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NATIONAL DAM SAFETY PROGRAM. ROANOKE NUMBER 72A INVENTORY NUMBE--ETC(U)
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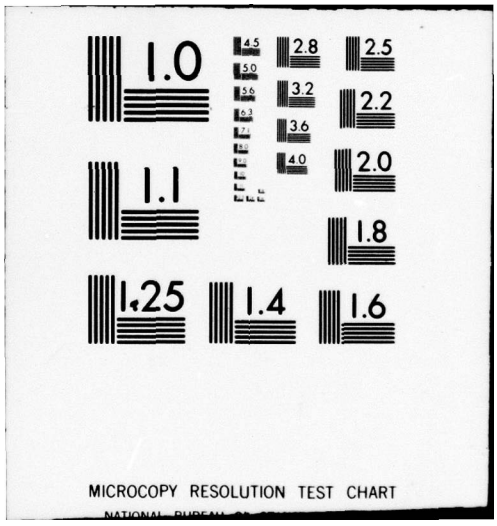
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ROANOKE RIVER BASIN

Name of Dam: Roanoke No. 72A
Location: Charlotte County, State of Virginia
Inventory Number: VA 03702

LEVEL II

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Roanoke Number 72A Inventory Number VA-Ø37Ø2.
Roanoke River Basin, Charlotte County,
State of Virginia. Phase I Inspection Report.

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U.S. ARMY CORPS OF ENGINEERS · NORFOLK DISTRICT ·

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PREPARED BY
MICHAEL BAKER, JR., INC.
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SEPTEMBER 1979

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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 aid 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 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Roanoke Creek No. 72A
State: Virginia
County: Charlotte
U.S.G.S. 7.5 Minute Quadrangle: Drakes Branch, VA
Stream: Twittys Creek
Date of Inspection: 22 May 1979

ABSTRACT

BRIEF ASSESSMENT OF DAM

Roanoke Creek No. 72A is a zoned, earthfill dam approximately 650 feet long and 46 feet high. The dam, located on Twittys Creek approximately 2 miles east of the Town of Drakes Branch, Virginia, is used for flood control. Roanoke No. 72A dam is an "intermediate" size-"high" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. Visual inspection and office analyses indicate no deficiencies requiring emergency attention.

ABSTRACT

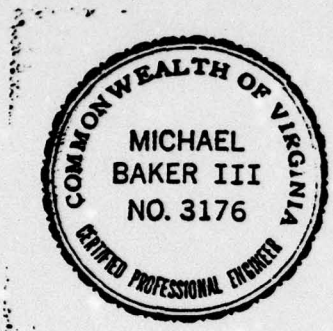
Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the Probable Maximum Flood (PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 3.9 feet with an average critical velocity of 5.2 f.p.s. Total duration of dam overtopping would be approximately 9.0 hours. The spillways are capable of passing only 40 percent of the PMF and are therefore considered inadequate.

The dam and appurtenant structures were found to be in generally good overall condition. No conditions indicating embankment instability were detected during the field inspection and office analyses. The safety factors determined during design are greater than those required for minimum accepted stability.

It is recommended that the following repair items be accomplished as part of the annual maintenance program: remove debris from the trash racks, observe spring area during yearly inspections, and install a staff gage.

MICHAEL BAKER, JR., INC.

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



SUBMITTED: Original signed by JAMES A. WALSH

James A. Walsh
Chief, Design Branch

RECOMMENDED: ORIGINAL SIGNED BY: JOHN R. PHILPOTT for

Jack G. Starr
Chief, Engineering

APPROVED: Original signed by: Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: SEP 21 1979

NAME OF DAM: ROANOKE CREEK No. 72A

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: ROANOKE No. 72A ID #VA 03702

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: Roanoke No. 72A dam is a zoned, earthfill embankment approximately 46 feet high[1] and 650 feet long. The upstream and downstream slopes are primarily 2.5:1 (horizontal to vertical) with a crest width of 15 feet.

The principal spillway is a drop-inlet structure consisting of a reinforced concrete riser which is 13.5 feet wide, 4.5 feet long, and approximately 27 feet high. A 54 inch reinforced concrete pipe discharges into the stilling basin at the toe of the downstream embankment.

The 300 foot wide, vegetated earth side channel emergency spillway (crest elevation 437.6 feet Mean Sea Level [M.S.L.]) is located outside the right[2] abutment of the dam. The approach channel slope is approximately

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1 Measured from streambed at the downstream toe to embankment crest.
2 Facing downstream.

2 percent to the 30 foot long level control section. The discharge slope of the emergency spillway channel is approximately 3 percent.

Two secondary level orifices, located on both the left and right side of the riser, are 0.5 foot high and 12.5 feet wide and have invert elevations of 417.8 feet M.S.L. The high stage riser is at elevation 426.3 feet M.S.L. A 36 inch pond drain with a manually operated sluice gate is provided at the bottom of the riser (invert elevation 402.8 feet M.S.L.). The dam and reservoir were also planned for future water supply to the Town of Drakes Branch. The plan and typical sections of the dam are shown on Plates 2 through 6.

1.2.2 Location: Roanoke No. 72A dam is located on Twittys Creek approximately 2 miles east of Drakes Branch, Charlotte County, Virginia. A Location Plan is included in this report.

1.2.3 Size Classification: The maximum height of the dam is 46 feet and the reservoir storage capacity to the top of dam elevation 442.9 feet M.S.L. is 5535 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: The dam is located approximately 3 miles upstream of the Town of Drakes Branch, Virginia (population 250). In the event of failure of the dam, loss of life would be possible, therefore, the dam is considered in the "high" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of the location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by the Town of Drakes Branch, Virginia.

1.2.6 Purpose: The dam is used for flood control within the Roanoke Creek Watershed. It has also been designed as a future water supply for Drakes Branch.

1.2.7 Design and Construction History: The existing facility was designed by the Department of Agriculture, Soil Conservation Service (SCS). The dam, completed in 1967, was built by Roy N. Ford.

1.2.8 Normal Operational Procedures: The reservoir is maintained at the normal pool elevation of 417.8 feet M.S.L. No formal operational procedures are followed for this dam. For a more detailed operating assessment, see paragraph 4.1.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area for Roanoke No. 72A dam is 15.51 square miles.

1.3.2 Discharge at Dam Site: The maximum discharge at the dam site is unknown.

Principal Spillway:
Pool level at top of dam . . 479 c.f.s.

Emergency Spillway:
Pool level at top of dam . . 9591 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir is 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	Reservoir Capacity Watershed inches	Length feet
Top of dam	442.9	312	5535	6.69	10,600
Emergency spillway crest	437.6	279	3846	4.65	9100
Principal spillway crest	426.3	154	1448	1.75	6800
Secondary level orifice invert (normal pool)	417.8	83	455	0.55	4000
Streambed at downstream toe of dam	397±	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The SCS investigated the proposed dam site and designed the embankment. According to the SCS reports and the as-built drawings, the dam is constructed directly on the alluvial and colluvial soils which consist of clayey and sandy silt (CL-ML and ML) on the floodplain of Twittys Creek; no embankment foundation undercutting was reported. The depth to the jointed chlorite schist bedrock along the centerline of the embankment varies from 1.5 to 7.5 feet in the floodplain area. However, in the abutment areas, the hard, impermeable to slightly permeable residual silts (ML and MH) are up to 21 feet thick.

Materials from emergency spillway excavation and borrow sources consisted of silts, clays, and gravels (MH, MH, CL, and GM). Two samples of representative borrow materials were analyzed in the laboratory to obtain parameters for embankment design. Consolidated undrained triaxial tests were made on two samples remolded to 95 percent maximum density. The following saturated shear strength parameters were obtained:

Unified Classification	ϕ	c, p.s.f.
ML (silt)	25.5°	600[3]
MH (silt)	15.5°	1350

The typical section of compacted fill and cut-off trench in the as-built drawings show a zoned embankment of two sections. Zone I, the cut-off trench backfill and central core, was constructed of plastic clays (CL) and silts (ML, MH). Zone II, which comprises the remainder of the dam, was built of silts (ML) and "suitable material" of unspecified classification from emergency and principal spillway excavation. The plans specified compaction to 95 percent maximum density. The as-built slope configuration is similar to that used in the stability analyses; the downstream slope ratio is a uniform 2.5:1; the upstream slope is 3:1 to elevation 418.3 feet M.S.L., at which elevation a 10 foot wide berm was constructed; above the berm to the crest, the slope ratio is a uniform 2.5:1.

During design, the SCS performed a series of stability analyses, using the Swedish Circle Method. In addition

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[3] Cohesion values were revised after initial analyses were made due to an apparent laboratory discrepancy; originally, c = 1050 p.s.f.

to the parameters for embankment materials given above, saturated shear values of ϕ = 21.5° and c = 200 p.s.f., as determined by consolidated undrained triaxial testing, were used for the 7 foot thick clayey silt (CL-ML) alluvial foundation soils. Separate analyses were initially made for homogeneous embankments constructed of each material (ML, then MH) on the alluvium, assuming vertical cracks through the crest to the phreatic line. The minimum safety factor for the upstream embankment of ML material was 1.53, assuming full drawdown and using the original laboratory parameters of ϕ = 25.5° and c = 1050 p.s.f.; using the given MH values, the minimum safety factory was 1.66. The downstream embankment was subsequently analyzed, also assuming a vertical crack to the phreatic line; the minimum safety factor was 1.85, assuming a drain at c/b = 0.6. After these analyses were completed, the revision of the cohesion value for the ML embankment soil from 1050 p.s.f. to 600 p.s.f. necessitated an additional analysis. Using the revised cohesion value and eliminating the vertical crack, a minimum safety factor of 1.35 was determined for the ML upstream embankment. No additional analyses were made using the revised parameters for the downstream slope.

A 20 foot wide cut-off trench to bedrock was constructed as recommended in the design report. A foundation drain consisting of a 6 inch diameter perforated drain pipe and filter material was constructed as the result of a design report recommendation.

Potential residual settlement of 2 percent was compensated for by increasing the embankment height an equivalent amount.

2.2 Construction: The dam, constructed by Roy N. Ford, was completed in 1967. Construction records were not available for this inspection; however, as-built drawings were reviewed and were subsequently verified in the field. Construction records are on file in Washington, District of Columbia.

2.3 Operation: There are no formal operating records for this dam. For a more detailed operating assessment, see paragraph 4.1.

2.4 Evaluation

2.4.1 Design: The as-built drawings and design report were available to assess all aspects of design. The hydrologic and hydraulic data provided was adequate for design review. The assessments made in this report are based on the design data along with field observations.

2.4.2 Construction: No construction logs were available for review. The as-built drawings indicate any changes or modifications that were made during construction.

2.4.3 Operation: Annual operation and maintenance inspection reports were available for review (see Appendix V).

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was made on 22 May 1979. The weather was cloudy and warm with a 75°F temperature. The reservoir was at normal pool elevation and ground conditions were dry. The embankment and appurtenant structures were found to be in good condition except for some debris in the trash rack of the riser (see Photo 2) which should be removed. The following are brief summaries of deficiencies found during the inspection. A Field Sketch of conditions is shown on Plate 1. The complete visual inspection check list is given in Appendix III.

3.1.2 Dam: The embankment was found to be in generally good condition with no surface cracks, slumps, or other indications of instability either on the embankment or at the toe. The slopes are well covered with grass and no significant erosion was observed. There are scattered small areas of dried out grass and occasional driftwood on the shoreline of the lake (see Photo 1).

A spring with a 14 inch vertical pipe is located 30 feet from the left abutment on the slope of an adjacent hill (see Field Sketch and Photos 3 and 4). Flow from the spring is too small to measure. The spring apparently contributes to the wet area near the downstream toe.

3.1.3 Appurtenant Structures: The principal spillway was in good condition (see Photo 6) except for some driftwood lodged in the trash racks of the riser (see Photo 2). There was a flow of approximately 0.25 g.p.m. in the right toe drain. The toe drain to the left of the outlet pipe was not flowing.

3.1.4 Reservoir Area: During the 1920's, a small excavation was made 15 feet deep in the reservoir near the left side of the embankment (see Field Sketch). A copper mine shaft 60 to 70 feet deep in the upstream left side of

the reservoir was also made. These mines were apparently limited in extent and have been satisfactorily backfilled.

3.1.5 Downstream Channels: The downstream channel was well defined and clear of debris.

3.2 Evaluation: Generally, the dam and appurtenant structures are in good condition. The removal of the driftwood lodged in the trash racks is recommended. The limited copper mining and the spring near the left abutment apparently do not affect the reservoir storage or the stability of the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Since Roanoke No. 72A is used as a flood control structure, no formal operational procedures are used. Although it was also designated for water supply for the Town of Drakes Branch, it is not presently used as such. The reservoir remains at normal pool elevation 417.8 feet M.S.L. and has an additional 19.8 feet of storage to the crest of the emergency spillway. During periods of heavy inflow, the excess water is diverted around the dam by means of the emergency spillway. A berm was constructed between the embankment and spillway to protect the downstream toe from erosion caused by flow through the emergency spillway channel.

4.2 Maintenance of Dam: Annual maintenance inspections are performed by the Southside Soil and Water Conservation District and the regional SCS office. During the visual inspections (see Appendix V), remedial measures are recommended for corrective maintenance. Copies of recent inspection reports are included in Appendix V. Maintenance of the dam is provided by the owner.

4.3 Maintenance of Operating Facilities: Maintenance of the operating equipment is the responsibility of the owner. The only operational equipment on this dam is the lift pedestal, stem, and sluice gate. The level of the reservoir was drawndown following the October 1972 flood to make repairs to the riprap in the stilling basin.

4.4 Warning Systems: At the present time there is no formal warning system or evacuation plan in operation. The dam and reservoir are visited after periods of intense rainfall.

4.5 Evaluation: Maintenance of the dam is considered adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Normal pool (elevation 417.8 feet M.S.L.) is maintained by two 0.5 foot high by 12.5 feet wide orifices, one located on each side of the concrete riser. The orifice inverts were established at an elevation sufficient to store the 50-year sediment accumulation (205 acre-feet) and an additional water supply storage of 250 acre-feet. The riser crest elevation (426.3 feet M.S.L.) was established at an elevation to store an additional 1.2 inches of runoff above normal pool. The capacity (447 c.f.s. with the reservoir level at the emergency spillway crest) of the principal spillway was established by consideration of a number of factors. These include:

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

2) Not passing damaging floods downstream.

3) The capability of the reservoir to store the floodwater.

The crest (elevation 437.6 feet M.S.L.) of the emergency spillway was established at the elevation needed to store the 100-year flood. The elevation of the top of dam (442.9 feet M.S.L.) was established by use of the freeboard hydrograph. The freeboard hydrograph was developed by the SCS for a class "b" structure and was obtained by utilizing a storm rainfall of 17.1 inches in 10 hours producing a runoff of 13.34 inches.

5.2 Hydrologic Records: No rainfall or stream flow records were available at the dam site.

5.3 Flood Experience: No exact high water marks were available. However, according to the owner, the emergency spillway has never been activated. Water was reported to have risen to the height of the entrance of the emergency spillway approach channel (estimated elevation 430± feet M.S.L.).

5.4 Flood Potential: The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix VIII) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's Tc and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to develop the unit

hydrograph was obtained from the U.S. Weather Bureau's publications (References 5 and 16, Appendix VIII). The inflow hydrograph for the PMF was developed by the Corps of Engineers using a rainfall of 32.6 inches in 24 hours producing a runoff of 30.9 inches. Losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch per hour.

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

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the low stage orifices in the riser with crest elevations of 417.8 feet M.S.L., and the high stage crest with an elevation of 426.3 feet M.S.L. Water entering these inlets flows through the dam in a 54 inch diameter reinforced concrete conduit. Water also flows past the dam through the ungated, vegetated, emergency spillway in the event water in the reservoir rises above an elevation of 437.6 feet M.S.L.

Outlet discharge capacity, and reservoir area and storage capacity were taken from the SCS Design Report. Hydrograph data and routing computations for PMF and 1/2 PMF were computed as part of this report. The flood routings were begun with reservoir level at normal pool. Outlet discharge capacity includes discharge from both the principal and emergency spillways.

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

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs 1/2 PMF	Hydrographs PMF(a)
Peak flow, c.f.s.			
Inflow	16	19,600	39,200
Outflow	16	16,900	38,500
Peak elev., ft. M.S.L.	417.8	444.1	446.8
Emergency spillway(b) (elev. 437.6 feet M.S.L.)			
Depth of flow, ft.	-	6.3	8.9
Average velocity, f.p.s.	-	3.2	4.6
Duration of flow, hrs.	-	21.0	23.8
Non-overflow section (elev. 442.9 ft. M.S.L.)			
Depth of flow, ft.	-	1.2	3.9
Average velocity, f.p.s.	-	2.9	5.2
Total duration of overtopping, hrs.	-	4.0	9.0
Tailwater elev., ft. M.S.L.(c)	401.1	-	-

(a) 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 a region.
(b) Depth and velocity estimates were based on critical depth at control section.
(c) Tailwater at time of inspection.

5.7 Reservoir Emptying Potential: According to the SCS Design Report, the time for the reservoir level to decrease from the emergency spillway crest (elevation 437.6 feet M.S.L.) to the riser crest (elevation 426.3 feet M.S.L.) is approximately 3 days. From this level, it would take approximately 5 days to return to normal pool. The reservoir may be dewatered from the riser elevation (normal pool) in approximately 3 days by use of the 36 inch sluice gate located on the upstream face of the riser. The reservoir drawdowns were computed neglecting inflow.

5.8 Evaluation: Roanoke Creek No. 72A dam is an "intermediate" size-"high" hazard dam requiring evaluation for a spillway design flood (SDF) equal to the PMF. The PMF was routed and found to overtop the dam by a maximum depth of 3.9 feet with an average critical velocity of 5.2 f.p.s. Total duration of dam overtopping would be approximately 9.0 hours. The spillways are capable of passing only 40 percent of the PMF.

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

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: Foundation conditions were determined from records of borings, test pits, laboratory analyses, and as-built drawings in conjunction with observations made in the field. According to SCS reports, the foundation soils beneath the dam on the floodplain of Twittys Creek consist of approximately 7.5 feet of clayey and sandy silts (CL-ML and ML) overlying chlorite schist and greenstone bedrock. The cut-off trench was excavated to the top of firm rock and backfilled with plastic silts and clays (ML, MH, and CL). No substantial undercutting of unstable foundation soils was specified.

There are approximately 21 feet of residual silts overlying chlorite schist and greenstone at the right abutment and 1.5 to 18.5 feet of similar soils over the schist and greenstone on the left side. The schistose planes dip 70°W and strike N50°E.

6.2 Stability Analysis ·

6.2.1 Visual Observations: No evidence of instability in the embankment or cut slopes was observed. There is clear flow from a small spring at the base of a hillside outside of the junction of the left abutment and embankment. The downstream slope was constructed to a uniform 2.5:1 ratio. From the toe of the upstream embankment to elevation 418.3 feet M.S.L., the slope ratio is 3:1; at elevation 418.3 feet M.S.L. a 10 foot wide berm is located. Above the berm to the crest, the slope is a uniform 2.5:1.

6.2.2 Design Data: A series of slope stability analyses was performed using the Swedish Circle Method. The shear strength parameters of representative samples of embankment materials and foundation soil used in the analyses were obtained from laboratory consolidated undrained triaxial shear tests, as follows:

Unified Classification	Material	ϕ	c (p.s.f.)
ML (silt)	Embankment	25.5°	600[4]
MH (silt)	Embankment	15.5°	1350
CL-ML (clayey silt)	Foundation	21.5°	200

Individual analyses, as summarized on pages VI-5 through VI-7 of Appendix VI, were initially made assuming homogenous embankments of the ML and MH soils. Full drawdown conditions were assumed for the upstream slope and the slope configuration was essentially the same as that constructed. A drain at c/b = 0.6 was assumed on the downstream side. In the analyses, it was assumed that the embankment was cracked vertically on both the upstream and downstream sides of the crest down to the phreatic line. The following summarizes the minimum safety factors calculated for the embankment constructed on the floodplain foundation soils:

Embankment	Upstream	Downstream
ML (silt)[5]	1.53	1.85
MH (silt)	1.66	-

However, after these analyses were prepared, a discrepancy was found in the laboratory interpretation of the cohesion value for the ML soil, lowering c from 1050 to 600 p.s.f. As a result, stability was recalculated for the upstream slope only, neglecting the crack assumed in the initial analyses. The resulting minimum safety factor was 1.35. No additional study was made using the parameters from the MH soil nor for the downstream slope.

The safety factors calculated for the upstream and downstream slopes are greater than those required for minimum accepted stability.

6.2.3 Operating Records: The inspection reports for the past four years indicate that trees

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[4] Cohesion values were revised after initial analyses were made due to an apparent laboratory discrepancy; originally c = 1050 p.s.f.

[5] Assuming c = 1050 p.s.f.

had been planted above the upper reaches of the reservoir where a considerable quantity of sediment has accumulated. The driftwood caught in the trash racks of the riser has been noted in the most recent inspection reports. No other significant deficiencies were reported.

6.2.4 Post-Construction Changes: There were no apparent alterations made to the dam since it was constructed.

6.2.5 Seismic Stability: Roanoke No. 72A Dam is situated in Seismic Zone 2 and is considered to have no hazard from earthquakes, according to the text of the Recommended Guidelines for Safety Inspection of Dams, provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: The as-built conditions of the embankment appear to be similar to those used for design. The embankment section chosen for the stability analyses is compatible with the as-built drawings except for core Zone 1 shown in section. The available materials are apparently similar enough to assume a homogeneous embankment. Since the results of the shear test on ML soil was questioned after the stability analyses had been run, a revision was made and the stability partially reanalyzed as indicated in Appendix VI. The analyses are considered to be satisfactory to verify the stability of the embankment. The seepage in the hillside near the left abutment apparently does not affect the stability of the dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The dam and appurtenant structures were found to be in generally good overall conditon. No structural deficiencies were discovered during the field inspection and office analysis which would indicate the need for emergency attention.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the PMF was selected as the SDF for the "intermediate" size-"high" hazard classification of Roanoke Creek No. 72A dam. It has been determined that the dam would be overtopped by the SDF by a maximum depth of 3.9 feet with an average critical velocity of 5.2 f.p.s. and would remain above the top of dam for 9.0 hours. The spillways are capable of passing approximately 40 percent of the PMF and are therefore considered inadequate.

The spring in the hillside immediately downstream of the junction of the left abutment and toe of the embankment is not considered to represent a threat to the stability of the dam.

7.2 Recommended Remedial Measures: The following repair items should be accomplished as part of the general maintenance of the dam:

1) Remove the debris from the trash racks on the riser.

2) Observe the spring area during yearly operation and maintenance inspections.

3) Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX I

PLATES

CONTENTS

Location Plan

Plate 1: Field Sketch

Plate 2: Plan of Dam and Emergency Spillway

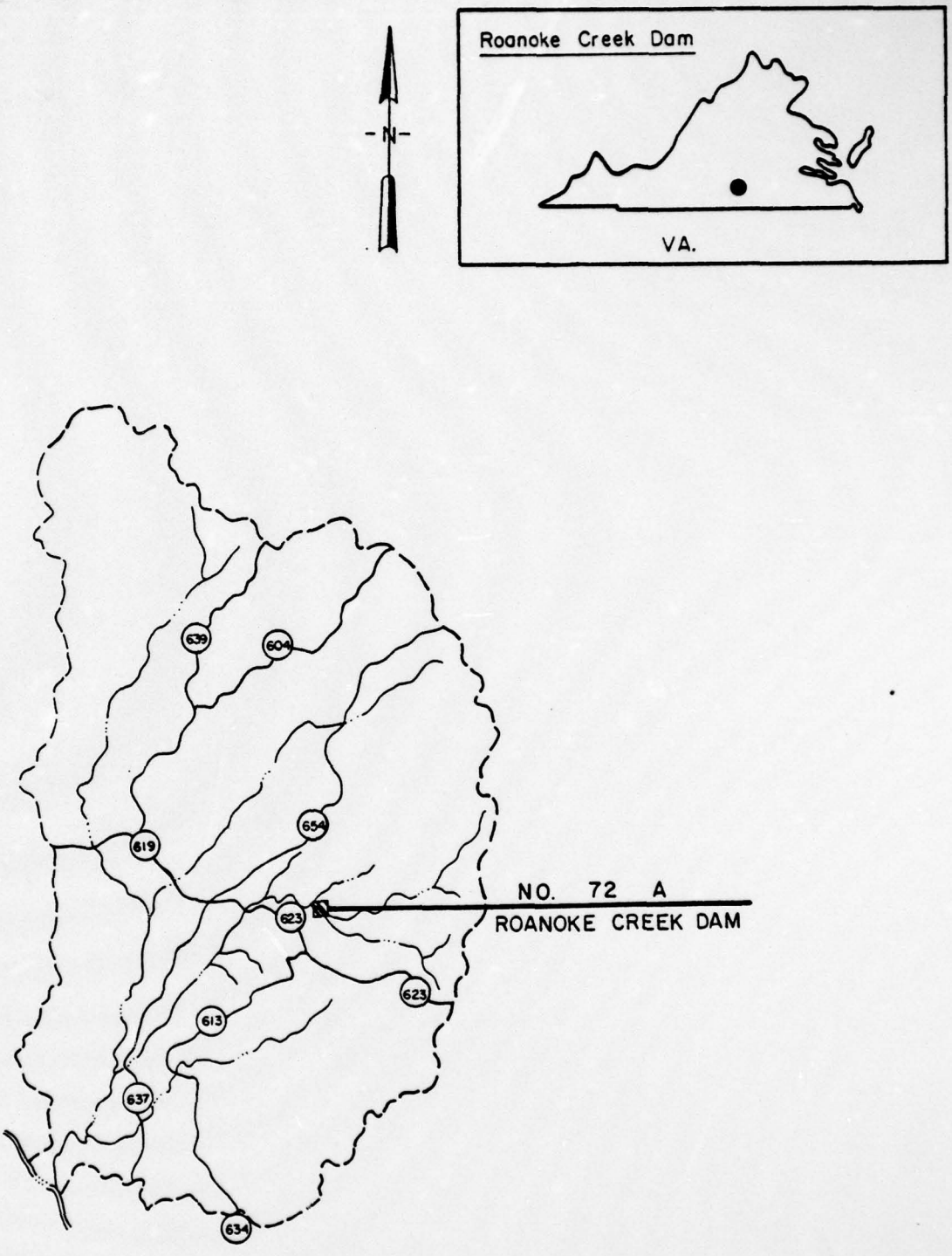
Plate 3: Profiles and Typical Sections

Plate 4: Drainage Details

Plate 5: Details of Cutoff Trench and Compacted Fill

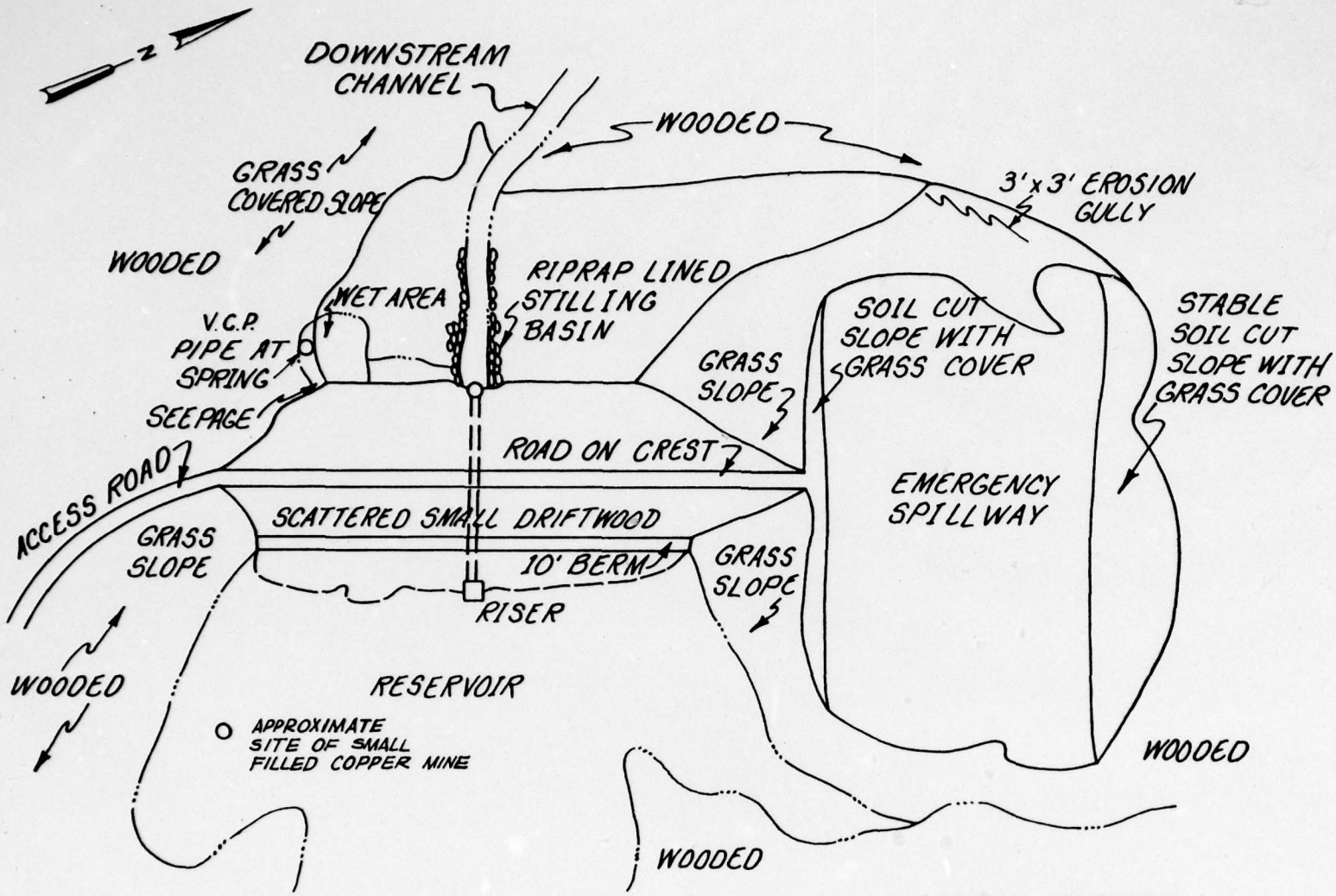
Plate 6: Plan-Profile of Principal Spillway

NAME OF DAM: ROANOKE CREEK No. 72A



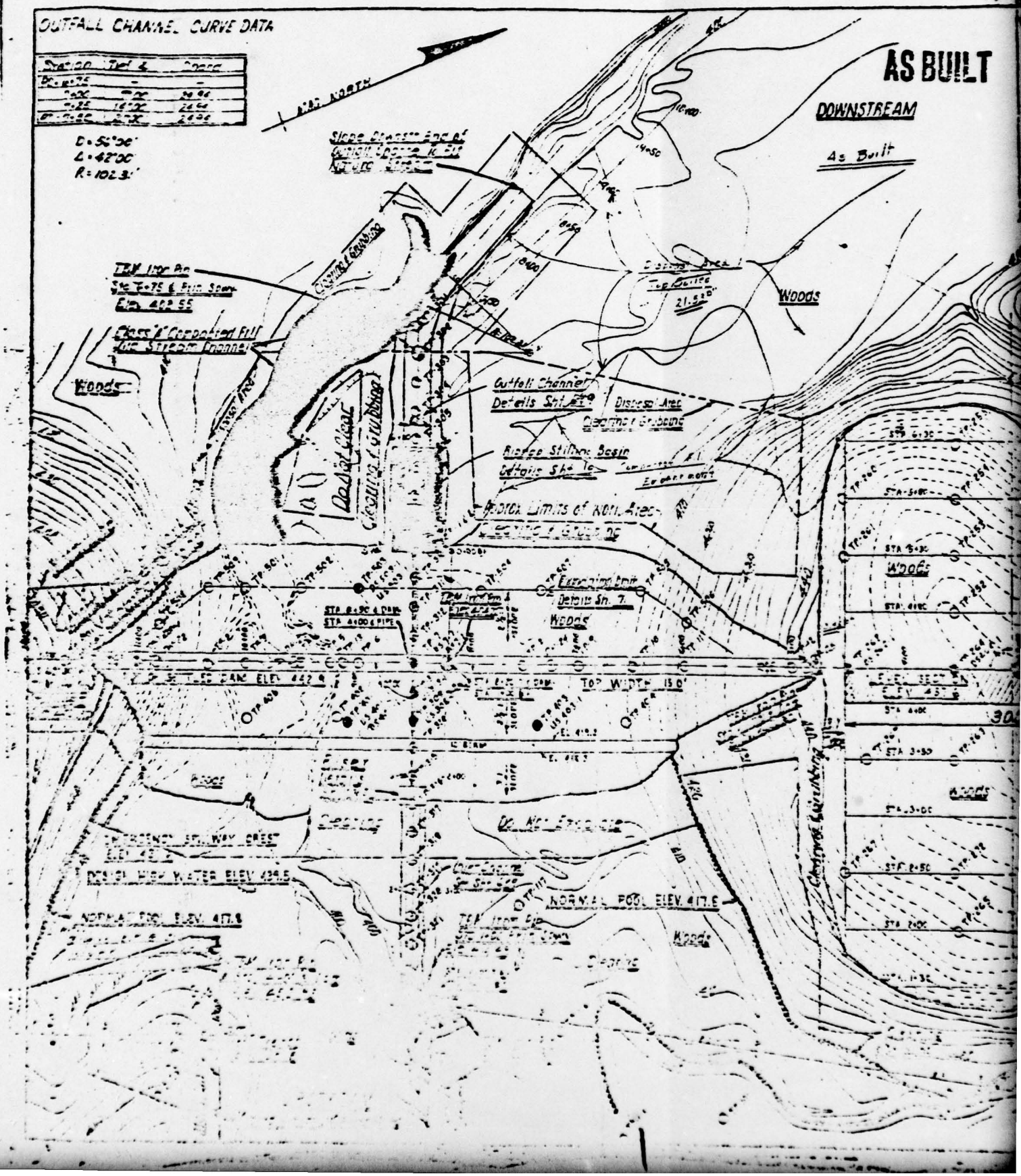
LOCATION PLAN

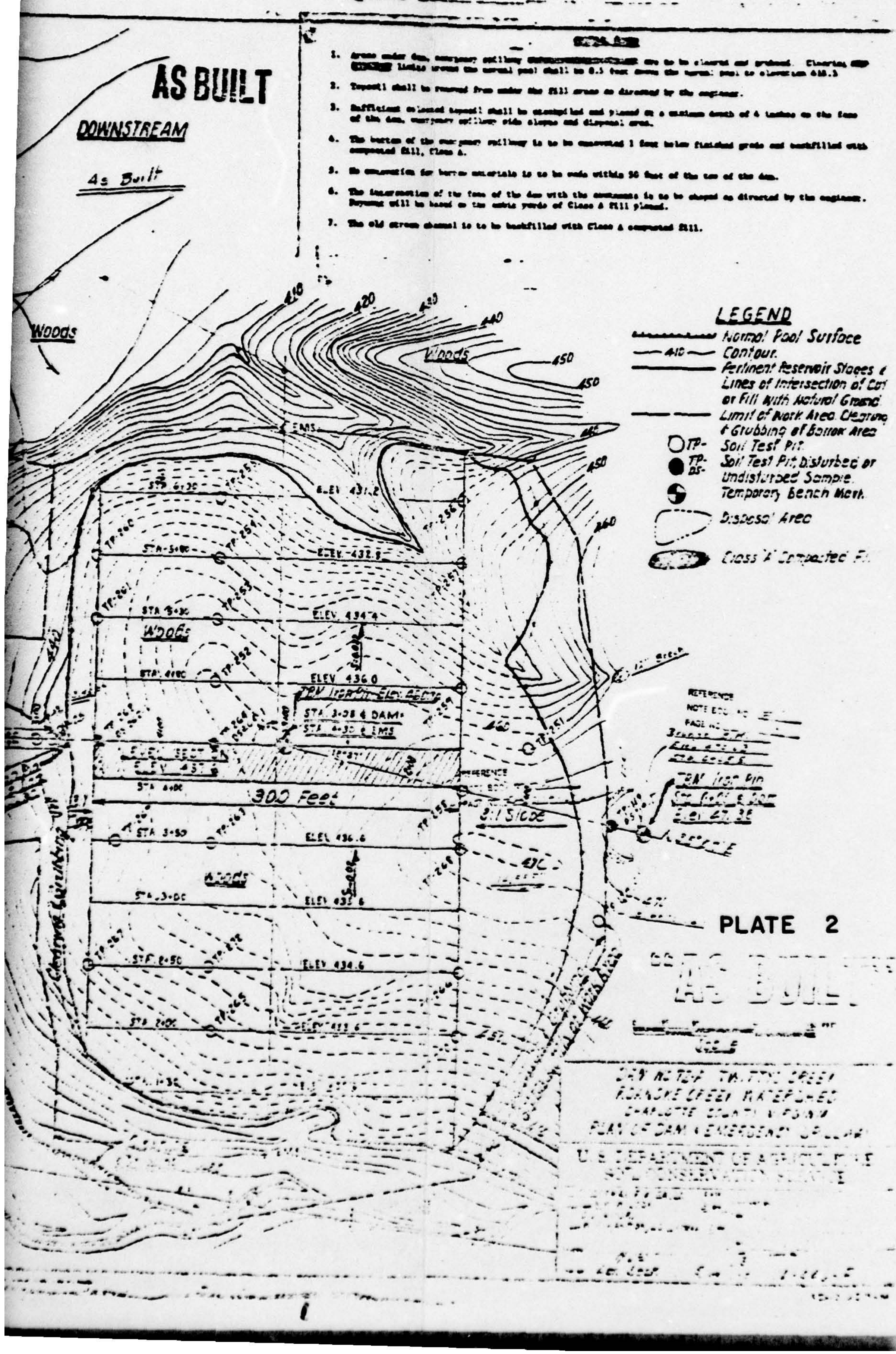
ROANOKE CREEK DAM

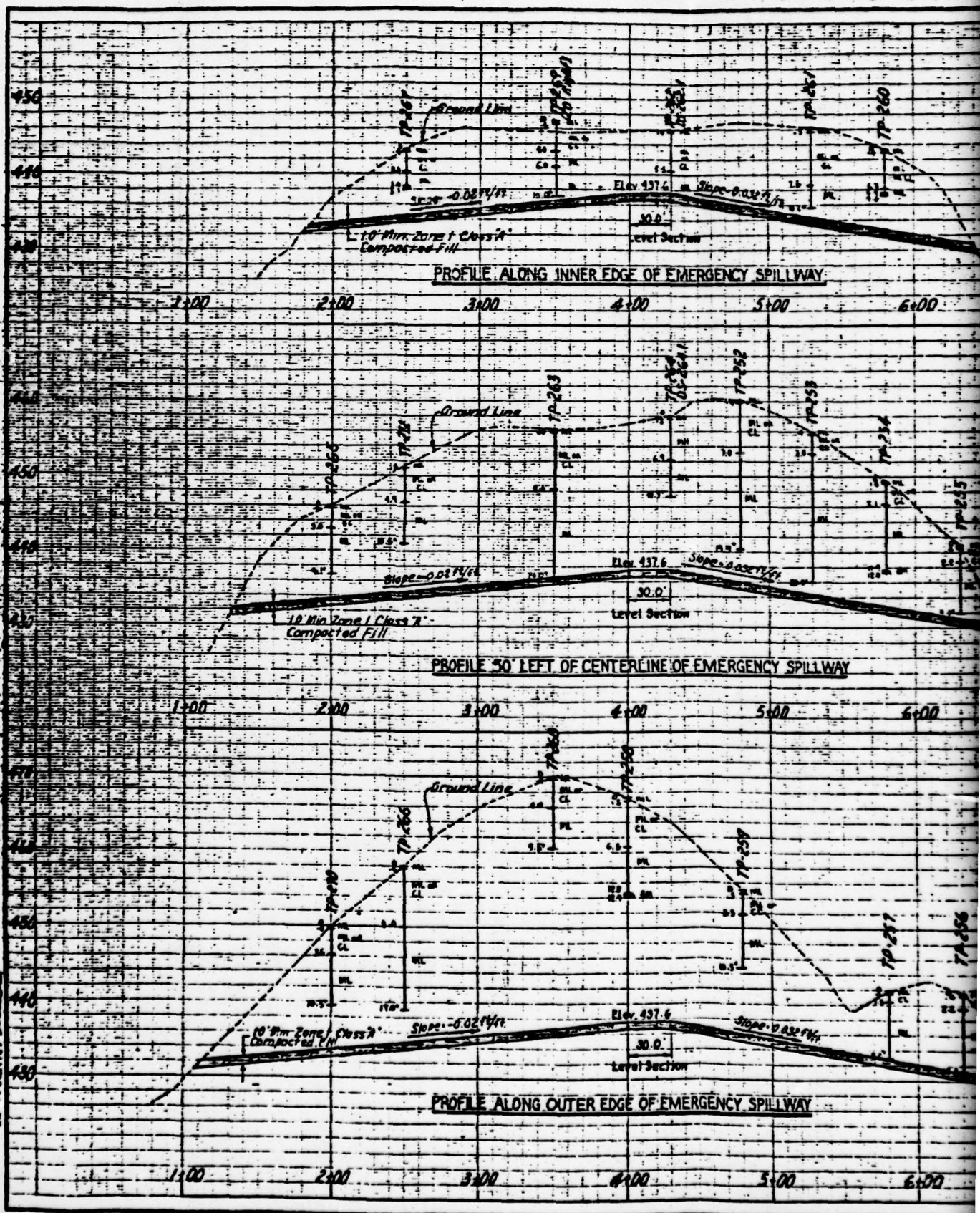


(NO SCALE)

FIELD SKETCH
ROANOKE CREEK
DAM No. 72A
Michael Baker, Jr. Inc.
July 1979
PLATE I


OUTFALL CHANNEL CURVE DATA
AS BUILT
DOWNSTREAM
As Built
D=5°30'
L=427.00'
R=1023.1'
WOODS
Outfall Channel Details Sht. 7
Riprap Stilling Basin Details Sht. 7
Existing Limits of Non-Urban Area
Existing Limit
Details Sh. 7
TOP WIDTH 15.0'
NORMAL POOL ELEV. 417.5
DESIGN HIGH WATER ELEV. 434.5
EMERGENCY SPILLWAY CREST ELEV. 432.5
Clearing & Grubbing
Clearing
Fence
Bridge


AS BUILT
DOWNSTREAM
As Built
Woods
Woods
Woods
7. The old stream channel is to be backfilled with Class A compacted fill.
LEGEND
Normal Pool Surface
Contour.
Pertinent Reservoir Stages & Lines of Intersection of Cut or Fill with Natural Ground
Limit of Work Area Clearing & Grubbing of Borrow Area
Soil Test Pit.
Soil Test Pit Disturbed or Undisturbed Sample.
Temporary Bench Mark.
Disposal Area
ELEV 431.2
ELEV 432.8
ELEV 436.0
ELEV 436.6
ELEV 434.6
STA 3+38 & DAM
300 Feet
3:1 Slope
PLATE 2
AS BUILT


Ground Line
Elev. 437.6
Slope -0.02 Ft/Ft
Slope -0.032 Ft/Ft
30.0'
Level Section
10' Min. Zone I Class 'A' Compacted Fill
PROFILE ALONG INNER EDGE OF EMERGENCY SPILLWAY
PROFILE 50' LEFT OF CENTERLINE OF EMERGENCY SPILLWAY
PROFILE ALONG OUTER EDGE OF EMERGENCY SPILLWAY

AS BUILT

As Built

TP-260

TP-254

TP-245

TP-257

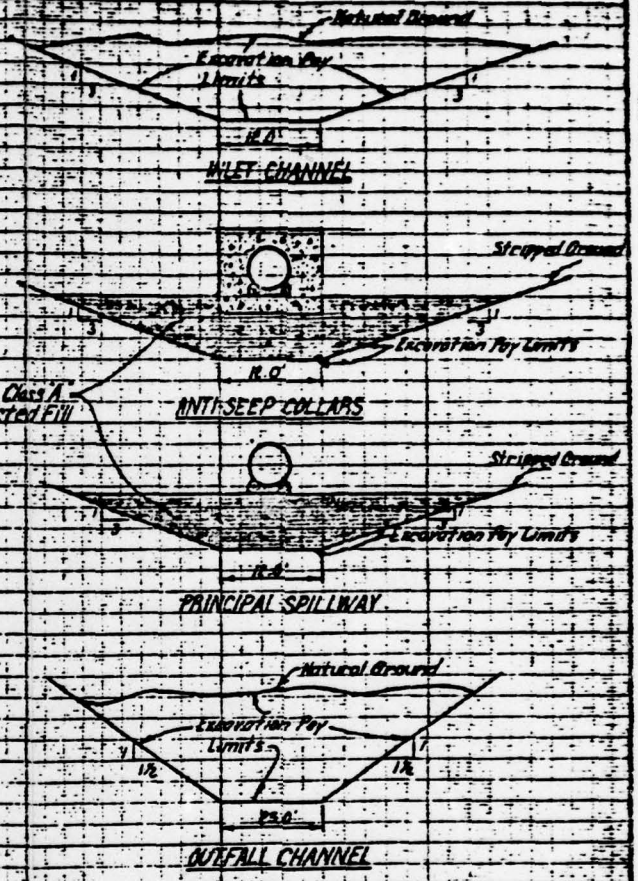
TA-256

6+00 7+00

6+00 7+00

6+00 7+00

WAY



TYPICAL EXCAVATION SECTIONS

PLATE 3

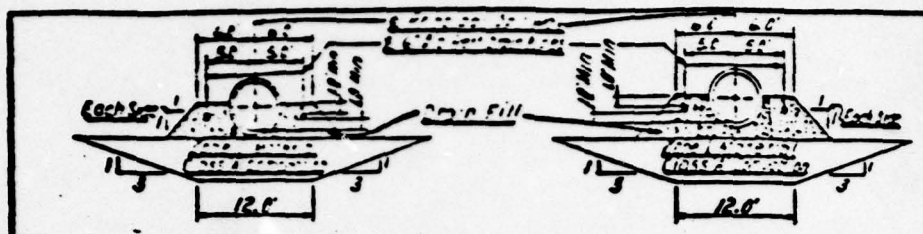
DAM NO. 12-A TWITTY CREEK
ROANOKE CREEK WATERSHED
CHARLOTTE COUNTY, VIRGINIA
PROFILES & TYPICAL SECTIONS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

L. S. COFFMAN		
B.N. WILSON & R.D. GALLOP	3/66	
W. F. HAMILTON		
L. S. COFFMAN	3/66	
LEN RECK	3/66	VA-446-P

1

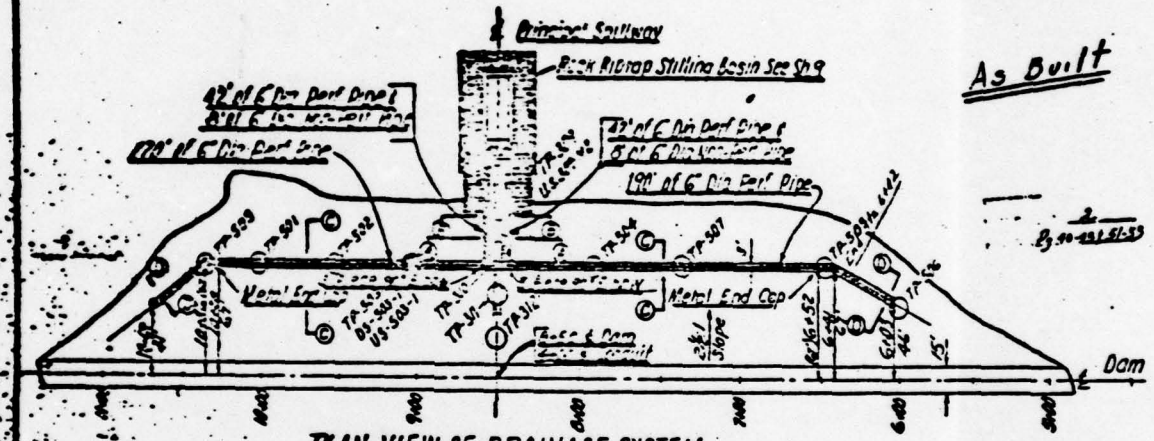
2

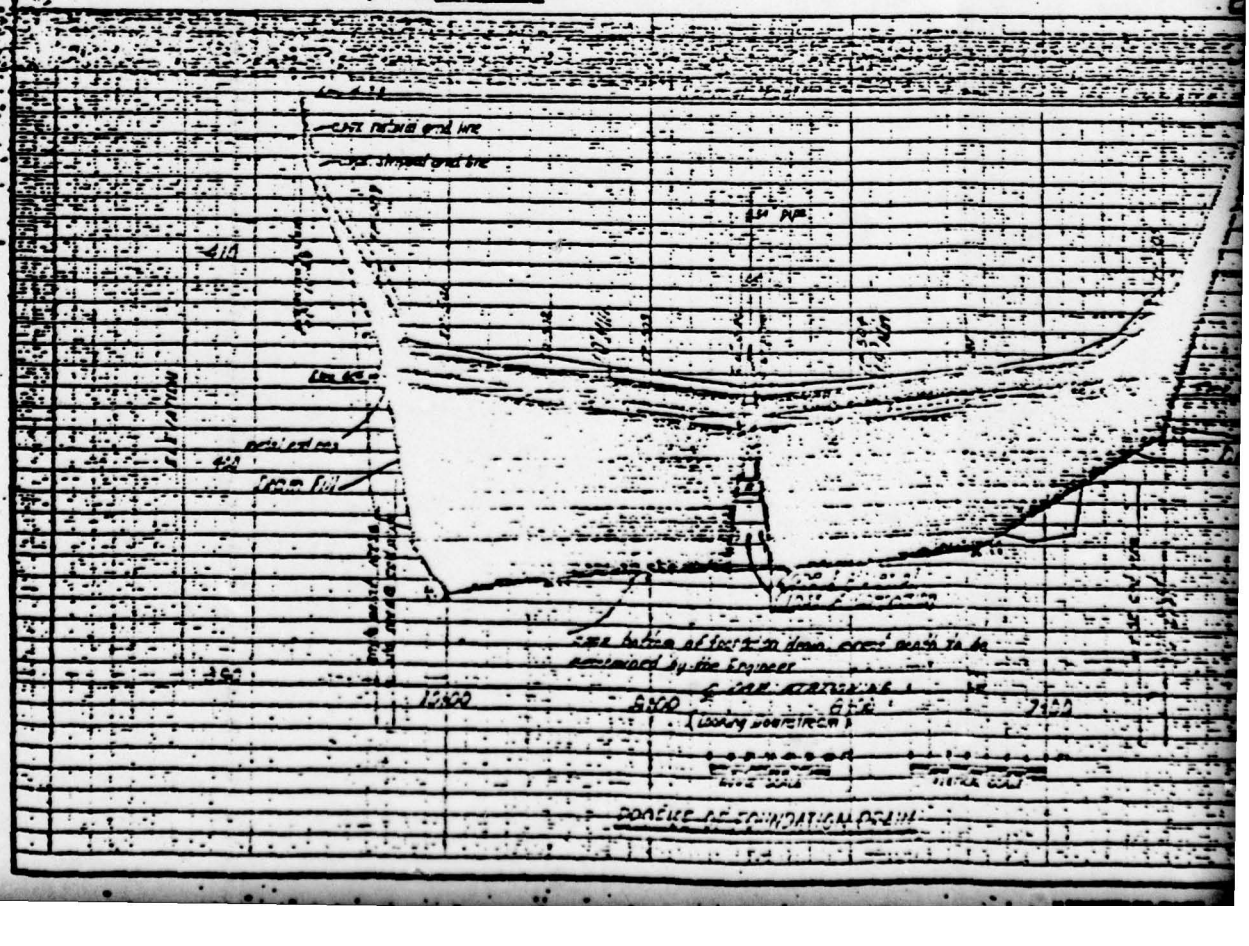


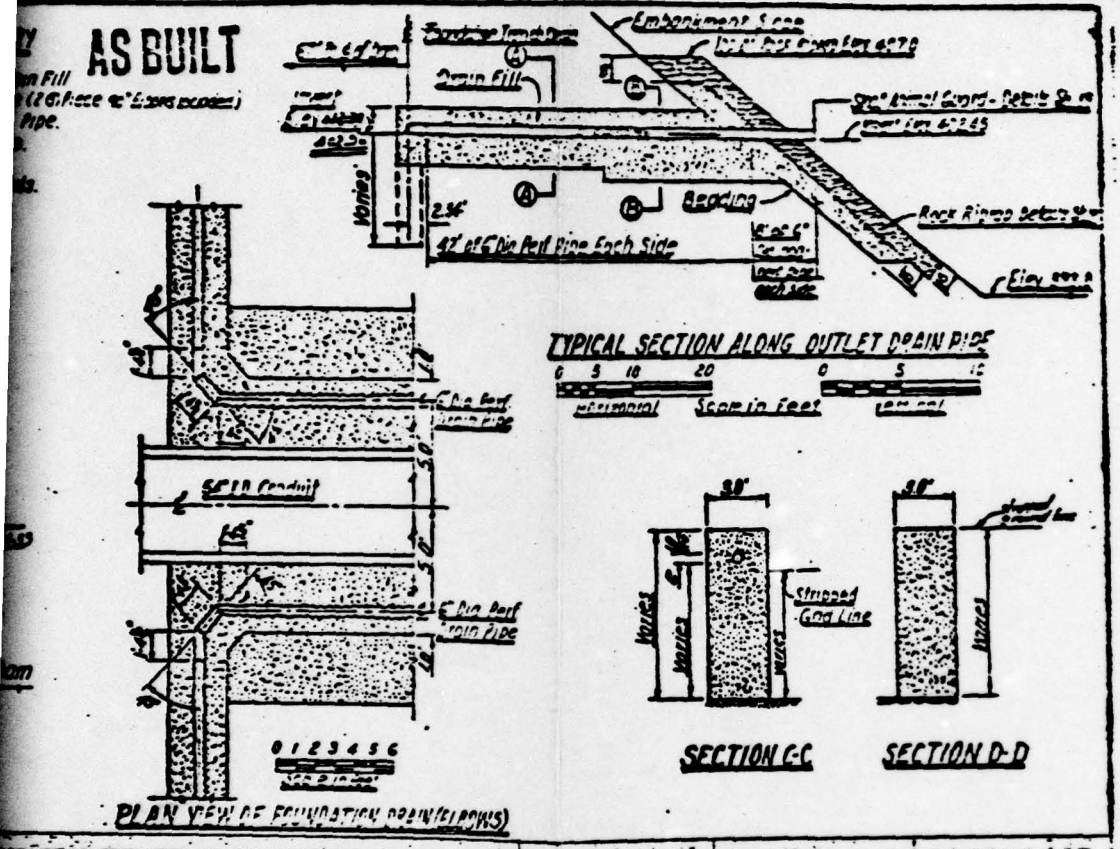
QUANTITY SUMMARY

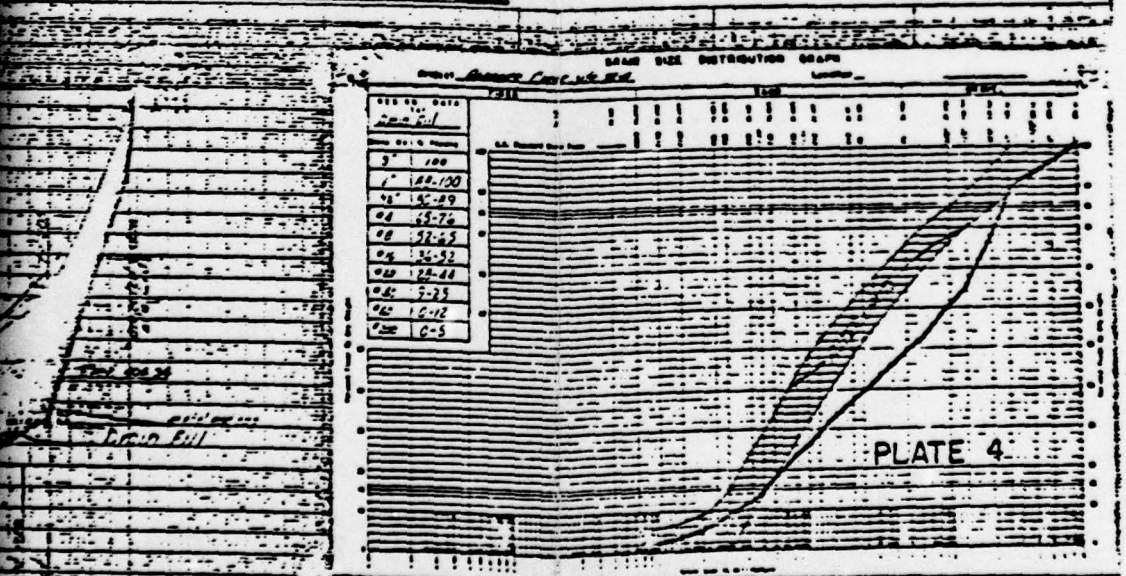
428 Cu. Yds. of Drain Fill
452 of 6" Dia Perf Pipe (2 6' Piece @ 2
16' of 6" Dia. Non-Perf. Pipe.
2 (9 Piece 90° Elbows.
2 Metal End Caps.
2 Small Animal Guards.

AS



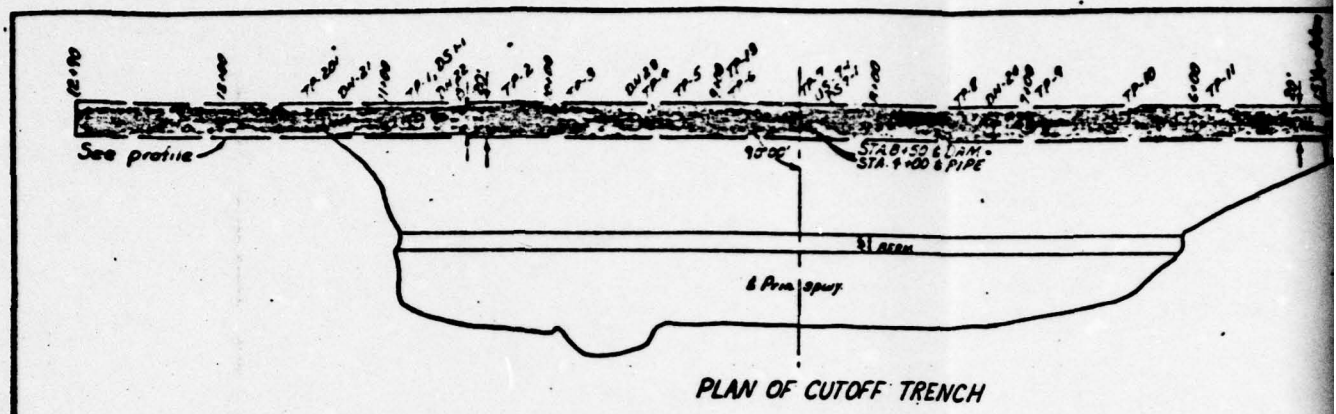






DAM NO. 2A TRIBUTARY TO
ROANOKE CREEK WATERSHED
CHARLOTTE COUNTY, VIRGINIA
DRAINAGE DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-44E-P

2



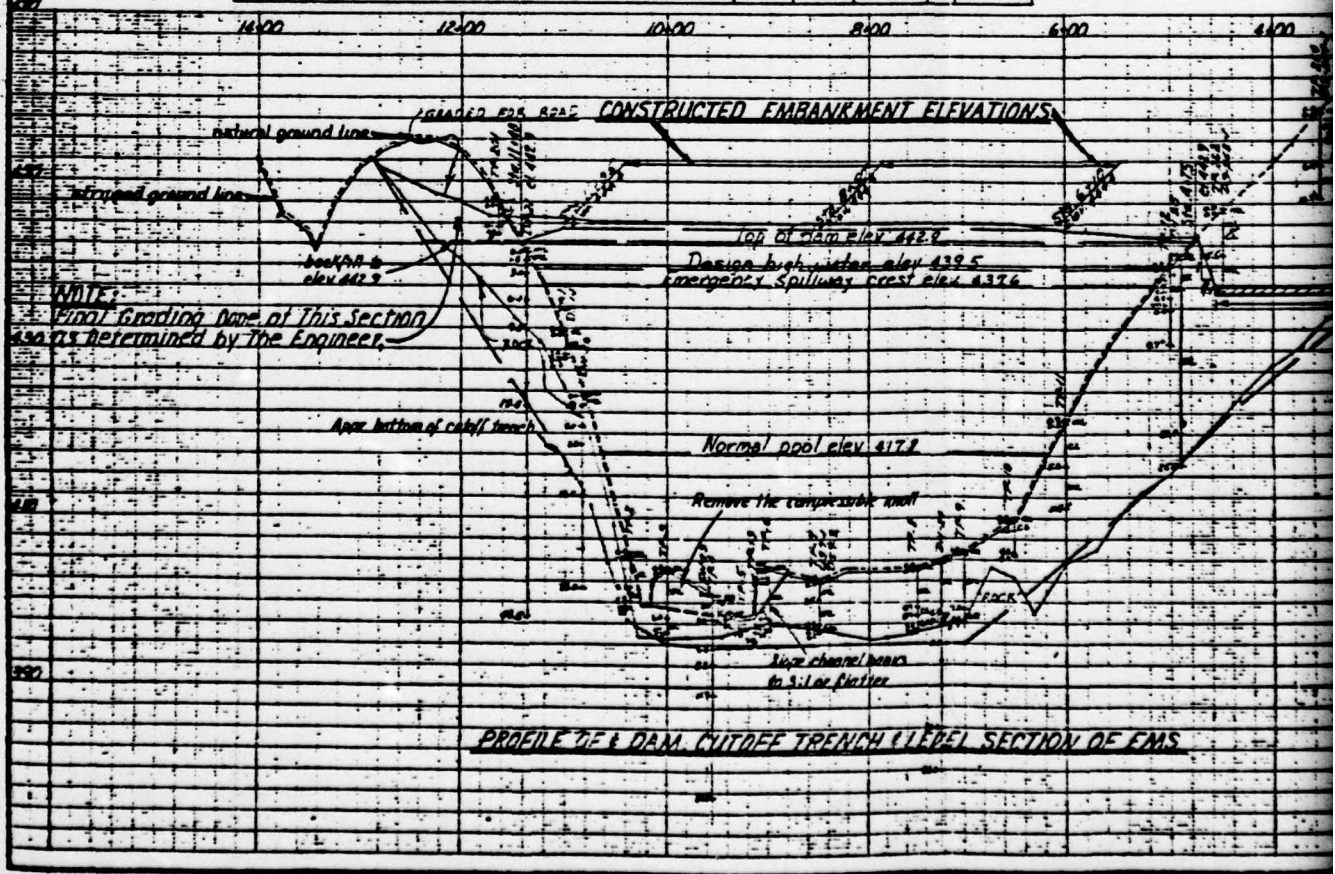
PLAN OF CUTOFF TRENCH

As Built

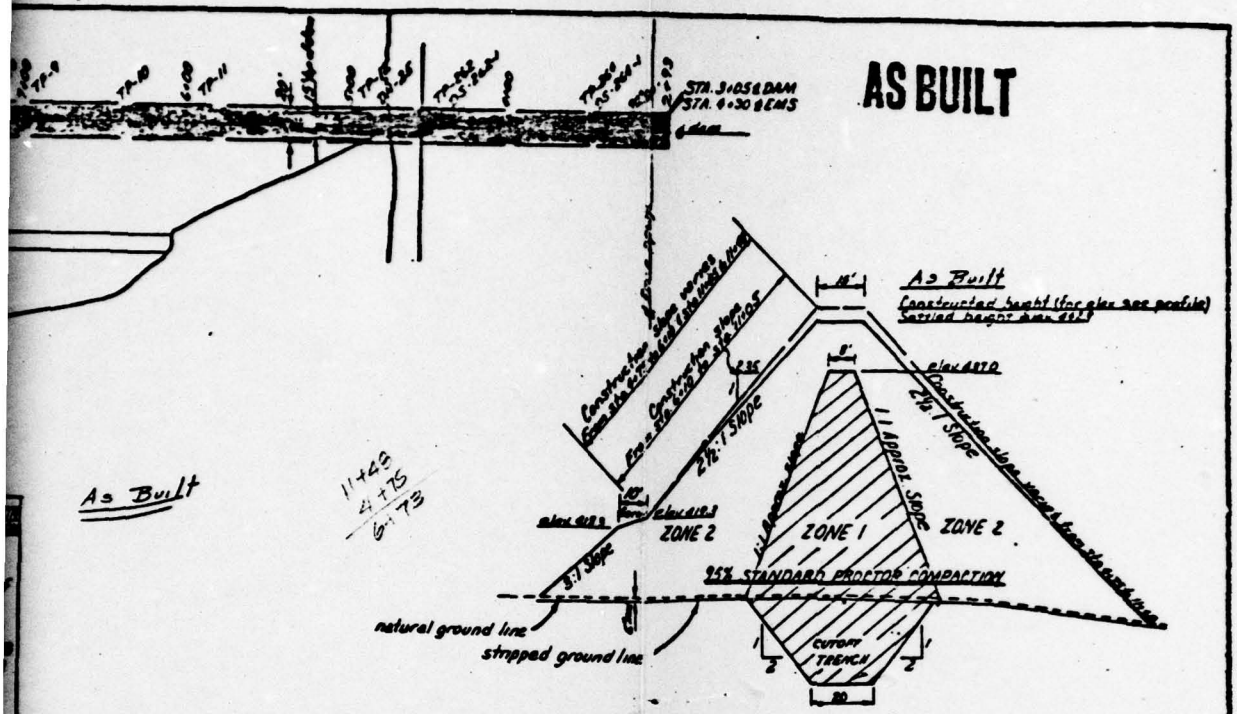
EARTH FILL REQUIREMENTS

ZONE NO	MATERIAL	MAX ROCK SIZE	* MAX LIFT THK	*REQ WATER CONTENT	CLASS	COMPACTION DEFINITION
1	(a) The plastic MH materials selected from the emer spwy ℄ represented by TP-264, 1' To 6.9' (b) The most plastic ML'S ℄ CL'S from the cutoff Trench ℄ prin. spwy. exc (c) If needed; the plastic CL material selected from alternate borrow area (A) and represented by TP-105, 1-9'. Also the plastic MH material selected from alternate borrow area "B" represented by TP-117, 04' To 8.8' and correlated To TP-264, 1'-6.9'	6"	9"	Opt. To +3%	A	95% of max density by D698 method A
2	(a) The ML material selected from the emer spwy and represented by TP-262, 5.5' To 9.7' (b) Suitable material from the cutoff Trench ℄ prin. Spwy excavation not used in zone 1	6"	9"	Opt To +3%	A	95% of max density by D698 method A

* max lift thickness prior To compa
* water content at Time of placem



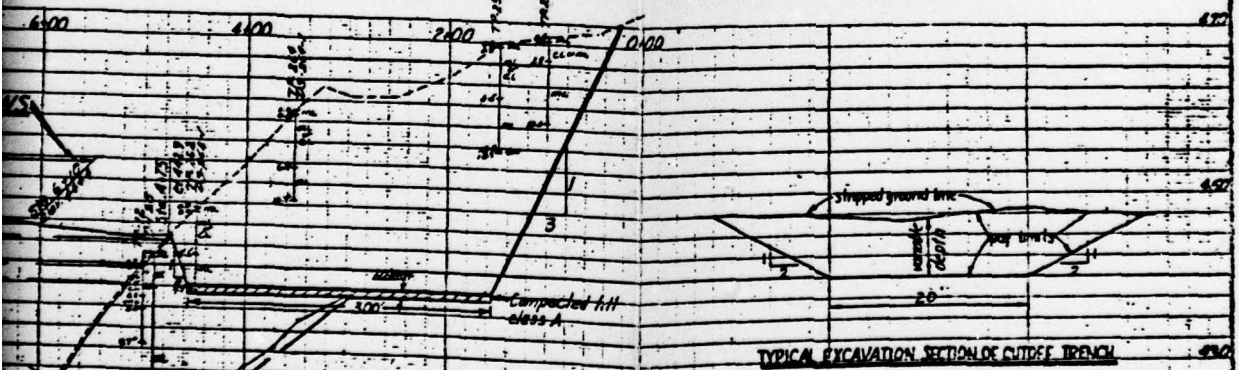
PROFILE OF ℄ DAM, CUTOFF TRENCH & LEVEL SECTION OF EMS



* max lift thickness prior To compaction.
• water content at Time of placement.

REFERENCE
NOTE BOOK NO. 2
PAGE NO. 11-2 24-31-37
36-5-6-1-2-63

TYPICAL SECTION OF COMPACTED FILL AND CUTOFF TRENCH



NOTE:
The profile of the cutoff trench excavation is approximate. The exact depth shall be determined by the Engineer.

PLATE 5

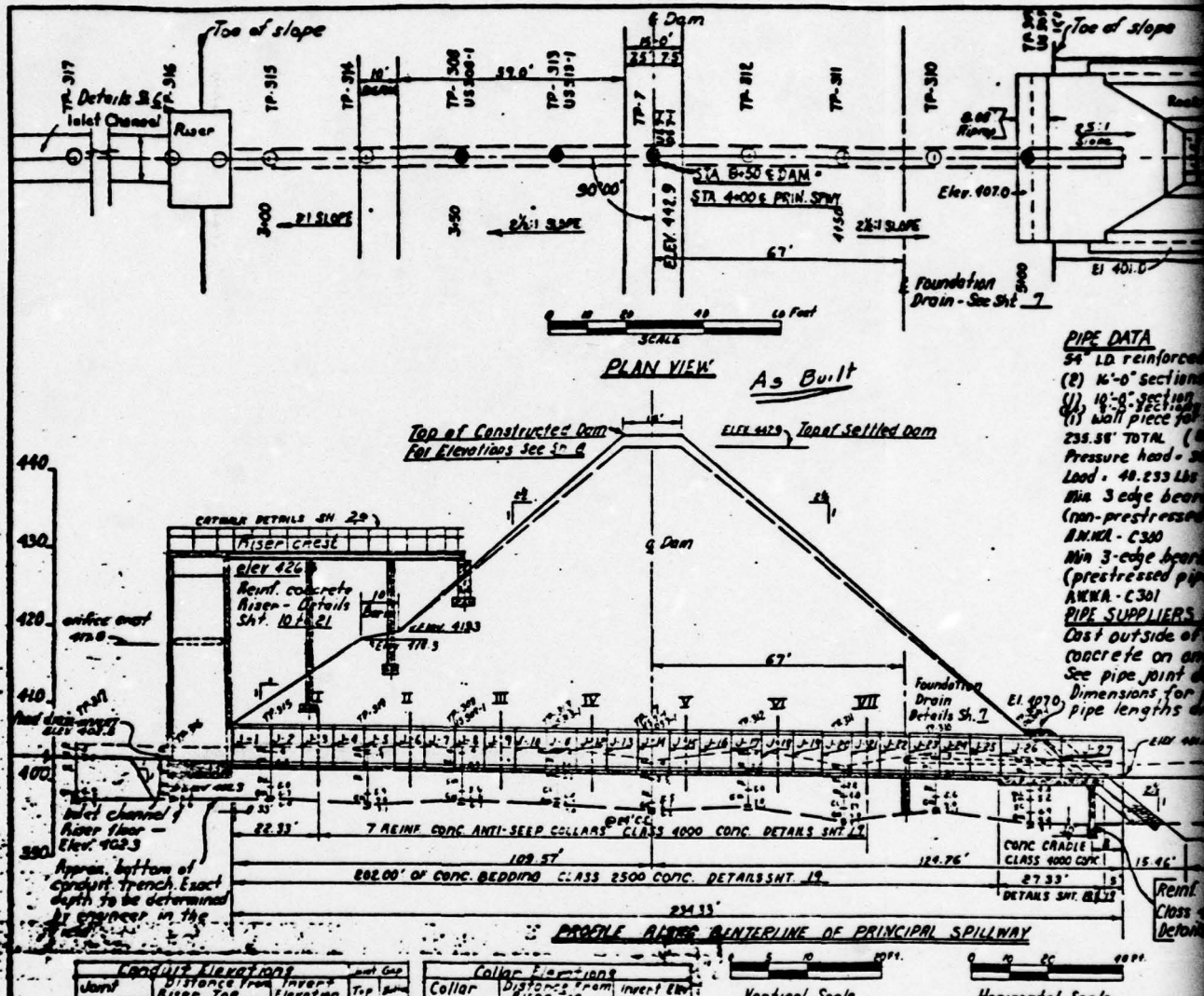
DAM NO 72-A TWITTYS CREEK
ROANOKE CREEK WATERSHED
CHARLOTTE COUNTY, VIRGINIA
DETAILS OF CUTOFF TRENCH & COMPACTED FILL

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

L.S. COFFMAN
N.W. WILSON / R.A. GALLO 3/66
C.L. MOORE / D.E. METZ 3/66
Joe Beck 5/66

VA-446-P

2



PIPE DATA

54" I.D. reinforce
(2) 16'-0" section
(1) 10'-0" section
(1) wall piece for
235.38' TOTAL (
Pressure head - 3
Load - 48,233 Lbs
Min. 3 edge bear
(non-prestresse
A.S.T.M. - C 300
Min 3-edge bear
(prestressed pi
AWWA - C 301

PIPE SUPPLIERS

Cast outside of
concrete on an
See pipe joint d
Dimensions for
pipe lengths a

Conduit Elevations			Joint Gap	
Joint	Distance from Riser Toe	Invert Elevation	Top	Bottom
J-1	0.33	402.30	.300	0.1
J-2	10.33	402.25	.125	.125
J-3	18.33	402.21	.125	.225
J-4	26.33	402.17	.075	.225
J-5	34.33	402.13	0.1	.300
J-6	42.33	402.09	.125	.075
J-7	50.33	402.05	0.1	.300
J-8	58.33	402.01	.250	.125
J-9	66.33	401.97	.175	.250
J-10	74.33	401.93	.125	.300
J-11	82.33	401.89	0.1	.225
J-12	90.33	401.85	.250	.250
J-13	98.33	401.81	.075	.300
J-14	106.33	401.77	.175	.125
J-15	114.33	401.73	.250	.250
J-16	122.33	401.69	.300	.075
J-17	130.33	401.65	.075	.300
J-18	138.33	401.61	.125	.125
J-19	146.33	401.57	.075	0.1
J-20	154.33	401.53	0.1	.250
J-21	162.33	401.49	0.1	.250
J-22	170.33	401.45	.250	.250
J-23	178.33	401.41	0.1	.175
J-24	186.33	401.37	.075	.250
J-25	194.33	401.33	.250	.075
J-26	202.33	401.29	.175	.225
J-27	210.33	401.21	.250	.250
Outlet	234.33	401.13		

Collar Elevations		
Collar	Distance from Riser Toe	Invert Elev
I	22.33	402.19
II	46.33	402.07
III	70.33	401.95
IV	94.33	401.83
V	118.33	401.71
VI	142.33	401.59
VII	166.33	401.47
OUTLET	234.33	401.13

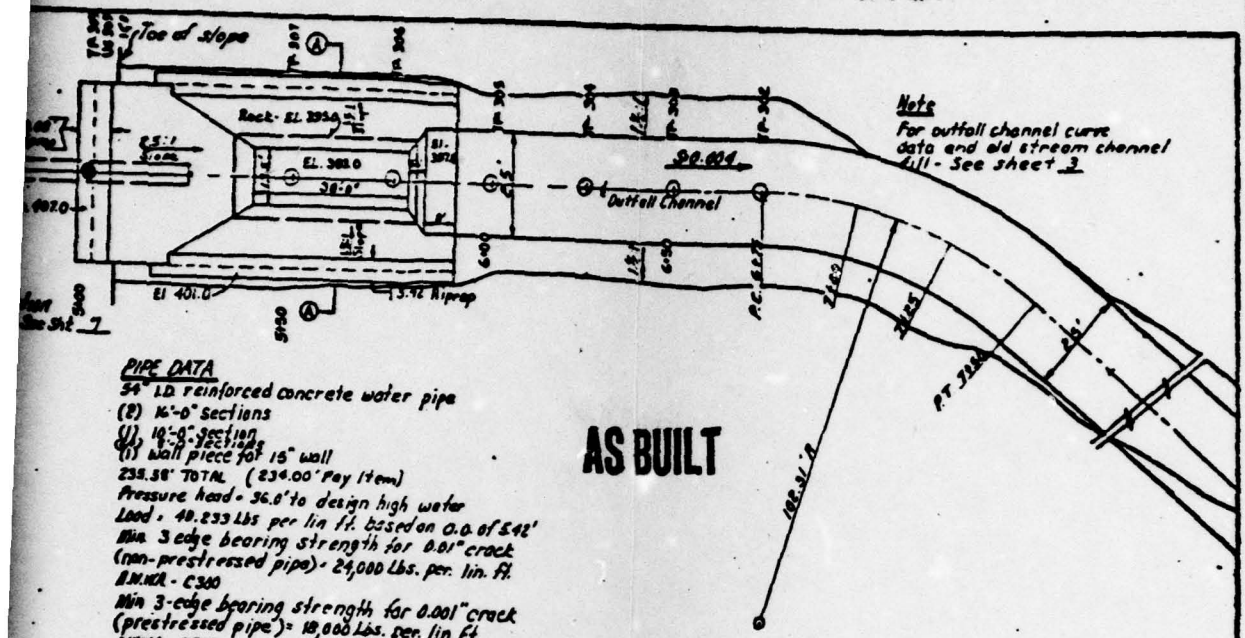
Slope - 0.005 ft/ft
Slope - 0.04 ft/8' Joint
Slope - 0.12 ft/Collar

Note Distance from riser toe & invert elevations are based on 8.00' laid sections.

21-28 of 33-35

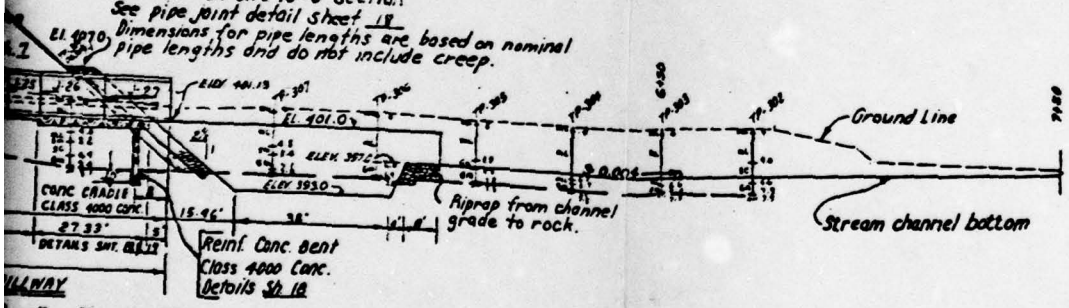
Notes:

1. Rock riprap shall be well graded from a minimum of 6" to a maximum of 18".
2. The rock riprap shall be laid on 18" of bedding as shown.
3. Bedding shall meet the gradation requirements for drain fill shown on sheet



PIPE DATA
54" I.D. reinforced concrete water pipe
(2) 16'-0" sections
(1) 10'-0" section
(2) 9'-3" sections
(1) wall piece for 15" wall
239.38' TOTAL (234.00' Pay Item)
Pressure head - 36.0' to design high water
Load - 49.233 Lbs per lin ft. based on O.D. of 5.42'
Min 3 edge bearing strength for 0.01" crack (non-prestressed pipe) - 24,000 Lbs. per lin. ft.
AWWA - C300
Min 3-edge bearing strength for 0.001" crack (prestressed pipe) = 18,000 Lbs. per lin. ft
AWWA - C301

PIPE SUPPLIERS NOTES
Cast outside of spigot joint ring with concrete on one 16'-0" section
See pipe joint detail Sheet 18
Dimensions for pipe lengths are based on nominal pipe lengths and do not include creep.



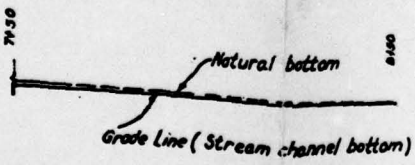
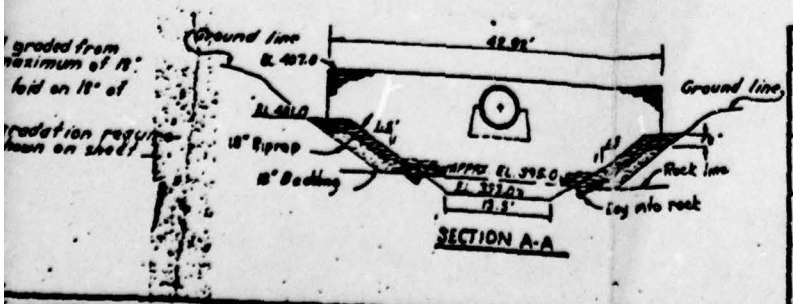


PLATE 6



DAM NO. 72A TWITTYS CREEK
ROANOKE CREEK WATERSHED
CHARLOTTE COUNTY, VIRGINIA
PLAN-PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Wilson Coffman	8/66		
Lon. Beck	8/66		VA-446-P

APPENDIX II

PHOTOGRAPHS

CONTENTS

Photo 1: Upstream Embankment, Riser, and Reservoir

Photo 2: Close-up View of Riser (Note Debris in Trash Racks)

Photo 3: Downstream Embankment and Spring Area (Arrow) on Left Abutment

Photo 4: Tall, Thick Vegetation in Spring Area on Left Abutment

Photo 5: Downstream Embankment Showing Right Abutment Area

Photo 6: Outlet Pipe, Stilling Basin, and Toe Drainpipe

Photo 7: Outlet Pipe, Riprapped Stilling Basin, and Downstream Channel

Photo 8: Downstream View of Emergency Spillway and Right Abutment

Note: Photographs were taken on 22 May 1979.

NAME OF DAM: ROANOKE CREEK No. 72A

ROANOKE No. 72A DAM

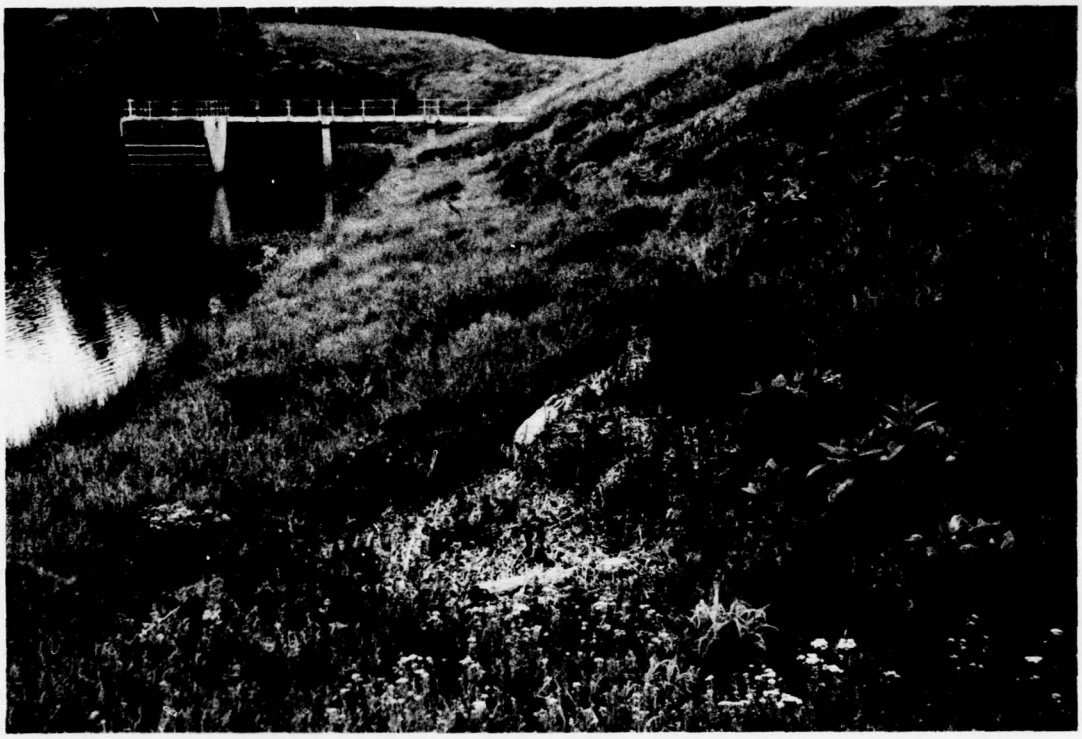


PHOTO 1. Upstream Embankment, Riser and Reservoir

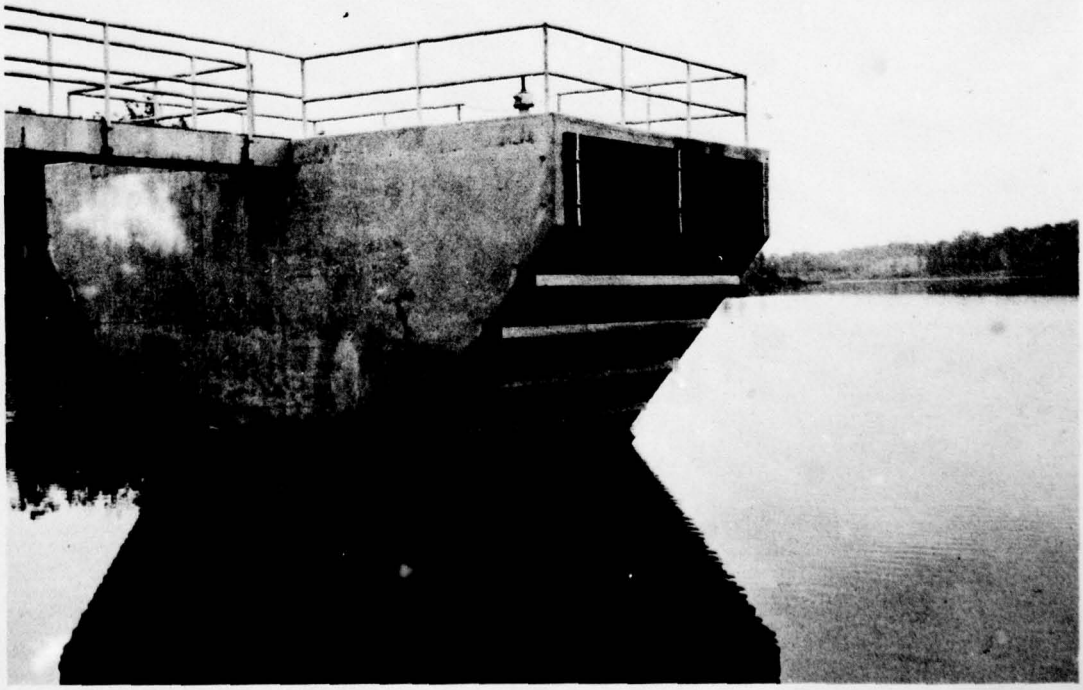


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PHOTO 7. Outlet Pipe, Riprapped Stilling Basin and Downstream Channel

PHOTO 8. Downstream View of Emergency Spillway and Right Abutment

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name of Dam Roanoke No. 72A County Charlotte State Virginia Coordinates Lat. 3659.5
Long. 7833.4

Date of Inspection 29 May 1979 Weather Cloudy, Warm Temperature 75°F.

Pool Elevation at Time of Inspection 417.9 ft. M.S.L. Tailwater at Time of Inspection 401.1 ft. M.S.L.

Inspection Personnel:

Virginia Water Control Board:
Doug Harvey

Michael Baker, Jr., Inc.:
W. L. Sheafer
J. E. Thompson
T. W. Smith

Owner's Representatives:
John Locke - Mayor of Drakes Branch

Soil Conservation Service:
Eugene Morris

Southside Soil and Water Conservation District:
Joe Vaden

T. W. Smith Recorder

EMBANKMENT

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The alignments appeared to be good.	
RIPRAP FAILURES	There was no riprap on the embankment.	
SLOPES	The slopes above the water level and downstream were formed at a 2.5:1 ratio and are well covered with grass 1 ft.-3 ft. tall. There are scattered small (2 ft. diameter) dried out areas. Occasional small draftwood was observed along the upstream shoreline. A 3:1 slope below the bench was used on the upstream side.	No immediate remedial attention is required for the dry areas and driftwood.

EMBANKMENT

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONSTRUCTION MATERIALS	The soil at the surface consisted of red silty clay, brown clayey silt, and sandy silt with rock fragments. The as-built plans indicate that there is a Zone 1 ML silt and CL clay core with an outer Zone 2 of ML silt and suitable soils from excavation.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Both left and right abutments are in sandy and clayey silts with little rock fragments (residual) which appear to have low permeability. The borings in the as-built plans indicate that chlorite schist and greenstone are approximately 21 ft. deep on the right side and from 1.5 ft. to 18.5 ft. on the left side. The spillway and dam junction on the right side have similar conditions to the right abutment.	
ANY NOTICEABLE SEEPAGE	Clear seepage was observed from the original ground at the toe of a hillside slope and near the contact with the left abutment. A spring is located 30 ft. from left abutment on a hill slope beneath a 14 in. vertical tile pipe with a constant water level. The lowland at the toe of the slope is wet.	There appears to be no threat to the stability of the dam caused by the seepage and spring in the adjacent hillside.
STAFF GAGE AND RECORDER	None	
DRAINS	One 6 in. C.M.P. toe drain is located on each side of the outlet of the principal spillway. Approximately 0.25 g.p.m. clear water flows from the pipe on the right side. The pipe on the left is dry with red staining, small roots, and silt (1 in. deep).	

EMBANKMENT

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION	Information concerning the foundation was obtained from the boring logs and test pits as shown in the plans and geologic report. There are approximately 7 ft. of ML-MH clayey silt over 12 in. yellowish ML-SM sandy silt over GM sandy gravel on top of chlorite schist and greenstone. The cut-off trench was dug to the top of rock and backfilled with silt and clay. The bedrock has been mapped as Greenstone Volcanics of an uncertain age.	

OUTLET WORKS

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No severe cracking or spalling of the exposed portions of the outlet conduit were observed.	
INTAKE STRUCTURE	The reinforced concrete riser was in good overall condition and no severe spalling or cracking of the exterior concrete surfaces were observed. The trash racks are clogged with several large logs.	The trash rack should be cleared of all debris.
OUTLET STRUCTURE	The outlet pipe and stilling basin are functioning properly. The sides of the basin are riprapped and the bottom is cut in rock.	
OUTLET CHANNEL	The outlet channel (approximately 25 ft. wide) is clear of obstructions and exits into the woods about 500± ft. downstream from the stilling basin.	
EMERGENCY GATE	The reservoir can be drained by means of a slide gate on the riser. The gate stem and guides above water level were in good condition.	The level of the reservoir was drawndown following the October 1972 flood to make repairs to the riprap in the stilling basin.

UNGATED SPILLWAY

Name of Dam: ROANOKE No. 72A

VISUAL ESAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTION	The control section is 300 ft. wide and 30 ft. long with a crest elevation of 437.6 ft. M.S.L.	
APPROACH CHANNEL"	The approach channel has a 2% adverse slope. The channel is grass covered, brown clayey silt.	
DISCHARGE CHANNEL	The discharge channel empties into a swale which directs the flow toward the stream. The discharge channel has approximately a 3% slope. There is a small (3 ft. x 3 ft.) gully cut by runoff in the upper portion of the swale.	
BRIDGE AND PIERS	Not Applicable	
SLOPES	The slopes in the cut on the right side were made at a 3:1 ratio in red clayey silt overlying brown sandy silt with rock fragments. There is a thick grass cover. The 3:1 slopes on the left side in brown clayey and sandy silt with rock fragments are adjacent to the right abutment of the dam.	

INSTRUMENTATION

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	Bench marks noted on the as-built drawings were not located in the field.	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes are moderately steep to steep and are primarily wooded. The soils are sandy and clayey silts with rock fragments. There is an occasional rock outcrop.	
SEDIMENTATION	No serious sedimentation was noted that would inhibit proper operation of the dam and reservoir.	
COPPER MINES	Mayor John Locke of Drakes Branch reported that copper had been mined in the area in the 1920's. One small excavation had been dug 15 ft. deep in the reservoir area several hundred ft. from the dam on the left side and was backfilled before impoundment. Another shaft was excavated 60 ft. to 70 ft. deep in the upper left side of the reservoir and was backfilled before impoundment.	Since the mines were apparently limited in extent and filled satisfactorily, no problems are anticipated.

DOWNSTREAM CHANNEL

Name of Dam: ROANOKE No. 72A

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	It was observed to be in good condition with no obstruction or debris.	
SLOPES	The slopes are well formed in sandy and clayey silt with rock fragments. There is low vegetation. The channel is about 10 ft. deep in the vicinity of the dam and has approximately a 3% slope downstream of the dam.	
APPROXIMATE NO. OF HOMES AND POPULATION	The Town of Drakes Branch, located approximately 3 mi. downstream of the dam, has a population of 250.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: ROANOKE No. 72A

ITEM	REMARKS
PLAN OF DAM	The plan of dam is shown on the as-built drawings and 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 fromthe COE. The dam was constructed by Roy N. Ford in 1967.
TYPICAL SECTIONS OF DAM	The typical sections are included in the as-built drawings and are presented in this report as Plates 3 and 5.
HYDROLOGIC/HYDRAULIC DATA	Hydrologic and hydraulic calculations were available.
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.

Name of Dam: ROANOKE No. 72A

ITEM	REMARKS
DESIGN REPORTS	Design reports were obtained from the SCS.
GEOLOGY REPORTS	Data on detailed geologic investigations are contained in the design report and included in Appendix VII.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS	Hydrology and hydraulic calculations were available for this inspection report.
DAM STABILITY SEEPAGE STUDIES	Stability and seepage analyses were available for this inspection report and are included in Appendix VI.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	A foundation and borrow area investigation was performed with core borings and test pits. Constant head borehole permeability tests and pressure testing were done in the borings. Field density and laboratory tests were performed. The data was printed in the as-built drawings and/or in the Detailed Geologic Report.
POST-CONSTRUCTION SURVEYS OF DAM	No known post-construction surveys were found.
BORROW SOURCES	The borrow sources are shown on the as-built drawings and the available materials are discussed in the Soils and Geologic Reports.

Name of Dam: ROANOKE No. 72A

ITEM	REMARKS
MONITORING SYSTEMS	No monitoring systems have been provided.
MODIFICATIONS	Data obtained during the inspection agrees closely with the as-built drawings, indicating that no major modifications were made.
HIGH POOL RECORDS	None available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No prior accidents or failure of the dam have been noted.
MAINTENANCE OPERATION RECORDS	Annual inspections are conducted by the Southside Soil and Water Conservation District and other agencies. Copies of the reports are included in Appendix V.

Name of Dam: ROANOKE No. 72A

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS and DETAILS	Information contained in the as-built drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Information contained in the as-built drawings.

APPENDIX V

OPERATION AND MAINTENANCE INSPECTION REPORTS

TERSHED Roanoke Creek Inspection Date(s) April 26, April 30, 1979

spected By: Eugene Morris, Martin Matthews, Bill Griffin
N. L. Ramsey, Garland Clark, W. F. Vaughan [x] - Maintenance Needed
[✓] - Maintenance Performed

llow-Up Report By: _____ Date: _____

	SITE NO.	35-A	72-A	68	43-A	70-A	67	54	4A	5B	6A
1. EMBANKMENT	(a) Vegetation	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
	(b) Slope Stability	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
	(c) Seepage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(d) Toe Drains	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. PRINCIPAL SPILLWAY	(a) Riser	✓	✓	✓	✓	✓	X	✓	✓	✓	✓
	(b) Trash Racks	✓	X	✓	✓	✓	X	✓	✓	✓	✓
	(c) Gate, Stem & Lift	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(d) Conduit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(e) Stilling or Impact Basin	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
	(f) Outfall Channel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. EMERGENCY SPILLWAY	(a) Vegetation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(b) Slope Stability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. BORROW AREAS	(a) Vegetation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(b) Slope Stability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. ACCESS ROADS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. CHANNELS	(a) Vegetation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(b) Slope Stability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(c) Blockage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

7. MAINTENANCE NEEDED: (Includes Cost Estimate)

43-A - Some erosion is occuring on road above dam. Presently it is a small gully about 20 yards in length. This problem is not caused by traffic. Four-wheel drive vehicles have been using the back slope of the dam for a road. Owner has been notified and he intends to stop traffic if possible. (Cost = $15.00 hand labor)

72-A - A few logs trapped in the riser. Town of Drakes Branch has been notified. (cost = town)

64 - Right hand side of impact basin is eroding. Riprap is needed to stabilize this area $300.00.

67 - Riser is deteriorating. Trash racks have fallen off.

OPERATION AND MAINTENANCE INSPECTIONS AND FOLL

RSHED Roanoke Creek Inspection Date(s) April 26, April 30, 1979

ected By: Eugene Morris, Martin Matthews, Bill Griffin
N. L. Ramsey, Garland Clark, W. F. Vaughan

X - Maintenance Needed
✓ - Maintenance Performed

ow-Up Report By: _____ Date: _____

	SITE NO.	61-A	62	49-A	31-B						
EMBANKMENT	(a) Vegetation	✓	✓	✓	✓						
	(b) Slope Stability	✓	✓	✓	✓						
	(c) Seepage	✓	✓	✓	✓						
	(d) Toe Drains	✓	✓	✓	✓						
PRINCIPAL SPILLWAY	(a) Riser	✓	✓	✓	✓						
	(b) Trash Racks	✓	✓	✓	✓						
	(c) Gate, Stem & Lift	✓	✓	✓	✓						
	(d) Conduit	✓	✓	✓	✓						
	(e) Stilling or Impact Basin	✓	X	✓	✓						
	(f) Outfall Channel	✓	X	✓	✓						
EMERGENCY SPILLWAY	(a) Vegetation	✓	✓	✓	✓						
	(b) Slope Stability	✓	✓	✓	✓						
BORROW AREAS	(a) Vegetation	✓	✓	✓	✓						
	(b) Slope Stability	✓	✓	✓	✓						
ACCESS ROADS		✓	✓	✓	✓						
CHANNELS	(a) Vegetation	✓	✓	✓	✓						
	(b) Slope Stability	✓	✓	✓	✓						
	(c) Blockage	✓	✓	✓	✓						

MAINTENANCE NEEDED: (Includes Cost Estimate)

62 - Beavers have blocked outflow channel and backed water into outflow pipe.

Eugene - Do you have copy of this.

OPERATION AND MAINTENANCE INSPECTIONS AND FOLLOW-UP REPORT

WATERSHED Rincon Creek Inspection Date(s) MAY 31, 1978

Inspected By: ARNOLD THORPE, Gordon Bulett, Eugene Mead, N.L. Ramsey, Joe Yaden, J.F. Blair, Tom May

Follow-Up Report By: Eugene Mead Date: 11-7-78

X/X - Maintenance Needed
X/X - Maintenance Performed

	SITE NO.	4-A	5-B	6-A	31-B	34-A	43-A	44-A	59-A	61-A	67
1. EMBANKMENT	(a) Vegetation						X/X				
	(b) Slope Stability										
	(c) Seepage										
	(d) Toe Drains										
2. PRINCIPAL SPILLWAY	(a) Riser										
	(b) Trash Racks										
	(c) Gate, Stem & Lift			X/X			X/X				
	(d) Conduit										
	(e) Stilling or Impact Basin										
	(f) Outfall Channel										
3. EMERGENCY SPILLWAY	(a) Vegetation										
	(b) Slope Stability										
4. BORROW AREAS	(a) Vegetation										
	(b) Slope Stability										
5. ACCESS ROADS											
6. CHANNELS	(a) Vegetation										
	(b) Slope Stability										
	(c) Blockage										

7. MAINTENANCE NEEDED: (Includes Cost Estimate)

Site 6A - Riser stem is bent due to ice storm in winter.

Site 43-A - Riser stem is bent and casing broken due to ice storm in winter.

Estimate for repairing both site is $695.00.

43-A & 70-A - Roads across dams are being used frequently causing ruts and loss of vegetation.

Action Taken - Land owners have been notified and action has been taken to reduce traffic.

Site 67 - Trash racks are missing and concrete is deteriorating on riser. Investigation made by core drilling on August 30, 1978.

Maintenance performed -

Site 43-A & 6-A - Riser stems straightened and casing repaired.

OPERATION AND MAINTENANCE INSPECTIONS AND FOLLOW-UP REPORT

WATERSHED Roanoke Creek Inspection Date(s) _____

Inspected By: _____, _____, _____ [X/X] - Maintenance Needed / Maintenance Performed

Follow-Up Report By: _____ Date: _____

		SITE NO.	67	68	70A	72A					
1.	EMBANKMENT	(a) Vegetation			X						
		(b) Slope Stability									
		(c) Seepage									
		(d) Toe Drains									
2.	PRINCIPAL SPILLWAY	(a) Riser	X								
		(b) Trash Racks	X								
		(c) Gate, Stem & Lift									
		(d) Conduit									
		(e) Stilling or Impact Basin									
		(f) Outfall Channel									
3.	EMERGENCY SPILLWAY	(a) Vegetation									
		(b) Slope Stability									
4.	BORROW AREAS	(a) Vegetation									
		(b) Slope Stability									
5.	ACCESS ROADS										
6.	CHANNELS	(a) Vegetation									
		(b) Slope Stability									
		(c) Blockage									

7. MAINTENANCE NEEDED: (Includes Cost Estimate)

ANNUAL OPERATION AND MAINTENANCE INSPECTION
ROANOKE CREEK WATERSHED - 1977

The annual operation and maintenance inspection of the completed works of construction and improvement in the Roanoke Creek Watershed was made June 2, 1977. The following participated in the inspection:

N. L. Ramsey	-	Southside S&WCD
Wm. F. Vaughan	-	Southside S&WCD
W. G. Pittard	-	Southside S&WCD
J. F. Blair	-	Field Rep. Southside S&WCD
James Ramsey	-	Town of Keysville
Tom May	-	Va. Division Forestry
E. R. Simmons	-	A.C.
Eugene Morris	-	D.C.

LAND TREATMENT PHASE

The conservation phase of this watershed project is more than 76% complete. Field strips, minimum tillage, and sod planting are a few of the conservation practices that are on the increase in the watershed area.

WOODLAND

The woodland program in the watershed area remains in good condition. The severe cold winter seems to have killed the pine bark beetle that was causing so much damage to the pine forest.

HIGHWAY MEASURES

The vegetative cover on the secondary road banks is generally in good condition.

STRUCTURAL MEASURES

All completed structures have been visited. Repairs to the entrance roads of dams 61A and 54 were noted. The new grass seems to be fairly well established along the ditches and cutouts on these roads. The removal of noxious weeds and cedar trees has been carried out on dams 62 and 49A. Removal of the noxious weeds, cedar trees, and the spray control practice on dams 4A, 5B, 6A and 49A is under contract and should be completed within a few days.

The Drakes Branch lake 72A and Keysville lake 70A are scheduled for clipping this month. Small trees around the out flow pipe of these two dams need to be cut down and removed.

A soil test has been taken on dam 62 to determine if there is a lime need. The small trees adjacient to the out flow pipes on dams 35A, 68, and 54 should be removed.(just above the dam). The top of dam 54 has several large and deep mud holes. This problem is aggravated by traffic during wet conditions.

The remaining structures appear to be in good condition and working properly.

The entrance roads into dams 67 and 68 (just above the dam) are rutted and eroded. Several cutouts and a few rock are needed to stablize these conditions.

CHANNEL UNITS

Some of the older channels in the project have become overgrown with willows, birches, and other trees. Beavers continue to obstruct many of the channels.

W. G. Pittard, Vice-Chairman
Southside S&WCD

16 June 1977
Date

Eugne Morris
District Conservationist

16 June 1977
Date

ANNUAL OPERATION AND MAINTENANCE INSPECTION
ROANOKE CREEK WATERSHED - 1976

The annual operation and maintenance inspection of the completed works of construction and improvement in the Roanoke Creek Watershed was made June 2, 1976. The following participated in the inspection:

N. L. Ramsey	-	Southside S&WCD
E. R. Simmons	-	A.C.
Charles Newton	-	C.E.D. A.S.C.S.
Roscoe Ramsey	-	Va. Division Forestry
Eugene Morris	-	D.C.

LAND TREATMENT PHASE

The conservation phase of this watershed project is about 76% completed as of June 30, 1975. A few practices such as terraces and contour strip cropping have been diminishing over the past few years but this trend has been more than offset by the increase in practices such as parallel strips minimum tillage, and sod planting.

WOODLAND

The woodland program in the watershed area remains in good condition. One large area above dam 72-A (approximately 3000 acres) has been planted. Another smaller area has been clear cut and will be planted this winter. The upper reaches of this lake has caught a large amount of sediment from these areas. Hopefully they will be stablized before too much more damage occurs.

The woodland area above dam 43-A has been planted and is fairly stable.

HIGHWAY SLOPING AND SEEDING

The vegetative cover on the secondary roadbanks is in generally good condition. A few eroded areas were noted.

STRUCTURAL MEASURES

All structures were visited. The road entrances down to dams 54 and 61-A needs regrading, shaping, and some gravel. Dams 54,67,68,72-A, 62, 61-A, 4-A, 5-B, 6-A, 31-B, and 49-A all need clipping and fertilizin A fall fertilizer appliaction would be desirable. Some spot spraying with "bush-killer" is needed on dams 6-A and 49-A to control thistle and other undesirable weeds. Dam 4-A has a minor erosion problem on the front and back slopes of the dam. This appears to have been caused by livestock using the same path to water. Older bushes were noted growing along the entrance of the spillway on several dams.

A request is to be made to the Commission for funds from the State Land and Rehabilitation Fund to correct these conditions.

Vegetation and structural conditions at all other dams were satisfactor

CHANNEL UNIT

Some channel disturbance was noted on channel unit TX 14 above the bridge on highway 651. The banks have not been stablized. A letter to the Virginia Dept. of Highways concerning this potential problem is in order.

Generally the channels are operating satisfactory. Some stream bank erosion has been reported.

Wm F. Vaughan — 6-15-76

William F. Vaughan, Chairman
Southside S&WCD

Date

Eugene J Morris — 6-15-76

Eugene Morris
District Conservationist

Date

APPENDIX VI

STABILITY ANALYSES

UNITED STATES GOVERNMENT

Memorandum

TO : R. C. Barnes, State Conservation Engineer, SCS, Richmond, Virginia 23240 DATE: October 6, 1965

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A (Charlotte County)

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 3 sheets.
2. Form SCS-127, Soil Permeability, 1 sheet.
3. Form SCS-128 and 128A, Consolidation Data, 3 sheets.
4. Form SCS-355, Triaxial Shear Test Data, 3 sheets.
5. Form SCS-352, Compaction and Penetration Resistance, 7 sheets.
6. Form SCS-357, Summary - Slope Stability Analysis, 3 sheets.
7. Form SCS-130, Drain Materials, 1 sheet.
8. Form SCS-372, Recommended Use of Excavated Material, 1 sheet.
9. Investigational Plans and Profiles.

INTERPRETATION AND DISCUSSION OF DATA

FOUNDATION MATERIALS:

A. Description and Classification: Bedrock at the site is mostly a jointed chlorite schist. The left abutment has a thin cover over weathered schist. The floodplain is covered with up to 8' of fine to sandy ML and CL-ML material with some GM near the rock surface. The right abutment is covered by residual ML and MH over saprolite.

Water table is at the rock surface in the floodplain.

B. Dry Unit Weight: Field density tests were made and undisturbed samples were taken. The field test results ranged from 85.5 p.c.f. to 92.5 p.c.f. in the fine ML and from 93.0 p.c.f. to 94.5 p.c.f. in the sandier ML and SM.

Density of specimens from undisturbed samples submitted range from 1.41 gm/cc (88.0 p.c.f.) for CL-ML to 1.64 gm/cc (102.0 p.c.f.) for SC-SM. These are relatively low densities for the classification of the materials.

C. Consolidation: A test on Sample 66W685 (401.1) indicated a consolidation potential of about 0.09 ft./ft. This was at an initial density of 1.41 gm/cc or 88.0 p.c.f. on a fine CL-ML. Average density was higher and a potential consolidation of 0.075 ft./ft. is believed more realistic for a 0.5' settlement within the average foundation section.

2 -- R. C. Barnes -- 10/6/65
Rey S. Decker
Subj: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A
(Charlotte County)

A maximum horizontal strain of 0.008 ft./ft. is computed along the conduit for placement at ℄ Station 8+50 and based on b = 128', h = 39' and d = 6'.

D. Permeability: The floodplain materials are relatively permeable at a low density (3.0 ft./day by extrapolation from the consolidation test).

The rock is noted in the geological report as being low in permeability, but is jointed. Most of the joints are clay filled.

E. Shear Strength: A consolidated, undrained triaxial shear test yielded values of ϕ = 21.5°, c = 200 p.s.f.

EMBANKMENT MATERIALS:

A. Classification: Borrow samples submitted consist of ML and MH from the spillway that represent 90,000 and 40,000 cubic yards, respectively, and CL, ML and GM representing 28,000, 15,000 and 4,000 cubic yards, respectively. Some saprolite is indicated, but no sample was received.

B. Compacted Dry Density: Standard Proctor compaction on minus No. 4 material yielded dry densities varying from 82.0 p.c.f. for the fine MH to 111.5 p.c.f. for sandy ML.

A standard compaction test on a minus 3/4" gradation of the GM yielded a maximum dry density of 98.0 p.c.f.

C. Permeability: No tests were made on compacted materials. Based on previous tests of such materials, the permeability will be low and very little difference would be noted between materials.

D. Shear Strength: Consolidated, undrained triaxial shear tests were made on the ML and the MH samples from the spillway. The specimens were molded at 95% of standard and near theoretical saturation for that density. Shear values obtained were ϕ = 25.5°, c = 1050 p.s.f. for the ML and ϕ = 15.5°, c = 1350 p.s.f. for the MH.

These strengths will be available unless swelling lowers the density of the fill or drying cracks are formed. The materials are brittle and could lose strength due to cracks from differential settlement.

E. Consolidation: The materials will exhibit very little consolidation at 95% of standard. A residual settlement of 2% of the fill height is suggested to compensate for residual settlement.

3 -- R. C. Barnes -- 10/6/65
Rey S. Decker
Subj: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A
(Charlotte County)

SLOPE STABILITY ANALYSIS:

Slope stability was checked by a circular failure method. The embankment was assumed to have cracked to the phreatic line. The strength of each embankment shear test was used as though in a homogeneous fill.

The lower safety factors were computed for failure through the floodplain section. The lowest was 1.53 for the upstream 2 1/2:1 over 3:1 slope with a 10' berm.

SETTLEMENT STRAINS:

The embankment material for this fill will be moderately brittle unless compacted at optimum moisture or above. Care should be taken to slope all banks normal to centerline to 3:1 or as flat as possible. Compressible material at the base of the steep left abutment should be removed to prevent high differentials in that area.

CONCLUSIONS AND RECOMMENDATIONS

A. Site Preparation: Creek banks should be sloped and compressible materials at the base of the steep left abutment should be removed.

B. Cutoff: A cutoff to bedrock should be made to the left of Station 6+50. To the right of that station, the cutoff should intercept all ground cracks or other surface disturbances. The cutoff trench should have a 20' bottom and 2:1 side slopes.

Backfill with CL materials placed at 95% of standard on the high side of optimum moisture. Use care to prevent drying cracks in the trench or backfill during construction.

C. Principal Spillway: The location proposed is acceptable unless it is desired to base the cradle directly on rock, which could be done near ℄ Station 6+50. Considerable variation in density of floodplain alluvium may make it desirable to undercut the conduit and place the pipe on compacted backfill unless the abutment location is used where the cradle can be set on rock.

Horizontal strain will be no problem if an abutment location is chosen. At ℄ Station 8+50 the maximum horizontal strain is computed as 0.008 ft./ft.

Make trench side slopes no steeper than 3:1.

4 -- R. C. Barnes -- 10/6/65
Rey S. Decker
Subj: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A
(Charlotte County)

Use $\phi = 32°$ to represent the strength of moist backfill in conduit loading computations.

A stilling basin should be cut into rock to prevent widened scour in loose floodplain materials.

D. Drainage: A foundation drain is desirable to prevent wet toe conditions and relieve uplift from seepage through any unfilled jointing in the bedrock.

Either a trench drain with a pipe outlet or a rock toe will be satisfactory.

Filter limits are suggested on Form SCS-353.

E. Embankment Design: The following are recommended:

1. Selectively place the CL and MH in the center and the fine ML outside with a thin cover of sandy ML or GM at the surface. (See Form SCS-372.)

2. Place all material at 95% of standard Proctor density with moisture controlled near optimum, but on the wet side.

3. Make embankment slopes 2 1/2:1 over 3:1 upstream with slope change and a 10' berm at elevation 418.8 as proposed and 2 1/2:1 downstream.

4. Provide 1.50' overfill from ℄ Station 6+00 to 10+30 to compensate for settlements in the fill and foundation.

Prepared by:

Roland B. Phillips

Attachments

cc: R. C. Barnes (4)
H. M. Kautz, Upper Darby, Pennsylvania (2)

Form SCS 357
Rev. 6-65

MATERIALS TESTING REPORT | U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE

SUMMARY - SLOPE STABILITY ANALYSIS

PROJECT and STATE: Barrick Creek - Site #7W-4 — Virginia

METHOD OF ANALYSIS: Swedish Circle

ANALYZED AT: SML - Lincoln

APPROVED BY:

DATE: 9-25-65

SOURCE AND USE OF MATERIALS	CLASSIFICATION	ADOPTED DESIGN DATA							REMARKS
		γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	γ_{sub} (pcf)	ϕ (deg.)	tan ϕ	c (psf)	
① Core Found.	CL-ML	89.6		117.0	54.5	21.5°	0.394	200	Sat shear values only.
② E. Spw. Emb.	ML	81.0	105.0	111.0	48.5	25.5°	0.477	1050	
③ E. Spw Emb.	MH	78.0	105.0	111.0	48.5	15.5°	0.277	1350	
④									
⑤									
⑥									
⑦									
⑧									

TRIAL NO.	SLOPE	CONDITIONS	F_s
		Flood Plain Section -	
		Upstream -	
1	2½:1 / 3:1	Full drawdown - 10' berm @ elev. 418.8 - Arc cut from bottom of crack thru Emb #2 & 7' into Found #1.	1.53
1A	2½:1 / 3:1	Same as #1 but emb #3 Downstream	1.66
2	2½:1 / 3:1	Drain at $c/\gamma h = 0.06$, no berm, arc from bottom of crack thru emb #2, and 7' into found #1	1.55
		Maximum Section	
		Upstream	
3	2½:1 / 3:1	Full drawdown - 10' berm @ elev 418.8 - Arc cut from bottom of crack thru emb #2 only.	2.8
3A	2½:1 / 3:1	Same as #3 except Emb #3.	3.1

VI-5

Sheet 1 of 2

Cover sheet

(See also)

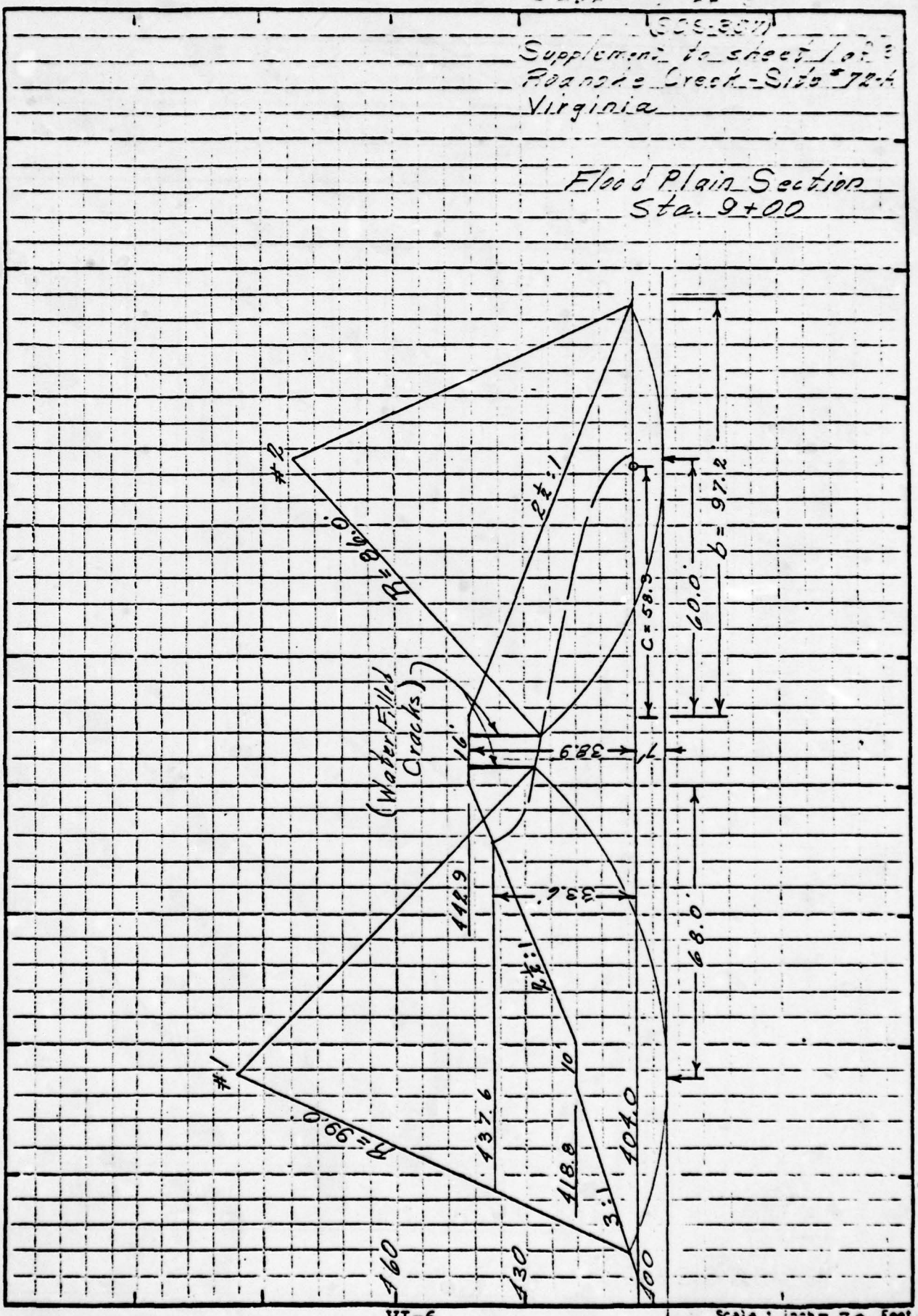
Supplement to sheet 1 of 3

Roanoke Creek - Site #72-A

Virginia

Flood Plain Section

Sta. 9+00



Scale 1 inch = 30 Feet

SCS-357
Supplement to sheet 1 of 3
Boonsboro Creek Site #72-A
Virginia

Maximum Section
Sta. 9+30

Scale 1 inch = 30 Feet

the two conditions the soils lab used to analyze the stability of the slope were through the line of the emergency spillway and the full pool. The first condition is almost complete drawdown of the reservoir with the soils in the core and the soils on the slopes. The soils lab obtained high safety factors on both slopes with pervious fill material so it is logical that a combination of the two materials will also be stable. A question arose on lab sample no. 630 as to the validity of the high cohesion intercept on the triaxial shear test on form SCS-ES-9 sht 2 of 3. The PI of the material is listed as E.

It was felt that the plotting of the unit shearing strength for this sample should have been subjected to the stress circle at lower lateral pressure rather than at 5 psi. By telephone conversation with R.E. Phillips on 2/16/66 this could be felt the test to be questionable also. The soils lab changed the parameters from $\phi = 22.5°$; $C = 1100$ psf to $\phi = 25.5°$ $C = 600$ psf. In recomputing the stability of the slopes the lab eliminated the cracking of the fill and found the minimum safety factor on the U changed from 1.55 to 1.35. This is acceptable so no further analysis is necessary.

The proportioning of the fill as recommended by the soils lab is not realistic since there is enough material in the emergency spillway and excavation to build the structure. Some materials from the borrow area represented by TP-III-1, TP-III-2, and TP-III-3 have been eliminated as borrow sources. All materials will be placed at slope A-3

COMPUTATION SHEET
SCS-522 REV 5-58

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Virginia PROJECT Roanoke Creek site No. 72 A
BY R.A.G. DATE 10/65 CHECKED BY N.W.W. DATE 11/65 JOB NO VA-446-E
SUBJECT Summary (cont.) SHEET 2 OF 12

no less than 95% of standard proctor with placement moisture contents between optimum and +3% opt.

The single element filter recommended by the soils lab is included in the final design, but if it proves to be impractical to obtain, a dual filter will be designed that might be more readily available.

From the grain-size distribution graphs all the soils in fill and foundation are fine-grained except that represented by sample 7-1. this is a gm material that forms a thin sense on the surface of the chlorite schist. Piping should not be a problem since the soil fill including the cutoff trench, is highly plastic and very slowly permeable. Cracking will present no problem since the excavations will have 2:1 or flatter slopes, the material will be placed at high moisture contents, and the overburden is relatively low.

The required joint extensibility was computed by the TR-18 approach (see structural section). It was found that a deep joint would not provide enough elongation with 16 sections. By recomputing the required extensibility with 8' sections it was found that a standard joint will provide enough depth.

It was decided to take the cutoff to unweathered rock throughout rather than widen the trench & cut off the most permeable rock as suggested by the lab.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—479067

STATE Virginia | PROJECT Roanoke Creek site No. 72A.
BY R.A.G. | DATE 10/65 | CHECKED BY JFA | DATE 1/66 | JOB NO. VA-446-E
SUBJECT Tightness against piping | SHEET 5 OF 12

Check the possibility of one material piping into the adjacent downstream material by the following criteria from Navdocks DM-7, fig. 7-8-13

A) 1) If $C_u > 1.5$, then $\frac{D_{15f}}{D_{85b}} < 5$

2) If $C_u < 1.5$ then $\frac{D_{15f}}{D_{85b}} < 6$

B) If $C_u < 1.5$ then $\frac{D_{50f}}{D_{50b}} < 25$

C) 1) If $C_u < 4$ then $\frac{D_{15f}}{D_{15b}} < 20$

2) If $C_u > 4$ then $\frac{D_{15f}}{D_{15b}} < 40$

} do not apply to this site

Core (Zone 1)				Shell (Zone 2)				Foundation			
sample	C_u	D_{15} mm	D_{85} mm	sample	C_u	D_{15} mm	D_{85} mm	sample	C_u	D_{15} mm	D_{85} mm
264-1	>4	<0.002	0.03	262-1	>4	<0.005	0.09	7-1	>4	0.005	0.097
								7-2	>4	1.20	42.0
105-1	>4	<0.002	0.21					309-1	>4	0.005	0.15
								503-1	>4	0.010	1.00
								503-2	>4	0.065	35.0
								308-1	>4	0.0	0.240
								401-1	>4	0.006	0.09
								403-1	>4	0.006	0.08
								313-1	>4	0.007	0.250
								1-1	>4	<0.002	0.085
								401-2	>4	0.065	2.40
								309-2	>4	0.011	0.30

Interfaces between the core & shell are OK.

The inter faces between fdtn. & core materials are okay except by fdtn sample 7-2. This is a 1" layer of gm on the surface of the chlorite schist. Since the core material is plastic (PI >20) & has more than 15% <0.005 mm it will not present a movement problem. (See "Design of Sand & Gravel Drainage Filters & Blankets" by Decker)

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Virginia PROJECT Roanoke creek site No 72A
BY R.A.G. DATE 10/65 CHECKED BY J.F.A. DATE 11/65 JOB NO VA-446-E
SUBJECT Permeability SHEET 6 OF 12

Appl. values of permeability are estimated on page 12 of "Study of effective use of coarse grained soil in earth dams".

$$\frac{E_s}{1+e}$$

Test No	% Gravel	E_s	e	D_{10} (mm)	K ft/min
264-1	78.0	2.75	1.20	<0.002	$> 3 \times 10^{-5}$
105-1	97.0	2.75	0.77	<0.002	$> 3 \times 10^{-5}$
262-1	61.7	2.77	1.12	<0.002	$> 3 \times 10^{-5}$

The materials listed above will represent over 90% of the embankment. The "K" value for the fill will be insignificant.
For the foundation, test pit 7; 2.5-5.5' has a "K" value of 1.9397 ft/day, and Test pit 38E; 3.3-5.6' has a "K" of 0.0049 ft/day. The perm rates are small and the fact that positive cut-off and adequate drainage will be provided further minimizes the chance that excessive flow will exist.

APPENDIX VII

GEOLOGIC REPORT

Form SCS 378a
Sheet 1 of 3

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

10-55

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL
SUPPLEMENTAL REPORT

State Virginia County Charlotte ; ___ ¼, ___ ¼, Sec. ___, T ___ R ___ ; Watershed Roanoke Creek

Subwatershed Twittys Branch Fund class ___ (FP-2, WP 1, etc.) Site number 72A Site group I Structure class c

Investigated by Mack, T., Geologist (signature and title) Equipment used Sprague & Henwood 40c drill (Type, size, make, model, etc.) Date 8-9/65

SITE DATA

Drainage area size 15.51 sq mi., 9926.4 acres. Type of structure Earth Fill Purpose Flood Prevention

Direction of valley trend (downstream) SW Maximum height of fill 46.2 feet. Length of fill 550 feet.

Estimated volume of compacted fill required 120,474 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	275	57.0	
Floodwater	3,280	365.0	38
Water supply	2,350	225.0	18

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Piedmont province Topography rolling Attitude ~~of rock~~ schistosity: Dip 67°W Strike N48°E

Steepness of abutments: Left 40 percent; Right 20 percent. Width of floodplain at centerline of dam 390 feet

General geology of site: Roanoke Creek site #72A is the first dam site in the southern piedmont of Virginia that the rock has been investigated by drilling. This lack of drilling is primarily due to the type of rock present here. This area is underlain by metamorphic rock that has been subjected to intense heat and pressure. Under these conditions the mineral composition of the rock is altered and the rock generally becomes more dense and completely impermeable. However, there are present joints that were emplaced in the metamorphic rock after it had cooled. Before Triassic time compression joints were formed. After Triassic time tension joints were emplaced. In the unweathered rock the joint pattern is generally tight. No water can pass through these unweathered joints. Thrust faults are absent in the Virginia piedmont. The reason for this is that the rock under metamorphism is in almost plastic form and thus will deform and not rupture. Thus generally the only area of the metamorphic rock that is permeable is the weathered zone. In this rock the

weathering not only breaks down the rock but it also opens the joint pattern so that water can pass through the fracture planes. The weathering action follows the fracture planes. The red and brown colors of oxidation are observed on the fracture planes.

The purpose of this drilling is to determine the depth of the weathered rock. Five drill holes were emplaced. All drill holes were taken into unweathered rock. This unweathered chlorite schist and greenstone are impermeable.

Drilling showed interbedded chlorite schist and greenstone occur on the left abutment. This rock type is also present in in the flood plain area on the centerline of the dam. Chlorite schist is present on the right abutment.

The origin of these rocks has previously been discussed. The chemical composition of the amorphous mass of basic lava present before metamorphism can be estimated by the formulae of the minerals. Also the genetic relationship of these minerals can be seen by their formulae. These chemical formulae (Niggli, 1954) are listed as follows:

Chlorite $(Si,Al)_4O_{10}(OH)_8(Mg\ Fe\ Al)_6$

Epidote $4CaO \cdot Fe_2O_3 \cdot 2Al_2O_3 \cdot 6SiO_2 \cdot H_2O$

Zoisite $4CaO \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot H_2O$

Hornblende $OH(Si,Al)_{16}O_{44}(Mg\ Fe\ Al)_{10-14}(CaNa)_{0-6}$

Feldspar $(Ca, K, Na)O_2 \cdot Al_2O_3 \cdot 6SiO_2$

Quartz SiO_2

Centerline of the Dam - On the left abutment weathered and fractured chlorite schist and epidote occur between a depth of 1.3 to 18.5 feet at the top of the dam. This is shown by DH 21 which is at station 11+38 on the centerline of the dam. Water loss under pressure is fairly high in this rock. From 18.5 to 43.5 feet there is present hard, compact greenstone that is impermeable. At station 10+82 on the left abutment DH 22 showed that weathered and fractured chlorite schist and greenstone occur. between a depth of 1.5 and 12.0 feet. Permeability of this layer is generally high. Below this weathered rock hard impermeable to very slightly permeable greenstone occurs. Shallow, tight residual soil (ML) that has a depth of 1.5 feet occurs on the left abutment.

DH 23 at station 9+55 on the centerline of the dam showed that coarse, well sorted sand occurs to a depth of 3.0 feet in this area of the flood plain. This alluvial material is underlain by weathered and fractured chlorite schist and some greenstone to a depth of 7.0 feet. Below this depth there is present almost impermeable chlorite schist and greenstone. At station 7+25 on the centerline of the dam DH 24 showed that mottled brown and gray clayey silt is present from 0.4 to 6.5 feet. Below this sandy gravel occurs to a depth of 7.5 feet. Tests showed this alluvial material to be impermeable. Below this soil fractured and slightly weathered interlayered chlorite schist and epidote occur to a depth of 10.0 feet. This rock is moderately permeable. Almost impermeable interlayered epidote and chlorite schist occur from 10.0 to 25.0 feet.

DH 25 was placed on the right abutment at station 4+90 on the centerline of the dam. This drill hole showed that red clayey silt (ML) is present from 0.4 to 4.0 feet. Yellow and yellow red sandy silt(ML) occurs from 4.0 to 21.0 feet. This residual soil is hard and impermeable to very slightly permeable as shown by penetration and permeability tests. Fractured weathered chlorite schist with veins of milky quartz is present from 21.0 to 25.0 feet. From 25.0 to 35.0 feet very slightly permeable to impermeable chlorite schist occurs. Below 35.0 feet there is present impermeable unweathered chlorite schist.

Niggli, Paul, 1954, Rocks and Mineral Deposits: W. H. Freeman and Co., San Francisco, pp. 134-137.

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

Virginia County Charlotte Watershed Roanoke Creek Subwatershed Twittys Creek

P number 72A Site group I Structure class C Investigated by T. Mack, Geologist (signature and title) Date 8-9/65

SUPPLEMENTAL REPORT
INTERPRETATIONS AND CONCLUSIONS

For In-Service Use Only

1. Weathered and fractured chlorite schist and greenstone are present to a depth of 18.5 feet on the left abutment and to a depth of 10.0 feet in the flood plain area of the dam. Fractured, weathered chlorite schist occurs from a depth of 21.0 to a depth of 25.0 on the right abutment. The residual soil in the right abutment is impermeable to very slightly permeable.

   Consideration should be given to the excavation of the cut-off trench to impermeable rock below the normal pool elevation. This dam is a water-supply dam.

   If the slightly weathered chlorite schist and greenstone are to be left below the cut-off trench above the normal pool elevation, dental grouting should be effected on weathered seams such as the seams at a depth of 7.0 and 12.0 feet in DH 22.

   On the right abutment the red and yellow ML residual soil is impermeable to very slightly permeable. This soil is almost as tight and impermeable as any core material that could be packed into the cut-off trench.

Concurred in
R W Bromwell

Form SCS-334
MAY 65

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SAMPLE LIST
SOIL AND FOUNDATION INVESTIGATIONS

Location Charlotte County, Va. Owner Town of Drakes Branch & Continental Can Company

Watershed Roanoke Creek Sub-watershed Twittys Creek Site No. 72-A

Submitted by Mack, T. Date 7 19 65

Sent by Truck (carrier) Government B/L No.

Lab. No.	Field Sample No.	Sample Description		Depth		Type of Sample	
		Location	Grid or Station	From	To	Undist.	Dist.
	7-1	C/L Dam	8+50 C/L Dam	2.0	3.0	gallon can	
	308-1	C/L Pipe	50' L 8+50C/L "	4.0	5.0	"	
	309-1	"	100' R " " "	3.0	4.0	"	
	309-2	"	" " " " "	5.0	6.0	"	
	313-1	"	25' L 8+50 " "	3.9	4.9	"	
	401-1	Foundation	52' L 9+10 " "	2.5	3.5	"	
	403-1	"	53' L 7+38 " "	3.0	4.0	"	
	503-1	Toe drain	67' R 9+00 " "	3.0	4.0	Shelby tube	
	1-1	C/L Dam	11+00 C/L Dam	1.0	2.9		Small
	7-2	"	8+50 " "	5.5	6.1		large
	401-2	Foundation	52' L 9+10C/L "	6.9	7.5		"
	503-2	Toe drain	67' R 9+00 " "	5.6	8.1		"
	105-1	Borrow Area	350' R 9+30 B/L A	1.0	9.0		large
	111-1	" "	470' R 12+80 " "	1.0	8.1		"
	114-1	" "	110' R 12+80 " "	1.0	3.8		"
	119-1	" "	0+25 C/L Dam	6.6	8.6		"
	262-1	E. Spillway	4+50 " "	5.5	9.7		"
	264-1	" "	3+55 " "	1.0	6.9		"

Original to Soils Laboratory
Copy to E and WP Unit
Distribute other copies as directed by State Conservationist

Sheet 7 of 7 Sheets

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

USDA SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Virginia County Charlotte Watershed Roanoke Creek Subwatershed Twittys Creek

Ref 72A Site group I Structure class C Investigated by [signature] Date 7/65
(Signature and title)
T. Mack, Geologist

INTERPRETATIONS AND CONCLUSIONS
For In-Service Use Only

1. The rock line under the centerline of the dam in the flood plain area is regular. It ranges in depth below the ground surface from 1.5 feet in the creek to 7.5 feet in recent alluvium - colluvium. A cutoff trench can easily be taken to rock in the flood plain area.

2. The cutoff trench can be easily taken to rock on the left abutment. On the right abutment the cutoff trench should be taken to hard rock below the normal pool elevation. Above the normal pool elevation the residual soil that occurs on the centerline of the dam is hard and impermeable. It is considered that here above the normal pool the cutoff trench needs only be taken to saprolite.

3. Little or no water is expected to pass through the metamorphic rock under the foundation. This basic lava has been subjected to heat and pressure of sufficient intensity to have easily sealed off any permeable layers, vugs or cooling fractures. The only place for passage of water through the foundation is through the joints in the rock. The attitudes of these joints is given in the logs. The joints appear tight. They appear to have been sealed by compression forces. Where the joint pattern has been exposed to weathering, the fractures are slightly open but filled with red silt. The age of the fractures in the chlorite schist is assumed to be Triassic.

4. The invert of the pipe will be approximately 3 feet above hard rock. This rockline is regular. The rock is considered sufficiently strong to bear the pipe and cradle.

5. Some weathered chlorite schist was found to occur above grade in the emergency spillway cut. A weak backhoe refusal was effected when this rock was encountered. With sharper teeth and more effort, this weathered schist could probably have been taken to grade. However, the character of the rock and the low seismic velocities clocked here show the rock to be rippable.

6. Sufficient borrow is present to construct the embankment. Placement of the borrow material is suggested as follows:

Sample	Depth	Classif.	Yards^3	Soil Series	Horizon	Suggested Use
105-1	1.0-9.0	CL	9,000	Roanoke	B	Core
111-1	1.0-8.1	ML or CL	19,000	Augusta	B	Core
114-1	1.0-3.8	ML	15,000	Congaree	B	Slopes
119-1	6.6-8.0	ML	4,000	Lloyd	C to Saprolite	Slopes
262-1	5.5-9.7	ML	90,000	Lloyd	C	Slopes
264-1	1.0-6.9	ML or CL	40,000	Lloyd	B	Core

Both borrow areas A and B contain core and slope material. If borrow area A is held to below the permanent pool elevation no re-seeding is necessary. However, the haul here is further than from borrow area B.

The deep residual soil in borrow area B is similar to the residual soil in the emergency spillway cut. A spine of saprolite occurs in the center of borrow area B. This spine is rippable. It can be used in the dam as slope material. Under a roller it should easily crumble to ML material.

7. Topsoil should be stockpiled and used for topdressing.

R. C. Barnes

UNITED STATES GOVERNMENT

Memorandum

TO : R. C. Barnes, State Conservation Engineer, SCS, Richmond, Virginia 23240 DATE: November 15, 1965

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A (Charlotte County)

REFER : Report of October 6, 1965.

The report was completed before the additional drilling and permeability testing results were received. Attached is the revised Form SCS-35B.

We have reviewed these additional logs and test results and have some comments. We are not sure we understand what procedures were used for the constant head permeability tests. It seems to us that the "Constant Head Permeability" tests which we have assumed to be open end pipe tests are probably not as reliable in the weathered rock as the "Pressure Tests" which we assume are packer tests.

To check on this we compared results in DH No. 21, No. 23 and No. 24 assuming the drill was NX. Results are as follows, using $k = 22.5 \times \frac{Q}{H}$ in ft./day for NX drill and a 5' test section.

Test Hole DH No.	Depth of Test Feet	Pressure Test $k = 22.5 \times \frac{Q}{H}$ in Ft./Day	Constant Head Permeability $k = \frac{420\ Q}{hr}$
23	3 - 8	10.7	
	5 - 8.5		780
24	7.5 - 12.5	5.4	
	7.5 - 12.5		50
NX Drill - 10' Section - $k = 13.4 \times \frac{Q}{H}$ for DH No. 21			
21	10 - 15	16.6	
	9.3 - 15		579

We might be able to give some help in interpreting these results if we knew the procedures for the tests.

2 -- R. C. Barnes -- 11/15/65
Rey S. Decker
Subj: ENG 22-5, Virginia WP-08, Roanoke Creek, Site No. 72-A
(Charlotte County)

RECOMMENDATIONS

Since the very permeable weathered rock in the left abutment is above storage elevation, the changes in the original recommendations are as follows:

1. Widen the cutoff trench bottom to 30'.

2. Bottom the trench below the more permeable weathered surface of the rock. Assumed trench depths are as follows:

Station	Trench Depth Feet	Bottom Elevation
5+00	4.5	436.0
6+00	7.0	415.0
6+50	10.0	400.0
7+25	11.0	394.0
9+50	8.0	393.0
10+10	8.0	395.0
10+40	9.0	398.0
11+20	9.0	429.0
11+40	6.0	437.0

3. Grout any open seams left on the trench bottom as proposed by the Geologist.

Prepared by:

Roland B. Phillips

Attachment

cc: R. C. Barnes (4)
H. M. Kautz, Upper Darby, Pennsylvania (2)

APPENDIX VIII

GENERAL REFERENCES

GENERAL REFERENCES

1. Bureau of Reclamation, U.S. Department of the Interior, Design of Small Dams, A Water Resources Technical Publication, Revised Reprint, 1977.

2. Chow, Ven Te, Handbook of Applied Hydrology, McGraw - Hill Book Company, New York, 1964.

3. Chow, Ven Te, Open Channel Hydraulics, McGraw - Hill Book Company, New York, First Edition, 1959.

4. Commonwealth of Virginia, "Geologic Map of Virginia," Department of Construction and Economic Development, and Division of Mineral Resources, 1963.

5. HR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).

6. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw - Hill Book Company, New York, 1963.

7. Soil Conservation Service, "National Engineering Handbook - Section 4, Hydrology," U.S. Department of Agriculture, 1964.

8. Soil Conservation Service, "National Engineering Handbook - Section 5, Hydraulics, "U.S. Department of Agriculture.

9. U.S. Army, Hydrologic Engineering Center, "Flood Hydrograph Package (HEC-1), Dam Safety Investigations, Users Manual," Corps of Engineers, Davis, California, September 1978.

10. U.S. Army, Hydrologic Engineering Center, "HEC-2 Water Surface Profiles, Users Manual," Corps of Engineers, Davis, California, October 1973.

11. U.S. Army, "Inventory of United States Dams," Corps of Engineers, 9 September 1978.

12. U.S. Army, Office of the Chief of Engineers, "Appendix D, Recommended Guidelines for Safety Inspection of Dams," National Program of Inspection of Dams, Volume 1, Corps of Engineers, Washington, D.C., May 1975.

13. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," (August 1975).

14. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-188, "Engineering and Design, National Program of Inspection of Non-Federal Dams," Corps of Engineers, Washington, D.C., 30 December 1977.

15. U.S. Army, Office of the Chief of Engineers, Engineer Technical Letter No. ETL 1110-2-234, "Engineering and Design, National Program of Inspection of Non-Federal Dams, Review of Spillway Adequacy," Corps of Engineers, Washington, D.C., 10 May 1978.

16. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.