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16. Abstracts On February 26, 1972, a coal refuse dam, owned and operated by the Buffalo Mining Company, failed near Saunders, W. Va. The resulting flooding of the Buffalo Creek Valley had national ramifications. The immediate consequences of the flooding were the deaths of 118 persons and 7 reported missing, the loss of over 500 homes, and extensive flood damage to other property in Buffalo Creek Valley. Basic data were gathered during the investigation of the Middle Fork Valley dams and refuse bank above Saunders during field investigations of the site conducted from the end of March through mid-September 1972. This information consisted of field mapping, subsurface exploration and sampling by means of auger drill holes, field density tests, field permeability tests, aerial photography, vane shear tests, and cone penetration tests. Volume II, the appendices, covers these details.

17. Key Words and Document Analysis. 17a. Descriptors

Coal refuse dam
Failure
Buffalo Creek
Flood
Buffalo Creek flood
Saunders, W. Va.

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 13L

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ANALYSIS OF COAL REFUSE DAM FAILURE

MIDDLE FORK BUFFALO CREEK SAUNDERS, WEST VIRGINIA

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON, D.C.

USBM CONTRACT NO. S0122084

VOLUME 2 OF 2 - APPENDICES

FEBRUARY 1973

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& ASSOCIATES

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198

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ANALYSIS OF

COAL REFUSE DAM FAILURE

MIDDLE FORK BUFFALO CREEK

SAUNDERS, WEST VIRGINIA

TABLE OF CONTENTS

VOLUME 2 - APPENDICES

APPENDIX A

TABLES (continued)

Table No.

Drill logs and Water Pressure Test Results (continued):

Hole No.	No. of Sheets
S-9	3
S-10	3
S-11	3
S-12	4
S-13	3
S-14	3
S-15	2
S-16	2
S-17	2
S-18	2
S-19	2
S-20	1
S-21	2
S-22	1

APPENDIX B

FIGURES

PHOTOPLATES

3

APPENDIX C

APPENDIX A

FIELD INVESTIGATION

A. INTRODUCTION

Basic data were gathered during the investigation of the Middle Fork Valley dams and refuse bank above Saunders, West Virginia, during field investigations of the site conducted from the end of March through mid-September, 1972. This information consisted of field mapping, subsurface exploration and sampling by means of auger drill holes, field density tests, field permeability tests, aerial photography, vane shear tests, and cone penetration tests. The locations of most exploration features are shown on Figure VI-20; Hole BS-19, at the downstream end of the refuse bank is shown on Figure III-3A, and exploration features at the upstream end of Pool 3 and in Dam No. 4 and Pool 4 are shown on Figure III-3C. A drill hole summary is included here as Table A-1. Hundreds of photographs were taken during the field investigation. The locations of most of those used in this report are indicated on Figure A-1; a few photograph locations are shown on Figure III-3C. Unless otherwise credited, the full-page photographs are by Robert T. Johnson of Logan, West Virginia. The small-format photographs are by staff personnel of W. A. Wahler and Associates.

B. AUGER DRILLING

Sixty exploration holes totaling 3302.9 feet were drilled in Middle Fork Valley utilizing truck-mounted Acker AD-2 and CME-45 drill rigs. The drilling services were subcontracted to Tinney Drilling Co., Bridgeville, Pennsylvania. The equipment used varied with the purpose of the hole.

Twenty-two S-series holes (S-1 through S-22) were drilled for sample retrieval. These holes were drilled with 6-inch O.D. (3 9/32-inch I.D.) hollow stem augers (Figure A-2, Photo A) except for hole S-20 which was drilled and sampled continuously with a Pitcher barrel of 5-7/8-inch O.D. (Figure A-2, Photo D). The S-series holes varied in depth from 14.0 to 174.0 feet, and their combined footage totaled 1,879.8 feet.

The hollow stem auger holes were sampled at intervals determined in the field by W. A. Wahler and Associates' representatives. Sampling was done largely with such conventional sampling tools as the standard (3-inch diameter by 30 inches long) Shelby tube, Shelby tube with piston, and the standard split-spoon penetrometer (ASTM D-1586-67). Figure A-3 (Photo B) shows typical disturbed recovery with the standard penetrometer sampler, and Figure A-2 (Photo B) shows the hammer set-up for a standard penetration test. The standard penetration test consists of driving a 2-inch O.D. by 1 3/8-inch I.D. split-spoon sampler with a 140-lb. hammer falling a distance of 30 inches. Where possible, the sampler was driven 18 inches into undisturbed material and the blow count recorded for each successive 6 inches of penetration. The standard penetrometer blow count, N, is the total number of blows for the second and third 6-inch intervals driven. It is recorded on the drill hole logs.

The Pitcher barrel, utilizing a Shelby-type tube measuring 4 inches in diameter by 36 inches long (Figure A-2, Photo D) was used in hole S-20 to retrieve larger diameter samples than could be obtained with the more common Shelby tubes. Non-standard sampling tools included a "poorboy" sampler (used in hole S-4) which was a discarded Nx inner core barrel, and double-length Shelby tubes, fabricated off-site by welding the nose of one standard (3 x 30 inches) Shelby tube to the top of another, and filling the attachment holes in the lower tube. A double Shelby tube is shown on Figure A-2, Photo C.

The materials encountered in the S-series holes were logged on a continuous basis by a W. A. Wahler and Associates representative and were described in accordance with the Unified Soil Classification (ASTM D-2487). The classification is described on the Key for Exploration Logs, which accompanies the logs included in this Appendix. Relatively undisturbed samples were obtained by pushing 3-inch O.D., thin-walled Shelby tubes into embankment and reservoir sediment (sludge) materials. When possible, the 2.5-foot long Shelby tubes were pushed 2.0 feet and the double Shelbys were pushed 4.0 to 4.5 feet if refusal was not met. The Pitcher sampling technique is properly described as a push-drill method of sampler advancement. The 3.0-foot long Pitcher tubes were advanced 2.0 feet unless earlier refused.

The presence of coarse gravel and cobbles in embankment materials made it difficult to obtain undisturbed samples in the embankment. In fact, attempts to take Shelby samples in this material often met with complete refusal of penetration in only a few tenths of a foot. Usually, Shelby samples obtained from the sludge were only slightly disturbed. However, recovery of this wet, fine-grained, material was also rendered difficult since samples were often lost from the tubes as they were pulled from the drill holes. The double Shelby tube was devised in an attempt to solve two problems: 1) poor recovery of samples of the sludge with normal Shelby or piston techniques, and 2) a sampler was needed that was long enough to get through the sludge which often rose into the auger stem after the inner bit was removed. The double Shelby tubes were moderately successful in both applications. A discussion of sampling problems and techniques in coal refuse will be included in another report to the Bureau of Mines.

When the auger was refused, Nx coring commenced in most holes. Generally, 10 feet of bedrock were cored; in some holes the coring was carried deeper. The following S-series holes were not cored: S-14, 16, 18, 19,

20, 21 and 22. Figure A-3, Photo A, shows typical core. Water pressure tests were conducted in the bedrock in holes S-3 and S-6. Results of the tests are presented immediately after the respective drill hole logs in this Appendix.

Nineteen BS-series holes (BS-1 through BS-19) were drilled with 4- and 6-inch diameter solid-stem augers. Nearly all of these holes were drilled to refusal, which was generally taken to represent the bedrock surface underlying the overburden and fill. The BS-series holes were used to supplement our knowledge of the configuration of the bedrock surface, and to provide more precision in delineating the surface than could be attained with scattered S-series holes.

Data for the BS-series holes are presented in Table A-1; the holes were not logged due to the difficulty of determining precisely the depth from which the auger returns came. Some data about depths to various contacts are presented in Table A-1, but they are approximate only, and in part based on correlation with nearby S-series holes. The total footage drilled in the BS-series holes is 1012.6 feet.

Five P-series pilot holes were drilled for the portable vane shear and cone penetrometer equipment. These holes, also listed in Table A-1, were drilled with the truck-mounted auger rig. They penetrated gravel that the vane and cone could not, and permitted the vane and cone to test the sludge material underlying the gravels. Descriptions of the results of vane shear and cone penetrometer testing are presented elsewhere in this Appendix. The total footage involved in these pilot holes is 205 feet.

Fourteen FP-series holes were drilled in the left abutment for field permeability tests. Most of these holes were drilled to shallow depths with either solid or hollow stem auger. Holes FP-9A through 14A were

drilled by pushing a Shelby tube or tubes and retrieving undisturbed samples where possible. The total footage involved in the FP-series holes is 205.5 feet. The field permeability tests are described below.

C. FIELD PERMEABILITY TESTS

Fourteen field permeability tests were conducted in substantial accordance with U.S. Bureau of Reclamation Designation E-19. Test conditions were modified slightly in the field to make the test procedure consistent with the nature of the material to be tested. Results of these tests follow the drill hole logs in this Appendix, and are summarized in Table A-1. Figure A-3, Photo C, shows the test equipment set up at hole FP-3A. All field permeability tests were located in the left abutment remnant of Dam No. 3 as shown on Figure VI-20.

D. FIELD DENSITY TESTS

In order to determine the in-place density variation of the embankment and foundation materials within the Middle Fork Valley, a total of 44 field density tests, which are summarized in Table A-2, were performed in accordance with ASTM Test Designation D-1556-65. The location of all tests performed near Dams 1, 2, and 3 are shown on Figure VI-20 and those upstream of Dam No. 3 on Figure III-3C. Because of the wide variation in grain sizes, two different size cones were used. A 6-inch diameter sand cone was used exclusively in the foundation sludge material, whereas a 12-inch diameter sand cone was used in areas of coarse coal and shale waste.

As a result of the massive failure of Dam No. 3, it was impossible to obtain a good cross section of in-place density variation of the

original embankment material; however, a large bulldozer trench was excavated (Figure A-3, Photo D and Figure VI-20) in the remnant of the left abutment from the crest to the downstream toe, and a total of 10 in-place density tests were performed at about 5-foot vertical intervals throughout the length of the trench. A second dozer trench was excavated in the refuse dump downstream of Dam No. 2 near hole S-4 in order to obtain some in-place density data on the older coal waste material.

E. CONE PENETROMETER AND VANE SHEAR TESTS

Static penetration tests were performed by W. A. Wahler and Associates personnel, using portable equipment manufactured in Sweden by Jonnell & Nillson. The test procedure consisted of mechanically advancing a 10 square centimeter cone with automatic and continuous recording of total penetration resistance. A specially sealed vertical slip coupling is provided about 10 cm from the tip, which facilitates separating the two components of total penetration resistance; namely, skin friction along the rod surface and actual tip friction resistance at the cone. Six penetration probes were performed at Buffalo Creek Dam No. 3, one at Dam No. 2, and three within Pool 3 sludge at the upstream end of Pool 3.

In situ shear strengths were determined using the same portable equipment described above, except the penetrometer tip was removed and a 17 cm long by 6 cm wide vane was attached to the end rod. The vane shear probes were located adjacent to the penetrometer probes in order to correlate penetration resistance to shear strength. Predrilled pilot holes were required at Dam No. 2 (Figure A-3, Photo D) and in the channel area of Dam No. 3 in order to penetrate the overlying coarse materials prior to starting the in-place testing.

Where the equipment did not have to penetrate gravel, the penetrometer was first advanced until refusal was met. At an interval of approximately two meters, a friction test was conducted in order to separate rod friction from total penetration resistance of the material. After completing the penetration tests, the equipment was moved approximately 1 to 2 feet from the penetration hole to insure that vane shear tests would be performed in undisturbed material. The penetrometer cone was replaced by a vane, which also was advanced to refusal. At two-meter intervals a shear test was conducted to determine in-place shear strength of the material. Figure V-15, Photo C, shows the site of tests in Pool 3 sludge. Results and locations of both penetration and vane shear tests are presented in Table A-3 and Figure A-5, sheets 1 through 10.

As a result of the coarse-grained nature of the foundation sludge material, the penetration and vane shear data were used only as a means of interpreting the consistency of the material. The vane shear test results, in particular, can be very misleading and were not, in any way, used in the engineering analyses. The reason for the data not providing more useful information was a result of the sludge material exhibiting a dilatency during the application of shearing strain. This dilatency resulted in the development of negative pore pressures at the tip of the vane, thus increasing the undrained shear strength by some unknown amount. Similarly, the vertical slip coupling associated with the penetrometer equipment was not effective in separating the total and tip penetration resistance. The reasons for this are thought to be associated with (1) the relatively low in-place densities, (2) the low undrained shear strength, and (3) absence of any cohesion of these materials when saturated. Because of the difficulties associated with interpreting the rod friction portion of the test, the results have been presented in the form of total penetration resistance versus depth.

F. BACKHOE PITS AND BULLDOZER TRENCHES

Eleven backhoe pits were excavated in the Pool 2, Pool 1, and Dam No. 1 areas to expose shallow contact relations and materials for observation. Logs of selected walls of the pits are presented on Figure A-6. Locations of the pits are shown on Figure VI-20. A typical backhoe operation is shown on Figure A-4, Photo A. Bulldozer trenches were excavated in the left abutment of Dam No. 3 and in the refuse bank near hole S-4. The trenches exposed the coal waste for detailed observation and for field density testing. The bulldozer was primarily used to construct an access road from the Buffalo Creek county road and secondarily for trenching and for on-site drill rig roads and ramps. The bulldozer and backhoe, along with equipment operators, were provided by the Paul J. Rayburn Company, a subcontractor from the local area.

G. AERIAL PHOTOGRAPHY AND TOPOGRAPHIC MAPPING

Aerial photography and the associated ground control were subcontracted to Michael Baker, Jr., Inc., of Beaver, Pennsylvania. Two series for vertical stereo coverage were flown as follows:

	Date	Photo scale	Medium
1.	March 9, 1972	1:6,000	black and white
2.	April 11, 1972	1:6,000	color

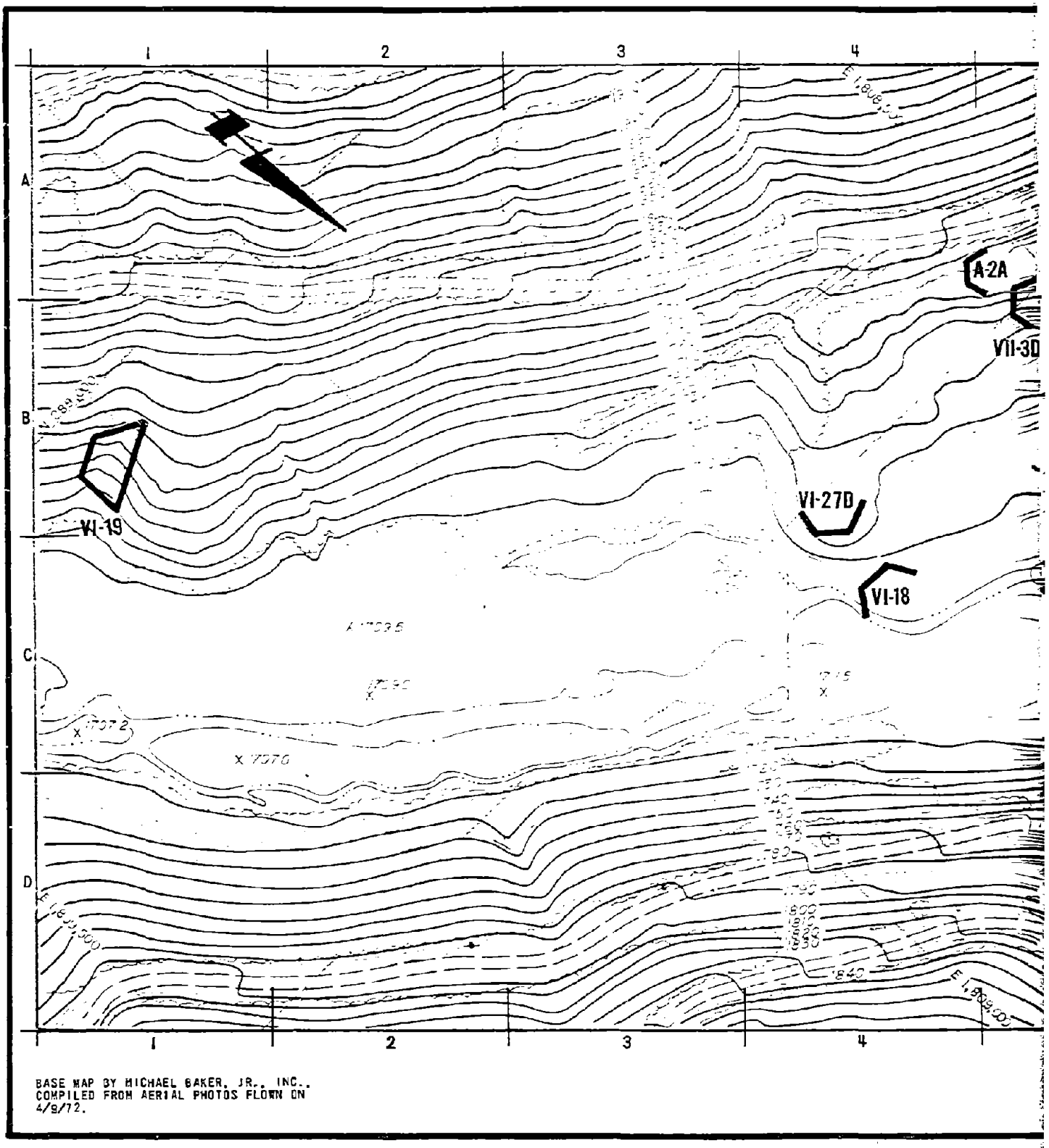
In addition, the subcontractor made available from his files black and white vertical aerial photographs taken February 28, 1972, November 28, 1962, and January 28, 1963.

The subcontractor prepared topographic maps of Middle Fork Valley and specific portions of the valley at scales of 1" = 100', 1" = 200',

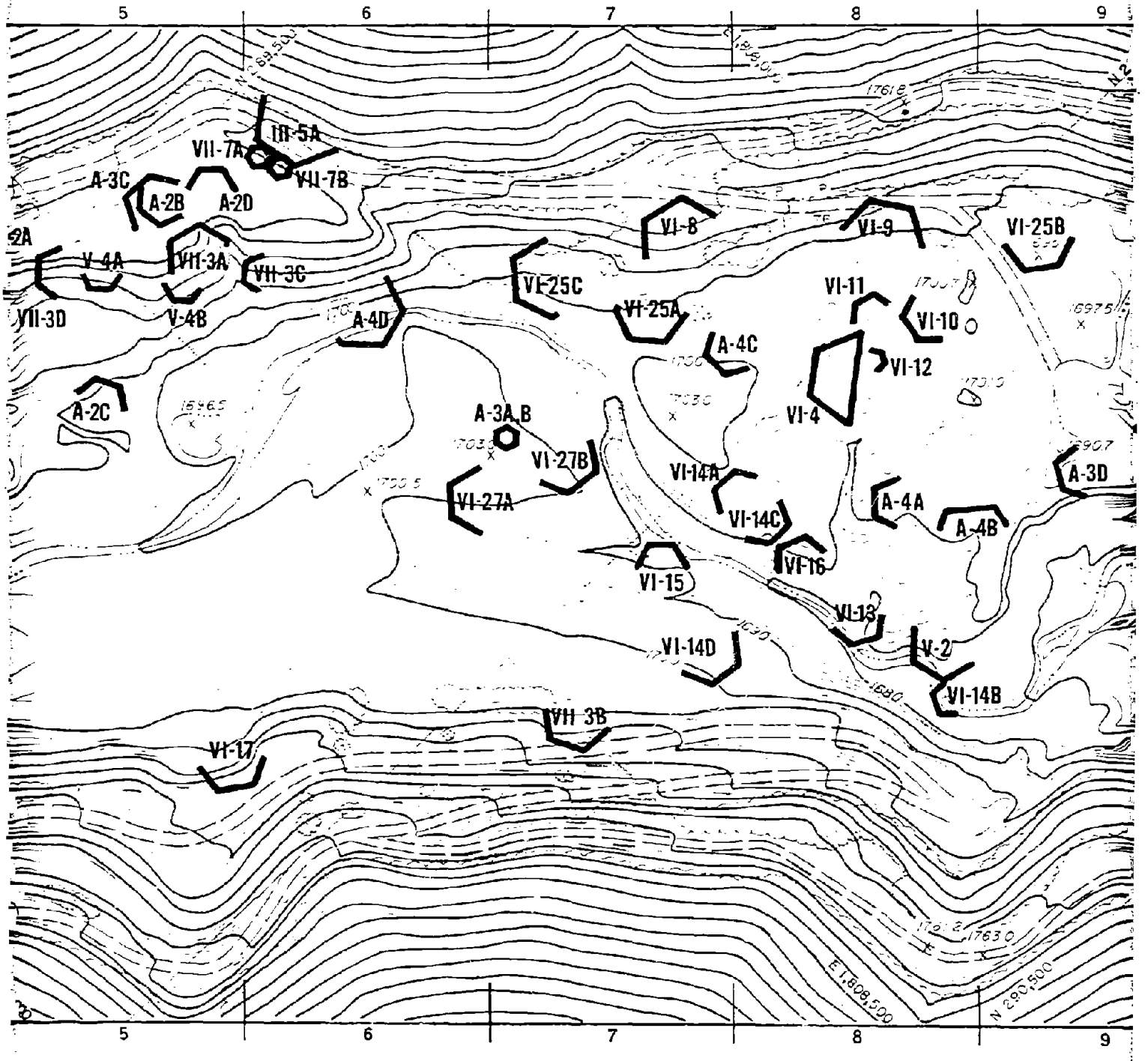
and 1" = 400'. Portions of the 1" = 100' map were enlarged to 1" = 50' for detailed geologic mapping. The 1" = 400' map was prepared from the small-scale November 28, 1962, aerial photographs in the files of the subcontractor.

H. GEOLOGIC MAPPING

Geologic mapping was done intermittently from April through September, 1972. The initial efforts were concentrated on the areas most likely to change due to natural erosion or sliding, or due to subsequent exploration activities such as constructing access roads. Conventional surface mapping was supplemented by the use of aerial photographs and subsurface exploration.



BASE MAP BY MICHAEL BAKER, JR., INC.,
COMPILED FROM AERIAL PHOTOS FLOWN ON
4/9/72.


5
6
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8
9
III-5A
VII-7A
VII-7B
A-3C
A-2B
A-2D
2A
V-4A
VII-3A
VII-3C
VII-3D
V-4B
A-4D
A-2C
VI-8
VI-9
VI-25B
VI-25C
VI-25A
VI-11
VI-10
A-4C
VI-12
VI-4
A-3A,B
VI-27B
VI-27A
VI-14A
VI-14C
VI-16
A-4A
A-4B
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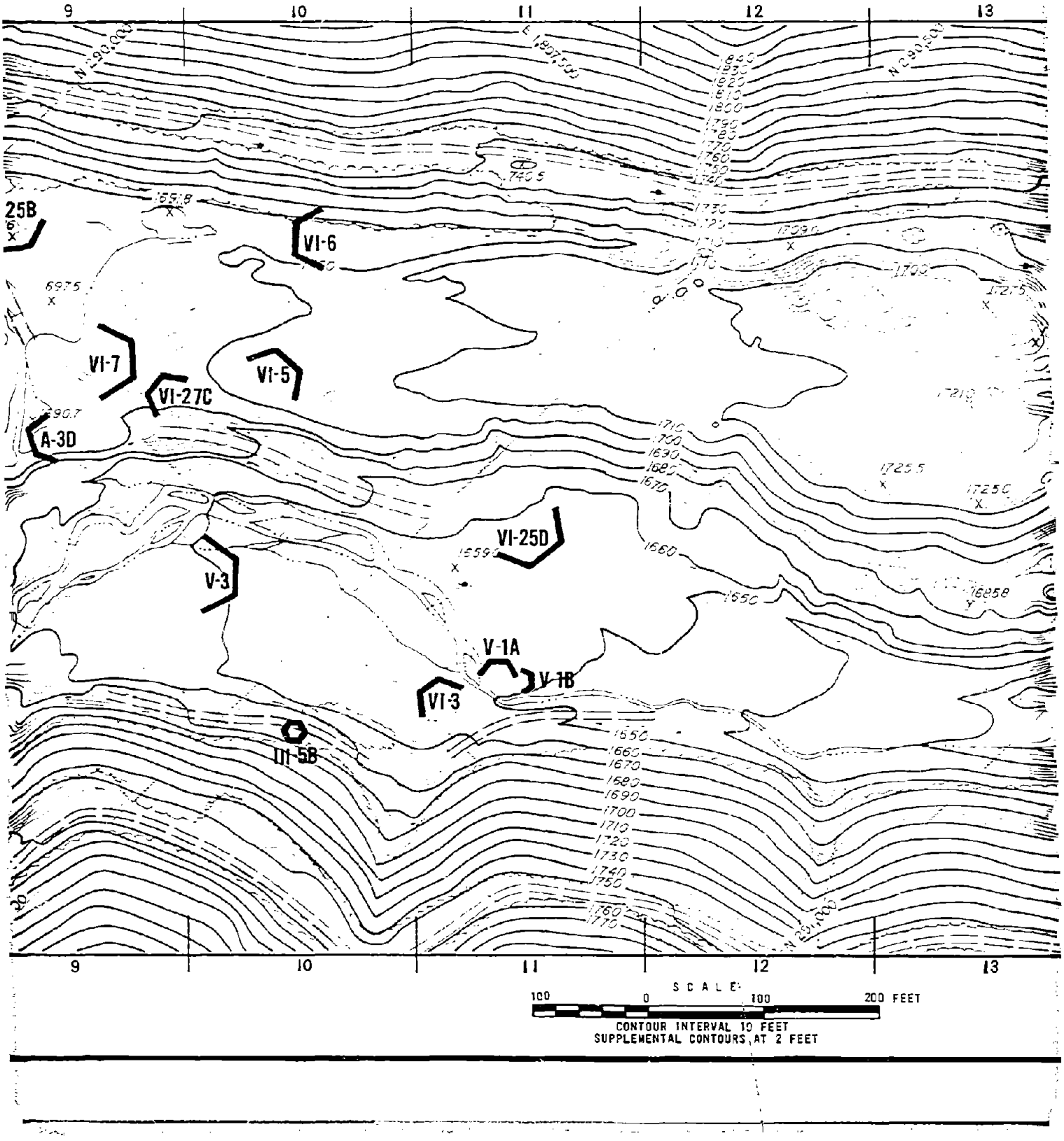
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VI-6
VI-7
VI-27C
VI-5
A-3D
VI-25D
V-3
V-1A
V-1B
VI-3
III-5B
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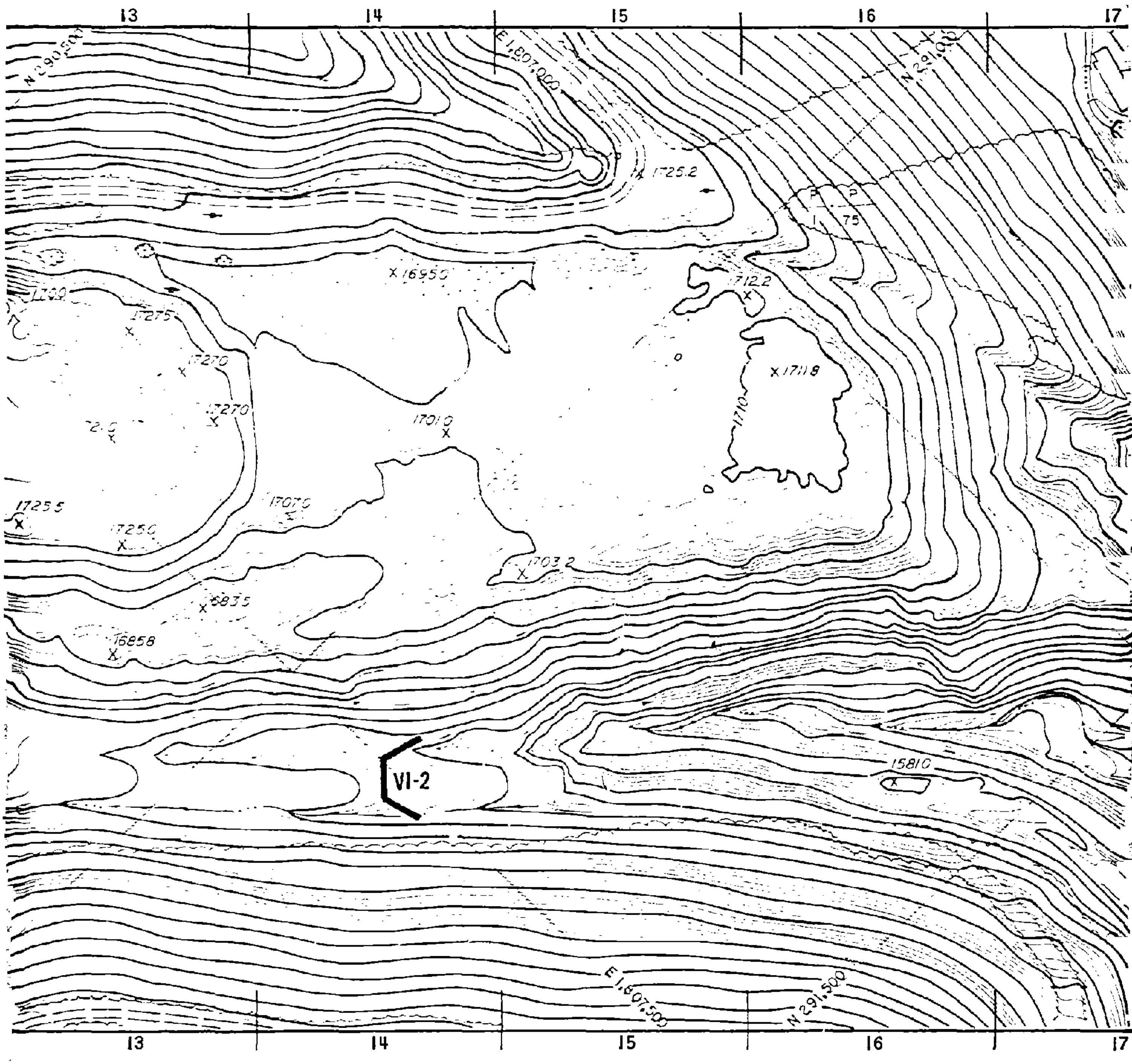
SCALE:
100 0 100 200 FEET
CONTOUR INTERVAL 10 FEET
SUPPLEMENTAL CONTOURS AT 2 FEET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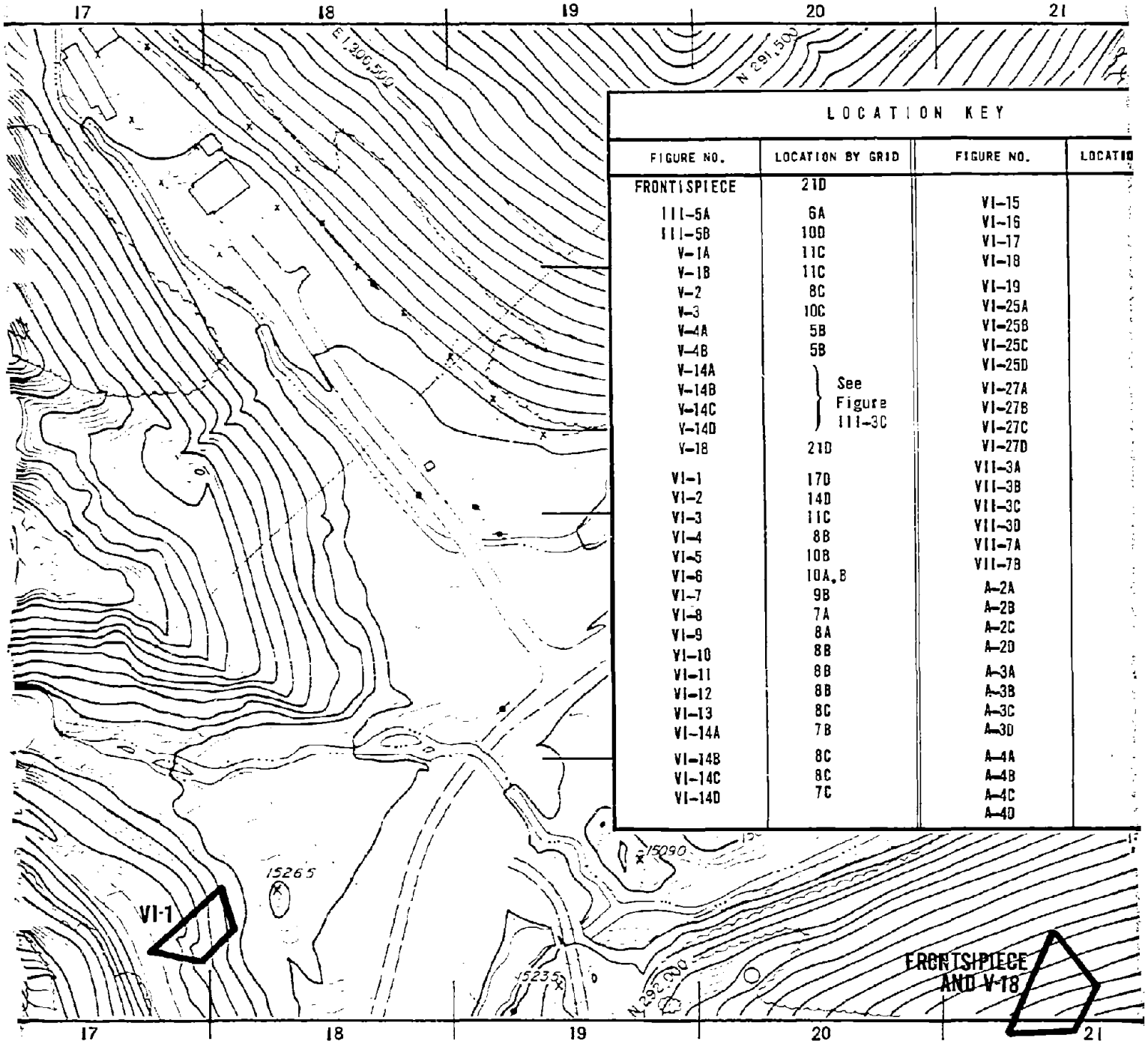
DO FEET



LOCATION KEY

FIGURE NO.	LOCATION BY GRID	FIGURE NO.	LOCATIO
FRONTISPIECE	21D	VI-15	
III-5A	6A	VI-16	
III-5B	10D	VI-17	
V-1A	11C	VI-18	
V-1B	11C	VI-19	
V-2	8C	VI-25A	
V-3	10C	VI-25B	
V-4A	5B	VI-25C	
V-4B	5B	VI-25D	
V-14A	See Figure III-3C	VI-27A	
V-14B		VI-27B	
V-14C		VI-27C	
V-14D		VI-27D	
V-18	21D	VII-3A	
VI-1	17D	VII-3B	
VI-2	14D	VII-3C	
VI-3	11C	VII-3D	
VI-4	8B	VII-7A	
VI-5	10B	VII-7B	
VI-6	10A,B	A-2A	
VI-7	9B	A-2B	
VI-8	7A	A-2C	
VI-9	8A	A-2D	
VI-10	8B	A-3A	
VI-11	8B	A-3B	
VI-12	8B	A-3C	
VI-13	8C	A-3D	
VI-14A	7B	A-4A	
VI-14B	8C	A-4B	
VI-14C	8C	A-4C	
VI-14D	7C	A-4D	

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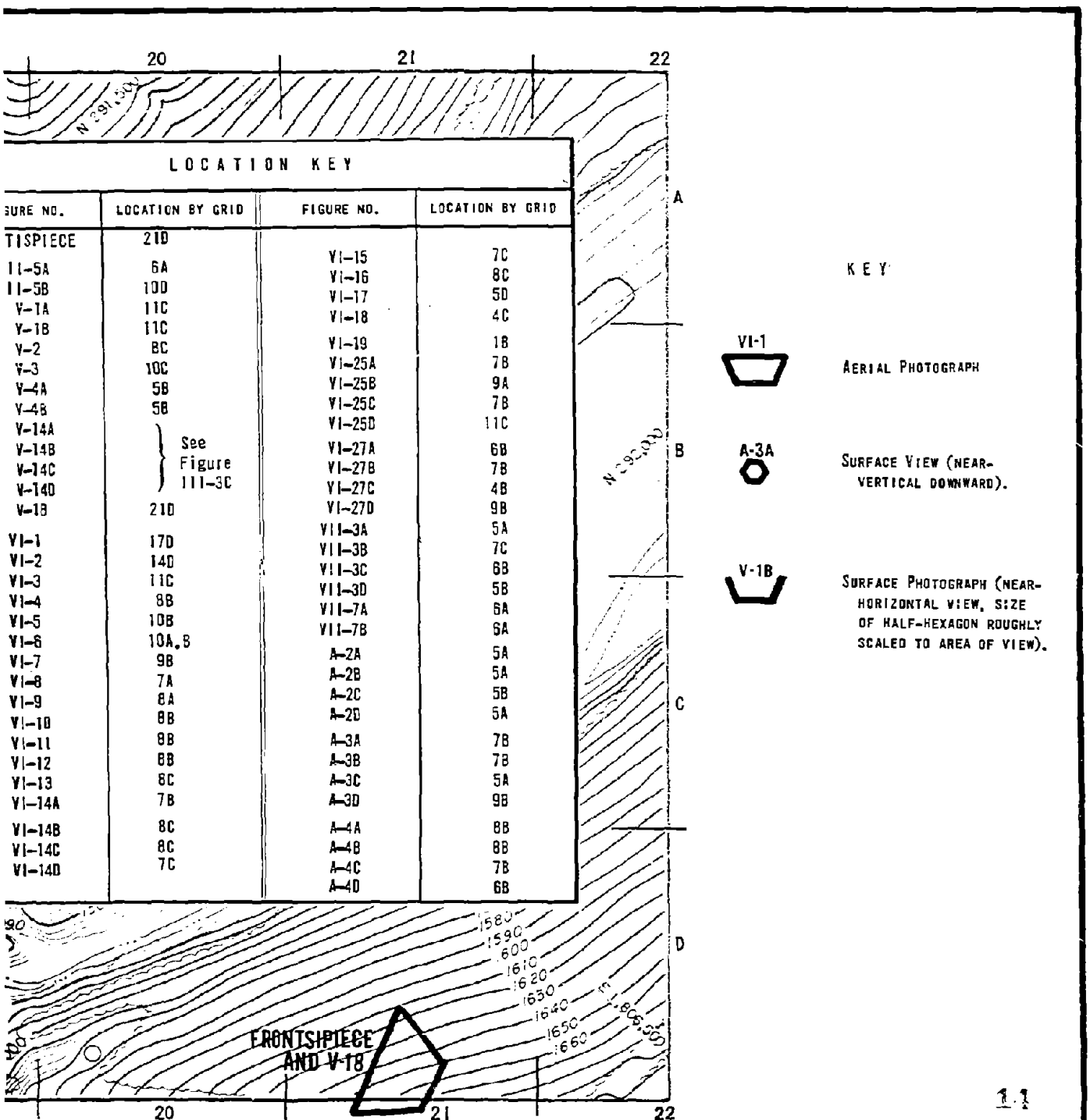

LOCATION KEY

FIGURE NO.	LOCATION BY GRID	FIGURE NO.	LOCATION BY GRID
FRONTISPIECE	21D	VI-15	7C
II-5A	6A	VI-16	8C
II-5B	10D	VI-17	5D
V-1A	11C	VI-18	4C
V-1B	11C	VI-19	1B
V-2	8C	VI-25A	7B
V-3	10C	VI-25B	9A
V-4A	5B	VI-25C	7B
V-4B	5B	VI-25D	11C
V-14A	See Figure III-3C	VI-27A	6B
V-14B		VI-27B	7B
V-14C		VI-27C	4B
V-14D		VI-27D	9B
V-18	21D	VII-3A	5A
VI-1	17D	VII-3B	7C
VI-2	14D	VII-3C	6B
VI-3	11C	VII-3D	5B
VI-4	8B	VII-7A	6A
VI-5	10B	VII-7B	6A
VI-6	10A,B	A-2A	5A
VI-7	9B	A-2B	5A
VI-8	7A	A-2C	5B
VI-9	8A	A-2D	5A
VI-10	8B	A-3A	7B
VI-11	8B	A-3B	7B
VI-12	8B	A-3C	5A
VI-13	8C	A-3D	9B
VI-14A	7B	A-4A	8B
VI-14B	8C	A-4B	8B
VI-14C	8C	A-4C	7B
VI-14D	7C	A-4D	6B

KEY

VI-1 — AERIAL PHOTOGRAPH

A-3A — SURFACE VIEW (NEAR-VERTICAL DOWNWARD).

V-1B — SURFACE PHOTOGRAPH (NEAR-HORIZONTAL VIEW, SIZE OF HALF-HEXAGON ROUGHLY SCALED TO AREA OF VIEW).

1.1

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PALO ALTO • NEWPORT BEACH • CALIF.

COAL REFUSE DAM FAILURE
SAUNDERS, WEST VIRGINIA

PHOTOGRAPH LOCATIONS

PROJECT NO	DATE	FIGURE NO.
0700	NOVEMBER 1972	A-1

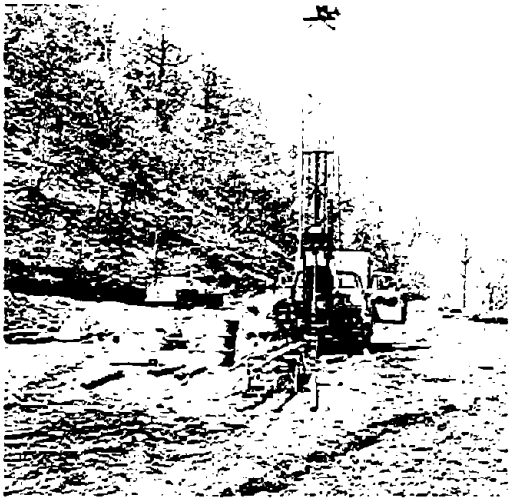


PHOTO A. CME-45 DRILL RIG USING HOLLOW STEM AUGERS ON HOLE S-1.

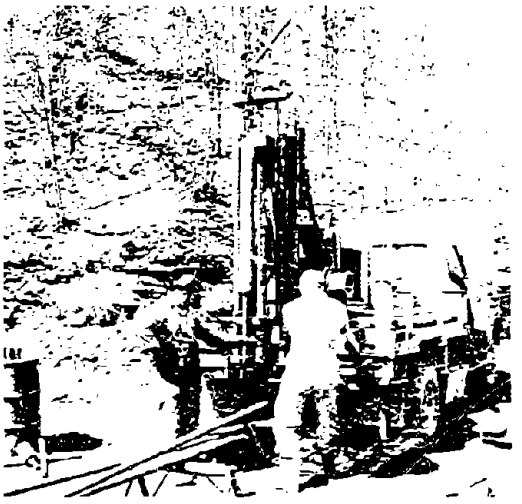


PHOTO B. STANDARD PENETROMETER TEST IN HOLE S-2.

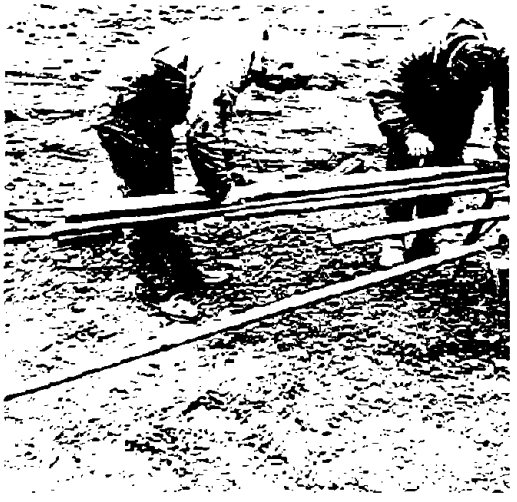


PHOTO C. SPECIAL DOUBLE-LENGTH SHELBY TUBE BEING REMOVED FROM SHELBY HEAD, HOLE S-8.

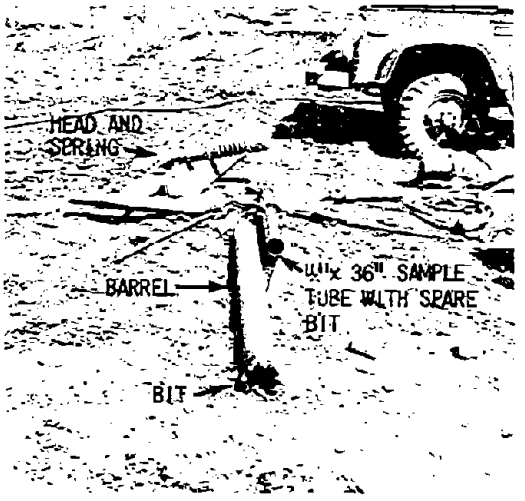


PHOTO D. PITCHER BARREL USED ON HOLE S-20. HERE DISASSEMBLED, PARTS LABELLED

W.A. WAHLER & ASSOCIATES

FIGURE A-2

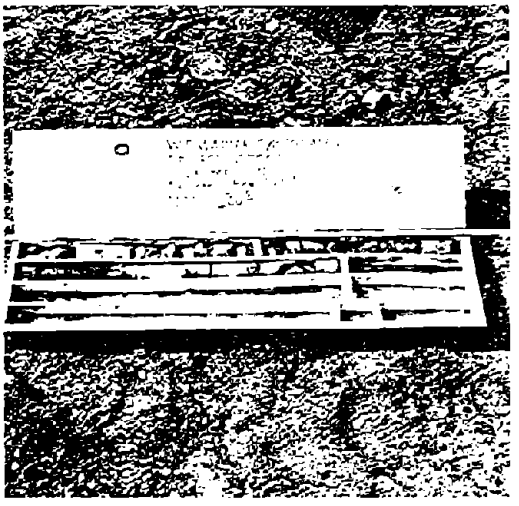


PHOTO A. CORE FROM HOLE S-11.

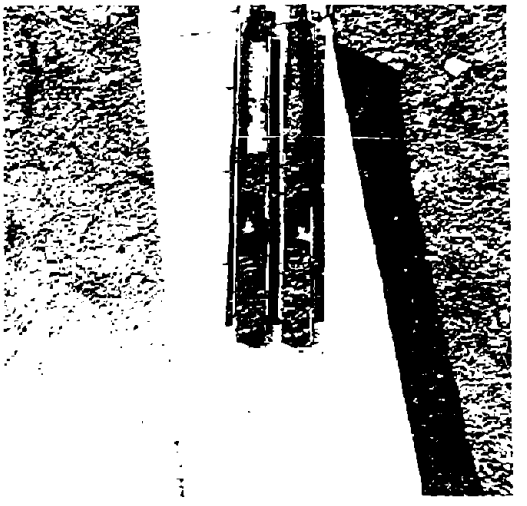


PHOTO B. STANDARD PENETROMETER RECOVERY. HOLE S-11.

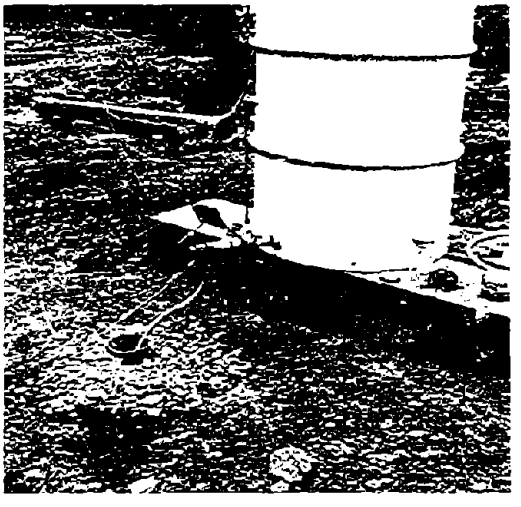


PHOTO C. TYPICAL FIELD PERMEABILITY TEST SET-UP FLOAT VALVE KEEPS CONSTANT HEAD IN HOLE; WATER LEVEL IN BARREL IS READ PERIODICALLY IN SIGHT TUBE.

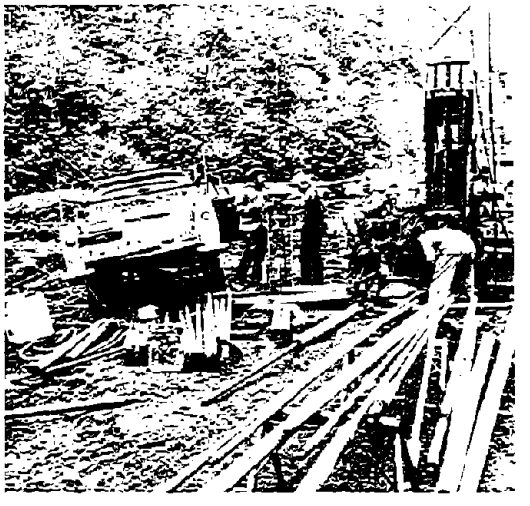


PHOTO D. PORTABLE VANE SHEAR EQUIPMENT IN USE ADJACENT TO HOLE S-4. THE DRILL RIG DRILLED A PILOT HOLE THROUGH THE REFUSE DUMP TO THE UNDERLYING SLUDGE FOR THE PORTABLE EQUIPMENT.

W. A. WAHLER & ASSOCIATES

FIGURE A-3

PHOTO A. BACKHOE EXCAVATING PIT 2.

PHOTO B. WALL OF PIT 2. HAMMER HEAD IS AT CONTACT OF DISPLACED POOL 2 SLUDGE OVER IN-PLACE DAM NO. 2 EMBANKMENT GRAVELS. SEE ALSO PIT 2 LOG IN FIGURE A-6.

PHOTO C. PIT 7, GRAVEL OF DAM NO. 3 OVERLYING SLUDGE OF POOL 2. SEE ALSO PIT 7 LOG IN FIGURE A-6.

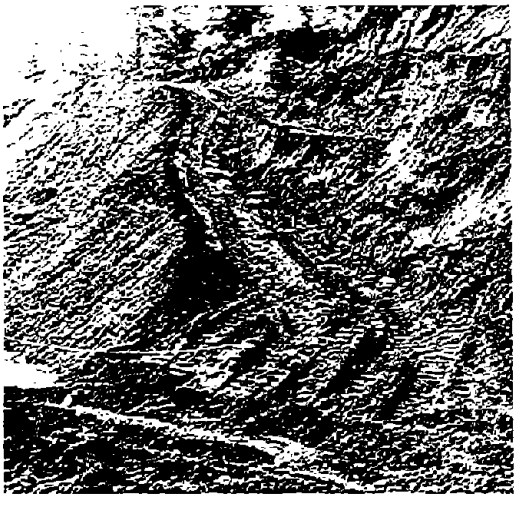
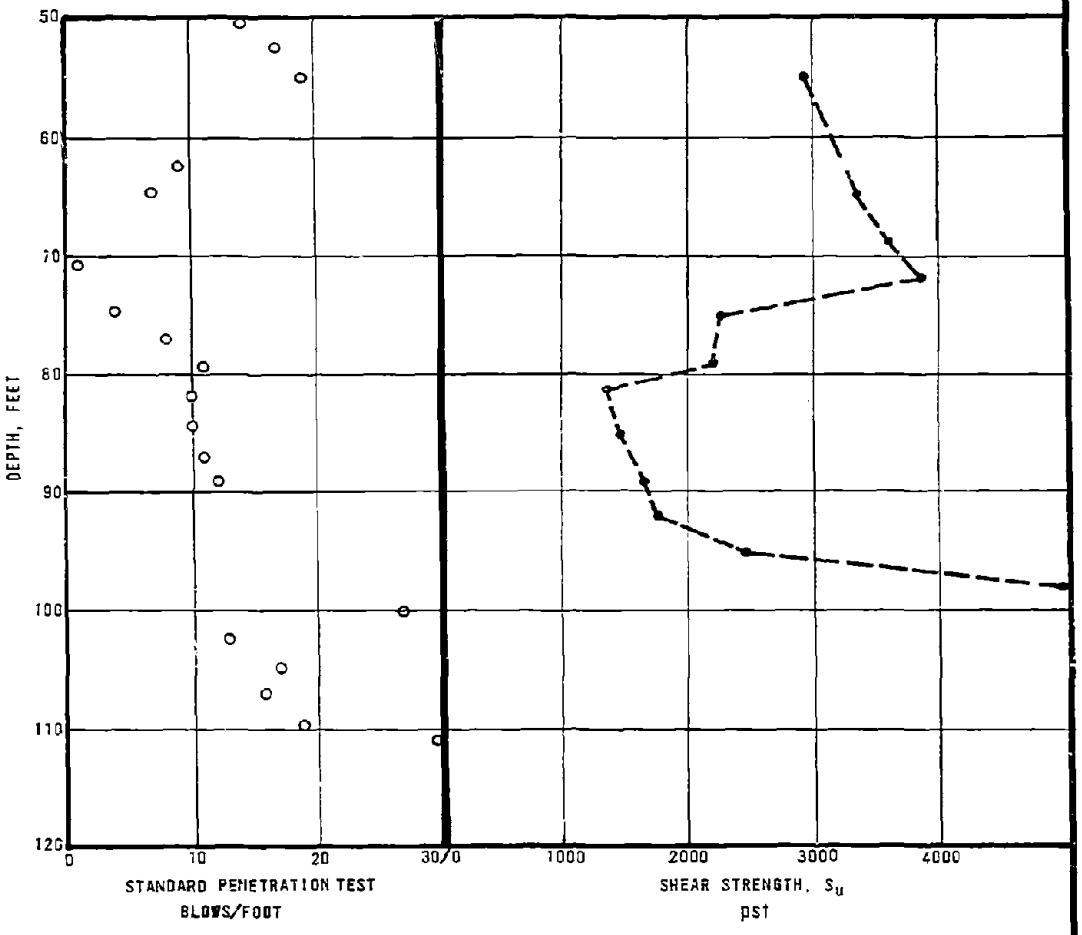


PHOTO D. EXPLORATORY BULLDOZER TRENCH IN LEFT ABUTMENT REMNANT OF DAM NO. 3. FIELD DENSITY TEST BEING SET UP IN MIDDLEGROUND.

BUFFALO CREEK, DAM NO.2, V-1

PREDRILLED HOLE AT S-4 TO 52.0 FEET



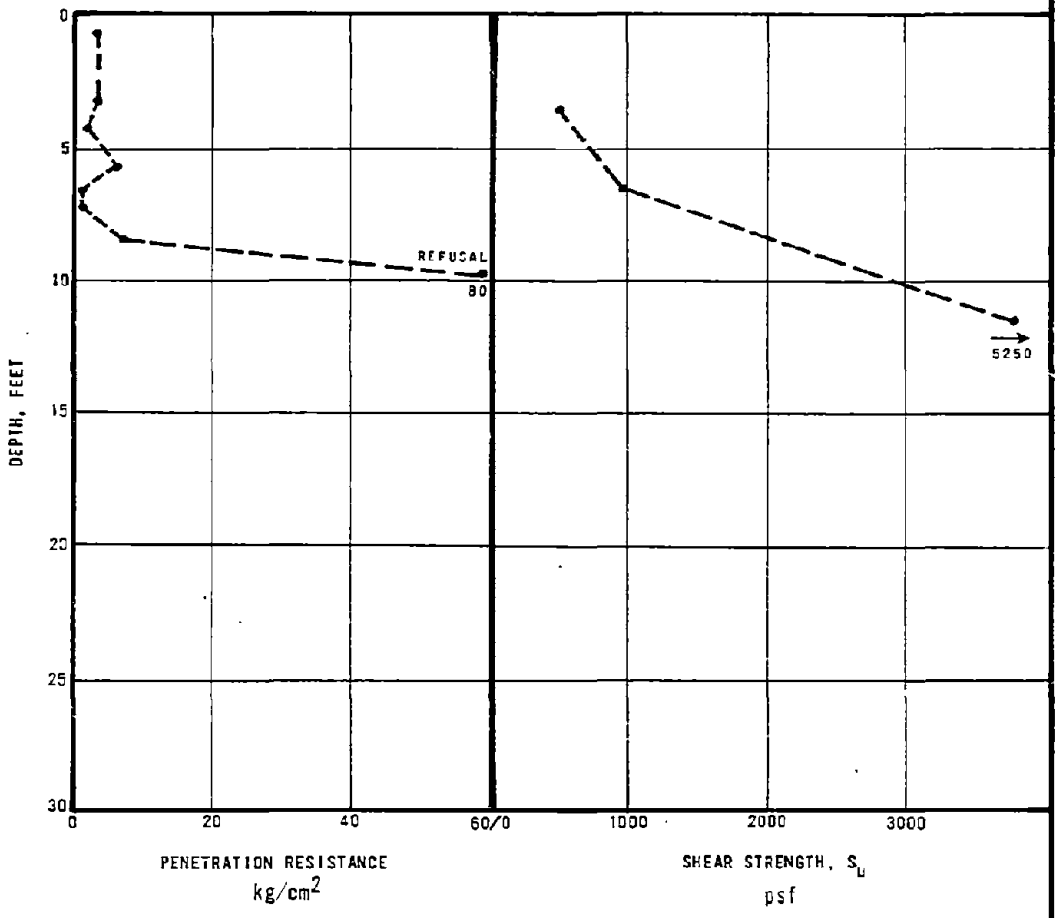
NOTE: STANDARD PENETRATION TEST RESULTS IN ADJACENT DRILL HOLE GIVEN FOR COMPARISON.

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO	DATE	FIGURE NO.
		0709	NOVEMBER 1972	A-5

SHEET 1 OF 10

BUFFALO CREEK DAM NO.3

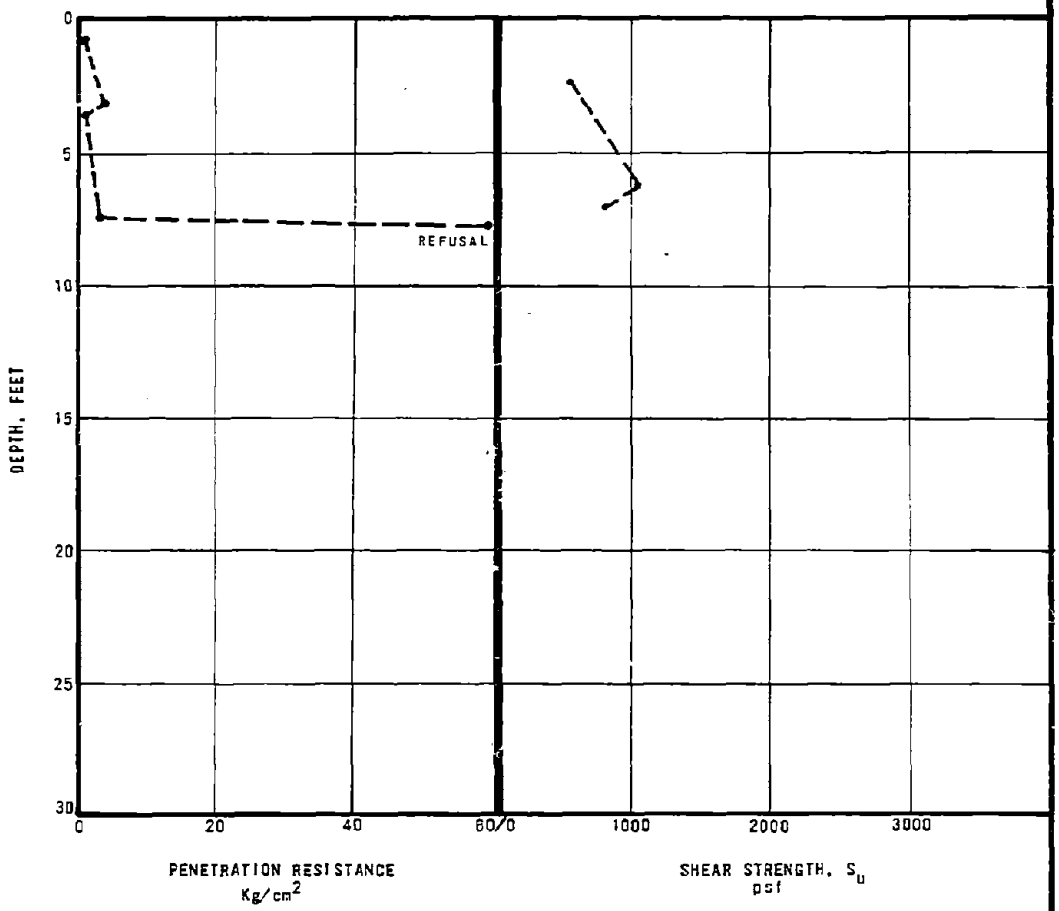
PV-1



W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

BUFFALO CREEK DAM NO.3

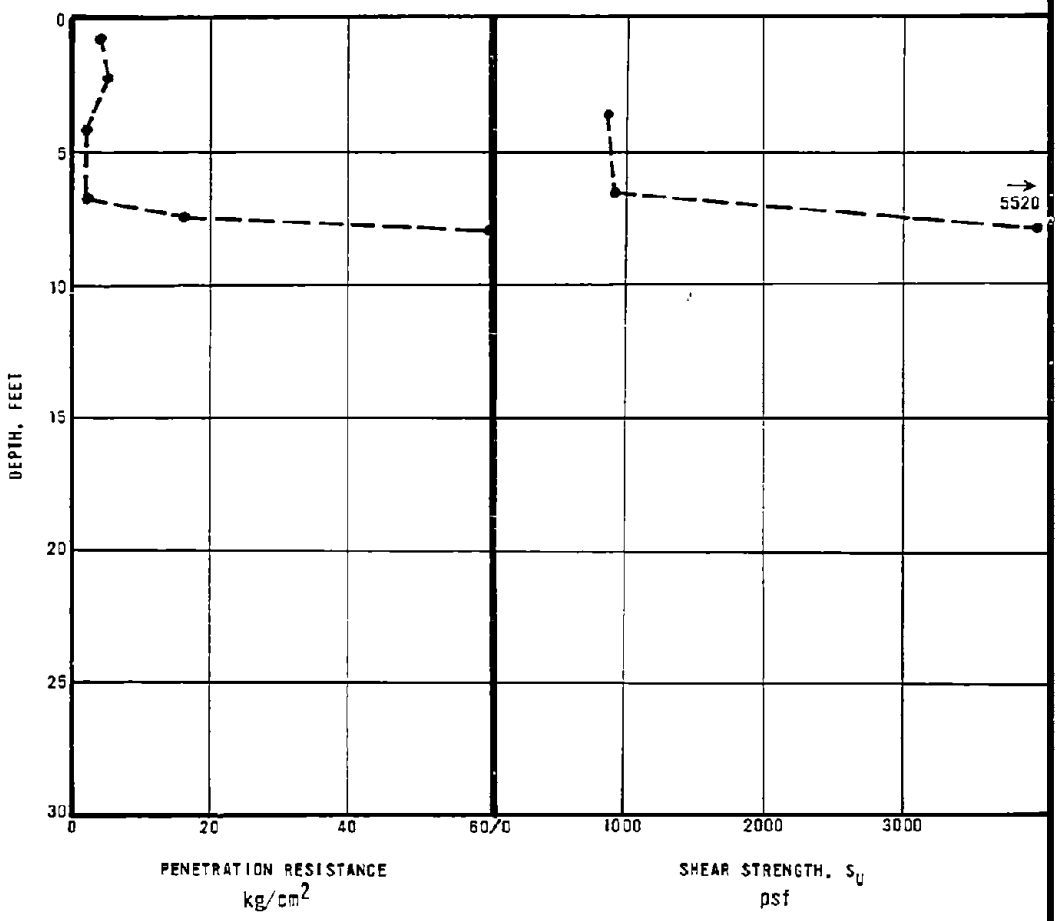
PV-2



W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

BUFFALO CREEK DAM NO.3

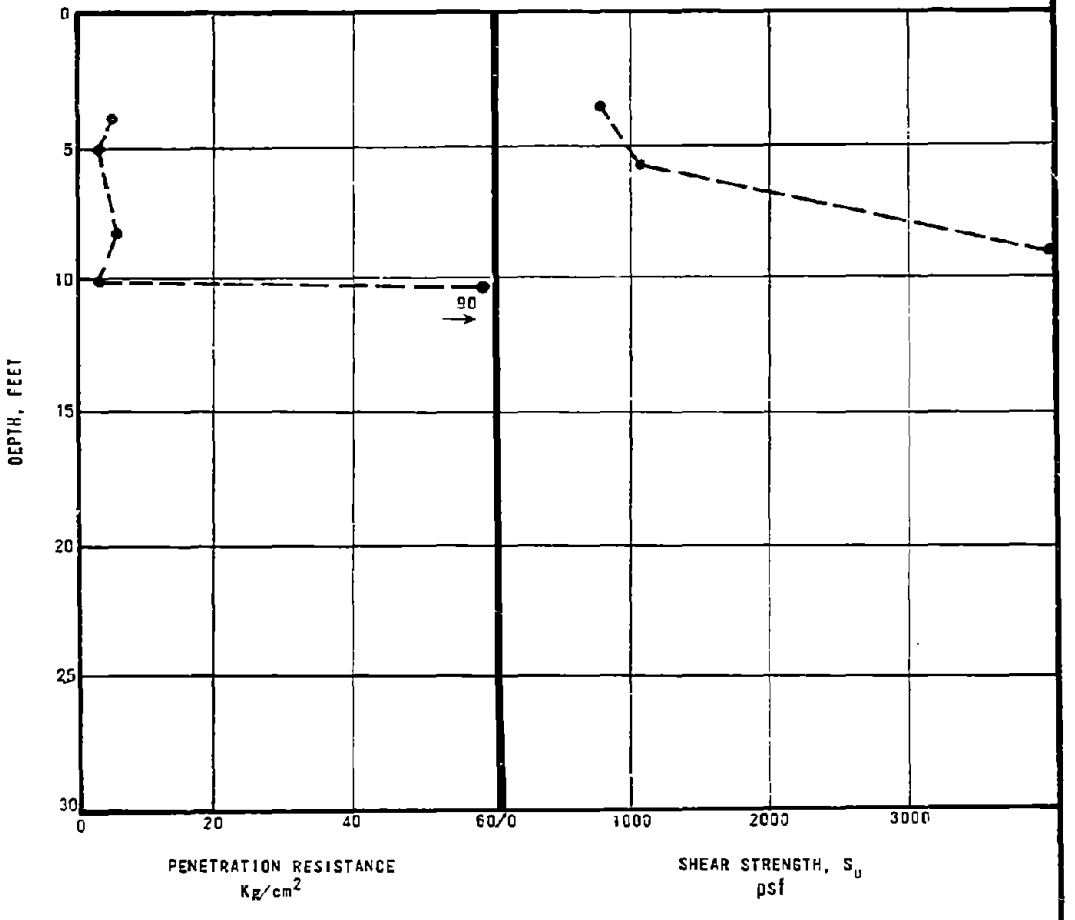
PV-3



W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

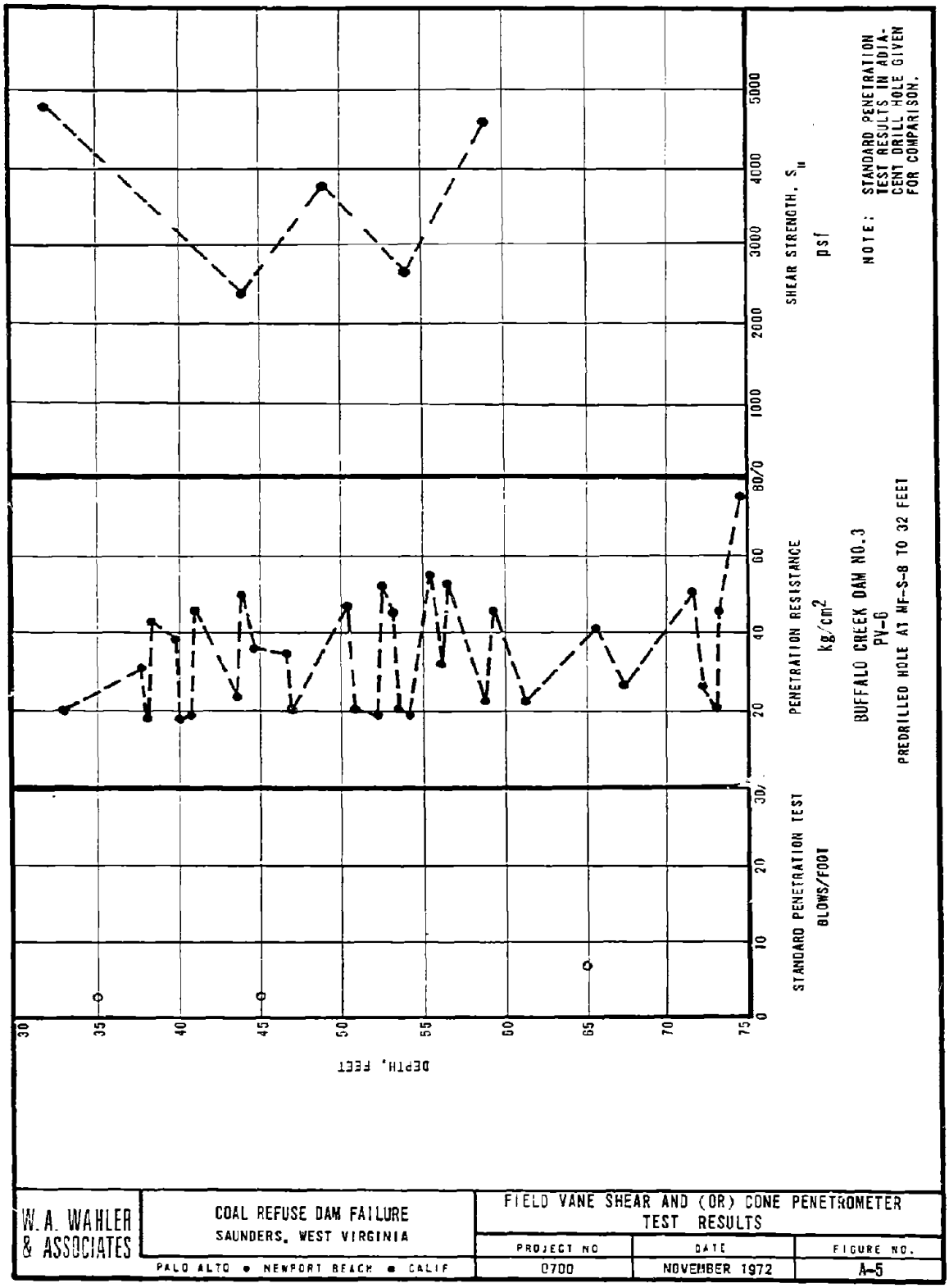
BUFFALO CREEK DAM NO.3

PV-4

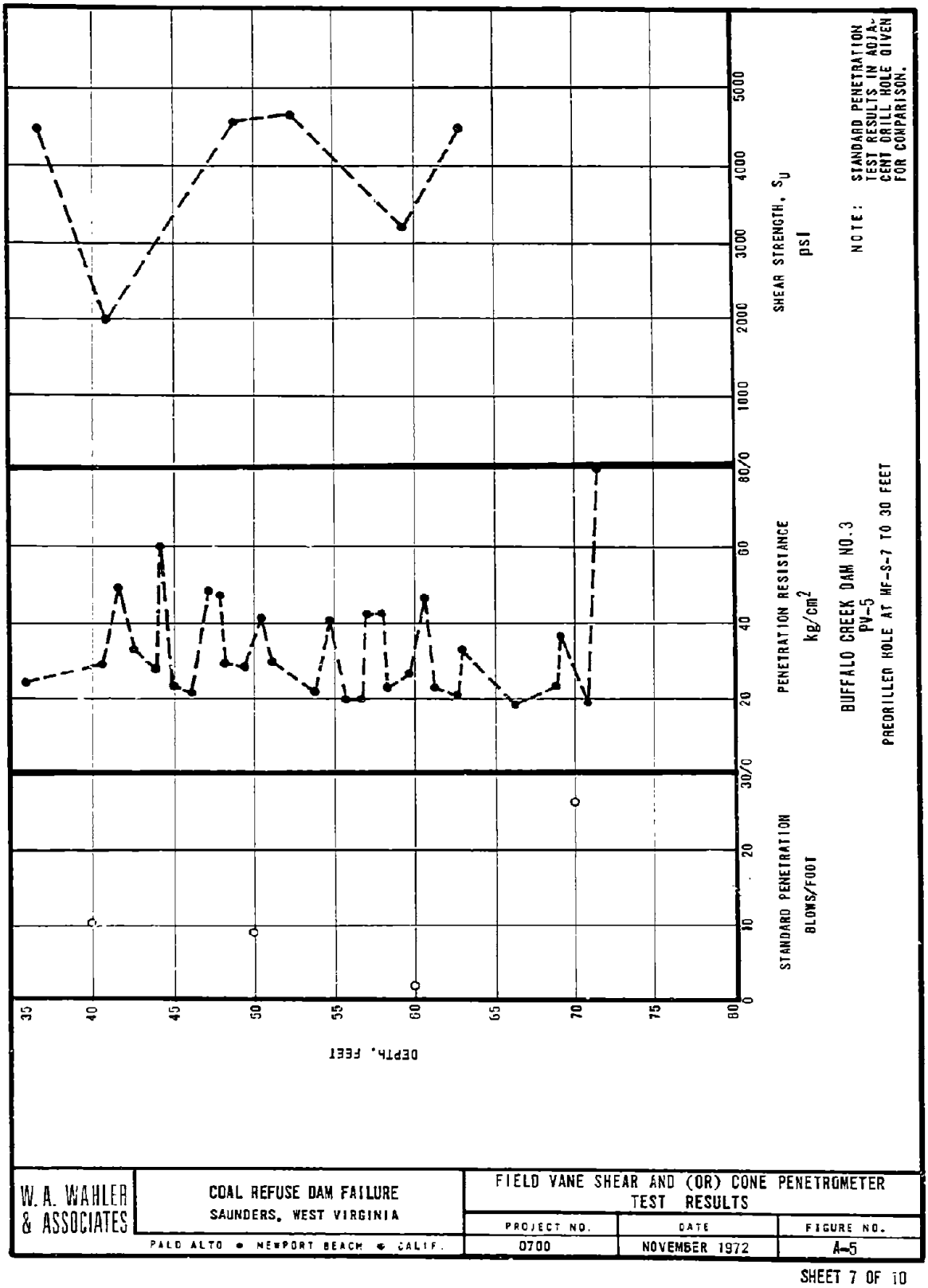


W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

SHEET 5 OF 10



W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
		PROJECT NO	DATE	FIGURE NO.
PALO ALTO • NEWPORT BEACH • CALIF		0700	NOVEMBER 1972	A-5

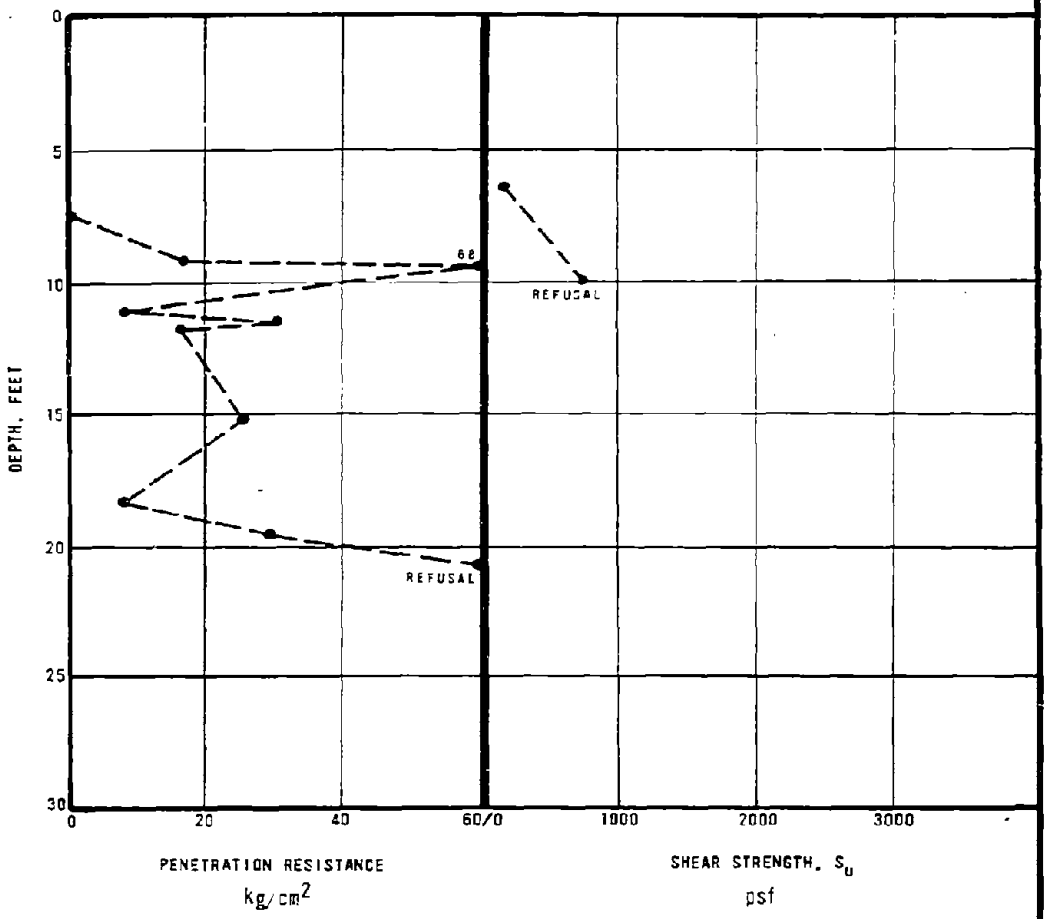


W. A. WAHLER & ASSOCIATES PALO ALTO • NEWPORT BEACH • CALIF.	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS	
		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

SHEET 7 OF 10

BUFFALO CREEK DAM NO 4,

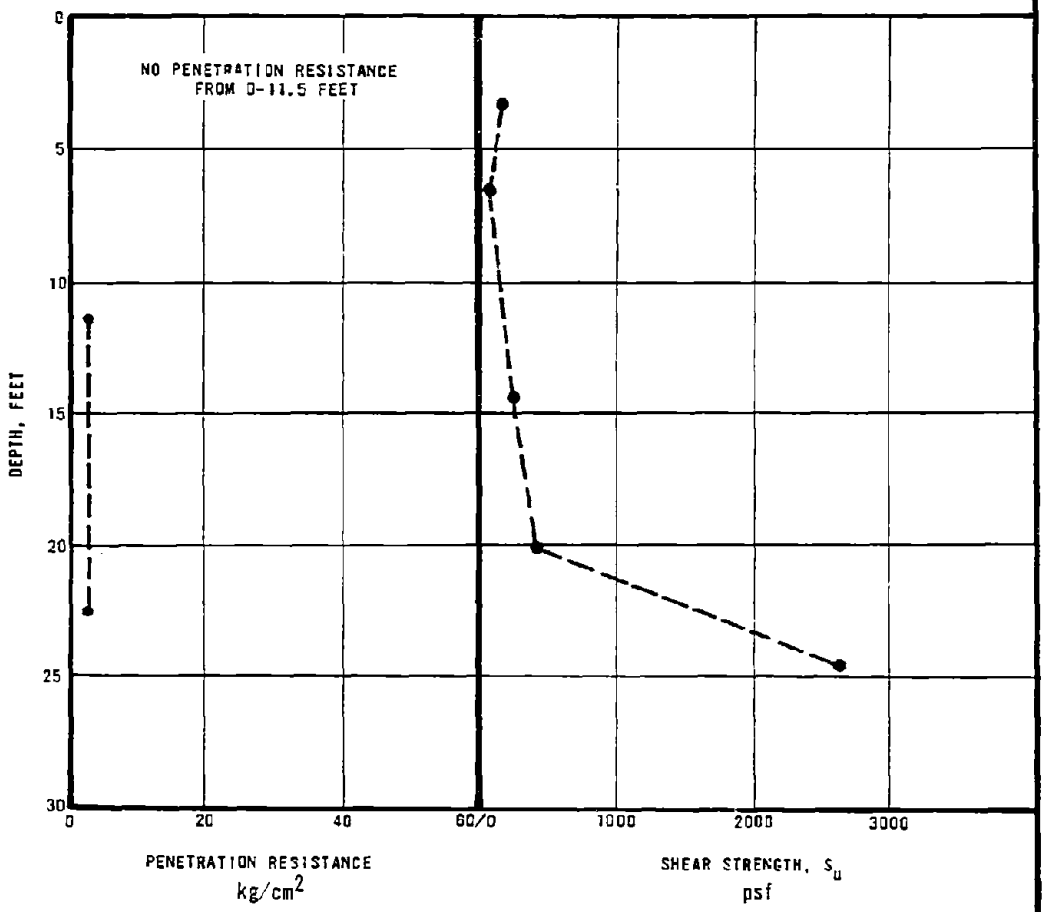
PV-1



W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

BUFFALO CREEK DAM NO.4

PV-2

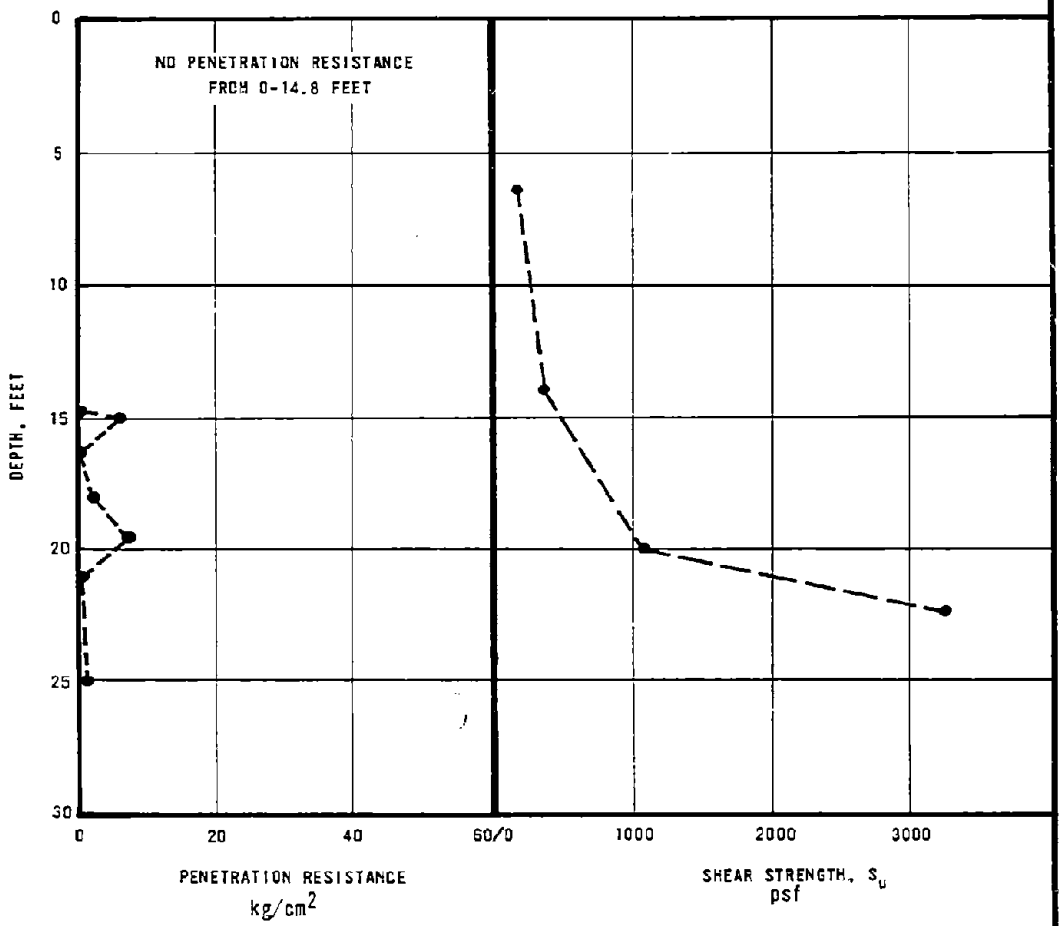


W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

SHEET 9 OF 10

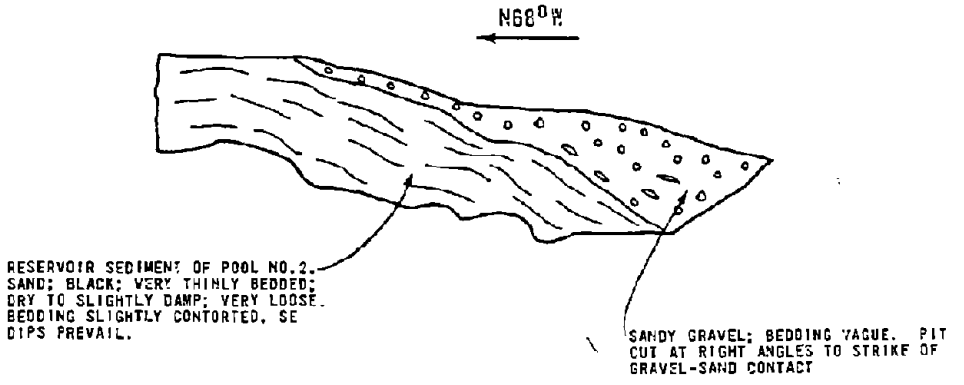
BUFFALO DAM NO.4

PV-3

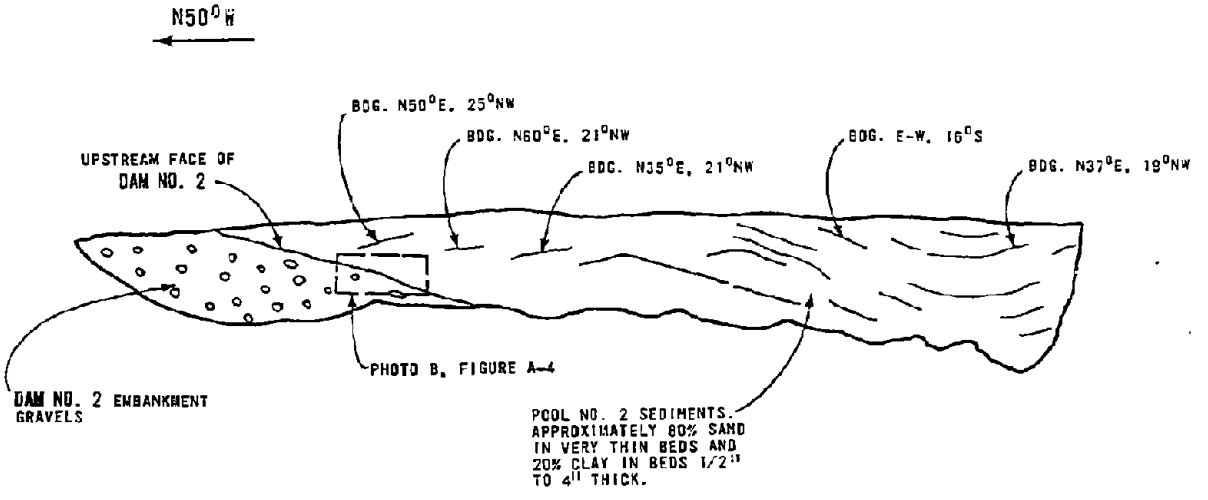


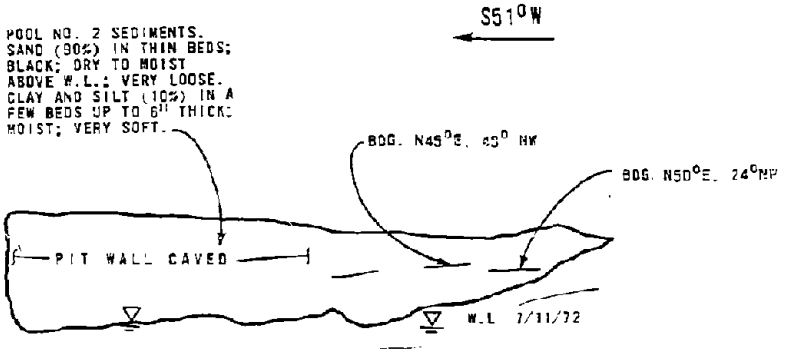
W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	FIELD VANE SHEAR AND (OR) CONE PENETROMETER TEST RESULTS		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-5

PIT NO. 1
NORTHEAST WALL



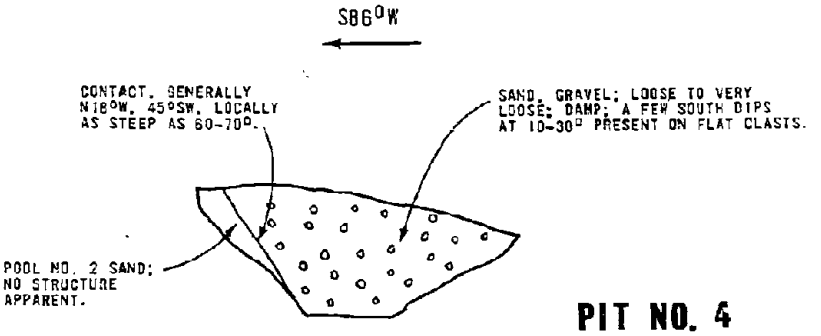
PIT NO. 2
NORTHEAST WALL





PIT NO. 3
NORTHWEST WALL

(PIT CUT SUB-PARALLEL TO STRIKE OF BEDDING. STRUCTURE OF SEDIMENTS IS OBSCURE LARGELY FOR THIS REASON.)



G. N37°E, 19°NW

PIT NO. 4
NORTH WALL

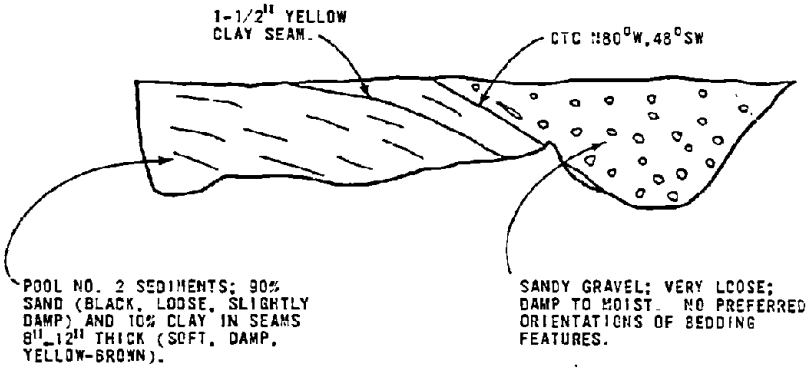
SCALE
10 0 10 FEET
HORIZONTAL = VERTICAL

SEE SHEET 3 FOR NOTES AND ABREVIATIONS.

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	BACKHOE PIT LOGS		28
		PROJECT NO.	DATE	FIGURE NO.
PALO ALTO NEWPORT BEACH CALIF		0700	NOVEMBER 1972	A-6

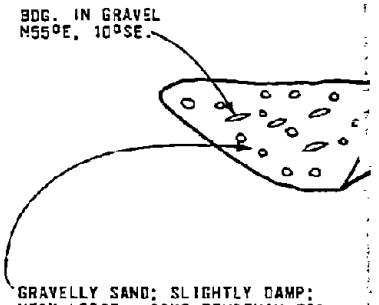
PIT NO. 5
EAST WALL

N2°E



S55°E

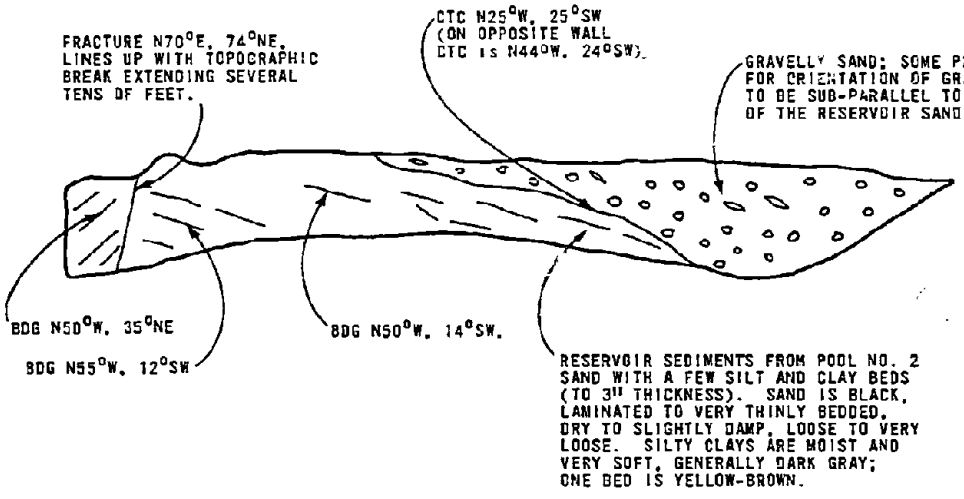
PIT
SOUTHWE



PIT NO. 6
SOUTHEAST WALL

N19°E

DUE N

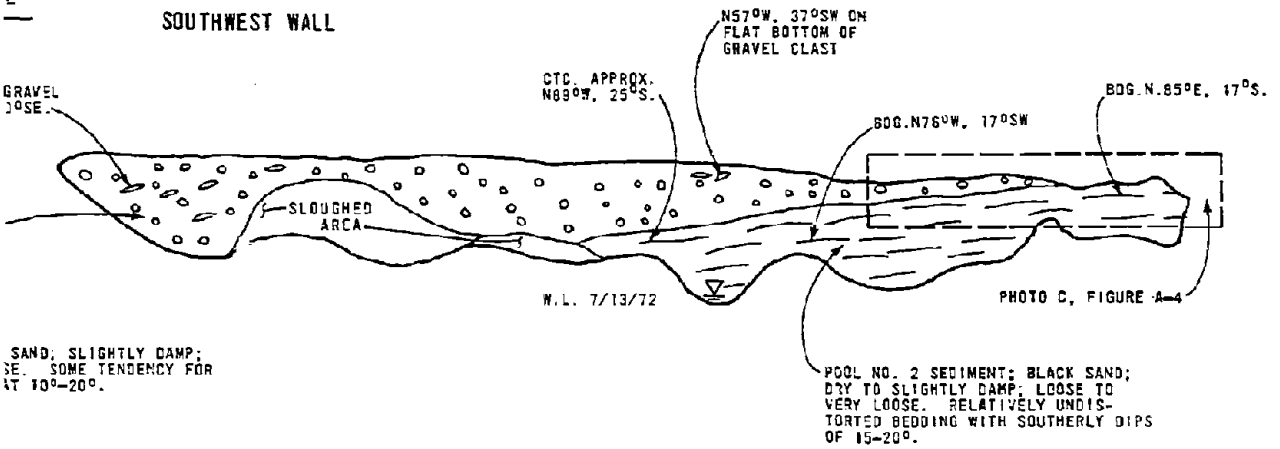


POOL
BLACK;
DAMP;

W.
&

E

PIT NO. 7
SOUTHWEST WALL



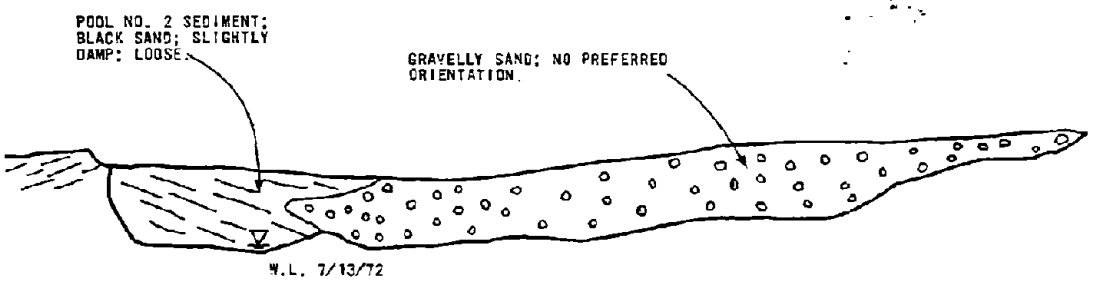
GRAVEL
OSE.

SAND; SLIGHTLY DAMP;
SE. SOME TENDENCY FOR
AT 10°–20°.

POOL NO. 2 SEDIMENT; BLACK SAND; DRY TO SLIGHTLY DAMP; LOOSE TO VERY LOOSE. RELATIVELY UNDISTORTED BEDDING WITH SOUTHERLY DIPS OF 15–20°.

PIT NO. 8
EAST WALL

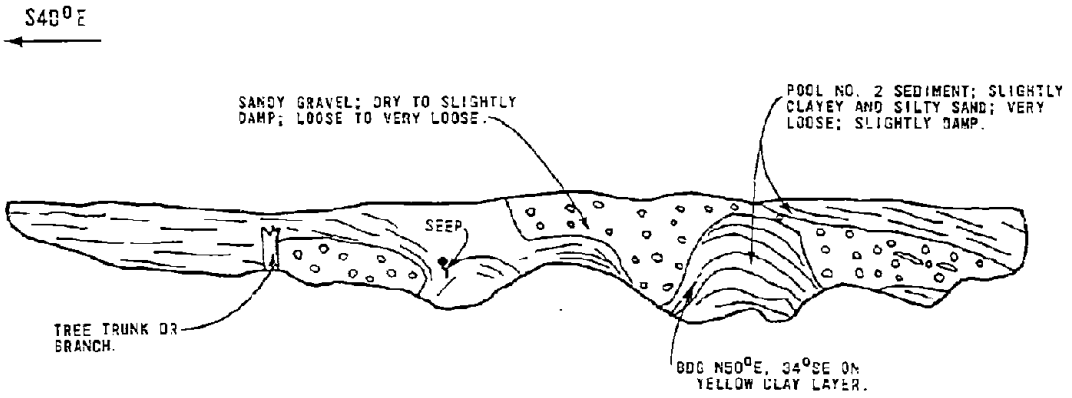
DUE N ←



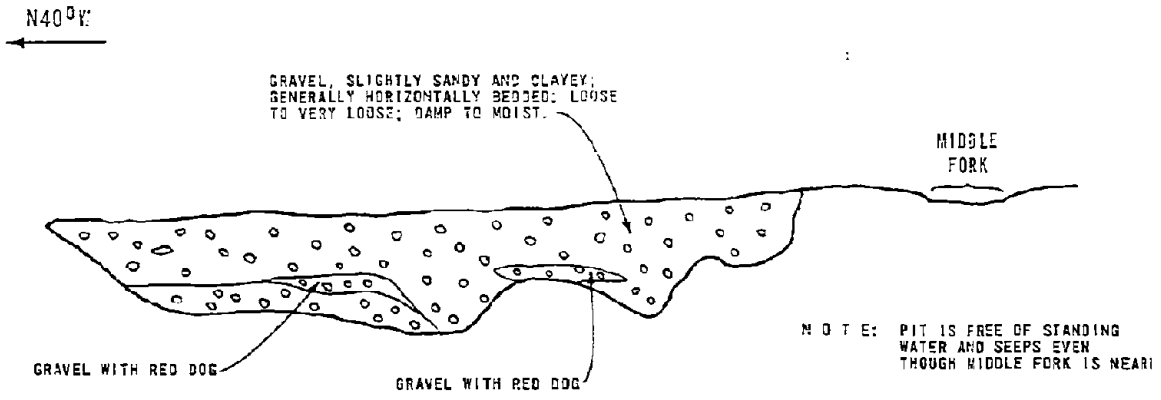
SCALE
10 0 10 FEET
HORIZONTAL = VERTICAL

SEE SHEET 3 FOR NOTES AND ABBREVIATIONS.

W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	BACKHOE PIT LOGS		
PALO ALTO NEWPORT BEACH CALIF		PROJECT NO.	DATE	FIGURE NO.
		0700	NOVEMBER 1972	A-6



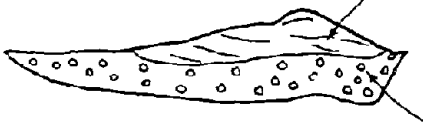
PIT NO. 9
SOUTHWEST WALL



PIT NO. 10
NORTHEAST WALL

N41°W

EDIMENT; SLIGHTLY
ILTY SAND; VERY
TLY DAMP.



SAND SLUDGE "RAFT", CONTORTED BEDDING GENERALLY DIPPING 30° OR LESS, SLIGHTLY DAMP, LOOSE TO VERY LOOSE.

GRAVEL, CLEAN; NO BLACK SAND; HORIZONTAL BEDDING; DAMP TO WET; VERY LOOSE.

PIT NO. 11
NORTHEAST WALL

NOTES:
1. SOIL DESCRIPTIONS ARE BASED ON UNIFIED SOIL CLASSIFICATION (SEE KEY TO DRILL HOLE LOGS IN THIS APPENDIX).
2. ABBREVIATIONS: BDG = BEDDING ATTITUDE
   CTC = CONTACT
3. FIRST FIGURE OF BEDDING ATTITUDE IS THE STRIKE, SECOND FIGURE IS THE DIP. EXAMPLE: BDG N50°E, 34°SE = BEDDING ATTITUDE: STRIKE N50°E, DIP 34°SE.
4. FOR LOCATION OF BACKHOE PITS SEE DRAWING NO. VI-20.

MIDDLE
FORK

IS FREE OF STANDING
TER AND SEEPS EVEN
OUGH MIDDLE FORK IS NEARBY.

SCALE
10 0 10 FEET
HORIZONTAL = VERTICAL

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	BACKHOE PIT LOGS 30		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO NEWPORT BEACH CALIF.	0700	NOVEMBER 1972	A-8

TABLE NO. A-1

DRILL HOLE SUMMARY

[FOR NOTES AND ABBREVIATIONS, SEE SHEET 2 OF 3]

HOLE NO.	DATE(S) DRILLED	TOTAL DEPTH (ft)	DEPTH TO... (ft)			ELEVATION AT COLLAR (ft)	LOCATION
			SLUDGE	SOIL TOP	BEDROCK SURFACE		
S-1	4/5-8/72	41.5	N.E.	29.0	32.5	1764.5	DAM NO. 3, LEFT ABUTMENT
2	4/6-12/72	56.0	N.E.	39.0	43.5	1763.6	DAM NO. 3, LEFT ABUTMENT
3	4/13-18/72	66.0	N.E.	?	47.0	1762.5	DAM NO. 3, LEFT ABUTMENT
4	4/19-5/6/72	126.0	58.0	111.0	113.0	1692.0	DAM NO. 2, REFUSE BANK
5	6/25-27/72	111.8	56.0	96.0	100.5	1690.0	DAM NO. 2, NOSE REMNANT
6	5/8-10/72	51.5	33.0E	34.0E	36.5	1706.0	DAM NO. 3, RIGHT CHANNEL
7	5/12-16/72	106.0	28.0E	80.0E	83.0	1702.0	DAM NO. 3, CENTER CHANNEL
8	5/17-18/72	86.0	32.0	69.0E	70.0	1707.0	DAM NO. 3, LEFT CHANNEL
9	5/10-22/72	105.0	34.0	?	86.0	1704.0	DAM NO. 3, CENTER CHANNEL UPSTREAM
10	5/24-6/2/72	120.0	75.0	?	109.5	1701.0	DAM NO. 3, CENTER CHANNEL DOWNSTREAM
11	6/5-9/72	120.5	79.0	108.0	112.0	1703.0	DAM NO. 3, CENTER CHANNEL DOWNSTREAM TOE
12	6/28/7/10-14/72	174.0	N.E.	N.E.?	28.0	1750.0	DAM NO. 3, RIGHT ABUTMENT
13	7/13-19/72	115.0	N.E.	94.0	102.0	1657.0	DAM NO. 1, LEFT ABUTMENT REFUSE BANK
14	7/19-24/72	115.5	34.0	104.0	115.5	1692.0	POOL 2
15	7/19-25/72	76.0	27.5	N.E.?	74.0	1657.0	POOL 1
16	7/27/72	81.5	68.0	80.5	81.5	1700.0	DAM NO. 3, CENTER CHANNEL DOWNSTREAM
17	7/24-25/72	70.0	33.0	N.E.	60.0	1700.0	POOL 2, LEFTSIDE
18	7/27-28/72	66.5	65.5	N.E.	N.E.	1695.0	POOL 2, CENTER, UPPER END
19	7/25-26/72	70.0	48.5	N.E.	68.0	1668.0	POOL 2, RIGHT SIDE
20	7/27-28/72	14.0	N.E.	N.E.	N.E.	1763.0	DAM NO. 3, LEFT ABUTMENT
21	7/27/72	85.5	50.0	N.E.	N.E.	1701.0	DAM NO. 3, CENTER CHANNEL DOWNSTREAM
22	7/31/72	41.5	40.0	N.E.	N.E.	1701.0	DAM NO. 3, CENTER CHANNEL DOWNSTREAM
TOTAL	----------	1879.8					
BS-1	5/2/72	31.4	N.E.	~28.0	31.4	1763.4	DAM NO. 3, LEFT ABUTMENT
2	5/2/72	26.5	N.E.	~24.0	26.5	1764.0	DAM NO. 3, LEFT ABUTMENT
3	5/2/72	25.7	N.E.	~22.0	25.7	1764.3	DAM NO. 3, LEFT ABUTMENT
4	5/2/72	26.0	N.E.	~23.0	26.0	1765.0	DAM NO. 3, LEFT ABUTMENT
5	5/2/72	37.0	N.E.	~35.0	37.0	1696.0	DAM NO. 2, REFUSE BANK
6	5/2,6/23/72	81.0	~60.0	~79.0	~80.0	1694.0	DAM NO. 2, REFUSE BANK
7	5/2,6/24/72	125.0	~60.0	95E	100E	1693.0	DAM NO. 2, REFUSE BANK
8	5/2/72	15.0	N.E.	N.E.?	10-15E	1705.0	DAM NO. 3, RIGHT CHANNEL AREA
9	5/3,10/72	97.5	~30.0	?	67.5	1704.0	DAM NO. 3, CENTER CHANNEL AREA
10	5/3,10/72	89.0	?	?	89.0	1704.0	DAM NO. 3, CENTER CHANNEL AREA
11	5/3/72	58.0	N.E.?	54.0E	58.0	1716.0	DAM NO. 3, LEFT CHANNEL AREA
12	5/2/72	39.5	N.E.	36.0E	39.5	1728.0	DAM NO. 3, LEFT CHANNEL AREA
13	5/2,11/72	81.0	~30.0	80.5E	81.0	1706.0	DAM NO. 3, CENTER CHANNEL AREA
14	5/3,11/72	99.5	?	90-98E	99.5	1700.0	DAM NO. 3, CENTER CHANNEL AREA
15	5/3/72	40.5	N.E.?	?	40.5	1702.0	DAM NO. 3, RIGHT CHANNEL AREA

TABLE NO. A-1 — CONTINUED

DRILL HOLE SUMMARY

HOLE NO.	DATES(S) DRILLED	TOTAL DEPTH (ft)	DEPTH TO...(ft)			ELEVATION AT COLLAR (ft)	LOCATION
			SLUDGE	SOIL TOP	BEDROCK SURFACE		
BS-16	5/3/72	46.5	?	?	46.5	1709.0	DAM NO. 3, RIGHT CHANNEL AREA
17	5/3,11/72	64.5	?	?	64.0E	1698.0	DAM NO. 3, LEFT CHANNEL AREA
18	5/3/72	36.5	N.E.?	?	36.5	1720.0	DAM NO. 3, LEFT CHANNEL AREA
19	7 18/72	20.5	----	?	20.5E	1500.0	TOE OF REFUSE BANK AT BUFFALO CREEK.
TOTAL	----------	1012.6					
P-1	5 4 72	65.0				1692.0	5' WEST OF S-4
2	5 23/72	35.0				1702.0	ADJACENT TO S-7
3	5/23/72	35.0				1707.0	ADJACENT TO S-8
4	5 23 72	35.0				1702.0	ADJACENT TO S-7
5	5 23 72	35.0				1707.0	ADJACENT TO S-8
TOTAL	----------	205.0					

NOTES

1. FOR LOCATION OF DRILL HOLES, EXCEPT BS-19 SEE FIGURE VI-20 BS-19 IS SHOWN ON FIGURE III-3A
2. ELEVATIONS ARE APPROXIMATE; THEY MAY NOT MATCH THE INDICATED ELEVATION ON FIGURE VI-20 DUE TO PAD CUT OR FILL.
3. ABBREVIATIONS AND SYMBOLS: N.E = NOT ENCOUNTERED· E = ESTIMATED; ~ = APPROXIMATE; ? = NOT DETECTED OR UNKNOWN
4. SEE FOLLOWING PAGE FOR FP SERIES HOLES.

TABLE NO. A-1 —CONTINUED

DRILL HOLE SUMMARY

HOLE NO.	DATE(S) DRILLED	TOTAL DEPTH (ft)	$K_{20°C}$ (cm/sec)	LOCATION
FP-1A	5/12/72	20.0	2.42×10^{-4}	ALL FP-SERIES HOLES ARE ON THE LEFT ABUTMENT REMNANT OF DAM NO. 3 AND THEIR LOCATIONS ARE PLOTTED ON FIGURE VI-20.
2A	5/15/72	40.0	----*	
3A	5/24-25/72	10.5	----*	
4A	5/31/72	25.0	----*	
5A	6/2/72	35.5	----*	
6A	7/17/72	15.0	*	
7A	7/18/72	15.0	2.17×10^{-4}	2 TESTS IN FP-7A
7A	7/20/72		1.79×10^{-4}	
8A	7/21/72	15.2	1.35×10^{-4}	
9A	7/26-27/72	4.9	**	
10A	7/25-26/72	4.5	4.64×10^{-5}	
11A	7/24-25/72	4.0	4.83×10^{-5}	
12A	7/27/72	6.8	*	
13A	7/26/72	4.9	2.85×10^{-4}	
14A	7/31/72	4.2	4.15×10^{-4}	
TOTAL	----------	205.5		
GRAND TOTAL	----------	3302.9		

* NO USEFUL DATA OBTAINED. SEE FIELD PERMEABILITY TEST RESULTS IN THIS APPENDIX FOR DETAILS.

** STANDARD TEST NOT RUN, BUT A TRAVEL-TIME TEST WAS MADE SEE FIELD PERMEABILITY TEST RESULTS HEREIN

W.A. WAHLER & ASSOCIATES

TABLE A-2

SUMMARY OF FIELD DENSITY TEST RESULTS

TEST NO.	LOCATION**	DEPTH (ft)	SAMPLE DESCRIPTION	FIELD		LABORATORY*		FIELD DENSITY AS % OF LAB. MAX.
				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT(%)	MAXIMUM DRY DENSITY(pcf)	
1	BC-3, 155' UPSTREAM FROM ℄ FROM LEFT ABUTMENT.	0.5	DARK GRAY, SILTY SAND (SM)	7.9	100.6	11.0	96.8	104.0
2	SAME AS ABOVE	1.5	SAME AS ABOVE	7.2	99.8	11.0	96.8	103.0
3	29' UPSTREAM FROM ℄ FROM LEFT ABUTMENT OF BC-3.	0.5	SAME AS ABOVE	8.4	81.3	11.0	96.8	84.0
4	37' DOWNSTREAM FROM ℄ FROM LEFT ABUTMENT OF BC-3.	0.5	SAME AS ABOVE	7.6	93.8	11.0	96.8	97.0
5	SAME AS ABOVE	1.5	SAME AS ABOVE	9.4	97.0	11.0	96.8	100.0
6	142' DOWNSTREAM FROM ℄ FROM LEFT ABUTMENT OF BC-3.	0.5	SAME AS ABOVE	8.0	88.6	11.0	96.8	92.0
7	SAME AS ABOVE	1.5	SAME AS ABOVE	9.6	80.2	11.0	96.8	83.0
8	GOB PILE AT BC	0.5	DARK GRAY, SILTY SAND (SM)	9.0	99.2	7.5	106.2	93.0
9	SAME AS ABOVE	1.5	SAME AS ABOVE	7.6	100.6	7.5	106.2	95.0
10	TAILS BY LEFT ABUTMENT OF BC-2***	0.5	BLACK, SANDY SILT (ML)	36.8	50.1	9.0	56.4	89.0
11	NATURAL MATERIAL ON SLOPE ABOVE BC-2.	0.3	LIGHT BROWN, GRAVELLY, SANDY SILT (ML)	20.7	60.0	12.5	118.2	51.0
12	SMALL REMNANT OF BC-1	1.0	DARK GRAY, SILTY SAND (SM)	6.8	98.6	7.7	106.2	91.0
13	TAILS AT BC-2 LEFT ABUTMENT, 25' UPSTREAM OF HOLE #4.***	0.8	BLACK, SANDY SILT (ML)	35.2	37.6	9.0	56.0	67.0

* COMPACTIVE ENERGY = 20,000 FT.LB./FT^3.

** SEE FIG. VI-20 FOR TEST LOCATION.

*** POSSIBLY DISTURBED - TEST TAKEN IN TRANSLATED MASS.

W. A. WAHLER & ASSOCIATES

TABLE A-2—CONTINUED

SUMMARY
OF
FIELD DENSITY TEST RESULTS

TEST NO.	LOCATION**	DEPTH (ft)	SAMPLE DESCRIPTION	FIELD		LABORATORY*		FIELD DENSITY AS % OF LAB. MAX.
				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT(%)	MAXIMUM DRY DENSITY(pcf)	
14	TAILS AT BC-2 LEFT ABUTMENT, 25' UPSTREAM OF HOLE #4***	0.8	BLACK, SANDY SILT (ML)	45.0	45.6	9.0	56.0	81.0
15	GOB PILE, LOWER SECTION	1.0	DARK GRAY, SILTY SAND (SM)	13.4	64.1	7.5	106.2	60.0
16	NATURAL MATERIAL ABOVE LEFT ABUTMENT BC-3.	0.4	LIGHT BROWN, GRAVELLY, SANDY SILT (ML)	18.9	82.5	12.5	118.2	70.0
1A	BC-4 TAILS, 50' UPSTREAM FROM CREST.	0	BLACK, SILTY SAND (SM)	32.1	77.4	20.0	74.3	104.0
2A	BC-4 TAILS, 100' UPSTREAM, 10' FROM RIGHT ABUTMENT.	0	SAME AS ABOVE	24.3	58.4	20.0	74.3	79.0
3A	BC-4 CREST, ℄, 25' IN FROM LEFT ABUTMENT.	1.0	LIGHT GRAY, SILTY GRAVEL (GM)	7.5	99.8	10.0	110.2	91.0
4A	BC-4 CREST, ℄, 10' IN FROM RIGHT ABUTMENT.	1.0	SAME AS ABOVE	10.4	107.6	10.0	110.2	98.0
5A	BC-3 RIGHT ABUTMENT, 15' UPSTREAM FROM ℄.	1.0	LIGHT GRAY, SILTY SAND (SM)	5.5	98.4	11.0	104.2	94.0
6A	BC-3 RIGHT ABUTMENT, 20' DOWNSTREAM FROM ℄.	1.0	SAME AS ABOVE	6.9	91.4	11.0	104.2	88.0
7A	BC-3 DOZER CUT TRENCHES IN CHANNEL EMBANKMENT.	5.1	LIGHT GRAY, SILTY, SANDY GRAVEL (GM-GP)	9.5	84.2	10.0	118.3	71.0
8A	SAME AS ABOVE	6.8	SAME AS ABOVE	6.8	104.7	10.0	118.3	89.0
9A	SAME AS ABOVE	4.3	SAME AS ABOVE	7.9	96.9	10.0	118.3	82.0
10A	SAME AS ABOVE	3.9	SAME AS ABOVE	5.8	90.5	10.0	118.3	77.0
11A	SAME AS ABOVE	3.5	SAME AS ABOVE	6.0	100.6	10.0	118.3	85.0

* COMPACTIVE ENERGY = 20,000 FT.LB./FT^3

** SEE FIG. VI-20 FOR TEST LOCATIONS.

*** POSSIBLY DISTURBED - TEST TAKEN IN TRANSLATED MASS.

TABLE A-2--CONTINUED

SUMMARY
OF
FIELD DENSITY TEST RESULTS

TEST NO.	LOCATION**	DEPTH (ft)	SAMPLE DESCRIPTION	FIELD		LABORATORY*		FIELD DENSITY AS % OF LAB. MAX.
				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT(%)	MAXIMUM DRY DENSITY(pcf)	
12A	BC-3 DOZER CUT TRENCHES IN CHANNEL EMBANKMENT.	3.3	LIGHT GRAY, SILTY, SANDY GRAVEL (GM-GP)	4.7	96.7	10.0	118.3	82.0
13A	SAME AS ABOVE	3.1	SAME AS ABOVE	5.2	87.3	10.0	118.3	74.0
14A	BC-3 DOZER CUT TRENCH IN LEFT ABUTMENT.	5.0	LIGHT GRAY, SILTY, GRAVELLY SAND (SM-SP)	9.3	80.5	9.0	115.4	70.0
15A	SAME AS ABOVE	10.0	SAME AS ABOVE	8 2	93.5	9.0	115.4	81.0
16A	SAME AS ABOVE	15.0	SAME AS ABOVE	6.3	103.8	9.0	115.4	90.0
17A	SAME AS ABOVE	20.0	SAME AS ABOVE	5.0	88.8	9.0	115.4	77.0
18A	SAME AS ABOVE	35.0	LIGHT GRAY, SILTY, GRAVELLY SAND (SM)	11.4	84.0	9.0	94.6	89.0
19A	SAME AS ABOVE	30.0	BLACK, SILTY, SANDY GRAVEL (GM)	12.1	89.4	12.5	96.2	93.0
20A	SAME AS ABOVE	25.0	LIGHT GRAY, SILTY, GRAVELLY SAND (SM)	11.0	98.0	9.0	94.6	104.0
21A	SAME AS ABOVE	20.0	BLACK, SILTY, SANDY GRAVEL (GM)	10.5	92.0	12.5	96.2	96.0
22A	SAME AS ABOVE	15.0	LIGHT GRAY, SILTY, GRAVELLY SAND (SM)	9.4	83.4	9.0	94.6	88.0
23A	SAME AS ABOVE	10.0	BLACK, SILTY, SANDY GRAVEL (GM)	8.9	82.6	12.5	96.2	86.0
24A	BC-2 DOZER CUT TRENCH IN LEFT ABUTMENT.	22.0	LIGHT GRAY, WELL GRADED, SILTY GRAVEL (GW-GM)	11.1	89.4	7.8	126.5	84.0

* COMPACTIVE ENERGY = 20,000 FT.LB./FT^3.

** SEE FIG. VI-20 FOR TEST LOCATION.

W.A. WAHLER & ASSOCIATES

TABLE A-2—CONTINUED

SUMMARY
OF
FIELD DENSITY TEST RESULTS

TEST NO.	LOCATION**	DEPTH (ft)	SAMPLE DESCRIPTION	FIELD		LABORATORY*		FIELD DENSITY AS % OF LAB. MAX.
				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT(%)	MAXIMUM DRY DENSITY(pcf)	
25A	BC-7-DOZER TRENCH IN LEFT ABUTMENT	17.0	LIGHT GRAY, WELL GRADED, SILTY GRAVEL (GW-GM)	14.3	107.8	7.8	128.5	84.0
26A	SAME AS ABOVE	12.0	SAME AS ABOVE	4.0	111.9	7.8	128.5	87.0
27A	SAME AS ABOVE	7.0	SAME AS ABOVE	7.4	102.1	7.8	128.5	79.0
28A	SAME AS ABOVE	2.0	LIGHT GRAY, WELL GRADED, SILTY, GRAVELLY SAND (SW-SM)	6.4	83.4	8.2	97.4	86.0

* COMPACTIVE ENERGY = 20,000 FT.LB./FT^3.

** SEE FIG. VI-20 FOR TEST LOCATION.

327

TABLE A-2
Sheet 4 of 4

TABLE A-3

PENETRATION AND VANE SHEAR TEST RESULTS

(1) LOCATION OF PROBES

LOCATION	PROBE NUMBER
PRE-DRILLED HOLE @ DAM NO. 2; S-4	V-1
UPPER REACH OF POOL NO. 3	P-1, V-1
UPPER REACH OF POOL NO. 3	P-2, V-2
UPPER REACH OF POOL NO. 3	P-3, V-3
UPPER REACH OF POOL NO. 3	P-4, V-4
PRE-DRILLED HOLE @ DAM NO. 3; S-7	P-5, V-5
PRE-DRILLED HOLE @ DAM NO. 3; S-6	P-6, V-6
POOL BEHIND DAM NO. 4	P-1, V-1
POOL BEHIND DAM NO. 4	P-2, V-2
POOL BEHIND DAM NO. 4	P-3, V-3

NOTE: SEE FIGURE V1-20 FOR FIELD LOCATION.

(2) PENETROMETER TEST RESULTS

PROBE NO.	DEPTH		TOTAL RESISTANCE kg/cm^2	PROBE NO.	DEPTH		TOTAL RESISTANCE kg/cm^2
	M	FT.			M	FT.	
DAM NO. 3				DAM NO. 4			
P-1	0.2	0.7	3	P-1	2.3	7.5	0
	1.0	3.3	3		2.3	7.5	12
	1.3	4.3	2		2.8	9.2	17
	1.8	5.9	6		2.9	9.5	68
	2.0	6.6	1		3.4	11.2	8
	2.2	7.2	10		3.5	11.5	30
	2.4	7.9	4		3.6	11.8	16
	2.6	8.5	7		4.6	15.1	25
	3.0	9.8	80		5.6	18.4	8
P-2	0.2	0.7	1		5.9	19.4	29
	1.0	3.3	4		6.2	20.4	14
	1.1	3.6	1		6.5	21.3	71
	2.3	7.5	3	P-2	0 - 3.5	0 - 11.5	0
	2.4	7.9	70		3.5 - 7.0	11.5 - 23.0	2
P-3	0.2	0.7	4	P-3	0 - 4.5	0 - 14.8	0
	0.7	2.3	5		4.5	14.8	6
	1.3	4.3	2		5.0	16.4	0
	2.0	6.6	2		5.5	18.0	2
	2.3	7.5	4		5.9	19.4	7
	2.4	7.9	50		6.4	21.0	0
P-4	0.3	1.0	0		6.4	21.0	7
	1.2	3.9	5		7.6	25.0	1
	1.6	5.2	3				
	2.5	8.2	6				
	3.0	9.8	3				
	3.1	10.2	90				

TABLE A-3 —CONTINUED
PENETRATION AND VANE SHEAR TEST RESULTS—CONTINUED

(2) PENETROMETER TEST RESULTS—CONTINUED

PROBE NO.	DEPTH		TOTAL RESISTANCE kg/cm^2	PROBE NO.	DEPTH		TOTAL RESISTANCE kg/cm^2
	M	FT.			M	FT.	
DAM NO. 3				DAM NO. 3—CONTINUED			
P-5	10.1	33.1	20	P-6	10.9	35.8	24
	11.5	37.7	31		12.4	40.7	29
	11.6	38.0	18		12.7	41.7	49
	11.7	38.4	43		13.0	42.6	32
	12.1	39.7	39		13.4	44.0	27
	12.2	40.0	18		13.5	44.3	60
	12.4	40.7	19		13.7	45.0	23
	12.5	41.0	46		14.1	46.2	21
	13.3	43.6	23		14.4	47.3	48
	13.4	43.9	50		14.6	47.9	47
	13.6	44.6	36		14.7	48.2	29
	14.2	46.6	35		15.1	49.5	28
	14.3	46.9	20		15.4	50.5	41
	15.4	50.5	47		15.6	51.2	29
	15.5	50.8	20		16.4	53.8	21
	15.9	52.2	19		16.7	54.8	40
	16.0	52.5	52		17.0	55.8	19
	16.2	53.1	45		17.3	56.8	19
	16.3	53.5	20		17.4	57.1	42
	16.5	54.1	19		17.7	58.1	42
	16.9	55.4	55		17.8	58.4	22
	17.1	56.1	32		18.2	59.7	26
	17.2	56.4	53		18.5	60.7	46
	17.9	58.7	22		18.7	61.4	22
	18.1	59.4	45		19.1	62.7	20
	19.0	62.3	22		19.2	63.0	32
	20.0	65.6	41		20.2	66.3	18
	20.5	67.3	26		21.0	68.9	23
	21.8	71.5	50		21.1	69.2	36
	22.0	72.2	25		21.6	70.9	18
	22.2	72.8	20		21.8	71.5	80
	22.3	73.1	45				
	22.7	74.5	75				

(3) VANE SHEAR TEST RESULTS

PROBE NO.	TEST NO.	DEPTH		"A" VALUE IN.	VANE COEF. psf/IN.	SHEAR STRENGTH* psf
		M	FT.			
DAM NO. 2						
V-1	S-1	20.0	65.6	2.59	1300	3370
	S-2	21.0	68.9	2.78	1300	3620
	S-3	21.9	71.9	2.98	1300	3870
	S-3 (REMOLDED)	21.9	71.9	1.40	1300	1820
	S-4	23.1	75.8	1.75	1300	2270
	S-5	24.0	78.8	1.69	1300	2200
	S-6	24.9	81.7	1.05	1300	1360
	S-6 (REMOLDED)	24.9	81.7	0.82	1300	1070

* SHEAR STRENGTH = "A" VALUE x VANE COEFFICIENT. SEE APPENDIX A, SECTION E FOR INTERPRETATION.

TABLE A-3 —CONTINUED
PENETRATION AND VANE SHEAR TEST RESULTS—CONTINUED

(3) VANE SHEAR TEST RESULTS—CONTINUED

PROBE NO.	TEST NO.	DEPTH M	DEPTH FT.	"A" VALUE IN.	VANE COEF. psi/IN.	SHEAR STRENGTH *
		DAM NO. 2—CONTINUED				
V-1 CONT.	S-7	26.0	85.3	1.10	1300	1430
	S-8	27.0	88.6	1.24	1300	1610
	S-9	28.0	91.9	1.34	1300	1740
	S-9 (REMOLDED)	28.0	91.9	1.08	1300	1400
	S-10	29.0	95.2	1.87	1300	2430
	S-11	29.7	97.5	3.14	1300	4080
		DAM NO. 3				
V-1	S-1	1.0	3.3	0.44	1300	570
	S-2	2.0	6.6	0.73	1300	950
	S-3	3.0	9.8	3.26	1300	4240
	S-3 (REMOLDED)	3.0	9.8	2.87	1300	3730
	S-4	3.5	11.5	4.03	1300	5250
V-2	S-1	1.0	3.3	0.39	1300	510
	S-2	1.9	6.2	0.78	1300	1010
	S-3	2.2	7.2	0.62	1300	810
	S-3 (REMOLDED)	2.2	7.2	0.45	1300	590
V-3	S-1	1.0	3.3	0.66	1300	860
	S-2	2.0	6.6	0.69	1300	900
	S-3	2.9	9.5	4.25	1300	5520
	S-3 (REMOLDED)	2.9	9.5	4.07	1300	5280
V-4	S-1	1.0	3.3	0.55	1300	720
	S-2	1.8	5.9	0.81	1300	1050
	S-3	2.8	9.2	3.13	1300	4070
	S-3 (REMOLDED)	2.8	9.2	2.52	1300	3280
V-5	S-1	11.0	36.1	3.65	1300	4750
	S-2	13.2	43.3	1.83	1300	2380
	S-3	15.0	49.2	2.89	1300	3760
	S-3 (REMOLDED)	15.0	49.2	1.70	1300	2210
	S-4	16.5	54.1	2.02	1300	2620
	S-5	17.8	58.4	3.5 +	1300	4550+
	S-6	18.1	59.3	3.5 +	1300	4550+
	S-6 (REMOLDED)	18.1	59.3	3.5 +	1300	4550+
V-6	S-1	11.2	36.7	3.40	1300	4420
	S-2	12.5	41.0	1.53	1300	1990
	S-3	14.9	48.9	3.48	1300	4530
	S-3 (REMOLDED)	14.9	48.9	2.04	1300	2650

* SHEAR STRENGTH = "A" VALUE x VANE COEFFICIENT. SEE APPENDIX A., SECTION E FOR INTERPRETATION.

TABLE A-3—CONTINUED
PENETRATION AND VANE SHEAR TEST RESULTS—CONTINUED

(3) VANE SHEAR TEST RESULTS—CONTINUED

PROBE NO.	TEST NO.	DEPTH M	DEPTH FT.	"A" VALUE IN.	VANE COEF. psf/IN.	SHEAR STRENGTH *
DAM NO. 3—CONTINUED						
V-6 CONT.	S-4	16.0	52.5	3.55	1300	4620
	S-5	18.1	59.4	2.42	1300	3150
	S-6	19.3	63.3	3.44	1300	4470
	S-6 (REMOLDED)	19.3	63.3	1.65	1300	2150
DAM NO. 4						
V-1	S-1	2.0	6.6	0.21	1300	270
	S-2	2.4	7.9	1.41	1300	1830
	S-2 (REMOLDED)	2.4	7.9	0.26	1300	340
V-2	S-1	1.0	3.3	0.16	650	100
	S-2	2.0	6.6	0.11	650	70
	S-3	4.4	14.4	0.32	650	210
	S-3 (REMOLDED)	4.4	14.4	0.19	650	120
	S-4	6.1	20.0	0.61	650	400
	S-5	7.5	24.6	3.93	650	2560
V-3	S-1	2.0	6.6	0.10	1300	130
	S-2	4.2	13.8	0.25	1300	325
	S-3	6.0	19.7	0.80	1300	1040
	S-3 (REMOLDED)	6.0	19.7	0.62	1300	810
	S-4	6.9	22.6	2.48	1300	3220

* SHEAR STRENGTH = "A" VALUE x VANE COEFFICIENT. SEE APPENDIX A, SECTION E FOR INTERPRETATION.

DRILL RIG	CME MODEL 45	HOLE ELEVATION	1764.5	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 inches max.	DATE DRILLED	4/5 - 6/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
	GP-SP	EMBANKMENT FILL Mixture of about 40% gravel, 50% sand, and 10% (or less) fines. Gravel is carbonaceous siltstone, clay shale, slate, with minor sandstone. Overall, about 5% is oversize (over 3" max. dimension). Oversize and gravel tend to be blocky or platy. The sand is largely coal processing refuse and is also platy to angular-blocky in grain shape. Top 2 feet wet from recent rain; 2-20 ft; slightly damp; 20-28 damp, 28-29 damp to wet. Firmness indicated by standard penetrometer blow counts in remarks. Dark gray to black.	D-1	D	1/3/6 N=9
			D-2		4/4/4 N=8
			D-3		6/8/7 N=15
(5)			D-4		6/7/5 N=12
			D-5		7/9/9 N=18
			D-6		9/9/8 N=17
(10)			S-1	P	Recovery 2.0/2.0
			S-2		Recovery 2.0/2.0
			D-7	D	7/6/15 N=21
(15)			D-8		9/7/6 N=13
			S-3	P	Recovery 1.7/2.0
			S-4		Recovery 1.6/2.0
(20)			D-9	D	3/2/5 N=7
4/5-72			D-10		3/2/3 N=5
4/6/72			S-5	P	Recovery 1.3/2.0
(25)			D-11	D	5/9/5 N=14
			D-12		4/3/4 N=7
	SP-SC	SOIL Yellow-brown clayey sand, damp to wet, firm.	S-6	P	Recovery 1.6/2.0
(30)			D-13	D	3/3/9 N=12
			D-14		9/7/18 N=25
		BEDROCK - KANAWHA SERIES SANDSTONE (33.0-37.0) Tan, arkosic, thin-bedded, hard, strong, closely fractured.	Core - Box 1	Nx	Run - Recovery 33.0-36.5 2.7/3.5
(35)					36.5-41.5 3.8/5.0
		MUDSTONE (37.0-40.0) Tan, severly fractured, weak			
(40)					
4/6/72		SANDSTONE (40.0-41.5). Mottled hard, with scattered shells.			
		HOLE TERMINATED @ 41.5 FEET.			
(45)					

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
	PALO ALTO • NEWPORT BEACH • CALIF.	PROJECT NO	DATE	SHEET NO	S-1
		0700	APRIL 1972	1 OF 1	

DRILL RIG CME MODEL 45	HOLE ELEVATION 1763.6	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches max.	DATE DRILLED 4/6 - 12/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
4/6/72	GP-SP	EMBANKMENT FILL About 30% gravel, 60% sand, and 10%(?) fines, with local concentrations of sand and/or gravel. Dark gray to black. Gravel is largely carbonaceous siltstone and impure coal, with minor shale and slate. Gravel sizes tend to be angular and blocky, sand size material is flaky. Damp near the surface becoming dry to slightly damp at 15 feet and below. Minor pyrite present in some of the shale and coal fragments.	D-1	D	3/5/5 N=10
			D-2		5/11/15 N=26
(5)			D-3		19/23/22 N=45
			D-4		16/13/13 N=26
4/7/72			-	All	-
			S-1	P	Recovery 2.0/2.0
(10)			P-1	P	Recovery 0.5(?)/2.5 Sample extruded from tube on site
4/10/72			-	All	-
4/11/72					
(15)			S-2	P	Recovery 1.8/2.0
			D-5	D	2/8/7 N=15
			S-3	P	Recovery 1.5/2.0
(20)			D-6	D	5/4/2 N=6
			D-7		4/5/4 N=9
			S-4	P	Recovery 2.0/2.0
(25)			D-8	D	13/15/10 N=25
			D-9		6/4/4 N=8
			S-5	P	Recovery 1.9/2.0
(30)			D-10	D	4/4/7 N=11
			D-11		6/7/5 N=12
			S-6	P	Recovery 2.0/2.0
(35)			D-12	D	5/6/5 N=11
			D-13		4/7/5 N=12
4/12/72			S-7	P	Recovery 2.0/2.0
(40)	SM	SOIL Silty sand, yellow-brown, moist, firm, scattered gravel and silt concentrations.	D-14	D	3/5/8 N=13
			D-15		10/5/5 N=10
			S-8	P	Recovery 0.5/0.5
(45)		BEDROCK - KANAWHA SERIES SANDSTONE (43.5-46.2) Tan, arkosic, hard, strong, cross-bedded.	Core - Box 1	Nx Core Barrel	Recovery 0.7/2.5
					Run 46.0-51.0 Recovery 2.6/5.0
(50)		MUDSTONE (46.2-51.0) Tan, weak, severely fractured			

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO	DATE	SHEET NO	S-2
		0700	APRIL 1972	1 of 2	

DRILL RIG CME MODEL 45	HOLE ELEVATION 1763.6	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches max.	DATE DRILLED 4/6 - 12/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
4/12/72		MUDSTONE (46.2-51.0) (cont.)	Core - Box 1	Nx Core Barrel	See Page 1
		SILTSTONE (51.0-55.0) Dark gray, laminated, locally fissile. Tends to slake.			Run 51.0-56.0 Recovery 4.7/5.0
(55)		SANDSTONE (55.0-56.0) Mottled light-dark gray, scattered fossil shells. Hard.			
(60)		HOLE TERMINATED @ 56.0 FEET.			
		WATER GRAVITY FLOW TEST, 4/12/72, AUGER BIT AT 43.5 FEET; PUMPED 18.5 GPM INTO HOLE FOR 10 MIN. WATER LEVEL AFTER TEST (1600 HRS)=43.7 FEET. WATER LEVEL 0800 HRS 4/13/72 = 45.4 FEET.			

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO	DATE	SHEET NO	S-2
		0700	APRIL 1972	2 of 2	

DRILL RIG	CME MODEL 45	HOLE ELEVATION	1762.5	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	not encountered	HOLE DIAMETER	6 inches max.	DATE DRILLED	4/13 - 18/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
4/13/72		EMBANKMENT FILL Mixture of about 30% gravel and minor oversize (over 3 inches maximum dimension), 60+% sand, and up to 10% fines. Sand and gravel are locally each concentrated above the percentages given above. Gravel is largely carbonaceous siltstone, impure coal, and shale, with minor slate and sandstone. Gravel and oversize are blocky and slabby; subangular. Sand is generally flaky. Damp near the surface, dry to slightly damp at 5-42 feet, wet to moist at 42-46. Dark gray to black.	D-1	D	5/13/14 N=27
			D-2		11/11/11 N=22
			S-1	P	Recovery 1.2/1.3(Note 1)
(5)			-	All	-
			D-3	D	3/2/3 N=5
			D-4		4/5/3 N=8
			S-2	P	Recovery 1.3/1.3
(10)			-	All	-
			S-3	P	Recovery 1.5/2.0
			D-5	D	4/4/2 N=6
			D-6		2/2/3 N=5
(15)			S-4	P	Recovery 2.0/2.0 (Note 1)
			D-7	D	2/3/2 N=5
			D-8		2/2/3 N=5
(20)			S-5	P	Recovery 1.8/2.0
			D-9	D	7/6/5 N=11
			D-10		4/3/3 N=6
(25)			S-6	P	Recovery 2.0/2.0
4/13/72					
4/17/72			D-11	D	14/13/6 N=9
			D-12		6/6/11 N=17
(30)			S-7	P	Recovery 1.6/2.0
			D-13	D	7/5/5 N=10
			D-14		4/5/3 N=8
(35)			S-8	P	Recovery 1.0/2.0 (Note 1)
			D-15	D	4/7/4 N=11
			D-16		4/6/4 N=10
(40)			S-9	P	Recovery 2.0/2.0
			D-17	D	6/4/3 N=7
			D-18		5/4/7 N=11
(45)			S-10	P	Recovery 0.2/0.7(Note 1)
	SM	SOIL, silty sand, yel-brn.	D-19	D	4/4/4 N=8
			-	All	-
		BEDROCK - KANAWHA SERIES SANDSTONE (48.0-52.2) Tan, arkosic, fine to	Core - Box 1	Nx Core bbl.	Run 48.0-51.0 Recovery 1.0/3.0
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	SHEET NO.	S-3
		0700	APRIL 1972	1 OF 2	

DRILL RIG	CME MODEL 45	HOLE ELEVATION	1762.5	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	not encountered	HOLE DIAMETER	6 inches max.	DATE DRILLED	4/13 - 18/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		medium grained. Hard, fresh, strong. Bedding horizontal. Large mud-filled fracture @ 51.3-52.2.	Core - Box 1	Nx Core bbl.	[illegible]
		SILTSTONE (52.2-53.2) Gray, laminated, weak.			Run 51.0-56.0 Recovery 3.3/5.0
		SANDSTONE (53.2-59.0) Fine-grained, mottled light and dark gray, wavy bedding. Hard, fresh, strong. Fractures rare. Contains a few scattered calcareous fossil shells			Set 4" casing to 48.0 ft.
(55)					Run 56.0-61.0 Recovery 4.2/5.0 Drove 4" casing to 54.8 ft.
		COAL (59.0-61.3) Black, vertical fractures (open). Interval 59.8-61.3 not recovered.			
(60)					Run 61.0-66.0 Recovery 4.5/5.0
		SILTSTONE (61.3-66.0) Light gray, laminated, fracture spacing 0.2-0.8 ft. Fractures are nearly vertical. Initially coherent and moderately hard, but tends to slake and weaken on exposure.			
(65)					
		HOLE TERMINATED @ 66.0 FEET.			

NOTES:
1. SAMPLE REMOVED FROM TUBE FOR ON-SITE EXAMINATION.
2. NOTE CHANGE IN VERTICAL SCALE FROM PAGE 1 TO PAGE 2.
3. SEE FOLLOWING SHEETS FOR WATER PRESSURE TEST DATA.

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	SHEET NO.	S-3
		0700	APRIL 1972	2 OF 2	

HOLE S-3 WATER PRESSURE TESTS

Test #1

I. Data Compilation

A. Interval 65.0-66.0
Gravity Head: 70 feet
PSIG = 25

Minute No.	Gallons Taken	Cumulative Gallons
1	0.5	0.5
2	0.7	1.2
3	0.7	1.9
4	0.7	2.6
5	0.5	3.1
6	0.6	3.7
7	0.5	4.2
8	0.6	4.8
9	0.6	5.4
10	0.5	5.9

Interval 65.0-66.0
Gravity Head: 70 feet
PSIG = 50

Minute No.	Gallons Taken	Cumulative Gallons
1	0.7	0.7
2	0.7	1.4
3	0.9	2.3
4	0.7	3.0
5	0.7	3.7
6	0.9	4.6
7	0.6	5.2
8	0.7	5.9
9	0.8	6.7
10	0.7	7.4

PSIG = 100, other data same as above

Minute No.	Gallons Taken	Cumulative Gallons
1	2.6	2.6
2	2.6	5.2
3	2.4	7.6
4	2.5	10.1
5	2.5	12.6
6	2.4	15.0
7	2.4	17.4
8	2.3	19.7
9	2.4	22.1
10	2.3	22.4

PSIG = 25, other data same as above

Minute No.	Gallons Taken	Cumulative Gallons
1	0.4	0.4
2	0.4	0.8
3	0.6	1.4
4	0.6	2.0
5	0.7	2.7
6	0.6	3.3
7	0.7	4.0
8	0.6	4.6
9	0.6	5.2
10	0.6	5.8

Test #2

B. Interval 60.0-65.0
Gravity Head: 72.5 feet
PSIG 25

Minute No.	Gallons Taken	Cumulative Gallons
1	5.9	5.9
2	6.0	11.9
3	5.6	17.5
4	5.6	23.1
5	5.7	28.8
6	5.5	34.3
7	6.6	40.9
8	5.4	46.3
9	5.5	51.8
10	5.3	57.1
11	5.4	62.5
12	5.3	67.8

Test #2 Continued: PSIG = 50, Gravity Head: 72.5 feet, Interval 60.0-65.0 Attempted test at 50 PSIG but packer would not hold - or injected water travelled from the test interval through fractures to enter the drill hole above the top packer. Test terminated, packers reset for Test #3.

HOLE S-3, WATER PRESSURE TESTS--Continued

Test #3

C. Interval 60.0-66.0
Gravity Head: 73 feet

PSIG = 25

Minute No.	Gallons Taken	Cumulative Gallons
1	8.8	8.8
2	8.0	16.8
3	9.5	26.3
4	8.5	34.8
5	8.6	43.4
6	8.6	52.0
7	8.5	60.5
8	8.4	68.9
9	8.3	77.2
10	8.4	85.6

PSIG = 75, other data same as above

Minute No.	Gallons Taken	Cumulative Gallons
1	13.3	13.3
2	13.6	26.9
3	13.7	40.6
4	13.7	54.3
5	13.5	67.8
6	14.0	81.8
7	13.9	95.7
8	14.0	109.7
9	13.0	122.7
10	13.6	136.3

Note: 75 PSIG = Max. pressure obtainable with this pump for the interval.

Interval = 60.0-66.0
Gravity Head = 73 feet
PSIG 50

Minute No.	Gallons Taken	Cumulative Gallons
1	10.3	10.3
2	10.7	21.0
3	10.1	31.1
4	10.5	41.6
5	10.3	51.9
6	10.6	62.5
7	10.5	73.0
8	10.6	83.6
9	10.8	94.4
10	10.6	105.0

Interval 60.0-66.0
Gravity Head: 73 feet
PSIG = 25

Minute No.	Gallons Taken	Cumulative Gallons
1	6.5	6.5
2	6.3	12.8
3	5.6	18.4
4	6.3	24.7
5	6.5	31.2
6	6.4	37.6
7	6.5	44.1
8	6.4	50.5
9	6.5	57.0
10	6.4	63.4

Test #4

Interval 54.0-59.0

Attempted test, but packer would not hold. Since there were no other potentially testable intervals in the hole, the water pressure test program for hole 3 was terminated.

DRILL RIG CME MODEL 45 | HOLE ELEVATION 1692 | LOGGED BY RET & KP
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 inches | DATE DRILLED 4/19 - 5/5/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
4/19/72	GP	ROAD SURFACING (RED DOG)	D-1	D	18/20/12 N=32
	GP-SP	EMBANKMENT FILL	D-2		9/8/9 N=17
		Mixed gravel and sand with minor fines. Overall about 30% gravel, 60% sand, 5% oversize, 5-% fines. Local concentrations of sand or gravel exist. Material is largely coal processing refuse and the gravel & oversize fragments are largely carbonaceous shale, slate, and minor coal. Sand and fines are largely coal. Gravel and oversize fragments are generally angular and blocky; sand is flaky. Dark gray to black. Consistency given by blow counts.	D-3		10/4/5 N=9
(5)			-	Att	-
			S-1	P	Recovery 2.0/2.0
			D-4	D	7/6/5 N=11
			D-5		7/5/5 N=10
(10)			S-2	P	Recovery 2.0/2.0
			D-6	D	6/7/5 N=12
			D-7		6/7/4 N=11
(15)			S-3	P	Recovery 1.7/2.0
			D-8	D	4/3/3 N=6
			D-9		3/2/6 N=8
(20)		Dry to damp 0.0-35.0 Damp to moist 35.0-45.0 Moist to locally saturated 45.0 and below	S-4	P	Recovery 1.5/2.0
			D-10	D	3/3/8 N=11
			D-11		5/7/4 N=11
(25)			S-5	P	Recovery 1.8/2.0
			D-12	D	9/7/5 N=12
4/19/72			D-13		10/7/5 N=12
(30)			S-6	P	Recovery 1.7/2.0
4/20/72			D-14	D	5/7/5 N=12
			D-15		7/8/11 N=19
(35)			S-7	P	Recovery 2.0/2.0
			D-16	D	5/7/8 N=15
			D-17		8/4/4 N=8
(40)			S-8, PST-1	P	S-8 Recovery 0, over-ran interval with PST-1, Recovery 0.
4/20/72			PST-2		Recovery 0.4/1.4 (Note 1)
4/21/72			-	Att	43.4-45.0
(45)			PST-3	P	Recovery 0.3/2.0 (Note 1)
			D-18	D	7/6/8 N=14
(50)			D-19		7/7/7 N=14

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG — PROJECT NO 0700 | DATE APRIL 1972 | SHEET NO 1 of 3
HOLE NO S-4

DRILL RIG CME MODEL 45 | HOLE ELEVATION 1692 | LOGGED BY RET & KP
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 inches | DATE DRILLED 4/19 - 5/5/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		EMBANKMENT FILL (cont.)	S-9	P	Recovery 1.5/2.0
			D-20	D	7/6/11 N=17
			D-21		9/10/9 N=19
(55)	SP, ML, CL	RESERVOIR SEDIMENTS Sand, fine to very fine, black, moist to locally saturated, laminated, bedding horizontal (locally cross-bedded), micaceous. Scattered small areas of silt and clay. consistency given by blow counts.	S-10	P	Recovery 0/2.0
4/21/72			-	Att	-
4/24/72			PST-4	P	Recovery 1.8/2.0
(60)			S-11		Recovery 0.5/2.0 (saved)
			D-22	D	2/3/6 N=9
			D-23		2/2/5 N=7
(65)			S-12	P	Recovery 2.0/2.0
			D-24	D	0/0/ N=very low
			-	Att	Augered 68-70 because material was flowing into hole from below.
(70)			S-13	P	Recovery 2.0/2.0
			D-25	D	0/½/½ N=1
			D-26		1/1/3 N=4
(75)			PST-5	P	Recovery 1.7/2.0
4/24/72			D-27	D	2/3/5 N=8
4/25/72			D-28		3/5/6 N=11
(80)			PST-6	P	Recovery 0/2.0
	ML	Sandy silt	D-29	D	4/4/6 N=10
			D-30		4/5/5 N=10
(85)	ML, CL-ML	Silt, dark gray, moist to saturated, locally clayey.	PST-7	P	Recovery 0.0/2.0
4/27/72			D-31	D	0/5/6 N=11
			D-32		5/5/7 N=12
(90)		Silty sand, fine, black, moist	S-14	P	Pushed S-14 90.0-92.0 Recovery 0.0/2.0
			S-15	D	Drove S-15 91.0-93.0 Recovery 0.0/2.0
			Core-Nx Pool boy #1	P	Pushed Nx inner bbl. 91.0-95.0 Recovery 3.7/4.0
(95)			S-16	P	Gravity 95.0-96.2, Pushed 96.2-97.4 Recovery 2.4/2.4
4/27/72			D-33	D	1/3/x N=very low
4/28/72			D-34		3/16/11 N=27
(100)		wood @ 99.5-100.0 (D-34A)			

Note 2

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG — PROJECT NO 0700 | DATE APRIL 1972 | SHEET NO 2 of 3
HOLE NO S-4

DRILL RIG CME MODEL 45	HOLE ELEVATION 1692	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 4/19 - 5/5/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)	ML	RESERVOIR SEDIMENTS (cont.) Silt, gray, laminated, moist, soft to firm, changing to pale yellow-brown sandy silt @ 107.5. Wood fragments @ 108.0.	S-17	P	Recovery 1.0/2.0
			D-35	D	7/6/7 N=13
			D-36		7/8/9 N=17
(105)			S-18	P	Recovery 0.0/2.0
			D-37	D	5/8/8 N=16
5/4/72 (110)			D-38		5/10/9 N=19
5/5/72			PST-8	P	Recovery 1.3/1.5 (Note 3)
	SM	SOIL, yellow-brown silty sand.	D-39	D	15/18/13 N=31
		BEDROCK - KANAWHA SERIES Sandstone, arkosic, tan, fine to medium grained, hard, strong. Bedding nearly horizontal, locally cross-bedded. Very closely fractured.	-	AH	-
(115)			D-40	D	22/45/52 N=97
			Core-Box 1	Nx Core Barrel	Run 116.5/119.5 Recovery 1.0/3.0
(120)					Run 119.5-126.0 Recovery 1.2/6.5
(125)					
(130)		HOLE TERMINATED @ 126.0 FEET			

NOTES:

1. SAMPLE REMOVED FROM SAMPLE TUBE FOR ON SITE EXAMINATION; NOT SAVED.

2. THE SERIES S-14, S-15, POORBOY #1 PROCEEDED AS FOLLOWS: S-14 WAS PUSHED 9.0-92.0 WITH NO RECOVERY; S-15 FOUND THE HOLE BOTTOM AT 91.0 AND WAS, AS AN EXPERIMENT, DRIVEN WITH THE 140-lb. HAMMER FROM 91.0 to 93.0 WITH NO RECOVERY. POORBOY #1 (A DISCARDED 5-FT. Nx INNER BARREL) WAS PUSHED FROM 91.0 to 95.0 WITH A RECOVERY OF 3.7 FEET.

3. PST-8 REFUSED AT 110.5.

WA. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO.
PALO ALTO • NEWPORT BEACH • [illegible]		PROJECT NO	DATE	SHEET NO	S-4
		0700	APRIL 1972	3 of 3	

DRILL RIG	CME-45	HOLE ELEVATION	1690	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	See Notes	HOLE DIAMETER	6 inches	DATE DRILLED	6/25-27/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GP-SP	EMBANKMENT FILL Coal processing refuse; sandy gravel and gravelly sand. Of the gravel-sized clasts, about 60% are siltstone, 35% carbonaceous shale, and the remainder coal and sandstone. Gravel clasts tend to be blocky or slabby; and angular. The sand is largely coal, and poorly graded (v. fine to medium grained). Dry to slightly damp @ 0-25 ft. Consistency given by blow counts.	-	AH	Hard augering
(5)					
(10)			D-1	D	6/5/7 N=12
(15)			-	AH	Hard augering
(20)			D-2	D	3/8/7 N=15
(25)			-	AH	Hard augering. Wood @ 23 ft.
(30)			D-3	D	3/4/5 N=9
(35)			-	AH	-
(40)		Measured water level @ 38.3 ft. depth when auger bit was @ 50 ft. depth.	S-1	P	Recovery 1.8/2.0
(45)			-	AH	-
(50)					

WA. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	S-5
		0700	JUNE 1972	1 OF 3	

DRILL RIG	CME-45	HOLE ELEVATION	1690	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	See Notes	HOLE DIAMETER	6 INCHES	DATE DRILLED	6/25-27/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	GP, SP	EMBANKMENT FILL (Continued)	S-2	P	1.0/1.0 NOTE 1
			D-4	D	9/16/11 N=27
			-	AH	-
(55)			S-3	P	Recovery 0.8/1.0 NOTE 1
	SP, SP-SM	RESERVOIR SEDIMENTS Sediments from pool #1. Sand, fine to medium-grained, black, with silty sand. Minor thin layers of silt and clay below about 70 ft. depth. Moist to saturated. Consistency given by blow counts. Composition largely coal with some siltstone and carbonaceous shale.	D-5	D	1/2/3 N=5
(60)			-	AH	-
			S-4	P	Recovery 2.0/2.0
			-	AH	-
(65)			S-5	P	Recovery 2.0/2.0
			-	AH	-
(70)			S-6	P	Recovery 2.0/2.0
			-	AH	-
(75)			S-7	P	Recovery 2.0/2.0
			-	AH	-
(80)			S-8	P	Recovery 1.9/2.0
			D-6	D	0/2/4 N=6
(85)			-	AH	-
(90)			S-9	P	Recovery 2.0/2.0
			-	AH	-
(95)			D-7	D	4/7/14 N-21
	SM, SC	ALLUVIUM Silty and clayey cobbly sand.	-	AH	-
(100)					

WA. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	S-5
		0700	JUNE 1972	2 OF 3	

DRILL RIG	CME-45	HOLE ELEVATION	1690	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	SEE NOTES	HOLE DIAMETER	6 INCHES	DATE DRILLED	6/25-27/72

ELEVATION (Per)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)	SM	ALLUVIUM (Continued)	D-8	D	70/0.5 ft.Rev. large
		BEDROCK - KANAWHA SERIES 100.5-111.8 Arkosic sandstone, little fractured, hard, generally fresh. Gray where fresh, tan where weathered (near top and along fractures) very fine to fine grained, very thinly bedded, locally cross-bedded, bedding dips about 3-4°. Fractures dip 80°.	CORE-BOX 1	Nx Core barrel	Run 100.5 - 106.8 Recovery 6.3/6.3
(105)					
					Run 106.8-111.8 Recovery 4.7/5.0
(110)					
		HOLE TERMINATED @ 111.8 FEET.			
(115)		NOTES: 1. Sample extruded from tube for on-site examination. 2. Water level @ 32.8 ft. depth 15 minutes after coring operations stopped.			

W.A WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO.
		PROJECT NO	DATE	SHEET NO	
PALO ALTO · NEWPORT BEACH · [illegible]		0700	JUNE 1972	3 of 3	S-5

DRILL RIG CME - 45 | HOLE ELEVATION 1706 | LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 inches | DATE DRILLED 5/8 - 10/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		ENBANKMENT FILL Coal processing refuse of variable size range and composition. Dumped fill. Estimated overall size distribution: 10% fines, 20% gravel and +3", 70% sand. Sand and fines largely coal, minor carbonaceous shale. Gravel and oversize largely carbonaceous shale and siltstone. Dark gray to black. Damp to moist @ 0-15 ft., moist to saturated @ 15-37.5 ft. Consistency given by blow counts.	D-1	D	1/3/4 N= 7
			D-2		5/3/2 N= 5
5/8/72			D-3		3/4/3 N= 7
(5)			-	All	-
5/9/72					
(10)			D-4	D	1/5/4 N= 9
			-	All	-
(15)			D-5	D	3/2/2 N= 4
			-	All	-
(20)			D-6	D	4/2/1 N= 3
			-	All	-
(25)		Note: a small interval of Reservoir sediments is probably located between 31.5 and 35.0 ft., based on a projection from hole S-7.	D-7	D	1/2/3 N= 5
			-	All	-
(30)		(See note 1 for explanation of this symbol)	D-8	D	4/2/2 N= 4
			-	All	-
(35)	SM	SOIL Yel-brn silty sand, moist.	D-9	D	4/11/23 N=34
5/9/72					
5/10/72		BEDROCK - KANAWHA SERIES Sandstone, arkosic, pale gray, locally iron-stained. Medium grained, well indurated. Moderately hard and strong, fresh. Fracture spacing 0.2 to 4.0 ft. Fractures dip 5°-15°, parallel to bedding planes. Composition about 75% quartz, 23% feldspar, 2% mica, dark minerals, and coal.	CORE - BOX 1	NX Core barrel	Set 4" casing to 38.0 feet. Run 38.0-41.5 Recovery 3.5/3.5
(40)					Run 41.5-51.5 Recovery 10.0/10.0
(45)					
(50)					

W A WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE MAY 1972 | SHEET NO 1 of 2
HOLE NO S-6

DRILL RIG CME | HOLE ELEVATION 1706 | LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 inches | DATE DRILLED 5/8 - 10/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
5/10/72		BEDROCK (cont.)	-	NX BBL.	-
(55)		HOLE TERMINATED @ 51.5 FEET.			Results of water pressure tests on following sheets.

NOTES:
1. The horizontal dashed line is the estimated location of the contact between the overlying and underlying units. Where the possible range of position of a contact is over 1 foot, the limits of this range are indicated by the open dashed "V" on either side of the horizontal line. In this hole, the interval so indicated, 31.5 to 35.0 feet, may also include some reservoir sediments, based on a projection of their locations in holes MF-S-7 and MF-S-8.
2. NOTE ADDED IN PROOF: MF-S-7 AND MF-S-8 IN NOTE 1 ABOVE SHOULD READ S-7 AND S-8 RESPECTIVELY.

W A WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE MAY 1972 | SHEET NO 2 of 2
HOLE NO S-6

HOLE S-6 WATER PRESSURE TESTS

5/10/72

Series I

Interval 49.0-51.5 Gravity Head 55.75 Ft.

Ia Minute No.	PSIG 25 Gals. Taken	Cum. Total
1	0.15	0.15
2	0.15	0.30
3	0.10	0.40
4	0.12	0.52
5	0.06	0.58
6	0.04	0.62
7	0.05	0.67
8	0.03	0.70
9	-	-
10	-	-

Note: guage pressure fluctuated @ 25-30

Ib Minute No.	PSIG 50 Gals. Taken	Cum. Total
1	0.45	0.45
2	0.35	0.80
3	0.40	1.20
4	0.55	1.75
5	0.30	2.05
6	0.40	2.45
7	0.01*	2.46
8	0.34	2.80
9	0.45	3.25
10	0.20	3.45

* Guage pressure gradually built to 60 psi; was cut back to 50 psi at beginning of minute no. 7.

Ic Minute No.	PSIG 100 Gals. Taken	Cum. Total
1	10	10
2	9	19
3	11	30
4	10	40
5	10.5	50.5

Id Minute No.	PSIG 25 Gals. Taken	Cum. Total
1	0.6	0.6
2	0.7	1.3
3	0.7	2.0
4	0.7	2.7
5	0.6	3.3

Holding Test

Pressure,psig	Time, sec.
100	0
50	5
25	30
10	70
5	150
0	210

HOLE S-6, WATER PRESSURE TESTS—Continued

Series II
Interval 41.0-49.0 Gravity Head 50.0 Ft.

IIa Minute No.	PSIG 25 Gals. Taken	Cum. Total	IIb Minute No.	PSIG 50 Gals. Taken	Cum. Total
1	0.0	0	1	0.5	0.5
2	0.0	0	2	0.0	0.5
3	0.0	0	3	0.0	0.5
4	0.0	0	4	0.0	0.5
5	0.0	0	5	0.0	0.5

IIc Minute No.	PSIG 100 Gals. Taken	Cum. Total	IId Minute No.	PSIG 25 Gals. Taken	Cum. Total
1	0.0	0	1	0.0	0
2	0.0	0	2	0.0	0
3	0.0	0	3	0.0	0
4	0.0	0	4	0.0	0
5	0.0	0	5	0.0	0

Holding Test

Pressure, PSIG	Time, Minutes
110	0
100	1/4
95	1
85	2
82	3
77	4
75	5 end test.

DRILL RIG CME - 45	HOLE ELEVATION 1702	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/12 - 16/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0) 5/12/72	SP, SP-SM, GP	EMBANKMENT FILL Dumped coal processing refuse. About 30% gravel and +3-inch material, and 70% sand, with minor fines. Gravel and oversize largely carbonaceous shale, siltstone and clay shale. Sand and fines about 10-20% coal, with the remainder largely carbonaceous shale. Dark gray to black. Moist at 0-10, saturated below 10 feet. Consistency given by blow counts. Top 2-5 feet may be reworked by flooding after failure of the dam.	-	All	-
(5)			D-1	D	3/5/4 N= 9
			-	All	-
(10)			S-1	P	Recovery 1.4/2.0
			-	All	-
(15)			D-2	D	2/2/2 N= 4
			-	All	-
(20)			S-2	P	Recovery 2.0/2.0
			-	All	-
(25)		See Note 1 for explanation of symbol.	D-3	D	5/6/11 N=17
			-	All	-
(30)		RESERVOIR SEDIMENTS Sand, fine to medium grained, angular, flaky. Mostly coal and carbonaceous shale, minor clay shale. Black, saturated to locally very moist. Scattered silt and clay (?) units a few inches thick are present but sparse.	S-3	P	Recovery 2.0/2.0
			-	All	-
(35)			D-4	D	1/1/2 N= 3
			-	All	-
(40)			S-4	P	Recovery 1.4/2.0
			-	All	-
(45)		Silt & clay in D-5 recovery	D-5	D	0/1/2 N= 3
			-	All	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO 0700	DATE MAY 1972	SHEET NO 1 of 3	S-7

DRILL RIG CME -45	HOLE ELEVATION 1702	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/12 - 16/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50) 5/12/72 5/15/72	SP, ML, SP-SM, CL.	RESERVOIR SEDIMENTS (cont.)	S-5	P	Recovery 1.5/2.0
			-	All	Augers filled with sand below 35 feet.
(55)			PST-1	P	Recovery 1.0/1.3
		Predominantly sandy at 50-70 feet.	-	All	-
(60)			S-6	P	Recovery 0.0/2.0 Sand flowing into augers.
			-	All	-
(65)			D-6	D	3/2/5 N= 7
			-	All	Cleaned augers with water in order to get inner bit in place.
(70)			PST-2	P	See Note 2
		Silty sand, local silt and clay at 70-79.	S-7	P	Pushed 71.1-73.5 Recovery 2.0/2.4
(75)			-	All	-
(80)		SOIL AND (OR) STREAM CHANNEL ALLUVIUM Gravelly-clayey sand, yellow brown, moist, dense.	S-8	P	Recovery 1.7/2.0
			-	All	Set augers to 85.0 to act as casing for Nx core rods
(85)		BEDROCK-KANAWHA SERIES 85.0-97.3 Sandstone, tan, medium to coarse grained, hard, strong, closely fractured. Fractures follow bedding, which dips 5° to 10°. Locally cross-bedded. Locally porous. Composition 90% + quartz, minor feldspar, dark minerals and mica. Coal @ 91.0-91.5	CORE - Box 1	Nx core barrel	Run 85.0-91.0 Recovery 1.8/6.0
(90)					Run 91.0-97.0 Recovery 1.9/6.0
(95)		97.3-102.0 Sandstone, light gray, very fine to fine grained. (cont.)			Run 97.0-106.0 Recovery 8.1/9.0
(100)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO 0700	DATE MAY 1972	SHEET NO 2 of 3	S-7

DRILL RIG CME -45	HOLE ELEVATION 1702	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/12 - 16/72

ELEVATION (Ft. MSL)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	WOOD	REMARKS
(100)		(cont.) Thin-bedded, locally cross-bedded, Moderately hard and strong.	CORE - Box 1	Nx Core barrel	See previous page for run-recovery information.
(105)		102.0-106.0 Siltstone, locally sandy and clayey. Laminated, gray, somewhat soft and weak, bedding horizontal.			
		HOLE TERMINATED @ 106.0 FEET.			
(110)		Notes: 1. The horizontal dashed line indicates the estimated elevation/depth of the contact between the two units it separates. The inclined dashed lines show the possible range in elevation/depth of the contact. 2. PST-2 refused at 70.5 on a large piece of gravel. Washed hole to 71.1 to clean sand from augers.			

W.A WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CHLEF		PROJECT NO	DATE	SHEET NO	S-7
		0700	MAY 1972	3 OF 3	

DRILL RIG	CME - 45	HOLE ELEVATION	1707	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 inches	DATE DRILLED	5/17 - 18/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GW, GP, SP.	EMBANKMENT FILL Sandy gravel, locally gravelly sand. Gray to black. About 5% +3" material (cobbles). Gravel and +3" material are mostly carbonaceous shale and slate, with minor clay shale, sandstone, and coal. Sand is mostly carbonaceous shale and coal. Damp to moist @ 0-15 feet, very moist to saturated below 15 feet. Consistency given by blow counts.	-	All	-
(5)			D-1	D	5/4/2 N= 6
			-	All	-
(10)			S-1	P	Recovery 1.9/2.0
			-	All	-
(15)			D-2	D	2/2/3 N= 5
			-	All	-
(20)			S-2	P	Recovery 1.7/2.0
			-	All	-
(25)			S-3	P	(25.0 to 26.6) Recovery 1.6/1.6
			D-3	D	(26.6-28.1)5/6/5 N=11
			D-4	D	(28.1-29.6)3/4/6 N=10
(30)			S-4	All P	30.0-31.4 Note 1 Recovery 0.9/1.1
			D-5	D	(31.1-32.6)8/4/3 N= 7
	SP, SM, ML, CL.	RESERVOIR SEDIMENTS Mostly sand, with scattered areas of silt and clay (?). Sand is largely (75%) coal, with the remainder carbonaceous shale and siltstone or slate. Black, saturated, fine to medium-grained.	-	All	Sand flowing into augers-rose 10 ft. in 20 minutes.
(35)			S-5	P	Recovery 0.0/2.0
			-	All	-
(40)			D-6	D	2/4/6 N=10
			-	All	Sand flowing into augers when inner bit removed.
(45)			PST-1	P	Recovery 0.7/1.1 Note1
			-	All	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va. PALO ALTO • NEWPORT BEACH • CALIF	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO	DATE	SHEET NO	
		0700	MAY 1972	1 of 2	S-8

DRILL RIG	CME - 45	HOLE ELEVATION	1707	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 inches	DATE DRILLED	5/17-18/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		RESERVOIR SEDIMENTS (cont.)	D-7	D	3/3/6 N= 9
			-	All	-
(55)			PST-2	P	Recovery 1.2/2.0
			-	All	-
(60)			D-8	D	2/1/1 N= 2
5/17/72 5/18/72			-	All	-
(65)			SS-1	P	Recovery 0.0/4.0
(70)	SM	SOIL, silty sand.	-	All	-
		BEDROCK - KANAWHA SERIES 70.0-77.6 Sandstone, tan, arkosic, med. grained, soft and weathered in the top few feet, hard below 75.0.	D-9	D	12/10/16 N=26
			-	All	-
(75)		77.6-78.8 Coal, bony, soft.	D-10	D	13/31/43 N=74
		78.8 82.3 Siltstone and clay shale, laminated, soft, weak, iron-stained, fractured	CORE-Box 1	Nx Core barrel	Run 76.5-86.0 Recovery 8.4/9.5
(80)		82.3-86.0 Sandstone, light gray, v. fine to fine grained thin-bedded, locally cross-bedded, Moderately hard and strong.			
(85)					
		HOLE TERMINATED @ 86.0 feet.			
(90)		Notes: 1. Sample removed from tube for on-site examination.			

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va. PALO ALTO • NEWPORT BEACH • CALIF	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO	DATE	SHEET NO	
		0700	MAY 1972	2 of 2	S-8

DRILL RIG CME - 45	HOLE ELEVATION 1704	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/18-23/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		PAD FILL	-	AH	MODE KEY: AH=Hollow-stem auger D=Drive P=Push
	GP, SP.	EMBANKMENT FILL Coal processing refuse. About 60% gravel and 40% sand with local concentrations of each, Minor fines. Dark gray to black; damp to moist at 2-15 feet, very moist to saturated below 15 feet. Mostly carbonaceous shale and siltstone; minor clay shale and coal. Consistency given by blow counts.	D-1	D	3/4/5 N= 9
(5)			-	AH	-
			S-1	P	Recovery 1.6/2.0
(10)			-	AH	-
			D-2	D	4/3/4 N= 7
(15)			-	AH	-
			S-2	P	Recovery 2.0/2.0
(20)			-	AH	-
			D-3	D	4/9/11 N=20
			-	AH	-
(25)			S-3	P	Recovery 1.0/1.0 Note1
			D-4	D	9/18/15 N=33
			-	AH	-
(30)			S-4	P	Recovery 1.2/2.0
	SP, SP-SM, ML, CL	RESERVOIR SEDIMENTS Fine to medium sand, with a few scattered layers of silty sand, silt, and clay. Black. About 50% coal, remainder carbonaceous shale, siltstone, and clay shale.	-	AH	-
(35)			D-5	D	1/4/5 N= 9
			-	AH	-
(40)			SS-1	P	Recovery 3.0/3.0
			-	AH	-
(45)					
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-9
		0700	MAY 1972	1 of 3	

DRILL RIG CME - 45	HOLE ELEVATION 1704	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/18-23/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		RESERVOIR SEDIMENTS (cont.)	D-6	D	1/6/7 N=13
			-	AH	Sand flowing into augers.
(55)		Clean, very fine sand at 59.0.	SS-2	P	Recovery 4.0/4.0
			-	AH	-
(60)			D-7	D	3/3/6 N= 9
			-	AH	-
(65)		Silty sand @ 67.0	S-5	P	Recovery 2.0/2.0
			-	AH	-
(70)					
5/19/72		Fine sand @ 71.5	D-8	D	2/5/9 N=14
5/22/72			-	AH	-
(75)			D-9	D	2/6/7 N=13
			-	AH	-
(80)			D-10	D	0/0/6 N= 6
		ALLUVIUM Mixed river alluvium and reservoir sediments.	-	AH	-
(85)		ALLUVIUM Sandstone cobbles and boulders. Possible thickness range 1-5 ft. Possible weathered bedrock in lower part.	D-11	D	19/21/19 N=40
			-	AH	-
(90)		BEDROCK - KANAWHA SERIES 90-93.5 Sandstone, tan, medium to coarse grained, hard, strong, locally arkosic. Bedding dips 5-10°, locally cross-bedded. 93.5-102.0 Sandstone, light gray, very fine to fine grained, thin-bedded to thinly cross-bedded. Moderately hard and strong.	D-12	D	16/27/23 N=50
			CORE-Box 1	Nx Core barrel	Run 95.0-105.0 Recovery 8.0/10.0 (some stick-up left in hole).
(95)					
(100)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-9
		0700	MAY 1972	2 of 3	

DRILL RIG CME - 45	HOLE ELEVATION 1704	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 inches	DATE DRILLED 5/18-23/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)		102.0-103.0 Silty sandstone, local siltstone, gray, soft. Siltstone laminated, bedding horizontal.	CORE - Box 1	Nx Core barrel	-
(105)		HOLE TEMINATED @ 105.0 FEET			
(110)		NOTE: 1. SAMPLE EXTRUDED FROM TUBE FOR ON-SIGHT EXAMINATION.			

W.A WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
	PALO ALTO • NEWPORT BEACH • CALIF.	PROJECT NO. 0700	DATE MAY 1972	SHEET NO 3 of 3	S-9

DRILL RIG CME-45 | HOLE ELEVATION 1701 | LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 INCHES | DATE DRILLED 5/25-6/2/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		EMBANKMENT MATERIALS May be slide material from the downstream face of Dam No. 3. Top few feet are flood deposits. Gravelly sand, dark grey to black. Estimate 25% gravel, 75% sand, minor fines. Coal processing waste; about 1/3 coal (mostly in the sand), remainder largely siltstone and clay shale. Locally saturated below 15 feet. Consistency given by blow counts. Local concentrations of both gravel and sand are present.	-	AH	-
(5)			D-1	D	2/2/2 N=4
			-	AH	-
(10)			S-1	P	Recovery 0.4/2.0 NOTE 1
			-	AH	-
(15)			D-2	D	3/4/2 N=6
			-	AH	-
(20)			S-2	P	Recovery 1.5/2.0
			D-3	D	2/3/2 N=5
			D-4	D	1/4/3 N=7
(25)			S-3	P	Recovery 1.6/2.0
			D-5	D	13/12/7 N=19
			D-6	D	3/4/2 N=6
(30)			S-4	P	Recovery 2.0/2.0
			D-7	D	5/7/3 N=10
5/24/72			D-8	D	6/17/4 N=21
(35)			S-5	P	Recovery 1.4/2.0
5/25/72			D-9	D	5/5/5 N=10
			D-10	D	4/2/2 N=4
(40)			S-6	P	Recovery 0.9/2.0 NOTE 1
			D-11	D	9/8/11 N=17
			D-12	D	9/12/16 N=28
(45)			S-7	P	Recovery 1.7/2.0
		EMBANKMENT FILL, INCORPORATING SLUDGE OR RESERVOIR SEDIMENTS	D-13	D	4/4/6 N=10
(50)			D-14	D	6/8/9 N=17

WA WAHLER & ASSOCIATES (PALO ALTO • NEWPORT BEACH • CALIF.)	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG	HOLE NO
	PROJECT NO 0700	DATE MAY 1972	SHEET NO 1 OF 3	S-10

DRILL RIG CME-45 | HOLE ELEVATION 1701 | LOGGED BY RET & KP
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 INCHES | DATE DRILLED 5/24-6/2/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		EMBANKMENT FILL, INCORPORATING SLUDGE OR RESERVOIR SEDIMENTS	SS-1	P	Recovery 2.0/2.0 Refused @ 52.0
		(Continued) About 20% fine gravel and 80% sand with minor fines. May be a part of a slide complex incorporating reservoir sediments.	D-15	D	9/14/5 N=19
(55)			-	AH	-
			S-8	P	Recovery 2.0/2.0
			D-16	D	9/10/12 N=22
5/25/72			-	AH	-
(60)					
5/31/72			S-9	P	60.7-62.7 Recovery 2.0/2.0
			D-17	D	62.7-64.2 5/6/8 N=14
			-	AH	-
(65)			S-10	P	Recovery 2.0/2.0
			D-18	D	4/5/7 N=12
			-	AH	-
(70)			S-11	P	Recovery 1.5/2.0
			D-19	D	6/6/8 N=14
			-	AH	-
(75)		RESERVOIR SEDIMENTS Fine to very fine black sand, mostly coal, some shale and siltstone. Saturated @ 77-95, locally damp to very moist below 95 feet, consistency given by blow counts	S-12	P	Recovery 0/2.0
			S-13	P	Recovery 1.5/1.5
			D-20	D	3/4/3 N=7
(80)			S-14	P	Push 80.0-81.6 Recovery 2.4/1.6 NOTE 2
			-	AH	-
5/31/72					
(85)					
6/1/72			SS-2	P	Recovery 0/4.0 Tube went to 87.4 on weight of rods without pushing.
(90)			-	AH	-
			D-21	D	2/4/7 N=11
			-	AH	-
(95)			SS-3 / D-22	P / D	Recovery 0/2.0 / 3/6/7 N=13
			-	AH	-
(100)					

WA WAHLER & ASSOCIATES (PALO ALTO • NEWPORT BEACH • CALIF.)	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG	HOLE NO
	PROJECT NO 0700	DATE MAY-JUNE 1972	SHEET NO 2 OF 3	S-10

DRILL RIG CME-45	HOLE ELEVATION 1701	LOGGED BY RET
GROUNDWATER DEPTH (Below ground surface)	HOLE DIAMETER 6 INCHES	DATE DRILLED 5/24-6/2/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)		RESERVOIR SEDIMENTS (Continued)	S-15	P	Recovery 0/1.6
			D-23	D	15/10/10 N=20 NOTE 3
6/1/72 (105) 6/2/72			-	All	Hole drilled 105.0 at end of work 6/1/72. At beginning of work 6/2/72, penetrometer was put in hole and went directly to 109.0'.
			D-24	D	5/80/R N=80+
(110)		112.0-115.5 Sandstone, light gray, very fine to fine grained. Thin-bedded and thinly cross-bedded, moderately hard and strong.	CORE-BOX 1	Nx Core Barrel	Run 110.0-115.0 Recovery 2.0/5.0
(115)		115.5-120.0 Siltstone, locally sandy or clayey. Thin-bedded to laminated. Dark grey. Somewhat soft and weak.			Run 115.0-120.0 Recovery 4.3/5.0
(120)		HOLE TERMINATED @ 120.0 FEET.			
(125)		NOTES: 1. Sample extruded from tube for on-site examination. 2. Excess recovery represents disturbed material which flowed into the auger stem. 3. With no recovery in S-15, the penetrometer was lowered into the hole. It was driven from 100.7 to 103.1. The blows recorded are for the interval 101.6-103.1			
(130)					
(135)					
(140)					
(145)					
(150)					

W.A. WAHLER & ASSOCIATES (PALO ALTO • NEWPORT BEACH • DENVER)	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO. S-10
		PROJECT NO. 0700	DATE JUNE 1972	SHEET NO. 3 OF 3	

69

DRILL RIG	CME 45	HOLE ELEVATION	1703	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	6/5-9/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	SP, GP, SM, SP-SM	EMBANKMENT MATERIALS SLIDE COMPLEX (Coal Processing Refuse) Gravelly sand, dark gray; about 30% fine gravel, 65% sand, and 5% coarse gravel and minor fines. Slightly damp to damp at 0-11 feet. Below 11 feet moisture content varies from damp to saturated, locally in intervals of 5 feet or less. Consistency given by blow counts. Top few feet are reworked by flood.	-	AH	-
(5)			D-1	D	2/1/1 N=2
			-	AH	Easy augering - one or two hard cobbles.
(10)			S-1	P	Irregular push-gravelly soil. Recovery 1.8/2.0
			-	AH	-
(15)			D-2	D	1/2/2 N=4
			-	AH	-
(20)			S-2	P	Easy push. Recovery 0/2.0
			-	AH	-
(25)			SS-1	P	Recovery 0/4.5 Sample fell from tube as tube was pulled up hole
(30)			-	AH	-
			D-3	D	1/2/4 N=6
			-	AH	W.L. @ approx. 20 ft. While drilling this interval.
(35)			PST-1	P	Pushed 34.7-37.0 Recovery 2.0/2.0
			-	AH	-
(40)			D-4	D	5/5/10 N=15
			-	AH	-
(45)			SS-2		Recovery 0
			PST-2	P	PST-2 @ 44.4-45.8 Recovery 0.5/1.4
			-	AH	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO	DATE	SHEET NO	
PALO ALTO • NEWPORT BEACH • CALIF		0700	JUNE 1972	1 OF 3	S-11

DRILL RIG	CME 45	HOLE ELEVATION	1703	LOGGED BY	RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	6/5-9/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
6/5/72 (50)	SP-SM	EMBANKMENT MATERIALS (Continued) Gravelly sand mixed or interbedded with local, black sand in layers up to a few feet thick. The black sand is similar to the "typical" reservoir sediments found deeper in this hole and beginning at depths of 30-35 feet in holes upstream of this one.	D-5	D	1/2/4 N=6
6/6/72			-	AH	D-5 Recovery: Gravel 51.0-51.5, sand 50.5-51.0
(55)			D-6	D	7/7/8 N=15
			-	AH	-
(60)			D-7	D	6/10/6 N=16
			-	AH	-
(65)			D-8	D	6/9/11 N=20
6/6/72 (70)			-	AH	Cleaned hole with water before taking PST-3
6/7/72			PST-3	P	Recovery 0.3/1.5
			-	AH	Locally hard augering in this material
(75)			D-9	D	10/18/19 N=37
			-	AH	-
(80)	SM, ML, CL	RESERVOIR SEDIMENTS Black fine to very fine sand, mostly coal with local silt and clayey silt layers. A few scattered areas of gravelly material. Generally moist to very moist. Locally saturated.	PST-4	P	Pushed 79.3-81.3 Recovery 0/2.0
			D-10	D	1/4/6 N=10
(85)			-	AH	Cleaned hole w/water to 85.0' after augering
			SS-3	P	Pushed 85.0-89.1 Recovery 4.0/4.1
(90)			-	AH	-
			D-11	D	1/2/4 N=6
			-	AH	-
(95)			PST-5	P	Recovery 0/2.0
6/7/72			D-12	D	1/0/4 N=4
6/8/72 (100)			-	AH	-

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO	DATE	SHEET NO	
PALO ALTO • NEWPORT BEACH • CALIF		0700	JUNE 1972	2 OF 3	S-11

DRILL RIG CME 45	HOLE ELEVATION 1703	LOGGED BY RET
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 INCHES	DATE DRILLED 6/5-9/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)		RESERVOIR SEDIMENTS (Continued)	D-13	D	1/1/1 N=2
			-	All	-
(105)			PST-6	P	Pushed 105.0-106.9 Recovery 0.2/1.9
		SOIL AND ALLUVIUM	-	All	Hard augering below 108.0 ft.
(110)		Silty clay soil, gravelly alluvium with scattered fragments of coal waste.	D-14	D	11/22/20 N=42 Reamed hole to 112.0' with Nx-type bit after D-14
		BEDROCK KANAWHA SERIES	Core Box 1	Nx Core BBL	Run 112.0-115.5 quick. Recovery 2.0/3.5
(115)		112.0-117.0 Sandstone, tan, arkosic, medium-grained			
		117.0-118.0 Black Carbonaceous shale.			Run 115.5-120.5' Recovery 4.4/5.0
(120)		118.0-118.6 Coal, black, hori. bedding, weak fracture.			
		118.6-120.5 Siltstone, gray, thin-bedded to laminated, bedding nearly horizontal.			
		HOLE TERMINATED @ 120.5 FEET.			
(125)					
(130)					
(135)					
(140)					
(145)					
(150)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
	PALO ALTO • NEWPORT BEACH • CALIF.	PROJECT NO	DATE	SHEET NO	S-11
		0700	JUNE 1972	3 of 3	

DRILL RIG	CME-45	HOLE ELEVATION	1750	LOGGED BY	RET/LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	6/28&7/10-7/14/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		EMBANKMENT FILL Coal Processing waste @0-10' Mixed coal processing waste and road cut derived fill @ 10-28 feet. Coal waste is about equal parts sand and gravel. The sand is largely coal and shale; the gravel mostly siltstone and carbonaceous shale, with minor coal and sandstone. The road cut derived is mostly hard sandstone gravel and cobbles with a binder of clayey sand soil, and minor coal waste.	D-1	D	2/7/8 N=15
			-	AH	-
(5)			D-2	D	1/2/2 N=4
			-	AH	-
(10)			D-3	D	12/18/6 N=24
			-	AH	-
(15)			D-4	D	4/4/5 N=9
			-	AH	-
(20)			D-5	D	1/2/4 N=6
			-	AH	Hole is cased with hollow-stem auger
(25)			D-6	D	4/12/8 N=20
			-	AH	Very hard augering below 28'
(30)		BEDROCK-KANAWHA SERIES 28.0-42.0 Mudstone: olive gray; low hardness; crushed to 40.5'; closely fractured 40.5'-42.0'. Mod. yell. brn. clay in all fractures.	D-7	D	60 blows/0.0 ft N = Very large
			Core Box 1 (30.0-45.0)	Nx Core Barrel	Run 30.0-36.8 Recovery difficult to measure because of crushed material
6/28/72 7/11/72 LAR					Run 36.8-42.0 Recovery 4.5/5.2
(40)		42.0-45.5 Sandstone: Silty; fine-grained; irregularly mottled lt. & dk. gray; mod. hard.			Run 42.0-47.0 Recovery 5.0/5.0 Casing set to 40.5
(45)		45.5-46.8 Mudstone: clayey contact w/ SS Dips 5° 46.8-47.8 Coal	Core Box 2 (45.0-60.2)		Run 47.0-52.0 Recovery 4.7/5.0
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • RENO		PROJECT NO	DATE	SHEET NO	S-12
		0700	JUNE-JULY1972	1 of 4	

DRILL RIG	CME-45	HOLE ELEVATION	1750	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	6/28&7/10-7/14/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		47.8-51.6 CLAYSTONE: Med. dk. gray; low hardness; internally slickensiden in random directions. Bedding is 16° from horizontal	Core Box 2 (45.0-60.2)	Nx Core BBL	Run 47.0-52.0 Cont.
7/11/72 7/12/72					Run 52.0-62.0 Recovery 10.0/10.0
(55)		51.6-52.5 SANDSTONE: Med. lt. gray; fine to med. grained; hard; 80% angular quartz grains; remainder is dark minerals, mica, and some feldspar. Dark materials are concentrated in streaks showing cross bedding with most fractures being on these bands.			
(60)			Core Box 3 (60.2-75.2)		Run 62.0-72.0 Recovery 10.0/10.0
(65)		52.5-55.1 MUDSTONE: clayey; med. dk. gray; low hardness.			
(70)		55.1-109.2 SANDSTONE: Same as 51.6-52.5; little fracturing; fresh.			Run 72.0-82.0 Recovery 10.0/10.0 Drilling Time 25 min for 10 ft.
(75)		1" Mudstone band @ 57.5 ½" Mudstone Band @62.0	Core Box 4 (75.2-89.3)		
(80)		Becomes medium grained @ 86.0-100.5			Run 82.0-87.0 Recovery 4.8/5.0
(85)		Contains Siltstone & detrital coal lens @ 89.8			
7/12/72 7/13/72					Run 87.0-97.0 Recovery 10.0/10.0
(90)		Many irregular siltstone lenses 91.0-92.0	Core Box 5 (89.3-104.4)		
(95)					
(100)					Run 97.0-107.0

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • RENO		PROJECT NO	DATE	SHEET NO	S-12
		0700	JUNE-JULY1972	2 of 4	

DRILL RIG	CME-45	HOLE ELEVATION	1750	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6"	DATE DRILLED	6/28&7/10-7/14/7

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)		55.1-109.2 SANDSTONE: (Continued) ¼" coal filled fractures @100.4 & 100.7 dipping 32° and many irregular fine lenses of siltstone and coal from 100.7 to 102.1 -Bedding dips 20° @ 103.0 -Becomes medium grained @105 -Many small lenses of siltstone from 105-107' Coal filled fractures @105.3 and 105.7 Siltstone lenses from 108.2-109.2 derived from shale below	Core Box 5 (89.3-104.4)	Nx Core BBL	Run 97.0-107.0 (Continued) Recovery 10.0/10.0
(105)			Core Box 6 (104.4-118.6)		Run 107.0-117.0 Recovery 10.0/10.0
(110)					
(115)		109.2-129.2 SHALE: Med. dk. gray; low hardness; fresh; little fracturing; horizontal bedding. Contact w/SS is irregular -fracture dipping 75° @112.0-112.9 coated with small tabular (barite?) crystals -1½" coal seam @ 113.0 -Coal lenses @114.0,115.0 -Massive from 115.0-123.0 -Detrital coal lens @122.3 and 122.8 Becomes finer grained and darker with depth below 12.2'			Run 117.0-127.0 Recovery 10.0/10.0
(120)			Core Box 7 (118.6-133.8)		
(125)					Run 127.0-137.0 Recovery 10.0/10.0
(130)		129.2-131.2 COAL: Horizontal bedding and contacts.			
(135)		131.2-131.7 CLAYSTONE: Dk. gray grading into	Core Box 8 (133.8-148.0)		Run 137.0-147.0 Recovery 10.0/10.0
(140)		131.7-150.6 SANDSTONE: Med. olive gray; fine grained; hard; irreg. motted lt. & Dk. gray w/minor cross bedding in darker minerals to 139', Bedding is mostly horizontal below 139'.			
(145)					
(150)			Core Box 9		Run 147.0-157.0 Recovery 10.0/10.0

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • IDAHO		PROJECT NO	DATE	SHEET NO	S-12
		0700	JUNE-JULY197	3 OF 4	

DRILL RIG	CME-45	HOLE ELEVATION	1750	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	6/28&7/10-7/14/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(150)		131.7-150.6 SANDSTONE: (Continued) Grades into	Core Box 9 (148.0-162.0)	Nx Core BBL.	Run 147.0-157.0 (Continued) Recovery 10.0/10.0
(155)		150.6-153.9 SILTSTONE: Med. dk. gray; mod. hard; little fractured; fresh; horizontal bedding.			
7/13/72					
7/14/72		153.9-156.0 CLAYSTONE: Med. dk. gray; mod hard; w/slickensided breaks dipping 35°; horizontal bedding; contact w/siltstone horiz. Grades into:			Run 157.0-164.0 Recovery 7.0/7.0
(160)			Core Box 10 (162.0-174.0)		
(165)		156.0-159.3 SILTSTONE: Med. dk. gray; mod hard; contains fine sand @ 157.6-158.3; clayey and crushed below 158.8.			Run 164.0-174.0 Recovery 9.8/10.0
(170)		159.3-160.8 COAL: Clayey @159.6-160.3; pyrite-rich lens @160.6			
(175)		159.3-174.0 SANDSTONE: Silty; fine; hard; mottled lt. and dk. gray below 161' ½' coal filled fracture (clastic dike) dipping 78° @162.2-163.1 -Becomes less silty with depth -Bedding dips 45° from 164.0-165.3, otherwise horizontal - 1½" clay seam @166.6' and 165' - Sandstone is silty from 167-168'			HOLE TERMINATED @ 174.0'
(180)		HOLE TERMINATED @ 174.0 FEET			

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • IDAHO		PROJECT NO	DATE	SHEET NO	S-12
		0700	JUNE-JULY197	4 OF 4	

DRILL RIG ACKER AD-2	HOLE ELEVATION 1657	LOGGED BY GJA
GROUNDWATER DEPTH (Below ground surface) 101.8	HOLE DIAMETER 6 INCHES	DATE DRILLED 7/13-14/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		EMBANKMENT FILL REFUSE BANK Coal processing waste of mixed sand and gravel with local concentrations of each. Sand is 50% coal. The remainder is shale and minor red-dog. Generally coarse grained, angular and blocky fragments.	-	AH	-
(5)			D-1	D	7/9/8 N=17
			-	AH	Drilling Rapid
7/13/72 (10)			S-1	P	Recovery 2.0/2.0
7/14/72		Gravel is mixed coal, carbonaceous shale, light gray shale, and red-dog. The fragments are angular, blocky to platy and are ¼" to greater than 3" in size. A few cobbles from 3" to 12" or more in diameter are present.	-	AH	-
(15)			D-2	D	3/3/3 N=6
			-	AH	-
(20)		Moisture content slightly damp to moist.	S-2	P	Recovery 1.8/2.0
		Consistency given by blow counts.	-	AH	Rapid Drilling
(25)			D-3	D	2/2/3 N=5
			-	AH	-
(30)			S-3	P	Recovery 1.9/2.0
			-	AH	-
(35)			D-4	D	5/3/3 N=6
			-	AH	-
(40)			S-4	P	Recovery 1.6/2.0
			-	AH	-
(45)			D-5	D	5/10/17 N=27
				AH	Rapid drilling
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	S-13
		0700	JULY 1972	1 OF 3	

DRILL RIG ACKER AD-2	HOLE ELEVATION 1657	LOGGED BY GJA
GROUNDWATER DEPTH (Below ground surface) 101.8	HOLE DIAMETER 6 INCHES	DATE DRILLED 7/14-18/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	SP& GP	EMBANKMENT FILL (Continued)	S-5	P	Recovery 1.7/1.9
7/14/72			-	AH	-
7/17/72 (55)			D-6	D	7/16/19 N=35
			-	AH	-
					S-6 0.2/0.3 Refusal, tube ruined
(60)			D-7	D	24/25/26 N=51
			-	AH	-
					S-7 0.2/0.2 refusal, tube ruined
(65)			D-8	D	28/22/28 N=51
			-	AH	Drilling hard saturated clay seams in nearly dry GP
(70)			D-9	D	10/11/41 N=54
			-	AH	-
(75)			D-10	D	5/4/9 N=13
			-	AH	-
(80)			D-11	D	9/10/7 N=17
7/18/72			-	AH	-
(85)			D-12	D	10/10/9 N=19
			-	AH	very hard drilling
(90)			D-13	D	9/31/48 N=79
			-	AH	Two large cobbles- one coal and one shale in bottom of D-13
(95)	SP-SC	SOIL Yellow-brown, slightly clayey fine sand with scattered pebbles.	D-14	D	12/9/10 N=19
(100)			-	AH	Rapid drilling

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	S-13
		0700	JULY 1972	2 OF 3	

DRILL RIG	ACKER AD-2	HOLE ELEVATION	1657	LOGGED BY	GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	101.8	HOLE DIAMETER	6 INCHES	DATE DRILLED	7/18-7/19/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(100)		SOIL (Continued)	D-15	D	13/14/13 N=27
7/18/72		BEDROCK	-	AU	
(105)		KANAWHA SERIES	D-16	D	0.1/R N=51 refusal
7/19/72		102.0-106.8 Silty Shale Light gray, moderately hard, slightly weathered shale with horizontal thin to laminated bedding.	Core Box 1	Nx Core BBL	
(110)		106.8-109.2 Coal Seam Coal layer with carbonaceous shale interbed at 107.2-108.0 coal has pitchy luster, blocky fracture, and is moderately hard and horizontally bedded. Shale interbed is soft, dark gray, clayey carbonaceous, and laminated.			
7/19/72					
(115)					Hole terminated at desired depth.
(120)		109.2-115.0 Silty, fine to medium-grained, light gray sandstone which is moderately hard, fresh, and cross-bedded. It contains thin medium grain, 1/10 inch thick interbeds of medium gray shale. The sandstone beds are approximately 0.8' to 1.5' thick.			
		HOLE TERMINATED @ 115.0 FEET.			

WA WAHLER & ASSOCIATES PALO ALTO • NEWPORT BEACH • CALIF	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO S-13
		PROJECT NO 0700	DATE JULY 1972	SHEET NO 3 of 3	

DRILL RIG CME-45 | HOLE ELEVATION 1692 | LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 INCHES | DATE DRILLED 7/19-24/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		0-34	-	All	Hole cased with 6" hollow stem auger.
	GM	EMBANKMENT FILL			
(5)		Dam embankment materials made up of coal processing waste. Mostly sandy gravels with the gravels being predominantly med.dk. gray siltstones and shale, fine to coarse and angular with some coal and sandstone fragments. There are occasional slabs of shale to 1' in diam.	D-1	D	3/2/2 N=4
			-	All	-
(10)			D-2	D	1/2/2 N=4
	SM-GM	The sand is fine to medium grained and silty from coal sludge.	-	All	-
(15)			D-3	D	1/1/2 N=3
			D-4	D	2/3/3 N=6
(20)			-	All	-
			S-1	P	Recovery 1.8/2.0 0.2' slough in hole
			D-5	D	2/3/3 N=6
(25)			-	All	-
			D-6	D	1/2/2 N=4
	GM		D-7	D	2/3/3 N=6
			-	All	-
(30)			D-8	D	1/2/2 N=4
			D-9	D	3/5/5 N=10
7/19/72			-	All	-
(35)		34'-104'	D-10	D	1/2/2 N=4
7/20/72		RESERVOIR SEDIMENTS	D-11	D	3/4/5 N=9
	SM	34'-70'	-	All	-
(40)		SAND: Silty; fine to medium grained; brownish black; carbonaceous.	D-12	D	0/1/1 N=2
	SC		D-13	D	1/1/2 N=3
		Clayey lens @ 41.5'.	-	All	-
(45)			D-14	D	0/1/1 N=2
	SM		D-15	D	2/3/5 N=8
(50)			-	All	-

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE JULY 1972 | SHEET NO 1 of 3
HOLE NO S-14

DRILL RIG CME-45 | HOLE ELEVATION 1692 | LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE) | HOLE DIAMETER 6 INCHES | DATE DRILLED 7/19-24/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		34'-104'	D-16	D	0/1/2 N=3
		RESERVOIR SEDIMENTS (Continued)	D-17	D	0/1/2 N=3
	SM		-	All	-
(55)		Lens of predominantly med.-grained coal fragments @60' - few fines.	D-18	D	1/2/3 N=5
	SP		-	All	-
(60)			D-19	D	2/4/4 N=8
	SM		-	All	-
(65)			D-20	D	2/3/5 N=8
			-	All	-
(70)		70'-104'	D-21	D	N=0
7/20/72	ML	SILT: With very fine carbonaceous sand; grayish black.	D-22		1/2/2 N=4
7/21/72		-Sampler usually drops under weight of rods for 2' then must be driven to retain sample.	-	All	-
(75)			D-23	D	N=0
			D-24		1/1/1 N=2
(80)			-	All	-
(85)			D-25	D	N=1
			D-26		Wood at bottom of sam.
			-	All	-
(90)					
(95)			D-27	D	N=0
			D-28		3/6/5 N=11
(100)			-	All	-

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF.
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE JULY 1972 | SHEET NO 2 of 3
HOLE NO S-14

DRILL RIG CME-45	HOLE ELEVATION 1692	LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6"	DATE DRILLED 7/19-24/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MOOC	REMARKS
(100)	ML	70-104.0' SILT (Continued)		AH	Drilling firmer @ 102'
(105) 7/21	SC-GC	104.0(approx.)-115.5' SAND: Gravelly; medium to coarse grained subangular to subrounded quartz sand with approx. 40-50% fine to coarse subrounded gravels of various types; lt. olive gray clay binder (approx. 10%)	D-29A D-29B	D	Sampler dropped under own wt.0.5' 5/9/14 N=23
7/24					
(110)				AH	
(115)		HOLE TERMINATED @ 115.5 FEET.			Auger refusal at 115.5' Hole left uncased.

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO.	DATE	SHEET NO.	
PALO ALTO • NEWPORT BEACH • CALIF.		0700	JULY 1972	3 of 3	S-14

DRILL RIG	ACKER AD-2	HOLE ELEVATION	1657	LOGGED BY	GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	8 FT.	HOLE DIAMETER	4 INCHES	DATE DRILLED	7/19/72-7/20/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GP& SP	STREAM GRAVEL Poorly sorted stream gravel and interbedded gravelly, med. to coarse, black sand. Gravel consists of shale, coal and minor red dog up to 12" or more in diameter. Sand is angular, blocky, poorly sorted and full of coal. Beds are nearly horizontal and 3 to 5 ft. thick (?). Saturated below depth of 8 ft.	-	AH	Drilling easy
(5)					Hit water at 8'.
(10)			D-1	D	2/5/4 N=9
7/19			-	AH	Installed 4" casing
(15)			D-2	D	3/3/4 N=7
7/20			-	AH	-
(20)			D-3	D	4/7/6 N=13
			-	AH	-
(25)			D-4	D	7/7/9 N=16
(30)	SM& ML	RESERVOIR SEDIMENT Saturated silty, black laminated coaly sand with clayey lens. Fine to medium grained.	-	RD	Attempted to clean hole at 30 ft. to sample. Casing began to sink ahead of bit. Caught casing and drilled to 36 ft. Took Shelby at this depth.
(35)			S-1	P	Recovery 2.0/2.0
			-	RD	Casing pushed into hole.
(40)	SP	REFUSE BANK (RED DOG) (Pushed casing to 43.5 ft. Had to be driven to 45 ft.)	S-2	P	Recovery 1.7/2.0 Top of S-2 is reservoir sediment. Bottom is red dog gravel.
			-	RD	
(45)			D-5	D	10/9/12 N=21
(50)			-	RD	D-5 is red dog gravel.

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO S-15
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	
		0700	JULY 1972	1 of 2	

DRILL RIG	ACKER AD-2	HOLE ELEVATION	1657	LOGGED BY	GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	4 INCHES	DATE DRILLED	7/20/72-7/25/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	GP	REFUSE BANK (RED DOG) (Continued) Red dog gravel ¼" to 4". Most appears to be 2" in diameter, in poorly sorted, black, coarse silty sand. No clay. Gray shale and pieces of coal rare, saturated.	-	RD	-
7/20					
(55)					
7/21			D-6	D	9/8/5 N=13
(60)			-	RD	-
(65)			D-7	D	15/15/15 N=30
(70)			-	RD	-
7/21					
(75)		KANAWHA SERIES SANDSTONE Medium to coarse-grained silty, buff-colored, weathered sandstone. HOLE TERMINATED @ 76 FEET.	D-8	D	12/85/0 N=85 Refusal D-8 consists of weathered silty sandstone. Pounded casing to 76 feet and met with refusal-- could not pound past this point. Casing when pulled also had about 1 foot of weathered sandstone in it.
7/25					
(80)					
(85)					
(90)					
(95)					
(100)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO S-15
PALO ALTO • NEWPORT BEACH • CALIF		PROJECT NO	DATE	SHEET NO	
		0700	JULY 1972	2 of 2	

DRILL RIG	CME-45	HOLE ELEVATION	1700	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GM	0-68' EMBANKMENT FILL: Dam embankment materials made up of coal processing waste. Mostly sandy gravels with the gravels being med. dk gray siltstones and shale, fine to coarse and angular with coal and sandstone fragments. Approx. 30% fine to med. grained silty sand.			Hole cased with 6" hollow stem auger.
(5)			-	All	-
(10)					
(15)					
(20)					
(25)	GC	Clayey sample @25'	D-1	D	3/4/5 N=9
			-	All	-
(30)			D-2	D	1/2/4 N=6
			-	All	-
(35)	GM		D-3	D	3/4/5 N=9
			-	All	Softer drilling @36'
(40)			D-4	D	2/3/4 N=7
			-	All	-
(45)			D-5	D	3/2/3 N=6
			-		-
(50)					

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO.
PALO ALTO • NEWPORT BEACH • CHICAGO		PROJECT NO	DATE	SHEET NO	S-16
		0700	JULY 1972	1 of 2	

DRILL RIG	CME-45	HOLE ELEVATION	1700	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	GM	0-68' EMBANKMENT FILL: (Continued)	D-6	D	2/3/3 N=6
			-	All	-
(55)			D-7A & 7B	D	4/6/7 N=13
			-	All	-
(60)			D-8	D	4/6/7 N=13
			-	All	-
(65)			D-9	D	5/7/9 N=16
			-	All	Drilling smooth and faster @68' Return material went down in casing @67'
(70)	SM	68'-80.5' RESERVOIR SEDIMENTS SAND: Silty; fine grained; grayish black; carbonaceous; horizontal streaks of olive gray clay.	D-10A	D	N=0
			D-10B		1/1/1 N=2
(75)			-	All	-
(80)	SM-SC	80.5-81.5' ALLUVIUM: SAND: Fine to coarse grained stream deposits. Approx. 60% angular coal fragments and 20% fines.	D-11A D-11B	D	1/6/6 N=12
		HOLE TERMINATED @ 81.5 FEET.			Hole terminated @81.5' and casing removed.
(85)					
(90)					
(95)					
(100)					

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO.
PALO ALTO • NEWPORT BEACH • CHICAGO		PROJECT NO	DATE	SHEET NO	S-16
		0700	JULY 1972	2 of 2	

DRILL RIG CME-45	HOLE ELEVATION 1700	LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 INCHES	DATE DRILLED 7/24-25/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		0-33'			Hole cased with 6"
		EMBANKMENT FILL:			hollow stem auger.
		Dam embankment materials made up of coal processing waste. Mostly sandy gravels consisting of med. dk. gray siltstones and shale; fine to coarse with coal fragments; approx. 30% fine to medium grained silty sand.	-	AH	
(5)					
(10)					Saturated at 12'
	GM				
(15)					
(20)					
(25)			D-1	D	1/1/2 N=3
			-	AH	-
(30)			D-2	D	1/2/1 N=3
			-	AH	no recovery sample fell out in hole (wet gravel)
		33'-60'			
(35)	SM	RESERVOIR SEDIMENTS:	D-3	D	1/2/3 N=5
		SAND: Silty; mostly fine grained; grayish black; carbonaceous.	-	AH	-
(40)			D-4 / D-5	D	0 Blows to 40'> 1/1/1 N=2
			-	AH	-
7/24 (45)					
	SC	Lt. olive gray clayey lens @46'.	D-6	D	1/1/1 N=2
7/25	SM		-	AH	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-17
		0700	JULY 1972	1 of 2	

DRILL RIG CME-45	HOLE ELEVATION 1700	LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 INCHES	DATE DRILLED 7/24-25/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)		33'-60'			
		RESERVOIR SEDIMENTS			
		(Continued)	-	AH	-
	SM				
(55)			D-7	D	1/1/1 N=2
			-	AH	Drilling is harder @60'.
(60)	BDRK	60'-70'			
		BEDROCK- KANAWHA SERIES:			
		SANDSTONE: Yellowish gray; weathers to mod. yell.brn.; mostly fine to medium, subrounded quartz grains and mica.			
(65)			D-8	D	14/16/17 N=33
			-	AH	
(70)					Auger Refusal @ 70'
		HOLE TERMINATED @ 70.0 FEET.			Hole left uncased.
(75)					
(80)					
(85)					
(90)					
(95)					
(100)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-17
		0700	JULY 1972	2 of 2	

DRILL RIG	CME-45	HOLE ELEVATION	1695	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27-28/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GM	0-65.5' DAM EMBANKMENT MATERIALS: GRAVEL: Silty; coal processing waste. Mostly med. dk. gray siltstones and shale with coal fragments and fine to coarse sands varying from 20-50%; sands are carbonaceous.			Hole cased with 6" hollow stem auger.
(5)			-	AH	-
(10)					
(15)					
(20)					
(25)					
7/27 (30)			D-1	D	1/2/1 N=3
7/28					
(35)			-	AH	-
(40)	GM		D-2	D	2/3/4 N=7
			-	AH	-
(45)			D-3	D	1/1/1 N=2
			-	AH	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • DALLAS		PROJECT NO	DATE	SHEET NO	S-18
		0700	JULY 1972	1 OF 2	

DRILL RIG	CME-45	HOLE ELEVATION	1695	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27-28/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	GC	0-65.5' DAM EMBANKMENT MATERIALS (Continued) Becomes clayey @50'	D-4	D	3/4/2 N=6
			-	AH	-
(55)			D-5	D	4/5/6 N=11
			-	AH	-
(60)	SM-GM	Sandy lens @ 60'; medium grained	D-6	D	2/3/4 N=7
	GC		-	AH	Drilling more easily @ 62.5'
(65)	SM	65.5-66.5' RESERVOIR SEDIMENTS: SAND: Silty; very fine grained brownish black; carbonaceous; 40% silt fines	D-7A D-7B	D	1/2/2 N=4
(70)		HOLE TERMINATED @ 66.5 FEET.			Hole terminated @66.5' Casing removed.

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • DALLAS		PROJECT NO	DATE	SHEET NO	S-18
		0700	JULY 1972	2 OF 2	

DRILL RIG ACKER AD-2 | HOLE ELEVATION 1688 | LOGGED BY GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE) (8 ft.) | HOLE DIAMETER 4 INCHES | DATE DRILLED 7/25/72-7/26/72

ELEVATION (Datum)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GP& SP	EMBANKMENT MATERIALS:			Drilling easy
		Surface material is coarse silty sand containing gravel and cobbles of gray shale and scattered buff-colored sandstone and coal. Gravel and SP approximately equal in amount.	-	SA	
(5)					Hit water at 8 feet.
(10)					
(15)		-----?-----?-----?-----?----- Pebbly to gravelly dark gray, medium to coarse grained silty, coaly sand. Lenses of pebbles and gravel up to several(?) feet thick contain dark gray shale and coal fragments. Plasticity of sand is low. Consistency is given by blow counts. The sand is very moist to wet.			
(20)			D-1	D	4/4/13 N=17
			-	SA	D-1 is dark gray, coarse SP with about 10% pebbles.
(25)			D-2	D	3/5/4 N=9
			-	SA	-
(30)			D-3	D	5/7/9 N=16
			-	SA	-
(35)			D-4	D	8/9/9 N=18
			-	SA	D-4 Few pebbles-mainly SP
7/25 (40) 7/26			D-5	D	13/16/20 N=36
			-	SA	-
(45)			D-6	D	4/5/5 N=10
			-	SA	D-6 very pebbly.
(50)		POOL 2 SEDIMENTS			

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE JULY 1972 | SHEET NO 1 OF 2
HOLE NO S-19

DRILL RIG ACKER AD-2 | HOLE ELEVATION 1688 | LOGGED BY GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE) (8 FEET) | HOLE DIAMETER 4 INCHES | DATE DRILLED 7/26/72

ELEVATION (Datum)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	SM	POOL 2 SEDIMENTS (Continued) Thinly interbedded, silty, medium to coarse-grained, dk. gray to black coaly poorly sorted sand. Some fine grained sand also present with occasional clayey silt layers with moderate plasticity. Very moist to wet. Consistency given by blow counts.	D-7	D	1/2/2 N=4
			-	SA	-
(55)			D-8	D	2/2/3 N=5
			-	SA	Small pebbles scattered in SP
(60)	SC& ML		D-9	D	1/1/2 N=3
			-	SA	D-9 clayey silt and black sand
(65)					
(70)		BEDROCK-KANAWHA SERIES Tan sandstone.			
		HOLE TERMINATED @ 70 FEET.			Augered to 68 feet-drilling very hard. Continued to 70 feet and met refusal. Hole terminated.
(75)					

WA WAHLER & ASSOCIATES — PALO ALTO • NEWPORT BEACH • CALIF
COAL REFUSE DAM FAILURE, Saunders, W. Va.
SOIL EXPLORATION DRILL HOLE LOG
PROJECT NO 0700 | DATE JULY 1972 | SHEET NO 2 OF 2
HOLE NO S-19

DRILL RIG	ACKER AD-2	HOLE ELEVATION	1763	LOGGED BY	GJA
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	DRY	HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27-7/28/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)	GP& SP	EMBANKMENT MATERIALS: Surface material is coarse loose, permeable, poorly-sorted sand and gravel. Sand exceeds gravel.	-	AH	Pitcher Barrel Hole
(5) 7/27		The sand is medium to coarse grained, dark gray, coaly, and angular.	PB-1	PD	2.0/2.5
7/28		The gravel is ¼" to greater than 3" in diameter. Numerous cobbles exceed 12". The material is generally platy, dark gray shale with minor light-gray shale, coal, and buff-colored sandstone fragments.	PB-2	PD	1.8/2.5
(10)		The embankment is essentially dry to slightly moist.	PB-3	PD	1.8/2.5
7/28			PB-4	PD	1.9/2.5
(15)		HOLE TERMINATED @ 14 FEET.			HOLE TERMINATED
(20)					

W.A. WAHLER & ASSOCIATES (PALO ALTO • NEWPORT BEACH • CHLEF)	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
		PROJECT NO	DATE	SHEET NO	S-20
		0700	JULY 1972	1 of 1	

DRILL RIG	CME-45	HOLE ELEVATION	1700	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27/72

ELEVATION (Depth)	CLASS	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		0-50'			Hole cased with 6" hollow stem auger.
		EMBANKMENT FILL: Dam embankment materials made up of coal processing waste. Mostly sandy gravels of medium dk. gray siltstones and shale; fine to coarse; angular with coal and sandstone fragments. 30% fine to coarse grained silty sand.	-	All	-
(5)					
(10)					
(15)					
(20)					
(25)					
(30)					
(35)					
(40)			D-1	D	3/7/9 N=16
			-	All	-
(45)			D-2	D	3/5/5 N=10
			-	All	-
(50)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-21
		0700	JULY 1972	1 of 2	

DRILL RIG	CME-45	HOLE ELEVATION	1701	LOGGED BY	LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)		HOLE DIAMETER	6 INCHES	DATE DRILLED	7/27/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(50)	SM	50'-66.5	D-3A	D	N=0
		RESERVOIR SEDIMENT:	D-3B		1/1/1 N=2
		SAND: Silty; fine grained; grayish black; carbonaceous; quick dilatancy in fines.	-	All	Drills easier after 50'
(55)			D-4A	D	N=0
		Sampler usually sinks under rod weight for 1' then is driven to retain sample.	D-4B		1/1/1 N=2
			-	All	-
(60)			D-5A	D	N=0
			D-5B		1/2/1 N=3
			-	All	-
(65)				D	1/2/3 N=5
		HOLE TERMINATED @ 65.5 FEET.			Hole terminated @ 65.5' Casing removed.
(70)					

WA WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG			HOLE NO.
PALO ALTO • NEWPORT BEACH • SALEM		PROJECT NO	DATE	SHEET NO	S-21
		0700	JULY 1972	2 of 2	

DRILL RIG CME-45	HOLE ELEVATION 1701	LOGGED BY LAR
GROUNDWATER DEPTH (BELOW GROUND SURFACE)	HOLE DIAMETER 6 INCHES	DATE DRILLED 7/31/72

ELEVATION (Depth)	CLASS.	DESCRIPTION FIELD IDENTIFICATION	SAMPLE NUMBER	MODE	REMARKS
(0)		0-40'			Hole cased with 6" hollow stem auger.
	GM	DAM EMBANKMENT MATERIALS: GRAVEL: Silty; coal processing waste; mostly fine to coarse grained med. dk. gray siltstone and shale fragments; 20-30% sand and silty fines.			
(5)			-	All	-
(10)					
(15)					
(20)					
(25)			D-1	D	4/3/4 N=7
			-	All	-
(30)			D-2	D	3/4/4 N=8
			-	All	-
(35)			D-3	D	3/4/5 N=9
			-	All	Contact appears to be at 40'
(40)		40-41.5'	D-4A D-4B	D	1/1/1 N=2
		RESERVOIR SEDIMENTS: SAND: silty; fine to very fine grained; brownish black; 30-40% silt fines; carbonaceous.	-	-	Hole terminated @41.5' Casing removed.
(45)		HOLE TERMINATED @ 41.5 FEET.			
(50)					

WA WAHLER & ASSOCIATES PALO ALTO • NEWPORT BEACH • DENVER	COAL REFUSE DAM FAILURE Saunders, W. Va.	SOIL EXPLORATION DRILL HOLE LOG		HOLE NO S-22
		PROJECT NO 0700	DATE JULY 1972	SHEET NO 1 OF 1

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS — MORE THAN 50% RETAINED ON NO. 200 SIEVE*	GRAVELS — 50% OR MORE OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES.
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES.
	SANDS — MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SANDS	SW	WELL-GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES.
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES.
FINE GRAINED SOILS — 50% OR MORE PASSES NO. 200 SIEVE*	SILTS & CLAYS — LIQUID LIMIT 50% OR LESS		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS.
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY.
	SILTS & CLAYS — LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS.
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY.
	HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS.

*BASED ON THE MATERIAL PASSING THE 3-IN. (75-MM) SIEVE.

DEFINITION OF TERMS

GRAIN SIZES

U.S. STANDARD SERIES SIEVES: 200 | 50 | 16 | 4 — CLEAR SQUARE SIEVE OPENINGS: 3/4" | 3" | 12"

SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY — SLIGHTLY DAMP — DAMP — MOIST (PL) — VERY MOIST — WET (SATURATED) (LL)

SAMPLE NUMBER COLUMN

TYPE OF SAMPLE CONTAINER:

- BAG ..... B
- JAR ..... J
- SHELBY TUBE ..... S
- LINER (TUBE) L
- WRAPPED CORE ..... WC
- BOX X
- PITCHER TUBE ..... PB
- PISTON ..... PST

MODE COLUMN

METHOD OF ADVANCING HOLE:

DRILL

- HOLLOW STEM AUGER ..... HA
- SPIN AUGER ..... SA
- ROTARY DRILL ..... RD
- CABLE TOOL ..... CT

SAMPLER

- DRIVE (STD. PENETROMETER)* ..... D
- PITCHER BARREL ..... PB
- CORE C
- PUSH ..... P

REMARKS COLUMN

NUMBER OF BLOWS REQUIRED TO DRIVE SAMPLER IS SHOWN FOR EACH 0.5' OF PENETRATION AS FOLLOWS: 17/22/29 FOR A TOTAL OF 1.5 FEET: N = 51 BLOW COUNTS SUMMED FOR LAST 1.0 FOOT.

RECOVERY RATIO INDICATED BY A FRACTION:

$\frac{1.2}{1.5} = \frac{\text{FOOTAGE RECOVERED}}{\text{FOOTAGE SAMPLED}}$

TERMINATED HOLE: SUFFICIENT INFORMATION OBTAINED.

SANDS & GRAVELS

RELATIVE DENSITY	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CLAYS & SILTS

CONSISTENCY	BLOWS/FOOT*	STRENGTH**
VERY SOFT	0-2	0-¼
SOFT	2-4	¼-½
FIRM	4-8	½-1
STIFF	8-16	1-2
VERY STIFF	16-32	2-4
HARD	OVER 32	OVER 4

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2-INCH O-D. (1-3/8 INCH I-D.) SPLIT SPOON (STANDARD PENETROMETER).

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ. FT.

W.A. WAHLER & ASSOCIATES

PALO ALTO • NEWPORT BEACH • CALIF.

KEY FOR EXPLORATION LOGS

TABLE A-4

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-1A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 10.0 to 20.0 feet

DATE OF TEST: May 12, 1972

TIME CLOCK (hrs)	TIME ACCUM. (min)	WATER VOLUME ACCUM. FLOW (gal)	WATER TEMPERATURE (degrees C)
955	0	0	-
1115	80	48.0	15
1133	-	-	-
1255	168	92.8	17
1305	-	-	-
1405	228	126.8	19
1421	-	-	-
1521	288	161.6	18
1536	-	-	-
1636	348	198.6	17
1648	-	-	-
1718	378	216.0	16

Coefficient of permeability from nomograph:

K_{20^oC} =250 ft/yr or 2.42 x 10^{-4}cm/sec

78

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-2A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 6"

TESTED INTERVAL: Not run

DATE OF TEST: May 15, 1972

Notes: Hole was set up drilled to 40 feet, gravel @ 20-40, casing @ 0-20. It was abandoned when initial results indicated the interval gravelled was too large for practical testing of a 6" hole. The hole took 6.1 gpm for approximately 1 hr. with the water level stabilized at the top of the gravel. The water did not rise into the casing.

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-3A

LOCATION: Left abutment, Dam No. 3.

HOLE DIAMETER: 6"

TESTED INTERVAL: 3.6 to 10.5 feet

DATE OF TEST: May 24-25, 1972

The results for two consecutive days of testing were inconsistent. Hole was abandoned and data not processed.

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-4A

LOCATION: Dam No. 3, left abutment remnant.

HOLE DIAMETER: 4"

TESTED INTERVAL: 19.6 to 25.0 feet

DATE OF TEST: May 31, 1972

Remarks: Could not establish a water level in the casing. Hole took 4 gal/minute from the supply hose for approximately 1/2 hour before efforts to establish water level in casing were abandoned.

81

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& ASSOCIATES

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-5A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 30.0 to 35.5 feet

DATE OF TEST: June 2, 1972

Remarks: Could not establish and maintain a water level just above the gravel top at 30.0 feet depth. Weight of float chain too high; when additional counterweights were added to the valve, it would not properly function while carrying the extra weight.
Hole abandoned in favor of additional shallow holes.

82

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-6A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 10.0 to 15.0 feet

DATE OF TEST: July 17, 1972

Remarks: 900 gallons of water placed in hole in 45 minutes.
Water level maintained at 6" above top of gravel during pouring - no sign of stabilizing.

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-7A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 7.5 to 15.0 feet

DATE OF TEST: July 18, 1972

TIME CLOCK (hrs)	TIME ACCUM. (min)	WATER VOLUME ACCUM. FLOW (gal)	WATER TEMPERATURE (degrees C)
902	0	0	25
917	15	8.0	25
932	30	17.0	25
947	45	26.5	25
1002	60	35.0	25
1037	95	52.5	26
1107	125	70.0	27
1211	189	105.5	28
1333	271	141.0	29
1520	378	169.0	30
1627	445	196.0	29

Coefficient of permeability from nomograph:

$K_{20^{\circ} C} = 225$ ft/yr or 2.17×10^{-4} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-7A (continued)

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 7.5 to 15.0 feet

DATE OF TEST: July 20, 1972

TIME		WATER VOLUME	WATER TEMPERATURE
CLOCK (hrs)	ACCUM. (min)	ACCUM. FLOW (gal)	(degrees C)
842	0	0	24
942	60	19.5	25
1042	120	38.5	26
1148	186	57.0	26
1300	258	79.0	29
1406	324	97.0	27
1506	384	115.0	29
1613	451	132.5	29
1645	483	142.0	29

Coefficient of permeability from nomograph:

$K_{20^\circ C}$ = 185 ft/yr or 1.79×10^{-4} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-8A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 9.1 to 15.2 feet

DATE OF TEST: July 21, 1972

TIME		WATER VOLUME	WATER TEMPERATURE
CLOCK (hrs)	ACCUM. (min)	ACCUM. FLOW (gal)	(degrees C)
1055	0	0	28
1110	15	3.5	28
1125	30	5.5	28
1140	45	8.0	28
1155	60	10.5	29
1255	120	20.0	30
1355	180	30.5	30
1455	240	40.5	31

Coefficient of permeability from nomograph:

$K_{20^\circ C} = 140$ ft/yr or 1.35×10^{-4} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-9A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 1.2 to 4.9 feet

DATE OF TEST: July 26-27, 1972

Remarks: Water seep observed in hillside 13' from hole. Elevation of seep is 2.5' below top of water in hole. Amount of flow was about the same as flow into hole. The test was terminated.

Travel time test: The obvious channel-type flow above negated any attempt to run the usual test, but provided an opportunity for a crude travel time test performed on July 27, 1972. Flow to the seep was re-established and a head of 2.45 feet was maintained. Red dye was added to the test hole and the seep was observed for its appearance. Water temperature was 70°F; horizontal distance from the hole to the seep was 13 feet. The first traces of red dye appeared at the seep 14.5 minutes after it was put in the hole; a stronger color appeared 16.0 minutes after the dye was put in the hole, and very strong color appeared at the seep 17.0 minutes after the dye was put in the hole.

87

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-10A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 0.9 to 4.5 feet

DATE OF TEST: July 25 and 26, 1972

TIME CLOCK (hrs)	TIME ACCUM. (min)	WATER VOLUME ACCUM. FLOW (gal)	WATER TEMPERATURE (degrees C)
926	0	0	25
1026	60	1.4	25
1126	120	2.5	26
1226	180	3.7	27
1326	240	5.3	27
1426	300	6.6	27
1526	360	8.0	28
1626	420	9.4	28
800 (7/26)	1354	29.7	21

Coefficient of permeability from nomograph:

$K_{20°C}$ = 48 ft/yr or 4.64 x 10^{-5} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-11A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 0.7 to 4.0 feet

DATE OF TEST: July 24 and 25, 1972

TIME CLOCK (hrs)	TIME ACCUM. (min)	WATER VOLUME ACCUM. FLOW (gal)	WATER TEMPERATURE (degrees C)
855	0	0	27
955	60	1.4	27
1055	120	2.6	27
1155	180	3.5	28
1255	240	4.7	29
1355	300	6.1	30
1455	360	7.4	30
1555	420	8.7	31
1655	480	10.1	32
805 (7/25)	1390	30.4	25

Coefficient of permeability from nomograph:

$K_{20^\circ C} = 50$ ft/yr or 4.83×10^{-5} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-12A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 3.8 to 6.8 feet

DATE OF TEST: July 27, 1972

Remarks: Water drained from hole as fast as barrel would empty for 324 gallons. Could not establish a water level in the casing.

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-13A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 1.3 to 4.9 feet

DATE OF TEST: July 28, 1972

TIME		WATER VOLUME	WATER TEMPERATURE
CLOCK (hrs)	ACCUM. (min)	ACCUM. FLOW (gal)	(degrees C)
1145	0	0	21
1215	30	4.2	21
1215	60	8.1	21
1315	90	12.0	22
1345	120	15.8	22
1415	150	19.5	22
1445	180	23.2	22
1515	210	26.9	22
1545	240	30.6	22
1615	270	34.3	22
1645	300	38.0	22

COEFFICIENT OF PERMEABILITY FROM NOMOGRAPH:

$K_{20^\circ C}$ = 295 ft/yr or 2.85 x 10^{-4} cm/sec

FIELD PERMEAMETER TEST RESULTS

TEST HOLE NO.: FP-14 A

LOCATION: Left abutment remnant, Dam No. 3.

HOLE DIAMETER: 4"

TESTED INTERVAL: 0.7 to 4.2 feet

DATE OF TEST: July 31, 1972

TIME CLOCK (hrs)	TIME ACCUM. (min)	WATER VOLUME ACCUM. FLOW (gal)	WATER TEMPERATURE (degrees C)
903	0	0	19
918	15	2.4	19
1003	60	9.3	19
1033	90	14.2	19
1133	120	24.1	19
1233	180	34.1	20
1340	247	44.2	20
1440	307	54.2	20
1540	367	64.1	21

Coefficient of permeability from nomograph:

$K_{20}o$ = 430 ft/yr or 4.15 x 10^{-4} cm/sec

APPENDIX B

LABORATORY INVESTIGATION

A. GENERAL

This Appendix includes a discussion of test procedures and actual test results for the laboratory investigation performed by W. A. Wahler and Associates on the various embankment and foundation materials for use in the engineering evaluation of the failure of the coal waste dams near Saunders, West Virginia.

The purpose of this investigation was to study the soil engineering characteristics of the various materials in order to determine the in-place soil engineering parameters necessary for use in these analyses. To this end, the laboratory testing was conducted employing currently accepted test procedures of the American Society of Testing and Materials (ASTM).

Various bulk and undisturbed samples used in the laboratory investigation were obtained during the course of the field investigation as discussed in Appendix A of this report. Then, after reviewing the drill hole logs, various undisturbed foundation and embankment samples, contained in 3-inch diameter Shelby tubes, were selected to remain in Logan, West Virginia for testing in our portable laboratory. The remainder of the undisturbed samples, including all 4-inch diameter Shelby-type tubes and the large (50-lb.) bulk samples, were transported to our laboratory in Palo Alto for more extensive examination and testing.

Laboratory testing completed in Logan, West Virginia consisted of 22 triaxial tests, 13 water contents and dry densities, and 8 permeability determinations in conjunction with triaxial tests. All other tests

reported herein were completed at our main laboratory in Palo Alto, California. All of the various laboratory tests performed during the course of this investigation are described below. Identification of each sample is by hole number and depth or by field density (FD) number if the sample was obtained by means other than rotary drilling. Additionally, a special series of triaxial tests was performed on samples, typical of Dam No. 3 embankment, and materials fabricated in the laboratory. These samples are referenced as Sample A-1.

B. INDEX PROPERTIES TESTING

In the field of soil mechanics and earth dam design, it is advantageous to have a standard method of identifying soils and classifying them into categories or groups that have similar or distinct engineering properties. The most commonly used method at present is the Unified Soils Classification System (USCS) as described by ASTM D2487-69T. The USCS is based on a recognition of the various types and significant distribution of soil constituents, considering individual grain-size, magnitude and type of gradation characteristics, and plasticity of materials.

The index properties tests presented in this report included the determination of natural water content and in-place dry density, specific gravity and absorption, Atterberg Limits and grain-size distribution for both the embankment and foundation materials.

1. Natural Water Content and Dry Density

Natural water content and in-place dry density data were determined in the laboratory on extruded 3-inch diameter Shelby tube samples used for triaxial testing. Moisture content and density data were also determined on additional samples for correlation. Each sample was trimmed

to obtain a smooth, square face and then accurately measured to obtain volume and wet weight before drying for a period of approximately 48 hours in an oven maintained at a temperature of 110°F. The 110°F temperature, which deviates from the specified 210°F in ASTM, was necessary to prevent spontaneous combustion of the coal waste material and was determined by trial and error methods.

The results of the natural water content and dry density testing are presented on Figure B-1 and also with the individual triaxial results.

2. Grain-Size Distribution

The gradation characteristics of selected samples of embankment and foundation materials were determined in accordance with ASTM designation D422-63 and D1140-54, except as modified below. Representative samples were quartered and/or prepared in accordance with ASTM designation D421-58. The samples were soaked in water until individual soil particles were separated, and then washed on a #200 mesh sieve. That portion of the material retained on the #200 mesh sieve was oven-dried and then mechanically sieved. A hydrometer analysis was performed using a constant temperature hydrometer bath, for those samples with more than approximately 30 percent passing the #200 mesh sieve. Sodium hexametaphosphate was used as a dispersing agent. The grain-size distribution test for samples tested are presented on Figure B-2, sheets 1 through 25.

3. Atterberg Limits

The liquid and plastic limits for selected samples were determined in accordance with ASTM designation D423 and D424. Results of the Atterberg Limits are presented on Figure B-3, sheets 1 through 3. Results of the Atterberg Limits have also been presented on the Gradation and Compaction Sheets and on the triaxial test result sheets, where appropriate, to aid in interpretation of such results.

4. Specific Gravity

Specific Gravity determinations were made primarily on samples used for compaction or triaxial testing in accordance with ASTM designation D854-58. In addition, bulk Specific Gravity determinations were conducted on the Field Density samples containing aa substantial amount of plus 3/4-inch size material, using ASTM Method C127. One bulk Specific Gravity was also conducted on the combined sample A-1, used for lab-fabricated 4.0-inch triaxial testing. The specific gravity test results are presented on Figure B-4, sheets 1 and 2, and also on the individual triaxial, gradation and compaction test results.

C. ENGINEERING PROPERTIES TESTING

The engineering properties testing constituted a significant portion of time and budget for the laboratory testing phase of the failure investigation. The engineering properties tests presented in this report include compaction, triaxial shear, and permeability tests.

1. Compaction Tests

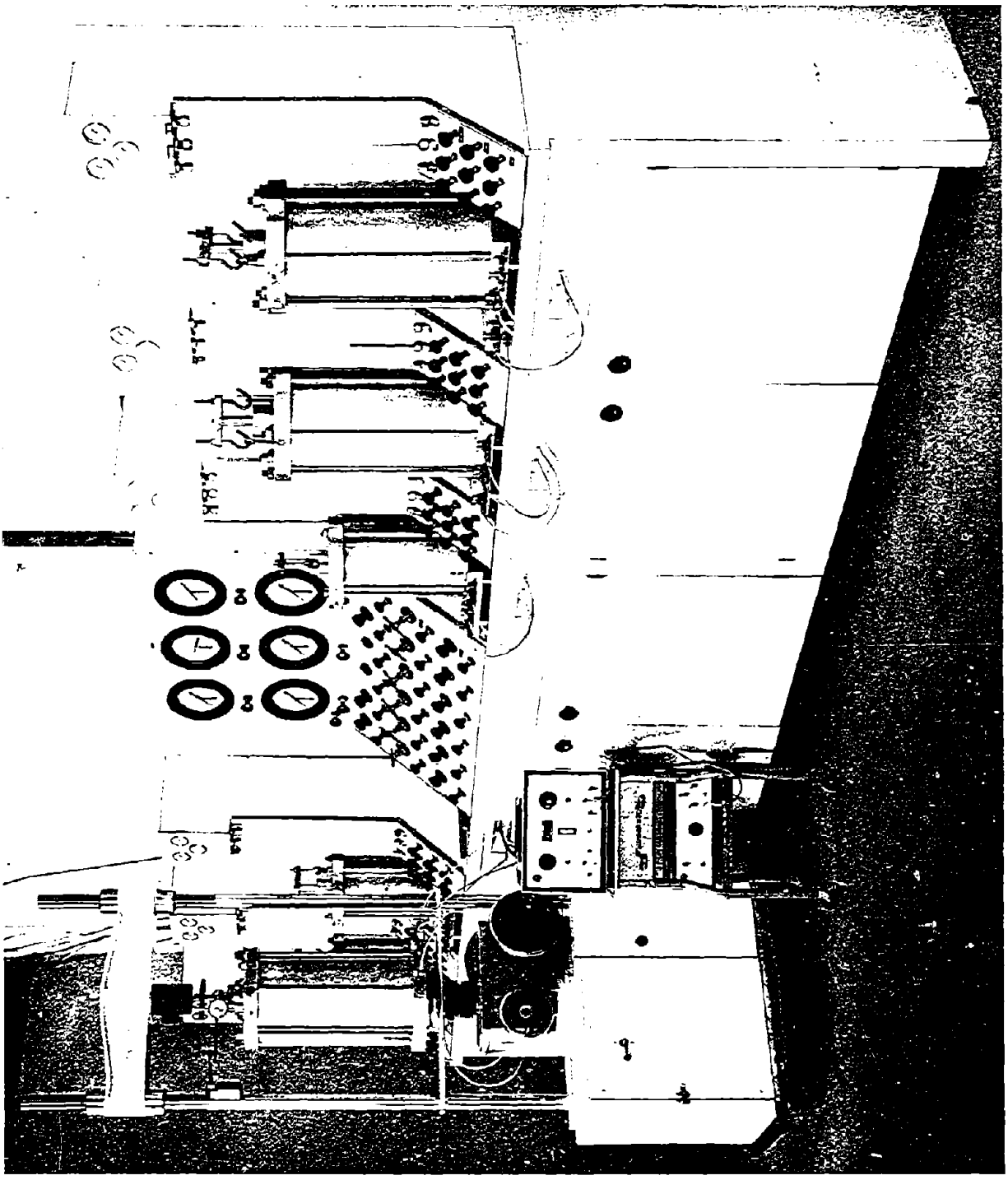
Compaction tests were performed to determine the moisture-density relationships of the materials. The tests were performed using a Howard mechanical compactor in accordance with ASTM designation D1557-70, modified to yield a compactive energy of 20,000 foot-pounds per cubic foot ($Ft\text{-}lb/ft^3$) by reducing the number of layers to 3 and the number of blows per layer of a 10-lb. hammer to 15. For the coarse-grained materials, it was necessary to scalp the total sample on the 3/4-inch sieve prior to performing the compaction tests. Compaction test results, together with gradation characteristics of the materials tested are presented on Figure B-5, sheets 1 through 13.

2. Static Triaxial Shear

The triaxial shear testing program was planned to determine the shear strength parameters of both the coarse waste and sludge constituents of the embankment and foundation materials. The program was detailed in scope and consisted of testing undisturbed 3-inch diameter Shelby tube samples and 4.0-inch diameter laboratory-fabricated samples.

Our main laboratory is equipped with a panel of 6 bays, with individual pressure control to each bay, such that the 6 triaxial samples can simultaneously be saturated and/or consolidated at different individual pressures. The portable laboratory trailer contains 3 bays for 3 individual samples. Other than this minor difference, the two laboratories possess the same triaxial testing capabilities. Bleeding air regulators capable of delivering air pressure up to 200 psi are used to control the top, bottom, and chamber lines leading to the triaxial cells. Each saturation bay is also equipped with constant diameter Pyrex sight tubes, each with a cross sectional area of 0.0767 square inches, which connect with the base of the triaxial cell, and thus to the sample. The sight tubes are easily read to the nearest 0.1 inch, which indicates an accuracy of volume change readings of better than 0.01 cubic inch. An overall view of the triaxial saturation bay, triaxial cell and strain control testing machine is shown in Photoplate B-1.

a. Undisturbed Samples - The undisturbed Shelby tube samples selected for testing either in Logan or Palo Alto were extruded using a hydraulically operated ram capable of exerting the minimum force necessary to free the sample from the Shelby tube. With the aid of a special trimming device which completely supported the sample, the possibility of sample disturbance due to handling was significantly reduced. The results of the undisturbed triaxial test results are on Figure B-6, sheets 1 through 15.



TRIAXIAL SATURATION BAY. STRAIN CONTROLLED 20,000 LB LOADING MACHINE AND STRAIN INDICATOR FOR ELECTRIC READOUT OF LOAD AND PORE PRESSURE. (NOTE THE INDIVIDUAL PRESSURE AND VOLUME CONTROL FOR THE TOP, BOTTOM, AND CHAMBER LINES OF EACH CELL.)

W.A. WAHLER
& ASSOCIATES

PHOTOPLATE B-1

b. Fabricated Samples - Due to the large grain size of some of the embankment materials, it was necessary to conduct a series of laboratory-fabricated 4.0-inch diameter triaxial tests. An extensive study was performed to obtain an average gradation, dry density and water content from all of the field and laboratory data. These averages were used as the guide for fabricating samples.

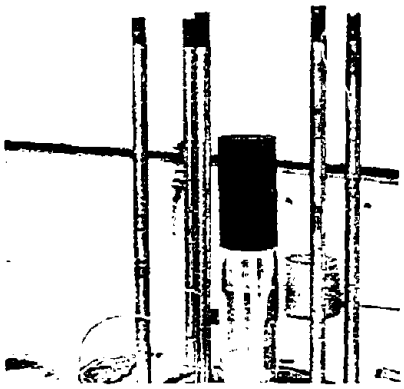
The set-up gradation for the triaxial samples simulated that of the total average gradation except for the exclusion of plus 1-inch material, the weight of which was compensated for by inclusion of 3/4 to 1-inch material so that the percent passing the 3/4-inch sieve was identical to the average total gradation (Figure B-2, sheet 15). This was done so that no more than a 1 to 4 ratio would exist between maximum particle size and diameter of sample.

The sample was then moisture-conditioned to the predetermined average moisture content and allowed to cure for approximately 24 hours. The fabrication of samples was performed in a 4-inch diameter mold with a height-to-diameter ratio of 2.1 to 1, using the rounded end of a 1/2-inch diameter shaft which was routed into the sample until a given weight of soil occupied a known volume. The sample was compacted in five equal layers with care being taken to scarify each compacted surface in order to preclude preferential bonding or laminae developing between layers. These specimens were compacted to the predetermined average dry density obtained as explained previously and were designated Sample A-1. The results of these laboratory fabricated triaxial tests are presented on Figure B-6, sheets 14 and 15. Photographs depicting various stages of the sample fabrication process are shown in Photoplate B-2.

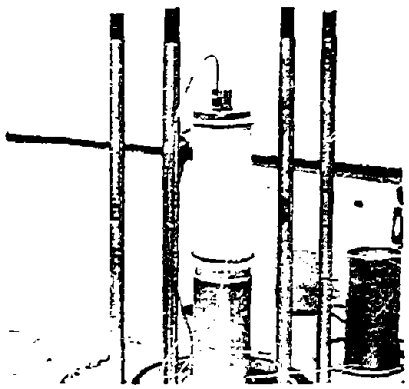
c. Sample Saturation and Consolidation - After fabrication or trimming and initial weight and volume measurements were completed, the samples for triaxial testing were placed in the triaxial cell, encased in a

STAGE 1.—SAMPLE IS FABRICATED BY KNEADING COMPACTION INTO 2.8" OR 4.0" DIAMETER MOLD USING FIVE EQUAL LAYERS.

STAGE 2.—REMOVAL OF MOLD AFTER COMPLETING SAMPLE FABRICATION. OVERCOMPACTED ZONES ARE PREVENTED BY SCARIFYING EACH COMPACTED LAYER.



STAGE 3.—SAMPLE IS MOUNTED ON PEDESTAL OF TRIAXIAL CELL. FILTER STRIPS MAY BE REQUIRED TO SPEED UP CONSOLIDATION TIME OF IMPERVIOUS SOILS.



STAGE 4.—SAMPLE IS ENCASED IN A RUBBER MEMBRANE AND SECURED TO BOTTOM PEDESTAL AND TOP CAP WITH "O" RINGS. DRAINAGE LINES LEAD FROM TOP AND BOTTOM OF SAMPLE TO EXTERNAL CELL CONNECTIONS.

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PHOTOPLATE B-2

rubber membrane and sealed to the bottom pedestal and topcap with rubber "O" rings. After securing the triaxial chamber, the cell was filled with water, fitted with a 1-inch diameter stainless steel piston for load application, and transported to the saturation bay. A back pressure of 50 psi was necessary to obtain a sufficient degree of saturation prior to the consolidation phase of the test. In order to determine whether the back pressure applied was causing complete saturation, Skempton's "B" parameter was measured for all samples. A value in excess of 0.95 was considered to represent a fully saturated condition. After achieving complete saturation, the samples were either consolidated isotropically or anisotropically, or failed unconsolidated.

1. I.C.U. Tests - For those samples consolidated isotropically, the chamber pressure was increased to a value in excess of the back pressure by an amount equal to the designated consolidation pressure, the top and bottom drainage lines were simultaneously opened, and the total volume of water expelled from the samples was monitored as a function of time. In some cases, strips of filter paper, placed along the sides of the specimen during set-up, were used to accelerate the consolidation process. Once consolidation was complete, the samples were failed in an undrained condition with pore pressure, axial load and sample strain monitored as described in (d) below. The results for the I.C.U. triaxial shear testing appear on Figure B-6, sheets 1 through 5 and 8 through 14.

2. K_o - Tests - The K_o-anisotropic consolidation was performed in a drained condition using strain control techniques. The K_o-value is an at-rest pressure coefficient defined by the ratio of minor principal effective stress to major principal effective stress. After achieving complete saturation, the samples were consolidated in a drained condition at a sufficiently slow rate of strain to preclude the build-up of pore pressure. During progress of the test. the volume

change was continuously monitored and the chamber pressure increased incrementally as necessary in order to cause the sample volume change to equal the product of the axial deformation times the initial cross sectional area. Once the desired lateral confining pressure (σ_3) was achieved, the top and bottom drainage lines were closed and the sample was failed in an undrained condition. Results for the K_o consolidation and triaxial shear tests appear on Figure B-6, sheet 6 and 15.

3. U.U. Tests - The samples tested under unconsolidated-undrained conditions were not consolidated prior to failure. The samples were failed undrained with pore pressure, axial load and sample strain monitored as described in (d) below. Results for the unconsolidated-undrained triaxial tests appear on Figure B-6, sheet 7.

d. Sample Failure - All triaxial specimens were failed by compression loading at a constant rate of strain while maintaining a constant minor principal stress. The rate of strain selected for sample failure was dependent upon the materials consolidation characteristics. The failure machines used both in Palo Alto and in Logan were geared to fail the undisturbed samples at approximately 4 percent of axial strain per hour. The rate of strain for the taller, fabricated samples varied slightly. The actual rate of strain for each test is presented on each individual data sheet. The axial load and pore pressure readings were obtained during the test at specified axial deformations using a BLH load cell (0-2,000 lbs.) and a Stathom pore pressure transducer (0-200 psi gauge). The adopted failure criterion used for the presentation of the Mohr circle of stress for most triaxial tests was the point of maximum principal effective stress ratio, except for the unconsolidated tests, in which 10 percent strain was used. The point of failure was developed at various strain rates, depending upon material type, method of consolidation and confining pressure.

3. Permeability Tests

Permeability coefficients for selected samples were determined in conjunction with triaxial shear tests by applying a constant head hydraulic gradient to the sample and monitoring the flow of water from bottom to top of sample through the sight tubes. Samples were tested for permeability at initial setup densities or after consolidation. In some cases, the same sample was tested at two or three different densities. Permeability test results are presented on Figure B-7.

a. Special Fabricated Piping Test - An undisturbed Shelby tube of sludge material from Hole 5 at 65 feet was extruded and observed. The coarser SM material in the tube was then separated from the finer ML material (Figure B-2, sheet 6). The coarser material was then compacted into a 4-inch diameter clear lucite tube to the approximate average dry density (51 pcf) of the sludge material. The sample was then saturated by allowing it free access to water at the bottom of the sample. A slight head was then established so that water would flow from bottom to top. When the applied gradient (head loss divided by sample length) exceeded 0.25, the sample began to rise in the tube and the migration of material, through a system of branching "pipes," was clearly visible. The "pipes" continued to enlarge and the moving material had the appearance of boiling.. The condition of piping described above physically substantiated the theoretical critical gradient of 0.26 as discussed in Chapter VII of this report.

FIGURE B-1

SUMMARY
OF
IN-SITU WATER CONTENT AND DRY UNIT WEIGHTS

HOLE NO	SAMPLE NO	DEPTH (ft)	MATERIAL TYPE	WATER CONTENT (%)	DRY WEIGHT (pcf)
2	S-4	23.0-25.0	EMBANKMENT, DAM NO. 3	3.3	80.3
2	S-4	23.0-25.0	EMBANKMENT, DAM NO. 3	4.2	80.5
2	S-4	23.0-25.0	EMBANKMENT, DAM NO. 3	5.9	77.4
3	S-6	25.0-27.0	EMBANKMENT, DAM NO. 3	9.7	75.9
4	S-2	10.0-12.0	EMBANKMENT, DAM NO. 2	8.7	83.7
4	S-6	30.0-32.0	EMBANKMENT, DAM NO. 2	8.2	106.5
4	S-7	35.0-37.0	EMBANKMENT, DAM NO. 2	10.3	84.2
4	S-7	35.0-37.0	EMBANKMENT, DAM NO. 2	8.5	90.7
4	S-12	68.0-70.0	FOUNDATION, POOL 1 SLUDGE	42.9	49.0
4	S-12	68.0-70.0	FOUNDATION, POOL 1 SLUDGE	26.4	47.7
4	S-12	68.0-70.0	FOUNDATION, POOL 1 SLUDGE	64.8	47.8
4	S-13	70.0-72.0	FOUNDATION, POOL 1 SLUDGE	49.2	51.1
4	S-13	70.0-72.0	FOUNDATION, POOL 1 SLUDGE	50.1	49.8
4	S-13	70.0-72.0	FOUNDATION, POOL 1 SLUDGE	38.2	58.7
4	PST-5	75.0-77.0	FOUNDATION, POOL 1 SLUDGE	38.3	55.6
4	PST-5	75.0-77.0	FOUNDATION, POOL 1 SLUDGE	44.9	62.4
5	S-5	65.0-67.0	FOUNDATION, POOL 1 SLUDGE	57.1	----
5	S-5	65.0-67.0	FOUNDATION, POOL 1 SLUDGE	45.3	----
5	S-7	75.0-77.0	FOUNDATION, POOL 1 SLUDGE	41.6	72.0
7	S-1	10.0-12.0	EMBANKMENT, DAM NO. 3	11.6	86.7
7	S-2	20.0-22.0	EMBANKMENT, DAM NO. 3	14.9	67.7
7	S-2	20.0-22.0	EMBANKMENT, DAM NO. 3	14.5	85.9
7	S-2	20.0-22.0	EMBANKMENT, DAM NO. 3	14.0	90.3
7	S-3	30.0-32.0	FOUNDATION, POOL 2 SLUDGE	47.6	48.3
7	S-4	40.0-42.0	FOUNDATION, POOL 2 SLUDGE	46.5	48.6
7	S-5	50.0-52.0	FOUNDATION, POOL 2 SLUDGE	30.7	60.8
7	S-5	50.0-52.0	FOUNDATION, POOL 2 SLUDGE	35.2	58.9
7	PST-1	52.0-53.6	FOUNDATION, POOL 2 SLUDGE	37.3	56.6
7	PST-1	52.0-53.6	FOUNDATION, POOL 2 SLUDGE	40.8	53.3
7	S-7	71.1-73.5	FOUNDATION, POOL 1 SLUDGE	38.1	65.0
7	S-7	71.1-73.5	FOUNDATION, POOL 1 SLUDGE	46.8	48.5
8	S-2	20.0-22.0	EMBANKMENT, DAM NO. 3	13.6	82.0
8	PST-2	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	41.2	49.7
9	S-2	20.0-22.0	EMBANKMENT, DAM NO. 3	9.4	84.6
9	S-4	35.0-37.0	FOUNDATION, POOL 2 SLUDGE	36.9	54.7
9	SS-1	45.0-48.0	FOUNDATION, POOL 2 SLUDGE	41.9	49.6
9	SS-2A	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	42.5	54.1
9	SS-2A	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	67.7	48.5
9	SS-2A	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	38.7	47.4
9	SS-2B	57.0-59.0	FOUNDATION, POOL 2 SLUDGE	40.6	55.8
9	SS-2B	57.0-59.0	FOUNDATION, POOL 2 SLUDGE	41.2	52.2

FIGURE B-1 — CONTINUED

SUMMARY
OF
IN-SITU WATER CONTENT AND DRY UNIT WEIGHTS

HOLE NO.	SAMPLE NO.	DEPTH (ft)	MATERIAL TYPE	WATER CONTENT (%)	DRY WEIGHT (pcf)
10	S-9	60.7-62.7	MIXED EMBANKMENT AND SLUDGE	18.4	73.9
10	S-9	60.7-62.7	MIXED EMBANKMENT AND SLUDGE	15.9	85.0
10	S-9	60.7-62.7	MIXED EMBANKMENT AND SLUDGE	10.7	106.0
10	S-13	77.0-78.5	FOUNDATION, POOL 1 SLUDGE	35.3	67.5
10	S-14	80.0-81.6	FOUNDATION, POOL 1 SLUDGE	34.7	54.5
10	S-14	80.0-81.6	FOUNDATION, POOL 1 SLUDGE	42.9	59.6
11	S-1	10.0-12.0	DISTURBED EMBANKMENT	13.8	77.8
11	PST-1	35.0-37.0	EMBANKMENT, DAM NO. 3	12.0	103.4
11	PST-1	35.0-37.0	EMBANKMENT, DAM NO. 3	10.5	104.6
11	PST-1	35.0-37.0	EMBANKMENT, DAM NO. 3	17.6	90.5
11	SS-3A	85.0-87.0	FOUNDATION, POOL 1 SLUDGE	37.3	56.5
11	SS-3A	85.0-87.0	FOUNDATION, POOL 1 SLUDGE	45.0	48.4
11	SS-3A	85.0-87.0	FOUNDATION, POOL 1 SLUDGE	32.0	65.2
11	SS-3B	87.0-89.0	FOUNDATION, POOL 1 SLUDGE	46.1	59.0
13	S-1	10.0-12.0	GOB PILE, COARSE COAL WASTE	9.3	84.2
13	S-3	30.0-32.0	GOB PILE, COARSE COAL WASTE	11.1	91.8
13	S-3	30.0-32.0	GOB PILE, COARSE COAL WASTE	10.9	87.0
13	S-4	40.0-42.0	GOB PILE, COARSE COAL WASTE	9.9	110.2
13	S-4	40.0-42.0	GOB PILE, COARSE COAL WASTE	10.7	87.7
13	S-5	50.0-52.0	GOB PILE, COARSE COAL WASTE	15.9	74.4
15	S-1	36.0-38.0	FOUNDATION, POOL 1 SLUDGE	55.3	49.5
15	S-2	40.0-42.0	RED DOG, BURNED COAL WASTE	18.5	86.5
15	S-2	40.0-42.0	RED DOG, BURNED COAL WASTE	19.2	91.5
20	PB-1	4.7-6.5	EMBANKMENT, DAM NO. 3	9.7	82.4
20	PB-1	4.7-6.5	EMBANKMENT, DAM NO. 3	12.2	68.8
20	PB-4	11.5-14.0	EMBANKMENT, DAM NO. 3	18.3	83.1
20	PB-4	11.5-14.0	EMBANKMENT, DAM NO. 3	10.4	84.8
FP-9A	S-1	1.9-3.9	EMBANKMENT, DAM NO. 3	9.0	98.9
FP-9A	S-1	1.9-3.9	EMBANKMENT, DAM NO. 3	7.9	87.7
FP-10A	S-2	3.5-4.5	EMBANKMENT, DAM NO. 3	8.6	93.9
FP-11A	S-1	1.2-3.1	EMBANKMENT, DAM NO. 3	8.4	101.4
FP-11A	S-1	1.2-3.1	EMBANKMENT, DAM NO. 3	8.1	94.3
FP-12A	S-1	4.8-6.8	EMBANKMENT, DAM NO. 3	10.1	87.6
FP-14A	S-2	3.5-4.5	EMBANKMENT, DAM NO. 3	6.6	105.3

HOLE 2

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

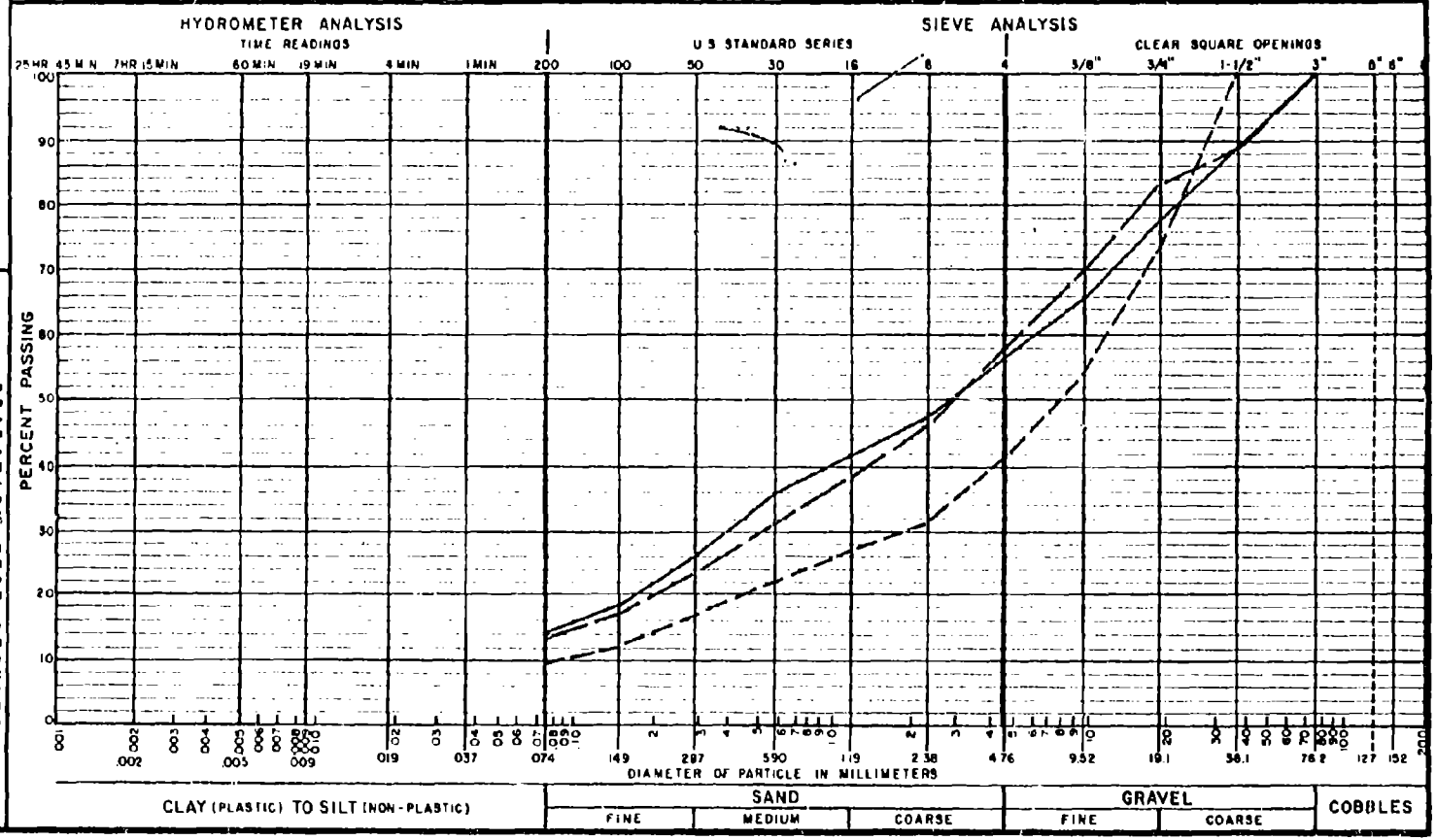
PROJECT NO. 0700

DATE NOV. 1972

DRAWING NO. B-2

K E Y: ——— – – – – ——— ———

LL			
PL			
PI	NP	NP	NP
NAT. W/C	3.3	4.2	5.9
SPEC. GRAVITY	1.70	1.70	1.70
CLASSIF. SYMB.	SM	CM	SM
SAMPLE NO.	S-4	S-4	S-4
DEPTH, FT.	23-25	23-25	23-25
HOLE NO.	2	2	2



Sheet 1 of 25

HOLE 3

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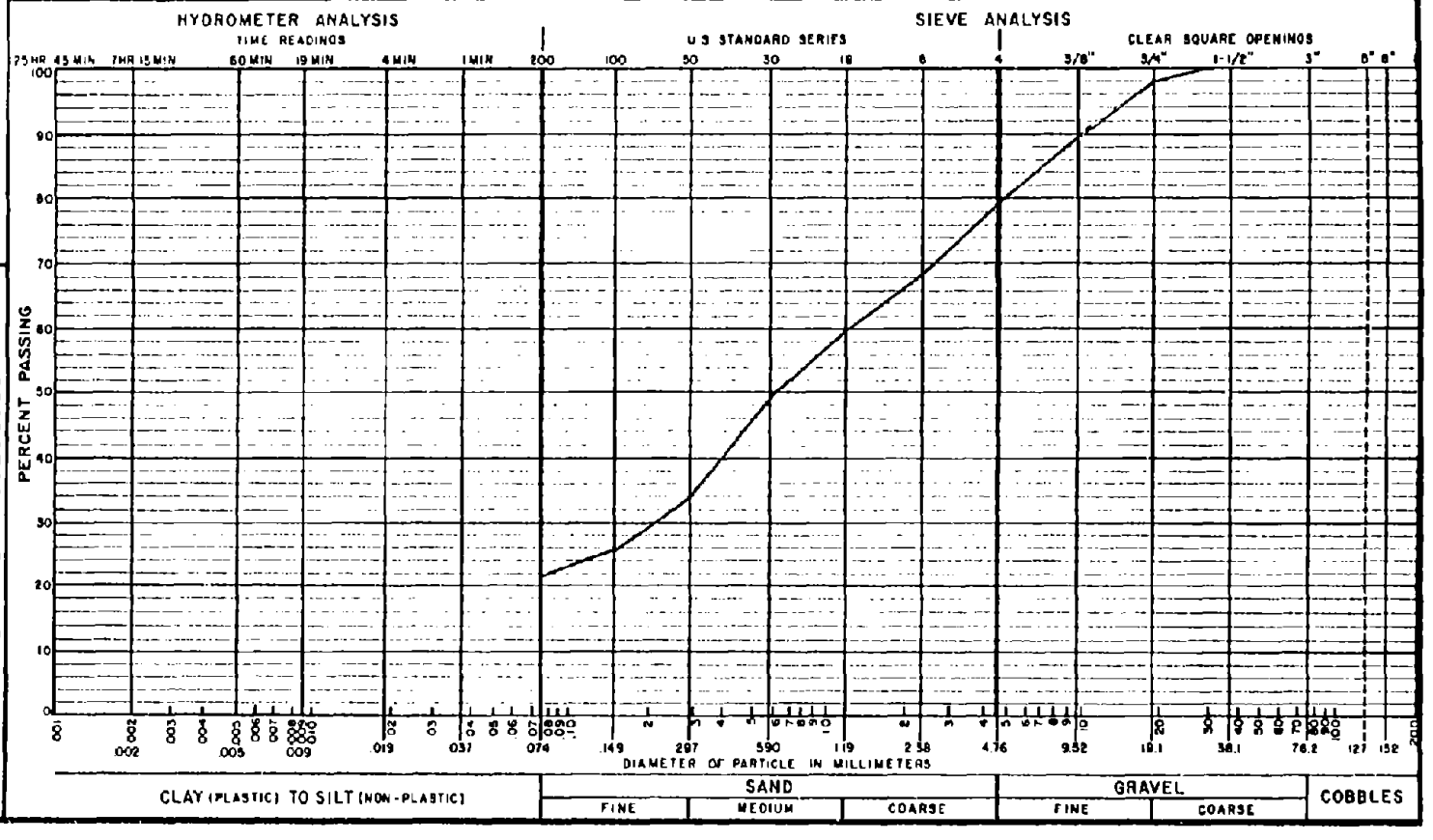
COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

PROJECT NO. 0700
DATE NOV. 1972
DRAWING NO. B-2

K E Y: ——————

LL									
PL									
PI	NP								
NAT. W/C	9.7								
SPEC. GRAVITY	---								
CLASSIF. SYMB.	SM								
SAMPLE NO.	S-6								
DEPTH, FT.	25-27								
HOLE NO.	3								



Sheet 2 of 25

HOLE 4

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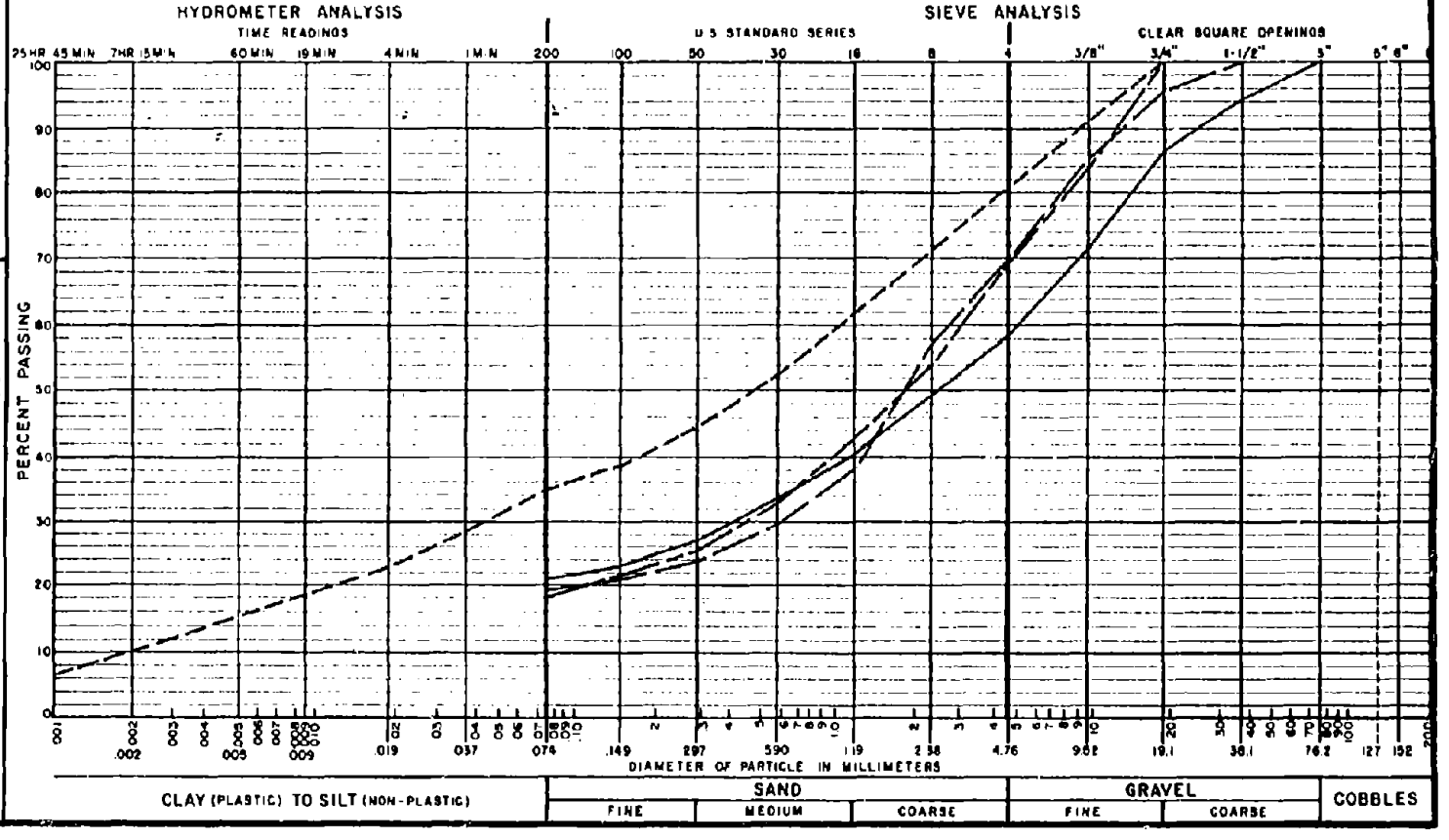
COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

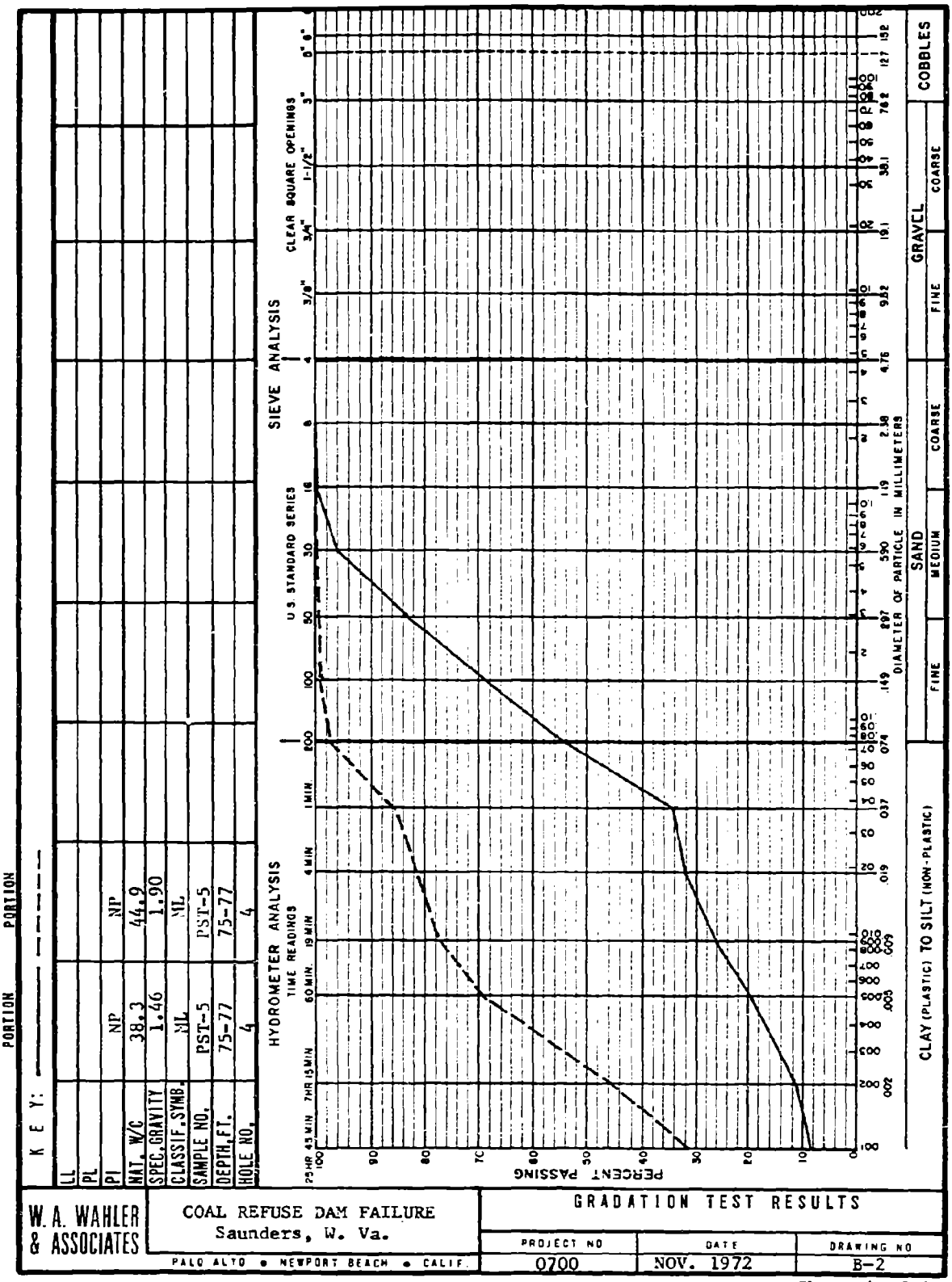
PROJECT NO. 0700
DATE NOV., 1972
DRAWING NO. B-2

KEY:

LL										
PL										
PI	NP	NP	NP	NP						
NAT. W/C	8.7	8.2	10.1	8.5						
SPEC. GRAVITY	---	2.72	1.87	1.87						
CLASSIF. SYMB.	SM	SM	SM	SM						
SAMPLE NO.	S-2	S-6	S-7	S-7						
DEPTH, FT.	10-12	30-32	35-37	35-37						
HOLE NO.	4	4	4	4						



Sheet 3 of 25


HOLE 4
COARSE PORTION
FINE PORTION
K E Y:
LL
PL
PI
NAT. W/C
SPEC. GRAVITY
CLASSIF. SYMB.
SAMPLE NO.
DEPTH, FT.
HOLE NO.
NP
38.3
1.46
ML
PST-5
75-77
4
NP
44.9
1.90
ML
PST-5
75-77
4
HYDROMETER ANALYSIS
TIME READINGS
24 HR 45 MIN
7 HR 15 MIN
60 MIN.
19 MIN.
4 MIN.
1 MIN.
SIEVE ANALYSIS
U.S. STANDARD SERIES
CLEAR SQUARE OPENINGS
3/8"
3/4"
1-1/2"
3"
6"
PERCENT PASSING
DIAMETER OF PARTICLE IN MILLIMETERS
COBBLES
GRAVEL
COARSE
FINE
SAND
COARSE
MEDIUM
FINE
CLAY (PLASTIC) TO SILT (NON-PLASTIC)
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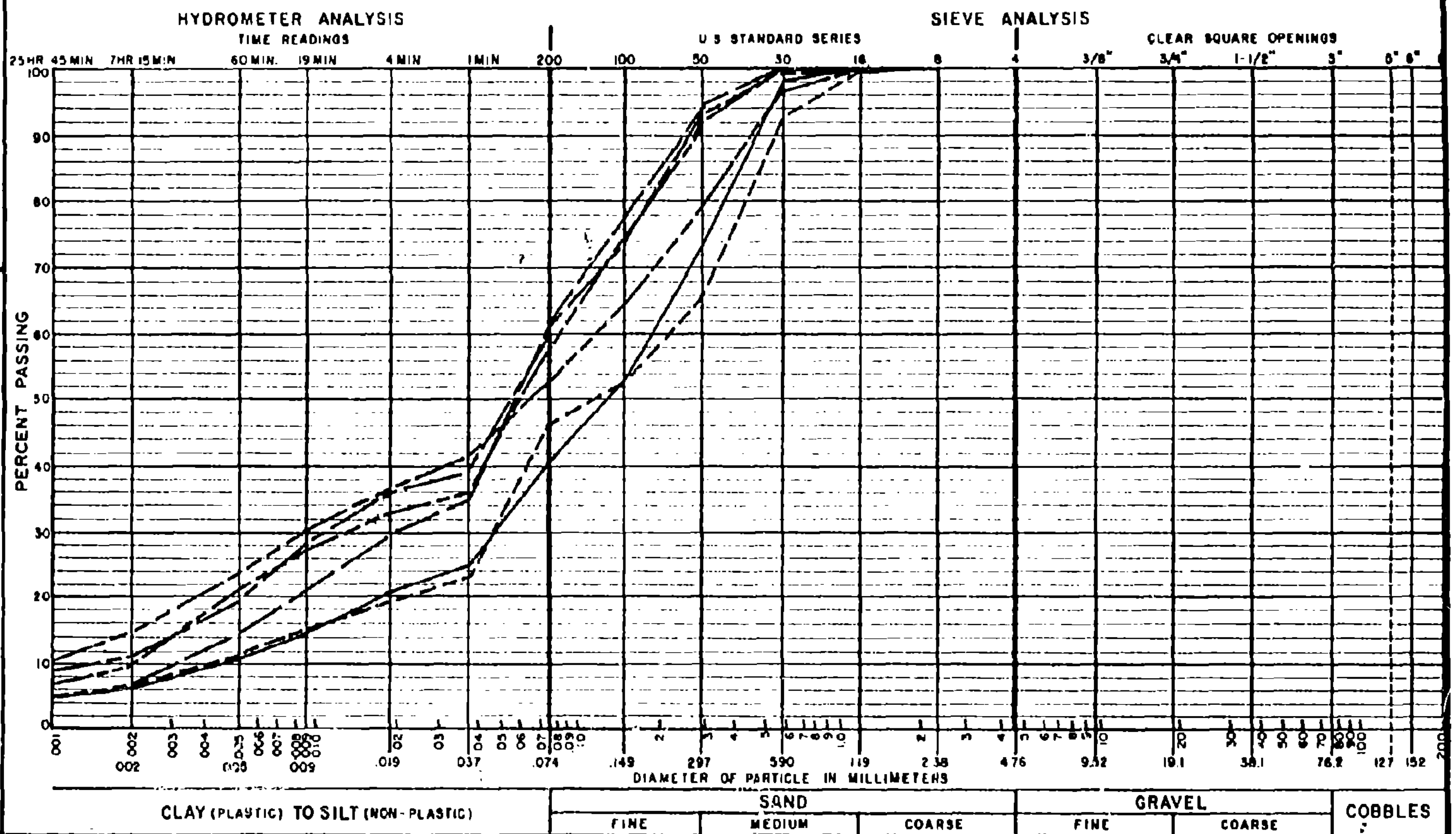
COAL REFUSE DAM FAILURE
Saunders, W. Va.
GRADATION TEST RESULTS
PROJECT NO
0700
DATE
NOV. 1972
DRAWING NO
B-2

HOLE 4

K E Y:									
LL									
PL									
PI	NP	NP	NP	NP	NP	NP			
NAT. W/C	42.9	26.4	64.8	49.2	50.1	38.2			
SPEC. GRAVITY	1.37	1.37	1.37	1.40	1.40	1.40			
CLASSIF. SYMB.	SM	SM	ML	ML	ML	ML			
SAMPLE NO.	S-12	S-12	S-12	S-13	S-13	S-13			
DEPTH, FT.	68-70	68-70	68-70	70-72	70-72	70-72			
HOLE NO.	4	4	4	4	4	4			



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COAL REFUSE DAM FAILURE
Saunders, W. Va.

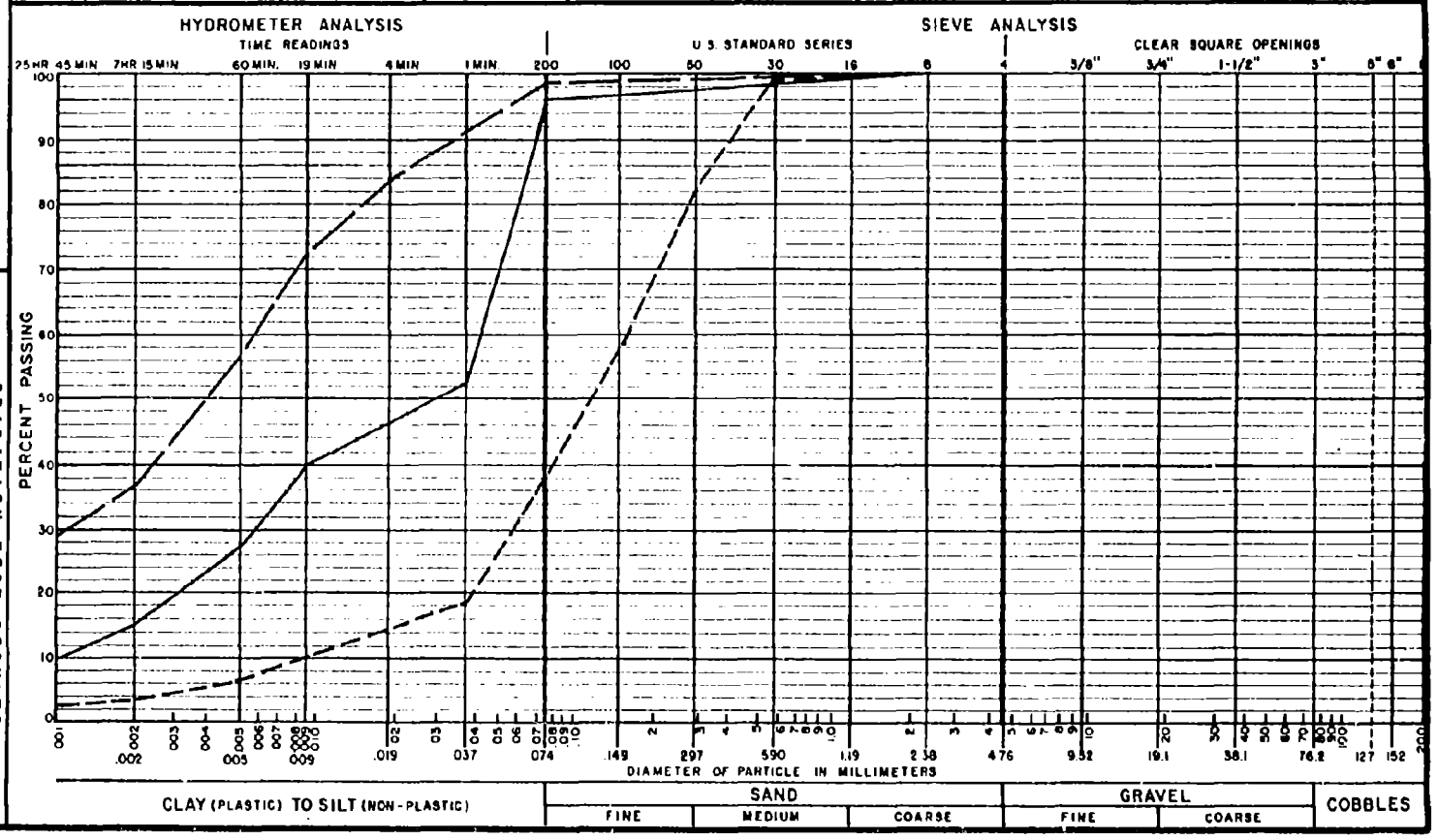
GRADATION TEST RESULTS

PROJECT NO	DATE	DRAWING NO
0700	NOV. 1972	B-2

Sheet 5 of 25

HOLE 5

	FINE PORTION	COARSE PORTION							
K E Y: —— – – – – —— ——									
LL	41								
PL	42								
PI	NP	NP	NP						
NAT. W/C	57.1	45.3	41.6						
SPEC. GRAVITY	1.39	1.37	--						
CLASSIF. SYMB.	ML	SM	ML						
SAMPLE NO.	S-5	S-5	S-7						
DEPTH, FT.	65-67	65-67	75-77						
HOLE NO.	5	5	5						



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COAL REFUSE DAM FAILURE
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GRADATION TEST RESULTS

PROJECT NO. 0700
DATE NOV. 1972
DRAWING NO. B-2

113

HOLE 7

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

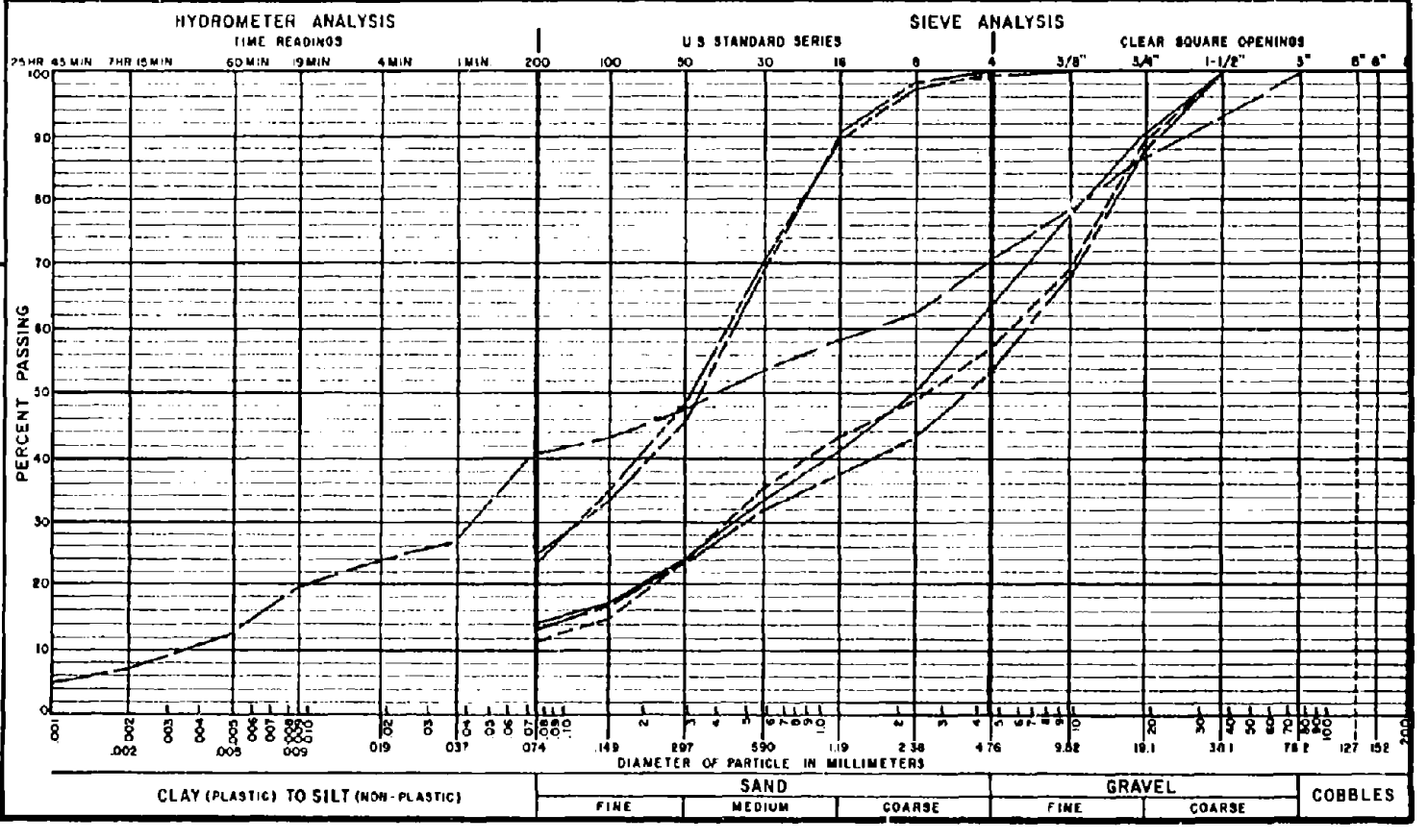
PROJECT NO. 0700

DATE NOV. 1972

DRAWING NO. G-2

GRADATION TEST RESULTS

KEY:									
LL									
PL									
PI	NP	NP	NP	NP	NP	NP			
NAT. W/C	11.6	14.9	14.5	14.0	30.7	35.2			
SPEC. GRAVITY	--	1.70	1.70	1.70	1.39	1.39			
CLASSIF. SYMB.	SM	SM	SM	ML	SM	SM			
SAMPLE NO.	S-1	S-2	S-2	S-2	S-5	S-5			
DEPTH, FT.	10-12	20-22	20-22	20-22	50-52	50-52			
HOLE NO.	7	7	7	7	7	7			



HOLE 7

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700

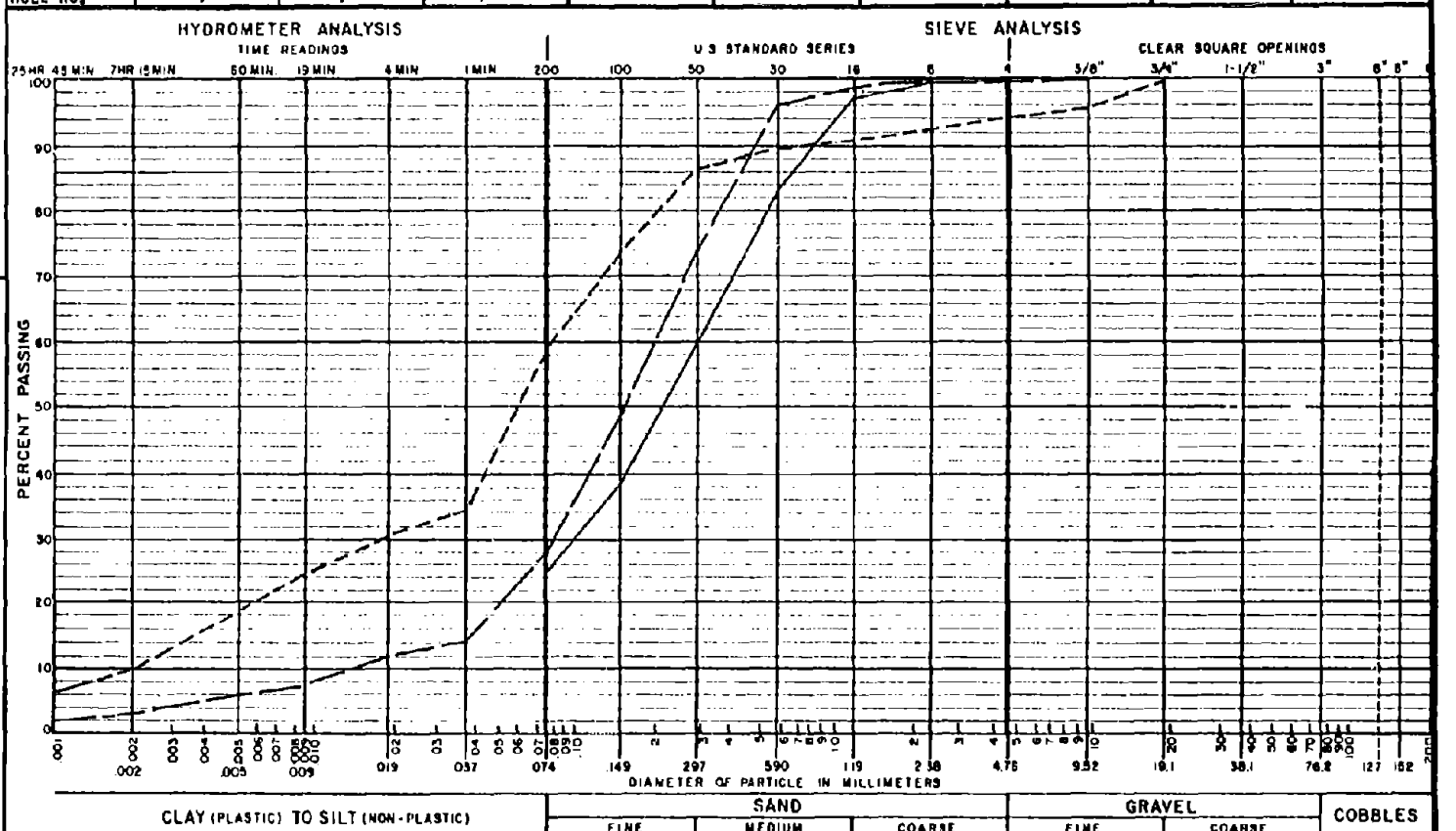
DATE NOV. 1972

DRAWING NO. B-2

GRADATION TEST RESULTS

KEY: ——— – – – – ——— ———

LL									
PL									
PI	NP	NP	NP						
NAT. W/C	37.3	38.1	46.8						
SPEC. GRAVITY	1.42	1.42	1.42						
CLASSIF. SYMB.	SM	SM	SM						
SAMPLE NO.	PST-1	S-7	S-7						
DEPTH, FT.	52-53.6	71.1-73.5	71.1-73.5						
HOLE NO.	7	7	7						



HOLE 8

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700

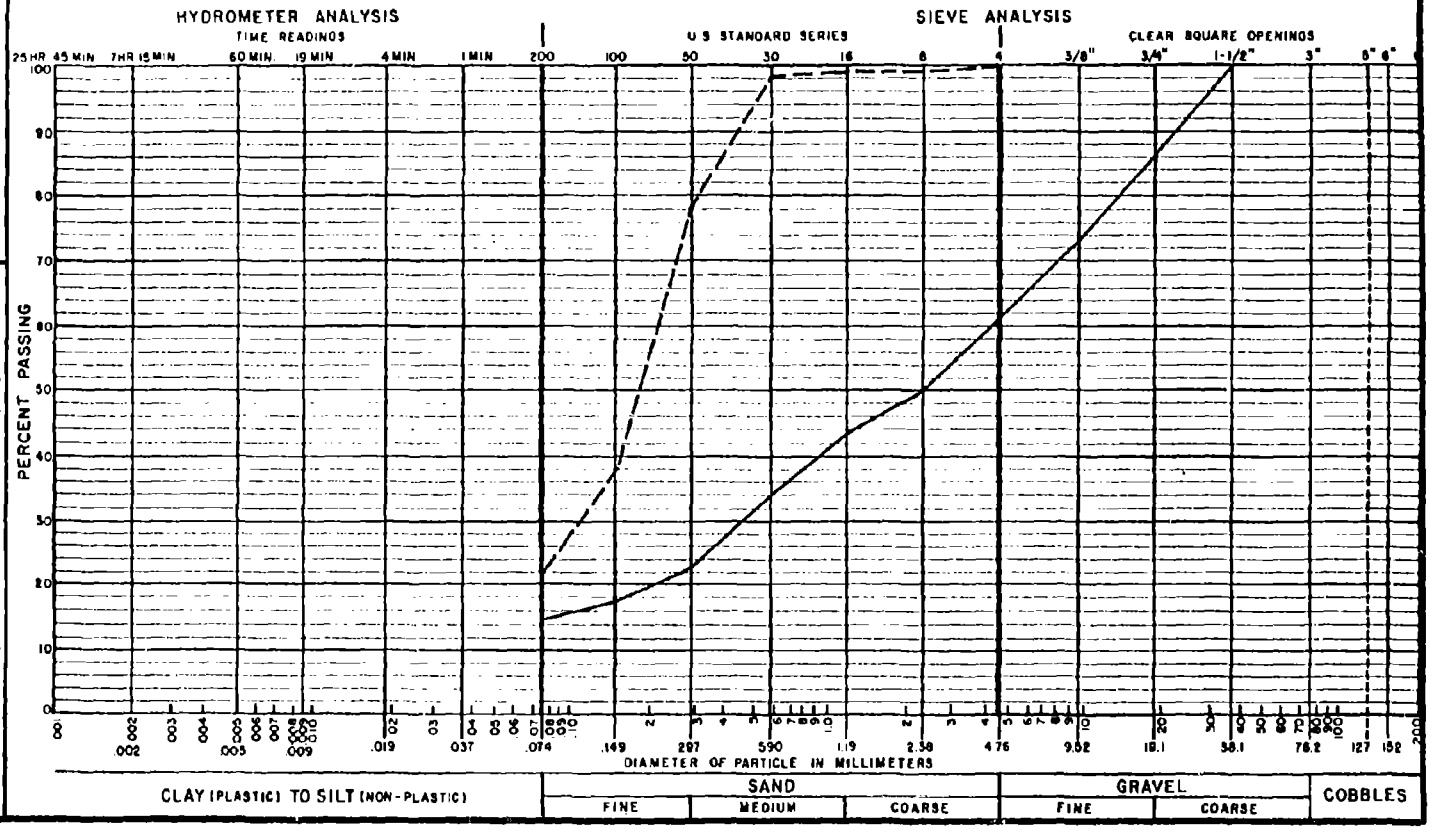
DATE NOV. 1972

DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y: ——— – – – – –

LL									
PL									
PI	NP	NP							
NAT. W/C	13.6	41.2							
SPEC. GRAVITY	---	1.34							
CLASSIF. SYMB.	SM	SM							
SAMPLE NO.	S-2	PST-2							
DEPTH, FT.	20-22	55-57							
HOLE NO.	8	8							



HOLE 9

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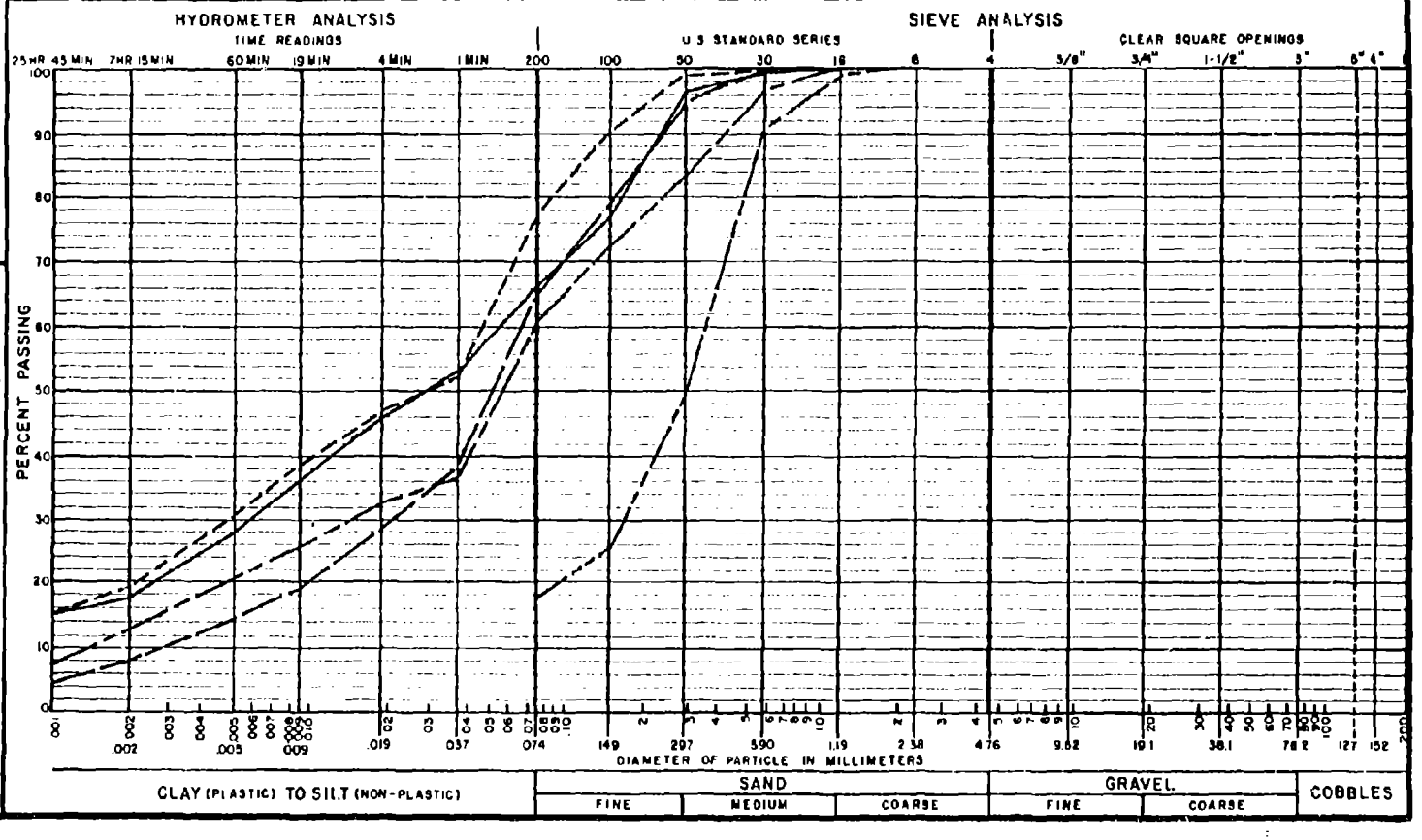
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE NOV. 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y:

LL									
PL									
PI	NP	NP	NP	NP	NP				
NAT. W/C	42.5	67.7	38.7	40.6	41.2				
SPEC. GRAVITY	1.45	1.45	1.45	1.39	1.39				
CLASSIF. SYMB.	ML	ML	ML	ML	SM				
SAMPLE NO.	SS-2A	SS-2A	SS-2A	SS-2B	SS-2B				
DEPTH, FT.	55-57	55-57	55-57	57-59	57-59				
HOLE NO.	9	9	9	9	9				



Sheet 10 of 25

HOLE 10

W.A. WAHLER & ASSOCIATES

PALO ALTO • NEWPORT BEACH • CALIF.

COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700

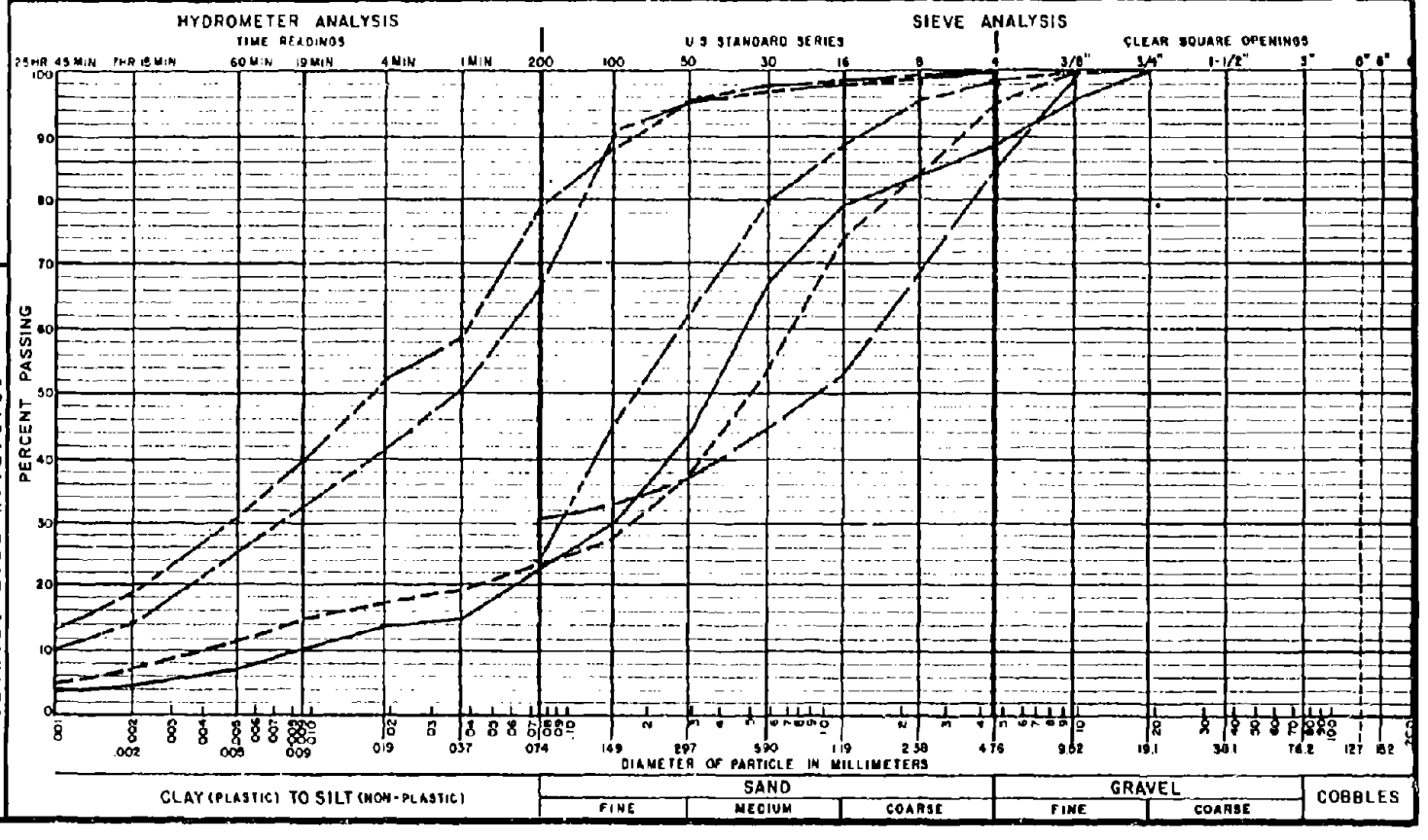
DATE NOV. 1972

DRAWING NO. B-2

GRADATION TEST RESULTS

KEY:

LL	23	23	23						
PL	23	23	23						
PI	NP	NP	NP	NP	NP	NP			
NAT. W/C	18.4	15.9	10.7	35.3	34.7	42.9			
SPEC. GRAVITY	1.52	1.52	1.52	1.81	1.77	1.83			
CLASSIF. SYMB.	SM	SM	SM	ML	SM	ML			
SAMPLE NO.	S-9	S-9	S-9	S-13	S-14	S-14			
DEPTH, FT.	60.7-62.7	60.7-62.7	60.7-62.7	77-78.5	80-81.6	80-81.6			
HOLE NO.	10	10	10	10	10	10			



HOLE 11

W. A. WAHLER & ASSOCIATES

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

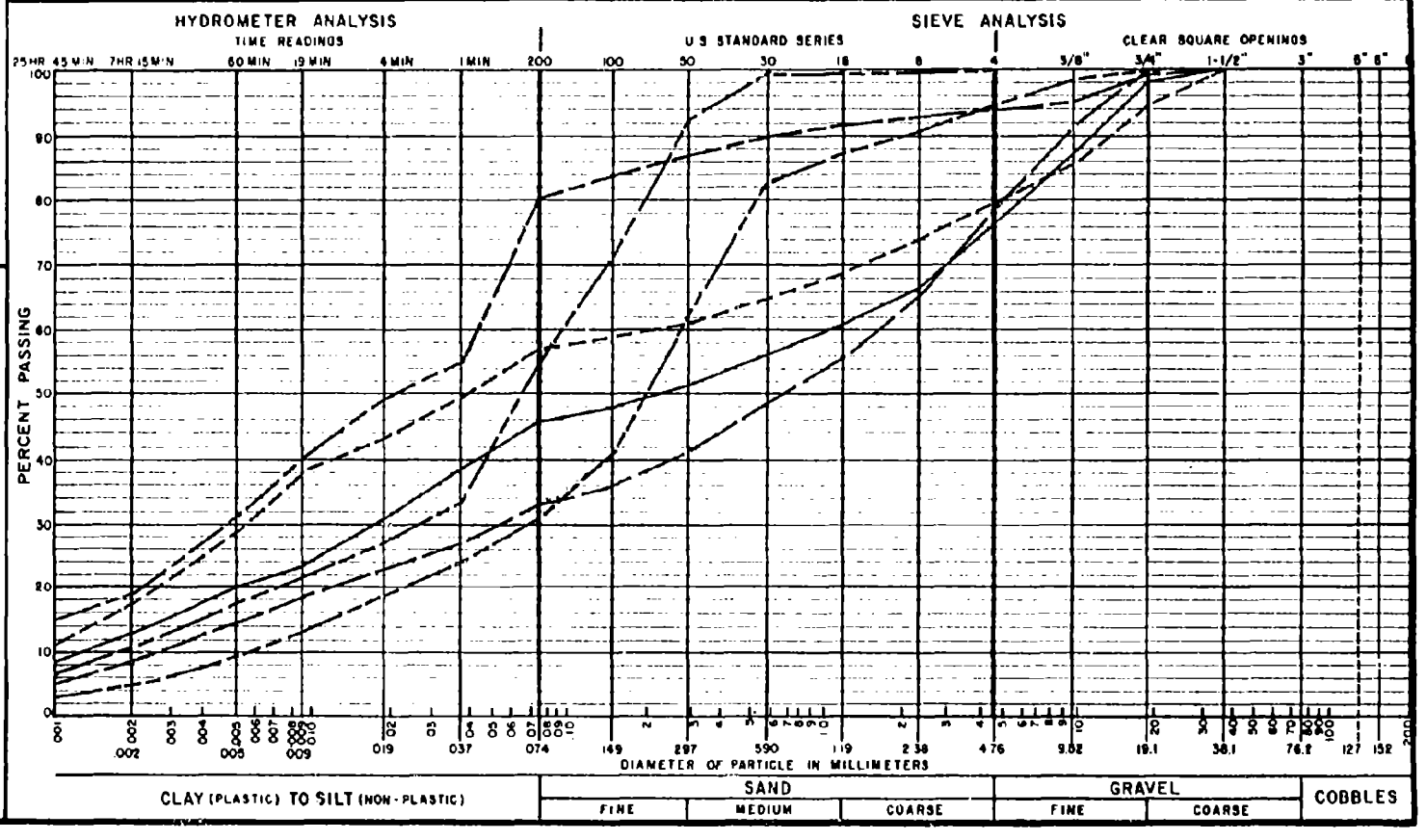
PROJECT NO. 0700

DATE NOV 1972

DRAWING NO. B-2

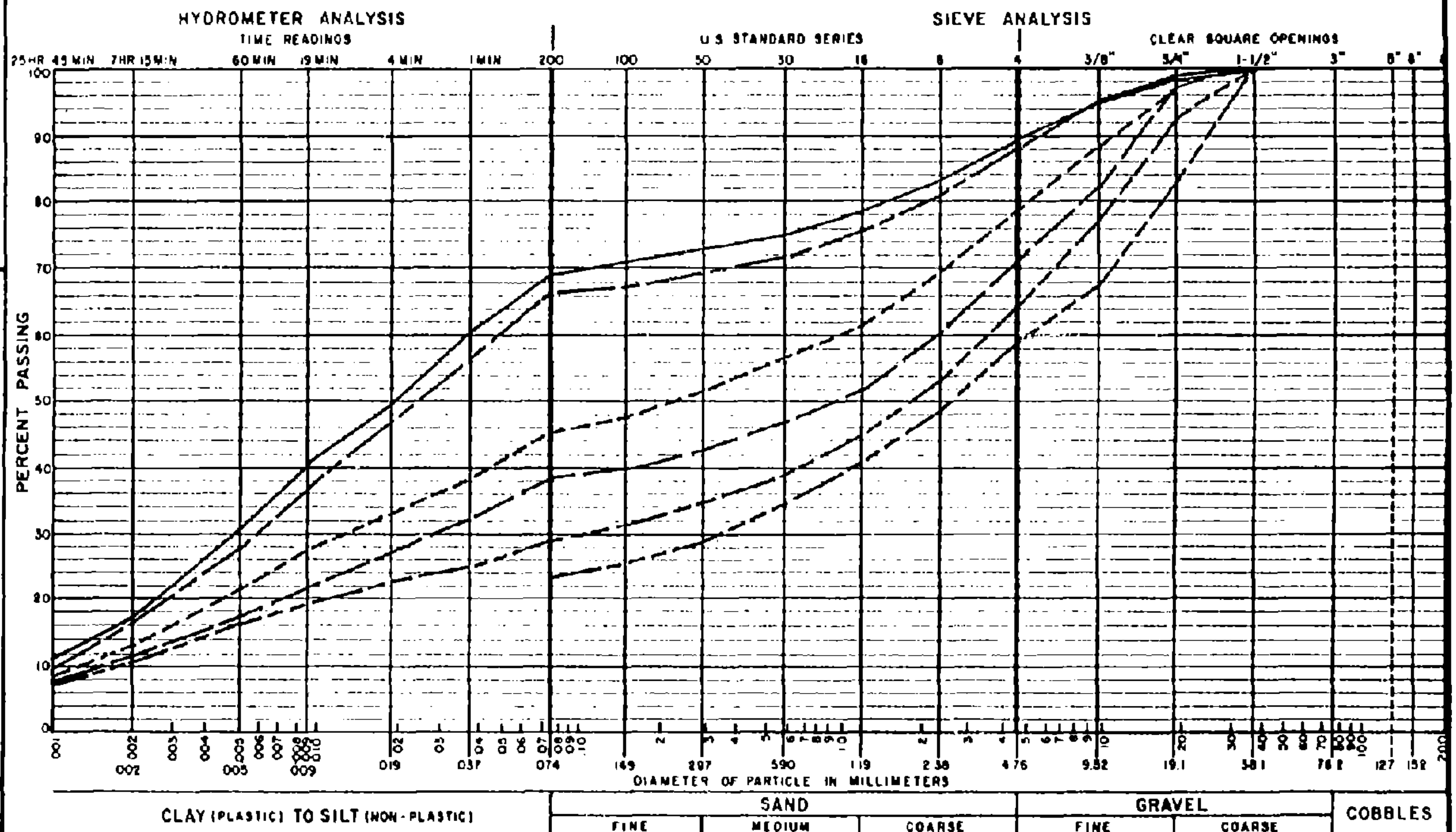
K E Y: ——— – – – – ——— – – – – ——— – – – – ———

LL										
PL										
PI	NP	NP	NP	NP	NP	NP				
NAT. W/C	12.0	10.5	17.6	37.3	45.0	32.0				
SPEC. GRAVITY	2.24	2.24	2.24	1.66	1.66	1.66				
CLASSIF. SYMB.	SM	ML	SM	ML	ML	SM				
SAMPLE NO.	PST-1	PST-1	PST-1	SS-3A	SS-3A	SS-3A				
DEPTH, FT.	35-37	35-37	35-37	85-87	85-87	85-87				
HOLE NO.	11	11	11	11	11	11				



HOLE 13

K E Y:									
LL									
PL									
PI	NP	NP	NP	NP	NP	NP			
NAT. W/C	9.3	11.1	10.9	9.9	10.7	15.8			
SPEC. GRAVITY	---	2.14	2.14	---	---	---			
CLASSIF. SYMB.	ML	SM	SM	ML	SM	SM			
SAMPLE NO.	S-1	S-3	S-3	S-4	S-4	S-5			
DEPTH, FT.	10-12	30-32	30-32	40-42	40-42	50-52			
HOLE NO.	13	13	13	13	13	13			



W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	GRADATION TEST RESULTS		
	PALO ALTO • NEWPORT BEACH • CALIF	PROJECT NO 0700	DATE NOV. 1972	DRAWING NO B-2

HOLE 15

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

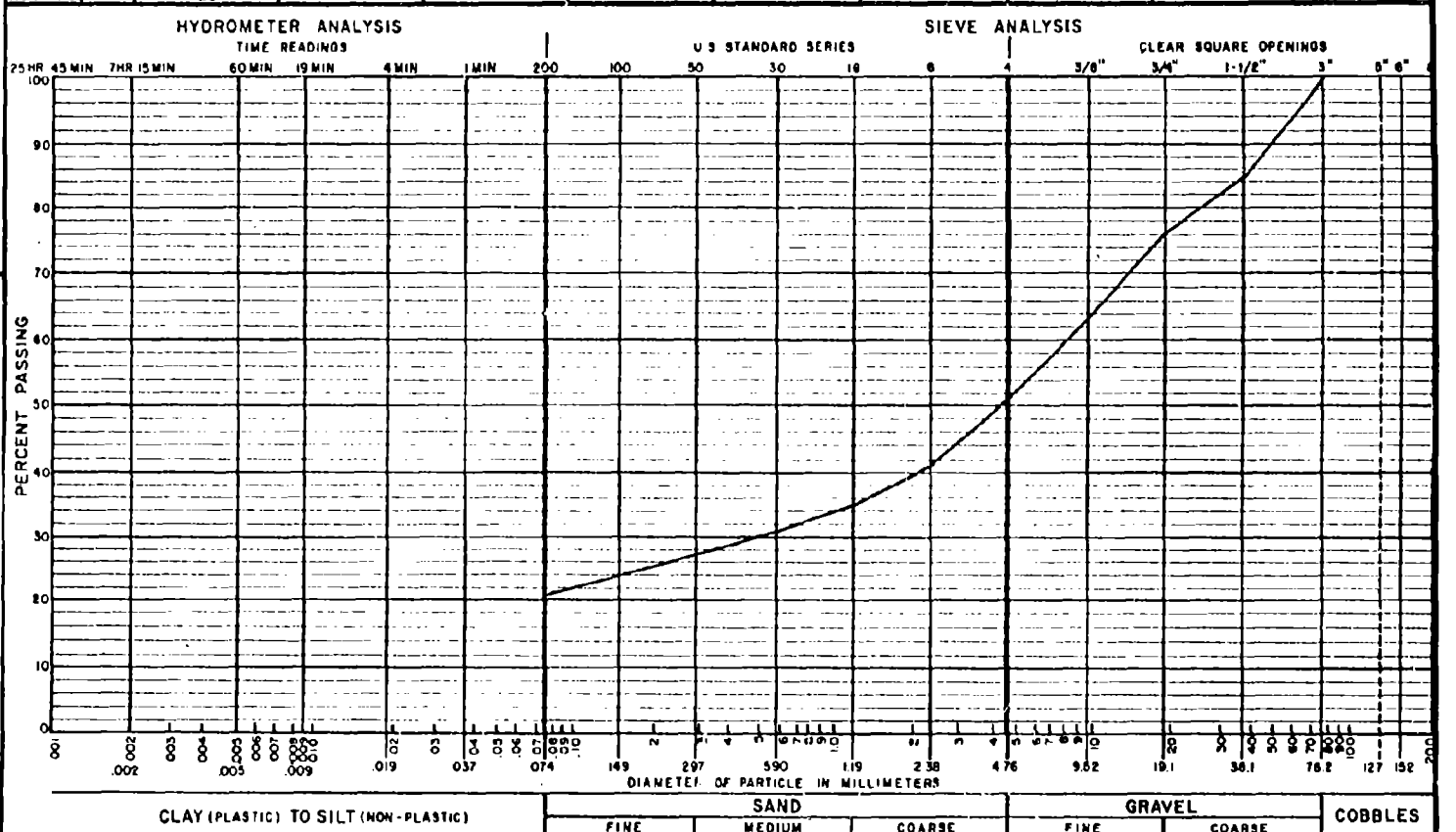
PROJECT NO 0700

DATE NOV. 1972

DRAWING NO B-2

K E Y: ——————

LL									
PL									
PI	NP								
NAT. W/C	18.5								
SPEC. GRAVITY	---								
CLASSIF. SYMB.	SM								
SAMPLE NO.	S-2								
DEPTH, FT.	40-42								
HOLE NO.	15								

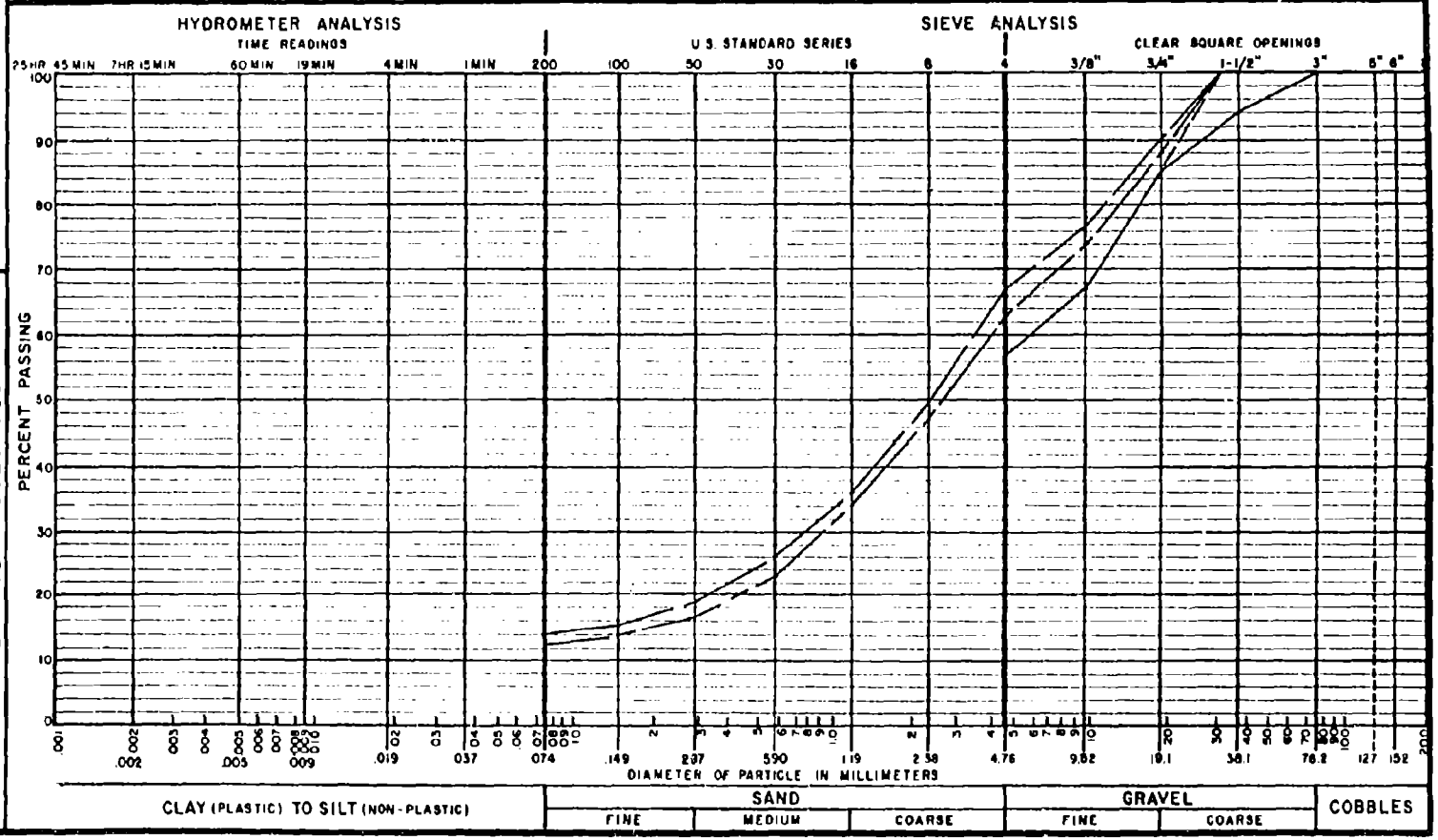


119

Sheet 14 of 25

SAMPLE A-1

	TOTAL AVERAGE GRADATION	SET-UP GRADATION	ICU SAMPLE AFTER FAILURE	K_o SAMPLE AFTER FAILURE
KEY:	———	- - - - -	———	- - - - -
LL				
PL				
PI	NP	NP	NP	NP
NAT. W/C	---	---	---	----
SPEC. GRAVITY	1.90	1.90	1.90	1.90
CLASSIF. SYMB.	SM	SM	SM	SM
SAMPLE NO.	A-1	A-1	A-1	A-1
DEPTH, FT.	---	---	---	---
HOLE NO.	---	---	---	---



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COAL REFUSE DAM FAILURE
Saunders, W. Va.

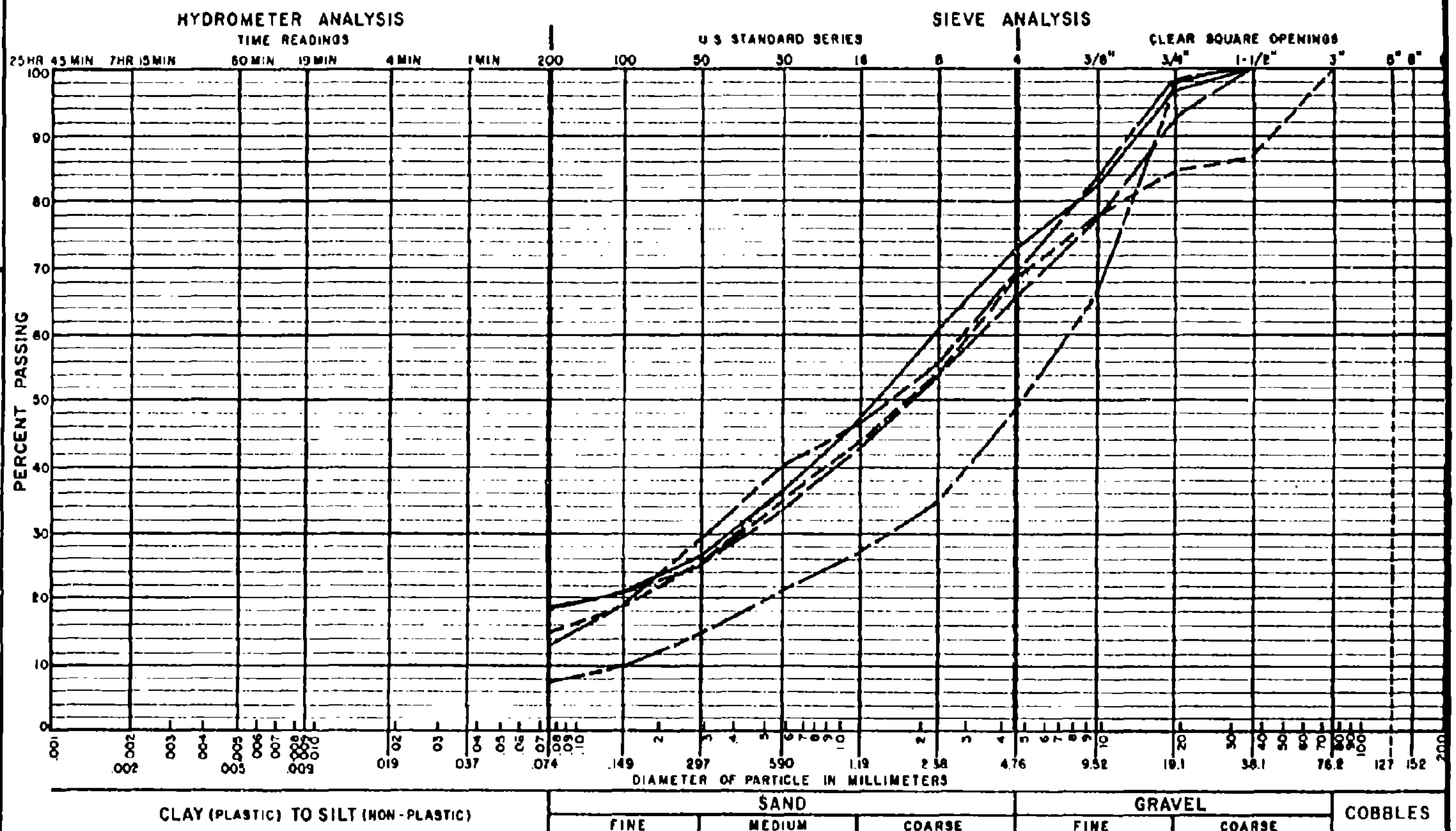
PROJECT NO. 0700
DATE NOV. 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

120

FIELD PERMEABILITY SAMPLES

KEY:					
LL					
PL					
PI	NP	NP	NP	NP	NP
NAT. W/C	9.0	8.6	8.4	10.1	6.6
SPEC. GRAVITY	---	1.66	---	2.23	1.62
CLASSIF. SYMB.	SM	SM	SM	SM	GM
SAMPLE NO.	S-1	S-2	S-1	S-1	S-2
DEPTH, FT.	1.9-3.9	3.5-4.5	1.2-3.1	4.8-6.8	3.5-4.5
HOLE NO.	FP-9-A	FP-10-A	FP-11-A	FP-12-A	FP-14-A



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COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

PROJECT NO	DATE	DRAWING NO
0700	NOV. 1972	B-2

Sheet 16 of 25

FOUNDATION/CHANNEL AREA - DAM 3 AND DAM 1

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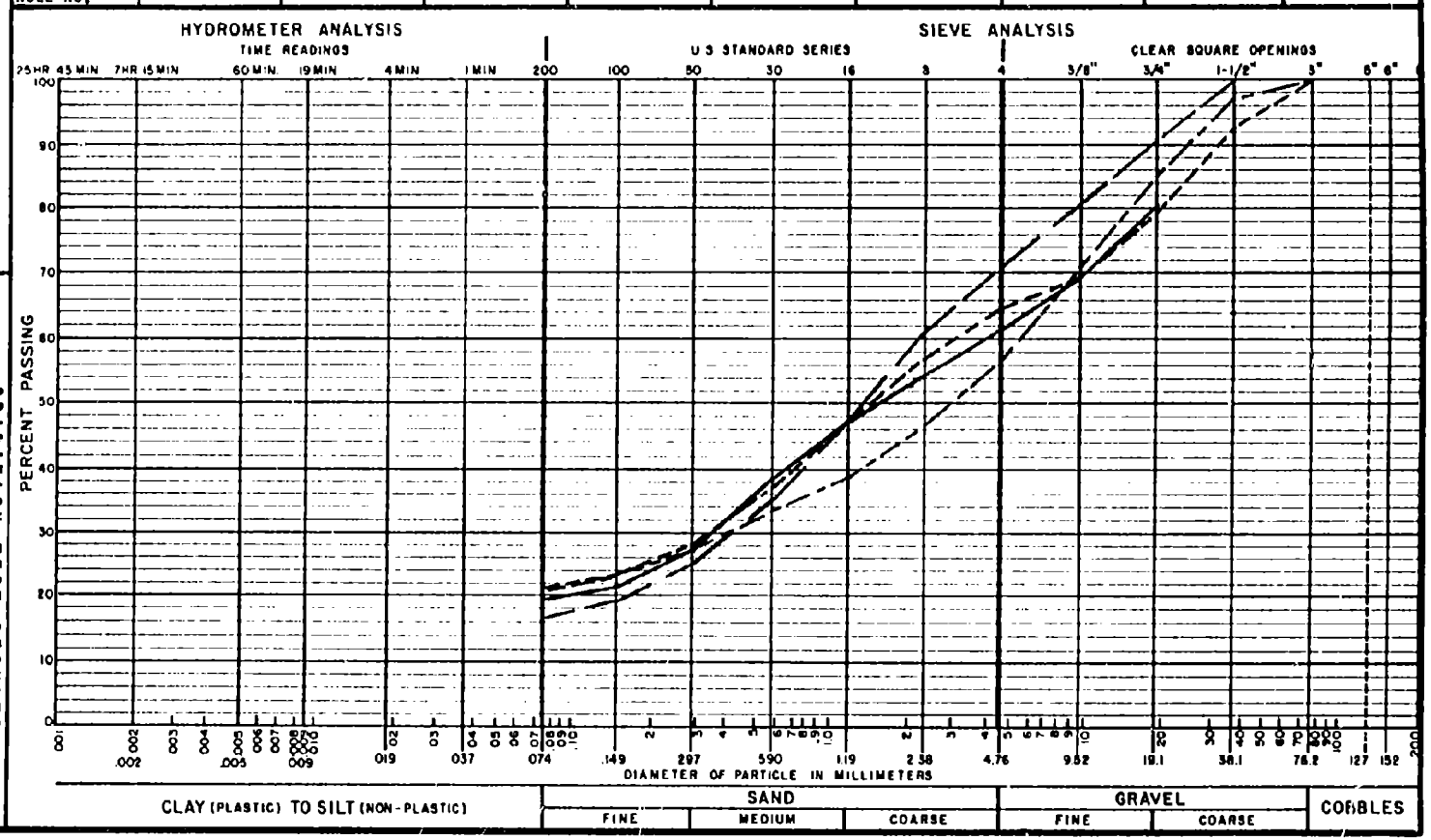
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y: ——— - - - - — — — — —·—·—

LL				27					
PL				21					
PI	NP	NP	NP	6					
NAT. W/C	7.99	7.61	9.44	6.77					
SPEC. GRAVITY	---	1.75	---	2.43					
CLASSIF. SYMB.	SM	SM	SM	SM					
SAMPLE NO.	FD-1	FD-4	FD-5	FD-12					
DEPTH, FT.	0.5	0.5	1.5	1.0					
HOLE NO.									



GOB PILE AT BUFFALO CREEK

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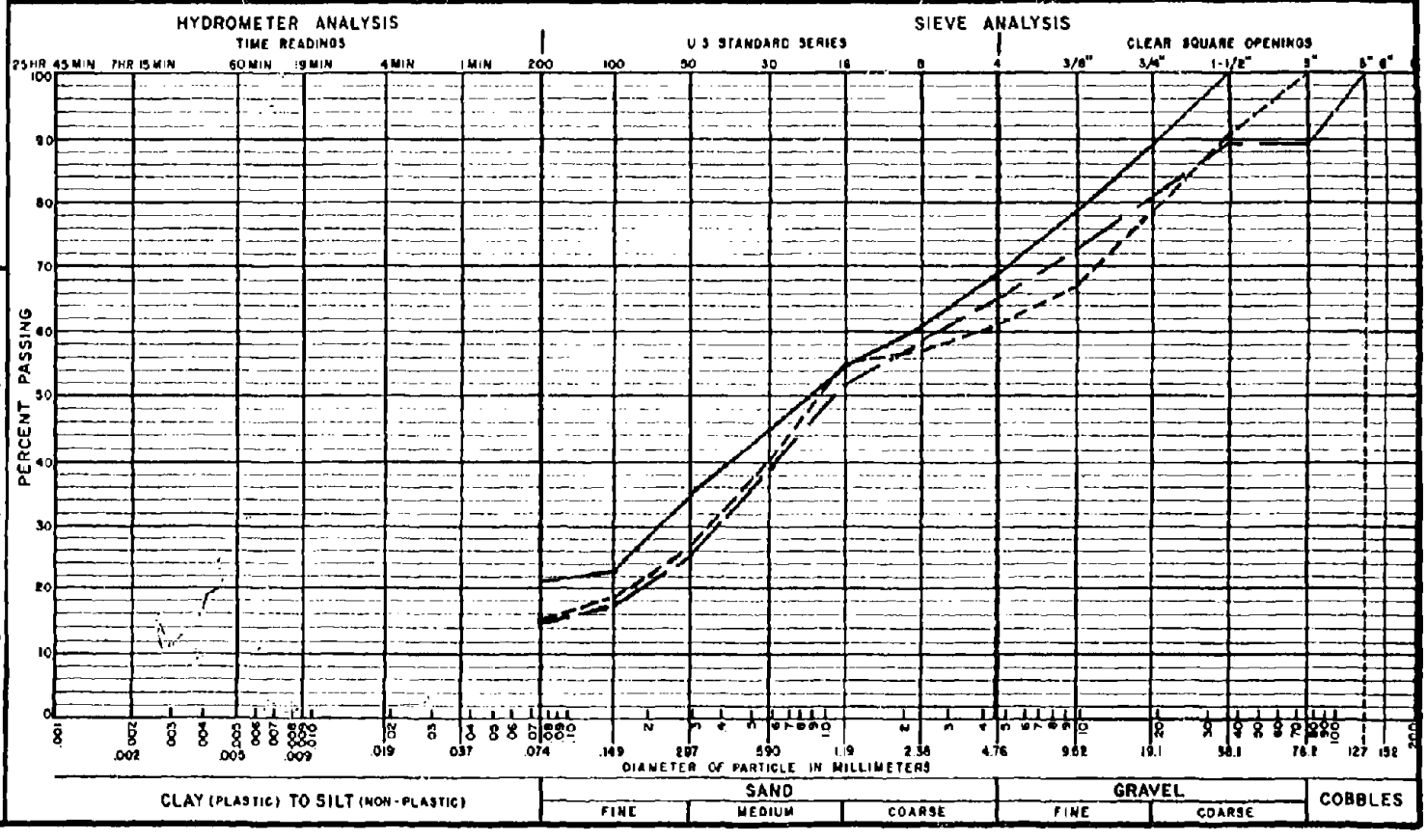
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y: ——— — — — — — — —

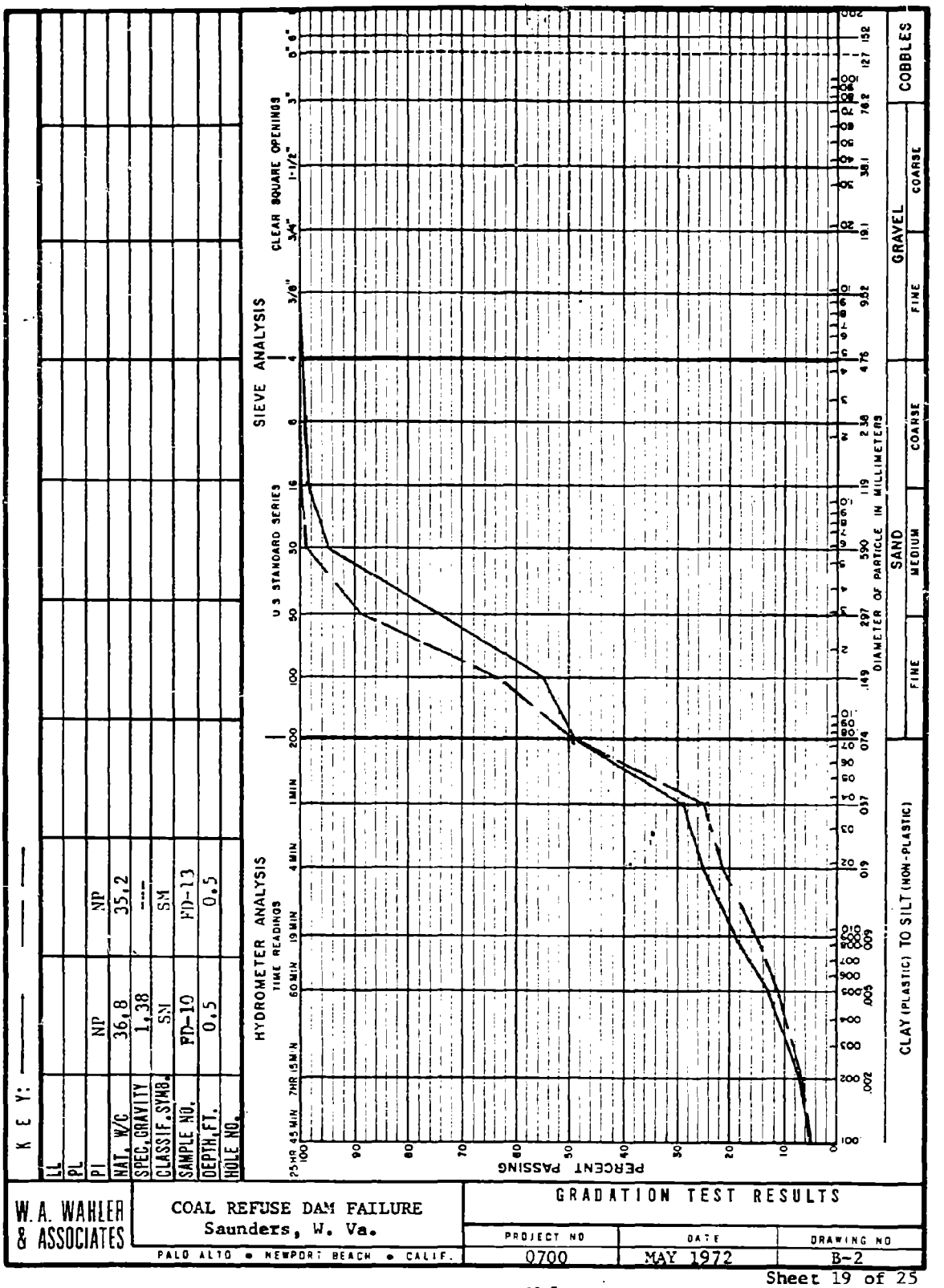
LL	22									
PL	19									
PI	3	NP	NP							
NAT. W/C	9.01	7.63	13.40							
SPEC. GRAVITY	---	1.80	---							
CLASSIF. SYMB.	SM	SM	SM							
SAMPLE NO.	FD-8	FD-9	FD-15							
DEPTH, FT.	0.5	1.5	1.0							
HOLE NO.										



123

Sheet 18 of 25

TAILINGS NEAR LEFT ABUTMENT OF DAM 2



W. A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	GRADATION TEST RESULTS	
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO 0700	DATE MAY 1972	DRAWING NO B-2

NATURAL MATERIAL – LEFT ABUTMENT DAM 2

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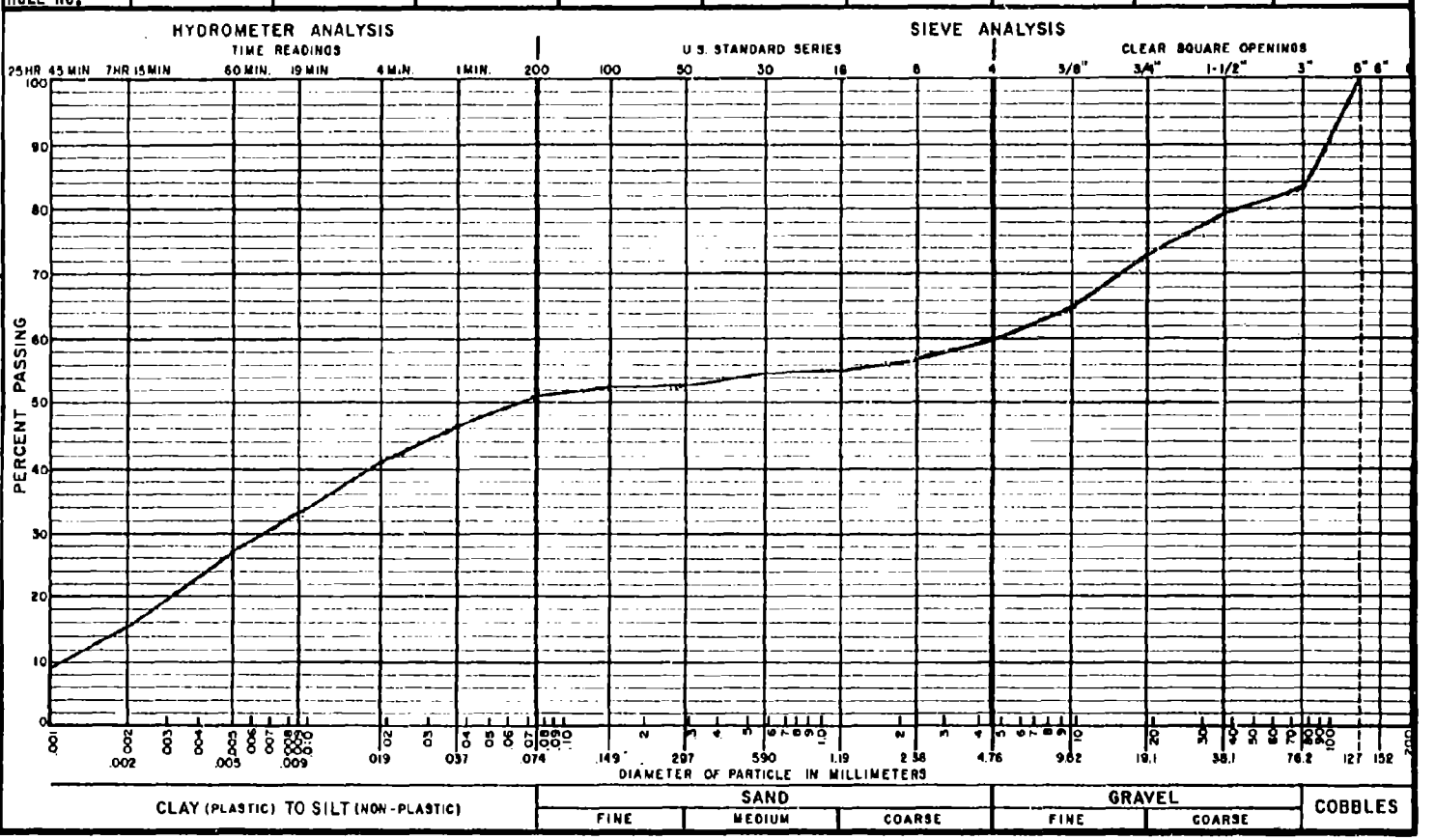
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

KEY:									
LL	40								
PL	28								
PI	12								
NAT. W/C	20.7								
SPEC. GRAVITY	2.58								
CLASSIF. SYMB.	ML								
SAMPLE NO.	FD-11								
DEPTH, FT.	0.3								
HOLE NO.									



125

TAILINGS - DAM 4

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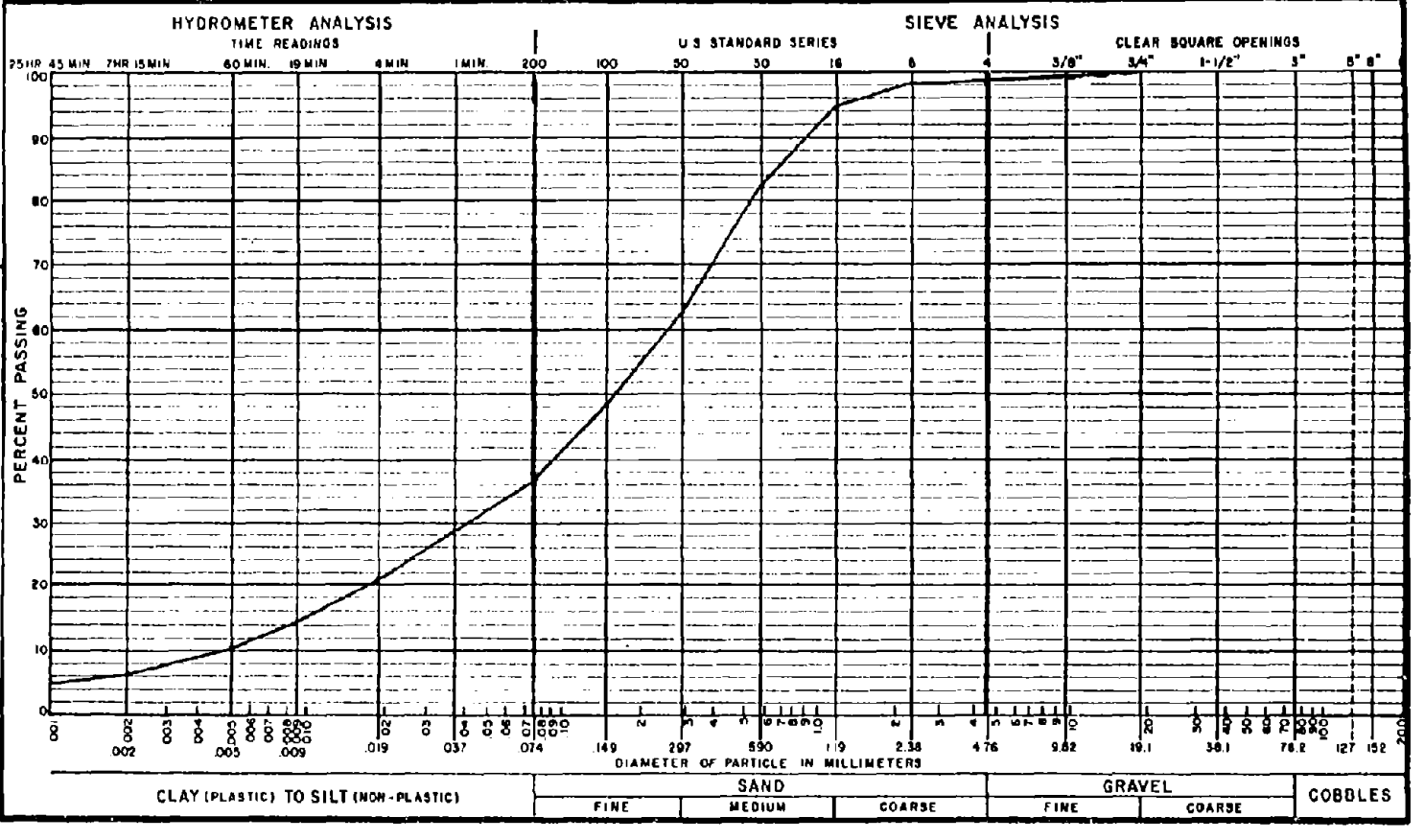
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

KEY:									
LL									
PL									
PI	NP								
NAT. W/C	32.1								
SPEC. GRAVITY	1.52								
CLASSIF. SYMB.	SM								
SAMPLE NO.	FD-1A								
DEPTH, FT.	0								
HOLE NO.									



Sheet 21 of 25

CREST
DAM 4

RIGHT ABUTMENT
DAM 3

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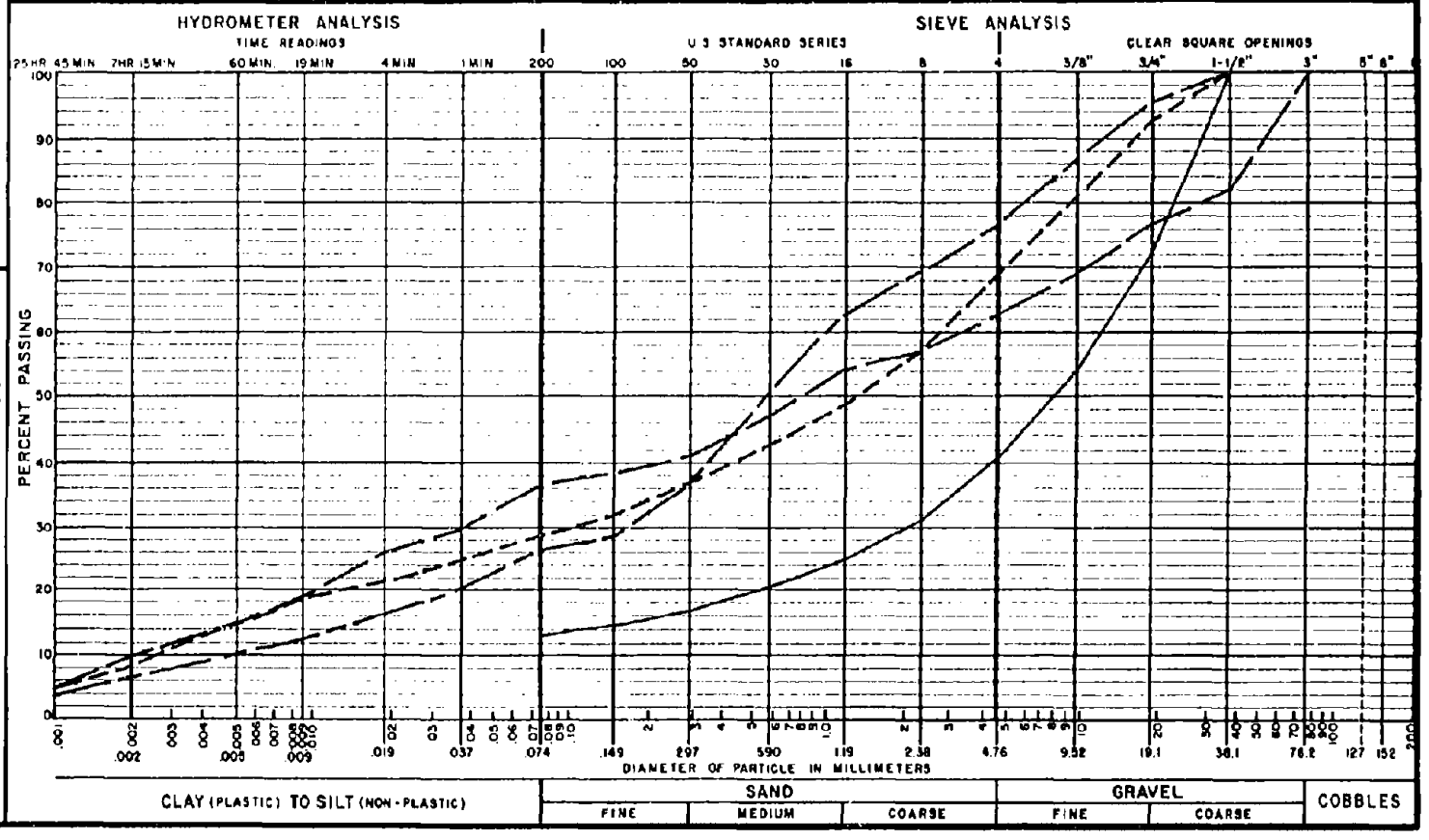
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y:

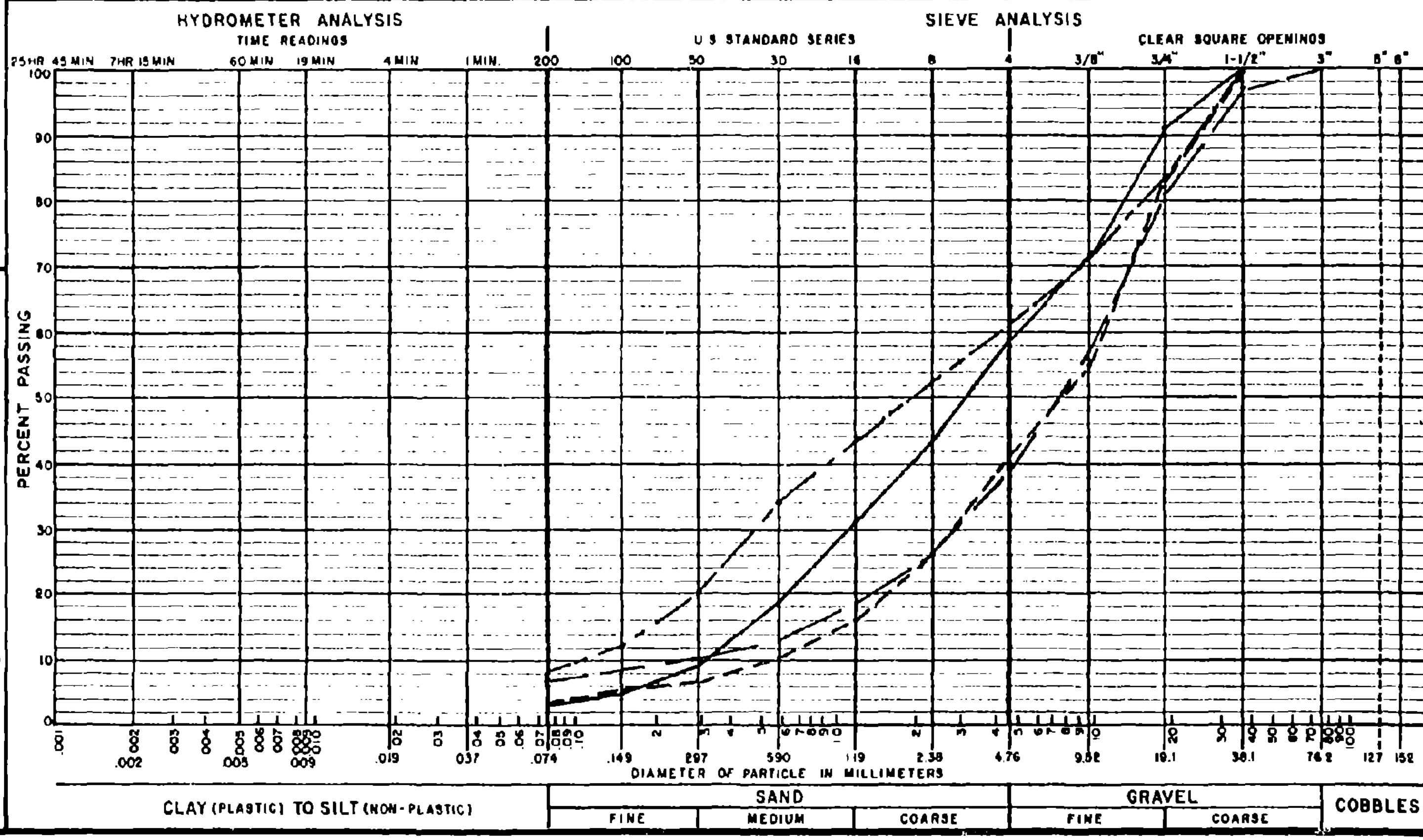
LL		29							
PL		23							
PI	NP	6	NP	NP					
NAT. W/C	7.54	10.40	5.49	6.85					
SPEC. GRAVITY	2.07	---	1.85	---					
CLASSIF. SYMB.	GM	SM	SM	SM					
SAMPLE NO.	FD-3A	FD-4A	FD-5A	FD-6A					
DEPTH, FT.	1.0	1.0	1.0	1.0					
HOLE NO.									



Sheet 22 of 25

DOZER CUT THROUGH REMNANT OF DAM 3

KEY:	—	— —	- - -	—·—
LL	23			
PL	21			
PI	2	NP	NP	NP
NAT. W/C	6.8	3.9	3.1	5.0
SPEC. GRAVITY	---	2.20	---	1.91
CLASSIF. SYMB.	SP	GW-GM	GW	SP-SM
SAMPLE NO.	FD-8A	FD-10A	FD-13A	FD-14A
DEPTH, FT.	6.8	5.8	5.2	9.3
HOLE NO.				



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COAL REFUSE DAM FAILURE
Saunders, W. Va.

GRADATION TEST RESULTS

PROJECT NO	DATE	DRAWING NO
0700	MAY 1972	B-2

Sheet 23 of 25

DOZER CUT THROUGH REMNANT OF DAM 3

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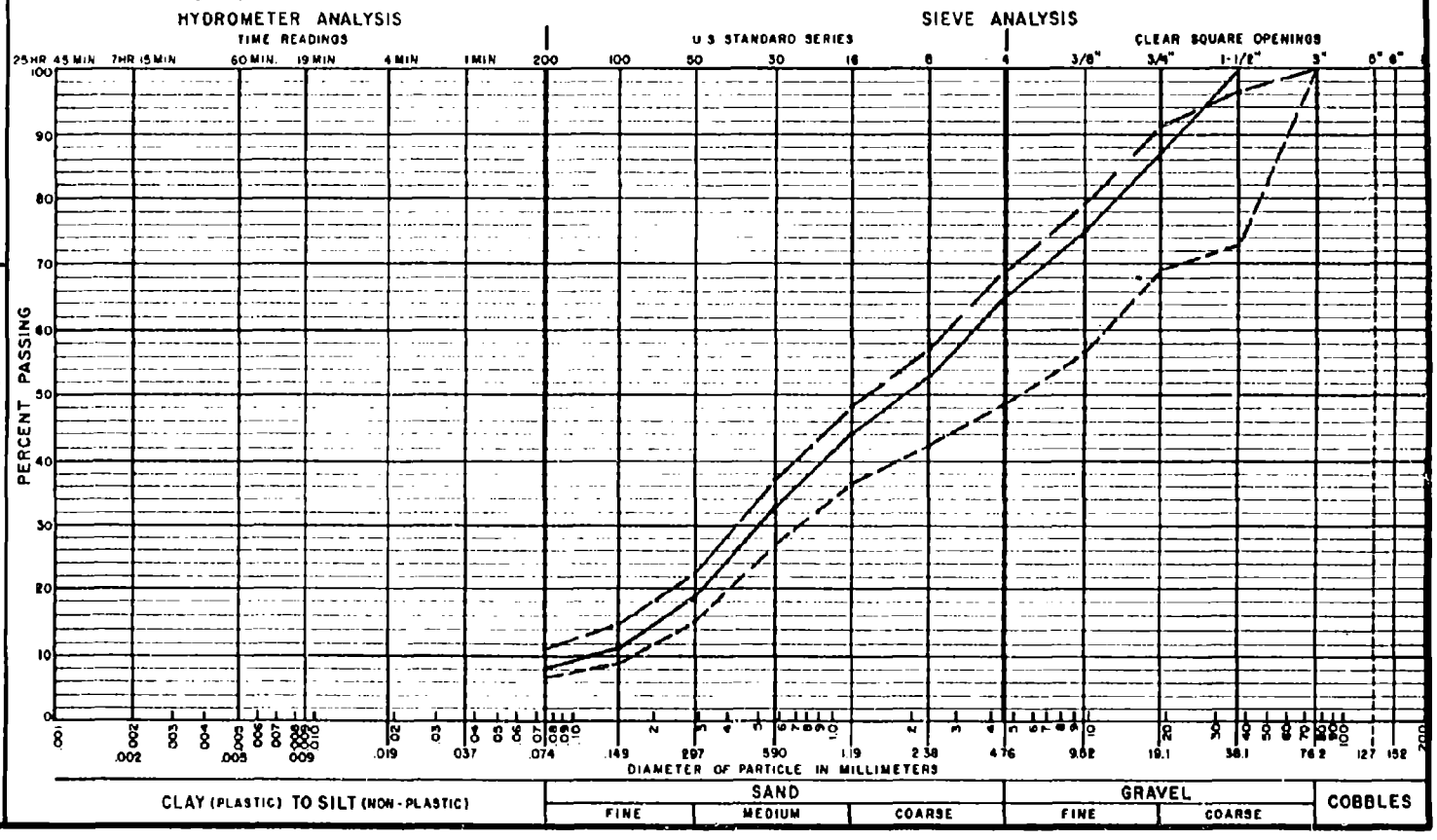
COAL REFUSE DAM FAILURE
Saunders, W. Va.

PROJECT NO. 0700
DATE MAY 1972
DRAWING NO. B-2

GRADATION TEST RESULTS

K E Y: ——— — — — — — — —

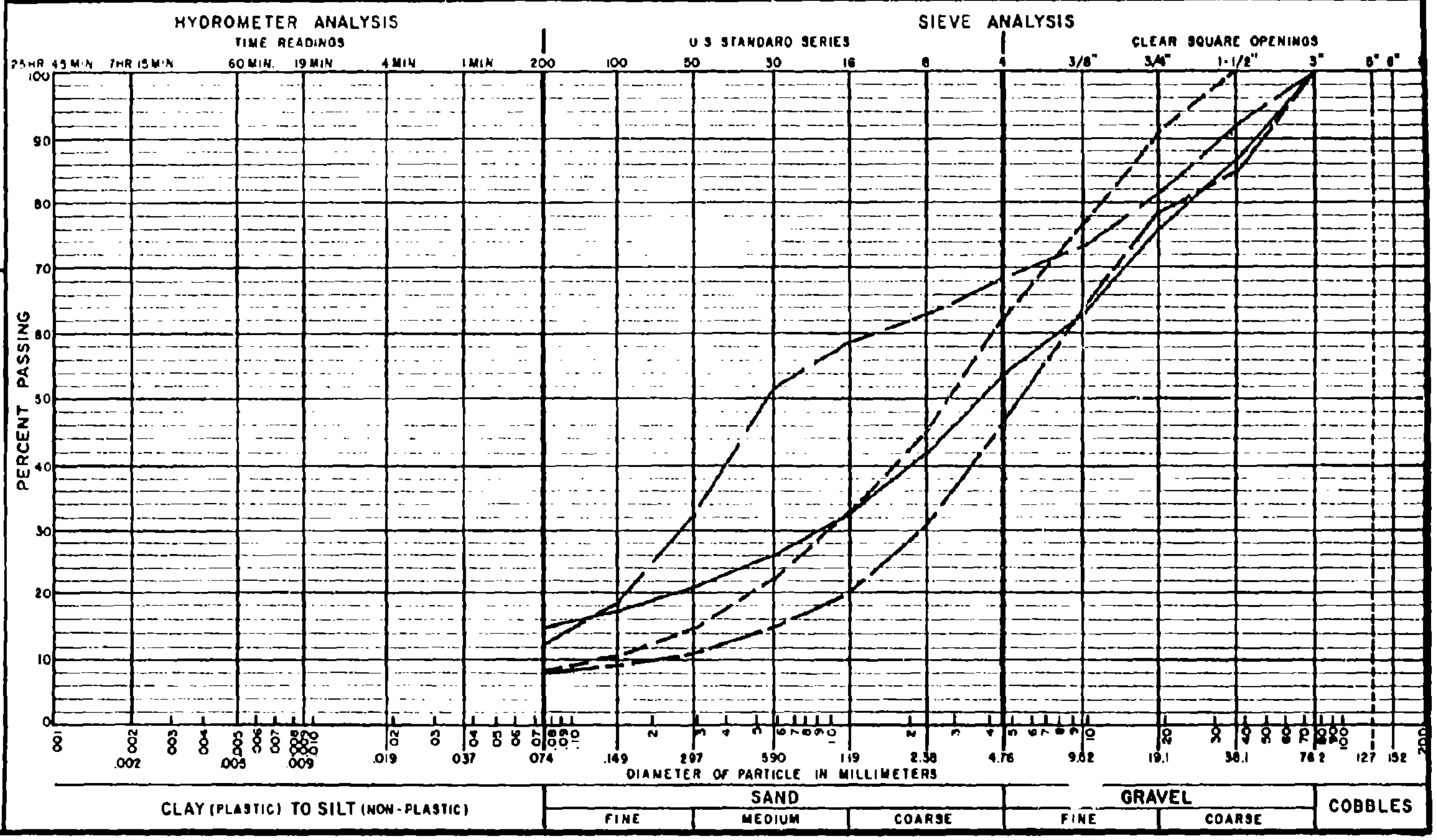
LL			
PL			
PI	N.P.	N.P.	N.P.
NAT. W/C	11.4	12.1	8.9
SPEC. GRAVITY	1.32	---	1.66
CLASSIF. SYMB.	SP-SM	SP-SM	GP-GM
SAMPLE NO.	FD-18A	FD-19A	FD-23A
DEPTH, FT.	28.0	23.0	18.0
HOLE NO.			



Sheet 24 of 25

DOZER CUT THROUGH REMNANT OF DAM 2

KEY:								
LL	31		27	28				
PL	22		22	22				
PI	9	N.P.	5	6				
NAT. W/C	11.1	14.3	7.4	6.4				
SPEC. GRAVITY	1.85	2.07	1.98	1.86				
CLASSIF. SYMB.	SC	SP-SM	GW-GM	SW-SM				
SAMPLE NO.	FD-24A	FD-25A	FD-27A	FD-28A				
DEPTH, FT.	22	17	7	2				
HOLE NO.								



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COAL REFUSE DAM FAILURE
Saunders, W. Va.

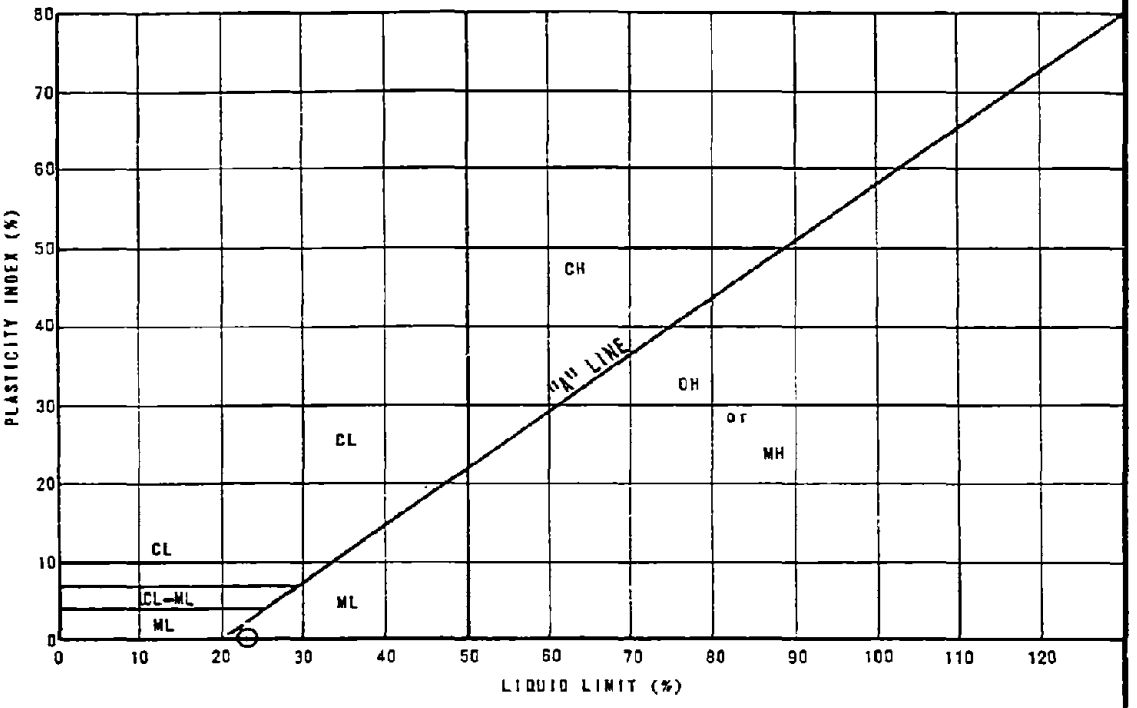
PALO ALTO • NEWPORT BEACH • CALIF

GRADATION TEST RESULTS

PROJECT NO	DATE	DRAWING NO
0700	MAY 1972	B-2

Sheet 25 of 25

PLASTICITY CHART



PLASTICITY DATA

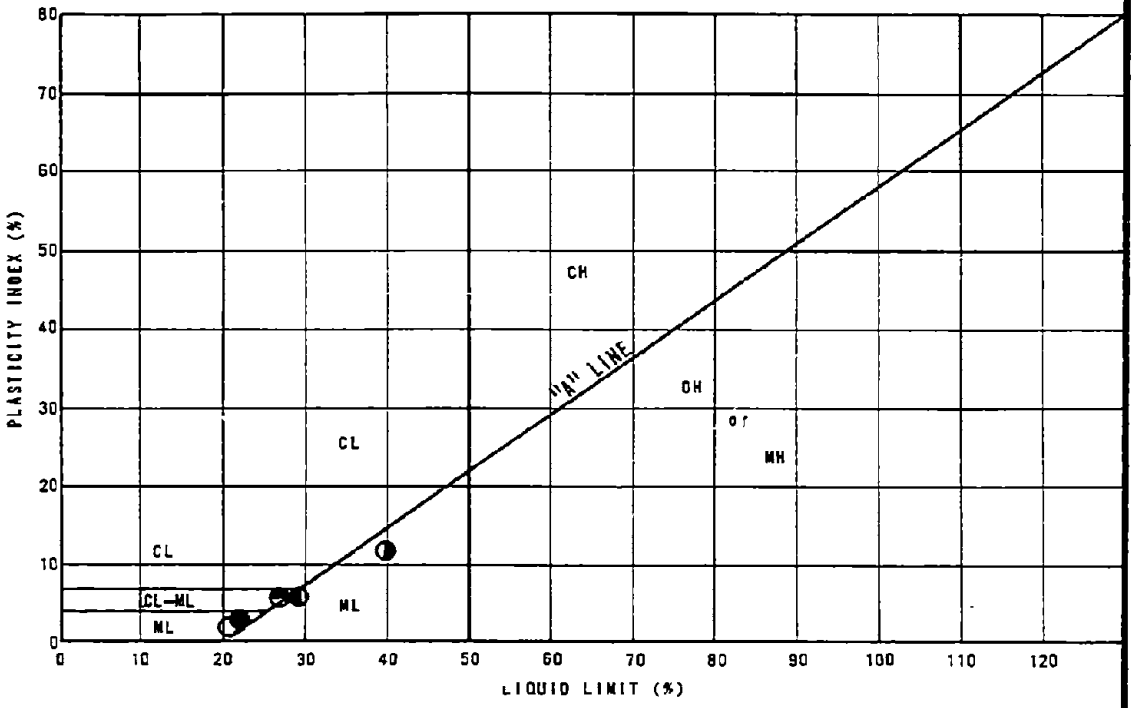
KEY SYMBOL	HOLE NUMBER	DEPTH (feet)	NATURAL WATER CONTENT W (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX $\left(\frac{W-PL}{LL-PL}\right)$	UNIFIED SOIL CLASSIFICATION SYMBOL
⊙	10	60.2-62.5		23	23	0	---	SM

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	ATTERBERG LIMITS - PLASTICITY DATA		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO.	DATE	DRAWING NO.
		0700	OCTOBER 1972	B-3

740-3

Sheet 1 of 3

PLASTICITY CHART



PLASTICITY DATA

KEY SYMBOL	HOLE NUMBER	DEPTH (feet)	NATURAL WATER CONTENT W (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX $\left(\frac{W-PL}{LL-PL}\right)$	UNIFIED SOIL CLASSIFICATION SYMBOL
●	FD-8	0.5	9.01	19	22	3		SM
◑	FD-11	0.3	20.70	28	40	12		ML
◓	FD-12	1.0	6.8	21	27	6		SM
◐	FD-4A	1.0	10.4	23	29	6		SM
○	FD-8A	6.8	6.8	23	21	2		SP
	FD-10A	3.9	5.8	—	—	N.P.		GW-GM
	FD-13A	3.1	5.2	—	—	N.P.		GW

740-3

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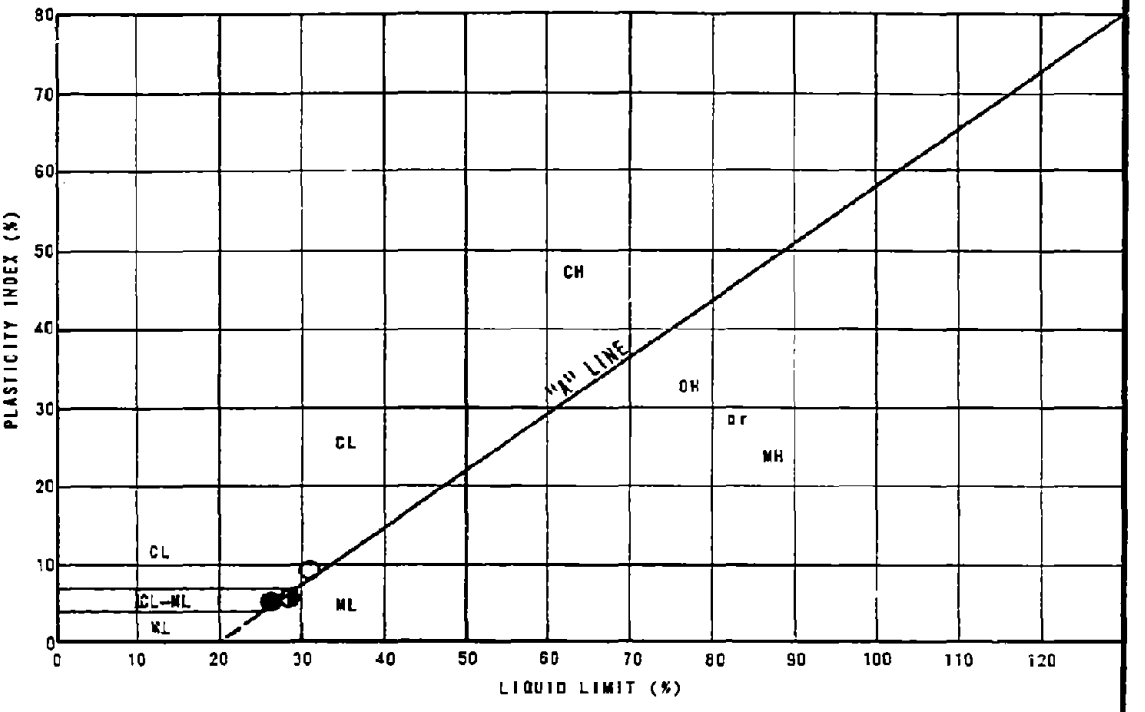
COAL REFUSE DAM FAILURE
Saunders, W. Va.

ATTERBERG LIMITS - PLASTICITY DATA

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-3

PLASTICITY CHART



PLASTICITY DATA

KEY SYMBOL	HOLE NUMBER	DEPTH (feet)	NATURAL WATER CONTENT W (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX $\left(\frac{W-PL}{LL-PL}\right)$	UNIFIED SOIL CLASSIFICATION SYMBOL
	FD-14A	5.0	9.3	—	—	N.P.		SP-SM
	FD-18A	10.0	11.4	—	—	N.P.		SP-SM
	FD-23A	35.0	8.9	—	—	N.P.		GP-GM
○	FD-24A	22.0	11.1	22	31	9		SC
	FD-25A	17.0	14.3	—	—	N.P.		SP-SM
●	FD-27A	7.0	7.4	22	27	5		GW-GM
◑	FD-28A	2.0	6.4	22	28	6		SW-SM

240-3

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

ATTERBERG LIMITS - PLASTICITY DATA

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	6-3

FIGURE B-4

SUMMARY
OF
SPECIFIC GRAVITY TEST RESULTS

HOLE NO.	SAMPLE NO.	DEPTH (ft)	MATERIAL TYPE	MINUS NO. 4 SPECIFIC GRAVITY	PLUS 3/4" SPECIFIC GRAVITY
2	S-4	23.0-25.0	EMBANKMENT, DAM NO. 3	1.70	----
4	S-6	30.0-32.0	EMBANKMENT, DAM NO. 2	2.32	----
4	S-7	35.0-37.0	EMBANKMENT, DAM NO. 2	1.87	----
4	S-12	68.0-70.0	FOUNDATION, POOL 1 SLUDGE	1.37	----
4	S-13	70.0-72.0	FOUNDATION, POOL 1 SLUDGE	1.40	----
4	PST-5	75.0-77.0	FOUNDATION, POOL 1 SLUDGE	1.46*	----
4	PST-5	75.0-77.0	FOUNDATION, POOL 1 SLUDGE	1.90*	----
5	S-5	65.0-67.0	FOUNDATION, POOL 1 SLUDGE	1.39	----
5	S-5	65.0-67.0	FOUNDATION, POOL 1 SLUDGE	1.37	----
7	S-2	20.0-22.0	EMBANKMENT, DAM. NO. 3	1.70	----
7	S-5	50.0-52.0	FOUNDATION, POOL 2 SLUDGE	1.39	----
7	PST-1	55.0-56.3	FOUNDATION, POOL 2 SLUDGE	1.42	----
7	S-7	71.1-73.5	FOUNDATION, POOL 1 SLUDGE	1.42	----
8	PST-2	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	1.34	----
9	SS-2A	55.0-57.0	FOUNDATION, POOL 2 SLUDGE	1.45	----
9	SS-2B	57.0-59.0	FOUNDATION, POOL 2 SLUDGE	1.39	----
10	S-9	60.7-62.7	MIXED EMBANKMENT AND SLUDGE	1.52	----
10	S-13	77.0-78.5	FOUNDATION, POOL 1 SLUDGE	1.81*	----
10	S-14	80.0-81.6	FOUNDATION, POOL 1 SLUDGE	1.77*	----
10	S-14	80.0-81.6	FOUNDATION, POOL 1 SLUDGE	1.83*	----
11	PST-1	35.0-37.0	EMBANKMENT, DAM NO. 3	2.24	----
11	SS-3A	85.0-87.0	FOUNDATION, POOL 1 SLUDGE	1.66	----
13	S-3	30.0-32.0	GOB PILE, COARSE COAL WASTE	2.14	----
FP-10A	S-2	3.5-4.5	EMBANKMENT, DAM NO. 3	1.66	----
FP-12A	S-1	4.8-6.8	EMBANKMENT, DAM NO. 3	2.23	----
FP-14A	S-2	3.5-4.5	EMBANKMENT, DAM NO. 3	1.62	----
	FD-1	0.5	EMBANKMENT, DAM NO. 3	----	2.34
	FD-3	0.5	EMBANKMENT, DAM NO. 3	----	1.75
	FD-4	0.5	EMBANKMENT, DAM NO. 3	1.75	1.68
	FD-9	1.5	GOB PILE, COARSE COAL WASTE	1.80	2.55
	FD-10	0.5	DISTURBED POOL 2 SLUDGE	1.38	----
	FD-11	0.3	NATURAL SOIL	2.58	2.66
	FD-12	1.0	EMBANKMENT, DAM NO. 1	2.43	----
	FD-1A	0	FOUNDATION, POOL 4 SLUDGE	1.52	----
	FD-3A	1.0	EMBANKMENT, DAM NO. 4	2.07	2.35
	FD-5A	1.0	EMBANKMENT, DAM NO. 3	1.85	2.12

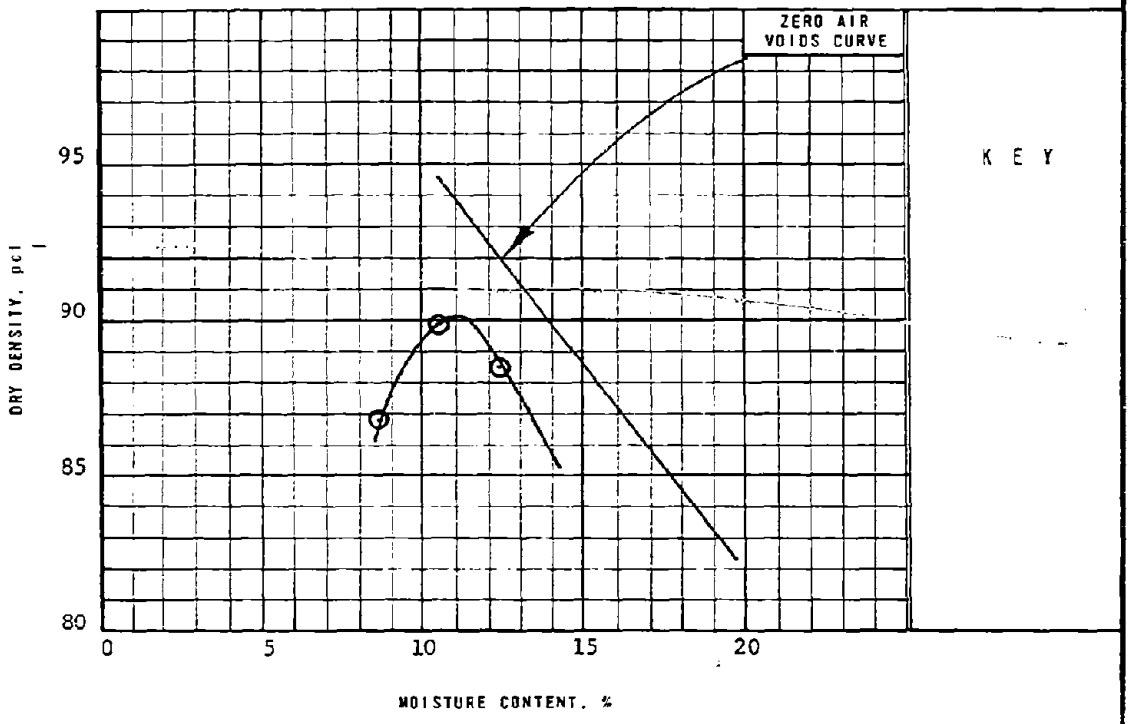
* QUESTIONABLE DATA DUE TO HIGH OVEN TEMPERATURE. THESE DATA WERE NOT INCLUDED IN THE DETERMINATION OF AVERAGE SPECIFIC GRAVITY.

FIGURE B–4 —CONTINUED

SUMMARY
OF
SPECIFIC GRAVITY TEST RESULTS

HOLE NO.	SAMPLE NO.	DEPTH (ft)	MATERIAL TYPE	MINUS NO. 4 SPECIFIC GRAVITY	PLUS 3/4" SPECIFIC GRAVITY
	FD–10A	3.9	EMBANKMENT, DAM NO. 3	2.20	2.06
	FD–14A	5.0	EMBANKMENT, DAM NO. 3	1.91	2.24
	FD–18A	35.0	EMBANKMENT, DAM NO. 3	1.32	2.02
	FD–23A	10.0	EMBANKMENT, DAM NO. 3	1.66	1.98
	FD–24A	22.0	EMBANKMENT, DAM NO. 3	1.85	----
	FD–25A	17.0	EMBANKMENT, DAM NO. 3	2.07	----
	FD–27A	7.0	EMBANKMENT, DAM NO. 3	1.98	2.51
	FD–28A	2.0	EMBANKMENT, DAM NO. 3	1.86	2.28
	A–1	COMBINED SAMPLE	EMBANKMENT, DAM NO. 3	1.90	1.84

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-4		0.5	Dark gray, silty SAND (SM)	1.75		NP	80	65



SAMPLE NO	FD-4		
NATURAL WATER CONTENT, %	7.6		
OPTIMUM WATER CONTENT, %	11.0		
MAXIMUM DRY DENSITY, pcf	90.3		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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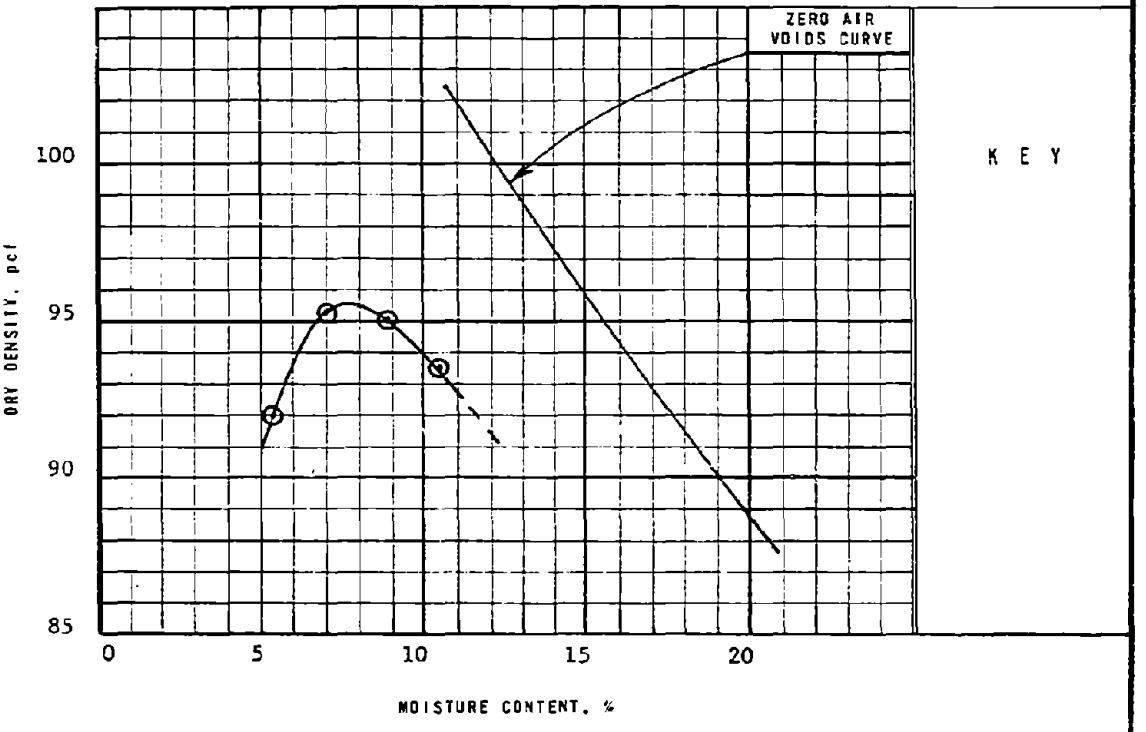
COAL REFUSE DAM FAILURE
Saunders, W. Va.

COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-9		1.5	Dark gray, silty SAND (SM)	1.80		NP	81	65



SAMPLE NO	FD-9		
NATURAL WATER CONTENT, %	7.6		
OPTIMUM WATER CONTENT, %	7.5		
MAXIMUM DRY DENSITY, pcf	95.5		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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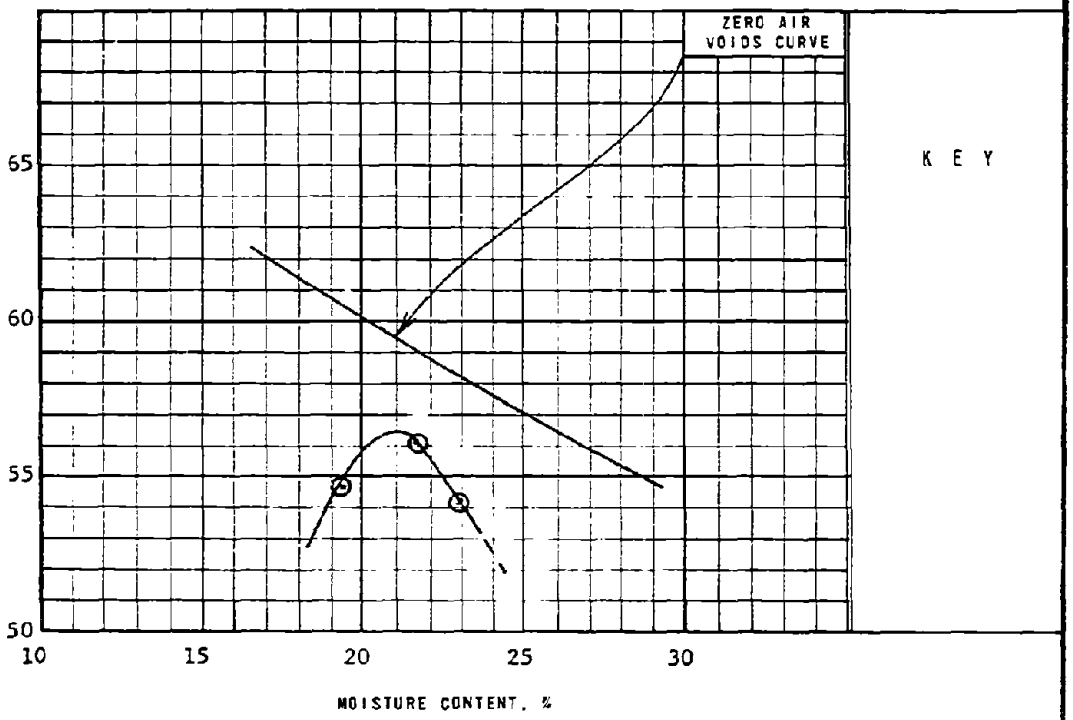
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-10		0.5	Black, sandy SILT (SM/ML)	1.38		NP	100	99



SAMPLE NO	FD-10		
NATURAL WATER CONTENT, %	36.8		
OPTIMUM WATER CONTENT, %	21.0		
MAXIMUM DRY DENSITY, pcf	56.4		
ASTM TEST DESIGNATION COMPACTIVE ENERGY $ft.lb/ft^3$	D-1557-70 20,000		

805-2

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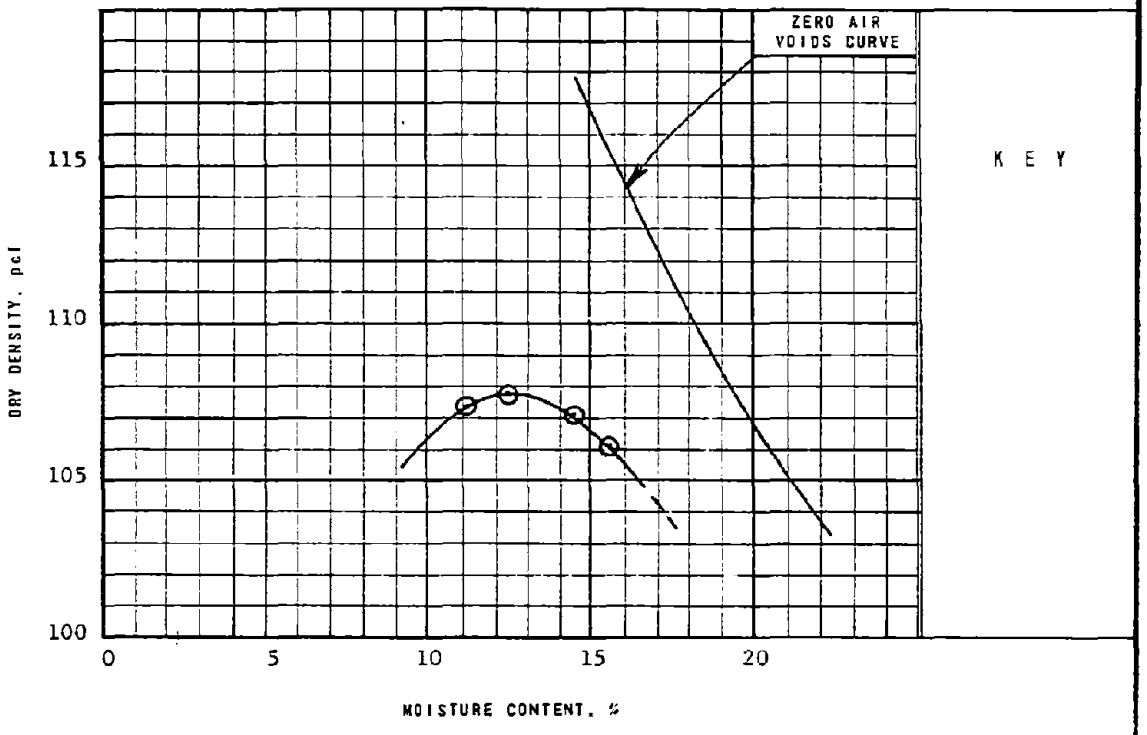
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO
0700	MAY 1972	D-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-11		0.3	Light brown, gravelly, sandy SILT (ML/GM)	2.58	40	28	73	60



SAMPLE NO	FD-11		
NATURAL WATER CONTENT, %	20.7		
OPTIMUM WATER CONTENT, %	12.5		
MAXIMUM DRY DENSITY, pcf	107.8		
ASTM TEST DESIGNATION COMPACTIVE ENERGY $ft.lb/ft^3$	D-1557-70 20,000		

805-2

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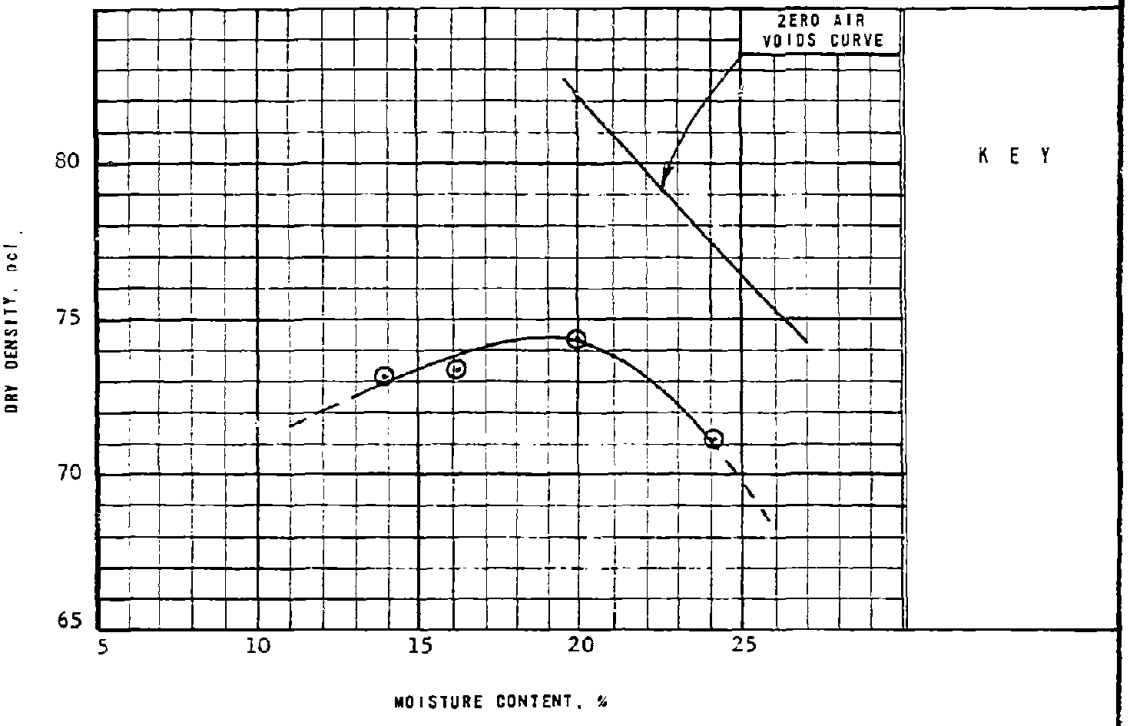
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-1A		0	Black, silty SAND (SM)	1.52		NP	100	99



SAMPLE NO	FD-1A		
NATURAL WATER CONTENT, %	32.1		
OPTIMUM WATER CONTENT, %	19.0		
MAXIMUM DRY DENSITY, pcf	74.4		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

B05-2

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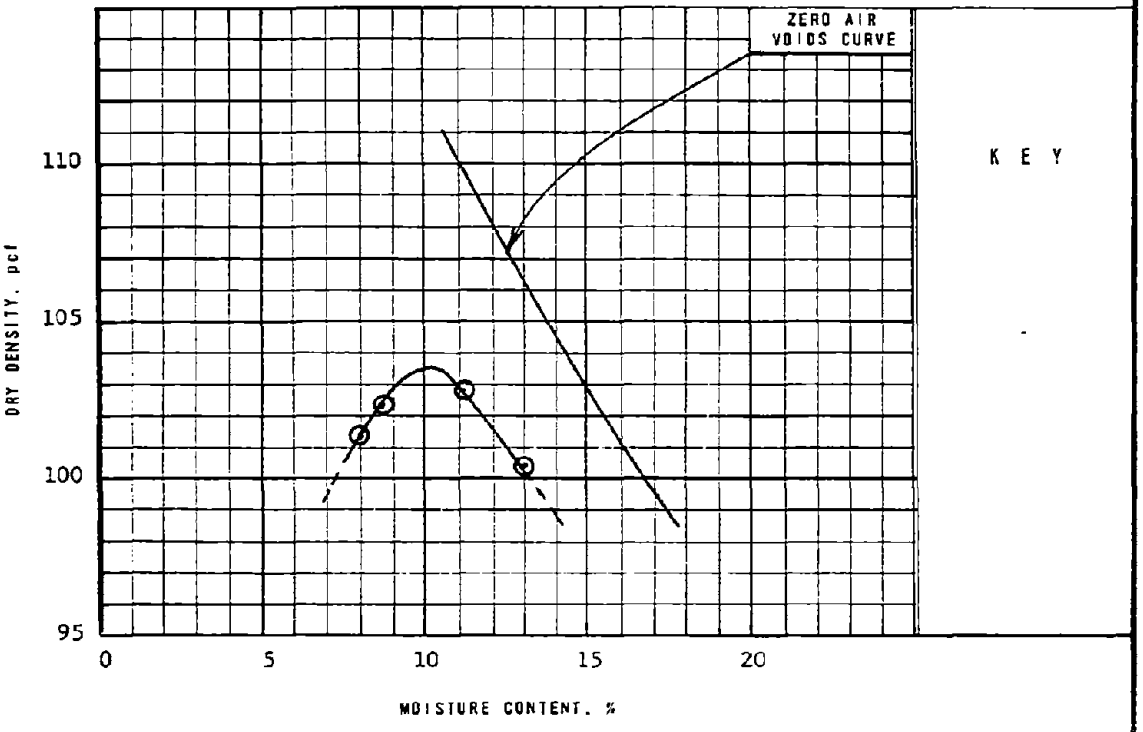
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO
0700	MAY 1972	B-3

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-3A		1.0	Light gray, silty GRAVEL (GP-GM)	2.07		NP	72	41

Combined sample of FD-3A and FD-4A.



SAMPLE NO	FD-3A		
NATURAL WATER CONTENT, %	7.5		
OPTIMUM WATER CONTENT, %	10.0		
MAXIMUM DRY DENSITY, pcf	103.4		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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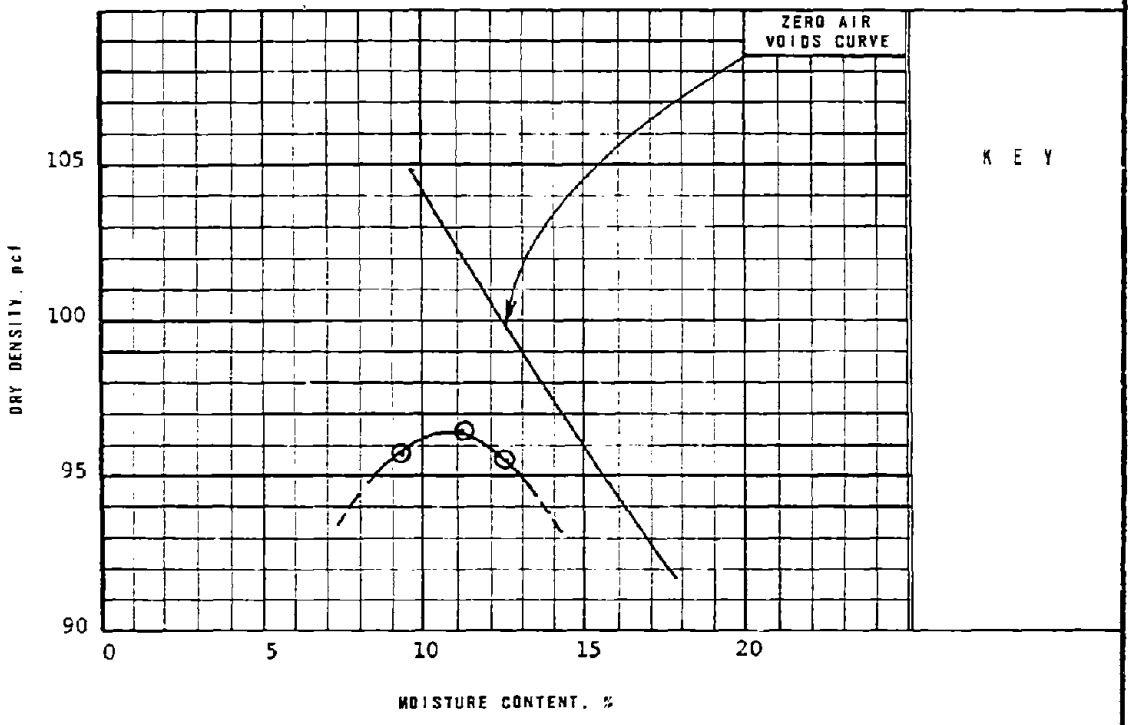
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	D-5

SAMPLE NO.	HOLE NO.	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO. 4
FD-5A		1.0	Light gray, silty SAND (SM)	1.85		NP	96	77

Combined sample from FD-5A and FD-6A.



SAMPLE NO	FD-5A		
NATURAL WATER CONTENT, %	5.5		
OPTIMUN WATER CONTENT, %	10.8		
MAXIMUM DRY DENSITY, pcf	96.5		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

B05-2

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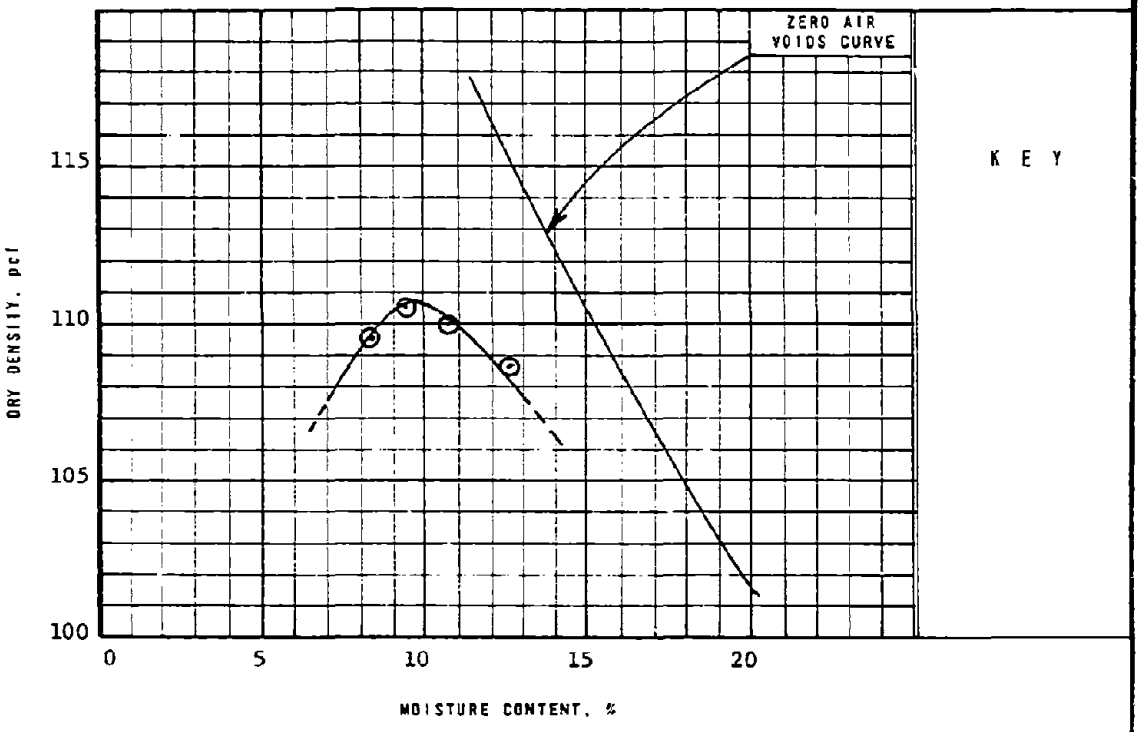
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-10A		5.8	Light gray, silty, sandy GRAVEL (GW-GM)	2.20		NP	81	40



SAMPLE NO	FD-10A		
NATURAL WATER CONTENT, %	3.9		
OPTIMUM WATER CONTENT, %	9.5		
MAXIMUM DRY DENSITY, pcf	110.7		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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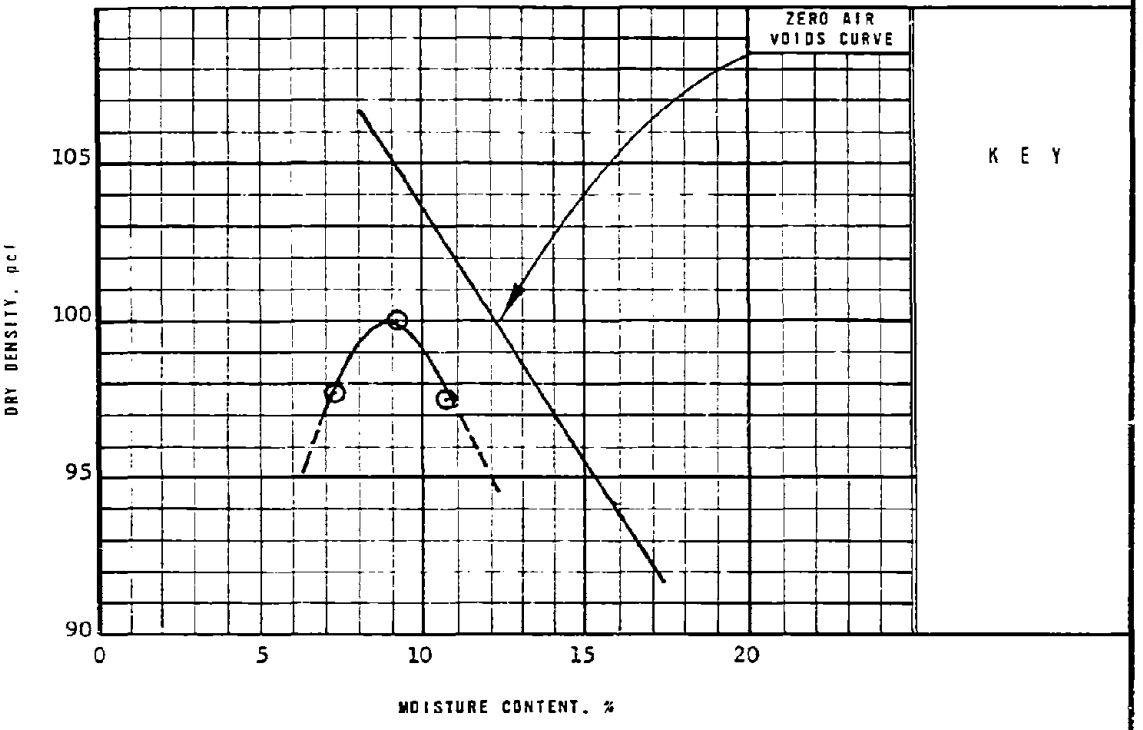
Saunders, W. Va.

COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-14A		9.3	Light gray, silty, gravelly SAND (SP-SM)	1.91		NP	84	62

Combined sample from FD-14A, FD-16A, and FD-17A.



SAMPLE NO	FD-14A		
NATURAL WATER CONTENT, %	5.0		
OPTIMUM WATER CONTENT, %	9.0		
MAXIMUM DRY DENSITY, pcf	100.1		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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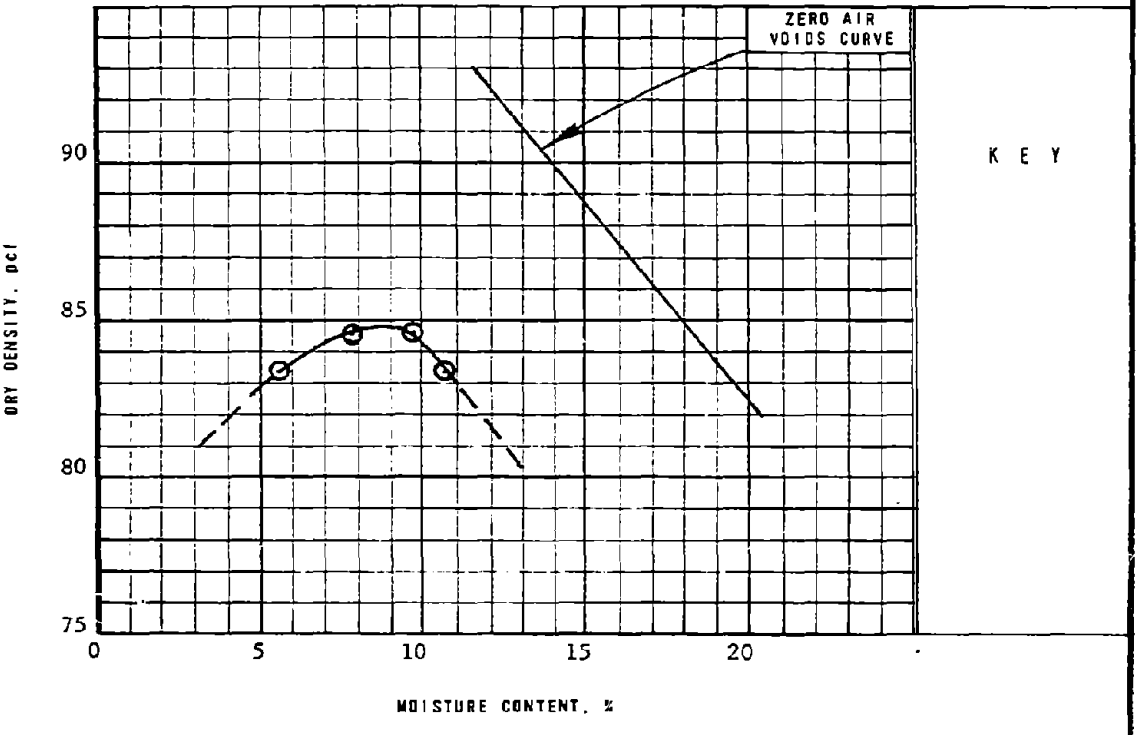
COAL REFUSE DAM FAILURE
Saunders, W. Va.

COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-18A		28.0	Light gray, silty, gravelly SAND (SP-SM)	1.32		NP	87	65

Combined sample of FD-18A, FD-20A, and FD-22A.



SAMPLE NO	FD-18A		
NATURAL WATER CONTENT, %	11.4		
OPTIMUM WATER CONTENT, %	9.0		
MAXIMUM DRY DENSITY, pcf	84.8		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

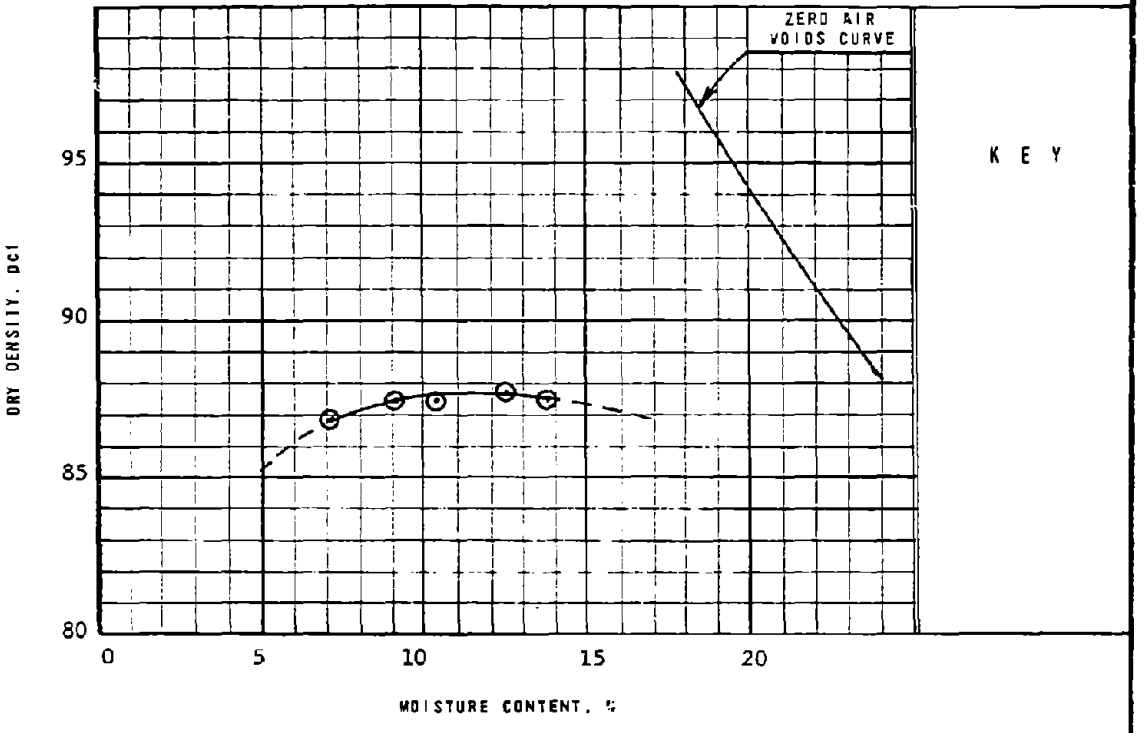
COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

805-2

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING	
							3/4"	NO 4
FD-23A		18.0	Black, slightly silty, sandy GRAVEL (GP-GM)	1.66		NP	69	49

NOTE: Combined sample from FD-19A, FD-21A, and FD-23A.



SAMPLE NO	FD-23A		
NATURAL WATER CONTENT, %	8.9		
OPTIMUM WATER CONTENT, %	12.5		
MAXIMUM DRY DENSITY, pcf	87.8		
ASTM TEST DESIGNATION COMPACTIVE ENERGY $ft.lb/ft^3$	D-1557-70 20,000		

805-2

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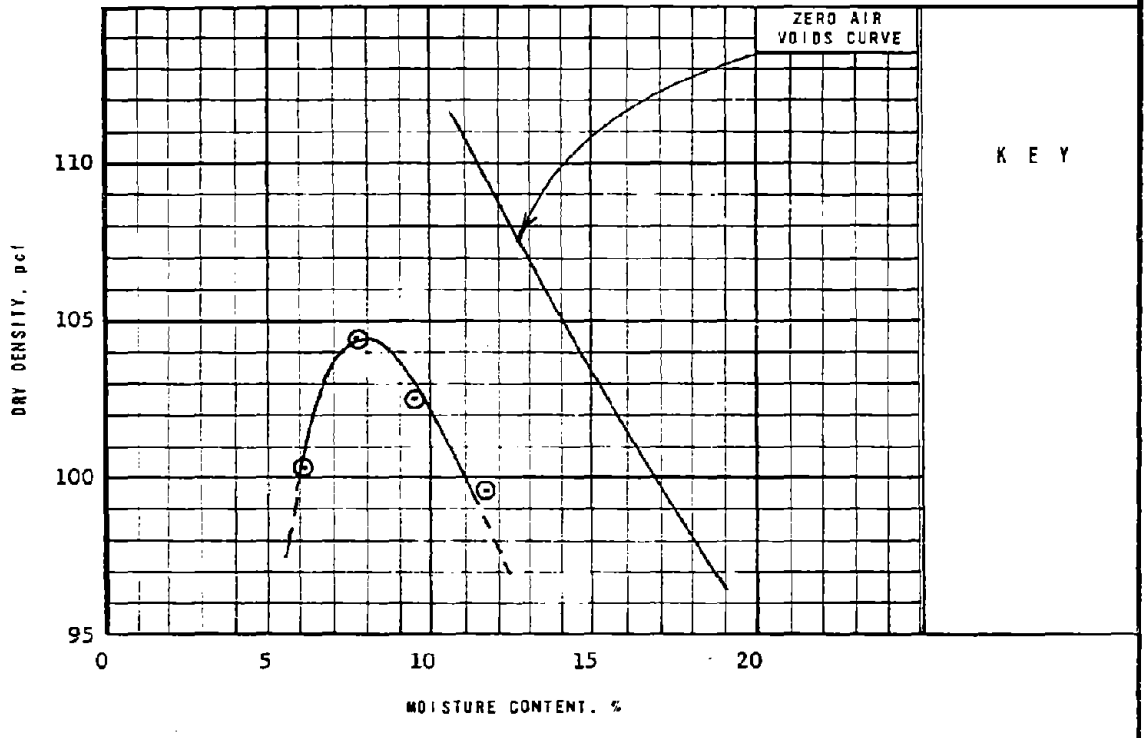
COAL REFUSE DAM FAILURE
Saunders, W. Va.

COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO
0700	May 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-27A		7.0	Light gray, well graded, silty GRAVEL (GW-GM)	1.98	27	22	92	62

NOTE: Combined sample from FD-26A and FD-27A.



SAMPLE NO	FD-27A		
NATURAL WATER CONTENT, %	7.4		
OPTIMUM WATER CONTENT, %	8.0		
MAXIMUM DRY DENSITY, pcf	104.4		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D1557-70 20,000		

805-2

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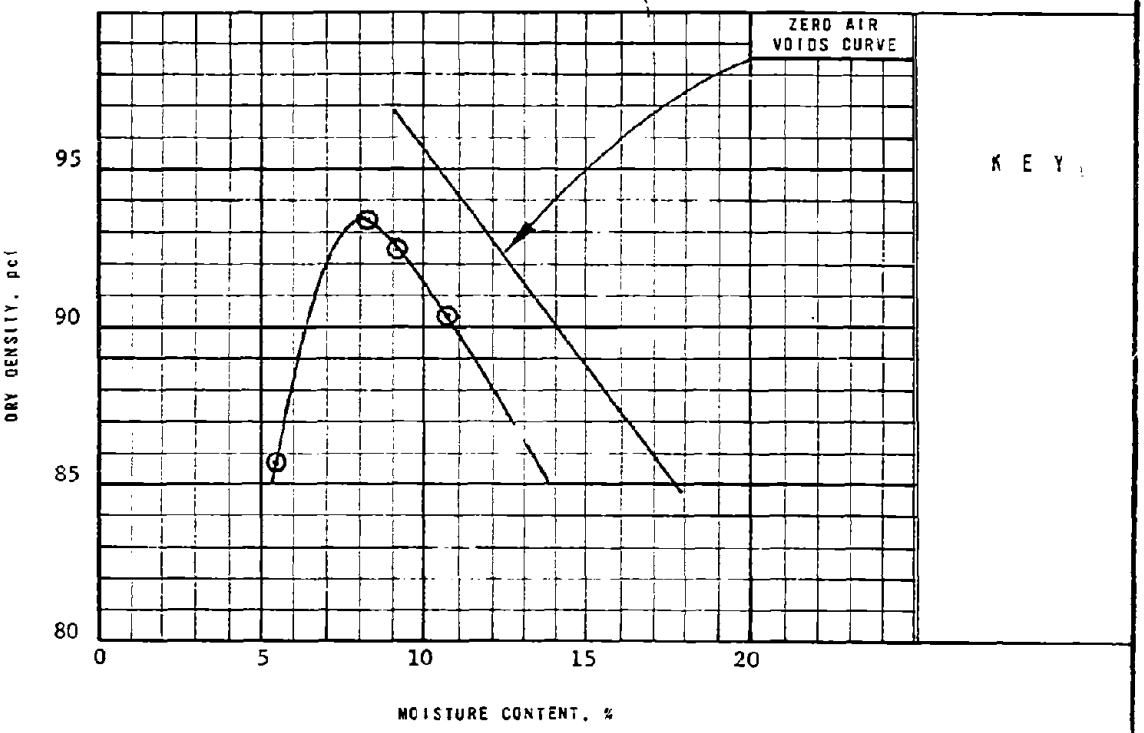
COAL REFUSE DAM FAILURE
Saunders, W. Va.

COMPACTION TEST RESULTS

PROJECT NO.	DATE	DRAWING NO.
0700	MAY 1972	B-5

SAMPLE NO.	HOLE NO	DEPTH (ft)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PERCENT PASSING 3/4"	PERCENT PASSING NO 4
FD-28A		2.0	Light gray, well graded, silty, gravelly SAND (SW-SM)	1.86	28	22	78	47



SAMPLE NO	FD-28A		
NATURAL WATER CONTENT, %	6.4		
OPTIMUM WATER CONTENT, %	8.2		
MAXIMUM DRY DENSITY, pcf	98.4		
ASTM TEST DESIGNATION COMPACTIVE ENERGY ft.lb/ft^3	D-1557-70 20,000		

805-2

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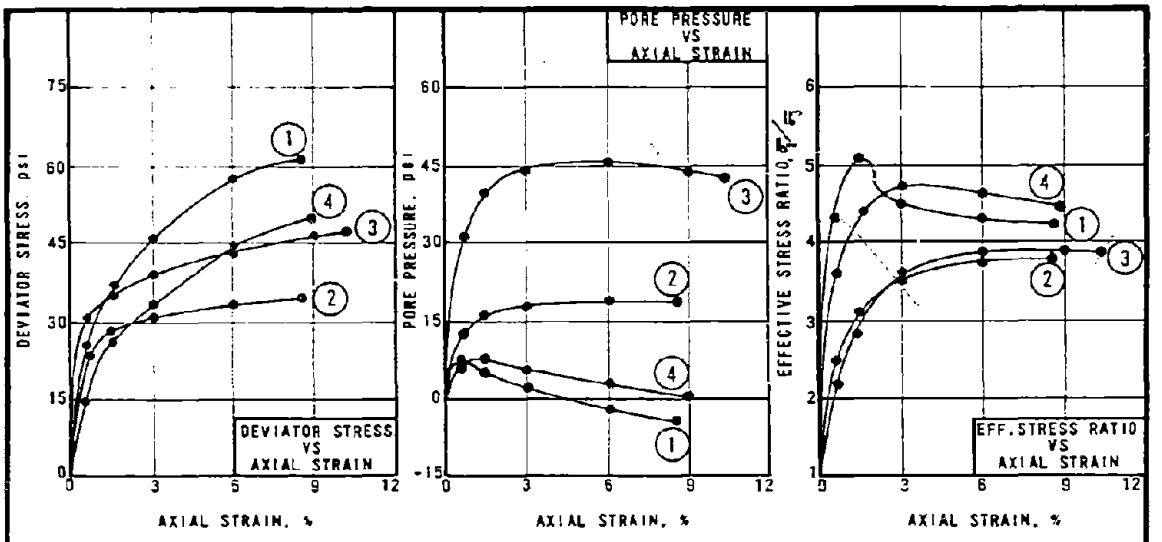
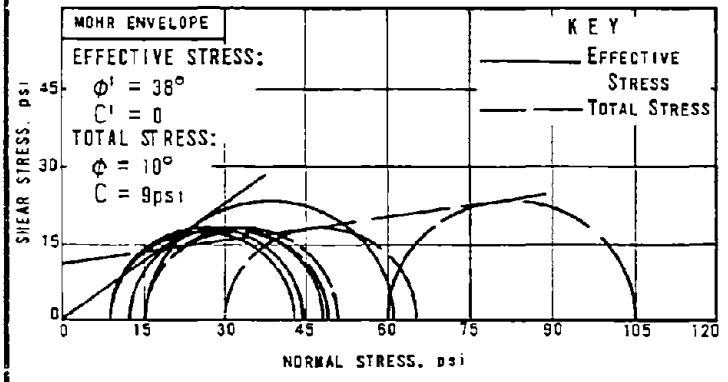
COAL REFUSE DAM FAILURE
Saunders, W. Va.

COMPACTION TEST RESULTS

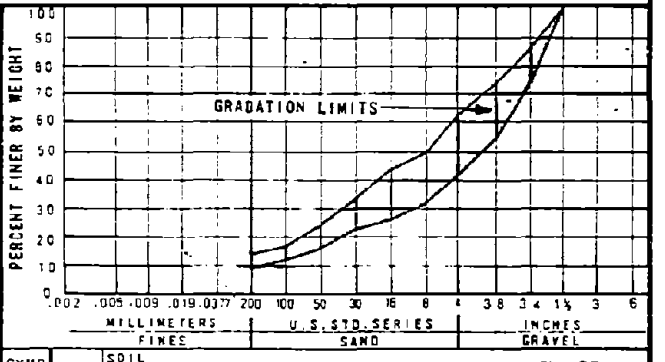
PROJECT NO.	DATE	DRAWING NO
0700	MAY 1972	B-5





SPECIMEN NO.	VOLUME CHANGE, %
1	1.77
2	4.13
3	5.40
4	0.76

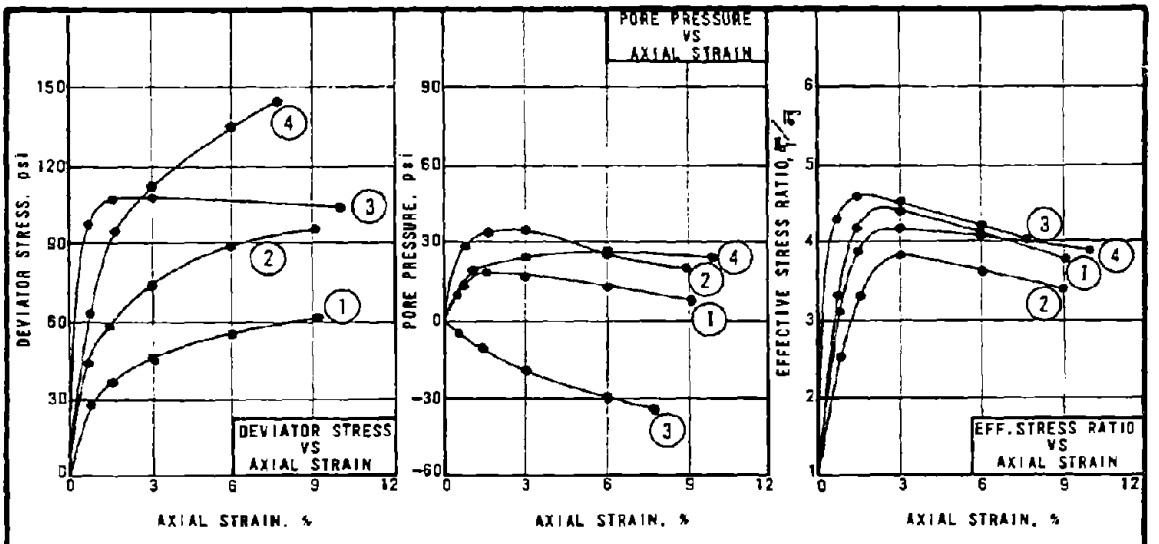
	SPECIMEN NO.	1	2	3	4
INITIAL CONDITION	Water Content, %	3.3	4.2	5.9	13.6
	Dot Water Content, %	---	---	---	---
	Dry Density, pcf	80.3	80.5	77.4	82.0
	Max. Dry Density, %	---	---	---	---
	Void Ratio	0.321	0.318	0.372	0.370
	Saturation, %	17.6	22.3	27.0	66.3
FINAL CONDITION	Consol. Pressure, psi	15.0	30.0	60.0	15.0
	Water Content, %	15.6	12.4	13.8	16.8
	Dry Density, pcf	81.8	84.0	81.8	82.6
	Void Ratio	0.298	0.264	0.298	0.360
	Saturation, %	100.0	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	60.0	60.0
	Test Time to Failure, min.	125	125	143	165
	Rate of Strain, %/hr	3.79	3.86	4.00	3.24

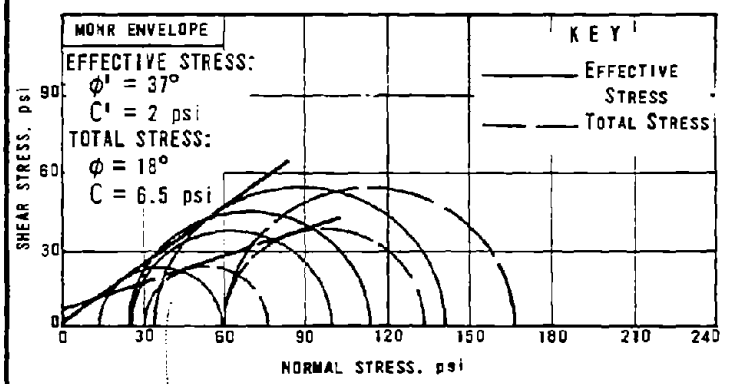


SYMB		SOIL CLASSIFICATION: BLACK, GRAVELLY SAND (SM) EXCEPT
LL	---	SPEC. 4, SANDY GRAVEL (GM).
PL	---	SAMPLE LOCATION: SPECIMENS 1, 2, AND 3 ARE FROM HOLE 2,
PI	NP	23'-25'. SPECIMEN 4 IS FROM HOLE 8, 20'-22'.
SG	1.70	NOTE: EMBANKMENT NO. 3.

834(REV)

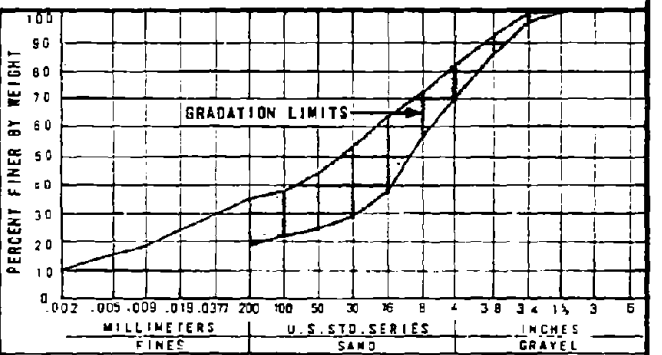
W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE Saunders, W. Va.	CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			SAMPLE NO.
PALO ALTO - NEWPORT BEACH - CALIF.		PROJECT NO.	DATE	SHEET NO.	2-S-4 & 8-S-2
		0700	Nov. 1972	Fig. B-6	





SPECIMEN NO.	VOLUME CHANGE %
1	1.98
2	3.32
3	1.79
4	----

	SPECIMEN NO.	1	2	3	4
INITIAL CONDITION	Water Content, %	8.2	8.7	10.3	8.5
	Opt Water Content, %	---	---	---	---
	Dry Density, pcf	106.5	83.7	84.2	90.7
	Max. Dry Density, %	---	---	---	---
	Void Ratio	0.055	0.342	0.386	0.286
	Saturation, %	100.0	46.0	50.1	55.7
FINAL CONDITION	Consol. Pressure, psi	30.0	60.0	15.0	60.0
	Water Content, %	11.9	10.3	13.4	12.7
	Dry Density, pcf	108.6	86.6	85.7	---
	Void Ratio	0.034	0.298	0.362	---
	Saturation, %	100.0	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	70.0	70.0
	Test Time to Failure, min.	165	165	128	138
	Rate of Strain, %/hr	3.31	3.28	3.70	4.44



SYMB	SM
LL	---
PL	---
PI	NP
SG	1.87

SOIL CLASSIFICATION: BLACK, SILTY, GRAVELLY SAND (SM).

SAMPLE LOCATION: HOLE 4: SPEC. 1, 30'-32'; SPEC 2, 10'-12'; SPECS. 3 & 4, 35'-37'.

NOTE: EMBANKMENT NO. 2.

834(REV)

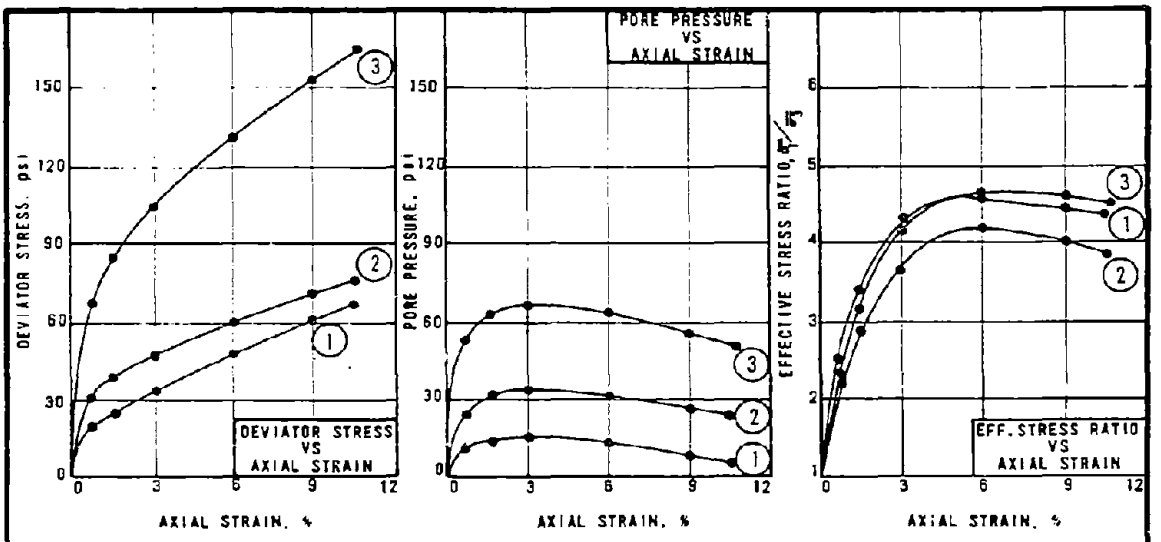
W.A. WAHLER & ASSOCIATES
PALO ALTO · NEWPORT BEACH · CALIF.

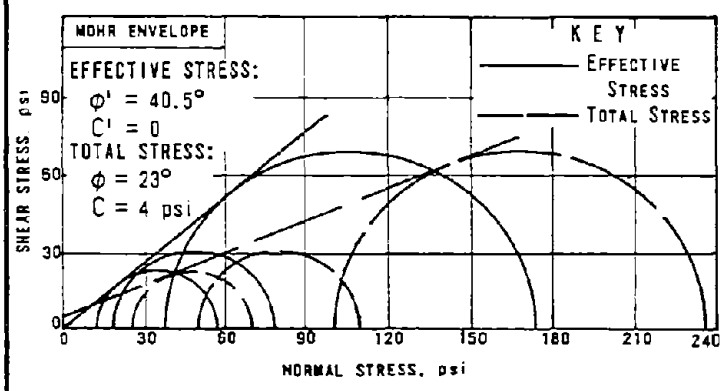
COAL REFUSE DAM FAILURE
Saunders, W. Va.

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

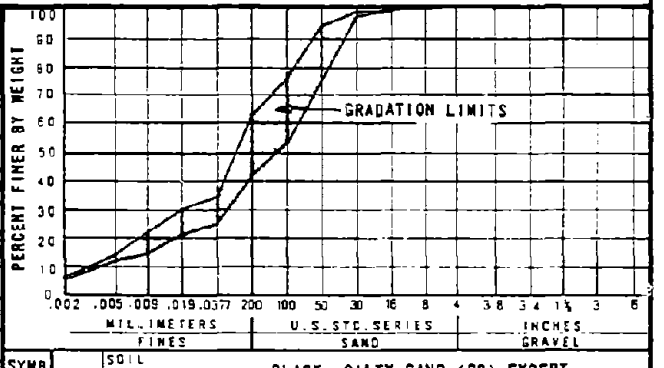
SAMPLE NO. 4-S-2, S-6 & S-7





SAMPLE NO.	VOLUME CHANGE %
1	2.37
2	3.43
3	8.68

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content,%	42.9	26.4	64.8
	Opt Water Content,%	---	---	---
	Dry Density,pcf	49.0	47.7	47.8
	Max.Dry Density,%	---	---	---
	Void Ratio	0.785	0.834	0.829
	Saturation,%	76.6	44.4	100.0
FINAL CONDITION	Consol.Pressure,psi	25.0	50.0	100.0
	Water Content,%	42.9	43.4	40.0
	Dry Density,pcf	50.1	49.4	52.3
	Void Ratio	0.784	0.771	0.670
	Saturation,%	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure,psi	60.0	60.0	60.0
	Test Time To Failure,min.	150	150	150
	Rate of Strain, %/hr	4.12	4.12	4.29



SYMB		SOIL CLASSIFICATION: BLACK, SILTY SAND (SC) EXCEPT
LL	---	SPEC. 3, SANDY SILT (ML).
PL	---	SAMPLE LOCATION: HOLE 4, 65'-67'.
PI	NP	
SG	1.37	NOTE: POOL NO. 1 SLUDGE

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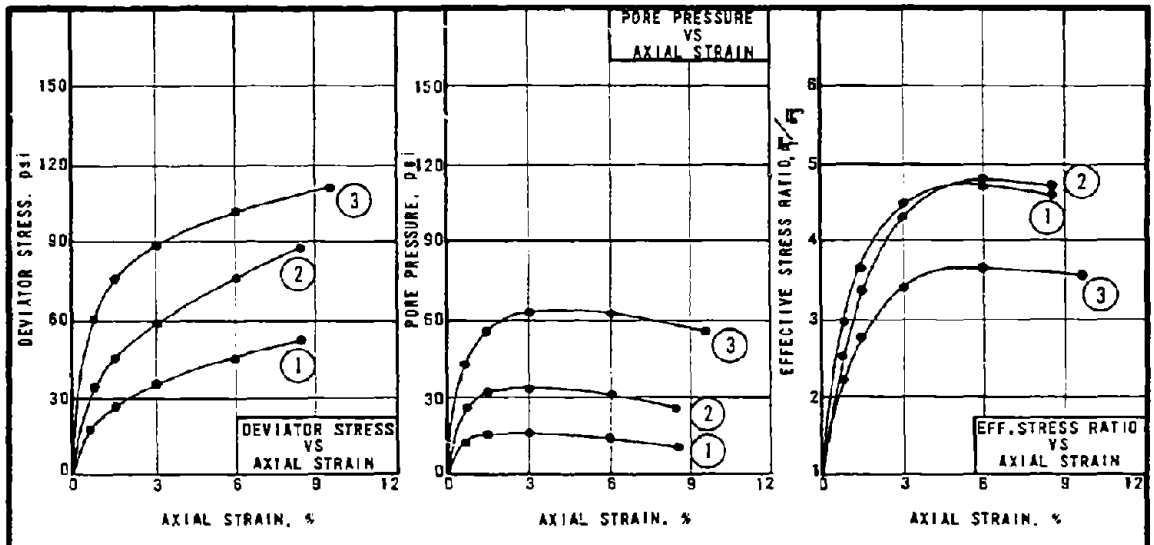
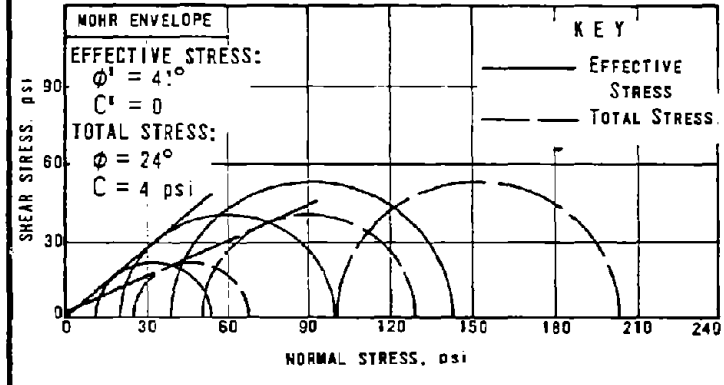
CONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

SAMPLE NO. 4-S-12

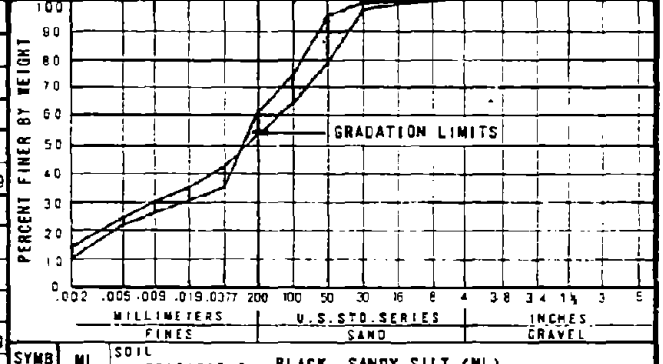
834(REV)





SPECIMEN NO.	VOLUME CHANGE %
1	3.43
2	5.16
3	5.36

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content, %	49.2	50.1	38.2
	Opt Water Content, %	---	---	---
	Dry Density, pcf	51.1	49.8	58.7
	Max. Dry Density, %	---	---	---
	Void Ratio	0.709	0.756	0.489
	Saturation, %	97.4	93.0	100.0
FINAL CONDITION	Consol. Pressure, psi	25.0	50.0	100.0
	Water Content, %	46.6	44.7	34.5
	Dry Density, pcf	53.0	52.5	62.0
	Void Ratio	0.650	0.665	0.409
	Saturation, %	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	60.0
	Test Time to Failure, min.	127	127	143
	Rate of Strain, %/hr	3.95	3.95	4.07



SYMB	ML	SOIL CLASSIFICATION: BLACK, SANDY SILT (ML)
LL	---	
PL	---	SAMPLE LOCATION: HOLE 4, 70'–72'.
PI	NP	
SG	2.40	NOTE: POOL NO. 1, SLUDGE.

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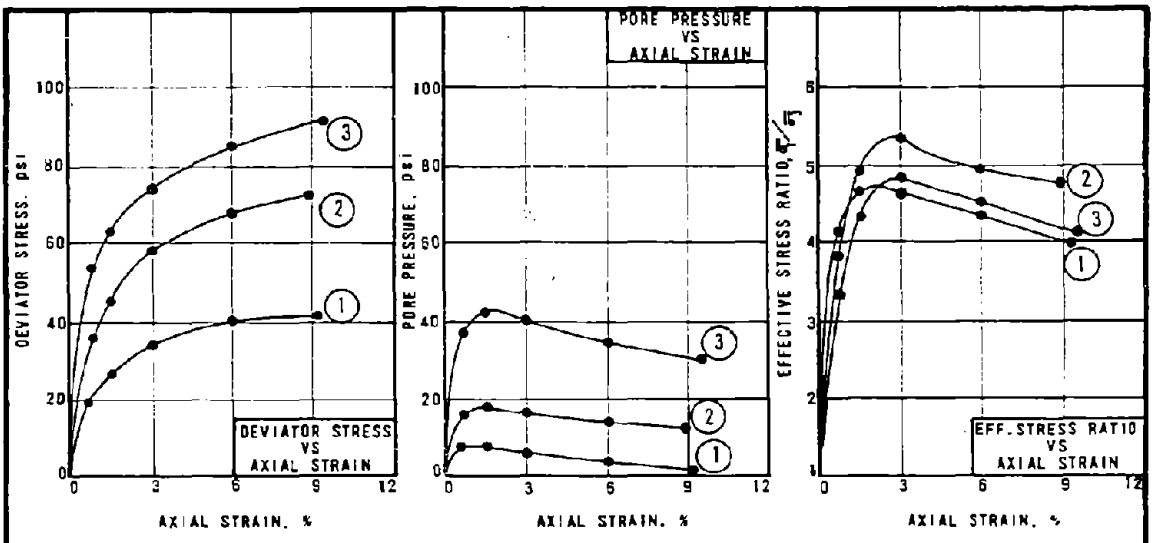
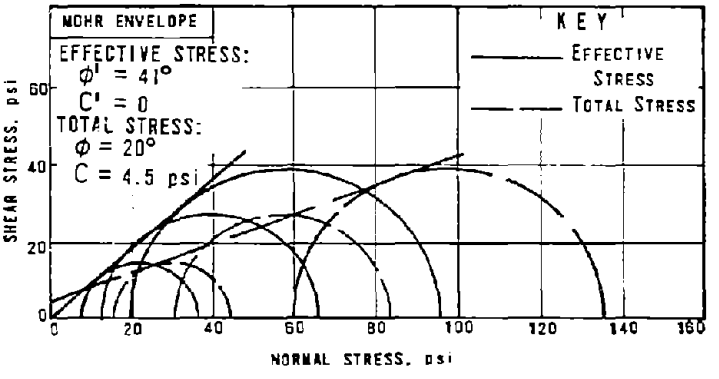
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

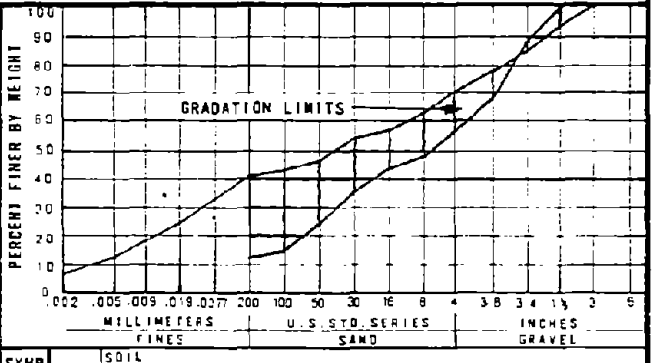
PROJECT NO.	DATE	SHEET NO.	SAMPLE NO.
0700	Nov. 1972	Fig. B-6	4-S-13





SPECIMEN NO.	VOLUME CHANGE %
1	0.93
2	2.10
3	3.06

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content,%	14.9	14.5	14.0
	Opt Water Content,%	---	---	---
	Dry Density,pcf	87.7	85.9	90.3
	Max.Dry Density,%	---	---	---
	Void Ratio	0.281	0.309	0.244
	Saturation,%	95.8	84.7	100.0
FINAL CONDITION	Consol Pressure,psi	15.0	30.0	60.0
	Water Content,%	16.9	14.5	14.0
	Dry Density,pcf	88.5	87.7	93.2
	Void Ratio	0.269	0.281	0.206
	Saturation,%	100.0	100.0	100.0
GENERAL	Specimen Diameter in.	2.875	2.875	2.875
	Back Pressure,psi	60.0	60.0	60.0
	Test Time to Failure,min.	165	165	165
	Rate of Strain %/hr	3.29	3.26	3.33



SYMB	SM	SOIL CLASSIFICATION: BLACK, SLIGHTLY SILTY, GRAVELLY SAND (SM)
LL	---	
PL	---	SAMPLE LOCATION: HOLE 7, 20'-22'.
PI	NP	
SG	1.70	NOTE: EMBANKMENT NO. 3.

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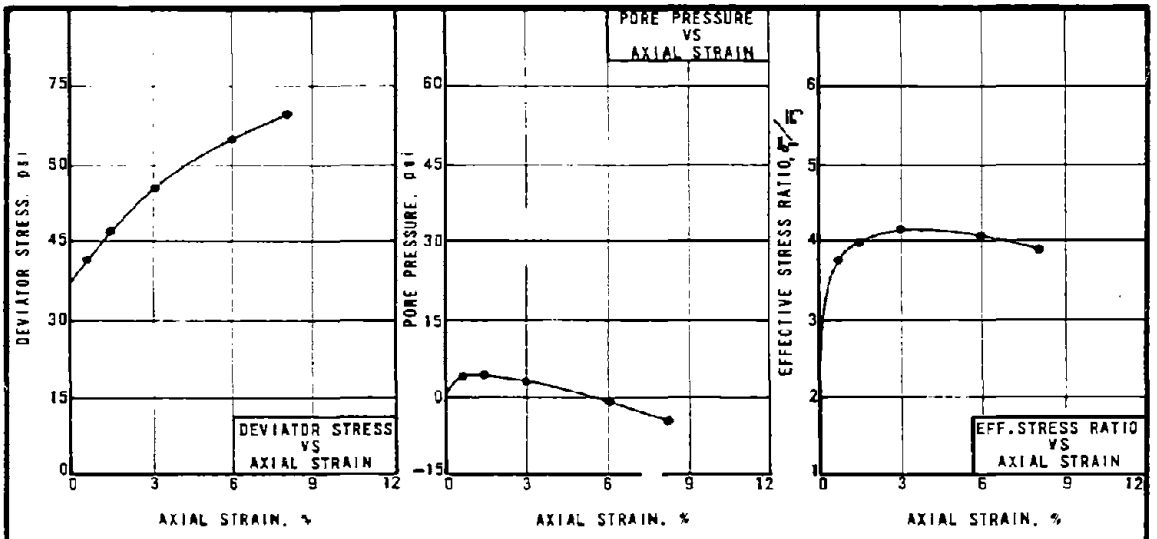
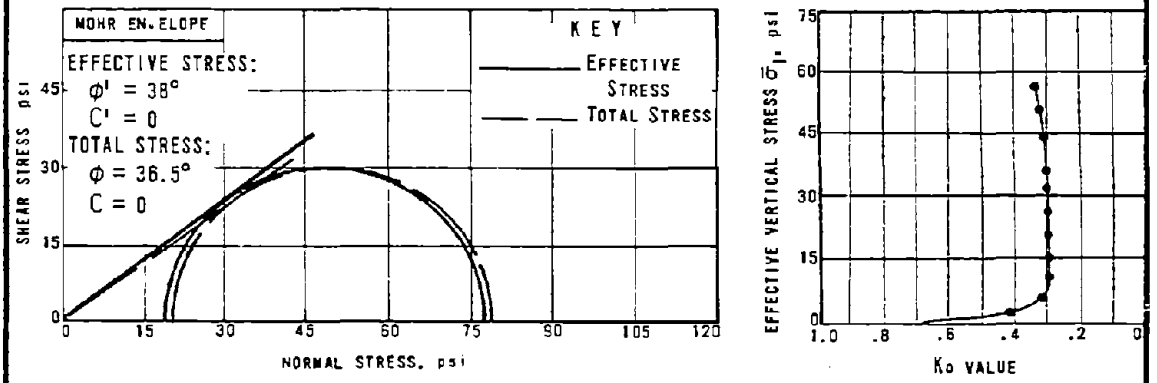
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

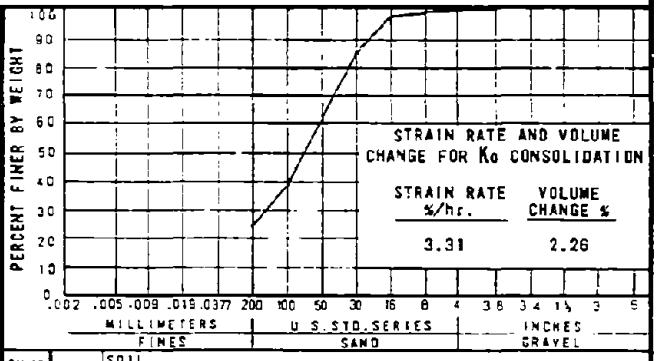
PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

SAMPLE NO. 7-S-2





	SPECIMEN NO.	1
INITIAL CONDITION	Water Content,%	37.3
	Opt Water Content,%	---
	Dry Density,pcf	56.6
	Max.Dry Density,%	---
	Void Ratio	0.565
	Saturation,%	93.9
FINAL CONDITION	Consol Pressure,psi	20.0
	Water Content,%	36.8
	Dry Density,pcf	57.9
	Void Ratio	0.530
	Saturation,%	100.0
GENERAL	Specimen Diameter, in.	2.875
	Back Pressure,psi	50.0
	Test Time to Failure,min. (ICU)	128
	Rate of Strain, %/hr (ICU)	3.87



STRAIN RATE AND VOLUME CHANGE FOR Ko CONSOLIDATION

STRAIN RATE %/hr.	VOLUME CHANGE %
3.31	2.26

SYMB	SM	SOIL CLASSIFICATION: BLACK SILTY SAND (SM)
LL	---	
PL	---	SAMPLE LOCATION: HOLE 7, 55.0'-56.3'.
PI	NP	
SG	1.42	NOTE: POOL NO. 2 SLUDGE.

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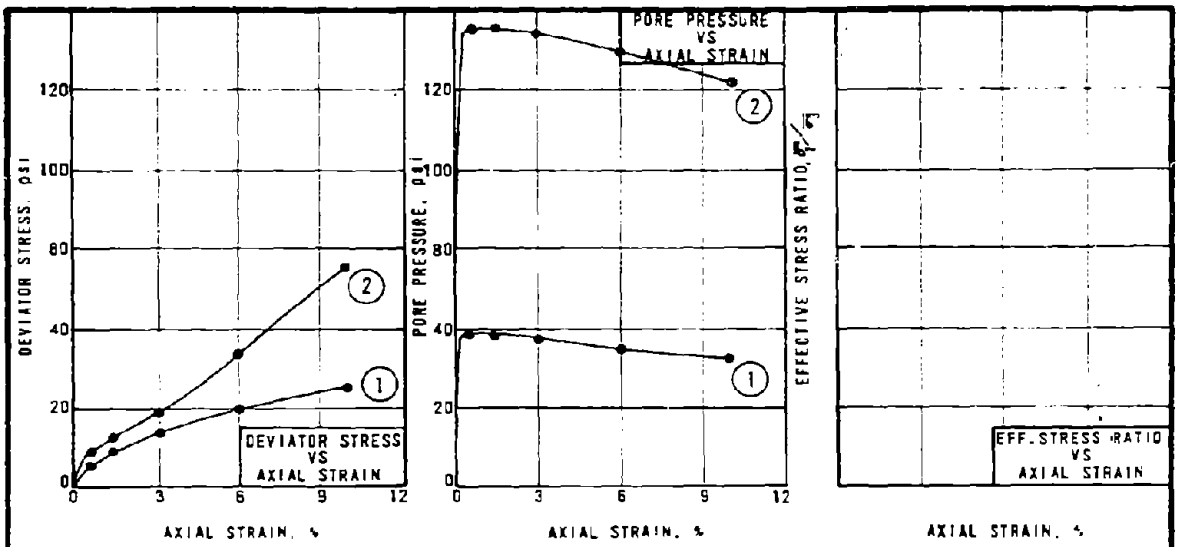
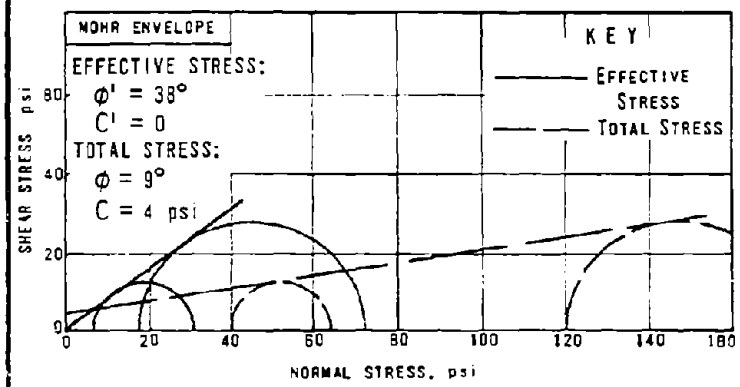
TRIAXIAL TEST RESULTS

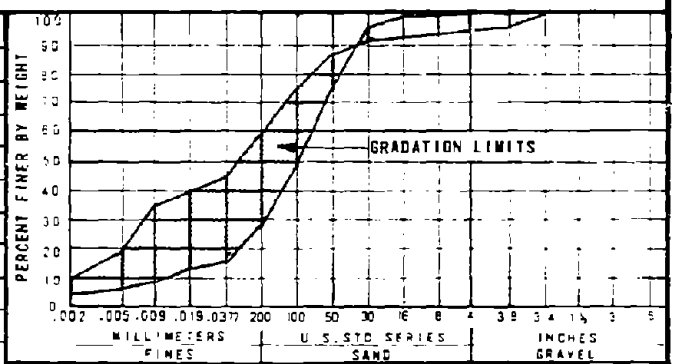
PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

SAMPLE NO. 7-PST-1





SPECIMEN NO.		1	2
INITIAL CONDITION	Water Content, %	38.1	46.8
	Opt. Water Content, %	---	---
	Dry Density, pcf	65.0	48.5
	Max. Dry Density, %	---	---
	Void Ratio	0.363	0.827
	Saturation, %	100.0	80.4
FINAL CONDITION	Confin. Pressure, psi	40.0	120.0
	Water Content, %	---	---
	Dry Density, pcf	---	---
	Void Ratio	---	---
	Saturation, %	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875
	Back Pressure, psi	50.0	50.0
	Test Time to Failure, min.	156	153
	Rate of Strain, %/hr	3.85	3.92



SYMB		SOIL CLASSIFICATION: SPEC. NO. 1, BLACK, SANDY SILT (ML),
LL	---	SPEC. NO. 2, BLACK, SILTY SAND (SM).
PL	---	SAMPLE LOCATION: HOLE 7, 71.1'-73.5'.
PI	NP	
SG	1.42	NOTE: POOL NO. 1 SLUDGE.
		FAILURE CRITERION: 10% STRAIN

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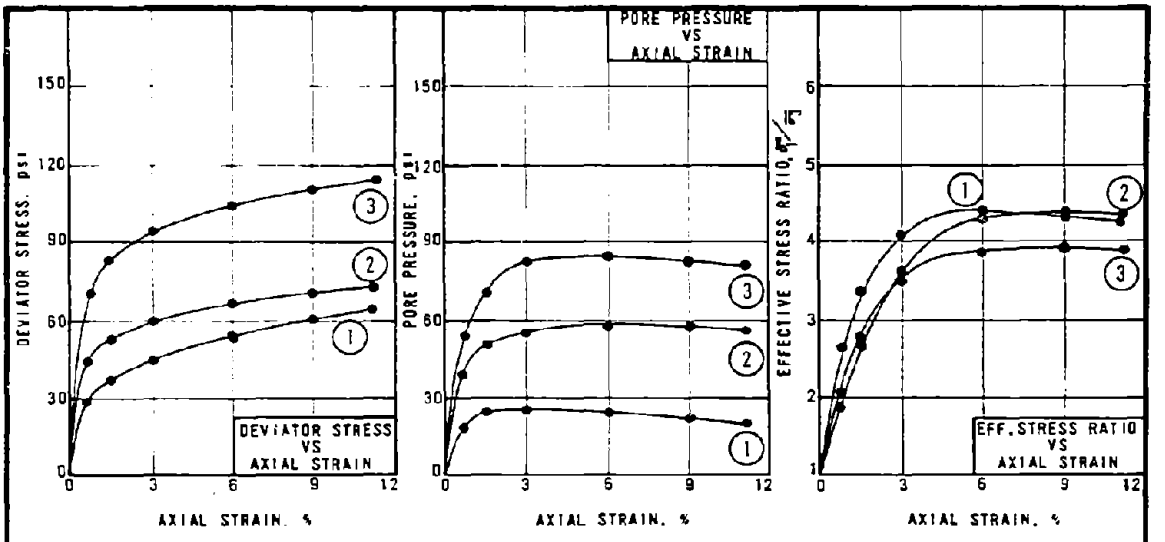
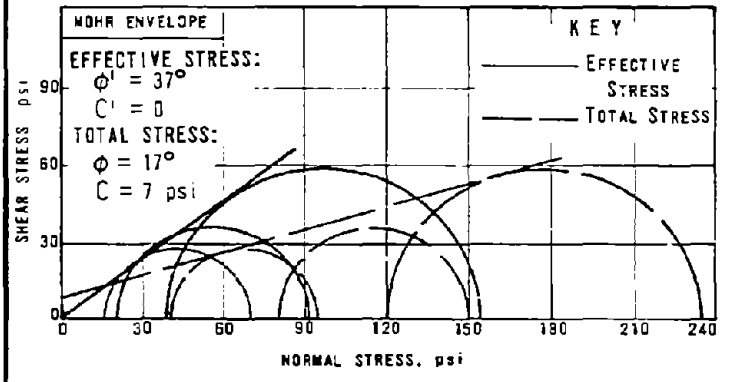
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

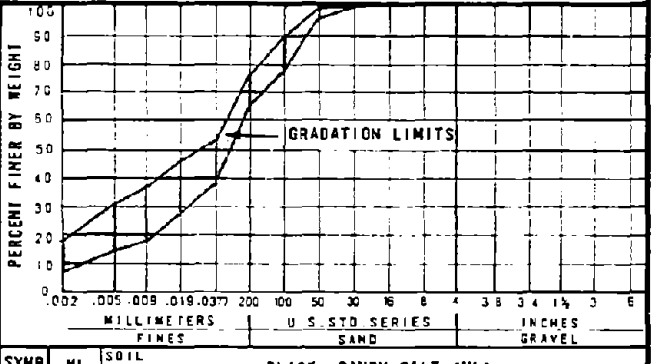
SAMPLE NO. 7-S-7





SPECIMEN NO.	VOLUME CHANGE %
1	6.15
2	9.11
3	5.70

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content, %	42.5	67.7	38.7
	Opt Water Content, %	---	---	---
	Dry Density, pcf	54.1	48.5	47.4
	Max. Dry Density, %	---	---	---
	Void Ratio	0.614	0.800	0.848
	Saturation, %	97.1	100.0	64.4
FINAL CONDITION	Consol Pressure, psi	40.0	80.0	120.0
	Water Content, %	42.5	50.7	47.2
	Dry Density, pcf	57.7	53.4	50.3
	Void Ratio	0.515	0.636	0.738
	Saturation, %	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	60.0
	Test Time to Failure, min.	150	150	150
	Rate of Strain, %/hr	4.55	4.56	4.50



SYMB	ML	SOIL CLASSIFICATION: BLACK, SANDY SILT (ML).
LL	---	
PL	---	SAMPLE LOCATION: HOLE 9, 55'-57'.
PI	NP	
SG	1.45	NOTE: POOL NO. 2 SLUDGE.

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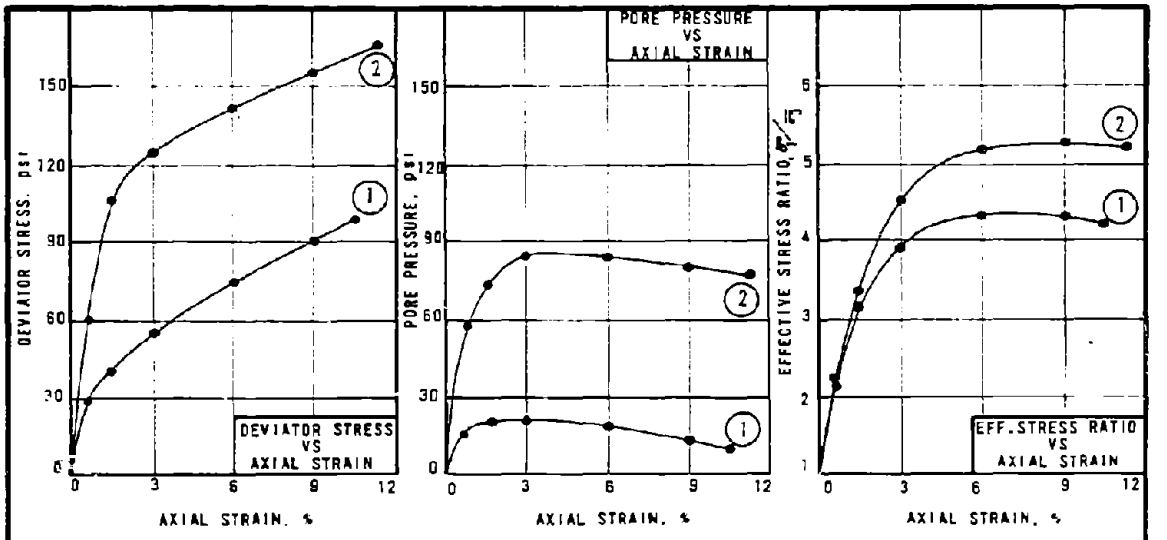
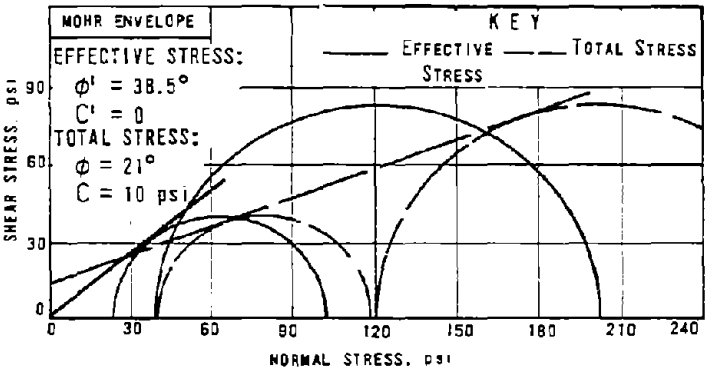
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

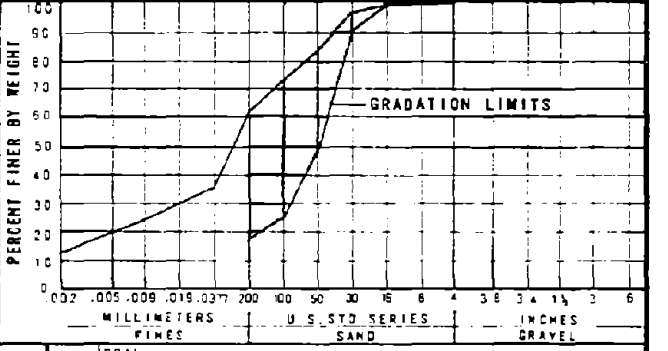
PROJECT NO.	DATE	SHEET NO.	SAMPLE NO.
0700	Nov. 1972	Fig. B-6	9-SS-2A





SPECIMEN NO.	VOLUME CHANGE %
1	4.39
2	----

	SPECIMEN NO.	1	2
INITIAL CONDITION	Water Content, %	40.6	41.2
	Opt. Water Content, %	---	---
	Dry Density, pcf	55.8	52.2
	Max. Dry Density, %	---	---
	Void Ratio	0.566	0.875
	Saturation, %	100.0	85.6
FINAL CONDITION	Consol. Pressure, psi	40.0	120.0
	Water Content, %	37.6	36.6
	Dry Density, pcf	58.4	---
	Void Ratio	0.497	---
	Saturation, %	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875
	Back Pressure, psi	50.0	50.0
	Test Time to Failure, min.	152	154
	Rate of Strain, %/hr.	4.10	5.43



SYMB		SOIL CLASSIFICATION:	SPEC. NO. 1, BLACK, SANDY SILT (ML).
LL	---		SPEC. NO. 2, BLACK, SILTY SAND (SM).
PL	---	SAMPLE LOCATION:	HOLE 9, 57'-59'.
PI	NP		
SG	1.39	NOTE:	POOL NO. 2 SLUDGE

834(REV)

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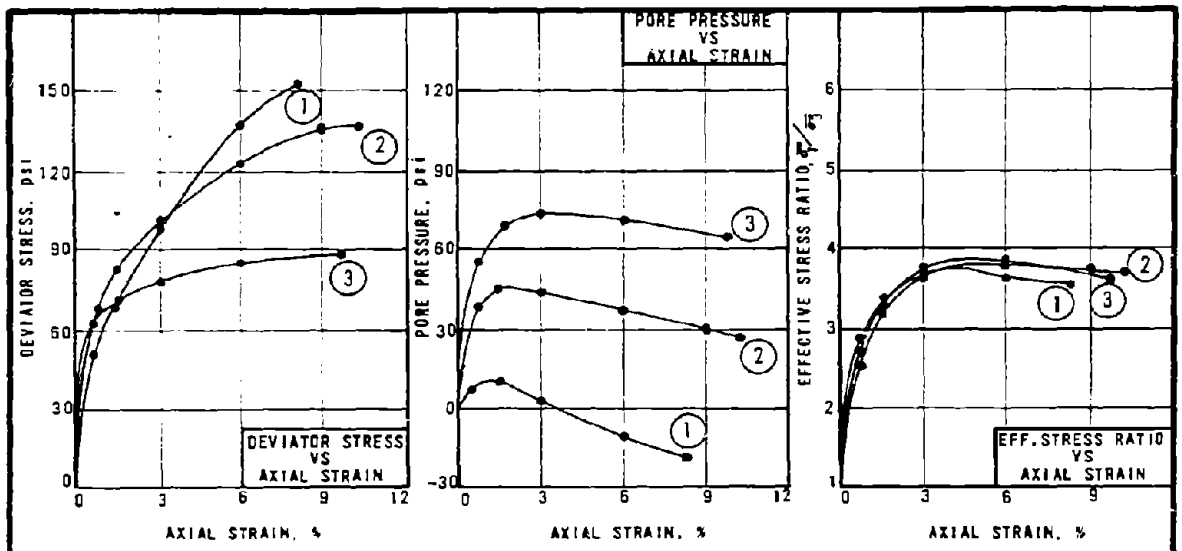
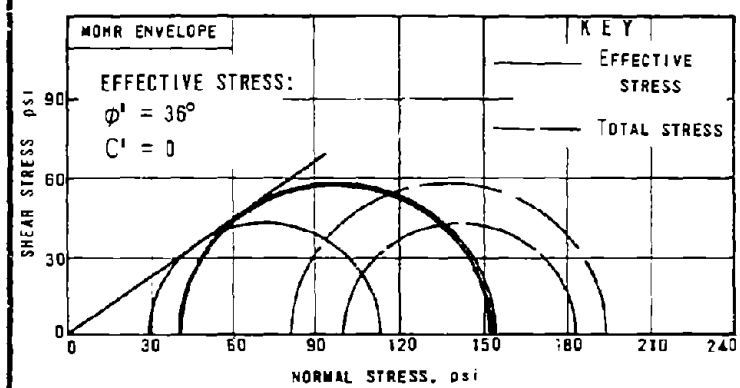
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

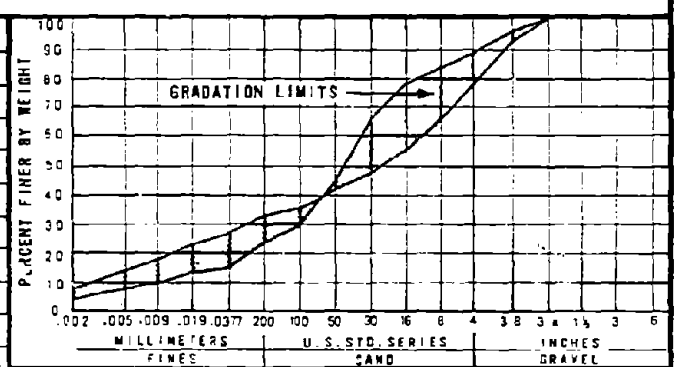
SAMPLE NO. 9-SS-2B





SPECIMEN NO.	VOLUME CHANGE %
1	2.22
2	4.26
3	6.58

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content, %	18.4	15.9	17.6
	Opt Water Content, %	---	---	---
	Dry Density, pcf	73.9	85.0	96.5
	Max. Dry Density, %	---	---	---
	Void Ratio	0.284	0.117	0.241
	Saturation, %	98.3	100.0	100.0
FINAL CONDITION	Consol. Pressure, psi	40.0	80.0	100.0
	Water Content, %	20.5	15.8	14.6
	Dry Density, pcf	75.6	88.7	96.9
	Void Ratio	0.256	0.069	0.159
	Saturation, %	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure, psi	50.0	50.0	60.0
	Test Time to Failure, min.	125	161	165
	Rate of Strain, %/hr	3.86	3.90	3.54



SYMB	SM	SOIL CLASSIFICATION: BLACK, SILTY, GRAVELLY SAND (SM)
LL	23	
PL	23	SAMPLE LOCATION: SPECIMENS 1 AND 2 ARE FROM HOLE 10,
PI	NP	60.7'-62.7', SPECIMEN 3 IS FROM HOLE 11, 35.0'-37.0'.
SG	1.52	NOTE: MIXED EMBANKMENT AND SLUDGE MATERIAL.

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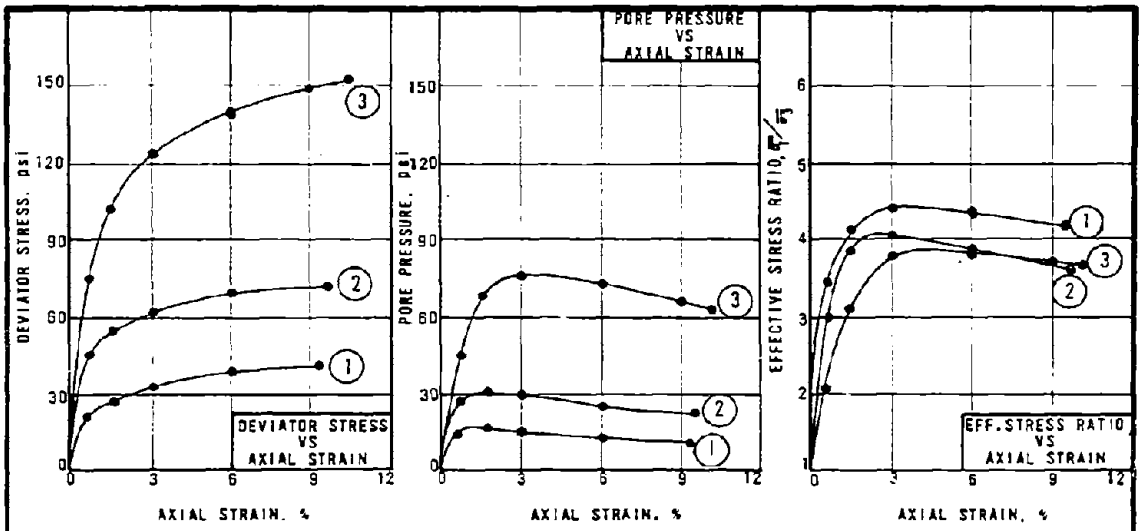
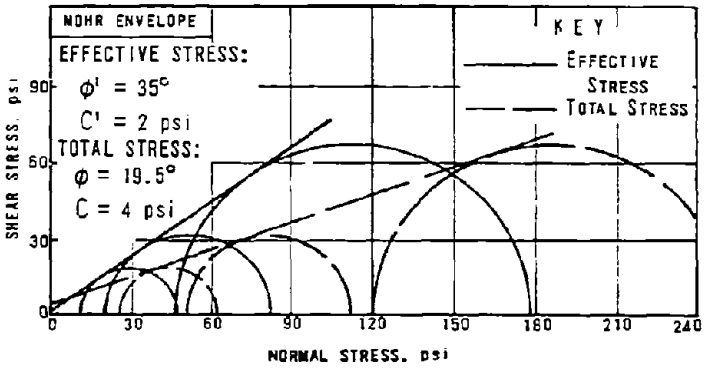
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

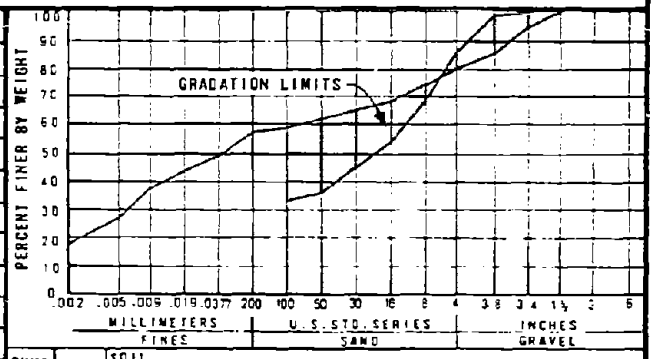
SAMPLE NO. 10-S-9 & 11-PST-1





SPECIMEN NO.	VOLUME CHANGE %
1	2.22
2	2.95
3	6.11

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content, %	12.0	10.5	10.7
	Opt Water Content, %	---	---	---
	Dry Density, pcf	103.4	104.6	106.0
	Max. Dry Density, %	---	---	---
	Void Ratio	0.087	0.074	0.177
	Saturation, %	100.0	100.0	100.0
FINAL CONDITION	Consol. Pressure, psi	25.0	50.0	120.0
	Water Content, %	12.0	11.0	10.6
	Dry Density, pcf	105.7	107.8	112.9
	Void Ratio	0.063	0.042	0.105
	Saturation, %	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	50.0
	Test Time to Failure, min.	165	165	156
	Rate of Strain, %/hr	3.37	3.50	3.93



SYMB	SM	SOIL CLASSIFICATION: BLACK, SILTY, GRAVELLY SAND (SM)
LL	---	EXCEPT SPECIMEN 2, SANDY SILT (ML)
PL	---	SAMPLE LOCATION: SPECIMENS 1 AND 2 ARE FROM HOLE 11,
PI	NP	35.0'-37.0'. SPECIMEN 3 IS FROM HOLE 10, 60.7'-62.7'
SG	2.24	NOTE: EMBANKMENT 3 AND SLUDGE (POSSIBLY DISTURBED).

834(REV)

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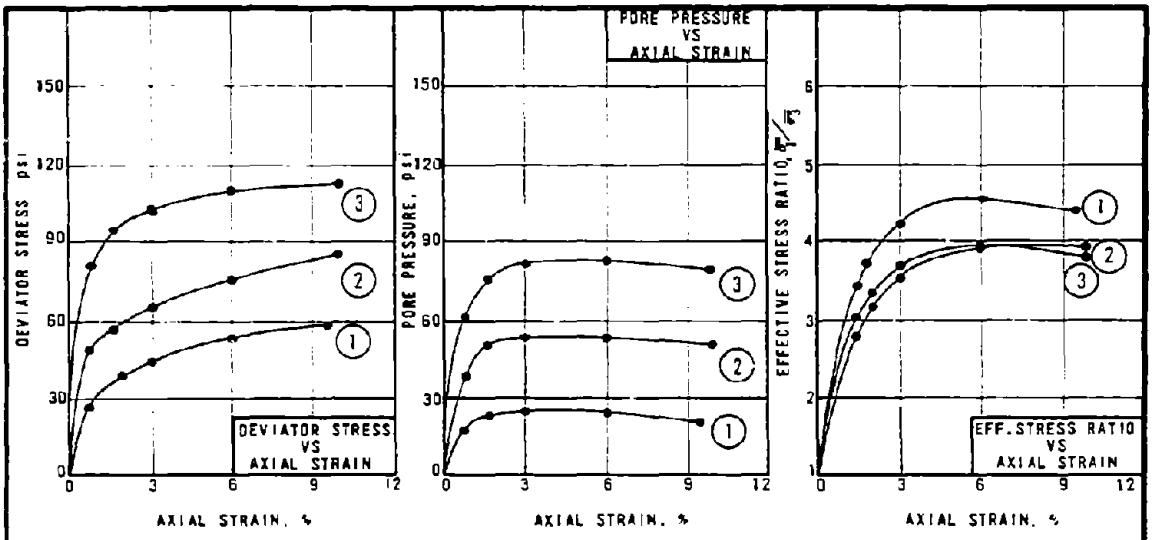
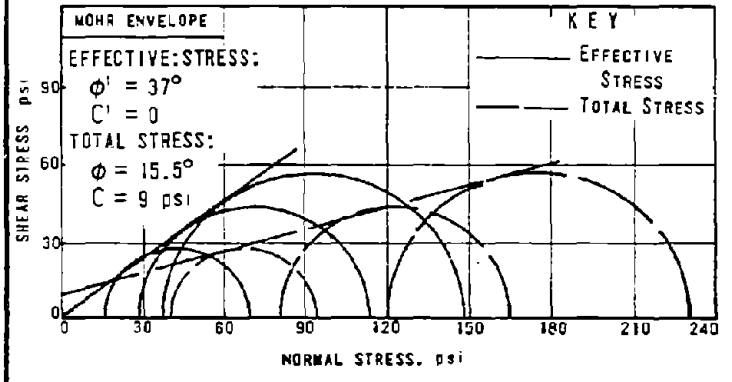
Saunders, W. Va.

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

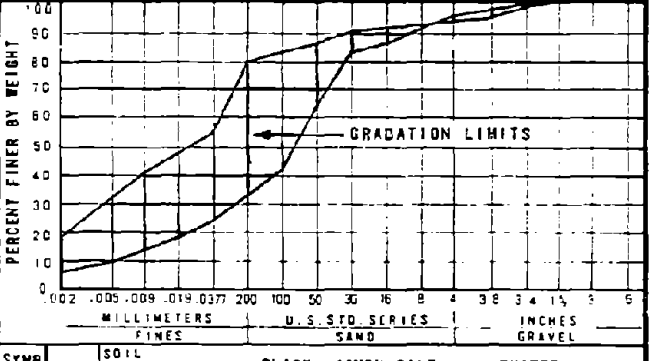
SAMPLE NO. 11-PST-1 & 10-S-9





SPECIMEN NO.	VOLUME CHANGE, %
1	3.18
2	5.12
3	5.63

	SPECIMEN NO.	1	2	3
INITIAL CONDITION	Water Content, %	37.3	45.0	32.0
	Opt Water Content, %	---	---	---
	Dry Density, pcf	58.5	48.4	65.2
	Max. Dry Density, %	---	---	---
	Void Ratio	0.495	0.807	0.340
	Saturation, %	100.0	78.1	100.0
FINAL CONDITION	Consol Pressure, psi	40.0	80.0	120.0
	Water Content, %	36.6	43.1	27.9
	Dry Density, pcf	60.4	51.0	69.1
	Void Ratio	0.447	0.715	0.295
	Saturation, %	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875
	Back Pressure, psi	60.0	60.0	60.0
	Test Time to Failure, min.	165	165	165
	Rate of Strain, %/hr.	3.33	3.42	3.42



SYMB		SOIL CLASSIFICATION: BLACK, SANDY SILT (ML) EXCEPT SPEC. 3, SILTY SAND (SM)
LL	---	
PL	---	SAMPLE LOCATION: HOLE 11, 85'-87'.
PI	NP	
SG	1.66	NOTE: POOL NO. 1 SLUDGE

834(PEV)

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COAL REFUSE DAM FAILURE
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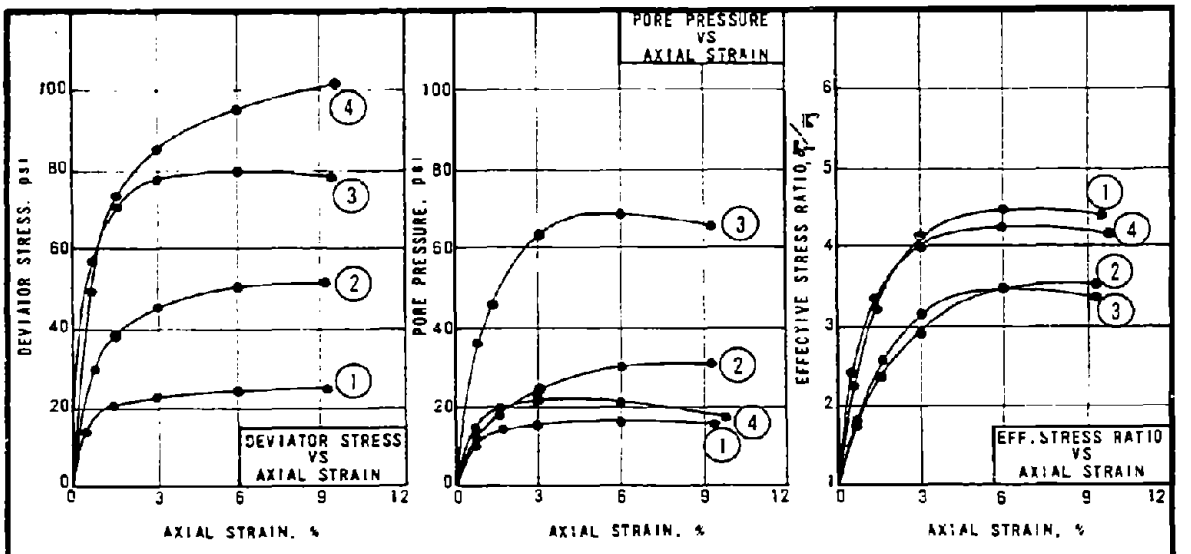
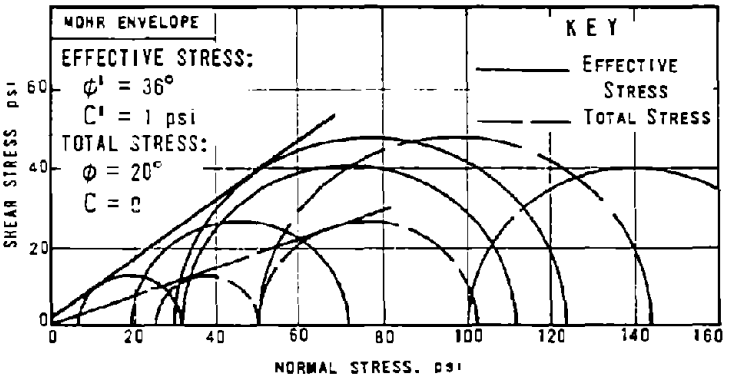
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

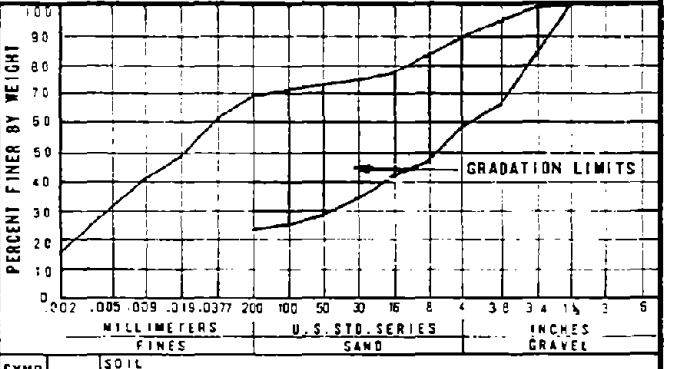
SAMPLE NO. 11-SS-3A





SPECIMEN NO.	VOLUME CHANGE %
1	2.76
2	3.54
3	6.70
4	3.82

	SPECIMEN NO.	1	2	3	4
INITIAL CONDITION	Water Content,%	11.1	9.3	10.9	15.8
	Opt Water Content,%	---	---	---	---
	Dry Density,pcf	91.8	84.2	87.0	74.4
	Max.Dry Density,%	---	---	---	---
	Void Ratio	0.224	0.334	0.292	0.509
	Saturation,%	89.6	50.3	67.7	55.8
FINAL CONDITION	Consol.Pressure,psi	25.0	50.0	100.0	50.0
	Water Content,%	14.0	13.5	12.4	21.8
	Dry Density,pcf	94.4	87.3	93.2	77.4
	Void Ratio	0.190	0.287	0.205	0.452
	Saturation,%	100.0	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	2.875	2.875	2.875	2.875
	Back Pressure,psi	60.0	60.0	60.0	60.0
	Test Time to Failure,min.	165	165	165	165
	Rate of Strain, %/hr	3.38	3.34	3.36	3.46



SYMB		SOIL CLASSIFICATION: BLACK SILTY SAND (SM) EXCEPT
LL	---	SPEC. NO. 2, SANDY SILT (ML).
PL	---	SAMPLE LOCATION: HOLE 13: SPECS. 1 & 3, 30'-32'; SPEC 2.
PI	NP	10'-12'; SPEC 4, 50'-52'.
SG	2.14	NOTE: EMBANKMENT NO. 1 (GOB PILE).

834(REV)

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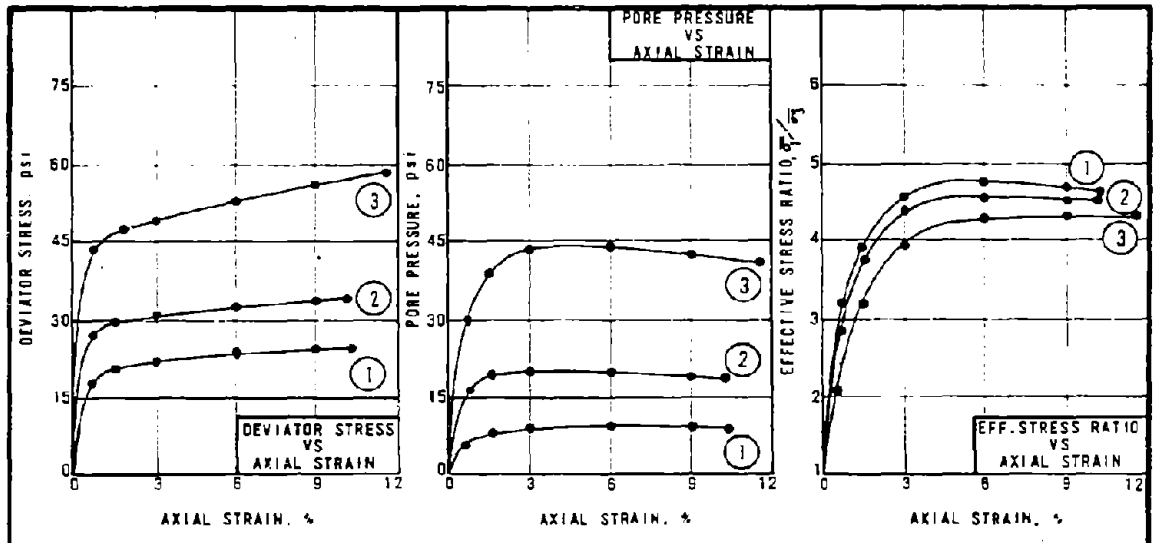
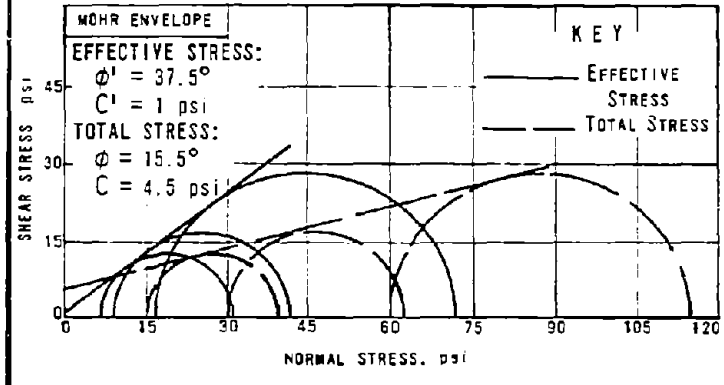
Saunders, W. Va.

CONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

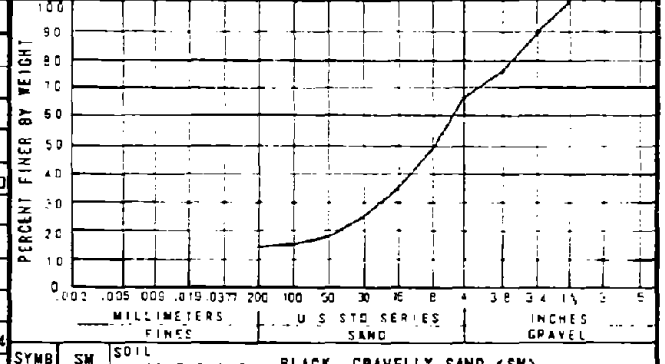
SAMPLE NO. 13-S-1, 5-3 & S-5





SPECIMEN NO.	VOLUME CHANGE %
1	0.62
2	2.49
3	2.74

	SPECIMEN NO	1	2	3
INITIAL CONDITION	Water Content,%	10.3	10.6	10.2
	Opt Water Content,%	---	---	---
	Dry Density,pcf	86.4	86.8	87.1
	Max.Dry Density,%	---	---	---
	Void Ratio	0.350	0.345	0.340
	Saturation,%	55.2	57.4	55.9
FINAL CONDITION	Consol Pressure,psi	15.0	30.0	60.0
	Water Content,%	17.3	17.1	14.7
	Dry Density,pcf	87.0	89.0	89.5
	Void Ratio	0.342	0.311	0.304
	Saturation,%	100.0	100.0	100.0
GENERAL	Specimen Diameter in.	4.0	4.0	4.0
	Back Pressure,psi	50.0	50.0	50.0
	Test Time to Failure,min.	114	111	147
	Rate of Strain, %/hr	3.58	3.54	5.42



SYMB	SM	SOIL CLASSIFICATION: BLACK, GRAVELLY SAND (SM).
LL	---	
PL	---	SAMPLE LOCATION: LABORATORY FABRICATED SAMPLE.
PI	NP	
SG	1.87	NOTE: SAMPLE FABRICATED TO APPROXIMATE AVERAGE
	(AVE.)	INPLACE DAM NO.3 DENSITY CONDITIONS

834(REV)

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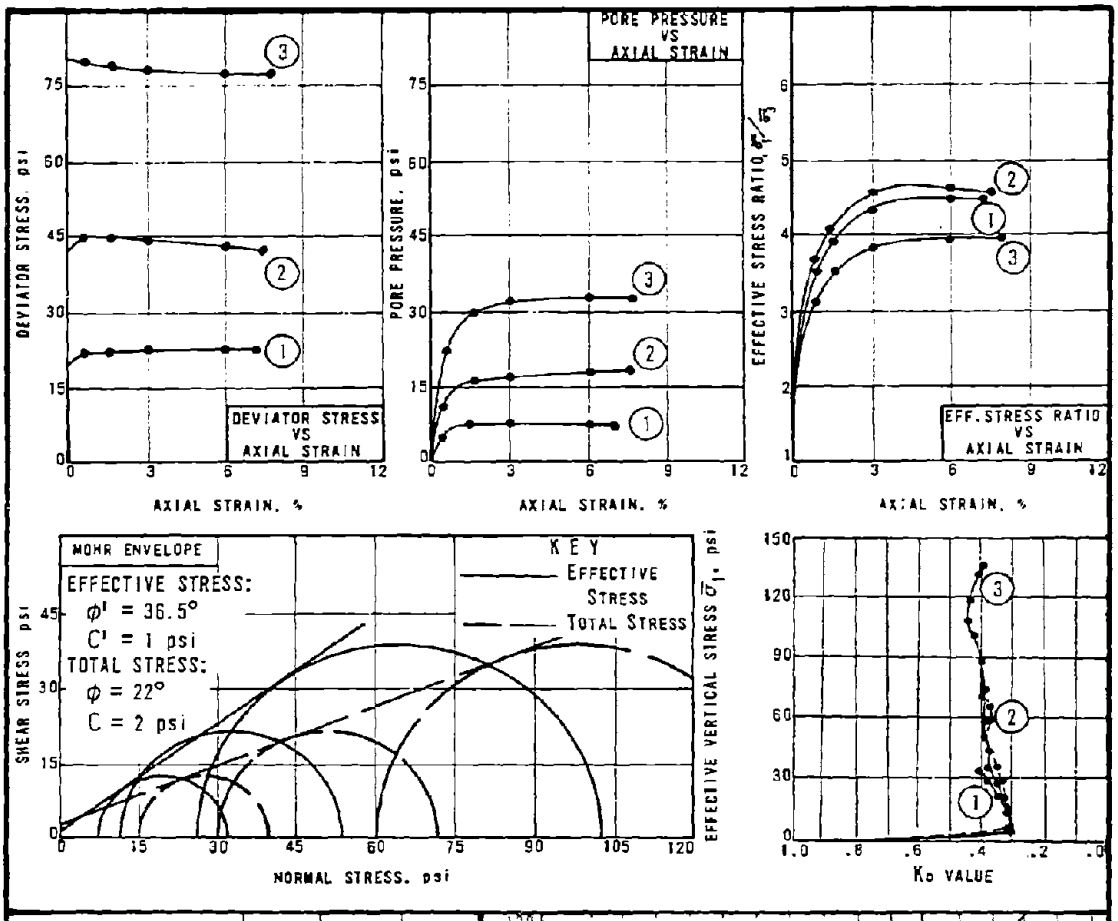
COAL REFUSE DAM FAILURE
Saunders, W. Va.

CONSOLIDATED UNDRAINED
TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

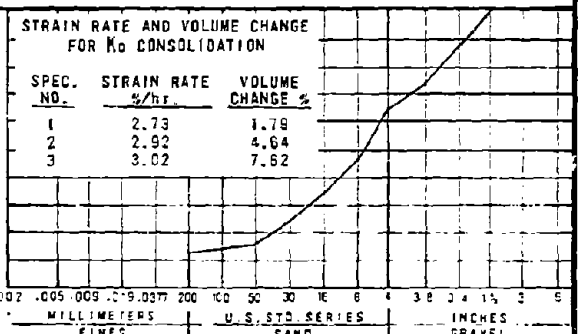
SAMPLE NO. A-1



SPECIMEN NO.		1	2	3
INITIAL CONDITION	Water Content,%	10.5	9.8	10.0
	Opt Water Content,%	---	---	---
	Dry Density,pcf	84.4	85.8	85.3
	Max.Dry Density,%	---	---	---
	Void Ratio	0.382	0.361	0.368
	Saturation,%	51.6	50.6	51.0
FINAL CONDITION	Consol Pressure,psi	15.0	30.0	60.0
	Water Content,%	15.6	20.4	15.3
	Dry Density,pcf	86.0	90.0	92.4
	Void Ratio	0.358	0.298	0.264
	Saturation,%	100.0	100.0	100.0
GENERAL	Specimen Diameter, in.	4.0	4.0	4.0
	Back Pressure,psi	50.0	50.0	50.0
	Test Time to Failure,min. (ICU)	79	79	80
	Rate of Strain, %/hr. (ICU)	5.45	5.62	5.73

STRAIN RATE AND VOLUME CHANGE FOR Ko CONSOLIDATION

SPEC. NO.	STRAIN RATE %/hr.	VOLUME CHANGE %
1	2.73	1.79
2	2.92	4.64
3	3.02	7.62



SYMB	SM	SOIL CLASSIFICATION: BLACK, GRAVELLY SAND (SM).
LL	---	
PL	---	SAMPLE LOCATION: LABORATORY FABRICATED SAMPLE.
PI	NP	
SG	1.87 (AVE.)	NOTE: SAMPLE FABRICATED TO APPROXIMATE AVERAGE INPLACE DAM NO. 3 DENSITY CONDITIONS.

834(REV)

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COAL REFUSE DAM FAILURE
Saunders, W. Va.

DRAINED Ko CONSOLIDATION-UNDRAINED SHEAR
TRIAXIAL TEST RESULTS

PROJECT NO.	DATE	SHEET NO.
0700	Nov. 1972	Fig. B-6

SAMPLE NO. A-1

FIGURE B–7

SUMMARY
OF
PERMEABILITY TEST DATA

SAMPLE NO.	DEPTH (ft)	SOIL* TYPE	DRY DENSITY (pcf)	VOID RATIO (%)	WATER CONTENT (%)	DEGREE OF SATURATION (%)		COEFFICIENT OF PERMEABILITY (cm/sec)
						INITIAL	DURING TEST	
4	70.0–72.0	ML	92.6	0.665	44.7	93.0	100.0	4.5×10^{-7}
4	75.0–77.0	ML	96.3	0.618	37.9	87.6	100.0	1.3×10^{-5}
4	75.0–77.0	ML	83.6	0.964	40.3	94.8	100.0	3.0×10^{-7}
7	10.0–12.0	SM	86.7	0.223	11.6	86.4	100.0	1.1×10^{-4}
7	20.0–22.0	SM	87.7	0.281	14.9	95.8	100.0	1.1×10^{-4}
7	55.0–56.3	SM	93.7	0.650	41.9	87.5	100.0	1.9×10^{-4}
7	55.0–56.3	SM	94.8	0.617	40.3	100.0	100.0	1.5×10^{-4}
9	20.0–22.0	SM	82.0	0.370	13.6	66.3	100.0	3.7×10^{-5}
9	55.0–57.0	SM	90.1	0.669	40.9	81.0	100.0	1.7×10^{-4}
9	55.0–57.0	ML	94.1	0.614	42.5	97.1	100.0	5.1×10^{-6}
10	77.0–79.5	ML	87.5	0.654	30.9	94.9	100.0	1.0×10^{-6}
10	80.0–81.6	SM	94.5	1.000	37.3	59.6	100.0	3.4×10^{-4}
10	80.0–81.6	ML	89.6	0.872	40.9	85.7	100.0	6.0×10^{-6}
11	35.0–37.0	SM	103.4	0.087	12.0	100.0	100.0	3.0×10^{-5}
11	85.0–87.0	ML	98.5	0.495	37.3	100.0	100.0	1.4×10^{-6}
13	30.0–32.0	SM	91.8	0.224	11.1	89.6	100.0	4.6×10^{-5}
13	50.0–52.0	SM	74.4	0.509	15.8	55.8	100.0	3.0×10^{-6}
FP-9A	1.9–3.9	SM	99.4	0.400	11.9	49.3	100.0	5.6×10^{-6}
FP-10A	3.5–4.5	SM	94.6	0.471	14.8	48.2	100.0	2.7×10^{-5}
FP-10A	3.5–4.5	SM	95.5	0.457	14.2	100.0	100.0	1.6×10^{-5}
FP-10A	3.5–4.5	SM	97.4	0.429	12.9	100.0	100.0	1.9×10^{-5}
FP-11A	1.2–3.1	SM	101.9	0.385	10.4	50.4	100.0	9.4×10^{-6}
FP-12A	4.8–6.8	SM	86.4	0.574	19.2	38.3	100.0	1.2×10^{-4}
FP-12A	4.8–6.8	SM	89.2	0.560	18.5	100.0	100.0	1.0×10^{-4}
FP-12A	4.8–6.8	SM	91.1	0.527	17.1	100.0	100.0	6.4×10^{-5}
FP-14A	3.5–4.5	SM	106.3	0.309	11.7	45.5	100.0	6.6×10^{-5}
FP-14A	3.5–4.5	SM	107.7	0.292	11.0	100.0	100.0	4.4×10^{-5}
FP-14A	3.5–4.5	SM	111.0	0.254	9.2	100.0	100.0	1.7×10^{-5}
A-1	COMBINED	SM	86.4	0.350	10.3	55.2	100.0	9.4×10^{-4}

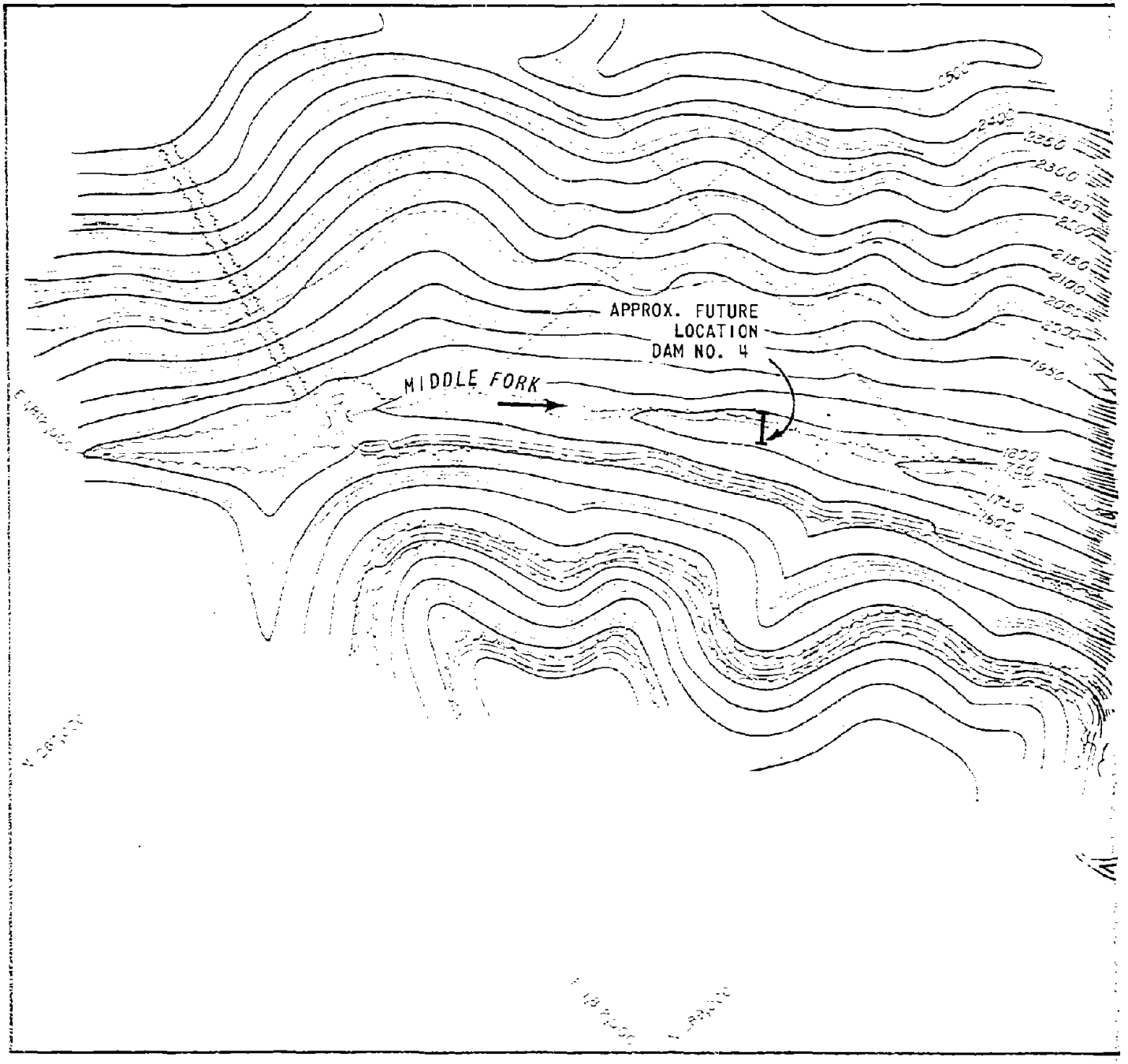
*UNIFIED SOIL CLASSIFICATION SYMBOL

NOTE DRY DENSITIES AND WATER CONTENTS SHOWN REPRESENT CONDITIONS AFTER SET-UP AND APPLICATION OF A SMALL CONFINING PRESSURE IN THE LABORATORY TRIAXIAL SHEAR APPARATUS, AND DO NOT NECESSARILY COINCIDE WITH IN-SITU CONDITIONS

APPENDIX C

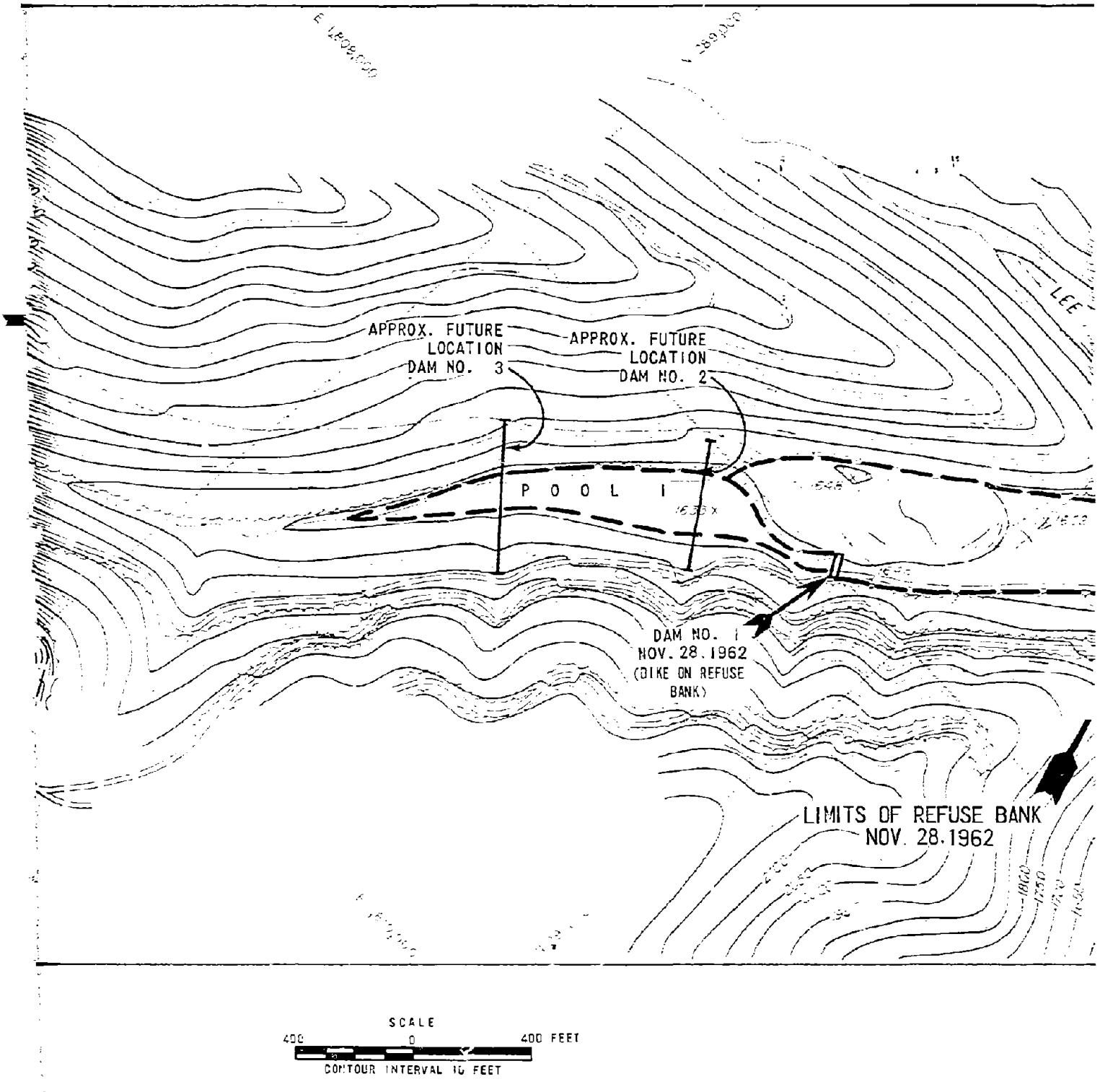
SUPPORTING DATA

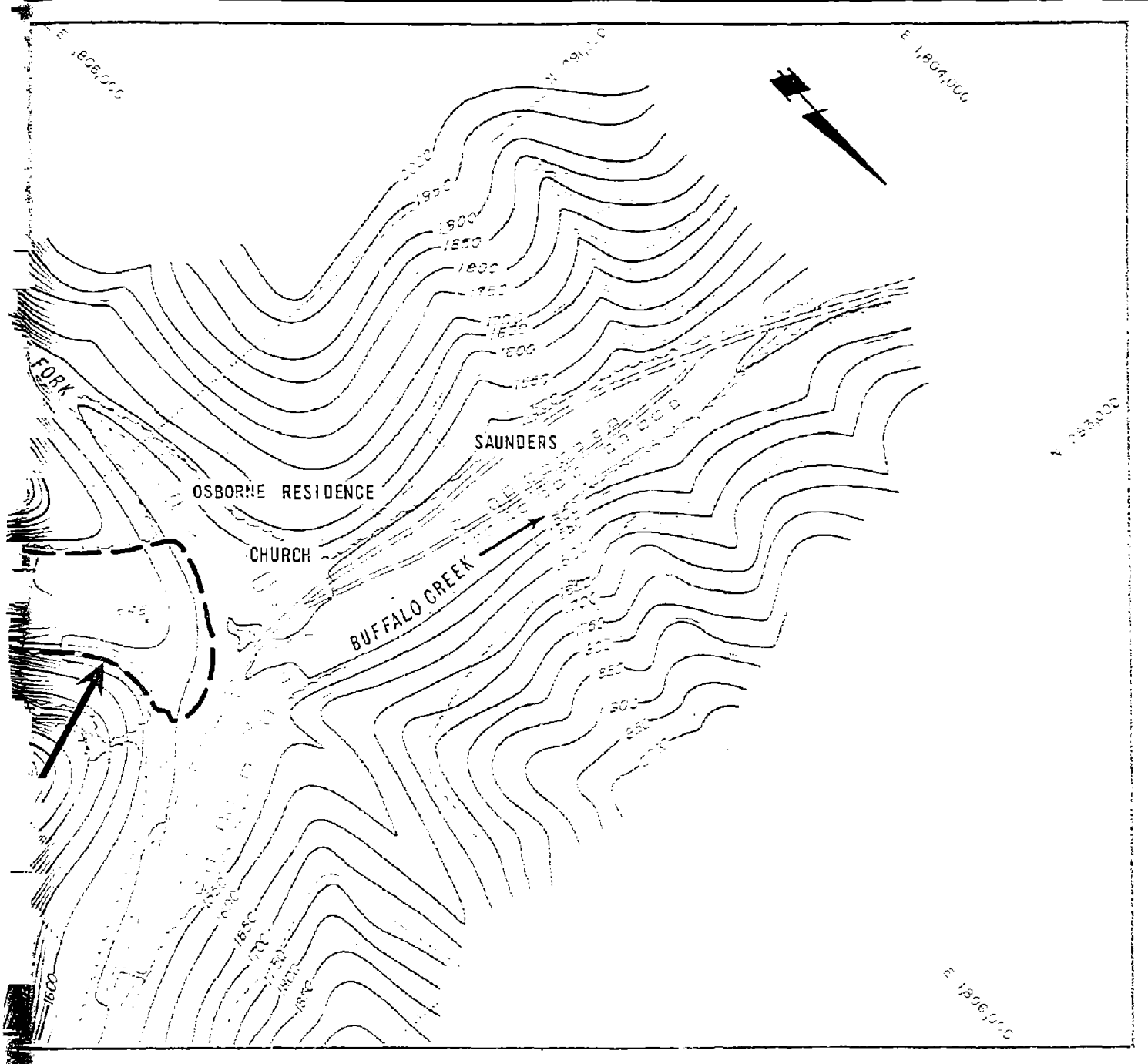
This Appendix contains a number of tables and figures that present significant data used or compiled during our investigation, but which were intentionally removed from Volume 1 of the report in order to avoid unnecessary text interruption by basic data inclusions.



NOTES (1) TOPOGRAPHY BY MICHAEL BAKER JR., INC., BASED ON AERIAL PHOTOGRAPHS TAKEN NOVEMBER 28, 1982

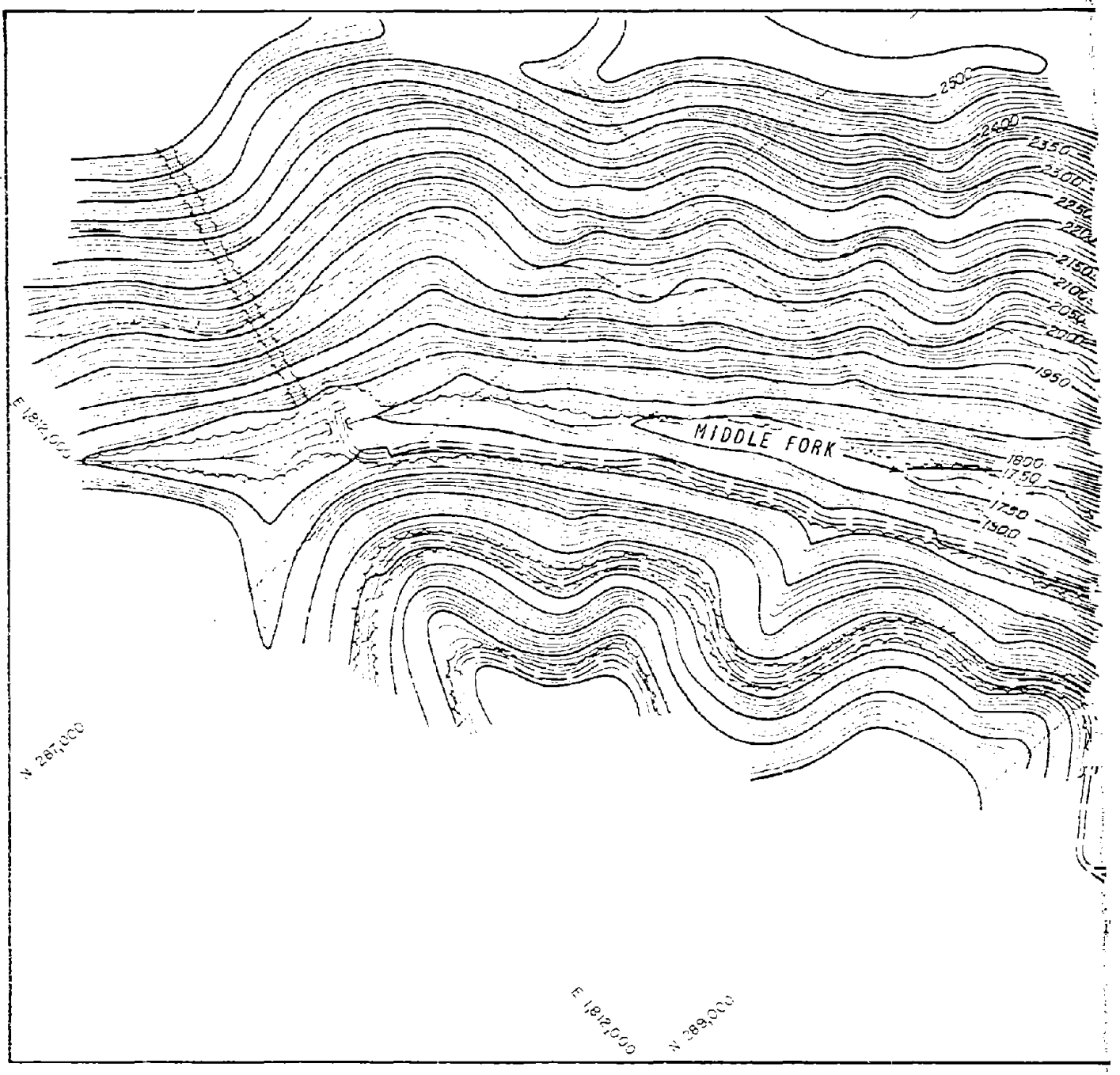
(2) ELEVATIONS ARE APPROXIMATE, NO FIELD CONTROL


APPROX. FUTURE
LOCATION
DAM NO. 3
APPROX. FUTURE
LOCATION
DAM NO. 2
POOL I
DAM NO. 1
NOV. 28, 1962
(DIKE ON REFUSE
BANK)
LIMITS OF REFUSE BANK
NOV. 28, 1962
LEE
SCALE
400 0 400 FEET
CONTOUR INTERVAL 10 FEET

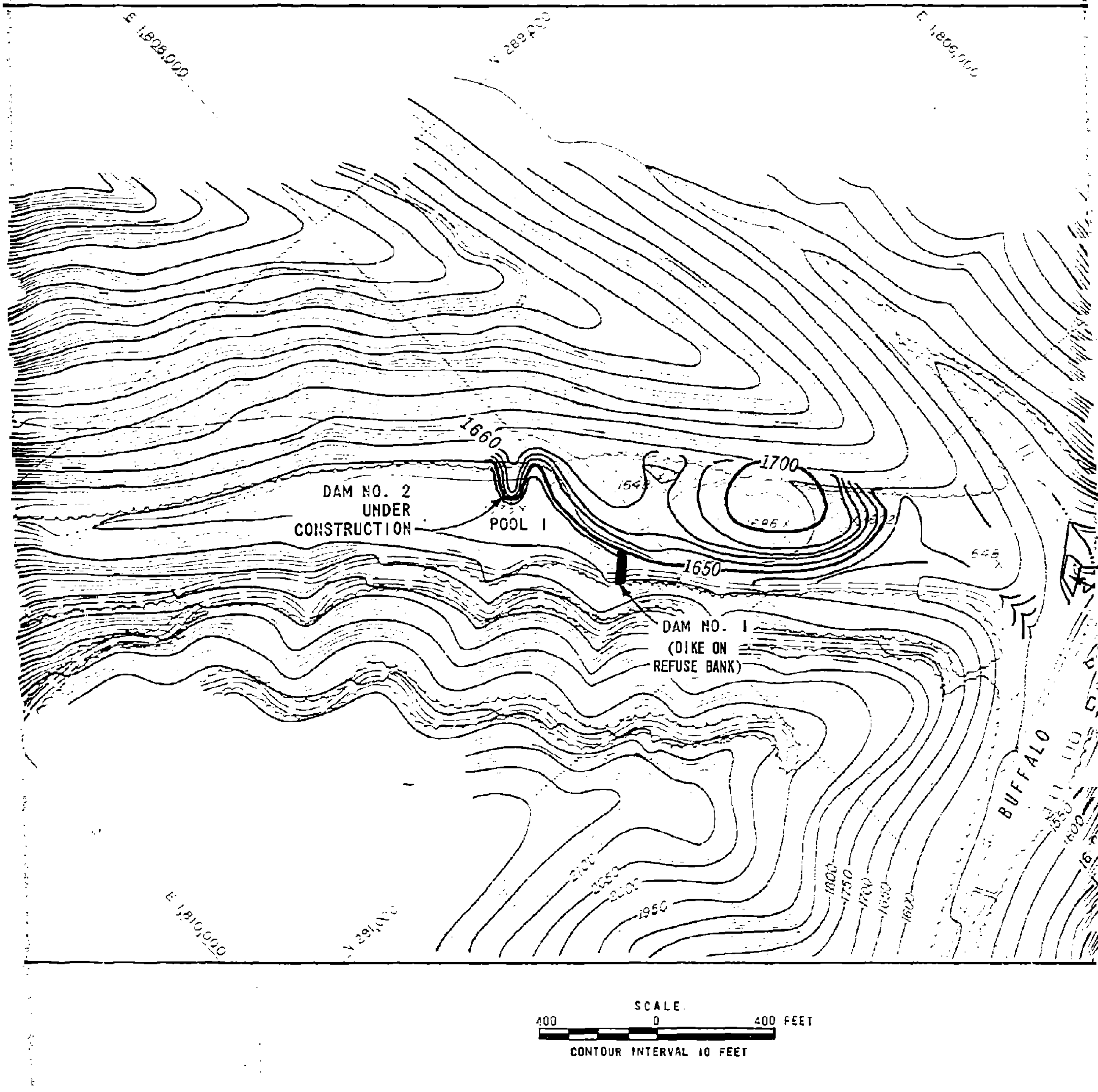


W.A. WAHLER & ASSOCIATES PALO ALTO • NEWPORT BEACH • CALIF.	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	TOPOGRAPHIC MAP OF MIDDLE FORK VALLEY NOVEMBER 28, 1962

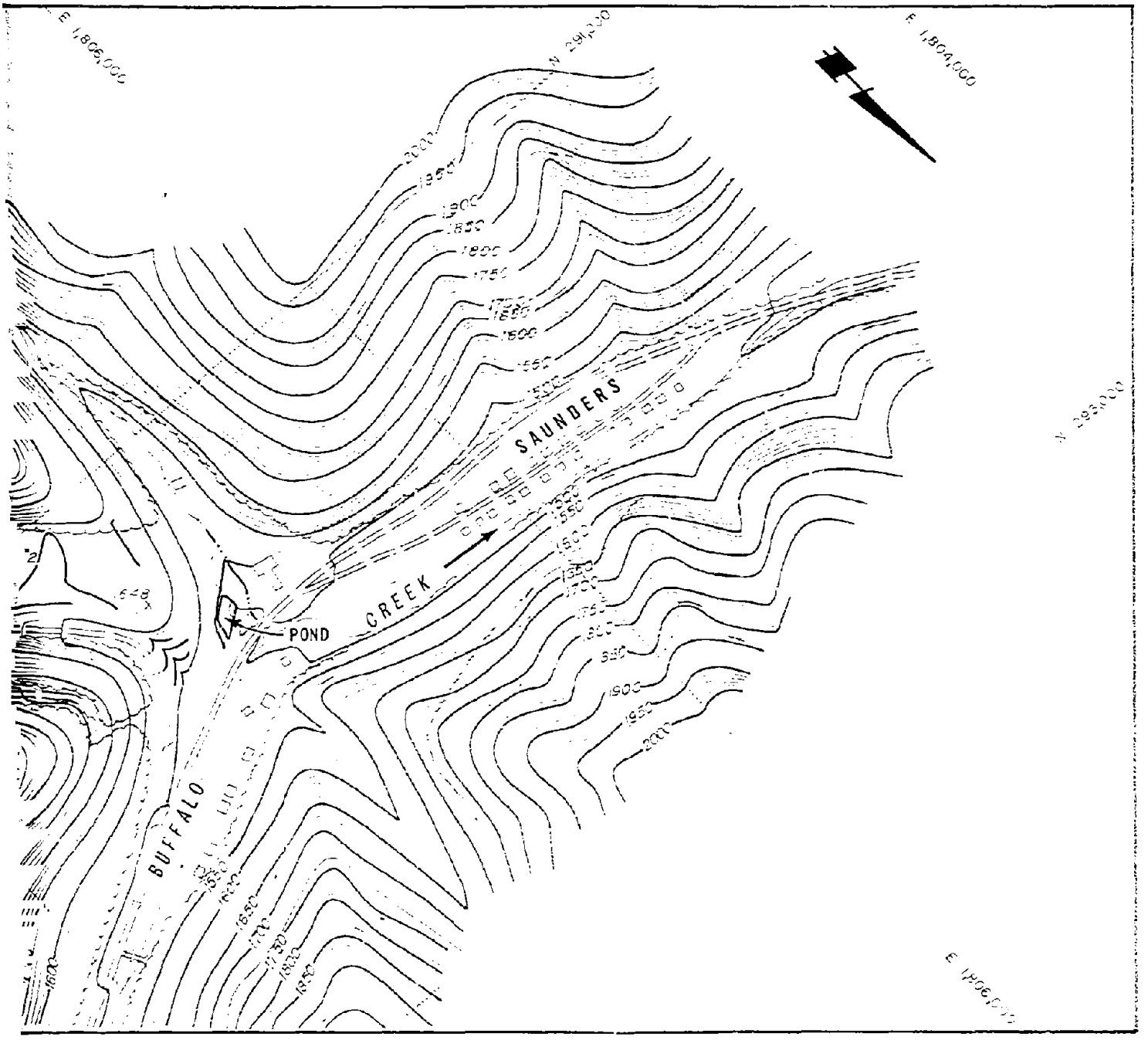
PROJECT NO.	DATE	DRAWING NO.
0700	NOVEMBER 1972	C-1



NOTES (1) TOPOGRAPHY MODIFIED FROM FIGURE C-1 OF THIS REPORT. 1966 CONTOURS SHOWN IN BOLD LINES.
(2) CONTOURS IN DAM NO. 2 - REFUSE BANK AREA ARE GENERALIZED. BASED ON SKETCH BY W E DAVIES 12/9/66

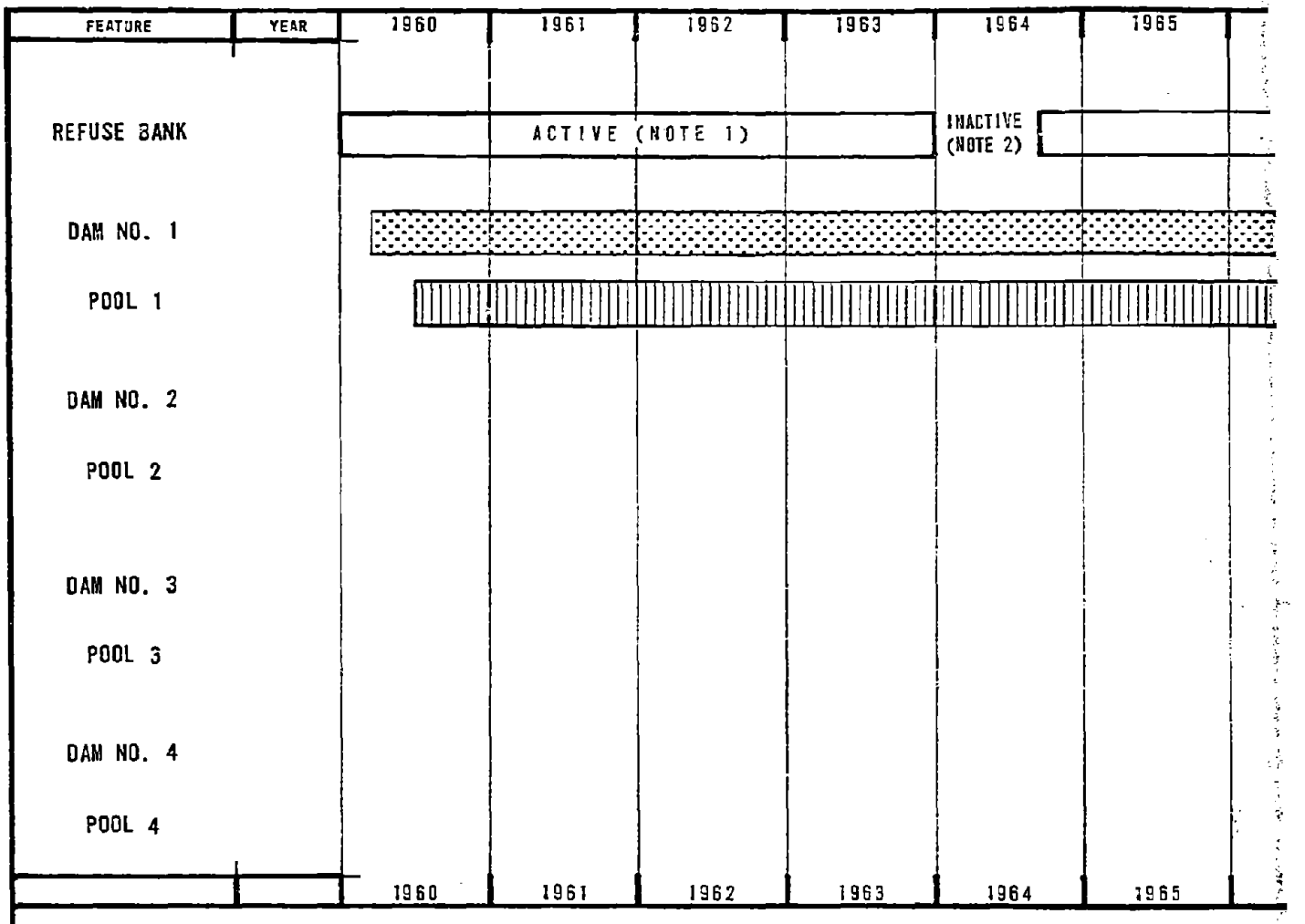


E 1,808,000
N 289,000
E 1,806,000
1660
1700
1650
DAM NO. 2
UNDER
CONSTRUCTION
POOL I
DAM NO. 1
(DIKE ON
REFUSE BANK)
BUFFALO
2100
2050
2000
1950
1800
1750
1700
1650
1600
1550
E 1,810,000
N 291,000
SCALE
400
0
400 FEET
CONTOUR INTERVAL 10 FEET



167

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	DECEMBER 1966 TOPOGRAPHY MIDDLE FORK VALLEY		
		PROJECT NO	DATE	FIGURE NO.
	PALO ALTO • NEWPORT BEACH • CALIF	0700	NOVEMBER 1972	C-2



CALENDAR OF DAM AND POOL
MIDDLE FORK
1960–1972

NOTES:

(1) REFUSE BANK ACTIVE = RECEIVING COAL REFUSE. REFUSE BANK WAS ACTIVE SINCE 1947.

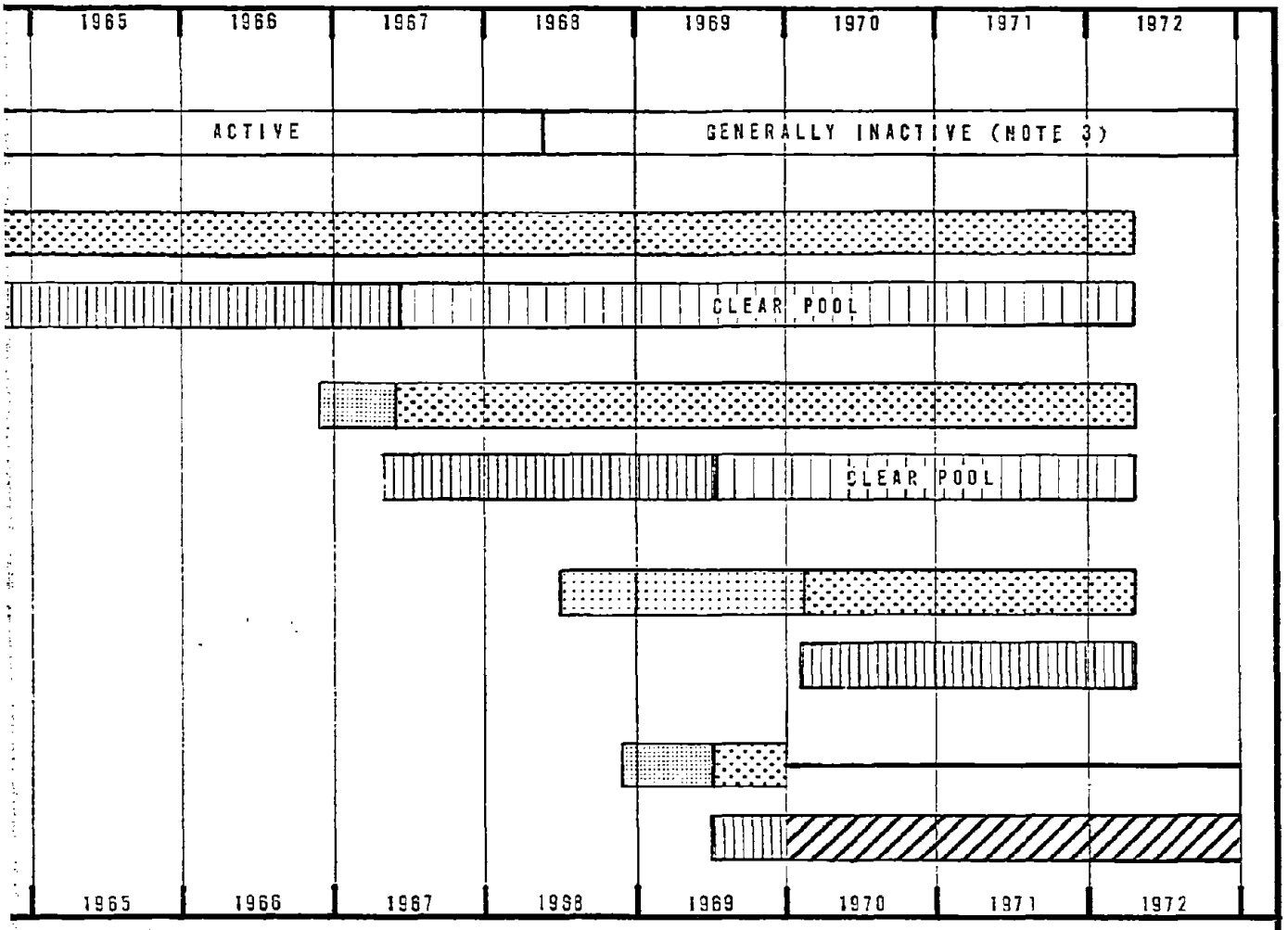
(2) REFUSE BANK INACTIVE = MINES CLOSED.

(3) REFUSE BANK GENERALLY INACTIVE = MOST OR ALL OF THE COAL REFUSE OUTPUT BEING USED TO BUILD OR ENLARGE DAMS, OR PLACED ELSEWHERE.

(4) THE PATTERN OR REFUSE PLACEMENT CAUSED THE REFUSE BANK TO COALESCE WITH DAM NO. 1 SOMETIME BETWEEN 1960 AND 1962. IT THUS BECAME FUNCTIONALLY A PART OF DAM NO. 1 AT THAT TIME. DURING THE PERIOD 1967–1969, THE PATTERN OF REFUSE PLACEMENT CAUSED THE REFUSE BANK TO COALESCE WITH THE LEFT PORTION OF THE DOWNSTREAM FACE OF DAM NO. 2 ALSO. SEE THE ARTIST'S SKETCHES IN THIS CHAPTER FOR A VISUAL REPRESENTATION OF THIS SEQUENCE.

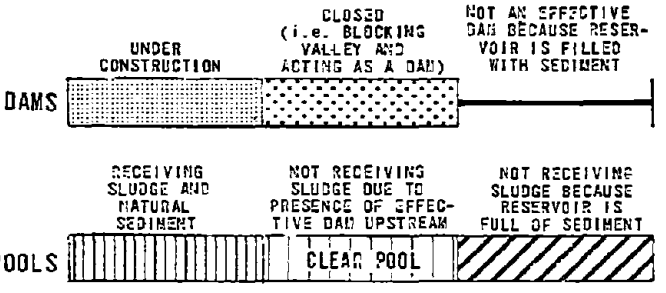
(5) THE TIMING SHOWN HEREON REPRESENTS AN INTERPRETATION OF THE AVAILABLE DATA AND TESTIMONY. SOME CONFLICTS EXIST IN THE SOURCE DATA.

HORIZONTAL
1/12"



F DAM AND POOL ACTIVITY
MIDDLE FORK
1960-1972

KEY



HORIZONTAL SCALE:
1/12" = 1 MONTH.

DNY.

W.A. WAHLER & ASSOCIATES	COAL REFUSE DAM FAILURE SAUNDERS, WEST VIRGINIA	CALENDAR OF DAM AND POOL ACTIVITY MIDDLE FORK		
PALO ALTO • NEWPORT BEACH • CALIF.		PROJECT NO	DATE	FIGURE NO.
		0700	NOVEMBER 1972	C-3

TABLE C-1

CONSTRUCTION METHODS

MIDDLE FORK REFUSE BANK AND DAMS

FEATURE	SOURCE AND REPORTED (OR INFERRED) CONSTRUCTION METHOD
REFUSE BANK	COMMISSION REPORT: TRUCK DUMPING U.S. CONGRESS, 1972a: NOT SPECIFICALLY MENTIONED DAVIES, 1967: TRUCK DUMPING DAVIES AND OTHERS, 1972: TRUCK DUMPING PARK AND OTHERS, 1972: DUMPING TASK FORCE PRELIMINARY REPORT 1972: TRUCK DUMPING WALKER, 1972: TRUCK DUMPING SPREAD INTO 20-FOOT LIFTS
DAM NO. 1	COMMISSION REPORT: NO DETAILS GIVEN U.S. CONGRESS, 1972a: NOT SPECIFICALLY COVERED, QUOTES PARK AND OTHERS (1972). DAVIES, 1966: TRUCK DUMPING DAVIES AND OTHERS, 1972: TRUCK DUMPING PARK AND OTHERS, 1972: "WAS CONSTRUCTED BY PLACING COAL REFUSE PARTIALLY ACROSS THE VALLEY AT A POINT UPSTREAM FROM THE THEN EXISTING REFUSE PILE. THIS REFUSE WAS APPARENTLY PLACED ON FIRM GROUND." TASK FORCE PRELIMINARY REPORT 1972: QUOTES PARK AND OTHERS, 1972 (SEE ABOVE). WALKER, 1972: "...BUILT BY END DUMPING FROM THE VALLEY SIDES IN ABOUT 20-FOOT LIFTS." (THIS DESCRIPTION MAY REFER MORE TO DAMS 2 AND 3 THAN TO DAM NO. 1.)
DAM NO. 2	COMMISSION REPORT: "DAM NO. 2... WAS CONSTRUCTED BY DUMPING REFUSE ACROSS THE WIDTH OF THE HOLLOW ON THE DEPOSITS REMAINING IN THE RESERVOIR BEHIND DAM NO. 1." U.S. CONGRESS, 1972a: "...CONSTRUCTED BY DUMPING REFUSE INTO AREAS OF IMPOUNDMENT WATER AND/OR PARTIALLY SETTLED COAL WASHINGS." DAVIES, 1966: TRUCK DUMPING DAVIES AND OTHERS, 1972: TRUCK DUMPING PARK AND OTHERS, 1972: "THE...DAM...(WAS) CONSTRUCTED BY HAULING REFUSE BY TRUCK...AND DUMPING IT INTO AN AREA WHICH CONTAINED SILT AND WATER IMPOUNDED EARLIER." TASK FORCE PRELIMINARY REPORT, 1972: QUOTES PARK AND OTHERS (1972), (SEE ABOVE). WALKER, 1972: "BUILT BY END DUMPING FROM THE VALLEY SIDES IN ABOUT 20-FOOT LIFTS."

TABLE C-1 —CONTINUED

CONSTRUCTION METHODS

MIDDLE FORK REFUSE BANK AND DAMS

FEATURE	SOURCE AND REPORTED (OR INFERRED) CONSTRUCTION METHOD
DAM NO. 3	COMMISSION REPORT: "DAM NO. 3 WAS CONSTRUCTED BY END DUMPING COAL WASTE FROM TRUCKS IN CLOSELY SPACED PILES FROM 4 TO 7 FEET HIGH AND THEN GRADED IN LAYERS 2 TO 4 FEET THICK. THE DUMPING WAS CARRIED ACROSS THE VALLEY FROM THE RIGHT ABUTMENT ON THE NO. 5 MINE ROAD TOWARD THE LEFT ABUTMENT... THE DUMPING WAS DONE IN THE FORM OF A SINGLE LIFT (LEVEL OF MATERIAL) WHICH RANGED UP TO 60 FEET THICK. ONCE THE DAM HAD BEEN COMPLETED ACROSS THE VALLEY, DUMPING WAS MAINLY ACROSS THE BACK SIDE OF THE DAM WHICH STEADILY GREW UPSTREAM." U.S. CONGRESS, 1972a: "AFTER THE EMBANKMENT FOR NO. 3 WAS COMPLETED ACROSS THE VALLEY BY DUMPING OVER THE END OF THE FILL, ADDITIONAL REFUSE WAS PLACED BY TRUCKS DUMPING OVER THE EDGE OF THE EMBANKMENT INTO THE IMPOUNDMENT OR ON TOP OF THE FILL. FOR THE LATTER, LEVELLING BY A DOZER AND BACKDRAGGING OF THE BLADE, TOGETHER WITH THE HAULING TRAFFIC, WAS THE ONLY COMPACTION THE REFUSE RECIEVED." DAVIES, 1966: (DAM NO. 3 NOT BUILT) DAVIES AND OTHERS, 1972: "IN CONSTRUCTING DAM NO. 3, THE COAL WASTE WAS DUMPED FROM TRUCKS IN CLOSELY SPACED PILES FROM 4 TO 7 FEET HIGH AND THEN GRADED IN LAYERS 2 TO 4 FEET THICK. THE DUMPING WAS CARRIED ACROSS THE DAM IN THE FORM OF "LIFTS" ON SUCCESSIVE LEVELS OF MATERIAL 10 TO 20 FEET THICK. ONCE THE DAM WAS CLOSED, DUMPING WAS MAINLY ACROSS THE BACK SIDE OF THE DAM, WHICH STEADILY GREW UPSTREAM. TREES IN THE PATH OF THE DAM CONSTRUCTION WERE NOT REMOVED BUT WERE COVERED BY DUMPING. THE POOL AREA ALSO WAS NOT CLEARED OF VEGETATION. THE SLUDGE ON WHICH THE WASTE WAS DUMPED WAS ONLY PARTIALLY DISPLACED AND MUCH OF IT FORMED THE FOUNDATION OF THE DAMS." PARK AND OTHERS, 1972: "THE ..DAM...(WAS) CONSTRUCTED BY HAULING REFUSE BY TRUCK. AND DUMPING IT INTO AN AREA WHICH CONTAINED SILT AND WATER IMPOUNDED EARLIER...RECENTLY, PLACING OF THE REFUSE WAS DONE BY TRUCKS DUMPING EITHER OVER THE ENDS OF THE DAM AND INTO THE IMPOUNDMENTS WHEN POSSIBLE, OR BY DUMPING THE LOADS ON THE TOP OF THE DAM FOR SPREADING. WHEN LOADS WERE DUMPED ON TOP, THIS MATERIAL HAD TO BE LEVELED PERIODICALLY TO PREVENT BLOCKING THE ACCESS FOR TRUCKS. THIS WAS DONE BY GRADING THE MATERIAL WITH A BULLDOZER AND THEN "BACK BLADING" OR SCRAPING THE MATERIAL WITH THE BACK OF THE BULLDOZER BLADE WHILE OPERATING IN A REVERSE DIRECTION. THIS PROVIDED A LEVEL SURFACE FOR HAULAGE. COMPACTION WAS DONE ONLY BY THE WEIGHT OF THE BULLDOZER AND TRUCKS AS THEY MOVED ACROSS THE MATERIAL."

TABLE C-1 —CONTINUED

CONSTRUCTION METHODS

MIDDLE FORK REFUSE BANK AND DAMS

FEATURE	SOURCE AND REPORTED (OR INFERRED) CONSTRUCTION METHOD
DAM NO. 3 (CONTINUED)	TASK FORCE PRELIMINARY REPORT, 1972: QUOTES PARK AND OTHERS (1972). (SEE ABOVE). WALKER, 1972: "...BUILT BY END DUMPING FROM THE VALLEY SIDES IN ABOUT 20-FOOT LIFTS."
DAM NO. 4	COMMISSION REPORT: "DAM NO. 4 WAS CONSTRUCTED IN 1969 AND IS STILL IN PLACE...CONSTRUCTED MAINLY OF SHALE AND COAL WASTE." U.S. CONGRESS, 1972a: DAM NO. 4 MENTIONED ONLY AS "STILL IN PLACE." DAVIES, 1966: (DAM NO. 4 NOT BUILT) DAVIES AND OTHERS, 1972: "...CONSTRUCTED MAINLY OF SHALE WITH COAL WASTE..." PARK AND OTHERS, 1972: (DAM NO. 4 NOT MENTIONED) TASK FORCE PRELIMINARY REPORT, 1972: (DAM NO. 4 NOT MENTIONED). WALKER, 1972: MENTIONS "FOURTH BARRIER"; DOES NOT GIVE ANY CONSTRUCTION DATA.

TABLE C-2

DAILY WEATHER CONDITIONS JANUARY 1972
(WEST VIRGINIA)

["T" DENOTES TRACE OF PRECIPITATION. TEMPERATURES SHOWN ARE DEGREES FAHRENHEIT. PRECIPITATION SHOWN IS IN INCHES.]

DATE	LOGAN			MADISON			PINEVILLE		
	MAX. TEMP.	MIN. TEMP.	PRECIP.	MAX. TEMP.	MIN. TEMP.	PRECIP.	MAX. TEMP.	MIN. TEMP.	PRECIP.
1	44	23	----	42	22	----	43	21	----
2	50	24	0.80	50	23	0.58	52	22	1.08
3	50	29	0.19	50	28	0.19	47	28	0.06
4	55	30	0.23	46	28	0.24	53	27	0.42
5	49	33	1.30	50	30	1.07	47	32	1.22
6	34	24	T	32	21	0.03	33	20	----
7	35	21	----	34	20	----	34	17	----
8	44	20	----	42	20	----	42	17	----
9	49	21	----	47	20	----	47	21	----
10	50	41	0.61	55	40	0.53	40	32	0.53
11	50	44	0.04	61	45	0.10	54	39	----
12	53	31	0.22	50	28	0.15	60	30	----
13	62	31	----	56	30	----	61	30	----
14	72	29	0.35	71	28	0.25	57	30	0.49
15	32	17	T	35	16	----	31	14	0.02
16	19	-5	----	23	-8	----	20	-7	T
17	15	2	----	15	-7	----	12	-7	----
18	44	11	----	40	12	----	40	5	----
19	59	17	0.10	53	18	0.08	50	13	0.05
20	48	39	0.05	52	38	0.09	42	34	0.10
21	57	40	0.65	58	40	0.39	46	36	1.37
22	51	45	0.02	48	41	T	59	38	0.06
23	67	43	0.04	65	40	0.03	63	42	0.04
24	58	46	0.30	62	48	0.34	57	43	0.03
25	76	41	0.33	72	38	0.29	72	38	0.24
26	43	19	----	40	17	----	41	19	----
27	50	19	----	45	17	----	46	18	----
28	42	26	0.85	37	23	0.60	46	19	1.00
29	39	26	T	37	23	----	42	26	T
30	35	26	----	38	23	----	46	26	----
31	35	20	----	34	20	T	34	21	T

TABLE C-2 —CONTINUED

DAILY WEATHER CONDITIONS FEBRUARY 1972
(WEST VIRGINIA)

["T" DENOTES TRACE OF PRECIPITATION. TEMPERATURES SHOWN ARE DEGREES FAHRENHEIT. PRECIPITATION SHOWN IS IN INCHES.]

DATE	LOGAN			MADISON			PINEVILLE		
	MAX. TEMP.	MIN. TEMP.	PRECIP.	MAX. TEMP.	MIN. TEMP.	PRECIP.	MAX. TEMP.	MIN. TEMP.	PRECIP.
1	39	18	----	37	17	----	36	17	----
2	42	18	----	42	17	----	43	18	T
3	55	31	0.06	54	29	0.04	45	29	0.12
4	45	18	0.52	44	17	0.42	42	15	0.29
5	22	11	----	22	10	T	21	11	----
6	35	11	----	33	11	----	31	12	----
7	39	27	0.32	40	24	0.22	35	24	0.32
8	29	10	T	25	7	T	29	3	----
9	32	12	----	30	7	----	29	4	0.30
10	37	24	----	34	17	----	37	16	----
11	45	23	----	41	18	----	41	10	----
12	57	12	----	51	23	----	52	20	----
13	40	28	0.92	59	25	0.81	58	24	0.78
14	57	30	0.29	40	32	0.28	38	31	0.34
15	45	32	----	53	32	----	53	23	----
16	49	28	----	54	25	----	45	27	----
17	50	25	0.06	47	26	0.09	46	26	0.18
18	43	31	0.10	40	31	0.10	41	32	0.70
19	41	24	0.34	42	23	0.30	41	22	0.22
20	28	19	0.04	27	16	0.10	25	15	0.14
21	36	18	----	33	16	----	29	9	----
22	55	18	0.14	56	18	0.16	49	9	0.15
23	45	28	----	42	22	----	42	25	----
24	49	27	1.41	51	24	1.27	47	26	1.33
25	*	*	0.41	53	39	0.52	49	40	0.86
26	68	40	1.90	65	40	1.87	68	41	1.54
27	50	29	0.05	46	28	0.08	56	28	0.03
28	57	28	----	57	28	----	56	28	----
29	71	31	----	69	36	----	65	29	----

* NOT REPORTED.

ORIGINAL SOURCE: CLIMATOLOGICAL DATA, WEST VIRGINIA
VOL. 80, NOS. 1 AND 2, JANUARY AND FEBRUARY, 1972
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ENVIROMENTAL DATA SERVICE.

TABLE C-3

SUMMARY

WEATHER CONDITIONS JANUARY 1 - FEBRUARY 29, 1972

[PRECIPITATION AND SNOW LEVEL RECORDS ARE GIVEN IN INCHES]

DESCRIPTION	LOGAN	MADISON	PINEVILLE
JANUARY (1-31)			
AVERAGE MAXIMUM TEMPERATURE	47.6	46.5	45.8
AVERAGE MINIMUM TEMPERATURE	26.9	25.2	24.0
AVERAGE DAILY TEMPERATURE	37.3	35.9	34.9
PRECIPITATION, TOTAL	6.08	4.96	6.55
PRECIPITATION, NORMAL	3.76	(1)	(1)
SNOW, TOTAL	-----	1.00	0.50
FEBRUARY (1-29)			
AVERAGE MAXIMUM TEMPERATURE	45.0	44.4	43.1
AVERAGE MINIMUM TEMPERATURE	23.7	22.7	21.1
AVERAGE DAILY TEMPERATURE	34.4	33.6	32.1
PRECIPITATION, TOTAL	6.56	6.26	7.30
PRECIPITATION, NORMAL	3.50	(1)	(1)
SNOW, TOTAL	2.50	3.20	10.60
FEBRUARY (11-25)			
AVERAGE MAXIMUM TEMPERATURE	45.7 *	45.9	43.7
AVERAGE MINIMUM TEMPERATURE	24.5 *	23.3	22.6
AVERAGE DAILY TEMPERATURE	35.1 *	34.6	33.2
PRECIPITATION, TOTAL	3.51	3.43	4.70
DAYS WITH MEASURABLE RAIN	9	9	9
FEBRUARY (24-25)			
AVERAGE MAXIMUM TEMPERATURE	49.0 *	52.0	48.0
AVERAGE MINIMUM TEMPERATURE	27.0 *	31.5	33.0
AVERAGE DAILY TEMPERATURE	38.0 *	41.8	40.5
PRECIPITATION, TOTAL	1.82	1.79	2.19
FEBRUARY (24-26)			
PRECIPITATION, TOTAL	1.82	1.79	2.19

*FEBRUARY 25 TEMPERATURE DATA MISSING AT LOGAN COUNTY.

(1) NOT DETERMINED

TABLE C-4

CHRONOLOGICAL LISTING OF VISITS TO REFUSE DAM NO. 3
PRIOR TO FAILURE

DAY	DATE	TIME	NAME	REFERENCE*	OBSERVATION LISTED IN TESTIMONY
TUESDAY	2/22/72	EARLY MORNING	DANIEL S. DASOVICH	VOL. III, p.40	DROVE ON IMPOUNDMENT. WATER SEVERAL FEET BELOW 24 INCH PIPE
TUESDAY	2/22/72	MORNING	EARL G. REEDY	VOL. VII, p.165	NONE
WEDNESDAY	2/23/72	MORNING	EARL G. REEDY	VOL. VII, p.165	NONE
WEDNESDAY	2/23/72	MORNING	MARIO VARASSI	VOL. III, p.184	NONE
THURSDAY	2/24/72	MORNING	EARL G. REEDY	VOL. VII, p.169	DAM LOOKED OKAY TO HIM
THURSDAY	2/24/72	MORNING	MARIO VARASSI	VOL. III, p.184	NONE
THURSDAY	2/24/72	AFTERNOON	DANIEL S. DASOVICH	VOL. III, p.41	WATER COMING THROUGH 24 INCH PIPE.
THURSDAY	2/24/72	4:00 P.M.	JACK KENT	VOL. I, p.129	PLACED MEASURING STICK IN DAM NEAR DRAIN PIPE.
THURSDAY	2/24/72	---	BEN TUDOR	VOL. III, p.135	NONE
THURSDAY	2/24/72	PERIODICALLY UNTIL 11:30 P.M.	JACK KENT	VOL. I, p.128	WATER RAISED AN INCH PER HOUR.
FRIDAY	2/25/72	EARLY MORNING	DANIEL S. DASOVICH	VOL. I, p.128	WATER LEVEL A FEW INCHES BELOW TOP OF DRAIN PIPE.
FRIDAY	2/25/72	4:00 P.M.	JACK KENT	VOL. I, p.128	LEVEL HAD RISEN 18 INCHES IN 36 HOURS.
FRIDAY	2/25/72	5:30 P.M.	BEN TUDOR	VOL. III, p.135	INSPECTED WATER LEVEL
FRIDAY	2/25/72	9:00 P.M.	JACK KENT	VOL. I, p.133	WATER LEVEL HAD BEEN CHECKED BY MR. KENT AT REGULAR INTERVALS BETWEEN 4:00 P.M. AND 9:00 P.M.
FRIDAY	2/25/72	9:00 P.M.	ELMER ELSWICK	VOL. I, p.133	NONE
FRIDAY	2/25/72	10:00-11:00 P.M.	EDGAR PIERSON	VOL. II, p. 84	SAW CRACK SIX TO EIGHT INCHES WIDE NEAR RIGHT OF DAM, EXTENDING THREE QUARTERS OF WAY ACROSS. WATER WAS TEN TO FIFTEEN INCHES FROM CREST. NO PIPES IN DAM. CREST WAS SOFT. SOME BLACK WATER SEEPING INTO POOL 2 AT TOE OF DAM NO. 3.

* REFERENCES GIVING VOLUME NUMBERS REFER TO THE HEARING TRANSCRIPT OF THE AD HOC COMMISSION REPORT.
REFERENCES GIVING APPENDICES REFER TO THE HEARINGS BEFORE THE SUBCOMMITTEE ON LABOR, U.S. CONGRESS, 1972B.

TABLE C-4 — CONTINUED

CHRONOLOGICAL LISTING OF VISITS TO REFUSE DAM NO. 3
PRIOR TO FAILURE

DAY	DATE	TIME	NAME	REFERENCE*	OBSERVATION LISTED IN TESTIMONY
FRIDAY	2/25/72	10:00-11:00 P.M.	MR. CHANDLER (ACCOMPANIED EDGAR PIERSON)	VOL. II, p.85	---
SATURDAY	2/26/72	12:30 A.M.	DENNY GIBSON, JACK KENT, AND HARVEY PIERSON	VOL. I, p.192	ALL THREE VISITED THE DAM SITES, OBSERVED A SLIDE IN THE RIGHT SIDE OF THE VALLEY BETWEEN DAMS 1 AND 2 WHICH WAS DIVERTING WATER INTO POOL 1.
SATURDAY	2/26/72	2:00 A.M.	HARVEY PIERSON	VOL. II, p.71	SAW NO PIPES ON DAM
SATURDAY	2/26/72	3:30 A.M.	JACK KENT	VOL. I, p.134	WATER LEVEL RISE INCREASED TO TWO INCHES AN HOUR.
SATURDAY	2/26/72	4:00 A.M.	KENNETH OSBORNE	VOL. I, p.134	DIDN'T SEE ANY PIPE
SATURDAY	2/26/72	4:30 A.M.	JACK KENT	VOL. I, p.134	WATER LEVEL HAD RISEN THREE INCHES IN AN HOUR.
SATURDAY	2/26/72	4:30 A.M.	DENNY GIBSON	VOL. II, p.71	MESSRS. KENT AND GIBSON REMOVED A TIRE FROM ONE OF THE DRAINPIPES ON DAM NO. 1.
SATURDAY	2/26/72	4:30 A.M.	HARVEY PIERSON	VOL. II, p.71	SURFACE OF DAM NO. 3 WAS SOFT. SAW NO PIPES ON TOP OF DAM. SAW NO WORKMEN AT DAM.
SATURDAY	2/26/72	6:00 A.M.	DENNY GIBSON	VOL. VIII, p.113	SAW PIPES ON DAM
SATURDAY	2/26/72	6:00 A.M.	KENNETH OSBORNE	VOL. II, pp.23, 34, 35, 36 AND 44.	TWO SECTIONS OF 24 INCH CORRUGATED STEEL PIPE LAID END TO END TO FORM 40 TO 60 FOOT SECTION ON CREST OF DAM. PART OF PIPE TOWARDS REAR OF DAM PARTLY BURIED. SMALL FLOW OF WATER OUT OF PIPE. SAW CRACK 10 FEET WIDE, 30 FEET LONG. ON LEFT FRONT OF DAM. WALKED ON DAM. FELT NO MOVEMENT.

* REFERENCES GIVING VOLUME NUMBERS REFER TO THE HEARING TRANSCRIPT OF THE AD HOC COMMISSION REPORT.
REFERENCES GIVING APPENDICES REFER TO THE HEARINGS BEFORE THE SUBCOMMITTEE ON LABOR, U.S. CONGRESS, 1972B.

TABLE C-4 — CONTINUED

CHRONOLOGICAL LISTING OF VISITS TO REFUSE DAM NO. 3
PRIOR TO FAILURE

DAY	DATE	TIME	NAME	REFERENCE*	OBSERVATION LISTED IN TESTIMONY
SATURDAY	2/26/72	6:30 A.M.	DANIEL S. DASOVICH	VOL. III, p.12	WATER COMING THROUGH OVERFLOW PIPE. DAM LOOKED STABLE. COULD HAVE DRIVEN ACROSS DAM. CRACKS IN LEFT FRONT FACE OF DAM. CONTEMPLATED ANOTHER PIPE ON DAM.
SATURDAY	2/26/72	6:30 A.M.	JACK KENT	VOL. III, p.12	WATER ONE FOOT FROM TOP OF COMPACTED DAM. 24 INCH PIPE IN DAM NO. 3 ABOUT 4 FEET FROM CREST RUNNING HALF FULL. CREST FIRM. WALKED COMPLETELY ACROSS DAM.
SATURDAY	2/26/72	6:30 A.M.	WALDON MULLINS	VOL. III, p.195	WALKED ON DAM, NOT SOGGY. WATER LEVEL 4 TO 6 FEET BELOW COMPACTED DAM.
SATURDAY	2/26/72	6:30 A.M.	WALDON MULLINS	APPENDIX A, p.1287	WATER COMING OUT OF DRAIN PIPE.
SATURDAY	2/26/72	6:30 A.M.	MELVIN DUBA	VOL. III, p.201	NONE
SATURDAY	2/26/72	6:45 A.M.	BEN TUDOR	APPENDIX A, p.308	"DAM HOLDING ITS OWN"
SATURDAY	2/26/72	7:00 A.M.	BEN TUDOR	VOL. III, p.152, 153	WATER LEVEL 8 FEET BELOW COMPACTED DAM. SURFACE FIRM. NO CRACKS.
SATURDAY	2/26/72	7:00-7:30 A.M.	MASON-BLANKENSHIP, JR.	VOL.II, p.177	WATER HAD NOT REACHED TOP OF DAM.
SATURDAY	2/26/72	7:15 A.M.	LEONARD LANKAS	VOL. II, p.151	WATER AT CREST ON LOW SIDE. TRASH BAGS CIRCLING LIKE A WHIRLPOOL ON RIGHT HAND SIDE OF POOL BEHIND DAM.
SATURDAY	2/26/72	7:30 A.M.	BEN TUDOR	VOL. III, p.153	NO DIFFERENCE IN LEVEL FROM 7:00 A.M.

* REFERENCES GIVING VOLUME NUMBERS REFER TO THE HEARING TRANSCRIPT OF THE AD HOC COMMISSION REPORT. REFERENCES GIVING APPENDICES REFER TO THE HEARINGS BEFORE THE SUBCOMMITTEE ON LABOR, U.S. CONGRESS, 1972B.

TABLE C-4 — CONTINUED

CHRONOLOGICAL LISTING OF VISITS TO REFUSE DAM NO. 3
PRIOR TO FAILURE

DAY	DATE	TIME	NAME	REFERENCE *	OBSERVATION LISTED IN TESTIMONY
SATURDAY	2/26/72	7:45 A.M.	WAYNE GOODMAN	VOL. III, p.232	SURFACE WET BUT FIRM. WATER 6 TO 8 FEET BELOW. OVERFLOW PIPES FLOWING.
SATURDAY	2/26/72	7:50 A.M.	DENNY GIBSON	VOL. I, p.193	SAW LARGE CRACKS AND SLUMPS ON DOWNSTREAM FACE OF DAM NO. 3 NEAR CENTER. ABOUT 20 FEET SLUMPED INTO POOL 2. TOP OF DAM NO. 3 SOFT AND SOGGY. WATER "OOZING" THROUGH LOOSE REFUSE. MR. KENT'S MEASURING STICK SUBMERGED.
SATURDAY	2/26/72	8:10 A.M.	WILLIAM PEYTON	VOL. IV, pp.226-231	SAW 75-100 FEET OF RIGHT SIDE OF DAM HAD FAILED, REMAINDER OF DAM SLIDING INTO BREACH.

* REFERENCES GIVING VOLUME NUMBERS REFER TO THE HEARING TRANSCRIPT OF THE AD HOC COMMISSION REPORT. REFERENCES GIVING APPENDICES REFER TO THE HEARINGS BEFORE THE SUBCOMMITTEE ON LABOR, U.S. CONGRESS, 1972 B.