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NATIONAL DAM SAFETY PROGRAM, CRAB ORCHARD CREEK DAM (INVENTORY --ETC(U)
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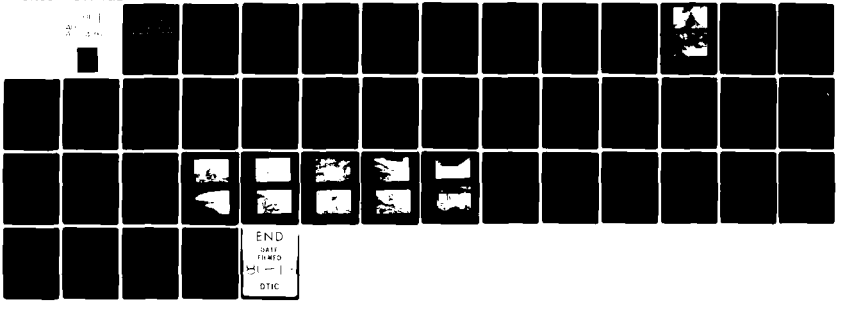

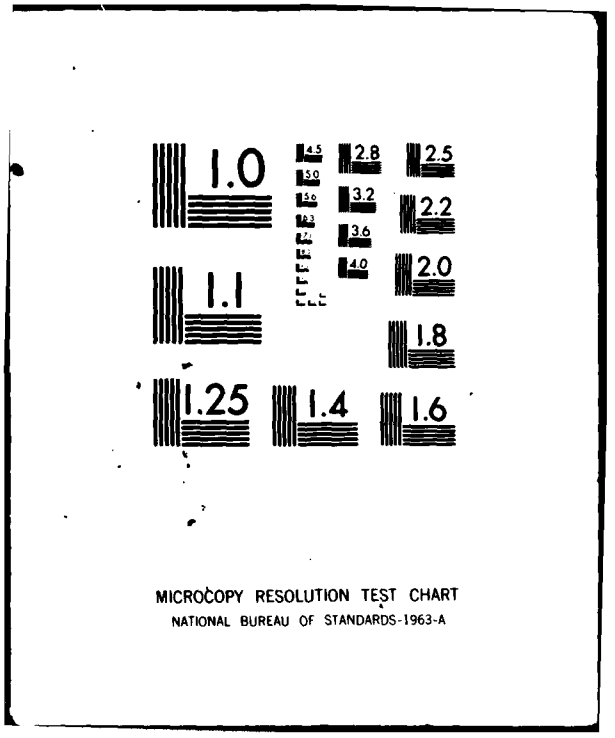
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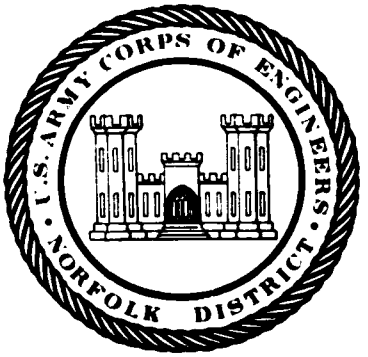
NEW RIVER BASIN

(1)

Name Of Dam: CRAB ORCHARD CREEK
Location: BLAND COUNTY
Inventory Number: VA. 02102

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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

JULY 1980

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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.

NAME OF DAM: CRAB ORCHARD CREEK Dam

~~LOCATION: [redacted] VIRGINIA~~

INVENTORY NUMBER: VA 02102, New River Basin,

Bland County, Virginia.

PHASE I INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

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TABLE OF CONTENTS

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:	Crab Orchard Creek
State:	Virginia
Location:	Bland County
USGS Quad Sheet:	Big Bend, Virginia
Stream:	Crab Orchard Creek
Date of Inspection:	4 June 1980

The Crab Orchard Creek Dam is an earthfill structure 510 feet long and 50.5 feet high. The dam is owned and maintained by Mr. Ronald A. Clyborne of Bluefield, West Virginia. The dam is classified as an intermediate size dam with a significant hazard classification. The principal spillway is a concrete drop-inlet connected to a concrete pipe passing through the dam at low level. The emergency spillway is an open channel cut into natural rock located at the left abutment. The reservoir is used for recreation.

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 spillways will pass 13 percent of the PMF or 26 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum 2.86 feet, reach an average critical velocity of 8.0 feet per second and flow over the dam for 6.5 hours. Flows overtopping the dam during the SDF are considered detrimental to the embankment. The spillways are adjudged seriously inadequate and the dam is assessed as unsafe non-emergency.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

It is recommended that within 2 months from the date of notification to the Governor of the Commonwealth of Virginia, the owner engage the services of a professional consultant to perform the following:

a. Determine by more sophisticated methods and procedures the adequacy of the spillway. The study should include a more detailed study of the Spillway Design Flood appropriate to this dam. Remedial measures to be considered include modification to the dam, spillway, flood plain, and for any other method of eliminating the danger imposed by the project.

b. Perform a stability analysis of the embankment for the long term steady seepage condition. Also, if the emergency gate is ever to be made operable, then a stability check of the upstream slope for a sudden drawdown condition is required.

Within 6 months of the notification to the Governor, the professional consultant's report of appropriate remedial mitigating measures should have been completed and the owner should have an agreement with the Commonwealth of Virginia for a reasonable time in which all remedial measures will be complete. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

The inspection also revealed several other items that require attention. The following items should be scheduled as part of an annual maintenance program:

a. Dress the gully at the right abutment contact with compacted fill and seed the area.

b. Trim the downstream slope of brush. Cut all trees to the ground. Remove the root structures of all trees greater than 3-inches in diameter. Dress all excavations with compacted fill and seed.

c. Seed the whole crest and the sparsely vegetated portion of the embankment right of the principal spillway.

d. Maintain regular inspection of the seep on the right downstream abutment. Should flow suddenly increase and/or become turbid without explanation contact a geotechnical engineering consultant for further evaluation.

e. Remove the debris from around the fence and cage protecting the intake structure, and along the upstream slope.

f. Install a staff gage in the reservoir to extend to the top of the dam to measure pool elevation.

g. Remove the pine tree fallen in the discharge channel by the outlet works.

Submitted By:

Original signed by
JAMES A. WALSH

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

Approved:

Original signed by:
Douglas L. Haller

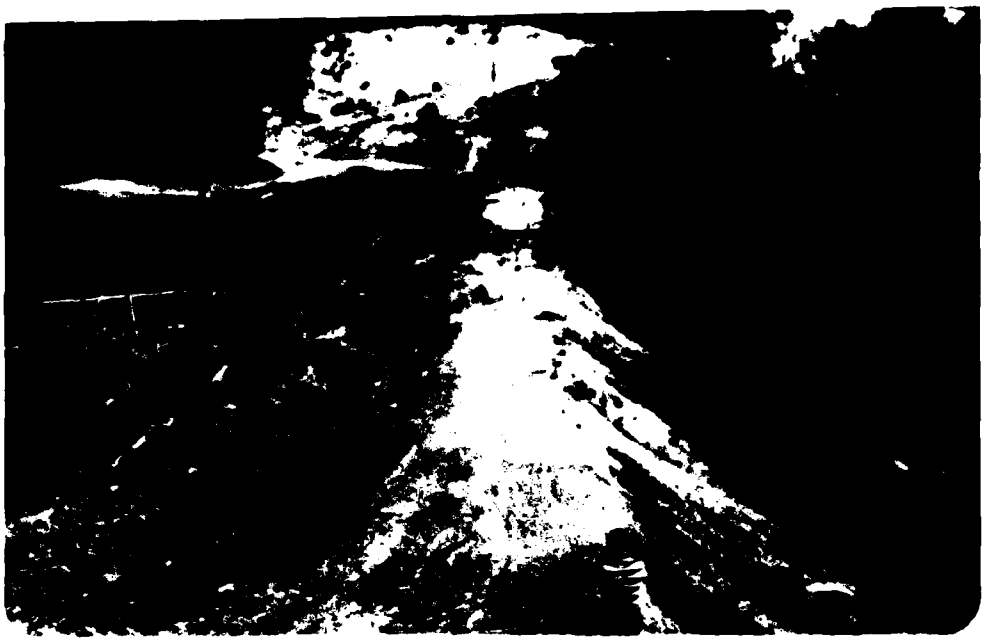
DOUGLAS L. HALLER
Colonel Corps of Engineers
District Engineer

Date: SEP 12 1980

Recommended By

Original signed by
JACK G. STARR

JACK G. STARR
Chief, Engineering Division



CREST

DOWNSTREAM SLOPE

CRAB ORCHARD CREEK DAM
OVERALL VIEWS

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: Crab Orchard Creek Dam is an earthfill embankment dam about 510 feet long and 50.5 feet high. The crest of the dam is 30 feet wide with a crest elevation of 108.0 TBM*. The upstream slope is 1 horizontal to 1 vertical (1:1) with dumped shale riprap protection. The downstream slope is benched at two elevations. The slope between the crest and upper bench (elevation 96.7) is 1.5:1, 1:1 to the lower bench (elevation 82.0) and 1.75:1 to the toe of the dam (elevation 67.7).

There is no foundation drain and it is unknown if the embankment is keyed into the foundation.

The principal spillway is a 24-inch vertical concrete pipe (drop-inlet) connected to a 24-inch horizontal concrete pipe running through the dam at low level. The crest of the drop-inlet is at elevation 100. The pipe outlets into a stilling pond below the dam. The invert elevation of the outlet pipe, which is submerged in the pool, is elevation 58.0. The pool is protected by placed riprap around the perimeter.

The emergency spillway is an open channel cut into natural rock at the left abutment with the crest at elevation 102.8 The spillway will discharge into the downstream channel about 300 feet downstream of the dam.

Wooden piles located about 50 feet upstream of the principal spillway indicate the site of an emergency gate that is in a collapsed condition, as reported by the owner's representative.

*TBM is a temporary bench mark based on principal spillway drop-inlet at elevation 100.0

1.2.2 Location: Crab Orchard Creek Dam is located on Crab Orchard Creek just upstream of Interstate 77 about 0.5 miles west of Bland, Virginia. A location map is provided on Plate 1, Appendix I.

1.2.3 Size Classification: The dam is classified as an intermediate size structure based on the height of the dam (50.5 feet).

1.2.4 Hazard Classification: The dam is located upstream of Bland, Virginia, with several homes and businesses located near the stream. A roadway embankment for Interstate 77 will reduce flows from the dam site and reduce the threat to lives and property in Bland, Virginia. However, large enough flows to create a potential hazard to lives and property can be passed through the roadway culverts. 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: Mr. Ronald A. Clyborne of Bluefield, West Virginia.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was originally built in approximately 1953 for J. T. Dunn of Bland, Virginia. The dam failed in about 1955 and was not rebuilt until about 1974, when Interstate 77 was built. It was reported that the dam failed due to overtopping. J. C. Hendricks, then new owner, got some assistance from a local university in designing the new dam. Large boulders excavated for the interstate were used in the dam embankment. It is not known of the dam was rebuilt in entirety or whether the breach was refilled. Mr. Clyborne bought the dam and property in October 1977 and has enlarged the emergency spillway. The downstream flood plain has been improved by allowing better drainage of flows from the dam. The reservoir has been lowered 2 feet by removing the top 2 feet of the principal spillway pipe.

1.2.8 Normal Operational Procedures: Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 4.98 square miles.

1.3.2 Discharge at Dam Site: Maximum flood - Unknown. The original dam did fail in 1955 but no data is available on the flows incurred. The dam has since been rebuilt and no maximum flows have been noted.

Pool level at top of dam

Emergency Spillway . . . . . 2579 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 1/	Length feet
Top of Dam	108*	27.5	550	2.1	.49
Emergency Spillway Crest	102.8	23.2	415	1.6	.44
Principal Spillway Crest	100	20.8	355	1.3	.42
Streambed at Downstream Toe of Dam	57.5	--	--	--	--

*Low point across dam's embankment.

SECTION 2

ENGINEERING DATA

2.1 Design: There is no known design information. The dam is located in the northwest belt of the Ridge and Valley physiographic province. This portion of the Ridge and Velley province is characterized by many high, narrow, linear northeast trending ridges and intervening valleys. Rock outcrops in the general vicinity consist of marine shales, sandstones, and dolomites of Mississippian, Devonian, and Cambrian ages. The Saltville-Bland fault is located within two miles of the dam site and extends in a southwest to northeast direction. The fault is responsible for the Mississippian age rocks coming into contract with the much older rocks of the Cambrian age.

2.2 Construction: There are no known construction records.

2.3 Evaluation: There is insufficient information to evaluate foundation conditions and embankment stability.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 4 June 1980 inspection are recorded in Appendix III. At the time of the inspection, the weather was sunny and clear. The temperature was 74°F. and the ground conditions were dry. The pool elevation was approximately 100.1 TBM or normal pool elevation. The tailwater elevation was about 60.4 TBM. Flow was passing through the principal spillway. No flow was passing through the emergency spillway. There are no known prior inspection reports.

3.1.2 Embankment: The embankment is in fair condition. Sketches showing a plan view, profile along the crest, and a typical cross section are provided on Plates II and III, Appendix I. Overall views of the crest and downstream slope are provided at the beginning of the report.

There are no signs of cracks, unusual movement, sloughing, misalignment, or riprap failures. However, there are erosion gullies beginning to develop on the portion of the embankment above the upper bench, right of the principal spillway. The slope is sparsely vegetated and runoff is eroding the surface. There is an existing gully at the right abutment contact as shown in Photo 3, Appendix II. The crest elevation slopes from the emergency spillway to the right abutment with a grade drop of about 2 feet. There is a particular dip of about 0.5 feet about 10 feet from the right abutment. The upstream slope is protected by a dumped shale riprap as shown in Photo 2. There is debris all along the upstream slope.

There is one seep located at the base of the dam at the right abutment as shown on Plate II. The origin was not found because of vegetation and boulders inhibiting the inspection in the area. The owner representative said he had checked the spring monthly for the past two years and had noted no changes. Flow is clear. No estimate of the quantity was made. The source and age are unknown.

The crest of the dam is sparsely vegetated (Photo 1) as well as that portion of the downstream slope right of the principal spillway. The downstream slope left of the principal spillway is heavily vegetated with brush and trees. The trees are pine and deciduous.

There are no drains. There are no signs of wet spots at or beyond the donwstream toe.

3.1.3 Principal Spillway: A vertical 24-inch concrete pipe, 34 feet upstream of the embankment, is the control section that establishes normal pool. A four-foot high wire fence is placed around the intake pipe to

prevent large debris from entering the pipe (Photo 4). A wire cage is placed over the intake to prevent finer debris from entering the intake pipe. Debris is located around three sides of the wire cage allowing clear flow through only one side. The 24-inch concrete discharge pipe is submerged in the stilling basin (Photo 5). Wooden piles are located about 75 feet upstream of the principal spillway intake. The owner's representative indicates that an emergency gate located beneath the piles is no longer useful. No outlet pipe was observed during the inspection.

3.1.4 Emergency Spillway: The approach channel and control section is in natural rock (Photo 7). The discharge channel is also cut into natural rock. Large boulders and some debris line the sides of the lower portion of the discharge channel (Photo 8).

3.1.5 Instrumentation: There is no instrumentation on the dam.

3.1.6 Reservoir: The reservoir area slopes are mostly mild, and heavily wooded. There are no signs of shoreline erosion or slope failures. There is no information available pertaining to sedimentation.

3.1.7 Downstream Channel: The downstream channel slopes are mild to steep with partial to heavy tree growth in the area (Photo 6). A road embankment is located about 1,100 feet downstream with three 8 by 10 foot culverts passing through the embankment at low level (Photos 9 and 10).

3.2 Evaluation: The inspection revealed no conditions that required immediate remedial measures. However, the inspection revealed certain preventive maintenance items which should be scheduled as part of an annual maintenance program. These are:

a. Dress the gully at the right abutment contact with compacted fill and seed the area.

b. Trim the downstream slope of brush. Cut all trees to the ground. Remove the root structures of all trees greater than 3-inches in diameter. Dress all excavations with compacted fill and seed.

c. Seed the whole crest and the sparsely vegetated portion of the embankment right of the principal spillway.

d. Maintain regular inspection of the seep on the right downstream abutment. Should flow suddenly increase and/or become turbid without explanation contact a geotechnical engineering consultant for further evaluation.

e. Remove the debris from around the fence and cage protecting the intake structure, and along the upstream slope.

f. Install a staff gage in the reservoir to extend to the top of the dam to measure pool elevation.

g. Remove the pine tree fallen in the discharge channel by the outlet works.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The normal storage pool is 100.0 TBM, which is the crest of the principal spillway. The reservoir provides private recreation. Water passes automatically through the principal spillway as the water level rises above the principal spillway crest. Water will also pass automatically through the emergency spillway when the water level in the reservoir rises above elevation 102.8 TBM. An emergency drawdown gate, of unknown size, is in a collapsed state, as noted by the owner's representative.

4.2 Maintenance: A regular maintenance program performed by the owner's representative includes debris removal around reservoir and a visual inspection after storms to remedy any new problems.

4.3 Warning System: At present time, there is no warning system or evacuation plan for Crab Orchard Creek Dam.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, the regular maintenance program should be expanded to include vegetation removal on the embankment and documentation of all work accomplished. An emergency operation and warning plan should be developed. 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: The maximum flow at the dam site is not known.

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

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1.

Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Rating curves for the principal spillway, emergency spillway, and non-overflow section were developed. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the principal spillway crest (elevation 100.0 TBM).

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	1/2 PMF	PMF 1/
Peak flow c.f.s.			
Inflow	5	11878	23757
Outflow	5	11877	23720
Maximum elevation ft. TBM	100.0	110.86	113.26
Non-overflow section (el 108.0 TBM)			
Depth of flow, ft		2.86	5.26
Duration		6.5	9.5
Velocity, fps 2/		8.0	10.6
Tailwater elevation ft., TBM	60.4		

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: The owner's representative reported that the emergency drawdown gate is in a collapsed condition and cannot be used.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant) the recommended Spillway Design Flood is 1/2 PMF to the PMF. Because of the risk involved, the 1/2 PMF has been selected as the SDF. The spillways will pass 13 percent of the PMF or 26 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum 2.86 feet with an average critical velocity of 8.0 feet per second and remain above the crest of the dam for 6.5 hours. It should be determined if the emergency drawdown outlet is in fact inoperable and, if so, returned to a functional position.

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

SECTION 6

DAM STABILITY

6.1 Foundation and Abutments: There is no information available on the foundation conditions. The dam is located in the Ridge and Valley physiographic province. It is unknown if the dam is keyed into the foundation. There is no foundation drainage system. The predominate foundation material is a shale bedrock. Outcrops on the right abutment show massively bedded shale with a blocky structure and open weathered joints. The strike was about N20°W with a gentle dip to the west. The dam is aligned N66°W. The area terrain is non-compressible. The stratigraphy at the dam site does not encourage sliding or continuous seepage paths. Based on the visual observations, the foundation appears stable.

6.2 Embankments:

6.2.1 Materials: There is no information available on the nature of the embankment materials. The area soils consist of residual silty sand weathered from the area shale.

6.2.2 Stability: There are no stability analysis calculations available for this dam, which is 50.5 feet high and 30 feet wide. The upstream slope is 1H:1V with riprap. The downstream slope is double benched. From the crest to the upper bench the slope is 1.5H:1V, to the lower bench it is 1H:1V, and to the toe 1.75H:1V. A plan view, profile of the crest and a typical cross-section are provided on Plates II and III, Appendix I.

For this dam, normal pool exists when the reservoir level is at the elevation of the principal spillway, as it was at the time of the inspection. This is also the maximum control storage pool. The dam experiences this pool level with no apparent adverse effects. The dam is not subjected to a drawdown because the emergency drawdown gate is in a collapsed condition and reported to be inoperable.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from an earthquake provided that static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. A stability check is required for the long-term steady seepage condition. If the emergency gate is ever to be made operable, then a stability check of the upstream slope for a sudden drawdown condition is required.

The SDF will overtop the dam by a maximum 2.85 feet with an average critical velocity of 8.0 feet per second and remain above the crest of the dam for 6.5 hours. The overtopping is considered detrimental, because the velocity at SDF is greater than 6 fps, the effective eroding velocity for a vegetated earth embankment.

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The available engineering data is inadequate. The visual inspection revealed no problems that require immediate attention. There is a limited regular maintenance program, but no emergency operation and warning plan. Corps guidelines indicate the appropriate Spillway Design Flood (SDF) for an intermediate size significant hazard dam is the 1/2 PMF. The spillways will pass 13 percent of the PMF or 26 percent of SDF without overtopping the dam. Flows overtopping the dam during the SDF are considered detrimental to the embankment. Therefore, the spillways are adjudged seriously inadequate and the dam is assessed as unsafe non-emergency.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

7.2 Recommended Remedial Measures: It is recommended that within 2 months from the date of notification to the Governor of the Commonwealth of Virginia, the owner engage the services of a professional consultant to perform the following:

a. Determine by more sophisticated methods and procedures the adequacy of the spillway. The study should include a more detailed study of the Spillway Design Flood appropriate to this dam. Remedial measures to be considered include modification to the dam, spillway, flood plain, and any other method of eliminating the danger imposed by the project.

b. Perform a stability analysis of the embankment for the long term steady seepage condition. Also, if the emergency gate is ever to be made operable, then a stability check of the upstream slope for a sudden drawdown condition is required.

Within 6 months of the notification to the Governor, the professional consultant's report of appropriate remedial mitigating measures should have been completed and the owner should have an

agreement with the Commonwealth of Virginia for a reasonable time in which all remedial measures will be complete. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

The inspection also revealed several other items that require attention. The following items should be scheduled as part of an annual maintenance program:

a. Dress the gully at the right abutment contact with compacted fill and seed the area.

b. Trim the downstream slope of brush. Cut all trees to the ground. Remove the root structures of all trees greater than 3-inches in diameter. Dress all excavations with compacted fill and seed.

c. Seed the whole crest and the sparsely vegetated portion of the embankment right of the principal spillway.

d. Maintain regular inspection of the seep on the right downstream abutment. Should flow suddenly increase and/or become turbid without explanation contact a geotechnical engineering consultant for further evaluation.

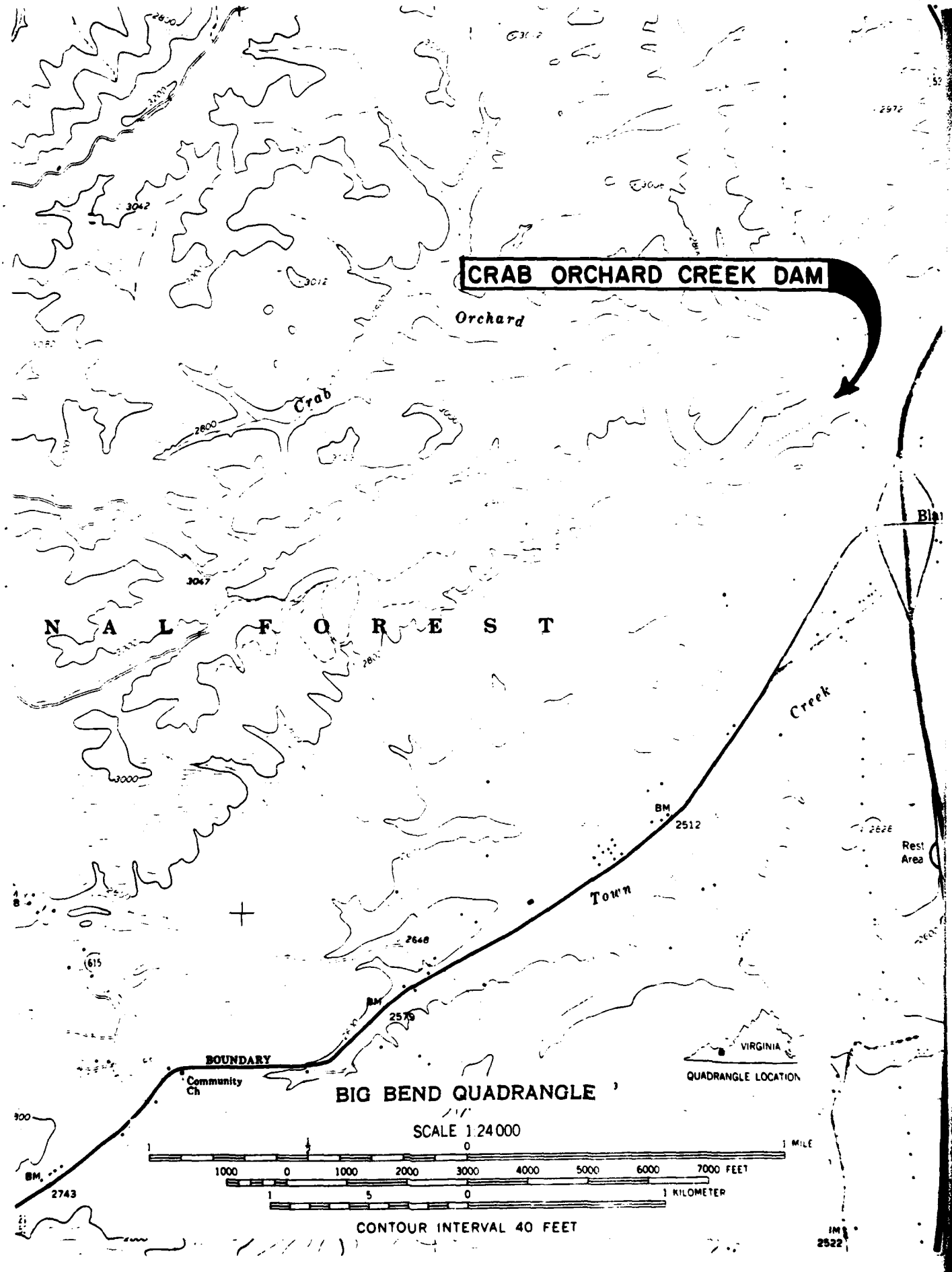
e. Remove the debris from around the fence and cage protecting the intake structure, and along the upstream slope.

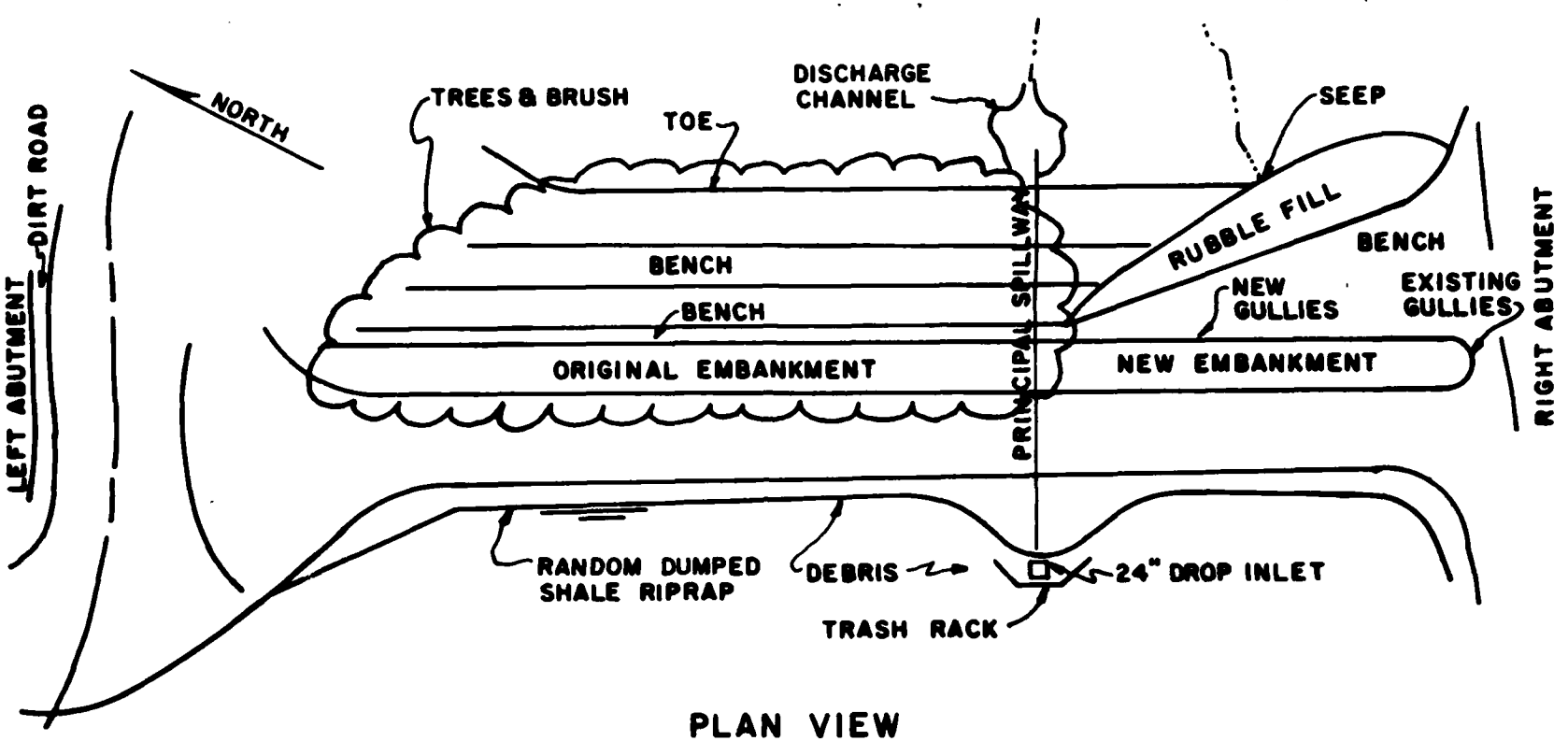
f. Install a staff gage in the reservoir to extend to the top of the dam to measure pool elevation.

g. Remove the pine tree fallen in the discharge channel by the outlet works.

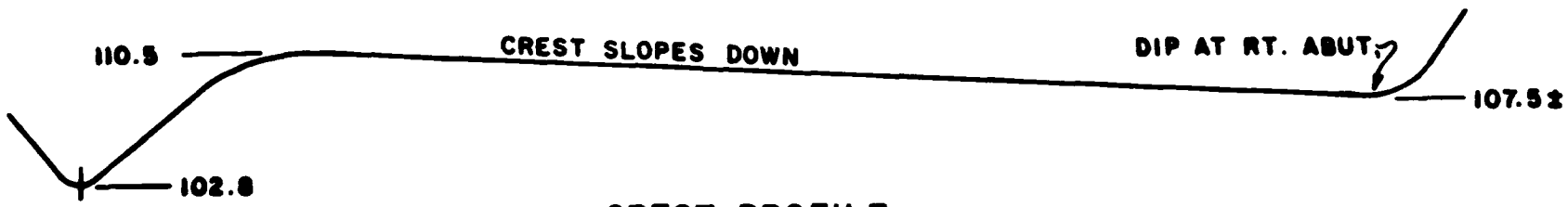
APPENDIX I

MAPS AND DRAWINGS


CRAB ORCHARD CREEK DAM
Orchard
Crab
N A L F O R E S T
Creek
Town
BM
2512
Rest
Area
BM
2579
BOUNDARY
Community
Ch
VIRGINIA
QUADRANGLE LOCATION
BIG BEND QUADRANGLE
SCALE 1:24000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
CONTOUR INTERVAL 40 FEET
BM
2743
BM
2522



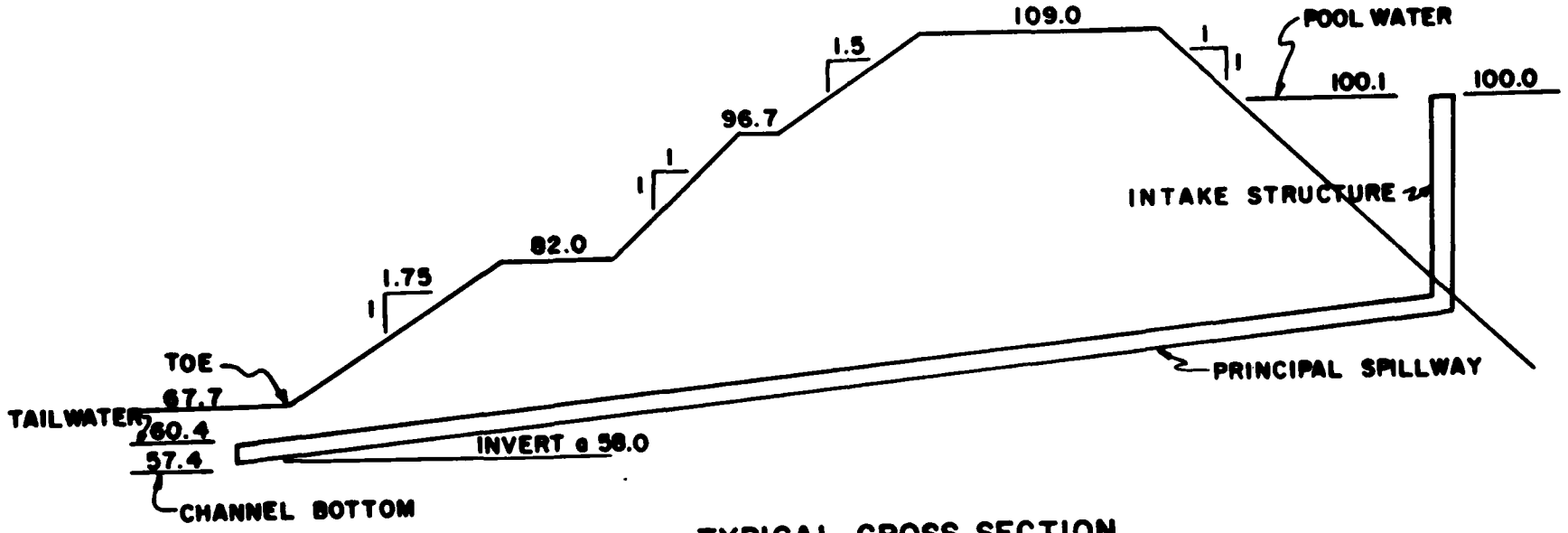
PLAN VIEW



CREST PROFILE

NOTE: TOP OF DROP INLET USED AS TBM = 100.0

CRAB ORCHARD CREEK
N.T.S.
PLATE 2



TYPICAL CROSS SECTION

NOTE:

1) TOP OF DROP INLET USED AS TBM = 100.0
2) CREST ELEVATION RANGES FROM 110 TO 108.

CRAB ORCHARD CREEK
N.T.S.
PLATE 3

APPENDIX II

PHOTOGRAPHS

PHOTO #1 CREST OF DAM

PHOTO #2 UPSTREAM SLOPE

PHOTO #3 DOWNSTREAM SLOPE
AND RT. ABUTMENT

PHOTO #4 PRINCIPAL SPILLWAY
INTAKE STRUCTURE

PHOTO *5 PRINCIPAL SPILLWAY DISCHARGE

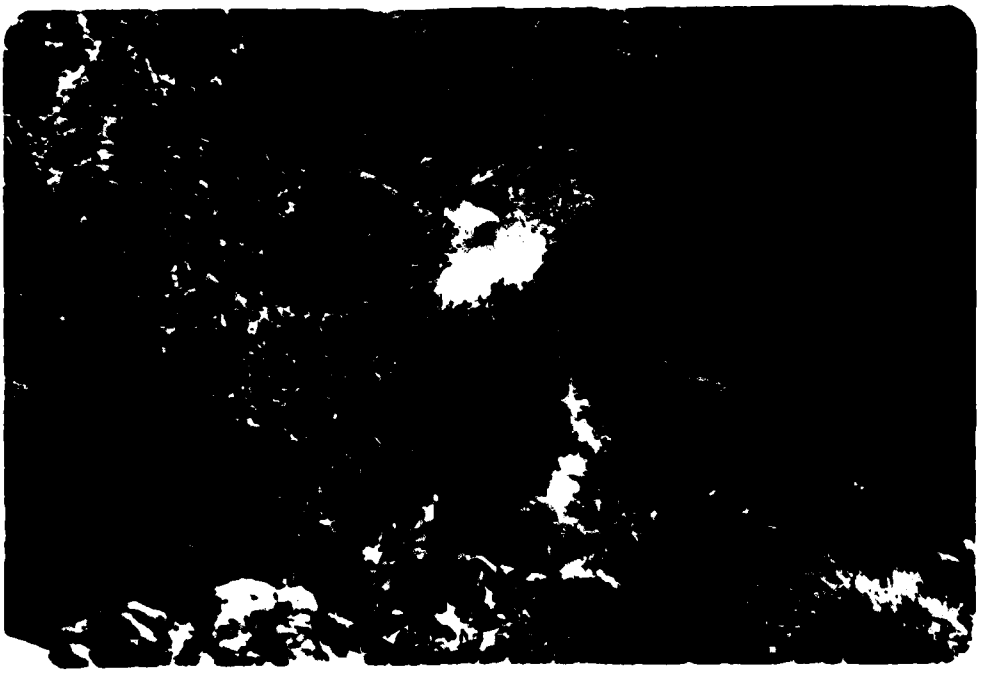


PHOTO *6 DOWNSTREAM CHANNEL

PHOTO #7 EMS APPROACH CHANNEL

PHOTO #8 EMERGENCY SPILLWAY (EMS)

PHOTO #9 VIEW FROM CREST OF DAM
LOOKING DOWNSTREAM
(NOTE I-77 HIGHWAY EMBANKMENT)

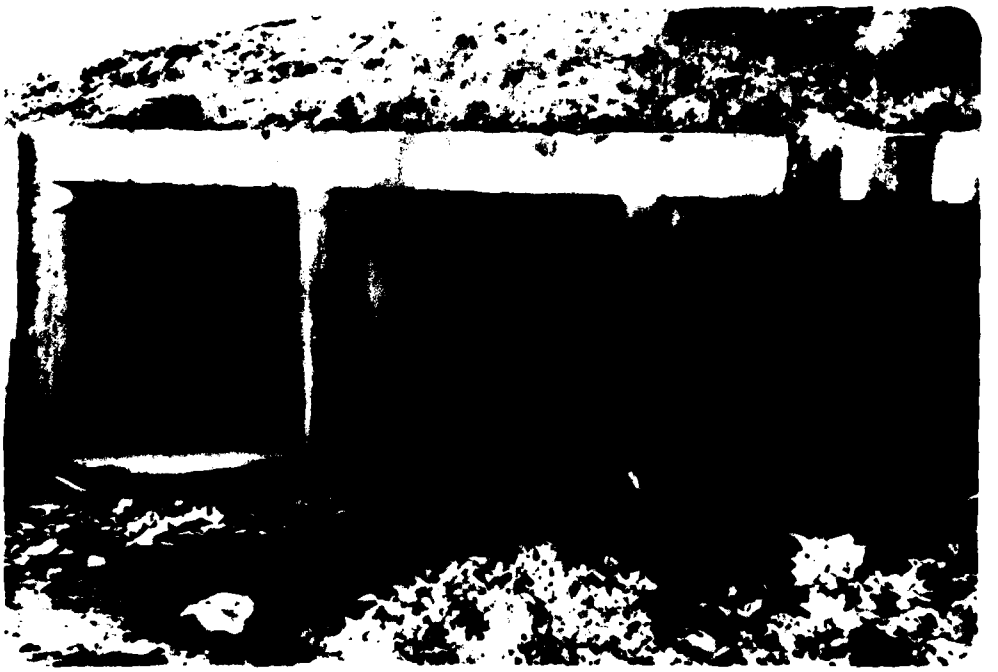


PHOTO #10 TRIPLE BARREL BOX CULVERT
THRU I-77 EMBANKMENT

APPENDIX III

FIELD OBSERVATIONS

Check list
Visual Inspection
Phase I

Name Dam: Crab Orchard Creek County: Bland State: VA Coordinates: Lat 3706.4 Long 8108.0

Date of Inspection: 4 June 80 Weather: Sunny & Partly Cloudy Temperature: 74°F

Pool Elevation at Time of Inspection: 100.1 TBM Tailwater at Time of Inspection: 60.4 TBM

Inspection Personnel:

B. Taran, COE
J. Robinson, COE
D. Pezza, COE
D. Bushman, SWCB
L. Musselwhite, SWCB
Bobby Nunn, Owner Rep.

Pezza & Robinson Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	There are no cracks in the dam. The general ground conditions are dry. The embankment right of the principal spillway was rebuilt in 1974 after 1955 failure. Original emergency spillway at right abutment. Embankment below bench consists of massive, buttressing, rubble fill on slope.	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking at or beyond toe.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	There are no signs of sloughing. Erosion gullies are beginning to develop on the portion of the embankment above the first bench, right of the principal spillway. The slope is sparsely vegetated and runoff is eroding the surface. There is an existing gully at the right abutment contact. The downstream slope right of the principal spillway is sparsely vegetated.	Dress the gully at the abutment contact with compacted fill. Seed the slope.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	There are no drawings with which to compare the existing alignment. The alignments do not show any signs of movement or settlement. The crest elevation slopes from the emergency spillway to the right abutment with a grade drop of about 2 feet. There is a particular dip of about 0.5 feet about 10 feet from the right abutment.	None.
RIPRAP FAILURES	The upstream slope is protected by a dumped shale riprap. There are no signs of failure. There is debris all along the upstream slope.	Clean up the debris collected on the embankment.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION	The foundation appears stable. There is no evidence of sliding or settlement noted. The area bedrock is shale. Rock outcrops on the right abutment and spillway show massively bedded shale with a blocky structure and open weathered joints. The strike is about N20°W. It dips gently to the west.	None.
VEGETATION	The crest of the dam is sparsely vegetated with grass. The downstream slope left of the principal spillway is heavily vegetated with brush and trees. The trees are both pine and deciduous. The downstream slope right of the spillway is sparsely vegetated.	Seed the crest. Trim the downstream slope of brush. Cut all trees to the ground. Remove the root structure of all trees 3-inches in diameter. Dress all excavations with compacted till and seed.
ANY NOTICEABLE SEEPAGE	There is one seep located at the base of the dam at the right abutment as shown on Plate II. The specific location was not noted because of vegetation and bolders in the area. The owner's representative says he has checked the spring monthly for the past two years and has noted no changes. Flow is clear. There is no estimate of the quantity. Source and age of seep unknown.	Maintain regular inspection of seep particularly during high flows. Should flow suddenly increase and/or become cloudy without explanation, contact a geotechnical engineering firm to evaluate the condition.
MATERIALS	The area materials consist of residual silty sand weathered from the shale.	None.
DRAINS	There are no drains. There are no signs of wet spots at or beyond the downstream toe.	None.

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
CONTROL SECTIONS	A vertical 24-inch concrete pipe 34 feet upstream of the embankment crest is the control section that establishes normal pool. Water is flowing (about 2") over the crest of the spillway.	The owner lowered the normal pool elevation about 2 feet by removing two feet of vertical pipe in the reservoir within the last 3 years.
APPROACH CHANNEL	A 4 foot high wire fence is placed around the intake pipe to prevent large debris from entering the pipe. A wire cage is placed over the intake to prevent finer debris from entering the intake pipe. Debris is located around 3 sides of the wire cage allowing clear flow through only one side.	The debris should be removed.
DISCHARGE CHANNEL	The 24-inch concrete discharge pipe is submerged in the stilling basin.	The flow from the principal spillway would be more efficient if the water was allowed to fall freely from the pipe. (i.e., lower the stilling basin elevation).
EMERGENCY GATE	Wooden piles are located about 75 feet upstream of the principal spillway intake. The owner's representative indicates that an emergency gate located beneath the piles is no longer useful. No outlet pipe was observed during the inspection.	The status of the pipe should be determined in case a drawdown becomes necessary.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
CONTROL SECTION	The control section is natural rock which appears in good condition. The spillway crest was lowered within the past 3 years.	None.
APPROACH CHANNEL	The area between the reservoir and the control section is natural rock. The slightly sloping area is free of debris.	None.
DISCHARGE CHANNEL	The discharge channel is cut into natural rock. Large boulders and some debris line the sides of the lower portion of the discharge channel.	None.
MISCELLANEOUS	The immediate flood plain area is in the process of being relandscaped by the owner.	None.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
MONUMENTATION/SURVEYS	There are no survey monuments.	None.
OBSERVATION WELLS	There are no wells.	None.
WEIRS	There are no weirs.	None.
PIEZOMETERS	There are no piezometers.	None.
STAFFGAGES	There are no staffgages.	A staffgage should be installed in the reservoir and extend to top of dam elevation.
OTHER	There is no instrumentation on the dam.	None.

RESERVOIR

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir area slopes are mostly mild with only a small portion being steep. The entire area is heavily wooded. The trees in the reservoir area were harvested in the early 70's. The debris seen at the embankment area is a result of the harvesting. The new growth of trees is preventing more debris from entering the reservoir. There are no signs of shoreline erosion or slope failures.	None.
SEDIMENTATION	There is no information available.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel appears to be in good condition. The stilling basin is adequate for the present dam condition. The submerged outlet pipe would function better if it were allowed to flow freely. A pine tree has fallen into the channel by the outlet works.	The recent fallen pine tree in the channel should be removed.
SLOPES	The area slopes are mild to steep with partial to thick tree growth in the area.	None.
APPROXIMATE NO. OF HOMES AND POPULATION	A road embankment is located about 1100 feet downstream with three 8 by 10 feet culverts passing through the embankment at low level. There are several homes and businesses along the stream's path after flow passes through the roadway embankment in Bland, Virginia.	None.

APPENDIX VI

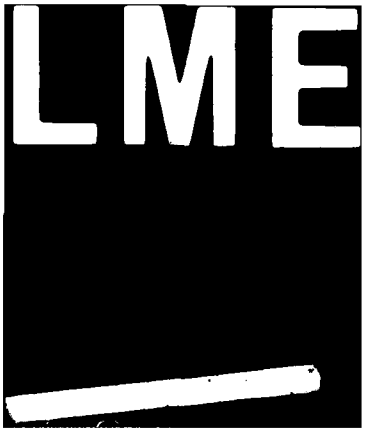
REFERENCES

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