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NATIONAL DAM SAFETY PROGRAM. EDMONDSON DAM (INVENTORY NUMBER VA--ETC(U)
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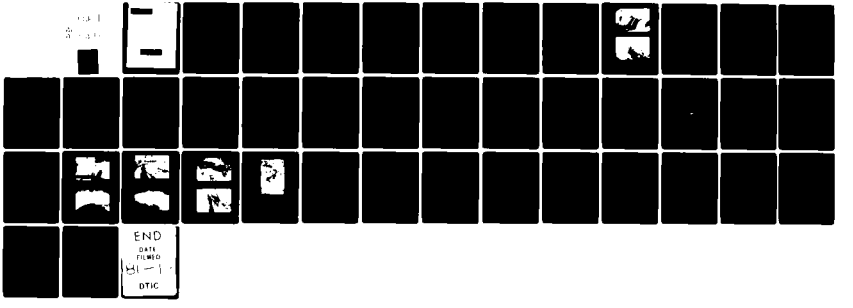

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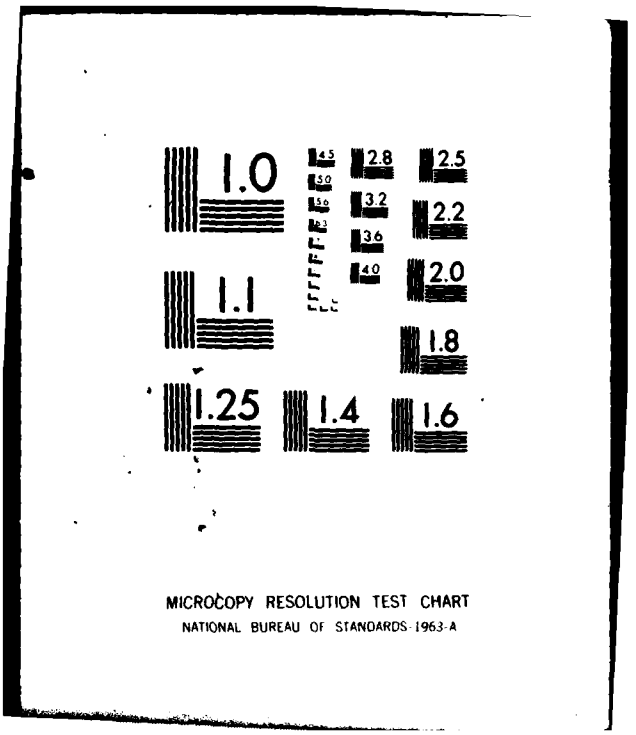
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20. Abstract

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.

(6) National Dam Safety Program.
Edmondson Dam

NAME OF DAM:
LOCATION: WASHINGTON COUNTY, VIRGINIA.
INVENTORY NUMBER: VA 19103
Tennessee River Basin

PHASE I INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

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

(9) Final rept., (11) Jul 84

(10) Jan - A. J. Walsh (12) 42

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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 the 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 continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. 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. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design 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.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Edmondson Dam
State:	Virginia
Location:	Washington County
USGS Quad Sheet:	Damascus, Va.
Stream:	Middle Fork Holston River
Date of Inspection:	5 June 1980

Edmondson Dam is a concrete gravity structure approximately 378 feet long and 47 feet high. The dam is owned and maintained by The Appalachian Power Company. The dam is classified as an intermediate size dam with a significant hazard classification. The dam is no longer used to generate power. The reservoir receives minimal recreation use.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the 1/2 PMF. The spillway will pass 17 percent of the PMF and 34 percent of the SDF without overtopping the top of the dam. The SDF will overtop the dam by a maximum 7.5 feet. The spillway is adjudged inadequate, but not seriously inadequate.

The dam is in poor condition. Seepage is passing through the dam at several locations. Approximately 50% of the downstream face of the dam is severely spalled. Calculations based on existing data indicate that the dam is stable with no safety factor when the SDF is applied.

Numerous sink holes and large amounts of seepage are located on the left abutment. These conditions represent a partial failure of the abutment. A complete failure of the left abutment could occur during flood conditions. A complete failure probably will occur unless corrective measures are taken.

Because of the unsafe condition of the dam during flooding and questions regarding the stability of the left abutment, the dam is classified unsafe non-emergency.

It is recommended that the owner, through his professional engineers, take the following action:

a. Within two months from the date of notification to the governor of the Commonwealth of Virginia, engage the services of a professional consultant or utilize his own professional engineering staff to determine the most advantageous method to eliminate the hazard posed by the dam.

b. Within 6 months of the notification to the Governor, the professional engineer's or consultant's report of appropriate remedial measures shall be complete. When the professional engineer's or consultants's report is completed, the owner should enter into an agreement with the Commonwealth of Virginia for a reasonable time frame in which recommended remedial measures will be complete.

c. Immediately develop an interim emergency operations plan and warning system. The emergency operation plan should require around-the-clock surveillance of the dam during periods of unusually heavy rainfall.

d. Inspect the left abutment monthly and additionally after periods of high water.

Submitted By:

Original signed by
JAMES A. WALSH

JAMES A. WALSH, P. E.
Chief, Design Branch

Approved:

Original signed by:
Douglas L. Haller

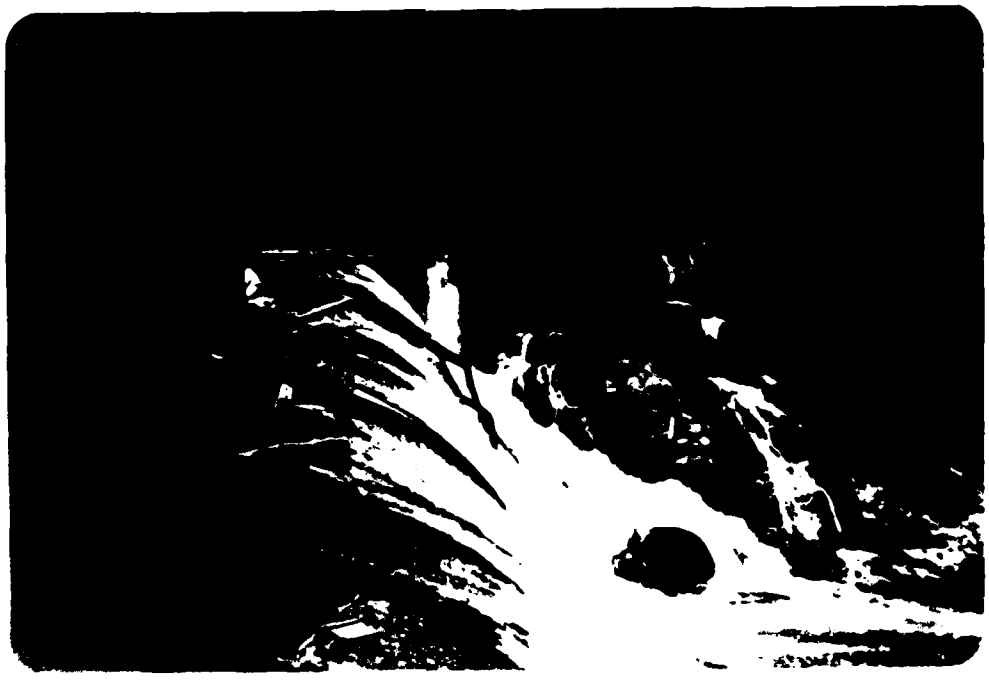
DOUGLAS L. HALLER
Colonel Corps of Engineers
District Engineer

Date: SEP 19 1980

Recommended By

Original signed by
JACK G. STARR

JACK G. STARR
Chief, Engineering Division



EDMONSON DAM
OVERALL VIEWS

5 JUNE 1980

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 (Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Edmondson Dam is a concrete gravity dam approximately 378 feet long and 47 feet high with the crest of the dam at elevation 1885 feet msl. The dam was constructed with nearly a 90 degree bend at the left abutment so the abutment could be tied into rock. The right side of the dam (crest of dam) serves as an operating platform for two 8 foot square control gates. These gates governed flow through the penstock to the generators located in the power house at the right abutment. The generators have been removed and these gates are now the only means of controlling reservoir releases of Edmondson Dam.

The spillway, at elevation 1876.5, extends from the left abutment to within 100 feet of the right abutment. The portion of the spillway perpendicular to the flow of the river consists of a 15'-6" radius at the crest which is tangent to the downstream face of the dam. The rest of the spillway allows vertical discharges.

A gate of unknown size is located between the powerhouse intake and the right side of the spillway.

1.2.2 Location: Edmondson Dam is located on the Middle Fork Holston River about 10 miles east of Abingdon, Virginia, near Camp Pocahontas.

1.2.3 Size Classification: The dam is classified as an intermediate size dam.

1.2.4 Hazard Classification: The dam is located 1 mile upstream of State Route 803 and 2 miles upstream of two houses. Therefore, a significant hazard classification is given for this structure according to guidelines contained in Section 2.1.2 of Reference 1, Appendix IV. The hazard classification used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: Appalachian Power Company.

1.2.6 Purpose: The dam was originally designed for power generation, however, generating capability was removed in 1963. The reservoir is now only used for recreation.

1.2.7 Design and Construction History: The dam was constructed to a height of 20 feet by Edmondson Brothers Construction and completed in 1921. The dam was later raised to a height of 38 feet. The original designer in unknown. A cross-section, dating from 1925, was found for a 38-foot high dam. It is probable that engineering for raising the dam was performed by William C. Whitner and Co., Inc.

1.2.8 Normal Operational Procedures: Water passes automatically over the spillway. Gates are not normally operated.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of about 209 square miles.

1.3.2 Discharge at Dam Site: Maximum flood - A discharge of 12,500 cfs was recorded November 7, 1977, at the streamgage (USGS Station 347500) located about 1 mile downstream of the dam.

Pool level at top of dam

Spillway . . . . . 24112 cfs

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet msl	Reservoir Capacity Area, acres	Acre, feet	Watershed, inches	Length miles
Top of Dam	1885	124.9	2620	.24	4.35
Spillway Crest	1876.5	87.2	1613.2	.14	3.50
Streambed	1838±	-			

SECTION 2

ENGINEERING DATA

2.1 Design: No design data is available.

The dam has been inspected regularly by Appalachiam Power Company personnel; detailed records of these inspections were not available.

Available information on the dam is listed below:

a. Report on Dam Safety Inspection, Edmondson Dam, Damascus, Virginia. Prepared by Woodward-Clyde Consultants, Clifton, New Jersey, dated 18 July 1978.

b. Cross section of dam titled: "Section of Dam, Edmondson Electric Co." prepared by William C. Whitner and Co., Inc., Cons. Engineers, Richmond, Virginia, dated 2 May 1925.

c. Drawing dated 22 April 1980, titled: "Edmondson Dam 'As-Built' Configuration Plan and Sections", prepared by: American Electric Power Service Corp., Survey and Mapping Section.

2.2 Construction Records: No construction records are available.

2.3 Evaluation: The available cross section is adequate to perform preliminary evaluation of the overflow section for overturning and sliding. A partial list of further engineering data which would be required for a full evaluation of the dam is listed below.

a. Further investigations of the dam to determine concrete quality and strength.

b. Cross-sections of non-overflow portions of the dam to evaluate structural stability.

c. A detailed study of site geology including subsurface investigation with particular attention to the left abutment.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 5 June 80 inspection are recorded in Appendix III. At the time of the inspection, the pool elevation was 1876.7, slightly above the crest of the dam. The weather was fair with a temperature in the 70's.

Edmondson Dam was previously inspected on 1 June 1978 by Woodward-Clyde Consultants. Their report, titled "Report on Dam Safety Inspection, Edmondson Dam, Damascus, Virginia", revealed the following major deficiencies:

a. A series of deep sinkholes were found on the left abutment. Considerable seepage was occurring through the left abutment.

b. Concrete on the downstream face of the dam was deeply pitted and spalled. The Woodward-Clyde report stated, however, that detailed observation of the downstream face of the dam was somewhat obscured by water flowing over the dam.

3.1.2 Dam: The dam is in generally poor condition. Seepage is passing through the dam from six distinct locations near the left abutment. Seepage points are located approximately 10 feet above the sill at the toe of the dam (see Photo #1). Seepage immediately adjacent to the power house is from a gated outlet passing through the dam. Total flow through these six seeps was estimated to be approximately 50 gpm. Other minor seeps were observed on the face of the dam, however, approximately 70% of the overflow portion of the dam could not be observed due to flowing water.

The pool level was lowered during the winter of 1980. Photographs taken of the downstream face of the dam revealed that significant seepage through the dam is also occurring near the center of the river, approximately 10 feet above the sill at the toe of the dam (see Photo #2).

Considerable seepage is also occurring at the non-overflow section of the dam behind the powerhouse. The origin of this seepage could not be determined due to overburden between the dam and powerhouse. Seepage behind the powerhouse is estimated to be 30 gpm.

The lower half of the downstream face of the dam is severely spalled. The average depth of spalling is approximately 6 inches. The maximum depth is estimated to be two feet. This large amount of spalling is due, in part, to the construction methods used for the dam. Large filler stone appears to

have been placed in the concrete. It is unknown whether this stone was placed in the concrete or merely random dumped. It is possible that the stone was initially placed and then covered with concrete. The appearance of the spalled areas suggests that voids may be present in the dam.

The vertical and horizontal alignment of the dam appears normal and no sign of movement was observed.

Structure to abutment contacts were tight with no sign of movement. Minor seepage was dripping at the contact 15 feet from the left edge of the dam. A 1-foot by 2-foot hole was observed on the top of the dam at the left abutment rock contact.

Seepage of approximately 10 gpm is occurring at two locations on the right abutment rock contact. One of these seeps is located approximately 40 feet from the right abutment. The other is located near the corner of the powerhouse, approximately 50 feet from the right abutment.

3.1.3 Foundation and Abutments:

Edmondson Dam is located within the Valley and Ridge physiographic province of Virginia. This area is characterized by broad rolling hills and lowlands of limestone and dolomite and by dissected ridges of shale and sandstone. The regional trend of the ridge is northeast-southwest. Portions of the limestone terrain are characterized by numerous sinkholes, subterranean streams and caves.

Bedrock consists of limestone, dolomite, and small outcrops of sandstone. It is believed these rocks belong to either Beekmantown or Conococheague formation of Ordovician and Cambrian age. The bedding of the rock in the vicinity of the dam dips to the southeast at an angle of 60° and strikes north 60° east. Jointing is present along the bedding planes and perpendicular to the bedding with a strike of north 25° west.

Inspection of the left abutment revealed numerous deep, apparently recent (Photo #7) sinkholes that have developed in the abutment. Approximately 9 sinkholes were sighted; the largest of these is about 200 feet long, 100 feet wide, and 25 feet deep. The series of sinkholes are aligned in a southwest direction so that they form a trough through the left abutment. The upstream end of the series of sinkholes is connected to the reservoir approximately 300 feet upstream of the dam. Flow visually estimated at 20 gallons per minute was observed entering the upper sinkhole. Located at the downstream end of the alignment of sinkholes is a subterranean spring surfacing at river level. Flow from the spring was visually estimated at 50 gallons per minute.

A smaller subterranean spring was observed on the crest of the abutment and is believed to be contributing flow to the numerous springs downstream of the dam. Several springs were observed downstream of the dam with flows estimated at 10 gallons per minute. Two clear flowing seeps (Photos #5 & 6) were found emerging from the open joints in the exposed limestone along the

downstream face of the abutment. Flow from the largest of these was estimated at 100 gallons per minute. Refer to plate I, Appendix I for location of sinkholes, subterranean springs, and seeps.

No visual deterioration or erosion was observed on the right abutment.

There was no visual evidence of settlement along the dam alignment during the inspection.

There was no visual evidence of movement along the dam alignment that may indicate sliding had occurred.

3.2 Evaluation

The development of sinkholes and uncontrolled bypassing of water through the left abutment indicates the left abutment is unstable.

There was no visual evidence for instability of the foundation or right abutment.

Deterioration of the downstream face of the dam is severe. This condition should be corrected.

No evidence of dam instability was observed during the visual inspection of the dam.

Seepage through the dam, if allowed to continue, will cause further deterioration of the structure.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The normal pool is elevation 1876.5, which is the crest of the spillway. The reservoir provides recreation for residents living upstream of the dam. Water passes automatically over the spillway as the reservoir pool rises above the spillway crest. Two 8-foot by 8-foot gates leading to the powerhouse can be operated to release water from the reservoir. An attempt to lower the pool during the winter of 1980 was foiled when debris clogged the trash rack covering the intakes to the gates.

4.2 Maintenance: There is no regular maintenance program for Edmondson Dam.

4.3 Warning System: There is no warning system or evacuation plan for Edmondson Dam.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, regular visits to the dam should be made to help detect and control problems as they occur. As a minimum, the left abutment should be inspected monthly and additionally after periods of high water. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: None were available.

5.3 Flood Experience: A discharge of 12,500 cfs was recorded November 7, 1977, at the streamgage (USGS Station 347500) located about 1 mile downstream of the dam.

5.4 Flood Potential: The 1/2 PMF and PMF hydrographs were developed and routed through the reservoir by use of the HEC-IDB computer program (Reference 2, Appendix IV) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's TC and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from a U. S. Weather Bureau Publication (Reference 3, Appendix IV).

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 5.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Rating curves were developed for the spillway and the nonoverflow section of the dam. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at elevation 1876.5. Flow through the gates and seeps were not included in the routings.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal Flow	Hydrograph 1/2 PMF	PMF 1/
Peak flow, cfs			
Inflow	237	69,509	139,018
Outflow	237	69,168	138,426
Maximum elevation feet, msl	1876.0	1892.45	1901.10
Nonoverflow section elevation 1885.0			
Depth of flow, feet	-	7.5	16.1
Duration, hours	-	28	38
Velocity fps 2/	-	13.2	19.3
Tailwater Elevation feet msl	1838±	1865.0	1875.8

1/ The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

2/ Critical Velocity

5.7 Reservoir Emptying Potential: There is no means of dewatering the reservoir completely. Two 8-foot by 8-foot gates and a smaller gate (unknown size) are located below the normal pool elevation. One attempt to lower the pool recently was foiled when debris clogged the trash rack covering the intakes. With an average inflow of 237 cfs, it would be very difficult to lower the pool substantially.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant) the recommended Spillway Design Flood (SDF) is the 1/2 PMF to the PMF. Because of the risk involved, the 1/2 PMF has been selected as the SDF. The spillway will pass 17 percent of the PMF or 34 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum 7.5 feet, reach an average critical velocity of 13.2 fps, and flow over the dam for 28 hours.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

DAM STABILITY

6.1 Stability Analysis: A preliminary stability analysis was performed based on a sketch by William C. Whitner & Co., Inc., Cons. Engineers, Richmond, Virginia, dated 2 May 1925. The sketch is titled "Section of Dam, Edmondson Electric Co." (see Plate II). The results of this analysis indicate that the dam is stable under normal conditions with reservoir level at the crest of the dam. When the spillway design flood is applied, however, the dam is on the verge of overturning failure with no margin of safety. Results of the stability analysis are summarized in Table 6.1. The spillway design flood, using present day criteria, is considered to be the 1/2 PMF for this structure (see Section 5.8). Since no original calculations are available, the basis of design is unknown.

6.2 Foundation and Abutment:

Numerous bedrock outcrops were exposed in the downstream river channel, downstream river bluffs, and abutments. The bedrock consisted of limestone, cherty limestone, dolomite, and sandstone. The rocks were slightly to non-weathered and jointed. The observed joints in the left abutment have a steep dip and a southwest trend.

Thin deposits of alluvium consisting of sediments ranging from clay to boulders were overlying the bedrock on the flood plain.

No evidence of settlement of the dam was noted during the inspection. Settlement should not occur since the dam is founded on bedrock.

The series of sinkholes and the existence of subterranean springs in the left abutment affects the stability of the abutments. This bypassing of water through the abutment is probably contributing to sinkhole enlargement.

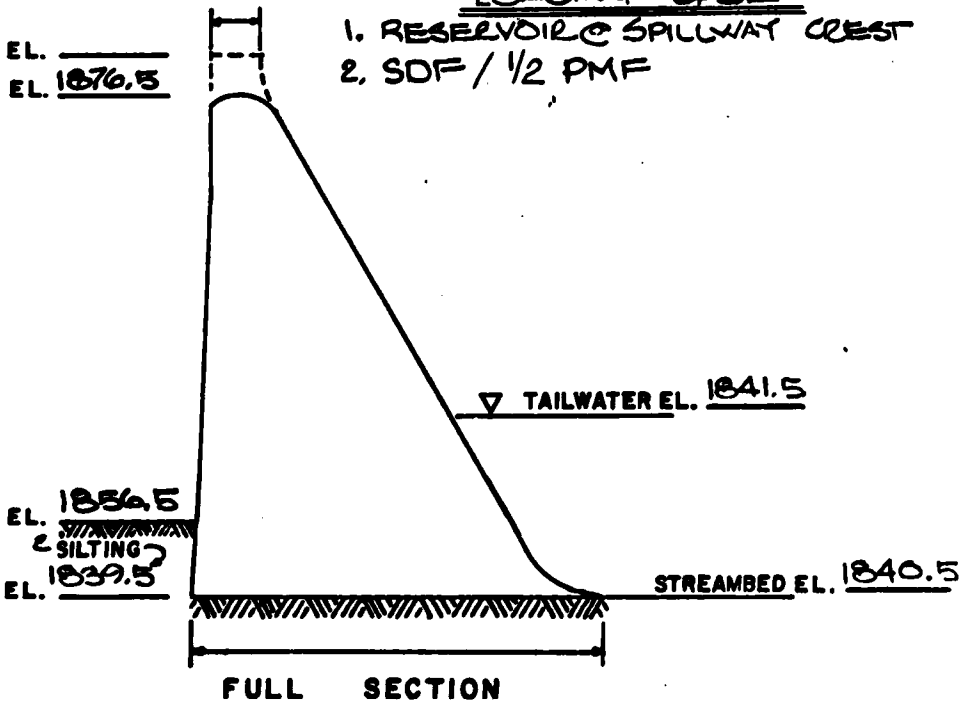
6.3 Evaluation: The development of deep sinkholes in the left abutment and bypassing of water through the abutment constitutes a partial failure of the dam. Due to the present condition of the left abutment and the presence of soluble limestone and dolomite, the possibility of complete failure of the abutment seems likely. Failure does not seem imminent based on conditions observed during this inspection, however, additionl geologic investigations are needed. The observed existing conditions indicate that a complete failure of the abutment could occur during or after high water. Since the spillway portion of the dam is stable with no safety factor under SDF loading and the left abutment is seriously deteriorated, the dam is considered to be unsafe during flood conditions.

GRAVITY DAM DESIGN
STABILITY ANALYSIS

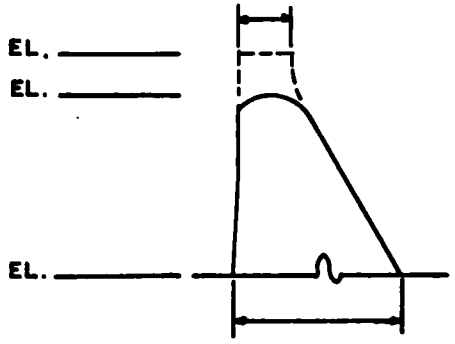
ANALYSIS DONE ON ✓ FULL SECTION ___ PARTIAL SECTION
LOCATION OF SECTION SPILLWAY/OVERFLOW SECTION OF DAM
ANALYSIS PREPARED BY NORFOLK DISTRICT CORPS OF ENGINEERS

LOADING CASE	ELEV. HEAD WATER	ELEV. TAIL WATER	ΣV	ΣH	ΣH/ΣV	LOCATION RESULTANT FROM TOE	% BASE IN COMPRESSION	FACTOR SAFETY SLIDING	FOUNDATION PRESSURE	
									TOE	HEEL
1	1876.5	1841.5	79.7 K	47.6K	0.6	16.4FT.	100%	2.6	39PSI	22 PSI
2	1892.5	1865.0	49.9K	64.3K	1.3	2.5FT.	12%	1.5	-	-

LOADING CASE
1. RESERVOIR @ SPILLWAY CREST
2. SDF / 1/2 PMF



FULL SECTION



PARTIAL SECTION

TABLE 6.1

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: Corps of Engineers guidelines indicate the appropriate Spillway Design Flood (SDF) for an intermediate size and significant hazard dam is 1/2 PMF. The spillway will pass 17 percent of the PMF and 34 percent of the SDF without overtopping the dam. The SDF will overtop the non-overflow section of the dam by 7.5 feet. The spillway is adjudged inadequate but not seriously inadequate.

Edmondson dam is in poor condition. Extreme amounts of seepage are passing through the left abutment. Numerous sinkholes were noted on the left abutment, and if no remedial work is performed, a complete abutment failure may occur. A stability analysis of the spillway section based on available engineering data was performed. This analysis indicates that during flood conditions of 1/2 PMF the dam is on the verge of failure with no margin of safety. For this reason, as well as the poor condition of the left abutment, the dam has been assessed as "unsafe non-emergency".

7.2 Recommended Remedial Measures:

7.2.1 It is recommended that within two months from the date of notification to the Governor of the Commonwealth of Virginia, the owner engage the services of a consultant or utilize his own professional engineering staff to determine the most advantageous method to eliminate the hazard posed by the dam. Studies should be performed in accordance with Reference 1, Appendix IV, Recommended Guidelines for Safety Inspection of Dams. The first priority for further study should be to determine by more sophisticated methods and procedures the Spillway Design Flood appropriate for this project and the dam's ability to withstand all loading conditions up to and including the 1/2 PMF. The study should include a detailed evaluation of the downstream flood plain as it relates to the hazard potential and the Spillway Design Flood appropriate for this dam. Remedial measures to be considered include modifications to the dam, left abutments, floodplain and/or any other method of eliminating the danger imposed by the project.

7.2.2 It is recommended that additional investigation address the stability of the left abutment and include the following:

a. Subsurface conditions between the concrete structure and rock

b. Rate of soluability of the limestone and dolomite.

c. Rate of sinkhole development

d. Mapping of jointing and bedding planes in the rock

e. Mapping of cavities and springs in the abutment

f. Determine fluctuation of ground water level

7.2.3 Within 6 months of the notification to the Governor, the professional engineer's or consultant's report of appropriate remedial measures shall be complete. At that time, the owner should enter into agreement with the Commonwealth of Virginia for a reasonsable time frame in which recommended remedial measures will be completed. In the interim, a detailed emergency operation plan and warning system should be promptly developed. The emergency operation plan should include the following:

a. Around-the-clock surveillance of the dam during periods of unusually heavy rainfall.

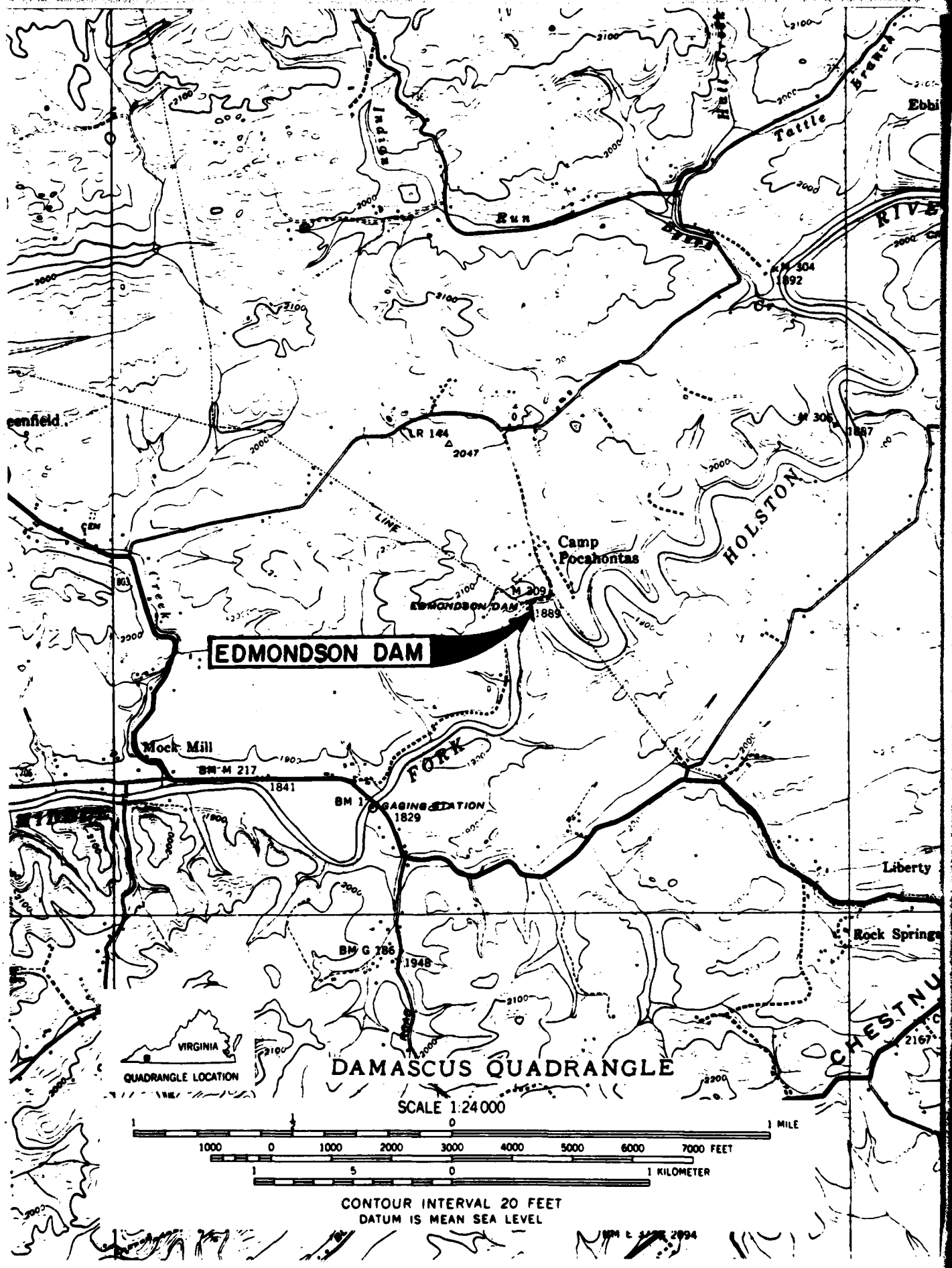
b. How to operate the dam during an emergency.

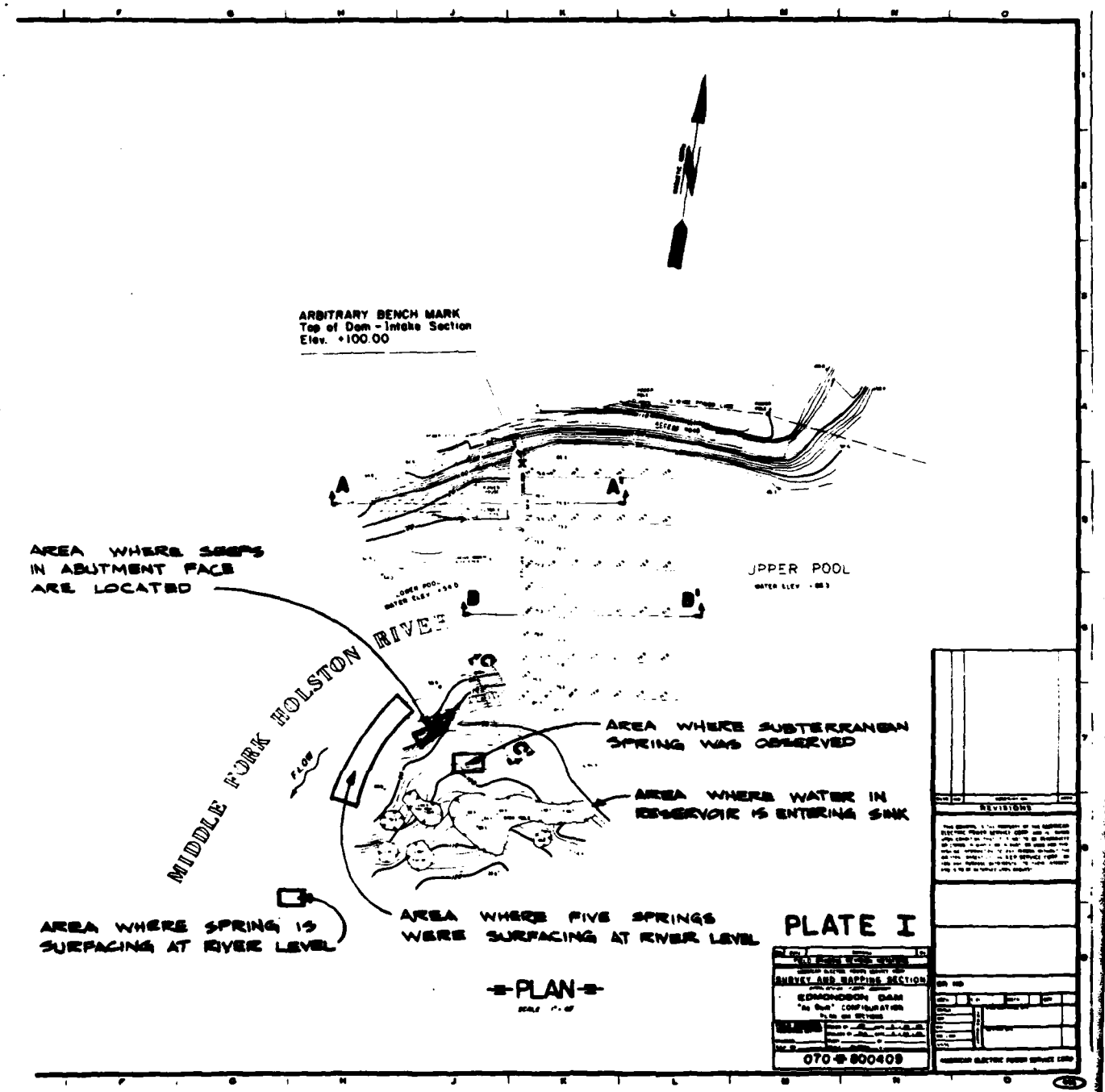
c. Who to notify, including public officials, in case evacuation of the downstream area is necessary.

7.2.4 The left abutment should be inspected monthly and additionally after periods of high water.

APPENDIX I

MAPS AND DRAWINGS


EDMONDSON DAM
Camp Pocahontas
Mock Mill
BM M 217
1841
BM 1
GAGING STATION
1829
BM G 786
1948
LR 144
2047
M 309
1889
M 304
1892
M 306
1887
Indian Run
Tattle Branch
HOLSTON
FORK
Liberty
Rock Spring
VIRGINIA
QUADRANGLE LOCATION
DAMASCUS QUADRANGLE
SCALE 1:24000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL


ARBITRARY BENCH MARK
Top of Dam - Intake Section
Elev. +100.00
A
A'
B
B'
UPPER POOL
AREA WHERE SEEPS IN ABUTMENT FACE ARE LOCATED
MIDDLE FORK HOLSTON RIVER
FLOW
AREA WHERE SUBTERRANEAN SPRING WAS OBSERVED
AREA WHERE WATER IN RESERVOIR IS ENTERING SINK
AREA WHERE SPRING IS SURFACING AT RIVER LEVEL
AREA WHERE FIVE SPRINGS WERE SURFACING AT RIVER LEVEL
PLATE I
PLAN
REVISIONS
SURVEY AND MAPPING SECTION
EDMONDSON DAM
070-800409

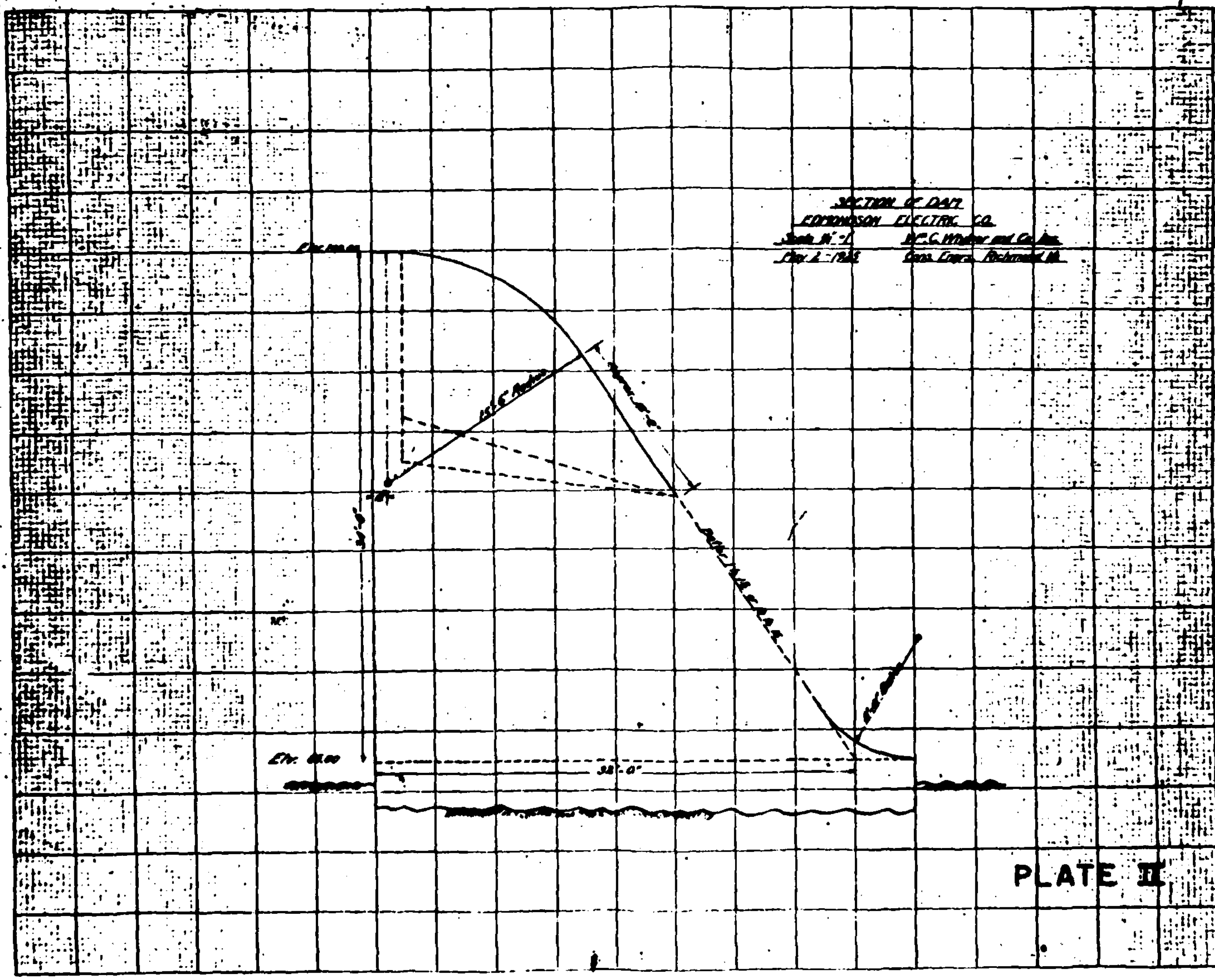


PLATE II

APPENDIX II

PHOTOGRAPHS

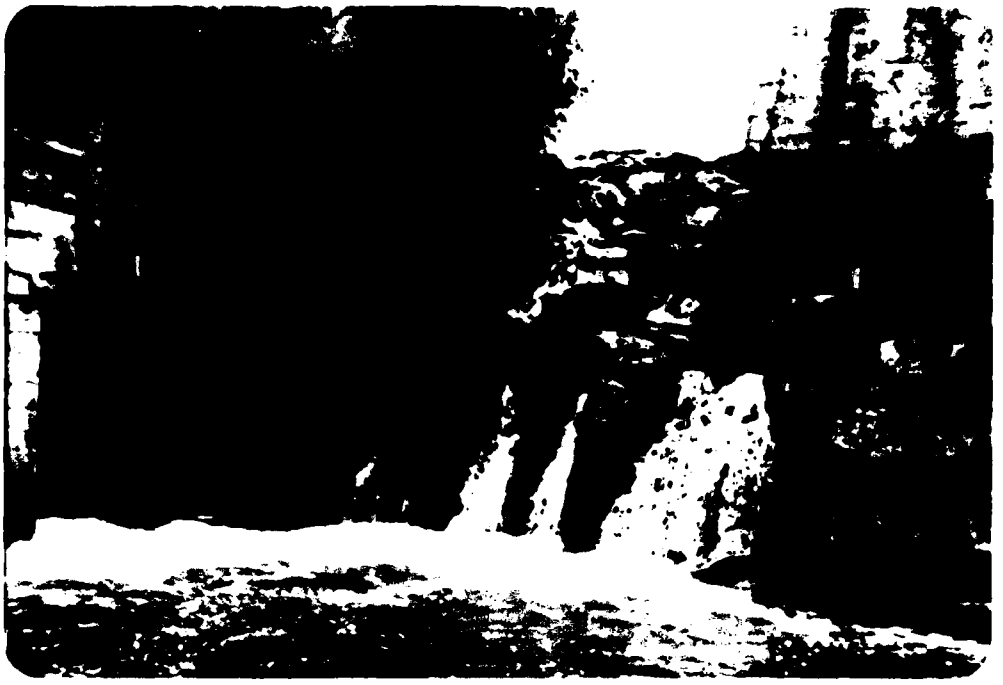


PHOTO #1 SEEPAGE NEAR POWERHOUSE

PHOTO #2 SEEPAGE THRU DAM DURING LOWERED POOL CONDITION. (PHOTO BY APCO)

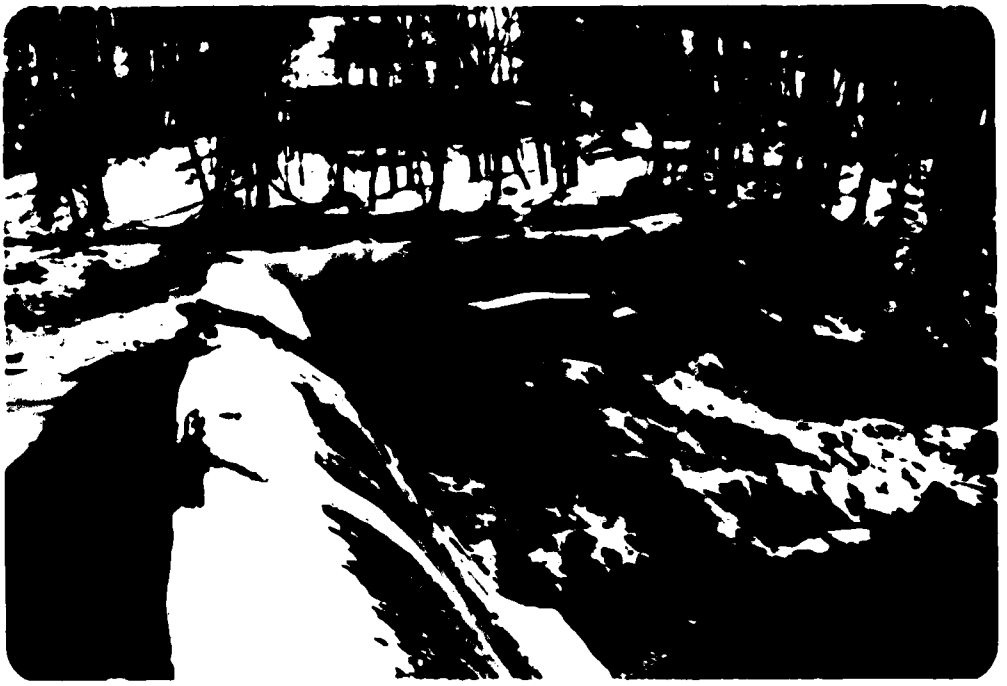


PHOTO # 3 VIEW OF LEFT ABUTMENT. NOTE SINK HOLES IN TREE LINE BEYOND. (PHOTO BY APCO)

PHOTO # 4 TRASH SCREENS DURING LOWERED POOL CONDITIONS. (PHOTO BY APCO)

PHOTO # 5 SEEPAGE OUT OF LT. ABUTMENT BEYOND CONTACT OF DAM AND ABUTMENT.

PHOTO # 6 SAME AS PHOTO # 5, DIFFERENT ANGLE

PHOTO # 7 TYPICAL SINKHOLE
IN LEFT ABUTMENT.

APPENDIX III

FIELD OBSERVATIONS

Check list
Visual Inspection
Phase I

Name Dam: Edmondson Dam **County:** Washington **State:** VA **Coordinates:** Lat 3643.3 Long 8148.6

Date Inspection: 5 June 80 **Weather:** Clear **Temperature:** 70's F.

Pool Elevation at Time of Inspection: 1876.7 **Tailwater at Time of Inspection:** 1838±

Inspection Personnel:

Corps of Engineers
Boris Taran, Dam Safety
Meade Stith, Structural
Jerry Swean, Geotechnical
Dave Pezza, Geotechnical
Jim Robinson, Hydrology

State Water Control Board
Leon Musselwhite

Appalachian Power Company
C. Michael Thacker, Hydro Engineer
Joe C. Plunk, Hydro Generation

Robinson, Stith, & Swean Recorders

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE/LEAKAGE	Considerable seepage through the dam was observed near right abutment and left of the powerhouse. This was occurring at six separate seeps located within 20 feet of the powerhouse approximately 10 feet above the sill on the D/S toe. Seepage closest to the powerhouse is from the gated outlet passing through the dam at this point. Estimated 50 gpm total from the six seeps.	Further investigation should be accomplished to determine concrete condition, dam construction, and most economical method of reapir. Seepage should be corrected.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Left Abutment: Rock/concrete contact is tight with no sign of movement. Minor seepage is dripping approximately 15 feet from the left end of the dam. A 1-foot x 2-foot hole is located at the top left end of the dam. Right Abutment: Location of seeps follow: Rock/concrete contact 40 feet from right abutment extimated 10 gpm. Rock/concrete contact 50 feet from right abutment near the powerhouse estimated 10 gpm. Additional seepage was coming from the overburden located between the dam and powerhouse This water was flowing from behind the powerhouse and its exact origin in unknown. Seepage estimated at 30 gpm.	Clean out debris and overburden between powerhouse and dam to examine rock contact. All seepage should should be monitored.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	The downstream lower half of the dam is severely eroded and spalled. The average depth of spall was estimated to be 6". Maximum depth of spall was estimated to be approximately 2 feet. Large rocks were noted in the concrete. The dam may be a form of rock masonry construction with concrete overlay or these stones may have been placed in the concrete as filler.	Correct spalled conditions.
STRUCTURAL CRACKING	No significant structural cracking was observed, however, the large amount of spalling would have made cracks difficult to observe if they exist.	None.
VERTICAL AND HORIZONTAL ALIGHMENT	No unusual conditions are apparent. No evidence of movement was observed.	None.
MONOLITH JOINTS	None were observed. Concrete formwork is visible but no joints could be seen.	None.
CONSTRUCTION JOINTS	None were observed.	None.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEFT ABUTMENT	A series of sinkholes have developed in the abutment. Water is flowing into the upstream sinkhole. Flow was estimated at 20 gallons per minute. Sinkholes appear to be recently developed. Little vegetation was found on sides of sinkholes. Trees that have fallen are still covered with green foilage. A large spring is located at the downstream end of the line of sinkholes. Nine sinkholes were observed. A subterranean spring is located on the crest of the abutment. Two clear flowing springs were found in left abutment face. The largest spring was flowing at 100 gallons per minute. Five springs were located downstream of the dam surfacing at river level. Flow was estimated at 10 gallons per minute. The left abutment consists of limestone medium bedded and jointed. Two sets of joints were present. Jointing along bedding planes had a 3.8' spacing. Jointing perpendicular to bedding was spaced at 4.8'. Joints are open and continuous. Rock appears slightly to non weathered. Bedding dips 60° to southeast with a strike of north 25° west.	
RIGHT ABUTMENT	No visual evidence of leakage was observed through the abutment. Further investigation downstream revealed no seeps or springs.	

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The crest of the concrete spillway is deteriorated with cracking and spalling across the entire length. Debris is lodged on the crest. For additional observations regarding the overflow portion of the dam, see Concrete/ Masonry Dams section.	The debris should be removed.
APPROACH CHANNEL	A survey in 1980 indicated that silt has accumulated to a depth of approximately 15 feet upstream of the dam. Some tree debris is located immediately upstream of the dam.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Due to the height of water in the reservoir and the discharge in the area of the powerhouse the concrete surface could not be observed on the inlet and outlet areas.	None.
INTAKE STRUCTURE	Two 8-foot by 8-foot gates are located on the left side of the dam that discharge into the powerhouse. Two turbines were operated to produce power until the early. 1960's. Trash racks consist of vertical bars spaced 2' o.c. which became clogged with leaves and debris during dewatering of the dam during the winter of 1980. The trash racks required continuous maintenance to allow racks to pass sufficient flow to partially dewater the dam.	Siltation and debris in the vicinity of the intake would have to be removed to operate the dam for power generation.
OUTLET STRUCTURE	There was flow during the inspection from the outlets of the old turbine exit pipes. The reservoir was lowered at one time and the gates did not seal properly, thus allowing flows to pass downstream. Concrete in the powerhouse foundation appears to be poor quality. A large amount of aggregate is exposed on the river side of the foundation.	None.
MISCELLANEOUS	An opening located to the left of the powerhouse approximately 2-foot square appears to be an outlet to lower the reservoir. A tree is growing in the opening of the exit end of the outlet.	The tree should be removed from the outlet opening.

RESERVOIR

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The river meanders approximately 38 miles with slopes varying from mild to steep. Most reservoir slopes are heavily wooded with some urban development.	None.
SEDIMENTATION	A survey by the owners in April 1980 showed that silt has accumulated to a depth of approximately 15 feet upstream of the dam. The water depth at the dam remains about 20 feet.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is wide and rock lined. Some debris has collected below the dam along the bank slopes from past floods. The natural rock channel allows little obstructions due to trees and shrubs.	None.
SLOPES	The downstream channel slopes vary from mild to steep with most areas heavily wooded.	None.
POTENTIAL DOWN-STREAM HAZARD AREAS (HOMES, BUSINESSES, ETC.)	State Route 803 crosses the Middle Fork Holston River about 1 mile downstream of the dam. One home is located about 2 miles below the dam.	None.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	No instrumentation was observed.	

APPENDIX IV

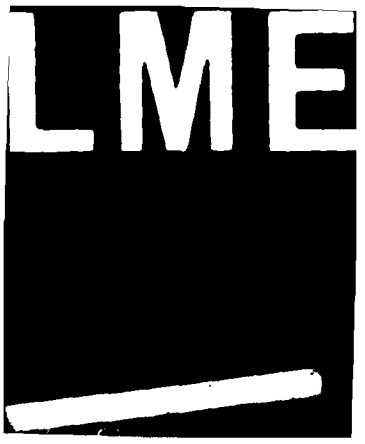
REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, September 1978.)

3. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, (U. S. Weather Bureau, June 1978).

4. "Rainfall Frequency Atlas of the Unites States", Technical Paper No. 40, (U.S. Weather Bureau, May 1961).


LME