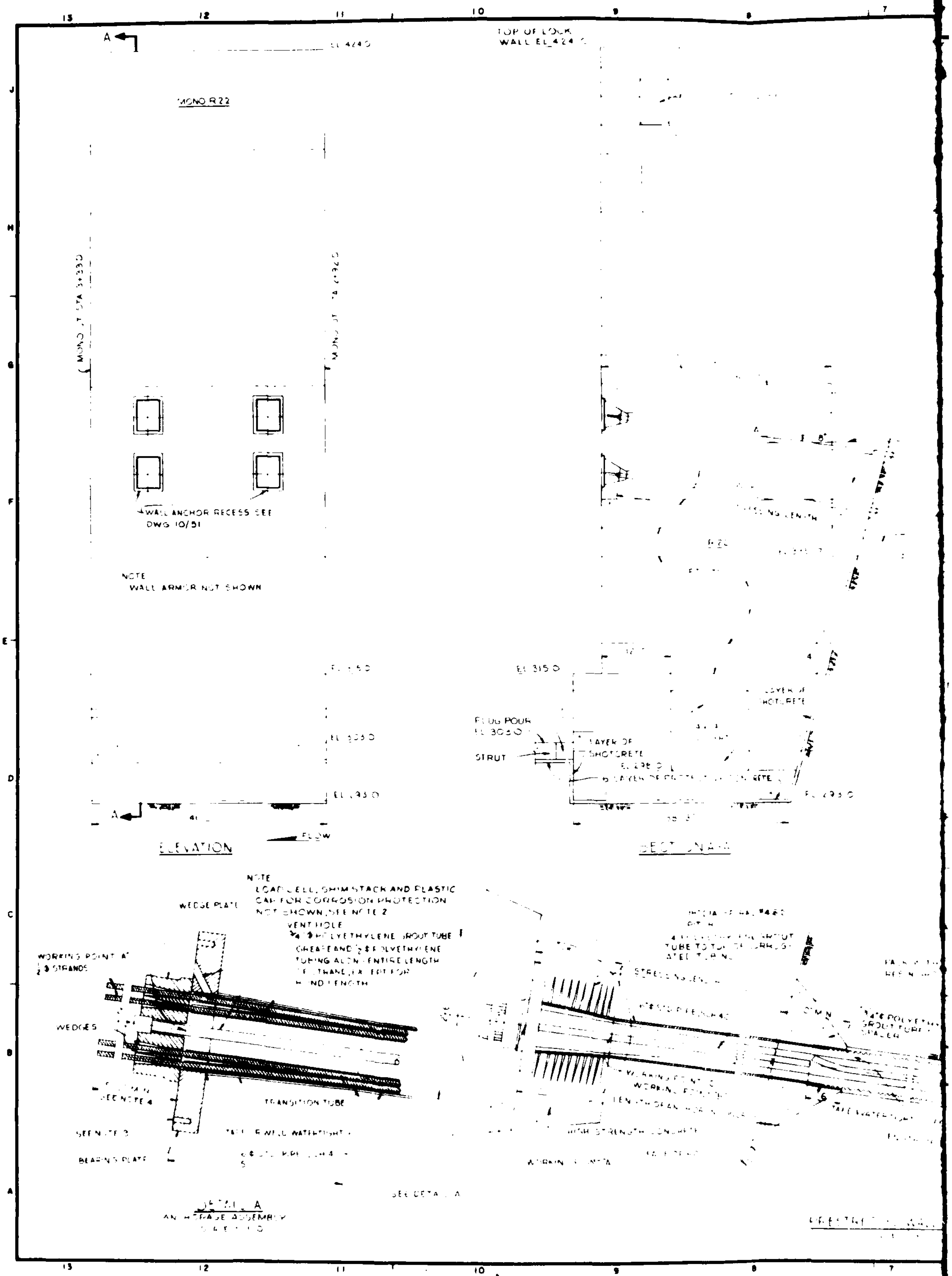
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS

DRAWN: P.S.
CHECKED: WRG

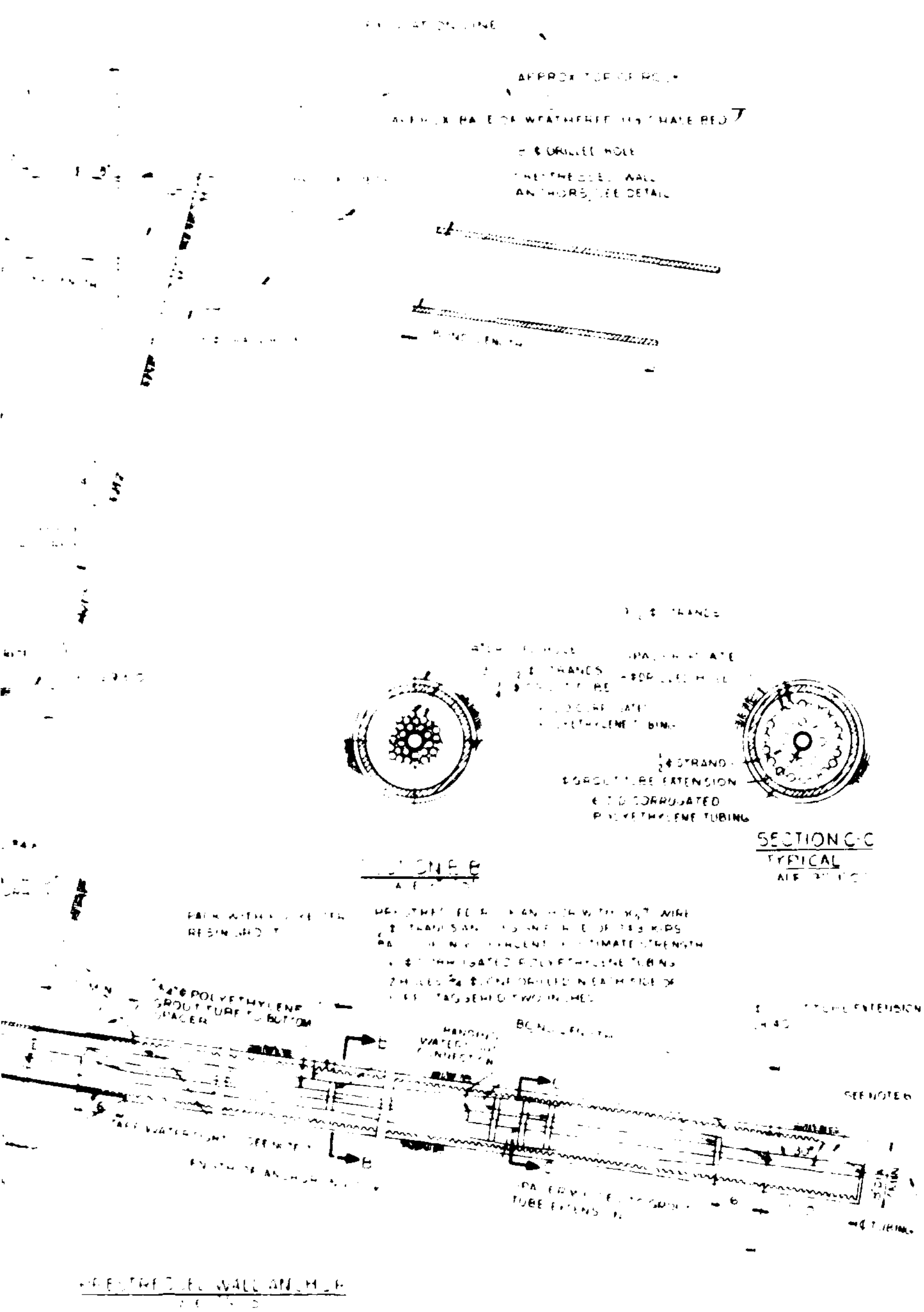
TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
LOCK WALLS
WALL ANCHOR LOCATIONS

SCALE 1" = 30'

BSFR-62
TTBS-10/4.4



TOP OF LOCK WALL EL 424.0
MONO R22
WALL ANCHOR RECESS SEE DWG 10/51
NOTE
WALL ARMOR NOT SHOWN
EL 315.0
PLUG POUR
STRUT
LAYER OF SHOTCRETE
FLOW
ELEVATION
NOTE
LOAD CELL, SHIM STACK AND PLASTIC CAP FOR CORROSION PROTECTION NOT SHOWN, SEE NOTE 2
WEDGE PLATE
VENT HOLE
WORKING POINT A
WEDGES
TRANSITION TUBE
BEARING PLATE
STRESSING LENGTH
HIGH STRENGTH CONCRETE
DETAIL A
ANCHORAGE ASSEMBLY
SEE DETAIL A



NOTES

1. FOR GENERAL NOTES SEE DWG [illegible]
2. THE PRESTRESSED WALL ANCHOR DETAIL [illegible] DETAILS OF THE PRESTRESSED WALL ANCHOR ARE TYPICAL FOR ALL ANCHORS IN MONOS [illegible] THRU [illegible] 30 AND [illegible] THRU [illegible] THE POSITIONS OF WORKING POINTS [illegible] AND EXTENSOMETER RECESSES, ANCHOR LENGTH, [illegible] LENGTH AND BOND LENGTH SEE DWGS [illegible] AND THE TABLE [illegible]
3. TWO HOLES SHALL BE DRILLED IN EACH BEARING PLATE AND IN THE BASE [illegible] AS DETAILED IN THE SPECIFICATIONS FOR [illegible] ALIGNMENT [illegible]
4. AFTER ACCEPTANCE OF EACH ANCHOR STRAND SHALL BE [illegible] BEARING PLATE
5. SOME DETAILS OF THE ANCHOR USED IN ANCHOR INSTALLATION [illegible] ARE DIFFERENT FROM THOSE SHOWN ON THIS DRAWING. SEE SPECIFICATIONS.
6. AT THE LOWER END OF THE CORRUGATED TUBING A [illegible] SHALL BE REMOVED BY CUTTING AS SHOWN ON THE DRAWING.
7. AFTER INSERTION OF CORRUGATED TUBING AND ANCHOR [illegible] AND VENT SYSTEM AT TOP OF HOLE. SEE SPECIFICATIONS.
8. FOR A DESCRIPTION OF THE SEQUENCE OF CONSTRUCTION REFER TO SECTION IX OF THE BAY SPRINGS FOUNDATION REPORT

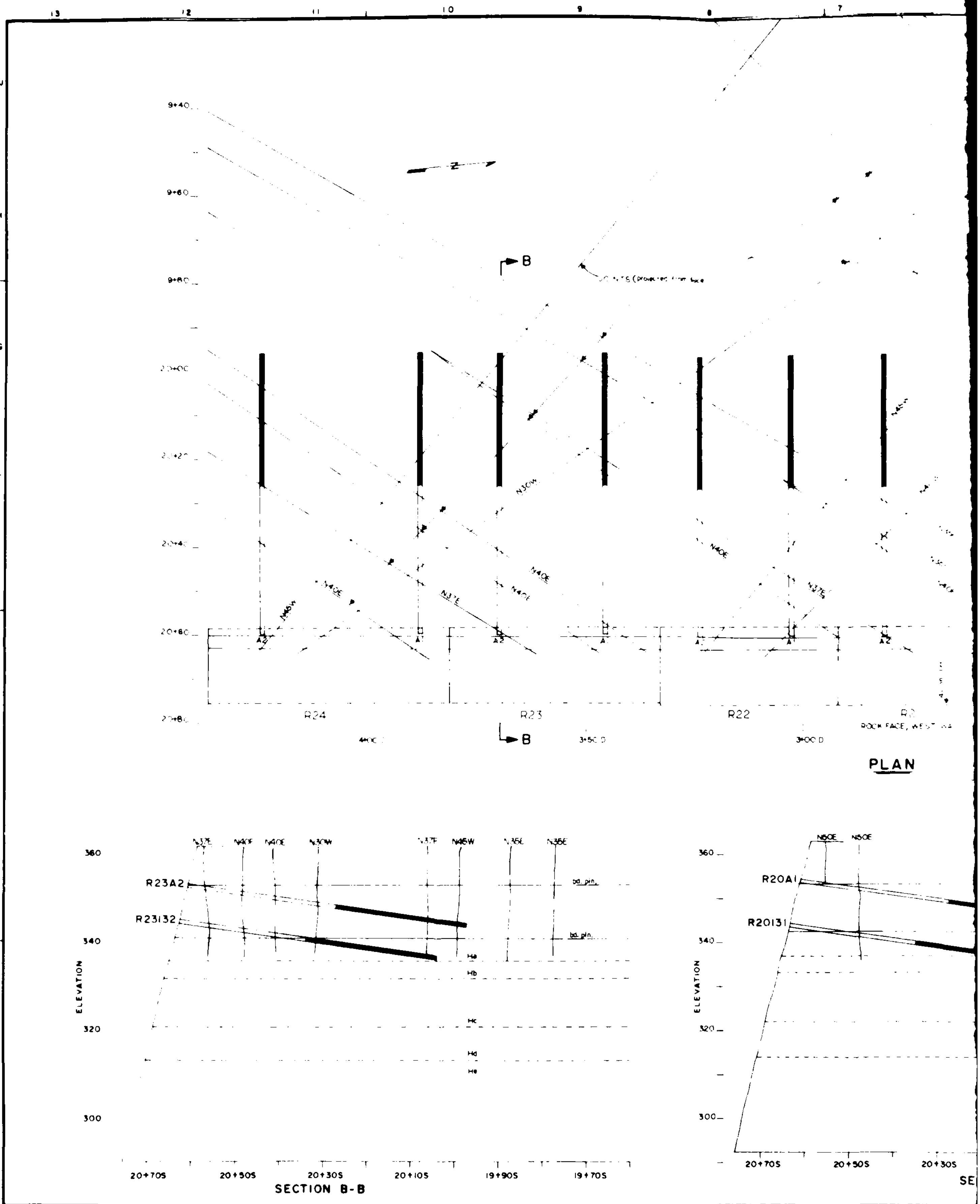
REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD
3	4 6 79	REVISED IN ACCORDANCE WITH AMEND. 0004	CS	JEM
2	2 15 79	CHANGE LENGTH AND OTHER DETAILS OF GROUT TUBE EXTENSION	[illegible]	[illegible]
1	12 8 78	GENERAL REVISIONS	[illegible]	[illegible]

GRAPHIC SCALE

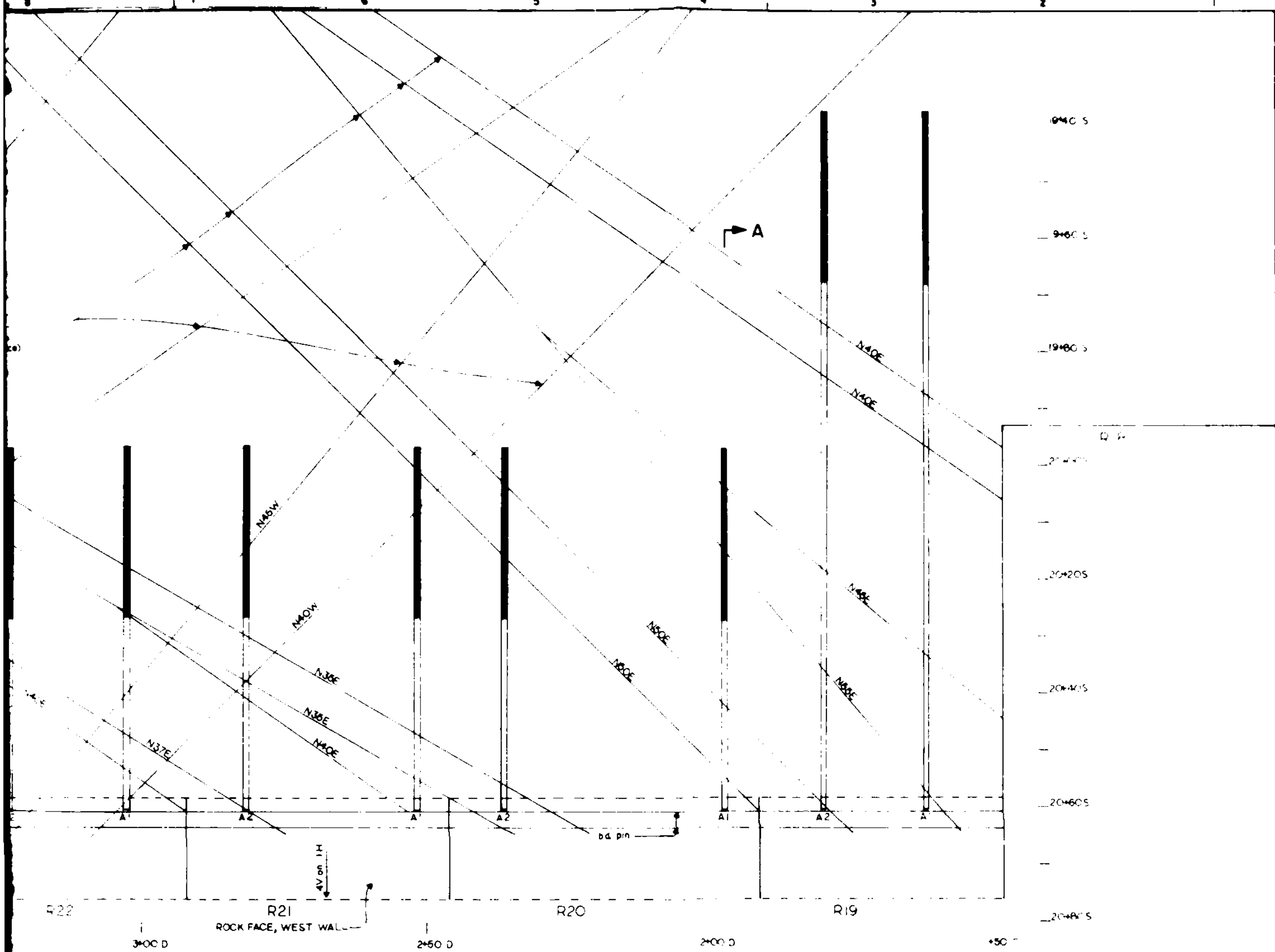
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
WALL ANCHORS
SHEET 1

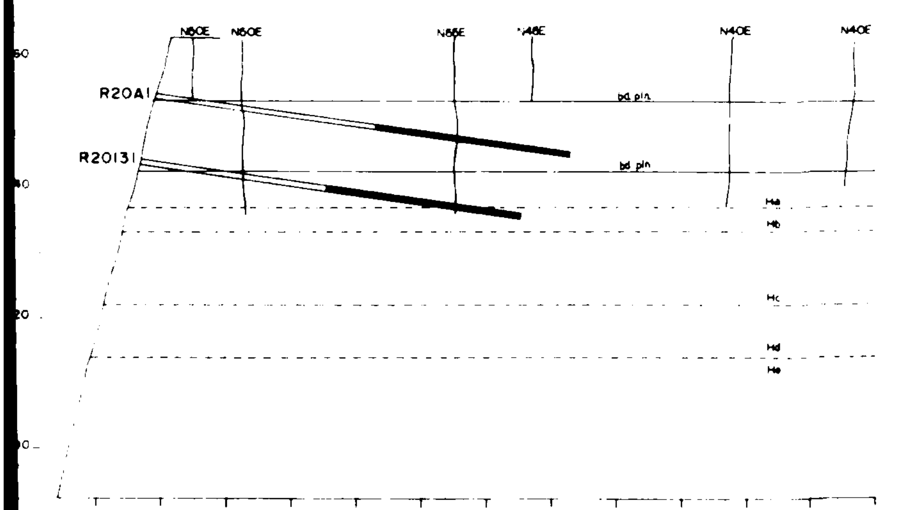
DRAWN B.L.G
CHECKED
TRACED
COMPUTED
SUBMITTED
APPROVAL RECOMMENDED
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE
SPEC NO
DRAWING NUMBER
BSFR-63
SHEET OF TTBS-10/50 3
RECORD DRAWING AS CONSTRUCTED DATED



9+40
9+60
9+80
20+00
20+20
20+40
20+60
20+80
N
B
JOINTS (Projected from face)
N30W
N40E
N37E
N46W
N37E
R24
R23
R22
ROCK FACE, WEST WALL
4+00
3+50
3+00
PLAN
360
340
320
300
ELEVATION
R23A2
R23132
N37E
N40E
N40E
N30W
N37E
N46W
N35E
N35E
bd. pln.
Ha
Hb
Hc
Hd
He
20+70S
20+50S
20+30S
20+10S
19+90S
19+70S
SECTION B-B
R20A1
R20131
N50E
N50E



PLAN



SECTION A-A

NOTES

1. FOR ABBREVIATIONS, SEE CONTRACT DRAWING TTBS 3/1
2. ELEVATIONS REFER TO MEAN SEA LEVEL
3. DISCONTINUITIES WERE PROJECTED FROM THE ROCK FACE ASSUMING THAT STRIKE AND DIP OF THE FEATURE, TAKEN AT THE ROCK FACE, DID NOT CHANGE WITH DISTANCE FROM THE FACE

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN DKS
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
WALL ANCHORS AND
GEOLOGIC DISCONTINUITIES
PLAN AND SECTIONS

SUBMITTED

APPROVAL RECOMMENDED

CHIEF ENGINEERING DIVISION

APPROVED

COLONEL C E DISTRICT ENGINEER

DATE

SCALE 1" = 10'

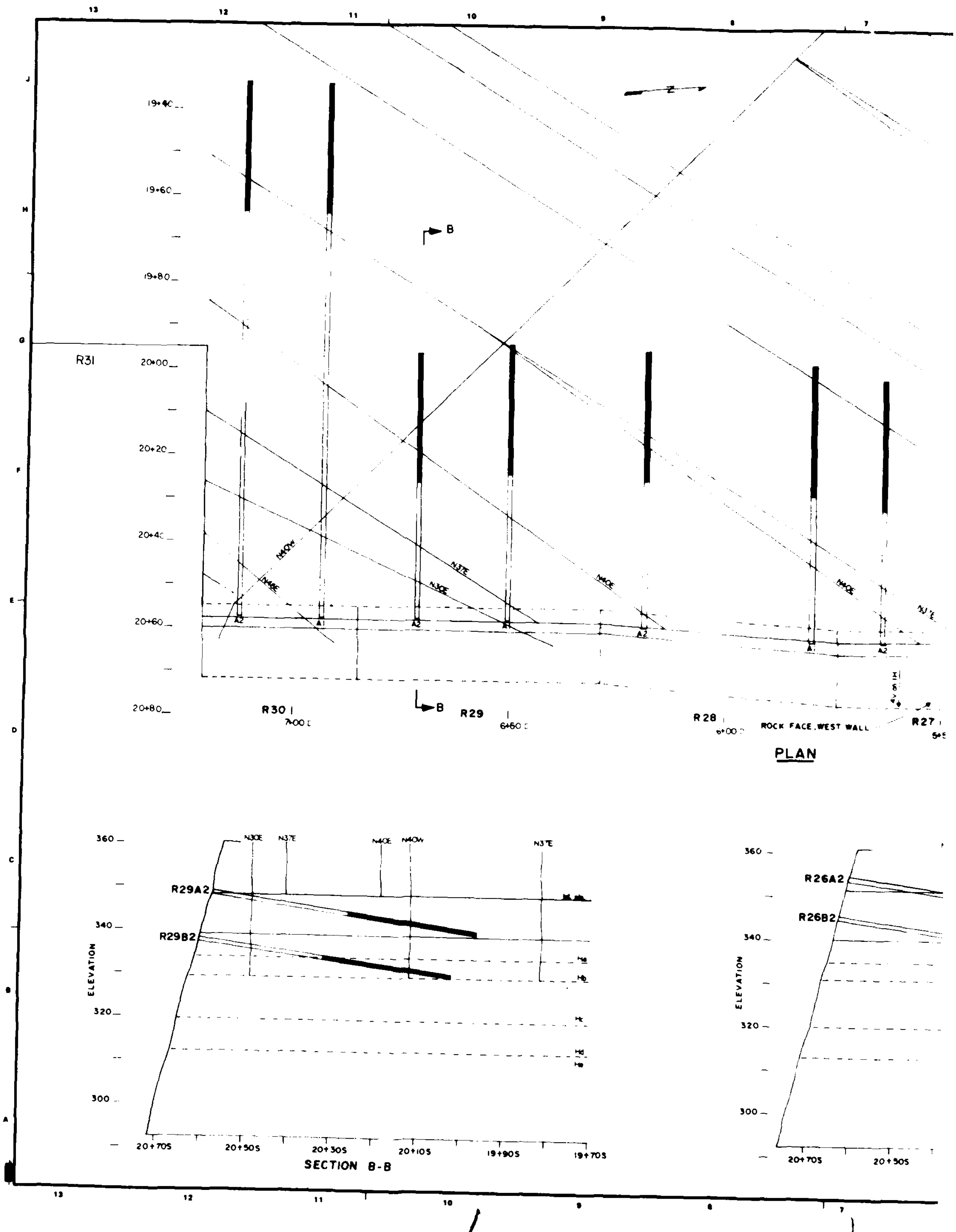
SPEC NO

DRAWING NUMBER

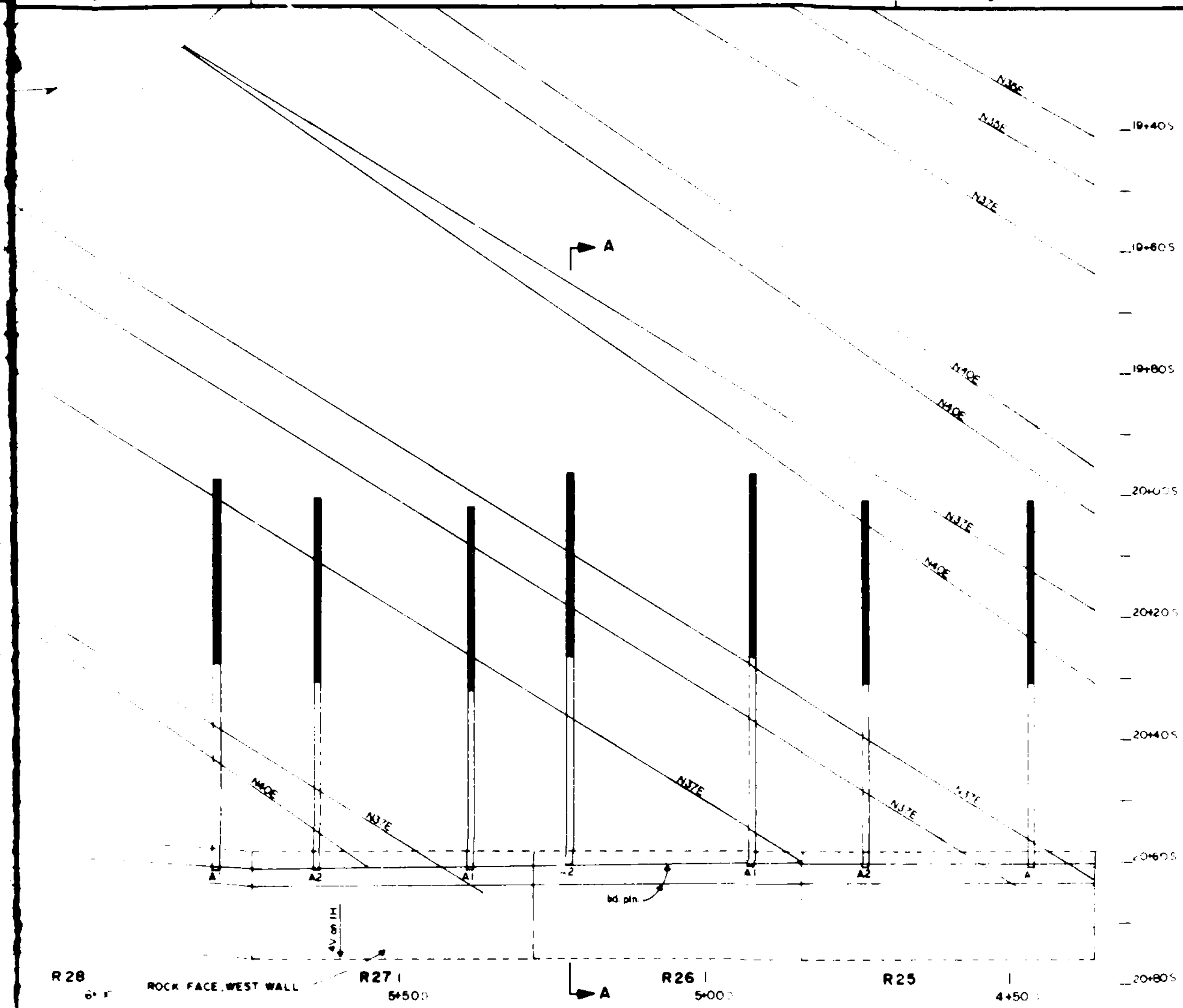
BSFR-64

SHEET OF

RECORD DRAWING AS CONSTRUCTED DATED

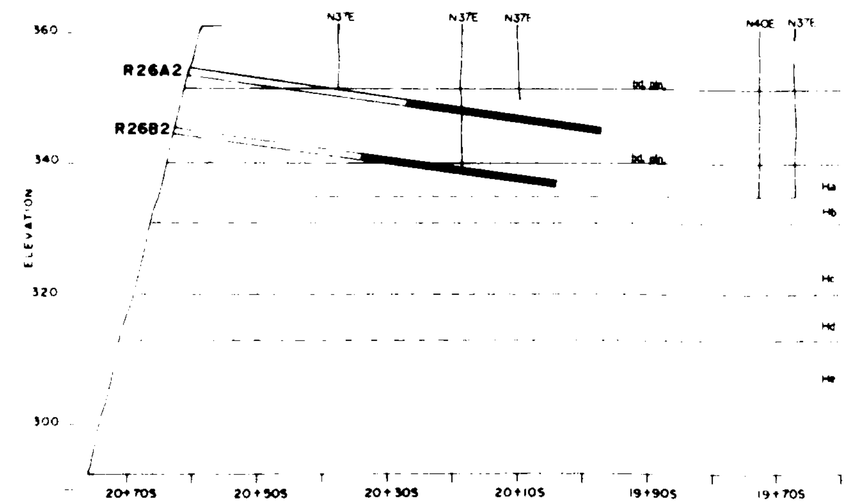


PLAN
SECTION B-B
R31
R30
R29
R28
R27
ROCK FACE, WEST WALL
R29A2
R29B2
R26A2
R26B2
ELEVATION
N40W
N30E
N37E
N40E
19+40
19+60
19+80
20+00
20+20
20+40
20+60
20+80
20+70S
20+50S
20+30S
20+10S
19+90S
19+70S
360
340
320
300



PLAN

NOTE
FOR NOTES, SEE DRAWING BSFR 64



SECTION A-A

REVISION	DATE	DESCRIPTION	BY	CHKD

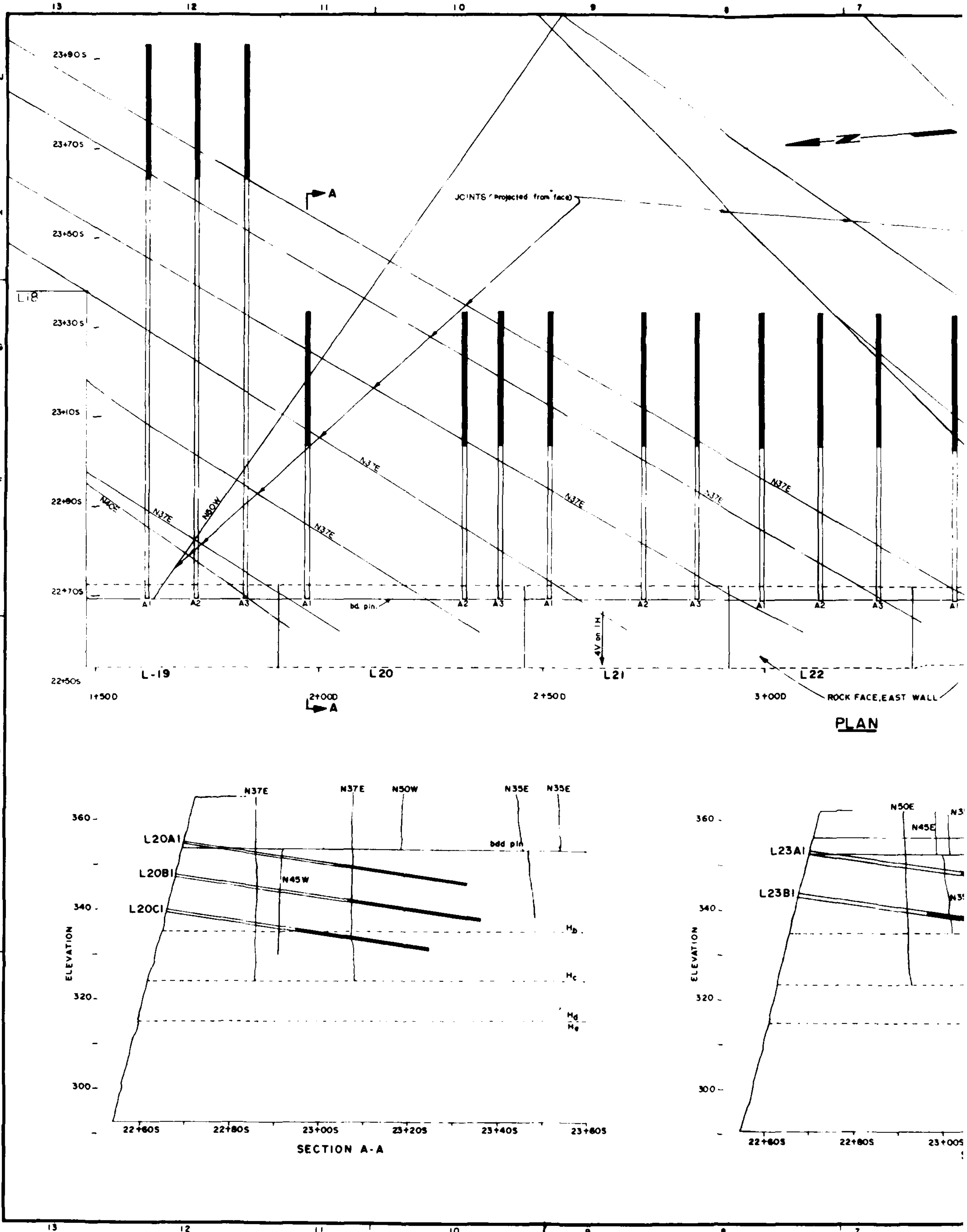
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

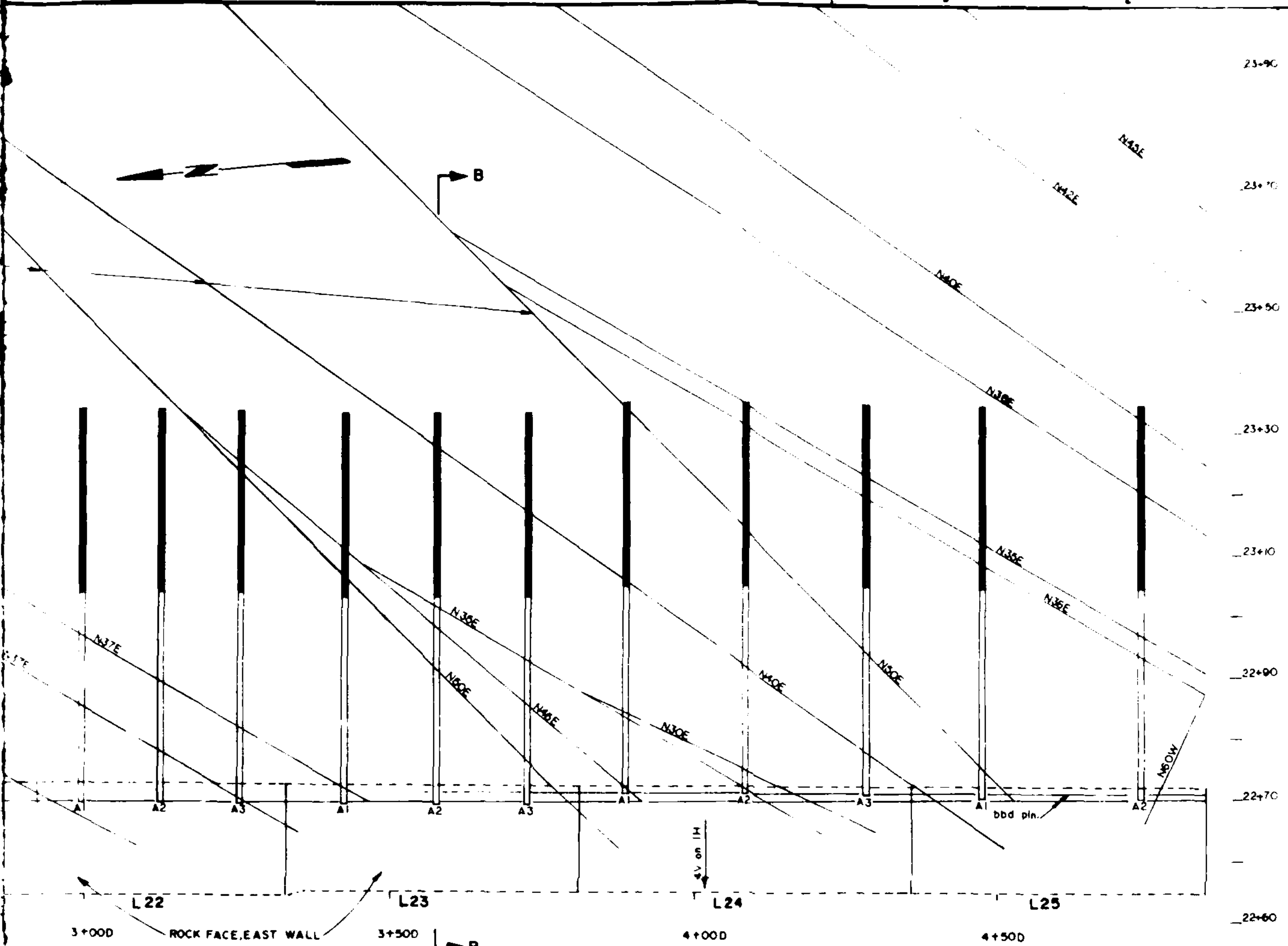
DRAWN DK
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
WALL ANCHORS AND
GEOLOGIC DISCONTINUITIES
PLAN AND SECTIONS

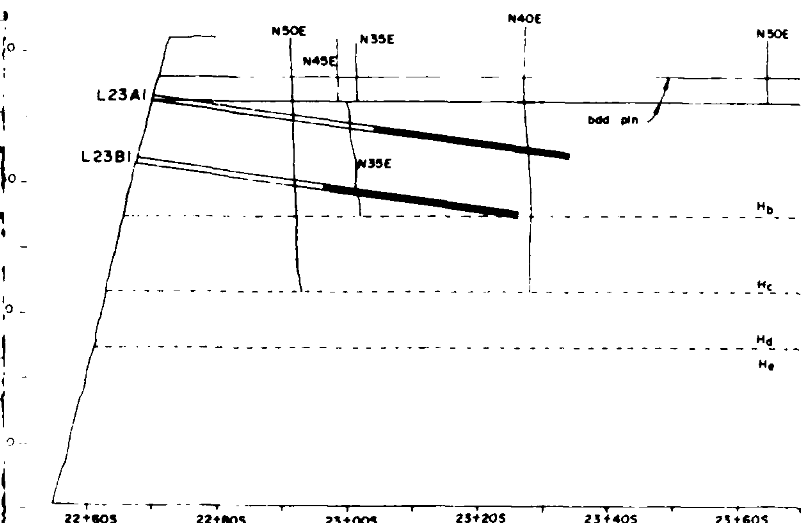
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR - 65
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



JOINTS (Projected from face)
23+90S
23+70S
23+50S
23+30S
23+10S
22+80S
22+70S
22+50S
L18
N37E
N80W
N40E
bd. pin.
A1
A2
A3
4V on 1H
L-19
L20
L21
L22
1+50D
2+00D
2+50D
3+00D
ROCK FACE, EAST WALL
PLAN
N37E
N50W
N35E
N45W
bdd pin
L20A1
L20B1
L20C1
ELEVATION
360
340
320
300
22+60S
22+80S
23+00S
23+20S
23+40S
23+60S
SECTION A-A
N50E
N45E
L23A1
L23B1



PLAN



SECTION B-B

NOTE
FOR NOTES, SEE DRAWING BSFR-64

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

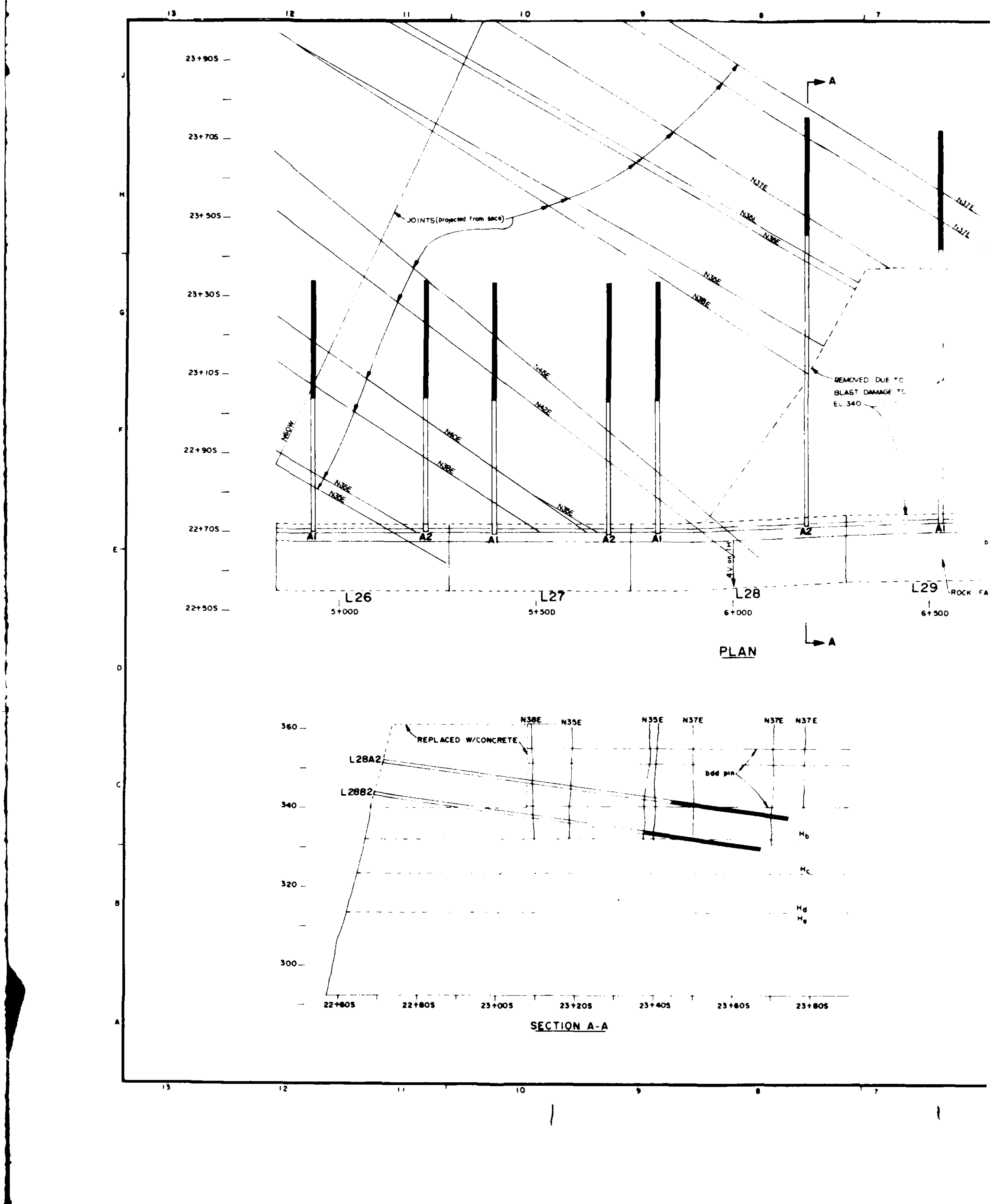
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE TENNESSEE

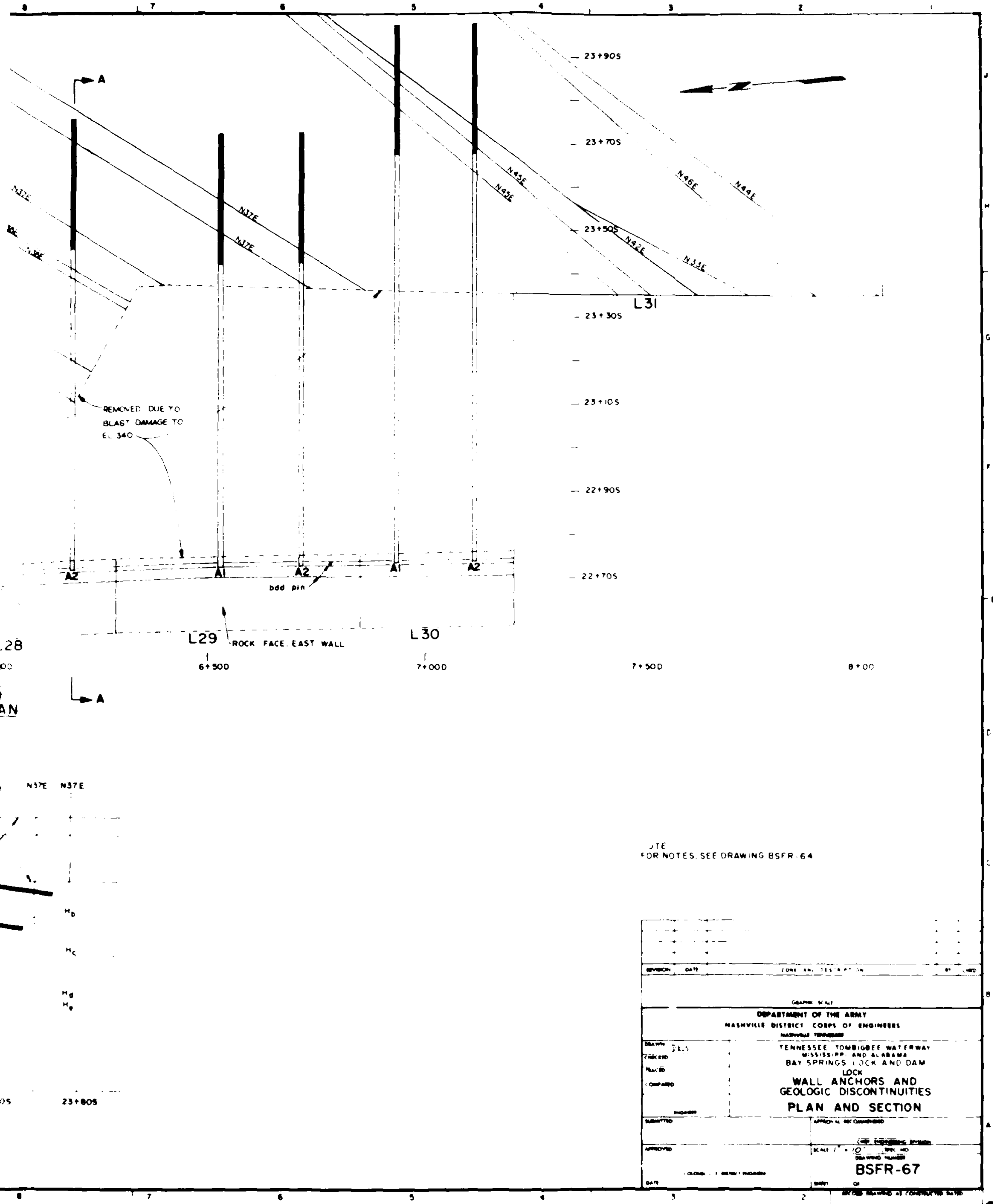
DRAWN DES
CHECKED
TRACED
COMPARED

TENNESSEE-TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
WALL ANCHORS AND
GEOLOGIC DISCONTINUITIES
PLAN AND SECTIONS

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 10'
SPEC NO
DRAWING NUMBER
BSFR-66
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



JOINTS (projected from face)
REMOVED DUE TO BLAST DAMAGE TO EL.340
ROCK FA
L26
5+000
L27
5+500
L28
6+000
L29
6+500
PLAN
REPLACED W/CONCRETE
L28A2
L28B2
bdd pin
SECTION A-A

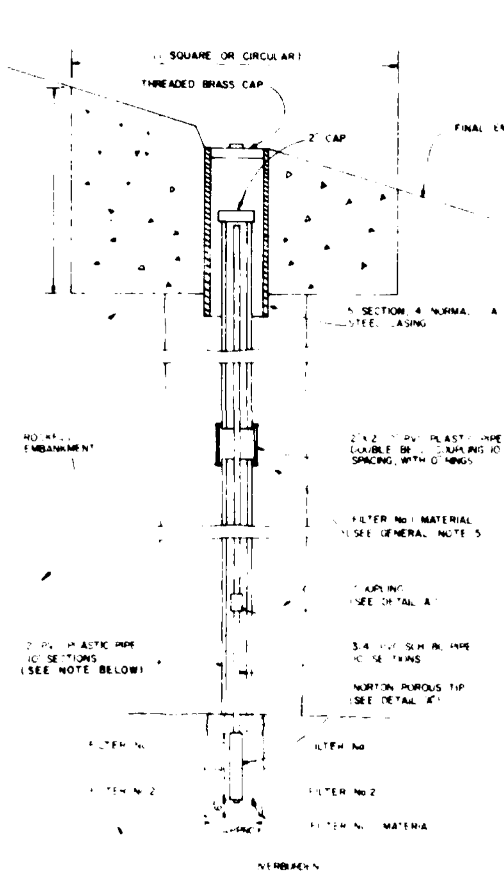


NOTE
FOR NOTES, SEE DRAWING BSFR-64

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK
WALL ANCHORS AND
GEOLOGIC DISCONTINUITIES
PLAN AND SECTION

BSFR-67

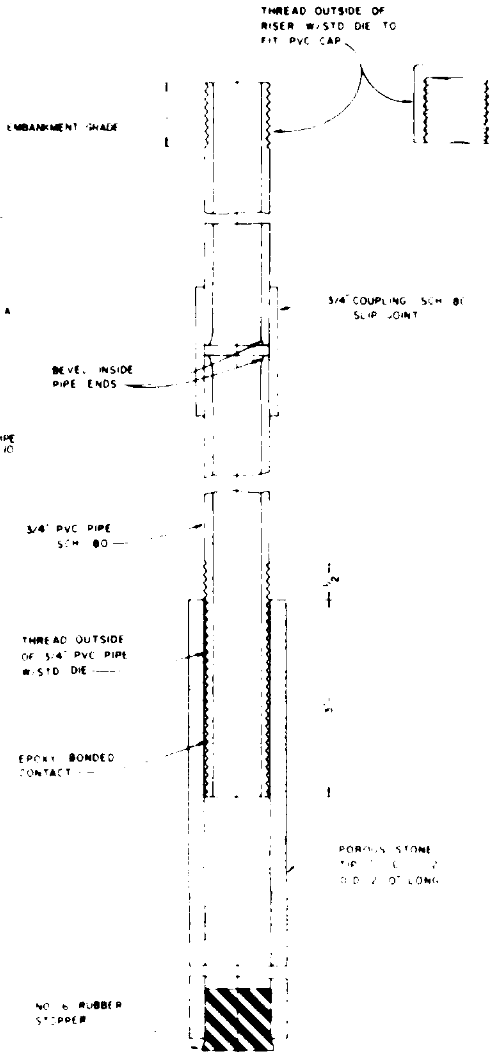


PIEZOMETER INSTALLATION

(NOT TO SCALE)

TYPICAL FOR INSTALLATION IN PERVIOUS MATERIALS

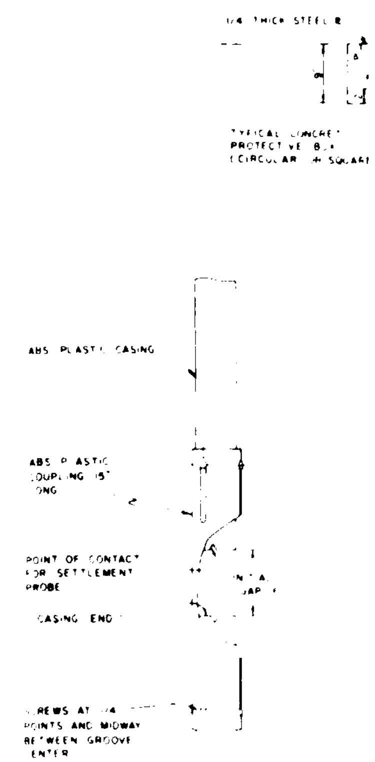
NOTE
WHERE 2 RISERS ARE TO BE PROTECTED WITHIN THE SAME CASING (e.g. BSPZ-15 AND BSPZ-15R) USE 4" DIAMETER PVC PIPE INSTEAD OF 2" DIAMETER



DETAIL "A"

SCALE FULL

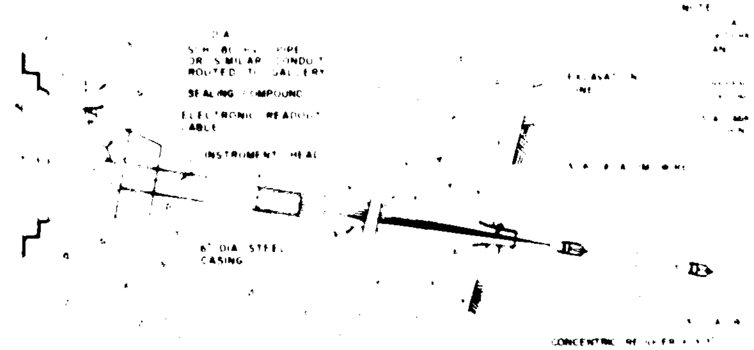
PIEZOMETER DETAIL FOR NORTON POROUS TIP CONNECTION, COUPLING AND THREADED AND CAPPED TOP OF RISER



DETAIL "B"

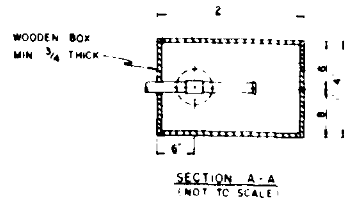
GENERAL NOTES

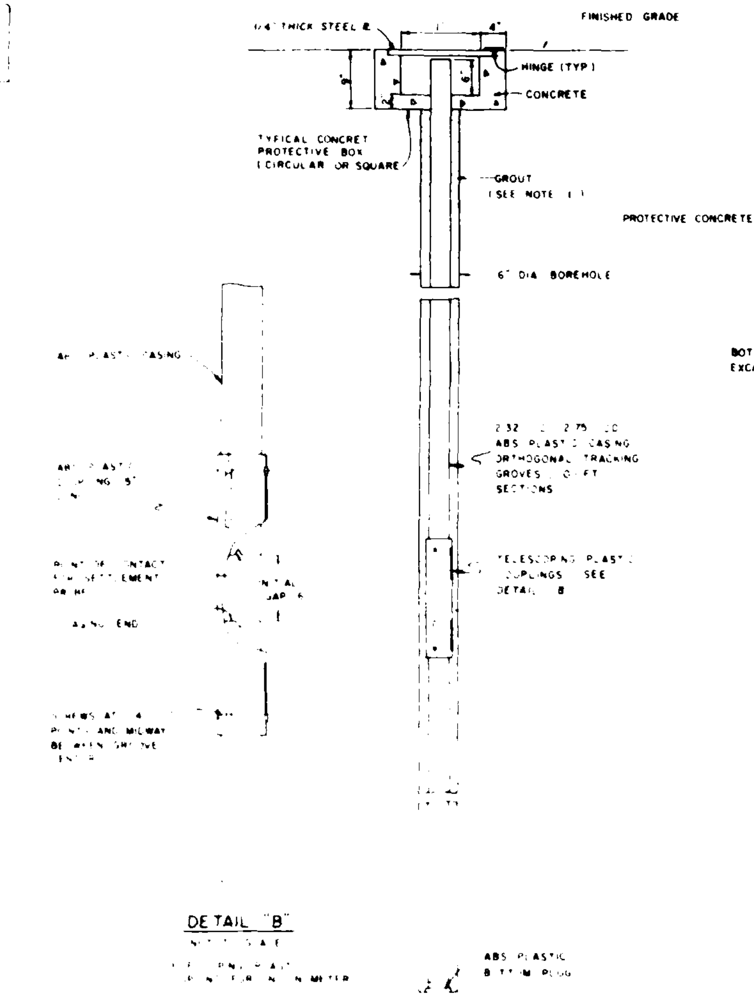
1. PLANS FOR PROTECTIVE HOUSINGS FOR PIEZOMETERS AND INCLINOMETERS SHALL BE DEVELOPED BY CONTRACTOR AND SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION OF INSTRUMENT
2. REFER TO DRAWING NOS TTBS-43/1, 43/2 FOR PIEZOMETER LOCATIONS AND SECTIONS
3. REFER TO DRAWING NOS TTBS-43/3, 43/4 FOR UPLIFT CELL, PORE PRESSURE CELL, AND EXTENSOMETER LOCATIONS AND SECTIONS
4. REFER TO DRAWING NOS TTBS-43/5 FOR INCLINOMETER LOCATIONS AND SECTIONS
5. FILTER No 1 MATERIAL SHALL BE HAND PLACED FOR A RADIUS OF 3 FEET AROUND EACH PIEZOMETER. COMPACTION OF THIS MATERIAL SHALL CONFORM TO SECTION 2D-6.5 AND 2D-8.4 OF THE SPECIFICATIONS



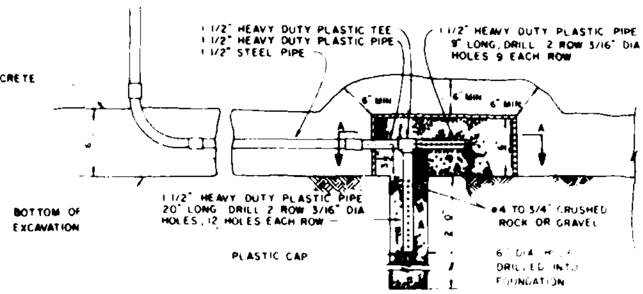
EXTENSOMETER INSTALLATION

NOT TO SCALE





DETAIL "B"



UPLIFT CELL INSTALLATION
(NOT TO SCALE)

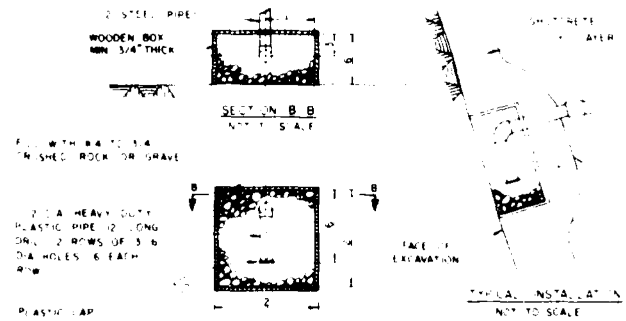
NOTES (UPLIFT CELLS AND PORE PRESSURE CELLS)

1. PLACE SHOTCRETE OR PROTECTIVE CONCRETE AT LEAST 12 HOURS AHEAD OF COVERING LIFT OF CONCRETE
2. WRAP PERFORATED SECTIONS OF PLASTIC PIPE WITH ONE LAYER OF POLYVINYLIDENE CHLORIDE FILTER SHEET
3. 1/2 GALVANIZED STEEL PIPE TO BE STANDARD WT
4. ALL UPLIFT CELLS AND PORE PRESSURE CELLS SHALL HAVE A MINIMUM 18 BEND COMING INTO VERTICAL RISER
5. ALL PLASTIC PIPES AND FITTINGS TO BE SCHEDULE 80 PVC OR HEAVIER
6. NON-VERTICAL SECTIONS OF PIPE SYSTEMS SHALL BE INSTALLED AS NEARLY HORIZONTAL AS CLEARANCES WILL ALLOW BUT NOT FLATTER THAN 1/4" PER FOOT. PIPE WILL SLOPE *UPWARD TOWARD RISER*

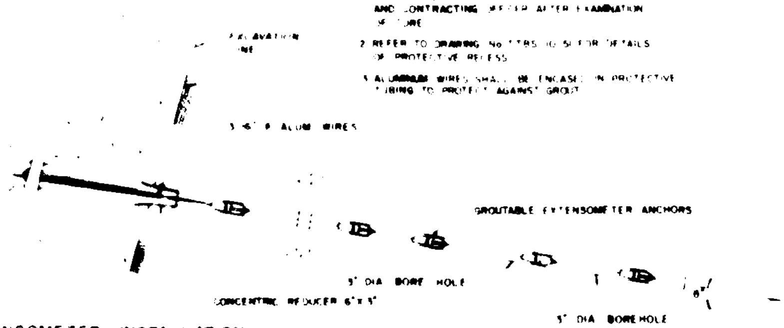
INCLINOMETER INSTALLATION
(NOT TO SCALE)

NOTE: INCLINOMETERS
FOR INSTALLATIONS IN ROCKFILL FILTER NO BACKFILL MATERIAL SHALL BE USED

NOTE: EXTENSOMETERS
1. LOCATION OF EXTENSOMETER ANCHORS TO BE DETERMINED BY THE FACTORY REPRESENTATIVE AND CONTRACTING OFFICER AFTER EXAMINATION OF CORE
2. REFER TO DRAWING No TTBS-10.5 FOR DETAILS OF PROTECTIVE RECESS
3. ALUMINUM WIRES SHALL BE ENCASED IN PROTECTIVE TUBING TO PROTECT AGAINST GROUT



PORE PRESSURE CELL INSTALLATION
(NOT TO SCALE)



EXTENSOMETER INSTALLATION
NOT TO SCALE

REVISION	DATE	ZONE AND DESCRIPTION	BY
3	8-3-79	ADDED NOTE 1 TO PIEZOMETER INSTALLATION DWG	
2	3-21-79	REVISED IN ACCORDANCE WITH AMENDMENT	
1	12-29-78	GENERAL REVISIONS	BRC

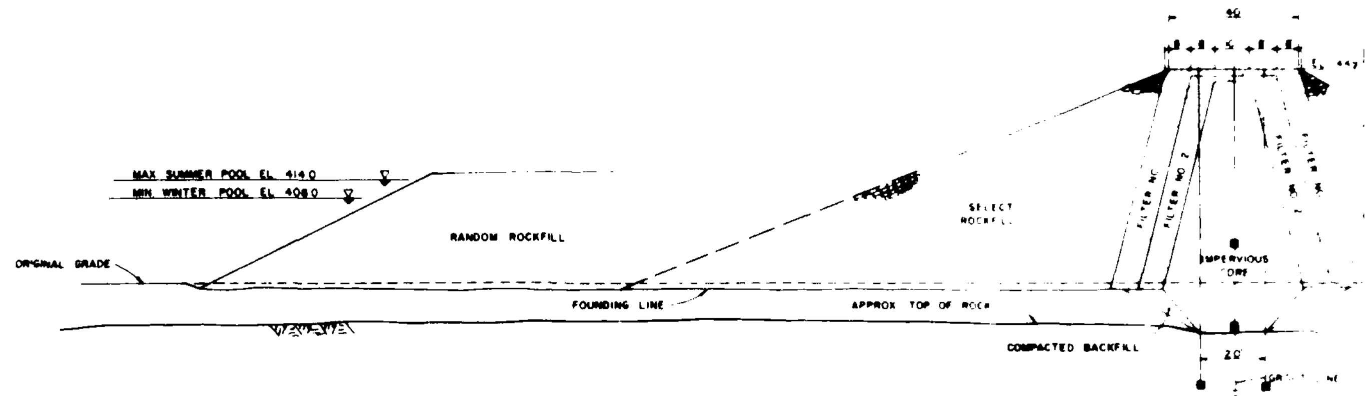
DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM

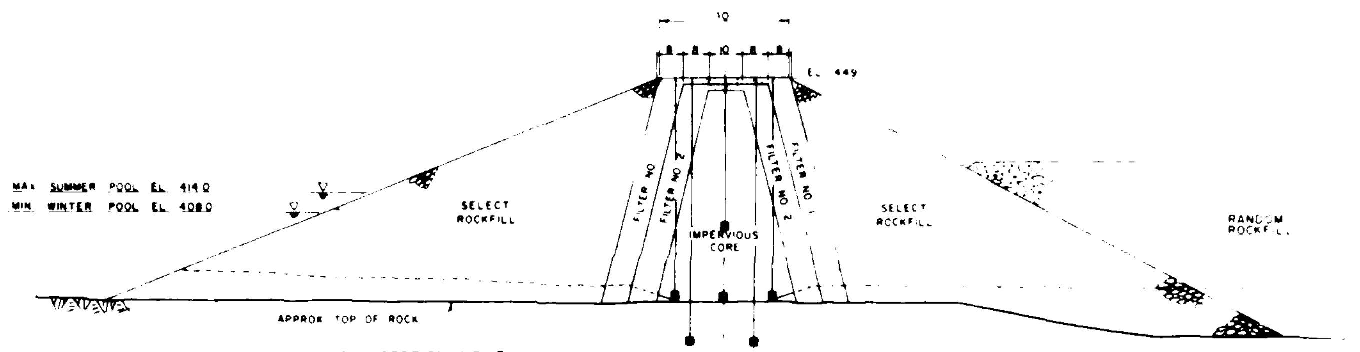
INSTRUMENTATION DETAILS

SCALE AS SHOWN

BSFR-68
TTBS-43/8.3



TYPICAL SECTION NO 2
SCALE 1" = 20'
(TYPICAL FROM STA 4+70S TO STA 15+35S)



TYPICAL SECTION NO 3
SCALE 1" = 20'
(TYPICAL FROM L LOCKWALL TO STA 23+60S)
AND 15 + 35S to R. LOCKWALL

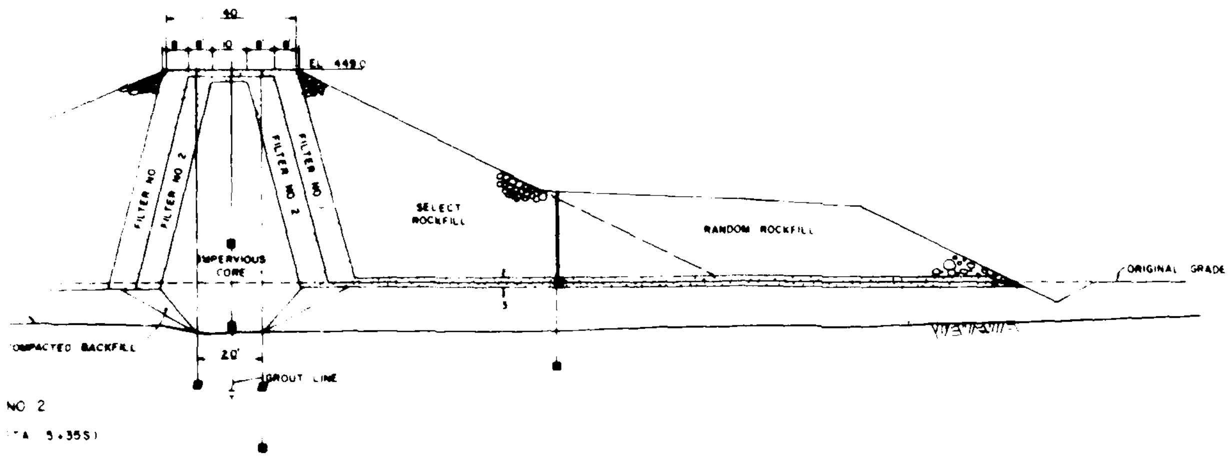
TABLE 1 - PIEZOMETER DATA

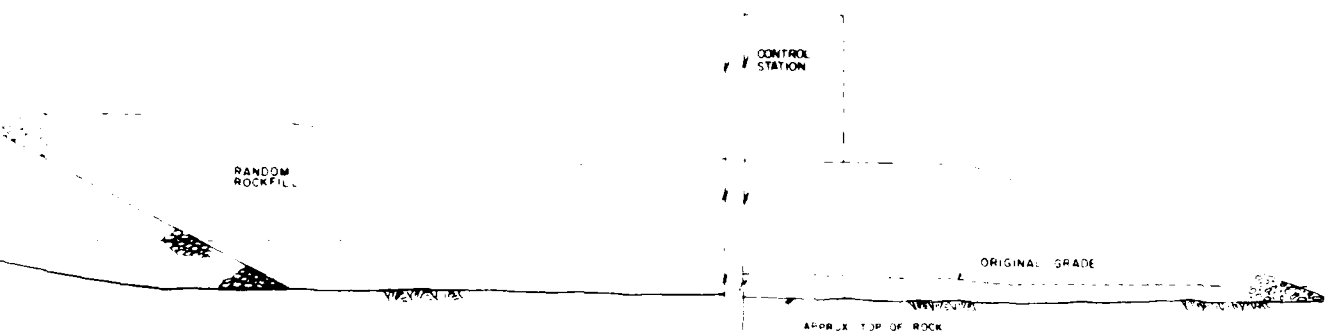
PIEZO METER	TYPICAL SECTION	LOCATIONS STA (AXIS)	LOCATIONS STA (U-D)	APPROXIMATE TIP ELEVATION	LOCATION OF TIP	TYPE	INSTALLED DURING CONST (1)	INSTALLED AFTER CONST (2)
BSPZ 1	IN RT ABUTMENT	1 00S	0.000	380 6	ORIGINAL GROUND ABOVE GORDO	NORTON		X
2	IN RT ABUTMENT	1 05S	0.000	361 1	TOP OF ROCK IN GORDO			X
3	IN RT ABUTMENT	1 10S	0.000	325 0	IN ROCK + 325 0 OR IN OPEN JOINT			X
4	1	4 00S	0 00	362 1	TOP OF ROCK IN GORDO			X
5	2	6 00S	0 00	389 8	IN CORE			X
6	2	6 05S	0 00	370 1	TOP OF ROCK IN CORE			X
7	2	8 00S	0 00	385 0	IN CORE			X
8	2	8 05S	0 00	380 0	IN OVERBURDEN			X
9	2	8 10S	0 00	370 3	TOP OF ROCK IN CORE			X
10	2	10 00S	0 00	390 0	IN CORE			X
11	2	10 05S	0 00	370 6	TOP OF ROCK IN CORE			X
12	2	10 00S	0 10U	354 7	IN ROCK U S OF GROUT CURTAIN			X
13	2	10 00S	0 100	345 0	IN ROCK D S OF GROUT CURTAIN	CLOSE TO A JOINT IF		X
14	2	10 05S	0 100	310 4	IN ROCK BELOW BOTTOM GROUT LINE	POSSIBLE		X
15	2	10 00S	1 000	377 5	IN D S FILTER BLANKET		X	
16	2	12 00S	0 00	385 0	IN CORE			X
17	2	12 05S	0-14U	371 8	IN CORE			X
18	2	12.05S	0 00	370 1	IN CORE			X
19	2	14 00S	0 00	390 8	IN CORE			X
20	2	14 05S	0 00	372 3	IN CORE			X
21	2	14 00S	0 10U	350 0	IN ROCK U S OF GROUT LINE			X
22	2	14 00S	0 100	348 2	IN ROCK D S OF GROUT LINE			X
BSPZ 23	2	14 05S	0 100	310 0	IN ROCK BELOW GROUT LINE	NORTON		X
BSP 10*		23 35S	3 830	282 4	IN ROCK	NORTON		
BSP 11*		24 88S	3 850	282 5	IN ROCK	NORTON		
BSP 12*		18 87S	3 850	290 2	IN ROCK	NORTON		
BSP 13*		18 84S	3 850	281 6	IN ROCK	NORTON		

*THESE PIEZOMETERS WERE INSTALLED BY THE GOVERNMENT DURING CONSTRUCTION

(1) BY CONTRACTOR
(2) BY GOVERNMENT

BSPZ-24	2	14 00S	1 000
-25	3	16 00S	0 00
-26	3	16 05S	0 00
-27	3	16 10S	0 00
-28	3	17 60S	0 00
-29	3	17 65S	0 00
-30	3	17 70S	0 00
-31	3	17 75S	0 00
-32	3	17 60S	0 10U
-33	3	17 60S	0 10U
-34	3	17 65S	0 100
-35	3	20 25S	0 00
-36	3	20 30S	0 00
-37	3	20 35S	0 00
-38	3	23 00S	0 00
-39	3	23 05S	0 00
-40	3	23 10S	0 00
-41	2	25 10S	0 00
-42	2	25 10S	0 10U
-43	2	25 15S	0 100
-44	2	25 10S	0 100
-45	1	27 00S	0 00
46	IN LT ABUTMENT	30 00S	0 00
-47	IN LT ABUTMENT	30 00S	0 050
18A	2	12+05S	0-14U
20A	2	14 10S	0 00
29A	3	17+65S	0-40
BSPZ 29B	3	17+65S	0-40
BSPZ 15R	[illegible]	[illegible]	[illegible]
BSPZ 24R	[illegible]	[illegible]	[illegible]
BSPZ 48		18 80S	0 150
BSPZ 49		18 00S	0 150





NOTES.

1 TYPICAL PIEZOMETER ARRANGEMENT IS SHOWN DOES NOT CORRESPOND PRECISELY TO SPECIFIC PIEZOMETERS BUT ILLUSTRATES INTENT OF SYSTEM
2 SEE NOTE 4 DWG TTBS 43/1
3 SEE DRAWING TTBS 43/1 FOR PLAN AND PROFILE VIEWS AND FOR TYPICAL SECTION NO 1
4 REFER TO DRAWINGS TTBS 9/2-9/5 FOR EMBANKMENT DETAILS
5 REFER TO DRAWING TTBS-43/8 FOR PIEZOMETER INSTALLATION AND DETAIL
6 REFER TO DRAWING TTBS 43/1 FOR LEGEND

24	2	14 00S	1 000	378 5	IN D S FILTER BLANKET	NORTON	I	
25	3	16 00S	0 00	395 0	IN CORE			I
26	3	16 05S	0 00	370 0	IN CORE			I
27	3	16 10S	0 00	338	IN CORE JUST ABOVE TOP OF ROCK			I
28	3	17 60S	0 00	395 0	IN CORE			I
29	3	17 65S	0 00	370 0	IN CORE			I
30	3	17 70S	0 00	344 6	IN CORE			I
31	3	17 75S	0 00	320 9	IN CORE JUST ABOVE TOP OF ROCK			I
32	3	17 80S	0 100	290 0	IN ROCK D S GROUT LINE			I
33	3	17 80S	0 100	290 0	IN ROCK U S GROUT LINE			I
34	3	17 85S	0 100	260 0	IN ROCK BELOW GROUT LINE			I
35	3	20 25S	0 00	394 8	IN CORE			I
36	3	20 30S	0 00	375 0	IN CORE			I
37	3	20 35S	0 00	363 8	IN CORE AT TOP OF ROCK OR TOP OF CONCRETE			I
38	3	23 00S	0 00	395 8	IN CORE			I
39	3	23 05S	0 00	375 9	IN CORE			I
40	3	23 10S	0 00	342 9	IN CORE AT TOP OF ROCK OR TOP OF CONCRETE			I
41	2	25 10S	0 00	389 8	IN CORE NEAR TOP OF ROCK			I
42	2	25 10S	0 100	358 9	IN ROCK U S GROUT LINE IN WEATH CLAY			I
43	2	25 15S	0 100	359 1	IN ROCK D S GROUT LINE IN WEATH CLAY			I
44	2	25 10S	0 100	310 3	IN ROCK BELOW GROUT CURTAIN			I
45	1	27 00S	0 00	383 2	TOP OF ROCK IN GORDO			I
46	IN LT ABUTMENT	30 00S	0 00	378 3	TOP OF ROCK			I
47	IN LT ABUTMENT	30 00S	0 050	355 7	IN ROCK IN WEATHERED CLAY			I
18A	2	12+05S	0+14C	371 7	IN CORE AT TOP OF ROCK			I
20A	2	14 10S	0 00	350 0	IN WEATHERED CLAY OF ROCK			I
29A	3	17+65S	0+40	323 2	IN CORE JUST ABOVE TOP OF ROCK			I
29B	3	17+65S	0+40	321 8	IN CORE JUST ABOVE TOP OF ROCK			I
15R		[illegible] 00S	[illegible] 00	388 8	IN ROCK APPROX [illegible] BELOW TOP		I	
24R		[illegible] 14	[illegible] 0C	384 0	IN ROCK APPROX 10 BELOW TOP	NORTON	I	
48		18 00S	0 150	378 28	IN CORE } AT THE CONTACT OF THE	NORTON		I
49		18 00S	0 150	370 11	IN CORE } FIRST EMBANKMENT	NORTON		I
					PLACEMENTS AND THE			
					TIE IN PLACEMENTS			

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD
6	11-3-83	REV MID-TIP ELEV, LOCATION OF TIP & ADDED BSP[illegible]	JTN	
5	2-1-83	REV. BSPZ 4-& 44 STA & TIP ELEV, BSPZ 20A STA	CPD	
4	10-25-82	ADDED BSPZ-48 & BSPZ-49	VPM	
3	8-3-79	ADDED BSPZ-15R & BSPZ-24R		
2	3-21-79	REVISED IN ACCORDANCE WITH AMEND 0002	CJD	
1	12-29-78	GENERAL REVISIONS	BRC	

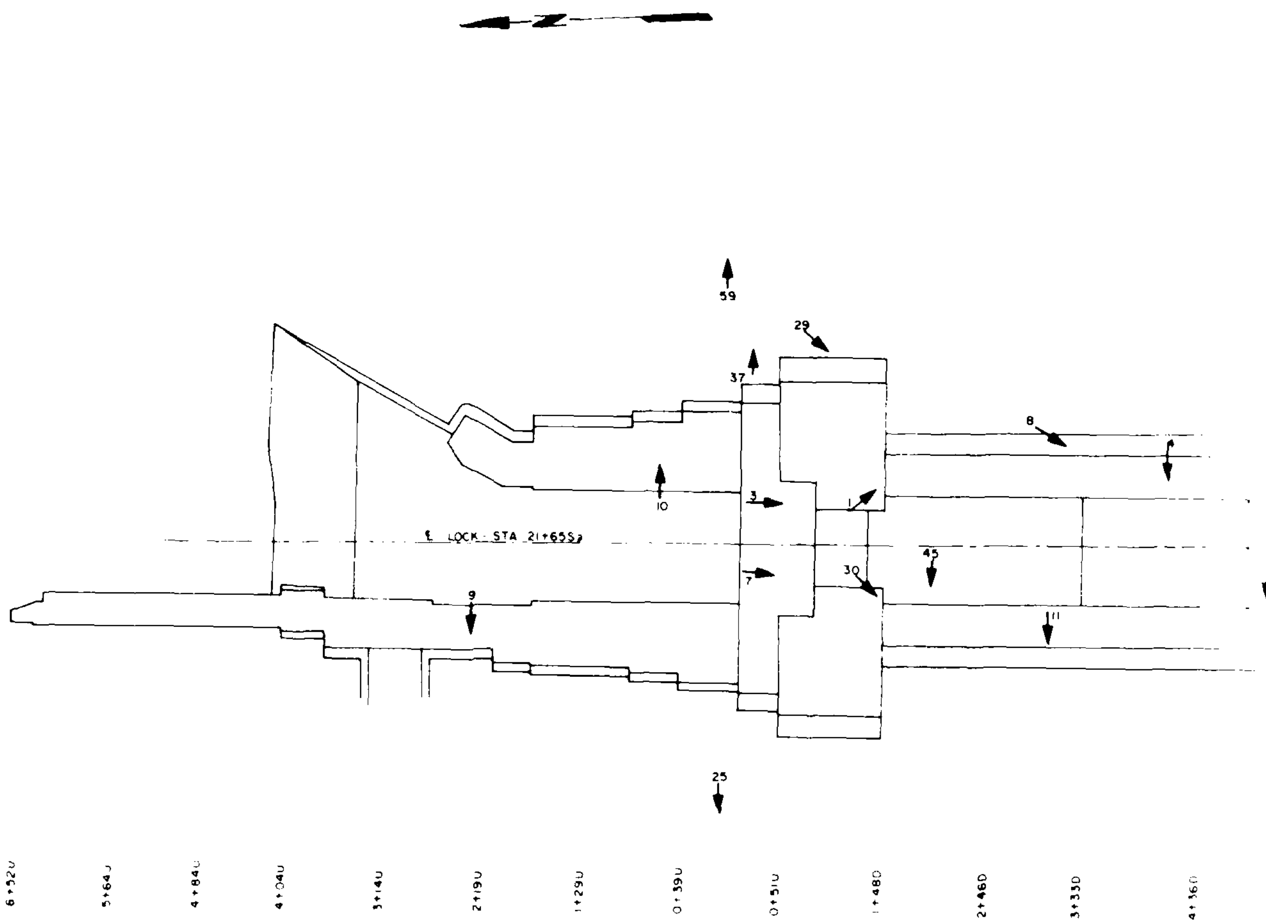
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT CORPS OF ENGINEERS
NASHVILLE TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
CHIEF FOUNDATIONS AND MATERIALS BRANCH
APPROVED
COLONEL C E DISTRICT ENGINEER
DATE

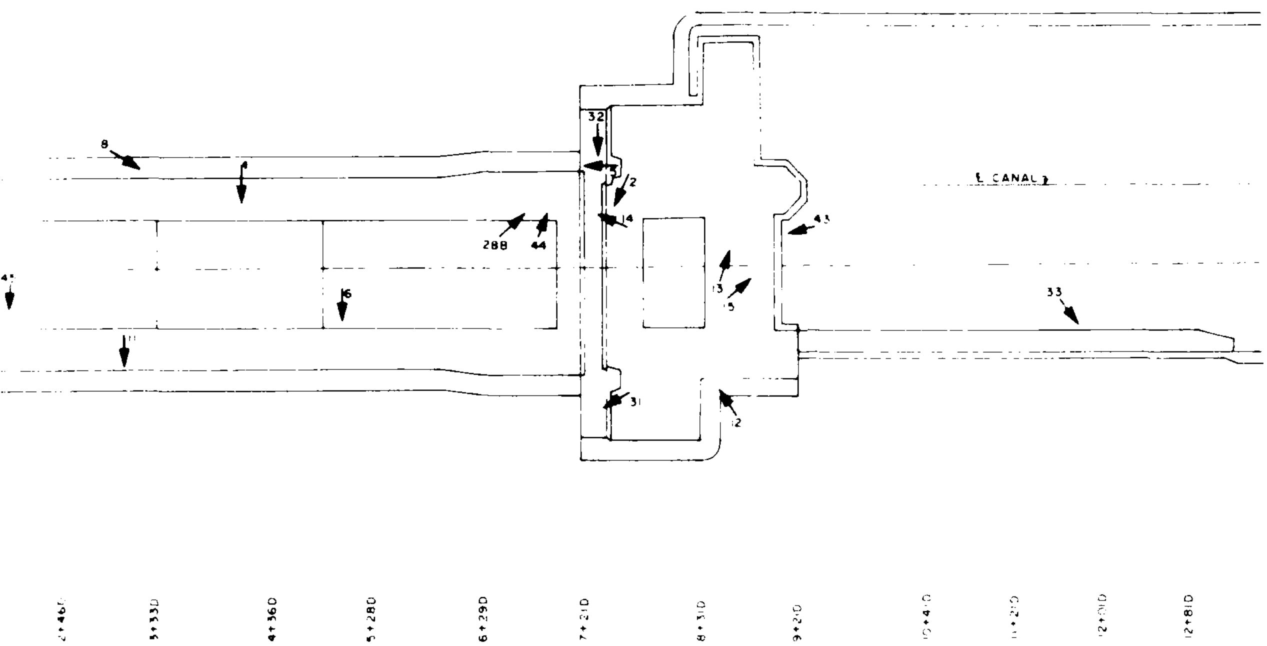
TENNESSEE TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
DAM
PIEZOMETERS
SECTIONS AND DATA
SUMMARY TABLE

APPROVAL RECOMMENDED
CHIEF ENGINEERING DIVISION
SCALE 1" = 20' 0" SPEC NO
DRAWING NUMBER
SHEET OF
BSFR-69
TTBS-43/2 6



59
29
37
8
10
3
1
℄ LOCK - STA 21+65S
45
30
7
9
11
25
6+52U
5+64U
4+84U
4+04U
3+14U
2+19U
1+29U
0+39U
0+51D
1+48D
2+46D
3+33D
4+56D

PLAN



PLAN

NOTES

1. FOR EMBANKMENT PHOTOGRAPH LOCATIONS AND ORIENTATIONS, SEE IMPERVIOUS CORE FOUNDATION DRAWINGS
2. PHOTOGRAPHS ARE LOCATED IN APPENDIX E OF THE BAY SPRINGS FOUNDATION REPORT
3. ADDITIONAL CONSTRUCTION PHOTOS ARE ON FILE AT THE BAY SPRINGS RESOURCE MANAGERS OFFICE (601-454-3481) ROUTE ONE, BOX 56, HWY 4, DENNIS, MS 38838

REVISION	DATE	ZONE AND DESCRIPTION	BY	CHKD

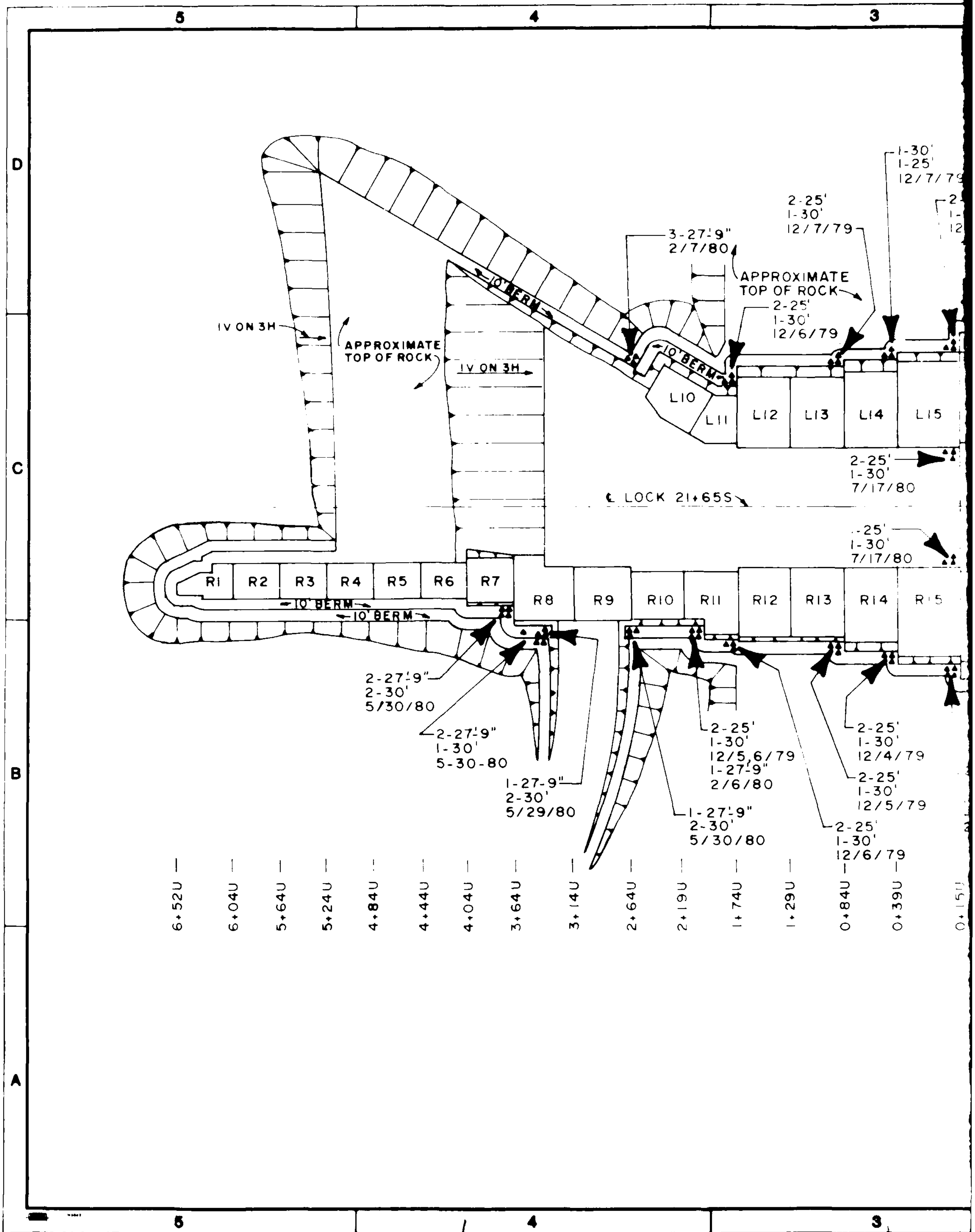
GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

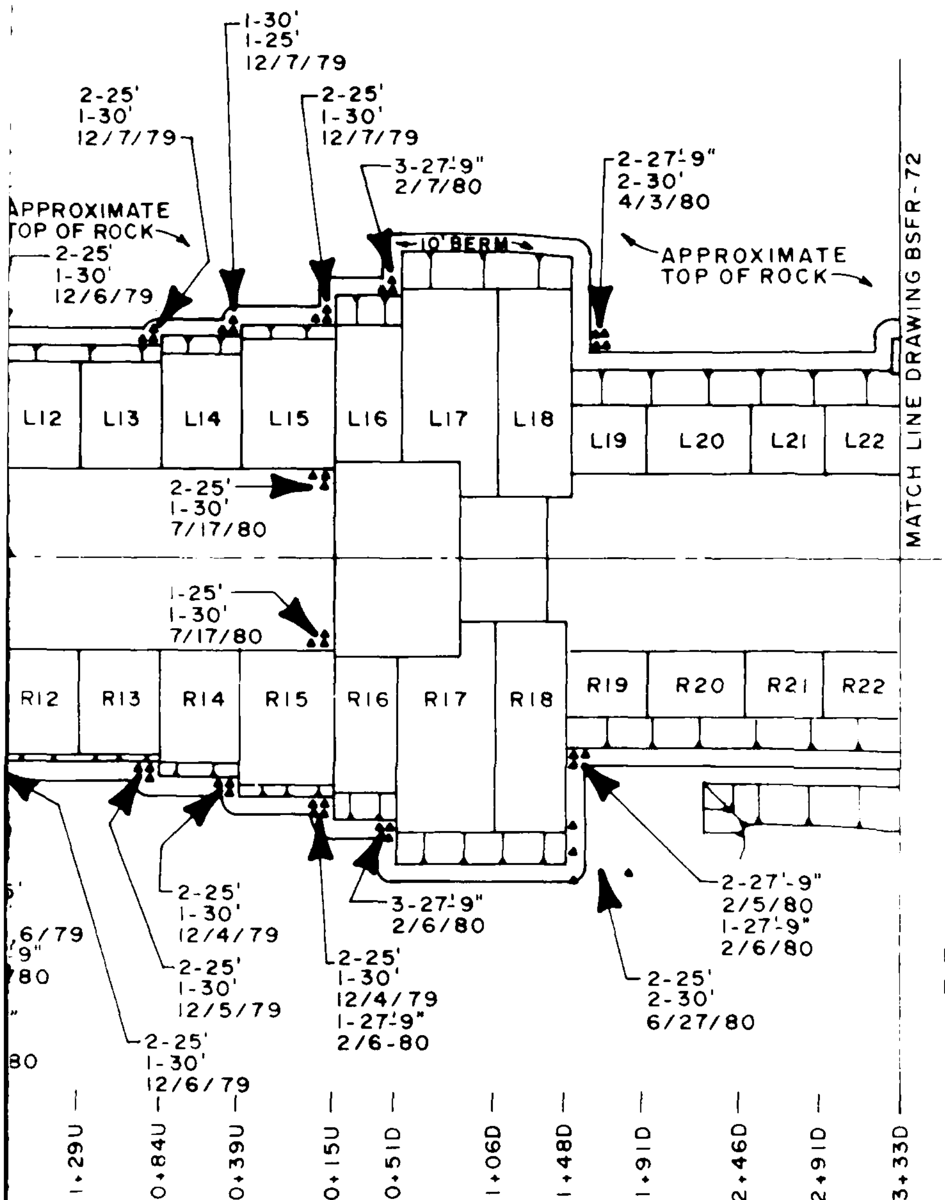
TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

CONSTRUCTION PHOTOGRAPHS
LOCATIONS AND ORIENTATIONS

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER
SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C.E. DISTRICT ENGINEER
DATE
SCALE 1" = 60'
SPEC NO
DRAWING NUMBER
BSFR-70
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED



5
4
3
D
C
B
A
1-30'
1-25'
12/7/79
2-25'
1-30'
12/7/79
3-27'-9"
2/7/80
APPROXIMATE
TOP OF ROCK
2-25'
1-30'
12/6/79
10' BERM
1V ON 3H
APPROXIMATE
TOP OF ROCK
1V ON 3H
L10
L11
L12
L13
L14
L15
2-25'
1-30'
7/17/80
℄ LOCK 21+65S
-25'
1-30'
7/17/80
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
10' BERM
10' BERM
2-27'-9"
2-30'
5/30/80
2-27'-9"
1-30'
5-30-80
1-27-9"
2-30'
5/29/80
1-27'-9"
2-30'
5/30/80
2-25'
1-30'
12/5,6/79
1-27'-9"
2/6/80
2-25'
1-30'
12/6/79
2-25'
1-30'
12/4/79
2-25'
1-30'
12/5/79
6+52U
6+04U
5+64U
5+24U
4+84U
4+44U
4+04U
3+64U
3+14U
2+64U
2+19U
1+74U
1+29U
0+84U
0+39U
5
4
3



NOTE
REFER TO DRAWING BSFR-72 FOR NOTES

Revision	Date	Description	By	Checked

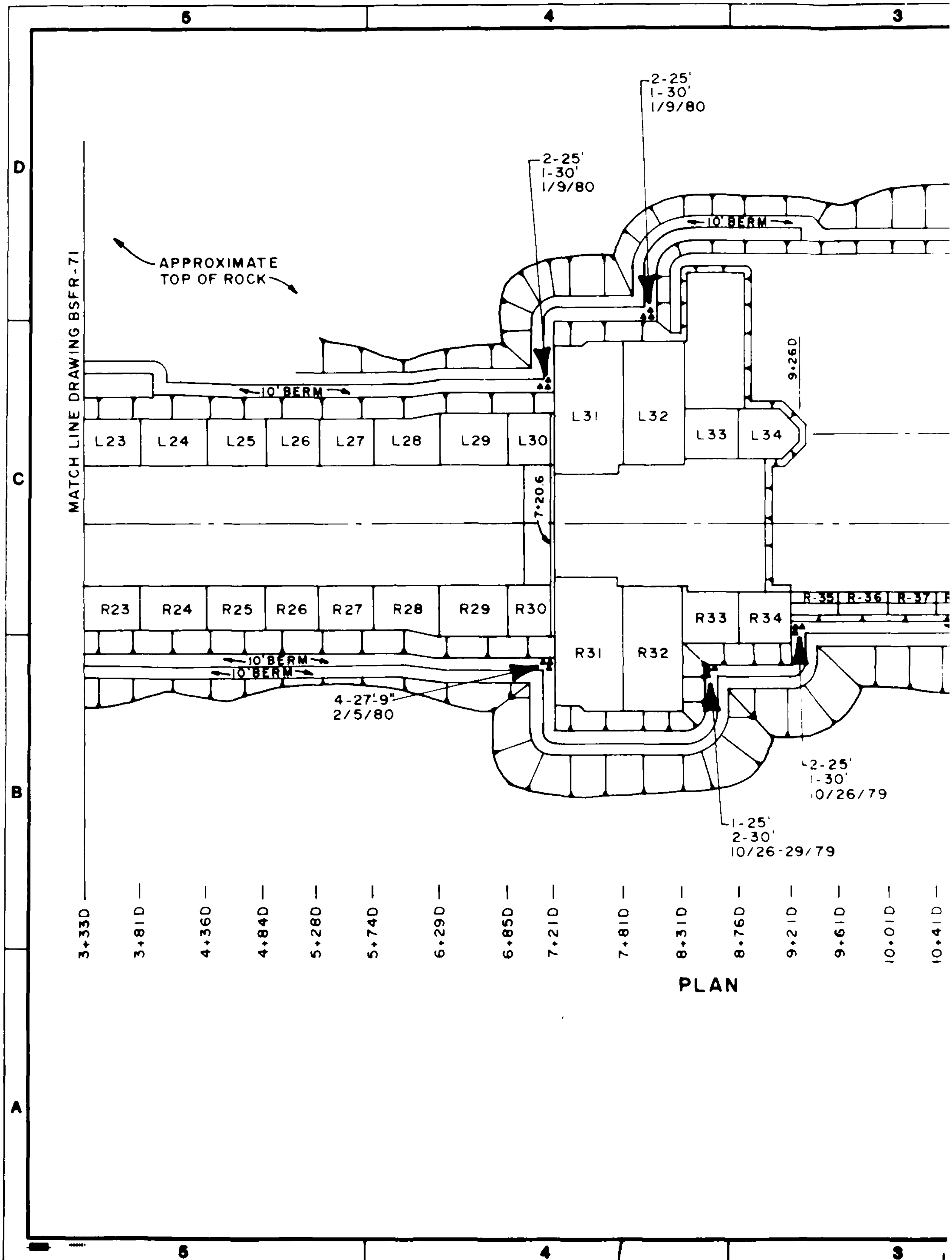
Graphic Scale

US ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NASHVILLE TENNESSEE

Designed by:
Drawn by:
Checked by:
Approved by:

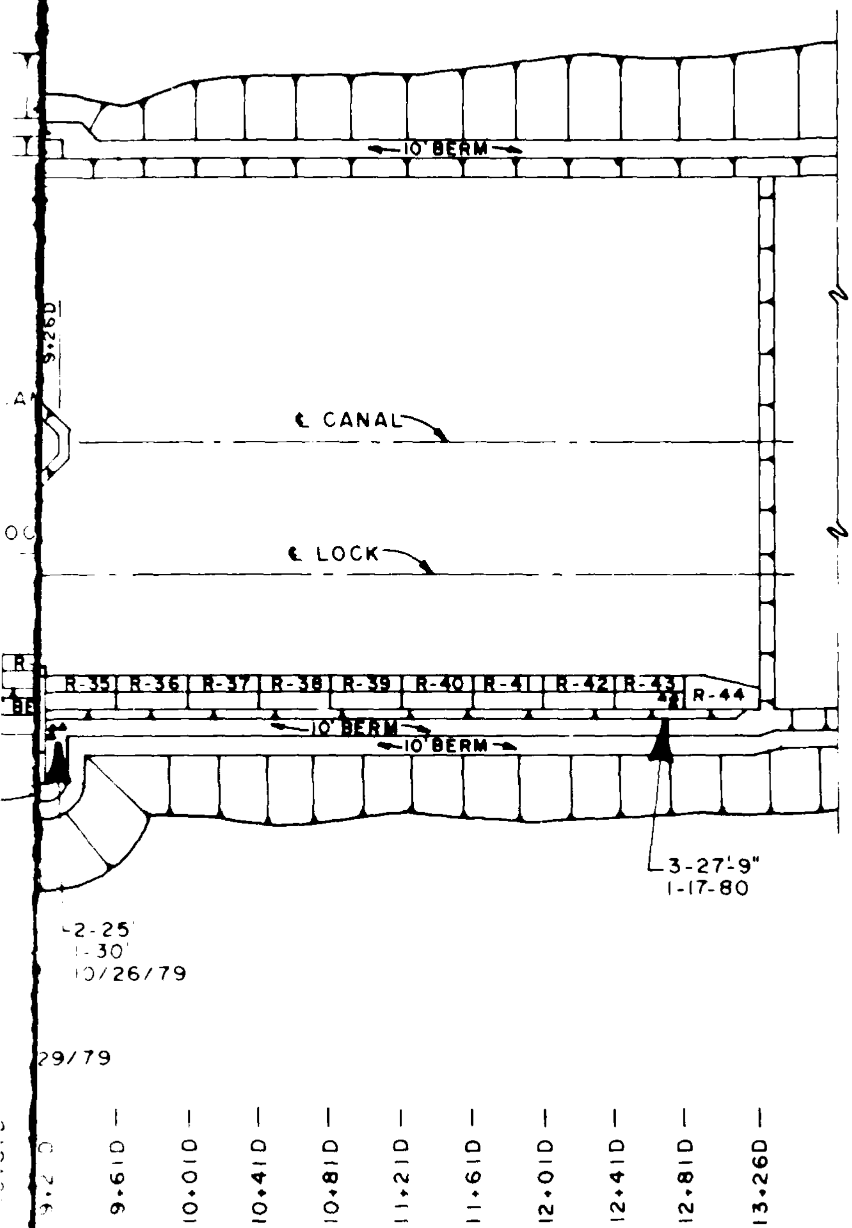
CORNER ROCK BOLT LOCATIONS

Date:
Sheet _ of _
Scale: 1"=60'
Drawing Number: BSFR-71
Record Drawing as constructed dated



5
4
3
D
C
B
A
MATCH LINE DRAWING BSFR-71
APPROXIMATE TOP OF ROCK
2-25'
1-30'
1/9/80
2-25'
1-30'
1/9/80
10' BERM
10' BERM
9+26D
L23
L24
L25
L26
L27
L28
L29
L30
L31
L32
L33
L34
7+20.6
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R-35
R-36
R-37
10' BERM
10' BERM
4-27'-9"
2/5/80
2-25'
1-30'
10/26/79
1-25'
2-30'
10/26-29/79
3+33D
3+81D
4+36D
4+84D
5+28D
5+74D
6+29D
6+85D
7+21D
7+81D
8+31D
8+76D
9+21D
9+61D
10+01D
10+41D

PLAN



NOTES:

1. ▲ DENOTES APPROXIMATE LOCATION OF CORNER ROCK BOLTS.
2. EXAMPLE — 2-27'-9", 2/5/80 DENOTES THAT 2 ROCK BOLTS, EACH 27 FEET 9" LONG WERE INSTALLED 05 FEBRUARY 1980 AT THE APPROXIMATE LOCATIONS SHOWN ON THE DRAWING.
3. CORNER ROCK BOLT DATA ARE SHOWN ON TABLE 12.

Revisions	Date	Description	By	Checked

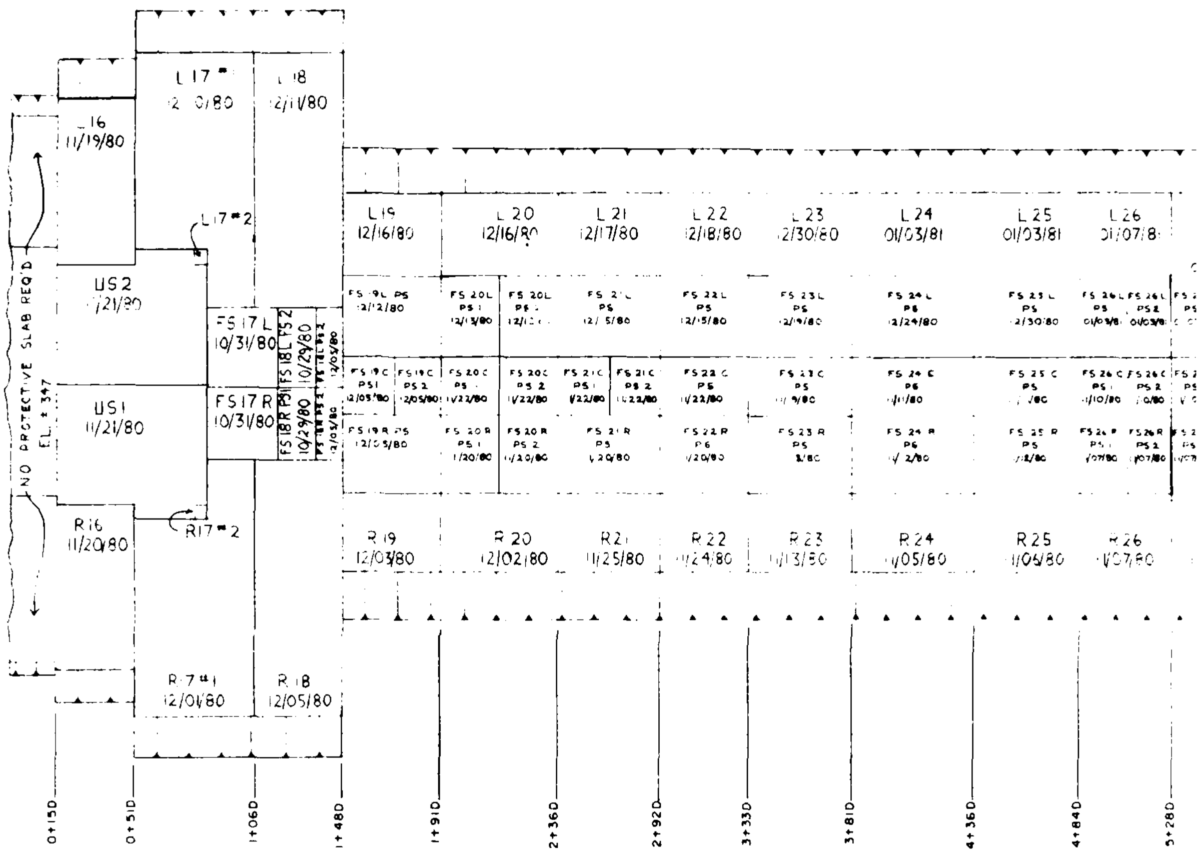
Graphic Scale

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NASHVILLE TENNESSEE

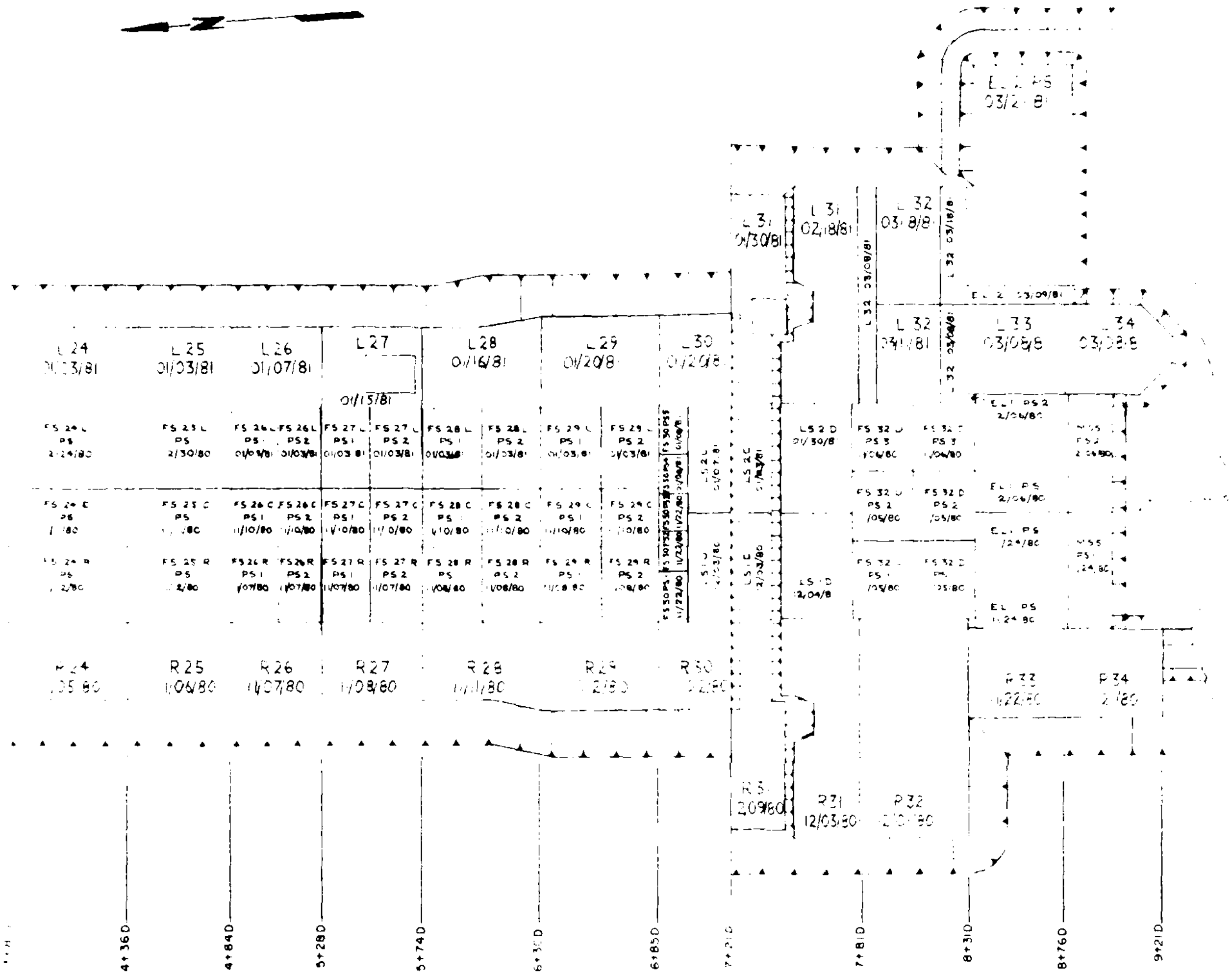
Designed by:
Drawn by:
Checked by:
Approved by:

CORNER ROCK BOLT LOCATIONS

Date:
Sheet _ of _
Scale: 1"=60'
Drawing Number: BSFR-72
Record Drawing as constructed dated


L17 #1
12/10/80
L18
12/11/80
L16
11/19/80
L17 #2
L19
12/16/80
L20
L21
12/17/80
L22
12/18/80
L23
12/30/80
L24
01/03/81
L25
01/03/81
L26
US2
FS17L
10/31/80
US1
11/21/80
FS17R
10/31/80
NO PROTECTIVE SLAB REQ'D
EL. # 347
R16
11/20/80
R17 #2
R19
R20
12/02/80
R21
11/25/80
R22
R23
R24
R25
R26
R17 #1
12/01/80
R18
12/05/80
0+150
0+510
1+060
1+480
1+910
2+360
2+920
3+330
3+810
4+360
4+840
5+280

PLAN



PLAN

NOTES
1 REFER TO DRAWING BSFR 60 FOR ELEVATION OF SLABS
2 DATES SHOWN ARE DATE OF SLAB PLACEMENT
3 CONCRETE SLABS WERE PLACED WITHIN 24 HOURS OF SLAB PLACEMENT

REVISION	DATE	DESCRIPTION	BY	CHKD

GRAPHIC SCALE

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

DRAWN
CHECKED
TRACED
COMPARED
ENGINEER

TENNESSEE - TOMBIGBEE WATERWAY
MISSISSIPPI AND ALABAMA
BAY SPRINGS LOCK AND DAM
LOCK

PROTECTIVE SLAB
PLACEMENT DATES

SUBMITTED
APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, C E DISTRICT ENGINEER
DATE
SCALE 1" = 30
SPEC NO
DRAWING NUMBER
BSFR-73
SHEET OF
RECORD DRAWING AS CONSTRUCTED DATED

FILMED

5 8