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NATIONAL DAM SAFETY PROGRAM. POTOMAC RIVER BASIN. SOUTH RIVER D--ETC(U)
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1 OF 1
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POTOMAC RIVER BASIN

Name Of Dam: SOUTH RIVER NO. 10A

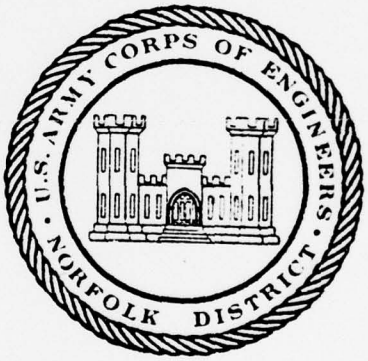
Location: AUGUSTA COUNTY, STATE OF VIRGINIA

Inventory Number: VA 01504

(1)

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

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

SEPTEMBER 1978

BY

MICHAEL BAKER, JR., INC.
BEAVER, PENNSYLVANIA 15009

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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.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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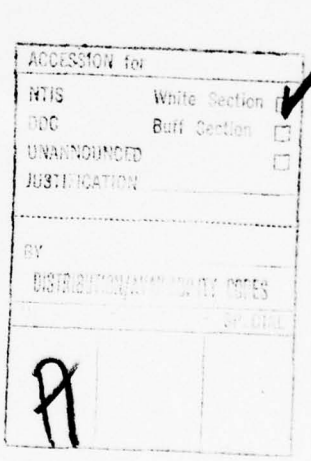

NAME OF DAM: SOUTH RIVER NO. 10A

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: South River No. 10A
State: Virginia
County: Augusta
Stream: Mills Creek
Date of Inspection: 18 July 1978

BRIEF ASSESSMENT OF DAM

South River Dam No. 10A is an earth dam approximately 715 feet long and 89.5 feet high, owned and operated by the U.S. Forest Service. The dam was designed by the U.S. Soil Conservation Service on the South River Sub-Watershed as part of the Potomac River Watershed Project. The visual inspection and review of engineering data indicate no serious deficiencies requiring emergency attention. No evidence of unstable slope conditions or seepage through the embankment was observed. However, a clear spring was noticed about 30 feet beyond the toe. Flow from the spring was estimated to be less than one g.p.m. at the time of the inspection.

The spillway will pass 75 percent of the Probable Maximum Flood which is consistent with the "significant" size-"high" hazard classification of the dam. Stability analyses done for the dam design showed a sufficient factor of safety; however, analyses performed on the upstream slope did not indicate full drawdown conditions.

It is recommended that stability analyses be performed on the upstream slope assuming full drawdown. The severe erosion of the channel downstream of the emergency spillway and minor erosion on both faces of the dam should be repaired as part of the annual maintenance program. It is also recommended that riprap be placed in the stilling basin to prevent further erosion in this area. The spring should be monitored regularly and especially during periods of high reservoir levels to determine if the rate of flow increases. If the rate of flow does increase, a more thorough investigation and possibly remedial measures will be necessary.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL
BAKER III
NO. 3176
CERTIFIED PROFESSIONAL ENGINEER

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Colonel, Corps of Engineers
District Engineer

Date: _____

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: SOUTH RIVER NO. 10A ID# VA 01504

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. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: South River Dam No. 10A (Mills Creek Dam) is a zoned earthfill dam about 715 feet long and 89.5 feet high. It was constructed with a 24 feet wide crest at elevation 1897.5. Side slopes of two and one-half horizontal to one vertical (2.5:1) have been provided; however, the upstream face of the dam flattens to a 3:1 slope below elevation 1862.0 feet. Seepage control is provided by an impervious core and cut-off trench which extends to bedrock and is backfilled with clayey and silty sand. The shell of the dam consists of silty to well graded gravel. A rock toe has been provided for drainage purposes. The plan-profile, typical cross sections and details of the dam are shown on Plates 2, 3 and 4.

The principal spillway consists of a reinforced concrete riser with a 24 inch concrete pipe as a discharge conduit. The discharge is presently controlled by a drop-inlet at the crest of the riser (elevation 1862.0 feet). Since the stored water was originally

used as a water supply for Augusta County, Virginia, four hand-operated slide gates were also provided to control discharge. The reservoir is no longer used as a water supply. A plan and profile of the principal spillway is shown on Plate 3.

The emergency spillway is a vegetated side-channel spillway which is cut primarily in bedrock. It has a bottom width of about 100 feet and a crest at elevation 1888.5 feet. The left side of the spillway is a rock-cut with a slope ratio of 0.5:1. The small 3:1 slope on the right side is cut primarily in soil.

1.2.2 Location: South River Dam No. 10A is located on Mills Creek about four miles upstream from Sherando, Virginia. A Location Plan is included in Appendix I.

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure as defined by the Recommended Guidelines for Safety Inspection of Dams. The maximum height of the dam is 89.5 feet, and the reservoir capacity to the top of the dam is 1252 acre-feet.

1.2.4 Hazard Classification: The dam is located in a rural area where failure may damage isolated homes. Therefore, this dam is considered in the "significant" hazard category as defined in Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by the U.S. Forest Service.

1.2.6 Purpose of Dam: Presently, this dam is used as a flood control structure; in past years, it had also been used for water supply.

1.2.7 Design and Construction History: The existing facility was constructed by the English Construction Company under the supervision of the U.S. Soil Conservation Service (S.C.S.). Construction was completed in 1963.

1.2.8 Normal Operational Procedures: The stored water is no longer used for water supply; therefore, no formal operating procedures are followed. Normal pool is controlled by the drop-inlet at the crest of the riser (elevation 1862.0 feet). Water rising above the crest of the drop-inlet is automatically passed downstream. Excess flows are diverted through the side-channel emergency spillway having a crest elevation of 1888.5 feet. Water may also be discharged downstream by use of the four slide gates.

1.3 Pertinent Data

1.3.1 Drainage Area: The dam controls a drainage area of 3.7 square miles.

1.3.2 Discharge at Dam Site: Maximum flood at the dam site is not known.

Principal Spillway:
- Pool level at emergency spillway crest . . . . . 84 c.f.s.
- Pool level at top of dam . . . . . 89 c.f.s.

Emergency Spillway:
- Pool level at top of dam . . . . . 7251 c.f.s.

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 M.S.L.	Reservoir Capacity: Area acres	Reservoir Capacity: Acre-feet(a)	Reservoir Capacity: Watershed inches(b)	Length feet
Top of dam	1897.5	31.5	1235	6.3	3115
Maximum pool, design surcharge	1894.2	30.1	1130	5.7	-
Emergency spillway crest	1888.5	27.7	970	4.9	2851
Principal spillway crest (c)	1862.0	17.4	370	1.9	1795
Streambed at center-line of dam	1808	-	-	-	-

(a) Total storage from bottom of reservoir.
(b) Based on a drainage area of 3.7 square miles.
(c) Controls normal pool elevations.

SECTION 2 - ENGINEERING DATA

2.1 Design: The design data reviewed included the following:

1) As-built drawings including plans, elevations and sections of the dam and appurtenant structures.

2) Hydrologic and hydraulic calculations including:

   a) Curve number computation.

   b) Reservoir storage capacity.

   c) Reservoir discharge capacity.

3) Logs of test borings and test pits.

4) Laboratory soil test results including:

   a) Standard and Modified Proctor test results.

   b) Grain Size Analyses and Atterberg Limits.

   c) Triaxial Shear Test results.

5) Geologic Report (Geologic Report including logs of test borings is presented in Appendix VI).

6) Slope Stability Analyses (the Stability Analyses were not of sufficient reproducible quality for inclusion in this report).

7) Geotechnical (Soils) Report containing slope stability (Appendix VII).

8) Work Plan.

2.2 Construction: The dam was constructed by the English Construction Company and completed in 1963. No construction records were available for this inspection report.

2.3 Operation: Presently, there are no formal operating procedures for this dam. Since the reservoir is not currently used for water supply, the four slide gates are infrequently operated.

2.4 Evaluation

2.4.1 Design: Foundation conditions were determined using the Geotechnical (Soils) and Geologic Reports. The Stability Analyses and as-built drawings were adequate for evaluating the structural stability of the downstream slope of the dam. Full drawdown conditions were not indicated on the stability analyses performed on the upstream slope. The hydrologic and hydraulic data provided were adequate for design review.

2.4.2 Construction: No construction records were available; however, the as-built drawings will indicate modifications and changes made during construction.

2.4.3 Operation: Operation of the slide gates should be included in the annual maintenance and inspection program.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The dam and its appurtenant structures were found to be in very good overall condition at the time of the inspection. The problems noted during the visual inspection of the dam do not require immediate remedial treatment, but the problems should be corrected as part of the maintenance program. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list is given in Appendix III.

3.1.2 Dam: A clear spring was observed 30 feet beyond the toe, about 30 feet to the right of the left abutment. The flow from this clear spring was estimated to be less than one g.p.m. Unauthorized vehicular traffic on both the upstream and downstream faces has caused some minor erosion (see Photos 7 and 8). An erosion channel has formed at the downstream side of the embankment - left abutment contact, and small trees were observed on the downstream slope.

The channel, downstream of the emergency spillway, shows signs of severe erosion (see Photo 3).

3.1.3 Appurtenant Structures: The water supply intake (currently not in use) located at the outlet of the principal spillway conduit has some erosion beneath its downstream end. This has caused the concrete slab on the left side to drop and separate about eight inches at a construction joint (see Photo 1).

The valve control handwheel on the riser has been broken. The handwheels for slide gates 2 and 3 were not padlocked to prevent unauthorized use.

3.1.4 Reservoir Area: No serious gully or shoreline erosion was observed.

3.1.5 Downstream Channel: The rocky downstream channel showed no signs of significant erosion except as described in paragraph 3.1.3. The banks of this channel are heavily overgrown.

3.2 Evaluation

3.2.1 Dam: None of the above items, with the exception of the clear spring beyond the toe is serious enough to warrant immediate repair since they do not threaten the integrity of the dam. These repair items are considered good maintenance and should be accomplished as part of an annual maintenance program.

The eroded areas on the upstream face, the downstream face, and the emergency spillway channel should be regraded and reseeded. All trees growing on the embankment should be removed.

The exact source of the clear spring can not be determined by visual inspection alone; the clear spring should be monitored during periods of high reservoir levels to determine if the rate of flow increases. If it is determined that the flow is originating from the reservoir, a more thorough investigation including installation of piezometers is necessary.

3.2.2 Appurtenant Structures: Placing riprap in the stilling basin to the level of the concrete toe should prevent any further erosion in this area. The location on the upstream face of the dam of the handwheels for slide gates 2 and 3 allow their unauthorized use. The handwheels should be removed or securely fastened.

3.2.3 Reservoir Area: Does not require further investigation.

3.2.4 Downstream Channel: Does not require further investigation.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: The dam was originally used for water supply by Augusta County, Virginia. Presently, the dam serves as a flood control structure, and no formal operating procedures are required.

4.2 Maintenance of Dam: The Augusta County Service Authority conducts a yearly maintenance program in conjunction with an annual inspection by the Headwaters Soil and Water Conservation District. Their maintenance responsibilities include liming, fertilizing, and mowing the embankment and spillways; seeding and mulching bare areas; painting the trash racks; and repairing gullies which occur in the dam and spillway areas.

In addition, annual inspections are conducted by the U.S. Forest Service.

4.3 Maintenance of Operating Facilities: The Augusta County Service Authority is responsible for the maintenance of the trash racks and the emergency slide gate.

4.4 Warning System: At the present time, there is no warning system or evacuation plan in operation. It is recommended that a formal emergency procedure be prepared, and prominently displayed and furnished to all operating personnel. This should include:

1) How to operate the dam during an emergency.

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

3) Procedures for evaluating inflow during periods of emergency operation.

4.5 Evaluation: Maintenance of the operating facilities is adequate. However, the emergency outlet should be operated regularly (during the annual inspection), and records should be kept of this operation.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: The crest of the drop-inlet to the principal spillway was established at an elevation of 1862 which would provide the conservation storage needed for sediment deposit and water supply. The capacity (84 c.f.s with reservoir level at crest of emergency spillway) of the principal spillway was established by consideration of a number of factors including:

1) The capability of evacuating the flood storage space within a reasonable time (± 10 days).

2) Not passing damaging flows downstream.

3) The capability of the reservoir to store the flood waters.

The crest elevation of 1888.5 for the emergency spillway was established with consideration of the maximum elevation reached in routing the principal spillway hydrograph or by the storage needed to store the 10 day, 100 year rainfall, whichever produces maximum elevation. The elevation of the top of the dam at 1897.5 was established by the maximum elevation reached in passing the freeboard hydrograph.

5.2 Hydrologic Records: No hydrologic records are available other than the S.C.S. calculations listed in paragraph 2.1.

5.3 Flood Experience: Flood experience is not available.

5.4 Flood Potential: Design features of the dam were established by routing various hydrographs as noted in paragraph 5.1.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Since the reservoir is no longer used for water supply, regulation of flow from the reservoir is automatic. Water rising above the crest of the drop-inlet flows into this inlet and through the dam in the 24 inch concrete conduit. Water also flows past the dam over the ungated emergency spillway in the event water in the reservoir rises over the crest of the spillway.

Outlet discharge capacity, reservoir area and storage capacity were obtained from reports and computations furnished by the S.C.S., which were verified as part of this report. All other determinations were computed as part of this report.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance in various hydrographs are shown in Table 5.1.

Flood routings for the P.M.F., the one-half P.M.F. and the 100 year flood were begun with the reservoir level at normal pool. The inflow hydrograph used by the S.C.S. to set the emergency spillway crest was comparable to the 100 year flood and therefore was routed for use in reservoir evaluation.

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs 100 Year	1/2 P.M.F.	P.M.F.
Peak flow, c.f.s.				
Inflow	-	1407	5540	11,080
Outflow	-	84	5109	10,869
Peak elev., ft. M.S.L.	1862.0	1888.0	1895.2	1898.8
Emergency spillway				
Depth of flow, ft. (a)	-	-	4.1	5.5
Avg. velocity, f.p.s.	-	-	11.5	13.3
Non-overflow section				
Depth of flow, ft. (b)	-	-	-	0.7
Avg. velocity, f.p.s.	-	-	-	4.7
Tailwater elev., ft. M.S.L.	-	-	-	-

(a) Actual depth at control section not including velocity head.
(b) Duration of overtopping is 2.5 hours.

5.7 Reservoir Emptying Potential: The 24 inch reinforced concrete pipe entering the upstream side of the riser at a low level will permit withdrawal of about 72 c.f.s. with the reservoir level at the riser crest and essentially dewater the reservoir in about three days.

5.8 Evaluation: South River Dam No. 10A has an "intermediate" size-"significant" hazard classification which requires it to pass from one-half P.M.F. to P.M.F. The South River

Dam No. 10A has a maximum discharge capacity at the top of dam of 8100 c.f.s. The dam is able to pass 75 percent of the P.M.F. without overtopping. Therefore, according to its classification, the spillway is considered adequate because the dam should pass from one-half P.M.F. to P.M.F.

It should be indicated that conclusions pertain to present day conditions, and that the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: According to the Geologic Report, approximately zero to thirty feet of alluvial gravel blankets the quartzite bedrock at the centerline of the dam. The cut-off trench provided for seepage control has been keyed into the quartzite. Both abutments consist of interbedded sandstone and siltstone; however, the base of the left abutment is comprised of quartzite. The bedding planes strike parallel to the trend of the valley and dip slightly toward the northwest.

6.2 Stability Analysis:

6.2.1 Visual Observations: No evidence of instability in the embankment or cut-slopes was observed. Seepage was not observed in the embankment or abutments. However, a clear spring was noticed 30 feet beyond the toe, about 30 feet to the right of the left abutment. The flow from this clear spring was estimated to be less than one g.p.m.

6.2.2 Design Data: Slope stability was checked by the Swedish Circle Method on a zoned embankment section. Original analyses were performed assuming strength parameters of $\phi = 35°$ and $c = 0$ for the shell material. The strength values used for the core (results of consolidated undrained triaxial shear tests) were $\phi = 23°$ and $c = 300$ p.s.f. Factors of safety of 1.5 upstream and 1.46 downstream were obtained with a core having 2:1 slope ratios and the shell section on 2.5:1 slopes with 10 feet berms at elevation 1854. Analyses performed on the upstream slope did not indicate that full drawdown conditions were assumed.

A triaxial shear test was later performed on a sample of the shell material. Shear values obtained were $\phi = 41.5°$ and $c = 425$ p.s.f. Slope stability was then checked using these shear strength values for shell material. The factor of safety for the upstream slope remained about the same; whereas, the safety factor for the downstream slope increased from 1.46 to 1.60.

6.2.3 Operating Records: The 1977 inspection report by the U.S. Forest Service indicated seepage on the downstream slope of the dam. Seepage was not observed in the embankment, however, during the visual inspection which was conducted as part of this report.

6.2.4 Post-Construction Changes: No alterations of the dam since it was constructed were apparent.

6.2.5 Seismic Stability: South River Dam No. 10A is located in Seismic Zone 2, indicating that there is virtually no hazard anticipated from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams.

6.3 Evaluation: The embankment section chosen for the Stability Analyses is slightly different from as-built conditions. The as-built drawings indicate a 2.5:1 over 3:1 upstream slope with no berm. This discrepancy should not affect the stability of the upstream slope. However, analyses assuming full drawdown should be performed.

The clear spring beyond the toe may be an indication of seepage through the foundation. If further observation indicates that the clear flow from the spring is originating from the reservoir; the piping potential should be assessed, and additional stability analyses should be made using the existing phreatic surface.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The spillway will pass 75 percent of the P.M.F. which is consistent with the "intermediate" size-"significant" hazard classification of the dam. Minor erosion, caused by unauthorized vehicular traffic, exists on both faces of the dam. Slope failures were not noted; however, a clear spring was observed 30 feet from the toe, about 30 feet to the right of the left abutment. The consequences of this clear spring depend on the source of the water and the effect of this clear spring on embankment stability.

The data available were sufficient to evaluate the adequacy of design. As-built drawings and visual inspection of the dam indicated no serious departure from design plans.

The dam will not require urgent remedial treatment.

7.2 Recommended Remedial Measures

7.2.1 Clear Spring: Immediately, the owner should establish and maintain a regular observation schedule of inspecting the clear spring to determine its source and prevent a worsening condition from going unobserved. If as a result of the periodic inspections, it is found that the flow is originating from the reservoir; then an in-depth investigation including installation of piezometers is recommended.

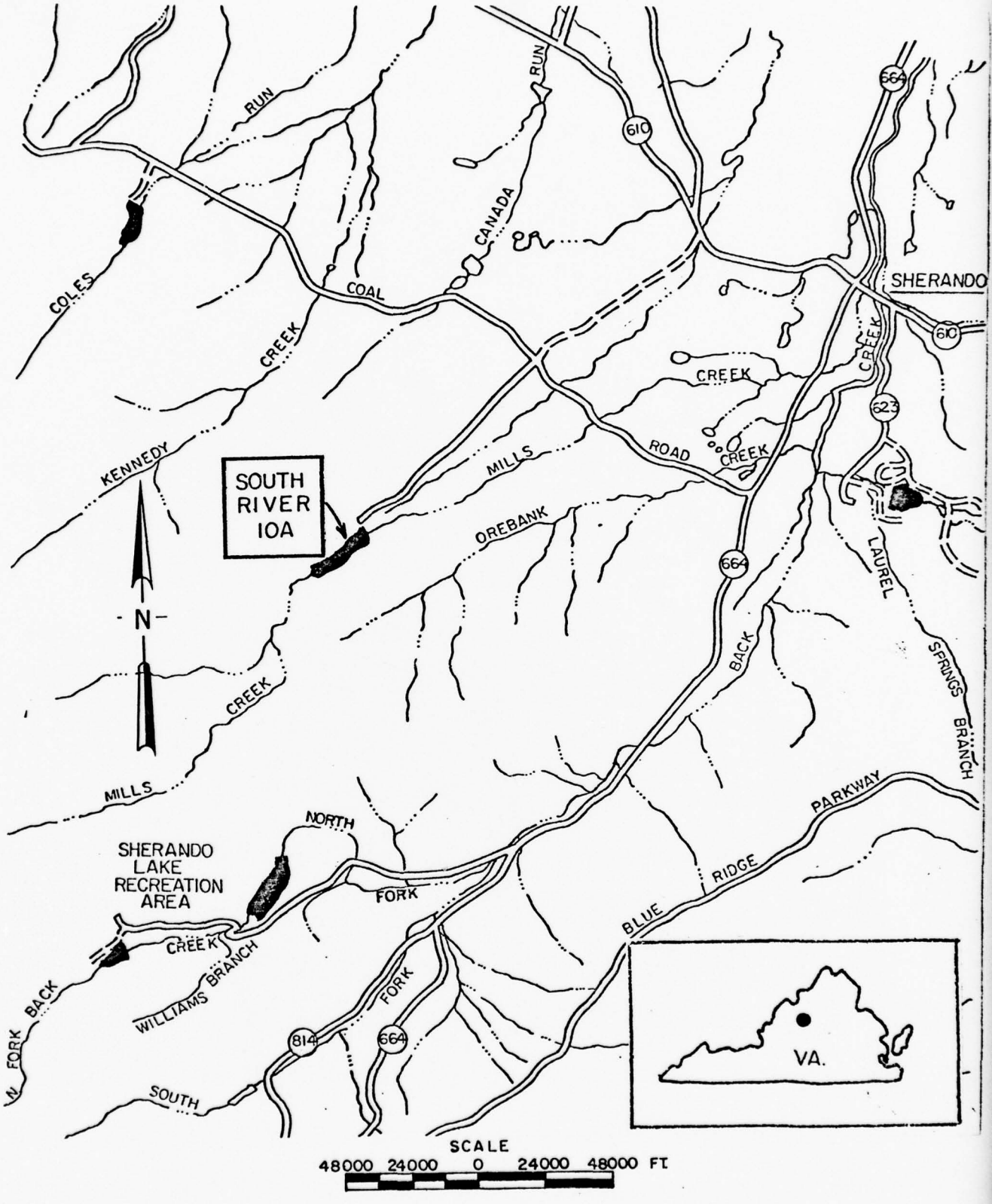
7.2.2 Other Recommendations: Repair of the eroded areas on the upstream and downstream slopes of the dam, and the channel downstream of the emergency spillway will be necessary. The erosion channel at the downstream side of the embankment - left abutment contact should be filled in and seeded. All small trees growing on the embankment should be removed. The vegetation covering the rock toe should also be removed. Riprap should be placed in the stilling basin to the level of the concrete toe to prevent further erosion in this area. The handwheels for slide gates 2 and 3 should be removed or securely fastened to prevent their unauthorized use. The heavy brush growing on the banks of the outlet channel should be cleared periodically. These items can be accomplished through the annual maintenance program. It is also recommended that the grass on the embankment and abutment be cut before the annual maintenance inspection. Stability analyses should be performed on the upstream slope assuming full drawdown conditions.

APPENDIX I

PLATES

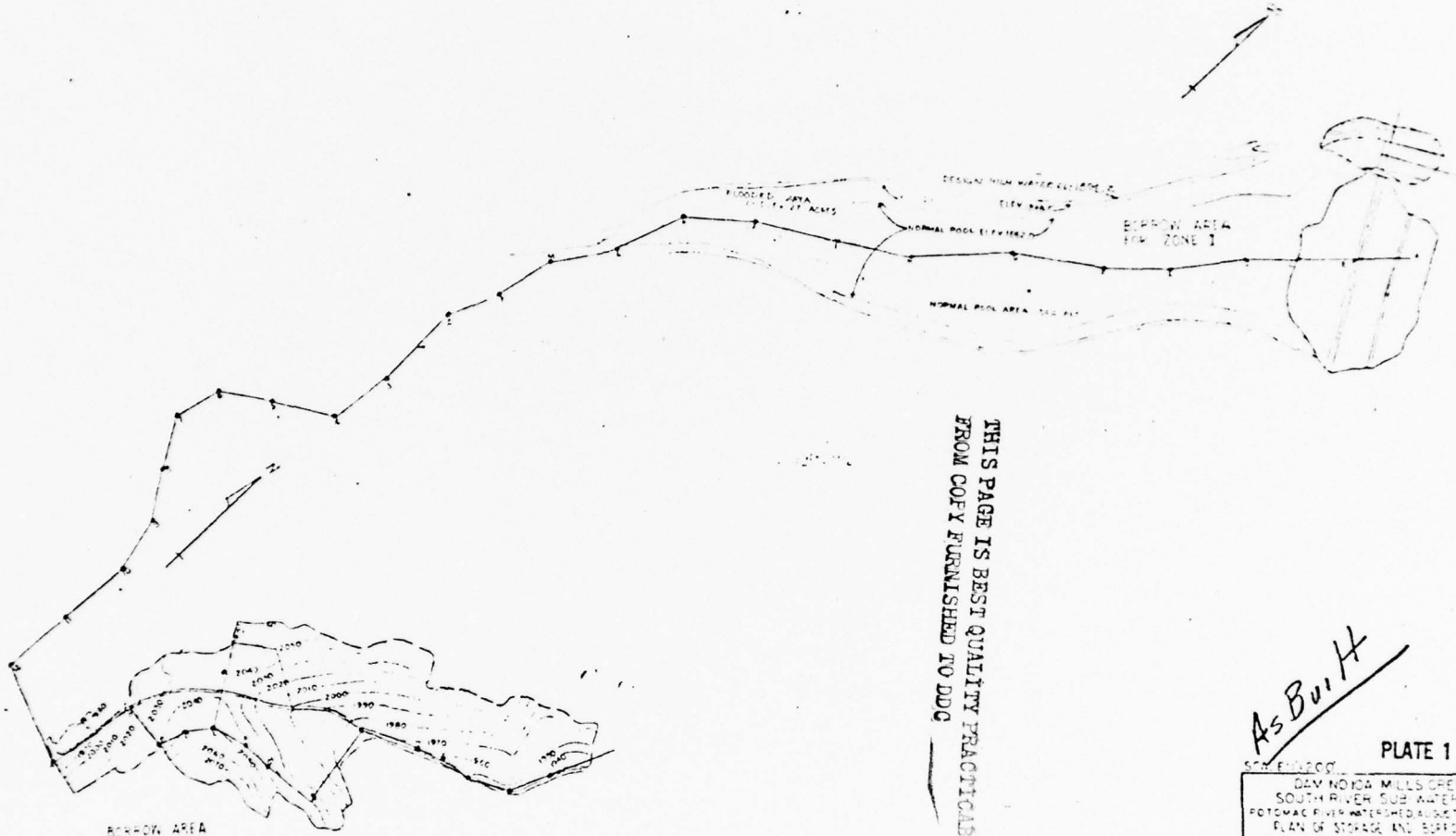
CONTENTS

NAME OF DAM: SOUTH RIVER NO. 10A



LOCATION PLAN

SOUTH RIVER No. 10A



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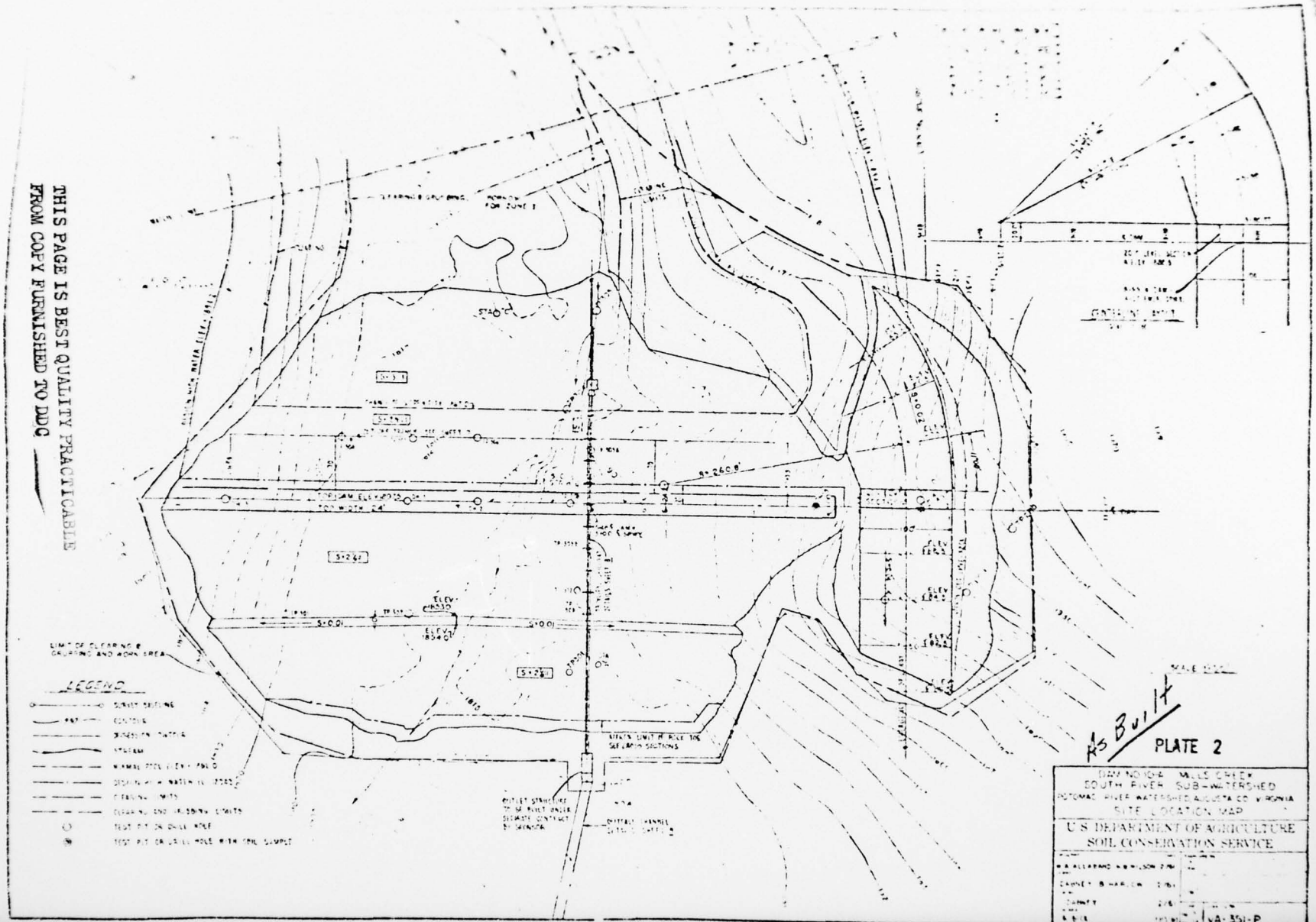
As Built

PLATE 1

DAY NOICA MILLS CREEK
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED, ANNE ARUNDEL COUNTY, MD.
PLAN OF STORAGE AND BORROW AREAS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



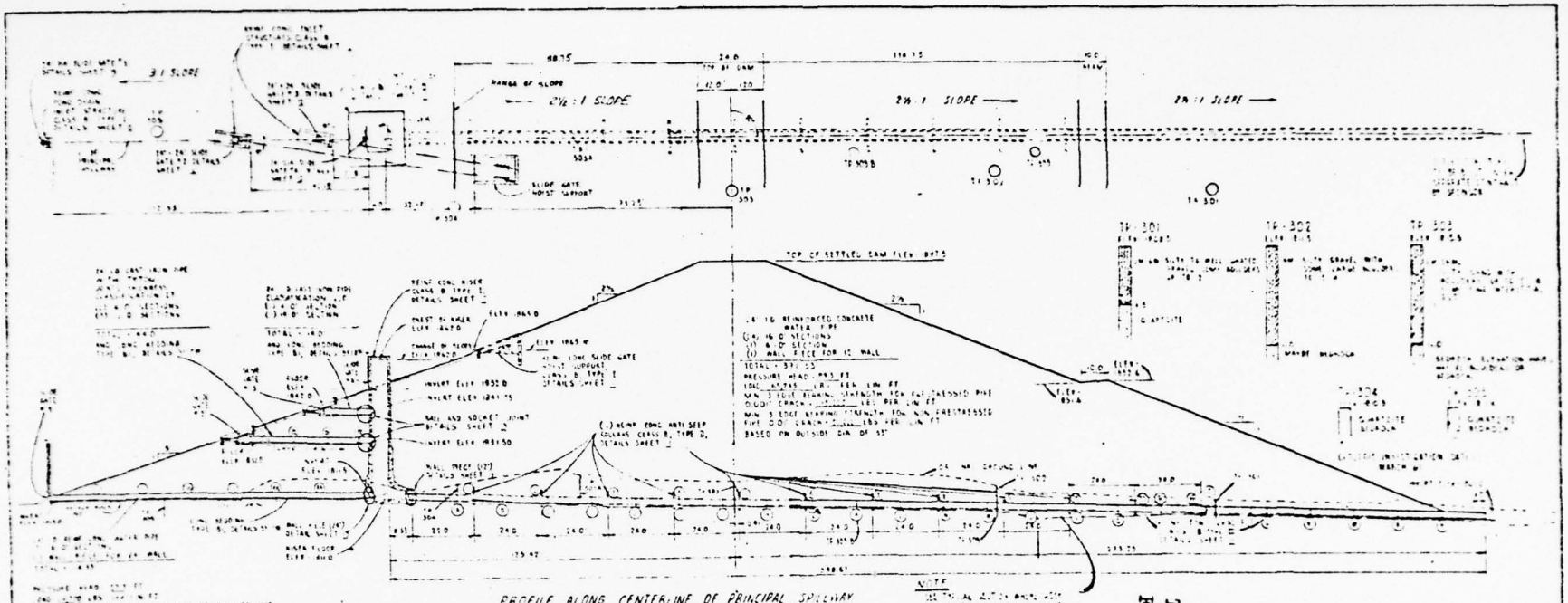
As Built

PLATE 2

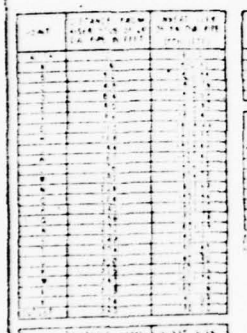
DAVENPORT MILLS CREEK
SOUTH RIVER SUB-WATERSHED
POTOMAC RIVER WATERSHED AUGUSTA CO. VIRGINIA
SITE LOCATION MAP

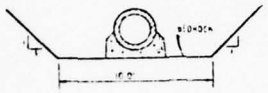
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-351-P



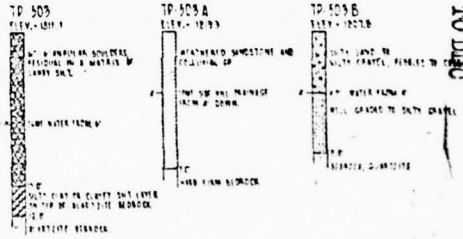
PROFILE ALONG CENTERLINE OF PRINCIPAL SPILLWAY
SCALE 1"=50'



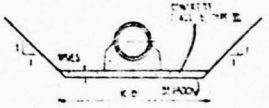


TYPICAL SECTION OF PRINCIPAL SPILLWAY EXCAVATION

TYPICAL SECTION OF TYPE BI CONCRETE BEDDING



GEOLOGIC INVESTIGATION DATE: JUNE '61



TYPICAL SECTION OF AUXILIARY SPILLWAY EXCAVATION WHERE ROCK IS 2' OR LESS BELOW BOTTOM OF CHANNEL

THIS PAGE IS BEST QUALITY PRACTICABLE FROM COPY FURNISHED TO DDC

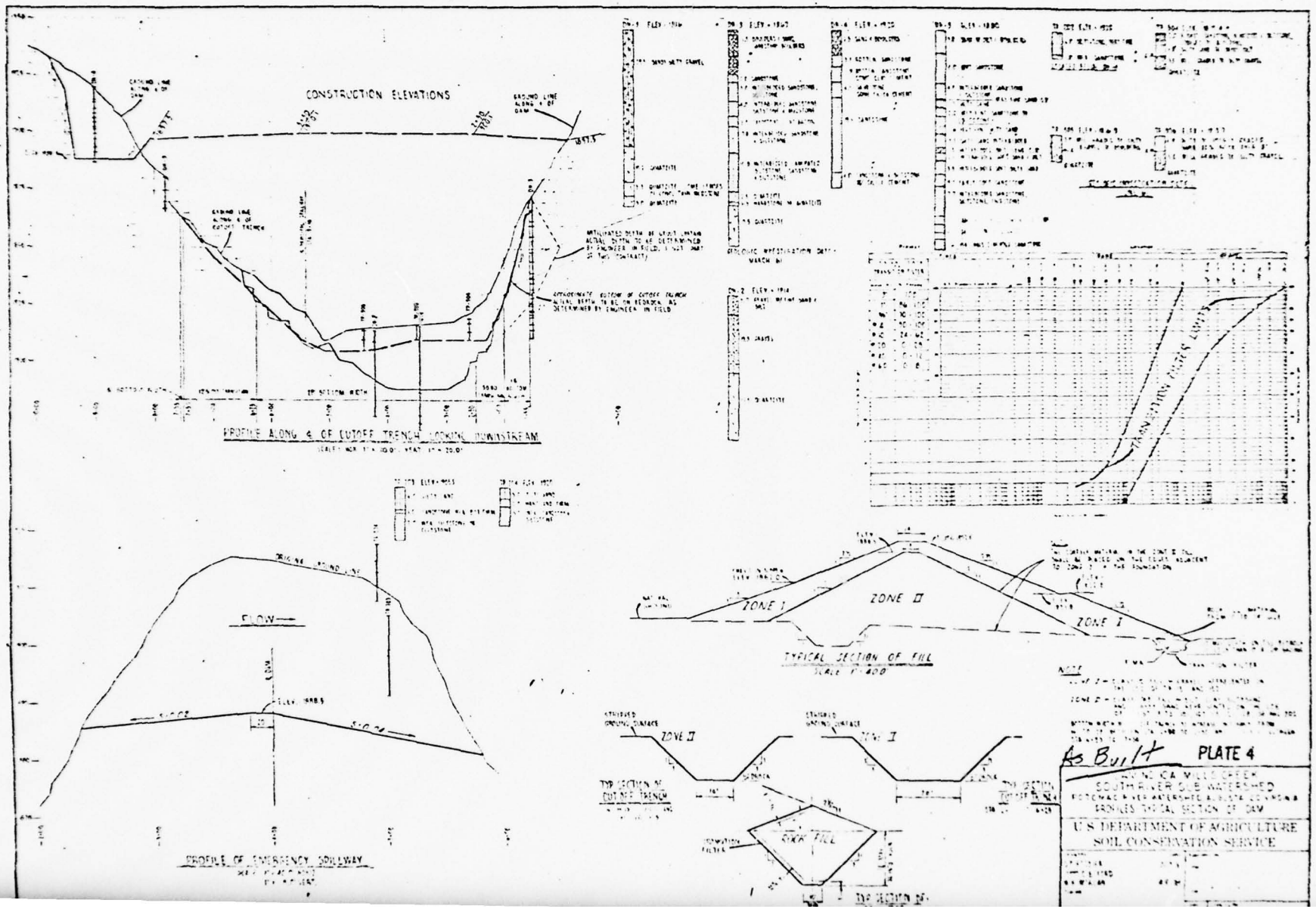
As Built

PLATE 3

DAM NO. ICE MILLS (TRIB. OF) SOUTH RIVER SUB WATERSHED
POTOMAC RIVER WATERSHED, ALLEGHENY COUNTY, MD.
PLAN-PROFILE OF PRINCIPAL SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MD-351-P


CONSTRUCTION ELEVATIONS
PROFILE ALONG ℄ OF CUTOFF TRENCH LOOKING DOWNSTREAM
PROFILE OF EMERGENCY SPILLWAY
TYPICAL SECTION OF FILL
SCALE 1"=20'
ZONE I
ZONE II
ZONE I
TYP SECTION OF CUTOFF TRENCH
ROCK FILL
TYP SECTION OF
TRANSITION SIZING LIMITS
As Built
PLATE 4
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken 18 July 1978.

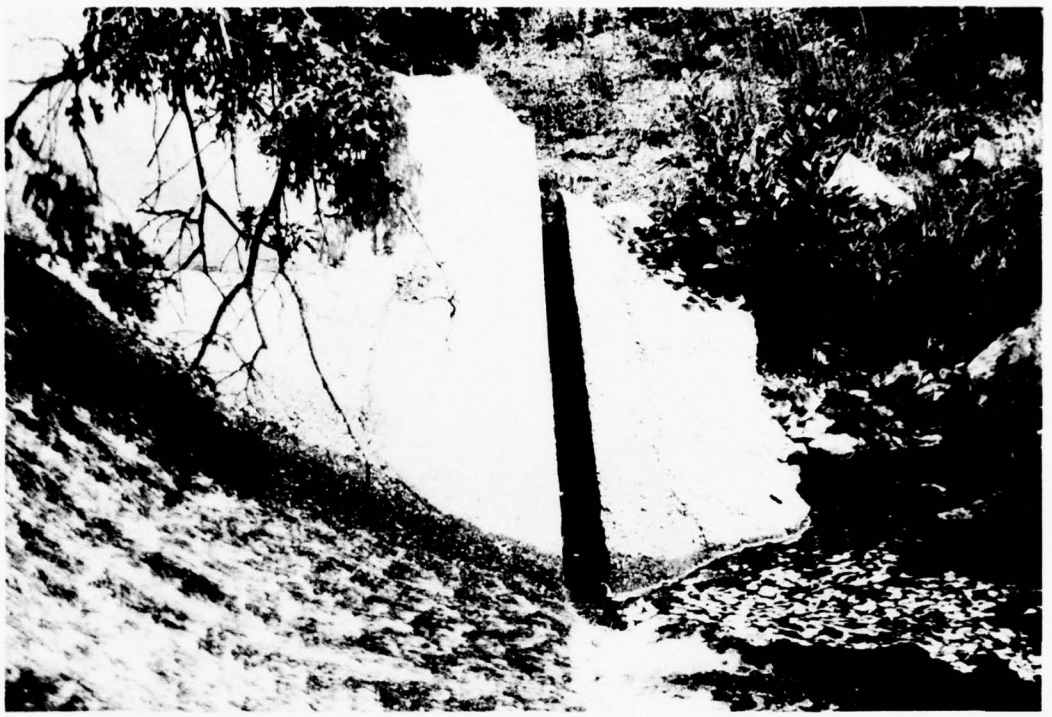


PHOTO 1. Spillway and Wing Wall of Outlet Structure

PHOTO 2. View of Outlet Structure Below the Embankment

Photo 3. Looking Upstream Towards Drop Off at Downstream End of Emergency Spillway

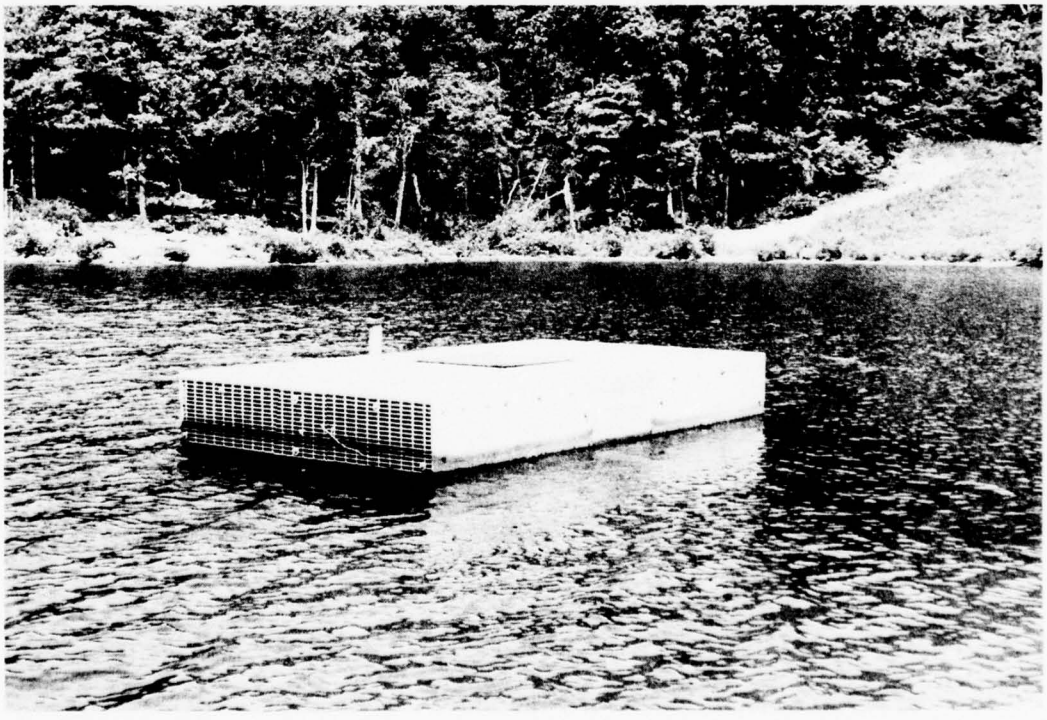


PHOTO 4. View of Outlet Structure in the Reservoir

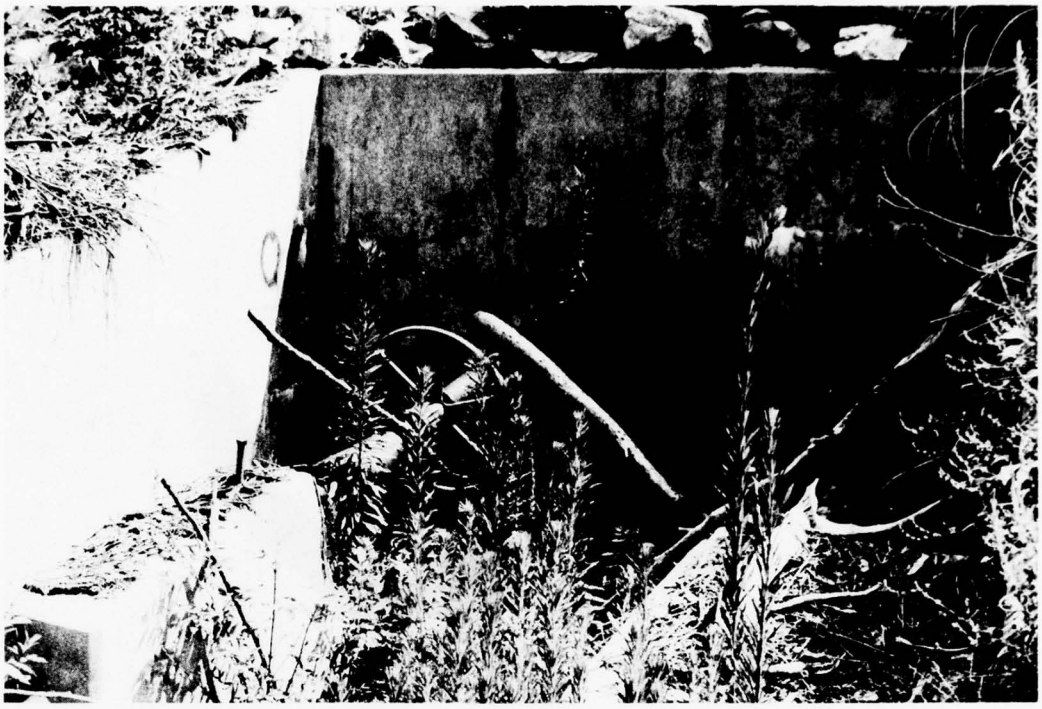


PHOTO 5. Pit for Operational Valves at Base of Front Face of Embankment

PHOTO 6. Brush and Trees on Downstream Embankment Near Intersection With Right Abutment

PHOTO 7. Ruts Made by Vehicles on Bench Area

PHOTO 8. Erosion From Vehicle Traffic on Downstream Face Near the Left Abutment

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name Dam South River No. 10A County Augusta State Virginia Coordinates Lat. 3757.1 Long. 7900.1

Date Inspection 18 July 1978 Weather Sunny, Hot Temperature 90°F.

Pool Elevation at Time of Inspection 1861.8 M.S.L. Tailwater at Time of Inspection 1798.4 M.S.L.

Inspection Personnel:

MICHAEL BAKER, JR., INC.:	SOIL AND WATER CONSERVATION DISTRICT:	VIRGINIA WATER CONTROL BOARD:
E. L. Brill	Folger Taylor	Keith Drohan
J. M. Thompson		
M. Mill		

M. Mill Recorder

EMBANKMENT

SOUTH RIVER NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No surface cracks were observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking at or beyond the toe was observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The dam has been constructed with 2.5:1 slopes. No sloughing was observed; however, erosion caused by vehicular traffic was observed on the downstream face of the dam. Another eroded pathway was observed on the upstream face. Eroded channels were visible on the downstream bench and tire tracks were observed adjacent to the downstream toe. Small trees were observed on the downstream face of the dam.	Attempts have been made to stop the vehicular traffic on the dam; however more effective provisions for stopping this traffic should be made. Erosion channels should be filled and seeded. Eroded areas should be reseeded. The trees should be removed from the face of the dam.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No bowing or bulging was observed. Elevations along the crest varied from 1898.3 to 1899.8.	
RIPRAP FAILURES	No riprap failures were observed. Riprap was observed on the upstream face at the edge of the water.	

EMBANKMENT

SOUTH RIVER NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION	According to the test borings and test pits, the foundation is composed of sandstone and quartzite. Light brown, fractured, jointed sandstone was encountered in the emergency spillway cut.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No tension cracks were observed. However, an erosion channel has formed at the downstream side of the embankment-left abutment contact.	The erosion channel should be filled and seeded.
ANY NOTICEABLE SEEPAGE	A spring, located about 30 feet beyond the toe and 30 feet to the right of the left abutment, was observed.	The spring should be inspected periodically.
STAFF GAGE AND RECORDER	None was observed.	
DRAINS	The as-built drawings indicate that a rockfill toe has been provided; however, a rock toe was not observed. The abundant vegetation may have prevented observation of this feature.	Presence of the rock toe should be confirmed by removing the vegetation in this vicinity.

OUTLET WORKS

SOUTH RIVER NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	These conditions, if any, were not observable due to the outlet structure.	
INTAKE STRUCTURE	There is slight spalling of concrete on the drop-inlet at the normal pool elevation. Slide valve control wheel on the drop-inlet was broken off. One of the slide valve control wheels in the valve pit on the upstream face of dam was not locked.	Remove or lock valve control wheels.
OUTLET STRUCTURE	The concrete outlet control structure shows only slight spalling. Valve control stems and deck beams are moderately rusted (surface only). Concrete spillway on the north side has separated about eight inches at a construction joint. Spillway is beginning to erode underneath.	Install riprap to prevent further erosion.
OUTLET CHANNEL	There is significant erosion. Heavy brush on both sides of channel could interfere with high flows.	Clear brush from channel periodically.
EMERGENCY GATE	There are four hand-operated intake gates (one below normal pool, one on the riser, and two on the upstream face of the dam). Control wheel on riser was broken off, and one of the wheels in the valve pit was unlocked.	Remove or lock control wheels.

UNGATED SPILLWAY

SOUTH RIVER NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None, the side channel spillway is cut in sandstone. Jointed, fractured sandstone was exposed on the left slope of the emergency spillway.	
APPROACH CHANNEL	The approach channel consists of both soil and rock according to the as-built drawings.	
DISCHARGE CHANNEL	Sandstone bedrock was exposed at the downstream end of the discharge channel. The discharge channel appears to have been severely eroded.	The area of the earth excavation should be repaired and seeded.
BRIDGE AND PIERS	Not Applicable	

INSTRUMENTATION

SOUTH RIVER NO. 10A

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	There are none.	
OBSERVATION WELLS	No wells were noted.	
WEIRS	There are none.	
PIEZOMETERS	Two capped standpipes which may be piezometers were observed at the following locations: 1) On downstream bench near right abutment. 2) At toe near right abutment. Unable to remove caps during this inspection.	If the standpipes are piezometers, periodic readings should be taken.
OTHER	There are none.	

RESERVOIR

SOUTH RIVER NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are moderately steep and wooded. No sloughing was observed.	
SEDIMENTATION	Only minor sedimentation was observed.	

DOWNSTREAM CHANNEL

SOUTH SOUTH NO. 10A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream channel shows no significant erosion, but the banks are heavily overgrown.	Remove brush periodically.
SLOPES	The downstream channel slopes approximately two percent.	
APPROXIMATE NO. OF HOMES AND POPULATION	No homes are located immediately downstream of the dam.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

SOUTH RIVER NO. 10A

ITEM	REMARKS
PLAN OF DAM	A complete set of as-built plans, provided by the S.C.S., are available at the Norfolk District Corps of Engineers. A plan view of the dam is included in this report as Plate 2.
REGIONAL VICINITY MAP	The vicinity map is presented in this report as the Location Plan.
CONSTRUCTION HISTORY	The contractor and completion date were obtained from the C.O.E.
TYPICAL SECTIONS OF DAM	Typical sections of the dam are included in the as-built drawings and are presented in this report as Plates 3 and 4.
HYDROLOGIC/HYDRAULIC DATA	Hydrologic and hydraulic design data, provided by the S.C.S., is available at the Norfolk District of the C.O.E.
OUTLETS - PLAN and DETAILS	Shown on the as-built drawings.
- CONSTRAINTS and DISCHARGE RATINGS	Contained in the hydrologic/hydraulic calculations.
RAINFALL/RESERVOIR RECORDS	No rainfall or reservoir records are available at the dam.

SOUTH RIVER NO. 10A

ITEM	REMARKS
DESIGN REPORTS	Design calculations by the S.C.S. are available at the Norfolk District, C.O.E.
GEOLOGY REPORTS	A Geologic Report was done by the S.C.S. and is included in Appendix VI.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Slope stability, and hydrology and hydraulic computations were done by the S.C.S. No seepage calculations were available. The dam was investigated through the S.C.S.'s Stability Analyses; however, the report was not of reproducible quality. The S.C.S. Geotechnical Report which discussed slope stability is included as Appendix VII.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Boring and test pit records, and soil test results are available at the Norfolk District, C.O.E.
POST-CONSTRUCTION SURVEYS OF DAM	No known post-construction surveys were made available.
BORROW SOURCES	Borrow areas are shown on the as-built drawings.

SOUTH RIVER NO. 10A

ITEM	REMARKS
MONITORING SYSTEMS	No known monitoring systems have been provided.
MODIFICATIONS	Data obtained during the inspection agrees very closely with the as-built drawings indicating that no major modifications were made.
HIGH POOL RECORDS	None are available.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	The Augusta County Service Authority has a yearly maintenance program in conjunction with an annual inspection by the Headwaters Soil and Water Conservation District. The U.S. Forest Service also conducts annual inspections. Copies of the inspection reports are included as Appendix V. No known major construction has been done since the dam was built.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	There are none that have been recorded.
MAINTENANCE OPERATION RECORDS	The Augusta County Service Authority has a yearly maintenance program in conjunction with an annual inspection by the Headwaters Soil and Water Conservation District. The U.S. Forest Service also conducts annual inspections.

SOUTH RIVER NO. 10A

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	This information is contained in the as-built drawings.
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Information on the slide gates is contained in the as-built drawings.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 3.7 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1862.0 (370 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1888.5 (970 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1894.2

ELEVATION TOP DAM: 1897.5

CREST: Emergency spillway

a. Elevation 1888.5
b. Type Earth-cut
c. Width 100 feet
d. Length 350 feet
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS: Reinforced concrete riser with drop-inlet and three lower level gates

a. Type
b. Location Riser in reservoir with reinforced concrete pipe extending to outfall channel
c. Entrance inverts 1862.0 (principal riser inlet), 1852.0, 1842.0, 1832.0
d. Exit inverts 1801.0 (invert of 24 inch outlet pipe) lower level gates at elevation 1832.0
e. Emergency draindown facilities Manually operated gate on 24 inch pipe on upstream side of riser invert (invert 1813.0)

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE Unknown

NAME OF DAM: SOUTH RIVER NO. 10A

APPENDIX V

ANNUAL MAINTENANCE INSPECTION REPORTS

ANNUAL MAINTENANCE INSPECTION OF FIVE COMPLETED FLOOD PREVENTION DAMS
Potomac River Watershed

April 16, 1968

DAM 77, Little North River (HEARTHSTONE LAKE):

Trees and stumps need to be removed from face of dam, and efforts to revegetate exposed areas need to be continued. This will be done by the Soil Conservation Service.

DAM 10, Skidmore Fork (TODD LAKE):

Locust bushes need to be cut from face of dam. This is the District's responsibility. Also need erosion protection on trails DRK.

DAM 76, North River (ELKHORN LAKE):

Logs, trees and stumps need to be removed from face of the dam. This is the responsibility of the City of Staunton.

DAM 27 at Sherando:

Need to cut locust brush, work with Forest Service on elimination of path on back and face of the dam, using a light tractor remove or replace rubble from outlet of primary spillway. This is the responsibility of the Forest Service.

DAM 10-A, MILLS CREEK: Is in good shape.

Inspections were made by David Walker (Supervisor of Shenandoah Valley Soil & Water Conservation District), Donald R. Kyle (U. S. Forest Service), and Wm. L. Blair, Jr. (Soil Conservation Service).

Wm. L. Blair, Jr.
Area Conservationist

APPROVED:

E. W. Armstrong, Chairman
Shenandoah Valley S&WCD 4/ /68

U. S. Forest Service

DISTR: SVS&WCD (2 cys)
USFS (2 cys)
SCS State Office
Area Office
Augusta WUC

Site #23 - Robinson Hollow - The vegetative cover is thinning out and the locust should be killed before they get out of control. The riser and pipe spillway are in good shape. The trash rack is scheduled to be replaced. The road in the emergency spillway should be watched as the ruts are hard to control. A mowing schedule should be followed. This site was overseeded with Sericea Lespedeza this Spring.

Site #26 - Inch Branch - The wooden trash rack is scheduled to be replaced. The pipe spillway and emergency spillway appear to be sound. The vegetative cover on the dam and emergency spillway is in satisfactory condition.

Site #19 - Waynesboro Nursery - This site has good vegetative cover except the cattle tracks which have become ruts should be healed over. The pipe spillway and emergency spillway appear to be sound. Thistle appear to be a problem on this dam and since they are dormant much of the winter they permit the soil when freezing and thawing to heave and then erode. A grass should be seeded in the thistle place after thistle have been eradicated.

On April 13, 1978, Sites 10A and 27 of the South River Watershed of the Potomac Watershed were inspected by Wayne Hypes, Folger Taylor, and William Lucas, Jr.

Site #10A - Mills Creek - This is a multiple purpose site so arrangements were made to meet with representatives from the Augusta County Service Authority but they did not show so we continued on the day's objective. The woody growth needs to be cut. It does not appear to have received any attention last year. The spillway pipe and riser appear to be in good shape. The emergency spillway is not showing much erosion but the cover is very sparse. The fill is taking a beating from abuse by off-the-road activities and the vegetation is being destroyed. The fill is also being rutted by attempting to have hill climbs when too wet. There should be toe drains re-established to eliminate the seep areas at the base of the dam. The borrow areas need seeding attention as well as some supervision by civil authorities of recreation pursuits. The borrow areas are being abused.

Site #27 - Upper Sherando Lake - David Frazier, USFS, accompanied the inspection team on this dam. Much work has been carried out on this dam. The woody growth has been cut and destroyed. The dam has had 1200 lbs. fertilizer, 40 lbs. Ky 31 and 10 lbs. Sericea Lespedeza seed on it. The structure appears sound. The following suggestions came out of discussions with persons present to make for better use of the recreational potential:

1. The berm area be covered with crushed stone, here and on future dual-purpose structures.
2. New parking areas be established below dam with paths established using flattened logs or rail ties as steps.

Wayne M. Hypes Jr.
William E. Lucas Jr.

USDA-FOREST SERVICE

DAM MAINTENANCE INSPECTION REPORT
Ref: FSM 7572.23

1. REGION (3-4)	2. FOREST (5-6)	3. RANGER DIST. (7-8)	4. FOREST INV. NO. (9-12)
08	08	05	0014

5. NAME OF DAM: Mills Creek Dam — West Yellowstone Country

BLOCK I - MAINTENANCE INSPECTION CHECKLIST

CARD NO. 12

ITEM (Describe deficient items on attached sheets)	NEEDED REPAIRS (By priority) 1	2	None
1. EMBANKMENTS			
a. Slumps, slides			✓
b. Settlement			✓
c. Cracks			✓
d. Seepage		✓	✓
e. Erosion Road up backside		✓	✓
f. Slope facing			✓
g. Debris		✓	
h. Traffic damage		✓	
i. Brush, tree (one tree)		✓	
j. Burrows			✓
k. Other			
2. CONCRETE STRUCTURES			
a. Settlement			✓
b. Overturning			✓
c. Heaving			✓
d. Cracks, spalls			✓
e. Joints			✓
f. Undermining			✓
g. Drains			✓
h. Seepage			✓
i. Other			
3. GATES, CONTROLS			
a. Corrosion			✓
b. Mechanical			✓
c. Structural			✓
d. Clogging			✓
e. Access			✓
f. Other			

ITEM (Describe deficient items on attached sheet)	NEEDED REPAIRS (By priority) 1	2	None
4. CLOSED CONDUITS			
a. Settlement			✓
b. Displacement			✓
c. Cracks, spalls			✓
d. Seepage			✓
e. Clogging			✓
f. Erosion			✓
g. Corrosion			✓
h. Joints			✓
i. Other			
5. SPILLWAYS			
a. Obstructions			✓
b. Erosion		✓	
c. Structural			✓
d. Vegetation			✓
e. Other			
6. DOWNSTREAM CONDITION			
a. Backwater			✓
b. Erosion			
c. Bars, pools			✓
d. Boils, piping			✓
e. Other			
7. RESERVOIR			
a. Shore erosion			✓
b. Debris			✓
c. Sediment			✓
d. Other			
8. OTHER (Identify)			
a.			
b.			
c.			
d.			

(OVER)

7500-2 (2/69)

BLOCK II - MAINTENANCE COST ESTIMATE

ITEM OF WORK	UNIT	UNIT COST	QUANTITY PRIORITY 1	QUANTITY PRIORITY 2	COST PRIORITY 1	COST PRIORITY 2
1(d) - Seepage occuring on backside of Dam. This should be checked and a determination made for correction of the seepage. 1(e) Road up side of Dam should be blocked off - 1(g) - Scattered debris needs removing. 1(h) - Traffic damage - need to seed + fertilize Dam. 1(i) - Remove tree 5(b) - Spillway needs seeding + fertilize.						

TOTALS (Enter in Block III, below)

BLOCK III - SUMMARY MAINTENANCE INSPECTION REPORT

1. DATE OF INSP. (13 18): 5/19/77 (MO. DAY YR.)

2. HIGHEST PRIOPITY CHECKED IN BLOCK 1. (19): –

3. EST. MAINT. COST ($1,000)
a. PRIORITY 1 (20 23): ---.-
b. PRIORITY 2 (24 27): ---.-

4. EST. ENGINEER TIME NEEDED (MAN-HR.)
a. PRIORITY 1 (28 30): ---
b. PRIORITY 2 (31 33): ---

5. EST. AID & TECH. TIME NEEDED (MAN-HR.)
a. PRIORITY 1 (34 36): ---
b. PRIORITY 2 (37 39): ---

6. NOTICE TO OWNER (40): YES / NO –

7. DATE OF NOTICE (41 46): --/--/-- (MO. DAY YR.)

8. LIMITATION (47): YES / NO –

CARD NO. 12

9. TYPE OF LIMITATION (48): –

10. REVISED ESTIMATE OF INSPECTION TIME (MAN-HRS.)
a. ENGINEER (49-50): --
b. FOREST OFFICER (51-52): --
c. AID & TECH. (53-54): --

REPORTED BY (Name & signature): Richard Lanier V-4

TITLE: Cord Engr.

DATE: 9-26-77

APPENDIX VI

GEOLOGIC REPORT

Form SCS 376
Sheet 2 of 5

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

70-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Augusta ; ¼, ¼, Sec. , T , R ; Watershed South River

Subwatershed Mills Creek Fund class FP-2 (FP-2, WP-1, etc.) Site number 10A Site group I Structure class b

Investigated by L. A. Gorman, Geologist (signature and title) Equipment used Joy skid mounted drill Acker trailor mounted drill Case tractor mounted backhoe (Type, size, make, model, etc.) Date 11/60 - 3/61

SITE DATA

Drainage area size 3.7 sq. mi., 2368 acres. Type of structure Earth fill Purpose Water supply and flood prevention

Direction of valley trend (downstream) NNE Maximum height of fill 86.5 feet. Length of fill 825 feet

Estimated volume of compacted fill required 343,500 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	58	5.5	22
Floodwater	575	27.5	84
Water supply	307	17.4	50

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Blue Ridge Province Topography Mountaineous Attitude of beds: Dip NW Strike NE

Steepness of abutments: Left 29 percent; Right 50 percent. Width of floodplain at centerline of dam 300 feet

General geology of site: The site is located in the George Washington National Forest, in an area of Basal quartzite of Lower Cambrian age. The valley section is underlain by hard dense quartzites and the abutments are underlain by interbedded quartzites, sandston and siltstones. The quartzite is very resistant to weathering and the sandstones and siltstones less resistant. The quartzite is very fine but has some thin zones of conglomeratic material. The sandstones are composed of very fine sand to silt. Almost no assessory minerals are present in these pure quartzose rocks.

:0-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Centerline of dam, principal spillway, emergency spillway, borrow areas, permanent poo
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Case tractor mounted backhoe	53	11		12*	
Acker Trailer drill		3			
Joy Skid Rig		5			
Total					

*3 samples were not submitted to Lincoln

SUMMARY OF FINDINGS
(include only factual data)

Centerline

The centerline is characterized by alluvial gravel. The gravel is composed of quartz and hard sandstone pebbles to boulders with interstitial sand and silt. It would classify as a GM-GW. The depth of fill varies from 0 to 30+ feet. The bedrock underlying the gravel has a thin weathered zone generally 1 to 2 feet thick. The left abutment is located in quartzite at the base and interbedded sandstone and siltstone further up the slope. The right abutment is located in an area of interbedded sandstone and siltstone covered by rubble of this material with some quartzite boulders rolled down from above. Both abutment areas are well drained. A small swamped area exists at the base of the right abutment due to drainage off the abutment and from the flood plain above. The stream channel is about in equilibrum although it is slightly intrenched in places. The stratigraphy of the site is shown in the cross section on the 35A. The beds seem to be striking parallel to the trend of the valley and dip slightly toward the north west.

Spillway

The foundation along the centerline of the principal spillway is firm and quite adequate. Test pit 305 which is located 200 feet upstream has bedrock at the surface and TP-303 at the intersection of the pipe and centerline of the dam has 10-12 feet of silt and boulders which are residual boulders from the underlying quartzite, and P-301 has about 6-7 feet of gravel over quartzite. The rock surface is bound to be uneven but by leveling the high points an adequate bedrock profile should be obtained.

Continued

Form SCS 376B
Sheet 3 of ___

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE _____
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Total					

Continued

SUMMARY OF FINDINGS
(include only factual data)

The emergency spillway is to be located in the left abutment. The material found in the test pits consisted of 4 to 10 feet of silty sand over a capping sandstone which was found to be 2 to 4 feet thick over a layer of pure white siltstone which was sampled (see 203-1) below this siltstone is sandstone down to below the level of the control section. The borrow obtained from the emergency spillway will be mainly a silty sand but about 5000 yards of silt (ML) should be expected below the capping sandstone. The rest of the borrow will be rubble obtained from the sandstone.

Borrow Area

The main borrow area is located about a mile upstream in an area which was once a manganese or iron mine. The material is mainly a silty gravel (GM) with angular quartzite fragments, but some of the material will classify as a gravelly silt (ML), some as a silty sand (SM), and some as a sandy silt (ML). The borrow area covers an area of approximately 18 acres and a minimum average thickness of 10 feet can be expected. About 50 percent of the material from this area will be GM-ML and 50 percent will be SM-ML. It is expected that more than 300,000 cubic yards will be obtained from this borrow area. The borrow area is composed of a residual material derived from sandstone, quartzite and siltstone. The gravel fragments are angular and are often imbedded in a silt. The borrow obtained from this area can be used in any part of the fill including the core.

Additional borrow will be obtained from the flood plain above the dam in the permanent pool area. This material was sampled and classifies as a GM-GW with about 60 percent greater than 6 inches. The permanent pool has a surface area of 17.4 acres and an average of 4 feet may be obtained for a total of about 100,000 yards.

12-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE _____
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of the Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Total					

SUMMARY OF FINDINGS
(include only factual data)

Continued

This material can be used in the downstream section of the dam.

The material excavated from the emergency spillway can be used for borrow, of the approximately 30,000 yards to be excavated the top 6 - 10 feet will be a very fine silty sand (SM). Below this silty sand is a capping sandstone 2-4 feet high which may be ripped or blasted. Below the capping sandstone is a layer of 4-6 feet of siltstone which is a ML. Below this silty layer is thin to thick bedded sandstone, interbedded with siltstone. The material excavated from the spillway can be used in the downstream section of the dam. The small amount of silt (ML) that will be excavated should be mixed with the other and better borrow. About 5000 cubic yards of the silt may be expected. Sample 203-1 represents this fine silt.

Concurred by:

W. A. Allaband
State Conservation Engineer

Form SCS 376C
Sheet 1 of 2
For In-Service Use Only

USDA SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Virginia County Augusta Watershed South River Subwatershed Mills Creek

Site number 10A Site group I Structure class b Investigated by L. A. Gorman, Geologist Date 11/60-3/61

FOR IN-SERVICE USE ONLY

INTERPRETATIONS AND CONCLUSIONS

1. Foundation conditions appear very adequate. The five drill holes on the center-line encountered either hard sandstone or extremely hard quartzite. Some of the sandstone in the abutment areas showed extensive weathering but the quartzite below was extremely hard and dense.

2. The rock excavation in the spillway will amount to about 15,000 cubic yards. This material is mainly an interbedded sandstone and siltstone which may be able to be ripped but tentatively it will be listed as rock excavation.

3. The principal spillway should be located in the vicinity of 5+20 on the centerline. Good firm bedrock is present at about stream level. The bedrock surface will be uneven but leveling the high spots shouldn't offer too much difficulty.

4. The flood plain is made up of a silty to well graded gravel so an impermeable core will be necessary. The material from the large upstream borrow area will make an impermeable core. The core should be brought up to the top of the permanent pool. Care should be taken in cutting the core trench in the abut-ments. Weathered sandstone and siltstone will be encountered so a deep enough cut off should be made. The quartzite in the foundation should be quite water tight as no large fracture or joints were encountered during drilling. The core trench should be keyed into the quartzite but because of the hardness only a shallow keyway will be possible, probably a foot or two will be sufficient.

5. It is suggested that no toe drain be installed but instead a blanket drain, of the flood plain material be used instead. The material is a GM-GW with about 50 percent of the material greater than 6 inch.

6. Some seepage or side hill drainage should be expected on top of the quartzite.

7. Sufficient borrow is not available at the site so a borrow area was located about one mile upstream. It is suggested that a large percentage of the borrow be obtained from this area. The material is a silty sand (SM) to silty gravel (GM) with a possibility of some sandy and gravelly silt (ML). Almost any of this material can be used in any part of the dam as core material or common fill. The laboratory will probably offer the best suggestions as to borrow uses.

8. A large quantity of borrow is available from the permanent pool area but implacement of this material should be limited to the downstream section because of its high permeability.

Continued

Form SCS 376G
Sheet 2 of 2
For In Service Use Only

USDA-SCS

9- 69

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State _____ County _____ Watershed _____ Subwatershed _____

Site number _____ Site group _____ Structure class _____ Investigated by _____ Date: _____
(signature and title)

INTERPRETATIONS AND CONCLUSIONS

Continued

9. Care should be taken in the emergency spillway because of the potential erodibility of the siltstone. Proper care should be made for proper vegetative measures.

10. This dam is to be a water supply structure so more than ordinary precautions should be undertaken to implace an impermeable core. Consultant Engineers employed by the County of Augusta feel the foundation will not leak, therefore, if an impermeable core is put in place the structure should hold water. The three holes drilled in the permanent pool area show a good impermeable bedrock underlying the pool area.

Concurred by:

W. A. Allaband
State Conservation Engineer

APPENDIX VII

GEOTECHNICAL REPORT
(CONTAINING SLOPE STABILITY)

OFFICE MEMORANDUM -- UNITED STATES GOVERNMENT

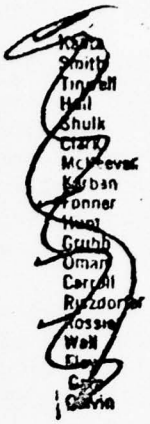
MAY 29 1961

TO : W. A. Allaband, State Conservation Engineer, SCS, Richmond, Virginia

DATE: May 26, 1961

FROM : Ray S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Virginia FP-2, South River Mills Creek, Site No. 10A



ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 3 sheets.
2. Form SCS 355, Triaxial Shear Test Data, 8 sheets.
3. Form SCS 352, Compaction and Penetration Resistance Reports:
   Modified, 9 sheets.
   Standard, 9 sheets.
4. Form SCS 357, Summary - Slope Stability Analysis, 1 sheet.
5. Form SCS 372, Embankment Placement Recommendation, 1 sheet.
6. Geological Plans and Profiles.

DISCUSSION

FOUNDATION:

Foundation materials are described as very compact alluvial silty sands with bolders. A field gradation test on a typical sample showed 50 percent larger than 6" with only 15 percent passing the number 4 sieve.

The alluvial valley material is underlain by a hard, dense quartzite at depths ranging from a few feet to about 30 feet.

The abutments are underlain by interbedded quartzite, sandstone and siltstone. Excessive weathering was noted in some of the sandstone.

EMBANKMENT:

A. Classification: Borrow samples submitted from the emergency spillway are classed as a moderately plastic sandy CL and a high plasticity silty CL.

Seven samples were submitted from the borrow area loacted 1 mile upstream. These materials are classed as CL and ML materials with liquid limits greater than 40, moderately plastic SCs and 1 sample of GC.

B. Compacted Density: Both Standard Proctor and Modified AASHO compaction tests were made on the samples submitted. Under Standard compaction, the density of the minus 4 size fraction ranged from about 101 p.c.f. to 104 p.c.f. on the CL and ML material, and from 110 p.c.f. to 116 p.c.f. on the SC and GC materials. The talc like material from the weathered siltstone zone in emergency spillway is very fine textured and had a density of 95 p.c.f. under Standard compaction.

Modified compaction resulted in densities of from 9 p.c.f. to 15 p.c.f. higher than the corresponding standard density. With the exception of the weathered

siltstone, the densities under modified compaction were as follows: The CL& ranged from 112.5 p.c.f. to 116 p.c.f. and SC and GC ranged from 120.5 p.c.f. to 128.0 p.c.f.

C. Permeability: Compacted permeability tests were made on three samples from the upstream borrow area to determine the range in permeability that might be expected in these materials. The tests were made at 90 percent of modified density corrected for the amount of gravel in the laboratory sample. The permeability tests were made on the size fraction smaller than 1 inch and the samples were regraded where necessary to maintain the same minus # 4 to plus # 4 ratio as the original sample.

Permeability rates of 0.004 ft./day, 0.16 ft./day and 0.017 feet per day were obtained on an ML, an SC and the GC, respectively. The difference in permeability between the SC and the GC will probably not be as great in the compacted fill as occurred in the laboratory permeameters.

D. Shear Strength: Triaxial shear tests were made on 6 of the samples submitted. The tests are summarized as follows:

Sample No.	Class	Test Dens.	% of Mod. Dens.	ϕ Sat.	c Sat. (p.s.f.)	ϕ Opt.	c Opt.	% Strain
61F2170	CL	92.2	88.3	21°	300			10
61F2171	ML	100.6	86.7	22°	150			10
61F2172	SC	106.5	88.3	23°	250			5
61F2173	CL-ML	100.6	87.5	23°	225			10
61F2173		102.9	89.5			23°	3450	2
61F2174	SC	111.0	88.8	23.5°	200			10
61F2173		111.9	89.4			27°	2275	1.5
61F2176	GC	124.4	90.8	26°	500			6

All of the tests except 61F2176 were made on the minus # 4 size material and the samples were soaked to saturation. The test on Sample 61F2176 was made on the material finer than 1" and the shear specimens were molded at saturation.

The shear strength of all materials tested is quite similar with the angle of internal friction between 21° and 26° and cohesion between 150 p.s.f. and 500 p.s.f. The samples that were soaked to saturation swelled somewhat during saturation and consequently were tested at densities less than 90 percent of modified density.

SLOPE STABILITY:

A modified Swedish circle stability analysis was made. The analysis was made on the embankment section only considering a zoned embankment with a center section of material like the samples submitted and rock shells of material from the flood plain.

The center section and the shell section were proportioned on the basis that shell section would amount to about 1/4 of the total embankment since the quantity of this material available is estimated to be about 100,000 cubic yards.

3 -- W. A. Allaband -- 5/26/61
Ney S. Decker
Subj: Virginia FP-2, South River Mills Creek, Site No. 10A

A strength value of $\phi = 35°$ and $c = 0$ was used for shell material and it was considered as free draining. A sample of this material is being submitted and a shear test will be made to determine the strength. The results of this test and any changes recommended based on it will be reported when the test is complete.

The strength values used for the center section were $\phi = 23°$ and $c = 300$ p.s.f. These values are a little higher than the weakest material tested. The test densities were less than 90% of modified on all of the samples that were soaked to saturation and it was judged that if the materials are placed in the fill at a minimum of 90 percent of modified density the values used in the analysis are realistic.

Factors of safety of 1.5 upstream and 1.46 downstream were obtained with the center section on a 2 1/2:1 slopes and the shell section on 2 1/2:1 slopes with 10 foot berms at elevation 1854.

Three to one slopes could be used below elevation 1854 as an alternative to the 10 foot berms with 2 1/2:1 slopes below the berm.

Prepared by:

Lorn P. Dunnigan

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: W. A. Allaband (3)
H. M. Kautz, Upper Darby, Pennsylvania
G. W. Grubb, Upper Darby, Pennsylvania

JUL 13 1961

Kautz

OFFICE MEMORANDUM UNITED STATES GOVERNMENT

TO : W. A. Allaband, State Conservation Engineer, SCS, Richmond, Virginia

DATE: July 11, 1961

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Virginia FP-2, South River Mills Creek Site No. 10A Supplemental

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS-353, Grain Size Distribution Graph, 1 sheet.
3. Form SCS-355, Triaxial Shear Test Data, 1 sheet.
4. Form SCS-352, Compaction and Penetration Resistance Report, 2 sheets.
5. Form SCS-357, Summary, Slope Stability Analyses, 1 sheet.

A shear test was made on the gravelly material submitted from the flood plain. The test was made on material finer than 1" and regraded as shown on the attached Grain Size Distribution Graph. The samples were molded to 95% of the density obtained on the regraded material finer than 1" under modified compactive effort. The compaction test was made in a 6" diameter mold. The test density is about equivalant to 90% of modified density when the compaction test is made on the minus No. 4 size fraction and corrected for the amount of coarse material contained in the shear specimens.

The shear test specimens were molded at saturation. Shear values obtained were, $\phi = 41.5°$, c = 425 p.c.f. at a test density of about 125 p.c.f.

Slope stability was checked using the density and shear strength obtained on the samples submitted from the flood plain for the shell material. The factor of safety for the upstream slope was about the same as reported previously. The factor of safety for a 2 1/2:1 downstream slope with a 10' berm at Elev. 1054 increased from 1.46 to 1.60. A factor of safety of 1.44 was obtained without the berm.

We call your attention to an error in the fifth paragraph under slope stability in the original report. This should read with the center section on 2:1 slopes instead of 2 1/2:1 slopes.

Attachments

Prepared by:

Lorn Dunnigan

cc: W. A. Allaband 3 copies
H. M. Kautz, Upper Darby, Pa. 2 copies.

Reviewed and Approved by:

Roland B. Phillips