

AD-A106 440

BLACK AND VEATCH KANSAS CITY MO  
NATIONAL DAM SAFETY PROGRAM, JOHNSON COUNTY DAM A-1 (MO 20020),--ETC(U)  
JUN 80 P R ZAMAN, E R BURTON, H L CALLAHAN DACW43-80-C-0074

F/G 13/13

UNCLASSIFIED

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2 of 2

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Fenn SCS-533  
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Missouri

State

Site No. A-1  
Pub. 46

Owner

Sub-watershed 03-7

Date 1/25 1963

Project: WP1 WP2

Location Johnson County

Watershed South Fork of Blackwater

Logged by Nuel F. Edmonds

Drilling Equipment Mobile B-0

Location of Holes Q Fill 11+50 E+00

Hole No.	Station and Surface Elev. Ft.	Hole Depth		Description of Materials	Unit, Soil Class Symb.	Type Bit Used	Samples				
		From Ft.	To Ft.				No.	Type	To Rec. Ft. %		
101		0	3	Clay, silty, yellowish brown to reddish brown moist, stiff, moderately plastic, residual soil	CL	FA	1	LBQ	1	7	100
				Refusal at 8'							
				No water level							
				Total Depth 8'							

\* Disturbed undisturbed-rock core. † Percent sample recovery.  
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.  
Other copies as directed by State Conservationist.

Sheet \_\_\_ of \_\_\_ Sheets





LOG OF TEST HOLES

Form SCS-113 Rev. Dec. 58  
 Location Johnson County State Missouri Site No. A-1  
 Watershed South Fork of Blackwater Sub-watershed \_\_\_\_\_  
 Logged by Wm. F. Edwards Date 4/25/63 Project: WP/08-7-WP2 FP \_\_\_\_\_ Pub. 46  
 Drilling Equipment Metric B-40 Location of Holes 9 Fill 12+30

Hole No.	Station and Surface Elev.	Hole Depth		Description of Materials	Unit Soil Class. Symb.	Type Bit Used	Samples		Rec. %
		From Ft.	To Ft.				No.	Type	
201	875.5	0	6	Clay, silty, yellowish brown mottled grey, slightly moist, stiff, moderately plastic, residual soil	CL	FA			
		6	10	Clay silty, reddish waxy, moist, stiff, plastic residuum	CL	FA			
				No water level refusal at 10'					

\* Disturbed undisturbed rock core. % Percent sample recovery.  
 1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.  
 Other copies as directed by State Conservationist.



LOG OF TEST HOLES

Form SCS-533  
Rev. Dec. 58

Location Johnson County State Missouri Site No. A-1  
 Watershed South Fork of Blackstone Sub-watershed \_\_\_\_\_  
 Logged by Huel F. Edwards Date 7/22/63 Project: WP 08-7 Pub. 46  
 Drilling Equipment Mobile 1-10 Location of Holes 3300 Fill 5+70 83' R offset to Sta approx.

Hole No.	Station and Surface Elev.	Hole Depth		Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples		To Rec. Ft. %
		From Ft.	To Ft.				No.	Type	
302	125.0	0	3	Gravel, clayey, 40% fine, silty fill	FA				
		3	16	Silt, clayey, 20% coarse sand and small gravel, maximum size 1/4", dark brown, wet, soft, slightly plastic, alluvial	ML FA				
		16	18	Dark gray shale, dry, hardness 2-3					
				Water level 1' Total Depth 18'					

\* Dist. bed undisturbed rock core. † Percent sample recovery.  
 1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.  
 Other copies as directed by State Conservationist.

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

**FILE  
DESIGN**

SCS-309  
2-58

RESERVOIR SEDIMENTATION DESIGN SUMMARY

WATERSHED S. Fork of Blackwater SITE NO. A-1 STATE Missouri  
LOCATION Johnson County DATE 1/25/53  
DATA COMPUTED BY Nuel F. Edmonds TITLE Geologist

SEDIMENT SOURCES (AVERAGE ANNUAL)

TYPE OF EROSION	PRESENT CONDITIONS			FUTURE (AFTER CONS. TREATMENT)			AREA OF WATERSHED: ACRES SQ. MI.	
	ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)	ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)		
SHEET EROSION	CULTIVATED LAND	563	10.18	5732	160	1.47	236	1600 2.50
	IDLE LAND	21						
	PASTURE-RANGE	617	4.53	2796	1197	1.29	1539	
	WOODLAND	340	1.95	663	184		255	
	OTHER	59	1.95	115	59	1.95	115	
TOTAL SHEET EROSION			DELIVERY RATE (%)		TONS DELIVERED	DELIVERY RATE (%)		TONS DELIVERED
			27	9306	2513	27	2145	579
CHANNEL EROSION	GULLY		95	766	723	95	138	131
	STREAMBANK							
	STREAMBED							
FLOODPLAIN SCOUR								
OTHER (ROADSIDE ETC.)			95	32	30	95	8	7
TOTALS					3271			717

DEPOSITION

AVERAGE DRY WEIGHT OF UPLAND SOILS: 80 LBS/CU. FT.			AVERAGE ANNUAL SEDIMENT DELIVERED TO SITE FROM ALL SOURCES (TONS)		TRAP EFFICIENCY (%)	ANNUAL DEPOSITION (TONS)	DESIGN PERIOD (YRS)	PERIOD TOTAL DEPOSITION (TONS)
TEXTURE OF SEDIMENT			PRESENT	3271	95	3107	7	21,749
% CLAY	% SILT	% COARSE	FUTURE	717	95	681	43	29,283
30	50	20	DESIGN TOTALS					51,032

SEDIMENT STORAGE REQUIREMENTS

CONDITION OF SEDIMENT	% OF TOTAL	DEPOSITION (TONS)	VOLUME WEIGHT OF SEDIMENT		STORAGE REQUIRED		STORAGE ALLOCATION (ACRE FEET)		
			LBS/CU. FT.	TONS/AC. FT.	ACRE- FEET	WATERSHED INCHES	SEDIMENT POOL	RETARDING POOL	OTHER
SUBMERGED	90	45,929	55	1197	38.4	.29	38.4		---
AERATED	10	5,103	80	1742	3.0	.02	---	3.0	---
TOTALS		51,032			41.4	.31	38.4	3.0	---

*Twice 100 yr.*

UNITED STATES GOVERNMENT

## Memorandum

TO : W. S. Culpepper, State Conservation Engineer, SCS, Columbia, Missouri

DATE: July 25, 1963

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Missouri WF-08, South Fork of Blackwater River, Site No. A-1

### ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 1 sheet.
2. Consolidation Data, 1 test, 3 sheets.
3. Form SCS-355, Triaxial Shear Test Data, 2 sheets.
4. Form SCS-352, Compaction & Penetration Resistance Report, 2 sheets.
5. Form SCS-357, Summary - Slope Stability Analysis, 1 sheet.

### DISCUSSION

#### FOUNDATION:

- A. Classification: The bedrock underlying this site consists of shale that contains a thin zone of limestone at about floodplain elevation. The soil mantling the bedrock is a moderately plastic CL. The CL mantle is quite uniform as indicated by the samples submitted. The gradation and plasticity varied within narrow limits. The CL mantle ranges in thickness from about 5 feet on the abutments to about 30 feet in the floodplain section.

Dispersion of the fraction finer than 0.005 mm is quite high.

- B. Blow Count and Density: Blow count in the saturated CL was in the range of 5 to 10 blows/foot except for a 5.5 foot zone from the 17 to 22.5 foot depth in Hole No. 4 (at Station 7+00) where 2 blows/foot were recorded. The core submitted from Test Hole 5 is quite typical of most of the foundation based on a comparison of the natural moisture contents of samples submitted. Generally the density of the CL foundation alluvium can be expected to be greater than 1.52 (95 p.c.f.) except for the 5.5 foot zone of soft material logged in Test Hole 4.

The moisture content of the split spoon sample submitted from the soft zone was 32.6 percent compared to less than 28.5 percent for the other samples submitted. The computed density of the CL in the soft zone is 1.43 g/cc.

- C. Shear Strength: A shear test was made on the core sample. The test was made at natural moisture content and the following strength values were

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Ray S. Decker

Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

obtained: The in-place strength is  $c = 575$  p.s.f. as indicated by the unconfined compression test; the consolidated strength is  $\phi = 16^\circ$ ,  $c = 425$  p.s.f. as indicated by the consolidated, undrained triaxial test.

The test values are in the same range as those shown for blow count vs. shear strength for CL material in the "Guide Manual". The strength of the soft CL based on blow count and computed density is estimated to be in the range of  $\phi = 10^\circ$ ,  $c = 300$  p.s.f.

- D. Consolidation: A consolidation test on the core sample indicates that the alluvium is normally consolidated and that the consolidation potential of this material is about 3% under the proposed loading at floodplain elevation (856). The compressible stratum is judged to be about 23 feet thick, therefore the total consolidation in the foundation is expected to be about 0.66 foot.

Differential consolidation around the relatively deep channel section is not expected to be a problem since the compacted fill in this section will have about the same consolidation potential as the foundation.

- E. Permeability: The vertical permeability of the alluvium is expected to be in the range of 0.01 ft./day.

#### EMBANKMENT:

- A. Classification: The borrow materials submitted consist of residual soil over shale that is classed as a high plasticity CL and moderately plastic CL alluvium.
- B. Compacted Density: Standard compaction tests on the borrow samples resulted in compacted densities of 106.5 p.c.f. and 110.0 p.c.f.
- C. Shear Strength: A consolidated, undrained triaxial shear test was made on Sample 63W3885 to represent the majority of the borrow material. The test was made at 95% of Standard density at saturation. The shear values obtained were  $\phi = 17.5^\circ$ ,  $c = 750$  p.s.f.

#### SLOPE STABILITY:

Stability of the proposed  $2\frac{1}{2}:1$  slopes was checked with a Swedish Circle Method of analysis. The analysis was made at the maximum section and the foundation was considered as stratified with a 6 foot stratum of soft CL ( $\phi = 10^\circ$ ,  $c = 300$  p.s.f.) immediately overlying the bedrock.

The factor of safety obtained against full drawdown on the  $2\frac{1}{2}:1$  upstream slope with a 10 foot berm at elevation 863 was  $F_s = 1.30$ . The factor of safety obtained for

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Ray S. Decker  
Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

the  $2\frac{1}{2}$ :1 downstream slope without a drain was  $F_s = 1.22$ . By adding a 10 foot berm in the channel, the factor of safety increases from  $F_s = 1.22$  to  $F_s = 1.36$ .

Trials No. 2A and 3 show the factors of safety for the dry slope condition immediately after construction assuming no foundation consolidation and an in-place shear strength of  $\phi = 0$ ,  $c = 575$  p.s.f. The  $F_s$  on the upstream slope for this condition is 1.27 for a deep arc failure.

#### RECOMMENDATIONS

- A. Cutoff Trench: We recommend a minimum depth of 6.0 feet for the cutoff trench between Stations 2+50 and 8+50. A trench depth greater than 6.0 feet may be required in the bottom of the channel depending on materials encountered. The cutoff trench should bottom on the limestone bedrock in the vicinity of Stations 2+50 and 8+50. On the right abutment above Station 2+50, the trench should bottom on shale. On the left abutment above Station 8+50, a minimum trench depth of 6.0 feet is suggested. We recommend that the trench bottom on the thin limestone stratum so that the limestone can be carefully examined for fractures, etc. in order to evaluate the permeability.

With the trench depths suggested, near positive cutoff is anticipated where the trench bottoms in CL or shale. The only uncertainty appears to be in the area of the limestone stratum on each side of the valley.

The trench should be backfilled with CL compacted to a minimum of 95% of Standard Proctor density.

The trench excavation may be used in the fill.

- B. Principal Spillway: Foundation conditions at the proposed location appear to be fairly uniform except for the channel bottom as shown by Test Hole 303 where the material is logged as soft ML. For this reason, it may be desirable to shift the conduit slightly so that the lower end of the conduit will be on the firm CL alluvium also.

The estimated consolidation potential at the intersection of the  $\phi$  of the dam and the principal spillway is estimated to be 0.66 foot. Based on this estimate, the horizontal strain at natural ground surface is expected to be in the range of 0.01 ft./ft.

- C. Drain: It appears that the only area where drainage might be necessary is at the base of each abutment where a thin limestone stratum is suspected. If the limestone proves to be in good condition and positive cutoff is obtained, drainage is not believed to be required. If, however, the limestone

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Ray S. Decker

Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

is permeable, drains should be installed to provide a safe outlet for seepage that will by-pass the cutoff trench. Any reasonably well graded sand and gravel could be used for the drain.

D. Embankment Design:

1. Placement of Materials: A homogeneous embankment of CL is recommended. The CL should be placed at a minimum of 95 percent of Standard Proctor density with placement moisture contents of near optimum to the wet side of optimum.

2. Slopes: The following slopes are recommended:

Upstream:  $2\frac{1}{2}$ :1 with a 10 foot berm at normal pool elevation and a 10 foot berm in the channel.

Downstream:  $2\frac{1}{2}$ :1 with a 10 foot berm in the channel. *used 12' - for pipe lengths*

The channel berms are believed to be necessary in view of the low factor of safety obtained on the downstream slope without the berm for the conditions assumed and also because soft ML material was logged below channel elevation in Test Hole 302.

3. Settlement: An overfill allowance of 1.0 foot is suggested to compensate for residual settlement within the fill and foundation.

Attachments

Prepared by:

*Lorn P. Dunnigan*  
Lorn P. Dunnigan

Reviewed & Approved by:

*R. B. Phillips*  
Roland B. Phillips

cc: W. S. Culpepper (2 copies)  
H. J. Behrens, Milwaukee, Wis.

Form 303-354  
Rev. 3/59

June 10, 1963

LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION	DEPTH	FIELD CLASS- IFICATION	GRA				
					FINES				
					002	0015	002	10	
634		South Park of Blackwater Site No. A-1							
3877	301-1	€ FILL 5+70 Jar	14.5- 15.5'	CL	25	32	51	72	
3878	301-2	€ FILL " Core Alluvium	19-21'	CL	20	26	41	61	
3879	301-3	€ FILL " Jar	24.5-25.5'	CL	23	32	53	71	
3880	4-1	€ FILL 7+00 Jar	9.5- 10.5'	CL	27	35	52	72	
3881	4-2	€ FILL " Jar	14.5- 15.5'	CL	25	35	56	72	
3882	4-3	€ FILL " Jar	19.5- 20.5'	CL	22	26	53	71	
3883	4-4	€ FILL " Jar	24.5- 25.5'	CL	25	34	52	71	
3884	101-1	5000 cu yds Borrow 7+00 11+50 L. Fill Residual soil over shale	1-7'	CL	24	30	55	71	
3885	102-1	Composite 7+00 5+00 L. Fill Comp.	1-7'	CL	23	30	52	71	
	103-1	Borrow 7+00 4+00 5+00 6+00 Alluvium + 13,500 cu yds		CL					

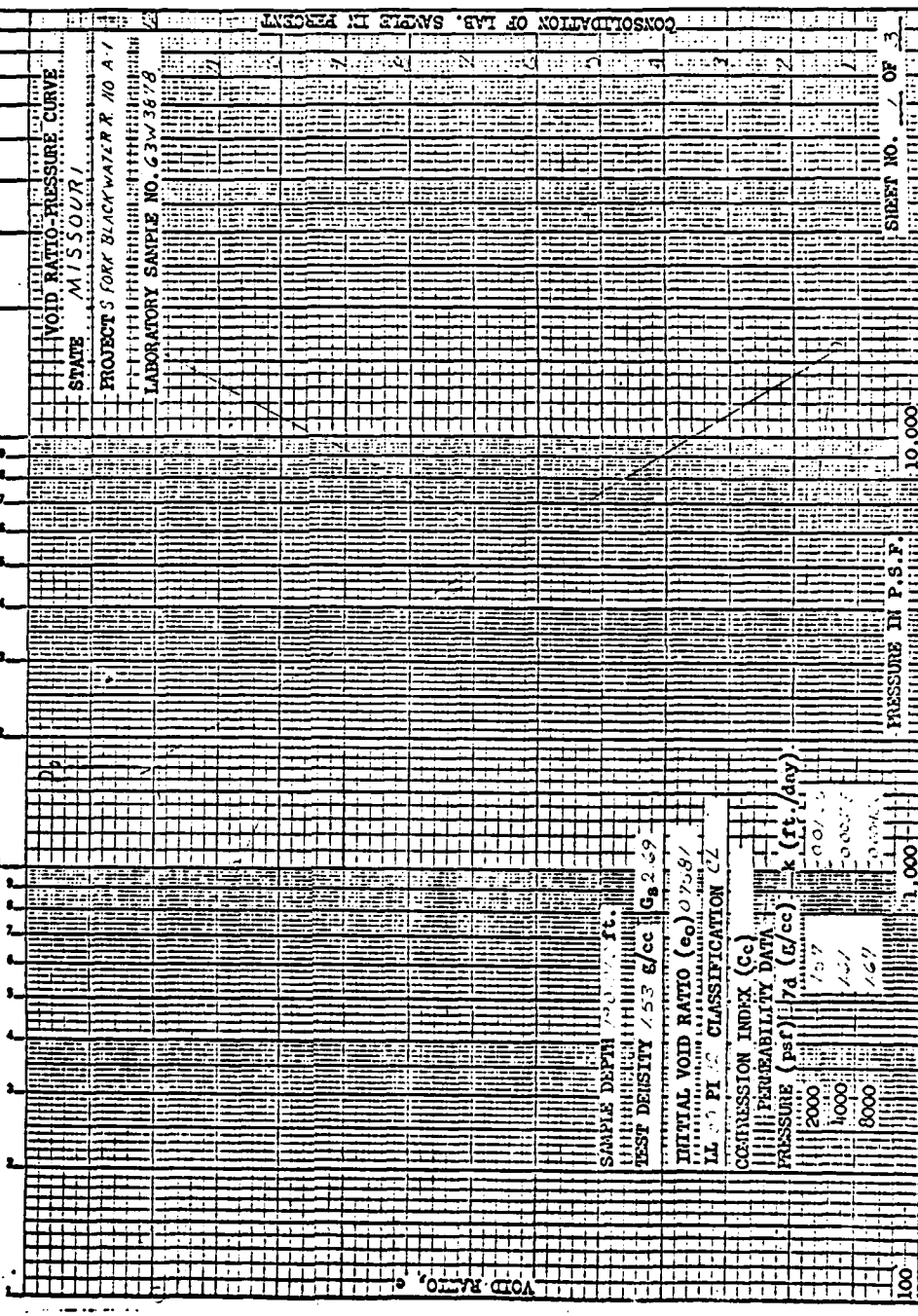




VOID RATIO-PRESSURE CURVE  
STATE MISSOURI

PROJECT 5 FORK BLACKWATER R. NO A-1  
LABORATORY SAMPLE NO. C3W3678

CONSOLIDATION OF LAB. SAMPLE IN PERCENT



SAMPLE DEPTH 2.0 ft.  
TEST DENSITY 1.53 g/cc  $G_s$  2.59

INITIAL VOID RATIO ( $e_0$ ) 0.757  
LL PI CLASSIFICATION CZ

COMPRESSION INDEX ( $C_c$ )  
PERMEABILITY DATA

Pressure (psf)  $k$  (ft./day)

2000 75.7  
1000 151  
8000 127

PRESSURE IN P.S.F.

10,000

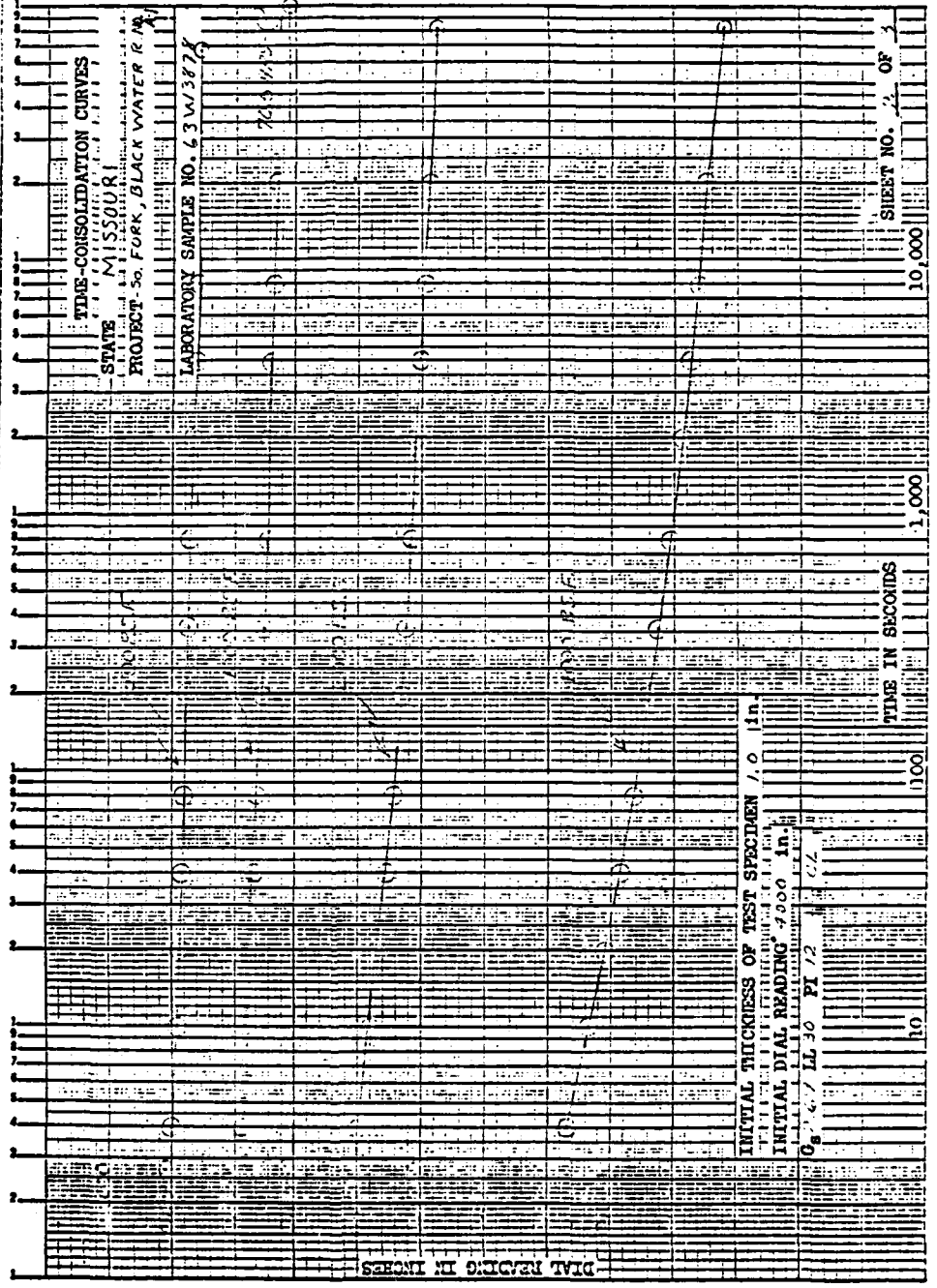
SHEET NO. 7 OF 3

TIME-CONSOLIDATION CURVES

STATE MISSOURI

PROJECT 50, FORK, BLACK WATER R.R.

LABORATORY SAMPLE NO. 63 W/377



INITIAL THICKNESS OF TEST SPECIMEN 1.0 in.

INITIAL DIAL READING 7000 in.

G 67 LL 50 PI 12

TIME IN SECONDS

SHEET NO. 2 OF 3

10,000

1,000

100

10

DIAL READING IN INCHES

TIME-CONSOLIDATION CURVES

STATE MISSISSIPPI  
PROJECT-S.O.FOKK, BLACK WATER R. NO. 1-A

LABORATORY SAMPLE NO. 45W3976

46.75/22.5

INITIAL THICKNESS OF TEST SPECIMEN 1.0 in.

INITIAL DIAL READING 0.0 in.

G 2.67 lb. sq. ft. / 2

TIME IN SECONDS

SHEET NO. 1 OF 3

10,000

1,000

100

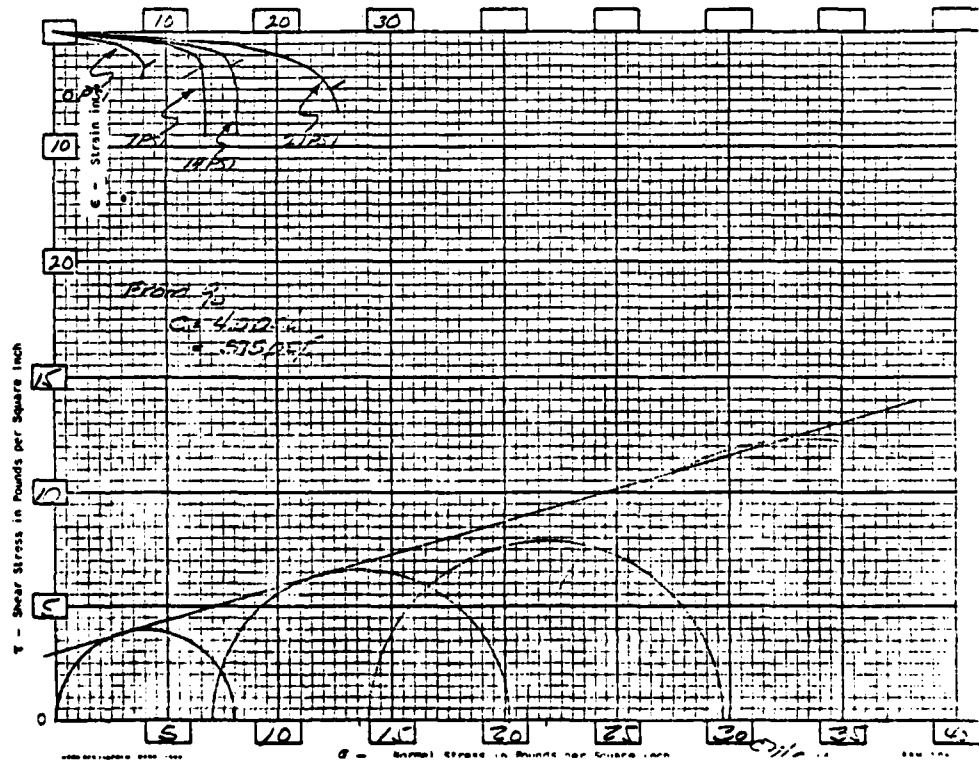
10

DIAL READING IN THOUS.

Project BLACKWATER RIVER #A-1 Location MISSOURI

Moisture-Density Data			Specifications:								
Standard <input type="checkbox"/>	Max. $\gamma$ _____ pcf		Specimen: Max. <input checked="" type="checkbox"/> Consolidated	<input type="checkbox"/> Drained							
Modified <input type="checkbox"/>	Optimum _____ %		Height _____ Size _____	<input type="checkbox"/> Unconsolidated	<input checked="" type="checkbox"/> Undrained						
Curve No. _____ of _____	Moisture _____ %		Diameter <u>1.25</u> Material _____								
L.L. <u>50</u> P.L. <u>12</u> Class <u>CL</u> $C_u$ <u>2.67</u>			<input checked="" type="checkbox"/> Undisturbed and Tested at: <input checked="" type="checkbox"/> Natural Moisture	<input type="checkbox"/> Saturation							
% Finer Than: 0.002mm <u>20</u> 0.005mm <u>26</u> 200 <u>22</u>			<input type="checkbox"/> Remolded and Tested at: _____ % of <input type="checkbox"/> Standard	<input type="checkbox"/> Modified							
Other Factors Affecting Shear:			with $w =$ _____ % which is								
% Dispersion <u>50</u> % Salt _____			<input type="checkbox"/> Lower than Optimum	<input type="checkbox"/> Optimum	<input type="checkbox"/> Higher than Optimum	<input type="checkbox"/> Saturated					
Before			Test Data								
Dry Density $\gamma_{dm}$ pcf/cc	Moist. Drym Den. cc	Moisture Content			Lateral Pressure $\sigma_3$	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure F	Internal Friction $\phi$ Tan $\phi$	Unit Cohesion
		Start %	% Sat. Start	End %		Orig. $e_0$	Final $e_f$				
1.54		26.3	25.3	26.4	0	71.67		80	3	$\phi$	
1.50	1.51	25.3	25.2	26.2	7	77.34	78.15	13.7	3	16°	30 psi
1.52	1.53	26.6	26.9	25.2	16	76.76	75.22	15.7	3		42.5 psf
1.49	1.50	25.9	26.6	25.2	21	82.54	79.34	24.7	5	Tan $\phi$	

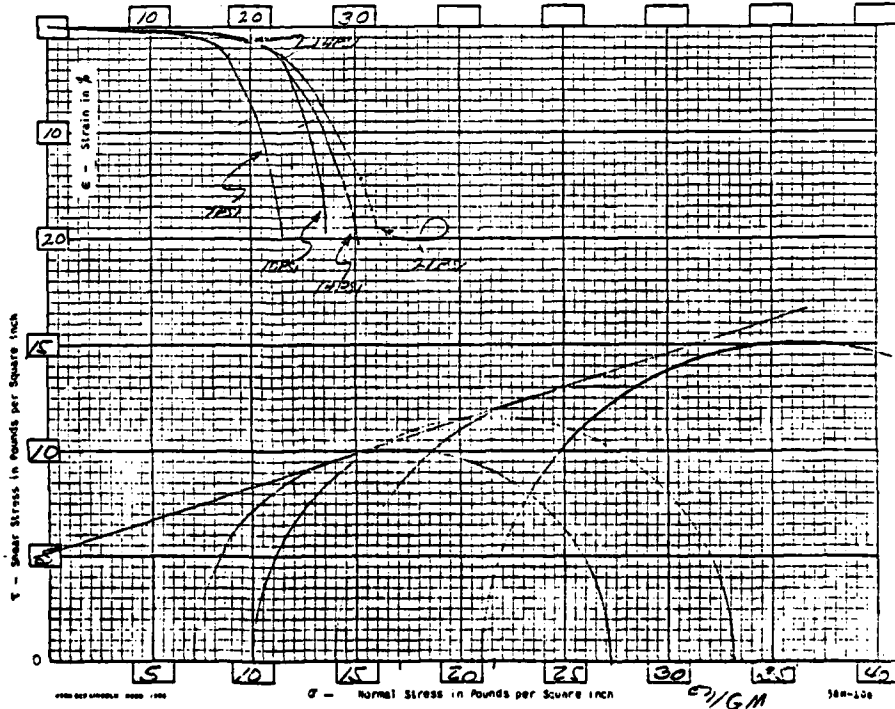
$\sigma_1 - \sigma_3$  in Pounds per Square Inch



Project Blackwater River #A-1 Location Missouri

Moisture-Density Data				Specifications:							
Standard <input type="checkbox"/>	Max. $\gamma$	110.0 pcf		Specimen:	Max.	<input checked="" type="checkbox"/> Consolidated	<input type="checkbox"/> Drained				
Modified <input type="checkbox"/>	Optimum			Height	Size	<input type="checkbox"/> Unconsolidated	<input checked="" type="checkbox"/> Undrained				
Curve No. <u>2</u> of <u>2</u>	Moisture	16.0 %		Diameter	Material						
L.L. <u>36</u>	P.L. <u>17</u>	Class	<u>CL</u>	<input type="checkbox"/> Undisturbed and Tested at: <input type="checkbox"/> Natural Moisture <input type="checkbox"/> Saturation							
\$ Finer Than: 0.002mm <u>2</u> 0.005mm <u>20</u>				<input checked="" type="checkbox"/> Remolded and Tested at: <u>2</u> % of <input checked="" type="checkbox"/> Standard <input type="checkbox"/> Modified							
Other Factors Affecting Shear:				with $w =$ _____ % which is							
\$ Dispersion <u>41</u> % Salt _____				<input type="checkbox"/> Lower than Optimum <input type="checkbox"/> Optimum <input type="checkbox"/> Higher than Optimum <input checked="" type="checkbox"/> Saturated							
Other: _____											
Test Data											
Dry Density $\gamma$	Max. Dry Den.	Moisture Content			Lateral Pressure $\sigma_3$	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	\$ Strain at Failure $f$	Internal Friction $\phi$	Unit Cohesion
		Start %	\$ Sat. Start	End %		Orig. $e_0$	Final $e_1$				
103.0	93.6	21.7	92.7	21.7	7	1.303	1.303	20.5	14	$\phi$	5.2 psi 750 psf
123.6	94.2	22.3	94.5	21.8	10	1.205	1.102	23.1	2.5	17.5°	
103.0	93.6	21.6	92.3	21.4	14	1.303	1.108	26.3	2.7		
102.3	93.0	22.1	92.9	21.3	21	1.402	1.108	30.4	14.1	Tan $\phi$	

$\sigma_1 - \sigma_3$  in Pounds per Square Inch

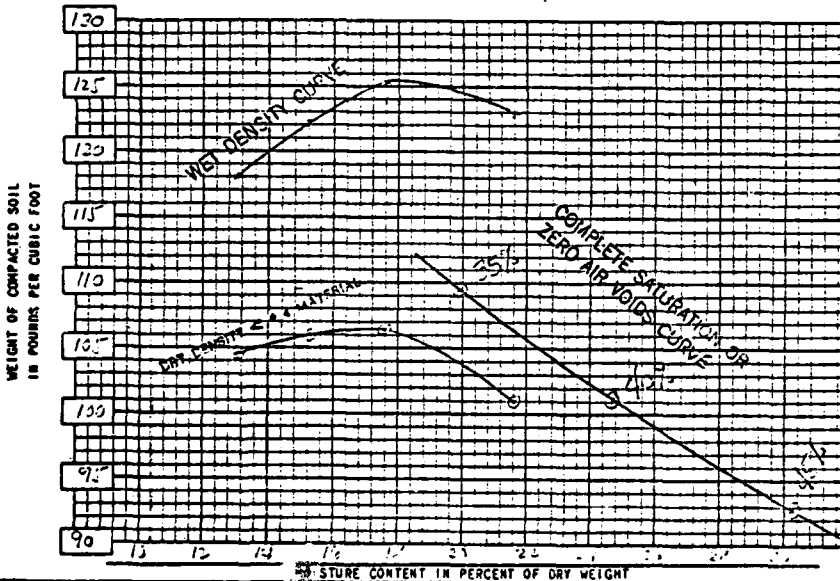
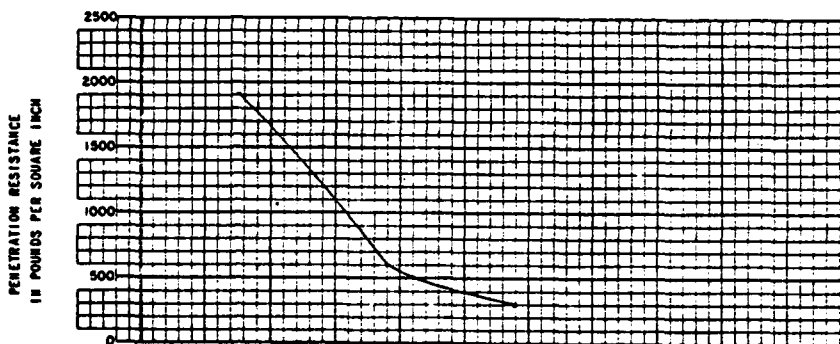


U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
SOIL MECHANICS LABORATORY

SCS-352 Rev. (10/58)

COMPACTION AND PENETRATION RESISTANCE REPORT

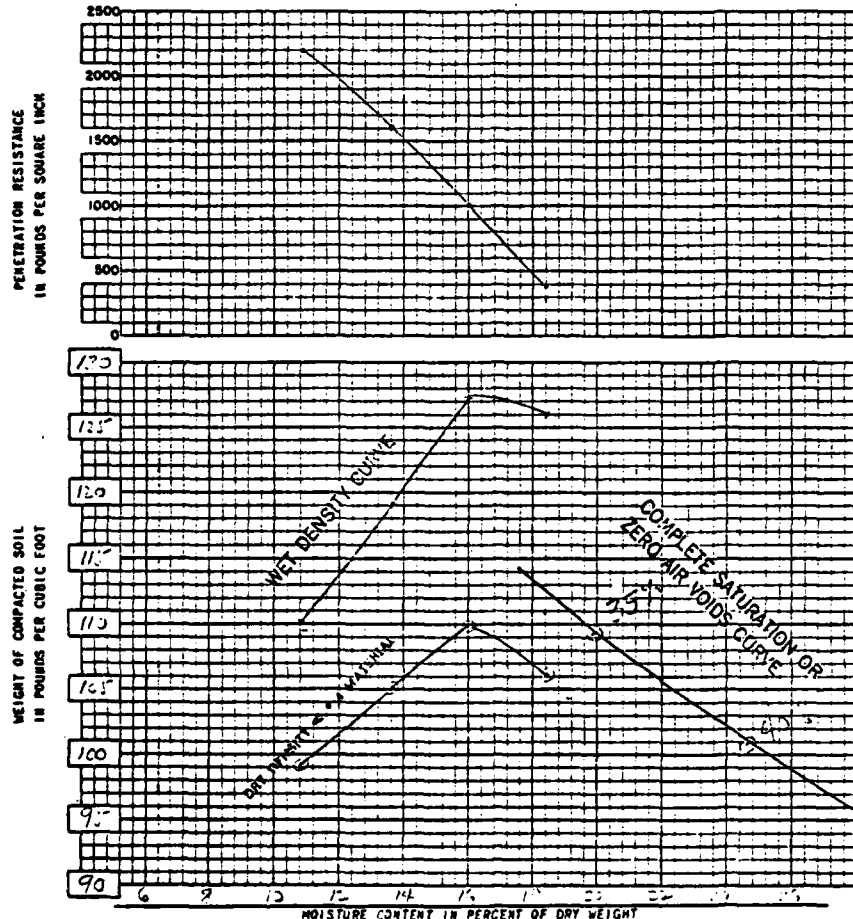
Date \_\_\_\_\_ Sample No.: Field 101-1 Lab 63W 3824  
Project: SO. PARK OF ROCKWATER Location MISSOURI  
Sample Location and Depth EASTON 3+00 (1+5) SEPT 1-7'



TYPE OF TEST	TEST PROCEDURE	Classification
<input checked="" type="checkbox"/> Standard Proctor	Weight of Hammer <u>5.5</u> Lbs.	<u>CL</u>
<input type="checkbox"/> Modified AASHTO	Drop <u>12</u> inches	Material compacted represents <u>100</u> percent of the sample and passed <u>#4</u> sieve
<input type="checkbox"/> Other _____	Lifts <u>3</u>	(Sp. Gr.) $G_s =$ <u>2.71</u>
	Vol. of Cylinder <u>1/30</u> Cu.Ft.	Curve <u>1</u> of <u>2</u>

COMPACTION AND PENETRATION RESISTANCE REPORT

Date \_\_\_\_\_ Sample No.: Field 4 Lab 63W378E  
 Project SO. FORK OF BUCKWATER Location MISSOURI  
 Sample Location and Depth \* COMPOSITE



TYPE OF TEST <input checked="" type="checkbox"/> Standard Proctor <input type="checkbox"/> Modified AASHTO <input type="checkbox"/> Other _____	TEST PROCEDURE Weight of Hammer <u>5.5</u> Lbs. Drop <u>12</u> Inches Lifts <u>3</u> Vol. of Cylinder <u>1/30</u> Cu.Ft.	Classification <u>CL</u> Material compacted represents <u>100</u> percent of the sample and passed <u>14</u> sieve (Sp. Gr.) G <sub>s</sub> = <u>2.69</u> Curve <u>2 of 2</u>
	504-26	

SHEET 1 of 1

FORM SCS-357  
10-58

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State MISSOURI Project Soil Conservation Service - Site 2-1

Date 7-18-62 Analysis Made By G. L. H. Checked By G. L. H.

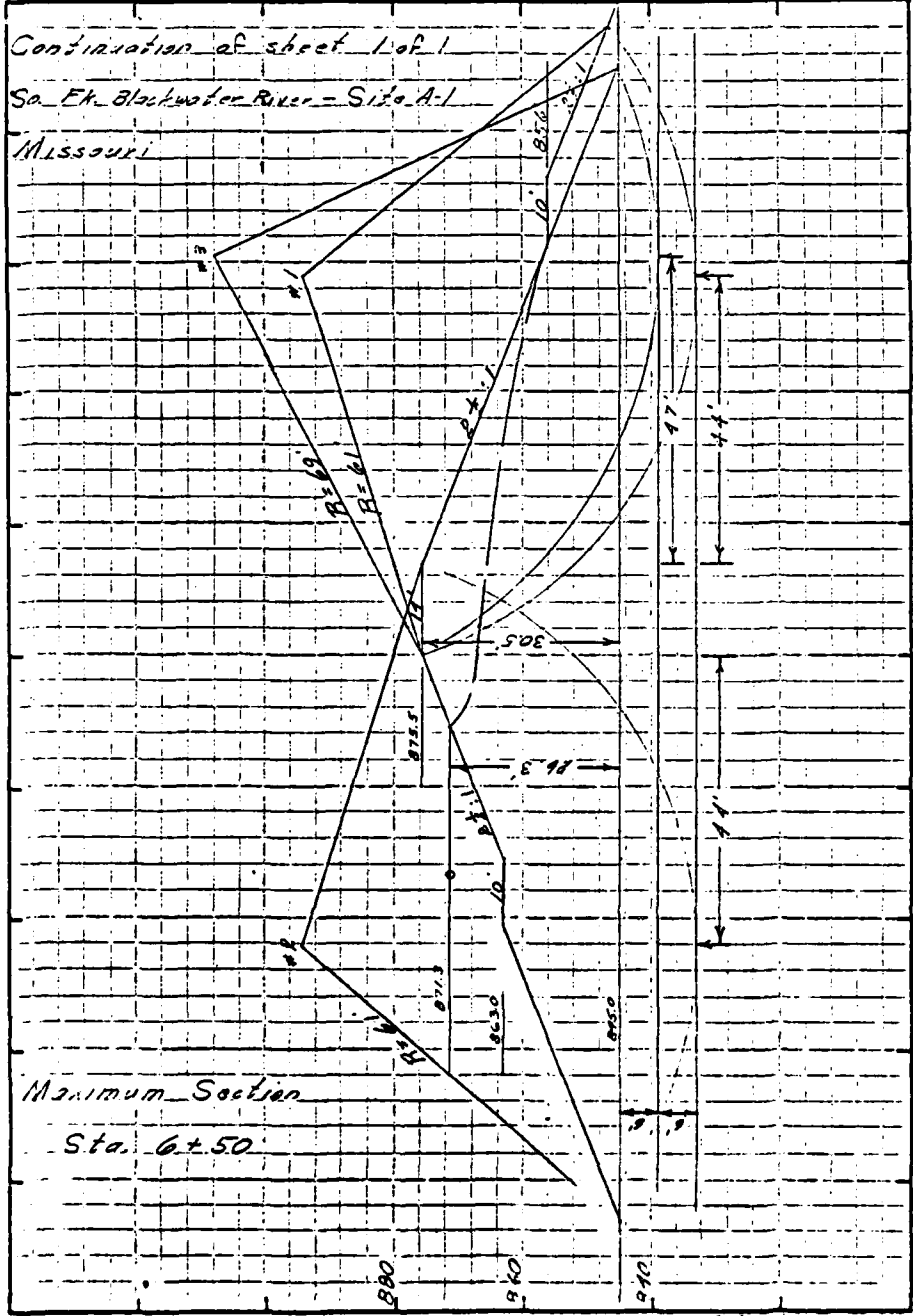
Method of Analysis SWEDISH CIRCLE

Location of Material	F <sub>max</sub>		F <sub>min</sub>		F <sub>avg</sub>		F <sub>std</sub>		F <sub>total</sub>	
	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
Sample No.	42W/297A	Guida	42W/295E							
γ <sub>d</sub>	94.5	92.0							103.0	
γ <sub>m</sub>									10.5	
γ <sub>s</sub>	119.0	119.0							105.5	
γ <sub>b</sub>	53.5	53.5							12.0	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
φ	30°	15.0°		10°					17.5°	
Tan φ	-	0.257		0.176					0.315	
c										
c	575	425		300					0.00	

UPSTREAM SLOPE			
Trial	Slope	Conditions	F <sub>s</sub>
2	2 1/2:1	Full cross-section; 10' from edge of cut from top shoulder over embankment 42W/295E & 10' from *zoned sand. γ <sub>d</sub> values as per.	1.30
2A	2 1/2:1	Unconsolidated Foundation Strength (C=575) Moist Embankment - Represents a Condition Immediately After Construction	1.27
		*Found zoning: 0'-6" of 42W/317A 6'-12" of φ=10°, C=300	

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	F <sub>s</sub>
1	2 1/2:1	No design for cut from top shoulder of embankment 42W/295E & 10' from *zoned sand. γ <sub>d</sub> values as per.	1.22
1A	2 1/2:1	Same as #1 except 10' from edge of embankment	1.36
3	2 1/2:1	Unconsolidated Sand layer - moist and weight's value - immediately after construction (Shallow Arc)	1.71

Continuation of sheet 1 of 1  
Sta. Ft. Blackwater River - Site A-1  
Missouri



Maximum Section  
Sta. 6+50

**APPENDIX C**  
**HYDROLOGIC AND HYDRAULIC DESIGN DATA**

**STRUCTURE DATA**

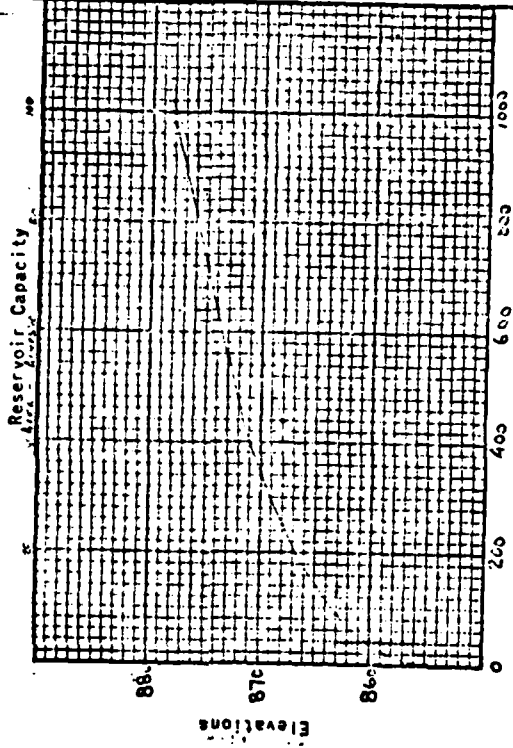
Class of Structure "0" Floodwater Retarding  
 Drainage Area (total) 29.54 Ac. 4.459 Sq. Mi.  
 (uncontrolled) 16.75 Ac. 2.617 Sq. Mi.  
 Time of Concentration 0.71 Hours  
 Soil Cover Complex Number 73 For A.M.C. II  
 Sediment Capacity Available 85.0 Ac. Ft. below Elev. 863.0  
 Total Sediment Capacity Available 85.0 Ac. Ft.  
 Retarding Capacity Provided 340.0 Ac. Ft.  
 Capacity Equivalents (Vol.) 10.61 In.  
 Capacity Equivalents (Vol.) 2.44 In.  
 Water Supply Provided NONE Ac. Ft. - Identify Uses

Principal Spillway:  
 Maximum Capacity (low-stage) 231.0 c.f.s.  
 Maximum Capacity (high-stage) \_\_\_\_\_ c.f.s.  
 10 Day Drawdown Elev. 863.0  
 Emergency Spillway:  
 Percent Chance Use 4 Storm Duration 6 Hours  
 Type Vegetation Factor Value Used 0.04  
 Emergency Spillway Hydrograph for Class "0" Structures

Rainfall 5.69 in.  
 Runoff 2.85 in.  
 Peak Inflow 288.5 c.f.s.  
 Maximum Discharge - Emergency Spillway 220 c.f.s.  
 Maximum Water Surface Elev. 871.72  
 Velocity of Flow (V<sub>e</sub>) 3.7 f.p.s.

Supplementary Data and Special Design Features:  
 Principal Spillway Crest Elev. = 863.0  
 Emergency Spillway Crest Elev. = 871.3  
 Emergency Spillway Bottom Width = 150'  
 Setback Top of Dam Elev = 874.3  
 H X S = 26.2 X 42.5

Freeboard Hydrograph for Class "0" Structures  
 Rainfall 8.21 in.  
 Runoff 5.13 in.  
 Peak Inflow 483.9 c.f.s.  
 Maximum Discharge - Emergency Spillway 499 c.f.s.  
 Maximum Water Surface Elev. 873.7



Total Storage - Ac. Ft.

Supplementary Data and Special Design Features:

<b>STRUCTURE A-1</b>	
Blackwater River Watershed PL-546	
Johnston County, Missouri	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Drawn by: <u>JAC</u>	Checked by: _____
Date: <u>12/77</u>	Year: _____
Project No: _____	Sheet No: <u>10/17</u>

**STRUCTURE DATA**

Class of Structure "A" Grade Stabilization  
 Drainage Area (total) 824 Ac. 1.258 Sq. Mi.  
 (uncontrolled) 824 Ac. 1.288 Sq. Mi.  
 Time of Concentration 0.72 Hours  
 Soil Cover Complex Number 74 For A.M.C. II  
 Sediment Capacity Available 75.8 Ac. Ft. below Elev. 944.0  
 Total Sediment Capacity Available 75.8 Ac. Ft.  
 Capacity Equivalents (Vol.) 1.10 in.  
 Retarding Capacity Provided 102.0 Ac. Ft.  
 Capacity Equivalents (Vol.) 1.48 in.  
 Water Supply Provided NONE Ac. Ft. - Identify Uses

**Principal Spillway:**

Maximum Capacity (low-stage) 173 c.f.s.  
 Maximum Capacity (high-stage) 944.0 c.f.s.  
 10 Day Drawdown Elev. 944.0  
 Emergency Spillway:  
 Percent Chance Use 4 Storm Duration 6 Hours  
 Type Reacted Earth "n" Value Used 0.04  
 Emergency Spillway Hydrograph for Class "A" Structures

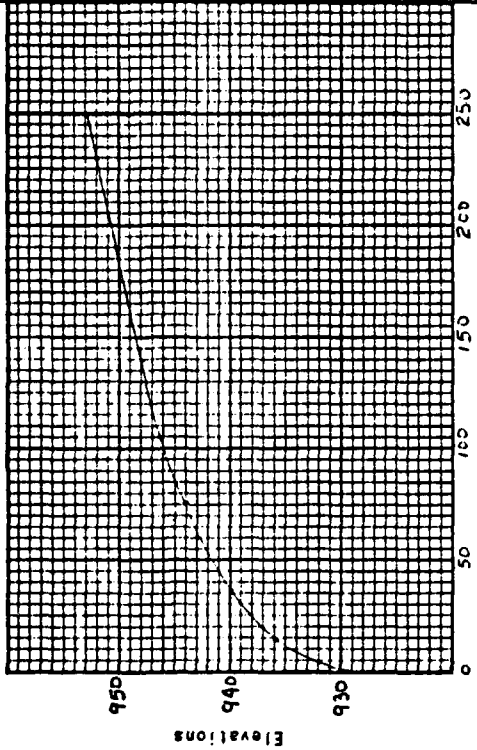
Rainfall 5.75 in.  
 Runoff 2.98 in.  
 Peak Inflow 122 c.f.s.  
 Maximum Discharge - Emergency Spillway 147 c.f.s.  
 Maximum Water Surface Elev. 950.7  
 Velocity of Flow (Vc) 5.1 f.p.s.

**Supplementary Data and Special Design Features:**

Principal Spillway Crest Elev. = 944.0  
 Emergency Spillway Crest Elev. = 949.8  
 Emergency Spillway Bottom Width. = 85'  
 Settled Top of Dam Elev. = 952.3  
 HXS = 26.5 x 177.8 = 4,712

Freeboard Hydrograph for Class "A" Structures  
 Rainfall 8.29 in.  
 Runoff 5.19 in.  
 Peak Inflow 2394 c.f.s.  
 Maximum Discharge - Emergency Spillway 967 c.f.s.  
 Maximum Water Surface Elev. 952.3

**Reservoir Capacity**



Total Storage - Ac. Ft.

**Supplementary Data and Special Design Features:**

<b>STRUCTURE A-20</b>	
Blackwater River Watershed PL-560	
Johnson County, Missouri	
U. S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Project	T.A.C.
Date	12-71
Drawn	J.E.S.
Checked	J.E.S.

**STRUCTURE DATA**

Class of Structure "A" Grade Stabilization  
 Drainage Area (total) 179 Ac. 1843 Sq. Mi.  
 (uncontrolled) 255 Ac. 0.555 Sq. Mi.  
 Time of Concentration 0.32 Hours  
 Soil Cover Complex Number 74 For A.M.C. II  
 Sediment Capacity Available 52.8 Ac. Ft. below Elev. 914.0  
 Total Sediment Capacity Available 52.8 Ac. Ft.  
 Capacity Equivalents (Vol.) 4.79 in.  
 Retarding Capacity Provided 164.0 Ac. Ft.  
 Capacity Equivalents (Vol.) 5.55 in.  
 Water Supply Provided None Ac. Ft. - Identify Uses

**Principal Spillway:**

Maximum Capacity (low-stage) 119 c.f.s.  
 Maximum Capacity (high-stage) \_\_\_\_\_ c.f.s.  
 10 Day Drawdown Elev. 914.0

**Emergency Spillway:**

Percent Chance Use A Storm Duration 6 Hour  
 Type Age-Total Earth "n" Value Used 0.0A  
 Emergency Spillway Hydrograph for Class "A" Structures

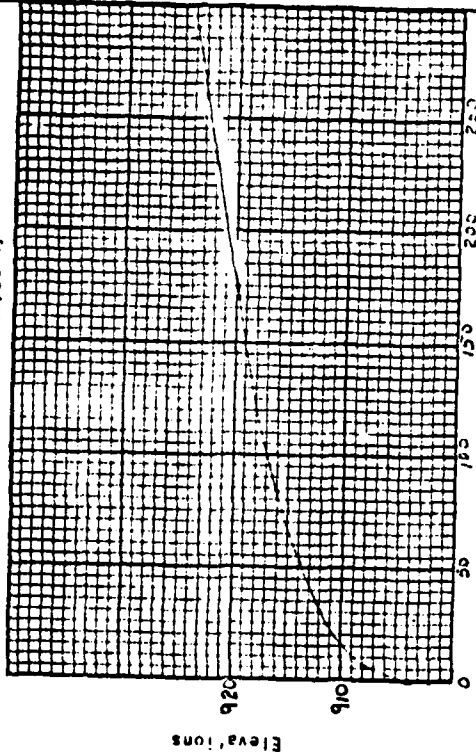
Rainfall 5.75 in.  
 Runoff 3.04 in.  
 Peak Inflow 793 c.f.s.  
 Maximum Discharge - Emergency Spillway 41 c.f.s.  
 Maximum Water Surface Elev. 921.1  
 Velocity of Flow (Vel) 2.9 f.p.s.

**Supplementary Data and Special Design Features:**

Principal Spillway Crest Elev = 914.0  
 Emergency Spillway Crest Elev = 921.5  
 Emergency Spillway Bottom Width = 100'  
 Settled Top of Dam Elev. = 923.7  
 HXS 21.7 X 216.8

Freeboard Hydrograph for Class "A" Structures  
 Rainfall 8.29 in.  
 Runoff 5.28 in.  
 Peak Inflow 1621 c.f.s.  
 Maximum Discharge - Emergency Spillway 723 c.f.s.  
 Maximum Water Surface Elev. 923.63

**Reservoir Capacity**



Total Storage - Ac. Ft.

**Supplementary Data and Special Design Features:**

<b>STRUCTURE A-21</b>	
Blackwater River Watershed PL-506	
Johnson County, Missouri	
U. S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Project	
Date	12-71
Drawn	E.E.S.

END

DATE  
FILMED

11-8

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