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NATIONAL DAM SAFETY PROGRAM. TOMS CREEK DAM (INVENTORY NUMBER V--ETC(U)
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SEPTEMBER 1979

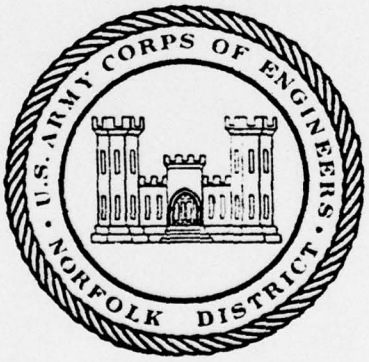
Name Of Dam: TOMS CREEK DAM

Location: WISE COUNTY, VIRGINIA

Inventory Number: VA. NO. 19510

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VA 19510	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Toms Creek Dam Wise County, VA		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Schnabel Engineering Associates, P.C./ J.K. Timmons and Associates, Inc.		8. CONTRACT OR GRANT NUMBER(s) DACW65-79-D-0004
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineering District, Norfolk 803 Front Street Norfolk, VA 23510		12. REPORT DATE September 1979 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

NAME OF DAM: TOMS CREEK
LOCATION: WISE COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 19510

(6) National Dam Safety Program. Toms Creek Dam (Inventory Number 19510), Wise County, Virginia. Phase I Inspection Report.

(VA)

(9) Final rept.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(11) Sep 79

(10) James A. Walsh

(12) 79

(15) DACW65-79-D-0004

PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

394014

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

Name of Dam: Toms Creek Dam Va. No. 19510
State: Virginia
County: Wise
USGS Quad Sheet: Coeburn
Coordinates: Lat 36° 58.7' Long 82° 24.9'
Stream: Toms Creek
Date of Inspection: May 23, 1979

BRIEF ASSESSMENT OF DAM

Toms creek Dam is an unreinforced concrete double arch structure about 320 ft long and 36 ft high which includes a spillway 150 ft long by 3 ft deep. Water is discharged over the spillway section and drops into a riprap basin. The dam is located on Toms Creek about 2.3 miles northeast of Toms Creek, Virginia.

The dam serves as a water supply for the Town of Coeburn and is owned and maintained by the Town of Coeburn. The dam was constructed in 1964.

The spillway will pass 20 percent of the PMF. Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the appropriate spillway design flood (SDF) is the ½ PMF. During the ½ PMF, the dam will be overtopped to a depth of 1.8 ft maximum, at a maximum velocity of 6 fps, and will be overtopped for a period of 3 hours. The dam is rated inadequate but not seriously inadequate.

Overall, the dam appeared to be in very good condition at the time of the inspection. The actual structure appears to be similar to the design drawings.

An evaluation of the stability condition could not be made since sufficient design data, calculations, and construction data, were not available. A stability analysis was made with a Portland Cement Association computer program for a double-arch concrete dam. Based on review of the test boring data, the foundation and abutments are supported on competent rock suitable for support of the dam.

The visual inspection revealed no apparent problems concerning the safety of the dam. However, the following remedial measures are recommended:

(1) A staff gage should be installed to monitor water levels.

(2) Action should be taken to prevent erosion at the dam abutments during periods of overtopping or careful observation of erosion is required in order that corrective measures can be taken immediately after erosion occurs.

(3) The highway drainage pipe located above the right upstream abutment should be relocated in order to prevent slope erosion and future damage to the dam.

Prepared by:

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

Ray B. Martin, Ph.D., P.E.
Commonwealth of Virginia

Submitted By:

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for Douglas L. Haller,
Colonel, Corps of Engineers
District Engineer

Recommended By:

Original signed by:
Carl S. Anderson, Jr.

for Jack G. Starr, R.A., P.E.
Chief, Engineering Division

Date: SEP 27 1979

OVERVIEW PHOTOGRAPH

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
TOMS CREEK DAM VA. NO. 19510

SECTION 1 - PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (See Reference 1, Appendix V). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description: Toms Creek Dam is a concrete double arch structure approximately 320 ft long and 36 ft high. The crest is 5.4 ft wide and at an elevation of 2296 M.S.L. (See Plates 2-5, Appendix I.)

The spillway section is 150 ft long by 3 ft deep with a crest elevation of 2293 M.S.L. There is a 30-inch diameter inlet at elevation 2262 M.S.L. located below the crest, which is used to drain the lake, and two 8-inch water intakes located at elevation 2261 and 2253 M.S.L. (See Plate 6, Appendix I.)

1.2.2 Location: Toms Creek Dam is located on Toms Creek, 2.3 miles northeast of Toms Creek, Virginia, (See Sheet 1, Appendix I).

1.2.3 Size Classification: The dam is classified as a "small" size structure because of height and maximum storage.

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the location of a home and water filtration plant approximately 300 ft downstream (See Photo 1, Appendix II), and the industrial development and several homes within 2 miles downstream of the dam, the dam is assigned a "significant" hazard classification. The hazard classification used to categorize a dam is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The Town of Coeburn owns and operates the dam.

1.2.6 Purpose: Water supply for the Town of Coeburn.

1.2.7 Design and Construction History: The dam was constructed in 1964 and was designed and constructed under the supervision of Hayes, Seay, Mattern and Mattern, Engineers, for the Town of Coeburn.

1.2.8 Normal Operational Procedures: The spillway is ungated; therefore, water rising above the crest is automatically discharged downstream.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The drainage area is 3.23 square miles.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in 1977; however, the pool elevation was not observed.

Spillway Discharge:

Pool at Crest of Dam (El 2296) 2572 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below.

Table 1.1 DAM AND RESERVOIR DATA

Item	Reservoir				
	Elevation Feet M.S.L.	Storage			
		Area Acres	Acre Feet	Watershed Inches	Length Miles
Crest of Dam	2296	3.3	51	.33	.2
Spillway Crest	2293	3.1	46	.30	.2
Streambed at Downstream Toe	2260	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was designed by Hayes, Seay, Mattern and Mattern of Roanoke, Virginia. Only design drawings and test boring logs with pressure test data were available. Design drawings are available at the Office of the Town Manager, Town of Coeburn, Virginia. The hydrologic and hydraulic design report was not available.

A subsurface investigation was conducted at the site by the engineer during the initial design stages. The investigation included the drilling of 10 core borings and pressure tests were made in 7 of the 10 holes. The complete design report was not provided; however, test boring logs and pressure test data are included in Appendix IV. Boring locations are shown on Plate 2, Appendix I.

The dam is an unreinforced, double-arch concrete structure. Design details are presented on Plates 2 through 6, Appendix I. A review of design drawings indicates a 15 ft wide trench was to be excavated into weathered rock (Elev. 2248.2 M.S.L.) along the centerline of the dam (Plate 5, Appendix I). All remaining unsuitable materials were to be removed and over-excavated areas were to be backfilled with concrete to elevation 2248.2, M.S.L. The excavation beyond 150 ft left and 100 ft right of center was planned to the top of sound rock until 50 ft from the abutments. Then the excavation was made to the top of weathered rock. A grout curtain consisting of a single line of primary grout holes spaced

at 10 ft on centers extended 17 ft below the sound rock line. The design specified that secondary grout holes may be required at intermediate spacings to complete the grout curtain. Trust blocks were to be constructed in the abutments. The structure was then constructed in individual rings as shown in design, Plate 2, Appendix I.

Referring to Plate 2, Appendix I, abandoned mine shafts exist approximately 150 ft below ground surface and immediately upstream from the structure.

2.2 Construction: The constructtion records are not available. The dam was constructed by Allegheny Construction Company of Roanoke, Virginia and was completed in 1964.

2.3 Operation: There are no known operation records.

2.4 Evaluation: Engineering calculations are not available, but the design drawings are representative of the dam and are good enough for review. There are no records available for dam performance.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: The general condition of the dam was good at the time of inspection. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made 24 May 1979 and the weather was overcast with light rain and a temperature of 60°F. The pool elevation at the time of inspection was 2293.1 M.S.L. and the tailwater elevation was 2260.4 M.S.L., which corresponds to normal flows.

3.1.2 Dam and Spillway: The dam was in good vertical and horizontal alignment and construction joints showed no deterioration, except for some occasional effervesence staining. Some minor cracks were observed in the dam near the left abutment. There was no spalling of concrete on the dam or spillway and there was no evidence of any leaks. The 30-inch drain and the raw water intakes were operational, and they showed no signs of deterioration. The riprap at the plunge pool below the spillway was not eroded and appeared in good condition.

A small area directly above the contact of the dam and right abutment is eroding due to runoff water from a 30 inch CMP highway drain (See Photo No. 2, Appendix II). Erosion is occurring in the form of embankment sloughing.

Bedrock was not exposed in the abutments, but was present at scattered locations upstream and downstream from the dam in cuts along Route 652. The bedrock is essentially flat-lying and consists of alternating beds of sand-

stone and shale with occasional conglomerate and interbeds of coal. No faults were observed in the field during this investigation and geologic maps of the area do not show the presence of any faults in the immediate vicinity.

3.1.3 Reservoir Area: The reservoir area showed no debris and had side slopes of approximately 1:1. Only minor sloughing of bank slopes was observed. Sediment was observed at the upper end of the reservoir.

3.1.4 Downstream Area: The downstream channel showed no erosion or debris collection. The channel is well defined and is generally a narrow floodplain covered with brush and trees. Side slopes are approximately 2:1 at the edge of floodplain. The floodplain is approximately 100 ft wide except immediately below the dam where it is restricted to $30^{\pm}$ ft. One home and the water filtration plant are located approximately 300 ft downstream. They appear to be approximately 5 ft above the streambed. Additional homes and a coal handling operation are located along the stream floodplain over a 2 mile distance.

3.2 Evaluation:

3.2.1 Dam and Spillway: The dam was in very good condition at the time of inspection, and appurtenances (valves) were in good operational order. Increased sediment buildup in the reservoir and minor surface damage to the dam are likely as long as sloughing continues below the 30 inch CMP.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Toms Creek Dam reservoir is used for water supply for the Town of Coeburn. The normal pool elevation is maintained by an overflow spillway which is the principal spillway. Water supply is constantly drawn off through two 8-inch lines. During periods of below normal flows water discharge is maintained through the dam by the demand for water supply. During periods of normal flows, the pool elevation is maintained slightly above the overflow spillway, and discharges downstream. Large increases in inflows, which cannot be absorbed by storage and the spillway, are passed over the non-overflow section when the pool rises above elevation 2296 M.S.L. There is a 30-inch drain pipe at elevation 2262 M.S.L. used to drain the reservoir.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the Town of Coeburn. Maintenance consists of dam inspection and debris removal. The operating appurtenances are reportedly in working order.

4.3 Warning System: No warning system exists.

4.4 Evaluation: The dam and appurtenances are in good operating condition; and maintenance is routinely performed. The maintenance of the dam is adequate.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: No hydraulic/hydrologic data is available.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: The maximum pool elevation observed was in April of 1977. The pool elevation was not recorded, but it was observed that the outflow was contained within the spillway.

5.4 Flood Potential: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. The Probable Maximum Flood (PMF), ½ PMF, and 100-year Flood hydrographs were developed by the SCS method (Reference 4, Appendix V). Precipitation amounts for the flood hydrographs of the PMF, ½ PMF, and 100-Year Flood are taken from the U. S. Weather Bureau Information (References 5 and 6, Appendix V). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulation: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 2293 M.S.L. Reservoir stage-storage data and stage-discharge data were determined from the available plans, field measurement and USGS quadrangle sheets. Floods were routed through the reservoir using the spillway discharge up to a pool storage elevation of 2296 M.S.L. and a combined spillway and non-overflow section discharge for pool elevations above 2296 M.S.L.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the flood conditions (PMF, ½ PMF, and 100 year Flood) are shown in the following Table 5.1.

TABLE 5.1 RESERVOIR PERFORMANCE

	Normal Flow	Hydrograph		
		100 Year	½ PMF	PMF
Peak Flow, CFS				
Inflow	3	1100	6,500	13,000
Outflow	3	1081	6,470	13,000
Maximum Pool Elevation Ft, MSL		2294.68	2297.81	2299.94
Non-Overflow Section (El 2296 MSL)				
Depth of Flow, ft	-	-	1.81	3.94
Duration, Hours	-	-	3	5
Velocity, fps*	-	-	6	8.9
Spillway (El 2293 MSL)				
Depth of Flow, ft	-	1.68	4.81	6.94
Duration	-	10	12	12
Velocity, fps*	-	6	10.1	12.2
Tailwater Elevation, ft., MSL	2260.5	2263	2271.7	2276.8

* Critical Velocity at Control Section

5.7 Reservoir Emptying Potential: A 30-inch circular gate at elevation 2262 M.S.L. is capable of draining the reservoir through the 30-inch pipe. Assuming that the lake is at normal pool elevation (2293 M.S.L.) and there is 3 cfs inflow, it would take approximately 6 hours to lower the reservoir to elevation 2262 M.S.L.

5.8 Evaluation: Department of the Army, COE, guidelines indicate the appropriate spillway design flood (SDF) for a small size significant hazard dam is the 100 year flood to ½ PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 20 percent of the PMF. The SDF will overtop the dam a maximum of 1.8 ft, and remain above the dam for 4 hours with a critical velocity of 6 fps. The SDF will also create a tailwater condition which will flood the area of the home located 300 ft downstream.

Hydrologic data used in the evaluation pertains to present day conditions with no consideration given to future development.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: Toms Creek Dam is located within the southeast edge of the Appalachian Plateau (locally Cumberland Plateau) Physiographic Province of Virginia. The dam site is underlain by rocks of the Norton Formation of Lower to Middle Pennsylvanian Age. This formation consists of alternate beds of sandstone and shale interbedded with coal. In Wise County the Norton Formation varies in thickness from 1300 to 1500 ft and thins in a northerly direction. Toms Creek Dam appears to be founded primarily on shale bedrock of the Norton Formation. The structure as built includes a grout curtain which extends 17 ft into sound bedrock. Design drawings are presented as Plates 2 through 6 of Appendix I. Test boring logs and related pressure test data are presented in Appendix IV.

Bedrock was not exposed in the abutments, but was present at scattered locations upstream and downstream from the dam and in cuts along Route 652. The bedrock is essentially flat-lying and consists of alternating beds of sandstone and shale with occasional conglomerate and interbeds

of coal. Test boring logs indicate the dam is underlain primarily by flat-lying slightly weathered shale. Interbeds of clay and fractured zones occur locally. The interbedded clay was usually encountered near the top of rock and decreased with depth. Rock core recoveries in the subsurface exploration program for the most part were greater than 90 percent. Sandstone with one coal bed was cored in the right abutment. Bedrock cored at the site was overlain by alluvial, colluvial, and residual soils which ranged in thickness from 5 to 24 ft. The overburden was generally described as consisting of sand, silt, and clay with gravel, cobbles, and boulders. No faults were observed in the field during this investigation and geologic maps of the area do not show the presence of any faults in the immediate vicinity.

6.2 Evaluation:

6.2.1 Foundation and Abutments: Arch dam foundations and abutments must be evaluated on the basis of potential settlement and seepage. Excessive settlement of the dam is not believed to be a problem because the structure rests upon fairly competent shale and sandstone bedrock.

Plate 2, Appendix I provides the approximate location for an interconnecting series of abandoned coal mine shafts. These shafts are shown to exist 150 ft$^{\pm}$ beneath the ground surface adjacent to but not under the dam, and beneath the reservoir. The locations shown are presented as accurately as could be determined from mine maps reviewed by the designer. The presence of the mine shafts has not apparently caused any problems.

Seepage was considered a problem in design because a grout curtain was specified. The pressure test data reflects the random and varied permeable condition within the bedrock. The planned grout curtain was to extend 17 ft into sound bedrock. Based upon the visual inspection and performance of the dam, it appears that the grouting was effective in controlling seepage through the bedrock.

The steep slopes which form the abutments were generally considered safe and stable at the time of investigation. One area of concern does exist along the upstream side of the right abutment. After construction of the dam the highway department placed a corrugated metal pipe beneath Route 652 to divert drainage from the north side of the road into the reservoir (to the right and above the bent handrail, Photo 2, Appendix II). Considerable erosion and sloughing directly related to the pipe have since occurred. In one instance during a period of heavy runoff, a large block of rock fell and damaged a section of handrail (Photo 2, Appendix II). The location of this drain pipe is detrimental to the normal operation

of the dam and it should be relocated downstream from the dam.

6.2.2 Stability Analysis: An evaluation of the stability of the dam could not be made since the design calculations were not available. The designer reportedly performed an analysis with a Portland Cement Association computer program for a double-arch concrete dam. A review of the geologic data and the test borings included in Appendix IV indicates that there are probably no adversely oriented weak planes within the rock of the foundation or abutments that would cause failure of the dam. The foundations and abutments appear to be founded on sound bedrock and the installation of the grout curtain also provides for a good foundation. Based upon the performance of the dam, it appears that the design was appropriate for the loading conditions.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Toms Creek Dam at the time of inspection appeared sound and in very good condition. The spillway will pass 20 percent of the PMF without overtopping. The SDF is the ½ PMF, and the dam will be overtopped by 1.8 ft during the SDF. The dam is considered inadequate but not seriously inadequate.

Based on the visual inspection and review of existing data, there is no apparent problem that would require immediate action for the normal pool conditions. The structure appears to have been constructed essentially as shown on the design drawings. The stability analysis was not available at the time of the inspection; however, the analysis was made with a Portland Cement Association computer program for a double-arch concrete dam. The method of embedment of the dam into bedrock and the installation of a grout curtain provide a good foundation for this structure.

7.2 Remedial Measures:

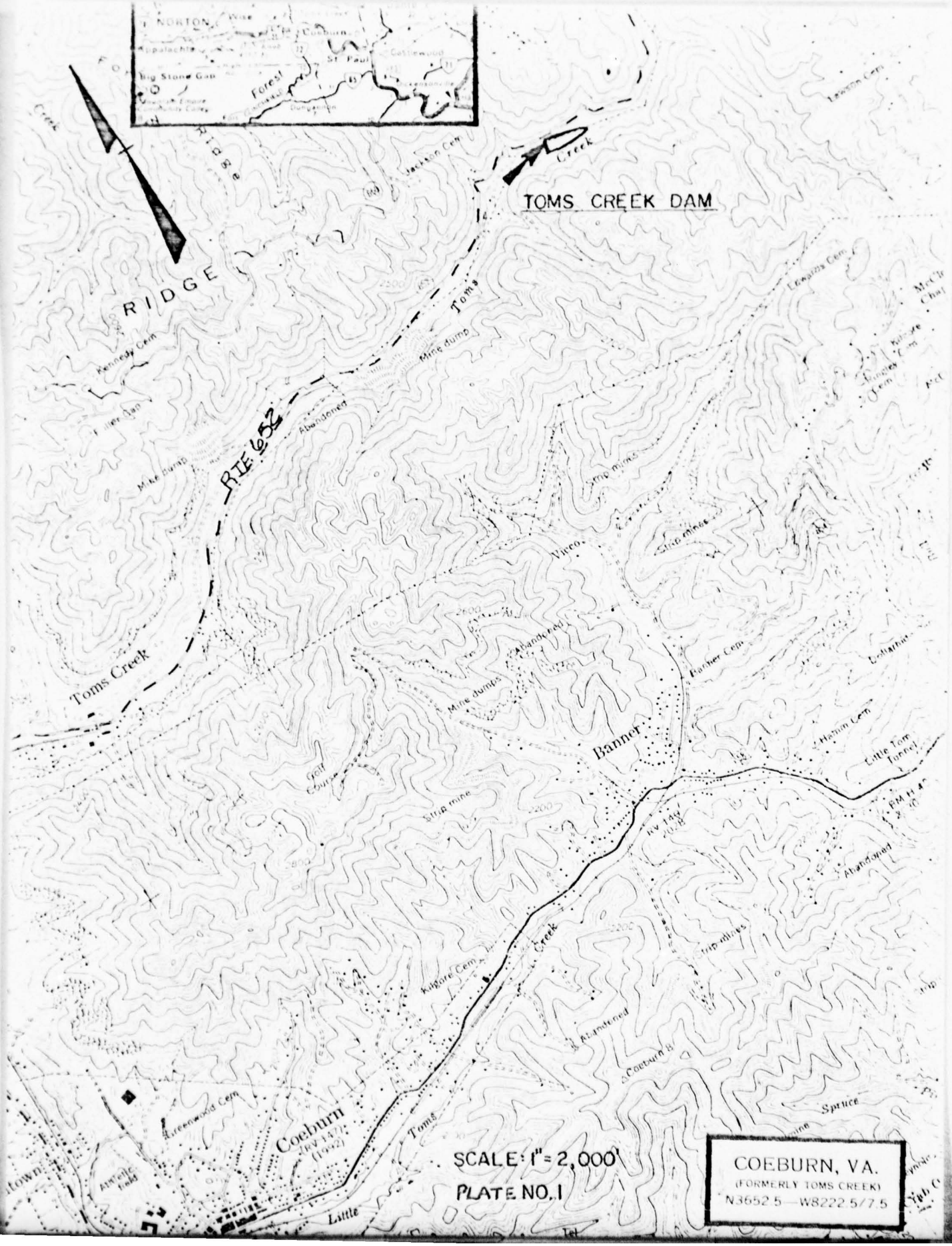
7.2.1 A staff gage should be installed to monitor high water levels.

7.2.2 Protection against erosion of the dam abutments should be provided or the abutments should be monitored after intense flooding conditions.

7.2.3 The drainage pipe located above the right abutment should be relocated. Slope erosion associated with outflow from the pipe has already caused minor damage and we recommend it be relocated within the next six months, as to prevent future damage.

APPENDIX I

MAPS AND DRAWINGS

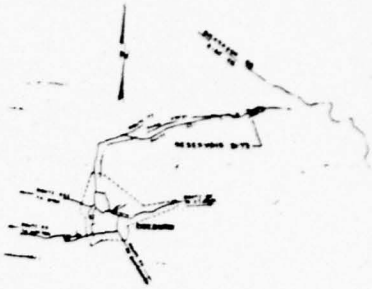

TOMS CREEK DAM
RIDGE
Toms Creek
Coeburn
SCALE: 1" = 2,000'
PLATE NO. 1
COEBURN, VA.
(FORMERLY TOMS CREEK)
N3652.5—W8222.5/7.5

WATER IMPROVEMENTS

TOWN OF COEBURN

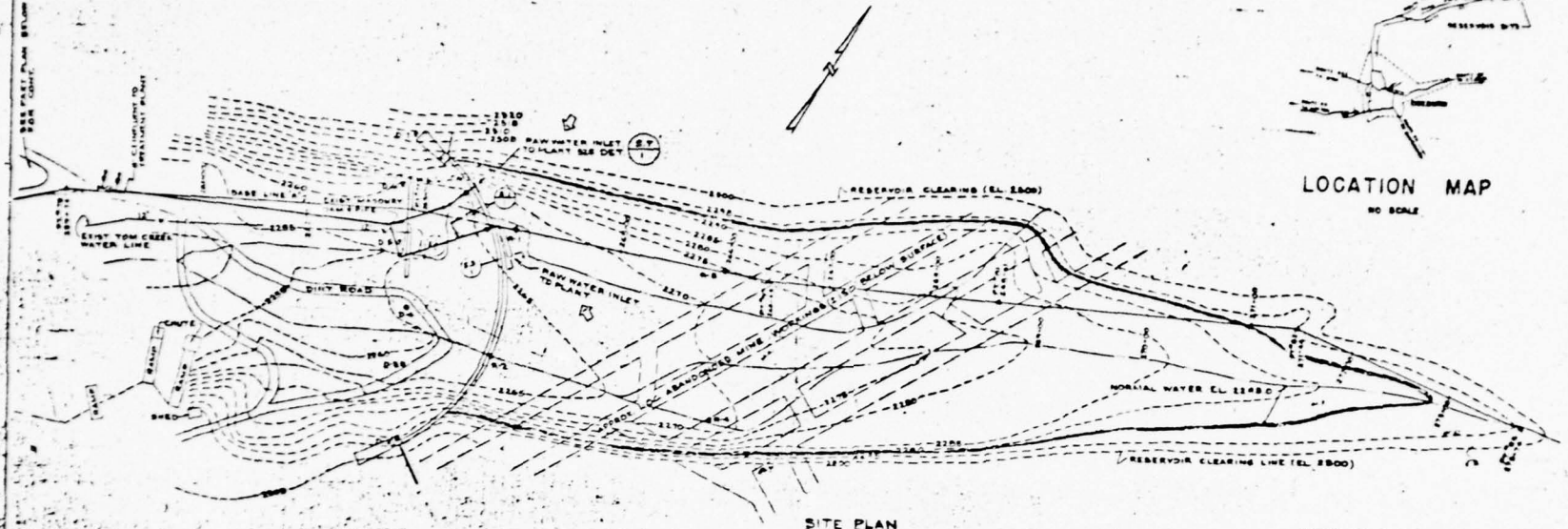
VIRGINIA

PROJECT NO. APW-VA-96



LOCATION MAP

NO SCALE

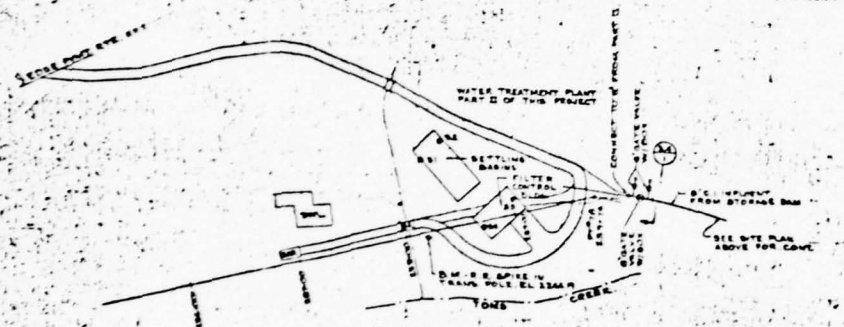


SITE PLAN

SCALE 1"=50'

(CONTOUR INTERVAL-5')

PART III WATER STORAGE DAM



PART PLAN

SCALE 1"=40'

LEGEND

2300 EXIST CONTOUR

2300 FINISH CONTOUR

D-5 SOIL BORING

SHEET WHERE DETAIL IS SHOWN — DETAIL NO. — SHEET WHERE DETAIL APPLIES

DETAIL SYMBOL

INDEX TO DRAWINGS

SHEET NO.	DESCRIPTION
1	TITLE SHEET & SITE PLAN
2	SITUATION PLAN
3	DIMENSIONAL LAYOUT
4	DETAILS
5	DETAILS

PLATE No. 2

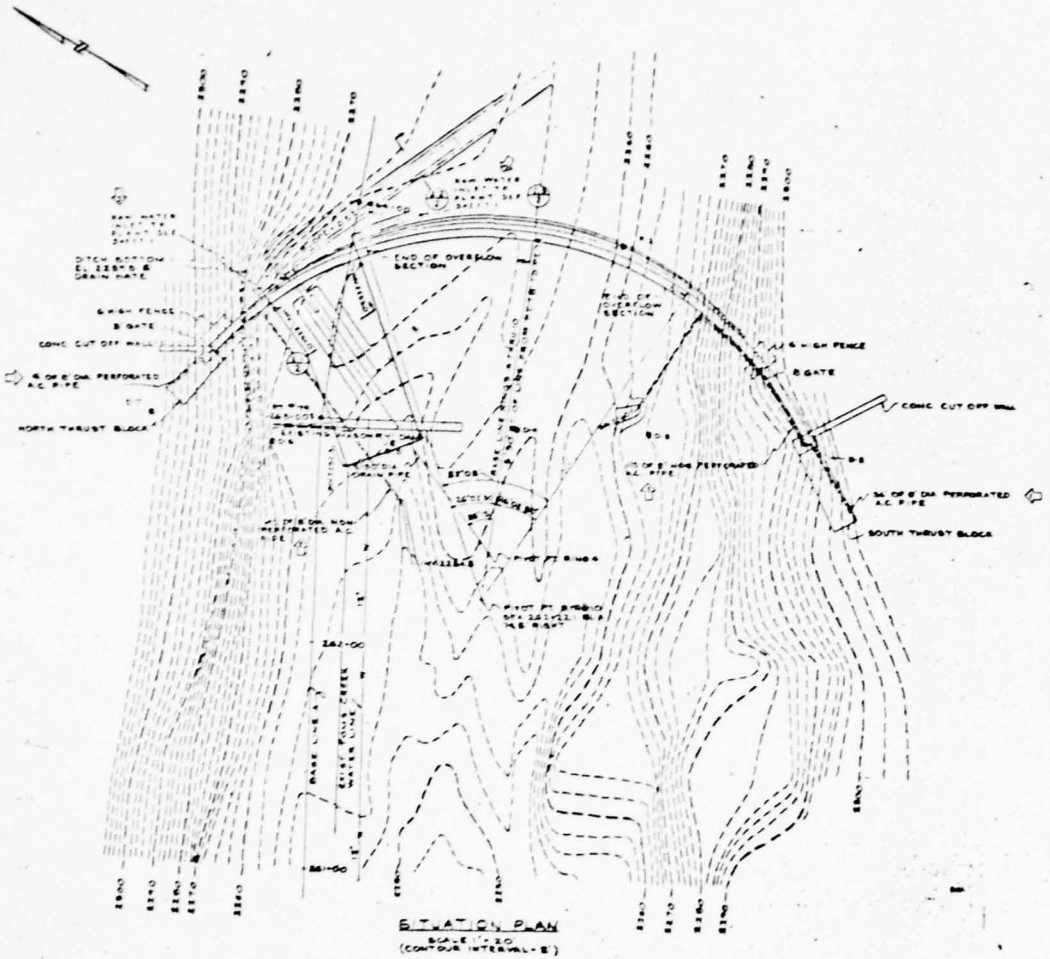
PROJECT APW-VA-96

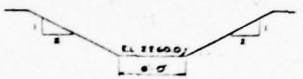
WATER STORAGE DAM PART III

TITLE SHEET & SITE PLAN

COEBURN VIRGINIA

MATTERN & MATTERN





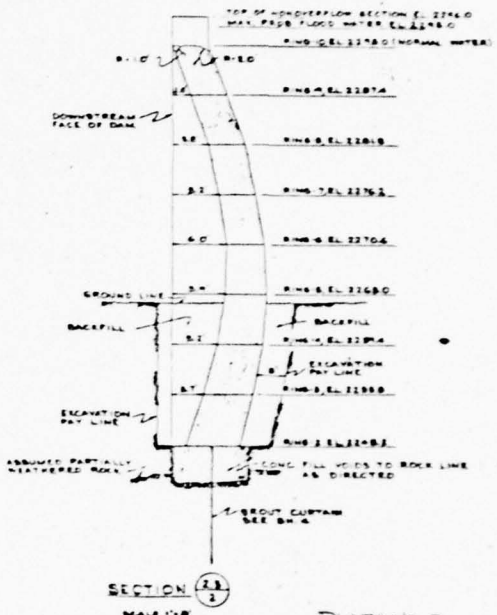
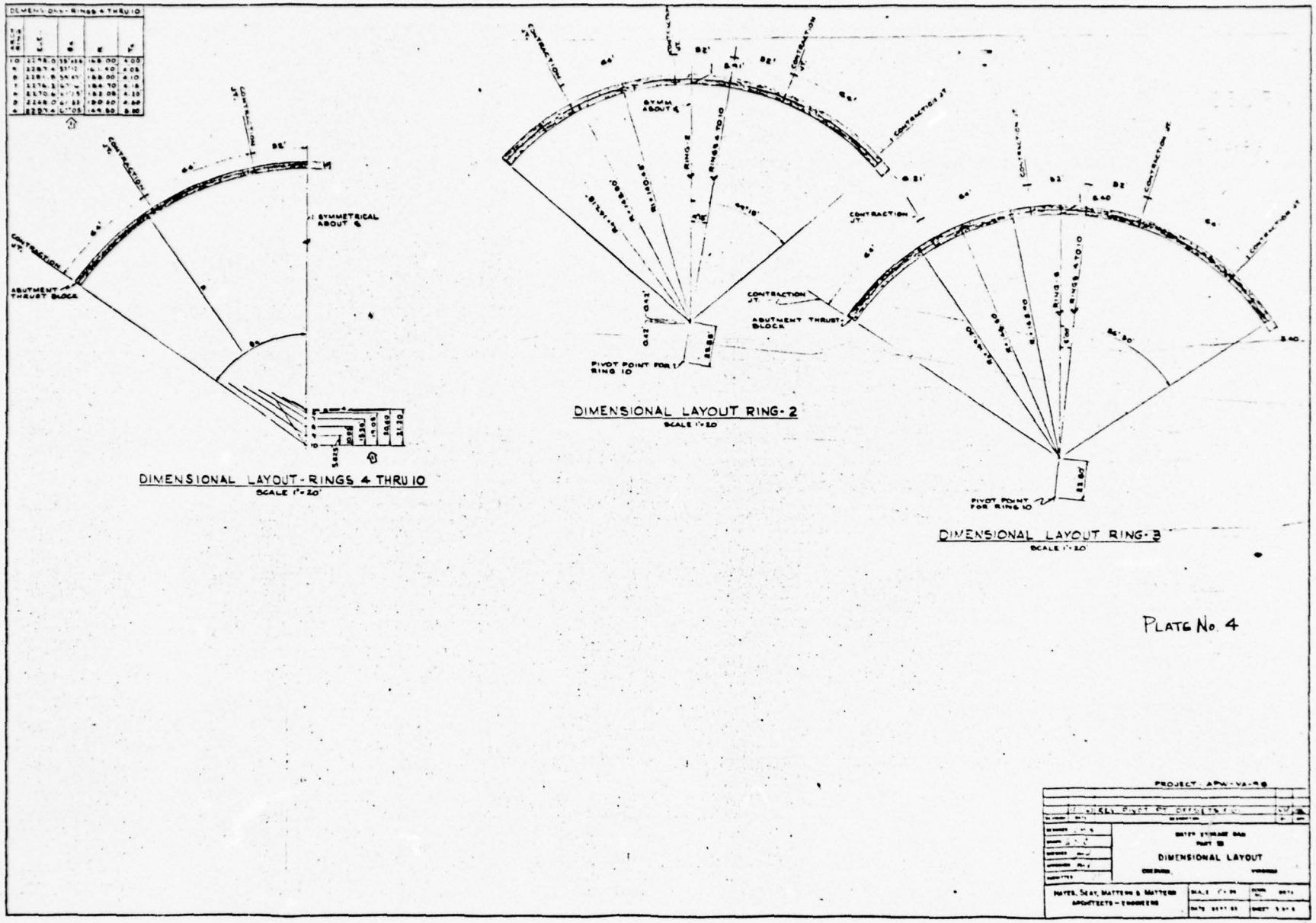
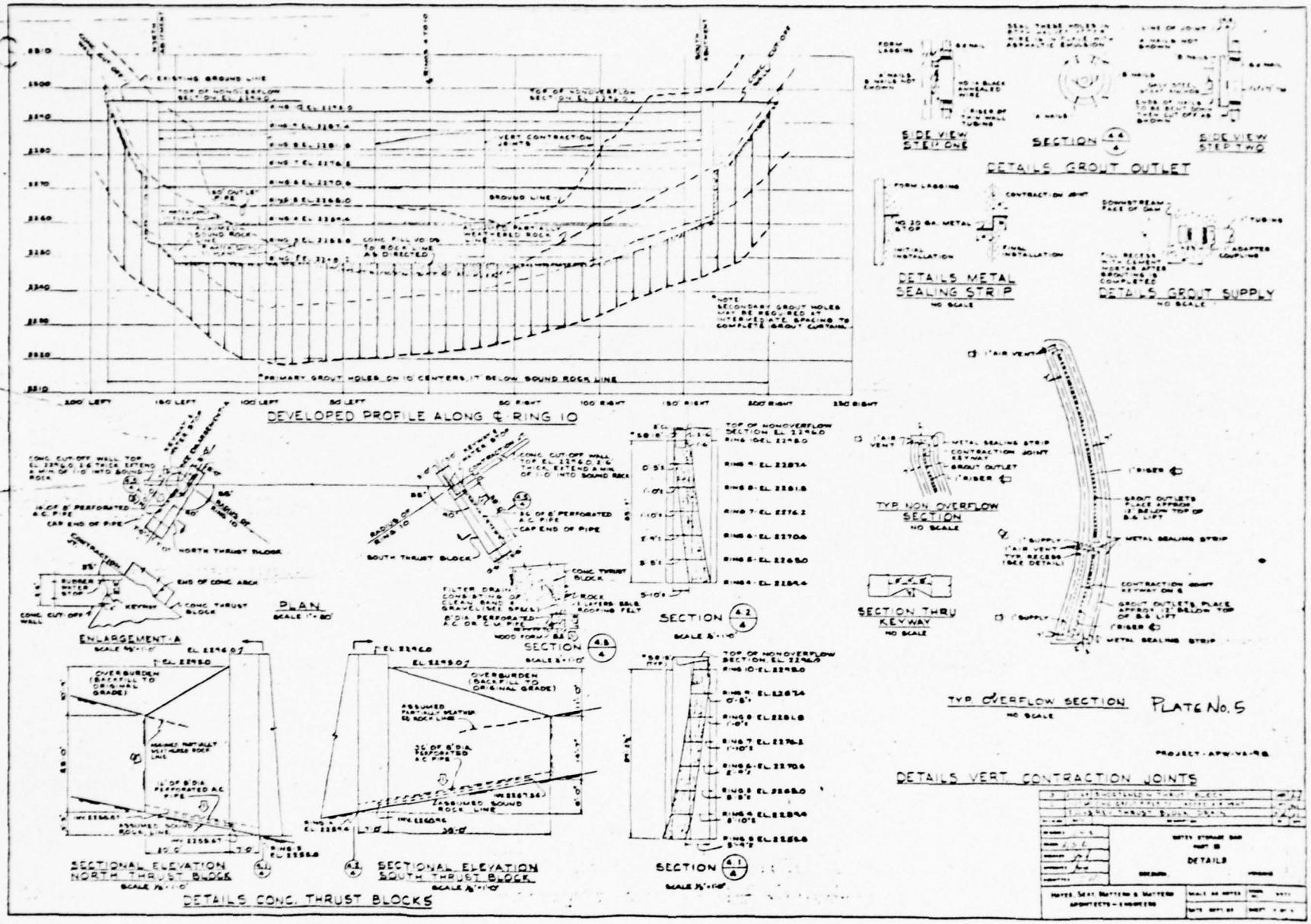
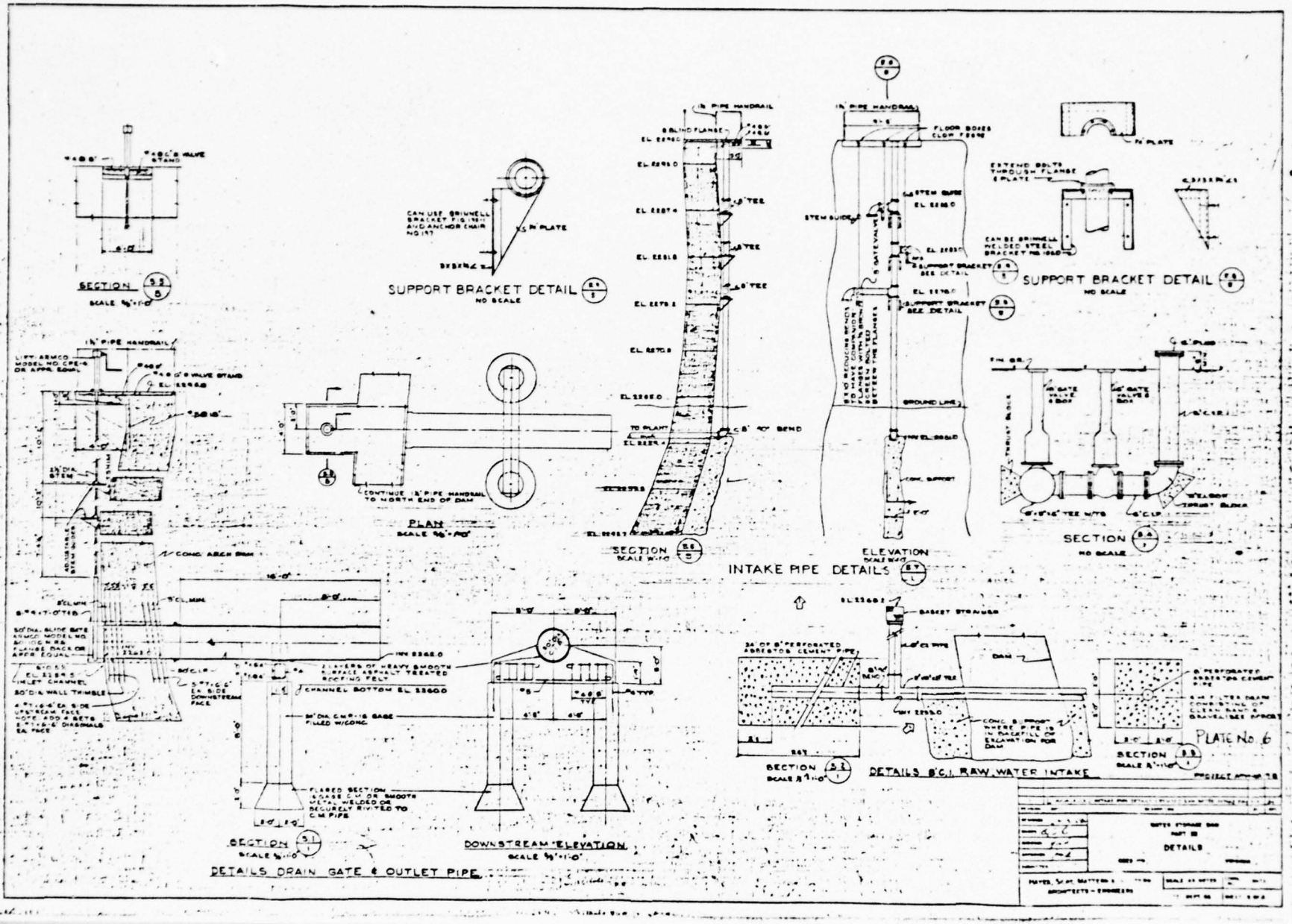


PLATE NO 3

SITUATION PLAN


DIMENSIONAL LAYOUT - RINGS 4 THRU 10
SCALE 1"=20'
DIMENSIONAL LAYOUT RING-2
SCALE 1"=20
DIMENSIONAL LAYOUT RING-3
SCALE 1"=20
CONTRACTION JT.
SYMMETRICAL ABOUT ℄
ABUTMENT THRUST BLOCK
PIVOT POINT FOR RING 10
PLATE No. 4
DIMENSIONAL LAYOUT

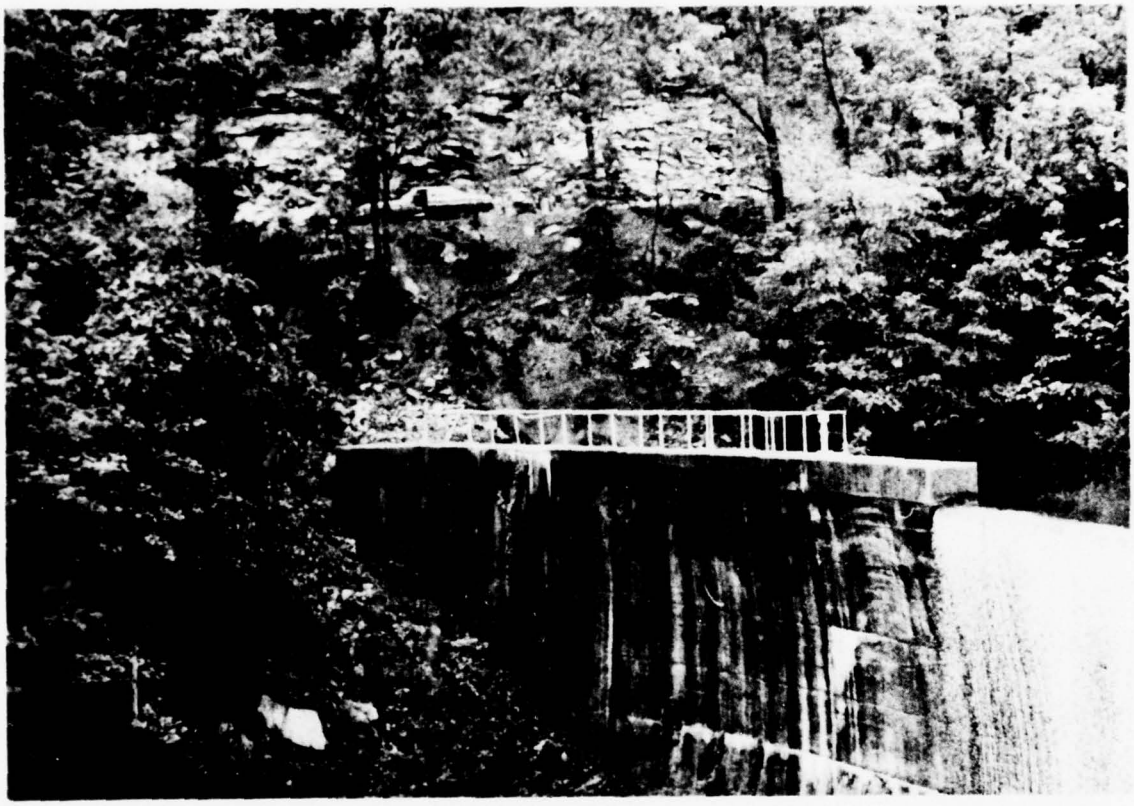

DEVELOPED PROFILE ALONG ℄ RING 10
PLAN
SECTION
SECTIONAL ELEVATION NORTH THRUST BLOCK
SECTIONAL ELEVATION SOUTH THRUST BLOCK
SECTION
DETAILS CONC. THRUST BLOCKS
SIDE VIEW STEP ONE
SECTION
SIDE VIEW STEP TWO
DETAILS GROUT OUTLET
DETAILS METAL SEALING STRIP
DETAILS GROUT SUPPLY
TYP NON OVERFLOW SECTION
SECTION THRU KEYWAY
TYP OVERFLOW SECTION
PLATE No. 5
DETAILS VERT. CONTRACTION JOINTS
DETAILS


SECTION
SUPPORT BRACKET DETAIL
NO SCALE
SUPPORT BRACKET DETAIL
NO SCALE
PLAN
SCALE 1/8"=1'-0"
SECTION
SCALE 1/4"=1'-0"
ELEVATION
SCALE 1/4"=1'-0"
SECTION
NO SCALE
INTAKE PIPE DETAILS
SECTION
SCALE 1/4"=1'-0"
DETAILS B'C.I. RAW WATER INTAKE
SECTION
SCALE 1/4"=1'-0"
DOWNSTREAM ELEVATION
SCALE 1/4"=1'-0"
DETAILS DRAIN GATE & OUTLET PIPE
PLATE No. 6
DETAILS

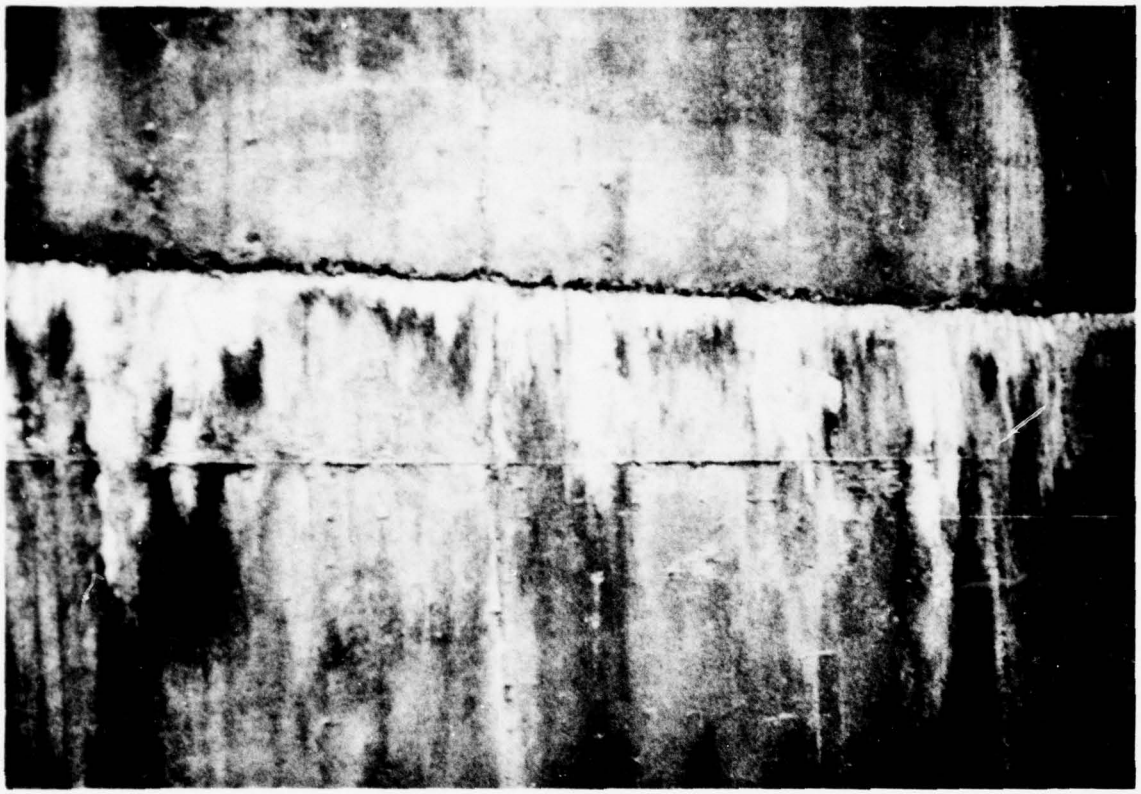
APPENDIX II

PHOTOGRAPHS

WATER TREATMENT PLANT DOWNSTREAM
(NOTE CARETAKER'S HOME, ARROW)



VIEW OF RIGHT ABUTMENT WHERE BOLDER WASHED OFF ROAD ONTO WALKWAY (NOTE BENT HANDRAIL)



VIEW OF COLD JOINT

CRACK IN SURFACE

SLOUGHING ABOVE LEFT ABUTMENT

APPENDIX III

FIELD OBSERVATIONS

FIELD OBSERVATIONS

Name of Dam: Toms Creek Va. No. 19510

County: Wise

State: Virginia

Coordinates: Lat 36° 58.7' Long 82° 24.9'

Date of Inspection: May 24, 1979

Weather: Overcast and light rain, temperature 60°F

Pool Elevation at Time of Inspection: Elevation 2293.1 MSL

Tailwater at Time of Inspection: 2260.4 MSL

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Ray E. Martin, P.E.*
Stephen G. Werner (recorder)

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
William A. Johns (recorder)

State Water Control Board
Hugh Gildea, P.E.

Town of Coeburn, Virginia
Terry L. Gibson, Town Manager

1 Concrete/Masonry:

1.1 Seepage or Leakage: A damp spot was located on the face of the dam 3/4 way up and 3/4 way across from the right edge of the spillway. Construction joints exhibit some bleeding. The toe and abutments of the dam were back-filled with coarse rock, consequently any seepage occurring would not be visible unless it was great enough to flow above the coarse rock fill.

---

*Not present during May 24, 1979 inspection, but visited dam on June 11, 1979.

1.2 Structure to Abutment/Embankment Junction: No bedrock is exposed at the junction. The contact is either thickly vegetated or covered with rock fill. Sandstone and shale outcrop is exposed along the right downstream portion of the abutment. Steep residual soil slopes occur on the upstream abutment edges. A shale slope with a thin coal seam occurs along the right upstream slope. The bedrock is flat lying. A 30 inch± highway drain expells water on the upper portion of the right abutment, causing a slope stability problem.

1.3 Drains: 30 inch gated drain.

1.4 Water Passages: Two 8 inch water lines.

1.5 Foundation: Not observable, but design called for the structure to be keyed into bedrock. Outcrops exposed along the adjacent road consist of fine to coarse gravel, massively bedded sandstone with a basal conglomerate overlying gray shale. The sandstone is gray to brown and weathers spheroidally. The bedrock is essentially flat lying.

1.6 Surface Cracks, Concrete Surfaces: Minor cracks were observed on left abutment. Only one thin crack, approximately 10 ft long and at a 60 degree angle across the left downstream face, was encountered. It is patched and is located near the left abutment.

1.7 Structural Cracking: None observed.

1.8 Vertical and Horizontal Alignment: Good.

1.9 Monolith Joints: Good condition.

1.10 Construction Joints: Good condition.

1.11 Erosion of Abutment Slopes: The only erosion observed is just below the outlet to the drain pipe above the right abutment. Water from one side of the road is diverted under the road, expelled on the right abutment slope and drains downward into the reservoir.

2 Ungated Spillway:

2.1 Concrete Weir: Good Condition.

2.2 Approach Channel: None

2.3 Discharge Channel: Riprap pool in good condition.

2.4 Bridges and Piers: None

3 Reservoir: In good condition, steep slopes, no debris noticed.

3.1 Slopes: Steep natural heavily wooded slopes with numerous rock outcrops bound the reservoir. Slopes appeared stable and only minor sloughing was observed.

3.2 Sedimentation: Some sediment buildup indicated on the upper lake reaches. Sounding at dam face indicated no build-up. The Town of Coeburn has a sediment removal program.

4 Downstream Channel:

4.1 Condition: Brush covered.

4.2 Slopes: Steep natural heavily wooded rock slopes bound the channel. There was no observed evidence of slides.

4.3 Population and Facilities: One home and the filtration plant exist approximately 300 ft below the dam. Coal loading operation and various homes several miles below dam.

5 Instrumentation:

5.1 Monumentation: None

5.2 Observation Wells and Piezometers: No observation wells or piezometers were located during our field observations.

APPENDIX IV

TEST BORING LOGS

AND

PRESSURE TEST DATA

BY

HAYES, SEAY, MATTERN AND MATTERN

BORING LOG

Location COEBURN, VA
Structure RESERVOIR
Geologist Berg
Contractor C.C.D.
Engineer
Comm. No. 897-A
Sheet 1 of 2
Boring No. R-1
Date 25 June 1963

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 430'
							Rock 35.0'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water 58.6
65.8	0.0						W.T. 0-24 hrs. 7.2
			OVERBURDEN AND ALLUVIUM - Sand clay, gravel, cobbles & boulders.				Casing Bit to 8.0 ft.
57.8	8.0		soft, domed soft, med. to dk. gray, weathered, thinly bedded SH 40E				core rec. 8.0 to 13.5 91%
55.8	10.0						
54.3	11.5		Soft clay seam				
53.7	12.1						lost circ. - 13.5
52.3	13.5						
47.8	18.0						25% return of circ. @ 18 ft.
45.8	20.0						
43.8	22.0		Increase in fracturing and weathering - 22.0 to 27.6				core rec. 13.5 to 23.5 93%; loss believed to be 22.0 to 23.5
42.3	23.5		Badly broken, fractured and weathered				
38.2	27.6						core rec. 23.5 to 33.5 95%

BORING LOG

Location Coeburn, Va. | Structure Reservoir | Comm. No. E97-A
Geologist J.F.B. | Sheet 2 of 2
Contractor C.C.D. | Engineer | Boring No. R-1
Date 25 June 1963

Stratification Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Sampler or Spoon: Penetration	Sample No.	Misc. Data / REMARKS
35.8	30.0		Med soft to med H. gray, slightly weathered, thinly bedded SHALE				Lnth of hole 43.0 Rock 35.0' Wt of hammer 140# Av fall of ham 30" El of grd. water 58.6
32.3	33.5						Core rec. 23.5 to 33.5 95%
31.7	34.1		Hard light, dense, slightly weathered SANDSTONE.				
30.6	35.2						
25.8	40.0		med. to hard, H. gray, slightly weathered, thinly bedded SHALE				Core rec. 33.5 to 43.0 100%
22.8	43.0		Bottom of Hole				

Boring R-1

Test #1 (30 ft. to 35 ft)
10 psi: - 0.8 gpm.
20 psi: - 0.0 gpm.
30 psi: - 0.0 gpm.
20 psi: - 0.0 gpm.
10 psi: - 0.0 gpm.

Test #2 (35 ft. to Bot. (43.0))
No pressure - 13.8 gpm.

Test. #3 (27 ft. to 32 ft)
10 psi: - 0.5 gpm.
20 psi: - 0.5 gpm.
30 psi: - 0.2 gpm.
20 psi: - 0.0 gpm.
10 psi: - 0.0 gpm.

Test #4 (17 ft. to 22 ft)
8 psi: (max) - 13.5

Test #5 (22 ft. to Bot. (43.0))
No pressure - 14.0 gpm.

Test #6 (12 ft. to 17 ft)
5 psi: (max) - 14.0 gpm.

Test #7 (22.5 ft. to 27.5 ft)
No pressure - 14.8 gpm.
Suction (all valves open) - 12.0 gpm.

BORING LOG

Location: Coeburn, Va
Contractor: C.C.D
Structure: Reservoir
Geologist: [illegible]
Engineer:
Comm. No. 897-A
Sheet 1 of 1
Boring No. R-2
Date 4 June 1963.

Misc. Data

- Lnth of hole 30.3'
- Rock 15.5'
- Wt of hammer 140#
- Av fall of ham 30"
- El of grd. water 54.0

Stratification: Elevation	Stratification: Depth	Stratification: Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Sampler or Spoon: Penetration	Sample No.	REMARKS
59.0	0.0						
							W.T. @ 24 hrs. 5.0 ft.
							casing bit to 14.0'
			OVERBURDEN ALLUVIUM - sand, silt, clay, cobbles & boulders				
49.0	10.0						
45.0	14.0		soft & very weathered, lt. gray SHALE!				
44.7	14.3						
44.6	14.6		soft to med. hard, partially weathered SHALE.				Core rec. 14.5 to 24.5 95%
44.2							
42.8	16.2						
			hard & med. hard slightly weathered dark gray SHALE slightly sandy Weathering decreasing with depth.				
39.0	20.0						
34.5	24.5						
							Core rec. 24.5 to 30.3 98%
							see over for test results.
29.0	30.0						

Boring P-2

Void

Test #1 — 13 p.s.i. — 28 gpm
26 — 135
13 — 55
} packers at 14.8 & 19.6 - leak around packer.

#2 — 13 p.s.i. — 28 gpm.
26 — 6.5
13 — ±.2
} 20 ft. to 30.3 ft. (bottom)

#3 — 13 p.s.i. — 4 gpm.
26 — .8
13 — .1
} packers at 16.5 & 21.5

#4 — 13 p.s.i. — 4 gpm.
26 — .5
13 — 1.2
} 21.5 to 30.3 ft. (bottom)

BORING LOG

Location COEBURN, VA
Structure RESERVOIR
Geologist Prof. Hall
Contractor C.C.D.
Engineer

Comm. No. 847-A
Sheet 1 of 2
Boring No. R-3
Date 20 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 51.9'
							Rock 26.8'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water
630	0.0						REMARKS
							wt @ 2 hrs. - Hole cratered - could not take water table.
			OVERBURDEN and ALLUVIAM- sand, clay, gravel, cobbles & boulders.				
630	10.0						Casing Bit @ 22.6
630	20.0						
51.5	21.5		soft lt. gray very weathered interbedded CLAY & SHALE plastic.				
50.4	22.6						Pitton core barrel 22.6
47.9	25.1		Med. soft to med. lt gray thinly bedded, highly fractured, weathered SHALE				Core rec. 22.6 to 26.1 62%
46.9	26.1						
							Core rec 26.1 to 31.9

BORING LOG

Location: Coburn Co.

Contractor: C.C.D

Structure: Reservoir

Geologist: [illegible]

Engineer: /

Comm. No. 897-A

Sheet 2 of 2

Boring No. R-3

Date 20 June 1963

Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 51.9 ft.
							Rock 26.8 ft.
							Wt of hammer 140 #
							Av fall of ham 30"
							El of grd. water
43.0	30.0						
			Med. soft to med. lt. gray, thin bedded, light to med. weathered SHALE.				
41.1	31.9						
41.0	32.0		lt gray fine grained hard, slight dense, lightly weathered SANDSTONE				
39.3	33.7						
							Core rec. 31.9 to 41.9 98%
							partial loss circ. 40.0
33.0	40.0						
31.1	41.9						
			Med hard, thinly bedded, lt. to dk. gray, lightly weathered SHALE				
							Core rec. 41.9 to 51.9 100%
23.0	50.0						
21.1	51.9		T.D. Bottom of Hole				

BORING LOG

Location Coeburn, Va | Structure Reservoir | Comm. No. 897-A
Geologist [illegible] | Sheet 1 of 2
Contractor C.C.D. | Engineer | Boring No. R-4
Date 21 June 1963

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 52.6
							Rock 44.1
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water 48.0
48.0	0.0						water table @ 10 hrs. free feet from top of casing
			OVERBURDEN and ALLUVIUM, sand, clay, gravel, cobbles & boulders.				
37.5	8.5						
36.0	10.0		soft to mod. d., lt. gray, weathered, thinly bedded SHALE				core rec. 8.5 to 13.0 95%
35.0	13.0						
							core rec. 13.0 to 23.0 100%
28.0	20.0		No changes in lithology				
25.0	23.0		Weathering in SHALE gradually decreases with depth. Hardness increases with depth.				See over for Test Results
							core 23.0 to 32.6 100%

BORING LOG

Location Cabarrus, Va.
Structure Reservoir
Geologist JSP
Contractor C.C.D.
Engineer

Comm. No. 697-A
Sheet 2 of 2
Boring No. R-4
Date 21 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 52.6 Rock 44.1 Wt of hammer 140# Av fall of ham 30" El of grd. water 68.0 REMARKS
38.0	30.0						core rec 23.0 to 32.6 100%
35.4	32.6		Mod. hard to hard, lt. gray, very slightly weathered, thinly bedded SHALE				
32.4	35.6						lost circ. @ 35.6
							core rec. 32.6 to 42.6 100%
28.0	40.0						
25.4	42.6						
							core rec. 42.6 to 52.6 100%
18.0	50.0						
15.4	52.6		Bottom of hole				

Boring B-4

Test #1 (Packers - 9ft - 14ft)
10 p.s.i. - 0.8 g.p.m.
20 p.s.i. - 6.8 g.p.m.
22 p.s.i. (max) - 12.5 g.p.m.
Blowout ←
10 p.s.i. - 13 g.p.m.

Test #2 (14ft. to Bot. [52.6])
10 p.s.i. - 7.5 g.p.m.
20 p.s.i. - 6.3 g.p.m.
30 p.s.i. - 6.8 g.p.m.
20 p.s.i. - 5.3 g.p.m.
10 p.s.i. - 1.5 g.p.m.

Test #3 (14ft. to 19ft)
10 p.s.i. - 0 g.p.m.
20 p.s.i. - 0 g.p.m.
30 p.s.i. - 0 g.p.m.
20 p.s.i. - 0 g.p.m.
10 p.s.i. - 0 g.p.m.

Test #4 (19ft. to Bot. [52.6])
No pressure - 14.5 g.p.m.

Test #5 (19ft to 24ft)
10 p.s.i. - 0.3 g.p.m.
20 p.s.i. - 1.3 g.p.m.
30 p.s.i. - 1.8 g.p.m.
20 p.s.i. - 1.5 g.p.m.
10 p.s.i. - 0.3 g.p.m.

Test #6 (24ft. to Bot. [52.6])
No pressure - 13.5 g.p.m.
Suction - all values open - 5.0 g.p.m.

Test #7 (24ft. to 29ft)
10 p.s.i. - 0.8 g.p.m.
20 p.s.i. - 1.8 g.p.m.
30 p.s.i. - 3.3 g.p.m.
20 p.s.i. - 1.8 g.p.m.
10 p.s.i. - 0.5 g.p.m.

Test #8 (29ft. to Bot. [52.6])
No pressure - 13.5 g.p.m.

Test #9 (29ft. to 34ft)
10 p.s.i. - 0.3 g.p.m.
20 p.s.i. - 1.3 g.p.m.
30 p.s.i. - 1.8 g.p.m.
20 p.s.i. - 1.8 g.p.m.
10 p.s.i. - 0.5 g.p.m.

Test #10 (34ft. to Bot. [52.6])
No pressure - 13.5 g.p.m.

Test #11 (34ft to 39ft.)
10 p.s.i. - 0.3 g.p.m.
20 p.s.i. - 0.5 g.p.m. LOST WATER
30 p.s.i. - 0.3 g.p.m. @ 35.6'
20 p.s.i. - 0.0 g.p.m.
10 p.s.i. - 0.0 g.p.m.

Test #12 (39ft. to Bot. [52.6])
No pressure - 13.5 g.p.m.

BORING LOG

Location COEBURN, VA | Structure DAM SITE | Comm. No. 897-A
Sheet 1 of 3
Geologist CWJ | Boring No. D-2
Contractor C.C.D | Engineer | Date 10 June 1963

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Misc. Data
							Lnth of hole 73.3'
							Rock 49.6'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water —
93.9	0.0						REMARKS
							Wt 24 hrs-Hole crater-ed caved not take water table. Fishtail to 30ft.
	3.0						3.0 ft. - Put on casing bit.
			OVERBURDEN. RESIDUUM clay, few boulders & weathered sandstone				NOTE: PRESSURE TESTING ON BACK OF SHEET.
88.9	10.0						
							casing bit to 23.7
78.9	20.0						
							25.8 to 26.3. badly weathered.
75.2	23.7						
			lt. gray, soft to med. hard, med. thinly bedded, weathered SHALE				
	25.8						
	29.3						Core rec 29.7 to 39.7 96%
63.9	30.0						

BORING LOG

Location Cockburn, Virginia | Structure Dam Site | Comm. No. 297-A
Contractor C.C.D. | Engineer | Sheet 2 of 3
Geologist K.F. | Boring No. D-2
Date 11 June 1963

Stratification Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon Blows	Penetration	Sample No.	Misc. Data / REMARKS
68.9	20						Lnth of hole 73.3'
							Rock 49.6'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water —
							WT @ 24 hrs.
65.2	33.7						
							Core rec. 33.7 to 43.6
							100%
61.4	37.5		Hard, light, lt. to med. gray slightly weathered SHALE				
	40.0						
58.6	40.1						
			Med hard to hard, lt. gray slightly weathered, thinly bedded SHALE. Very small amt. fracturing				
55.3	43.1						
							Core rec. 43.6 to 53.6
							100%
							NOTE
50.4	48.5						48.5 partial loss circ.
	50.0						
45.3	53.6		No change in lithology				
							Core rec. 53.6 to 63.6
							100%
38.9	60.0						

BORING LOG

Location Coshocton Co. | Structure Dam Site | Comm. No. 697-A
Contractor C.C.D. | Engineer | Sheet 3 of 3
Geologist | Boring No. D-2
Date 11 June 63

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 73.3'
							Rock 49.6'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water —
38.9	60.0						REMARKS
35.3	63.6						
			Med hard to hard lt. gray slightly weathered, thinly bedded, SHALE				Core rec. 63.6 to 73.3 100%
	70.0						
25.6	73.3		Bottom of hole.				

D-2

12 JUNE 1963

7:30 AM - 9:30 AM

PRESSURE TESTING

T-1 El - 72.9 - 47.9
Depth 26' - 31'

10 psi	2.1 gpm
20	4.4
30	10.0

10 psi	4.1 gpm
20	7.0
30	13.0
20	9.4
10	6.4

T-2 El - 67.9 - 25.6
Depth 31' - 73.3'

20 psi	8.5 gpm.
30	10.8
20	8.0

T-3 El - 52.9 - 47.9
Depth 46' - 51'

10 psi	6.3 gpm
20	8.1
30	8.5
20	6.5
10	5.8

T-4 Depth 47.9 - 25.6
51' - 73.3'

10 psi	1.3 gpm.
20	1.8
30	1.8
20	1.8
10	1.3

BORING LOG

Location *Coeburn, Va*
Contractor *C.C.D.*

Structure *Dam Site*
Geologist *[illegible signature]*
Engineer

Comm. No. *847-A*
Sheet *1* of *2*
Boring No. *D-3*
Date *12 June 1963*

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole *64.1*
							Rock *50.9*
							Wt of hammer *140#*
							Av fall of ham *30"*
							El of grd. water *55.0*
62.5	*0.0*						
							W.T. @ 24 hrs 7.5
			OVERBURDEN				
			ALLUVIUM - sand, clay, cobbles and boulders				
52.5	*10.0*						*casing bit to 14.1*
49.3	*13.2*		*Lt gray, soft to med. hard, med. dense, weathered SHALE. Intermittent ½"-¾" clay partings and very bad weathering. Clay is dark gray, plastic. Shale is thin bedded.*				
48.4	*14.1*						
							Core rec. 14.1 to 24.1 91%
42.5	*20.0*						
			Weathering and clay partings decrease with depth				
38.4	*24.1*						*Core 24.1 to 34.1 99%*
36.2	*26.3*		*Med. hard, dense, lt to med gray slightly weathered SHALE. Thinly bedded.*				*5.1' core unbroken*

BORING LOG

Location Cochran, Va. | Structure Dam site | Comm. No. 697-R
Sheet 2 of 2
Geologist [illegible] | Boring No. D-3
Contractor C.C.D. | Engineer | Date 13 June 1962

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 64.1 Rock 50.9 Wt of hammer 140 # Av fall of ham 30" El of grd. water 55.0 REMARKS
32.5	20.0		med hard dense lt. brown gray slightly weathered, thinbedded SHALE				
							core rec 24.1 to 34.1 99%
28.4	34.1						
26.1	36.4						complete loss circ. 36.4
22.5	40.0						
							core rec. 34.1 to 44.1 100%
18.4	44.1		No change in lithology				3.7 ft. core unbroken.
							core rec. 44.1 to 54.1 100%
13.5	50.0						
8.4	54.1						
							core rec. 54.1 to 64.1 99%

D-3

NOTE: High flows would not permit a pressure greater than 10psi in T-1, T-2 and T-3.

PRESSUER TESTS.

T-1 El - 42.5 22.4
Depth 20.0' - 34.1'

10 psi 10.5 gpm.
10 psi 15.5 gpm.

T-2 El - 47.5 42.5
Depth 15.0' - 20.0'

10 psi 12.8 gpm
10 psi 14.3 gpm.

T-3 El - 42.5 37.5
Depth 20.0' - 25.0'

10psi 15gpm.

T-4 El - 37.5 28.4
Depth 25.0' - 34.1'

10psi 0 gpm
20psi 0 gpm
30psi 0 gpm.

T-5 Depth 26.0 to 64.1 - No pressure - No test.

T-6 El 36.5 31.5
Depth 26.0' - 31.0
10psi. 0 gpm
20psi. 0 gpm.
30psi. 0 gpm.
20 psi. 0 gpm.

T-7 Depth 31.5 31.0 to 64.1
No pressure - 15 gpm.

T-8 Depth 31.5 31.0 to 26.5 36.0
10psi. - 0 gpm.
20 psi. - 0 gpm

D-3

T-9 Depth 36.0 to 64.1 (26.5)
No Pressure - 17 g.p.m.

T-10 Depth 36 to 41 (26.5 / 21.5)
No Pressure / 16.8 gpm.

T-11 Depth 41 (21) to 64.1
10 psi - 0.5 g.p.m.
20 psi - 0 gpm
30 psi - 0 gpm
20 psi - 0 gpm
10 psi - 0 gpm

BORING LOG

Location Coeburn, Va | Structure Dam Site | Comm. No. 897-A
Geologist Barg, Hall | Sheet 1 of 2
Contractor C.C.D | Engineer | Boring No. D-4
Date 4 June 1963

Stratification Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 62.5
							Rock 40ft
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water 56.2
46.2	0.0						REMARKS
							WT @ 24 hrs 4.0 ft. fishtail to 14.1
			OVERBURDEN				
			ALLUVIUM - sand, silt, clay, cobbles & very				
			large boulders of coarse micaceous, badly weathered SANDSTONE				
							Casing bit to 22.0ft
	11						
46.1	14.1						Core rec. 14.1 to 22.5 32%
31.7	13.5		LL gray plastic very hard				
	22.0		weathered SHALE & CLAY				
37.7	22.5						Core rec. 22.5 to 32.5 98%
			med. to dark gray soft to med. hard, weathered SHALE with intermittent clay (1/4") partings.				
34.5	25.7						
			LL to med. gray med. hard lightly weathered SHALE, occasional clay parting (1/8 - 1/4")				
20.5	27						

BORING LOG

Location Cochran, Va. | Structure Dam Site | Comm. No. 897-A
Geologist [illegible] | Sheet 2 of 2
Contractor CCD | Engineer | Boring No. D-1
Date 5 June, 1963

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 62.5
							Rock 40 ft
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water 56.2
36.2	20.0		Mod. hard to hard, light gray, tight, dense, very slightly weathered SHALE. Weathering decreases and hardness increases with depth.				Core rec. 22.5 to 32.5 98%
27.7	32.5						
							Core rec. 32.5 to 42.5 99%
	40.0						NOTE.
19.7	40.5		*NOTE.				Lost circulation at 40.5 ft
							No return below 40.5'
17.7	42.5						
							Core recovery 42.5 to 52.5 99%
	50.0						
7.7	52.5						Core. rec. 52.5 to 62.5 96%
0.2	62.0						

BORING LOG

Location: Coeburn, Va
Contractor: C.C.D
Structure: Dam Site
Geologist: [illegible]
Engineer:
Comm. No. 847-A
Sheet 1 of 3
Boring No. D-5
Date 17 June 1963

Misc. Data
Lnth of hole 65.7
Rock 50.4
Wt of hammer 140#
Av fall of ham 30"
El of grd. water

Stratification: Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon: Blows	Penetration	Sample No.	REMARKS
59.9	0.0						wt. ga bre hole cratered grade not take water table.
			ALLUVIUM - sand, clay, boulders & cobbles.				Casing bit to 15.5
49.9	10.0						
44.6	15.3						
44.4	15.5						
			soft & med. lt. gray badly weathered alternating lenses of SHALE & SANDSTONE. Thin lenses of clay (plastic)	(S?)			partial loss circ. 16.0
40.6	19.3		slight fracturing SANDSTONE very fine grained dark thin bedded.				core rec. 15.5 to 25.5 97%
39.9	20.0						
			soft to med. lt & med. gray weathered thinly bedded SHALE. Occasional clay partings 1" to 3" apart.				clay partings 1/4" to 1/2"
							core rec. 25.5 to 35.5 100%
34.4	25.5		Weathering decreasing with depth.				
							see over for Test Results
29.9	30.0						

BORING LOG

Location Coeburn, Virginia | Structure Dam Site | Comm. No. E97-2
Sheet 2 of 3
Geologist Geol. | Boring No. D-5
Contractor C.C.D. | Engineer / | Date 17 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 65.7 Rock 50.4 Wt of hammer 140# Av fall of ham 30" El of grd. water REMARKS
29.9	30.0						
28.8	31.1		very fine grained mod hard to hard slightly weathered lt. gray SANDSTONE. Tight and dense.				core rec. 25.5 to 35.5 100%
26.7	33.2						
24.4	35.5						
			Mod. hard lt. grey, slightly weathered thin bedded, SHALE. Clay partings 3 to 4 apart.				
19.9	40.0						
			No change in lithology				Core rec 35.5 to 45.7 100%
14.2	45.7						
							core rec. 45.7 to 55.7 100%
9.9	50.0						
8.9	51.0		slight increase in weathering between depth 51.0 Ft. and 55.2 Ft.				
4.7	55.2						
			No change in lithology				
							Core rec. 55.7 to 65.7 99%

BORING LOG

Location Cheat Canyon, Virginia
Structure Dam Site
Geologist [illegible]
Contractor C.C.D.
Engineer
Comm. No. 697-A
Sheet 3 of 3
Boring No. D-5
Date 17 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 65.7 Rock 50.4 Wt of hammer 140# Av fall of ham 30" El of grd. water REMARKS
94.9	60.0		Mod hard, D gray, slightly weathered, thin bedded SHALE.				Core rec. 55.7 to 65.7 99%
94.2	65.7		Bottom of hole				

El- 44.4 39.4
Test #1 (15.5 to 20.5)

10 psi. - 13.8 gpm.
17 psi (water) - 15.5 gpm.
10 psi. - 13.5 gpm.

El- 39.4
Test #2 20.5 to Bot. (65.7)

10 psi. - 10.8 gpm.
20 psi (water) - 14.5 gpm.
10 psi. - 11 gpm.

El- 39.4 - 34.4
Test #3 20.5 to 25.5

10 psi. - 9 gpm.
20 psi. - 13 gpm.
25 psi (water) - 16.3 gpm.
20 psi. - 12.5 gpm.
10 psi. - 9.8 gpm.

El- 34.4
Test #4 25.5 to Bot. (65.7)

10 psi. - 4 gpm.
20 psi. - 6.3 gpm.
30 psi. - 7.5 gpm.
20 psi. - 5.3 gpm.
10 psi. - 4.5 gpm.

El- 34.4 - 29.4
Test #5 (25.5 to 30.5)

10 psi. - 2.8 gpm.
20 psi. - 3.0 gpm
30 psi. - 4.0 gpm.
20 psi. - 2.8 gpm.
10 psi. - 2.5 gpm.

El- 29.4
Test #6 30.5 to Bot. (65.7)

10 psi. - 2.5 gpm.
20 psi. - 5.0 gpm.
30 psi. - 6.8 gpm.
20 psi. - 4.0 gpm.
10 psi. - 2.8 gpm.

BORING LOG

Location Coeburn, Va | Structure Dam Site | Comm. No. 897-A
Sheet 1 of 2
Geologist Bmj | Boring No. D-2a
Contractor C.C.D | Engineer | Date 6 June 1963.

Stratification Elevation	Depth	Legend	Description of Materials (Type, color & Consistency)	Sampler or Spoon Blows	Penetration	Sample No.	Misc. Data / REMARKS
							Lnth of hole 61.5'
							Rock 54.4'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water
56.2	0.0						REMARKS
			ALLUVIUM & OVERBURDEN. sand, silt, clay, cobbles & boulders. Boulders very				Hole offset 11.5 ft. from plans location see plans
			weathered, micaceous, coarse sandstone.				WT @ 72 hrs. - 22.5 ft. casing bit to. 48 ft.
51.4	4.8						core rec. 4.8 to 6.0' 75%
50.2	6.0		Lt. to med. gray gray, med. soft. to med. hard lightly weathered SHALE.				
49.1	7.1		Lt. to med. gray, med. hard, lightly weathered SHALE.				
							core rec. 6.0 to 11.0 98%
	10.0						
45.2	11.0						
							Core rec. 11.0 to 20.7 95%
			alternating med. soft to med. hard (@ 15')				
	20.0						
35.5	20.7						
32.3	23.9						
31.0	25.2		Lt. gray, weathered SHALE with clay partings				
			Lt. to med. gray, med. hard, lightly weathered SHALE				Core rec. 20.7 to 31.0 98%
28.9	27.3		Thinly bed. lt. gray SHALE.				
27.7	28.5		Med. weathered w/ clay partings				
26.2	30.0		Med. hard, thin bedded, lightly weathered SHALE				

BORING LOG

Location Cadburn, Va. Structure Dam Site Comm. No. 591-A

Sheet 2 of 2

Geologist [illegible] Boring No. D-6

Contractor C.C.D. Engineer ' Date 7 June, 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 61.5'
							Rock 54.4'
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water
26.2	30.0						REMARKS
25.2	31.0		badly broken, weathered, lt gray, med. soft SHALE, CLAY & Silt				core rec 30.7 to 31.0 96%
			thin bedded weathered gray SHALE				
23.9	32.3		Med hard, med gray lightly weathered SHALE.				lost circ. @ 33.5 ft.
22.1	33.5						
22.1	34.1		Hard, light, dense, lt gray, slightly micaceous, slightly weathered, fine grained SAND-STONE				core rec. 31.0 to 37.5 95.%
20.1	36.1		Med hard, med gray, lightly weathered thinly bedded lightly fractured SHALE				
18.7	37.5						
17.7	38.5		some fracturing along bedding plane. Thin (2") med. weathered areas.				core rec. 37.5 to 40.8 82%
	40.1						
15.4	40.6						core rec 40.6 to 41.3 60%
14.9	41.2						Core rec. 41.3 to 41.9
14.3	41.9			41.9	1 per 1"	HX Core	80% " "
13.9	42.3						42.3 to 43.3 - drill fell thru believed to be clay, sand & gravel.
12.9	43.3						
12.5	43.7		thin bedded, light lt. weathered gray, med. hard SHALE.				core rec. 41.9 to 46.0 77%
8.2	48.0						
							core rec. 46.0 to 52.3 83%
	51.1						severe polishing below piece. Tr of loss unkn.
3.9	52.3						
							core rec 52.3 to 57.5 97%
			No change in lithology				
98.1	57.5						
							core rec. 57.5 to 61.5 95%
	10.0						

BORING LOG

Location COEBURN, VA
Structure DAM SITE
Geologist [illegible]
Contractor C.C.D.
Engineer

Comm. No. 897-A
Sheet 1 of 3
Boring No. D-7
Date 18 JUNE 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 78.4' Rock 65.0' Wt of hammer 140# Av fall of ham 30" El of grd. water 66.7 REMARKS
2310.0	0.0						
			OVER BURDEN and RESIDUAL MATERIAL clay, sand, Boulders.				WT@12hrs. 26.3 fishtail to 6.2
03.6	6.2		very Badly weathered, very soft, lt. brown SHALE, plastic CLAY				Core rec. 6.2 to 11.8 73%
01.3 00.2	8.7 9.8		Badly weathered, broken, fractured black SHALE				
00.0	10.0		COAL and interbedded SHALE				
96.6	13.4		Very fine grained, dense, med. Hard, weathered, lt. gray SANDSTONE grading downward into SILTSTONE, CLAY Partings Some fossil content				Core rec. 11.8 to 21.3 82%
93.7	16.3		lt. to dk. gray, badly weathered, med. soft, badly fractured SHALE & CLAY				
91.8 90.9 90.0	16.2 19.1 20.0		Med. hard, slightly weathered, med. to coarse grained, lt. gray SANDSTONE lt. gray, weathered, soft, fractured SHALE and CLAY				
86.7 58.4	21.3 21.6		Clay seam 21.3 to 21.6				
86.4	23.6						lost circ. 23.6
54.9	25.1		fine to med. grain, lt. gray, med. hard SANDSTONE				Core rec. 21.3 to 31.3 91%.

BORING LOG

Location Cochran, Va. Structure Dam Site Comm. No. E97-A
Sheet 2 of 3
Geologist [illegible] Boring No. D-7
Contractor C.C.D. Engineer [illegible] Date 18 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data Lnth of hole 78.4' Rock 65.0' Wt of hammer 140 # Av fall of ham 30" El of grd. water 66.7
Elevation	Depth	Legend		Blows	Penetration		REMARKS
80.0	30.0						
78.7	31.3		fine to med grained, lt gray, med hard SANDSTONE Intermittent SHALE lenses				
							core rec. 31.3 to 39.2 96%
			No change in lithology				core in one piece 78
70.8	39.2						
70.0	40.0						
69.8	40.2						
			Med. soft to med. lt gray, thin bedded, slightly weathered SANDY SHALE.				
							core rec. 39.2 to 48.0 95%
							2 pcs. core. 4.6 5.2
62.0	48.0		Gradual increase in shale and decrease in sand with depth.				
60.0	50.0						
							core rec. 48.0 to 58.0 100%
52.0	58.0						
51.6	58.4		Plastic CLAY and very soft to soft, thinly bedded dk gray SHALE. Plugged barrel				core rec. 58.0 to 58.4 50%
50.0	60.0						

BORING LOG

Location Coeburn Va. | Structure Dam Site | Comm. No. E97-A
Geologist [illegible] | Sheet 3 of 3
Contractor C.C.D. | Engineer [illegible] | Boring No. D-7
Date 19 June 1963

Stratification			Description of Materials (Type, color & Consistency)	Sampler or Spoon		Sample No.	Misc. Data
Elevation	Depth	Legend		Blows	Penetration		Lnth of hole 78.4
							Rock 65.0
							Wt of hammer 140#
							Av fall of ham 30"
							El of grd. water 66.7
50.0	60.0		Med hard, thin bedded slightly weathered shale. Random particles of coal.				REMARKS
							Core rec. 58.4 to 68.4 100%
			Weathering decreases and hardness increases with depth.				
42.5	67.5		Vertical fracture				
41.6	68.4						
40.0	70.0						
							Core rec. 68.4 to 78.4 95.%
			No change in lithology				
31.6	78.4		T.D. Bottom of hole				

D-7

Test #1 18.5 to 23.5'
10 psi. — 0.0 gpm.
20 psi. — 0.3 gpm.
30 psi. — 1.0 gpm.
20 psi. — 0.3 gpm.
10 psi. — 0.0 gpm.

Test #2 23.5 to Bot. (78.4)
No pressure - 14.5 gpm.

Test #3 · 23.5 to 28.5
9 psi. - 12 gpm (pressure
fall off to zero)

Test #4 28.5 to Bot. (78.4)
10 psi. — 3.8 gpm
20 " — 5.5"
30 " — 6.5"
20 " — 4.0
10 " — 3.8

Test #5 13.5 to 18.5'
10 psi. - 1.3 gpm
18 (max) - 11.5" "
10 psi. — - 5.8 "

APPENDIX V - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. The Geology and Mineral Resources of Wise County and the Coal-Bearing Portion of Scott County, Virginia, Bulletin 24, J. Brian Eby, Virginia Division of Mineral Resources, 1923, 617 pp.
4. Section 4, Hydrology, Part 1 Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U. S. Department of Agriculture, 1964.
5. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D. C., April 1956.
6. Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau, Washington, D. C., May 1961.