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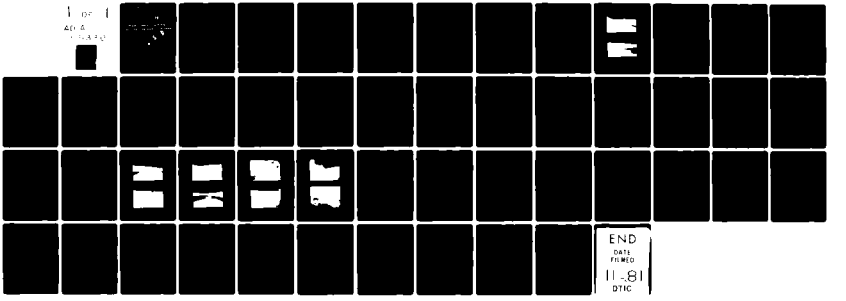

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JAMES RIVER BASIN

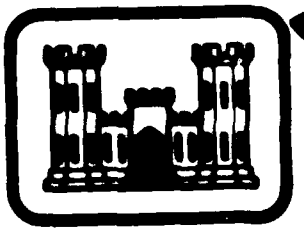
(1)

Name Of Dam: NELSON
Location: NELSON COUNTY
Inventory Number: VA 12501

LEVEL I

AD A106330

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
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NORFOLK, VIRGINIA 23510

IN CONJUNCTION WITH

COMMONWEALTH OF VIRGINIA
STATE WATER CONTROL BOARD

JULY 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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 Inspection 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 inspection. 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 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.

JAMES RIVER BASIN

NAME OF DAM: Nelson Dam
LOCATION: Nelson County
INVENTORY NUMBER: VA 12501

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

National Dam Safety Program. Nelson Dam (Inventory Number VA 12501), James River Basin, Nelson County, Virginia. Phase I Inspection Report.

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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:	Nelson Dam
State:	Virginia
Location:	Nelson County
USGS Quad Sheet:	Arrington, Virginia
Stream:	Tributary of Bob's Creek
Date of Inspection:	June 24, 1981

~~The Nelson~~ Dam is an earthfill structure about 738 feet long and 40.5 feet high. The dam is owned and maintained by the Virginia Commission of Game and Inland Fisheries. The dam is classified as "intermediate" on the basis of size, and given a hazard classification of "significant" on the basis of downstream area development. The principal spillway consists of an octagonally shaped concrete riser with eight rectangular openings serving as drop inlets. The concrete riser is connected to a 30-inch diameter corrugated metal pipe which passes through the dam at a low level. The emergency spillway is an open concrete channel cut at the right abutment. The reservoir is used for recreation (fishing).

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 41 percent of the PMF or 82 percent of the SDF without overtopping the crest of the dam. The SDF will overtop the dam by a maximum of 0.5 feet, reach an average critical velocity of 3.4 feet per second and flow over the dam for 2.0 hours. Flows overtopping the dam during the SDF are not considered detrimental to the embankment. The spillway is adjudged inadequate but not seriously inadequate.

The visual inspection revealed no apparent problems and there are no immediate needs for remedial measures. Maintenance is performed by the owner. However, there is no formal documented maintenance operations program or warning system. It is recommended that a regular maintenance and operations program be instituted with

provisions for accurate records of all maintenance performed. It is also recommended that a warning system be established and that the maintenance items listed in Section 7.2 be accomplished as part of the regular maintenance program within the next 12 months.

Submitted By:

Original signed by:
Carl S. Anderson, Jr.

CARL S. ANDERSON, Jr. P.E.
Acting Chief, Design Branch

Approved:

Original Signed by:
Michael M. Jenks

RONALD E. HUDSON
Colonel, Corps of Engineers
Commander and District Engineer

Recommended By:

Original signed by
JACK G. STARR

JACK G. STARR, P.E.
Chief, Engineering Division

Date: SEP 16 1981

CREST

RESERVOIR AREA

OVERALL VIEWS NELSON DAM NELSON COUNTY

24 JUNE 1981

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 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:

1.2.1 Dam and Appurtenances: Nelson Dam is an earthfill embankment about 738 feet long and 40.5 feet high. The crest of the dam is 12 feet wide. The upstream slope is 2.5 feet horizontal to 1 foot vertical and the downstream slope is 2.6 feet horizontal to 1 foot vertical. According to the owner, the dam was constructed with a cutoff trench. There is some riprap on the upstream face of the dam to provide slope protection at the waterline. There are no foundation drains.

The principal spillway consists of an octagonally shaped concrete riser 9 feet 2 inches in diameter with eight 26-inch by 32-inch rectangular openings serving as drop inlets at elevation 602 MSL. The concrete riser is connected to a 30-inch diameter corrugated metal pipe which passes through the dam at a low level. The riser has a concrete cover. Each drop inlet opening has a trash guard of steel bars. Beneath one drop inlet is an opening approximately 28 inches by 36 inches completely blocked with flashboards. The crest of the lower opening is four feet below the 8 drop inlet openings.

The emergency spillway is a concrete trapezoidal open channel located at the right abutment with a 75 feet wide control section at elevation 602.4 MSL. Three rows of baffle blocks at the lower end of the channel serve as energy dissipators.

There is a drawdown slidegate set in the principal spillway concrete riser. The valve is operated by a control wheel mnounted on a stem secured to the riser top. The slidegate was observed visually and estimated to be 24 inches square.

An additional drawdown valve is set at an undetermined intermediate elevation in the concrete spillway riser. The valve may be controlled with an extension that protrudes through the concrete top of the spillway riser. The intermediate level valve was observed and estimated to be 6 inches in size. Beneath one drop inlet is an opening approximately 28 inches by 36 inches completely blocked with flashboards. The crest of the lower opening is four feet below the eight drop inlet openings, or about elevation 598.

1.2.2 Location: Nelson Dam is located in Nelson County on a tributary of Bobs Creek, 1-1/3 miles northeast of the community of Arrington.

1.2.3 Size Classification: Nelson Dam is classified as "intermediate" in size based on the criteria in Reference 1 of Appendix V.

1.2.4 Hazard Classification: Nelson Dam is located in a rural area. There are two residences, a state road and a bridge in the downstream area. Therefore, a "significant" hazard classification is given to this structure according to the guidelines contained in Section 2.1.2 of Reference 1 of Appendix V. 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: The dam is owned by the Virginia Commission of Game and Inland Fisheries.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was constructed in 1959 by Mr. Jack Yeatts, contractor. According to Mr. Yeatts, the dam was constructed with a cut-off trench. The fill material was of good quality with the best material placed in the core of the dam. The principal spillway pipe through the dam was cradled.

Mr. Warren C. Perrow was the consulting engineer for this project.

The construction of the emergency spillway was halted in 1959 due to winter weather. The reservoir was supposed to be left dry until the completion of the emergency spillway. However the principal spillway's drawdown valve was left closed and the reservoir began filling. Upon examination the next spring, water was observed seeping through the exposed rock in the emergency spillway and the reservoir was subsequently drained. Based on recommendations made by Mr. Warren C. Perrow, the consulting engineer for the project, the rock in the spillway was drilled and grouted and a concrete lined spillway was installed.

1.2.8 Normal Operational Procedures: Water passes automatically through the spillways when the reservoir reaches the crest elevation.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 1.24 square miles.

1.3.2 Discharge at Dam Site: The emergency spillway has been used only four times. The maximum flow through the emergency spillway was experienced in 1969. The depth of flow was estimated to be four feet. The flow was estimated to be 15 inches in depth in 1971. At two other times the emergency spillway experienced flows of 4-5 inches.

Discharge at crest of dam

Principal Spillway . . . . . 201 cfs
Emergency Spillway . . . . . 2592 cfs

1.3.3 Dam and Reservoir Data: Pertinent data shown in the table below:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet msl	Reservoir Capacity Area, acres	Reservoir Capacity Acre-feet	Watershed, inches	Length feet
Crest of Dam	607.5	56.5	920	13.8	3450
Emergency Spillway Crest	602.4	42.8	690	10.4	3130
Principal Spillway Crest	602.0	40.4	640	9.6	3115
Stream Bed at Toe of Dam	567.0	---	---	---	----

SECTION 2

ENGINEERING DATA

2.1 Design: A copy of the dam specification was available for review. However, no drawings or design data were available.

2.2 Construction: There are no known formal construction records, but Mr. Ashby Lincoln, Jr., a property owner, was present when the dam was built and closely observed the process. The dam was designed by Mr. Warren C. Perrow, Consulting Engineer, was built by Mr. Jack Yeatts, Contractor.

The dam does have a core trench, and the material placed in the embankment was from the reservoir bottom and left side of the reservoir. According to the contractor the fill was well compacted in accordance with accepted practices for such projects with the best material placed in the core.

The dam was constructed in summer and fall of 1959. The emergency spillway was not completed before winter weather. It was planned that the lake be left dry until construction of the emergency spillway could be completed. However, the drawdown valve was left closed and the lake was allowed to fill. Water was seeping through the exposed rock in the emergency spillway the next spring and the lake had to be drained. The rock in the spillway was drilled and grouted. After the lake was drained and the flows stopped, the concrete spillway was installed in the spring the summer of 1960.

Previous inspection reports are included in Appendix IV.

2.3 Evaluation: There is insufficient information to completely evaluate foundation and embankment stability due to the absence of soil testing and related design data.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the inspection on 24 June 1981 are recorded in Appendix III. At the time of the inspection, the weather was overcast with a temperature was 75°F and the ground conditions were dry. The pool elevation was 601.9 feet msl, or about 0.2 feet below normal pool elevation. The tailwater was at 567.0 feet msl. A very small amount of flow was passing through the principal spillway and no flow was passing through the emergency spillway. However, water was flowing from some of the weep holes in the emergency spillway channel. A previous inspection was made by Froehling and Robertson, Inc. of Richmond in June of 1972. A copy of the report is listed in Appendix IV. This report cites the concrete emergency spillway as having areas of spalling, two small seepage areas approximately one-third of the way above the toe, and scattered small saplings growing in cracks and joints. A growth of underbrush and locust saplings on the dam and missing riprap in scattered spots was noted also.

3.1.2 Embankment: The embankment is in good condition. Sketches showing the plan view and cross section are provided in Appendix I. An overall view of the dam is provided at the beginning of the report.

There were no signs of surface cracks, unusual movement, sloughing, erosion, or misalignment. However, there were some riprap failures on the upstream face at the shoreline with wave benches forming in these areas.

A spring or possible seep was noted at the base of the junction of the left abutment and embankment. However, there was no flow noted at this spot at the time of the inspection. Beyond this was a general marshy area which functions as a fish holding pond. Water is diverted into this pond by way of a 12-inch concrete pipe located in the outlet structure.

The dam had good grass cover but was in need of mowing. The toe in areas and the left downstream abutment contact was heavily overgrown with dense brush and honeysuckle. Bushes were also growing from the upstream shoreline and areas of the embankment.

3.1.3 Principal Spillway: The concrete intake riser structure is in good condition. The emergency gate valve stem and wheel located on the riser appeared to be in good condition. The discharge pipe passes through the embankment and discharges into a concrete box structure at the toe of the dam. The outlet was in good condition with the exception of some minor corrosion of the 36-inch CMP outlet.

3.1.4 Emergency Spillway: The emergency spillway is a trapezoidal concrete lined open channel located in the right abutment. The approach channel was clear of obstructions. There were some small shrubs growing on the upstream side of the concrete sill forming the control section. The lower end of the concrete lined discharge channel was in poor condition with severe spalling and grass growing out of many of the joints. The concrete baffle blocks forming the energy dissipator were in good condition. The channel below this was heavily overgrown with brush. Weep holes, located in the concrete slab, were functioning.

3.1.5 Instrumentation: There is no instrumentation of the dam.

3.1.6 Reservoir: The reservoir slopes are moderate with a mixture of woodlands and pasture. There were no signs of slope failures in the reservoir area although minor wave erosion was evident at the shoreline. The inspection team was unable to evaluate reservoir sedimentation. An overall view of the reservoir is provided at the beginning of the report.

3.1.7 Downstream Channel: The downstream channel slopes are moderately steep and heavily wooded with dense underbrush. One home is located approximately 2 miles below the dam, and a second home, a state road, and a bridge are located farther downstream.

3.2 Evaluation: Overall, the dam appeared to be in good condition. The inspection revealed certain preventative maintenance items which should be scheduled as part of an annual maintenance program. These are:

a. Place riprap in areas of shoreline where needed.

b. Monitor seep at toe for any increase in flow or turbidity and, if either condition develops, contact a qualified geotechnical engineer to evaluate the situation.

c. Mow dam on a regular basis and cut all brush from the embankment.

d. Remove dense underbrush and honeysuckle from the left downstream abutment area and the toe.

e. Cut brush and shrubs from upstream side of emergency spillway control section.

f. Repair spalled concrete in emergency spillway.

g. Clear grass from joints in emergency spillway and place joint compound to prevent grass from returning.

h. Clear discharge channel for emergency spillway so that water can flow unrestricted into the stream below.

i. Install a staffgage which extends above the crest of the dam, to monitor the reservoir level.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The operation of this lake is not complicated. The normal storage pool is at elevation 602.0 MSL which is the crest of the principal spillway riser drop inlets. Water passes automatically through the principal spillway when the reservoir rises above elevation 602.0 Water will pass through the emergency spillway when the reservoir rises above its crest, at elevation 602.4. The level of the lake may be lowered by means of the two valves and the flashboard gate located within the intake riser.

4.2 Maintenance: Maintenance is performed as needed by the owner, which includes maintaining the grass cover on the embankment and the gravel road across the crest.

4.3 Warning System: At present time, there is no warning system or evacuation plan for dam.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, the present program of periodic observation and maintenance should be well documented to help detect and correct any problems that may arise. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared to be readily available to anyone managing the facility. This should include:

a. How to operate the dam during an emergency.

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

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: None were available at the dam site, but a gage one mile away indicated a rainfall of 14.0 inches during tropical storm Camille.

5.3 Flood Experience: The maximum pool observed was about 606.4 feet msl or about 4 feet in the emergency spillway. This occurred during August of 1969 during tropical storm Camille.

5.4 Flood Potential: The 100-Year Flood, 1/2 PMF, and PMF were developed by use of the HEC-1 computer program (Reference 2, Appendix V) and routed through the reservoir using the NWS-Dambreak computer program (Reference 3, Appendix V). 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 National Weather Service Publications (Reference 4 and 5, Appendix V).

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

Water passes automatically through the principal as the reservoir rises above the spillway crest.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Survey data, taken during the inspection, was correlated to the Arrington, Virginia Quadrangle Map to help develop the area-storage data. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the principal spillway crest (elevation 602.0).

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	100-Year Flood 1/	1/2 PMF	PMF 2/
Peak flow cfs				
Inflow	1	2314	4963	9760
Outflow	1	1431	4115	9435
Maximum elevation feet msl	602.0	605.4	608.0	609.3
Non-over flow section (elevation 2235.8)				
Depth of flow, feet.	---	0.0	0.5	1.8
Duration, hrs.	---	0.0	2.0	2.5
Velocity, fps 3/	---	0.0	3.4	6.2
Tailwater elevation feet msl	567.0	---	---	----

1/ The 100-Year Flood has one chance in 100 of occurring in any given year.
2/ 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.
3/ Critical Velocity.

5.7 Reservoir Emptying Potential: A 24-inch slidegate at the base of the principal spillway riser is available for dewatering the reservoir. It has an invert elevation of 57.0 ft. msl. The slidegate will permit the withdrawal of about 105 cfs with the reservoir level at the crest of the principal spillway and essentially dewater the reservoir in less than 4-1/2 days. This equivalent to an approximate drawdown rate of 7.1 feet per day. This is based on the hydraulic height measured from the maximum storage pool at elevation 602.0 to the sluice gate invert elevation of 570.0 ft. divided by the time to dewater the reservoir. In calculating the drawdown rate, the effects of the 28-inch by 36-inch opening beneath one of the drop inlets, presently covered by flashboards, and of the 6-inch drawdown valve in the riser were neglected.

5.8 Evaluation: Based on the size (intermediate) and the hazard classification (significant), the recommended spillway design flood is the 1/2 PMF. Because of the risk involved, the 1/2 PMF was chosen as the SDF. The spillway will pass 41 percent of the PMF or 82 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum of 0.5 feet, reach an average critical velocity of 3.4 feet per second, and flow over the dam for 2 hours.

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

SECTION 6
DAM STABILITY

6.1 Foundation and Abutments: There is little documented information available on the foundation conditions at the site, which lies near the western edge of the Piedmont physiographic province. Based on the Geologic Map of Virginia, the site lies near the boundary of the Marshall and Lynchburg formations, and is probably underlain by the Marshall formation. The Marshall formation, which is of Precambrian Age and a part of the Virginia Blue Ridge complex, is characterized by biotite, quartz, feldspar granite, gneiss and quartz monzonsite. The Lynchburg formation, also of Precambrian age, is typified by phyllite, quartzite, graywacke and conglomerate, according to the Geologic Map of Virginia. The Soil Conservation Service investigated the site and performed some borings prior to the construction of the dam, but no record of this work is available. The Soil Conservation Service has not prepared a comprehensive soil survey for Nelson County, but its General Soil Map for Virginia indicates for the area a Northern Piedmont soil association of Elioak-Hazel-Gleneig Soils, composed of residuum derived from the underlying rock.

Soils observed at the site during the inspection appear to be clays and silty clays of medium to high plasticity. Weathered schist was noted in the area of the right abutment, along with some quartz fragments. Some blasting was required in the emergency spillway when the dam was constructed, and this area was subsequently grouted in an attempt to limit seepage there. A core trench was constructed; "good material" was reached at a depth of about five feet, according to Mr. Jack Yeatts, the contractor.

No boring logs or other subsurface data was available, but a previous inspection report of the dam prepared by the owner's consultant cites "the great complexity of bedrock which may affect the quality of the dam's foundation." Indeed in the absence of detailed subsurface data on the dam, it is very difficult to evaluate foundation conditions. However, the visual inspection revealed no evidence of undue settlement, shifting, cracking, or other problems associated with inadequate foundation conditions. There is no evidence that the dam has a foundation drainage system, but seepage does not appear to be excessive for a structure of this type. The problem of seepage through the rock in the emergency spillway area has already been mentioned, and if the dam is underlain by similar material, seepage could be expected beneath the dam also. A seep was also noted at the base of the left abutment. The removal of the underbrush presently growing at the toe of the embankment would facilitate monitoring this area for changes in flow or turbidity.

6.2 Embankment:

6.2.1 Materials: The material used for the embankment was taken principally from the reservoir area and the left side on the dam site. As noted, the soils observed at the site appear to be residual clays and silty clays of medium to high plasticity. Mr. Yeatts reported that the best material available at the site was used in the core of the dam. For the purpose of stability assessment, the dam is classified as homogeneous.

6.2.2 Stability: There are no available stability calculations. The dam is 40.5 feet high and 12 feet wide at the crest. The upstream slope is 2.5H:1V and the downstream slope is 2.6H:1V. The dam is subject to a rapid drawdown condition because the drawdown rate exceeds the critical rate for earth dams (0.5 feet per day). With the low level slide gate open, the pool would fall at a rate of 7.1 feet per day. Routinely, the dam is in a normal pool state, but on at least four occasions it has existed at maximum control storage pool (water at or exceeding the elevation of the emergency spillway) with no apparent ill effects.

According to the guidelines presented in Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation, the slopes recommended for a homogeneous dam of similar material subjected to a rapid drawdown are 4H:1V upstream and 2.5H:1V downstream. The recommended crest width is 18 feet. Based on these guidelines, the Lake Nelson Dam has an adequate downstream slope, and an inadequate upstream slope and crest width.

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 earthquakes provided 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. However, the visual inspection revealed no apparent instability. Based on the visual inspection, the foundation is considered sound. Based on the Bureau of Reclamation guidelines, the downstream slope is adequate, and the crest width and upstream slope are inadequate. The embankment is considered stable during both normal pool and maximum control storage pool operations, which are only 0.4 of a foot different in elevation. In addition, overtopping is not a problem because flows are of less than one foot in depth (0.5 feet) are of relatively brief duration (2 hours) and have a velocity of less than 6 feet per second (3.4 feet per second), the effective eroding velocity for a vegetated earth embankment. A stability check is not required.

SECTION 7

ASSESMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The available engineering data is insufficient to completely evaluate the stability of the embankment. The visual inspection revealed no findings that proved the dam to be unsound. The dam is maintained by the owner, but there is no formal documented maintenance operations program or emergency operations and warning plan. 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 pass 41 percent of the Probable Maximum Flood (PMF) or 82 percent of the SDF without overtopping the dam. Flows overtopping the dam during the SDF are not considered detrimental to the embankment. The combined capacity of the spillways is adjudged inadequate but not seriously inadequate. Overall the dam is in good condition and there is no immediate need for remedial measures. A stability check of the dam is required.

7.2 Recommended Remedial Measures: It is recommended that the regular maintenance operations program be documented for future reference; for example, by keeping a log of the work performed (mowing, tree removal, seeding of bare or eroded areas, etc.) along with observations of any changes in seepage or spring flows. A formal emergency procedure should be prepared and furnished to all operating personnel. This should include how to operate the dam during an emergency, and who to notify, including public officials, in case evacuation from the downstream area is necessary. Also, the inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months:

a. Place riprap in areas of shoreline where needed.

b. Monitor seep at toe for any increase in flow or turbidity and, if either condition develops, contact a qualified geotechnical engineer to evaluate the situation.

c. Mow dam on a regular basis and cut all brush from the embankment.

d. Remove dense underbrush and honeysuckle from the left downstream abutment area and the toe.

e. Cut brush and shrubs from upstream side of emergency spillway control section.

f. Repair spalled concrete in emergency spillway.

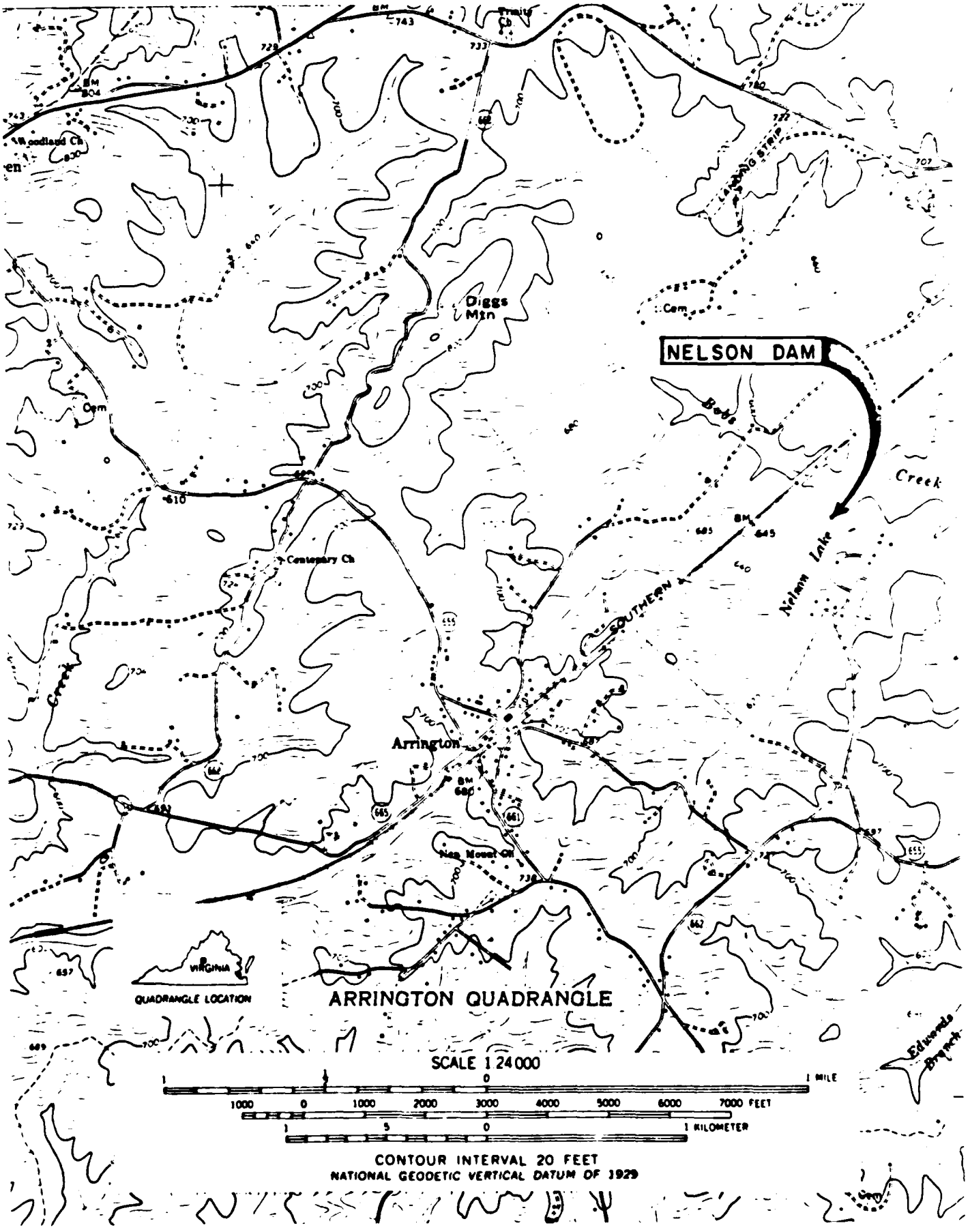
g. Clear grass from joints in emergency spillway and place joint compound to prevent grass from returning.

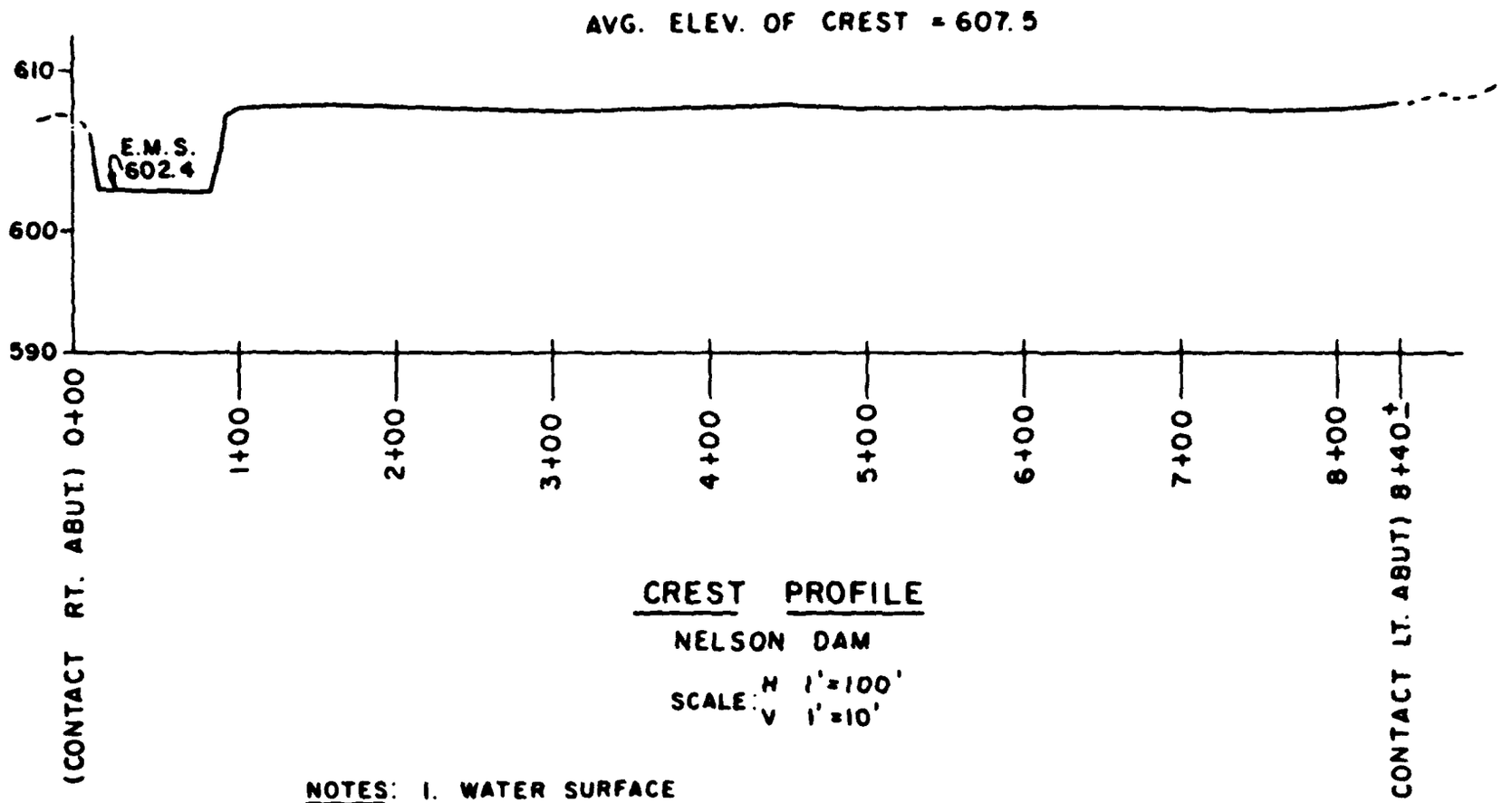
h. Clear discharge channel for emergency spillway so that water can flow unrestricted into the stream below.

i. Install a staffgage which extends above the crest of the dam to monitor the reservoir level.

APPENDIX I

MAPS AND DRAWINGS


NELSON DAM
Diggs Mtn
Arrington
Nelson Lake
SOUTHERN
Edwards Branch
VIRGINIA
QUADRANGLE LOCATION
ARRINGTON 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 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



CREST PROFILE

NELSON DAM

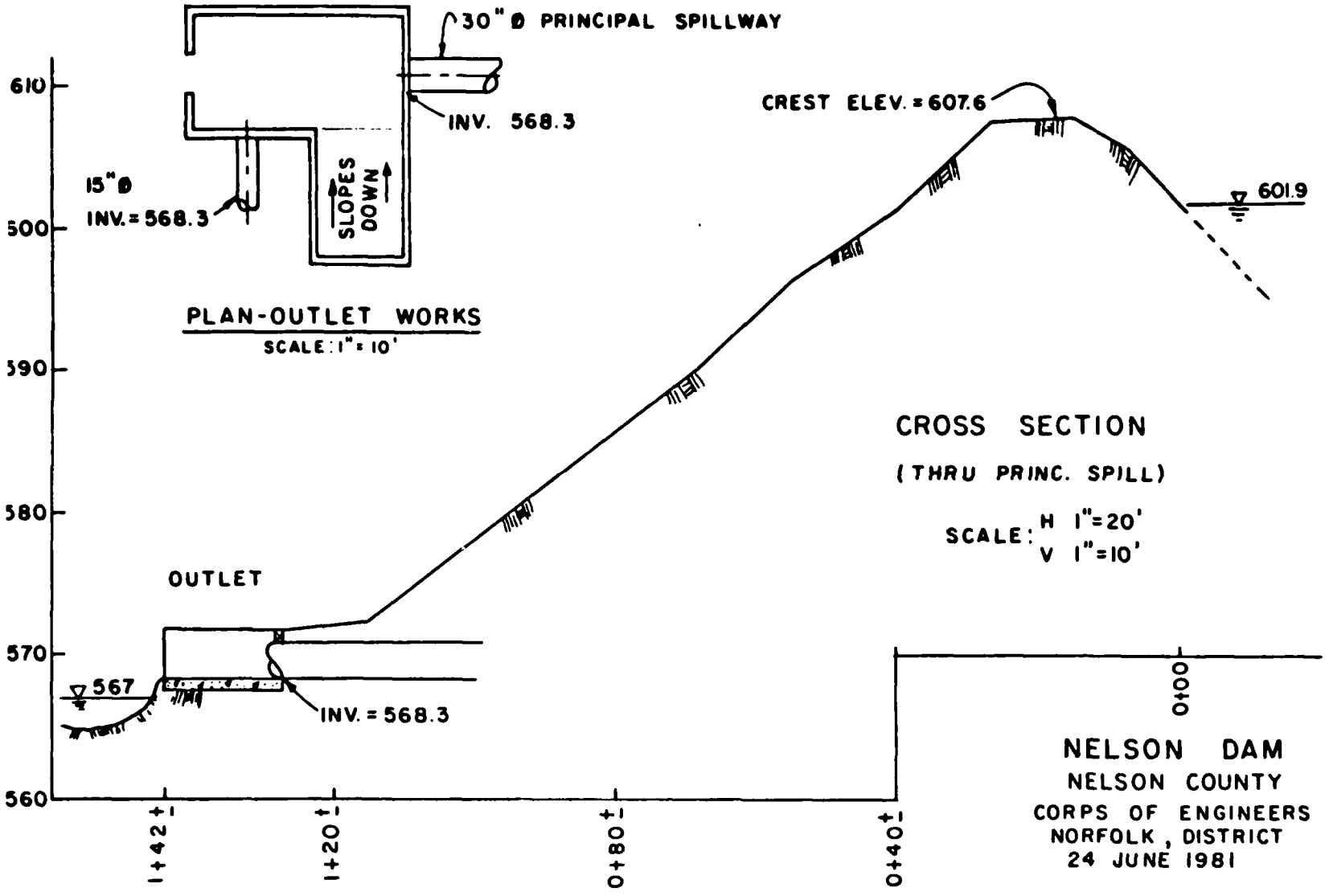
SCALE: H 1'=100'
V 1'=10'

NOTES: 1. WATER SURFACE ELEV. = 602.0 (NORMAL POOL)

2. SIDE SLOPE EMERGENCY SPILLWAY (E.M.S.) APPROXIMATELY 1H:1V

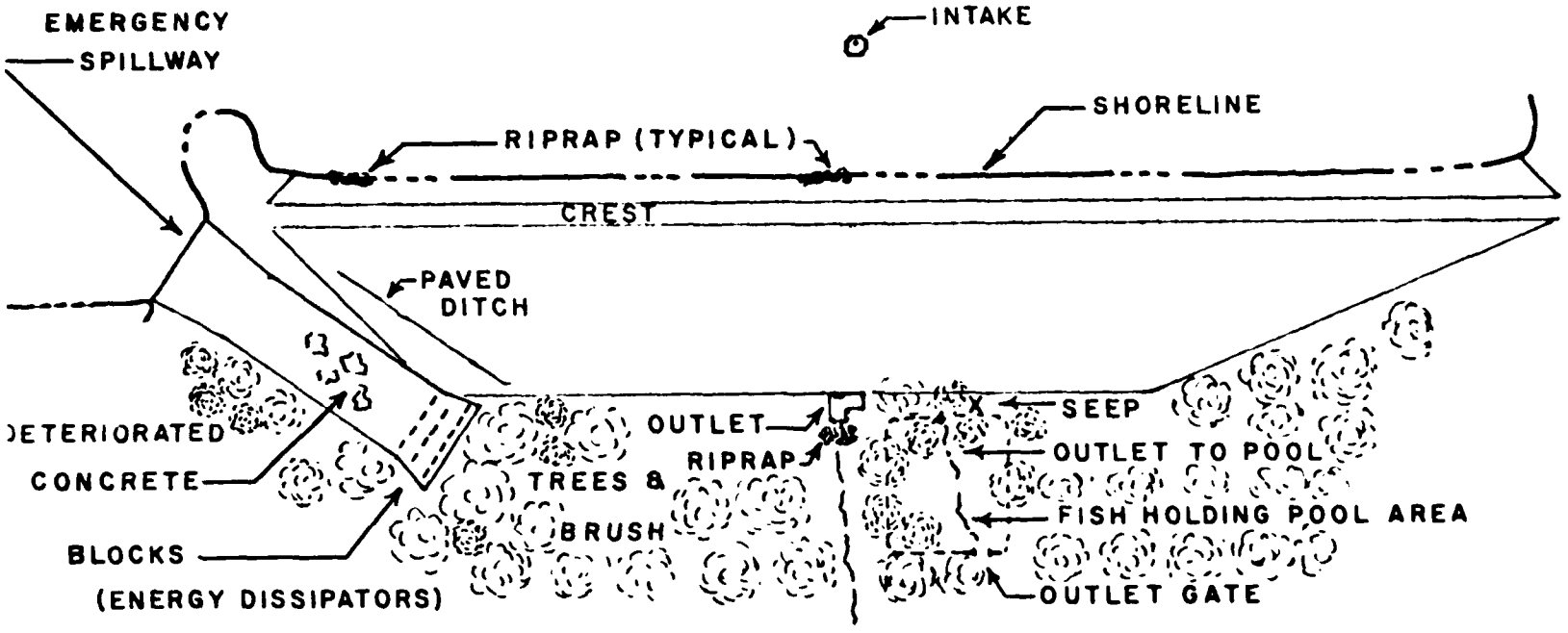
NELSON DAM
NELSON COUNTY
CORPS OF ENGINEERS
NORFOLK, DISTRICT
24 JUNE 1981

PLATE I



NELSON DAM
NELSON COUNTY
CORPS OF ENGINEERS
NORFOLK, DISTRICT
24 JUNE 1981

PLATE II



FIELD SKETCH - PLAN VIEW

LAKE NELSON DAM

NELSON COUNTY, VIRGINIA

24 JUNE 1981 SCALE: 1" 100'

HMG

APPENDIX II

PHOTOGRAPHS

PHOTO #1 CREST OF DAM

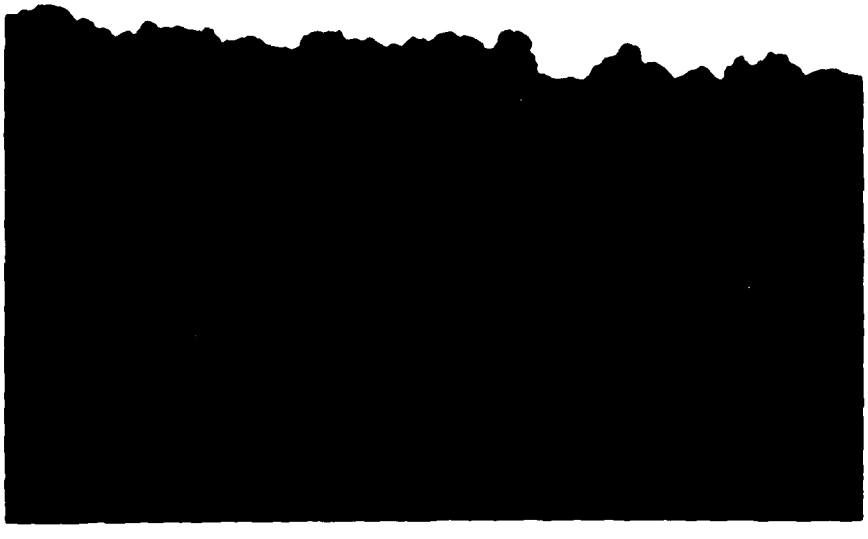


PHOTO #2 DOWNSTREAM FACE

PHOTO #3 UPSTREAM FACE

PHOTO #4 PRINCIPAL SPILLWAY INTAKE

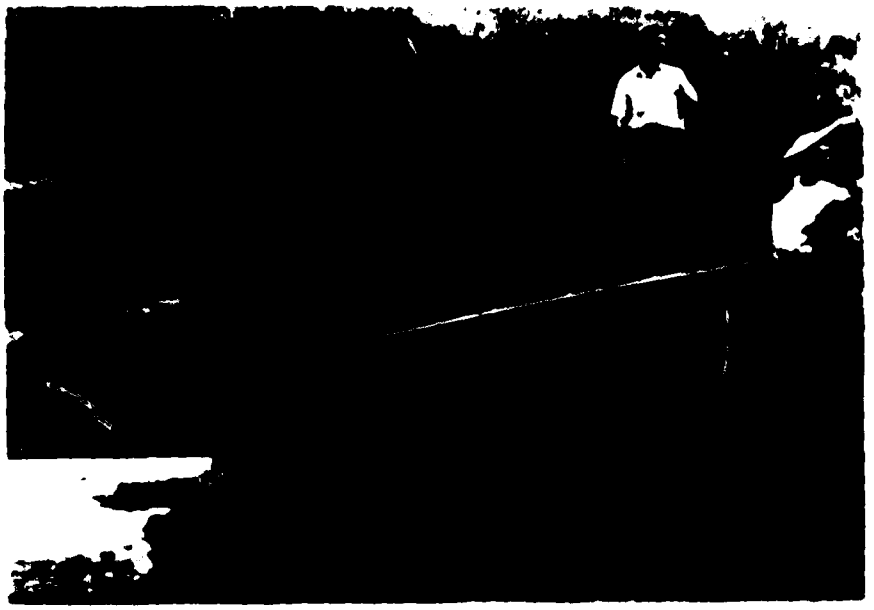


PHOTO #5 PRINCIPAL SPILLWAY OUTLET

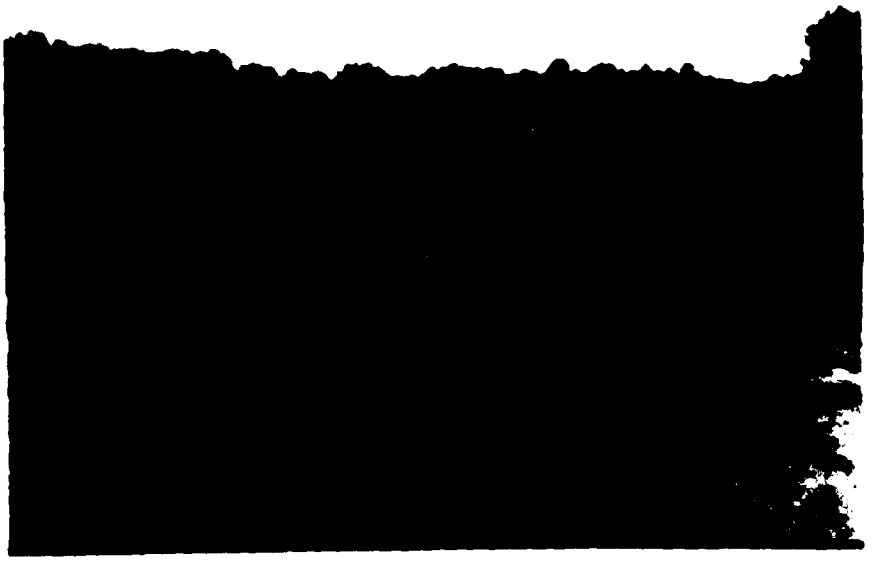


PHOTO #6 EMERGENCY SPILLWAY

PHOTO #7 EMERGENCY SPILLWAY

PHOTO #8 BAFFLE BLOCK AT APRON
OF EMERGENCY SPILLWAY

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: Lake Nelson County: Nelson State: Virginia Coordinates: Lat. 37-41.6
Long. 78-52.8

Date of Inspection: 24 June 1981 Weather: Overcast Temperature: 75°F

Pool Elevation at Time of Inspection: 601.8 msl Tailwater at Time of Inspection: 567.0 msl

Inspection Personnel:

Bo Taran, COE
Jim Robinson, COE
Len Jones, COE
Dave Bushman, SWCB
Leon Musselwhite, SWCB
Ed Constantine, SWCB
John Kauffman, Game Comm.

Dave Bushman Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	None.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appeared to be good.	None.
RIPRAP FAILURES	There were some riprap failure on the upstream face with wave benches forming in these areas.	Place riprap in areas where needed.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION	No sign of foundation instability. There are outcrops of weathered schist in the area of the right abutment, and at least some portions of the dam may vest on this material.	None.
ANY NOTICEABLE SEEPAGE	There is evidence of a spring or possible seep at base of junction of left abutment and and embankment, but no flow was observed. General marshy area to the left of outlet structure appears to be an old fish holding pond.	Monitor seep for any increase of flow or turbidity.
DRAINS	No foundation drain outlet was observed.	None.
MATERIALS	Soils observed at the site are clays and silty clays of medium to high plasticity.	None.
VEGETATION	The dam had good grass cover but was in need of mowing. The toe in areas and the left abutment contact was heavily overgrown with brush and honeysuckle. This made it difficult to evaluate the embankment condition in these areas. Bushes were also growing from the the upstream shoreline and areas of the embankment.	Mow dam on a regular basis. Remove dense brush and honeysuckle to help facilitate inspecting the dam. Cut brush from shoreline on upstream face and on the embankment.

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	Consist of an octagonally shaped concrete riser with 32" x 24" openings on each side with vertical bars forming a trash guard. Was in good condition.	None
APPROACH CHANNEL	None.	None.
DISCHARGE CHANNEL	36-inch CMP discharging into a concrete box structure that was designed to allow water to be diverted to a fish holding pond through a 12-inch concrete pipe. The outlet to the box has a place for a slide gate to facilitate diverting the water. Some minor corrosion has taken place in the invert of the 36-inch CMP outlet. In general the outlet works were in good condition.	None.
BRIDGE AND PIERS	None	None.
EMERGENCY GATE	There is what appeared to be a 24-inch slide gate at the base of the riser structure. It is controlled by a valve stem on the top of the riser. A 6-inch valve is located at an intermediate level on the riser. Above this there is a wooden slide gate, which allows the reservoir to be lowered a couple of feet.	None.
GATES AND OPERATION EQUIPMENT.	Appeared to be in good condition.	None.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	Located in right abutment. Consists of a concrete sill 75 feet wide with 1:1 side slopes. There were small shrubs and brush growing on upstream side of sill. The concrete was in good condition.	Keep brush and shrubs cut.
APPROACH CHANNEL	Clear of obstructions.	None.
DISCHARGE CHANNEL	Concrete lined channel in right abutment. The lower end of the channel was in poor condition with severe spalling and grass growing out many of the joints at the base of the channel were 3 rows of concrete baffle blocks creating an energy dissipator. The baffle blocks were in good condition. Below the concrete portion of the channel, heavy brush was growing. There was riprap placed at the end of the concrete to prevent erosion. The weepholes on the slab portion of the channel were working.	Repair spalled concrete, clean joints and fill with appropriate joint compound. Cut and remove brush growing below concrete portion of channel until it ties into the existing stream bed.
BRIDGE AND PIERS	None.	None.
MISCELLANEOUS	None.	None.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	None.
OBSERVATION WELLS	None.	None.
WEIRS	None.	None.
PIEZOMETERS	None.	None.
STAFFGAGES	None.	Install a staff gage.
OTHER	None.	None.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate with a mixture of woods and pasture. There were no signs of slope failures, except for minor wave erosion at the waterline.	None.
SEDIMENTATION	Not evaluated	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Heavily wooded with thick underbrush on banks.	None.
SLOPES	Moderate slopes.	None.
APPROXIMATE NO.	1 home approximately 2 miles	None.

APPENDIX IV

ENGINEERING DATA

COMMONWEALTH of VIRGINIA

Commission of Game and Inland Fisheries

P.O. Box 66
Free Union, Va. 22940
June 29, 1981

Mr. Musselwhite
P. O. Box 11143
2111 N. Hamilton St.
Richmond, Va. 23230

Dear Mr. Musselwhite:

We have contour mapped the lake and have derived the following data.

Surface area	40.4 acres
Maximum depth	32 feet
Mean depth	12.4 feet
Volume	501.5 acre feet
Watershed area	825.46

All of these figures are slightly below the values listed on the sheets from Bob Gay of SWCB.

This may be the result of Lake Volume and area discrepencies may be the result of siltation. We have a detailed contour map available if you need one.

Sincerely,

John

John Kauffman
Supervising Fish Biologist

JK/cc

Copied the map. Please disregard last sentences

COMMONWEALTH OF VIRGINIA

COMMISSION OF GAME AND INLAND FISHERIES

MEMORANDUM

TO : File **DATE:** 6-17-81

FROM: Larry Hart **SUBJECT:** Construction of Lake Nelson Dam

I talked with Mr. Jack Yeatts ((804) 369-5922) concerning the construction of the dam at Lake Nelson. Mr. Yeatts was the contractor but has retired from the business. Mr. Yeatts had the following comments:

Mr. Warren C. Perrow, consultant, is probably dead since he was an old man when the lake was built.

The dam had a good cut-off trench installed and they hit good material about five feet below the ground level.

The fill was of good quality and the best material was placed in the core of the dam. Mr. Yeatts was not sure if the plans called for a zoned fill or not.

The pipe through the dam was cradled.

Several yards (about 10) had to be blasted from the spillway.

The dam was constructed one summer or fall. The spillway was not completed before winter weather so the lake was to be left dry through the winter. Someone closed the gate and the lake was allowed to fill. Water was seeping through the exposed rock in the spillway the next sping and the lake had to be drained. The rock in the spillway was drilled and grouted but never really sealed. After the lake was drained and the flows stopped, the concrete spillway was installed.

Mr. Yeatts did not have a copy of the plans and had no idea where a set could be found.

TO: Jack Hoffman

DATE: May 4, 1977

FROM: Lloyd Byrd

On Tuesday, April 26, 1977 I inspected the dam at Lake Nelson and found that the area has been cleared of all brush and trees and looks very good.

I talked to Mr. Ashby Lincoln and he requested that I remind you that you had promised him you would provide two (2) walkways at the lake to be used by older people who wanted to be able to embark and debark from boats more easily. Mr. Lincoln already has two (2) barrels located approximately twelve (12) feet from the shoreline in two (2) locations that can be used to attach one end of the walkway.

He also requested that you provide him with approximately ten (10) bags of fertilizer within the next several weeks so that he can treat the lake. I told him I would pass the word to you.

LHB/pl

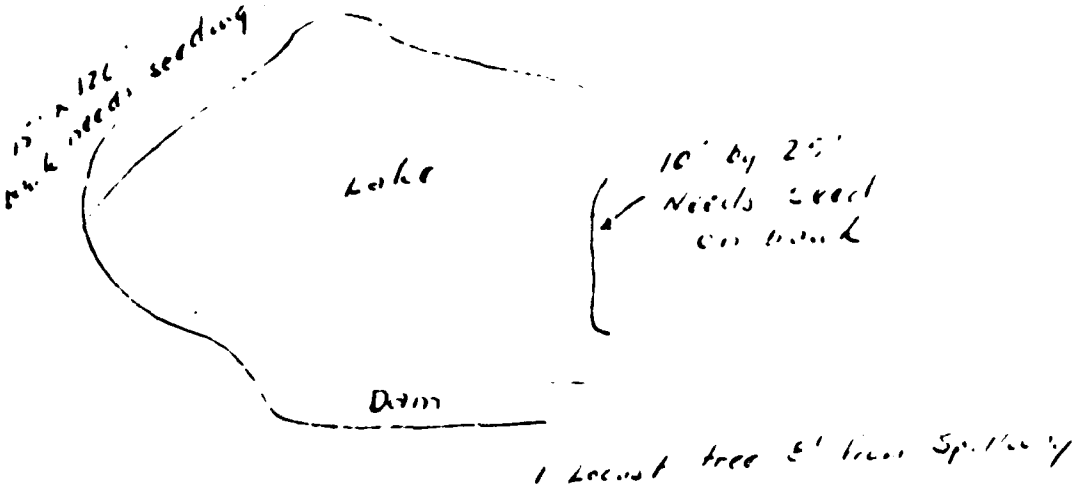
cc: Mr. Engle
Mr. Kauffman

Lake Nelson

John Kauffman - Biologist in charge

This dam has a lot of bushes which can be bush hoged OK on back slope-some on top. Few alter bushes in front of dam which can be cut with power saw.

Emergency spillway is of cement 80 ft. wide. Very few bushes at waters edge - balance of spillway good and clean.



Date of inspection 6-1-76

Biologist satisfied with inspection

Contact to do work:
Mr. Russel A. Stevens
Arrington, Va. 22922
Ph. 804-263-5915

Est. Cost $150.00 - $200.00

FROEHLING & ROBERTSON, INC.
INSPECTION ENGINEERS • CHEMISTS • BACTERIOLOGISTS
CABLE ADDRESS—"FROEHLING"
1881

BRANCH LABORATORIES

Richmond, Virginia
June 30, 1972

Commonwealth of Virginia
Commission of Game & Inland Fisheries
P. O. Box 11104
Richmond, Virginia 23230

Attn: Mr. Jack Hoffman

Ref: Inspection of Nelson Lake Dam
F&R Report #X-2001-6

Gentlemen:

Upon authorization of Mr. Jack Hoffman of Commission of Game & Inland Fisheries, the writer visited the Nelson Lake Dam for the purpose of inspecting the dam. This visual inspection was aimed at determining the general dam conditions, presence of piping, leakage through the dam and around the primary spillway, condition of primary and emergency spillway and abutments and any other conditions pertinent to the function and safety of the structure. This report is of necessity general and limited to a visual inspection, review of available drawings and information, and knowledge of the geological history of the area. This general inspection does not however guarantee the integrity of the dam.

PAST HISTORY AND DESIGN INFORMATION

Lake Nelson is located in Nelson County near the community of Arrington. The lake covers an area of 45 acres. It is not known when the lake was built, but it was drained and renovated in the late sixties.

GEOLOGY

Nelson Lake is situated next to the Southern Railway tracks about 1½ miles northeast of the town of Arrington in Nelson County, Virginia. It was formed along a tributary of Bob's Creek which flows eastward into Buffalo River. The area lies at the western edge of the Piedmont just east of the Blue Ridge where bedrock has been subjected to considerabl deformation.

The rocks of the locality are chiefly part of the Virginia Blue Ridge Complex which at this point, consists of biotite granite, quartz monzonite and gneiss. However strata of the variable Lynchburg formation may also be along Bob's Creek. Some added investigation of this site should be made, because of the great complexity of bedrock which may affect the quality of the dam's foundation.

INSPECTION AND OBSERVATIONS

The writer visited Lake Nelson and made a visual inspection of the dam and emergency spillway on June 27, 1972. Visual inspection was hindered by a heavy growth of grasses and weeds on the dam and by a thick stand of locust saplings extending from the NW abutment to the center of the dam. Locust saplings are scattered over the remainder

of the dam in a random manner.

The concrete spillway has several areas of spalling, at least two small seepage areas approximately 1/3 of the way above the toe and scattered small saplings growing in cracks and joints.

On the upstream face, riprap is missing in scattered spots.

CONCLUSIONS AND RECOMMENDATIONS

A program of periodic maintenance should be initiated at Nelson Lake Dam. The first step in this program should be cutting of all trees and brush from the dam and spillway to prevent further root damage to the structure. After the trees are cut, the dam should be mowed on a regular basis to prevent the tangled high growth of grasses and weeds which greatly hinder visual inspections of the dam and also to prevent trees and shrubs from attaining a size sufficient to cause damage from root growth.

Coarse riprap, equal or similar to Virginia Department of Highways dry riprap, Class 1, should be added to the upstream face.

The dam should receive an annual visual inspection bc competent personnel. Ideally this inspection should be made shortly after the dam has been mowed.

We hope we have supplied the required information. If there are any questions, feel f to contact the writer.

Very truly yours,

FROEHLING & ROBERTSON, INC.

W. H. Duhling, Jr.

WHD/dw

APPENDIX V

REFERENCES

APPENDIX V
REFERENCES

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

2. HEC-1 Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, January 1973.

3. NWS-Dambreak Computer Model, (Office of Hydrology, National Weather Service (NWS), Silver Spring, Mayrland, September 1980).

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

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

6. Bureau of Reclamation, U. S. Dept of the Interior, Design of Small Dams, 1977.

7. "Geologic Map of Virginia", Virginia Division of Mineral resources, 1963.

8. "General Soil Mpa, Virginia", Soil Conservation Service, U. S. Dept. of Agriculture, July 1969.


ATE
LME